CHAPTER

2 Model Building and Gains from Trade

BIG QUESTIONS

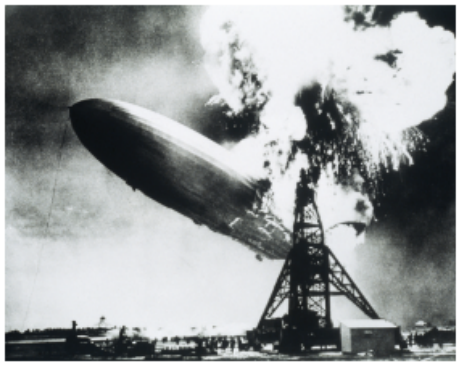
- **How do economists study the economy?**
- **What is a production possibilities frontier?**
- **What are the benefits of specialization and trade?**
- **What is the trade-off between having more now and having more later?**

How Do Economists Study the Economy?

Economics is a social science that uses the scientific method to develop *economic models*. To create these models, economists make many assumptions to simplify reality. These models help economists understand the key relationships that drive economic decisions.

The Scientific Method in Economics

On the television show *MythBusters*, Jamie Hyneman and Adam Savage put popular myths to the test. In Savage's words, "We replicate the circumstances, then duplicate the results." The entire show is dedicated to scientific testing of the myths. At the end of each episode, the myth is confirmed, decreed plausible, or busted. For instance, in a memorable episode, Hyneman and Savage explored the reasons behind the *Hindenburg* disaster. The *Hindenburg* was a German passenger airship, or zeppelin, that caught fire and became engulfed in flames as it attempted to dock in New Jersey on May 6, 1937. Thirty-six people died.



The scientific method was used to discover why the *Hindenburg* caught fire.

Some people have claimed that the fire was sparked by the painted fabric in which the zeppelin was wrapped. Others have suggested that the hydrogen used to give the airship lift was the primary cause of the disaster. To test the hypothesis (proposed explanation) that the paint used on the fabric was to blame, Hyneman and Savage built two small-scale models. The first model was filled with hydrogen and had a nonflammable skin. The second model used a replica of the original fabric for the skin but did not contain any hydrogen. Hyneman and Savage then compared their models' burn times with original footage of the disaster.

After examining the results, they "busted" the myth that the paint was to blame. Why? The model containing the hydrogen burned twice as fast as the one with just the painted fabric skin. It seems reasonable to conclude that hydrogen caused the disaster, not paint.

Economists work in much the same way as Hyneman and Savage: they use the scientific method to answer questions about observable phenomena and to explain how the world works. The scientific method consists of four steps:

- First, researchers observe a phenomenon that interests them.
- Next, based on these observations, researchers develop a *hypothesis*, which is a proposed explanation for the phenomenon.
- Then they construct a model to test the hypothesis.
- Finally, they design experiments to test how well the model (which is based on the hypothesis) works. After collecting data from the experiments, they can verify, revise, or refute the hypothesis.

The economist's laboratory is the world around us, and it ranges from the economy as a whole to the decisions made by firms and individuals. As a result, economists cannot always design experiments to test their hypotheses. Often, they must gather historical data or wait for real-world events to take place—for example, the Great Recession (economic downturn) of 2007–2009—to better understand the economy.

POSITIVE VS. NORMATIVE ANALYSIS

SHOW

Positive and Normative Analysis

As scientists, economists strive to approach their subject with objectivity. This means that they rigorously avoid letting personal beliefs and values influence the outcome of their analysis. To be as objective as possible, economists deploy positive analysis. A **positive statement** can be tested and validated. Each positive statement can be thought of as a description of "what is." For instance, the statement "The unemployment rate is 7%" is a positive statement because it can be tested by gathering data.

In contrast, a **normative statement** cannot be tested or validated; it is about "what ought to be." For instance, the statement "An unemployed worker should receive financial assistance to help make ends meet" is a matter of opinion. One can reasonably argue that financial assistance to the

unemployed is beneficial for society as a whole because it helps eliminate poverty. However, many argue that financial assistance to the unemployed provides the wrong incentives. If the financial assistance provides enough to meet basic needs, workers may end up spending more time unemployed than they otherwise would. Neither opinion is right or wrong; they are differing viewpoints based on values, beliefs, and opinions.

Economists are concerned with positive analysis. In contrast, normative statements are the realm of policymakers, voters, and philosophers. For example, if the unemployment rate rises, economists try to understand the conditions that created the situation. Economics does not attempt to determine who should receive unemployment assistance, which involves normative analysis. Maintaining a positive (as opposed to normative) framework is crucial for economic analysis because it allows decision-makers to observe the facts objectively.

Economic Models

Thinking like an economist means learning how to analyze complex issues and problems. Many economic topics, such as international trade, Social Security, job loss, and inflation, are complicated. To analyze these phenomena and to determine the effect of various government policy options related to them, economists use economic models, which are simplified versions of reality. Models help us analyze the components of the economy.

The Wright brothers' wind tunnel

A good model should be simple, flexible, and useful for making accurate predictions. Let's consider one of the most famous models in history, designed by Wilbur and Orville Wright. Before the Wright brothers made their famous first flight in 1903, they built a small wind tunnel out of a 6-foot-long wooden box. Inside the box they placed a device to measure aerodynamics, and at one end they attached a small fan to supply the wind. The brothers then tested over 200 different wing configurations to determine the lifting properties of each design. Using the data they collected, the Wright brothers were able to determine the best type of wing to use on their aircraft.

Similarly, economic models provide frameworks that help us to predict the effects of changes in prices, production processes, and government policies on real-life behavior.

Ceteris Paribus

Using a controlled setting that held many other variables constant enabled the Wright brothers to experiment with different wing designs. By altering only a single element—for example, the angle of the wing—they could test whether the change in design was advantageous. The process of examining a change in one variable while holding everything else constant involves a concept known as ***ceteris paribus***, from the Latin meaning "other things being equal" or "all else equal."

The *ceteris paribus* assumption is central to model building. If the Wright brothers had changed many design elements simultaneously and found that a new version of the wing worked better, they would have had no way of knowing which change was responsible for the improved performance. For this reason, engineers generally modify only one design element at a time and test only that one element before testing additional elements.

Like the Wright brothers, economists start with a simplified version of reality. Economists build models, change one variable at a time, and ask whether the change in the variable had a positive or negative impact on performance. Perhaps the best-known economic model is supply and demand, which we study in Chapter 3.

Endogenous versus Exogenous Factors

Models must account for factors that we can control and factors that we can't. Factors that we know about and can control are **endogenous factors**. The Wright brothers' wind tunnel was critical to their success because it allowed them to control for as many endogenous factors as possible. For example, the wind tunnel enabled the Wright brothers to see how well each wing design—an important part of the model—performed under controlled conditions.

Factors beyond our control—outside the model—are **exogenous factors**. Once the Wright brothers had determined the best wing design, they built the full-scale airplane that took flight at Kitty Hawk, North Carolina. At that point the plane, known as the "Flyer," was no longer in a controlled environment. It was subject to the gusting wind and other exogenous factors that made the first flight so challenging.

