

PRINCIPLES OF MICROECONOMIC



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Principles of Microeconomic

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This text was compiled on 06/16/2026

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CHAPTER OVERVIEW

1: Economics - The Study of Choice

[1.1: Defining Economics](#)

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1.1: Defining Economics

Learning Objective

1. Define economics.
2. Explain the concepts of scarcity and opportunity cost and how they relate to the definition of economics.
3. Understand the three fundamental economic questions: What should be produced? How should goods and services be produced? For whom should goods and services be produced?
4. Be able to distinguish between the various types of economic systems.

Economics is a social science that examines how people make decisions as they face scarce resource. It is social because it involves people and their behavior. It is a science because it uses, as much as possible, a scientific approach in its investigation of choices.

Scarce Resources and Opportunity Cost

All choices mean that one alternative is selected over another. Selecting among alternatives involves two concepts central to economics: scarce resources and opportunity cost.

Scarce Resources

In economics, **resources** (also referred to as inputs or factors of production) are classified into four different categories based on their nature and availability. The types of resources are:

Land - resource derived from nature and is used in economic activities. It includes land, water, minerals, soil, gas, and timber.

Labor - also known as human resource, labor refers to the physical and mental abilities of individuals that contribute to economic production. It includes the skills, knowledge, and expertise of people employed in various sectors of the economy.

Capital - this resource is man-made good used in the production of other goods and services. It includes machinery, equipment, buildings, tools, and infrastructure.

Entrepreneur - the risk-taker and innovator who combines other inputs to produce an output. It includes skills like innovation, leadership, and decision-making.

Our resources are limited or scarce. **Scarcity** is the condition in which our wants are greater than the limited resources available to satisfy those wants. At any one time, we have only so much land, so many factories, so much oil, so many people. But our wants, our desires for the things that we can produce with those resources, are unlimited. We would always like more and better housing, more and better education—more and better of practically everything.

Virtually everything is scarce. Consider the air we breathe, which is available in huge quantity at no charge to us. Could it possibly be scarce?

The test of whether air is scarce is whether it has alternative uses. What uses can we make of the air? We breathe it. We pollute it when we drive our cars, heat our houses, or operate our factories. In effect, one use of the air is as a garbage dump. We certainly need the air to breathe. But just as certainly, we choose to dump garbage in it. Those two uses are clearly alternatives to each other. The more garbage we dump in the air, the less desirable—and healthy—it will be to breathe. If we decide we want to breathe cleaner air, we must limit the activities that generate pollution. Air is a scarce good because it has alternative uses.

Not all goods, however, confront us with such choices. A **free good** is one for which the choice of one use does not require that we give up another. One example of a free good is gravity. The fact that gravity is holding you to the earth does not mean that your neighbor is forced to drift up into space! One person's use of gravity is not an alternative to another person's use.

There are not many free goods. Outer space, for example, was a free good when the only use we made of it was to gaze at it. But now, our use of space has reached the point where one use can be an alternative to another. Conflicts have already arisen over the allocation of orbital slots for communications satellites. Thus, even parts of outer space are scarce. Space will surely become more scarce as we find new ways to use it. Scarcity characterizes virtually everything. Consequently, the scope of economics is wide indeed.

Opportunity Cost

It is within the context of scarcity that economists define what is perhaps the most important concept in all of economics, the concept of opportunity cost. **Opportunity cost** is the value of the best alternative forgone in making any choice.

The opportunity cost to you of reading the remainder of this chapter will be the value of the best other use to which you could have put your time. If you choose to spend \$20 on a potted plant, you have simultaneously chosen to give up the benefits of spending the \$20 on pizzas or a paperback book or a night at the movies. If the book is the most valuable of those alternatives, then the opportunity cost of the plant is the value of the enjoyment you otherwise expected to receive from the book.

The concept of opportunity cost must not be confused with the purchase price of an item. Consider the cost of a college or university education. That includes the value of the best alternative use of money spent for tuition, fees, and books. But the most important cost of a college education is the value of the forgone alternative uses of time spent studying and attending class instead of using the time in some other endeavor. Students sacrifice that time in hopes of even greater earnings in the future or because they place a value on the opportunity to learn. Or consider the cost of going to the doctor. Part of that cost is the value of the best alternative use of the money required to see the doctor. But, the cost also includes the value of the best alternative use of the time required to see the doctor. The essential thing to see in the concept of opportunity cost is found in the name of the concept. Opportunity cost is the value of the best opportunity forgone in a particular choice. It is not simply the amount spent on that choice.

Scarcity, the Fundamental Economic Questions, and The Economic Systems

Scarcity forces every society to answer the following questions:

1. **What should be produced?** Using the economy's scarce resources to produce one thing requires giving up another. Producing better education, for example, may require cutting back on other services, such as health care. A decision to preserve a wilderness area requires giving up other uses of the land. Every society must decide what it will produce with its scarce resources.
2. **How should goods and services be produced?** There are all sorts of choices to be made in determining how goods and services should be produced. Should a firm employ a few skilled or a lot of unskilled workers? Should it produce in its own country or should it use foreign plants? Should manufacturing firms use new or recycled raw materials to make their products?
3. **For whom should goods and services be produced?** If a good or service is produced, a decision must be made about who will get it. A decision to have one person or group receive a good or service usually means it will not be available to someone else.

Every society must determine what should be produced, how it should be produced, and for whom it should be produced. The mechanism it uses to answer the economic questions is called economic system. An **economic system** refers to the way a society organizes and manages its resources, production, distribution, and consumption of goods and services. The various types of economic systems are:

Capitalism - In a capitalist economy, also known as a market economy, the production and distribution of goods and services are primarily determined by the interactions of supply and demand in the marketplaces.

Adam Smith, 18th-century Scottish philosopher and economist, also known as the father of modern economics proposed that a free market economy is capable of achieving an efficient allocation of resources without the need for government's intervention. In his most famous work "The Wealth of Nations," published in 1776, Smith discussed various economic concepts, including the idea of the invisible hand and the concepts of laissez-faire.

The **invisible hand** is a metaphor used by Smith to describe how individual self-interest can lead to positive outcomes for society as a whole. According to Smith, when individuals pursue their self-interest in a free market, they are guided by an invisible hand that promotes the overall well-being of society. This means that the pursuit of personal gain can indirectly benefit others by stimulating economic growth, innovation, and the efficient allocation of resources.

The concept of **laissez-faire**, which translates to "let do" or "let it be," is closely related to the idea of the invisible hand. Smith argued that the government should adopt a hands-off approach to economic affairs and refrain from excessive interference in the free market.

Socialism - In a socialist economy, also known as a planned or command economy, the government controls and plans the production, distribution, and pricing of goods and services.

Karl Marx and Friedrich Engels are known for their influential ideas on socialism, which they outlined in their works, particularly in "The Communist Manifesto" and "Das Kapital." They believed that a government-controlled or socialist economy would be

necessary initially, but would eventually lead to a communist system in which each person contributes according to ability and takes according to need. It is important to note that these ideas have been interpreted and implemented in various ways by different socialist movements and governments throughout history.

Mixed Economy - A mixed economy is an economic system that combines elements of both capitalism and socialism. In a mixed economy, there is a blend of private ownership and control of resources and industries, as well as government intervention and regulation. The exact balance between private enterprise and government intervention can vary in a mixed economy, with some countries leading more toward a market-oriented approach while others have a greater degree of government involvement.

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1.2: The Field of Economics

Learning Objective

1. Explain the distinguishing characteristics of the economic way of thinking.
2. Distinguish between microeconomics and macroeconomics.

We have examined the basic concepts of scarcity and opportunity cost in economics. In this section, we will look at economics as a field of study. We begin with the characteristics that distinguish economics from other social sciences.

The Economic Way of Thinking

Economists study choices. This fact is not what distinguishes economics from other social sciences; all social scientists are interested in choices. An anthropologist might study the choices of ancient peoples; a political scientist might study the choices of legislatures; a psychologist might study how people choose a mate; a sociologist might study the factors that have led to a rise in single-parent households. Economists study such questions as well. What is it about the study of choices by economists that makes economics different from these other social sciences?

Three features distinguish the economic approach to choice from the approaches taken in other social sciences:

1. Economists give special emphasis to the role of opportunity costs in their analysis of choices.
2. Economists assume that individuals make choices that seek to maximize the value of some objective, and that they define their objectives in terms of their own self-interest.
3. Individuals maximize by deciding whether to do a little more or a little less of something. Economists argue that individuals pay attention to the consequences of small changes in the levels of the activities they pursue.

The emphasis economists place on opportunity cost, the idea that people make choices that maximize the value of objectives that serve their self-interest, and a focus on the effects of small changes are ideas of great power. They constitute the core of economic thinking. The next three sections examine these ideas in greater detail.

Opportunity Costs Are Important

If doing one thing requires giving up another, then the expected benefits of the alternatives we face will affect the ones we choose. Economists argue that an understanding of opportunity cost is crucial to the examination of choices.

As the set of available alternatives changes, we expect that the choices individuals make will change. A rainy day could change the opportunity cost of reading a good book; we might expect more reading to get done in bad than in good weather. A high income can make it very costly to take a day off; we might expect highly paid individuals to work more hours than those who are not paid as well. If individuals are maximizing their level of satisfaction and firms are maximizing profits, then a change in the set of alternatives they face may affect their choices in a predictable way.

The emphasis on opportunity costs is an emphasis on the examination of alternatives. One benefit of the economic way of thinking is that it pushes us to think about the value of alternatives in each problem involving choice.

Individuals Maximize in Pursuing Self-Interest

What motivates people as they make choices? Perhaps more than anything else, it is the economist's answer to this question that distinguishes economics from other fields.

Economists assume that individuals make choices that they expect will create the maximum value of some objective, given the constraints they face. Furthermore, economists assume that people's objectives will be those that serve their own self-interest.

Unfortunately it is not possible to observe or measure well-being of individuals, however, economists use the concept of **utility** to refer to satisfaction one receives from engaging in an activity and have developed a measurement called **utils** to describe how much satisfaction or pleasure someone enjoys. We can say that the goal of individuals is to maximize total utility, given the limitations created by the one's budget.

Economists assume, for example, that the owners of business firms seek to maximize profit. Given the assumed goal of profit maximization, economists can predict how firms in an industry will respond to changes in the markets in which they operate. As

labor costs in the United States rise, for example, economists are not surprised to see firms moving some of their manufacturing operations overseas.

Similarly, economists assume that maximizing behavior is at work when they examine the behavior of consumers. In studying consumers, economists assume that individual consumers make choices aimed at maximizing their level of satisfaction. In the next chapter, we will look at the results of the shift from one good to another; that is a shift that reflects the pursuit of self-interest by consumers and by manufacturers.

In assuming that people pursue their self-interest, economists are not assuming people are selfish. People clearly gain satisfaction by helping others, as suggested by the large charitable contributions people make. Pursuing one's own self-interest means pursuing the things that give one satisfaction. It need not imply greed or selfishness.

Choices Are Made at the Margin

Economists argue that most choices are made “at the margin.” The margin is the current level of an activity. Think of it as the edge from which a choice is to be made. A choice at the **margin** is a decision to do a little more or a little less of something.

Assessing choices at the margin can lead to extremely useful insights. Consider, for example, the problem of curtailing water consumption when the amount of water available falls short of the amount people now use. Economists argue that one way to induce people to conserve water is to raise its price. A common response to this recommendation is that a higher price would have no effect on water consumption, because water is a necessity. Many people assert that prices do not affect water consumption because people “need” water.

But choices in water consumption, like virtually all choices, are made at the margin. Individuals do not make choices about whether they should or should not consume water. Rather, they decide whether to consume a little more or a little less water. Let's say that the household water consumption in the United States totals about 105 gallons per person per day. Think of that starting point as the edge from which a choice at the margin in water consumption is made. Could a higher price cause you to use less water brushing your teeth, take shorter showers, or water your lawn less? Could a higher price cause people to reduce their use, say, to 104 gallons per person per day? To 103? When we examine the choice to consume water at the margin, the notion that a higher price would reduce consumption seems much more plausible. Prices affect our consumption of water because choices in water consumption, like other choices, are made at the margin.

The elements of opportunity cost, maximization, and choices at the margin can be found in each of two broad areas of economic analysis: microeconomics and macroeconomics. Your economics course, for example, may be designated as a “micro” or as a “macro” course. We will look at these two areas of economic thought in the next section.

Microeconomics and Macroeconomics

The field of economics is typically divided into two broad realms: microeconomics and macroeconomics. It is important to see the distinctions between these broad areas of study.

Microeconomics is the branch of economics that focuses on the choices made by individual decision-making units in the economy—typically consumers and firms—and the impacts those choices have on individual markets. **Macroeconomics** is the branch of economics that focuses on the impact of choices on the total, or aggregate, level of economic activity.

Why do tickets to the best concerts cost so much? How does the threat of global warming affect real estate prices in coastal areas? Why do women end up doing most of the housework? Why do senior citizens get discounts on public transit systems? These questions are generally regarded as microeconomic because they focus on individual units or markets in the economy.

Is the total level of economic activity rising or falling? Is the rate of inflation increasing or decreasing? What is happening to the unemployment rate? These are questions that deal with aggregates, or totals, in the economy; they are problems of macroeconomics. The question about the level of economic activity, for example, refers to the total value of all goods and services produced in the economy. Inflation is a measure of the rate of change in the average price level for the entire economy; it is a macroeconomic problem. The total levels of employment and unemployment in the economy represent the aggregate of all labor markets; unemployment is also a topic of macroeconomics.

Both microeconomics and macroeconomics give attention to individual markets. But in microeconomics that attention is an end in itself; in macroeconomics it is aimed at explaining the movement of major economic aggregates—the level of total output, the level of employment, and the price level.

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1.3: The Economists' Tool Kit

Learning Objective

1. Explain how economists test hypotheses, develop economic theories, and use models in their analyses.
2. Explain how the all-other-things unchanged (*ceteris paribus*) problem and the fallacies affect the testing of economic hypotheses and how economists try to overcome these problems.
3. Distinguish between normative and positive statements.

Economics differs from other social sciences because of its emphasis on opportunity cost, the assumption of maximization in terms of one's own self-interest, and the analysis of choices at the margin. But certainly much of the basic methodology of economics and many of its difficulties are common to every social science—indeed, to every science. This section explores the application of the scientific method to economics.

Models in Economics

All scientific thought involves simplifications of reality. The real world is far too complex for the human mind—or the most powerful computer—to consider. Scientists use models instead. A **model** is designed to simplify reality in an attempt to explain real-world relationships and to predict outcomes. Economic models take many forms and those used by governments, academics, and businesses in real world tend to be fairly complicated mathematical and statistical models that require the use of a computer. In this course, however, we will rely on simple equations, two dimensional graphs and tables.

Testing Hypotheses in Economics

Here is a hypothesis suggested by the model of demand and supply: an increase in the price of gasoline will reduce the quantity of gasoline consumers demand. How might we test such a hypothesis?

Economists try to test hypotheses such as this one by observing actual behavior and using empirical (that is, real-world) data. Let's say, for example, that the average retail price of gasoline in the United States rose from an average of \$2.25 per gallon at the beginning of the year to \$3.08 per gallon by the end of the year. Let's also say, for example, that the number of gallons of gasoline consumed by U.S. motorists rose 0.3% during that same period.

The small increase in the quantity of gasoline consumed by motorists as its price rose is inconsistent with the hypothesis that an increased price will lead to a reduction in the quantity demanded. Does that mean that we should dismiss the original hypothesis? On the contrary, we must be cautious in assessing this evidence. Several problems exist in interpreting any set of economic data. One problem is that several things may be changing at once; another is that the initial event may be unrelated to the event that follows. The next two sections examine these problems in detail.

The All-Other-Things-Unchanged Problem

The hypothesis that an increase in the price of gasoline produces a reduction in the quantity demanded by consumers carries with it the assumption that there are no other changes that might also affect consumer demand. A better statement of the hypothesis would be: An increase in the price of gasoline will reduce the quantity consumers demand, *ceteris paribus*. **Ceteris paribus** is a Latin phrase that means “all other things unchanged.”

But things can change during the observed period. Economic activity and incomes may rise in the United States, and people with higher incomes may buy more gasoline. Employment may rise as well, and people with jobs may use more gasoline as they drive to work. Population in the United States may increase during the period. In short, many things may change during the period, all of which tend to increase the quantity of gasoline people purchase.

Our observation of the gasoline market during the year did not offer a conclusive test of the hypothesis that an increase in the price of gasoline would lead to a reduction in the quantity demanded by consumers. Other things changed and affected gasoline consumption. Such problems are likely to affect any analysis of economic events. We cannot ask the world to stand still while we conduct experiments in economic phenomena. Economists employ a variety of statistical methods to allow them to isolate the impact of single events such as price changes, but they can never be certain that they have accurately isolated the impact of a single event in a world in which virtually everything is changing all the time.

In laboratory sciences such as chemistry and biology, it is relatively easy to conduct experiments in which only selected things change and all other factors are held constant. The economists' laboratory is the real world; thus, economists do not generally have the luxury of conducting controlled experiments.

The Fallacy of False Cause

Hypotheses in economics typically specify a relationship in which a change in one variable causes another to change. We call the variable that responds to the change the dependent variable; the variable that induces a change is called the independent variable. Sometimes the fact that two variables move together can suggest the false conclusion that one of the variables has acted as an independent variable that has caused the change we observe in the dependent variable.

Consider the following hypothesis: People wearing shorts cause warm weather. Certainly, we observe that more people wear shorts when the weather is warm. Presumably, though, it is the warm weather that causes people to wear shorts rather than the wearing of shorts that causes warm weather; it would be incorrect to infer from this that people cause warm weather by wearing shorts.

Reaching the incorrect conclusion that one event causes another because the two events tend to occur together is called the **fallacy of false cause**.

Because of the danger of the fallacy of false cause, economists use special statistical tests that are designed to determine whether changes in one thing actually do cause changes observed in another. Given the inability to perform controlled experiments, however, these tests do not always offer convincing evidence that persuades all economists that one thing does, in fact, cause changes in another.

In the case of gasoline prices and consumption, there are good theoretical reasons to believe the price increase should lead to a reduction in the quantity consumers demand. And economists have tested the hypothesis about price and the quantity demanded quite extensively. They have developed elaborate statistical tests aimed at ruling out problems of the fallacy of false cause. While we cannot prove that an increase in price will, *ceteris paribus*, lead to a reduction in the quantity consumers demand, we can have considerable confidence in the proposition.

Other Relevant Fallacies

The **fallacy of division** occurs when it is incorrectly assumed that what is true for the whole is also true for the parts. For instance, let's say someone argues that since a football team is collectively skilled and successful, every player on the team must also possess the same level of skill and talent. This assumption ignores the fact that individual players on the team may have varying levels of skill, experience, and contributions. So, what is true for the team does not necessarily reflect the characteristics of each player.

The **fallacy of composition** occurs when it is incorrectly assumed that what is true for the individual parts is also true for the whole. For example, let's say someone argues that since each individual brick in the wall is small and lightweight, the entire wall must also be small and lightweight. This assumption ignores the fact that when individual bricks are combined, they can form a large and sturdy structure. So, what is true of the individual bricks does not necessarily reflect the characteristics of the entire wall.

Normative and Positive Statements

Two kinds of assertions in economics can be subjected to testing. We have already examined one, the hypothesis. Another testable assertion is a statement of fact, such as "It is raining outside" or "Microsoft is the largest producer of operating systems for personal computers in the world." A statement of fact or a hypothesis is a **positive statement**.

Although people often disagree about positive statements, such disagreements can ultimately be resolved through investigation. There is another category of assertions, however, for which investigation can never resolve differences. A **normative statement** is one that makes a value judgment. Such a judgment is the opinion of the speaker; no one can "prove" that the statement is or is not correct. Here are some examples of normative statements in economics: "We ought to do more to help the poor." "People in the United States should save more." "Corporate profits are too high." The statements are based on the values of the person who makes them. They cannot be proven false.

Because people have different values, normative statements often provoke disagreement. An economist whose values lead him or her to conclude that we should provide more help for the poor will disagree with one whose values lead to a conclusion that we should not. Because no test exists for these values, these two economists will continue to disagree, unless one persuades the other to adopt a different set of values. Many of the disagreements among economists are based on such differences in values and therefore are unlikely to be resolved.

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CHAPTER OVERVIEW

2: Confronting Scarcity- Choices in Production

[2.1: The Production Possibilities Curve](#)

[2.2: Applications of the Production Possibilities Model](#)

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2.1: The Production Possibilities Curve

Learning Objective

1. Explain the concept of the production possibilities curve and understand the implications of its downward slope and bowed-out shape.
2. Use the production possibilities model to distinguish between full employment and situations of idle factors of production and between efficient and inefficient production.
3. Understand specialization and its relationship to the production possibilities model and comparative advantage.

An economy's factors of production are scarce; they cannot produce an unlimited quantity of goods and services. A production possibilities curve is a graphical representation of the alternative combinations of goods and services an economy can produce. It illustrates the production possibilities model. In drawing the production possibilities curve, we shall assume that the economy can produce only two goods and that the quantities of factors of production and the technology available to the economy are fixed.

Constructing a Production Possibilities Curve

To construct a production possibilities curve, we will begin with the case of a hypothetical firm, Alpine Sports, Inc., a specialized sports equipment manufacturer. Christie Ryder began the business 15 years ago with a single ski production facility near Killington ski resort in central Vermont. Ski sales grew, and she also saw demand for snowboards rising—particularly after snowboard competition events were included in the 2002 Winter Olympics in Salt Lake City. She added a second plant in a nearby town. The second plant, while smaller than the first, was designed to produce snowboards as well as skis. She also modified the first plant so that it could produce both snowboards and skis. Two years later she added a third plant in another town. While even smaller than the second plant, the third was primarily designed for snowboard production but could also produce skis.

We can think of each of Ms. Ryder's three plants as a miniature economy and analyze them using the production possibilities model. We assume that the factors of production and technology available to each of the plants operated by Alpine Sports are unchanged.

Suppose the first plant, Plant 1, can produce 200 pairs of skis per month when it produces only skis. When devoted solely to snowboards, it produces 100 snowboards per month. It can produce skis and snowboards simultaneously as well.

The table in Figure 2.1 gives three combinations of skis and snowboards that Plant 1 can produce each month. Combination A involves devoting the plant entirely to ski production; combination C means shifting all of the plant's resources to snowboard production; combination B involves the production of both goods. These values are plotted in a production possibilities curve for Plant 1. The curve is a downward-sloping straight line, indicating that there is a linear, negative relationship between the production of the two goods.

Neither skis nor snowboards is an independent or a dependent variable in the production possibilities model; we can assign either one to the vertical or to the horizontal axis. Here, we have placed the number of pairs of skis produced per month on the vertical axis and the number of snowboards produced per month on the horizontal axis.

The negative slope of the production possibilities curve reflects the scarcity of the plant's capital and labor. Producing more snowboards requires shifting resources out of ski production and thus producing fewer skis. Producing more skis requires shifting resources out of snowboard production and thus producing fewer snowboards.

The slope of Plant 1's production possibilities curve measures the rate at which Alpine Sports must give up ski production to produce additional snowboards. Because the production possibilities curve for Plant 1 is linear, we can compute the slope between any two points on the curve and get the same result. Between points A and B, for example, the slope equals -2 pairs of skis/snowboard (equals -100 pairs of skis/50 snowboards). (Many students are helped when told to read this result as " -2 pairs of skis *per* snowboard.") We get the same value between points B and C, and between points A and C.

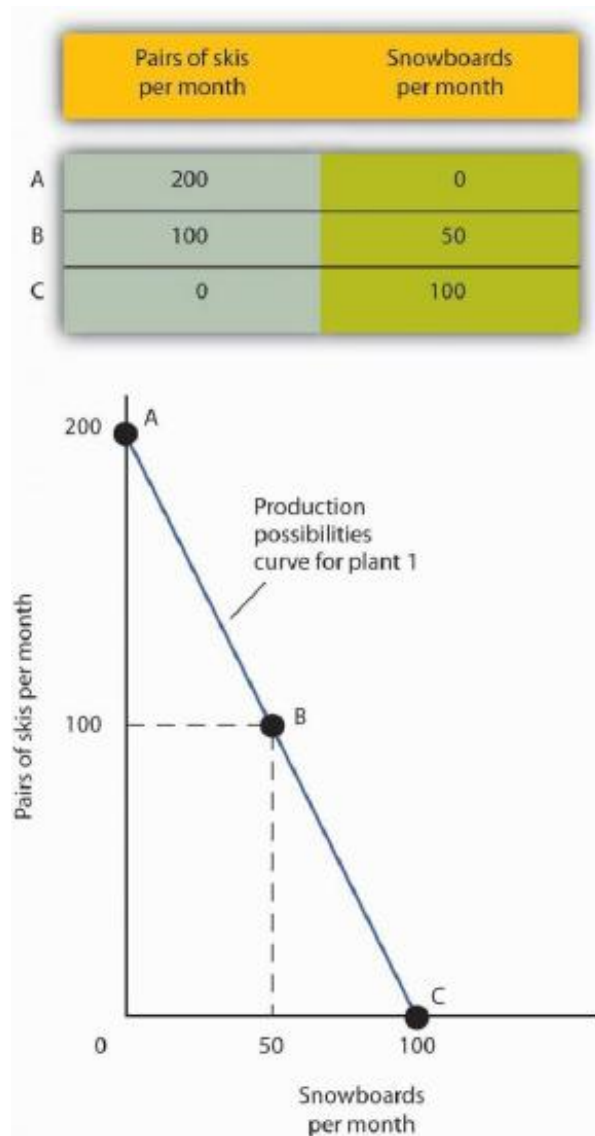
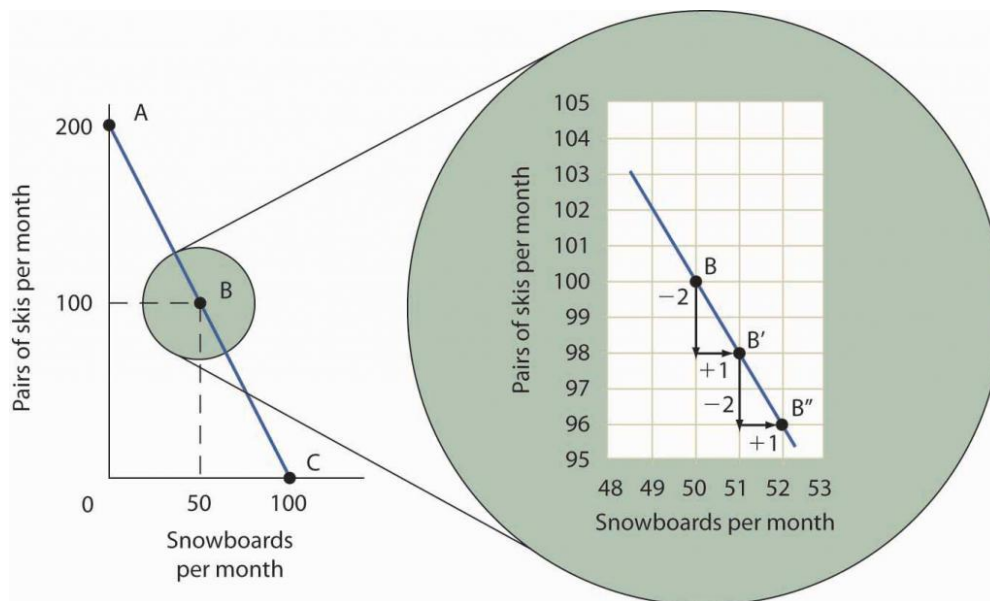


Figure 2.1 A Production Possibilities Curve The table shows the combinations of pairs of skis and snowboards that Plant 1 is capable of producing each month. These are also illustrated with a production possibilities curve. Notice that this curve is linear.

To see this relationship more clearly, examine Figure 2.2. Suppose Plant 1 is producing 100 pairs of skis and 50 snowboards per month at point B. Now consider what would happen if Ms. Ryder decided to produce 1 more snowboard per month. The segment of the curve around point B is magnified in Figure 2.2. The slope between points B and B' is -2 pairs of skis/snowboard. Producing 1 additional snowboard at point B' requires giving up 2 pairs of skis. We can think of this as the opportunity cost of producing an additional snowboard at Plant 1. This opportunity cost equals the absolute value of the slope of the production possibilities curve.

Figure 2.2 The Slope of a Production Possibilities Curve



The slope of the linear production possibilities curve in Figure 2.1 is constant; it is -2 pairs of skis/snowboard. In the section of the curve shown in Figure 2.2, the slope can be calculated between points B and B'. Expanding snowboard production to 51 snowboards per month from 50 snowboards per month requires a reduction in ski production to 98 pairs of skis per month from 100 pairs. The slope equals -2 pairs of skis/snowboard (that is, it must give up two pairs of skis to free up the resources necessary to produce one additional snowboard). To shift from B' to B'', Alpine Sports must give up two more pairs of skis per snowboard. The absolute value of the slope of a production possibilities curve measures the opportunity cost of an additional unit of the good on the horizontal axis measured in terms of the quantity of the good on the vertical axis that must be forgone.

The absolute value of the slope of any production possibilities curve equals the opportunity cost of an additional unit of the good on the horizontal axis. It is the amount of the good on the vertical axis that must be given up in order to free up the resources required to produce one more unit of the good on the horizontal axis. We will make use of this important fact as we continue our investigation of the production possibilities curve.

Figure 2.3 shows production possibilities curves for each of the firm's three plants. Each of the plants, if devoted entirely to snowboards, could produce 100 snowboards. Plants 2 and 3, if devoted exclusively to ski production, can produce 100 and 50 pairs of skis per month, respectively. The exhibit gives the slopes of the production possibilities curves for each plant. The opportunity cost of an additional snowboard at each plant equals the absolute values of these slopes (that is, the number of pairs of skis that must be given up per snowboard).

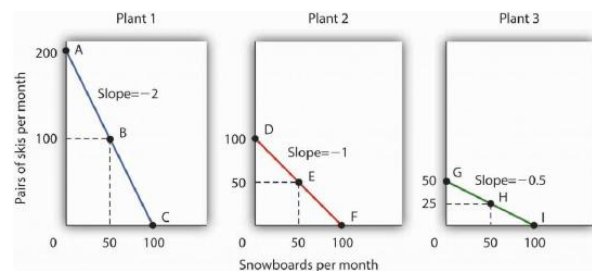


Figure 2.3 Production Possibilities at Three Plants: The slopes of the production possibilities curves for each plant differ. The steeper the curve, the greater the opportunity cost of an additional snowboard. Here, the opportunity cost is lowest at Plant 3 and greatest at Plant 1.

Figure 2.3 gives the slopes of the production possibilities curves for each of the firm's three plants. The opportunity cost of an additional snowboard at each plant equals the absolute values of these slopes. More generally, the absolute value of the slope of any

production possibilities curve at any point gives the opportunity cost of an additional unit of the good on the horizontal axis, measured in terms of the number of units of the good on the vertical axis that must be forgone.

The greater the absolute value of the slope of the production possibilities curve, the greater the opportunity cost will be. The plant for which the opportunity cost of an additional snowboard is greatest is the plant with the steepest production possibilities curve; the plant for which the opportunity cost is lowest is the plant with the flattest production possibilities curve. The plant with the lowest opportunity cost of producing snowboards is Plant 3; its slope of -0.5 means that Ms. Ryder must give up half a pair of skis in that plant to produce an additional snowboard. In Plant 2, she must give up one pair of skis to gain one more snowboard. We have already seen that an additional snowboard requires giving up two pairs of skis in Plant 1.

Comparative Advantage and the Production Possibilities Curve

To construct a combined production possibilities curve for all three plants, we can begin by asking how many pairs of skis Alpine Sports could produce if it were producing only skis. To find this quantity, we add up the values at the vertical intercepts of each of the production possibilities curves in Figure 2.3. These intercepts tell us the maximum number of pairs of skis each plant can produce. Plant 1 can produce 200 pairs of skis per month, Plant 2 can produce 100 pairs of skis at per month, and Plant 3 can produce 50 pairs. Alpine Sports can thus produce 350 pairs of skis per month if it devotes its resources exclusively to ski production. In that case, it produces no snowboards.

Now suppose the firm decides to produce 100 snowboards. That will require shifting one of its plants out of ski production. Which one will it choose to shift? The sensible thing for it to do is to choose the plant in which snowboards have the lowest opportunity cost—Plant 3. It has an advantage not because it can produce more snowboards than the other plants (all the plants in this example are capable of producing up to 100 snowboards per month) but because it is the least productive plant for making skis. Producing a snowboard in Plant 3 requires giving up just half a pair of skis.

Economists say that an economy has a comparative advantage in producing a good or service if the opportunity cost of producing that good or service is lower for that economy than for any other. Plant 3 has a comparative advantage in snowboard production because it is the plant for which the opportunity cost of additional snowboards is lowest. To put this in terms of the production possibilities curve, Plant 3 has a comparative advantage in snowboard production (the good on the horizontal axis) because its production possibilities curve is the flattest of the three curves.

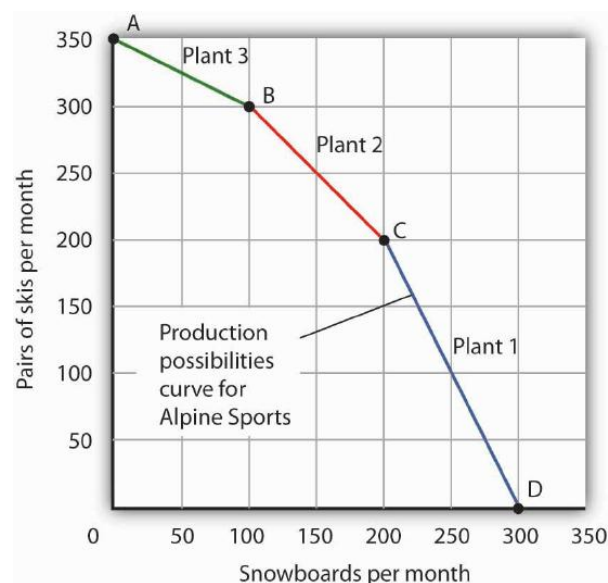


Figure 2.4 The Combined Production Possibilities Curve for Alpine Sports The curve shown combines the production possibilities curves for each plant. At point A, Alpine Sports produces 350 pairs of skis per month and no snowboards. If the firm wishes to increase snowboard production, it will first use Plant 3, which has a comparative advantage in snowboards.

Plant 3's comparative advantage in snowboard production makes a crucial point about the nature of comparative advantage. It need not imply that a particular plant is especially good at an activity. In our example, all three plants are equally good at snowboard

production. Plant 3, though, is the least efficient of the three in ski production. Alpine thus gives up fewer skis when it produces snowboards in Plant 3. Comparative advantage thus can stem from a lack of efficiency in the production of an alternative good rather than a special proficiency in the production of the first good.

The combined production possibilities curve for the firm's three plants is shown in Figure 2.4. We begin at point A, with all three plants producing only skis. Production totals 350 pairs of skis per month and zero snowboards. If the firm were to produce 100 snowboards at Plant 3, ski production would fall by 50 pairs per month (recall that the opportunity cost per snowboard at Plant 3 is half a pair of skis). That would bring ski production to 300 pairs, at point B. If Alpine Sports were to produce still more snowboards in a single month, it would shift production to Plant 2, the facility with the next-lowest opportunity cost. Producing 100 snowboards at Plant 2 would leave Alpine Sports producing 200 snowboards and 200 pairs of skis per month, at point C. If the firm were to switch entirely to snowboard production, Plant 1 would be the last to switch because the cost of each snowboard there is 2 pairs of skis. With all three plants producing only snowboards, the firm is at point D on the combined production possibilities curve, producing 300 snowboards per month and no skis.

Notice that this production possibilities curve, which is made up of linear segments from each assembly plant, has a bowed-out shape; the absolute value of its slope increases as Alpine Sports produces more and more snowboards. This is a result of transferring resources from the production of one good to another according to comparative advantage. We shall examine the significance of the bowed-out shape of the curve in the next section.

The Law of Increasing Opportunity Cost

We see in Figure 2.4 that, beginning at point A and producing only skis, Alpine Sports experiences higher and higher opportunity costs as it produces more snowboards. The fact that the opportunity cost of additional snowboards increases as the firm produces more of them is a reflection of an important economic law. The law of increasing opportunity cost holds that as an economy moves along its production possibilities curve in the direction of producing more of a particular good, the opportunity cost of additional units of that good will increase.

We have seen the law of increasing opportunity cost at work traveling from point A toward point D on the production possibilities curve in Figure 2.4. The opportunity cost of each of the first 100 snowboards equals half a pair of skis; each of the next 100 snowboards has an opportunity cost of 1 pair of skis, and each of the last 100 snowboards has an opportunity cost of 2 pairs of skis. The law also applies as the firm shifts from snowboards to skis. Suppose it begins at point D, producing 300 snowboards per month and no skis. It can shift to ski production at a relatively low cost at first. The opportunity cost of the first 200 pairs of skis is just 100 snowboards at Plant 1, a movement from point D to point C, or 0.5 snowboards per pair of skis. We would say that Plant 1 has a comparative advantage in ski production. The next 100 pairs of skis would be produced at Plant 2, where snowboard production would fall by 100 snowboards per month. The opportunity cost of skis at Plant 2 is 1 snowboard per pair of skis. Plant 3 would be the last plant converted to ski production. There, 50 pairs of skis could be produced per month at a cost of 100 snowboards, or an opportunity cost of 2 snowboards per pair of skis.

The bowed-out production possibilities curve for Alpine Sports illustrates the law of increasing opportunity cost. Scarcity implies that a production possibilities curve is downward sloping; the law of increasing opportunity cost implies that it will be bowed out, or concave, in shape.

The bowed-out curve of Figure 2.4 becomes smoother as we include more production facilities. Suppose Alpine Sports expands to 10 plants, each with a linear production possibilities curve. Panel (a) of Figure 2.5 shows the combined curve for the expanded firm, constructed as we did in Figure 2.5. This production possibilities curve includes 10 linear segments and is almost a smooth curve. As we include more and more production units, the curve will become smoother and smoother. In an actual economy, with a tremendous number of firms and workers, it is easy to see that the production possibilities curve will be smooth. We will generally draw production possibilities curves for the economy as smooth, bowed-out curves, like the one in Panel (b). This production possibilities curve shows an economy that produces only skis and snowboards. Notice the curve still has a bowed-out shape; it still has a negative slope. Notice also that this curve has no numbers. Economists often use models such as the production possibilities model with graphs that show the general shapes of curves but that do not include specific numbers.

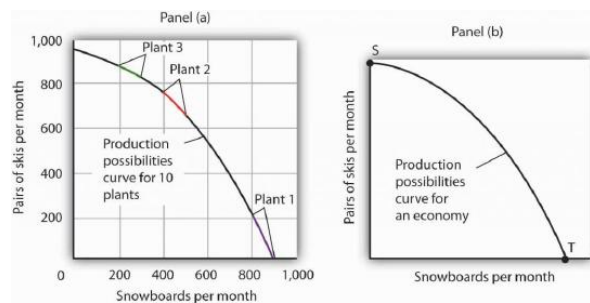


Figure 2.5 Production Possibilities for the Economy As we combine the production possibilities curves for more and more units, the curve becomes smoother. It retains its negative slope and bowed-out shape. In Panel (a) we have a combined production possibilities curve for Alpine Sports, assuming that it now has 10 plants producing skis and snowboards. Even though each of the plants has a linear curve, combining them according to comparative advantage, as we did with 3 plants in Figure 2.4, produces what appears to be a smooth, nonlinear curve, even though it is made up of linear segments. In drawing production possibilities curves for the economy, we shall generally assume they are smooth and “bowed out,” as in Panel (b). This curve depicts an entire economy that produces only skis and snowboards.

Movements Along the Production Possibilities Curve

We can use the production possibilities model to examine choices in the production of goods and services. In applying the model, we assume that the economy can produce two goods, and we assume that technology and the factors of production available to the economy remain unchanged. In this section, we shall assume that the economy operates on its production possibilities curve so that an increase in the production of one good in the model implies a reduction in the production of the other.

We shall consider two goods and services: national security and a category we shall call “all other goods and services.” This second category includes the entire range of goods and services the economy can produce, aside from national defense and security. Clearly, the transfer of resources to the effort to enhance national security reduces the quantity of other goods and services that can be produced. In the wake of the 9/11 attacks in 2001, nations throughout the world increased their spending for national security. This spending took a variety of forms. One, of course, was increased defense spending. Local and state governments also increased spending in an effort to prevent terrorist attacks. Airports around the world hired additional agents to inspect luggage and passengers.

The increase in resources devoted to security meant fewer “other goods and services” could be produced. In terms of the production possibilities curve in Figure 2.6, the choice to produce more security and less of other goods and services means a movement from A to B. Of course, an economy cannot really *produce* security; it can only attempt to provide it. The attempt to provide it requires resources; it is in that sense that we shall speak of the economy as “producing” security.

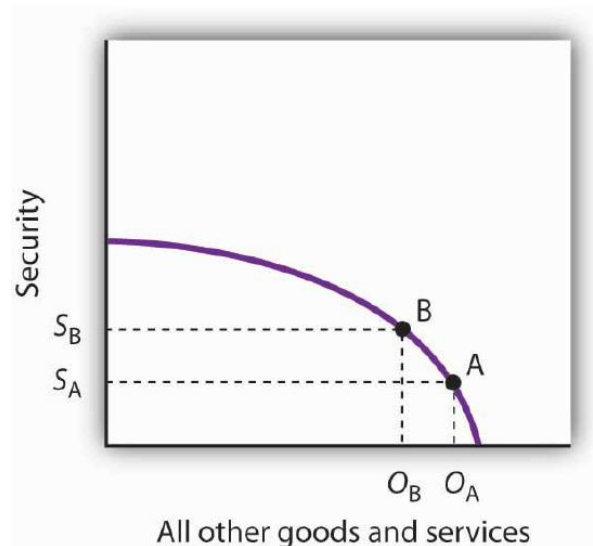


Figure 2.6 Spending More for Security Here, an economy that can produce two categories of goods, security and “all other goods and services,” begins at point A on its production possibilities curve. The economy produces S_A units of security and O_A units of all other goods and services per period. A movement from A to B requires shifting resources out of the production of all other goods and services and into spending on security. The increase in spending on security, to S_B units of security per period, has an opportunity cost of reduced production of all other goods and services. Production of all other goods and services falls by $O_A - O_B$ units per period.

At point A, the economy was producing S_A units of security on the vertical axis—defense services and various forms of police protection—and O_A units of other goods and services on the horizontal axis. Next, the economy chose to increase spending on security in the effort to defeat terrorism. Since we have assumed that the economy has a fixed quantity of available resources, the increased use of resources for security and national defense necessarily reduces the number of resources available for the production of other goods and services.

The law of increasing opportunity cost tells us that, as the economy moves along the production possibilities curve in the direction of more of one good, its opportunity cost will increase. We may conclude that, as the economy moved along this curve in the direction of greater production of security, the opportunity cost of the additional security began to increase. That is because the resources transferred from the production of other goods and services to the production of security had a greater and greater comparative advantage in producing things other than security.

The production possibilities model does not tell us where on the curve a particular economy will operate. Instead, it lays out the possibilities facing the economy. Many countries, for example, chose to move along their respective production possibilities curves to produce more security and national defense and less of all other goods in the wake of 9/11. We will see in the chapter on demand and supply how choices about what to produce are made in the marketplace.

Producing on Versus Producing Inside the Production Possibilities Curve

An economy that is operating inside its production possibilities curve could, by moving onto it, produce more of all the goods and services that people value, such as food, housing, education, medical care, and music. Increasing the availability of these goods would improve the standard of living. Economists conclude that it is better to be on the production possibilities curve than inside it.

Two things could leave an economy operating at a point inside its production possibilities curve. First, the economy might fail to use fully the resources available to it. Second, it might not allocate resources on the basis of comparative advantage. In either case, production within the production possibilities curve implies the economy could improve its performance.

Idle Factors of Production

Suppose an economy fails to put all its factors of production to work. Some workers are without jobs, some buildings are without occupants, some fields are without crops. Because an economy’s production possibilities curve assumes the full use of the factors of production available to it, the failure to use some factors results in a level of production that lies inside the production possibilities curve.

If all the factors of production that are available for use under current market conditions are being utilized, the economy has achieved full employment. An economy cannot operate on its production possibilities curve unless it has full employment.

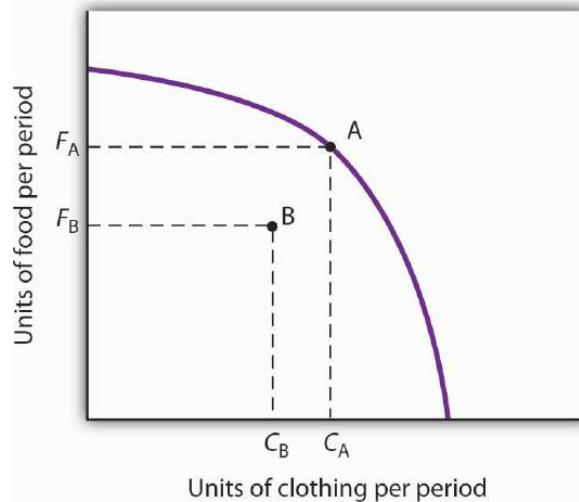


Figure 2.7 Idle Factors and Production The production possibilities curve shown suggests an economy that can produce two goods, food and clothing. As a result of a failure to achieve full employment, the economy operates at a point such as B, producing F_B units of food and C_B units of clothing per period. Putting its factors of production to work allows a move to the production possibilities curve, to a point such as A. The production of both goods rises.

Figure 2.7 shows an economy that can produce food and clothing. If it chooses to produce at point A, for example, it can produce F_A units of food and C_A units of clothing. Now suppose that a large fraction of the economy's workers lose their jobs, so the economy no longer makes full use of one factor of production: labor. In this example, production moves to point B, where the economy produces less food (F_B) and less clothing (C_B) than at point A. We often think of the loss of jobs in terms of the workers; they have lost a chance to work and to earn income. But the production possibilities model points to another loss: goods and services the economy could have produced that are not being produced.

Inefficient Production

Now suppose Alpine Sports is fully employing its factors of production. Could it still operate inside its production possibilities curve? Could an economy that is using all its factors of production still produce less than it could? The answer is "Yes," and the key lies in comparative advantage. An economy achieves a point on its production possibilities curve only if it allocates its factors of production on the basis of comparative advantage. If it fails to do that, it will operate inside the curve.

Suppose that, as before, Alpine Sports has been producing only skis. With all three of its plants producing skis, it can produce 350 pairs of skis per month (and no snowboards). The firm then starts producing snowboards. This time, however, imagine that Alpine Sports switches plants from skis to snowboards in numerical order: Plant 1 first, Plant 2 second, and then Plant 3. Figure 2.8 illustrates the result. Instead of the bowed-out production possibilities curve ABCD, we get a bowed-in curve, AB'C'D. Suppose that Alpine Sports is producing 100 snowboards and 150 pairs of skis at point B'. Had the firm based its production choices on comparative advantage, it would have switched Plant 3 to snowboards and then Plant 2, so it could have operated at a point such as C. It would be producing more snowboards and more pairs of skis—and using the same quantities of factors of production it was using at B'. Had the firm based its production choices on comparative advantage, it would have switched Plant 3 to snowboards and then Plant 2, so it would have operated at point C. It would be producing more snowboards and more pairs of skis—and using the same quantities of factors of production it was using at B'. When an economy is operating on its production possibilities curve, we say that it is engaging in efficient production. If it is using the same quantities of factors of production but is operating inside its production possibilities curve, it is engaging in inefficient production. Inefficient production implies that the economy could be producing more goods without using any additional labor, capital, or natural resources.

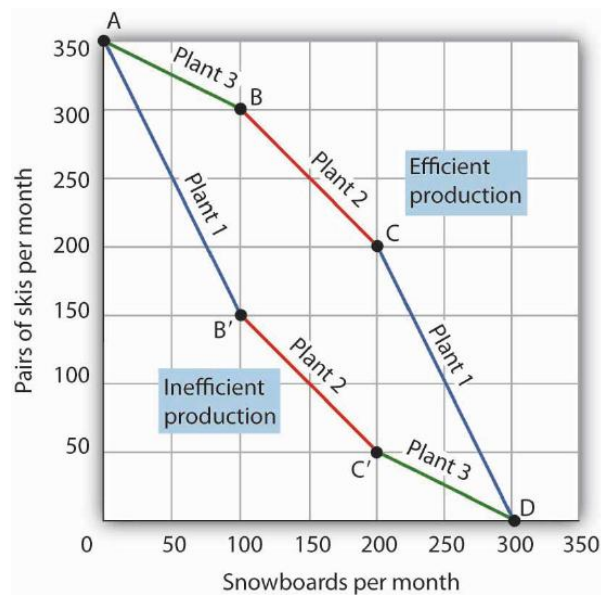


Figure 2.8 Efficient Versus Inefficient Production: When factors of production are allocated on a basis other than comparative advantage, the result is inefficient production. Suppose Alpine Sports operates the three plants we examined in Figure 2.4. Suppose further that all three plants are devoted exclusively to ski production; the firm operates at A. Now suppose that, to increase snowboard production, it transfers plants in numerical order: Plant 1 first, then Plant 2, and finally Plant 3. The result is the bowed-in curve AB'C'D. Production on the production possibilities curve ABCD requires that factors of production be transferred according to comparative advantage.

Points on the production possibilities curve thus satisfy two conditions: the economy is making full use of its factors of production, and it is making efficient use of its factors of production. If there are idle or inefficiently allocated factors of production, the economy will operate inside the production possibilities curve. Thus, the production possibilities curve not only shows what can be produced; it provides insight into how goods and services should be produced. It suggests that to obtain efficiency in production, factors of production should be allocated on the basis of comparative advantage. Further, the economy must make full use of its factors of production if it is to produce the goods and services it is capable of producing.

Specialization

The production possibilities model suggests that specialization will occur. Specialization implies that an economy is producing the goods and services in which it has a comparative advantage. If Alpine Sports selects point C in Figure 2.8, for example, it will assign Plant 1 exclusively to ski production and Plants 2 and 3 exclusively to snowboard production.

Such specialization is typical in an economic system. Workers, for example, specialize in particular fields in which they have a comparative advantage. People work and use the income they earn to buy—perhaps import—goods and services from people who have a comparative advantage in doing other things. The result is a far greater quantity of goods and services than would be available without this specialization.

Think about what life would be like without specialization. Imagine that you are suddenly completely cut off from the rest of the economy. You must produce everything you consume; you obtain nothing from anyone else. Would you be able to consume what you consume now? Clearly not. It is hard to imagine that most of us could even survive in such a setting. The gains we achieve through specialization are enormous.

Nations specialize as well. Much of the land in the United States has a comparative advantage in agricultural production and is devoted to that activity. Hong Kong, with its huge population and tiny endowment of land, allocates virtually none of its land to agricultural use; that option would be too costly. Its land is devoted largely to nonagricultural use.

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2.2: Applications of the Production Possibilities Model

Learning Objective

1. Understand the argument for unrestricted international trade in terms of economic specialization and comparative advantage.
2. Define economic growth in terms of the production possibilities model and discuss factors that make such growth possible.
3. Explain the classification of economic systems.

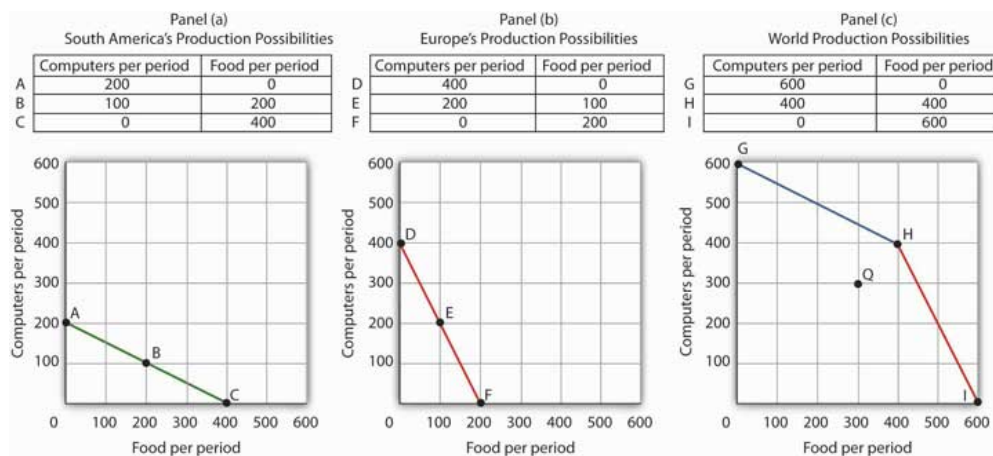
The production possibilities curve gives us a model of an economy. The model provides powerful insights about the real world, insights that help us to answer some important questions: How does trade between two countries affect the quantities of goods available to people? What determines the rate at which production will increase over time? What is the role of economic freedom in the economy? In this section we explore applications of the model to questions of international trade, economic growth, and the choice of an economic system.

Comparative Advantage and International Trade

One of the most important implications of the concepts of comparative advantage and the production possibilities curve relates to international trade. We can think of different nations as being equivalent to Christie Ryder's plants. Each will have a comparative advantage in certain activities, and efficient world production requires that each nation specialize in those activities in which it has a comparative advantage. A failure to allocate resources in this way means that world production falls inside the production possibilities curve; more of each good could be produced by relying on comparative advantage.

If nations specialize, then they must rely on each other. They will sell the goods in which they specialize and purchase other goods from other nations. Suppose, for example, that the world consists of two continents that can each produce two goods: South America and Europe can produce food and computers. Suppose they can produce the two goods according to the tables in Panels (a) and (b) of Figure 2.9. We have simplified this example by assuming that each continent has a linear production possibilities curve; the curves are plotted below the tables in Panels (a) and (b). Each continent has a separate production possibilities curve; the two have been combined to illustrate a world production possibilities curve in Panel (c) of the exhibit.

Figure 2.9 Production Possibilities Curves and Trade



Suppose the world consists of two continents: South America and Europe. They can each produce two goods: food and computers. In this example, we assume that each continent has a linear production possibilities curve, as shown in Panels (a) and (b). South America has a comparative advantage in food production and Europe has a comparative advantage in computer production. With free trade, the world can operate on the bowed-out curve GHI, shown in Panel (c). If the continents refuse to trade, the world will operate inside its production possibilities curve. If, for example, each continent were to produce at the midpoint of its production possibilities curve, the world would produce 300 computers and 300 units of food per period at point Q. If each continent were to specialize in the good in which it has a comparative advantage, world production could move to a point such as H, with more of both goods produced.

The world production possibilities curve assumes that resources are allocated between computer and food production based on comparative advantage. Notice that, even with only two economies and the assumption of linear production possibilities curves for each, the combined curve still has a bowed-out shape. At point H, for example, South America specializes in food, while Europe produces only computers. World production equals 400 units of each good. In this situation, we would expect South America to export food to Europe while Europe exports computers to South America.

