After studying this chapter, you will be able to:

- Define the production possibilities frontier and use it to calculate opportunity cost
- Distinguish between production possibilities and preferences and describe an efficient allocation of resources
- Explain how current production choices expand future production possibilities
- Explain how specialization and trade expand production possibilities
- Describe the economic institutions that coordinate decisions

2 THE ECONOMIC PROBLEM

Why does food cost much more today than it did a few years ago? One reason is that we now use part of our corn crop to produce ethanol, a clean biofuel substitute for gasoline. Another reason is that drought in some parts of the world has decreased global grain production. In this chapter, you will study an economic model—the production possibilities frontier—and you will learn why ethanol production and drought have increased the cost of producing food. You will also learn how to assess whether it is a good idea to increase corn production to produce fuel; how we can expand our production possibilities; and how we gain by trading with others.

At the end of the chapter, in *Reading Between the Lines*, we'll apply what you've learned to understanding why ethanol production is raising the cost of food.

Production Possibilities and Opportunity Cost

Every working day, in mines, factories, shops, and offices and on farms and construction sites across the United States, 138 million people produce a vast variety of goods and services valued at $50 billion. But the quantities of goods and services that we can produce are limited both by our available resources and by technology. And if we want to increase our production of one good, we must decrease our production of something else—we face a tradeoff. You are going to learn about the production possibilities frontier, which describes the limit to what we can produce and provides a neat way of thinking about and illustrating the idea of a tradeoff.

The **production possibilities frontier** (*PPF*) is the boundary between those combinations of goods and services that can be produced and those that cannot. To illustrate the *PPF*, we focus on two goods at a time and hold the quantities produced of all the other goods and services constant. That is, we look at a *model* economy in which everything remains the same except for the production of the two goods we are considering.

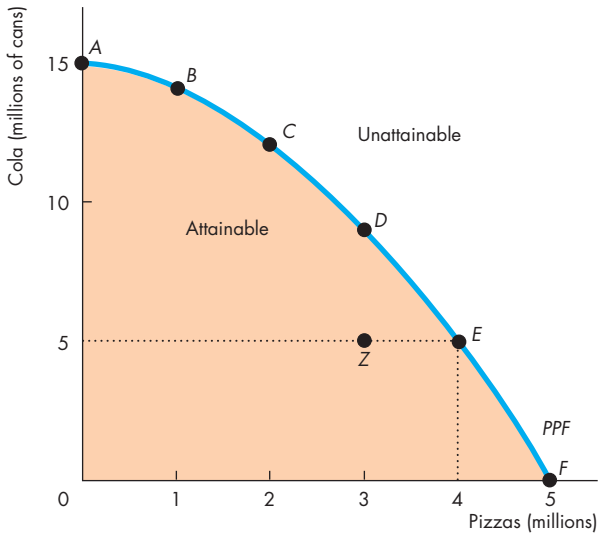
Let's look at the production possibilities frontier for cola and pizza, which represent *any* pair of goods or services.

Production Possibilities Frontier

The *production possibilities frontier* for cola and pizza shows the limits to the production of these two goods, given the total resources and technology available to produce them. Figure 2.1 shows this production possibilities frontier. The table lists some combinations of the quantities of pizza and cola that can be produced in a month given the resources available. The figure graphs these combinations. The *x*-axis shows the quantity of pizzas produced, and the *y*-axis shows the quantity of cola produced.

The *PPF* illustrates *scarcity* because we cannot attain the points outside the frontier. These points describe wants that can't be satisfied. We can produce at any point *inside* the *PPF* or *on* the *PPF*. These points are attainable. Suppose that in a typical month, we produce 4 million pizzas and 5 million cans of cola. Figure 2.1 shows this combination as point *E* and as possibility *E* in the table. The figure

FIGURE 2.1 Production Possibilities Frontier



Possibility	Pizzas (millions)		Cola (millions of cans)
A	0	and	15
B	1	and	14
C	2	and	12
D	3	and	9
E	4	and	5
F	5	and	0

The table lists six production possibilities for cola and pizzas. Row *A* tells us that if we produce no pizzas, the maximum quantity of cola we can produce is 15 million cans. Points *A*, *B*, *C*, *D*, *E*, and *F* in the figure represent the rows of the table. The curve passing through these points is the production possibilities frontier (*PPF*).

The *PPF* separates the attainable from the unattainable. Production is possible at any point *inside* the orange area or *on* the frontier. Points outside the frontier are unattainable. Points inside the frontier, such as point *Z*, are inefficient because resources are wasted or misallocated. At such points, it is possible to use the available resources to produce more of either or both goods.

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also shows other production possibilities. For example, we might stop producing pizza and move all the people who produce it into producing cola. Point *A* in the figure and possibility *A* in the table show this case. The quantity of cola produced increases to 15 million cans, and pizza production dries up. Alternatively, we might close the cola factories and switch all the resources into producing pizza. In this situation, we produce 5 million pizzas. Point *F* in the figure and possibility *F* in the table show this case.

Production Efficiency

We achieve **production efficiency** if we produce goods and services at the lowest possible cost. This outcome occurs at all the points *on* the *PPF*. At points *inside* the *PPF*, production is inefficient because we are giving up more than necessary of one good to produce a given quantity of the other good.

For example, at point *Z* in Fig. 2.1, we produce 3 million pizzas and 5 million cans of cola. But we have enough resources to produce 3 million pizzas and 9 million cans of cola. Our pizzas cost more cola than necessary. We can get them for a lower cost. Only when we produce *on* the *PPF* do we incur the lowest possible cost of production.

Production is *inefficient* inside the *PPF* because resources are either *unused* or *misallocated* or both.

Resources are *unused* when they are idle but could be working. For example, we might leave some of the factories idle or some workers unemployed.

Resources are *misallocated* when they are assigned to tasks for which they are not the best match. For example, we might assign skilled pizza chefs to work in a cola factory and skilled cola producers to work in a pizza shop. We could get more pizzas *and* more cola from these same workers if we reassigned them to the tasks that more closely match their skills.

Tradeoff Along the *PPF*

Every choice *along* the *PPF* involves a *tradeoff*. On the *PPF* in Fig. 2.1, we trade off cola for pizzas.

Tradeoffs arise in every imaginable real-world situation in which a choice must be made. At any given point in time, we have a fixed amount of labor, land, capital, and entrepreneurship. By using our available technologies, we can employ these resources to produce goods and services, but we are limited in what we can produce. This limit defines a boundary between what we can attain and what we cannot attain. This boundary is the real-world's production possibilities frontier, and it defines the tradeoffs that we must make. On our real-world *PPF*, we can produce more of any one good or service only if we produce less of some other goods or services.

When doctors want to spend more on AIDS and cancer research, they face a tradeoff: more medical research for less of some other things. When Congress wants to spend more on education and health care, it faces a tradeoff: more education and health care for less national defense or less homeland security. When an environmental group argues for less logging, it is suggesting a tradeoff: greater conservation of endangered wildlife for less paper. When you want to study more, you face a tradeoff: more study time for less leisure or sleep.

All tradeoffs involve a cost—an opportunity cost.

Opportunity Cost

The **opportunity cost** of an action is the highest-valued alternative forgone. The *PPF* makes this idea precise and enables us to calculate opportunity cost. Along the *PPF*, there are only two goods, so there is only one alternative forgone: some quantity of the other good. Given our current resources and technology, we can produce more pizzas only if we produce less cola. The opportunity cost of producing an additional pizza is the cola we *must* forgo. Similarly, the opportunity cost of producing an additional can of cola is the quantity of pizza we must forgo.

In Fig. 2.1, if we move from point *C* to point *D*, we get 1 million more pizzas but 3 million fewer cans of cola. The additional 1 million pizzas *cost* 3 million cans of cola. One pizza costs 3 cans of cola.

We can also work out the opportunity cost of moving in the opposite direction. In Fig. 2.1, if we move from point *D* to point *C*, the quantity of cola produced increases by 3 million cans and the quantity of pizzas produced decreases by 1 million. So if we choose point *C* over point *D*, the additional 3 million cans of cola *cost* 1 million pizzas. One can of cola costs 1/3 of a pizza.

Opportunity Cost Is a Ratio Opportunity cost is a ratio. It is the decrease in the quantity produced of one good divided by the increase in the quantity produced of another good as we move along the production possibilities frontier.

Because opportunity cost is a ratio, the opportunity cost of producing an additional can of cola is equal to the *inverse* of the opportunity cost of producing an additional pizza. Check this proposition by returning to the calculations we've just worked through. When we move along the *PPF* from *C* to *D*, the opportunity cost of a pizza is 3 cans of cola. The inverse of 3 is 1/3. If we decrease the production of pizza and increase the production of cola by moving from *D* to *C*, the opportunity cost of a can of cola must be 1/3 of a pizza. That is exactly the number that we calculated for the move from *D* to *C*.