Building an economic model is very similar to the process Wilbur and Orville used. We need to be mindful of three factors: (1) what we include in the model, (2) the assumptions we make when choosing what to include in the model, and (3) the outside conditions that can affect the model's performance. In the case of the first airplane, the design was an endogenous factor because it was within the Wright brothers' control. In contrast, the weather (wind, air pressure, and other atmospheric conditions) was an exogenous factor because the Wright brothers could not control it. Because the world is a complex place, an airplane model that flies perfectly in a wind tunnel may not fly reliably when it is exposed to the elements. Therefore, if we add more exogenous variables, or factors we cannot control—for example, wind and rain—to test our model's performance, the test becomes more realistic.

The Danger of Faulty Assumptions

When we build a model, we need to make choices about which variables to include. Ideally, we would like to include all the important variables inside the model and exclude all the variables that should be ignored. However, no matter what we include, using a model that contains faulty assumptions can lead to spectacular failures. An excellent example is the financial crisis and Great Recession that began in December 2007.

In the years leading up to the crisis, banks sold and repackaged mortgage-backed investments under the faulty assumption that real estate prices will always rise. This assumption seemed perfectly reasonable in a world where real estate prices were rising annually. Unfortunately, the assumption turned out to be false. From 2006 to 2008, real estate prices fell. Because of one faulty assumption, the entire financial market teetered on the edge of collapse.

In the late 1990s and early 2000s, some investors believed that real estate prices could only rise.

What Is a Production Possibilities Frontier?

Now it's time to learn our first economic model. However, before you go on, you might want to review the appendix on graphing at the end of this chapter. Graphs are a key tool in economics because they display the relationship between two variables. Your ability to read a graph and understand the model it represents is crucial to learning economics.

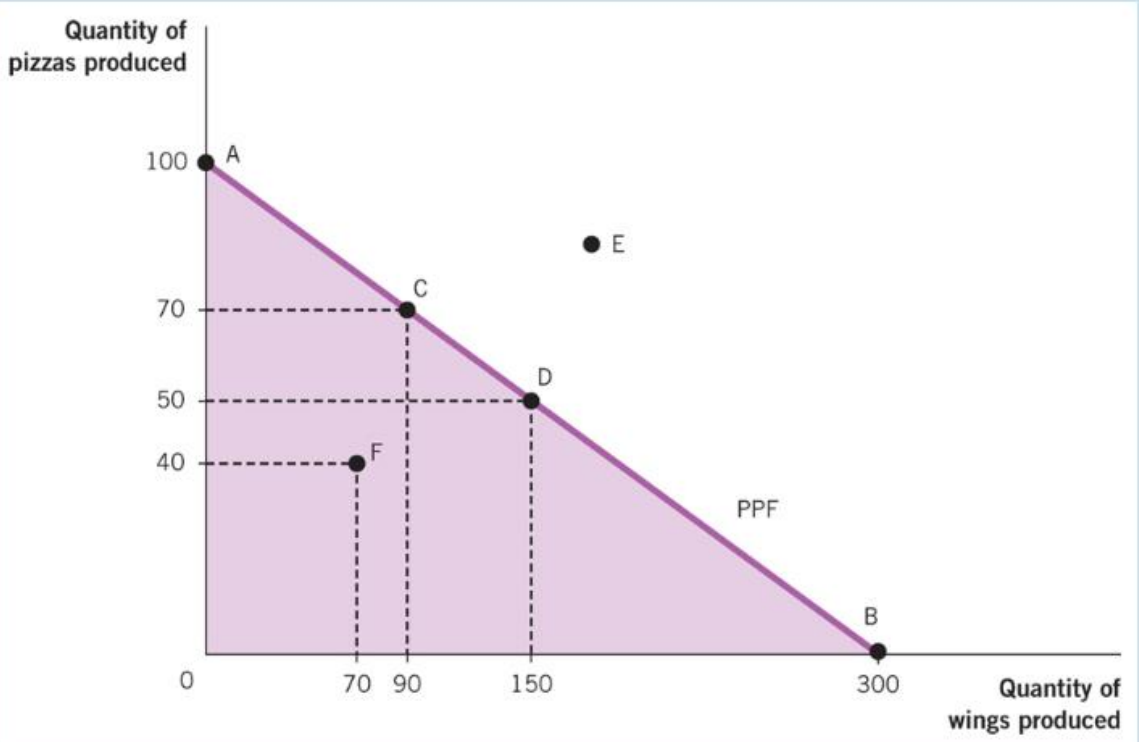
In Chapter 1, we learned that economics is about the trade-offs individuals and societies face every day. For instance, you may frequently have to decide between spending more time studying or hanging out with your friends. The more time you study, the less time you have for your friends. Similarly, a society has to determine how to allocate its resources. The decision to build new roads will mean that there is less money available for new schools, and vice versa.

A **production possibilities frontier (PPF)** is a model that illustrates the combinations of outputs that a society can produce if all of its resources are being used efficiently. An outcome is considered *efficient* when resources are fully utilized and potential output is maximized. To preserve *ceteris paribus*, we assume that the technology available for production and the quantity of resources remain fixed, or constant. These assumptions allow us to model trade-offs more clearly.

Let's begin by imagining a society that produces only two goods—pizza and chicken wings. This may not seem like a very realistic assumption, since a real economy produces millions of different goods and services, but this approach helps us understand trade-offs by keeping the analysis simple.

Figure 2.1 shows the production possibilities frontier for our simplified two-product society. Remember that the number of people and the total resources in this two-product society are fixed. If the economy uses all of its resources to produce pizza, it can produce 100 pizzas and 0 wings. If it uses all of its resources to produce wings, it can make 300 wings and 0 pizzas. These outcomes are represented by points A and B, respectively, on the production possibilities frontier. It is unlikely that the society will choose either of these extreme outcomes because it is human nature to enjoy variety.

FIGURE 2.1



The Production Possibilities Frontier for Pizza and Chicken Wings

The production possibilities frontier (PPF) shows the trade-off between producing pizza and producing wings. Any combination of pizza and wings is possible along, or inside, the line. Combinations of pizza and wings beyond the production possibilities frontier—for example, at point E—are not possible with the current set of resources. Point F and any other points located in the shaded region are inefficient.

If our theoretical society decides to spend some of its resources producing pizzas and some of its resources making wings, its economy will end up with a combination of pizza and wings that is somewhere along the PPF between points A and B. At point C, for example, the society would deploy its resources to produce 70 pizzas and 90 wings. At point D, the combination would be 50 pizzas and 150 wings. Each point along the production possibilities frontier represents a possible set of outcomes that the society can choose if it uses all of its resources efficiently.

Notice that some combinations of pizza and wings cannot be produced because not enough resources are available. Our theoretical society would enjoy point E, but given the available resources, it cannot produce that output level. Points beyond the production possibilities frontier are desirable but not feasible with the available resources and technology.