But suppose the regions refuse to trade; each insists on producing its own food and computers. Suppose further that each chooses to produce at the midpoint of its own production possibilities curve. South America produces 100 units of computers and 200 units of food per period, while Europe produces 200 units of computers and 100 units of food per period. World production thus totals 300 units of each good per period; the world operates at point Q in Figure 2.9. If the two continents were willing to move from isolation to trade, the world could achieve an increase in the production of both goods. Producing at point H requires no more resources, no more effort than production at Q. It does, however, require that the world's resources be allocated on the basis of comparative advantage.

The implications of our model for trade are powerful indeed. First, we see that trade allows the production of more of all goods and services. Restrictions on trade thus reduce production of goods and services. Second, we see a lesson often missed in discussions of trade: a nation's trade policy has nothing to do with its level of employment of its factors of production. In our example, when South America and Europe do not engage in trade and produce at the midpoints of each of their respective production possibilities curves, *they each have full employment*. With trade, the two nations still operate on their respective production possibilities curves: *they each have full employment*. Trade certainly redistributes employment in the two continents. In South America, employment shifts from computer production to food production. In Europe, it shifts from food production to computer production. Once the shift is made, though, there is no effect on employment in either continent.

Of course, this idealized example would have all of South America's computer experts becoming farmers while all of Europe's farmers become computer geeks! That is a bit much to swallow, but it is merely the result of assuming linear production possibilities curves and complete specialization. In the real world, production possibilities curves are concave, and the reallocation of resources required by trade is not nearly as dramatic. Still, free trade can require shifts in resources from one activity to another. These shifts produce enormous benefits, but they do not come without costs.

Nearly all economists agree that largely unrestricted trade between countries is desirable; restrictions on trade generally force the world to operate inside its production possibilities curve. In some cases restrictions on trade could be desirable, but in the main, free trade promotes greater production of goods and services for the world's people.

Economic Growth

An increase in the physical quantity or in the quality of factors of production available to an economy or a technological gain will allow the economy to produce more goods and services; it will shift the economy's production possibilities curve outward. The process through which an economy achieves an outward shift in its production possibilities curve is called economic growth. An outward shift in a production possibilities curve is illustrated in Figure 2.10. In Panel (a), a point such as N is not attainable; it lies outside the production possibilities curve. Growth shifts the curve outward, as in Panel (b), making previously unattainable levels of production possible.

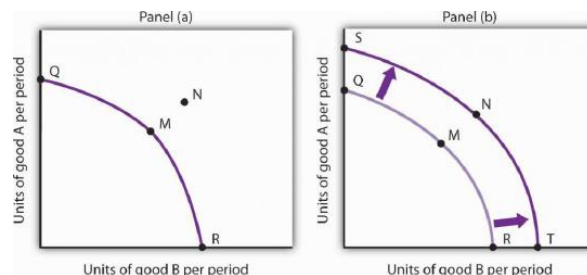


Figure 2.10 Economic Growth and the Production Possibilities Curve An economy capable of producing two goods, A and B, is initially operating at point M on production possibilities curve OMR in Panel (a). Given this production possibilities curve, the economy could not produce a combination such as shown by point N, which lies outside the curve. An increase in the factors of production available to the economy would shift the curve outward to SNT, allowing the choice of a point such as N, at which more of both goods will be produced.

The Sources of Economic Growth

Economic growth implies an outward shift in an economy's production possibilities curve. Recall that when we draw such a curve, we assume that the quantity and quality of the economy's factors of production and its technology are unchanged. Changing these will shift the curve. Anything that increases the quantity or quality of the factors of production available to the economy or that improves the technology available to the economy contributes to economic growth.

Consider, for example, the dramatic gains in human capital that have occurred in the United States since the beginning of the past century. In 1900, about 3.5% of U.S. workers had completed a high school education. By 2006, that percentage rose almost to 92. Fewer than 1% of the workers in 1900 had graduated from college; as late as 1940 only 3.5% had graduated from college. By 2006, nearly 32% had graduated from college. In addition to being better educated, today's workers have received more and better training on the job. They bring far more economically useful knowledge and skills to their work than did workers a century ago.

Moreover, the technological changes that have occurred within the past 100 years have greatly reduced the time and effort required to produce most goods and services. Automated production has become commonplace. Innovations in transportation (automobiles, trucks, and airplanes) have made the movement of goods and people cheaper and faster. A dizzying array of new materials is available for manufacturing. And the development of modern information technology—including computers, software, and communications equipment—that seemed to proceed at breathtaking pace especially during the final years of the last century and continuing to the present has transformed the way we live and work.

Look again at the technological changes of the last few years described in the Case in Point on advances in technology. Those examples of technological progress through applications of computer technology—from new ways of mapping oil deposits to new methods of milking cows—helped propel the United States and other economies to dramatic gains in the ability to produce goods and services. They have helped shift the countries' production possibilities curve outward. They have helped fuel economic growth.

Waiting for Growth

One key to growth is, in effect, the willingness to wait, to postpone current consumption in order to enhance future productive capability. When Stone Age people fashioned the first tools, they were spending time building capital rather than engaging in consumption. They delayed current consumption to enhance their future consumption; the tools they made would make them more productive in the future.

Resources society could have used to produce consumer goods are being used to produce new capital goods and new knowledge for production instead—all to enhance future production. An even more important source of growth in many nations has been increased human capital. Increases in human capital often require the postponement of consumption. If you are a college student, you are engaged in precisely this effort. You are devoting time to study that could have been spent working, earning income, and thus engaging in a higher level of consumption. If you are like most students, you are making this choice to postpone consumption because you expect it will allow you to earn more income, and thus enjoy greater consumption, in the future.

Think of an economy as being able to produce two goods, capital and consumer goods (those destined for immediate use by consumers). By focusing on the production of consumer goods, the people in the economy will be able to enjoy a higher standard of living today. If they reduce their consumption—and their standard of living—today to enhance their ability to produce goods and services in the future, they will be able to shift their production possibilities curve outward. That may allow them to produce even more consumer goods. A decision for greater growth typically involves the sacrifice of present consumption.

Arenas for Choice: A Comparison of Economic Systems

Under what circumstances will a nation achieve efficiency in the use of its factors of production? The discussion above suggested that Christie Ryder would have an incentive to allocate her plants efficiently because by doing so she could achieve greater output of skis and snowboards than would be possible from inefficient production. But why would she want to produce more of these two goods—or of any goods? Why would decision makers throughout the economy want to achieve such efficiency?

Economists assume that privately owned firms seek to maximize their profits. The drive to maximize profits will lead firms such as Alpine Sports to allocate resources efficiently to gain as much production as possible from their factors of production. But whether firms will seek to maximize profits depends on the nature of the economic system within which they operate.

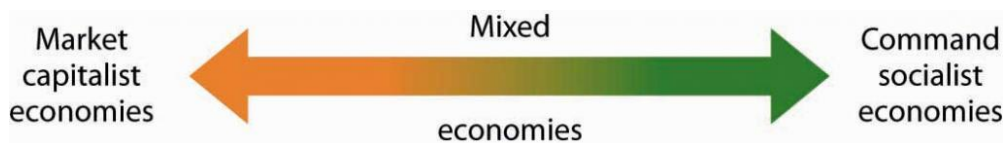
Classifying Economic Systems

Each of the world's economies can be viewed as operating somewhere on a spectrum between market capitalism and command socialism. In a market capitalist economy, resources are generally owned by private individuals who have the power to make decisions about their use. A market capitalist system is often referred to as a free enterprise economic system. In a command socialist economy, the government is the primary owner of capital and natural resources and has broad power to allocate the use of factors of production. Between these two categories lie mixed economies that combine elements of market capitalist and of command socialist economic systems.

No economy represents a pure case of either market capitalism or command socialism. While we talk about capitalist leaning economies and command leaning economies, it is safe to say that all economies of the world are mixed economies. To determine where an economy lies between these two types of systems, we evaluate the extent of government ownership of capital and natural resources and the degree to which government is involved in decisions about the use of factors of production.

Figure 2.11 suggests the spectrum of economic systems. Market capitalist economies lie toward the left end of this spectrum; command socialist economies appear toward the right. Mixed economies lie in between.

Figure 2.11 Economic Systems



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CHAPTER OVERVIEW

3: Demand and Supply

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[3.3: Demand, Supply, and Equilibrium](#)

[3.4: Government Intervention - Price Floors and Price Ceilings](#)

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3.1: Demand

Learning Objective

1. Define the quantity demanded of a good or service and illustrate it using a demand schedule and a demand curve.
2. Distinguish between the following pairs of concepts: demand and quantity demanded, demand schedule and demand curve, movement along and shift in a demand curve.
3. Identify demand shifters and determine whether a change in a demand shifter causes the demand curve to shift to the right or to the left.

How many pizzas will people eat this year? How many doctor visits will people make? How many houses will people buy?

Each good or service has its own special characteristics that determine the quantity people are willing and able to consume. One is the price of the good or service itself. Other independent variables that are important determinants of demand include consumer preferences, prices of related goods and services, income, demographic characteristics such as population size, and buyer expectations. The number of pizzas people will purchase, for example, depends very much on whether they like pizza. It also depends on the prices for alternatives such as hamburgers or spaghetti. The number of doctor visits is likely to vary with income—people with higher incomes are likely to see a doctor more often than people with lower incomes. The demands for pizza, for doctor visits, and for housing are certainly affected by the age distribution of the population and its size.

While different variables play different roles in influencing the demands for different goods and services, economists pay special attention to one: the price of the good or service. Given the values of all the other variables that affect demand, a higher price tends to reduce the quantity people demand, and a lower price tends to increase it. A medium pizza typically sells for \$5 to \$10. Suppose the price were \$30. Chances are, you would buy fewer pizzas at that price than you do now. Suppose pizzas typically sold for \$2 each. At that price, people would be likely to buy more pizzas than they do now.

We will discuss first how price affects the quantity demanded of a good or service and then how other variables affect demand.

Price and the Demand Curve

Because people will purchase different quantities of a good or service at different prices, economists must be careful when speaking of the “demand” for something. They have therefore developed some specific terms for expressing the general concept of demand.

The quantity demanded of a good or service is the quantity buyers are willing and able to buy at a particular price during a particular period, all other things unchanged. (As we learned, we can substitute the Latin phrase “*ceteris paribus*” for “all other things unchanged.”) Suppose, for example, that 100,000 movie tickets are sold each month in a particular town at a price of \$8 per ticket. That quantity—100,000—is the quantity of movie admissions demanded per month at a price of \$8. If the price were \$12, we would expect the quantity demanded to be less. If it were \$4, we would expect the quantity demanded to be greater. The quantity demanded at each price would be different if other things that might affect it, such as the population of the town, were to change. That is why we add the qualifier that other things have not changed to the definition of quantity demanded.

A demand schedule is a table that shows the quantities of a good or service demanded at different prices during a particular period, all other things unchanged. To introduce the concept of a demand schedule, let us consider the demand for coffee in the United States. We will ignore differences among types of coffee beans and roasts, and speak simply of coffee. The table in Figure 3.1 shows quantities of coffee that will be demanded each month at prices ranging from \$9 to \$4 per pound; the table is a demand schedule. We see that the higher the price, the lower the quantity demanded.

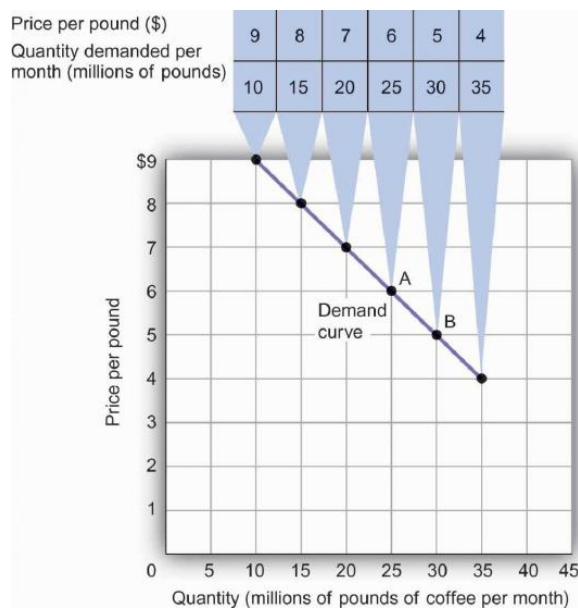


Figure 3.1 A Demand Schedule and a Demand Curve: The table is a demand schedule; it shows quantities of coffee demanded per month in the United States at particular prices, all other things unchanged. These data are then plotted on the demand curve. At point A on the curve, 25 million pounds of coffee per month are demanded at a price of \$6 per pound. At point B, 30 million pounds of coffee per month are demanded at a price of \$5 per pound.

The information given in a demand schedule can be presented with a demand curve, which is a graphical representation of a demand schedule. A demand curve thus shows the relationship between the price and quantity demanded of a good or service during a particular period, all other things unchanged. The demand curve in Figure 3.1 shows the prices and quantities of coffee demanded that are given in the demand schedule. At point A, for example, we see that 25 million pounds of coffee per month are demanded at a price of \$6 per pound. By convention, economists graph price on the vertical axis and quantity on the horizontal axis.

Price alone does not determine the quantity of coffee or any other good that people buy. To isolate the effect of changes in price on the quantity of a good or service demanded, however, we show the quantity demanded at each price, assuming that those other variables remain unchanged. We do the same thing in drawing a graph of the relationship between any two variables; we assume that the values of other variables that may affect the variables shown in the graph (such as income or population) remain unchanged for the period under consideration.

A change in price, with no change in any of the other variables that affect demand, results in a movement *along* the demand curve. For example, if the price of coffee falls from \$6 to \$5 per pound, consumption rises from 25 million pounds to 30 million pounds per month. That is a movement from point A to point B along the demand curve in Figure 3.1. A movement along a demand curve that results from a change in price is called a change in quantity demanded. Note that a change in quantity demanded is not a change or shift in the demand curve; it is a movement *along* the demand curve.

The negative slope of the demand curve in Figure 3.1 suggests a key behavioral relationship of economics. All other things unchanged, the law of demand holds that, for virtually all goods and services, a higher price leads to a reduction in quantity demanded and a lower price leads to an increase in quantity demanded.

The law of demand is called a law because the results of countless studies are consistent with it. Undoubtedly, you have observed one manifestation of the law. When a store finds itself with an overstock of some item, such as running shoes or tomatoes, and needs to sell these items quickly, what does it do? It typically has a sale, expecting that a lower price will increase the quantity demanded. In general, we expect the law of demand to hold. Given the values of other variables that influence demand, a higher price reduces the quantity demanded. A lower price increases the quantity demanded. Demand curves, in short, slope downward.

Changes in Demand

Of course, price alone does not determine the quantity of a good or service that people consume. Coffee consumption, for example, will be affected by such variables as income and population. Preferences also play a role. We also expect other prices to affect

coffee consumption. People often eat doughnuts or bagels with their coffee, so a reduction in the price of doughnuts or bagels might induce people to drink more coffee. An alternative to coffee is tea, so a reduction in the price of tea might result in the consumption of more tea and less coffee. Thus, a change in any one of the variables held constant in constructing a demand schedule will change the quantities demanded at each price. The result will be a *shift* in the entire demand curve rather than a movement along the demand curve. A *shift* in a demand curve is called a change in demand.

Suppose, for example, that something happens to increase the quantity of coffee demanded at each price. Several events could produce such a change: an increase in incomes, an increase in population, or an increase in the price of tea would each be likely to increase the quantity of coffee demanded at each price. Any such change produces a new demand schedule. Figure 3.2 shows such a change in the demand schedule for coffee. We see that the quantity of coffee demanded per month is greater at each price than before. We show that graphically as a shift in the demand curve. The original curve, labeled D_1 , shifts to the right to D_2 . At a price of \$6 per pound, for example, the quantity demanded rises from 25 million pounds per month (point A) to 35 million pounds per month (point A').

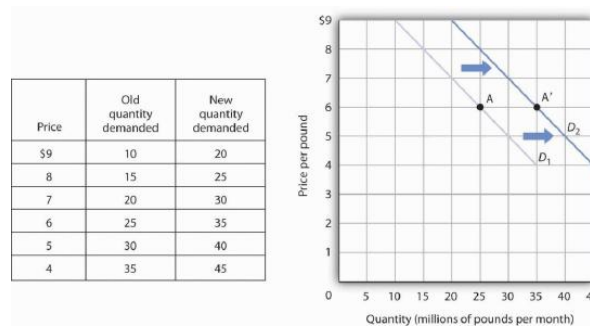


Figure 3.2 An Increase in Demand: An increase in the quantity of a good or service demanded at each price is shown as an increase in demand. Here, the original demand curve D_1 shifts to D_2 . Point A on D_1 corresponds to a price of \$6 per pound and a quantity demanded of 25 million pounds of coffee per month. On the new demand curve D_2 , the quantity demanded at this price rises to 35 million pounds of coffee per month (point A').

Just as demand can increase, it can decrease. In the case of coffee, demand might fall as a result of events such as a reduction in population, a reduction in the price of tea, or a change in preferences. For example, a finding that the caffeine in coffee contributes to heart disease, which is occasionally being debated in the scientific community, could change preferences and reduce the demand for coffee.

A reduction in the demand for coffee is illustrated in Figure 3.3. The demand schedule shows that less coffee is demanded at each price than in Figure 3.1. The result is a shift in demand from the original curve D_1 to D_3 . The quantity of coffee demanded at a price of \$6 per pound falls from 25 million pounds per month (point A) to 15 million pounds per month (point A'').

Note, again, that a change in quantity demanded, *ceteris paribus*, refers to a movement *along* the demand curve, while a change in demand refers to a *shift* in the demand curve.

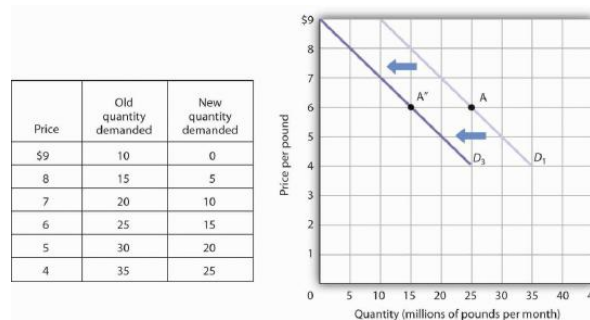


Figure 3.3 A Reduction in Demand: A reduction in demand occurs when the quantities of a good or service demanded fall at each price. Here, the demand schedule shows a lower quantity of coffee demanded at each price than we had in Figure 3.1. The reduction shifts the demand curve for coffee to D_3 from D_1 . The quantity demanded at a price of \$6 per pound, for example, falls from 25 million pounds per month (point A) to 15 million pounds of coffee per month (point A'').

A variable that can change the quantity of a good or service demanded at each price is called a demand shifter. When these other variables change, the all-other-things-unchanged conditions behind the original demand curve no longer hold. Although different goods and services will have different demand shifters, the demand shifters are likely to include (1) consumer preferences, (2) the prices of related goods and services, (3) income, (4) demographic characteristics, and (5) buyer expectations. Next we look at each of these.

Preferences

Changes in preferences of buyers can have important consequences for demand. We have already seen how Starbucks supposedly increased the demand for coffee. Another example is reduced demand for cigarettes caused by concern about the effect of smoking on health. A change in preferences that makes one good or service more popular will shift the demand curve to the right. A change that makes it less popular will shift the demand curve to the left.

Prices of Related Goods and Services

Suppose the price of doughnuts were to fall. Many people who drink coffee enjoy dunking doughnuts in their coffee; the lower price of doughnuts might therefore increase the demand for coffee, shifting the demand curve for coffee to the right. A lower price for tea, however, would be likely to reduce coffee demand, shifting the demand curve for coffee to the left.

In general, if a reduction in the price of one good increases the demand for another, the two goods are called complements. If a reduction in the price of one good reduces the demand for another, the two goods are called substitutes. These definitions hold in reverse as well: two goods are complements if an increase in the price of one reduces the demand for the other, and they are substitutes if an increase in the price of one increases the demand for the other. Doughnuts and coffee are complements; tea and coffee are substitutes. This information is summarized in Figure 3.4.

Complementary goods are goods used in conjunction with one another. Tennis rackets and tennis balls, eggs and bacon, and stationery and postage stamps are complementary goods. Substitute goods are goods used instead of one another. iPods, for example, are likely to be substitutes for CD players. Breakfast cereal is a substitute for eggs. A file attachment to an e-mail is a substitute for both a fax machine and postage stamps.

Figure 3.4: Complements and Substitutes

Complements (coffee and doughnuts)			
	Reducing the price of one...		increases the demand for the other.
	Increasing the price of one...		reduces the demand for the other.
Substitutes (coffee and tea)			
	Increasing the price of one...		increases the demand for the other.
	Reducing the price of one...		reduces the demand for the other.

Income

As incomes rise, people increase their consumption of many goods and services, and as incomes fall, their consumption of these goods and services falls. For example, an increase in income is likely to raise the demand for gasoline, ski trips, new cars, and

jewelry. There are, however, goods and services for which consumption falls as income rises—and rises as income falls. As incomes rise, for example, people tend to consume more fresh fruit but less canned fruit.

A good for which demand increases when income increases is called a normal good. A good for which demand decreases when income increases is called an inferior good. An increase in income shifts the demand curve for fresh fruit (a normal good) to the right; it shifts the demand curve for canned fruit (an inferior good) to the left.

Demographic Characteristics

The number of buyers affects the total quantity of a good or service that will be bought; in general, the greater the population, the greater the demand. Other demographic characteristics can affect demand as well. As the share of the population over age 65 increases, the demand for medical services, ocean cruises, and motor homes increases. The birth rate in the United States fell sharply between 1955 and 1975 but has gradually increased since then. That increase has raised the demand for such things as infant supplies, elementary school teachers, soccer coaches, in-line skates, and college education. Demand can thus shift as a result of changes in both the number and characteristics of buyers.

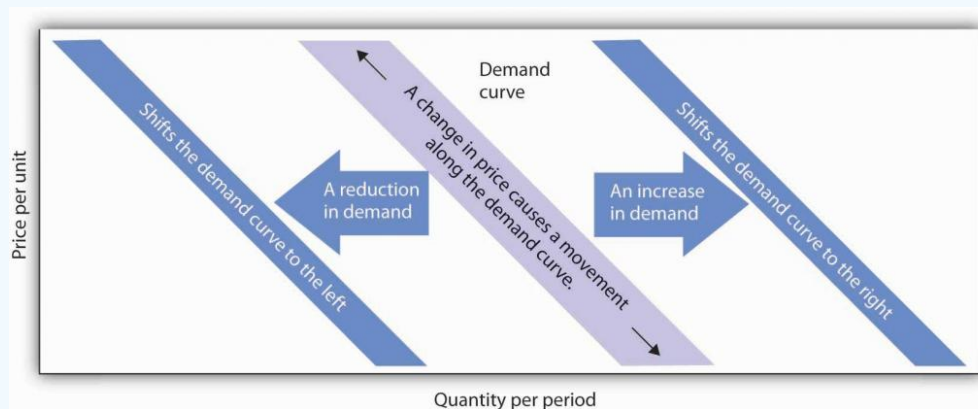
Buyer Expectations

The consumption of goods that can be easily stored, or whose consumption can be postponed, is strongly affected by buyer expectations. The expectation of newer TV technologies, such as high-definition TV, could slow down sales of regular TVs. If people expect gasoline prices to rise tomorrow, they will fill up their tanks today to try to beat the price increase. The same will be true for goods such as automobiles and washing machines: an expectation of higher prices in the future will lead to more purchases today. If the price of a good is expected to fall, however, people are likely to reduce their purchases today and await tomorrow's lower prices. The expectation that computer prices will fall, for example, can reduce current demand.

In Summary

It is crucial to distinguish between a change in quantity demanded, which is a movement along the demand curve caused by a change in price, and a change in demand, which implies a shift of the demand curve itself. A change in demand is caused by a change in a demand shifter. An increase in demand is a shift of the demand curve to the right. A decrease in demand is a shift in the demand curve to the left. Figure 3.5 highlights the difference.

Figure 3.5: Movements vs. Shifts



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3.2: Supply

Learning Objective

1. Define the quantity supplied of a good or service and illustrate it using a supply schedule and a supply curve.
2. Distinguish between the following pairs of concepts: supply and quantity supplied, supply schedule and supply curve, movement along and shift in a supply curve.
3. Identify supply shifters and determine whether a change in a supply shifter causes the supply curve to shift to the right or to the left.

What determines the quantity of a good or service sellers are willing to offer for sale? Price is one factor; *ceteris paribus*, a higher price is likely to induce sellers to offer a greater quantity of a good or service. Production cost is another determinant of supply. Variables that affect production cost include the prices of factors used to produce the good or service, returns from alternative activities, technology, the expectations of sellers, and natural events such as weather changes. Still another factor affecting the quantity of a good that will be offered for sale is the number of sellers—the greater the number of sellers of a particular good or service, the greater will be the quantity offered at any price per time period.

Price and the Supply Curve

The quantity supplied of a good or service is the quantity sellers are willing to sell at a particular price during a particular period, all other things unchanged. *Ceteris paribus*, the receipt of a higher price increases profits and induces sellers to increase the quantity they supply.

In general, when there are many sellers of a good, an increase in price results in an increase in quantity supplied, and this relationship is often referred to as the law of supply. We will see, though, through our exploration of microeconomics, that there are a number of exceptions to this relationship. There are cases in which a higher price will not induce an increase in quantity supplied. Goods that cannot be produced, such as additional land on the corner of Park Avenue and 56th Street in Manhattan, are fixed in supply—a higher price cannot induce an increase in the quantity supplied. There are even cases, which we investigate in microeconomic analysis, in which a higher price induces a reduction in the quantity supplied.

Generally speaking, however, when there are many sellers of a good, an increase in price results in a greater quantity supplied. The relationship between price and quantity supplied is suggested in a supply schedule, a table that shows quantities supplied at different prices during a particular period, all other things unchanged. Figure 3.6 gives a supply schedule for the quantities of coffee that will be supplied per month at various prices, *ceteris paribus*. At a price of \$4 per pound, for example, producers are willing to supply 15 million pounds of coffee per month. A higher price, say \$6 per pound, induces sellers to supply a greater quantity—25 million pounds of coffee per month.

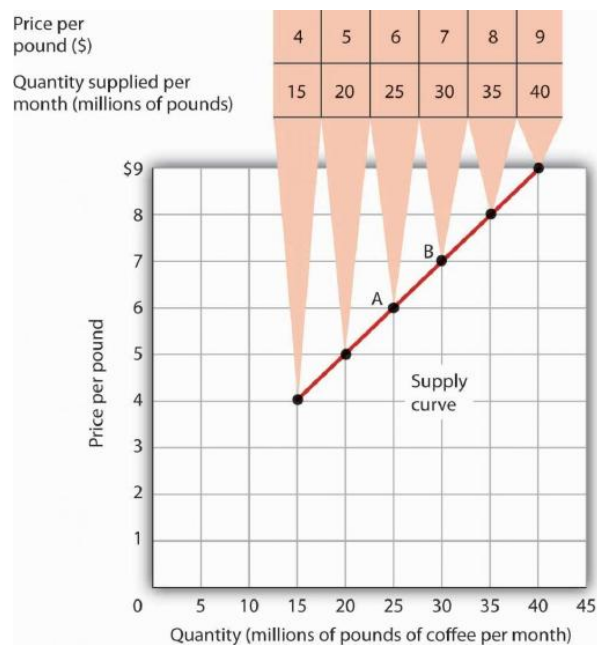


Figure 3.6 A Supply Schedule and a Supply Curve The supply schedule shows the quantity of coffee that will be supplied in the United States each month at particular prices, all other things unchanged. The same information is given graphically in the supply curve. The values given here suggest a positive relationship between price and quantity supplied.

A supply curve is a graphical representation of a supply schedule. It shows the relationship between price and quantity supplied during a particular period, all other things unchanged. Because the relationship between price and quantity supplied is generally positive, supply curves are generally upward sloping. The supply curve for coffee in Figure 3.6 shows graphically the values given in the supply schedule.

A change in price causes a movement *along* the supply curve; such a movement is called a change in quantity supplied. As is the case with a change in quantity demanded, a change in quantity supplied does not shift the supply curve. By definition, it is a movement along the supply curve. For example, if the price rises from \$6 per pound to \$7 per pound, the quantity supplied rises from 25 million pounds per month to 30 million pounds per month. That's a movement from point A to point B along the supply curve in Figure 3.6.

Changes in Supply

When we draw a supply curve, we assume that other variables that affect the willingness of sellers to supply a good or service are unchanged. It follows that a change in any of those variables will cause a change in supply, which is a shift in the supply curve. A change that increases the quantity of a good or service supplied at each price shifts the supply curve to the right. Suppose, for example, that the price of fertilizer falls. That will reduce the cost of producing coffee and thus increase the quantity of coffee producers will offer for sale at each price. The supply schedule in Figure 3.7 shows an increase in the quantity of coffee supplied at each price. We show the increase graphically as a shift in the supply curve from S_1 to S_2 . We see that the quantity supplied at each price increases by 10 million pounds of coffee per month. At point A on the original supply curve S_1 , for example, 25 million pounds of coffee per month are supplied at a price of \$6 per pound. After the increase in supply, 35 million pounds per month are supplied at the same price (point A' on curve S_2).

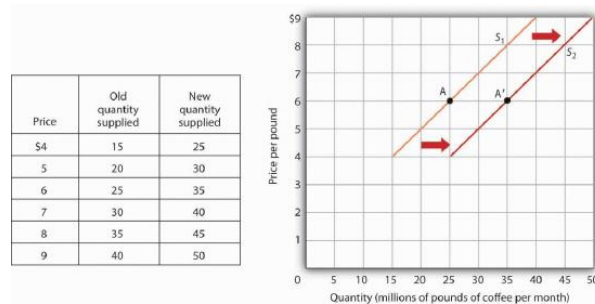


Figure 3.7 An Increase in Supply If there is a change in supply that increases the quantity supplied at each price, as is the case in the supply schedule here, the supply curve shifts to the right. At a price of \$6 per pound, for example, the quantity supplied rises from the previous level of 25 million pounds per month on supply curve S_1 (point A) to 35 million pounds per month on supply curve S_2 (point A').

An event that reduces the quantity supplied at each price shifts the supply curve to the left. An increase in production costs and excessive rain that reduces the yields from coffee plants are examples of events that might reduce supply. Figure 3.8 shows a reduction in the supply of coffee. We see in the supply schedule that the quantity of coffee supplied falls by 10 million pounds of coffee per month at each price. The supply curve thus shifts from S_1 to S_3 .

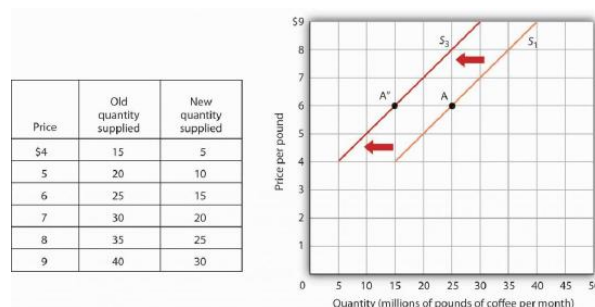


Figure 3.8 A Reduction in Supply A change in supply that reduces the quantity supplied at each price shifts the supply curve to the left. At a price of \$6 per pound, for example, the original quantity supplied was 25 million pounds of coffee per month (point A). With a new supply curve S_3 , the quantity supplied at that price falls to 15 million pounds of coffee per month (point A'').

A variable that can change the quantity of a good or service supplied at each price is called a supply shifter. Supply shifters include (1) prices of factors of production, (2) returns from alternative activities, (3) technology, (4) seller expectations, (5) natural events, and (6) the number of sellers. When these other variables change, the all-other-things-unchanged conditions behind the original supply curve no longer hold. Let us look at each of the supply shifters.

Prices of Factors of Production

A change in the price of labor or some other factor of production will change the cost of producing any given quantity of the good or service. This change in the cost of production will change the quantity that suppliers are willing to offer at any price. An increase in factor prices should decrease the quantity suppliers will offer at any price, shifting the supply curve to the left. A reduction in factor prices increases the quantity suppliers will offer at any price, shifting the supply curve to the right.

Suppose coffee growers must pay a higher wage to the workers they hire to harvest coffee or must pay more for fertilizer. Such increases in production cost will cause them to produce a smaller quantity at each price, shifting the supply curve for coffee to the left. A reduction in any of these costs increases supply, shifting the supply curve to the right.

Returns from Alternative Activities

To produce one good or service means forgoing the production of another. The concept of opportunity cost in economics suggests that the value of the activity forgone is the opportunity cost of the activity chosen; this cost should affect supply. For example, one opportunity cost of producing eggs is not selling chickens. An increase in the price people are willing to pay for fresh chicken

would make it more profitable to sell chickens and would thus increase the opportunity cost of producing eggs. It would shift the supply curve for eggs to the left, reflecting a decrease in supply.

Technology

A change in technology alters the combinations of inputs or the types of inputs required in the production process. An improvement in technology usually means that fewer and/or less costly inputs are needed. If the cost of production is lower, the profits available at a given price will increase, and producers will produce more. With more produced at every price, the supply curve will shift to the right, meaning an increase in supply.

Impressive technological changes have occurred in the computer industry in recent years. Computers are much smaller and are far more powerful than they were only a few years ago—and they are much cheaper to produce. The result has been a huge increase in the supply of computers, shifting the supply curve to the right.

While we usually think of technology as enhancing production, declines in production due to problems in technology are also possible. Outlawing the use of certain equipment without pollution-control devices has increased the cost of production for many goods and services, thereby reducing profits available at any price and shifting these supply curves to the left.

Seller Expectations

All supply curves are based in part on seller expectations about future market conditions. Many decisions about production and selling are typically made long before a product is ready for sale. Those decisions necessarily depend on expectations. Changes in seller expectations can have important effects on price and quantity.

Consider, for example, the owners of oil deposits. Oil pumped out of the ground and used today will be unavailable in the future. If a change in the international political climate leads many owners to expect that oil prices will rise in the future, they may decide to leave their oil in the ground, planning to sell it later when the price is higher. Thus, there will be a decrease in supply; the supply curve for oil will shift to the left.

Natural Events

Storms, insect infestations, and drought affect agricultural production and thus the supply of agricultural goods. If something destroys a substantial part of an agricultural crop, the supply curve will shift to the left. The terrible cyclone that killed more than 50,000 people in Myanmar in 2008 also destroyed some of the country's prime rice growing land. That shifted the supply curve for rice to the left. If there is an unusually good harvest, the supply curve will shift to the right.

The Number of Sellers

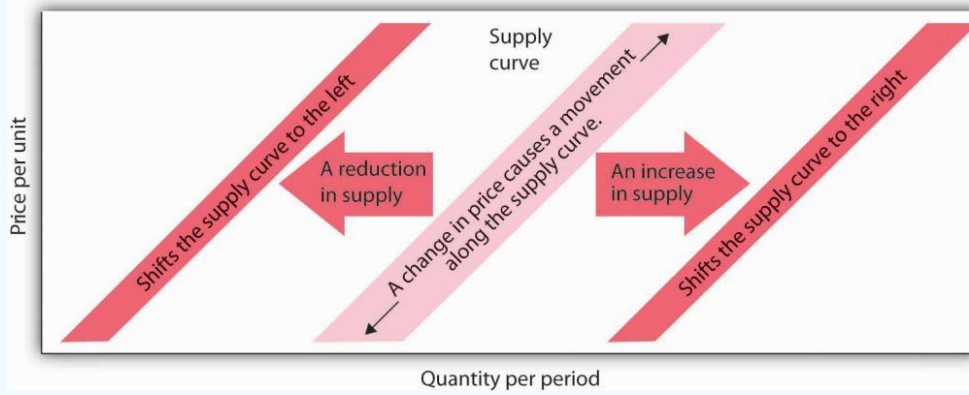
The supply curve for an industry, such as coffee, includes all the sellers in the industry. A change in the number of sellers in an industry changes the quantity available at each price and thus changes supply. An increase in the number of sellers supplying a good or service shifts the supply curve to the right; a reduction in the number of sellers shifts the supply curve to the left.

The market for cellular phone service has been affected by an increase in the number of firms offering the service. Over the past decade, new cellular phone companies emerged, shifting the supply curve for cellular phone service to the right.

In Summary

It is crucial to distinguish between a change in quantity supplied, which is a movement along the supply curve caused by a change in price, and a change in supply, which implies a shift of the supply curve itself. A change in supply is caused by a change in a supply shifter. An increase in supply is a shift of the supply curve to the right. A decrease in supply is a shift in the supply curve to the left. Figure 3.9 highlights the difference.

Figure 3.9 Movements vs. Shifters



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3.3: Demand, Supply, and Equilibrium

Learning Objective

1. Use demand and supply to explain how equilibrium price and quantity are determined in a market.
2. Understand the concepts of surpluses and shortages and the pressures on price they generate.
3. Explain the impact of a change in demand or supply on equilibrium price and quantity.
4. Explain how the circular flow model provides an overview of demand and supply in product and factor markets and how the model suggests ways in which these markets are linked.

In this section we combine the demand and supply curves we have just studied into a new model. The model of demand and supply uses demand and supply curves to explain the determination of price and quantity in a market.

The Determination of Price and Quantity

The logic of the model of demand and supply is simple. The demand curve shows the quantities of a particular good or service that buyers will be willing and able to purchase at each price during a specified period. The supply curve shows the quantities that sellers will offer for sale at each price during that same period. By putting the two curves together, we should be able to find a price at which the quantity buyers are willing and able to purchase equals the quantity sellers will offer for sale.

Figure 3.10 combines the demand and supply data introduced in Figure 3.1 and Figure 3.6. Notice that the two curves intersect at a price of \$6 per pound—at this price the quantities demanded and supplied are equal. Buyers want to purchase, and sellers are willing to offer for sale, 25 million pounds of coffee per month. The market for coffee is in equilibrium. Unless the demand or supply curve shifts, there will be no tendency for price to change. The equilibrium price in any market is the price at which quantity demanded equals quantity supplied. The equilibrium price in the market for coffee is thus \$6 per pound. The equilibrium quantity is the quantity demanded and supplied at the equilibrium price.



Figure 3.10 The Determination of Equilibrium Price and Quantity: When we combine the demand and supply curves for a good in a single graph, the point at which they intersect identifies the equilibrium price and equilibrium quantity. Here, the equilibrium price is \$6 per pound. Consumers demand, and suppliers supply, 25 million pounds of coffee per month at this price.

With an upward-sloping supply curve and a downward-sloping demand curve, there is only a single price at which the two curves intersect. This means there is only one price at which equilibrium is achieved. It follows that at any price other than the equilibrium price, the market will not be in equilibrium. We next examine what happens at prices other than the equilibrium price.

Surpluses

Figure 3.11 shows the same demand and supply curves we have just examined, but this time the initial price is \$8 per pound of coffee. Because we no longer have a balance between quantity demanded and quantity supplied, this price is not the equilibrium price. At a price of \$8, we read over to the demand curve to determine the quantity of coffee consumers will be willing to buy—15 million pounds per month. The supply curve tells us what sellers will offer for sale—35 million pounds per month. The difference, 20 million pounds of coffee per month, is called a surplus. More generally, a surplus is the amount by which the quantity supplied exceeds the quantity demanded at the current price. There is, of course, no surplus at the equilibrium price; a surplus occurs only if the current price exceeds the equilibrium price.

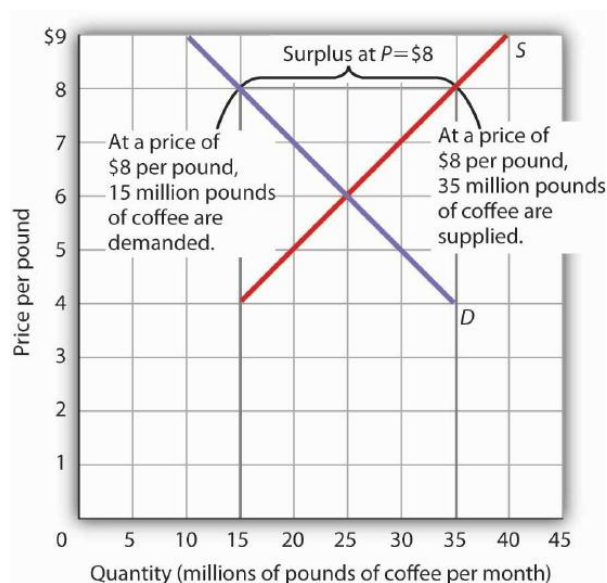


Figure 3.11 A Surplus in the Market for Coffee At a price of \$8, the quantity supplied is 35 million pounds of coffee per month and the quantity demanded is 15 million pounds per month; there is a surplus of 20 million pounds of coffee per month. Given a surplus, the price will fall quickly toward the equilibrium level of \$6.

A surplus in the market for coffee will not last long. With unsold coffee on the market, sellers will begin to reduce their prices to clear out unsold coffee. As the price of coffee begins to fall, the quantity of coffee supplied begins to decline. At the same time, the quantity of coffee demanded begins to rise. Remember that the reduction in quantity supplied is a movement *along* the supply curve—the curve itself does not shift in response to a reduction in price. Similarly, the increase in quantity demanded is a movement *along* the demand curve—the demand curve does not shift in response to a reduction in price. Price will continue to fall until it reaches its equilibrium level, at which the demand and supply curves intersect. At that point, there will be no tendency for price to fall further. In general, surpluses in the marketplace are short-lived. The prices of most goods and services adjust quickly, eliminating the surplus. Later on, we will discuss some markets in which adjustment of price to equilibrium may occur only very slowly or not at all.

Shortages

Just as a price above the equilibrium price will cause a surplus, a price below equilibrium will cause a shortage. A shortage is the amount by which the quantity demanded exceeds the quantity supplied at the current price.

Figure 3.12 shows a shortage in the market for coffee. Suppose the price is \$4 per pound. At that price, 15 million pounds of coffee would be supplied per month, and 35 million pounds would be demanded per month. When more coffee is demanded than supplied, there is a shortage.

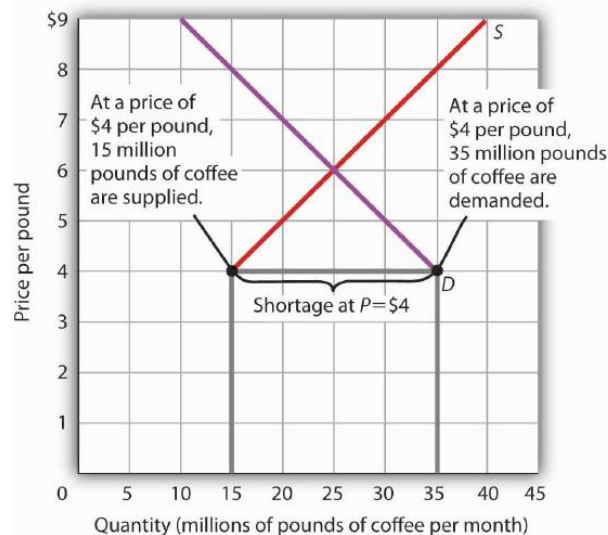


Figure 3.12 A Shortage in the Market for Coffee: At a price of \$4 per pound, the quantity of coffee demanded is 35 million pounds per month and the quantity supplied is 15 million pounds per month. The result is a shortage of 20 million pounds of coffee per month.

In the face of a shortage, sellers are likely to begin to raise their prices. As the price rises, there will be an increase in the quantity supplied (but not a change in supply) and a reduction in the quantity demanded (but not a change in demand) until the equilibrium price is achieved.

Shifts in Demand and Supply

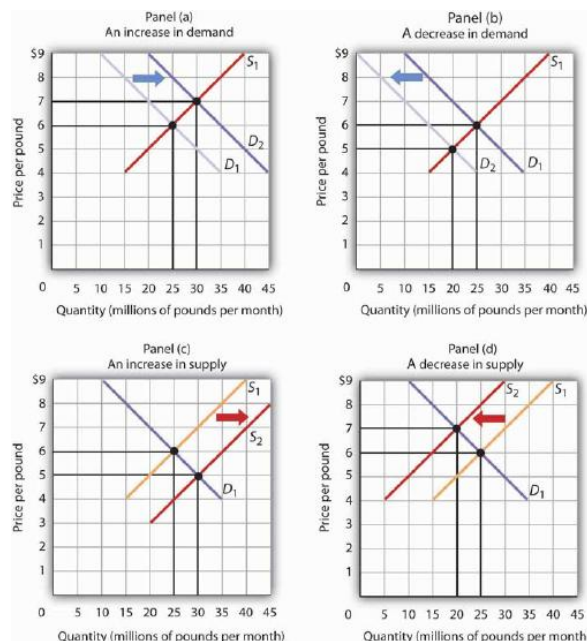


Figure 3.13 Changes in Demand and Supply: A change in demand or in supply changes the equilibrium solution in the model. Panels (a) and (b) show an increase and a decrease in demand, respectively; Panels (c) and (d) show an increase and a decrease in supply, respectively.

A change in one of the variables (shifters) held constant in any model of demand and supply will create a change in demand or supply. A shift in a demand or supply curve changes the equilibrium price and equilibrium quantity for a good or service. Figure 3.13 combines the information about changes in the demand and supply of coffee presented in Figure 3.2, Figure 3.3, Figure 3.7 and

Figure 3.8 In each case, the original equilibrium price is \$6 per pound, and the corresponding equilibrium quantity is 25 million pounds of coffee per month. Figure 3.13 shows what happens with an increase in demand, a reduction in demand, an increase in supply, and a reduction in supply. We then look at what happens if both curves shift simultaneously. Each of these possibilities is discussed in turn below.

An Increase in Demand

An increase in demand for coffee shifts the demand curve to the right, as shown in Panel (a) of Figure 3.13. The equilibrium price rises to \$7 per pound. As the price rises to the new equilibrium level, the quantity supplied increases to 30 million pounds of coffee per month. Notice that the supply curve does not shift; rather, there is a movement along the supply curve.

Demand shifters that could cause an increase in demand include a shift in preferences that leads to greater coffee consumption; a lower price for a complement to coffee, such as doughnuts; a higher price for a substitute for coffee, such as tea; an increase in income; and an increase in population. A change in buyer expectations, perhaps due to predictions of bad weather lowering expected yields on coffee plants and increasing future coffee prices, could also increase current demand.

A Decrease in Demand

Panel (b) of Figure 3.13 shows that a decrease in demand shifts the demand curve to the left. The equilibrium price falls to \$5 per pound. As the price falls to the new equilibrium level, the quantity supplied decreases to 20 million pounds of coffee per month.

Demand shifters that could reduce the demand for coffee include a shift in preferences that makes people want to consume less coffee; an increase in the price of a complement, such as doughnuts; a reduction in the price of a substitute, such as tea; a reduction in income; a reduction in population; and a change in buyer expectations that leads people to expect lower prices for coffee in the future.

An Increase in Supply

An increase in the supply of coffee shifts the supply curve to the right, as shown in Panel (c) of Figure 3.13. The equilibrium price falls to \$5 per pound. As the price falls to the new equilibrium level, the quantity of coffee demanded increases to 30 million pounds of coffee per month. Notice that the demand curve does not shift; rather, there is movement along the demand curve.

Possible supply shifters that could increase supply include a reduction in the price of an input such as labor, a decline in the returns available from alternative uses of the inputs that produce coffee, an improvement in the technology of coffee production, good weather, and an increase in the number of coffee-producing firms.

A Decrease in Supply

Panel (d) of Figure 3.13 shows that a decrease in supply shifts the supply curve to the left. The equilibrium price rises to \$7 per pound. As the price rises to the new equilibrium level, the quantity demanded decreases to 20 million pounds of coffee per month.

Possible supply shifters that could reduce supply include an increase in the prices of inputs used in the production of coffee, an increase in the returns available from alternative uses of these inputs, a decline in production because of problems in technology (perhaps caused by a restriction on pesticides used to protect coffee beans), a reduction in the number of coffee-producing firms, or a natural event, such as excessive rain.

Simultaneous Shifts

As we have seen, when *either* the demand or the supply curve shifts, the results are unambiguous; that is, we know what will happen to both equilibrium price and equilibrium quantity, so long as we know whether demand or supply increased or decreased. However, in practice, several events may occur at around the same time that cause *both* the demand and supply curves to shift. To figure out what happens to equilibrium price and equilibrium quantity, we must know not only in which direction the demand and supply curves have shifted but also the relative amount by which each curve shifts. Of course, the demand and supply curves could shift in the same direction or in opposite directions, depending on the specific events causing them to shift.

For example, all three panels of Figure 3.14 show a decrease in demand for coffee (caused perhaps by a decrease in the price of a substitute good, such as tea) and a simultaneous decrease in the supply of coffee (caused perhaps by bad weather). Since reductions in demand and supply, considered separately, each cause the equilibrium quantity to fall, the impact of both curves shifting simultaneously to the left means that the new equilibrium quantity of coffee is less than the old equilibrium quantity. The effect on

the equilibrium price, though, is ambiguous. Whether the equilibrium price is higher, lower, or unchanged depends on the extent to which each curve shifts.

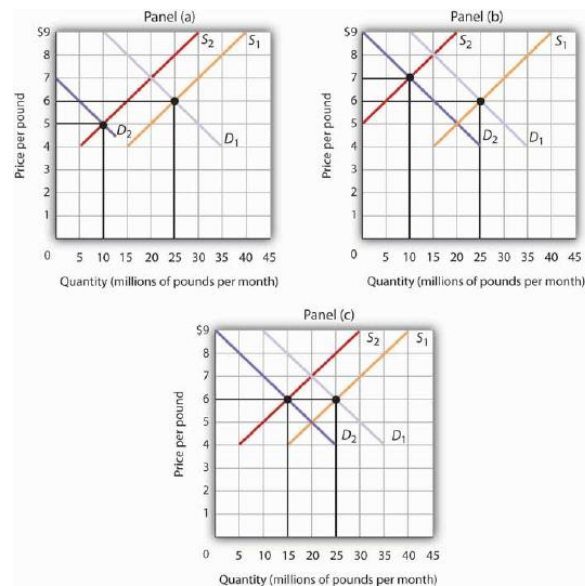


Figure 3.14 Simultaneous Decreases in Demand and Supply: Both the demand and the supply of coffee decrease. Since decreases in demand and supply, considered separately, each cause equilibrium quantity to fall, the impact of both decreasing simultaneously means that a new equilibrium quantity of coffee must be less than the old equilibrium quantity. In Panel (a), the demand curve shifts farther to the left than does the supply curve, so equilibrium price falls. In Panel (b), the supply curve shifts farther to the left than does the demand curve, so the equilibrium price rises. In Panel (c), both curves shift to the left by the same amount, so equilibrium price stays the same.

If the demand curve shifts farther to the left than does the supply curve, as shown in Panel (a) of Figure 3.14, then the equilibrium price will be lower than it was before the curves shifted. In this case the new equilibrium price falls from \$6 per pound to \$5 per pound. If the shift to the left of the supply curve is greater than that of the demand curve, the equilibrium price will be higher than it was before, as shown in Panel (b). In this case, the new equilibrium price rises to \$7 per pound. In Panel (c), since both curves shift to the left by the same amount, equilibrium price does not change; it remains \$6 per pound.

Regardless of the scenario, changes in equilibrium price and equilibrium quantity resulting from two different events need to be considered separately. If both events cause equilibrium price or quantity to move in the same direction, then clearly price or quantity can be expected to move in that direction. If one event causes price or quantity to rise while the other causes it to fall, the extent by which each curve shifts is critical to figuring out what happens. Figure 3.15 summarizes what may happen to equilibrium price and quantity when demand and supply both shift.

		Shift in supply	
		Decrease in supply	Increase in supply
Shift in demand	Decrease in demand	Equilibrium price ? Equilibrium quantity ↓	Equilibrium price ↓ Equilibrium quantity ?
	Increase in demand	Equilibrium price ↑ Equilibrium quantity ?	Equilibrium price ? Equilibrium quantity ↑

Figure 3.15 Simultaneous Shifts in Demand and Supply If simultaneous shifts in demand and supply cause equilibrium price or quantity to move in the same direction, then equilibrium price or quantity clearly moves in that direction. If the shift in one of the curves causes equilibrium price or quantity to rise while the shift in the other curve causes equilibrium price or quantity to fall, then the relative amount by which each curve shifts is critical to figuring out what happens to that variable.

As demand and supply curves shift, prices adjust to maintain a balance between the quantity of a good demanded and the quantity supplied. If prices did not adjust, this balance could not be maintained.

Notice that the demand and supply curves that we have examined in this chapter have all been drawn as linear. This simplification of the real world makes the graphs a bit easier to read without sacrificing the essential point: whether the curves are linear or nonlinear, demand curves are downward sloping and supply curves are generally upward sloping. As circumstances that shift the demand curve or the supply curve change, we can analyze what will happen to price and what will happen to quantity.

An Overview of Demand and Supply: The Circular Flow Model

Implicit in the concepts of demand and supply is a constant interaction and adjustment that economists illustrate with the circular flow model. The circular flow model provides a look at how markets work and how they are related to each other. It shows flows of spending and income through the economy.

A great deal of economic activity can be thought of as a process of exchange between households and firms. Firms supply goods and services to households. Households buy these goods and services from firms. Households supply factors of production—labor, capital, and natural resources—that firms require. The payments firms make in exchange for these factors represent the incomes households earn.

The flow of goods and services, factors of production, and the payments they generate is illustrated in Figure 3.16. This circular flow model of the economy shows the interaction of households and firms as they exchange goods and services and factors of production. For simplicity, the model here shows only the private domestic economy; it omits the government and foreign sectors.

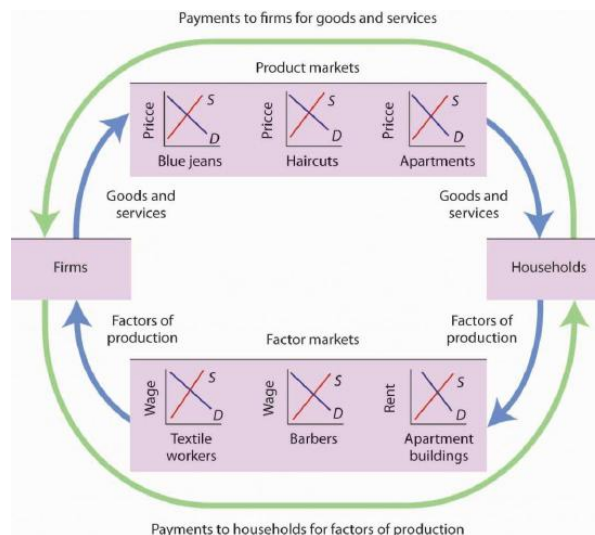


Figure 3.16 The Circular Flow of Economic Activity: This simplified circular flow model shows flows of spending between households and firms through product and factor markets. The inner arrows show goods and services flowing from firms to households and factors of production flowing from households to firms. The outer flows show the payments for goods, services, and factors of production. These flows, in turn, represent millions of individual markets for products and factors of production.

The circular flow model shows that goods and services that households demand are supplied by firms in product markets. The exchange for goods and services is shown in the top half of Figure 3.16. The bottom half of the exhibit illustrates the exchanges that take place in factor markets. factor markets are markets in which households supply factors of production—labor, capital, and natural resources—demanded by firms.