Increasing Opportunity Cost The opportunity cost of a pizza increases as the quantity of pizzas produced increases. The outward-bowed shape of the *PPF* reflects increasing opportunity cost. When we produce a large quantity of cola and a small quantity of pizza—between points *A* and *B* in Fig. 2.1—the frontier has a gentle slope. An increase in the quantity of pizzas costs a small decrease in the quantity of cola—the opportunity cost of a pizza is a small quantity of cola.

When we produce a large quantity of pizzas and a small quantity of cola—between points *E* and *F* in Fig. 2.1—the frontier is steep. A given increase in the quantity of pizzas *costs* a large decrease in the quantity of cola, so the opportunity cost of a pizza is a large quantity of cola.

The *PPF* is bowed outward because resources are not all equally productive in all activities. People with many years of experience working for PepsiCo are good at producing cola but not very good at making pizzas. So if we move some of these people from PepsiCo to Domino's, we get a small increase in the quantity of pizzas but a large decrease in the quantity of cola.

Similarly, people who have spent years working at Domino's are good at producing pizzas, but they have no idea how to produce cola. So if we move some of these people from Domino's to PepsiCo, we get a small increase in the quantity of cola but a large decrease in the quantity of pizzas. The more of either good we try to produce, the less productive are the additional resources we use to produce that good and the larger is the opportunity cost of a unit of that good.

Economics in Action

Increasing Opportunity Cost on the Farm

Sanders Wright, a homesick Mississippi native, is growing cotton in Iowa. The growing season is short, so his commercial success is unlikely. Cotton does not grow well in Iowa, but corn does. A farm with irrigation can produce 300 bushels of corn per acre—twice the U.S. average.

Ronnie Gerik, a Texas cotton farmer, has started to grow corn. Ronnie doesn't have irrigation and instead relies on rainfall. That's not a problem for cotton, which just needs a few soakings a season. But it's a big problem for corn, which needs an inch of water a week. Also, corn can't take the heat like cotton, and if the temperature rises too much, Ronnie will be lucky to get 100 bushels an acre.

An Iowa corn farmer gives up almost no cotton to produce his 300 bushels of corn per acre—corn has a low opportunity cost. But Ronnie Gerick gives up a huge amount of cotton to produce his 100 bushels of corn per acre. By switching some land from cotton to corn, Ronnie has increased the production of corn, but the additional corn has a high opportunity cost.

"Deere worker makes 'cotton pickin' miracle happen," WCFCourier.com; and "Farmers stampede to corn," *USA Today*.

REVIEW QUIZ

1. How does the production possibilities frontier illustrate scarcity?
2. How does the production possibilities frontier illustrate production efficiency?
3. How does the production possibilities frontier show that every choice involves a tradeoff?
4. How does the production possibilities frontier illustrate opportunity cost?
5. Why is opportunity cost a ratio?
6. Why does the *PPF* bow outward and what does that imply about the relationship between opportunity cost and the quantity produced?

You can work these questions in Study Plan 2.1 and get instant feedback. myeconlab

We've seen that what we can produce is limited by the production possibilities frontier. We've also seen that production on the *PPF* is efficient. But we can produce many different quantities on the *PPF*. How do we choose among them? How do we know which point on the *PPF* is the best one?

Using Resources Efficiently

We achieve *production efficiency* at every point on the *PPF*, but which point is best? The answer is the point on the *PPF* at which goods and services are produced in the quantities that provide the greatest possible benefit. When goods and services are produced at the lowest possible cost and in the quantities that provide the greatest possible benefit, we have achieved **allocative efficiency.**

The questions that we raised when we reviewed the four big issues in Chapter 1 are questions about allocative efficiency. To answer such questions, we must measure and compare costs and benefits.

The *PPF* and Marginal Cost

The **marginal cost** of a good is the opportunity cost of producing one more unit of it. We calculate marginal cost from the slope of the *PPF*. As the quantity of pizzas produced increases, the *PPF* gets steeper and the marginal cost of a pizza increases. Figure 2.2 illustrates the calculation of the marginal cost of a pizza.

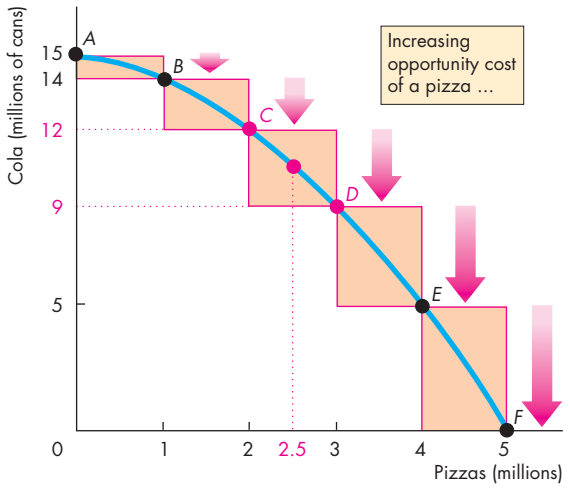
Begin by finding the opportunity cost of pizza in blocks of 1 million pizzas. The cost of the first million pizzas is 1 million cans of cola; the cost of the second million pizzas is 2 million cans of cola; the cost of the third million pizzas is 3 million cans of cola, and so on. The bars in part (a) illustrate these calculations.

The bars in part (b) show the cost of an average pizza in each of the 1 million pizza blocks. Focus on the third million pizzas—the move from *C* to *D* in part (a). Over this range, because 1 million pizzas cost 3 million cans of cola, one of these pizzas, on average, costs 3 cans of cola—the height of the bar in part (b).

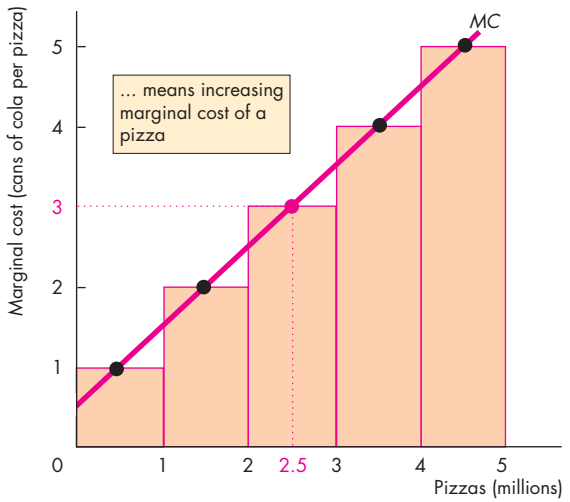
Next, find the opportunity cost of each additional pizza—the marginal cost of a pizza. The marginal cost of a pizza increases as the quantity of pizzas produced increases. The marginal cost at point *C* is less than it is at point *D*. On average over the range from *C* to *D*, the marginal cost of a pizza is 3 cans of cola. But it exactly equals 3 cans of cola only in the middle of the range between *C* and *D*.

The red dot in part (b) indicates that the marginal cost of a pizza is 3 cans of cola when 2.5 million pizzas are produced. Each black dot in part (b) is interpreted in the same way. The red curve that passes through these dots, labeled *MC*, is the marginal cost curve. It shows the marginal cost of a pizza at each quantity of pizzas as we move along the *PPF*.

FIGURE 2.2 The *PPF* and Marginal Cost



(a) *PPF* and opportunity cost



(b) Marginal cost

Marginal cost is calculated from the slope of the *PPF*. As the quantity of pizzas produced increases, the *PPF* gets steeper and the marginal cost of a pizza increases. The bars in part (a) show the opportunity cost of pizza in blocks of 1 million pizzas. The bars in part (b) show the cost of an average pizza in each of these 1 million blocks. The red curve, *MC*, shows the marginal cost of a pizza at each point along the *PPF*. This curve passes through the center of each of the bars in part (b).

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Preferences and Marginal Benefit

The **marginal benefit** from a good or service is the benefit received from consuming one more unit of it. This benefit is subjective. It depends on people's **preferences**—people's likes and dislikes and the intensity of those feelings.

Marginal benefit and *preferences* stand in sharp contrast to *marginal cost* and *production possibilities*. Preferences describe what people like and want and the production possibilities describe the limits or constraints on what is feasible.

We need a concrete way of illustrating preferences that parallels the way we illustrate the limits to production using the *PPF*.

The device that we use to illustrate preferences is the **marginal benefit curve**, which is a curve that shows the relationship between the marginal benefit from a good and the quantity consumed of that good. Note that the *marginal benefit curve* is *unrelated* to the *PPF* and cannot be derived from it.

We measure the marginal benefit from a good or service by the most that people are *willing to pay* for an additional unit of it. The idea is that you are willing to pay less for a good than it is worth to you but you are not willing to pay more: The most you are willing to pay for something is its marginal benefit.