At any combination of wings and pizzas along the production possibilities frontier, the society is using all of its resources in the most efficient way possible. But what about point F and any other points located in the shaded region? These points represent outcomes inside the production possibilities frontier, and they indicate an inefficient use of the society's resources. Consider, for example, the labor resource. If employees spend many hours at work surfing the Web instead of doing their jobs, the output of pizza and wings will drop and the outcome will no longer be efficient. As long as workers use all of their time efficiently, they will produce an efficient amount of pizza and wings, and output will lie somewhere on the PPF.

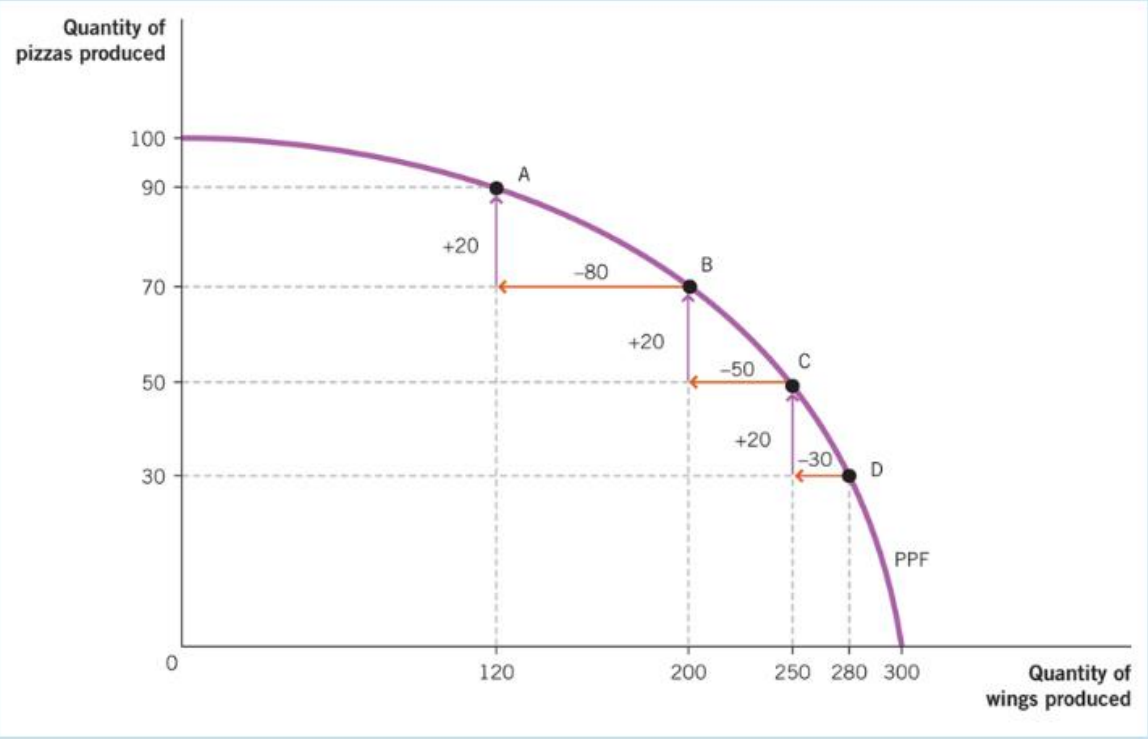
Whenever society is producing on the production possibilities frontier, the only way to get more of one good is to accept less of another. Because an economy operating at a point on the frontier will be efficient, economists do not favor one point over another. But a society may favor one point over another because it prefers that combination of goods. For example, in our theoretical two-good society, if wings suddenly become more popular, the movement from point C to point D will represent a desirable trade-off. The society will produce 20 fewer pizzas (decreasing from 70 to 50) but 60 additional wings (increasing from 90 to 150).

The Production Possibilities Frontier and Opportunity Cost

Because our two-good society produces only pizza and wings, the trade-offs that occur along the production possibilities frontier represent the opportunity cost of producing one good instead of the other. As we saw in Chapter 1, an opportunity cost is the highest-valued alternative given up to pursue another course of action. As Figure 2.1 shows, when society moves from point C to point D, it gives up 20 pizzas; this is the opportunity cost of producing more wings. The movement from point D to point C has an opportunity cost of 60 wings.

Until now, we have assumed a constant trade-off between the number of pizzas and the number of wings produced. However, not all resources in our theoretical society are perfectly adaptable for use in making pizza and wings. Some workers are good at making pizza, and others are not so good. When the society tries to make as many pizzas as possible, it will be using both types of workers. That is, to get more pizzas, the society will have to use workers who are increasingly less skilled at making them. For this reason, pizza production will not expand at a constant rate. You can see this effect in the new production possibilities frontier in Figure 2.2; it is bowed outward rather than a straight line.

FIGURE 2.2



The Law of Increasing Opportunity Cost

To make more pizzas, the society will have to use workers who are increasingly less skilled at making them. As a result, as we move up along the PPF, the opportunity cost of producing an extra 20 pizzas rises from 30 wings between points D and C to 80 wings between points B and A.

Because resources are not perfectly adaptable, production does not expand at a constant rate. For example, to produce 20 extra pizzas, the society can move from point D (30 pizzas) to point C (50 pizzas). But moving from point D (280 wings) to point C (250 wings) means giving up 30 wings. So moving from point D to point C has an opportunity cost of 30 wings.

Now suppose that the society decides it wants even more pizzas and moves from point C (50 pizzas) to point B (70 pizzas). Now the opportunity cost of 20 more pizzas is 50 wings, because wing production declines from 250 to 200. If the society decides that 70 pizzas are not enough, it can expand pizza production from point B (70 pizzas) to point A (90 pizzas). Now the society gives up 80 wings. Notice that as we move up along the PPF from point D to point A, the opportunity cost of producing an extra 20 pizzas rises from 30 wings to 80 wings. This higher opportunity cost reflects the increased trade-off necessary to produce more pizzas.