Our model is called a circular flow model because households use the income they receive from their supply of factors of production to buy goods and services from firms. Firms, in turn, use the payments they receive from households to pay for their factors of production.

The demand and supply model developed in this chapter gives us a basic tool for understanding what is happening in each of these product or factor markets and also allows us to see how these markets are interrelated. In Figure 3.16, markets for three goods and services that households want—blue jeans, haircuts, and apartments—create demands by firms for textile workers, barbers, and apartment buildings. The equilibrium of supply and demand in each market determines the price and quantity of that item. Moreover, a change in equilibrium in one market will affect equilibrium in related markets. For example, an increase in the demand for haircuts would lead to an increase in demand for barbers. Equilibrium price and quantity could rise in both markets. For some purposes, it will be adequate to simply look at a single market, whereas at other times we will want to look at what happens in related markets as well.

In either case, the model of demand and supply is one of the most widely used tools of economic analysis. That widespread use is no accident. The model yields results that are, in fact, broadly consistent with what we observe in the marketplace. Your mastery of this model will pay big dividends in your study of economics.

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3.4: Government Intervention - Price Floors and Price Ceilings

Learning Objective

1. Use the model of demand and supply to explain what happens when the government imposes price floors or price ceilings.
2. Discuss the reasons why governments sometimes choose to control prices and the consequences of price control policies.

So far, we have learned that markets tend to move toward their equilibrium prices and quantities. Surpluses and shortages of goods are short-lived as prices adjust to equate quantity demanded with quantity supplied.

In some markets, however, governments have been called on by groups of citizens to intervene to keep prices of certain items higher or lower than what would result from the market finding its own equilibrium price. In this section we will examine agricultural markets and apartment rental markets—two markets that have often been subject to price controls. Through these examples, we will identify the effects of controlling prices. In each case, we will look at reasons why governments have chosen to control prices in these markets and the consequences of these policies.

Agricultural Price Floors

Governments often seek to assist farmers by setting price floors in agricultural markets. A minimum allowable price set above the equilibrium price is a price floor. With a price floor, the government forbids a price below the minimum. (Notice that, if the price floor were for whatever reason set below the equilibrium price, it would be irrelevant to the determination of the price in the market since nothing would prohibit the price from rising to equilibrium.) A price floor that is set above the equilibrium price creates a surplus.

Figure 3.17 shows the market for wheat. Suppose the government sets the price of wheat at P_F . Notice that P_F is above the equilibrium price of P_E . At P_F , we read over to the demand curve to find that the quantity of wheat that buyers will be willing and able to purchase is W_1 bushels. Reading over to the supply curve, we find that sellers will offer W_2 bushels of wheat at the price floor of P_F . Because P_F is above the equilibrium price, there is a surplus of wheat equal to $(W_2 - W_1)$ bushels. The surplus persists because the government does not allow the price to fall.

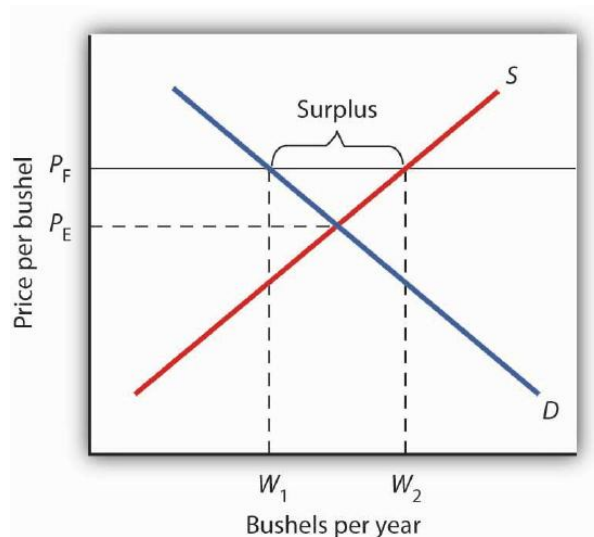


Figure 3.17 Price Floors in Wheat Markets: A price floor for wheat creates a surplus of wheat equal to $(W_2 - W_1)$ bushels.

Why have many governments around the world set price floors in agricultural markets? Farming has changed dramatically over the past two centuries. Technological improvements in the form of new equipment, fertilizers, pesticides, and new varieties of crops have led to dramatic increases in crop output per acre. Worldwide production capacity has expanded markedly. As we have learned, technological improvements cause the supply curve to shift to the right, reducing the price of food. While such price reductions

have been celebrated in, for example, computer markets, farmers have successfully lobbied for government programs aimed at keeping their prices from falling.

While the supply curve for agricultural goods has shifted to the right, the demand has increased with rising population and with rising income. But as incomes rise, people spend a smaller and smaller fraction of their incomes on food. While the demand for food has increased, that increase has not been nearly as great as the increase in supply. Figure 3.18 shows that the supply curve has shifted much farther to the right, from S_1 to S_2 , than the demand curve has, from D_1 to D_2 . As a result, equilibrium quantity has risen dramatically, from Q_1 to Q_2 , and equilibrium price has fallen, from P_1 to P_2 .

On top of this long-term historical trend in agriculture, agricultural prices are subject to wide swings over shorter periods. Droughts or freezes can sharply reduce supplies of particular crops, causing sudden increases in prices. Demand for agricultural goods of one country can suddenly dry up if the government of another country imposes trade restrictions against its products, and prices can fall. Such dramatic shifts in prices and quantities make incomes of farmers unstable.

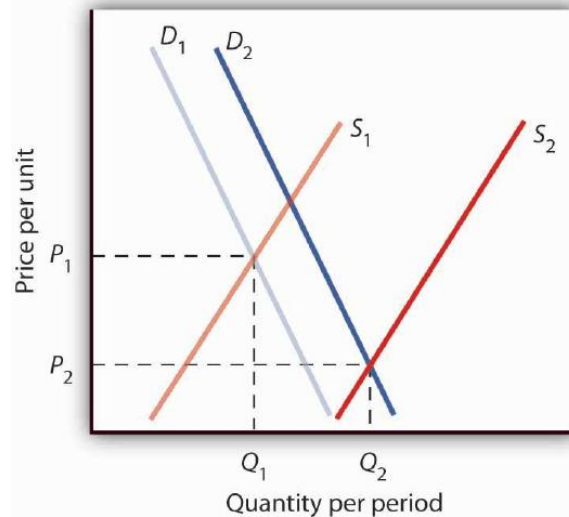


Figure 3.18 Supply and Demand Shifts for Agricultural Products: A relatively large increase in the supply of agricultural products, accompanied by a relatively small increase in demand, has reduced the price received by farmers and increased the quantity of agricultural goods.

The Great Depression of the 1930s led to a major federal role in agriculture. The Depression affected the entire economy, but it hit farmers particularly hard. Prices received by farmers plunged nearly two-thirds from 1930 to 1933. Many farmers had a tough time keeping up mortgage payments. By 1932, more than half of all farm loans were in default.

Farm legislation passed during the Great Depression has been modified many times, but the federal government has continued its direct involvement in agricultural markets. This has meant a variety of government programs that guarantee a minimum price for some types of agricultural products. These programs have been accompanied by government purchases of any surplus, by requirements to restrict acreage in order to limit those surpluses, by crop or production restrictions, and the like.

To see how such policies work, look back at Figure 3.17. At P_F , W_2 bushels of wheat will be supplied. With that much wheat on the market, there is market pressure on the price of wheat to fall. To prevent price from falling, the government buys the surplus of $(W_2 - W_1)$ bushels of wheat, so that only W_1 bushels are actually available to private consumers for purchase on the market. The government can store the surpluses or find special uses for them. For example, surpluses generated in the United States have been shipped to developing countries as grants-in-aid or distributed to local school lunch programs. As a variation on this program, the government can require farmers who want to participate in the price support program to reduce acreage in order to limit the size of the surpluses.

After 1973, the government stopped buying the surpluses (with some exceptions) and simply guaranteed farmers a “target price.” If the average market price for a crop fell below the crop’s target price, the government paid the difference. If, for example, a crop had a market price of \$3 per unit and a target price of \$4 per unit, the government would give farmers a payment of \$1 for each unit sold. Farmers would thus receive the market price of \$3 plus a government payment of \$1 per unit. For farmers to receive these

payments, they had to agree to remove acres from production and to comply with certain conservation provisions. These restrictions sought to reduce the size of the surplus generated by the target price, which acted as a kind of price floor.

What are the effects of such farm support programs? The intention is to boost and stabilize farm incomes. But, with price floors, consumers pay more for food than they would otherwise, and governments spend heavily to finance the programs. With the target price approach, consumers pay less, but government financing of the program continues. U.S. federal spending for agriculture averaged well over \$22 billion per year between 2003 and 2007, roughly \$70 per person.

Help to farmers has sometimes been justified on the grounds that it boosts incomes of “small” farmers. However, since farm aid has generally been allotted on the basis of how much farms produce rather than on a per-farm basis, most federal farm support has gone to the largest farms. If the goal is to eliminate poverty among farmers, farm aid could be redesigned to supplement the incomes of small or poor farmers rather than to undermine the functioning of agricultural markets.

In 1996, the U.S. Congress passed the Federal Agriculture Improvement and Reform Act of 1996, or FAIR. The thrust of the new legislation was to do away with the various programs of price support for most crops and hence provide incentives for farmers to respond to market price signals. To protect farmers through a transition period, the act provided for continued payments that were scheduled to decline over a seven-year period. However, with prices for many crops falling in 1998, the U.S. Congress passed an emergency aid package that increased payments to farmers. In 2008, as farm prices reached record highs, Congress passed a farm bill that increased subsidy payments to \$40 billion. It did, however, for the first time limit payments to the wealthiest farmers. Individual farmers whose farm incomes exceed \$750,000 (or \$1.5 million for couples) would be ineligible for some subsidy programs.

Rental Price Ceilings

The purpose of rent control is to make rental units cheaper for tenants than they would otherwise be. Unlike agricultural price controls, rent control in the United States has been largely a local phenomenon, although there were national rent controls in effect during World War II. Currently, about 200 cities and counties have some type of rent control provisions, and about 10% of rental units in the United States are now subject to price controls. New York City’s rent control program, which began in 1943, is among the oldest in the country. Many other cities in the United States adopted some form of rent control in the 1970s. Rent controls have been pervasive in Europe since World War I, and many large cities in poorer countries have also adopted rent controls.

Rent controls in different cities differ in terms of their flexibility. Some cities allow rent increases for specified reasons, such as to make improvements in apartments or to allow rents to keep pace with price increases elsewhere in the economy. Often, rental housing constructed after the imposition of the rent control ordinances is exempted. Apartments that are vacated may also be decontrolled. For simplicity, the model presented here assumes that apartment rents are controlled at a price that does not change.

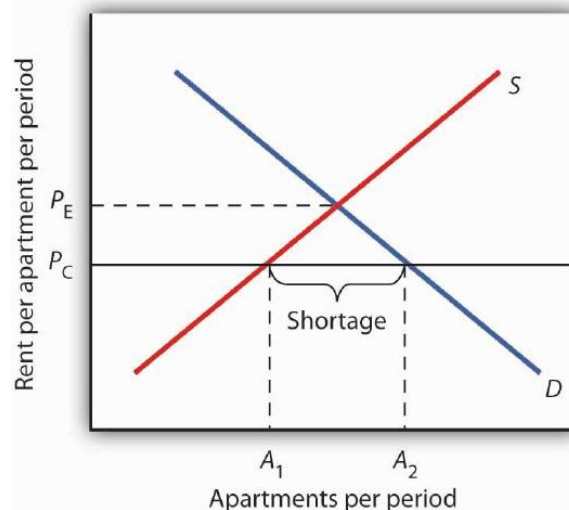


Figure 3.19 Effect of a Price Ceiling on the Market for Apartments A price ceiling on apartment rents that is set below the equilibrium rent creates a shortage of apartments equal to $(A_2 - A_1)$ apartments.

Figure 3.19 shows the market for rental apartments. Notice that the demand and supply curves are drawn to look like all the other demand and supply curves you have encountered so far in this text: the demand curve is downward-sloping and the supply curve is upward-sloping.

The demand curve shows that a higher price (rent) reduces the quantity of apartments demanded. For example, with higher rents, more young people will choose to live at home with their parents. With lower rents, more will choose to live in apartments. Higher rents may encourage more apartment sharing; lower rents would induce more people to live alone.

The supply curve is drawn to show that as rent increases, property owners will be encouraged to offer more apartments to rent. Even though an aerial photograph of a city would show apartments to be fixed at a point in time, owners of those properties will decide how many to rent depending on the amount of rent they anticipate. Higher rents may also induce some homeowners to rent out apartment space. In addition, renting out apartments implies a certain level of service to renters, so that low rents may lead some property owners to keep some apartments vacant.

Rent control is an example of a price ceiling, a maximum allowable price. With a price ceiling, the government forbids a price above the maximum. A price ceiling that is set below the equilibrium price creates a shortage that will persist.

Suppose the government sets the price of an apartment at P_C in Figure 3.19. Notice that P_C is below the equilibrium price of P_E . At P_C , we read over to the supply curve to find that sellers are willing to offer A_1 apartments. Reading over to the demand curve, we find that consumers would like to rent A_2 apartments at the price ceiling of P_C . Because P_C is below the equilibrium price, there is a shortage of apartments equal to $(A_2 - A_1)$. (Notice that if the price ceiling were set above the equilibrium price it would have no effect on the market since the law would not prohibit the price from settling at an equilibrium price that is lower than the price ceiling.)

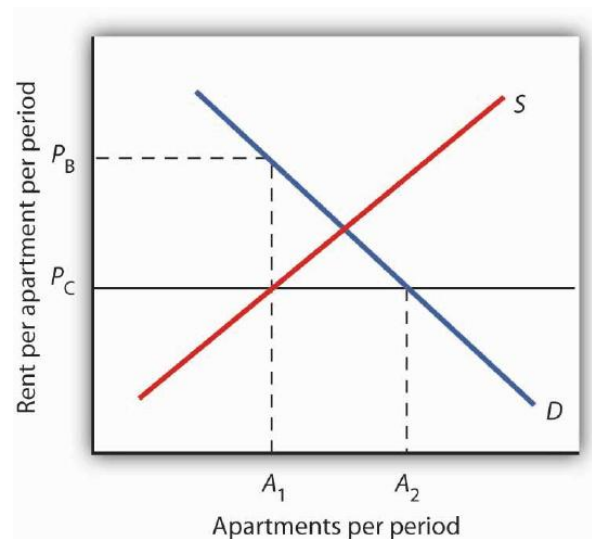


Figure 3.20 The Unintended Consequences of Rent Control Controlling apartment rents at P_C creates a shortage of $(A_2 - A_1)$ apartments. For A_1 apartments, consumers are willing and able to pay P_B , which leads to various “backdoor” payments to apartment owners.

If rent control creates a shortage of apartments, why do some citizens nonetheless clamor for rent control and why do governments often give in to the demands? The reason generally given for rent control is to keep apartments affordable for low- and middle-income tenants.

But the reduced quantity of apartments supplied must be rationed in some way, since, at the price ceiling, the quantity demanded would exceed the quantity supplied. Current occupants may be reluctant to leave their dwellings because finding other apartments will be difficult. As apartments do become available, there will be a line of potential renters waiting to fill them, any of whom is willing to pay the controlled price of P_C or more. In fact, reading up to the demand curve in Figure 3.20 from A_1 apartments, the quantity available at P_C , you can see that for A_1 apartments, there are potential renters willing and able to pay P_B . This often leads to various “backdoor” payments to apartment owners, such as large security deposits, payments for things renters may not want (such as furniture), so-called “key” payments (“The monthly rent is \$500 and the key price is \$3,000”), or simple bribes.

In the end, rent controls and other price ceilings often end up hurting some of the people they are intended to help. Many people will have trouble finding apartments to rent. Ironically, some of those who do find apartments may actually end up paying more than they would have paid in the absence of rent control. And many of the people that the rent controls do help (primarily current occupants, regardless of their income, and those lucky enough to find apartments) are not those they are intended to help (the poor). There are also costs in government administration and enforcement.

Because New York City has the longest history of rent controls of any city in the United States, its program has been widely studied. There is general agreement that the rent control program has reduced tenant mobility, led to a substantial gap between rents on controlled and uncontrolled units, and favored long-term residents at the expense of newcomers to the city (Arnott, R., 1995). These distortions have grown over time, another frequent consequence of price controls.

A more direct means of helping poor tenants, one that would avoid interfering with the functioning of the market, would be to subsidize their incomes. As with price floors, interfering with the market mechanism may solve one problem, but it creates many others at the same time.

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CHAPTER OVERVIEW

4: Elasticity- A Measure of Response

[4.1: The Price Elasticity of Demand](#)

[4.2: Responsiveness of Demand to Other Factors](#)

[4.3: Price Elasticity of Supply](#)

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4.1: The Price Elasticity of Demand

Learning Objective

1. Explain the concept of price elasticity of demand and its calculation.
2. Explain what it means for demand to be price inelastic, unit price elastic, price elastic, perfectly price inelastic, and perfectly price elastic.
3. Explain how and why the value of the price elasticity of demand changes along a linear demand curve.
4. Understand the relationship between total revenue and price elasticity of demand.
5. Discuss the determinants of price elasticity of demand.

We know from the law of demand how the quantity demanded will respond to a price change: it will change in the opposite direction. But how *much* will it change? It seems reasonable to expect, for example, that a 10% change in the price charged for a visit to the doctor would yield a different percentage change in quantity demanded than a 10% change in the price of a Ford Mustang. But how much is this difference?

To show how responsive quantity demanded is to a change in price, we apply the concept of elasticity. The price elasticity of demand for a good or service, e_D , is the percentage change in quantity demanded of a particular good or service divided by the percentage change in the price of that good or service, all other things unchanged. Thus we can write

Equation 4.1

$$e_D = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}$$

Because the price elasticity of demand shows the responsiveness of quantity demanded to a price change, assuming that other factors that influence demand are unchanged, it reflects movements *along* a demand curve. With a downward-sloping demand curve, price and quantity demanded move in opposite directions, so the price elasticity of demand is always negative. A positive percentage change in price implies a negative percentage change in quantity demanded, and vice versa. Often you will see the absolute value of the price elasticity measure reported. In essence, the minus sign is ignored because it is expected that there will be a negative (inverse) relationship between quantity demanded and price. In this text, however, we will retain the minus sign in reporting price elasticity of demand and will say “the absolute value of the price elasticity of demand” when that is what we are describing.

Heads Up!

Be careful not to confuse elasticity with slope. The slope of a line is the change in the value of the variable on the vertical axis divided by the change in the value of the variable on the horizontal axis between two points. Elasticity is the ratio of the percentage changes. The slope of a demand curve, for example, is the ratio of the change in price to the change in quantity between two points on the curve. The price elasticity of demand is the ratio of the percentage change in quantity to the percentage change in price. As we will see, when computing elasticity at different points on a linear demand curve, the slope is constant—that is, it does not change—but the value for elasticity will change.

Computing the Price Elasticity of Demand

Finding the price elasticity of demand requires that we first compute percentage changes in price and in quantity demanded. We calculate those changes between two points on a demand curve.

Figure 4.1 shows a particular demand curve, a linear demand curve for public transit rides. Suppose the initial price is \$0.80, and the quantity demanded is 40,000 rides per day; we are at point A on the curve. Now suppose the price falls to \$0.70, and we want to report the responsiveness of the quantity demanded. We see that at the new price, the quantity demanded rises to 60,000 rides per day (point B). To compute the elasticity, we need to compute the percentage changes in price and in quantity demanded between points A and B.

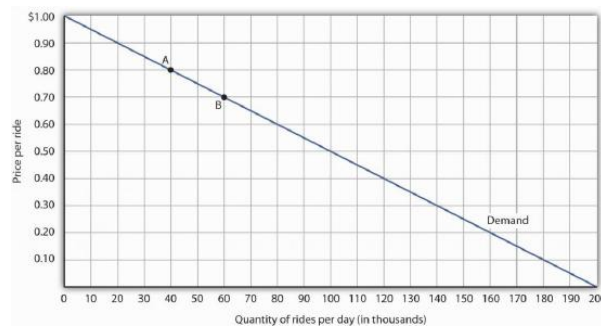


Figure 4.1 Responsiveness and Demand The demand curve shows how changes in price lead to changes in the quantity demanded. A movement from point A to point B shows that a \$0.10 reduction in price increases the number of rides per day by 20,000. A movement from B to A is a \$0.10 increase in price, which reduces quantity demanded by 20,000 rides per day.

We measure the percentage change between two points as the change in the variable divided by the *average* value of the variable between the two points. Thus, the percentage change in quantity between points A and B in Figure 4.1 is computed relative to the *average* of the quantity values at points A and B: $(60,000 + 40,000)/2 = 50,000$. The percentage change in quantity, then, is $20,000/50,000$, or 40%. Likewise, the percentage change in price between points A and B is based on the *average* of the two prices: $(\$0.80 + \$0.70)/2 = \$0.75$, and so we have a percentage change of $-0.10/0.75$, or -13.33%. The price elasticity of demand between points A and B is thus $40\%/(-13.33\%) = -3.00$.

This measure of elasticity, which is based on percentage changes relative to the average value of each variable between two points, is called arc elasticity. The arc elasticity method has the advantage that it yields the same elasticity whether we go from point A to point B or from point B to point A. It is the method we shall use to compute elasticity.

The arc elasticity method gives us an estimate of elasticity. It gives the value of elasticity at the midpoint over a range of change, such as the movement between points A and B. For a precise computation of elasticity, we would need to consider the response of a dependent variable to an extremely small change in an independent variable. The fact that arc elasticities are approximate suggests an important practical rule in calculating arc elasticities: we should consider only small changes in independent variables. We cannot apply the concept of arc elasticity to large changes.

Another argument for considering only small changes in computing price elasticities of demand will become evident in the next section. We will investigate what happens to price elasticities as we move from one point to another along a linear demand curve.

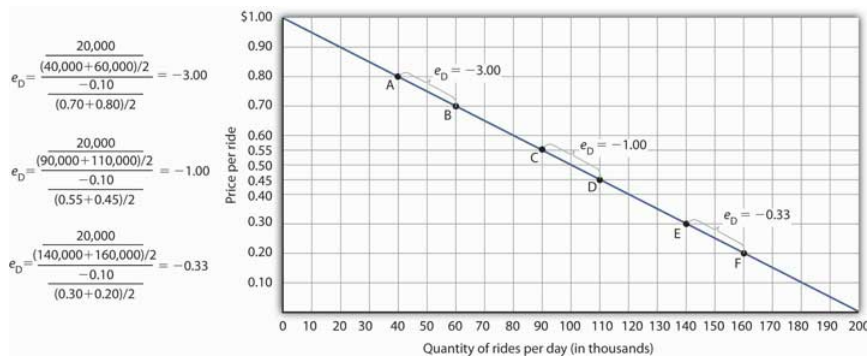
Heads Up!

Notice that in the arc elasticity formula, the method for computing a percentage change differs from the standard method with which you may be familiar. That method measures the percentage change in a variable relative to its original value. For example, using the standard method, when we go from point A to point B, we would compute the percentage change in quantity as $20,000/40,000 = 50\%$. The percentage change in price would be $-\$0.10/\$0.80 = -12.5\%$. The price elasticity of demand would then be $50\%/(-12.5\%) = -4.00$. Going from point B to point A, however, would yield a different elasticity. The percentage change in quantity would be $-20,000/60,000$, or -33.33%. The percentage change in price would be $\$0.10/\$0.70 = 14.29\%$. The price elasticity of demand would thus be $-33.33\%/14.29\% = -2.33$. By using the average quantity and average price to calculate percentage changes, the arc elasticity approach avoids the necessity to specify the direction of the change and, thereby, gives us the same answer whether we go from A to B or from B to A.

Price Elasticities Along a Linear Demand Curve

What happens to the price elasticity of demand when we travel along the demand curve? The answer depends on the nature of the demand curve itself. On a linear demand curve, such as the one in Figure 4.2, elasticity becomes smaller (in absolute value) as we travel downward and to the right.

Figure 4.2 Price Elasticities of Demand for a Linear Demand Curve



The price elasticity of demand varies between different pairs of points along a linear demand curve. The lower the price and the greater the quantity demanded, the lower the absolute value of the price elasticity of demand.

Figure 4.2 shows the same demand curve we saw in Figure 4.1. We have already calculated the price elasticity of demand between points A and B; it equals -3.00 . Notice, however, that when we use the same method to compute the price elasticity of demand between other sets of points, our answer varies. For each of the pairs of points shown, the changes in price and quantity demanded are the same (a $\$0.10$ decrease in price and 20,000 additional rides per day, respectively). But at the high prices and low quantities on the upper part of the demand curve, the percentage change in quantity is relatively large, whereas the percentage change in price is relatively small. The absolute value of the price elasticity of demand is thus relatively large. As we move down the demand curve, equal changes in quantity represent smaller and smaller percentage changes, whereas equal changes in price represent larger and larger percentage changes, and the absolute value of the elasticity measure declines. Between points C and D, for example, the price elasticity of demand is -1.00 , and between points E and F the price elasticity of demand is -0.33 .

On a linear demand curve, the price elasticity of demand varies depending on the interval over which we are measuring it. For any linear demand curve, the absolute value of the price elasticity of demand will fall as we move down and to the right along the curve.

The Price Elasticity of Demand and Changes in Total Revenue

Suppose the public transit authority is considering raising fares. Will its total revenues go up or down? Total revenue is the price per unit times the number of units sold¹. In this case, it is the fare times the number of riders. The transit authority will certainly want to know whether a price increase will cause its total revenue to rise or fall. In fact, determining the impact of a price change on total revenue is crucial to the analysis of many problems in economics.

We will do two quick calculations before generalizing the principle involved. Given the demand curve shown in Figure 4.2, we see that at a price of $\$0.80$, the transit authority will sell 40,000 rides per day. Total revenue would be $\$32,000$ per day ($\$0.80$ times 40,000). If the price were lowered by $\$0.10$ to $\$0.70$, quantity demanded would increase to 60,000 rides and total revenue would increase to $\$42,000$ ($\$0.70$ times 60,000). The reduction in fare *increases* total revenue. However, if the initial price had been $\$0.30$ and the transit authority reduced it by $\$0.10$ to $\$0.20$, total revenue would *decrease* from $\$42,000$ ($\$0.30$ times 140,000) to $\$32,000$ ($\$0.20$ times 160,000). So it appears that the impact of a price change on total revenue depends on the initial price and, by implication, the original elasticity. We generalize this point in the remainder of this section.

The problem in assessing the impact of a price change on total revenue of a good or service is that a change in price always changes the quantity demanded in the opposite direction. An increase in price reduces the quantity demanded, and a reduction in price increases the quantity demanded. The question is how much. Because total revenue is found by multiplying the price per unit times the quantity demanded, it is not clear whether a change in price will cause total revenue to rise or fall.

We have already made this point in the context of the transit authority. Consider the following three examples of price increases for gasoline, pizza, and diet cola.

Suppose that 1,000 gallons of gasoline per day are demanded at a price of $\$4.00$ per gallon. Total revenue for gasoline thus equals $\$4,000$ per day ($=1,000$ gallons per day times $\$4.00$ per gallon). If an increase in the price of gasoline to $\$4.25$ reduces the quantity demanded to 950 gallons per day, total revenue rises to $\$4,037.50$ per day ($=950$ gallons per day times $\$4.25$ per gallon). Even though people consume less gasoline at $\$4.25$ than at $\$4.00$, total revenue rises because the higher price more than makes up for the drop in consumption.

Next consider pizza. Suppose 1,000 pizzas per week are demanded at a price of \$9 per pizza. Total revenue for pizza equals \$9,000 per week (=1,000 pizzas per week times \$9 per pizza). If an increase in the price of pizza to \$10 per pizza reduces quantity demanded to 900 pizzas per week, total revenue will still be \$9,000 per week (=900 pizzas per week times \$10 per pizza). Again, when price goes up, consumers buy less, but this time there is no change in total revenue.

Now consider diet cola. Suppose 1,000 cans of diet cola per day are demanded at a price of \$0.50 per can. Total revenue for diet cola equals \$500 per day (=1,000 cans per day times \$0.50 per can). If an increase in the price of diet cola to \$0.55 per can reduces quantity demanded to 880 cans per month, total revenue for diet cola falls to \$484 per day (=880 cans per day times \$0.55 per can). As in the case of gasoline, people will buy less diet cola when the price rises from \$0.50 to \$0.55, but in this example total revenue drops.

In our first example, an increase in price increased total revenue. In the second, a price increase left total revenue unchanged. In the third example, the price rise reduced total revenue. Is there a way to predict how a price change will affect total revenue? There is; the effect depends on the price elasticity of demand.

Elastic, Unit Elastic, and Inelastic Demand

To determine how a price change will affect total revenue, economists place price elasticities of demand in three categories, based on their absolute value. If the absolute value of the price elasticity of demand is greater than 1, demand is termed price elastic. If it is equal to 1, demand is unit price elastic. And if it is less than 1, demand is price inelastic.

Relating Elasticity to Changes in Total Revenue

When the price of a good or service changes, the quantity demanded changes in the opposite direction. Total revenue will move in the direction of the variable that changes by the larger percentage. If the variables move by the same percentage, total revenue stays the same. If quantity demanded changes by a larger percentage than price (i.e., if demand is price elastic), total revenue will change in the direction of the quantity change. If price changes by a larger percentage than quantity demanded (i.e., if demand is price inelastic), total revenue will move in the direction of the price change. If price and quantity demanded change by the same percentage (i.e., if demand is unit price elastic), then total revenue does not change.

When demand is price inelastic, a given percentage change in price results in a smaller percentage change in quantity demanded. That implies that total revenue will move in the direction of the price change: a reduction in price will reduce total revenue, and an increase in price will increase it.

Consider the price elasticity of demand for gasoline. In the example above, 1,000 gallons of gasoline were purchased each day at a price of \$4.00 per gallon; an increase in price to \$4.25 per gallon reduced the quantity demanded to 950 gallons per day. We thus had an average quantity of 975 gallons per day and an average price of \$4.125. We can thus calculate the arc price elasticity of demand for gasoline:

Percentage change in quantity demanded = $-50/975 = -5.1\%$

Percentage change in price = $0.25/4.125 = 6.06\%$

Price elasticity of demand = $-5.1\%/6.06\% = -.084$

The demand for gasoline is price inelastic, and total revenue moves in the direction of the price change. When price rises, total revenue rises. Recall that in our example above, total spending on gasoline (which equals total revenues to sellers) rose from \$4,000 per day (=1,000 gallons per day times \$4.00) to \$4037.50 per day (=950 gallons per day times \$4.25 per gallon).

When demand is price inelastic, a given percentage change in price results in a smaller percentage change in quantity demanded. That implies that total revenue will move in the direction of the price change: an increase in price will increase total revenue, and a reduction in price will reduce it.

Consider again the example of pizza that we examined above. At a price of \$9 per pizza, 1,000 pizzas per week were demanded. Total revenue was \$9,000 per week (=1,000 pizzas per week times \$9 per pizza). When the price rose to \$10, the quantity demanded fell to 900 pizzas per week. Total revenue remained \$9,000 per week (=900 pizzas per week times \$10 per pizza). Again, we have an average quantity of 950 pizzas per week and an average price of \$9.50. Using the arc elasticity method, we can compute:

Percentage change in quantity demanded = $-100/950 = -10.5\%$

Percentage change in price = $\$1.00/\$9.50 = 10.5\%$

Price elasticity of demand = $-10.5\%/10.5\% = -1.0$

Demand is unit price elastic, and total revenue remains unchanged. Quantity demanded falls by the same percentage by which price increases.

Consider next the example of diet cola demand. At a price of \$0.50 per can, 1,000 cans of diet cola were purchased each day. Total revenue was thus \$500 per day ($=\$0.50$ per can times 1,000 cans per day). An increase in price to \$0.55 reduced the quantity demanded to 880 cans per day. We thus have an average quantity of 940 cans per day and an average price of \$0.525 per can. Computing the price elasticity of demand for diet cola in this example, we have:

Percentage change in quantity demanded = $-120/940 = -12.8\%$

Percentage change in price = $\$0.05/\$0.525 = 9.5\%$

Price elasticity of demand = $-12.8\%/9.5\% = -1.3$

The demand for diet cola is price elastic, so total revenue moves in the direction of the quantity change. It falls from \$500 per day before the price increase to \$484 per day after the price increase.

A demand curve can also be used to show changes in total revenue. Figure 4.3 shows the demand curve from Figure 4.1 and Figure 5.2. At point A, total revenue from public transit rides is given by the area of a rectangle drawn with point A in the upper right-hand corner and the origin in the lower left-hand corner. The height of the rectangle is price; its width is quantity. We have already seen that total revenue at point A is \$32,000 ($\$0.80 \times 40,000$). When we reduce the price and move to point B, the rectangle showing total revenue becomes shorter and wider. Notice that the area gained in moving to the rectangle at B is greater than the area lost; total revenue rises to \$42,000 ($\$0.70 \times 60,000$). Recall from Figure 4.2 that demand is elastic between points A and B. In general, demand is elastic in the upper half of any linear demand curve, so total revenue moves in the direction of the quantity change.

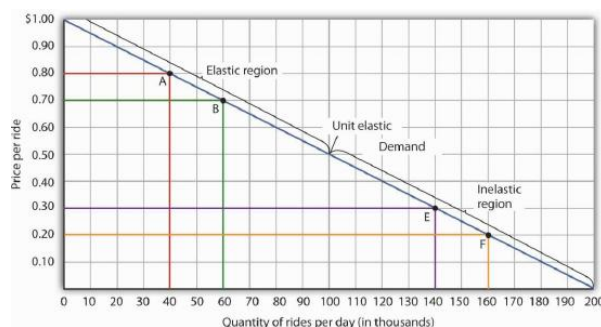


Figure 4.3 Changes in Total Revenue and a Linear Demand Curve Moving from point A to point B implies a reduction in price and an increase in the quantity demanded. Demand is elastic between these two points. Total revenue, shown by the areas of the rectangles drawn from points A and B to the origin, rises. When we move from point E to point F, which is in the inelastic region of the demand curve, total revenue falls.

A movement from point E to point F also shows a reduction in price and an increase in quantity demanded. This time, however, we are in an inelastic region of the demand curve. Total revenue now moves in the direction of the price change—it falls. Notice that the rectangle drawn from point F is smaller in area than the rectangle drawn from point E, once again confirming our earlier calculation.

Figure 4.4

Price Elastic			
↑	An increase in price...	↓	reduces total revenue.
↓	A reduction in price...	↑	Increases total revenue.
Total revenue moves in the direction of the quantity change.			
Price Inelastic			
↑	An increase in price...	↑	Increases total revenue.
↓	A reduction in price...	↓	reduces total revenue.
Total revenue moves in the direction of the price change.			
Unit price Elastic			
↑	An increase in price...	●	no change in total revenue.
↓	A reduction in price...	●	no change in total revenue.
Total revenue does not change as price changes.			

We have noted that a linear demand curve is more elastic where prices are relatively high and quantities relatively low and less elastic where prices are relatively low and quantities relatively high. We can be even more specific. *For any linear demand curve, demand will be price elastic in the upper half of the curve and price inelastic in its lower half. At the midpoint of a linear demand curve, demand is unit price elastic.*

Constant Price Elasticity of Demand Curves

Figure 4.5 shows four demand curves over which price elasticity of demand is the same at all points. The demand curve in Panel (a) is vertical. This means that price changes have no effect on quantity demanded. The numerator of the formula given in Equation 5.1 for the price elasticity of demand (percentage change in quantity demanded) is zero. The price elasticity of demand in this case is therefore zero, and the demand curve is said to be perfectly inelastic. This is a theoretically extreme case, and no good that has been studied empirically exactly fits it. A good that comes close, at least over a specific price range, is insulin. A diabetic will not consume more insulin as its price falls but, over some price range, will consume the amount needed to control the disease.

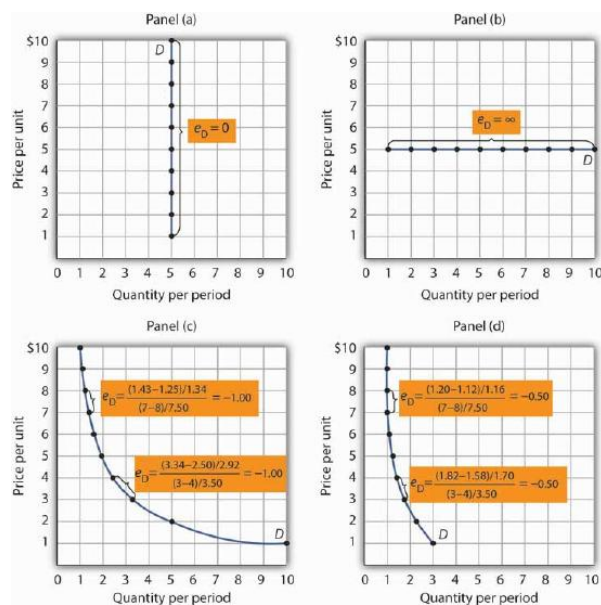


Figure 4.5 Demand Curves with Constant Price Elasticities The demand curve in Panel (a) is perfectly inelastic. The demand curve in Panel (b) is perfectly elastic. Price elasticity of demand is -1.00 all along the demand curve in Panel (c), whereas it is -0.50 all along the demand curve in Panel (d).

As illustrated in Figure 4.5, several other types of demand curves have the same elasticity at every point on them. The demand curve in Panel (b) is horizontal. This means that even the smallest price changes have enormous effects on quantity demanded. The denominator of the formula given in Equation 4.1 for the price elasticity of demand (percentage change in price) approaches zero. The price elasticity of demand in this case is therefore infinite, and the demand curve is said to be perfectly elastic. This is the type of demand curve faced by producers of standardized products such as wheat. If the wheat of other farms is selling at \$4 per bushel, a typical farm can sell as much wheat as it wants to at \$4 but nothing at a higher price and would have no reason to offer its wheat at a lower price.

The nonlinear demand curves in Panels (c) and (d) have price elasticities of demand that are negative; but, unlike the linear demand curve discussed above, the value of the price elasticity is constant all along each demand curve. The demand curve in Panel (c) has price elasticity of demand equal to -1.00 throughout its range; in Panel (d) the price elasticity of demand is equal to -0.50 throughout its range. Empirical estimates of demand often show curves like those in Panels (c) and (d) that have the same elasticity at every point on the curve.

Heads Up!

Do not confuse price inelastic demand and perfectly inelastic demand. Perfectly inelastic demand means that the change in quantity is zero for any percentage change in price; the demand curve in this case is vertical. Price inelastic demand means only that the percentage change in quantity is less than the percentage change in price, not that the change in quantity is zero. With price inelastic (as opposed to perfectly inelastic) demand, the demand curve itself is still downward sloping.

Determinants of the Price Elasticity of Demand

The greater the absolute value of the price elasticity of demand, the greater the responsiveness of quantity demanded to a price change. What determines whether demand is more or less price elastic? The most important determinants of the price elasticity of demand for a good or service are the availability of substitutes, the importance of the item in household budgets, and time.

Availability of Substitutes

The price elasticity of demand for a good or service will be greater in absolute value if many close substitutes are available for it. If there are lots of substitutes for a particular good or service, then it is easy for consumers to switch to those substitutes when there is a price increase for that good or service. Suppose, for example, that the price of Ford automobiles goes up. There are many close substitutes for Fords—Chevrolets, Chryslers, Toyotas, and so on. The availability of close substitutes tends to make the demand for Fords more price elastic.

If a good has no close substitutes, its demand is likely to be somewhat less price elastic. There are no close substitutes for gasoline, for example. The price elasticity of demand for gasoline in the intermediate term of, say, three–nine months is generally estimated to be about -0.5 . Since the absolute value of price elasticity is less than 1, it is price inelastic. We would expect, though, that the demand for a particular brand of gasoline will be much more price elastic than the demand for gasoline in general.

Importance in Household Budgets

One reason price changes affect quantity demanded is that they change how much a consumer can buy; a change in the price of a good or service affects the purchasing power of a consumer's income and thus affects the amount of a good the consumer will buy. This effect is stronger when a good or service is important in a typical household's budget.

A change in the price of jeans, for example, is probably more important in your budget than a change in the price of pencils. Suppose the prices of both were to double. You had planned to buy four pairs of jeans this year, but now you might decide to make do with two new pairs. A change in pencil prices, in contrast, might lead to very little reduction in quantity demanded simply because pencils are not likely to loom large in household budgets. The greater the importance of an item in household budgets, the greater the absolute value of the price elasticity of demand is likely to be.

Time

Suppose the price of electricity rises tomorrow morning. What will happen to the quantity demanded?

The answer depends in large part on how much time we allow for a response. If we are interested in the reduction in quantity demanded by tomorrow afternoon, we can expect that the response will be very small. But if we give consumers a year to respond to the price change, we can expect the response to be much greater. We expect that the absolute value of the price elasticity of demand will be greater when more time is allowed for consumer responses.

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4.2: Responsiveness of Demand to Other Factors

Learning Objective

1. Explain the concept of income elasticity of demand and its calculation.
2. Classify goods as normal or inferior depending on their income elasticity of demand.
3. Explain the concept of cross price elasticity of demand and its calculation.
4. Classify goods as substitutes or complements depending on their cross price elasticity of demand.

Although the response of quantity demanded to changes in price is the most widely used measure of elasticity, economists are interested in the response to changes in the demand shifters as well. Two of the most important measures show how demand responds to changes in income and to changes in the prices of related goods and services.

Income Elasticity of Demand

We saw in the chapter that introduced the model of demand and supply that the demand for a good or service is affected by income. We measure the income elasticity of demand, e_Y , as the percentage change in quantity demanded *at a specific price* divided by the percentage change in income that produced the demand change, all other things unchanged:

Equation 4.2

$$e_Y = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}}$$

The symbol Y is often used in economics to represent income. Because income elasticity of demand reports the responsiveness of quantity demanded to a change in income, all other things unchanged (including the price of the good), it reflects a shift in the demand curve at a given price. Remember that price elasticity of demand reflects movements *along* a demand curve in response to a change in price.

A positive income elasticity of demand means that income and demand move in the same direction—an increase in income increases demand, and a reduction in income reduces demand. As we learned, a good whose demand rises as income rises is called a normal good.

Studies show that most goods and services are normal, and thus their income elasticities are positive. Goods and services for which demand is likely to move in the same direction as income include housing, seafood, rock concerts, and medical services.

If a good or service is inferior, then an increase in income reduces demand for the good. That implies a negative income elasticity of demand. Goods and services for which the income elasticity of demand is likely to be negative include used clothing, beans, and urban public transit. For example, the studies we have already cited concerning the demands for urban public transit in France and in Madrid found the long-run income elasticities of demand to be negative (-0.23 in France and -0.25 in Madrid) (Bresson, G., et. al., 2004; Matas, A., 2004).

Figure 4.6

Normal Good			
↑	An increase in income...	↑	increases demand.
↓	A decrease in income...	↓	decreases demand.
Inferior Good			
↑	An increase in income...	↓	decreases demand.
↓	A decrease in income...	↑	increases demand.

When we compute the income elasticity of demand, we are looking at the change in the quantity demanded at a specific price. We are thus dealing with a change that shifts the demand curve. An increase in income shifts the demand for a normal good to the right; it shifts the demand for an inferior good to the left.

Cross Price Elasticity of Demand

The demand for a good or service is affected by the prices of related goods or services. A reduction in the price of salsa, for example, would increase the demand for chips, suggesting that salsa is a complement of chips. A reduction in the price of chips, however, would reduce the demand for peanuts, suggesting that chips are a substitute for peanuts.

The measure economists use to describe the responsiveness of demand for a good or service to a change in the price of another good or service is called the cross price elasticity of demand, $e_{A,B}$. It equals the percentage change in the quantity demanded of one good or service *at a specific price* divided by the percentage change in the price of a related good or service. We are varying the price of a related good when we consider the cross price elasticity of demand, so the response of quantity demanded is shown as a shift in the demand curve.

The cross price elasticity of the demand for good A with respect to the price of good B is given by:

Equation 4.3

$$e_{A,B} = \frac{\% \text{ change in quantity demanded of good A}}{\% \text{ change in price of good B}}$$

Cross price elasticities of demand define whether two goods are substitutes, complements, or unrelated. If two goods are substitutes, an increase in the price of one will lead to an increase in the demand for the other—the cross price elasticity of demand is positive. If two goods are complements, an increase in the price of one will lead to a reduction in the demand for the other—the cross price elasticity of demand is negative. If two goods are unrelated, a change in the price of one will not affect the demand for the other—the cross price elasticity of demand is zero.

Figure 4.7

Substitutes			
	An increase in $P_{B...}$		increases demand for good A.
	A decrease in $P_{B...}$		decreases demand for good A.
Complements			
	An increase in $P_{B...}$		decreases demand for good A.
	A decrease in $P_{B...}$		increases demand for good A.

An examination of the demand for local television advertising with respect to the price of local radio advertising revealed that the two goods are clearly substitutes. A 10 per cent increase in the price of local radio advertising led to a 10 per cent increase in demand for local television advertising, so that the cross price elasticity of demand for local television advertising with respect to changes in the price of radio advertising was 1.0 (Ekelund, R. B., et. al., 2000).

Heads Up!

Notice that with income elasticity of demand and cross price elasticity of demand we are primarily concerned with whether the measured value of these elasticities is positive or negative. In the case of income elasticity of demand this tells us whether the good or service is normal or inferior. In the case of cross price elasticity of demand it tells us whether two goods are substitutes or complements. With price elasticity of demand we were concerned with whether the measured absolute value of this elasticity was greater than, less than, or equal to 1, because this gave us information about what happens to total revenue as price changes. The terms elastic and inelastic apply to price elasticity of demand. They are not used to describe income elasticity of demand or cross price elasticity of demand.

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4.3: Price Elasticity of Supply

Learning Objective

1. Explain the concept of elasticity of supply and its calculation.
2. Explain what it means for supply to be price inelastic, unit price elastic, price elastic, perfectly price inelastic, and perfectly price elastic.
3. Explain why time is an important determinant of price elasticity of supply.
4. Apply the concept of price elasticity of supply to the labor supply curve.

The elasticity measures encountered so far in this chapter all relate to the demand side of the market. It is also useful to know how responsive quantity supplied is to a change in price.

Suppose the demand for apartments rises. There will be a shortage of apartments at the old level of apartment rents and pressure on rents to rise. All other things unchanged, the more responsive the quantity of apartments supplied is to changes in monthly rents, the lower the increase in rent required to eliminate the shortage and to bring the market back to equilibrium. Conversely, if quantity supplied is less responsive to price changes, price will have to rise more to eliminate a shortage caused by an increase in demand.

This is illustrated in Figure 4.8. Suppose the rent for a typical apartment had been R_0 and the quantity Q_0 when the demand curve was D_1 and the supply curve was either S_1 (a supply curve in which quantity supplied is less responsive to price changes) or S_2 (a supply curve in which quantity supplied is more responsive to price changes). Note that with either supply curve, equilibrium price and quantity are initially the same. Now suppose that demand increases to D_2 , perhaps due to population growth. With supply curve S_1 , the price (rent in this case) will rise to R_1 and the quantity of apartments will rise to Q_1 . If, however, the supply curve had been S_2 , the rent would only have to rise to R_2 to bring the market back to equilibrium. In addition, the new equilibrium number of apartments would be higher at Q_2 . Supply curve S_2 shows greater responsiveness of quantity supplied to price change than does supply curve S_1 .

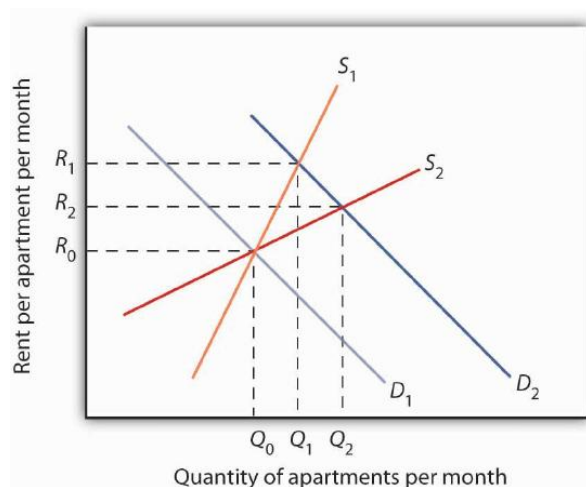


Figure 4.8 Increase in Apartment Rents Depends on How Responsive Supply Is The more responsive the supply of apartments is to changes in price (rent in this case), the less rents rise when the demand for apartments increases.

We measure the price elasticity of supply (e_S) as the ratio of the percentage change in quantity supplied of a good or service to the percentage change in its price, all other things unchanged:

Equation 4.3

$$e_S = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$$

Because price and quantity supplied usually move in the same direction, the price elasticity of supply is usually positive. The larger the price elasticity of supply, the more responsive the firms that supply the good or service are to a price change.

Supply is price elastic if the price elasticity of supply is greater than 1, unit price elastic if it is equal to 1, and price inelastic if it is less than 1. A vertical supply curve, as shown in Panel (a) of Figure 4.9, is perfectly inelastic; its price elasticity of supply is zero. The supply of Beatles' songs is perfectly inelastic because the band no longer exists. A horizontal supply curve, as shown in Panel (b) of Figure 4.9, is perfectly elastic; its price elasticity of supply is infinite. It means that suppliers are willing to supply any amount at a certain price.

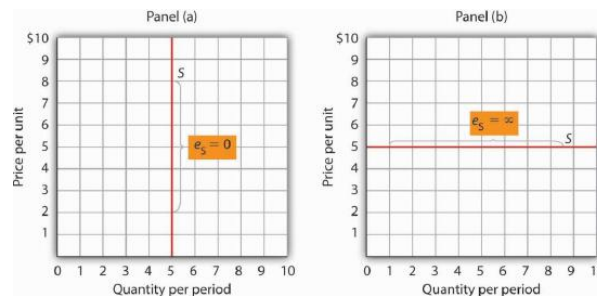


Figure 4.9 Supply Curves and Their Price Elasticities The supply curve in Panel (a) is perfectly inelastic. In Panel (b), the supply curve is perfectly elastic.

Time: An Important Determinant of the Elasticity of Supply

Time plays a very important role in the determination of the price elasticity of supply. Look again at the effect of rent increases on the supply of apartments. Suppose apartment rents in a city rise. If we are looking at a supply curve of apartments over a period of a few months, the rent increase is likely to induce apartment owners to rent out a relatively small number of additional apartments. With the higher rents, apartment owners may be more vigorous in reducing their vacancy rates, and, indeed, with more people looking for apartments to rent, this should be fairly easy to accomplish. Attics and basements are easy to renovate and rent out as additional units. In a short period of time, however, the supply response is likely to be fairly modest, implying that the price elasticity of supply is fairly low. A supply curve corresponding to a short period of time would look like S_1 in Figure 5.10. It is during such periods that there may be calls for rent controls.

If the period of time under consideration is a few years rather than a few months, the supply curve is likely to be much more price elastic. Over time, buildings can be converted from other uses and new apartment complexes can be built. A supply curve corresponding to a longer period of time would look like S_2 in Figure 4.8.

Elasticity of Labor Supply: A Special Application

The concept of price elasticity of supply can be applied to labor to show how the quantity of labor supplied responds to changes in wages or salaries. What makes this case interesting is that it has sometimes been found that the measured elasticity is negative, that is, that an increase in the wage rate is associated with a reduction in the quantity of labor supplied.

In most cases, labor supply curves have their normal upward slope: higher wages induce people to work more. For them, having the additional income from working more is preferable to having more leisure time. However, wage increases may lead some people in very highly paid jobs to cut back on the number of hours they work because their incomes are already high and they would rather have more time for leisure activities. In this case, the labor supply curve would have a negative slope.

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CHAPTER OVERVIEW

5: The Analysis of Consumer Choice

[5.1: The Concept of Utility](#)

[5.2: Utility Maximization and Demand](#)

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5.1: The Concept of Utility

Learning Objective

1. Define what economists mean by utility.
2. Distinguish between the concepts of total utility and marginal utility.
3. State the law of diminishing marginal utility and illustrate it graphically.
4. State, explain, and illustrate algebraically the utility-maximizing condition.

Why do you buy the goods and services you do? It must be because they provide you with satisfaction—you feel better off because you have purchased them. Economists call this satisfaction *utility*.

The concept of utility is an elusive one. A person who consumes a good such as peaches gains utility from eating the peaches. But we cannot measure this utility the same way we can measure a peach's weight or calorie content. There is no scale we can use to determine the quantity of utility a peach generates.

Francis Edgeworth, one of the most important contributors to the theory of consumer behavior, imagined a device he called a *hedonimeter* (after hedonism, the pursuit of pleasure):

“[L]et there be granted to the science of pleasure what is granted to the science of energy; to imagine an ideally perfect instrument, a psychophysical machine, continually registering the height of pleasure experienced by an individual.... From moment to moment the hedonimeter varies; the delicate index now flickering with the flutter of passions, now steadied by intellectual activity, now sunk whole hours in the neighborhood of zero, or momentarily springing up towards infinity” (Edgeworth, F. Y., 1967).

Perhaps some day a hedonimeter will be invented. The utility it measures will not be a characteristic of particular goods, but rather of each consumer's reactions to those goods. The utility of a peach exists not in the peach itself, but in the preferences of the individual consuming the peach. One consumer may wax ecstatic about a peach; another may say it tastes OK.

When we speak of maximizing utility, then, we are speaking of the maximization of something we cannot measure. We assume, however, that each consumer acts as if he or she can measure utility and arranges consumption so that the utility gained is as high as possible.

Total Utility

If we could measure utility, total utility would be the number of units of utility that a consumer gains from consuming a given quantity of a good, service, or activity during a particular time period. The higher a consumer's total utility, the greater that consumer's level of satisfaction.

Panel (a) of Figure 5.1 shows the total utility Henry Higgins obtains from attending movies. In drawing his total utility curve, we are imagining that he can measure his total utility. The total utility curve shows that when Mr. Higgins attends no movies during a month, his total utility from attending movies is zero. As he increases the number of movies he sees, his total utility rises. When he consumes 1 movie, he obtains 36 units of utility. When he consumes 4 movies, his total utility is 101. He achieves the maximum level of utility possible, 115, by seeing 6 movies per month. Seeing a seventh movie adds nothing to his total utility.