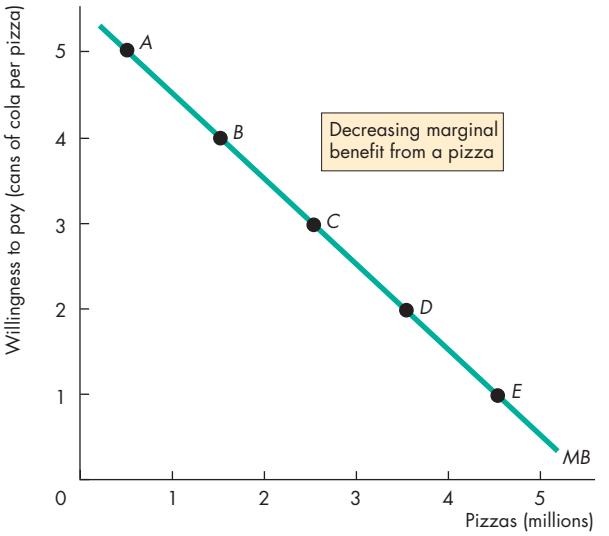
It is a general principle that the more we have of any good or service, the smaller is its marginal benefit and the less we are willing to pay for an additional unit of it. This tendency is so widespread and strong that we call it a principle—the *principle of decreasing marginal benefit*.

The basic reason why marginal benefit decreases is that we like variety. The more we consume of any one good or service, the more we tire of it and would prefer to switch to something else.

Think about your willingness to pay for a pizza. If pizza is hard to come by and you can buy only a few slices a year, you might be willing to pay a high price to get an additional slice. But if pizza is all you've eaten for the past few days, you are willing to pay almost nothing for another slice.

You've learned to think about cost as opportunity cost, not as a dollar cost. You can think about marginal benefit and willingness to pay in the same way. The marginal benefit, measured by what you are willing to pay for something, is the quantity of other goods and services that you are willing to forgo. Let's continue with the example of cola and pizza and illustrate preferences this way.

FIGURE 2.3 Preferences and the Marginal Benefit Curve



Possibility	Pizzas (millions)	Willingness to pay (cans of cola per pizza)
A	0.5	5
B	1.5	4
C	2.5	3
D	3.5	2
E	4.5	1

The smaller the quantity of pizzas available, the more cola people are willing to give up for an additional pizza. With 0.5 million pizzas available, people are willing to pay 5 cans of cola per pizza. But with 4.5 million pizzas, people are willing to pay only 1 can of cola per pizza. Willingness to pay measures marginal benefit. A universal feature of people's preferences is that marginal benefit decreases.

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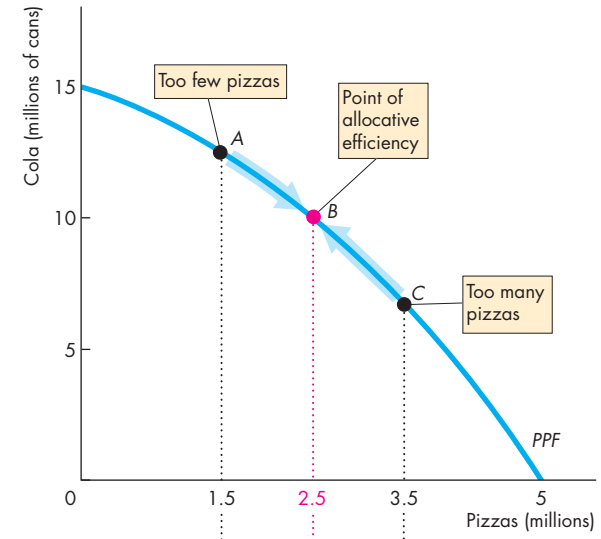
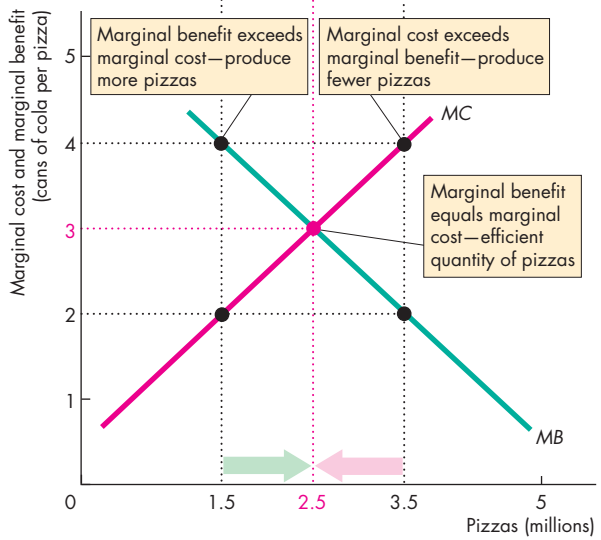
Figure 2.3 illustrates preferences as the willingness to pay for pizza in terms of cola. In row *A*, with 0.5 million pizzas available, people are willing to pay 5 cans of cola per pizza. As the quantity of pizzas increases, the amount that people are willing to pay for a pizza falls. With 4.5 million pizzas available, people are willing to pay only 1 can of cola per pizza.

Let's now use the concepts of marginal cost and marginal benefit to describe allocative efficiency.

FIGURE 2.4 Efficient Use of Resources



(a) On the *PPF*



(b) Marginal benefit equals marginal cost

The greater the quantity of pizzas produced, the smaller is the marginal benefit (*MB*) from pizza—the less cola people are willing to give up to get an additional pizza. But the greater the quantity of pizzas produced, the greater is the marginal cost (*MC*) of a pizza—the more cola people must give up to get an additional pizza. When marginal benefit equals marginal cost, resources are being used efficiently.

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Allocative Efficiency

At *any* point on the *PPF*, we cannot produce more of one good without giving up some other good. At the *best* point on the *PPF*, we cannot produce more of one good without giving up some other good that provides greater benefit. We are producing at the point of allocative efficiency—the point on the *PPF* that we prefer above all other points.

Suppose in Fig. 2.4, we produce 1.5 million pizzas. The marginal cost of a pizza is 2 cans of cola, and the marginal benefit from a pizza is 4 cans of cola. Because someone values an additional pizza more highly than it costs to produce, we can get more value from our resources by moving some of them out of producing cola and into producing pizza.

Now suppose we produce 3.5 million pizzas. The marginal cost of a pizza is now 4 cans of cola, but the marginal benefit from a pizza is only 2 cans of cola. Because the additional pizza costs more to produce than anyone thinks it is worth, we can get more value from our resources by moving some of them away from producing pizza and into producing cola.

Suppose we produce 2.5 million pizzas. Marginal cost and marginal benefit are now equal at 3 cans of cola. This allocation of resources between pizzas and cola is efficient. If more pizzas are produced, the forgone cola is worth more than the additional pizzas. If fewer pizzas are produced, the forgone pizzas are worth more than the additional cola.

REVIEW QUIZ

1. What is marginal cost? How is it measured?
2. What is marginal benefit? How is it measured?
3. How does the marginal benefit from a good change as the quantity produced of that good increases?
4. What is allocative efficiency and how does it relate to the production possibilities frontier?
5. What conditions must be satisfied if resources are used efficiently?

You can work these questions in Study Plan 2.2 and get instant feedback. myeconlab

You now understand the limits to production and the conditions under which resources are used efficiently. Your next task is to study the expansion of production possibilities.

Economic Growth

During the past 30 years, production per person in the United States has doubled. The expansion of production possibilities is called **economic growth**. Economic growth increases our *standard of living,* but it doesn't overcome scarcity and avoid opportunity cost. To make our economy grow, we face a trade-off—the faster we make production grow, the greater is the opportunity cost of economic growth.

The Cost of Economic Growth

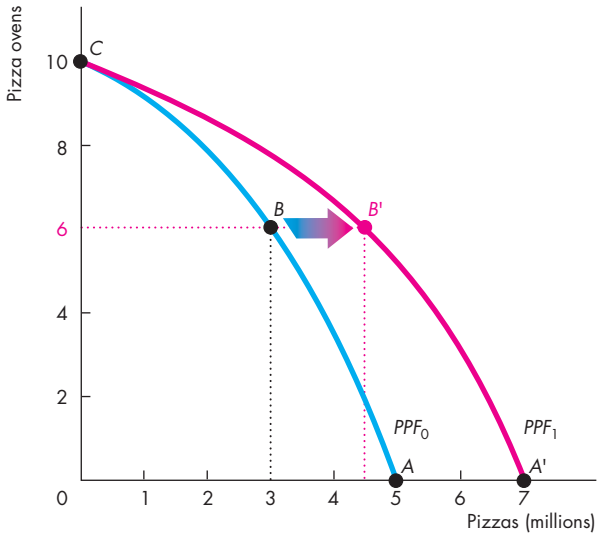
Economic growth comes from technological change and capital accumulation. **Technological change** is the development of new goods and of better ways of producing goods and services. **Capital accumulation** is the growth of capital resources, including *human capital*.

Technological change and capital accumulation have vastly expanded our production possibilities. We can produce automobiles that provide us with more transportation than was available when we had only horses and carriages. We can produce satellites that provide global communications on a much larger scale than that available with the earlier cable technology. But if we use our resources to develop new technologies and produce capital, we must decrease our production of consumption goods and services. New technologies and new capital have an opportunity cost. Let's look at this opportunity cost.