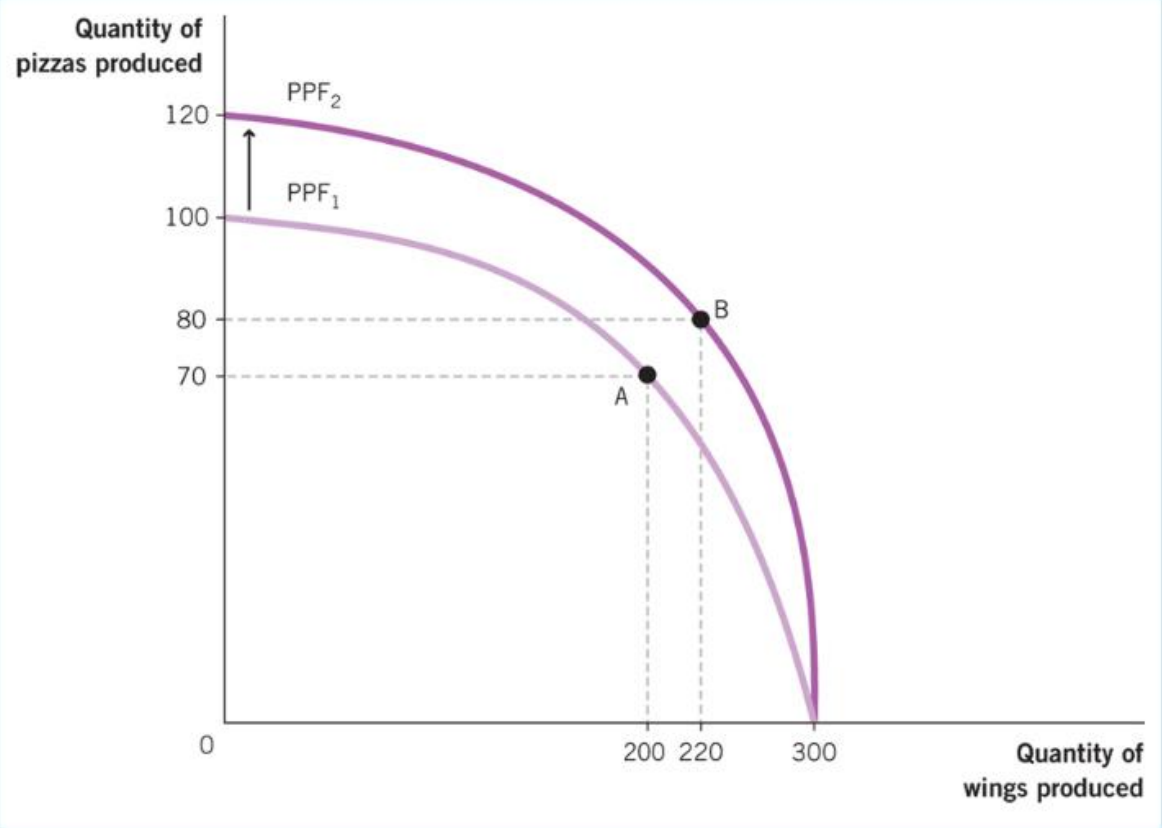
A bowed-out production possibilities frontier reflects the increasing opportunity cost of production. Figure 2.2 illustrates the **law of increasing opportunity cost**, which states that the opportunity cost of producing a good rises as a society produces more of it. Changes in relative cost mean that a society faces a significant trade-off if it tries to produce an extremely large amount of a single good.

The Production Possibilities Frontier and Economic Growth

So far, we have modeled the production possibilities frontier based on the resources available to society at a particular moment in time. However, most societies hope to create economic growth. *Economic growth* is the process that enables a society to produce more output in the future.

We can use the production possibilities frontier to explore economic growth. For example, we can ask what would happen to the PPF if our two-good society develops a new technology that increases efficiency. Suppose that a new pizza assembly line improves the pizza production process and that the new assembly line does not require the use of more resources—it simply redeploys the resources that already exist. This development would allow the society to make more pizza with the same number of workers. Or it would allow the same amount of pizza to be made with fewer workers than previously. Either way, the society has expanded its resource base. Figure 2.3 shows this change as a shift in the PPF.

FIGURE 2.3



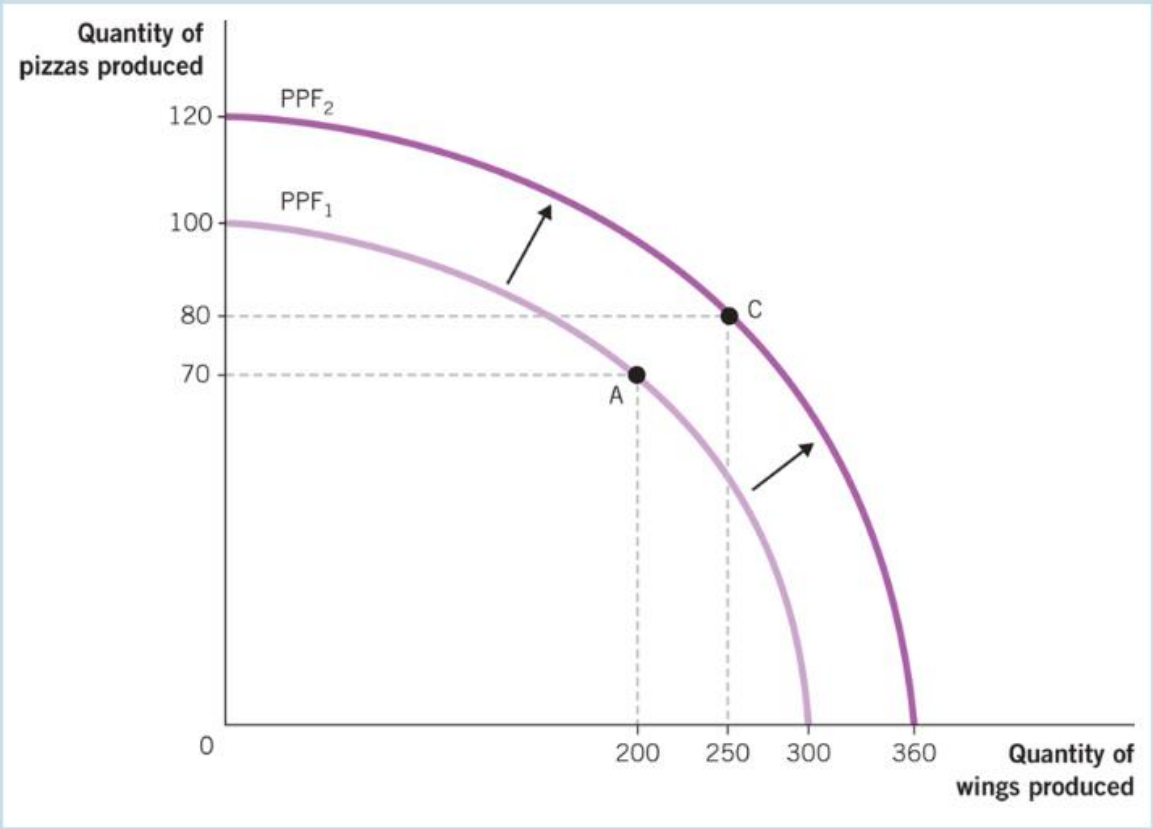
A Shift in the Production Possibilities Frontier

A new pizza assembly line that improves the productive capacity of pizza makers shifts the PPF upward from PPF_1 to PPF_2. More pizzas can be produced. Comparing points A and B, you can see that the enhanced pizza-making capacity also makes it possible to produce more wings at the same time.

With the new technology, it becomes possible to produce 120 pizzas using the same number of workers and in the same amount of time that it previously took to produce 100 pizzas. Although the ability to produce wings has not changed, the new pizza-making technology expands the production possibilities frontier outward from PPF_1 to PPF_2. It is now possible for the society to move from point A to point B, where it can produce more of both goods (80 pizzas and 220 wings). Why can the society produce more of both? Because the improvement in pizza-making technology—the assembly line—allows a redeployment of the labor force that also increases the production of wings. Improvements in technology make point B possible.

The production possibilities frontier will also expand if the population grows. A larger population means more workers to make pizza and wings. Figure 2.4 illustrates what happens when the society adds workers to help produce pizza and wings. With more workers, the society can produce more pizzas and wings than before. The PPF curve shifts from PPF_1 to PPF_2, expanding up along the y axis and out along the x axis. Like improvements in technology, additional resources expand the frontier and allow the society to reach a point—in this case, point C—that was not possible before. The extra workers have pushed the entire frontier out—not just one end of it, as the pizza assembly line did.