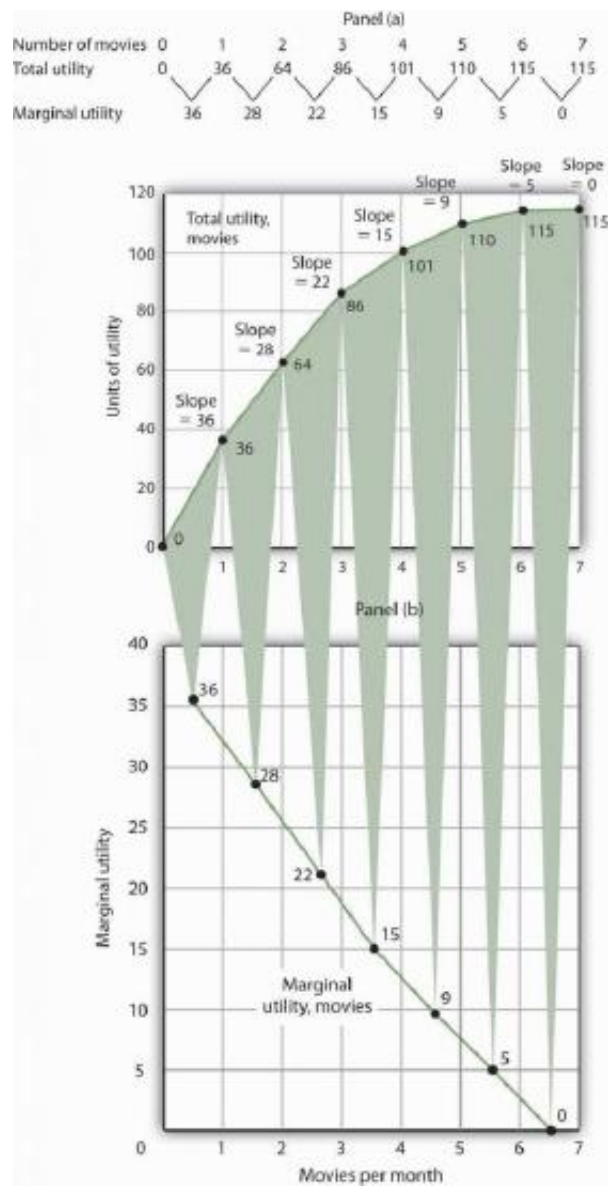


Figure 5.1 Total Utility and Marginal Utility Curves Panel (a) shows Henry Higgins's total utility curve for attending movies. It rises as the number of movies increases, reaching a maximum of 115 units of utility at 6 movies per month. Marginal utility is shown in Panel (b); it is the slope of the total utility curve. Because the slope of the total utility curve declines as the number of movies increases, the marginal utility curve is downward sloping.

Mr. Higgins's total utility rises at a decreasing rate. The rate of increase is given by the slope of the total utility curve, which is reported in Panel (a) of Figure 5.1 as well. The slope of the curve between 0 movies and 1 movie is 36 because utility rises by this amount when Mr. Higgins sees his first movie in the month. It is 28 between 1 and 2 movies, 22 between 2 and 3, and so on. The slope between 6 and 7 movies is zero; the total utility curve between these two quantities is horizontal.

Marginal Utility

The amount by which total utility rises with consumption of an additional unit of a good, service, or activity, all other things unchanged, is marginal utility. The first movie Mr. Higgins sees increases his total utility by 36 units. Hence, the marginal utility of the first movie is 36. The second increases his total utility by 28 units; its marginal utility is 28. The seventh movie does not increase his total utility; its marginal utility is zero. Notice that in the table marginal utility is listed between the columns for total utility because, similar to other marginal concepts, marginal utility is the change in utility as we go from one quantity to the next. Mr. Higgins's marginal utility curve is plotted in Panel (b) of Figure 5.1 The values for marginal utility are plotted midway between

the numbers of movies attended. The marginal utility curve is downward sloping; it shows that Mr. Higgins's marginal utility for movies declines as he consumes more of them.

Mr. Higgins's marginal utility from movies is typical of all goods and services. Suppose that you are *really* thirsty and you decide to consume a soft drink. Consuming the drink increases your utility, probably by a lot. Suppose now you have another. That second drink probably increases your utility by less than the first. A third would increase your utility by still less. This tendency of marginal utility to decline beyond some level of consumption during a period is called the law of diminishing marginal utility. This law implies that all goods and services eventually will have downward-sloping marginal utility curves. It is the law that lies behind the negatively sloped marginal benefit curve for consumer choices that we examined in the chapter on markets, maximizers, and efficiency.

One way to think about this effect is to remember the last time you ate at an "all you can eat" cafeteria-style restaurant. Did you eat only one type of food? Did you consume food without limit? No, because of the law of diminishing marginal utility. As you consumed more of one kind of food, its marginal utility fell. You reached a point at which the marginal utility of another dish was greater, and you switched to that. Eventually, there was no food whose marginal utility was great enough to make it worth eating, and you stopped.

What if the law of diminishing marginal utility did not hold? That is, what would life be like in a world of constant or increasing marginal utility? In your mind go back to the cafeteria and imagine that you have rather unusual preferences: Your favorite food is creamed spinach. You start with that because its marginal utility is highest of all the choices before you in the cafeteria. As you eat more, however, its marginal utility does not fall; it remains higher than the marginal utility of any other option. Unless eating more creamed spinach somehow increases your marginal utility for some other food, you will eat only creamed spinach. And until you have reached the limit of your body's capacity (or the restaurant manager's patience), you will not stop. Failure of marginal utility to diminish would thus lead to extraordinary levels of consumption of a single good to the exclusion of all others. Since we do not observe that happening, it seems reasonable to assume that marginal utility falls beyond some level of consumption.

Maximizing Utility

Economists assume that consumers behave in a manner consistent with the maximization of utility. To see how consumers do that, we will put the marginal decision rule to work. First, however, we must reckon with the fact that the ability of consumers to purchase goods and services is limited by their budgets.

The Budget Constraint

The total utility curve in Figure 5.1 shows that Mr. Higgins achieves the maximum total utility possible from movies when he sees six of them each month. It is likely that his total utility curves for other goods and services will have much the same shape, reaching a maximum at some level of consumption. We assume that the goal of each consumer is to maximize total utility. Does that mean a person will consume each good at a level that yields the maximum utility possible?

The answer, in general, is no. Our consumption choices are constrained by the income available to us and by the prices we must pay. Suppose, for example, that Mr. Higgins can spend just \$25 per month for entertainment and that the price of going to see a movie is \$5. To achieve the maximum total utility from movies, Mr. Higgins would have to exceed his entertainment budget. Since we assume that he cannot do that, Mr. Higgins must arrange his consumption so that his total expenditures do not exceed his budget constraint: a restriction that total spending cannot exceed the budget available.

Suppose that in addition to movies, Mr. Higgins enjoys concerts, and the average price of a concert ticket is \$10. He must select the number of movies he sees and concerts he attends so that his monthly spending on the two goods does not exceed his budget.

Individuals may, of course, choose to save or to borrow. When we allow this possibility, we consider the budget constraint not just for a single period of time but for several periods. For example, economists often examine budget constraints over a consumer's lifetime. A consumer may in some years save for future consumption and in other years borrow on future income for present consumption. Whatever the time period, a consumer's spending will be constrained by his or her budget.

To simplify our analysis, we shall assume that a consumer's spending in any one period is based on the budget available in that period. In this analysis consumers neither save nor borrow. We could extend the analysis to cover several periods and generate the same basic results that we shall establish using a single period. We will also carry out our analysis by looking at the consumer's choices about buying only two goods. Again, the analysis could be extended to cover more goods and the basic results would still hold.

Applying the Marginal Decision Rule

Because consumers can be expected to spend the budget they have, utility maximization is a matter of arranging that spending to achieve the highest total utility possible. If a consumer decides to spend more on one good, he or she must spend less on another in order to satisfy the budget constraint.

The marginal decision rule states that an activity should be expanded if its marginal benefit exceeds its marginal cost. The marginal benefit of this activity is the utility gained by spending an additional \$1 on the good. The marginal cost is the utility lost by spending \$1 less on another good.

How much utility is gained by spending another \$1 on a good? It is the marginal utility of the good divided by its price. The utility gained by spending an additional dollar on good X, for example, is

$$\frac{MU_x}{P_x}$$

This additional utility is the *marginal benefit* of spending another \$1 on the good.

Suppose that the marginal utility of good X is 4 and that its price is \$2. Then an extra \$1 spent on X buys 2 additional units of utility ($MU_X/P_X = 4/2 = 2$). If the marginal utility of good X is 1 and its price is \$2, then an extra \$1 spent on X buys 0.5 additional units of utility ($MU_X/P_X = 1/2 = 0.5$).

The loss in utility from spending \$1 less on another good or service is calculated the same way: as the marginal utility divided by the price. The *marginal cost* to the consumer of spending \$1 less on a good is the loss of the additional utility that could have been gained from spending that \$1 on the good.

Suppose a consumer derives more utility by spending an additional \$1 on good X rather than on good Y:

Equation 5.1

$$\frac{MU_X}{P_X} > \frac{MU_Y}{P_Y}$$

The marginal benefit of shifting \$1 from good Y to the consumption of good X exceeds the marginal cost. In terms of utility, the gain from spending an additional \$1 on good X exceeds the loss in utility from spending \$1 less on good Y. The consumer can increase utility by shifting spending from Y to X.

As the consumer buys more of good X and less of good Y, however, the marginal utilities of the two goods will change. The law of diminishing marginal utility tells us that the marginal utility of good X will fall as the consumer consumes more of it; the marginal utility of good Y will rise as the consumer consumes less of it. The result is that the value of the left-hand side of Equation 5.1 will fall and the value of the right-hand side will rise as the consumer shifts spending from Y to X. When the two sides are equal, total utility will be maximized. In terms of the marginal decision rule, the consumer will have achieved a solution at which the marginal benefit of the activity (spending more on good X) is equal to the marginal cost:

Equation 5.2

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

We can extend this result to all goods and services a consumer uses. Utility maximization requires that the ratio of marginal utility to price be equal for all of them, as suggested in Equation 5.3:

Equation 5.3

$$\frac{MU_A}{P_A} = \frac{MU_B}{P_B} = \frac{MU_C}{P_C} = \dots = \frac{MU_n}{P_n}$$

Equation 5.3 states the utility-maximizing condition: Utility is maximized when total outlays equal the budget available and when the ratios of marginal utilities to prices are equal for all goods and services.

Consider, for example, the shopper introduced in the opening of this chapter. In shifting from cookies to ice cream, the shopper must have felt that the marginal utility of spending an additional dollar on ice cream exceeded the marginal utility of spending an

additional dollar on cookies. In terms of Equation 5.1, if good X is ice cream and good Y is cookies, the shopper will have lowered the value of the left-hand side of the equation and moved toward the utility-maximizing condition, as expressed by Equation 5.1.

The Problem of Divisibility

If we are to apply the marginal decision rule to utility maximization, goods must be divisible; that is, it must be possible to buy them in any amount. Otherwise we cannot meaningfully speak of spending \$1 more or \$1 less on them. Strictly speaking, however, few goods are completely divisible.

Even a small purchase, such as an ice cream bar, fails the strict test of being divisible; grocers generally frown on requests to purchase one-half of a \$2 ice cream bar if the consumer wants to spend an additional dollar on ice cream. Can a consumer buy a little more movie admission, to say nothing of a little more car?

In the case of a car, we can think of the quantity as depending on characteristics of the car itself. A car with a compact disc player could be regarded as containing “more car” than one that has only a cassette player. Stretching the concept of quantity in this manner does not entirely solve the problem. It is still difficult to imagine that one could purchase “more car” by spending \$1 more.

Remember, though, that we are dealing with a model. In the real world, consumers may not be able to satisfy Equation 7.3 precisely. The model predicts, however, that they will come as close to doing so as possible.

References

Edgeworth, F. Y., *Mathematical Psychics: An Essay on the Application of Mathematics to the Moral Sciences* (New York: Augustus M. Kelley, 1967), p. 101. First Published 1881.

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5.2: Utility Maximization and Demand

Learning Objective

1. Derive an individual demand curve from utility-maximizing adjustments to changes in price.
2. Derive the market demand curve from the demand curves of individuals.
3. Explain the substitution and income effects of a price change.
4. Explain the concepts of normal and inferior goods in terms of the income effect.

Choices that maximize utility—that is, choices that follow the marginal decision rule—generally produce downward-sloping demand curves. This section shows how an individual's utility-maximizing choices can lead to a demand curve.

Deriving an Individual's Demand Curve

Suppose, for simplicity, that Mary Andrews consumes only apples, denoted by the letter A, and oranges, denoted by the letter O. Apples cost \$2 per pound and oranges cost \$1 per pound, and her budget allows her to spend \$20 per month on the two goods. We assume that Ms. Andrews will adjust her consumption so that the utility-maximizing condition holds for the two goods: The ratio of marginal utility to price is the same for apples and oranges. That is,

$$\frac{MU_A}{\$2} = \frac{MU_O}{\$1} \quad (5.2.1)$$

Here MU_A and MU_O are the marginal utilities of apples and oranges, respectively. Her spending equals her budget of \$20 per month; suppose she buys 5 pounds of apples and 10 of oranges.

Now suppose that an unusually large harvest of apples lowers their price to \$1 per pound. The lower price of apples increases the marginal utility of each \$1 Ms. Andrews spends on apples, so that at her current level of consumption of apples and oranges

$$\frac{MU_A}{\$1} > \frac{MU_O}{\$1} \quad (5.2.2)$$

Ms. Andrews will respond by purchasing more apples. As she does so, the marginal utility she receives from apples will decline. If she regards apples and oranges as substitutes, she will also buy fewer oranges. That will cause the marginal utility of oranges to rise. She will continue to adjust her spending until the marginal utility per \$1 spent is equal for both goods:

$$\frac{MU_A}{\$1} = \frac{MU_O}{\$1} \quad (5.2.3)$$

Suppose that at this new solution, she purchases 12 pounds of apples and 8 pounds of oranges. She is still spending all of her budget of \$20 on the two goods [(12 x \$1)+(8 x \$1)=\$20].

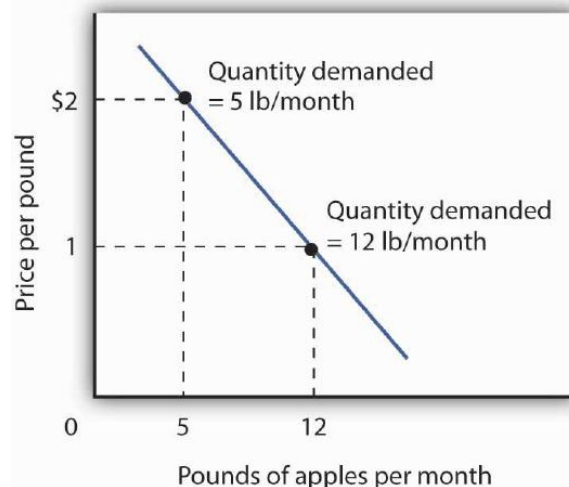


Figure 5.2 Utility Maximization and an Individual's Demand Curve Mary Andrews's demand curve for apples, d , can be derived by determining the quantities of apples she will buy at each price. Those quantities are determined by the application of the marginal decision rule to utility maximization. At a price of \$2 per pound, Ms. Andrews maximizes utility by purchasing 5 pounds of apples per month. When the price of apples falls to \$1 per pound, the quantity of apples at which she maximizes utility increases to 12 pounds per month.

It is through a consumer's reaction to different prices that we trace the consumer's demand curve for a good. When the price of apples was \$2 per pound, Ms. Andrews maximized her utility by purchasing 5 pounds of apples, as illustrated in Figure 5.2. When the price of apples fell, she increased the quantity of apples she purchased to 12 pounds.

Heads Up!

Notice that, in this example, Ms. Andrews maximizes utility where not only the ratios of marginal utilities to price are equal, but also the marginal utilities of both goods are equal. But, the equal-marginal-utility outcome is only true here because the prices of the two goods are the same: each good is priced at \$1 in this case. If the prices of apples and oranges were different, the marginal utilities at the utility maximizing solution would have been different. The condition for maximizing utility—consume where the ratios of marginal utility to price are equal—holds regardless. The utility-maximizing condition is not that consumers maximize utility by equating marginal utilities.

Utility maximizing condition is:

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} \quad (5.2.4)$$

Utility maximizing condition is not:

$$MU_X = MU_Y \quad (5.2.5)$$

From Individual to Market Demand

The market demand curves we studied in previous chapters are derived from individual demand curves such as the one depicted in Figure 5.2. Suppose that in addition to Ms. Andrews, there are two other consumers in the market for apples—Ellen Smith and Koy Keino. The quantities each consumes at various prices are given in Figure 5.3, along with the quantities that Ms. Andrews consumes at each price. The demand curves for each are shown in Panel (a). The market demand curve for all three consumers, shown in Panel (b), is then found by adding the quantities demanded at each price for all three consumers. At a price of \$2 per pound, for example, Ms. Andrews demands 5 pounds of apples per month, Ms. Smith demands 3 pounds, and Mr. Keino demands 8 pounds. A total of 16 pounds of apples are demanded per month at this price. Adding the individual quantities demanded at \$1 per pound yields market demand of 40 pounds per month. This method of adding amounts along the horizontal axis of a graph is referred to as summing horizontally. The market demand curve is thus the horizontal summation of all the individual demand curves.

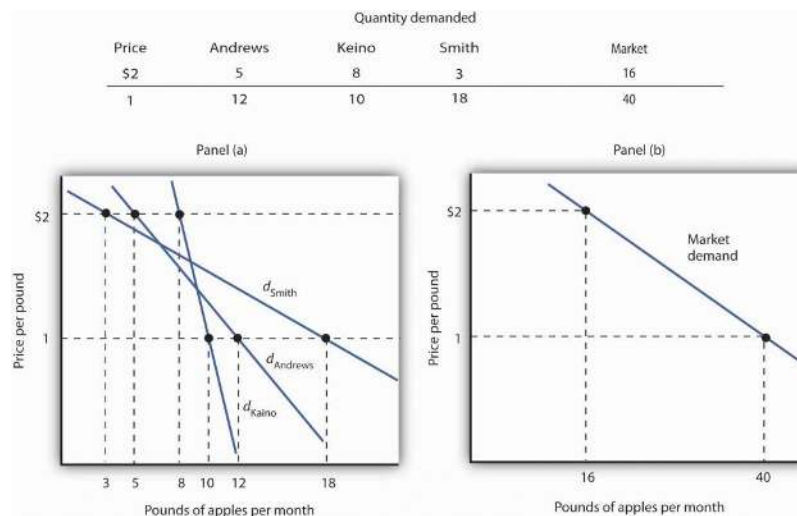


Figure 5.3 Deriving a Market Demand Curve The demand schedules for Mary Andrews, Ellen Smith, and Koy Keino are given in the table. Their individual demand curves are plotted in Panel (a). The market demand curve for all three is shown in Panel (b).

Individual demand curves, then, reflect utility-maximizing adjustment by consumers to various market prices. Once again, we see that as the price falls, consumers tend to buy more of a good. Demand curves are downward-sloping as the law of demand asserts.

Substitution and Income Effects

We saw that when the price of apples fell from \$2 to \$1 per pound, Mary Andrews increased the quantity of apples she demanded. Behind that adjustment, however, lie two distinct effects: the substitution effect and the income effect. It is important to distinguish these effects, because they can have quite different implications for the elasticity of the demand curve.

First, the reduction in the price of apples made them cheaper relative to oranges. Before the price change, it cost the same amount to buy 2 pounds of oranges or 1 pound of apples. After the price change, it cost the same amount to buy 1 pound of either oranges or apples. In effect, 2 pounds of oranges would exchange for 1 pound of apples before the price change, and 1 pound of oranges would exchange for 1 pound of apples after the price change.

Second, the price reduction essentially made consumers of apples richer. Before the price change, Ms. Andrews was purchasing 5 pounds of apples and 10 pounds of oranges at a total cost to her of \$20. At the new lower price of apples, she could purchase this same combination for \$15. In effect, the price reduction for apples was equivalent to handing her a \$5 bill, thereby increasing her purchasing power. Purchasing power refers to the quantity of goods and services that can be purchased with a given budget.

To distinguish between the substitution and income effects, economists consider first the impact of a price change with no change in the consumer's ability to purchase goods and services. An income-compensated price change is an imaginary exercise in which we assume that when the price of a good or service changes, the consumer's income is adjusted so that he or she has just enough to purchase the original combination of goods and services at the new set of prices. Ms. Andrews was purchasing 5 pounds of apples and 10 pounds of oranges before the price change. Buying that same combination after the price change would cost \$15. The income-compensated price change thus requires us to take \$5 from Ms. Andrews when the price of apples falls to \$1 per pound. She can still buy 5 pounds of apples and 10 pounds of oranges. If, instead, the price of apples increased, we would give Ms. Andrews more money (i.e., we would "compensate" her) so that she could purchase the same combination of goods.

With \$15 and cheaper apples, Ms. Andrews *could* buy 5 pounds of apples and 10 pounds of oranges. But would she? The answer lies in comparing the marginal benefit of spending another \$1 on apples to the marginal benefit of spending another \$1 on oranges. It shows that the extra utility per \$1 she could obtain from apples now exceeds the extra utility per \$1 from oranges. She will thus increase her consumption of apples. If she had only \$15, any increase in her consumption of apples would require a reduction in her consumption of oranges. In effect, she responds to the income-compensated price change for apples by substituting apples for oranges. The change in a consumer's consumption of a good in response to an income-compensated price change is called the substitution effect. The change in a consumer's consumption of a good in response to an income-compensated price change.

Suppose that with an income-compensated reduction in the price of apples to \$1 per pound, Ms. Andrews would increase her consumption of apples to 9 pounds per month and reduce her consumption of oranges to 6 pounds per month. The substitution effect of the price reduction is an increase in apple consumption of 4 pounds per month.

The substitution effect always involves a change in consumption in a direction opposite that of the price change. When a consumer is maximizing utility, the ratio of marginal utility to price is the same for all goods. An income-compensated price reduction increases the extra utility per dollar available from the good whose price has fallen; a consumer will thus purchase more of it. An income-compensated price increase reduces the extra utility per dollar from the good; the consumer will purchase less of it.

In other words, when the price of a good falls, people react to the lower price by substituting or switching toward that good, buying more of it and less of other goods, *if* we artificially hold the consumer's ability to buy goods constant. When the price of a good goes up, people react to the higher price by substituting or switching away from that good, buying less of it and instead buying more of other goods. By examining the impact of consumer purchases of an income-compensated price change, we are looking at *just* the change in relative prices of goods and eliminating any impact on consumer buying that comes from the effective change in the consumer's ability to purchase goods and services (that is, we hold the consumer's purchasing power constant).

To complete our analysis of the impact of the price change, we must now consider the \$5 that Ms. Andrews effectively gained from it. After the price reduction, it cost her just \$15 to buy what cost her \$20 before. She has, in effect, \$5 more than she did before. Her additional income may also have an effect on the number of apples she consumes. The change in consumption of a good resulting from the implicit change in income because of a price change is called the income effect. The change in consumption of a good resulting from the implicit change in income because of a price change. When the price of a good rises, there is an implicit reduction in income. When the price of a good falls, there is an implicit increase. When the price of apples fell, Ms. Andrews (who was consuming 5 pounds of apples per month) received an implicit increase in income of \$5.

Suppose Ms. Andrews uses her implicit increase in income to purchase 3 more pounds of apples and 2 more pounds of oranges per month. She has already increased her apple consumption to 9 pounds per month because of the substitution effect, so the added 3 pounds brings her consumption level to 12 pounds per month. That is precisely what we observed when we derived her demand curve; it is the change we would observe in the marketplace. We see now, however, that her increase in quantity demanded consists of a substitution effect and an income effect. Figure 5.4 shows the combined effects of the price change.

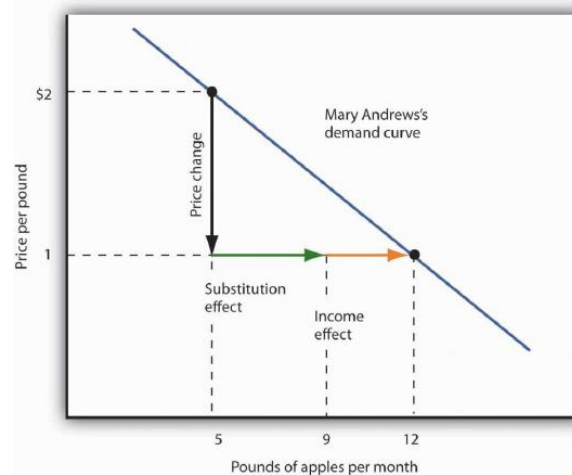


Figure 5.4 The Substitution and Income Effects of a Price Change This demand curve for Ms. Andrews was presented in Figure 5.2. It shows that a reduction in the price of apples from \$2 to \$1 per pound increases the quantity Ms. Andrews demands from 5 pounds of apples to 12. This graph shows that this change consists of a substitution effect and an income effect. The substitution effect increases the quantity demanded by 4 pounds, the income effect by 3, for a total increase in quantity demanded of 7 pounds.

The size of the substitution effect depends on the rate at which the marginal utilities of goods change as the consumer adjusts consumption to a price change. As Ms. Andrews buys more apples and fewer oranges, the marginal utility of apples will fall and the marginal utility of oranges will rise. If relatively small changes in quantities consumed produce large changes in marginal utilities, the substitution effect that is required to restore the equality of marginal-utility-to-price ratios will be small. If much larger

changes in quantities consumed are needed to produce equivalent changes in marginal utilities, then the substitution effect will be large.

The magnitude of the income effect of a price change depends on how responsive the demand for a good is to a change in income and on how important the good is in a consumer's budget. When the price changes for a good that makes up a substantial fraction of a consumer's budget, the change in the consumer's ability to buy things is substantial. A change in the price of a good that makes up a trivial fraction of a consumer's budget, however, has little effect on his or her purchasing power; the income effect of such a price change is small.

Because each consumer's response to a price change depends on the sizes of the substitution and income effects, these effects play a role in determining the price elasticity of demand. All other things unchanged, the larger the substitution effect, the greater the absolute value of the price elasticity of demand. When the income effect moves in the same direction as the substitution effect, a greater income effect contributes to a greater price elasticity of demand as well. There are, however, cases in which the substitution and income effects move in opposite directions. We shall explore these ideas in the next section.

Normal and Inferior Goods

The nature of the income effect of a price change depends on whether the good is normal or inferior. The income effect reinforces the substitution effect in the case of normal goods; it works in the opposite direction for inferior goods.

Normal Goods

A normal good is one whose consumption increases with an increase in income. When the price of a normal good falls, there are two identifying effects:

1. The substitution effect contributes to an increase in the quantity demanded because consumers substitute more of the good for other goods.
2. The reduction in price increases the consumer's ability to buy goods. Because the good is normal, this increase in purchasing power further increases the quantity of the good demanded through the income effect.

In the case of a normal good, then, the substitution and income effects reinforce each other. Ms. Andrews's response to a price reduction for apples is a typical response to a lower price for a normal good.

An increase in the price of a normal good works in an equivalent fashion. The higher price causes consumers to substitute more of other goods, whose prices are now relatively lower. The substitution effect thus reduces the quantity demanded. The higher price also reduces purchasing power, causing consumers to reduce consumption of the good via the income effect.

Inferior Goods

In the chapter that introduced the model of demand and supply, we saw that an inferior good is one for which demand falls when income rises. It is likely to be a good that people do not really like very much. When incomes are low, people consume the inferior good because it is what they can afford. As their incomes rise and they can afford something they like better, they consume less of the inferior good. When the price of an inferior good falls, two things happen:

1. Consumers will substitute more of the inferior good for other goods because its price has fallen relative to those goods. The quantity demanded increases as a result of the substitution effect.
2. The lower price effectively makes consumers richer. But, because the good is inferior, this reduces quantity demanded.

The case of inferior goods is thus quite different from that of normal goods. The income effect of a price change works in a direction *opposite* to that of the substitution effect in the case of an inferior good, whereas it reinforces the substitution effect in the case of a normal good.

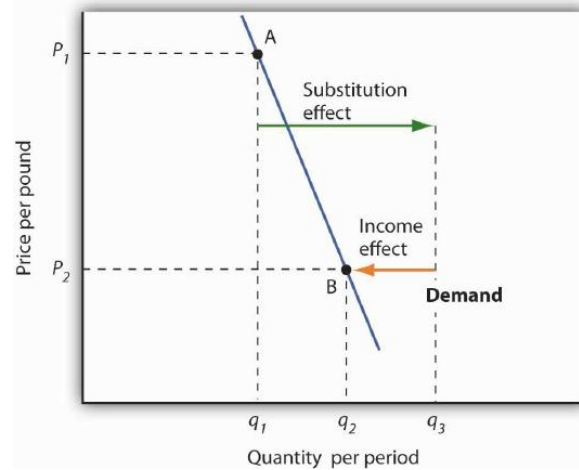


Figure 5.5 Substitution and Income Effects for Inferior Goods The substitution and income effects work against each other in the case of inferior goods. The consumer begins at point A, consuming q_1 units of the good at a price P_1 . When the price falls to P_2 , the consumer moves to point B, increasing quantity demanded to q_2 . The substitution effect increases quantity demanded to q_3 , but the income effect reduces it from q_3 to q_2 .

Figure 5.5 illustrates the substitution and income effects of a price reduction for an inferior good. When the price falls from P_1 to P_2 , the quantity demanded by a consumer increases from q_1 to q_2 . The substitution effect increases quantity demanded from q_1 to q_3 . But the income effect reduces quantity demanded from q_3 to q_2 ; the substitution effect is stronger than the income effect. The result is consistent with the law of demand: A reduction in price increases the quantity demanded. The quantity demanded is smaller, however, than it would be if the good were normal. Inferior goods are therefore likely to have less elastic demand than normal goods.

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CHAPTER OVERVIEW

6: Markets, Maximizers, and Efficiency

[6.1: Maximizing in the Marketplace](#)

[6.2: Market Failure](#)

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6.1: Maximizing in the Marketplace

Learning Objective

1. Explain what is meant by an efficient allocation of resources in an economy and describe the market conditions that must exist to achieve this goal.
2. Define consumer and producer surplus.
3. Discuss the relationship between efficiency and equity.

In perhaps the most influential book in economics ever written, *An Inquiry into the Nature and Causes of the Wealth of Nations*, published in 1776, Adam Smith argued that the pursuit of self-interest in a marketplace would promote the general interest. He said resources would be guided, as if by an “invisible hand,” to their best uses. That invisible hand was the marketplace.

Smith’s idea was radical for its time; he saw that the seemingly haphazard workings of the marketplace could promote the common good. In this section, we will use the tools we have developed thus far to see the power of Smith’s invisible hand. Efforts by individuals to maximize their own net benefit can maximize net benefit for the economy as a whole.

When the net benefits of all economic activities are maximized, economists say the allocation of resources is efficient. This concept of efficiency is broader than the notion of efficient production that we encountered when discussing the production possibilities curve. There, we saw that the economy’s factors of production would be efficient *in production* if they were allocated according to the principle of comparative advantage. That meant producing as much as possible with the factors of production available. The concept of an efficient allocation of resources incorporates production, as in that discussion, but it includes efficiency in the consumption of goods and services as well.

Achieving Efficiency

Imagine yourself arriving at the store to purchase some food. In your choice, you will weigh your own benefits and costs to maximize your net benefit. The farmers, the distributors, and the grocer have sought to maximize their net benefits as well. How can we expect that all those efforts will maximize net benefits for the economy as a whole? How can we expect the marketplace to achieve an efficient allocation of food, or of anything else?

One condition that must be met if the market’s allocation is to be efficient is that the marketplace must be competitive or function as if it were. We will have a great deal more to say about competitive markets versus less competitive ones in subsequent chapters. For now, we can simply note that a competitive market is one with many buyers and sellers in each market and in which entry and exit are fairly easy. No one controls the price; the forces of demand and supply determine price.

The second condition that must hold if the market is to achieve an efficient allocation concerns property rights. We turn to that topic in the next section.

The Role of Property Rights

A smoothly functioning market requires that producers possess property rights to the goods and services they produce and that consumers possess property rights to the goods and services they buy. Property rights are a set of rules that specify the ways in which an owner can use a resource.

Consider the tomato market. Farmers who grow tomatoes have clearly defined rights to their land and to the tomatoes they produce and sell. Distributors who purchase tomatoes from farmers and sell them to grocers have clear rights to the tomatoes until they sell them to grocers. The grocers who purchase the tomatoes retain rights to them until they sell them to consumers. When you buy a tomato, you have the exclusive right to its use.

A system of property rights forms the basis for all market exchange. Before exchange can begin, there must be a clear specification of who owns what. The system of property rights must also show what purchasers are acquiring when they buy rights to particular resources. Because property rights must exist if exchange is to occur, and because exchange is the process through which economic efficiency is achieved, a system of property rights is essential to the efficient allocation of resources.

Imagine what would happen in the market for tomatoes if property rights were not clearly defined. Suppose, for example, that grocers could not legally prevent someone from simply grabbing some tomatoes and leaving without paying for them. If that were

the case, grocers would not be likely to offer tomatoes for sale. If it were the case for all grocery items, there would not be grocery stores at all.

Although property rights vary for different resources, two characteristics are required if the marketplace is to achieve an efficient allocation of resources:

1. Property rights must be exclusive. An exclusive property right is one that allows its owner to prevent others from using the resource. The owner of a house, for example, has the right to exclude others from the use of the house. If this right did not exist, ownership would have little value; it is not likely that the property could be exchanged in a market. And the inability to sell property would limit the incentive of owners to maintain it.
2. Property rights must be transferable. A transferable property right is one that allows the owner of a resource to sell or lease it to someone else. In the absence of transferability, no exchange could occur.

Markets and the Efficiency Condition

A competitive market with well-defined and transferable property rights satisfies the efficiency condition. If met, we can assume that the market's allocation of resources will be efficient.

Consider again your purchase of tomatoes. Suppose the curves of demand and supply for tomatoes are those given in Figure 6.1; the equilibrium price equals \$1.50 per pound. Suppose further that the market satisfies the efficiency condition. With that assumption, we can relate the model of demand and supply to our analysis of marginal benefits and costs.

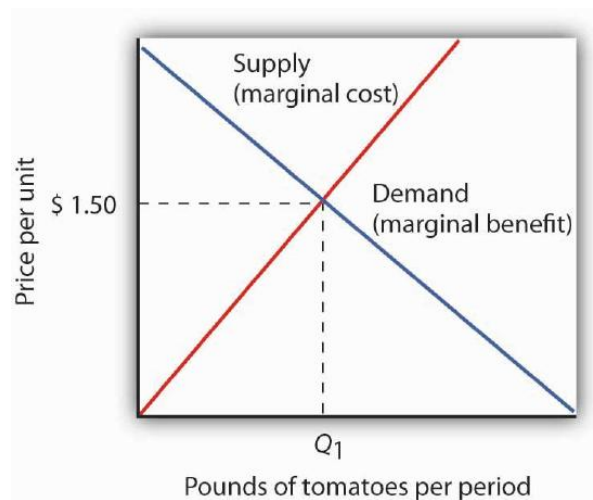


Figure 6.1 Demand and Supply and the Efficiency Condition In a competitive market with exclusive and transferable property rights, such as the market for tomatoes, the efficiency condition is met. Buyers and sellers are faced with all of the relevant benefits and costs, and the equilibrium price equals the marginal cost to society of producing that good, here \$2.50 per pound. We can interpret the market demand and supply curve as marginal benefit and marginal cost curves, respectively.

The demand curve tells us that the last pound of tomatoes was worth \$1.50; we can think of that as the marginal benefit of the last pound of tomatoes since that is how much consumers were willing to pay. We can say that about any price on a market demand curve; a demand curve can be considered as a marginal benefit curve. Similarly, the supply curve can be considered the marginal cost curve. In the case of the tomato market, for example, the price tells us that the marginal cost of producing the last pound of tomatoes is \$1.50. This marginal cost is considered in the economic sense—other goods and services worth \$1.50 were not produced in order to make an additional pound of tomatoes available.

On what basis can we presume that the price of a pound of tomatoes equals its marginal cost? The answer lies in our marginal decision rule. Profit-maximizing tomato producers will produce more tomatoes as long as their marginal benefit exceeds their marginal cost. What is the marginal benefit to a producer of an extra pound of tomatoes? It is the price that the producer will receive. What is the marginal cost? It is the value that must be given up to produce an extra pound of tomatoes.

Producers maximize profit by expanding their production up to the point at which their marginal cost equals their marginal benefit, which is the market price. The price of \$1.50 thus reflects the marginal cost to society of making an additional pound of tomatoes

available.

At the equilibrium price and output of tomatoes, then, the marginal benefit of tomatoes to consumers, as reflected by the price they are willing to pay, equals the marginal cost of producing tomatoes. Where marginal benefit equals marginal cost, net benefit is maximized. The equilibrium quantity of tomatoes, as determined by demand and supply, is efficient.

Producer and Consumer Surplus

Think about the last thing you purchased. You bought it because you expected that its benefits would exceed its opportunity cost; you expected that the purchase would make you better off. The seller sold it to you because he or she expected that the money you paid would be worth more than the value of keeping the item. The seller expected to be better off as a result of the sale. Exchanges in the marketplace have a remarkable property: Both buyers and sellers expect to emerge from the transaction better off.

Panel (a) of Figure 6.2 shows a market demand curve for a particular good. Suppose the price equals OB and the quantity equals OE. The area under the demand curve over the range of quantities from the origin at O to the quantity at E equals the total benefit of consuming OE units of the good. It is the area OCDE. Consumers pay for this benefit; their total expenditures equal the rectangle OBDE, which is the dark shaded region in the graph. Because the total benefits exceed total expenditures, there is a consumer surplus given by the triangle BCD. Consumer surplus is the amount by which the total benefits to consumers from consuming a good exceed their total expenditures on the good.

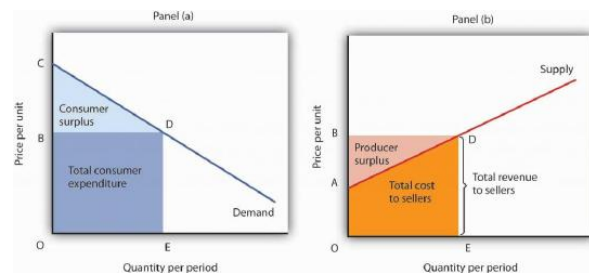


Figure 6.2 Consumer and Producer Surplus Consumer surplus [Panel (a)] measures the difference between total benefit of consuming a given quantity of output and the total expenditures consumers pay to obtain that quantity. Here, total benefits are given by the shaded area OCDE; total expenditures are given by the rectangle OBDE. The difference, shown by the triangle BCD, is consumer surplus.

Producer surplus [Panel (b)] measures the difference between total revenue received by firms at a given quantity of output and the total cost of producing it. Here, total revenue is given by the rectangle OBDE, and total costs are given by the area OADE. The difference, shown by the triangle ABD, is producer surplus.

Now consider the sellers' side of transactions. Panel (b) of Figure 6.2 shows a market supply curve; recall that it gives us marginal cost. Suppose the market price equals OB and quantity supplied is OE; those are the same values we had in Panel (a). The price times the quantity equals the total revenue received by sellers. It is shown as the shaded rectangle OBDE. The total revenue received by sellers equals total expenditures by consumers.

The total cost to sellers is the area under the marginal cost curve; it is the area OADE. That cost is less than revenue. The difference between the total revenue received by sellers and their total cost is called producer surplus. In Panel (b) it is the light-shaded triangle ABD.

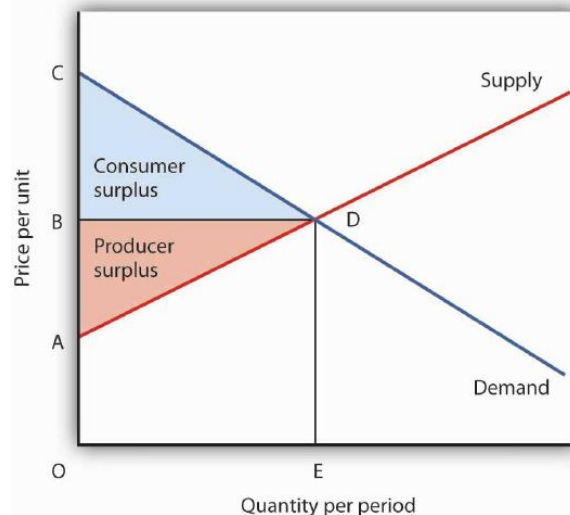


Figure 6.3 Net Benefit: The Sum of Consumer and Producer Surplus The sum of consumer surplus and producer surplus measures the net benefit to society of any level of economic activity. Net benefit is maximized when production and consumption are carried out at the level where the demand and supply curves intersect. Here, the net benefit to society equals the area ACD. It is the sum of consumer surplus, BCD, and producer surplus, ABD.

We put the demand and supply curves of Figure 6.2 Panels (a) and (b) together in Figure 6.3. The intersection of the two curves determines the equilibrium price, OB, and the equilibrium quantity, OE. The shaded regions give us consumer and producer surplus. The sum of these two surpluses is net benefit. This net benefit is maximized where the demand and supply curves intersect.

Efficiency and Equity

Consumer demands are affected by incomes. Demand, after all, reflects ability as well as willingness to pay for goods and services. The market will be more responsive to the preferences of people with high incomes than to those of people with low incomes.

In a market that satisfies the efficiency condition, an efficient allocation of resources will emerge from any particular distribution of income. Different income distributions will result in different, but still efficient, outcomes. For example, if 1% of the population controls virtually all the income, then the market will efficiently allocate virtually all its production to those same people.

What is a fair, or equitable, distribution of income? What is an unfair distribution? Should everyone have the same income? Is the current distribution fair? Should the rich have less and the poor have more? Should the middle class have more? Equity is very much in the mind of the observer. What may seem equitable to one person may seem inequitable to another. There is, however, no test we can apply to determine whether the distribution of income is or is not equitable. That question requires a normative judgment.

Determining whether the allocation of resources is or is not efficient is one problem. Determining whether the distribution of income is fair is another. The governments of all nations act in some way to redistribute income. That fact suggests that people generally have concluded that leaving the distribution of income solely to the market would not be fair and that some redistribution is desirable. This may take the form of higher taxes for people with higher incomes than for those with lower incomes. It may take the form of special programs, such as welfare programs, for low-income people.

Whatever distribution society chooses, an efficient allocation of resources is still preferred to an inefficient one. Because an efficient allocation maximizes net benefits, the gain in net benefits could be distributed in a way that leaves all people better off than they would be at any inefficient allocation. If an efficient allocation of resources seems unfair, it must be because the distribution of income is unfair.

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6.2: Market Failure

Learning Objective

1. Explain what is meant by market failure and the conditions that may lead to it.
2. Distinguish between private goods and public goods and relate them to the free rider problem and the role of government.
3. Explain the concepts of external costs and benefits and the role of government intervention when they are present.
4. Explain why a common property resource is unlikely to be allocated efficiently in the marketplace.

Private decisions in the marketplace may not be consistent with the maximization of the net benefit of a particular activity. The failure of private decisions in the marketplace to achieve an efficient allocation of scarce resources is called market failure. Markets will not generate an efficient allocation of resources if they are not competitive or if property rights are not well defined and fully transferable. Either condition will mean that decision makers are not faced with the marginal benefits and costs of their choices.

Think about the drive that we had you take at the beginning of this chapter. You faced some, but not all, of the opportunity costs involved in that choice. In particular, your choice to go for a drive would increase air pollution and might increase traffic congestion. That means that, in weighing the marginal benefits and marginal costs of going for a drive, not all of the costs would be counted. As a result, the net benefit of the allocation of resources such as the air might not be maximized.

Noncompetitive Markets

The model of demand and supply assumes that markets are competitive. No one in these markets has any power over the equilibrium price; each consumer and producer takes the market price as given and responds to it. Under such conditions, price is determined by the intersection of demand and supply.

In some markets, however, individual buyers or sellers are powerful enough to influence the market price. In subsequent chapters, we will study cases in which producers or consumers are in a position to affect the prices they charge or must pay, respectively. We shall find that when individual firms or groups of firms have market power, which is the ability to change the market price, the price will be distorted—it will not equal marginal cost.

Public Goods

Some goods are unlikely to be produced and exchanged in a market because of special characteristics of the goods themselves. The benefits of these goods are such that exclusion is not feasible. Once they are produced, anyone can enjoy them; there is no practical way to exclude people who have not paid for them from consuming them. Furthermore, the marginal cost of adding one more consumer is zero. A good for which the cost of exclusion is prohibitive and for which the marginal cost of an additional user is zero is a public good. A good for which exclusion is possible and for which the marginal cost of another user is positive is a private good.

National defense is a public good. Once defense is provided, it is not possible to exclude people who have not paid for it from its consumption. Further, the cost of an additional user is zero—an army does not cost any more if there is one more person to be protected. Other examples of public goods include law enforcement, fire protection, and efforts to preserve species threatened with extinction.

Free Riders

Suppose a private firm, Terror Alert, Inc., develops a completely reliable system to identify and intercept 98% of any would-be terrorists that might attempt to enter the United States from anywhere in the world. This service is a public good. Once it is provided, no one can be excluded from the system's protection on grounds that he or she has not paid for it, and the cost of adding one more person to the group protected is zero. Suppose that the system, by eliminating a potential threat to U.S. security, makes the average person in the United States better off; the benefit to each household from the added security is worth \$40 per month (about the same as an earthquake insurance premium). There are roughly 113 million households in the United States, so the total benefit of the system is \$4.5 billion per month. Assume that it will cost Terror Alert, Inc., \$1 billion per month to operate. The benefits of the system far outweigh the cost.

Suppose that Terror Alert installs its system and sends a bill to each household for \$20 for the first month of service—an amount equal to half of each household's benefit. If each household pays its bill, Terror Alert will enjoy a tidy profit; it will receive

revenues of more than \$2.25 billion per month.

But will each household pay? Once the system is in place, each household would recognize that it will benefit from the security provided by Terror Alert whether it pays its bill or not. Although some households will voluntarily pay their bills, it seems unlikely that very many will. Recognizing the opportunity to consume the good without paying for it, most would be free riders. Free riders are people or firms that consume a public good without paying for it. Even though the total benefit of the system is \$4.5 billion, Terror Alert will not be faced by the marketplace with a signal that suggests that the system is worthwhile. It is unlikely that it will recover its cost of \$1 billion per month. Terror Alert is not likely to get off the ground.

The bill for \$20 from Terror Alert sends the wrong signal, too. An efficient market requires a price equal to marginal cost. But the marginal cost of protecting one more household is zero; adding one more household adds nothing to the cost of the system. A household that decides not to pay Terror Alert anything for its service is paying a price equal to its marginal cost. But doing that, being a free rider, is precisely what prevents Terror Alert from operating.

Because no household can be excluded and because the cost of an extra household is zero, the efficiency condition will not be met in a private market. What is true of Terror Alert, Inc., is true of public goods in general: they simply do not lend themselves to private market provision.

Public Goods and the Government

Because many individuals who benefit from public goods will not pay for them, private firms will produce a smaller quantity of public goods than is efficient, if they produce them at all. In such cases, it may be desirable for government agencies to step in. Government can supply a greater quantity of the good by direct provision, by purchasing the public good from a private agency, or by subsidizing consumption. In any case, the cost is financed through taxation and thus avoids the free-rider problem.

Most public goods are provided directly by government agencies. Governments produce national defense and law enforcement, for example. Private firms under contract with government agencies produce some public goods. Park maintenance and fire services are public goods that are sometimes produced by private firms. In other cases, the government promotes the private consumption or production of public goods by subsidizing them. Private charitable contributions often support activities that are public goods; federal and state governments subsidize these by allowing taxpayers to reduce their tax payments by a fraction of the amount they contribute.

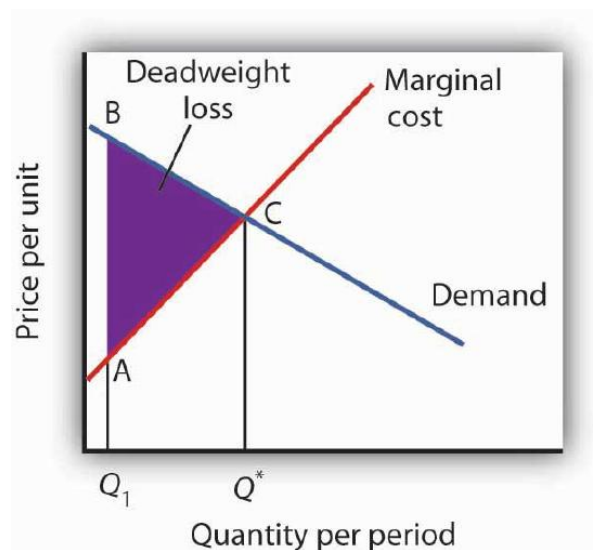


Figure 6.4 Public Goods and Market Failure Because free riders will prevent firms from being able to require consumers to pay for the benefits received from consuming a public good, output will be less than the efficient level. In the case shown here, private donations achieved a level of the public good of Q_1 per period. The efficient level is Q^* . The deadweight loss is shown by the triangle ABC.

While the market will produce some level of public goods in the absence of government intervention, we do not expect that it will produce the quantity that maximizes net benefit. Figure 6.4 illustrates the problem. Suppose that provision of a public good such as

national defense is left entirely to private firms. It is likely that some defense services would be produced; suppose that equals Q_1 units per period. This level of national defense might be achieved through individual contributions. But it is very unlikely that contributions would achieve the correct level of defense services. The efficient quantity occurs where the demand, or marginal benefit, curve intersects the marginal cost curve, at Q^* . The deadweight loss is the shaded area ABC; we can think of this as the net benefit of government intervention to increase the production of national defense from Q_1 up to the efficient quantity, Q^* .

Heads Up!

Note that the definitions of public and private goods are based on characteristics of the goods themselves, not on whether they are provided by the public or the private sector. Postal services are a private good provided by the public sector. The fact that these goods are produced by a government agency does not make them a public good.

External Costs and Benefits

Suppose that in the course of production, the firms in a particular industry generate air pollution. These firms thus impose costs on others, but they do so outside the context of any market exchange—no agreement has been made between the firms and the people affected by the pollution. The firms thus will not be faced with the costs of their action. A cost imposed on others outside of any market exchange is an external cost.

We saw an example of an external cost in our imaginary decision to go for a drive. Here is another: violence on television, in the movies, and in video games. Many critics argue that the violence that pervades these media fosters greater violence in the real world. By the time a child who spends the average amount of time watching television finishes elementary school, he or she will have seen 100,000 acts of violence, including 8,000 murders, according to the American Psychological Association. Thousands of studies of the relationship between violence in the media and behavior have concluded that there is a link between watching violence and violent behaviors. Video games are a major element of the problem, as young children now spend hours each week playing them. Any tendency of increased violence resulting from increased violence in the media constitutes an external cost of such media.

An action taken by a person or firm can also create benefits for others, again in the absence of any market agreement; such a benefit is called an external benefit. A firm that builds a beautiful building generates benefits to everyone who admires it; such benefits are external.

External Costs and Efficiency

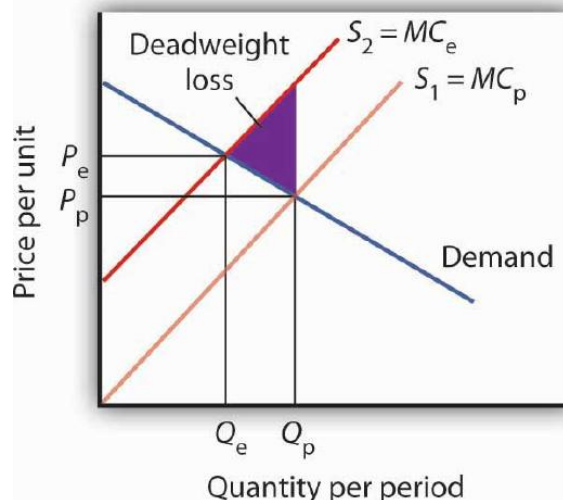


Figure 6.5 External Costs When firms in an industry generate external costs, the supply curve S_1 reflects only their private marginal costs, MC_p . Forcing firms to pay the external costs they impose shifts the supply curve to S_2 , which reflects the full marginal cost of the firms' production, MC_e . Output is reduced and price goes up. The deadweight loss that occurs when firms are not faced with the full costs of their decisions is shown by the shaded area in the graph.

The case of the polluting firms is illustrated in Figure 6.5. The industry supply curve S_1 reflects private marginal costs, MC_p . The market price is P_p for a quantity Q_p . This is the solution that would occur if firms generating external costs were not forced to pay those costs. If the external costs generated by the pollution were added, the new supply curve S_2 would reflect higher marginal costs, MC_e . Faced with those costs, the market would generate a lower equilibrium quantity, Q_e . That quantity would command a higher price, P_e . The failure to confront producers with the cost of their pollution means that consumers do not pay the full cost of the good they are purchasing. The level of output and the level of pollution are therefore higher than would be economically efficient. If a way could be found to confront producers with the full cost of their choices, then consumers would be faced with a higher cost as well. Figure 6.5 shows that consumption would be reduced to the efficient level, Q_e , at which demand and the full marginal cost curve (MC_e) intersect. The deadweight loss generated by allowing the external cost to be generated with an output of Q_p is given as the shaded region in the graph.

External Costs and Government Intervention

If an activity generates external costs, the decision makers generating the activity will not be faced with its full costs. Agents who impose these costs will carry out their activities beyond the efficient level; those who consume them, facing too low a price, will consume too much. As a result, producers and consumers will carry out an excessive quantity of the activity. In such cases, government may try to intervene to reduce the level of the activity toward the efficient quantity. In the case shown in Figure 6.5, for example, firms generating an external cost have a supply curve S_1 that reflects their private marginal costs, MC_p . A per-unit pollution fee imposed on the firms would increase their marginal costs to MC_e , thus shifting the supply curve to S_2 , and the efficient level of production would emerge. Taxes or other restrictions may be imposed on the activity that generates the external cost in an effort to confront decision makers with the costs that they are imposing. In many areas, firms and consumers that pollute rivers and lakes are required to pay fees based on the amount they pollute. Firms in many areas are required to purchase permits in order to pollute the air; the requirement that permits be purchased serves to confront the firms with the costs of their choices.

Another approach to dealing with problems of external costs is direct regulation. For example, a firm may be ordered to reduce its pollution. A person who turns his or her front yard into a garbage dump may be ordered to clean it up. Participants at a raucous party may be told to be quiet. Alternative ways of dealing with external costs are discussed later in the text.

Common Property Resources

Common property resources are resources for which no property rights have been defined. The difficulty with common property resources is that individuals may not have adequate incentives to engage in efforts to preserve or protect them. Consider, for example, the relative fates of cattle and buffalo in the United States in the nineteenth century. Cattle populations increased throughout the century, while the buffalo nearly became extinct. The chief difference between the two animals was that exclusive property rights existed for cattle but not for buffalo.

Owners of cattle had an incentive to maintain herd sizes. A cattle owner who slaughtered all of his or her cattle without providing for replacement of the herd would not have a source of future income. Cattle owners not only maintained their herds but also engaged in extensive efforts to breed high-quality livestock. They invested time and effort in the efficient management of the resource on which their livelihoods depended.

Buffalo hunters surely had similar concerns about the maintenance of buffalo herds, but they had no individual stake in doing anything about them—the animals were a common property resource. Thousands of individuals hunted buffalo for a living. Anyone who cut back on hunting in order to help to preserve the herd would lose income—and face the likelihood that other hunters would go on hunting at the same rate as before.

Today, exclusive rights to buffalo have been widely established. The demand for buffalo meat, which is lower in fat than beef, has been increasing, but the number of buffalo in the United States is rising rapidly. If buffalo were still a common property resource, that increased demand, in the absence of other restrictions on hunting of the animals, would surely result in the elimination of the animal. Because there are exclusive, transferable property rights in buffalo and because a competitive market brings buyers and sellers of buffalo and buffalo products together, we can be reasonably confident in the efficient management of the animal.