Instead of studying the *PPF* of pizzas and cola, we'll hold the quantity of cola produced constant and examine the *PPF* for pizzas and pizza ovens. Figure 2.5 shows this *PPF* as the blue curve PPF_0. If we devote no resources to producing pizza ovens, we produce at point *A*. If we produce 3 million pizzas, we can produce 6 pizza ovens at point *B*. If we produce no pizza, we can produce 10 ovens at point *C*.

The amount by which our production possibilities expand depends on the resources we devote to technological change and capital accumulation. If we devote no resources to this activity (point *A*), our *PPF* remains the blue curve PPF_0 in Fig. 2.5. If we cut the current pizza production and produce 6 ovens (point *B*), then in the future, we'll have more capital and our *PPF* will rotate outward to the position shown by the red curve PPF_1. The fewer resources we use for producing pizza and the more resources we use for producing ovens, the greater is the expansion of our future production possibilities.

FIGURE 2.5 Economic Growth



PPF_0 shows the limits to the production of pizzas and pizza ovens, with the production of all other goods and services remaining the same. If we devote no resources to producing pizza ovens and produce 5 million pizzas, our production possibilities will remain the same at PPF_0. But if we decrease pizza production to 3 million and produce 6 ovens, at point *B*, our production possibilities expand. After one period, the *PPF* rotates outward to PPF_1 and we can produce at point *B'*, a point outside the original PPF_0. We can rotate the *PPF* outward, but we cannot avoid opportunity cost. The opportunity cost of producing more pizzas in the future is fewer pizzas today.

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Economic growth brings enormous benefits in the form of increased consumption in the future, but it is not free and it doesn't abolish scarcity.

In Fig. 2.5, to make economic growth happen we must use some resources to produce new ovens, which leaves fewer resources to produce pizzas. To move to *B'* in the future, we must move from *A* to *B* today. The opportunity cost of more pizzas in the future is fewer pizzas today. Also, on the new *PPF*, we still face a tradeoff and opportunity cost.

The ideas about economic growth that we have explored in the setting of the pizza industry also apply to nations. Hong Kong and the United States provide a striking case study.

Economics in Action

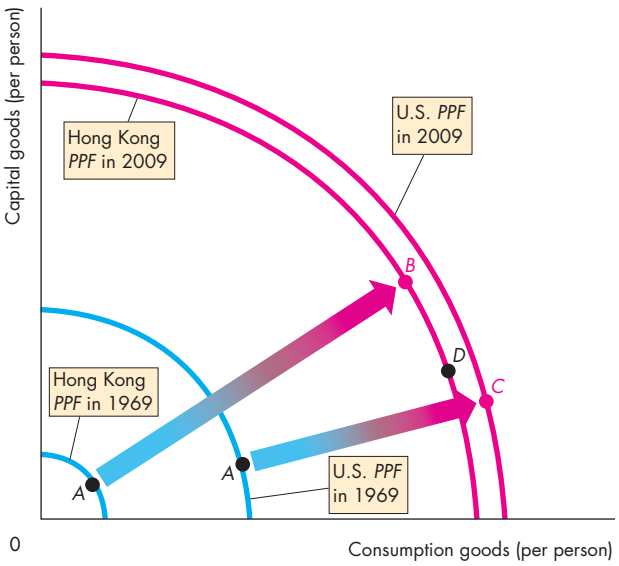
Hong Kong Catching Up to the United States

In 1969, the production possibilities per person in the United States were more than four times those in Hong Kong (see the figure). The United States devotes one fifth of its resources to accumulating capital and in 1969 was at point *A* on its *PPF*. Hong Kong devotes one third of its resources to accumulating capital and in 1969, Hong Kong was at point *A* on its *PPF*.

Since 1969, both countries have experienced economic growth, but because Hong Kong devotes a bigger fraction of its resources to accumulating capital, its production possibilities have expanded more quickly.

By 2009, production possibilities per person in Hong Kong had reached 94 percent of those in the United States. If Hong Kong continues to devote more resources to accumulating capital than we do (at point *B* on its 2009 *PPF*), it will continue to grow more rapidly. But if Hong Kong decreases capital accumulation (moving to point *D* on its 2009 *PPF*), then its rate of economic growth will slow.

Hong Kong is typical of the fast-growing Asian economies, which include Taiwan, Thailand, South Korea, China, and India. Production possibilities expand in these countries by between 5 and almost 10 percent a year.



Economic Growth in the United States and Hong Kong

If such high economic growth rates are maintained, these other Asian countries will continue to close the gap between themselves and the United States, as Hong Kong is doing.

A Nation's Economic Growth

The experiences of the United States and Hong Kong make a striking example of the effects of our choices about consumption and capital goods on the rate of economic growth.

If a nation devotes all its factors of production to producing consumption goods and services and none to advancing technology and accumulating capital, its production possibilities in the future will be the same as they are today.

To expand production possibilities in the future, a nation must devote fewer resources to producing current consumption goods and services and some resources to accumulating capital and developing new technologies. As production possibilities expand, consumption in the future can increase. The decrease in today's consumption is the opportunity cost of tomorrow's increase in consumption.

REVIEW QUIZ

1. What generates economic growth?
2. How does economic growth influence the production possibilities frontier?
3. What is the opportunity cost of economic growth?
4. Why has Hong Kong experienced faster economic growth than the United States?
5. Does economic growth overcome scarcity?

You can work these questions in Study Plan 2.3 and get instant feedback. myeconlab

Next, we're going to study another way in which we expand our production possibilities—the amazing fact that *both* buyers and sellers gain from specialization and trade.

Gains from Trade

People can produce for themselves all the goods and services that they consume, or they can produce one good or a few goods and trade with others. Producing only one good or a few goods is called *specialization.* We are going to learn how people gain by specializing in the production of the good in which they have a *comparative advantage* and trading with others.

Comparative Advantage and Absolute Advantage

A person has a **comparative advantage** in an activity if that person can perform the activity at a lower opportunity cost than anyone else. Differences in opportunity costs arise from differences in individual abilities and from differences in the characteristics of other resources.

No one excels at everything. One person is an outstanding pitcher but a poor catcher; another person is a brilliant lawyer but a poor teacher. In almost all human endeavors, what one person does easily, someone else finds difficult. The same applies to land and capital. One plot of land is fertile but has no mineral deposits; another plot of land has outstanding views but is infertile. One machine has great precision but is difficult to operate; another is fast but often breaks down.

Although no one excels at everything, some people excel and can outperform others in a large number of activities—perhaps even in all activities. A person who is more productive than others has an **absolute advantage**.

Absolute advantage involves comparing productivities—production per hour—whereas comparative advantage involves comparing opportunity costs.

A person who has an absolute advantage does not have a *comparative* advantage in every activity. John Grisham is a better lawyer and a better author of fast-paced thrillers than most people. He has an absolute advantage in these two activities. But compared to others, he is a better writer than lawyer, so his *comparative* advantage is in writing.

Because ability and resources vary from one person to another, people have different opportunity costs of producing various goods. These differences in opportunity cost are the source of comparative advantage.

Let's explore the idea of comparative advantage by looking at two smoothie bars: one operated by Liz and the other operated by Joe.

Liz's Smoothie Bar Liz produces smoothies and salads. In Liz's high-tech bar, she can turn out either a smoothie or a salad every 2 minutes—see Table 2.1. If Liz spends all her time making smoothies, she can produce 30 an hour. And if she spends all her time making salads, she can also produce 30 an hour. If she splits her time equally between the two, she can produce 15 smoothies and 15 salads an hour. For each additional smoothie Liz produces, she must decrease her production of salads by one, and for each additional salad she produces, she must decrease her production of smoothies by one. So

> Liz's opportunity cost of producing 1 smoothie is 1 salad,

and

> Liz's opportunity cost of producing 1 salad is 1 smoothie.

Liz's customers buy smoothies and salads in equal quantities, so she splits her time equally between the two items and produces 15 smoothies and 15 salads an hour.

Joe's Smoothie Bar Joe also produces smoothies and salads, but his bar is smaller than Liz's. Also, Joe has only one blender, and it's a slow, old machine. Even if Joe uses all his resources to produce smoothies, he can produce only 6 an hour—see Table 2.2. But Joe is good at making salads. If he uses all his resources to make salads, he can produce 30 an hour.

Joe's ability to make smoothies and salads is the same regardless of how he splits an hour between the two tasks. He can make a salad in 2 minutes or a smoothie in 10 minutes. For each additional smoothie

TABLE 2.1 Liz's Production Possibilities

Item	Minutes to produce 1	Quantity per hour
Smoothies	2	30
Salads	2	30

TABLE 2.2 Joe's Production Possibilities

Item	Minutes to produce 1	Quantity per hour
Smoothies	10	6
Salads	2	30

Joe produces, he must decrease his production of salads by 5. And for each additional salad he produces, he must decrease his production of smoothies by 1/5 of a smoothie. So

> Joe's opportunity cost of producing 1 smoothie is 5 salads,

and

> Joe's opportunity cost of producing 1 salad is 1/5 of a smoothie.