FIGURE 2.4



More Resources and the Production Possibilities Frontier

When more resources (such as additional workers) are available for the production of either pizza or wings, the entire PPF shifts upward and outward. This shift makes point C, along PPF_2, possible.

What Are the Benefits of Specialization and Trade?

We have seen that improving technology and adding resources make an economy more efficient. A third way to create gains for society is through specialization and trade. **Specialization** is the limiting of one's work to a particular area. Determining what to specialize in is an important part of the process. Every worker, business, or country is relatively good at producing certain products or services. Suppose that you decide to learn about information technology. You earn a certificate or degree and find an employer who hires you for your specialized skills. Your information technology skills determine your salary. You can then use your salary to purchase other goods and services that you desire and that you are not so skilled at making yourself.

In the next section, we explore why specializing and exchanging your skilled expertise with others makes gains from trade possible.

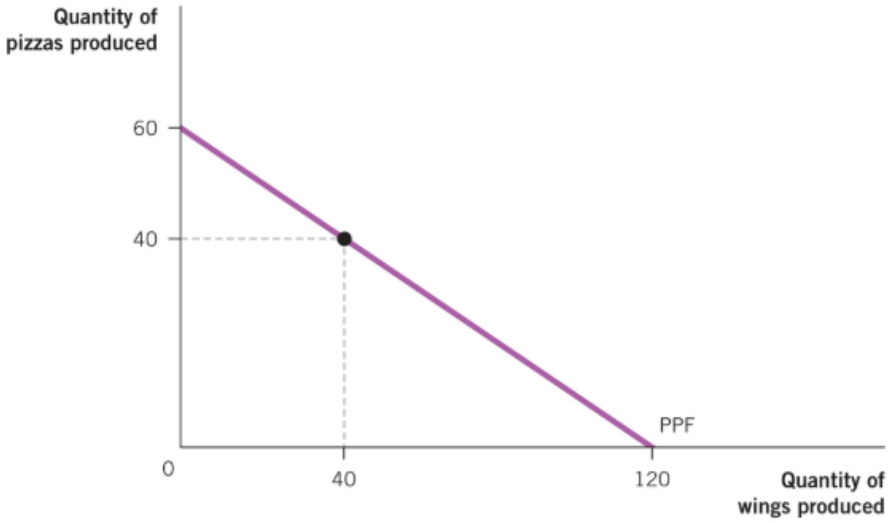
Gains from Trade

Let's return to our two-good economy. Now we'll make the further assumption that this economy has only two people. One person is better at making pizzas, and the other is better at making wings. In this case, the potential gains from trade are clear. Each person will specialize in what he or she is better at producing and then will trade to acquire some of the good produced by the other person.

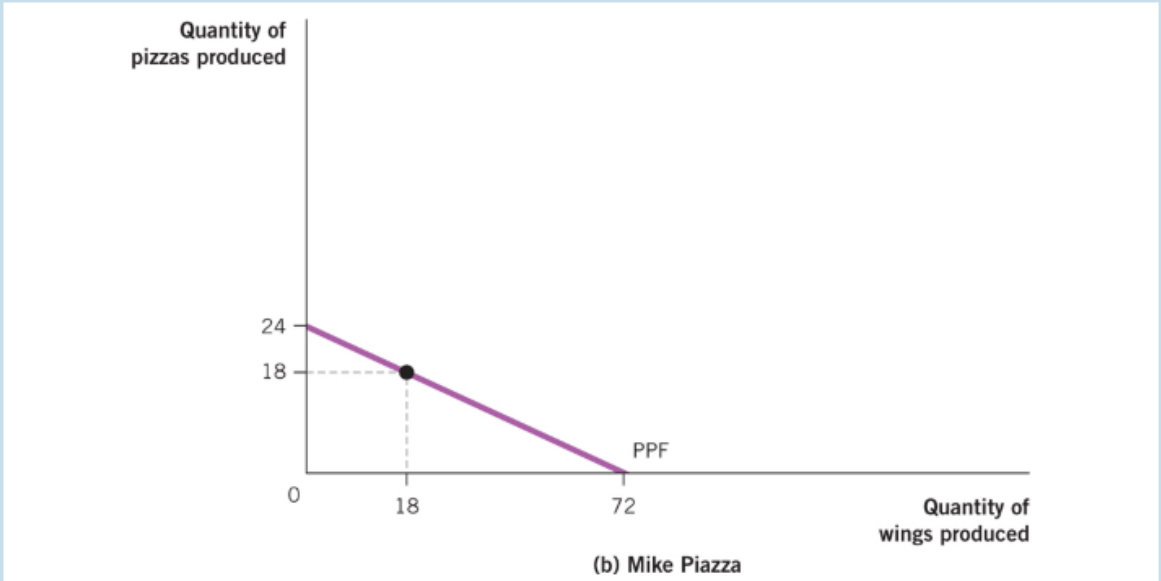
Figure 2.5 shows the production potential of the two people in our economy, Debra Winger and Mike Piazza. From the table at the top of the figure, we see that if Debra Winger devotes all of her work time to making pizzas, she can produce 60 pizzas. If she does not spend any time on pizzas, she can make 120 wings. In contrast, Mike Piazza can spend all his time on pizzas and produce 24 pizzas or all his time on wings and produce 72 wings.

FIGURE 2.5

Person	Daily production	
	Pizzas	Wings
Debra Winger	60	120
Mike Piazza	24	72



(a) Debra Winger



The Production Possibilities Frontier with No Trade

(a) If Debra cannot trade with Mike, she chooses to produce 40 pizzas and 40 wings, because she likes both foods equally.

(b) If Mike cannot trade with Debra, he chooses to produce 18 pizzas and 18 wings, because he likes both foods equally.

The graphs illustrate the amount of pizza and wings that each person produces daily. Wing production is plotted on the *x* axis, pizza production on the *y* axis. Each production possibilities frontier is drawn from the data in the table at the top of the figure.

Debra and Mike each face a constant trade-off between producing pizza and producing wings. Debra produces 60 pizzas for every 120 wings; this means her trade-off between producing pizza and producing wings is fixed at 60:120, or 1:2. Mike produces 24 pizzas for every 72 wings. His trade-off between producing pizza and producing wings is fixed at 24:72, or 1:3. Because Debra and Mike can choose to produce at any point along their production possibilities frontiers, let's assume that they each want to produce an equal number of pizzas and wings. In this case, Debra produces 40 pizzas and 40 wings, while Mike produces 18 pizzas and 18 wings. Since Debra is more productive in general, she produces more of each food. Debra has an **absolute advantage**, meaning she can produce more than Mike can produce with the same quantity of resources.

At first glance, it would appear that Debra should continue to work alone. But consider what happens if Debra and Mike each specialize and then trade. Table 2.1 compares production with and without specialization and trade. Without trade, Debra and Mike have a combined production of 58 units of pizza and 58 units of wings (Debra's 40 + Mike's 18). But when Debra specializes and produces only pizza, her production is 60 units. In this case, her individual pizza output is greater than the combined output of 58 pizzas (Debra's 40 + Mike's 18). Similarly, if Mike specializes in wings, he is able to make 72 units. His individual wing output is greater than their combined output of 58 wings (Debra's 40 + Mike's 18). Specialization has resulted in the production of 2 additional pizzas and 14 additional wings.