When a species is threatened with extinction, it is likely that no one has exclusive property rights to it. Whales, condors, grizzly bears, elephants in Central Africa—whatever the animal that is threatened—are common property resources. In such cases a government agency may impose limits on the killing of the animal or destruction of its habitat. Such limits can prevent the excessive private use of a common property resource. Alternatively, as was done in the case of the buffalo, private rights can be established, giving resource owners the task of preservation.

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CHAPTER OVERVIEW

7: Production and Cost

[7.1: Production Choices and Costs- The Short Run](#)

[7.2: Production Choices and Costs- The Long Run](#)

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7.1: Production Choices and Costs- The Short Run

Learning Objective

1. Understand the terms associated with the short-run production function—total product, average product, and marginal product—and explain and illustrate how they are related to each other.
2. Explain the concepts of increasing, diminishing, and negative marginal returns and explain the law of diminishing marginal returns.
3. Understand the terms associated with costs in the short run—total variable cost, total fixed cost, total cost, average variable cost, average fixed cost, average total cost, and marginal cost—and explain and illustrate how they are related to each other.
4. Explain and illustrate how the product and cost curves are related to each other and to determine in what ranges on these curves marginal returns are increasing, diminishing, or negative.

Our analysis of production and cost begins with a period economists call the short run. The short run in this microeconomic context is a planning period over which the managers of a firm must consider one or more of their factors of production as fixed in quantity. For example, a restaurant may regard its building as a fixed factor over a period of at least the next year. It would take at least that much time to find a new building or to expand or reduce the size of its present facility. Decisions concerning the operation of the restaurant during the next year must assume the building will remain unchanged. Other factors of production could be changed during the year, but the size of the building must be regarded as a constant.

When the quantity of a factor of production cannot be changed during a particular period, it is called a fixed factor of production. For the restaurant, its building is a fixed factor of production for at least a year. A factor of production whose quantity can be changed during a particular period is called a variable factor of production; factors such as labor and food are examples.

While the managers of the restaurant are making choices concerning its operation over the next year, they are also planning for longer periods. Over those periods, managers may contemplate alternatives such as modifying the building, building a new facility, or selling the building and leaving the restaurant business. The planning period over which a firm can consider *all* factors of production as variable is called the long run.

At any one time, a firm will be making both short-run and long-run choices. The managers may be planning what to do for the next few weeks and for the next few years. Their decisions over the next few weeks are likely to be short-run choices. Decisions that will affect operations over the next few years may be long-run choices, in which managers can consider changing every aspect of their operations. Our analysis in this section focuses on the short run. We examine long-run choices later in this chapter.

The Short-Run Production Function

A firm uses factors of production to produce a product. The relationship between factors of production and the output of a firm is called a production function. Our first task is to explore the nature of the production function.

Consider a hypothetical firm, Acme Clothing, a shop that produces jackets. Suppose that Acme has a lease on its building and equipment. During the period of the lease, Acme's capital is its fixed factor of production. Acme's variable factors of production include things such as labor, cloth, and electricity. In the analysis that follows, we shall simplify by assuming that labor is Acme's *only* variable factor of production.

Total, Marginal, and Average Products

Figure 7.1 shows the number of jackets Acme can obtain with varying amounts of labor (in this case, tailors) and its given level of capital. A total product curve shows the quantities of output that can be obtained from different amounts of a variable factor of production, assuming other factors of production are fixed.

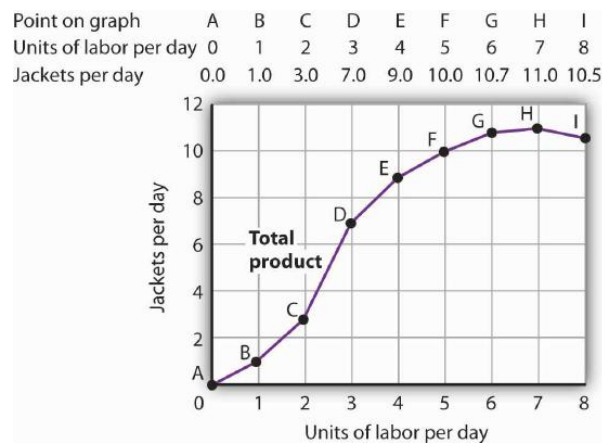


Figure 7.1 Acme Clothing's Total Product Curve The table gives output levels per day for Acme Clothing Company at various quantities of labor per day, assuming the firm's capital is fixed. These values are then plotted graphically as a total product curve.

Notice what happens to the slope of the total product curve in Figure 7.1. Between 0 and 3 units of labor per day, the curve becomes steeper. Between 3 and 7 workers, the curve continues to slope upward, but its slope diminishes. Beyond the seventh tailor, production begins to decline and the curve slopes downward.

We measure the slope of any curve as the vertical change between two points divided by the horizontal change between the same two points. The slope of the total product curve for labor equals the change in output (ΔQ) divided by the change in units of labor (ΔL):

$$\text{Slope of the total product curve} = \Delta Q / \Delta L$$

The slope of a total product curve for any variable factor is a measure of the change in output associated with a change in the amount of the variable factor, with the quantities of all other factors held constant. The amount by which output rises with an additional unit of a variable factor is the marginal product of the variable factor. Mathematically, marginal product is the ratio of the change in output to the change in the amount of a variable factor. The marginal product of labor (MP_L), for example, is the amount by which output rises with an additional unit of labor. It is thus the ratio of the change in output to the change in the quantity of labor ($\Delta Q / \Delta L$), all other things unchanged.

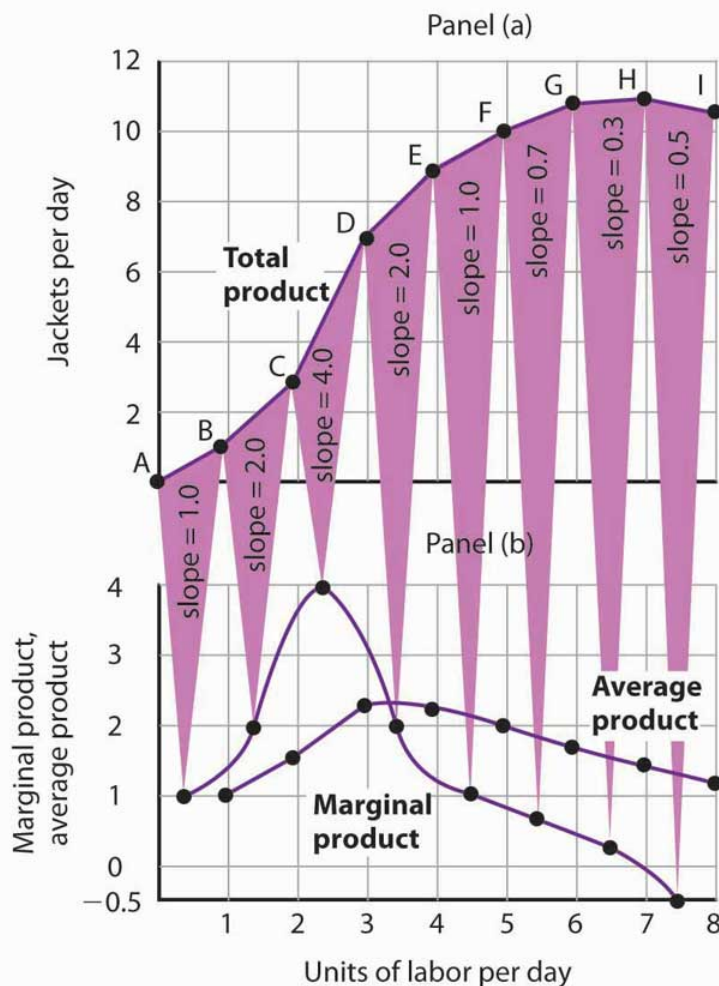
In addition we can define the average product of a variable factor. It is the output per unit of variable factor. The average product of labor (AP_L), for example, is the ratio of output to the number of units of labor (Q/L).

The concept of average product is often used for comparing productivity levels over time or in comparing productivity levels among nations. When you read in the newspaper that productivity is rising or falling, or that productivity in the United States is nine times greater than productivity in China, the report is probably referring to some measure of the average product of labor.

The total product curve in Panel (a) of Figure 7.2 is repeated from Figure 7.1. Panel (b) shows the marginal product and average product curves. Notice that marginal product is the slope of the total product curve, and that marginal product rises as the slope of the total product curve increases, falls as the slope of the total product curve declines, reaches zero when the total product curve achieves its maximum value, and becomes negative as the total product curve slopes downward. As in other parts of this text, marginal values are plotted at the midpoint of each interval. The marginal product of the fifth unit of labor, for example, is plotted between 4 and 5 units of labor. Also notice that the marginal product curve intersects the average product curve at the maximum point on the average product curve. When marginal product is above average product, average product is rising. When marginal product is below average product, average product is falling.

Figure 7.2 From Total Product to the Average and Marginal Product of Labor

Units of labor per day	0	1	2	3	4	5	6	7	8
Jackets per day	0	1.0	3.0	7.0	9.0	10.0	10.7	11.0	10.5
Marginal product		1.0	2.0	4.0	2.0	1.0	0.7	0.3	-0.5
Average product	—	1.0	1.5	2.33	2.25	2.0	1.78	1.57	1.31



The first two rows of the table give the values for quantities of labor and total product from Figure 8.1. Marginal product, given in the third row, is the change in output resulting from a one-unit increase in labor. Average product, given in the fourth row, is output per unit of labor. Panel (a) shows the total product curve. The slope of the total product curve is marginal product, which is plotted in Panel (b). Values for marginal product are plotted at the midpoints of the intervals. Average product rises and falls. Where marginal product is above average product, average product rises. Where marginal product is below average product, average product falls. The marginal product curve intersects the average product curve at the maximum point on the average product curve.

As a student you can use your own experience to understand the relationship between marginal and average values. Your grade point average (GPA) represents the average grade you have earned in all your course work so far. When you take an additional course, your grade in that course represents the marginal grade. What happens to your GPA when you get a grade that is higher than your previous average? It rises. What happens to your GPA when you get a grade that is lower than your previous average? It falls. If your GPA is a 3.0 and you earn one more B, your marginal grade equals your GPA and your GPA remains unchanged.

The relationship between average product and marginal product is similar. However, unlike your course grades, which may go up and down willy-nilly, marginal product always rises and then falls, for reasons we will explore shortly. As soon as marginal product falls below average product, the average product curve slopes downward. While marginal product is above average product, whether marginal product is increasing or decreasing, the average product curve slopes upward.

As we have learned, maximizing behavior requires focusing on making decisions at the margin. For this reason, we turn our attention now toward increasing our understanding of marginal product.

Increasing, Diminishing, and Negative Marginal Returns

Adding the first worker increases Acme's output from 0 to 1 jacket per day. The second tailor adds 2 jackets to total output; the third adds 4. The marginal product goes up because when there are more workers, each one can specialize to a degree. One worker might cut the cloth, another might sew the seams, and another might sew the buttonholes. Their increasing marginal products are reflected by the increasing slope of the total product curve over the first 3 units of labor and by the upward slope of the marginal product curve over the same range. The range over which marginal products are increasing is called the range of increasing marginal returns. Increasing marginal returns exist in the context of a total product curve for labor, so we are holding the quantities of other factors constant. Increasing marginal returns may occur for any variable factor.

The fourth worker adds less to total output than the third; the marginal product of the fourth worker is 2 jackets. The data in Figure 7.2 show that marginal product continues to decline after the fourth worker as more and more workers are hired. The additional workers allow even greater opportunities for specialization, but because they are operating with a fixed amount of capital, each new worker adds less to total output. The fifth tailor adds only a single jacket to total output. When each additional unit of a variable factor adds less to total output, the firm is experiencing diminishing marginal returns. Over the range of diminishing marginal returns, the marginal product of the variable factor is positive but falling. Once again, we assume that the quantities of all other factors of production are fixed. Diminishing marginal returns may occur for any variable factor. Panel (b) shows that Acme experiences diminishing marginal returns between the third and seventh workers, or between 7 and 11 jackets per day.

After the seventh unit of labor, Acme's fixed plant becomes so crowded that adding another worker actually reduces output. When additional units of a variable factor reduce total output, given constant quantities of all other factors, the company experiences negative marginal returns. Now the total product curve is downward sloping, and the marginal product curve falls below zero. Figure 7.3 shows the ranges of increasing, diminishing, and negative marginal returns. Clearly, a firm will never intentionally add so much of a variable factor of production that it enters a range of negative marginal returns.

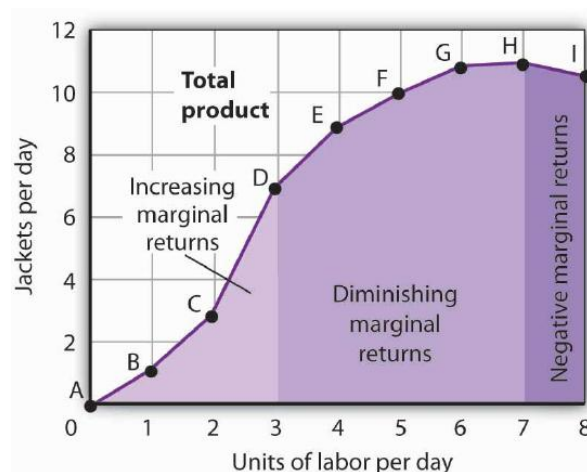


Figure 7.3 Increasing Marginal Returns, Diminishing Marginal Returns, and Negative Marginal Returns This graph shows Acme's total product curve from Figure 7.1 with the ranges of increasing marginal returns, diminishing marginal returns, and negative marginal returns marked. Acme experiences increasing marginal returns between 0 and 3 units of labor per day, diminishing marginal returns between 3 and 7 units of labor per day, and negative marginal returns beyond the 7th unit of labor.

The idea that the marginal product of a variable factor declines over some range is important enough, and general enough, that economists state it as a law. The law of diminishing marginal returns holds that the marginal product of any variable factor of production will eventually decline, assuming the quantities of other factors of production are unchanged.

Heads Up!

It is easy to confuse the concept of diminishing marginal returns with the idea of negative marginal returns. To say a firm is experiencing diminishing marginal returns is not to say its output is falling. Diminishing marginal returns mean that the marginal

product of a variable factor is declining. Output is still increasing as the variable factor is increased, but it is increasing by smaller and smaller amounts. As we saw in Figure 7.2 and Figure 7.3, the range of diminishing marginal returns was between the third and seventh workers; over this range of workers, output rose from 7 to 11 jackets. Negative marginal returns started after the seventh worker.

To see the logic of the law of diminishing marginal returns, imagine a case in which it does not hold. Say that you have a small plot of land for a vegetable garden, 10 feet by 10 feet in size. The plot itself is a fixed factor in the production of vegetables. Suppose you are able to hold constant all other factors—water, sunshine, temperature, fertilizer, and seed—and vary the amount of labor devoted to the garden. How much food could the garden produce? Suppose the marginal product of labor kept increasing or was constant. Then you could grow an *unlimited* quantity of food on your small plot—enough to feed the entire world! You could add an unlimited number of workers to your plot and still increase output at a constant or increasing rate. If you did not get enough output with, say, 500 workers, you could use 5 million; the five-millionth worker would add at least as much to total output as the first. If diminishing marginal returns to labor did not occur, the total product curve would slope upward at a constant or increasing rate.

The shape of the total product curve and the shape of the resulting marginal product curve drawn in Figure 7.2 are typical of *any* firm for the short run. Given its fixed factors of production, increasing the use of a variable factor will generate increasing marginal returns at first; the total product curve for the variable factor becomes steeper and the marginal product rises. The opportunity to gain from increased specialization in the use of the variable factor accounts for this range of increasing marginal returns. Eventually, though, diminishing returns will set in. The total product curve will become flatter, and the marginal product curve will fall.

Costs in the Short Run

A firm's costs of production depend on the quantities and prices of its factors of production. Because we expect a firm's output to vary with the firm's use of labor in a specific way, we can also expect the firm's costs to vary with its output in a specific way. We shall put our information about Acme's product curves to work to discover how a firm's costs vary with its level of output.

We distinguish between the costs associated with the use of variable factors of production, which are called variable costs, and the costs associated with the use of fixed factors of production, which are called fixed costs. For most firms, variable costs includes costs for raw materials, salaries of production workers, and utilities. The salaries of top management may be fixed costs; any charges set by contract over a period of time, such as Acme's one-year lease on its building and equipment, are likely to be fixed costs. A term commonly used for fixed costs is *overhead*. Notice that fixed costs exist only in the short run. In the long run, the quantities of all factors of production are variable, so that all long-run costs are variable.

Total variable cost (TVC) is cost that varies with the level of output. Total fixed cost (TFC) is cost that does not vary with output. Total cost (TC) is the sum of total variable cost and total fixed cost:

$$TVC + TFC = TC$$

From Total Production to Total Cost

Next we illustrate the relationship between Acme's total product curve and its total costs. Acme can vary the quantity of labor it uses each day, so the cost of this labor is a variable cost. We assume capital is a fixed factor of production in the short run, so its cost is a fixed cost.

Suppose that Acme pays a wage of \$100 per worker per day. If labor is the only variable factor, Acme's total variable costs per day amount to \$100 times the number of workers it employs. We can use the information given by the total product curve, together with the wage, to compute Acme's total variable costs.

We know from Figure 7.1 that Acme requires 1 worker working 1 day to produce 1 jacket. The total variable cost of a jacket thus equals \$100. Three units of labor produce 7 jackets per day; the total variable cost of 7 jackets equals \$300. Figure 7.4 shows Acme's total variable costs for producing each of the output levels given in Figure 7.1

Figure 8.4 gives us costs for several quantities of jackets, but we need a bit more detail. We know, for example, that 7 jackets have a total variable cost of \$300. What is the total variable cost of 6 jackets?

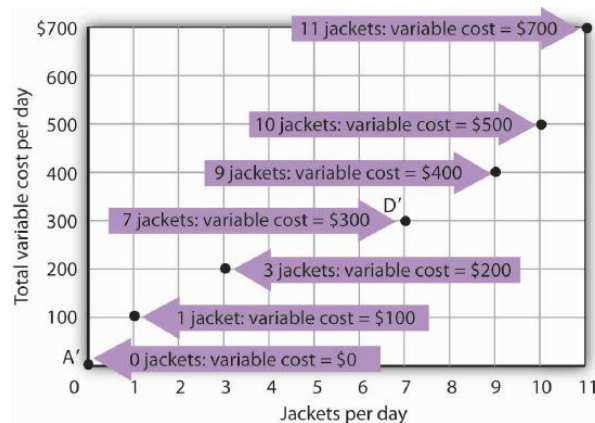


Figure 7.4 Computing Variable Costs The points shown give the variable costs of producing the quantities of jackets given in the total product curve in Figure 7.1 and Figure 7.2. Suppose Acme's workers earn \$100 per day. If Acme produces 0 jackets, it will use no labor—its variable cost thus equals \$0 (Point A'). Producing 7 jackets requires 3 units of labor; Acme's variable cost equals \$300 (Point D').

We can estimate total variable costs for other quantities of jackets by inspecting the total product curve in Figure 7.1. Reading over from a quantity of 6 jackets to the total product curve and then down suggests that the Acme needs about 2.8 units of labor to produce 6 jackets per day. Acme needs 2 full-time and 1 part-time tailors to produce 6 jackets. Figure 7.5 gives the precise total variable costs for quantities of jackets ranging from 0 to 11 per day. The numbers in boldface type are taken from Figure 7.4; the other numbers are estimates we have assigned to produce a total variable cost curve that is consistent with our total product curve. You should, however, be certain that you understand how the numbers in boldface type were found.

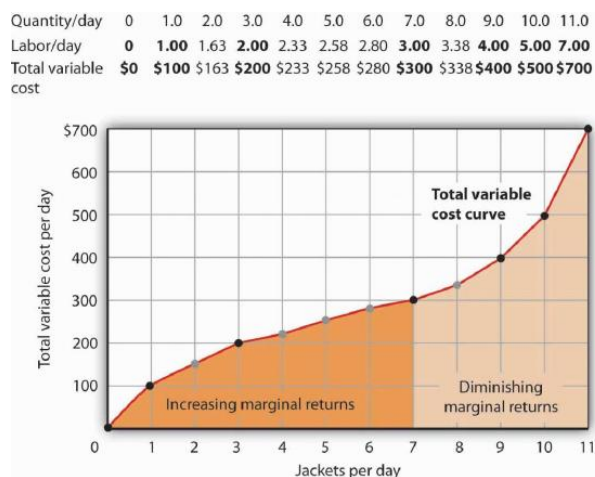


Figure 7.5 The Total Variable Cost Curve Total variable costs for output levels shown in Acme's total product curve were shown in Figure 7.4. To complete the total variable cost curve, we need to know the variable cost for each level of output from 0 to 11 jackets per day. The variable costs and quantities of labor given in Figure 7.4 are shown in boldface in the table here and with black dots in the graph. The remaining values were estimated from the total product curve in Figure 7.1 and Figure 7.2. For example, producing 6 jackets requires 2.8 workers, for a variable cost of \$280.

Suppose Acme's present plant, including the building and equipment, is the equivalent of 20 units of capital. Acme has signed a long-term lease for these 20 units of capital at a cost of \$200 per day. In the short run, Acme cannot increase or decrease its quantity of capital—it must pay the \$200 per day no matter what it does. Even if the firm cuts production to zero, it must still pay \$200 per day in the short run.

Acme's total cost is its total fixed cost of \$200 plus its total variable cost. We add \$200 to the total variable cost curve in Figure 7.5 to get the total cost curve shown in Figure 7.6.

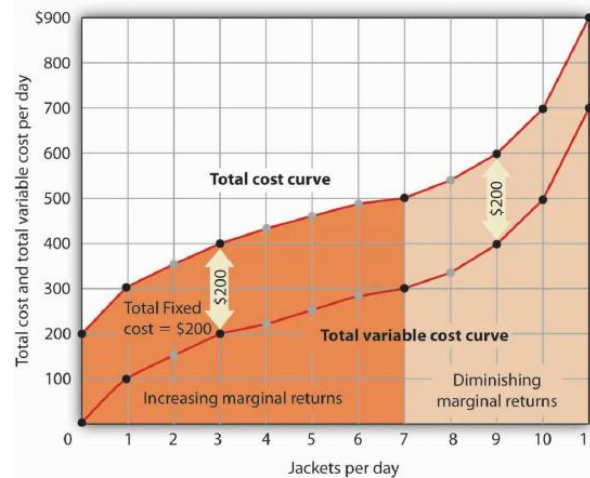


Figure 7.6 From Variable Cost to Total Cost We add total fixed cost to the total variable cost to obtain total cost. In this case, Acme's total fixed cost equals \$200 per day.

Notice something important about the shapes of the total cost and total variable cost curves in Figure 7.6. The total cost curve, for example, starts at \$200 when Acme produces 0 jackets—that is its total fixed cost. The curve rises, but at a decreasing rate, up to the seventh jacket. Beyond the seventh jacket, the curve becomes steeper and steeper. The slope of the total variable cost curve behaves in precisely the same way.

Recall that Acme experienced increasing marginal returns to labor for the first three units of labor—or the first seven jackets. Up to the third worker, each additional worker added more and more to Acme's output. Over the range of increasing marginal returns, each additional jacket requires less and less additional labor. The first jacket required one tailor; the second required the addition of only a part-time tailor; the third required only that Acme boost that part-time tailor's hours to a full day. Up to the seventh jacket, each additional jacket requires less and less additional labor, and thus costs rise at a decreasing rate; the total cost and total variable cost curves become flatter over the range of increasing marginal returns.

Acme experiences diminishing marginal returns beyond the third unit of labor—or the seventh jacket. Notice that the total cost and total variable cost curves become steeper and steeper beyond this level of output. In the range of diminishing marginal returns, each additional unit of a factor adds less and less to total output. That means each additional unit of output requires larger and larger increases in the variable factor, and larger and larger increases in costs.

Marginal and Average Costs

Marginal and average cost curves, which will play an important role in the analysis of the firm, can be derived from the total cost curve. *Marginal cost* shows the additional cost of each additional unit of output a firm produces. This is a specific application of the general concept of marginal cost presented earlier. Given the marginal decision rule's focus on evaluating choices at the margin, the marginal cost curve takes on enormous importance in the analysis of a firm's choices. The second curve we shall derive shows the firm's average total cost at each level of output. Average total cost (ATC) is total cost divided by quantity; it is the firm's total cost per unit of output.

We shall also discuss average variable costs (AVC), which is the firm's variable cost per unit of output; it is total variable cost divided by quantity.

We are still assessing the choices facing the firm in the short run, so we assume that at least one factor of production is fixed. Finally, we will discuss average fixed cost (AFC), which is total fixed cost divided by quantity.

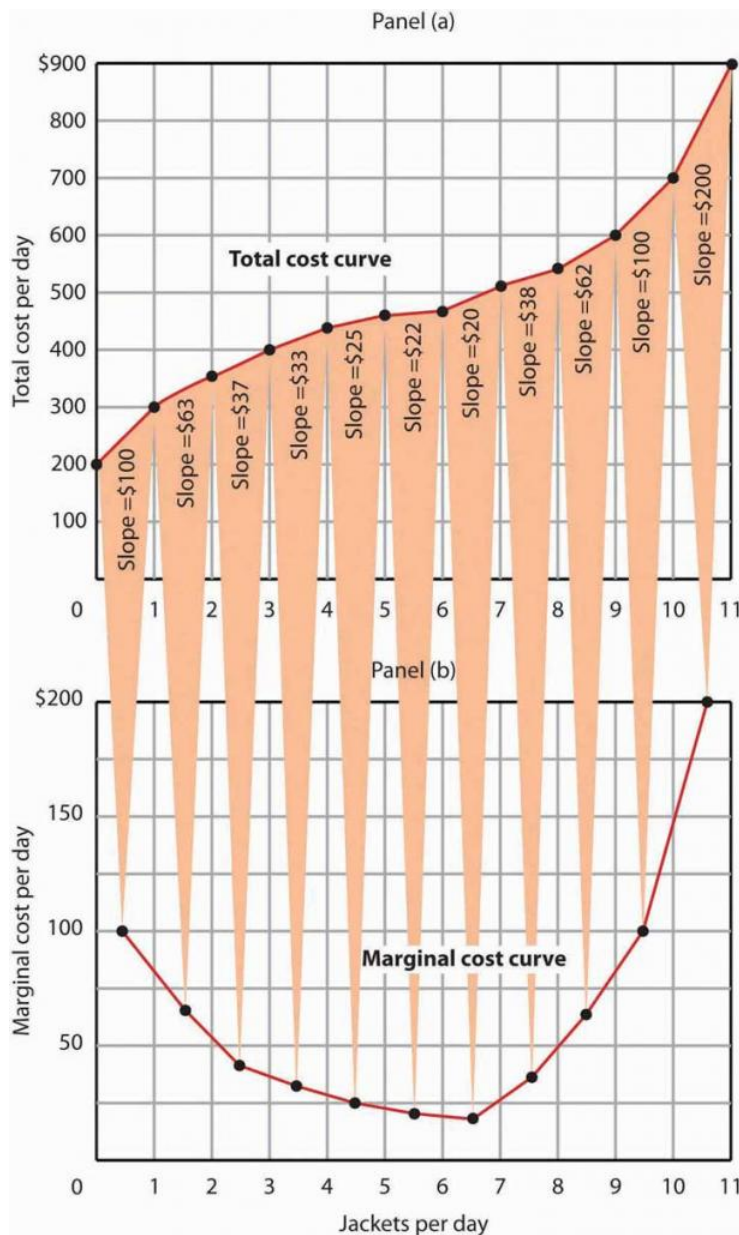
Marginal cost (MC) is the amount by which total cost rises with an additional unit of output. It is the ratio of the change in total cost to the change in the quantity of output.

It equals the slope of the total cost curve. Figure 7.7 shows the same total cost curve that was presented in Figure 7.6. This time the slopes of the total cost curve are shown; these slopes equal the marginal cost of each additional unit of output. For example, increasing output from 6 to 7 units ($\Delta Q=1$) increases total cost from \$480 to \$500 ($\Delta TC=\$20$). The seventh unit thus has a marginal cost of \$20 ($\Delta TC/\Delta Q=\$20/1=\$20$). Marginal cost falls over the range of increasing marginal returns and rises over the range of diminishing marginal returns.

Heads Up!

Notice that the various cost curves are drawn with the quantity of output on the horizontal axis. The various product curves are drawn with quantity of a factor of production on the horizontal axis. The reason is that the two sets of curves measure different relationships. Product curves show the relationship between output and the quantity of a factor; they therefore have the factor quantity on the horizontal axis. Cost curves show how costs vary with output and thus have output on the horizontal axis.

Figure 7.7 Total Cost and Marginal Cost



Marginal cost in Panel (b) is the slope of the total cost curve in Panel (a).

Figure 7.8 shows the computation of Acme's short-run average total cost, average variable cost, and average fixed cost and graphs of these values. Notice that the curves for short-run average total cost and average variable cost fall, then rise. We say that these cost curves are U-shaped. Average fixed cost keeps falling as output increases. This is because the fixed costs are spread out more and more as output expands; by definition, they do not vary as labor is added. Since average total cost (ATC) is the sum of average variable cost (AVC) and average fixed cost (AFC), i.e.,

$$AVC + AFC = ATC$$

the distance between the ATC and AVC curves keeps getting smaller and smaller as the firm spreads its overhead costs over more and more output.

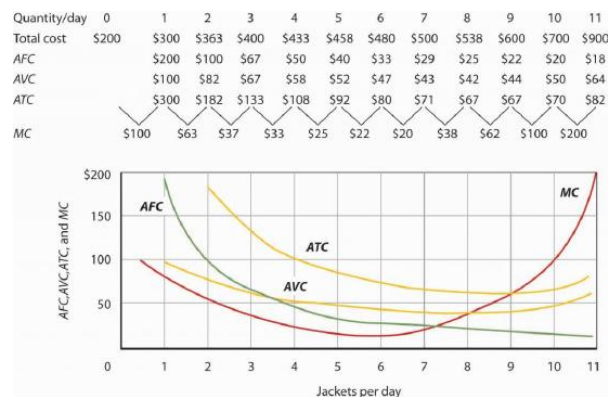


Figure 7.8 Marginal Cost, Average Fixed Cost, Average Variable Cost, and Average Total Cost in the Short Run Total cost figures for Acme Clothing are taken from Figure 7.7. The other values are derived from these. Average total cost (ATC) equals total cost divided by quantity produced; it also equals the sum of the average fixed cost (AFC) and average variable cost (AVC) (exceptions in table are due to rounding to the nearest dollar); average variable cost is variable cost divided by quantity produced. The marginal cost (MC) curve (from Figure 8.7) intersects the ATC and AVC curves at the lowest points on both curves. The AFC curve falls as quantity increases.

Figure 7.8 includes the marginal cost data and the marginal cost curve from Figure 7.7. The marginal cost curve intersects the average total cost and average variable cost curves at their lowest points. When marginal cost is below average total cost or average variable cost, the average total and average variable cost curves slope downward. When marginal cost is greater than short-run average total cost or average variable cost, these average cost curves slope upward. The logic behind the relationship between marginal cost and average total and variable costs is the same as it is for the relationship between marginal product and average product.

We turn next in this chapter to an examination of production and cost in the long run, a planning period in which the firm can consider changing the quantities of any or all factors.

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7.2: Production Choices and Costs- The Long Run

Learning Objective

1. Apply the marginal decision rule to explain how a firm chooses its mix of factors of production in the long run.
2. Define the long-run average cost curve and explain how it relates to economies and diseconomies of scale.

In a long-run planning perspective, a firm can consider changing the quantities of *all* its factors of production. That gives the firm opportunities it does not have in the short run. First, the firm can select the mix of factors it wishes to use. Should it choose a production process with lots of labor and not much capital, like the street sweepers in China? Or should it select a process that uses a great deal of capital and relatively little labor, like street sweepers in the United States? The second thing the firm can select is the scale (or overall size) of its operations. In the short run, a firm can increase output only by increasing its use of a variable factor. But in the long run, all factors are variable, so the firm can expand the use of all of its factors of production. The question facing the firm in the long run is: How much of an expansion or contraction in the scale of its operations should it undertake? Alternatively, it could choose to go out of business.

In its long-run planning, the firm not only regards all factors as variable, but it regards all costs as variable as well. There are no fixed costs in the long run. Because all costs are variable, the structure of costs in the long run differs somewhat from what we saw in the short run.

Choosing the Factor Mix

How shall a firm decide what mix of capital, labor, and other factors to use? We can apply the marginal decision rule to answer this question.

Suppose a firm uses capital and labor to produce a particular good. It must determine how to produce the good and the quantity it should produce. We address the question of how much the firm should produce in subsequent chapters, but certainly the firm will want to produce whatever quantity it chooses at as low a cost as possible. Another way of putting that goal is to say that the firm seeks the maximum output possible at every level of total cost.

At any level of total cost, the firm can vary its factor mix. It could, for example, substitute labor for capital in a way that leaves its total cost unchanged. In terms of the marginal decision rule, we can think of the firm as considering whether to spend an additional \$1 on one factor, hence \$1 less on another. The marginal decision rule says that a firm will shift spending among factors as long as the marginal benefit of such a shift exceeds the marginal cost.

What is the marginal benefit, say, of an additional \$1 spent on capital? An additional unit of capital produces the marginal product of capital. To determine the marginal benefit of \$1 spent on capital, we divide capital's marginal product by its price: MP_K/P_K . The price of capital is the "rent" paid for the use of a unit of capital for a given period. If the firm already owns the capital, then this rent is an opportunity cost; it represents the return the firm could get by renting the capital to another user or by selling it and earning interest on the money thus gained.

If capital and labor are the only factors, then spending an additional \$1 on capital while holding total cost constant means taking \$1 out of labor. The cost of that action will be the output lost from cutting back \$1 worth of labor. That cost equals the ratio of the marginal product of labor to the price of labor, MP_L/P_L , where the price of labor is the wage.

Suppose that a firm's marginal product of labor is 15 and the price of labor is \$5 per unit; the firm gains 3 units of output by spending an additional \$1 on labor. Suppose further that the marginal product of capital is 50 and the price of capital is \$50 per unit, so the firm would lose 1 unit of output by spending \$1 less on capital.

$$\frac{MP_L}{P_L} > \frac{MP_K}{P_K}$$

$$\frac{15}{5} > \frac{50}{50}$$

The firm achieves a net gain of 2 units of output, without any change in cost, by transferring \$1 from capital to labor. It will continue to transfer funds from capital to labor as long as it gains more output from the additional labor than it loses in output by reducing capital. As the firm shifts spending in this fashion, however, the marginal product of labor will fall and the marginal product of capital will rise. At some point, the ratios of marginal product to price will be equal for the two factors. At this point, the firm will obtain the maximum output possible for a given total cost.

$$\frac{MP_L}{P_L} = \frac{MP_K}{P_K}$$

Suppose that a firm that uses capital and labor is satisfying above condition when suddenly the price of labor rises. At the current usage levels of the factors, a higher price of labor (P_L') lowers the ratio of the marginal product of labor to the price of labor:

$$\frac{MP_L}{P_L'} > \frac{MP_K}{P_K}$$

The firm will shift funds out of labor and into capital. It will continue to shift from labor to capital until the ratios of marginal product to price are equal for the two factors. In general, a profit-maximizing firm will seek a combination of factors such that

$$\frac{MP_1}{P_1} = \frac{MP_2}{P_2} = \dots = \frac{MP_n}{P_n}$$

When a firm satisfies the condition given above for efficient use, it produces the greatest possible output for a given cost. To put it another way, the firm achieves the lowest possible cost for a given level of output.

As the price of labor rises, the firm will shift to a factor mix that uses relatively more capital and relatively less labor. As a firm increases its ratio of capital to labor, we say it is becoming more capital intensive. A lower price for labor will lead the firm to use relatively more labor and less capital, reducing its ratio of capital to labor. As a firm reduces its ratio of capital to labor, we say it is becoming more labor intensive. The notions of labor-intensive and capital-intensive production are purely relative; they imply only that a firm has a higher or lower ratio of capital to labor.

Sometimes economists speak of labor-intensive versus capital-intensive countries in the same manner. One implication of the marginal decision rule for factor use is that firms in countries where labor is relatively expensive, such as the United States, will use capital-intensive production methods. Less developed countries, where labor is relatively cheap, will use labor-intensive methods.

Now that we understand how to apply the marginal decision rule to the problem of choosing the mix of factors, we can answer the question that began this chapter: Why does the United States employ a capital-intensive production process to clean streets while China chooses a labor-intensive process? Given that the same technology—know-how—is available, both countries could, after all, use the same production process. Suppose for a moment that the relative prices of labor and capital are the same in China and the United States. In that case, China and the United States can be expected to use the same method to clean streets. But the price of labor relative to the price of capital is, in fact, far lower in China than in the United States. A lower relative price for labor increases the ratio of the marginal product of labor to its price, making it efficient to substitute labor for capital. China thus finds it cheaper to clean streets with lots of people using brooms, while the United States finds it efficient to clean streets with large machines and relatively less labor.

Maquiladoras, plants in Mexico where processing is done using low-cost workers and labor-intensive methods, allow some U.S. firms to have it both ways. They complete part of the production process in the United States, using capital-intensive methods. They then ship the unfinished goods to *maquiladoras*. For example, many U.S. clothing manufacturers produce cloth at U.S. plants on large high-speed looms. They then ship the cloth to Mexico, where it is fashioned into clothing by workers using sewing machines. Another example is plastic injection molding, which requires highly skilled labor and is made in the U.S. The parts are molded in Texas border towns and are then shipped to *maquiladoras* and used in cars and computers. The resulting items are shipped back to the United States, labeled “Assembled in Mexico from U.S. materials.” Overall *maquiladoras* import 97% of the components they use, of which 80 to 85% come from the U.S.

The *maquiladoras* have been a boon to workers in Mexico, who enjoy a higher demand for their services and receive higher wages as a result. The system also benefits the U.S. firms that participate and U.S. consumers who obtain less expensive goods than they

would otherwise. It works because different factor prices imply different mixes of labor and capital. Companies are able to carry out the capital-intensive side of the production process in the United States and the labor-intensive side in Mexico (Vargas, L., 2001; Gruben, W. C., 2004).

Costs in the Long Run

As in the short run, costs in the long run depend on the firm's level of output, the costs of factors, and the quantities of factors needed for each level of output. The chief difference between long- and short-run costs is there are no fixed factors in the long run. There are thus no fixed costs. All costs are variable, so we do not distinguish between total variable cost and total cost in the long run: total cost is total variable cost.

The long-run average cost (*LRAC*) curve shows the firm's lowest cost per unit at each level of output, assuming that all factors of production are variable. The *LRAC* curve assumes that the firm has chosen the optimal factor mix, as described in the previous section, for producing any level of output. The costs it shows are therefore the lowest costs possible for each level of output. It is important to note, however, that this does not mean that the minimum points of each short-run *ATC* curves lie on the *LRAC* curve. This critical point is explained in the next paragraph and expanded upon even further in the next section.

Figure 7.9 shows how a firm's *LRAC* curve is derived. Suppose Lifetime Disc Co. produces compact discs (CDs) using capital and labor. We have already seen how a firm's average total cost curve can be drawn in the short run for a given quantity of a particular factor of production, such as capital. In the short run, Lifetime Disc might be limited to operating with a given amount of capital; it would face one of the short-run average total cost curves shown in Figure 7.9. If it has 30 units of capital, for example, its average total cost curve is ATC_{30} . In the long run the firm can examine the average total cost curves associated with varying levels of capital. Four possible short-run average total cost curves for Lifetime Disc are shown in Figure 7.9 for quantities of capital of 20, 30, 40, and 50 units. The relevant curves are labeled ATC_{20} , ATC_{30} , ATC_{40} , and ATC_{50} respectively. The *LRAC* curve is derived from this set of short-run curves by finding the lowest average total cost associated with each level of output. Again, notice that the U-shaped *LRAC* curve is an envelope curve that surrounds the various short-run *ATC* curves. With the exception of ATC_{40} , in this example, the lowest cost per unit for a particular level of output in the long run is not the minimum point of the relevant short-run curve.

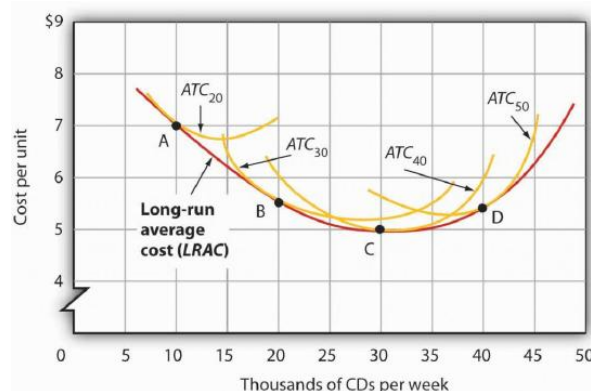


Figure 7.9 Relationship Between Short-Run and Long-Run Average Total Costs The *LRAC* curve is found by taking the lowest average total cost curve at each level of output. Here, average total cost curves for quantities of capital of 20, 30, 40, and 50 units are shown for the Lifetime Disc Co. At a production level of 10,000 CDs per week, Lifetime minimizes its cost per CD by producing with 20 units of capital (point A). At 20,000 CDs per week, an expansion to a plant size associated with 30 units of capital minimizes cost per unit (point B). The lowest cost per unit is achieved with production of 30,000 CDs per week using 40 units of capital (point C). If Lifetime chooses to produce 40,000 CDs per week, it will do so most cheaply with 50 units of capital (point D).

Economies and Diseconomies of Scale

Notice that the long-run average cost curve in Figure 7.9 first slopes downward and then slopes upward. The shape of this curve tells us what is happening to average cost as the firm changes its scale of operations. A firm is said to experience economies of scale when long-run average cost declines as the firm expands its output. A firm is said to experience diseconomies of scale when

long-run average cost increases as the firm expands its output. Constant returns to scale occur when long-run average cost stays the same over an output range.

Why would a firm experience economies of scale? One source of economies of scale is gains from specialization. As the scale of a firm's operation expands, it is able to use its factors in more specialized ways, increasing their productivity. Another source of economies of scale lies in the economies that can be gained from mass production methods. As the scale of a firm's operation expands, the company can begin to utilize large-scale machines and production systems that can substantially reduce cost per unit.

Why would a firm experience diseconomies of scale? At first glance, it might seem that the answer lies in the law of diminishing marginal returns, but this is not the case. The law of diminishing marginal returns, after all, tells us how output changes as a single factor is increased, with all other factors of production held constant. In contrast, diseconomies of scale describe a situation of rising average cost even when the firm is free to vary any or all of its factors as it wishes. Diseconomies of scale are generally thought to be caused by management problems. As the scale of a firm's operations expands, it becomes harder and harder for management to coordinate and guide the activities of individual units of the firm. Eventually, the diseconomies of management overwhelm any gains the firm might be achieving by operating with a larger scale of plant, and long-run average costs begin rising. Firms experience constant returns to scale at output levels where there are neither economies nor diseconomies of scale. For the range of output over which the firm experiences constant returns to scale, the long-run average cost curve is horizontal.

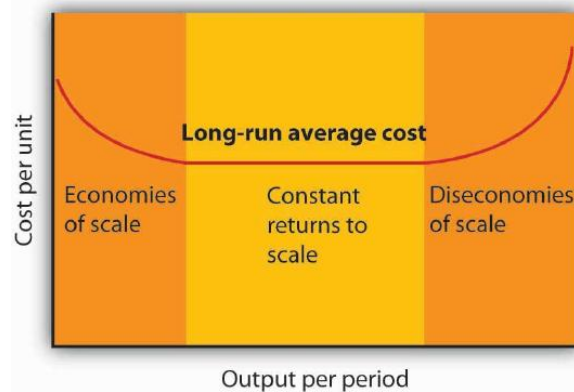


Figure 7.10 Economies and Diseconomies of Scale and Long-Run Average Cost The downward-sloping region of the firm's *LRAC* curve is associated with economies of scale. There may be a horizontal range associated with constant returns to scale. The upward-sloping range of the curve implies diseconomies of scale.

Firms are likely to experience all three situations, as shown in Figure 7.10. At very low levels of output, the firm is likely to experience economies of scale as it expands the scale of its operations. There may follow a range of output over which the firm experiences constant returns to scale—empirical studies suggest that the range over which firms experience constant returns to scale is often very large. And certainly there must be some range of output over which diseconomies of scale occur; this phenomenon is one factor that limits the size of firms. A firm operating on the upward-sloping part of its *LRAC* curve is likely to be undercut in the market by smaller firms operating with lower costs per unit of output.

The Size Distribution of Firms

Economies and diseconomies of scale have a powerful effect on the sizes of firms that will operate in any market. Suppose firms in a particular industry experience diseconomies of scale at relatively low levels of output. That industry will be characterized by a large number of fairly small firms. The restaurant market appears to be such an industry. Barbers and beauticians are another example.

If firms in an industry experience economies of scale over a very wide range of output, firms that expand to take advantage of lower cost will force out smaller firms that have higher costs. Such industries are likely to have a few large firms instead of many small ones. In the refrigerator industry, for example, the size of firm necessary to achieve the lowest possible cost per unit is large enough to limit the market to only a few firms. In most cities, economies of scale leave room for only a single newspaper.

One factor that can limit the achievement of economies of scale is the demand facing an individual firm. The scale of output required to achieve the lowest unit costs possible may require sales that exceed the demand facing a firm. A grocery store, for

example, could minimize unit costs with a large store and a large volume of sales. But the demand for groceries in a small, isolated community may not be able to sustain such a volume of sales. The firm is thus limited to a small scale of operation even though this might involve higher unit costs.

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CHAPTER OVERVIEW

8: Competitive Markets for Goods and Services

[8.1: Perfect Competition- A Model](#)

[8.2: Output Determination in the Short Run](#)

[8.3: Perfect Competition in the Long Run](#)

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8.1: Perfect Competition- A Model

Learning Objective

1. Explain what economists mean by perfect competition.
2. Identify the basic assumptions of the model of perfect competition and explain why they imply price-taking behavior.

Virtually all firms in a market economy face competition from other firms. In this chapter, we will be working with a model of a highly idealized form of competition called “perfect” by economists.

Perfect competition is a model of the market based on the assumption that a large number of firms produce identical goods consumed by a large number of buyers. The model of perfect competition also assumes that it is easy for new firms to enter the market and for existing ones to leave. And finally, it assumes that buyers and sellers have complete information about market conditions.

As we examine these assumptions in greater detail, we will see that they allow us to work with the model more easily. No market fully meets the conditions set out in these assumptions. As is always the case with models, our purpose is to understand the way things work, not to describe them. And the model of perfect competition will prove enormously useful in understanding the world of markets.

Assumptions of the Model

The assumptions of the model of perfect competition, taken together, imply that individual buyers and sellers in a perfectly competitive market accept the market price as given. No one buyer or seller has any influence over that price. Individuals or firms who must take the market price as given are called price takers. A consumer or firm that takes the market price as given has no ability to influence that price. A price-taking firm or consumer is like an individual who is buying or selling stocks. He or she looks up the market price and buys or sells at that price. The price is determined by demand and supply in the market—not by individual buyers or sellers. In a perfectly competitive market, each firm and each consumer is a price taker. A price-taking consumer assumes that he or she can purchase any quantity at the market price—without affecting that price. Similarly, a price-taking firm assumes it can sell whatever quantity it wishes at the market price without affecting the price.

You are a price taker when you go into a store. You observe the prices listed and make a choice to buy or not. Your choice will not affect that price. Should you sell a textbook back to your campus bookstore at the end of a course, you are a price-taking seller. You are confronted by a market price and you decide whether to sell or not. Your decision will not affect that price.

To see how the assumptions of the model of perfect competition imply price-taking behavior, let us examine each of them in turn.

Identical Goods

In a perfectly competitive market for a good or service, one unit of the good or service cannot be differentiated from any other on any basis. A bushel of, say, hard winter wheat is an example. A bushel produced by one farmer is identical to that produced by another. There are no brand preferences or consumer loyalties.

The assumption that goods are identical is necessary if firms are to be price takers. If one farmer’s wheat were perceived as having special properties that distinguished it from other wheat, then that farmer would have some power over its price. By assuming that all goods and services produced by firms in a perfectly competitive market are identical, we establish a necessary condition for price-taking behavior. Economists sometimes say that the goods or services in a perfectly competitive market are *homogeneous*, meaning that they are all alike. There are no brand differences in a perfectly competitive market.

A Large Number of Buyers and Sellers

How many buyers and sellers are in our market? The answer rests on our presumption of price-taking behavior. There are so many buyers and sellers that none of them has any influence on the market price regardless of how much any of them purchases or sells. A firm in a perfectly competitive market can react to prices, but cannot affect the prices it pays for the factors of production or the prices it receives for its output.

Ease of Entry and Exit

The assumption that it is easy for other firms to enter a perfectly competitive market implies an even greater degree of competition. Firms in a market must deal not only with the large number of competing firms but also with the possibility that still more firms might enter the market.

Later in this chapter, we will see how ease of entry is related to the sustainability of economic profits. If entry is easy, then the promise of high economic profits will quickly attract new firms. If entry is difficult, it won't.

The model of perfect competition assumes easy exit as well as easy entry. The assumption of easy exit strengthens the assumption of easy entry. Suppose a firm is considering entering a particular market. Entry may be easy, but suppose that getting out is difficult. For example, suppliers of factors of production to firms in the industry might be happy to accommodate new firms but might require that they sign long-term contracts. Such contracts could make leaving the market difficult and costly. If that were the case, a firm might be hesitant to enter in the first place. Easy exit helps make entry easier.

Complete Information

We assume that all sellers have complete information about prices, technology, and all other knowledge relevant to the operation of the market. No one seller has any information about production methods that is not available to all other sellers. If one seller had an advantage over other sellers, perhaps special information about a lower-cost production method, then that seller could exert some control over market price—the seller would no longer be a price taker.

We assume also that buyers know the prices offered by every seller. If buyers did not know about prices offered by different firms in the market, then a firm might be able to sell a good or service for a price other than the market price and thus could avoid being a price taker.

The availability of information that is assumed in the model of perfect competition implies that information can be obtained at low cost. If consumers and firms can obtain information at low cost, they are likely to do so. Information about the marketplace may come over the internet, over the airways in a television commercial, or over a cup of coffee with a friend. Whatever its source, we assume that its low cost ensures that consumers and firms have enough of it so that everyone buys or sells goods and services at market prices determined by the intersection of demand and supply curves.

The assumptions of the perfectly competitive model ensure that each buyer or seller is a price taker. The market, not individual consumers or firms, determines price in the model of perfect competition. No individual has enough power in a perfectly competitive market to have any impact on that price.

Perfect Competition and the Real World

The assumptions of identical products, a large number of buyers, easy entry and exit, and perfect information are strong assumptions. The notion that firms must sit back and let the market determine price seems to fly in the face of what we know about most real firms, which is that firms customarily do set prices. Yet this is the basis for the model of demand and supply, the power of which you have already seen.

When we use the model of demand and supply, we assume that market forces determine prices. In this model, buyers and sellers respond to the market price. They are price takers. The assumptions of the model of perfect competition underlie the assumption of price-taking behavior. Thus we are using the model of perfect competition whenever we apply the model of demand and supply.

We can understand most markets by applying the model of demand and supply. Even though those markets do not fulfill all the assumptions of the model of perfect competition, the model allows us to understand some key features of these markets.

Changes within your lifetime have made many markets more competitive. Falling costs of transportation, together with dramatic advances in telecommunications, have opened the possibility of entering markets to firms all over the world. A company in South Korea can compete in the market for steel in the United States. A furniture maker in New Mexico can compete in the market for furniture in Japan. A firm can enter the world market simply by creating a web page to advertise its products and to take orders.

In the remaining sections of this chapter, we will learn more about the response of firms to market prices. We will see how firms respond, in the short run and in the long run, to changes in demand and to changes in production costs. In short, we will be examining the forces that constitute the supply side of the model of demand and supply.

We will also see how competitive markets work to serve consumer interests and how competition acts to push economic profits down, sometimes eliminating them entirely. When we have finished we will have a better understanding of the market conditions

facing farmers and of the conditions that prevail in any competitive industry.

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8.2: Output Determination in the Short Run

Learning Objective

1. Show graphically how an individual firm in a perfectly competitive market can use total revenue and total cost curves or marginal revenue and marginal cost curves to determine the level of output that will maximize its economic profit.
2. Explain when a firm will shut down in the short run and when it will operate even if it is incurring economic losses.
3. Derive the firm's supply curve from the firm's marginal cost curve and the industry supply curve from the supply curves of individual firms.

Our goal in this section is to see how a firm in a perfectly competitive market determines its output level in the short run—a planning period in which at least one factor of production is fixed in quantity. We shall see that the firm can maximize economic profit by applying the marginal decision rule and increasing output up to the point at which the marginal benefit of an additional unit of output is just equal to the marginal cost. This fact has an important implication: over a wide range of output, the firm's marginal cost curve is its supply curve.

Price and Revenue

Each firm in a perfectly competitive market is a price taker; the equilibrium price and industry output are determined by demand and supply. Figure 8.1 shows how demand and supply in the market for radishes, which we shall assume are produced under conditions of perfect competition, determine total output and price. The equilibrium price is \$0.40 per pound; the equilibrium quantity is 10 million pounds per month.

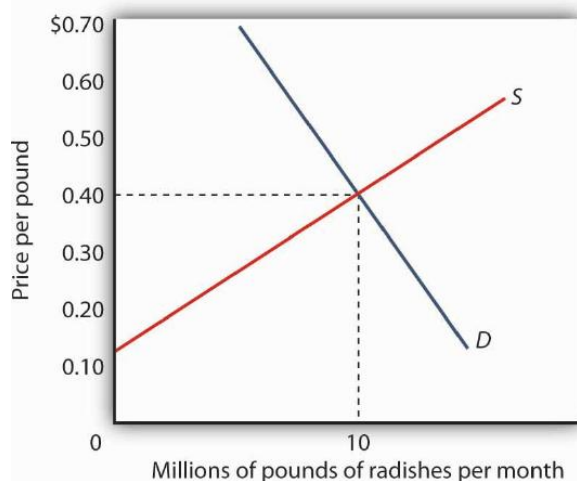


Figure 8.1 The Market for Radishes Price and output in a competitive market are determined by demand and supply. In the market for radishes, the equilibrium price is \$0.40 per pound; 10 million pounds per month are produced and purchased at this price.

Because it is a price taker, each firm in the radish industry assumes it can sell all the radishes it wants at a price of \$0.40 per pound. No matter how many or how few radishes it produces, the firm expects to sell them all at the market price.

The assumption that the firm expects to sell all the radishes it wants at the market price is crucial. If a firm did not expect to sell all of its radishes at the market price—if it had to lower the price to sell some quantities—the firm would not be a price taker. And price-taking behavior is central to the model of perfect competition.