Joe's customers, like Liz's, buy smoothies and salads in equal quantities. So Joe spends 50 minutes of each hour making smoothies and 10 minutes of each hour making salads. With this division of his time, Joe produces 5 smoothies and 5 salads an hour.

Liz's Comparative Advantage In which of the two activities does Liz have a comparative advantage? Recall that comparative advantage is a situation in which one person's opportunity cost of producing a good is lower than another person's opportunity cost of producing that same good. Liz has a comparative advantage in producing smoothies. Her opportunity cost of a smoothie is 1 salad, whereas Joe's opportunity cost of a smoothie is 5 salads.

Joe's Comparative Advantage If Liz has a comparative advantage in producing smoothies, Joe must have a comparative advantage in producing salads. Joe's opportunity cost of a salad is 1/5 of a smoothie, whereas Liz's opportunity cost of a salad is 1 smoothie.

Achieving the Gains from Trade

Liz and Joe run into each other one evening in a singles bar. After a few minutes of getting acquainted, Liz tells Joe about her amazing smoothie business. Her only problem, she tells Joe, is that she would like to produce more because potential customers leave when her lines get too long.

Joe is hesitant to risk spoiling his chances by telling Liz about his own struggling business, but he takes the risk. Joe explains to Liz that he spends 50 minutes of every hour making 5 smoothies and 10 minutes making 5 salads. Liz's eyes pop. "Have I got a deal for you!" she exclaims.

Here's the deal that Liz sketches on a paper napkin. Joe stops making smoothies and allocates all his time to producing salads; Liz stops making salads and allocates all her time to producing smoothies. That is, they both specialize in producing the good in which they have a comparative advantage. Together they produce 30 smoothies and 30 salads—see Table 2.3(b).

They then trade. Liz sells Joe 10 smoothies and Joe sells Liz 20 salads—the price of a smoothie is 2 salads—see Table 2.3(c).

After the trade, Joe has 10 salads—the 30 he produces minus the 20 he sells to Liz. He also has the 10 smoothies that he buys from Liz. So Joe now has increased the quantities of smoothies and salads that he can sell to his customers—see Table 2.3(d).

TABLE 2.3 Liz and Joe Gain from Trade

(a) Before trade	Liz	Joe
Smoothies	15	5
Salads	15	5
(b) Specialization	**Liz**	**Joe**
Smoothies	30	0
Salads	0	30
(c) Trade	**Liz**	**Joe**
Smoothies	sell 10	buy 10
Salads	buy 20	sell 20
(d) After trade	**Liz**	**Joe**
Smoothies	20	10
Salads	20	10
(e) Gains from trade	**Liz**	**Joe**
Smoothies	+5	+5
Salads	+5	+5

Liz has 20 smoothies—the 30 she produces minus the 10 she sells to Joe. She also has the 20 salads that she buys from Joe. Liz has increased the quantities of smoothies and salads that she can sell to her customers—see Table 2.3(d). Liz and Joe both gain 5 smoothies and 5 salads an hour—see Table 2.3(e).

To illustrate her idea, Liz grabs a fresh napkin and draws the graphs in Fig. 2.6. The blue *PPF* in part (a) shows Joe's production possibilities. Before trade, he is producing 5 smoothies and 5 salads an hour at point *A*. The blue *PPF* in part (b) shows Liz's production possibilities. Before trade, she is producing 15 smoothies and 15 salads an hour at point *A*.

Liz's proposal is that they each specialize in producing the good in which they have a comparative advantage. Joe produces 30 salads and no smoothies at point *B* on his *PPF*. Liz produces 30 smoothies and no salads at point *B* on her *PPF*.

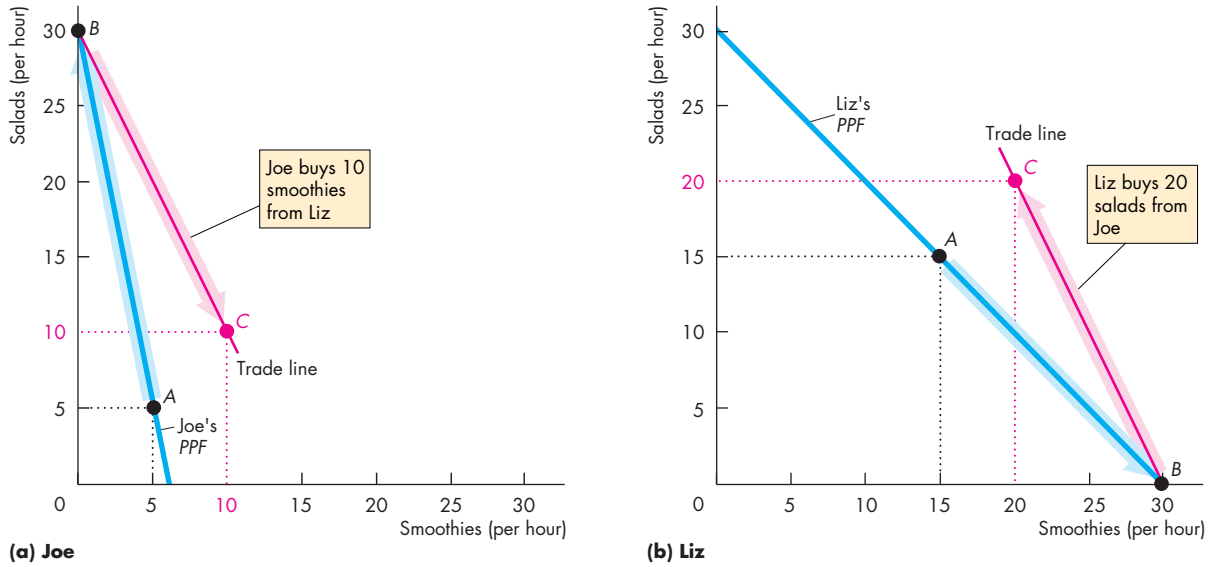
Liz and Joe then trade smoothies and salads at a price of 2 salads per smoothie or 1/2 a smoothie per salad. Joe gets smoothies for 2 salads each, which is less than the 5 salads it costs him to produce a smoothie. Liz gets salads for 1/2 a smoothie each, which is less than the 1 smoothie that it costs her to produce a salad.

With trade, Joe has 10 smoothies and 10 salads at point *C*—a gain of 5 smoothies and 5 salads. Joe moves to a point *outside* his *PPF*.

With trade, Liz has 20 smoothies and 20 salads at point *C*—a gain of 5 smoothies and 5 salads. Liz moves to a point *outside* her *PPF*.

Despite Liz being more productive than Joe, both of them gain from specializing—producing the good in which they have a comparative advantage—and trading.

FIGURE 2.6 The Gains from Trade



Initially, Joe produces at point *A* on his *PPF* in part (a), and Liz produces at point *A* on her *PPF* in part (b). Joe's opportunity cost of producing a salad is less than Liz's, so Joe has a comparative advantage in producing salads. Liz's opportunity cost of producing a smoothie is less than Joe's, so Liz has a comparative advantage in producing smoothies.

If Joe specializes in making salads, he produces 30 salads and no smoothies at point *B* on his *PPF*. If Liz specializes in making smoothies, she produces 30 smoothies and no salads at point *B* on her *PPF*. They exchange salads for smoothies along the red "Trade line." Liz buys salads from Joe for less than her opportunity cost of producing them. Joe buys smoothies from Liz for less than his opportunity cost of producing them. Each goes to point *C*—a point outside his or her *PPF*. With specialization and trade, Joe and Liz gain 5 smoothies and 5 salads each with no extra resources.

Economics in Action

The United States and China Gain From Trade

In Chapter 1 (see p. 5), we asked whether globalization is in the social interest. What you have just learned about the gains from trade provides a big part of the answer. We gain from specialization and trade.

The gains that we achieve from *international* trade are similar to those achieved by Joe and Liz. When Americans buy clothes that are manufactured in China and when China buys Boeing airplanes manufactured in the United States, the people of both countries gain.

We could slide along our *PPF* producing fewer airplanes and more jackets. Similarly, China could slide along its *PPF* producing more airplanes and fewer jackets. But everyone would lose. The opportunity cost of our jackets and China's opportunity cost of airplanes would rise.

By specializing in airplanes and trading with China, we get our jackets at a lower cost than that at which we can produce them, and China gets its aircraft at a lower cost than that at which it can produce them.

REVIEW QUIZ

1 What gives a person a comparative advantage?
2 Distinguish between comparative advantage and absolute advantage.
3 Why do people specialize and trade?
4 What are the gains from specialization and trade?
5 What is the source of the gains from trade?

You can work these questions in Study Plan 2.4 and get instant feedback. myeconlab

Economic Coordination

People gain by specializing in the production of those goods and services in which they have a comparative advantage and then trading with each other. Liz and Joe, whose production of salads and smoothies we studied earlier in this chapter, can get together and make a deal that enables them to enjoy the gains from specialization and trade. But for billions of individuals to specialize and produce millions of different goods and services, their choices must somehow be coordinated.