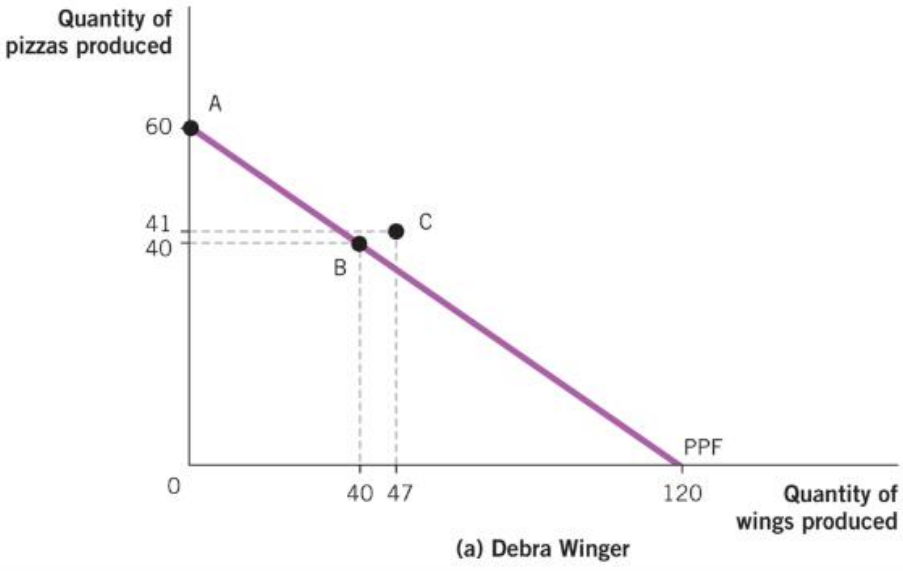
TABLE 2.1

The Gains from Trade

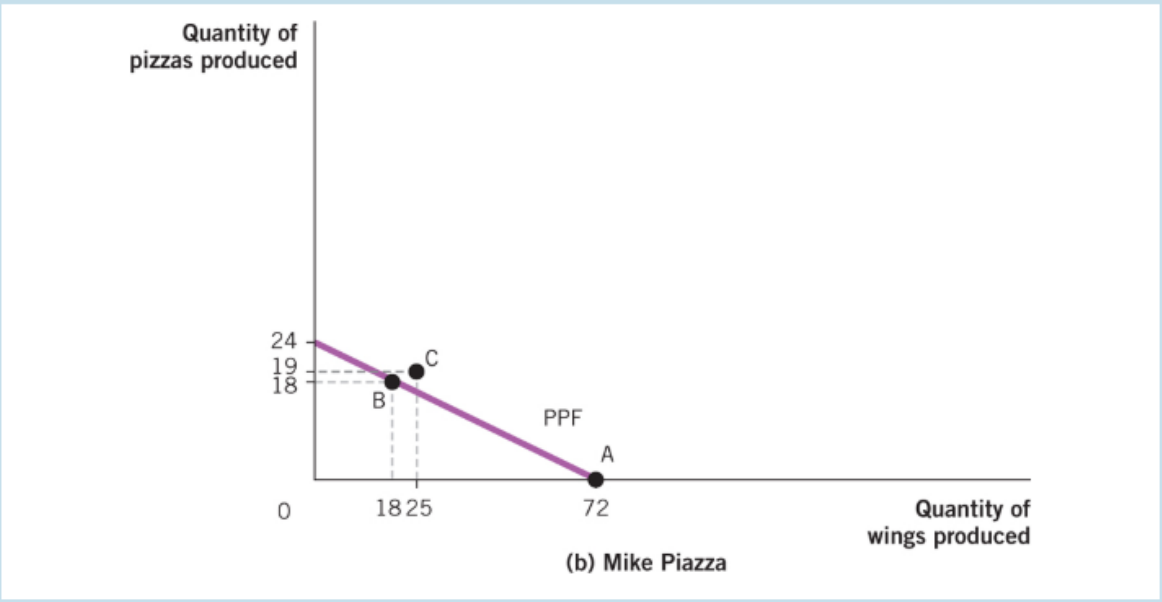
		Without trade		With specialization and trade		Gains from trade
Person	**Good**	**Production**	**Consumption**	**Production**	**Consumption**	
Debra	Pizza	40	40	60	41 (keeps)	+1
	Wings	40	40	0	47 (from Mike)	+7
Mike	Pizza	18	18	0	19 (from Debra)	+1
	Wings	18	18	72	25 (keeps)	+7

Specialization leads to greater output. But Debra and Mike would like to eat both pizza and wings. So if they specialize and then trade with each other, they will benefit. If Debra gives Mike 19 pizzas in exchange for 47 wings, they are each better off by 1 pizza and 7 wings. This result is evident in the final column of Table 2.1 and in Figure 2.6.

FIGURE 2.6



(a) Debra Winger



The Production Possibilities Frontier with Trade

(a) If Debra produces only pizza, she will have 60 pizzas, shown at point A. If she does not specialize, she will produce 40 pizzas and 40 wings (point B). If she specializes and trades with Mike, she will have 41 pizzas and 47 wings (point C).

(b) If Mike produces only wings, he will have 72 wings (point A). If he does not specialize, he will produce 18 pizzas and 18 wings (point B). If he specializes and trades with Debra, he can have 19 pizzas and 25 wings (point C).

In Figure 2.6a, we see that at point A, Debra produces 60 pizzas and 0 wings. If she does not specialize, she produces 40 pizzas and 40 wings, represented at point B. If she specializes and then trades with Mike, she can have 41 pizzas and 47 wings, shown at point C. Her value gained from trade is 1 pizza and 7 wings. In Figure 2.6b, we see a similar benefit for Mike. If he produces only wings, he will have 72 wings, shown at point A. If he does not specialize, he produces 18 pizzas and 18 wings (point B). If he specializes and trades with Debra, he can have 19 pizzas and 25 wings, shown at point C. His value gained from trade is 1 pizza and 7 wings. In spite of Debra's absolute advantage in making both pizza and wings, she is still better off trading with Mike. This amazing result occurs because of specialization. When Debra and Mike spend their time on what they do best, they are able to produce more collectively and then divide the gain.

Comparative Advantage

We have seen that specialization enables workers to enjoy gains from trade. The concept of opportunity cost provides us with a second way of validating the principle that trade creates value. Recall that opportunity cost is the highest-valued alternative that is sacrificed to pursue something else. Looking at Table 2.2, you can see that in order to produce 1 more pizza, Debra must give up producing 2 wings. We can say that the opportunity cost of 1 pizza is 2 wings. We can also reverse the observation and say that the opportunity cost of one wing is $\frac{1}{2}$ pizza. In Mike's case, each pizza he produces means giving up the production of 3 wings. In other words, the opportunity cost for him to produce 1 pizza is 3 wings. In reverse, we can say that when he produces 1 wing, he gives up $\frac{1}{3}$ pizza.