Radish growers—and perfectly competitive firms in general—have no reason to charge a price lower than the market price. Because buyers have complete information and because we assume each firm's product is identical to that of its rivals, firms are unable to charge a price higher than the market price. For perfectly competitive firms, the price is very much like the weather: they may complain about it, but in perfect competition there is nothing any of them can do about it.

Total Revenue

While a firm in a perfectly competitive market has no influence over its price, it does determine the output it will produce. In selecting the quantity of that output, one important consideration is the revenue the firm will gain by producing it.

A firm's total revenue is found by multiplying its output by the price at which it sells that output. For a perfectly competitive firm, total revenue (TR) is the market price (P) times the quantity the firm produces (Q), or

$$TR = P \times Q$$

The relationship between market price and the firm's total revenue curve is a crucial one. Panel (a) of Figure 8.2 shows total revenue curves for a radish grower at three possible market prices: \$0.20, \$0.40, and \$0.60 per pound. Each total revenue curve is a linear, upward-sloping curve. At any price, the greater the quantity a perfectly competitive firm sells, the greater its total revenue. Notice that the greater the price, the steeper the total revenue curve is.

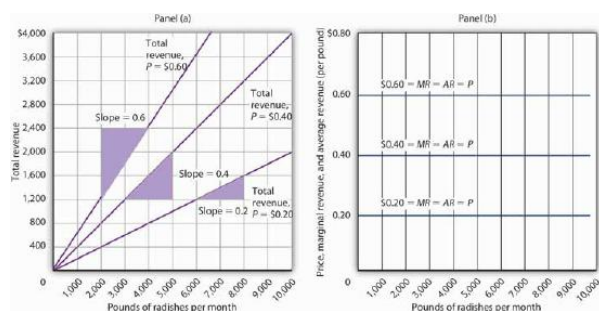


Figure 8.2 Total Revenue, Marginal Revenue, and Average Revenue Panel (a) shows different total revenue curves for three possible market prices in perfect competition. A total revenue curve is a straight line coming out of the origin. The slope of a total revenue curve is MR ; it equals the market price (P) and AR in perfect competition. Marginal revenue and average revenue are thus a single horizontal line at the market price, as shown in Panel (b). There is a different marginal revenue curve for each price.

Price, Marginal Revenue, and Average Revenue

The slope of a total revenue curve is particularly important. It equals the change in the vertical axis (total revenue) divided by the change in the horizontal axis (quantity) between any two points. The slope measures the rate at which total revenue increases as output increases. We can think of it as the increase in total revenue associated with a 1-unit increase in output. The increase in total revenue from a 1-unit increase in quantity is marginal revenue. Thus marginal revenue (MR) equals the slope of the total revenue curve.

How much additional revenue does a radish producer gain from selling one more pound of radishes? The answer, of course, is the market price for 1 pound. Marginal revenue equals the market price. Because the market price is not affected by the output choice of a single firm, the marginal revenue the firm gains by producing one more unit is always the market price. The marginal revenue curve shows the relationship between marginal revenue and the quantity a firm produces. For a perfectly competitive firm, the marginal revenue curve is a horizontal line at the market price. If the market price of a pound of radishes is \$0.40, then the marginal revenue is \$0.40. Marginal revenue curves for prices of \$0.20, \$0.40, and \$0.60 are given in Panel (b) of Figure 8.2. In perfect competition, a firm's marginal revenue curve is a horizontal line at the market price.

Price also equals average revenue, which is total revenue divided by quantity. To obtain average revenue (AR), we divide total revenue by quantity, Q . Because total revenue equals price (P) times quantity (Q), dividing by quantity leaves us with price.

$$AR = \frac{TR}{Q} = \frac{P \times Q}{Q} = P$$

The marginal revenue curve is a horizontal line at the market price, and average revenue equals the market price. The average and marginal revenue curves are given by the same horizontal line. This is consistent with what we have learned about the relationship between marginal and average values. When the marginal value exceeds the average value, the average value will be rising. When the marginal value is less than the average value, the average value will be falling. What happens when the average and marginal values do not change, as in the horizontal curves of Panel (b) of Figure 8.2? The marginal value must equal the average value; the two curves coincide.

Marginal Revenue, Price, and Demand for the Perfectly Competitive Firm

We have seen that a perfectly competitive firm's marginal revenue curve is simply a horizontal line at the market price and that this same line is also the firm's average revenue curve. For the perfectly competitive firm, $MR=P=AR$. The marginal revenue curve has another meaning as well. It is the demand curve facing a perfectly competitive firm.

Consider the case of a single radish producer, Tony Gortari. We assume that the radish market is perfectly competitive; Mr. Gortari runs a perfectly competitive firm. Suppose the market price of radishes is \$0.40 per pound. How many pounds of radishes can Mr. Gortari sell at this price? The answer comes from our assumption that he is a price taker: He can sell *any* quantity he wishes at this price. How many pounds of radishes will he sell if he charges a price that exceeds the market price? None. His radishes are identical to those of every other firm in the market, and everyone in the market has complete information. That means the demand curve facing Mr. Gortari is a horizontal line at the market price as illustrated in Figure 8.3. Notice that the curve is labeled d to distinguish it from the market demand curve, D , in Figure 8.1. The horizontal line in Figure 8.3 is also Mr. Gortari's marginal revenue curve, MR , and his average revenue curve, AR . It is also the market price, P .

Of course, Mr. Gortari could charge a price below the market price, but why would he? We assume he can sell all the radishes he wants at the market price; there would be no reason to charge a lower price. Mr. Gortari faces a demand curve that is a horizontal line at the market price. In our subsequent analysis, we shall refer to the horizontal line at the market price simply as marginal revenue. We should remember, however, that this same line gives us the market price, average revenue, and the demand curve facing the firm.

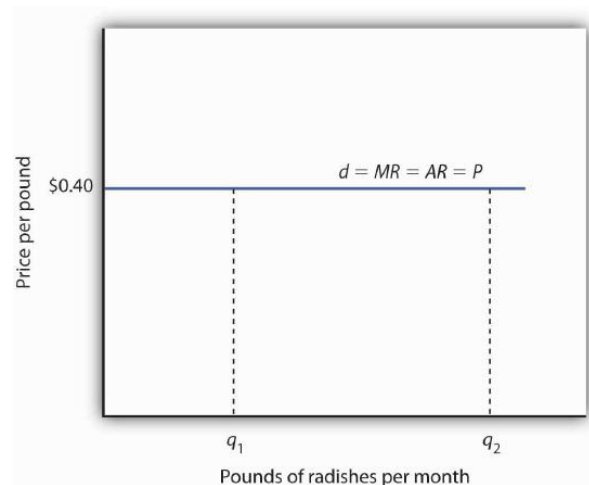


Figure 8.3 Price, Marginal Revenue, and Demand A perfectly competitive firm faces a horizontal demand curve at the market price. Here, radish grower Tony Gortari faces demand curve d at the market price of \$0.40 per pound. He could sell q_1 or q_2 —or any other quantity—at a price of \$0.40 per pound.

More generally, we can say that *any* perfectly competitive firm faces a horizontal demand curve at the market price. We saw an example of a horizontal demand curve in the chapter on elasticity. Such a curve is perfectly elastic, meaning that any quantity is demanded at a given price.

Economic Profit in the Short Run

A firm's economic profit is the difference between total revenue and total cost. Recall that total cost is the opportunity cost of producing a certain good or service. When we speak of economic profit we are speaking of a firm's total revenue less the total opportunity cost of its operations.

As we learned, a firm's total cost curve in the short run intersects the vertical axis at some positive value equal to the firm's total fixed costs. Total cost then rises at a decreasing rate over the range of increasing marginal returns to the firm's variable factors. It rises at an increasing rate over the range of diminishing marginal returns. Figure 8.4 shows the total cost curve for Mr. Gortari, as well as the total revenue curve for a price of \$0.40 per pound. Suppose that his total fixed cost is \$400 per month. For any given

level of output, Mr. Gortari's economic profit is the vertical distance between the total revenue curve and the total cost curve at that level.

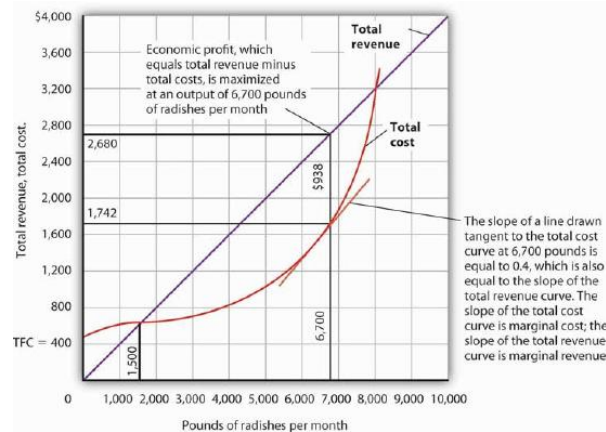


Figure 8.4 Total Revenue, Total Cost, and Economic Profit Economic profit is the vertical distance between the total revenue and total cost curves (revenue minus costs). Here, the maximum profit attainable by Tony Gortari for his radish production is \$938 per month at an output of 6,700 pounds.

Let us examine the total revenue and total cost curves in Figure 8.4 more carefully. At zero units of output, Mr. Gortari's total cost is \$400 (his total fixed cost); total revenue is zero. Total cost continues to exceed total revenue up to an output of 1,500 pounds per month, at which point the two curves intersect. At this point, economic profit equals zero. As Mr. Gortari expands output above 1,500 pounds per month, total revenue becomes greater than total cost. We see that at a quantity of 1,500 pounds per month, the total revenue curve is steeper than the total cost curve. Because revenues are rising faster than costs, profits rise with increased output. As long as the total revenue curve is steeper than the total cost curve, profit increases as the firm increases its output.

The total revenue curve's slope does not change as the firm increases its output. But the total cost curve becomes steeper and steeper as diminishing marginal returns set in. Eventually, the total cost and total revenue curves will have the same slope. That happens in Figure 8.4 at an output of 6,700 pounds of radishes per month. Notice that a line drawn tangent to the total cost curve at that quantity has the same slope as the total revenue curve.

As output increases beyond 6,700 pounds, the total cost curve continues to become steeper. It becomes steeper than the total revenue curve, and profits fall as costs rise faster than revenues. At an output slightly above 8,000 pounds per month, the total revenue and cost curves intersect again, and economic profit equals zero. Mr. Gortari achieves the greatest profit possible by producing 6,700 pounds of radishes per month, the quantity at which the total cost and total revenue curves have the same slope. More generally, we can conclude that a perfectly competitive firm maximizes economic profit at the output level at which the total revenue curve and the total cost curve have the same slope.

Applying the Marginal Decision Rule

The slope of the total revenue curve is marginal revenue; the slope of the total cost curve is marginal cost. Economic profit, the difference between total revenue and total cost, is maximized where marginal revenue equals marginal cost. This is consistent with the marginal decision rule, which holds that a profit-maximizing firm should increase output until the marginal benefit of an additional unit equals the marginal cost. The marginal benefit of selling an additional unit is measured as marginal revenue. Finding the output at which marginal revenue equals marginal cost is thus an application of our marginal decision rule.

Figure 8.5 shows how a firm can use the marginal decision rule to determine its profit-maximizing output. Panel (a) shows the market for radishes; the market demand curve (D), and supply curve (S) that we had in Figure 8.1; the market price is \$0.40 per pound. In Panel (b), the MR curve is given by a horizontal line at the market price. The firm's marginal cost curve (MC) intersects the marginal revenue curve at the point where profit is maximized. Mr. Gortari maximizes profits by producing 6,700 pounds of radishes per month. That is, of course, the result we obtained in Figure 8.4, where we saw that the firm's total revenue and total cost curves differ by the greatest amount at the point at which the slopes of the curves, which equal marginal revenue and marginal cost, respectively, are equal.

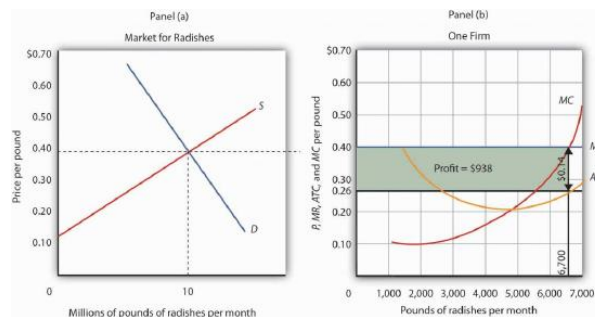


Figure 8.5 Applying the Marginal Decision Rule The market price is determined by the intersection of demand and supply. As always, the firm maximizes profit by applying the marginal decision rule. It takes the market price, \$0.40 per pound, as given and selects an output at which MR equals MC . Economic profit per unit is the difference between ATC and price (here, \$0.14 per pound); economic profit is profit per unit times the quantity produced ($\$0.14 \times 6,700 = \$938$).

We can use the graph in Figure 8.5 to compute Mr. Gortari's economic profit. Economic profit per unit is the difference between price and average total cost. At the profit-maximizing output of 6,700 pounds of radishes per month, average total cost (ATC) is \$0.26 per pound, as shown in Panel (b). Price is \$0.40 per pound, so economic profit per unit is \$0.14. Economic profit is found by multiplying economic profit per unit by the number of units produced; the firm's economic profit is thus \$938 ($\$0.14 \times 6,700$). It is shown graphically by the area of the shaded rectangle in Panel (b); this area equals the vertical distance between marginal revenue (MR) and average total cost (ATC) at an output of 6,700 pounds of radishes times the number of pounds of radishes produced, 6,700, in Figure 9.7.

Heads Up!

Look carefully at the rectangle that shows economic profit in Panel (b) of Figure 8.5. It is found by taking the profit-maximizing quantity, 6,700 pounds, then reading up to the ATC curve and the firm's demand curve at the market price. Economic profit per unit equals price minus average total cost ($P - ATC$).

The firm's economic profit equals economic profit per unit times the quantity produced. It is found by extending horizontal lines from the ATC and MR curve to the vertical axis and taking the area of the rectangle formed.

There is no reason for the profit-maximizing quantity to correspond to the lowest point on the ATC curve; it does not in this case. Students sometimes make the mistake of calculating economic profit as the difference between the price and the lowest point on the ATC curve. That gives us the maximum economic profit per unit, but we assume that firms maximize economic profit, not economic profit per unit. The firm's economic profit equals economic profit per unit times quantity. The quantity that maximizes economic profit is determined by the intersection of ATC and MR .

Economic Losses in the Short Run

In the short run, a firm has one or more inputs whose quantities are fixed. That means that in the short run the firm cannot leave its industry. Even if it cannot cover *all* of its costs, including both its variable and fixed costs, going entirely out of business is not an option in the short run. The firm may close its doors, but it must continue to pay its fixed costs. It is forced to accept an economic loss, the amount by which its total cost exceeds its total revenue.

Suppose, for example, that a manufacturer has signed a 1-year lease on some equipment. It must make payments for this equipment during the term of its lease, whether it produces anything or not. During the period of the lease, the payments represent a fixed cost for the firm.

A firm that is experiencing economic losses—whose economic profits have become negative—in the short run may either continue to produce or shut down its operations, reducing its output to zero. It will choose the option that minimizes its losses. The crucial test of whether to operate or shut down lies in the relationship between price and average variable cost.

Producing to Minimize Economic Loss

Suppose the demand for radishes falls to D_2 , as shown in Panel (a) of Figure 8.6. The market price for radishes plunges to \$0.18 per pound, which is below average total cost. Consequently Mr. Gortari experiences negative economic profits—a loss. Although the

new market price falls short of average total cost, it still exceeds average variable cost, shown in Panel (b) as AVC . Therefore, Mr. Gortari should continue to produce an output at which marginal cost equals marginal revenue. These curves (labeled MC and MR_2) intersect in Panel (b) at an output of 4,444 pounds of radishes per month.

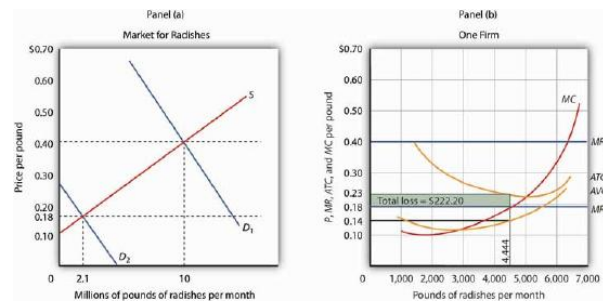


Figure 8.6 Suffering Economic Losses in the Short Run Tony Gortari experiences a loss when price drops below ATC , as it does in Panel (b) as a result of a reduction in demand. If price is above AVC , however, he can minimize his losses by producing where MC equals MR_2 . Here, that occurs at an output of 4,444 pounds of radishes per month. The price is \$0.18 per pound, and average total cost is \$0.23 per pound. He loses \$0.05 per pound, or \$222.20 per month.

When producing 4,444 pounds of radishes per month, Mr. Gortari faces an average total cost of \$0.23 per pound. At a price of \$0.18 per pound, he loses a nickel on each pound produced. Total economic losses at an output of 4,444 pounds per month are thus \$222.20 per month ($=4,444 \times \$0.05$).

No producer likes a loss (that is, negative economic profit), but the loss solution shown in Figure 8.6 is the best Mr. Gortari can attain. Any level of production other than the one at which marginal cost equals marginal revenue would produce even greater losses.

Suppose Mr. Gortari were to shut down and produce no radishes. Ceasing production would reduce variable costs to zero, but he would still face fixed costs of \$400 per month (recall that \$400 was the vertical intercept of the total cost curve in Figure 8.4). By shutting down, Mr. Gortari would lose \$400 per month. By continuing to produce, he loses only \$222.20.

Mr. Gortari is better off producing where marginal cost equals marginal revenue because at that output price exceeds average variable cost. Average variable cost is \$0.14 per pound, so by continuing to produce he covers his variable costs, with \$0.04 per pound left over to apply to fixed costs. Whenever price is greater than average variable cost, the firm maximizes economic profit (or minimizes economic loss) by producing the output level at which marginal revenue and marginal cost curves intersect.

Shutting Down to Minimize Economic Loss

Suppose price drops below a firm's average variable cost. Now the best strategy for the firm is to shut down, reducing its output to zero. The minimum level of average variable cost, which occurs at the intersection of the marginal cost curve and the average variable cost curve, is called the shutdown point. Any price below the minimum value of average variable cost will cause the firm to shut down. If the firm were to continue producing, not only would it lose its fixed costs, but it would also face an additional loss by not covering its variable costs.

Figure 8.7 shows a case where the price of radishes drops to \$0.10 per pound. Price is less than average variable cost, so Mr. Gortari not only would lose his fixed cost but would also incur additional losses by producing. Suppose, for example, he decided to operate where marginal cost equals marginal revenue, producing 1,700 pounds of radishes per month. Average variable cost equals \$0.14 per pound, so he would lose \$0.04 on each pound he produces (\$68) plus his fixed cost of \$400 per month. He would lose \$468 per month. If he shut down, he would lose only his fixed cost. Because the price of \$0.10 falls below his average variable cost, his best course would be to shut down.

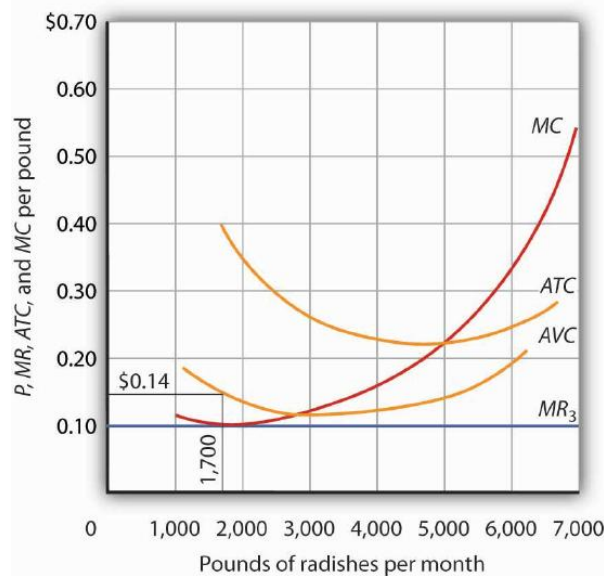


Figure 8.7 Shutting Down The market price of radishes drops to \$0.10 per pound, so MR_3 is below Mr. Gortari's AVC . Thus he would suffer a greater loss by continuing to operate than by shutting down. Whenever price falls below average variable cost, the firm will shut down, reducing its production to zero.

Shutting down is not the same thing as going out of business. A firm shuts down by closing its doors; it can reopen them whenever it expects to cover its variable costs. We can even think of a firm's decision to close at the end of the day as a kind of shutdown point; the firm makes this choice because it does not anticipate that it will be able to cover its variable cost overnight. It expects to cover those costs the next morning when it reopens its doors.

Marginal Cost and Supply

In the model of perfect competition, we assume that a firm determines its output by finding the point where the marginal revenue and marginal cost curves intersect. Provided that price exceeds average variable cost, the firm produces the quantity determined by the intersection of the two curves.

A supply curve tells us the quantity that will be produced at each price, and that is what the firm's marginal cost curve tells us. The firm's supply curve in the short run is its marginal cost curve for prices above the average variable cost. At prices below average variable cost, the firm's output drops to zero.

Panel (a) of Figure 8.8 shows the average variable cost and marginal cost curves for a hypothetical astrologer, Madame LaFarge, who is in the business of providing astrological consultations over the telephone. We shall assume that this industry is perfectly competitive. At any price below \$10 per call, Madame LaFarge would shut down. If the price is \$10 or greater, however, she produces an output at which price equals marginal cost. The marginal cost curve is thus her supply curve at all prices greater than \$10.

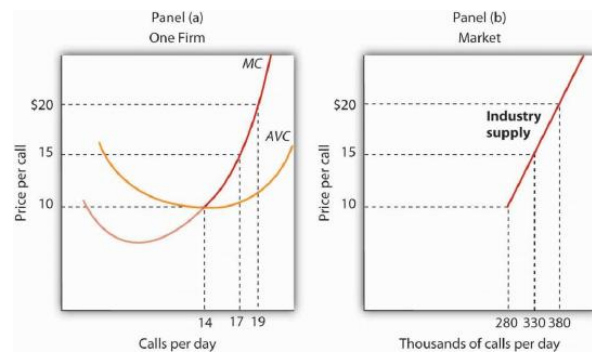


Figure 8.8 Marginal Cost and Supply The supply curve for a firm is that portion of its MC curve that lies above the AVC curve, shown in Panel (a). To obtain the short-run supply curve for the industry, we add the outputs of each firm at each price. The industry supply curve is given in Panel (b).

Now suppose that the astrological forecast industry consists of Madame LaFarge and thousands of other firms similar to hers. The market supply curve is found by adding the outputs of each firm at each price, as shown in Panel (b) of Figure 8.8. At a price of \$10 per call, for example, Madame LaFarge supplies 14 calls per day. Adding the quantities supplied by all the other firms in the market, suppose we get a quantity supplied of 280,000. Notice that the market supply curve we have drawn is linear; throughout the book we have made the assumption that market demand and supply curves are linear in order to simplify our analysis.

Looking at Figure 8.8, we see that profit-maximizing choices by firms in a perfectly competitive market will generate a market supply curve that reflects marginal cost. Provided there are no external benefits or costs in producing a good or service, a perfectly competitive market satisfies the efficiency condition.

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8.3: Perfect Competition in the Long Run

Learning Objective

1. Distinguish between economic profit and accounting profit.
2. Explain why in long-run equilibrium in a perfectly competitive industry firms will earn zero economic profit.
3. Describe the three possible effects on the costs of the factors of production that expansion or contraction of a perfectly competitive industry may have and illustrate the resulting long-run industry supply curve in each case.
4. Explain why under perfect competition output prices will change by less than the change in production cost in the short run, but by the full amount of the change in production cost in the long run.
5. Explain the effect of a change in fixed cost on price and output in the short run and in the long run under perfect competition.

In the long run, a firm is free to adjust all of its inputs. New firms can enter any market; existing firms can leave their markets. We shall see in this section that the model of perfect competition predicts that, at a long-run equilibrium, production takes place at the lowest possible cost per unit and that all economic profits and losses are eliminated.

Economic Profit and Economic Loss

Economic profits and losses play a crucial role in the model of perfect competition. The existence of economic profits in a particular industry attracts new firms to the industry in the long run. As new firms enter, the supply curve shifts to the right, price falls, and profits fall. Firms continue to enter the industry until economic profits fall to zero. If firms in an industry are experiencing economic losses, some will leave. The supply curve shifts to the left, increasing price and reducing losses. Firms continue to leave until the remaining firms are no longer suffering losses—until economic profits are zero.

Before examining the mechanism through which entry and exit eliminate economic profits and losses, we shall examine an important key to understanding it: the difference between the accounting and economic concepts of profit and loss.

Economic Versus Accounting Concepts of Profit and Loss

Economic profit equals total revenue minus total cost, where cost is measured in the economic sense as opportunity cost. An economic loss (negative economic profit) is incurred if total cost exceeds total revenue.

Accountants include only explicit costs in their computation of total cost. Explicit costs include charges that must be paid for factors of production such as labor and capital, together with an estimate of depreciation. Profit computed using only explicit costs is called accounting profit. It is the measure of profit firms typically report; firms pay taxes on their accounting profits, and a corporation reporting its profit for a particular period reports its accounting profits. To compute his accounting profits, Mr. Gortari, the radish farmer, would subtract explicit costs, such as charges for labor, equipment, and other supplies, from the revenue he receives.

Economists recognize costs in addition to the explicit costs listed by accountants. If Mr. Gortari were not growing radishes, he could be doing something else with the land and with his own efforts. Suppose the most valuable alternative use of his land would be to produce carrots, from which Mr. Gortari could earn \$250 per month in accounting profits. The income he forgoes by not producing carrots is an opportunity cost of producing radishes. This cost is not explicit; the return Mr. Gortari could get from producing carrots will not appear on a conventional accounting statement of his accounting profit. A cost that is included in the economic concept of opportunity cost, but that is not an explicit cost, is called an implicit cost.

The Long Run and Zero Economic Profits

Given our definition of economic profits, we can easily see why, in perfect competition, they must always equal zero in the long run. Suppose there are two industries in the economy, and that firms in Industry A are earning economic profits. By definition, firms in Industry A are earning a return greater than the return available in Industry B. That means that firms in Industry B are earning less than they could in Industry A. Firms in Industry B are experiencing economic losses.

Given easy entry and exit, some firms in Industry B will leave it and enter Industry A to earn the greater profits available there. As they do so, the supply curve in Industry B will shift to the left, increasing prices and profits there. As former Industry B firms enter Industry A, the supply curve in Industry A will shift to the right, lowering profits in A. The process of firms leaving Industry B and

entering A will continue until firms in both industries are earning zero economic profit. That suggests an important long-run result: *Economic profits in a system of perfectly competitive markets will, in the long run, be driven to zero in all industries.*

Eliminating Economic Profit: The Role of Entry

The process through which entry will eliminate economic profits in the long run is illustrated in Figure 8.9, which is based on the situation presented in Figure 8.5. The price of radishes is \$0.40 per pound. Mr. Gortari's average total cost at an output of 6,700 pounds of radishes per month is \$0.26 per pound. Profit per unit is \$0.14 (\$0.40 – \$0.26). Mr. Gortari thus earns a profit of \$938 per month ($=\$0.14 \times 6,700$).

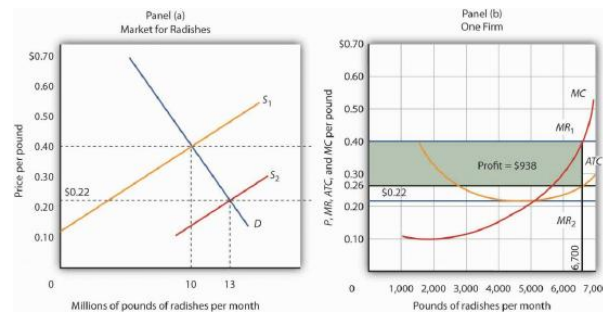


Figure 8.9 Eliminating Economic Profits in the Long Run If firms in an industry are making an economic profit, entry will occur in the long run. In Panel (b), a single firm's profit is shown by the shaded area. Entry continues until firms in the industry are operating at the lowest point on their respective average total cost curves, and economic profits fall to zero.

Profits in the radish industry attract entry in the long run. Panel (a) of Figure 8.9 shows that as firms enter, the supply curve shifts to the right and the price of radishes falls. New firms enter as long as there are economic profits to be made—as long as price exceeds ATC in Panel (b). As price falls, marginal revenue falls to MR₂ and the firm reduces the quantity it supplies, moving along the marginal cost (MC) curve to the lowest point on the ATC curve, at \$0.22 per pound and an output of 5,000 pounds per month. Although the output of individual firms falls in response to falling prices, there are now more firms, so industry output rises to 13 million pounds per month in Panel (a).

Eliminating Losses: The Role of Exit

Just as entry eliminates economic profits in the long run, exit eliminates economic losses. In Figure 8.10, Panel (a) shows the case of an industry in which the market price P_1 is below ATC. In Panel (b), at price P_1 a single firm produces a quantity q_1 , assuming it is at least covering its average variable cost. The firm's losses are shown by the shaded rectangle bounded by its average total cost C_1 and price P_1 and by output q_1 .

Because firms in the industry are losing money, some will exit. The supply curve in Panel (a) shifts to the left, and it continues shifting as long as firms are suffering losses. Eventually the supply curve shifts all the way to S₂, price rises to P_2 , and economic profits return to zero.

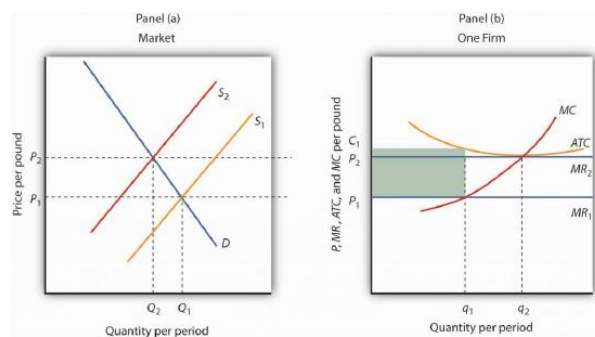


Figure 8.10 Eliminating Economic Losses in the Long Run Panel (b) shows that at the initial price P_1 , firms in the industry cannot cover average total cost (MR_1 is below ATC). That induces some firms to leave the industry, shifting the supply curve in Panel (a) to S_2 , reducing industry output to Q_2 and raising price to P_2 . At that price (MR_2), firms earn zero economic profit, and exit from the industry ceases. Panel (b) shows that the firm increases output from q_1 to q_2 ; total output in the market falls in Panel (a) because there are fewer firms. Notice that in Panel (a) quantity is designated by uppercase Q , while in Panel (b) quantity is designated by lowercase q . This convention is used throughout the text to distinguish between the quantity supplied in the market (Q) and the quantity supplied by a typical firm (q).

Entry, Exit, and Production Costs

In our examination of entry and exit in response to economic profit or loss in a perfectly competitive industry, we assumed that the ATC curve of a single firm does not shift as new firms enter or existing firms leave the industry. That is the case when expansion or contraction does not affect prices for the factors of production used by firms in the industry. When expansion of the industry does not affect the prices of factors of production, it is a constant-cost industry. In some cases, however, the entry of new firms may affect input prices.

As new firms enter, they add to the demand for the factors of production used by the industry. If the industry is a significant user of those factors, the increase in demand could push up the market price of factors of production for all firms in the industry. If that occurs, then entry into an industry will boost average costs at the same time as it puts downward pressure on price. Long-run equilibrium will still occur at a zero level of economic profit and with firms operating on the lowest point on the ATC curve, but that cost curve will be somewhat higher than before entry occurred. Suppose, for example, that an increase in demand for new houses drives prices higher and induces entry. That will increase the demand for workers in the construction industry and is likely to result in higher wages in the industry, driving up costs.

An industry in which the entry of new firms bids up the prices of factors of production and thus increases production costs is called an increasing-cost industry. As such an industry expands in the long run, its price will rise.

Some industries may experience reductions in input prices as they expand with the entry of new firms. That may occur because firms supplying the industry experience economies of scale as they increase production, thus driving input prices down. Expansion may also induce technological changes that lower input costs. That is clearly the case of the computer industry, which has enjoyed falling input costs as it has expanded. An industry in which production costs fall as firms enter in the long run is a decreasing-cost industry.

Just as industries may expand with the entry of new firms, they may contract with the exit of existing firms. In a constant-cost industry, exit will not affect the input prices of remaining firms. In an increasing-cost industry, exit will reduce the input prices of remaining firms. And, in a decreasing-cost industry, input prices may rise with the exit of existing firms.

The behavior of production costs as firms in an industry expand or reduce their output has important implications for the long-run industry supply curve, a curve that relates the price of a good or service to the quantity produced after all long-run adjustments to a price change have been completed. Every point on a long-run supply curve therefore shows a price and quantity supplied at which firms in the industry are earning zero economic profit. Unlike the short-run market supply curve, the long-run industry supply curve does not hold factor costs and the number of firms unchanged.

Figure 8.11 shows three long-run industry supply curves. In Panel (a), S_{CC} is a long-run supply curve for a constant-cost industry. It is horizontal. Neither expansion nor contraction by itself affects market price. In Panel (b), S_{IC} is a long-run supply curve for an increasing-cost industry. It rises as the industry expands. In Panel (c), S_{DC} is a long-run supply curve for a decreasing-cost industry. Its downward slope suggests a falling price as the industry expands.

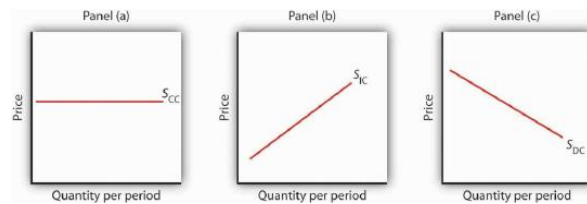


Figure 8.11 Long-Run Supply Curves in Perfect Competition The long-run supply curve for a constant-cost, perfectly competitive industry is a horizontal line, S_{CC} , shown in Panel (a). The long-run curve for an increasing-cost industry is an upward-sloping curve, S_{IC} , as in Panel (b). The downward-sloping long-run supply curve, S_{DC} , for a decreasing cost industry is given in Panel (c).

Changes in Demand and in Production Cost

The primary application of the model of perfect competition is in predicting how firms will respond to changes in demand and in production costs. To see how firms respond to a particular change, we determine how the change affects demand or cost conditions and then see how the profit-maximizing solution is affected in the short run and in the long run. Having determined how the profit-maximizing firms of the model would respond, we can then predict firms' responses to similar changes in the real world.

In the examples that follow, we shall assume, for simplicity, that entry or exit do not affect the input prices facing firms in the industry. That is, we assume a constant-cost industry with a horizontal long-run industry supply curve similar to S_{CC} in Figure 8.11. We shall assume that firms are covering their average variable costs, so we can ignore the possibility of shutting down.

Changes in Demand

Changes in demand can occur for a variety of reasons. There may be a change in preferences, incomes, the price of a related good, population, or consumer expectations. A change in demand causes a change in the market price, thus shifting the marginal revenue curves of firms in the industry.

Let us consider the impact of a change in demand for oats. Suppose new evidence suggests that eating oats not only helps to prevent heart disease, but also prevents baldness in males. This will, of course, increase the demand for oats. To assess the impact of this change, we assume that the industry is perfectly competitive and that it is initially in long-run equilibrium at a price of \$1.70 per bushel. Economic profits equal zero.

The initial situation is depicted in Figure 8.12. Panel (a) shows that at a price of \$1.70, industry output is Q_1 (point A), while Panel (b) shows that the market price constitutes the marginal revenue, MR_1 , facing a single firm in the industry. The firm responds to that price by finding the output level at which the MC and MR_1 curves intersect. That implies a level of output q_1 at point A'.

The new medical evidence causes demand to increase to D_2 in Panel (a). That increases the market price to \$2.30 (point B), so the marginal revenue curve for a single firm rises to MR_2 in Panel (b). The firm responds by increasing its output to q_2 in the short run (point B'). Notice that the firm's average total cost is slightly higher than its original level of \$1.70; that is because of the U shape of the curve. The firm is making an economic profit shown by the shaded rectangle in Panel (b). Other firms in the industry will earn an economic profit as well, which, in the long run, will attract entry by new firms. New entry will shift the supply curve to the right; entry will continue as long as firms are making an economic profit. The supply curve in Panel (a) shifts to S_2 , driving the price down in the long run to the original level of \$1.70 per bushel and returning economic profits to zero in long-run equilibrium. A single firm will return to its original level of output, q_1 (point A') in Panel (b), but because there are more firms in the industry, industry output rises to Q_3 (point C) in Panel (a).

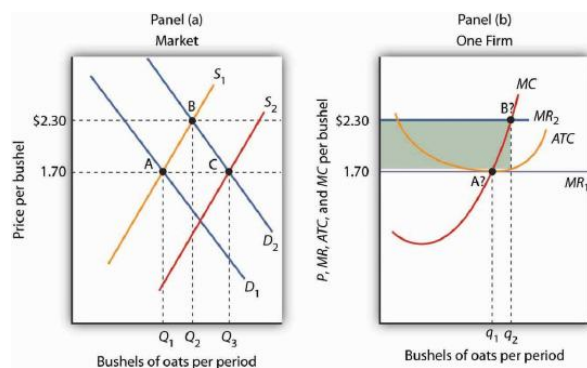


Figure 8.12 Short-Run and Long-Run Adjustments to an Increase in Demand The initial equilibrium price and output are determined in the market for oats by the intersection of demand and supply at point A in Panel (a). An increase in the market demand for oats, from D_1 to D_2 in Panel (a), shifts the equilibrium solution to point B. The price increases in the short run from \$1.70 per bushel to \$2.30. Industry output rises to Q_2 . For a single firm, the increase in price raises marginal revenue from MR_1 to MR_2 ; the firm responds in the short run by increasing its output to q_2 . It earns an economic profit given by the shaded rectangle. In the long run, the opportunity for profit attracts new firms. In a constant-cost industry, the short-run supply curve shifts to S_2 ; market equilibrium now moves to point C in Panel (a). The market price falls back to \$1.70. The firm's demand curve returns to MR_1 , and its output falls back to the original level, q_1 . Industry output has risen to Q_3 because there are more firms.

A reduction in demand would lead to a reduction in price, shifting each firm's marginal revenue curve downward. Firms would experience economic losses, thus causing exit in the long run and shifting the supply curve to the left. Eventually, the price would rise back to its original level, assuming changes in industry output did not lead to changes in input prices. There would be fewer firms in the industry, but each firm would end up producing the same output as before.

Changes in Production Cost

A firm's costs change if the costs of its inputs change. They also change if the firm is able to take advantage of a change in technology. Changes in production cost shift the ATC curve. If a firm's variable costs are affected, its marginal cost curves will shift as well. Any change in marginal cost produces a similar change in industry supply, since it is found by adding up marginal cost curves for individual firms.

Suppose a reduction in the price of oil reduces the cost of producing oil changes for automobiles. We shall assume that the oil-change industry is perfectly competitive and that it is initially in long-run equilibrium at a price of \$27 per oil change, as shown in Panel (a) of Figure 8.13. Suppose that the reduction in oil prices reduces the cost of an oil change by \$3.

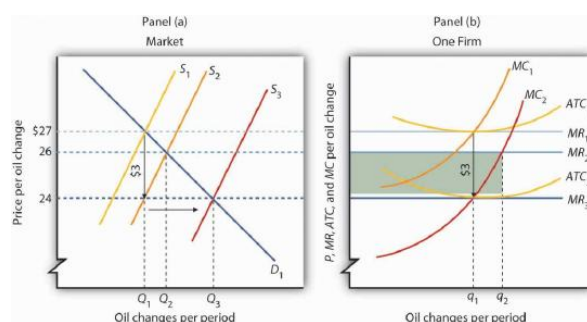


Figure 8.13 A Reduction in the Cost of Producing Oil Changes The initial equilibrium price, \$27, and quantity, Q_1 , of automobile oil changes are determined by the intersection of market demand, D_1 , and market supply, S_1 in Panel (a). The industry is in long-run equilibrium; a typical firm, shown in Panel (b), earns zero economic profit. A reduction in oil prices reduces the marginal and average total costs of producing an oil change by \$3. The firm's marginal cost curve shifts to MC_2 , and its average total cost curve shifts to ATC_2 . The short-run industry supply curve shifts down by \$3 to S_2 . The market price falls to \$26; the firm increases its output to q_2 and earns an economic profit given by the shaded rectangle. In the long run, the opportunity for profit shifts the industry supply curve to S_3 . The price falls to \$24, and the firm reduces its output to the original level, q_1 . It now earns zero economic profit once again. Industry output in Panel (a) rises to Q_3 because there are more firms; price has fallen by the full amount of the reduction in production costs.

A reduction in production cost shifts the firm's cost curves down. The firm's average total cost and marginal cost curves shift down, as shown in Panel (b). In Panel (a) the supply curve shifts from S_1 to S_2 . The industry supply curve is made up of the marginal cost curves of individual firms; because each of them has shifted downward by \$3, the industry supply curve shifts downward by \$3.

Notice that price in the short run falls to \$26; it does not fall by the \$3 reduction in cost. That is because the supply and demand curves are sloped. While the supply curve shifts downward by \$3, its intersection with the demand curve falls by less than \$3. The firm in Panel (b) responds to the lower price and lower cost by increasing output to q_2 , where MC_2 and MR_2 intersect. That leaves firms in the industry with an economic profit; the economic profit for the firm is shown by the shaded rectangle in Panel (b). Profits attract entry in the long run, shifting the supply curve to the right to S_3 in Panel (a). Entry will continue as long as firms are making an economic profit—it will thus continue until the price falls by the full amount of the \$3 reduction in cost. The price falls to \$24, industry output rises to Q_3 , and the firm's output returns to its original level, q_1 .

An increase in variable costs would shift the average total, average variable, and marginal cost curves upward. It would shift the industry supply curve upward by the same amount. The result in the short run would be an increase in price, but by less than the increase in cost per unit. Firms would experience economic losses, causing exit in the long run. Eventually, price would increase by the full amount of the increase in production cost.

Some cost increases will not affect marginal cost. Suppose, for example, that an annual license fee of \$5,000 is imposed on firms in a particular industry. The fee is a fixed cost; it does not affect marginal cost. Imposing such a fee shifts the average total cost curve upward but causes no change in marginal cost. There is no change in price or output in the short run. Because firms are suffering economic losses, there will be exit in the long run. Prices ultimately rise by enough to cover the cost of the fee, leaving the remaining firms in the industry with zero economic profit.

Price will change to reflect whatever change we observe in production cost. A change in variable cost causes price to change in the short run. In the long run, any change in average total cost changes price by an equal amount.

The message of long-run equilibrium in a competitive market is a profound one. The ultimate beneficiaries of the innovative efforts of firms are consumers. Firms in a perfectly competitive world earn zero profit in the long-run. While firms can earn accounting profits in the long-run, they cannot earn economic profits.

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CHAPTER OVERVIEW

9: Monopoly

[9.1: The Nature of Monopoly](#)

[9.2: The Monopoly Model](#)

[9.3: Assessing Monopoly](#)

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9.1: The Nature of Monopoly

Learning Objective

1. Define monopoly and the relationship between price setting and monopoly power.
2. List and explain the sources of monopoly power and how they can change over time.
3. Define what is meant by a natural monopoly.

Monopoly is at the opposite end of the spectrum of market models from perfect competition. A monopoly firm has no rivals. It is the only firm in its industry. There are no close substitutes for the good or service a monopoly produces. Not only does a monopoly firm have the market to itself, but it also need not worry about other firms entering. In the case of monopoly, entry by potential rivals is prohibitively difficult.

A monopoly does not take the market price as given; it determines its own price. It selects from its demand curve the price that corresponds to the quantity the firm has chosen to produce in order to earn the maximum profit possible. The entry of new firms, which eliminates profit in the long run in a competitive market, cannot occur in the monopoly model.

A firm that sets or picks price based on its output decision is called a price setter. A firm that acts as a price setter possesses monopoly power. We shall see in the next chapter that monopolies are not the only firms that have this power; however, the absence of rivals in monopoly gives it much more price-setting power.

As was the case when we discussed perfect competition in the previous chapter, the assumptions of the monopoly model are rather strong. In assuming there is one firm in a market, we assume there are no other firms producing goods or services that could be considered part of the same market as that of the monopoly firm. In assuming blocked entry, we assume, for reasons we will discuss below, that no other firm can enter that market. Such conditions are rare in the real world. As always with models, we make the assumptions that define monopoly in order to simplify our analysis, not to describe the real world. The result is a model that gives us important insights into the nature of the choices of firms and their impact on the economy.

Sources of Monopoly Power

Why are some markets dominated by single firms? What are the sources of monopoly power? Economists have identified a number of conditions that, individually or in combination, can lead to domination of a market by a single firm and create barriers that prevent the entry of new firms.

Barriers to entry are characteristics of a particular market that block new firms from entering it. They include economies of scale, special advantages of location, high sunk costs, a dominant position in the ownership of some of the inputs required to produce the good, and government restrictions. These barriers may be interrelated, making entry that much more formidable. Although these barriers might allow one firm to gain and hold monopoly control over a market, there are often forces at work that can erode this control.

Economies of Scale

Scale economies and diseconomies define the shape of a firm's long-run average cost (*LRAC*) curve as it increases its output. If long-run average cost declines as the level of production increases, a firm is said to experience *economies of scale*.

A firm that confronts economies of scale over the entire range of outputs demanded in its industry is a natural monopoly. Utilities that distribute electricity, water, and natural gas to some markets are examples. In a natural monopoly, the *LRAC* of any one firm intersects the market demand curve where long-run average costs are falling or are at a minimum. If this is the case, one firm in the industry will expand to exploit the economies of scale available to it. Because this firm will have lower unit costs than its rivals, it can drive them out of the market and gain monopoly control over the industry.

Suppose there are 12 firms, each operating at the scale shown by ATC_1 (average total cost) in Figure 9.1. A firm that expanded its scale of operation to achieve an average total cost curve such as ATC_2 could produce 240 units of output at a lower cost than could the smaller firms producing 20 units each. By cutting its price below the minimum average total cost of the smaller plants, the larger firm could drive the smaller ones out of business. In this situation, the industry demand is not large enough to support more than one firm. If another firm attempted to enter the industry, the natural monopolist would always be able to undersell it.

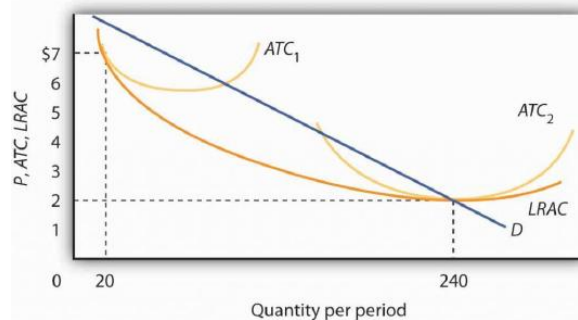


Figure 9.1 Economies of Scale Lead to Natural Monopoly A firm with falling $LRAC$ throughout the range of outputs relevant to existing demand (D) will monopolize the industry. Here, one firm operating with a large plant (ATC_2) produces 240 units of output at a lower cost than the \$7 cost per unit of the 12 firms operating at a smaller scale (ATC_1), and producing 20 units of output each.

Location

Sometimes monopoly power is the result of location. For example, sellers in markets isolated by distance from their nearest rivals have a degree of monopoly power. The local movie theater in a small town has a monopoly in showing first-run movies. Doctors, dentists, and mechanics in isolated towns may also be monopolists.

Sunk Costs

The greater the cost of establishing a new business in an industry, the more difficult it is to enter that industry. That cost will, in turn, be greater if the outlays required to start a business are unlikely to be recovered if the business should fail.

Suppose, for example, that entry into a particular industry requires extensive advertising to make consumers aware of the new brand. Should the effort fail, there is no way to recover the expenditures for such advertising. An expenditure that has already been made and that cannot be recovered is called a sunk cost.

If a substantial fraction of a firm's initial outlays will be lost upon exit from the industry, exit will be costly. Difficulty of exit can make for difficulty of entry. The more firms have to lose from an unsuccessful effort to penetrate a particular market, the less likely they are to try. The potential for high sunk costs could thus contribute to the monopoly power of an established firm by making entry by other firms more difficult.

Restricted Ownership of Raw Materials and Inputs

In very few cases the source of monopoly power is the ownership of strategic inputs. If a particular firm owns all of an input required for the production of a particular good or service, then it could emerge as the only producer of that good or service.

The Aluminum Company of America (ALCOA) gained monopoly power through its ownership of virtually all the bauxite mines in the world (bauxite is the source of aluminum). The International Nickel Company of Canada at one time owned virtually all the world's nickel. De Beers acquired rights to nearly all the world's diamond production, giving it enormous power in the market for diamonds. With new diamond supplies in Canada, Australia, and Russia being developed and sold independently of DeBeers, however, this power has declined, and today DeBeers controls a substantially smaller percentage of the world's supply.

Government Restrictions

Another important basis for monopoly power consists of special privileges granted to some business firms by government agencies. State and local governments have commonly assigned exclusive franchises—rights to conduct business in a specific market—to taxi and bus companies, to cable television companies, and to providers of telephone services, electricity, natural gas, and water, although the trend in recent years has been to encourage competition for many of these services. Governments might also regulate entry into an industry or a profession through licensing and certification requirements. Governments also provide patent protection to inventors of new products or production methods in order to encourage innovation; these patents may afford their holders a degree of monopoly power during the 17-year life of the patent.

Patents can take on extra importance when network effects are present. Network effects arise in situations where products become more useful the larger the number of users of the product. For example, one advantage of using the Windows computer operating

system is that so many other people use it. That has advantages in terms of sharing files and other information.

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9.2: The Monopoly Model

Learning Objective

1. Explain the relationship between price and marginal revenue when a firm faces a downward-sloping demand curve.
2. Explain the relationship between marginal revenue and elasticity along a linear demand curve.
3. Apply the marginal decision rule to explain how a monopoly maximizes profit.

Analyzing choices is a more complex challenge for a monopoly firm than for a perfectly competitive firm. After all, a competitive firm takes the market price as given and determines its profit-maximizing output. Because a monopoly has its market all to itself, it can determine not only its output but its price as well. What kinds of price and output choices will such a firm make?

We will answer that question in the context of the marginal decision rule: a firm will produce additional units of a good until marginal revenue equals marginal cost. To apply that rule to a monopoly firm, we must first investigate the special relationship between demand and marginal revenue for a monopoly.

Monopoly and Market Demand

Because a monopoly firm has its market all to itself, it faces the market demand curve. Figure 9.2 compares the demand situations faced by a monopoly and a perfectly competitive firm. In Panel (a), the equilibrium price for a perfectly competitive firm is determined by the intersection of the demand and supply curves. The market supply curve is found simply by summing the supply curves of individual firms. Those, in turn, consist of the portions of marginal cost curves that lie above the average variable cost curves. The marginal cost curve, MC , for a single firm is illustrated. Notice the break in the horizontal axis indicating that the quantity produced by a single firm is a trivially small fraction of the whole. In the perfectly competitive model, one firm has *nothing* to do with the determination of the market price. Each firm in a perfectly competitive industry faces a horizontal demand curve defined by the market price.

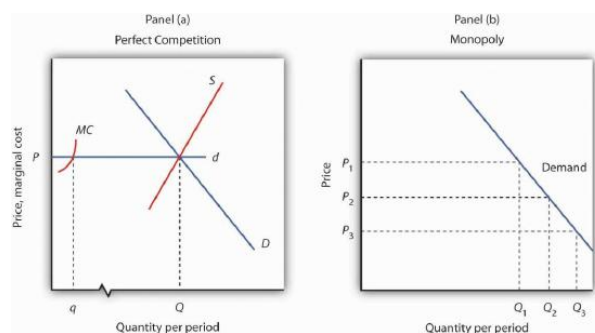


Figure 9.2 Perfect Competition Versus Monopoly Panel (a) shows the determination of equilibrium price and output in a perfectly competitive market. A typical firm with marginal cost curve MC is a price taker, choosing to produce quantity q at the equilibrium price P . In Panel (b) a monopoly faces a downward-sloping market demand curve. As a profit maximizer, it determines its profit-maximizing output. Once it determines that quantity, however, the price at which it can sell that output is found from the demand curve. The monopoly firm can sell additional units only by lowering price. The perfectly competitive firm, by contrast, can sell any quantity it wants at the market price.

Contrast the situation shown in Panel (a) with the one faced by the monopoly firm in Panel (b). Because it is the only supplier in the industry, the monopolist faces the downward-sloping market demand curve alone. It may choose to produce any quantity. But, unlike the perfectly competitive firm, which can sell all it wants at the going market price, a monopolist can sell a greater quantity only by cutting its price.

Suppose, for example, that a monopoly firm can sell quantity Q_1 units at a price P_1 in Panel (b). If it wants to increase its output to Q_2 units—and sell that quantity—it must reduce its price to P_2 . To sell quantity Q_3 it would have to reduce the price to P_3 . The monopoly firm may choose its price and output, but it is restricted to a combination of price and output that lies on the demand curve. It could not, for example, charge price P_1 and sell quantity Q_3 . To be a price setter, a firm must face a downward-sloping demand curve.

Demand and Marginal Revenue

In the perfectly competitive case, the additional revenue a firm gains from selling an additional unit—its marginal revenue—is equal to the market price. The firm's demand curve, which is a horizontal line at the market price, is also its marginal revenue curve. But a monopoly firm can sell an additional unit only by lowering the price. That fact complicates the relationship between the monopoly's demand curve and its marginal revenue.

Examine figure 9.3 when firm sells 2 units it charges a price of \$8 per unit. Its total revenue is \$16. Now it wants to sell a third unit and wants to know the marginal revenue of that unit. To sell 3 units rather than 2, the firm must lower its price to \$7 per unit. Total revenue rises to \$21. The marginal revenue of the third unit is thus \$5. But the *price* at which the firm sells 3 units is \$7. Marginal revenue is less than price.

To see why the marginal revenue of the third unit is less than its price, we need to examine more carefully how the sale of that unit affects the firm's revenues. The firm brings in \$7 from the sale of the third unit. But selling the third unit required the firm to charge a price of \$7 instead of the \$8 the firm was charging for 2 units. Now the firm receives less for the first 2 units. The marginal revenue of the third unit is the \$7 the firm receives for that unit *minus* the \$1 reduction in revenue for each of the first two units. The marginal revenue of the third unit is thus \$5. (In this chapter we assume that the monopoly firm sells all units of output at the same price)

Marginal revenue is less than price for the monopoly firm. Figure 9.3 shows the relationship between demand and marginal revenue.