Two competing economic coordination systems have been used: central economic planning and decentralized markets.

Central economic planning was tried in Russia and China and is still used in Cuba and North Korea. This system works badly because government economic planners don't know people's production possibilities and preferences. Resources get wasted, production ends up *inside* the *PPF,* and the wrong things get produced.

Decentralized coordination works best but to do so it needs four complementary social institutions. They are

- Firms
- Markets
- Property rights
- Money

Firms

A **firm** is an economic unit that hires factors of production and organizes those factors to produce and sell goods and services. Examples of firms are your local gas station, Wal-Mart, and General Motors.

Firms coordinate a huge amount of economic activity. For example, Wal-Mart buys or rents large buildings, equips them with storage shelves and checkout lanes, and hires labor. Wal-Mart directs the labor and decides what goods to buy and sell.

But Sam Walton would not have become one of the wealthiest people in the world if Wal-Mart

produced all the goods that it sells. He became rich by specializing in providing retail services and buying from other firms that specialize in producing goods (just as Liz and Joe did). This trade between firms takes place in markets.

Markets

In ordinary speech, the word *market* means a place where people buy and sell goods such as fish, meat, fruits, and vegetables. In economics, a *market* has a more general meaning. A **market** is any arrangement that enables buyers and sellers to get information and to do business with each other. An example is the market in which oil is bought and sold—the world oil market. The world oil market is not a place. It is the network of oil producers, oil users, wholesalers, and brokers who buy and sell oil. In the world oil market, decision makers do not meet physically. They make deals by telephone, fax, and direct computer link.

Markets have evolved because they facilitate trade. Without organized markets, we would miss out on a substantial part of the potential gains from trade. Enterprising individuals and firms, each pursuing their own self-interest, have profited from making markets—standing ready to buy or sell the items in which they specialize. But markets can work only when property rights exist.

Property Rights

The social arrangements that govern the ownership, use, and disposal of anything that people value are called **property rights**. *Real property* includes land and buildings—the things we call property in ordinary speech—and durable goods such as plant and equipment. *Financial property* includes stocks and bonds and money in the bank. *Intellectual property* is the intangible product of creative effort. This type of property includes books, music, computer programs, and inventions of all kinds and is protected by copyrights and patents.

Where property rights are enforced, people have the incentive to specialize and produce the goods in which they have a comparative advantage. Where people can steal the production of others, resources are devoted not to production but to protecting possessions. Without property rights, we would still be hunting and gathering like our Stone Age ancestors.

Money

Money is any commodity or token that is generally acceptable as a means of payment. Liz and Joe didn't use money in the example above. They exchanged salads and smoothies. In principle, trade in markets can exchange any item for any other item. But you can perhaps imagine how complicated life would be if we exchanged goods for other goods. The "invention" of money makes trading in markets much more efficient.

Circular Flows Through Markets

Figure 2.7 shows the flows that result from the choices that households and firms make. Households specialize and choose the quantities of labor, land, capital, and entrepreneurial services to sell or rent to firms. Firms choose the quantities of factors of production to hire. These (red) flows go through the *factor markets*. Households choose the quantities of goods and services to buy, and firms choose the quantities to produce. These (red) flows go through the *goods markets*. Households receive incomes and make expenditures on goods and services (the green flows).

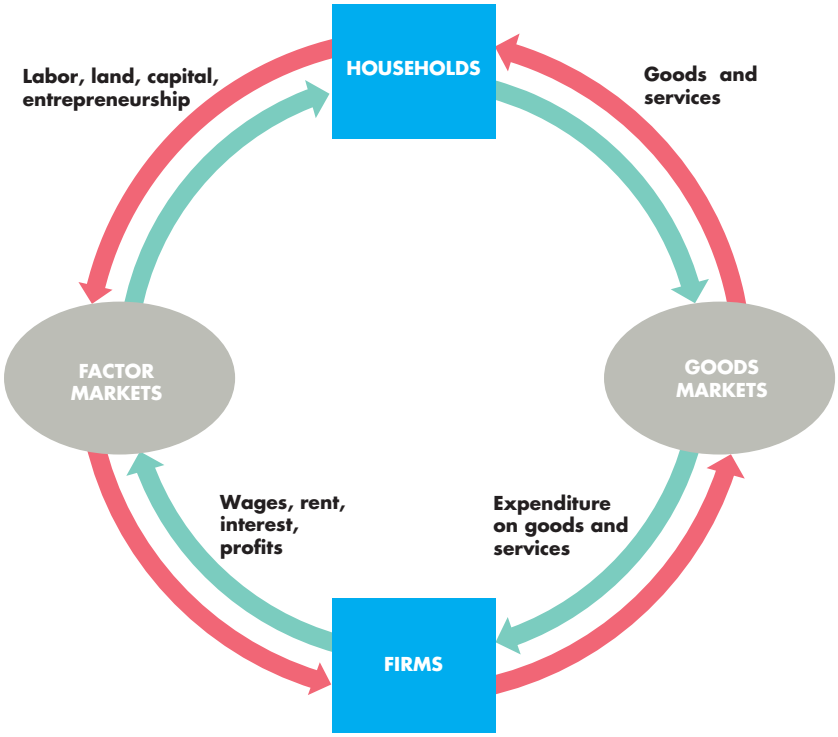
How do markets coordinate all these decisions?

Coordinating Decisions

Markets coordinate decisions through price adjustments. To see how, think about your local market for hamburgers. Suppose that too few hamburgers are available and some people who want to buy hamburgers are not able to do so. To make buying and selling plans the same, either more hamburgers must be offered for sale or buyers must scale down their appetites (or both). A rise in the price of a hamburger produces this outcome. A higher price encourages producers to offer more hamburgers for sale. It also encourages some people to change their lunch plans. Fewer people buy hamburgers, and more buy hot dogs. More hamburgers (and more hot dogs) are offered for sale.

Alternatively, suppose that more hamburgers are available than people want to buy. In this case, to make the choices of buyers and sellers compatible, more hamburgers must be bought or fewer hamburgers must be offered for sale (or both). A fall in the price of a hamburger achieves this outcome. A lower price encourages people to buy more hamburgers. It also encourages firms to produce a smaller quantity of hamburgers.

FIGURE 2.7 Circular Flows in the Market Economy



Households and firms make economic choices and markets coordinate these choices.

Households choose the quantities of labor, land, capital, and entrepreneurial services to sell or rent to firms in exchange for wages, rent, interest, and profits. Households also choose how to spend their incomes on the various types of goods and services available.

Firms choose the quantities of factors of production to hire and the quantities of goods and services to produce.

Goods markets and factor markets coordinate these choices of households and firms.

The counterclockwise red flows are real flows—the flow of factors of production from households to firms and the flow of goods and services from firms to households.

The clockwise green flows are the payments for the red flows. They are the flow of incomes from firms to households and the flow of expenditure on goods and services from households to firms.

myeconlab animation

REVIEW QUIZ

1 Why are social institutions such as firms, markets, property rights, and money necessary?
2 What are the main functions of markets?
3 What are the flows in the market economy that go from firms to households and the flows from households to firms?

You can work these questions in Study Plan 2.5 and get instant feedback. myeconlab

You have now begun to see how economists approach economic questions. Scarcity, choice, and divergent opportunity costs explain why we specialize and trade and why firms, markets, property rights, and money have developed. You can see all around you the lessons you've learned in this chapter. *Reading Between the Lines* on pp. 44–45 provides an opportunity to apply the *PPF* model to deepen your understanding of the reasons for the increase in the cost of food associated with the increase in corn production.

The Rising Opportunity Cost of Food

Fuel Choices, Food Crises, and Finger-Pointing

http://www.nytimes.com
April 15, 2008

The idea of turning farms into fuel plants seemed, for a time, like one of the answers to high global oil prices and supply worries. That strategy seemed to reach a high point last year when Congress mandated a fivefold increase in the use of biofuels.

But now a reaction is building against policies in the United States and Europe to promote ethanol and similar fuels, with political leaders from poor countries contending that these fuels are driving up food prices and starving poor people. …

In some countries, the higher prices are leading to riots, political instability, and growing worries about feeding the poorest people. …

Many specialists in food policy consider government mandates for biofuels to be ill advised, agreeing that the diversion of crops like corn into fuel production has contributed to the higher prices. But other factors have played big roles, including droughts that have limited output and rapid global economic growth that has created higher demand for food.

That growth, much faster over the last four years than the historical norm, is lifting millions of people out of destitution and giving them access to better diets. But farmers are having trouble keeping up with the surge in demand.

While there is agreement that the growth of biofuels has contributed to higher food prices, the amount is disputed. …

C. Ford Runge, an economist at the University of Minnesota, said it is "extremely difficult to disentangle" the effect of biofuels on food costs. Nevertheless, he said there was little that could be done to mitigate the effect of droughts and the growing appetite for protein in developing countries.