TABLE 2.2

The Opportunity Cost of Pizza and Wings

	Opportunity cost	
Person	**1 Pizza**	**1 Wing**
Debra Winger	2 wings	$\frac{1}{2}$ pizza
Mike Piazza	3 wings	$\frac{1}{3}$ pizza

Recall from Chapter 1 that comparative advantage is the ability to make a good at a lower opportunity cost than another producer. Looking at Table 2.2, you can see that Debra has a lower opportunity cost of producing pizza than Mike does—she gives up 2 wings for each pizza she produces, while he gives up 3 wings for each pizza he produces. In other words, Debra has a comparative advantage in producing pizzas. However, Debra does not have a comparative advantage in producing wings. For Debra to produce 1 wing, she would have to give up production of $\frac{1}{2}$ pizza. Mike, in contrast, gives up $\frac{1}{3}$ pizza each time he produces 1 wing. So Debra's opportunity cost for producing wings is higher than Mike's. Because Mike is the low-opportunity-cost producer of wings, he has a comparative advantage in producing them. Recall that Debra has an absolute advantage in the production of both pizzas and wings; she is better at making both. However, from this example we see that she cannot have a comparative advantage in making both goods.

Applying the concept of opportunity cost helps us see why specialization enables people to produce more. Debra's opportunity cost of producing pizzas (she gives up 2 wings for every pizza) is less than Mike's opportunity cost of producing pizzas (he gives up 3 wings for every pizza). Therefore, Debra should specialize in producing pizzas. If you want to double-check this result, consider who should produce wings. Debra's opportunity cost of producing wings (she gives up $\frac{1}{2}$ pizza for every wing she makes) is more than Mike's opportunity cost of producing wings (he gives up $\frac{1}{3}$ pizza for every wing he makes). Therefore, Mike should specialize in producing wings. When

Debra produces only pizzas and Mike produces only wings, their combined output is 60 pizzas and 72 wings.

Finding the Right Price to Facilitate Trade

We have seen that Debra and Mike will do better if they specialize and then trade. But how many wings should it cost to buy a pizza? How many pizzas for a wing? In other words, what trading price will benefit both parties? To answer this question, we need to return to opportunity cost. For context, think of the process you likely went through when trading lunch food with friends in grade school. Perhaps you wanted a friend's apple and he wanted a few of your Oreos. If you agreed to trade three Oreos for the apple, the exchange benefited both parties because you valued your three cookies less than your friend's apple and your friend valued your three cookies more than his apple.

In our example, Debra and Mike will benefit from exchanging a good at a price that is lower than the opportunity cost of producing it. Recall that Debra's opportunity cost is 1 pizza per 2 wings. We can express this opportunity cost as a ratio of 1:2. This means that any exchange with a value lower than 1:2 (0.50) will be beneficial to her because she ends up with more pizza and wings than she had without trade. Mike's opportunity cost is 1 pizza per 3 wings, or a ratio of 1:3 (0.33). For trade to be mutually beneficial, the amount exchanged must fall between Debra's opportunity cost of 1:2 and Mike's opportunity cost of 1:3. Outside of that range, either Debra or Mike will be better off without trade, because the trade will not be attractive to both parties. In the example shown in Table 2.3, Debra trades 19 pizzas for 47 wings. The ratio of 19:47 (0.40) falls between Debra's and Mike's opportunity costs and is therefore advantageous to both of them.

TABLE 2.3

Gaining from Trade

Person	Opportunity cost	Ratio
Debra Winger	1 pizza equals 2 wings	1:2 = 0.50
Terms of trade	19 pizzas for 47 wings	19:47 = 0.40
Mike Piazza	1 pizza equals 3 wings	1:3 = 0.33

As long as the terms of trade fall between the trading partners' opportunity costs, the trade benefits both sides. But if Mike insists on a trading ratio of 1 wing for 1 pizza, which would be a good deal for him, Debra will refuse to trade because she will be better off producing both goods on her own. Likewise, if Debra insists on receiving 4 wings for every pizza she gives to Mike, he will refuse to trade with her because he will be better off producing both goods on his own.

What Is the Trade-off between Having More Now and Having More Later?

So far, we have examined short-run trade-offs. In looking at our wings–pizza trade-off, we were essentially living in the moment. But both individuals and society as a whole must weigh the benefits available today (the short run) with those available tomorrow (the long run). In the **short run**, we make decisions that reflect our immediate or short-term wants, needs, or limitations. In the short run, consumers can partially adjust their behavior. In the **long run**, we make decisions that reflect our wants, needs, and limitations over a much longer time horizon. In the long run, consumers have time to fully adjust to market conditions.

Many of life's important decisions are about the long run. We must decide where to live, whether and whom to marry, whether and where to go to college, and what type of career to pursue. Getting these decisions right is far more important than simply deciding how many wings and pizzas to produce. For instance, the decision to save money requires giving up something you want to buy today for the benefit of having more money available in the future. Similarly, if you decide to go to a party tonight, you benefit today, while staying home to study creates a larger benefit at exam time. We are constantly making decisions that reflect this tension between today and tomorrow—eating a large piece of cake or a healthy snack, taking a nap or exercising at the gym, buying a jet ski or purchasing stocks in the stock market. Each of these decisions is a trade-off between the present and the future.

Consumer Goods, Capital Goods, and Investment

We have seen that the trade-off between the present and the future is evident in the tension between what we consume now and what we plan to consume later. Any good that is produced for present consumption is a **consumer good**. These goods help to satisfy our needs or wants now. Food, entertainment, and clothing are all examples of consumer goods. **Capital goods** help in the production of other valuable goods and services in the future. Capital goods are everywhere. Roads, factories, trucks, and computers are all capital goods.

Education is a form of capital. The time you spend earning a college degree makes you more attractive to future employers. When you decide to go to college instead of working, you are investing in your *human capital*. **Investment** is the process of using resources to create or buy new capital.

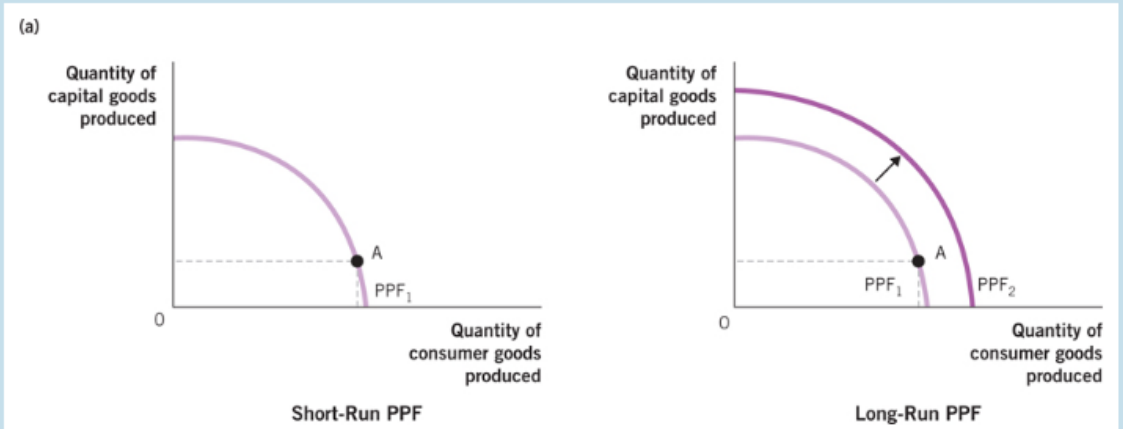
Because we live in a world with scarce resources, every investment in capital goods has an opportunity cost of forgone consumer goods. For example, if you decide to buy a new laptop, you cannot use the money to travel over spring break. Similarly, a firm that decides to invest in a new factory to expand future production is unable to use that money to hire more workers now.