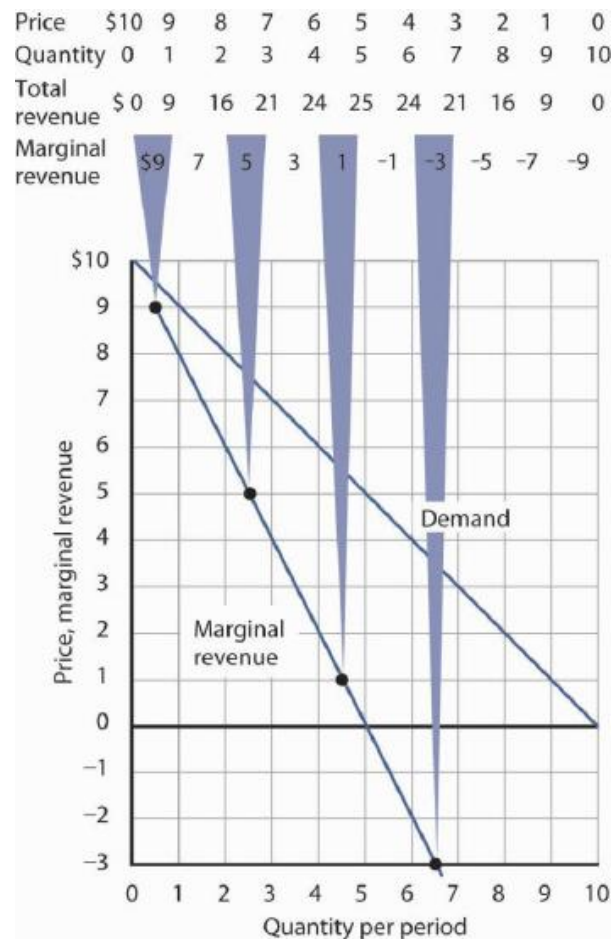


Figure 9.3 Demand and Marginal Revenue The marginal revenue curve for the monopoly firm lies below its demand curve. It shows the additional revenue gained from selling an additional unit. Notice that, as always, marginal values are plotted at the midpoints of the respective intervals.

When the demand curve is linear, as in Figure 9.3, the marginal revenue curve can be placed according to the following rules: the marginal revenue curve is always below the demand curve and the marginal revenue curve will bisect any horizontal line drawn between the vertical axis and the demand curve. To put it another way, the marginal revenue curve will be twice as steep as the demand curve.

The marginal revenue and demand curves in Figure 9.3 follow these rules. The marginal revenue curve lies below the demand curve, and it bisects any horizontal line drawn from the vertical axis to the demand curve. At a price of \$6, for example, the quantity demanded is 4. The marginal revenue curve passes through 2 units at this price. At a price of 0, the quantity demanded is 10; the marginal revenue curve passes through 5 units at this point.

Monopoly Equilibrium: Applying the Marginal Decision Rule

Profit-maximizing behavior is always based on the marginal decision rule: Additional units of a good should be produced as long as the marginal revenue of an additional unit exceeds the marginal cost. The maximizing solution occurs where marginal revenue equals marginal cost. As always, firms seek to maximize economic profit, and costs are measured in the economic sense of opportunity cost.

Figure 9.4 shows a demand curve and an associated marginal revenue curve facing a monopoly firm. The marginal cost curve is like those we derived earlier; it falls over the range of output in which the firm experiences increasing marginal returns, then rises as the firm experiences diminishing marginal returns.

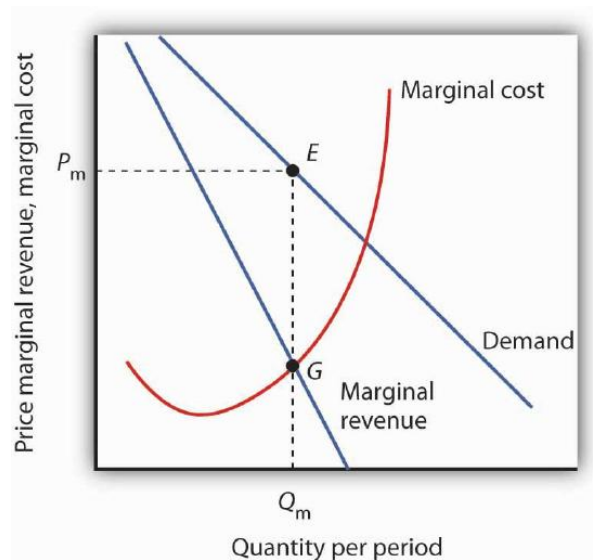


Figure 9.4 The Monopoly Solution The monopoly firm maximizes profit by producing an output Q_m at point G, where the marginal revenue and marginal cost curves intersect. It sells this output at price P_m .

To determine the profit-maximizing output, we note the quantity at which the firm's marginal revenue and marginal cost curves intersect (Q_m in Figure 9.4). We read up from Q_m to the demand curve to find the price P_m at which the firm can sell Q_m units per period. The profit-maximizing price and output are given by point E on the demand curve.

Thus we can determine a monopoly firm's profit-maximizing price and output by following three steps:

1. Determine the demand, marginal revenue, and marginal cost curves.
2. Select the output level at which the marginal revenue and marginal cost curves intersect.
3. Determine from the demand curve the price at which that output can be sold.

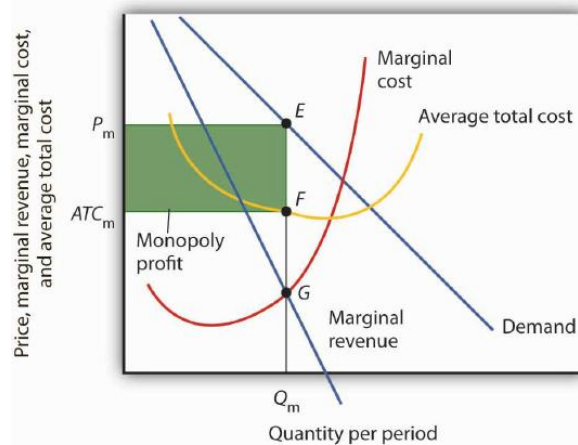


Figure 9.5 Computing Monopoly Profit A monopoly firm's profit per unit is the difference between price and average total cost. Total profit equals profit per unit times the quantity produced. Total profit is given by the area of the shaded rectangle $ATC_m P_m EF$.

Once we have determined the monopoly firm's price and output, we can determine its economic profit by adding the firm's average total cost curve to the graph showing demand, marginal revenue, and marginal cost, as shown in Figure 9.5. The average total cost (ATC) at an output of Q_m units is ATC_m . The firm's profit per unit is thus $P_m - ATC_m$. Total profit is found by multiplying the firm's output, Q_m , by profit per unit, so total profit equals $Q_m(P_m - ATC_m)$ —the area of the shaded rectangle in Figure 9.5.

Heads Up!

Dispelling Myths About Monopoly

Three common misconceptions about monopoly are:

1. Because there are no rivals selling the products of monopoly firms, they can charge whatever they want.
2. Monopolists will charge whatever the market will bear.
3. Because monopoly firms have the market to themselves, they are guaranteed huge profits.

As Figure 9.4 shows, once the monopoly firm decides on the number of units of output that will maximize profit, the price at which it can sell that many units is found by “reading off” the demand curve the price associated with that many units. If it tries to sell Q_m units of output for more than P_m , some of its output will go unsold. The monopoly firm can set its price, but is restricted to price and output combinations that lie on its demand curve. It cannot just “charge whatever it wants.” And if it charges “all the market will bear,” it will sell either 0 or, at most, 1 unit of output.

Neither is the monopoly firm guaranteed a profit. Consider Figure 9.5 Suppose the average total cost curve, instead of lying below the demand curve for some output levels as shown, were instead everywhere above the demand curve. In that case, the monopoly will incur losses no matter what price it chooses, since average total cost will always be greater than any price it might charge. As is the case for perfect competition, the monopoly firm can keep producing in the short run so long as price exceeds average variable cost. In the long run, it will stay in business only if it can cover all of its costs.

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9.3: Assessing Monopoly

Learning Objective

1. Explain and illustrate that a monopoly firm produces an output that is less than the efficient level and why this results in a deadweight loss to society.
2. Explain and illustrate how the higher price that a monopoly charges, compared to an otherwise identical perfectly competitive firm, transfers part of consumer surplus to the monopolist and raises questions of equity.
3. Considering both advantages and disadvantages, discuss the potential effects that a monopoly may have on consumer choices, price, quality of products, and technological innovations.
4. Discuss the public policy responses to monopoly.

We have seen that for monopolies pursuing profit maximization, the outcome differs from the case of perfect competition. Does this matter to society? In this section, we will focus on the differences that stem from market structure and assess their implications.

Efficiency, Equity, and Concentration of Power

A monopoly firm determines its output by setting marginal cost equal to marginal revenue. It then charges the price at which it can sell that output, a price determined by the demand curve. That price exceeds marginal revenue; it therefore exceeds marginal cost as well. That contrasts with the case in perfect competition, in which price and marginal cost are equal. The higher price charged by a monopoly firm may allow it a profit—in large part at the expense of consumers, whose reduced options may give them little say in the matter. The monopoly solution thus raises problems of efficiency, equity, and the concentration of power.

Monopoly and Efficiency

The fact that price in monopoly exceeds marginal cost suggests that the monopoly solution violates the basic condition for economic efficiency, that the price system must confront decision makers with all of the costs and all of the benefits of their choices. Efficiency requires that consumers confront prices that equal marginal costs. Because a monopoly firm charges a price greater than marginal cost, consumers will consume less of the monopoly's good or service than is economically efficient.

To contrast the efficiency of the perfectly competitive outcome with the inefficiency of the monopoly outcome, imagine a perfectly competitive industry whose solution is depicted in Figure 9.6. The short-run industry supply curve is the summation of individual marginal cost curves; it may be regarded as the marginal cost curve for the industry. A perfectly competitive industry achieves equilibrium at point C, at price P_c and quantity Q_c .

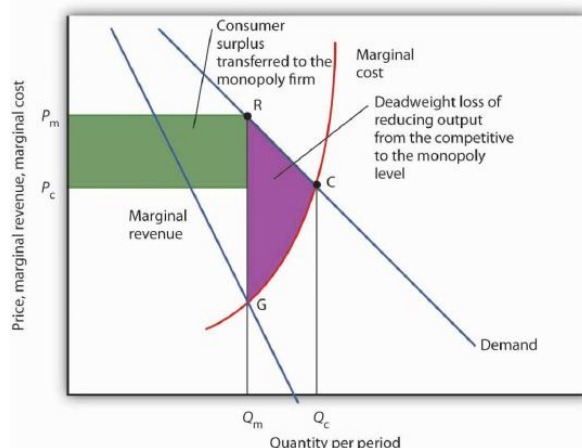


Figure 9.6 Perfect Competition, Monopoly, and Efficiency Given market demand and marginal revenue, we can compare the behavior of a monopoly to that of a perfectly competitive industry. The marginal cost curve may be thought of as the supply curve of a perfectly competitive industry. The perfectly competitive industry produces quantity Q_c and sells the output at price P_c . The monopolist restricts output to Q_m and raises the price to P_m .

Reorganizing a perfectly competitive industry as a monopoly results in a deadweight loss to society given by the shaded area GRC. It also transfers a portion of the consumer surplus earned in the competitive case to the monopoly firm.

Now, suppose that all the firms in the industry merge and a government restriction prohibits entry by any new firms. Our perfectly competitive industry is now a monopoly. Assume the monopoly continues to have the same marginal cost and demand curves that the competitive industry did. The monopoly firm faces the same market demand curve, from which it derives its marginal revenue curve. It maximizes profit at output Q_m and charges price P_m . Output is lower and price higher than in the competitive solution.

Society would gain by moving from the monopoly solution at Q_m to the competitive solution at Q_c . The benefit to consumers would be given by the area under the demand curve between Q_m and Q_c ; it is the area Q_mRCQ_c . An increase in output, of course, has a cost. Because the marginal cost curve measures the cost of each additional unit, we can think of the area under the marginal cost curve over some range of output as measuring the total cost of that output. Thus, the total cost of increasing output from Q_m to Q_c is the area under the marginal cost curve over that range—the area Q_mGCQ_c . Subtracting this cost from the benefit gives us the net gain of moving from the monopoly to the competitive solution; it is the shaded area GRC. That is the potential gain from moving to the efficient solution. The area GRC is a deadweight loss.

Monopoly and Equity

The monopoly solution raises issues not just of efficiency but also of equity. Figure 10.11 shows that the monopolist charges price P_m rather than the competitive price P_c ; the higher price charged by the monopoly firm reduces consumer surplus. Consumer surplus is the difference between what consumers are willing to pay for a good and what they actually pay. It is measured by the area under the demand curve and above the price of the good over the range of output produced.

If the industry were competitive, consumer surplus would be the area below the demand curve and above P_cC . With monopoly, consumer surplus would be the area below the demand curve and above P_mR . Part of the reduction in consumer surplus is the area under the demand curve between Q_c and Q_m ; it is contained in the deadweight loss area GRC. But consumers also lose the area of the rectangle bounded by the competitive and monopoly prices and by the monopoly output; this lost consumer surplus is transferred to the monopolist.

The fact that society suffers a deadweight loss due to monopoly is an efficiency problem. But the transfer of a portion of consumer surplus to the monopolist is an equity issue. Is such a transfer legitimate? After all, the monopoly firm enjoys a privileged position, protected by barriers to entry from competition. Should it be allowed to extract these gains from consumers? We will see that public policy suggests that the answer is no. Regulatory efforts imposed in monopoly cases often seek to reduce the degree to which monopoly firms extract consumer surplus from consumers by reducing the prices these firms charge.

Monopoly and the Concentration of Power

The objections to monopoly run much deeper than worries over economic efficiency and high prices. Because it enjoys barriers that block potential rivals, a monopoly firm wields considerable market power. For many people, that concentration of power is objectionable. A decentralized, competitive market constantly tests the ability of firms to satisfy consumers, pushes them to find new products and new and better production methods, and whittles away economic profits. Firms that operate in the shelter of monopoly may be largely immune to such pressures. Consumers are likely to be left with fewer choices, higher costs, and lower quality.

Perhaps more important in the view of many economists is the fact that the existence of economic profits provides both an incentive and the means for monopolists to aggressively protect their position and extend it if possible. These economists point out that monopolists may be willing to spend their economic profits in attempts to influence political leaders and public authorities (including regulatory authorities) who can help them maintain or enhance their monopoly position. Graft and corruption may be the result, claim these critics. Indeed, Microsoft has been accused by its rivals of bullying computer manufacturers into installing its web browser, Internet Explorer, exclusively on their computers.

Attitudes about Microsoft reflect these concerns. Even among people who feel that its products are good and fairly priced, there is uneasiness about our seeming dependence on them. And once it has secured its dominant position, will it charge more for its products? Will it continue to innovate?

Public Policy Toward Monopoly

Pulling together what we have learned in this chapter on monopoly and previously on perfect competition, Table 10.1 “Characteristics of Perfect Competition and Monopoly” summarizes the differences between the models of perfect competition and monopoly. Most importantly we note that whereas the perfectly competitive firm is a price taker, the monopoly firm is a price

setter. Because of this difference, we can object to monopoly on grounds of economic efficiency; monopolies produce too little and charge too much. Also, the high price and persistent profits strike many as inequitable. Others may simply see monopoly as an unacceptable concentration of power.

Table 10.1 Characteristics of Perfect Competition and Monopoly

Characteristic or Event	Perfect Competition	Monopoly
Market	Large number of sellers and buyers producing a homogeneous good or service, easy entry.	Large number of buyers, one seller. Entry is blocked.
Demand and marginal revenue curves	The firm's demand and marginal revenue curve is a horizontal line at the market price.	The firm faces the market demand curve; marginal revenue is below market demand.
Price	Determined by demand and supply; each firm is a price taker. Price equals marginal cost.	The monopoly firm determines price; it is a price setter. Price is greater than marginal cost.
Profit maximization	Firms produce where marginal cost equals marginal revenue	Firms produce where marginal cost equals marginal revenue and charge the corresponding price on the demand curve.
Profit	Entry forces economic profit to zero in the long run.	Because entry is blocked, a monopoly firm can sustain an economic profit in the long run.
Efficiency	The equilibrium solution is efficient because price equals marginal cost.	The equilibrium solution is inefficient because price is greater than marginal cost.

Public policy toward monopoly generally recognizes two important dimensions of the monopoly problem. On the one hand, the combining of competing firms into a monopoly creates an inefficient and, to many, inequitable solution. On the other hand, some industries are characterized as natural monopolies; production by a single firm allows economies of scale that result in lower costs.

The combining of competing firms into a monopoly firm or unfairly driving competitors out of business is generally forbidden in the United States. Regulatory efforts to prevent monopoly fall under the purview of the nation's antitrust laws, discussed in more detail in a later chapter.

At the same time, we must be careful to avoid the mistake of simply assuming that competition is the alternative to monopoly, that every monopoly can and should be replaced by a competitive market. One key source of monopoly power, after all, is economies of scale. In the case of natural monopoly, the alternative to a single firm is many small, high-cost producers. We may not like having only one local provider of water, but we might like even less having dozens of providers whose costs—and prices—are higher. Where monopolies exist because economies of scale prevail over the entire range of market demand, they may serve a useful economic role. We might want to regulate their production and pricing choices, but we may not want to give up their cost advantages.

Where a natural monopoly exists, the price charged by the firm and other aspects of its behavior may be subject to regulation. Water or natural gas, for example, are often distributed by a public utility—a monopoly firm—at prices regulated by a state or local government agency. Typically, such agencies seek to force the firm to charge lower prices, and to make less profit, than it would otherwise seek.

Although economists are hesitant to levy blanket condemnations of monopoly, they are generally sharply critical of monopoly power where no rationale for it exists. When firms have substantial monopoly power only as the result of government policies that block entry, there may be little defense for their monopoly positions.

Public policy toward monopoly aims generally to strike the balance implied by economic analysis. Where rationales exist, as in the case of natural monopoly, monopolies are permitted—and their prices are regulated. In other cases, monopoly is prohibited

outright. Societies are likely to at least consider taking action of some kind against monopolies unless they appear to offer cost or other technological advantages.

The Fragility of Monopoly Power

An important factor in thinking about public policy toward monopoly is to recognize that monopoly power can be a fleeting thing. Firms constantly seek out the market power that monopoly offers. When conditions are right to achieve this power, firms that succeed in carving out monopoly positions enjoy substantial profits. But the potential for high profits invites continuing attempts to break down the barriers to entry that insulate monopolies from competition.

Technological change and the pursuit of profits chip away constantly at the entrenched power of monopolies. Breathtaking technological change has occurred in the telecommunications industry. Catalog companies are challenging the monopoly positions of some retailers; internet booksellers and online textbook companies such as [gone.2012books.lardbucket.org](https://2012books.lardbucket.org) are challenging the monopoly power of your university's bookstore; and Federal Express, UPS, and other companies are taking on the U.S. Postal Service. The assaults on monopoly power are continuous. Thus, even the monopoly firm must be on the lookout for potential competitors.

Potential rivals are always beating at the door and thereby making the monopoly's fragile market contestable—that is, open to entry, at least in the sense of rival firms producing “close enough,” if not perfect, substitutes—close enough that they might eliminate the firm's monopoly power.

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9.4: Antitrust Laws and Their Interpretation

Learning Objective

1. Define antitrust policies and tell when and why they were introduced in the United States.
2. Discuss highlights in the history of antitrust policies in the United States, focusing on major issues.
3. Explain the guidelines the Justice Department uses in dealing with mergers.

In the decades after the Civil War, giant corporations and cartels began to dominate railroads, oil, banking, meat packing, and a dozen other industries. These businesses were led by entrepreneurs who, rightly or wrongly, have come to be thought of as “robber barons” out to crush their competitors, monopolize their markets, and gouge their customers. The term “robber baron” was associated with such names as J.P. Morgan and Andrew Carnegie in the steel industry, Philip Armour and Gustavas and Edwin Swift in meat packing, James P. Duke in tobacco, and John D. Rockefeller in the oil industry. They gained their market power through cartels and other business agreements aimed at restricting competition. Some formed *trusts*, a combination of corporations designed to consolidate, coordinate, and control the operations and policies of several companies. It was in response to the rise of these cartels and giant firms that antitrust policy was created in the United States. Antitrust policy refers to government attempts to prevent the acquisition and exercise of monopoly power and to encourage competition in the marketplace.

A Brief History of Antitrust Policy

The final third of the nineteenth century saw two major economic transitions. The first was industrialization—a period in which U.S. firms became far more capital intensive. The second was the emergence of huge firms able to dominate whole industries. In the oil industry, for example, Standard Oil of Ohio (after 1899, the Standard Oil Company of New Jersey) began acquiring smaller firms, eventually controlling 90% of U.S. oil-refining capacity. American Tobacco gained control of up to 90% of the market for most tobacco products, excluding cigars.

Public concern about the monopoly power of these giants led to a major shift in U.S. policy. What had been an economic environment in which the government rarely intervened in the affairs of private firms was gradually transformed into an environment in which government agencies took on a much more vigorous role. The first arena of intervention was antitrust policy, which authorized the federal government to challenge the monopoly power of firms head-on. The application of this policy, however, has followed a wandering and rocky road.

The Sherman Antitrust Act

The Sherman Antitrust Act of 1890 remains the cornerstone of U.S. antitrust policy. The Sherman Act outlawed contracts, combinations, and conspiracies in restraint of trade.

An important issue in the interpretation of the Sherman Act concerns which actions by firms are illegal *per se*, meaning illegal in and of itself without regard to the circumstances under which it occurs. Shoplifting, for example, is illegal *per se*; courts do not inquire whether shoplifters have a good reason for stealing something in determining whether their acts are illegal. One key question of interpretation is whether it is illegal *per se* to control a large share of a market. Another is whether a merger that is likely to produce substantial monopoly power is illegal *per se*.

Two landmark Supreme Court cases in 1911 in which the Sherman Act was effectively used to break up Standard Oil and American Tobacco enunciated the rule of reason, which holds that whether or not a particular business practice is illegal depends on the circumstances surrounding the action. In both cases, the companies held dominant market positions, but the Court made it clear that it was their specific “unreasonable” behaviors that the breakups were intended to punish. In determining what was illegal and what was not, emphasis was placed on the conduct, not the structure or size, of the firms.

In the next 10 years, the Court threw out antitrust suits brought by government prosecutors against Eastman Kodak, International Harvester, United Shoe Machinery, and United States Steel. The Court determined that none of them had used unreasonable means to achieve their dominant positions in the industry. Rather, they had successfully exploited economies of scale to reduce costs below competitors’ costs and had used reasonable means of competition to reap the rewards of efficiency.

The rule of reason suggests that “bigness” is no offense if it has been achieved through legitimate business practices. This precedent, however, was challenged in 1945 when the U.S. Court of Appeals ruled against the Aluminum Company of America (Alcoa). The court acknowledged that Alcoa had been able to capture over 90% of the aluminum industry through reasonable

business practices. Nevertheless, the court held that by sheer size alone, Alcoa was in violation of the prohibition against monopoly.

In a landmark 1962 court case involving a proposed merger between United Shoe Machinery and the Brown Shoe Company, one of United's competitors, the Supreme Court blocked the merger because the resulting firm would have been so efficient that it could have undersold all of its competitors. The Court recognized that lower shoe prices would have benefited consumers, but chose to protect competitors instead.

The Alcoa case and the Brown Shoe case, along with many other antitrust cases in the 1950s and 1960s, added confusion and uncertainty to the antitrust environment by appearing to reinvoke the doctrine of per se illegality. In the government's case against Visa and MasterCard, the government argued successfully that the behavior of the two firms was a per se violation of the Sherman Act.

The Sherman Act also aimed, in part, to prevent price-fixing, in which two or more firms agree to set prices or to coordinate their pricing policies. For example, in the 1950s General Electric, Westinghouse, and several other manufacturers colluded to fix prices. They agreed to assign market segments in which one firm would sell at a lower price than the others. In 1961, the General Electric–Westinghouse agreement was declared illegal. The companies paid a multimillion-dollar fine, and their officers served brief jail sentences. In 2008, three manufacturers of liquid crystal display panels—the flat screens used in televisions, cell phones, personal computers, and such—agreed to pay \$585 million in fines for price fixing, with LG Display paying \$400 million, Sharp Corporation paying \$120 million, and Chunghwa Picture Tubes paying \$65 million. The \$400 million fine to LG is still less than the record single fine of \$500 million paid in 1999 by F. Hoffman-LaRoche, the Swiss pharmaceutical company, in a case involving fixing prices of vitamin supplements.

Other Antitrust Legislation

Concerned about the continued growth of monopoly power, in 1914 Congress created the Federal Trade Commission (FTC), a five-member commission that, along with the antitrust division of the Justice Department, has the power to investigate firms that use illegal business practices.

In addition to establishing the FTC, Congress enacted new antitrust laws intended to strengthen the Sherman Act. The Clayton Act (1914) clarifies the illegal per se provision of the Sherman Act by prohibiting the purchase of a rival firm if the purchase would substantially decrease competition, and outlawing interlocking directorates, in which there are the same people sitting on the boards of directors of competing firms. More significantly, the act prohibits price discrimination that is designed to lessen competition or that tends to create a monopoly and exempts labor unions from antitrust laws.

The Sherman and Clayton acts, like other early antitrust legislation, were aimed at preventing mergers that reduce the number of firms in a single industry. The consolidation of two or more producers of the same good or service is called a horizontal merger. Such mergers increase concentration and, therefore, the likelihood of collusion among the remaining firms.

The Celler–Kefauver Act of 1950 extended the antitrust provisions of earlier legislation by blocking vertical mergers, which are mergers between firms at different stages in the production and distribution of a product if a reduction in competition will result. For example, the acquisition by Ford Motor Company of a firm that supplies it with steel would be a vertical merger.

U.S. Antitrust Policy Today

The “bigness is badness” doctrine dominated antitrust policy from 1945 to the 1970s. But the doctrine always had its critics. If a firm is more efficient than its competitors, why should it be punished? Critics of the antitrust laws point to the fact that of the 500 largest companies in the United States in 1950, over 100 no longer exist. New firms, including such giants as Walmart, Microsoft, and Federal Express, have taken their place. The critics argue that the emergence of these new firms is evidence of the dynamism and competitive nature of the modern corporate scene.

There is no evidence to suggest, for example, that the degree of concentration across all industries has increased over the past 25 years. Global competition and the use of the internet as a marketing tool have increased the competitiveness of a wide range of industries. Moreover, critics of antitrust policy argue that it is not necessary that an industry be perfectly competitive to achieve the benefits of competition. It need merely be contestable—open to entry by potential rivals. A large firm may be able to prevent small firms from competing, but other equally large firms may enter the industry in pursuit of the high profits earned by the initial large firm. For example, Time Warner, primarily a competitor in the publishing and entertainment industries, has in recent years become a main competitor in the cable television market.

Currently, the Justice Department follows guidelines based on the Herfindahl–Hirschman Index (HHI). The HHI is calculated by summing the squared percentage market shares of all firms in an industry, where the percentages are expressed as whole numbers (for example 30% would be expressed as 30). The higher the value of the index, the greater the degree of concentration. Possible values of the index range from 0 in the case of perfect competition to 10,000 (=100²) in the case of a monopoly.

Current guidelines stipulate that any industry with an HHI under 1,000 is unconcentrated. Except in unusual circumstances, mergers of firms with a postmerger index under 1,000 will not be challenged. The Justice Department has said it would challenge proposed mergers with a postmerger HHI between 1,000 and 1,800 if the index increased by more than 100 points. Industries with an index greater than 1,800 are deemed highly concentrated, and the Justice Department has said it would seek to block mergers in these industries if the postmerger index would increase by 50 points or more. Table 10.2 “The Herfindahl-Hirschman Index and Antitrust Policy” summarizes the use of the HHI by the Justice Department.

Table 10.2 The Herfindahl-Hirschman Index and Antitrust Policy

If the postmerger Herfindahl-Hirschman Index is found to be...	then the Justice Department will likely take the following action.
Unconcentrated (<1,000)	No challenge
Moderately concentrated (1,000–1,800)	Challenge if postmerger index changes by more than 100 points.
Highly concentrated (>1,800)	Challenge if postmerger index changes by more than 50 points.

One difficulty with the use of the HHI is that its value depends on the definition of the market. With a sufficiently narrow definition of the market, even a highly competitive market could have an HHI close to the value for a monopoly. The late George Stigler commented on the difficulty in a fanciful discussion of the definition of the relevant market for cameras:

“Consider the problem of defining a market within which the existence of competition or some form of monopoly is to be determined. The typical antitrust case is an almost impudent exercise in economic gerrymandering. The plaintiff sets the market, at a maximum, as one state in area and including only aperture-priority SLR cameras selling between \$200 and \$250. This might be called J-Shermanizing the market, after Senator John Sherman. The defendant will in turn insist that the market be world-wide, and include not only all cameras, but all portrait artists and all transportation media, since a visit is a substitute for a picture. This might also be called T-Shermanizing the market, after the Senator’s brother, General William Tecumseh Sherman. Depending on who convinces the judge, the concentration ratio will be awesome or trivial, with a large influence on the verdict” (Stigler, G. J., 1982).

In the 1980s both the courts and the Justice Department held that bigness did not necessarily translate into badness, and corporate mergers proliferated. In the period 1982–1989 there were almost 200 mergers and acquisitions of firms whose value exceeded \$1 billion. The total value of these companies was nearly half a trillion dollars.

Megamergers continued in the 1990s and into the 21st-century. In 2000, there were 212 mergers valued at \$1 billion or more and in 2006 nearly that many. Since then, merger activity has decreased, in part due to turmoil in financial markets (Krantz, M., 2006; Krantz, M., 2007).

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9.5: Antitrust and Competitiveness in a Global Economy

Learning Objective

1. Define joint ventures and explain the evolution of U.S. antitrust policy towards them.
2. Discuss other antitrust policy changes that relate to U.S. firms competing with foreign firms.

In the early 1980s, U.S. imports from foreign firms rose faster than U.S. exports. In 1986 the trade deficit reached a record level at that time. Antitrust laws played a relatively minor role in increasing the deficit, but business interests and politicians pressed for the relaxation of antitrust policy in order to make U.S. firms more competitive against multinational companies headquartered in other countries.

Antitrust enforcement was altered in the late 1980s so that horizontally competitive U.S. firms could cooperate in research and development (R&D) ventures aimed at innovation, cost-cutting technological advances, and new product development. In an antitrust context, joint ventures refer to cooperative arrangements between two or more firms that otherwise would violate antitrust laws. Proponents of the change argued that foreign multinational firms were not subject to stringent antitrust restrictions and therefore had a competitive advantage over U.S. firms. The International Competition Policy Advisory Committee (ICPAC) was formed in the Department of Justice in 1997 in recognition of the dramatic increases in both international commerce and international anticompetitive activity. Composed of a panel of business, industrial relations, academic, economic, and legal experts, ICPAC is to provide advice and information to the department on international antitrust issues such as transnational cartels and international anticompetitive business practices.

Cooperative Ventures Abroad

Policymakers who revised U.S. antitrust restrictions on joint ventures pointed out that Japanese and European firms are encouraged to cooperate and to collude not only in basic R&D projects, but in production and marketing as well.

The evidence is difficult to interpret, but in Japan, for example, a substantial percentage of research projects are sponsored jointly by firms in the same market. Moreover, the evidence is fairly clear that Japan allows horizontal consolidations and mergers in moderately concentrated markets where antitrust policy would be applied in the United States. Mergers that create substantial monopoly power in Japan are not typically prosecuted by the government.

In Europe, the potential competitive threat to U.S. firms is twofold. First, as the European Union (EU) moved toward economic unification in 1992, it relaxed antitrust enforcement for mergers between firms in different nations, even though they would become a single transnational firm in the near future. In 1984, for example, the European Community (EC), the forerunner of the EU, adopted a regulation that provided blanket exemptions from antitrust provisions against collusion in R&D for firms whose total market share did not exceed 20%. This exemption included horizontal R&D and extended to production and distribution to the point of final sale. Moreover, firms that had a market share greater than 20% could apply for an exemption based on a case-by-case examination.

The U.S. government has relaxed antitrust restrictions in some cases in an effort to make domestic firms more competitive in global competition. For example, producers of semiconductors were allowed to form a research consortium, Sematech, in order to promote the U.S. semiconductor industry. This type of joint venture was formerly prohibited. Sematech has since created the International Sematech Manufacturing Initiative (ISMI), a wholly owned subsidiary dedicated to improve the productivity and cost performance of equipment and manufacturing operations well beyond a narrowly defined semiconductor industry. Its membership includes both domestic and foreign firms, and they collectively represent half of the world's integrated circuit (semiconductor and microchip) production. In this case, we see the U.S. government is supporting cooperation among multinational and international firms ostensibly for product improvement. One suspects, however, that member firms gain a competitive advantage over non-member firms wherever in the world they are located.

Antitrust Policy and U.S. Competitiveness

In the 1980s Congress passed several laws that relaxed the antitrust prohibition against cooperation among U.S. firms, including the National Cooperative Research Act of 1984 (NCRA) and the Omnibus Trade and Competitiveness Act (OTCA).

The NCRA provided a simple registration procedure for joint ventures in R&D. The NCRA protects members of registered joint ventures from punitive antitrust penalties if the venture is later found to illegally reduce competition or otherwise act in restraint of

trade. Between 1984 and 1990 over 200 research joint ventures were registered, substantially more than were formed over the same period within the EC.

Congress passed the OTCA in 1988. The OTCA made unfair methods of competition by foreign firms and importers punishable under the U.S. antitrust laws. It also changed the wording of existing laws concerning “dumping” (selling below cost) by foreign firms. In the past, a domestic firm that claimed injury from a foreign competitor had to prove that the foreign firm was “undercutting” the U.S. market prices. The OTCA changed this provision to the much less restrictive term “underselling” and specifically stated that the domestic firm did not have to prove predatory intent. This legislation opened the door for U.S. competitors to use antitrust laws to *prevent* competition from foreigners, quite the opposite of the laws’ original purpose.

In another policy shift, the Justice Department announced in 1988 that the rule of reason would replace per se illegality in analysis of joint ventures that would increase U.S. competitiveness. The Justice Department uses the domestic guidelines and the Herfindahl–Hirschman Index to determine whether a proposed joint venture would increase concentration and thereby lessen competition. In making that assessment, the Justice Department also looks at (1) whether the firms directly compete in other markets, (2) the possible impact on vertical markets, and (3) whether any offsetting efficiency benefits outweigh the anticompetitiveness of the joint venture. Although mergers between two firms in a moderately or highly concentrated industry are prohibited, joint ventures between them may be allowed.

The major antitrust issues to be resolved in the first decade of the twenty-first century go beyond joint R&D ventures. The World Trade Organization, the international organization created in 1995 to supervise world trade, has established a group to study issues relating to the interaction between trade and competition policy, including anticompetitive practices. Nations currently have quite different antitrust laws, as the Case in Point in this section illustrates. The United States has argued against any internationalization of antitrust issues that would reduce its ability to apply U.S. laws. On the other hand, the United States, via the 1994 International Antitrust Enforcement Assistance Act, is negotiating bilateral agreements that allow antitrust agencies in different countries to exchange information for use in antitrust enforcement. The issue of how to deal with anticompetitive practices on a worldwide basis remains unresolved, and this area of antitrust practice and policy will be closely watched and studied by economists.

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CHAPTER OVERVIEW

10: The World of Imperfect Competition

[10.1: Monopolistic Competition- Competition Among Many](#)

[10.2: Oligopoly- Competition Among the Few](#)

[10.3: Extensions of Imperfect Competition- Advertising and Price Discrimination](#)

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10.1: Monopolistic Competition- Competition Among Many

Learning Objective

1. Explain the main characteristics of a monopolistically competitive industry, describing both its similarities and differences from the models of perfect competition and monopoly.
2. Explain and illustrate both short-run equilibrium and long-run equilibrium for a monopolistically competitive firm.
3. Explain what it means to say that a firm operating under monopolistic competition has excess capacity in the long run and discuss the implications of this conclusion.

The first model of an imperfectly competitive industry that we shall investigate has conditions quite similar to those of perfect competition. The model of monopolistic competition assumes a large number of firms. It also assumes easy entry and exit. This model differs from the model of perfect competition in one key respect: it assumes that the goods and services produced by firms are differentiated. This differentiation may occur by virtue of advertising, convenience of location, product quality, reputation of the seller, or other factors. Product differentiation gives firms producing a particular product some degree of price-setting or monopoly power. However, because of the availability of close substitutes, the price-setting power of monopolistically competitive firms is quite limited. Monopolistic competition is a model characterized by many firms producing similar but differentiated products in a market with easy entry and exit.

Restaurants are a monopolistically competitive sector; in most areas there are many firms, each is different, and entry and exit are very easy. Each restaurant has many close substitutes—these may include other restaurants, fast-food outlets, and the deli and frozen-food sections at local supermarkets. Other industries that engage in monopolistic competition include retail stores, barber and beauty shops, auto-repair shops, service stations, banks, and law and accounting firms.

Profit Maximization

Suppose a restaurant raises its prices slightly above those of similar restaurants with which it competes. Will it have any customers? Probably. Because the restaurant is different from other restaurants, some people will continue to patronize it. Within limits, then, the restaurant can set its own prices; it does not take the market prices as given. In fact, differentiated markets imply that the notion of a single “market price” is meaningless.

Because products in a monopolistically competitive industry are differentiated, firms face downward-sloping demand curves. Whenever a firm faces a downward-sloping demand curve, the graphical framework for monopoly can be used. In the short run, the model of monopolistic competition looks exactly like the model of monopoly. An important distinction between monopoly and monopolistic competition, however, emerges from the assumption of easy entry and exit. In monopolistic competition, entry will eliminate any economic profits in the long run. We begin with an analysis of the short run.

The Short Run

Because a monopolistically competitive firm faces a downward-sloping demand curve, its marginal revenue curve is a downward-sloping line that lies below the demand curve, as in the monopoly model. We can thus use the model of monopoly that we have already developed to analyze the choices of a monopolistic competition in the short run.

Figure 10.1 shows the demand, marginal revenue, marginal cost, and average total cost curves facing a monopolistically competitive firm, Mama's Pizza. Mama's competes with several other similar firms in a market in which entry and exit are relatively easy. Mama's demand curve D_1 is downward-sloping; even if Mama's raises its prices above those of its competitors, it will still have some customers. Given the downward-sloping demand curve, Mama's marginal revenue curve MR_1 lies below demand. To sell more pizzas, Mama's must lower its price, and that means its marginal revenue from additional pizzas will be less than price.

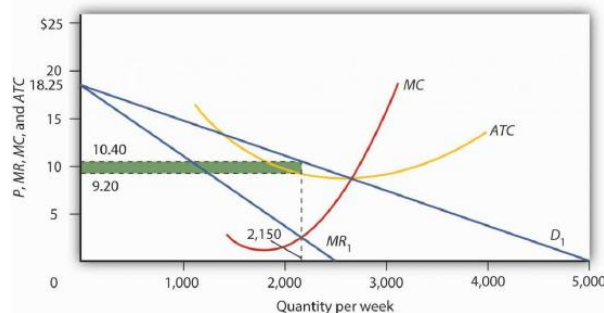


Figure 10.1 Short-Run Equilibrium in Monopolistic Competition Looking at the intersection of the marginal revenue curve MR_1 and the marginal cost curve MC , we see that the profit-maximizing quantity is 2,150 units per week. Reading up to the average total cost curve ATC , we see that the cost per unit equals \$9.20. Price, given on the demand curve D_1 , is \$10.40, so the profit per unit is \$1.20. Total profit per week equals \$1.20 times 2,150, or \$2,580; it is shown by the shaded rectangle.

Given the marginal revenue curve MR and marginal cost curve MC , Mama's will maximize profits by selling 2,150 pizzas per week. Mama's demand curve tells us that it can sell that quantity at a price of \$10.40. Looking at the average total cost curve ATC , we see that the firm's cost per unit is \$9.20. Its economic profit per unit is thus \$1.20. Total economic profit, shown by the shaded rectangle, is \$2,580 per week.

The Long Run

We see in Figure 10.1 that Mama's Pizza is earning an economic profit. If Mama's experience is typical, then other firms in the market are also earning returns that exceed what their owners could be earning in some related activity. Positive economic profits will encourage new firms to enter Mama's market.

As new firms enter, the availability of substitutes for Mama's pizzas will increase, which will reduce the demand facing Mama's Pizza and make the demand curve for Mama's Pizza more elastic. Its demand curve will shift to the left. Any shift in a demand curve shifts the marginal revenue curve as well. New firms will continue to enter, shifting the demand curves for existing firms to the left, until pizza firms such as Mama's no longer make an economic profit. The zero-profit solution occurs where Mama's demand curve is tangent to its average total cost curve—at point A in Figure 10.2. Mama's price will fall to \$10 per pizza and its output will fall to 2,000 pizzas per week. Mama's will just cover its opportunity costs, and thus earn zero economic profit. At any other price, the firm's cost per unit would be greater than the price at which a pizza could be sold, and the firm would sustain an economic loss. Thus, the firm and the industry are in long-run equilibrium. There is no incentive for firms to either enter or leave the industry.

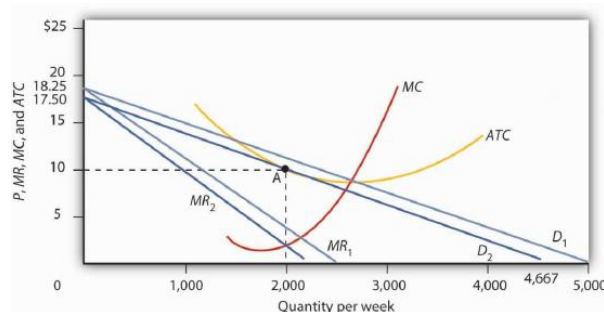


Figure 10.2 Monopolistic Competition in the Long Run The existence of economic profits in a monopolistically competitive industry will induce entry in the long run. As new firms enter, the demand curve D_1 and marginal revenue curve MR_1 facing a typical firm will shift to the left, to D_2 and MR_2 . Eventually, this shift produces a profit-maximizing solution at zero economic profit, where D_2 is tangent to the average total cost curve ATC (point A). The long-run equilibrium solution here is an output of 2,000 units per week at a price of \$10 per unit.

Had Mama's Pizza and other similar restaurants been incurring economic losses, the process of moving to long-run equilibrium would work in reverse. Some firms would exit. With fewer substitutes available, the demand curve faced by each remaining firm

would shift to the right. Price and output at each restaurant would rise. Exit would continue until the industry was in long-run equilibrium, with the typical firm earning zero economic profit.

Such comings and goings are typical of monopolistic competition. Because entry and exit are easy, favorable economic conditions in the industry encourage start-ups. New firms hope that they can differentiate their products enough to make a go of it. Some will; others will not. Competitors to Mama's may try to improve the ambience, play different music, offer pizzas of different sizes and types. It might take a while for other restaurants to come up with just the right product to pull customers and profits away from Mama's. But as long as Mama's continues to earn economic profits, there will be incentives for other firms to try.

Heads Up!

The term “monopolistic competition” is easy to confuse with the term “monopoly.” Remember, however, that the two models are characterized by quite different market conditions. A monopoly is a single firm with high barriers to entry. Monopolistic competition implies an industry with many firms, differentiated products, and easy entry and exit.

Why is the term monopolistic competition used to describe this type of market structure? The reason is that it bears some similarities to both perfect competition and to monopoly. Monopolistic competition is similar to perfect competition in that in both of these market structures many firms make up the industry and entry and exit are fairly easy. Monopolistic competition is similar to monopoly in that, like monopoly firms, monopolistically competitive firms have at least some discretion when it comes to setting prices. However, because monopolistically competitive firms produce goods that are close substitutes for those of rival firms, the degree of monopoly power that monopolistically competitive firms possess is very low.

Excess Capacity: The Price of Variety

The long-run equilibrium solution in monopolistic competition always produces zero economic profit at a point to the left of the minimum of the average total cost curve. That is because the zero profit solution occurs at the point where the downward-sloping demand curve is tangent to the average total cost curve, and thus the average total cost curve is itself downward-sloping. By expanding output, the firm could lower average total cost. The firm thus produces less than the output at which it would minimize average total cost. A firm that operates to the left of the lowest point on its average total cost curve has excess capacity.

Because monopolistically competitive firms charge prices that exceed marginal cost, monopolistic competition is inefficient. The marginal benefit consumers receive from an additional unit of the good is given by its price. Since the benefit of an additional unit of output is greater than the marginal cost, consumers would be better off if output were expanded. Furthermore, an expansion of output would reduce average total cost. But monopolistically competitive firms will not voluntarily increase output, since for them, the marginal revenue would be less than the marginal cost.

One can thus criticize a monopolistically competitive industry for falling short of the efficiency standards of perfect competition. But monopolistic competition is inefficient because of product differentiation. Think about a monopolistically competitive activity in your area. Would consumers be better off if all the firms in this industry produced identical products so that they could match the assumptions of perfect competition? If identical products were impossible, would consumers be better off if some of the firms were ordered to shut down on grounds the model predicts there will be “too many” firms? The inefficiency of monopolistic competition may be a small price to pay for a wide range of product choices. Furthermore, remember that perfect competition is merely a model. It is not a goal toward which an economy might strive as an alternative to monopolistic competition.

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10.2: Oligopoly- Competition Among the Few

Learning Objective

1. Explain the main characteristics of an oligopoly, differentiating it from other types of market structures.
2. Explain the measures that are used to determine the degree of concentration in an industry.
3. Explain and illustrate the collusion model of oligopoly.
4. Discuss how game theory can be used to understand the behavior of firms in an oligopoly.

In July, 2005, General Motors Corporation (GMC) offered “employee discount pricing” to virtually all GMC customers, not just employees and their relatives. This new marketing strategy introduced by GMC obviously affected Ford, Chrysler, Toyota and other automobile and truck manufacturers; Ford matched GMC’s employee-discount plan by offering up to \$1,000 to its own employees who convinced friends to purchase its cars and trucks. Ford also offered its customers the same prices paid by its employees. By mid-July, Chrysler indicated that it was looking at many alternatives, but was waiting for GMC to make its next move. Ultimately, Chrysler also offered employee discount pricing.

Toyota had to respond. It quickly developed a new marketing strategy of its own, which included lowering the prices of its cars and offering new financing terms. The responses of Ford, Chrysler, and Toyota to GMC’s pricing strategy obviously affected the outcome of that strategy. Similarly, a decision by Procter & Gamble to lower the price of Crest toothpaste may elicit a response from Colgate-Palmolive, and that response will affect the sales of Crest. In an oligopoly, the fourth and final market structure that we will study, the market is dominated by a few firms, each of which recognizes that its own actions will produce a response from its rivals and that those responses will affect it.

The firms that dominate an oligopoly recognize that they are interdependent: What one firm does affects each of the others. This interdependence stands in sharp contrast to the models of perfect competition and monopolistic competition, where we assume that each firm is so small that it assumes the rest of the market will, in effect, ignore what it does. A perfectly competitive firm responds to the market, not to the actions of any other firm. A monopolistically competitive firm responds to its own demand, not to the actions of specific rivals. These presumptions greatly simplify the analysis of perfect competition and monopolistic competition. We do not have that luxury in oligopoly, where the interdependence of firms is the defining characteristic of the market.

Some oligopoly industries make standardized products: steel, aluminum, wire, and industrial tools. Others make differentiated products: cigarettes, automobiles, computers, ready-to-eat breakfast cereal, and soft drinks.

Measuring Concentration in Oligopoly

Oligopoly means that a few firms dominate an industry. But how many is “a few,” and how large a share of industry output does it take to “dominate” the industry?

Compare, for example, the ready-to-eat breakfast cereal industry and the ice cream industry. The cereal market is dominated by two firms, Kellogg’s and General Mills, which together hold more than half the cereal market. This oligopoly operates in a highly concentrated market. The market for ice cream, where the four largest firms account for just less than a third of output, is much less concentrated.

One way to measure the degree to which output in an industry is concentrated among a few firms is to use a concentration ratio, which reports the percentage of output accounted for by the largest firms in an industry. The higher the concentration ratio, the more the firms in the industry take account of their rivals’ behavior. The lower the concentration ratio, the more the industry reflects the characteristics of monopolistic competition or perfect competition.

An alternative measure of concentration is found by squaring the percentage share (stated as a whole number) of each firm in an industry, then summing these squared market shares to derive a Herfindahl–Hirschman Index (HHI). The largest HHI possible is the case of monopoly, where one firm has 100% of the market; the index is 100^2 , or 10,000. An industry with two firms, each with 50% of total output, has an HHI of 5,000 ($50^2 + 50^2$). In an industry with 10,000 firms that have 0.01% of the market each, the HHI is 1.

The Collusion Model

There is no single model of profit-maximizing oligopoly behavior that corresponds to economists’ models of perfect competition, monopoly, and monopolistic competition. Uncertainty about the interaction of rival firms makes specification of a single model of

oligopoly impossible. Instead, economists have devised a variety of models that deal with the uncertain nature of rivals' responses in different ways. In this section we review one type of oligopoly model, the collusion model. After examining this traditional approach to the analysis of oligopoly behavior, we shall turn to another method of examining oligopolistic interaction: game theory.

Firms in any industry could achieve the maximum profit attainable if they all agreed to select the monopoly price and output and to share the profits. One approach to the analysis of oligopoly is to assume that firms in the industry collude, selecting the monopoly solution.

Suppose an industry is a duopoly, an industry with two firms. Figure 10.3 shows a case in which the two firms are identical. They sell identical products and face identical demand and cost conditions. To simplify the analysis, we will assume that each has a horizontal marginal cost curve, MC . The demand and marginal revenue curves are the same for both firms. We find the combined demand curve for the two firms, D_{combined} , by adding the individual demand curves together. Because one firm's demand curve, D_{firm} , represents one-half of market demand, it is the same as the combined marginal revenue curve for the two firms. If these two firms act as a monopoly, together they produce Q_m and charge a price P_m . This result is achieved if each firm selects its profit-maximizing output, which equals $1/2 Q_m$. This solution is inefficient; the efficient solution is price P_c and output Q_c , found where the combined market demand curve D_{combined} and the marginal cost curve MC intersect.

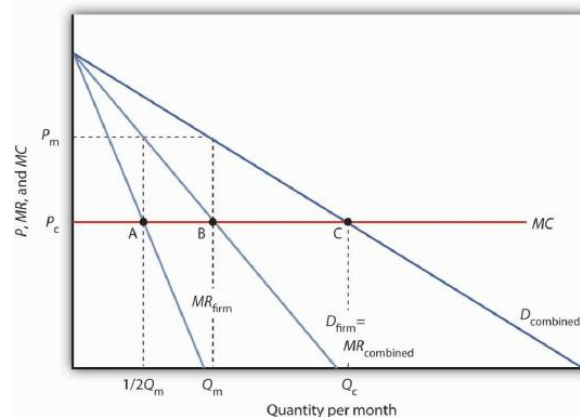


Figure 10.3 Monopoly Through Collusion Two identical firms have the same horizontal marginal cost curve MC . Their demand curves D_{firm} and marginal revenue curves MR_{firm} are also identical. The combined demand curve is D_{combined} ; the combined marginal revenue curve is MR_{combined} . The profits of the two firms are maximized if each produces $1/2 Q_m$ at point A. Industry output at point B is thus Q_m and the price is P_m . At point C, the efficient solution output would be Q_c , and the price would equal MC .

In the simplest form of collusion, overt collusion, firms openly agree on price, output, and other decisions aimed at achieving monopoly profits. Firms that coordinate their activities through overt collusion and by forming collusive coordinating mechanisms make up a cartel.

Firms form a cartel to gain monopoly power. A successful cartel can earn large profits, but there are several problems with forming and maintaining one. First, in many countries, including the United States, cartels are generally illegal¹. They are banned, because their purpose is to raise prices and restrict output. Second, the cartel may not succeed in inducing all firms in the industry to join. Firms that remain outside the cartel can compete by lowering price, and thus they prevent the cartel from achieving the monopoly solution. Third, there is always an incentive for individual members to cheat on cartel agreements. Suppose the members of a cartel have agreed to impose the monopoly price in their market and to limit their output accordingly. Any one firm might calculate that it could charge slightly less than the cartel price and thus capture a larger share of the market for itself. Cheating firms expand output and drive prices down below the level originally chosen.

The Organization of Petroleum Exporting Countries (OPEC), perhaps the best-known cartel, is made up of 13 oil-producing countries. In the 1970s, OPEC successfully acted like a monopoly by restricting output and raising prices. By the mid-1980s, however, the monopoly power of the cartel had been weakened by expansion of output by nonmember producers such as Mexico and Norway and by cheating among the cartel members.

An alternative to overt collusion is tacit collusion, an unwritten, unspoken understanding through which firms agree to limit their competition. Firms may, for example, begin following the price leadership of a particular firm, raising or lowering their prices when the leader makes such a change. The price leader may be the largest firm in the industry, or it may be a firm that has been

particularly good at assessing changes in demand or cost. At various times, tacit collusion has been alleged to occur in a wide range of industries, including steel, cars, and breakfast cereals.

It is difficult to know how common tacit collusion is. The fact that one firm changes its price shortly after another one does cannot prove that a tacit conspiracy exists. After all, we expect to see the prices of all firms in a perfectly competitive industry moving together in response to changes in demand or production costs.

Game Theory and Oligopoly Behavior

Oligopoly presents a problem in which decision makers must select strategies by taking into account the responses of their rivals, which they cannot know for sure in advance. A choice based on the recognition that the actions of others will affect the outcome of the choice and that takes these possible actions into account is called a strategic choice. Game theory is an analytical approach through which strategic choices can be assessed.

Among the strategic choices available to an oligopoly firm are pricing choices, marketing strategies, and product-development efforts. An airline's decision to raise or lower its fares—or to leave them unchanged—is a strategic choice. The other airlines' decision to match or ignore their rival's price decision is also a strategic choice. IBM boosted its share in the highly competitive personal computer market in large part because a strategic product-development strategy accelerated the firm's introduction of new products.

Once a firm implements a strategic decision, there will be an outcome. The outcome of a strategic decision is called a payoff. In general, the payoff in an oligopoly game is the change in economic profit to each firm. The firm's payoff depends partly on the strategic choice it makes and partly on the strategic choices of its rivals. Some firms in the airline industry, for example, raised their fares in 2005, expecting to enjoy increased profits as a result. They changed their strategic choices when other airlines chose to slash their fares, and all firms ended up with a payoff of lower profits—many went into bankruptcy.

We shall use two applications to examine the basic concepts of game theory. The first examines a classic game theory problem called the prisoners' dilemma. The second deals with strategic choices by two firms in a duopoly.

The Prisoners' Dilemma

Suppose a local district attorney (DA) is certain that two individuals, Frankie and Johnny, have committed a burglary, but she has no evidence that would be admissible in court.

The DA arrests the two. On being searched, each is discovered to have a small amount of cocaine. The DA now has a sure conviction on a possession of cocaine charge, but she will get a conviction on the burglary charge only if at least one of the prisoners confesses and implicates the other.

The DA decides on a strategy designed to elicit confessions. She separates the two prisoners and then offers each the following deal: "If you confess and your partner doesn't, you will get the minimum sentence of one year in jail on the possession and burglary charges. If you both confess, your sentence will be three years in jail. If your partner confesses and you do not, the plea bargain is off and you will get six years in prison. If neither of you confesses, you will each get two years in prison on the drug charge."

The two prisoners each face a dilemma; they can choose to confess or not confess. Because the prisoners are separated, they cannot plot a joint strategy. Each must make a strategic choice in isolation.