"Ethanol is the one thing we can do something about," he said. "It's about the only lever we have to pull, but none of the politicians have the courage to pull the lever." …

ESSENCE OF THE STORY

- In 2007, Congress mandated a fivefold increase in the use of biofuels.
- Political leaders in poor countries and specialists in food policy say the biofuel mandate is ill advised and the diversion of corn into fuel production has raised the cost of food.
- Drought that has limited corn production and global economic growth that has increased the demand for protein have also raised the cost of food.
- An economist at the University of Minnesota says that while it is difficult to determine the effect of biofuels on food costs, it is the only factor under our control.

ECONOMIC ANALYSIS

- Ethanol is made from corn in the United States, so biofuel and food compete to use the same resources.
- To produce more ethanol and meet the Congress's mandate, farmers increased the number of acres devoted to corn production.
- In 2008, the amount of land devoted to corn production increased by 20 percent in the United States and by 2 percent in the rest of the world.
- Figure 1 shows the U.S. production possibilities frontier, *PPF*, for corn and other goods and services.
- The increase in the production of corn is illustrated by a movement along the *PPF* in Fig. 1 from point *A* in 2007 to point *B* in 2008.
- In moving from point *A* to point *B*, the United States incurs a higher opportunity cost of producing corn, as the greater slope of the *PPF* at point *B* indicates.
- In other regions of the world, despite the fact that more land was devoted to corn production, the amount of corn produced didn't change.
- The reason is that droughts in South America and Eastern Europe lowered the crop yield per acre in those regions.
- Figure 2 shows the rest of the world's *PPF* for corn and other goods and services in 2007 and 2008.
- The increase in the amount of land devoted to producing corn is illustrated by a movement along PPF_{07}.
- With a decrease in the crop yield, production possibilities decreased and the *PPF* rotated inward.
- The rotation from PPF_{07} to PPF_{08} illustrates this decrease in production possibilities.
- The opportunity cost of producing corn in the rest of the world increased for two reasons: the movement along its *PPF* and the inward rotation of the *PPF*.
- With a higher opportunity cost of producing corn, the cost of both biofuel and food increases.

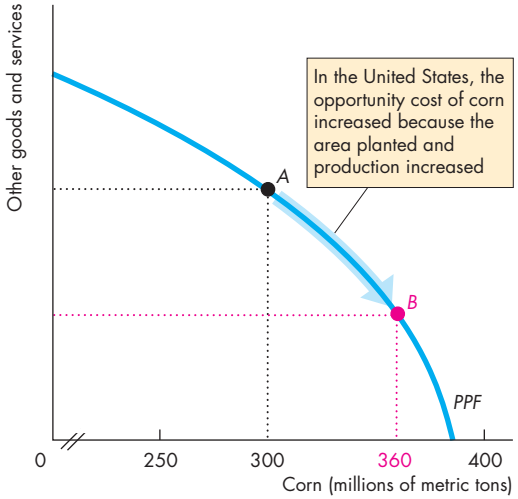


Figure 1 U.S. *PPF*

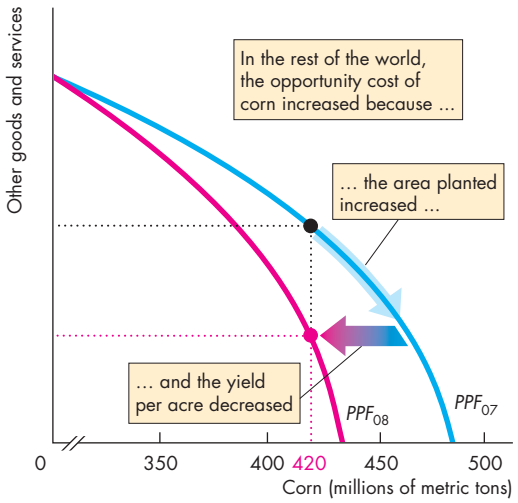


Figure 2 Rest of the World *PPF*

SUMMARY

Key Points

Production Possibilities and Opportunity Cost

(pp. 30–32)

- The production possibilities frontier is the boundary between production levels that are attainable and those that are not attainable when all the available resources are used to their limit.
- Production efficiency occurs at points on the production possibilities frontier.
- Along the production possibilities frontier, the opportunity cost of producing more of one good is the amount of the other good that must be given up.
- The opportunity cost of all goods increases as the production of the good increases.

Working Problems 1 to 3 will give you a better understanding of production possibilities and opportunity cost.

Using Resources Efficiently (pp. 33–35)

- Allocative efficiency occurs when goods and services are produced at the least possible cost and in the quantities that bring the greatest possible benefit.
- The marginal cost of a good is the opportunity cost of producing one more unit of it.
- The marginal benefit from a good is the benefit received from consuming one more unit of it and is measured by the willingness to pay for it.
- The marginal benefit of a good decreases as the amount of the good available increases.
- Resources are used efficiently when the marginal cost of each good is equal to its marginal benefit.

Working Problems 4 to 10 will give you a better understanding of the efficient use of resources.

Economic Growth (pp. 36–37)

- Economic growth, which is the expansion of production possibilities, results from capital accumulation and technological change.
- The opportunity cost of economic growth is forgone current consumption.
- The benefit of economic growth is increased future consumption.

Working Problem 11 will give you a better understanding of economic growth.

Gains from Trade (pp. 38–41)

- A person has a comparative advantage in producing a good if that person can produce the good at a lower opportunity cost than everyone else.
- People gain by specializing in the activity in which they have a comparative advantage and trading with others.

Working Problems 12 and 13 will give you a better understanding of the gains from trade.

Economic Coordination (pp. 41–43)

- Firms coordinate a large amount of economic activity, but there is a limit to the efficient size of a firm.
- Markets coordinate the economic choices of people and firms.
- Markets can work efficiently only when property rights exist.
- Money makes trading in markets more efficient.

Working Problem 14 will give you a better understanding of economic coordination.

Key Terms

Absolute advantage, 38
Allocative efficiency, 33
Capital accumulation, 36
Comparative advantage, 38
Economic growth, 36
Firm, 41
Marginal benefit, 34
Marginal benefit curve, 34
Marginal cost, 33
Market, 42
Money, 42
Opportunity cost, 31
Preferences, 34
Production efficiency, 31
Production possibilities frontier, 30
Property rights, 42
Technological change, 36

STUDY PLAN PROBLEMS AND APPLICATIONS

myeconlab You can work Problems 1 to 20 in MyEconLab Chapter 2 Study Plan and get instant feedback.

Production Possibilities and Opportunity Cost

(Study Plan 2.1)

Use the following information to work Problems 1 to 3. Brazil produces ethanol from sugar, and the land used to grow sugar can be used to grow food crops. Suppose that Brazil's production possibilities for ethanol and food crops are as follows

Ethanol (barrels per day)		Food crops (tons per day)
70	and	0
64	and	1
54	and	2
40	and	3
22	and	4
0	and	5

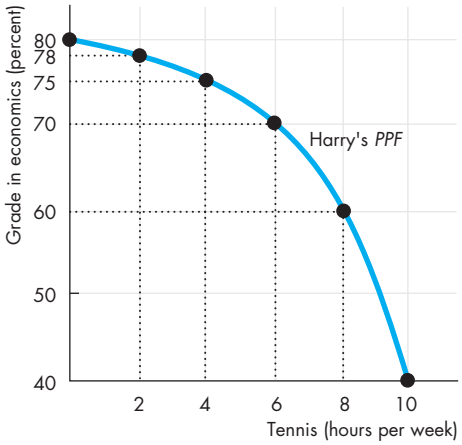
1. a. Draw a graph of Brazil's PPF and explain how your graph illustrates scarcity.
   b. If Brazil produces 40 barrels of ethanol a day, how much food must it produce to achieve production efficiency?
   c. Why does Brazil face a tradeoff on its *PPF*?
2. a. If Brazil increases its production of ethanol from 40 barrels per day to 54 barrels per day, what is the opportunity cost of the additional ethanol?
   b. If Brazil increases its production of food crops from 2 tons per day to 3 tons per day, what is the opportunity cost of the additional food?
   c. What is the relationship between your answers to parts (a) and (b)?
3. Does Brazil face an increasing opportunity cost of ethanol? What feature of Brazil's *PPF* illustrates increasing opportunity cost?

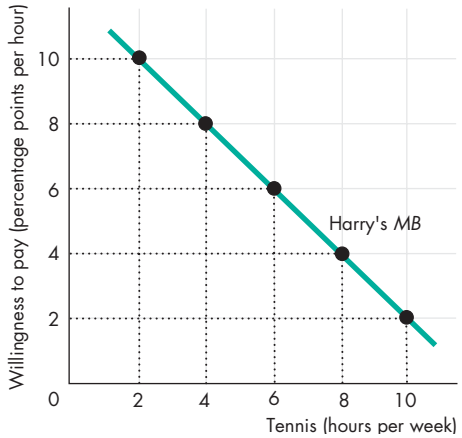
Using Resources Efficiently (Study Plan 2.2)

Use the above table to work Problems 4 and 5.