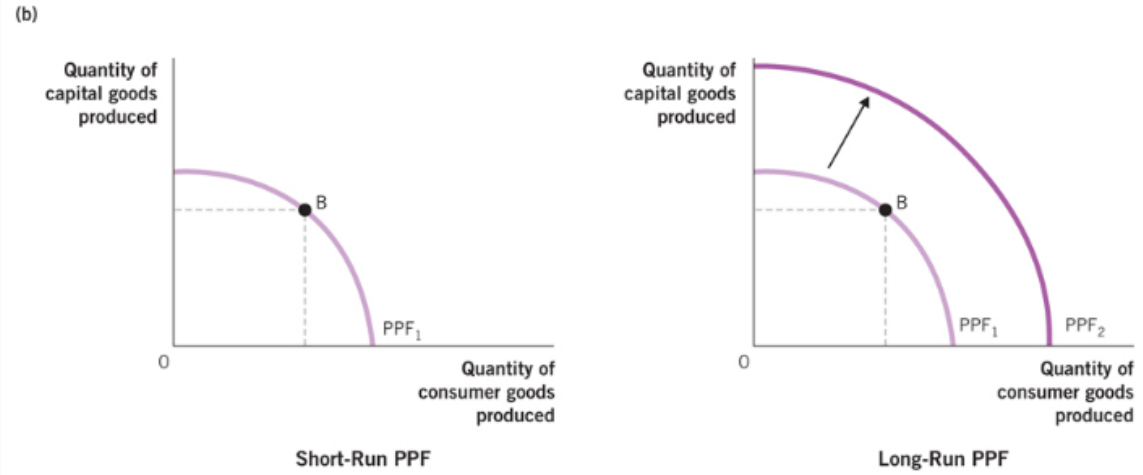
Study now . . .

. . . enjoy life later.

The decision between whether to consume or to invest has a significant impact on economic growth in the future, or long run. What happens when society chooses to produce many more consumer goods than capital goods? Figure 2.7a shows the result. When relatively few resources are invested in producing capital goods in the short run, very little new capital is created. Because new capital is a necessary ingredient for economic growth in the future, the long-run production possibilities curve expands only a small amount.

FIGURE 2.7





Investing in Capital Goods and Promoting Growth

(a) When a society chooses point A in the short run, very few capital goods are created. Because capital goods are needed to enhance future growth, the long-run PPF_2 expands, but only slightly.

(b) When a society chooses point B in the short run, many capital goods are created, and the long-run PPF_2 expands significantly.

What happens when society chooses to plan for the future by producing more capital goods than consumer goods in the short run? Figure 2.7b shows the result. With investment in new capital, the long-run production possibilities curve expands outward much more.

Failing to Account for Exogenous Factors When Making Predictions

Predictions are often based on past experiences and current observations. Often the least accurate predictions fail to take into account how much technological change influences the economy. Here we repeat a few wildly inaccurate predictions as a cautionary reminder that technology doesn't remain constant.

PREDICTION: "There is no reason anyone would want a computer in their home." Said in 1977 by Ken Olson, founder of Digital Equipment Corp. (DEC), a maker of mainframe computers.

FAIL: Over 80% of all American households have a computer today.

PREDICTION: "There will never be a bigger plane built." Said in 1933 by a Boeing engineer referring to the 247, a twin-engine plane that holds 10 people.

FAIL: Today, the Airbus A380 can hold more than 800 people.

PREDICTION: "The world potential market for copying machines is five thousand at most." Said in 1959 by executives of IBM to the people who founded Xerox.

FAIL: Today, a combination printer, fax machine, and copier costs less than $100. There are tens of millions of copiers in use throughout the United States.

These predictions may seem funny to us today, but note the common feature: they did not account for how new technology would affect consumer demand and behavior. Nor did these predictions anticipate how improvements in technology through time make future versions of new products substantially better. The lesson: Don't count on the status quo. Adapt with the times to take advantage of opportunities.

Source: Listverse.com, "Top 30 Failed Technology Predictions."

Conclusion

Does trade create winners and losers? After reading this chapter, you know the answer: trade creates value. We have dispelled the misconception that every trade results in a winner and a loser. The simple, yet powerful, idea that trade creates value has far-reaching consequences for how we should organize our society.

We have also developed our first model, the production possibilities frontier. This model illustrates the benefits of trade and also enables us to describe ways to grow the economy. Trade and growth rest on a more fundamental idea—specialization. When producers specialize, they focus their efforts on those goods and services for which they have the lowest opportunity cost and trade with others who are good at making something else. To have something valuable to trade, each producer, in effect, must find its comparative advantage. As a result, trade creates value and contributes to an improved standard of living in society.

In the next chapter, we examine the supply and demand model to illustrate how markets work. While the model is different, the fundamental result we learned here—that trade creates value—still holds.

ANSWERING THE BIG QUESTIONS

How do economists study the economy?

- Economists design hypotheses (proposed explanations) and then test them by collecting real data. The economist's laboratory is the world around us.
- A good model should be simple, flexible, and useful for making accurate predictions. A model is both more realistic and harder to understand when it involves many variables. To keep models simple, economists often use the concept of *ceteris paribus*, or "all else equal." Maintaining a positive (as opposed to normative) framework is crucial for economic analysis because it allows decision-makers to observe the facts objectively.

What is a production possibilities frontier?

- A production possibilities frontier (PPF) is a model that illustrates the combinations of outputs that a society can produce if all of its resources are being used efficiently. An outcome is considered efficient when resources are fully utilized and potential output is maximized. Economists use the PPF to illustrate trade-offs and to explain opportunity costs and the role of additional resources and technology in creating economic growth.

What are the benefits of specialization and trade?

- Society is better off if individuals and firms specialize and trade on the basis of the principle of comparative advantage.
- Parties that are better at producing goods and services than all their potential trading partners (and thus hold an absolute advantage) still benefit from trade. Trade allows them to specialize and trade what they produce for other goods and services that they are relatively less skilled at making.
- As long as the terms of trade fall between the opportunity costs of both trading partners, the trade benefits both sides.

What is the trade-off between having more now and having more later?

- All societies face a crucial trade-off between consumption in the short run and economic growth in the long run. Investments in capital goods today help to spur economic growth in the future. However, because capital goods are not consumed in the short run, society must be willing to sacrifice how well it lives today in order to have more later.