The outcomes of these strategic choices, as outlined by the DA, depend on the strategic choice made by the other prisoner. The payoff matrix for this game is given in Figure 10.4. The two rows represent Frankie's strategic choices; she may confess or not confess. The two columns represent Johnny's strategic choices; he may confess or not confess. There are four possible outcomes: Frankie and Johnny both confess (cell A), Frankie confesses but Johnny does not (cell B), Frankie does not confess but Johnny does (cell C), and neither Frankie nor Johnny confesses (cell D). The portion at the lower left in each cell shows Frankie's payoff; the shaded portion at the upper right shows Johnny's payoff.

		Johnny's Strategies	
		Confess	Don't confess
Frankie's Strategies	Confess	A Johnny: 3 years Frankie: 3 years	B Johnny: 6 years Frankie: 1 year
	Don't confess	C Johnny: 1 year Frankie: 6 years	D Johnny: 2 years Frankie: 2 years

Figure 10.4 Payoff Matrix for the Prisoners' Dilemma The four cells represent each of the possible outcomes of the prisoners' game.

If Johnny confesses, Frankie's best choice is to confess—she will get a three-year sentence rather than the six-year sentence she would get if she did not confess. If Johnny does not confess, Frankie's best strategy is still to confess—she will get a one-year sentence rather than a two-year sentence. In this game, Frankie's best strategy is to confess, regardless of what Johnny does. When a player's best strategy is the same regardless of the action of the other player, that strategy is said to be a dominant strategy. Frankie's dominant strategy is to confess to the burglary.

For Johnny, the best strategy to follow, if Frankie confesses, is to confess. The best strategy to follow if Frankie does not confess is also to confess. Confessing is a dominant strategy for Johnny as well. A game in which there is a dominant strategy for each player is called a dominant strategy equilibrium. Here, the dominant strategy equilibrium is for both prisoners to confess; the payoff will be given by cell A in the payoff matrix.

From the point of view of the two prisoners together, a payoff in cell D would have been preferable. Had they both denied participation in the robbery, their combined sentence would have been four years in prison—two years each. Indeed, cell D offers the lowest combined prison time of any of the outcomes in the payoff matrix. But because the prisoners cannot communicate, each is likely to make a strategic choice that results in a more costly outcome. Of course, the outcome of the game depends on the way the payoff matrix is structured.

Repeated Oligopoly Games

The prisoners' dilemma was played once, by two players. The players were given a payoff matrix; each could make one choice, and the game ended after the first round of choices.

The real world of oligopoly has as many players as there are firms in the industry. They play round after round: a firm raises its price, another firm introduces a new product, the first firm cuts its price, a third firm introduces a new marketing strategy, and so on. An oligopoly game is a bit like a baseball game with an unlimited number of innings—one firm may come out ahead after one round, but another will emerge on top another day. In the computer industry game, the introduction of personal computers changed the rules. IBM, which had won the mainframe game quite handily, struggles to keep up in a world in which rivals continue to slash prices and improve quality.

Oligopoly games may have more than two players, so the games are more complex, but this does not change their basic structure. The fact that the games are repeated introduces new strategic considerations. A player must consider not just the ways in which its choices will affect its rivals now, but how its choices will affect them in the future as well.

We will keep the game simple, however, and consider a duopoly game. The two firms have colluded, either tacitly or overtly, to create a monopoly solution. As long as each player upholds the agreement, the two firms will earn the maximum economic profit possible in the enterprise.

There will, however, be a powerful incentive for each firm to cheat. The monopoly solution may generate the maximum economic profit possible for the two firms combined, but what if one firm captures some of the other firm's profit? Suppose, for example, that two equipment rental firms, Quick Rent and Speedy Rent, operate in a community. Given the economies of scale in the business and the size of the community, it is not likely that another firm will enter. Each firm has about half the market, and they have agreed to charge the prices that would be chosen if the two combined as a single firm. Each earns economic profits of \$20,000 per month.

Quick and Speedy could cheat on their arrangement in several ways. One of the firms could slash prices, introduce a new line of rental products, or launch an advertising blitz. This approach would not be likely to increase the total profitability of the two firms, but if one firm could take the other by surprise, it might profit at the expense of its rival, at least for a while.

We will focus on the strategy of cutting prices, which we will call a strategy of cheating on the duopoly agreement. The alternative is not to cheat on the agreement. Cheating increases a firm's profits *if* its rival does not respond. Figure 10.5 shows the payoff matrix facing the two firms at a particular time. As in the prisoners' dilemma matrix, the four cells list the payoffs for the two firms. If neither firm cheats (cell D), profits remain unchanged.

		Speedy's Strategies	
		Cheat	Don't cheat
Quick's Strategies	Cheat	A Speedy: -5 Quick: -5	B Speedy: -8 Quick: 8
	Don't cheat	C Speedy: 8 Quick: -8	D Speedy: 0 Quick: 0

Figure 10.5 To Cheat or Not to Cheat: Game Theory in Oligopoly Two rental firms, Quick Rent and Speedy Rent, operate in a duopoly market. They have colluded in the past, achieving a monopoly solution. Cutting prices means cheating on the arrangement; not cheating means maintaining current prices. The payoffs are changes in monthly profits, in thousands of dollars. If neither firm cheats, then neither firm's profits will change. In this game, cheating is a dominant strategy equilibrium.

This game has a dominant strategy equilibrium. Quick's preferred strategy, regardless of what Speedy does, is to cheat. Speedy's best strategy, regardless of what Quick does, is to cheat. The result is that the two firms will select a strategy that lowers their combined profits!

Quick Rent and Speedy Rent face an unpleasant dilemma. They want to maximize profit, yet each is likely to choose a strategy inconsistent with that goal. If they continue the game as it now exists, each will continue to cut prices, eventually driving prices down to the point where price equals average total cost (presumably, the price-cutting will stop there). But that would leave the two firms with zero economic profits.

Both firms have an interest in maintaining the status quo of their collusive agreement. Overt collusion is one device through which the monopoly outcome may be maintained, but that is illegal. One way for the firms to encourage each other not to cheat is to use a tit-for-tat strategy. In a tit-for-tat strategy a firm responds to cheating by cheating, and it responds to cooperative behavior by cooperating. As each firm learns that its rival will respond to cheating by cheating, and to cooperation by cooperating, cheating on agreements becomes less and less likely.

Still another way firms may seek to force rivals to behave cooperatively rather than competitively is to use a trigger strategy, in which a firm makes clear that it is willing and able to respond to cheating by permanently revoking an agreement. A firm might, for

example, make a credible threat to cut prices down to the level of average total cost—and leave them there—in response to any price-cutting by a rival. A trigger strategy is calculated to impose huge costs on any firm that cheats—and on the firm that threatens to invoke the trigger. A firm might threaten to invoke a trigger in hopes that the threat will forestall any cheating by its rivals.

Game theory has proved to be an enormously fruitful approach to the analysis of a wide range of problems. Corporations use it to map out strategies and to anticipate rivals' responses. Governments use it in developing foreign-policy strategies. Military leaders play war games on computers using the basic ideas of game theory. Any situation in which rivals make strategic choices to which competitors will respond can be assessed using game theory analysis.

One rather chilly application of game theory analysis can be found in the period of the Cold War when the United States and the former Soviet Union maintained a nuclear weapons policy that was described by the acronym MAD, which stood for *mutually assured destruction*. Both countries had enough nuclear weapons to destroy the other several times over, and each threatened to launch sufficient nuclear weapons to destroy the other country if the other country launched a nuclear attack against it or any of its allies. On its face, the MAD doctrine seems, well, mad. It was, after all, a commitment by each nation to respond to any nuclear attack with a counterattack that many scientists expected would end human life on earth. As crazy as it seemed, however, it worked. For 40 years, the two nations did not go to war. While the collapse of the Soviet Union in 1991 ended the need for a MAD doctrine, during the time that the two countries were rivals, MAD was a very effective trigger indeed.

Of course, the ending of the Cold War has not produced the ending of a nuclear threat. Several nations now have nuclear weapons. The threat that Iran will introduce nuclear weapons, given its stated commitment to destroy the state of Israel, suggests that the possibility of nuclear war still haunts the world community.

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10.3: Extensions of Imperfect Competition- Advertising and Price Discrimination

Learning Objective

1. Discuss the possible effects of advertising on competition, price, and output.
2. Define price discrimination, list the conditions that make it possible, and explain the relationship between the price charged and price elasticity of demand.

The models of monopoly and of imperfectly competitive markets allow us to explain two commonly observed features of many markets: advertising and price discrimination. Firms in markets that are not perfectly competitive try to influence the positions of the demand curves they face, and hence profits, through advertising. Profits may also be enhanced by charging different customers different prices. In this section we will discuss these aspects of the behavior of firms in markets that are not perfectly competitive.

Advertising

Firms in monopoly, monopolistic competition, and oligopoly use advertising when they expect it to increase their profits. We see the results of these expenditures in a daily barrage of advertising on television, radio, newspapers, magazines, billboards, passing buses, park benches, the mail, home telephones, and the ubiquitous pop-up advertisements on our computers—in virtually every medium imaginable. Is all this advertising good for the economy?

We have already seen that a perfectly competitive economy with fully defined and easily transferable property rights will achieve an efficient allocation of resources. There is no role for advertising in such an economy, because everyone knows that firms in each industry produce identical products. Furthermore, buyers already have complete information about the alternatives available to them in the market.

But perfect competition contrasts sharply with imperfect competition. Imperfect competition can lead to a price greater than marginal cost and thus generate an inefficient allocation of resources. Firms in an imperfectly competitive market may advertise heavily. Does advertising cause inefficiency, or is it part of the solution? Does advertising insulate imperfectly competitive firms from competition and allow them to raise their prices even higher, or does it encourage greater competition and push prices down?

There are two ways in which advertising could lead to higher prices for consumers. First, the advertising itself is costly; in 2007, firms in the United States spent about \$149 billion on advertising. By pushing up production costs, advertising may push up prices. If the advertising serves no socially useful purpose, these costs represent a waste of resources in the economy. Second, firms may be able to use advertising to manipulate demand and create barriers to entry. If a few firms in a particular market have developed intense brand loyalty, it may be difficult for new firms to enter—the advertising creates a kind of barrier to entry. By maintaining barriers to entry, firms may be able to sustain high prices.

But advertising has its defenders. They argue that advertising provides consumers with useful information and encourages price competition. Without advertising, these defenders argue, it would be impossible for new firms to enter an industry. Advertising, they say, promotes competition, lowers prices, and encourages a greater range of choice for consumers.

Advertising, like all other economic phenomena, has benefits as well as costs. To assess those benefits and costs, let us examine the impact of advertising on the economy.

Advertising and Information

Advertising does inform us about products and their prices. Even critics of advertising generally agree that when advertising advises consumers about the availability of new products, or when it provides price information, it serves a useful function. But much of the information provided by advertising appears to be of limited value. Hearing that “Pepsi is the right one, baby” or “Tide gets your clothes whiter than white” may not be among the most edifying lessons consumers could learn.

Some economists argue, however, that even advertising that seems to tell us nothing may provide useful information. They note that a consumer is unlikely to make a repeat purchase of a product that turns out to be a dud. Advertising an inferior product is likely to have little payoff; people who do try it are not likely to try it again. It is not likely a firm could profit by going to great expense to launch a product that produced only unhappy consumers. Thus, if a product is heavily advertised, its producer is likely to be confident that many consumers will be satisfied with it and make repeat purchases. If this is the case, then the fact that the product is advertised, regardless of the content of that advertising, signals consumers that at least its producer is confident that the product will satisfy them.

Advertising and Competition

If advertising creates consumer loyalty to a particular brand, then that loyalty may serve as a barrier to entry to other firms. Some brands of household products, such as laundry detergents, are so well established they may make it difficult for other firms to enter the market.

In general, there is a positive relationship between the degree of concentration of market power and the fraction of total costs devoted to advertising. This relationship, critics argue, is a causal one; the high expenditures on advertising are the cause of the concentration. To the extent that advertising increases industry concentration, it is likely to result in higher prices to consumers and lower levels of output. The higher prices associated with advertising are not simply the result of passing on the cost of the advertising itself to consumers; higher prices also derive from the monopoly power the advertising creates.

But advertising may encourage competition as well. By providing information to consumers about prices, for example, it may encourage price competition. Suppose a firm in a world of no advertising wants to increase its sales. One way to do that is to lower price. But without advertising, it is extremely difficult to inform potential customers of this new policy. The likely result is that there would be little response, and the price experiment would probably fail. Price competition would thus be discouraged in a world without advertising.

Empirical studies of markets in which advertising is not allowed have confirmed that advertising encourages price competition. One of the most famous studies of the effects of advertising looked at pricing for prescription eyeglasses. In the early 1970s, about half the states in the United States banned advertising by firms making prescription eyeglasses; the other half allowed it. A comparison of prices in the two groups of states by economist Lee Benham showed that the cost of prescription eyeglasses was far lower in states that allowed advertising than in states that banned it (Benham, L., 1972). Mr. Benham's research proved quite influential—virtually all states have since revoked their bans on such advertising. Similarly, a study of the cigarette industry revealed that before the 1970 ban on radio and television advertising market shares of the leading cigarette manufacturers had been declining, while after the ban market shares and profit margins increased (Eckard, W., 1991).

Advertising may also allow more entry by new firms. When Kia, a South Korean automobile manufacturer, entered the U.S. low-cost compact car market in 1994, it flooded the airwaves with advertising. Suppose such advertising had not been possible. Could Kia have entered the market in the United States? It seems highly unlikely that any new product could be launched without advertising. The absence of advertising would thus be a barrier to entry that would increase the degree of monopoly power in the economy. A greater degree of monopoly power would, over time, translate into higher prices and reduced output.

Advertising is thus a two-edged sword. On the one hand, the existence of established and heavily advertised rivals may make it difficult for a new firm to enter a market. On the other hand, entry into most industries would be virtually impossible without advertising.

Economists do not agree on whether advertising helps or hurts competition in particular markets, but one general observation can safely be made—a world with advertising is more competitive than a world without advertising would be. The important policy question is more limited—and more difficult to answer: Would a world with *less* advertising be more competitive than a world with more?

Price Discrimination

In some cases, however, firms can charge different prices to different consumers. If such an opportunity exists, the firm can increase profits further.

When a firm charges different prices for the same good or service to different consumers, even though there is no difference in the cost to the firm of supplying these consumers, the firm is engaging in price discrimination. Except for a few situations of price discrimination that have been declared illegal, such as manufacturers selling their goods to distributors at different prices when there are no differences in cost, price discrimination is generally legal.

The potential for price discrimination exists in all market structures except perfect competition. As long as a firm faces a downward-sloping demand curve and thus has some degree of monopoly power, it may be able to engage in price discrimination. But monopoly power alone is not enough to allow a firm to price discriminate. Monopoly power is one of three conditions that must be met:

1. **A Price-Setting Firm** The firm must have some degree of monopoly power—it must be a price setter. A price-taking firm can only take the market price as given—it is not in a position to make price choices of any kind. Thus, firms in perfectly

competitive markets will not engage in price discrimination. Firms in monopoly, monopolistically competitive, or oligopolistic markets may engage in price discrimination.

2. **Distinguishable Customers** The market must be capable of being fairly easily segmented—separated so that customers with different elasticities of demand can be identified and treated differently.
3. **Prevention of Resale** The various market segments must be isolated in some way from one another to prevent customers who are offered a lower price from selling to customers who are charged a higher price. If consumers can easily resell a product, then discrimination is unlikely to be successful. Resale may be particularly difficult for certain services, such as dental checkups.

Examples of price discrimination abound. Senior citizens and students are often offered discount fares on city buses. Children receive discount prices for movie theater tickets and entrance fees at zoos and theme parks. Faculty and staff at colleges and universities might receive discounts at the campus bookstore. Airlines give discount prices to customers who are willing to stay over a Saturday night. Physicians might charge wealthy patients more than poor ones. People who save coupons are able to get discounts on many items. In all these cases a firm charges different prices to different customers for what is essentially the same product.

Not every instance of firms charging different prices to different customers constitutes price discrimination. Differences in prices may reflect different costs associated with providing the product. One buyer might require special billing practices, another might require delivery on a particular day of the week, and yet another might require special packaging. Price differentials based on differences in production costs are not examples of price discrimination.

Why would a firm charge different prices to different consumers? The answer can be found in the marginal decision rule and in the relationship between marginal revenue and elasticity.

Suppose an airline has found that its long-run profit-maximizing solution for a round-trip flight between Minneapolis and Cleveland, when it charges the same price to all passengers, is to carry 300 passengers at \$200 per ticket. The airline has a degree of monopoly power, so it faces a downward-sloping demand curve. The airline has noticed that there are essentially two groups of customers on each flight: people who are traveling for business reasons and people who are traveling for personal reasons (visiting family or friends or taking a vacation). We will call this latter group “tourists.” Of the 300 passengers, 200 are business travelers and 100 are tourists. The airline’s revenue from business travelers is therefore currently \$40,000 (\$200 times 200 business travelers) and from tourists is currently \$20,000 (\$200 times 100 tourists).

It seems likely that the price elasticities of demand of these two groups for a particular flight will differ. Tourists may have a wide range of substitutes: They could take their trips at a different time, they could vacation in a different area, or they could easily choose not to go at all. Business travelers, however, might be attending meetings or conferences at a particular time and in a particular city. They have options, of course, but the range of options is likely to be more limited than the range of options facing tourists. Given all this, tourists are likely to have relatively more price elastic demand than business travelers for a particular flight.

The difference in price elasticities suggests the airline could increase its profit by adjusting its pricing. To simplify, suppose that at a price of about \$200 per ticket, demand by tourists is relatively price elastic and by business travelers is relatively less price elastic. It is plausible that the marginal cost of additional passengers is likely to be quite low, since the number of crewmembers will not vary and no food is served on short flights. Thus, if the airline can increase its revenue, its profits will increase. Suppose the airline lowers the price for tourists to \$190. Suppose that the lower price encourages 10 more tourists to take the flight. Of course, the airline cannot charge different prices to different tourists; rather it charges \$190 to all, now 110, tourists. Still, the airline’s revenue from tourist passengers increases from \$20,000 to \$20,900 (\$190 times 110 tourists). Suppose it charges \$250 to its business travelers. As a result, only 195 business travelers take the flight. The airline’s revenue from business travelers still rises from \$40,000 to \$48,750 (\$250 times 195 business travelers). The airline will continue to change the mix of passengers, and increase the number of passengers, so long as doing so increases its profit. Because tourist demand is relatively price elastic, relatively small reductions in price will attract relatively large numbers of additional tourists. Because business demand is relatively less elastic, relatively large increases in price will discourage relatively small numbers of business travelers from making the trip. The airline will continue to reduce its price to tourists and raise its price to business travelers as long as it gains profit from doing so.

Of course, the airline can impose a discriminatory fare structure only if it can distinguish tourists from business travelers. Airlines typically do this by looking at the travel plans of their customers. Trips that involve a stay over a weekend, for example, are more likely to be tourist related, whereas trips that begin and end during the workweek are likely to be business trips. Thus, airlines charge much lower fares for trips that extend through a weekend than for trips that begin and end on weekdays.

In general, price-discrimination strategies are based on differences in price elasticity of demand among groups of customers and the differences in marginal revenue that result. A firm will seek a price structure that offers customers with more elastic demand a lower price and offers customers with relatively less elastic demand a higher price.

It is always in the interest of a firm to discriminate. Yet most of the goods and services that we buy are not offered on a discriminatory basis. A grocery store does not charge a higher price for vegetables to vegetarians, whose demand is likely to be less elastic than that of its omnivorous customers. An audio store does not charge a different price for Pearl Jam's compact disks to collectors seeking a complete collection than it charges to casual fans who could easily substitute a disk from another performer. In these cases, firms lack a mechanism for knowing the different demands of their customers and for preventing resale.

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CHAPTER OVERVIEW

11: Wages and Employment in Perfect Competition

[11.1: The Demand for Labor](#)

[11.2: The Supply of Labor](#)

[11.3: Labor Markets at Work](#)

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11.1: The Demand for Labor

Learning Objective

1. Apply the marginal decision rule to determine the quantity of labor that a firm in a perfectly competitive market will demand and illustrate this quantity graphically using the marginal revenue product and marginal factor cost curves.
2. Describe how to find the market demand curve for labor and discuss the factors that can cause the market demand curve for labor to shift.

A firm must have labor to produce goods and services. But how much labor will the firm employ? A profit-maximizing firm will base its decision to hire additional units of labor on the marginal decision rule: If the extra output that is produced by hiring one more unit of labor adds more to total revenue than it adds to total cost, the firm will increase profit by increasing its use of labor. It will continue to hire more and more labor up to the point that the extra revenue generated by the additional labor no longer exceeds the extra cost of the labor.

For example, if a computer software company could increase its annual total revenue by \$50,000 by hiring a programmer at a cost of \$49,000 per year, the marginal decision rule says that it should do so. Since the programmer will add \$49,000 to total cost and \$50,000 to total revenue, hiring the programmer will increase the company's profit by \$1,000. If still another programmer would increase annual total revenue by \$48,000 but would also add \$49,000 to the firm's total cost, that programmer should not be hired because he or she would add less to total revenue than to total cost and would reduce profit.

Marginal Revenue Product and Marginal Factor Cost

The amount that an additional unit of a factor adds to a firm's total revenue during a period is called the marginal revenue product (MRP) of the factor. An additional unit of a factor of production adds to a firm's revenue in a two-step process: first, it increases the firm's output. Second, the increased output increases the firm's total revenue. We find marginal revenue product by multiplying the marginal product (MP) of the factor by the marginal revenue (MR).

$$MRP = MP \times MR$$

In a perfectly competitive market the marginal revenue a firm receives equals the market-determined price P . Therefore, for firms in perfect competition, we can express marginal revenue product as follows:

$$\text{In perfect competition, } MRP = MP \times P$$

The marginal revenue product of labor (MRP_L) is the marginal product of labor (MP_L) times the marginal revenue (which is the same as price under perfect competition) the firm obtains from additional units of output that result from hiring the additional unit of labor. If an additional worker adds 4 units of output per day to a firm's production, and if each of those 4 units sells for \$20, then the worker's marginal revenue product is \$80 per day. With perfect competition, the marginal revenue product for labor, MRP_L , equals the marginal product of labor, MP_L , times the price, P , of the good or service the labor produces:

$$\text{In perfect competition, } MRP_L = MP_L \times P$$

The law of diminishing marginal returns tells us that if the quantity of a factor is increased while other inputs are held constant, its marginal product will eventually decline. If marginal product is falling, marginal revenue product must be falling as well.

Suppose that an accountant, Stephanie Lancaster, has started an evening call-in tax advisory service. Between the hours of 7 p.m. and 10 p.m., customers can call and get advice on their income taxes. Ms. Lancaster's firm, TeleTax, is one of several firms offering similar advice; the going market price is \$10 per call. Ms. Lancaster's business has expanded, so she hires other accountants to handle the calls. She must determine how many accountants to hire.

As Ms. Lancaster adds accountants, her service can take more calls. The table in Figure 11.1 gives the relationship between the number of accountants available to answer calls each evening and the number of calls TeleTax handles. Panel (a) shows the increase in the number of calls handled by each additional accountant—that accountant's marginal product. The first accountant can handle 13 calls per evening. Adding a second accountant increases the number of calls handled by 20. With two accountants, a degree of specialization is possible if each accountant takes calls dealing with questions about which he or she has particular expertise. Hiring the third accountant increases TeleTax's output per evening by 23 calls.

Suppose the accountants share a fixed facility for screening and routing calls. They also share a stock of reference materials to use in answering calls. As more accountants are added, the firm will begin to experience diminishing marginal returns. The fourth accountant increases output by 20 calls. The marginal product of additional accountants continues to decline after that. The marginal product curve shown in Panel (a) of Figure 11.1 thus rises and then falls.

Each call TeleTax handles increases the firm's revenues by \$10. To obtain marginal revenue product, we multiply the marginal product of each accountant by \$10; the marginal revenue product curve is shown in Panel (b) of Figure 11.1.

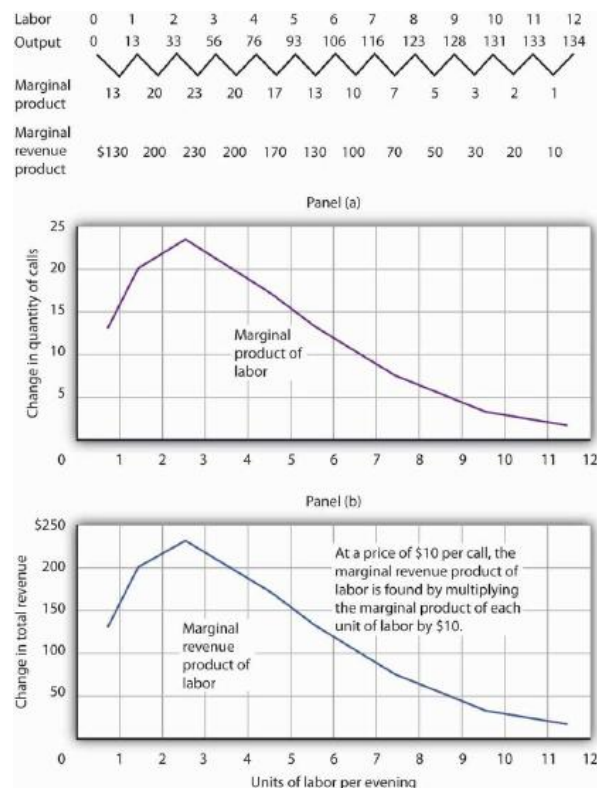


Figure 11.1 Marginal Product and Marginal Revenue Product The table gives the relationship between the number of accountants employed by TeleTax each evening and the total number of calls handled. From these values we derive the marginal product and marginal revenue product curves.

We can use Ms. Lancaster's marginal revenue product curve to determine the quantity of labor she will hire. Suppose accountants in her area are available to offer tax advice for a nightly fee of \$150. Each additional accountant Ms. Lancaster hires thus adds \$150 per night to her total cost. The amount a factor adds to a firm's total cost per period is called its marginal factor cost (MFC). Marginal factor cost (*MFC*) is the change in total cost (ΔTC) divided by the change in the quantity of the factor (Δf):

$$MFC = \frac{\Delta TC}{\Delta f}$$

The marginal factor cost to TeleTax of additional accountants (\$150 per night) is shown as a horizontal line in Figure 11.2. It is simply the market wage (i.e., the price per unit of labor).



Figure 11.2 Marginal Revenue Product and Demand The downward-sloping portion of a firm's marginal revenue product curve is its demand curve for a variable factor. At a marginal factor cost of \$150, TeleTax hires the services of five accountants.

TeleTax will maximize profit by hiring additional units of labor up to the point where the downward-sloping portion of the marginal revenue product curve intersects the marginal factor cost curve; we see in Figure 11.2 that it will hire five accountants. Based on the information given in the table in Figure 11.1, we know that the five accountants will handle a total of 93 calls per evening; TeleTax will earn total revenue of \$930 per evening. The firm pays \$750 for the services of the five accountants—that leaves \$180 to apply to the fixed cost associated with the tax advice service and the implicit cost of Stephanie Lancaster's effort in organizing the service. Recall that these implicit costs include the income forgone (that is, opportunity cost) by not shifting her resources, including her own labor, to her next best alternative.

If TeleTax had to pay a higher price for accountants, it would face a higher marginal factor cost curve and would hire fewer accountants. If the price were lower, TeleTax would hire more accountants. The downward-sloping portion of TeleTax's marginal revenue product curve shows the number of accountants it will hire at each price for accountants; it is thus the firm's demand curve for accountants. It is the portion of the curve that exhibits diminishing returns, and a firm will always seek to operate in the range of diminishing returns to the factors it uses.

It may seem counterintuitive that firms do not operate in the range of increasing returns, which would correspond to the upward-sloping portion of the marginal revenue product curve. However, to do so would forgo profit-enhancing opportunities. For example, in Figure 11.2, adding the second accountant adds \$200 to revenue but only \$150 to cost, so hiring that accountant clearly adds to profit. But why stop there? What about hiring a third accountant? That additional hire adds even more to revenue (\$230) than to cost. In the region of increasing returns, marginal revenue product rises. With marginal factor cost constant, not to continue onto the downward-sloping part of the marginal revenue curve would be to miss out on profit-enhancing opportunities. The firm continues adding accountants until doing so no longer adds more to revenue than to cost, and that necessarily occurs where the marginal revenue product curve slopes downward.

In general, then, we can interpret the downward-sloping portion of a firm's marginal revenue product curve for a factor as its demand curve for that factor¹. We find the market demand for labor by adding the demand curves for individual firms.

Heads Up!

The Two Rules Lead to the Same Outcome

In the chapter on competitive output markets we learned that profit-maximizing firms will increase output so long as doing so adds more to revenue than to cost, or up to the point where marginal revenue, which in perfect competition is the same as the market-determined price, equals marginal cost. In this chapter we have learned that profit-maximizing firms will hire labor up to the point where marginal revenue product equals marginal factor cost. Is it possible that a firm that follows the marginal decision rule for hiring labor would end up producing a different quantity of output compared to the quantity of output it would choose if it followed the marginal decision rule for deciding directly how much output to produce? Is there a conflict between these two marginal decision rules?

The answer is no. These two marginal decision rules are really just two ways of saying the same thing: one rule is in terms of quantity of output and the other in terms of the quantity of factors required to produce that quantity of output. Hiring an additional unit of a factor means producing a certain amount of additional output.

Using the example of TeleTax, at \$150 per accountant per night, we found that Ms. Lancaster maximizes profit by hiring five accountants. The MP_L of the fifth accountant is ΔQ ; it is 17. At five accountants, the marginal cost of a call is $\Delta TC / \Delta Q = \$150 / 17 = \$8.82$, which is less than the price of \$10 per call, so hiring that accountant adds to her profit. At six accountants, the marginal cost of a call would be $\$150 / 13 = \$11.54$, which is greater than the \$10 price, so hiring a sixth accountant would lower profit. The

profit-maximizing output of 93 calls, found by comparing marginal cost and price, is thus consistent with the profit-maximizing quantity of labor of five accountants, found by comparing marginal revenue product and marginal factor cost.

Shifts in Labor Demand

The fact that a firm's demand curve for labor is given by the downward-sloping portion of its marginal revenue product of labor curve provides a guide to the factors that will shift the curve. In perfect competition, marginal revenue product equals the marginal product of labor times the price of the good that the labor is involved in producing; anything that changes either of those two variables will shift the curve. The marginal revenue product of labor will change when there is a change in the quantities of other factors employed. It will also change as a result of a change in technology, a change in the price of the good being produced, or a change in the number of firms hiring the labor.

Changes in the Use of Other Factors of Production

As a firm changes the quantities of different factors of production it uses, the marginal product of labor may change. Having more reference manuals, for example, is likely to make additional accountants more productive—it will increase their marginal product. That increase in their marginal product would increase the demand for accountants. When an increase in the use of one factor of production increases the demand for another, the two factors are complementary factors of production.

One important complement of labor is human capital, the set of skills and abilities workers bring to the production of goods and services. When workers gain additional human capital, their marginal product rises. The demand for them by firms thus increases. This is perhaps one reason why you have decided to pursue a college education.

Other inputs may be regarded as substitutes for each other. A robot, for example, may substitute for some kinds of assembly-line labor. Two factors are substitute factors of production if the increased use of one lowers the demand for the other.

Changes in Technology

Technological changes can increase the demand for some workers and reduce the demand for others. The production of a more powerful computer chip, for example, may increase the demand for software engineers. It may also allow other production processes to be computerized and thus reduce the demand for workers who had been employed in those processes.

Technological changes have significantly increased the economy's output over the past century. The application of sophisticated technologies to production processes has boosted the marginal products of workers who have the skills these technologies require. That has increased the demand for skilled workers. The same technologies have been a substitute for less-skilled workers, and the demand for those workers has fallen. As the Case in Point on the impact of computer technology implies, envisioning the impact of technological change on demand for different kinds of labor may be something to keep in mind as you consider educational options. As you consider your major, for example, you should keep in mind that some occupations may benefit from technological changes; others may not.

Changes in Product Demand

A change in demand for a final product changes its price, at least in the short run. An increase in the demand for a product increases its price and increases the demand for factors that produce the product. A reduction in demand for a product reduces its price and reduces the demand for the factors used in producing it. Because the demand for factors that produce a product depends on the demand for the product itself, factor demand is said to be derived demand. That is, factor demand is derived from the demand for the product that uses the factor in its production.

Suppose, for example, that the demand for airplanes increases. The price and quantity of airplanes available will go up. A higher price for airplanes increases the marginal revenue product of labor of airplane-assembly workers and thus increases the demand for these workers.

Just as increases in the demand for particular goods or services increase the demand for the workers that produce them, so reductions in demand for particular goods or services will reduce the demand for the workers that produce them. An example is the relationship between the demand for train travel and the demand for conductors. Over the years, the fall in demand for train travel has reduced the demand for railroad conductors.

Changes in the Number of Firms

We can determine the demand curve for any factor by adding the demand for that factor by each of the firms using it. If more firms employ the factor, the demand curve shifts to the right. A reduction in the number of firms shifts the demand curve to the left. For example, if the number of restaurants in an area increases, the demand for waiters and waitresses in the area goes up. We expect to see local wages for these workers rise as a result.

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11.2: The Supply of Labor

Learning Objective

1. Explain the income and substitution effects of a wage change and how they affect the shape of the labor supply curve.
2. Discuss the factors that can cause the supply curve for labor to shift.

The demand for labor is one determinant of the equilibrium wage and equilibrium quantity of labor in a perfectly competitive market. The supply of labor, of course, is the other.

Economists think of the supply of labor as a problem in which individuals weigh the opportunity cost of various activities that can fill an available amount of time and choose how to allocate it. Everyone has 24 hours in a day. There are lots of uses to which we can put our time: we can raise children, work, sleep, play, or participate in volunteer efforts. To simplify our analysis, let us assume that there are two ways in which an individual can spend his or her time: in work or in leisure. Leisure is a type of consumption good; individuals gain utility directly from it. Work provides income that, in turn, can be used to purchase goods and services that generate utility.

The more work a person does, the greater his or her income, but the smaller the amount of leisure time available. An individual who chooses more leisure time will earn less income than would otherwise be possible. There is thus a tradeoff between leisure and the income that can be earned from work. We can think of the supply of labor as the flip side of the demand for leisure. The more leisure people demand, the less labor they supply.

Two aspects of the demand for leisure play a key role in understanding the supply of labor. First, leisure is a normal good. All other things unchanged, an increase in income will increase the demand for leisure. Second, the opportunity cost or “price” of leisure is the wage an individual can earn. A worker who can earn \$10 per hour gives up \$10 in income by consuming an extra hour of leisure. The \$10 wage is thus the price of an hour of leisure. A worker who can earn \$20 an hour faces a higher price of leisure.

Income and Substitution Effects

Suppose wages rise. The higher wage increases the price of leisure. We saw in the chapter on consumer choice that consumers substitute more of other goods for a good whose price has risen. The substitution effect of a higher wage causes the consumer to substitute labor for leisure. To put it another way, the higher wage induces the individual to supply a greater quantity of labor.

We can see the logic of this substitution effect in terms of the marginal decision rule. Suppose an individual is considering a choice between extra leisure and the additional income from more work. Let MU_{Le} denote the marginal utility of an extra hour of leisure. What is the price of an extra hour of leisure? It is the wage W that the individual forgoes by not working for an hour. The extra utility of \$1 worth of leisure is thus given by MU_{Le}/W .

Suppose, for example, that the marginal utility of an extra hour of leisure is 20 and the wage is \$10 per hour. Then MU_{Le}/W equals $20/10$, or 2. That means that the individual gains 2 units of utility by spending an additional \$1 worth of time on leisure. For a person facing a wage of \$10 per hour, \$1 worth of leisure would be the equivalent of 6 minutes of leisure time.

Let MU_Y be the marginal utility of an additional \$1 of income (Y is the abbreviation economists generally assign to income). The price of \$1 of income is just \$1, so the price of income P_Y is always \$1. Utility is maximized by allocating time between work and leisure so that:

$$\frac{MU_Y}{P_Y} = \frac{MU_{Le}}{W}$$

Now suppose the wage rises from W to W' . That reduces the marginal utility of \$1 worth of leisure, MU_{Le}/W , so that the extra utility of earning \$1 will now be greater than the extra utility of \$1 worth of leisure:

$$\frac{MU_Y}{P_Y} > \frac{MU_{Le}}{W'}$$

Faced with the inequality an individual will give up some leisure time and spend more time working. As the individual does so, however, the marginal utility of the remaining leisure time rises and the marginal utility of the income earned will fall. The individual will continue to make the substitution until the two sides of the equation are again equal. For a worker, the substitution effect of a wage increase always reduces the amount of leisure time consumed and increases the amount of time spent working. A higher wage thus produces a positive substitution effect on labor supply.

But the higher wage also has an income effect. An increased wage means a higher income, and since leisure is a normal good, the quantity of leisure demanded will go up. And that means a *reduction* in the quantity of labor supplied.

For labor supply problems, then, the substitution effect is always positive; a higher wage induces a greater quantity of labor supplied. But the income effect is always negative; a higher wage implies a higher income, and a higher income implies a greater demand for leisure, and more leisure means a lower quantity of labor supplied. With the substitution and income effects working in opposite directions, it is not clear whether a wage increase will increase or decrease the quantity of labor supplied—or leave it unchanged.

Figure 11.3 illustrates the opposite pull of the substitution and income effects of a wage change facing an individual worker. A janitor, Meredith Wilson, earns \$10 per hour. She now works 42 hours per week, on average, earning \$420.

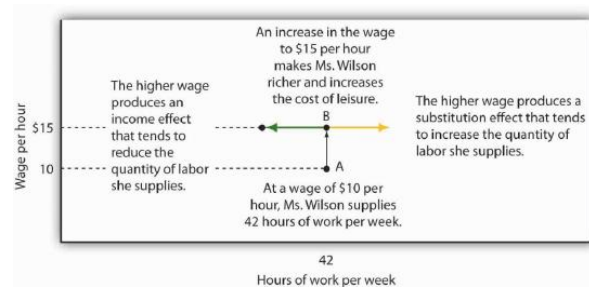


Figure 11.3 The Substitution and Income Effects of a Wage Change The substitution and income effects influence Meredith Wilson’s supply of labor when she gets a pay raise. At a wage of \$10 per hour, she supplies 42 hours of work per week (point A). At \$15 per hour, the substitution effect pulls in the direction of an increased quantity of labor supplied, and the income effect pulls in the opposite direction.

Now suppose Ms. Wilson receives a \$5 raise to \$15 per hour. As shown in Figure 12.7 “The Substitution and Income Effects of a Wage Change”, the substitution effect of the wage change induces her to increase the quantity of labor she supplies; she substitutes some of her leisure time for additional hours of work. But she is richer now; she can afford more leisure. At a wage of \$10 per hour, she was earning \$420 per week. She could earn that same amount at the higher wage in just 28 hours. With her higher income, she can certainly afford more leisure time. The income effect of the wage change is thus negative; the quantity of labor supplied falls. The effect of the wage increase on the quantity of labor Ms. Wilson actually supplies depends on the relative strength of the substitution and income effects of the wage change. We will see what Ms. Wilson decides to do in the next section.

Wage Changes and the Slope of the Supply Curve

What would any one individual’s supply curve for labor look like? One possibility is that over some range of labor hours supplied, the substitution effect will dominate. Because the marginal utility of leisure is relatively low when little labor is supplied (that is, when most time is devoted to leisure), it takes only a small increase in wages to induce the individual to substitute more labor for less leisure. Further, because few hours are worked, the income effect of those wage changes will be small.

Figure 11.4 shows Meredith Wilson’s supply curve for labor. At a wage of \$10 per hour, she supplies 42 hours of work per week (point A). An increase in her wage to \$15 per hour boosts her quantity supplied to 48 hours per week (point B). The substitution effect thus dominates the income effect of a higher wage.

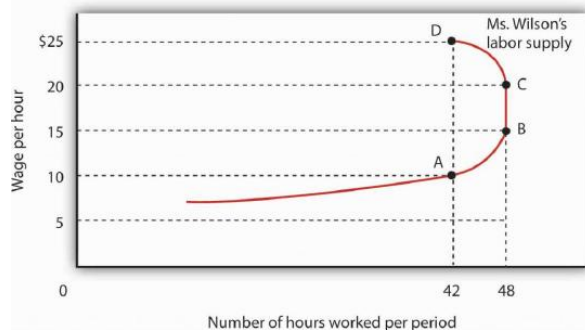


Figure 11.4 A Backward-Bending Supply Curve for Labor As the wage rate increases from \$10 to \$15 per hour, the quantity of labor Meredith Wilson supplies increases from 42 to 48 hours per week. Between points A and B, the positive substitution effect of the wage increase outweighs the negative income effect. As the wage rises above \$15, the negative income effect just offsets the substitution effect, and Ms. Wilson's supply curve becomes a vertical line between points B and C. As the wage rises above \$20, the income effect becomes stronger than the substitution effect, and the supply curve bends backward between points C and D.

It is possible that beyond some wage rate, the negative income effect of a wage increase could just offset the positive substitution effect; over that range, a higher wage would have no effect on the quantity of labor supplied. That possibility is illustrated between points B and C on the supply curve in Figure 11.4; Ms. Wilson's supply curve is vertical. As wages continue to rise, the income effect becomes even stronger, and additional increases in the wage reduce the quantity of labor she supplies. The supply curve illustrated here bends backward beyond point C and thus assumes a negative slope. The supply curve for labor can thus slope upward over part of its range, become vertical, and then bend backward as the income effect of higher wages begins to dominate the substitution effect.

It is quite likely that some individuals have backward-bending supply curves for labor—beyond some point, a higher wage induces those individuals to work less, not more. However, supply curves for labor in specific labor markets are generally upward sloping. As wages in one industry rise relative to wages in other industries, workers shift their labor to the relatively high-wage one. An increased quantity of labor is supplied in that industry. While some exceptions have been found, the mobility of labor between competitive labor markets is likely to prevent the total number of hours worked from falling as the wage rate increases. Thus we shall assume that supply curves for labor in particular markets are upward sloping.

Shifts in Labor Supply

What events shift the supply curve for labor? People supply labor in order to increase their utility—just as they demand goods and services in order to increase their utility. The supply curve for labor will shift in response to changes in the same set of factors that shift demand curves for goods and services.

Changes in Preferences

A change in attitudes toward work and leisure can shift the supply curve for labor. If people decide they value leisure more highly, they will work fewer hours at each wage, and the supply curve for labor will shift to the left. If they decide they want more goods and services, the supply curve is likely to shift to the right.

Changes in Income

An increase in income will increase the demand for leisure, reducing the supply of labor. We must be careful here to distinguish movements along the supply curve from shifts of the supply curve itself. An income change resulting from a change in wages is shown by a movement along the curve; it produces the income and substitution effects we already discussed. But suppose income is from some other source: a person marries and has access to a spouse's income, or receives an inheritance, or wins a lottery. Those nonlabor increases in income are likely to reduce the supply of labor, thereby shifting the supply curve for labor of the recipients to the left.

Changes in the Prices of Related Goods and Services

Several goods and services are complements of labor. If the cost of child care (a complement to work effort) falls, for example, it becomes cheaper for workers to go to work, and the supply of labor tends to increase. If recreational activities (which are a substitute for work effort) become much cheaper, individuals might choose to consume more leisure time and supply less labor.

Changes in Population

An increase in population increases the supply of labor; a reduction lowers it. Labor organizations have generally opposed increases in immigration because their leaders fear that the increased number of workers will shift the supply curve for labor to the right and put downward pressure on wages.

Changes in Expectations

One change in expectations that could have an effect on labor supply is life expectancy. Another is confidence in the availability of Social Security. Suppose, for example, that people expect to live longer yet become less optimistic about their likely benefits from Social Security. That could induce an increase in labor supply.

Labor Supply in Specific Markets

The supply of labor in particular markets could be affected by changes in any of the variables we have already examined—changes in preferences, incomes, prices of related goods and services, population, and expectations. In addition to these variables that affect the supply of labor in general, there are changes that could affect supply in specific labor markets.

A change in wages in related occupations could affect supply in another. A sharp reduction in the wages of surgeons, for example, could induce more physicians to specialize in, say, family practice, increasing the supply of doctors in that field. Improved job opportunities for women in other fields appear to have decreased the supply of nurses, shifting the supply curve for nurses to the left.

The supply of labor in a particular market could also shift because of a change in entry requirements. Most states, for example, require barbers and beauticians to obtain training before entering the profession. Elimination of such requirements would increase the supply of these workers. Financial planners have, in recent years, sought the introduction of tougher licensing requirements, which would reduce the supply of financial planners.

Worker preferences regarding specific occupations can also affect labor supply. A reduction in willingness to take risks could lower the supply of labor available for risky occupations such as farm work (the most dangerous work in the United States), law enforcement, and fire fighting. An increased desire to work with children could raise the supply of child-care workers, elementary school teachers, and pediatricians.

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11.3: Labor Markets at Work

Learning Objective

1. Explain and illustrate how wage and employment levels are determined in a perfectly competitive market and for an individual firm within that market.
2. Describe the forces that can raise or lower the equilibrium wage in a competitive market and illustrate these processes.
3. Describe the ways that government can increase wages and incomes.

We have seen that a firm's demand for labor depends on the marginal product of labor and the price of the good the firm produces. We add the demand curves of individual firms to obtain the market demand curve for labor. The supply curve for labor depends on variables such as population and worker preferences. Supply in a particular market depends on variables such as worker preferences, the skills and training a job requires, and wages available in alternative occupations. Wages are determined by the intersection of demand and supply.

Once the wage in a particular market has been established, individual firms in perfect competition take it as given. Because each firm is a price taker, it faces a horizontal supply curve for labor at the market wage. For one firm, changing the quantity of labor it hires does not change the wage. In the context of the model of perfect competition, buyers and sellers are price takers. That means that a firm's choices in hiring labor do not affect the wage.

The operation of labor markets in perfect competition is illustrated in Figure 11.5. The wage W_1 is determined by the intersection of demand and supply in Panel (a). Employment equals L_1 units of labor per period. An individual firm takes that wage as given; it is the supply curve s_1 facing the firm. This wage also equals the firm's marginal factor cost. The firm hires l_1 units of labor, a quantity determined by the intersection of its marginal revenue product curve for labor MRP_1 and the supply curve s_1 . We use lowercase letters to show quantity for a single firm and uppercase letters to show quantity in the market.

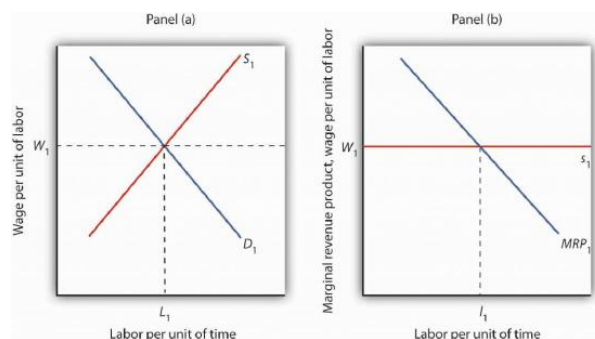


Figure 11.5 Wage Determination and Employment in Perfect Competition Wages in perfect competition are determined by the intersection of demand and supply in Panel (a). An individual firm takes the wage W_1 as given. It faces a horizontal supply curve for labor at the market wage, as shown in Panel (b). This supply curve s_1 is also the marginal factor cost curve for labor. The firm responds to the wage by employing l_1 units of labor, a quantity determined by the intersection of its marginal revenue product curve MRP_1 and its supply curve s_1 .

Changes in Demand and Supply

If wages are determined by demand and supply, then changes in demand and supply should affect wages. An increase in demand or a reduction in supply will raise wages; an increase in supply or a reduction in demand will lower them.

Panel (a) of Figure 11.6 shows how an increase in the demand for labor affects wages and employment. The shift in demand to D_2 pushes the wage to W_2 and boosts employment to L_2 . Such an increase implies that the marginal product of labor has increased, that the number of firms has risen, or that the price of the good the labor produces has gone up. As we have seen, the marginal product of labor could rise because of an increase in the use of other factors of production, an improvement in technology, or an increase in human capital.

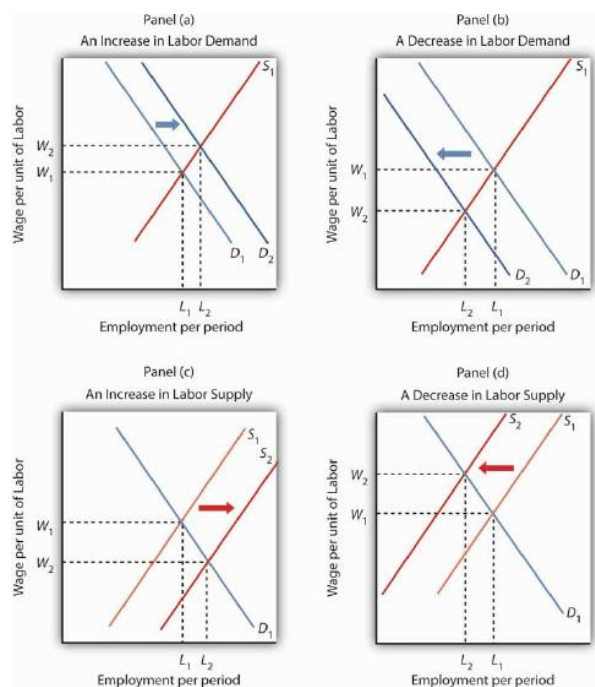


Figure 11.6 Changes in the Demand for and Supply of Labor Panel (a) shows an increase in demand for labor; the wage rises to W_2 and employment rises to L_2 . A reduction in labor demand, shown in Panel (b), reduces employment and the wage level. An increase in the supply of labor, shown in Panel (c), reduces the wage to W_2 and increases employment to L_2 . Panel (d) shows the effect of a reduction in the supply of labor; wages rise and employment falls.

Clearly, a rising demand for labor has been the dominant trend in the market for U.S. labor through most of the nation's history. Wages and employment have generally risen as the availability of capital and other factors of production have increased, as technology has advanced, and as human capital has increased. All have increased the productivity of labor, and all have acted to increase wages.

Panel (b) of Figure 11.6 shows a reduction in the demand for labor to D_2 . Wages and employment both fall. Given that the demand for labor in the aggregate is generally increasing, reduced labor demand is most often found in specific labor markets. For example, a slump in construction activity in a particular community can lower the demand for construction workers. Technological changes can reduce as well as increase demand. The Case in Point on wages and technology suggests that technological changes since the late 1970s have tended to reduce the demand for workers with only a high school education while increasing the demand for those with college degrees.

Panel (c) of Figure 11.6 shows the impact of an increase in the supply of labor. The supply curve shifts to S_2 , pushing employment to L_2 and cutting the wage to W_2 . For labor markets as a whole, such a supply increase could occur because of an increase in population or an increase in the amount of work people are willing to do. For individual labor markets, supply will increase as people move into a particular market.

Just as the demand for labor has increased throughout much of the history of the United States, so has the supply of labor. Population has risen both through immigration and through natural increases. Such increases tend, all other determinants of wages unchanged, to reduce wages. The fact that wages have tended to rise suggests that demand has, in general, increased more rapidly than supply. Still, the more supply rises, the smaller the increase in wages will be, even if demand is rising.

Finally, Panel (d) of Figure 11.6 shows the impact of a reduction in labor supply. One dramatic example of a drop in the labor supply was caused by a reduction in population after the outbreak of bubonic plague in Europe in 1348—the so-called Black Death. The plague killed about one-third of the people of Europe within a few years, shifting the supply curve for labor sharply to the left. Wages doubled during the period (Cipolla, C. M., 1980).

The fact that a reduction in the supply of labor tends to increase wages explains efforts by some employee groups to reduce labor supply. Members of certain professions have successfully promoted strict licensing requirements to limit the number of people who

can enter the profession—U.S. physicians have been particularly successful in this effort. Unions often seek restrictions in immigration in an effort to reduce the supply of labor and thereby boost wages.

Competitive Labor Markets and the Minimum Wage

The Case in Point on technology and the wage gap points to an important social problem. Changes in technology boost the demand for highly educated workers. In turn, the resulting wage premium for more highly educated workers is a signal that encourages people to acquire more education. The market is an extremely powerful mechanism for moving resources to the areas of highest demand. At the same time, however, changes in technology seem to be leaving less educated workers behind. What will happen to people who lack the opportunity to develop the skills that the market values highly or who are unable to do so?

In order to raise wages of workers whose wages are relatively low, governments around the world have imposed minimum wages. A minimum wage works like other price floors. The impact of a minimum wage is shown in Panel (a) of Figure 11.7. Suppose the current equilibrium wage of unskilled workers is W_1 , determined by the intersection of the demand and supply curves of these workers. The government determines that this wage is too low and orders that it be increased to W_m , a minimum wage. This strategy reduces employment from L_1 to L_2 , but it raises the incomes of those who continue to work. The higher wage also increases the quantity of labor supplied to L_3 . The gap between the quantity of labor supplied and the quantity demanded, $L_3 - L_2$, is a surplus—a surplus that increases unemployment.

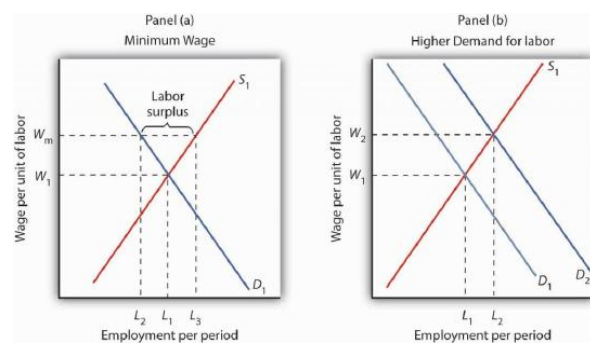


Figure 11.7 Alternative Responses to Low Wages Government can respond to a low wage by imposing a minimum wage of W_m in Panel (a). This increases the quantity of labor supplied and reduces the quantity demanded. It does, however, increase the income of those who keep their jobs. Another way the government can boost wages is by raising the demand for labor in Panel (b). Both wages and employment rise.

Some economists oppose increases in the minimum wage on grounds that such increases boost unemployment. Other economists argue that the demand for unskilled labor is relatively inelastic, so a higher minimum wage boosts the incomes of unskilled workers as a group. That gain, they say, justifies the policy, even if it increases unemployment.

An alternative approach to imposing a legal minimum is to try to boost the demand for labor. Such an approach is illustrated in Panel (b). An increase in demand to D_2 pushes the wage to W_2 and at the same time increases employment to L_2 . Public sector training programs that seek to increase human capital are examples of this policy.

Still another alternative is to subsidize the wages of workers whose incomes fall below a certain level. Providing government subsidies—either to employers who agree to hire unskilled workers or to workers themselves in the form of transfer payments—enables people who lack the skills—and the ability to acquire the skills—needed to earn a higher wage to earn more without the loss of jobs implied by a higher minimum wage. Such programs can be costly. They also reduce the incentive for low-skilled workers to develop the skills that are in greater demand in the marketplace.

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