4. Define marginal cost and calculate Brazil's marginal cost of producing a ton of food when the quantity produced is 2.5 tons per day.
5. Define marginal benefit, explain how it is measured, and explain why the data in the table does not enable you to calculate Brazil's marginal benefit from food.
6. Distinguish between *production efficiency* and *allocative efficiency.* Explain why many production possibilities achieve production efficiency but only one achieves allocative efficiency.

Use the following graphs to work Problems 7 to 10. Harry enjoys tennis but wants a high grade in his economics course. The graphs show his *PPF* for these two "goods" and his *MB* curve from tennis.





7. What is Harry's marginal cost of tennis if he plays for (i) 3 hours a week; (ii) 5 hours a week; and (iii) 7 hours a week?
8. a. If Harry uses his time to achieve allocative efficiency, what is his economics grade and how many hours of tennis does he play?
   b. Explain why Harry would be worse off getting a grade higher than your answer to part (a).
9. If Harry becomes a tennis superstar with big earnings from tennis, what happens to his *PPF*, *MB* curve, and his efficient time allocation?
10. If Harry suddenly finds high grades in economics easier to attain, what happens to his *PPF*, his *MB* curve, and his efficient time allocation?

Economic Growth (Study Plan 2.3)

11. A farm grows wheat and produces pork. The marginal cost of producing each of these products increases as more of it is produced.
    a. Make a graph that illustrates the farm's *PPF*.
    b. The farm adopts a new technology that allows it to use fewer resources to fatten pigs. Use your graph to illustrate the impact of the new technology on the farm's *PPF*.
    c. With the farm using the new technology described in part (b), has the opportunity cost of producing a ton of wheat increased, decreased, or remained the same? Explain and illustrate your answer.
    d. Is the farm more efficient with the new technology than it was with the old one? Why?

Gains from Trade (Study Plan 2.4)

12. In an hour, Sue can produce 40 caps or 4 jackets and Tessa can produce 80 caps or 4 jackets.
    a. Calculate Sue's opportunity cost of producing a cap.
    b. Calculate Tessa's opportunity cost of producing a cap.
    c. Who has a comparative advantage in producing caps?
    d. If Sue and Tessa specialize in producing the good in which each of them has a comparative advantage, and they trade 1 jacket for 15 caps, who gains from the specialization and trade?
13. Suppose that Tessa buys a new machine for making jackets that enables her to make 20 jackets an hour. (She can still make only 80 caps per hour.)
    a. Who now has a comparative advantage in producing jackets?
    b. Can Sue and Tessa still gain from trade?
    c. Would Sue and Tessa still be willing to trade 1 jacket for 15 caps? Explain your answer.

Economic Coordination (Study Plan 2.5)

14. For 50 years, Cuba has had a centrally planned economy in which the government makes the big decisions on how resources will be allocated.
    a. Why would you expect Cuba's production possibilities (per person) to be smaller than those of the United States?
    b. What are the social institutions that Cuba might lack that help the United States to achieve allocative efficiency?

Economics in the News (Study Plan 2.N)

Use the following data to work Problems 15 to 17. Brazil produces ethanol from sugar at a cost of 83 cents per gallon. The United States produces ethanol from corn at a cost of $1.14 per gallon. Sugar grown on one acre of land produces twice the quantity of ethanol as the corn grown on an acre. The United States imports 5 percent of the ethanol it uses and produces the rest itself. Since 2003, U.S. ethanol production has more than doubled and U.S. corn production has increased by 45 percent.

15. a. Does Brazil or the United States have a comparative advantage in producing ethanol?
    b. Sketch the *PPF* for ethanol and other goods and services for the United States.
    c. Sketch the *PPF* for ethanol and other goods and services for Brazil.
16. a. Do you expect the opportunity cost of producing ethanol in the United States to have increased since 2003? Explain why.
    b. Do you think the United States has achieved production efficiency in its manufacture of ethanol? Explain why or why not.
    c. Do you think the United States has achieved allocative efficiency in its manufacture of ethanol? Explain why or why not.
17. Sketch a figure similar to Fig. 2.6 on p. 40 to show how both the United States and Brazil can gain from specialization and trade.

Use this news clip to work Problems 18 to 20.

Time For Tea

Americans are switching to loose-leaf tea for its health benefits. Tea could be grown in the United States, but picking tea leaves would be costly because it can only be done by workers and not by machine.

Source: *The Economist,* July 8, 2005

18. a. Sketch *PPF*s for the production of tea and other goods and services in India and in the United States.
    b. Sketch marginal cost curves for the production of tea in India and in the United States.
19. a. Sketch the marginal benefit curves for tea in the United States before and after Americans began to appreciate the health benefits of loose tea.
    b. Explain how the quantity of loose tea that achieves allocative efficiency has changed.
    c. Does the change in preferences toward tea affect the opportunity cost of producing tea?
20. Explain why the United States does not produce tea and instead imports it from India.

ADDITIONAL PROBLEMS AND APPLICATIONS

myeconlab You can work these problems in MyEconLab if assigned by your instructor.

Production Possibilities and Opportunity Cost

Use the following table to work Problems 21 to 22.

Suppose that Yucatan's production possibilities are

Food (pounds per month)		Sunscreen (gallons per month)
300	and	0
200	and	50
100	and	100
0	and	150

21. a. Draw a graph of Yucatan's *PPF* and explain how your graph illustrates a tradeoff.
    b. If Yucatan produces 150 pounds of food per month, how much sunscreen must it produce if it achieves production efficiency?
    c. What is Yucatan's opportunity cost of producing 1 pound of food?
    d. What is Yucatan's opportunity cost of producing 1 gallon of sunscreen?
    e. What is the relationship between your answers to parts (c) and (d)?
22. What feature of a *PPF* illustrates increasing opportunity cost? Explain why Yucatan's opportunity cost does or does not increase.

Using Resources Efficiently

23. In problem 21, what is the marginal cost of a pound of food in Yucatan when the quantity produced is 150 pounds per day? What is special about the marginal cost of food in Yucatan?
24. The table describes the preferences in Yucatan.

Sunscreen (gallons per month)	Willingness to pay (pounds of food per gallon)
25	3
75	2
125	1

    a. What is the marginal benefit from sunscreen and how is it measured?
    b. Draw a graph of Yucatan's marginal benefit from sunscreen.

Economic Growth

25. Capital accumulation and technological change bring economic growth, which means that the *PPF* keeps shifting outward: Production that was unattainable yesterday becomes attainable today; production that is unattainable today will become attainable tomorrow. Why doesn't this process of economic growth mean that scarcity is being defeated and will one day be gone?

Gains from Trade

Use the following data to work Problems 26 and 27.

Kim can produce 40 pies or 400 cakes an hour. Liam can produce 100 pies or 200 cakes an hour.

26. a. Calculate Kim's opportunity cost of a pie and Liam's opportunity cost of a pie.
    b. If each spends 30 minutes of each hour producing pies and 30 minutes producing cakes, how many pies and cakes does each produce?
    c. Who has a comparative advantage in producing pies? Who has a comparative advantage in producing cakes?
27. a. Draw a graph of Kim's *PPF* and Liam's *PPF*.
    b. On your graph, show the point at which each produces when they spend 30 minutes of each hour producing pies and 30 minutes producing cakes.
    c. On your graph, show what Kim produces and what does Liam produces when they specialize.
    d. When they specialize and trade, what are the total gains from trade?
    e. If Kim and Liam share the total gains equally, what trade takes place between them?

Economic Coordination

28. Indicate on a graph of the circular flows in the market economy, the real and money flows in which the following items belong:
    a. You buy an iPad from the Apple Store.
    b. Apple Inc. pays the designers of the iPad.
    c. Apple Inc. decides to expand and rents an adjacent building.
    d. You buy a new e-book from Amazon.
    e. Apple Inc. hires a student as an intern during the summer.

Economics in the News

29. After you have studied *Reading Between the Lines* on pp. 44–45, answer the following questions.
    a. How has an Act of the United States Congress increased U.S. production of corn?
    b. Why would you expect an increase in the quantity of corn produced to raise the opportunity cost of corn?

c. Why did the cost of producing corn increase in the rest of the world?

d. Is it possible that the increased quantity of corn produced, despite the higher cost of production, moves the United States closer to allocative efficiency?

30. **Malaria Eradication Back on the Table**
In response to the Gates Malaria Forum in October 2007, countries are debating the pros and cons of eradication. Dr. Arata Kochi of the World Health Organization believes that with enough money malaria cases could be cut by 90 percent, but he believes that it would be very expensive to eliminate the remaining 10 percent of cases. He concluded that countries should not strive to eradicate malaria.
Source: *The New York Times*, March 4, 2008

a. Is Dr. Kochi talking about *production efficiency* or *allocative efficiency* or both?

b. Make a graph with the percentage of malaria cases eliminated on the *x*-axis and the marginal cost and marginal benefit of driving down malaria cases on the *y*-axis. On your graph:

(i) Draw a marginal cost curve that is consistent with Dr. Kochi's opinion.

(ii) Draw a marginal benefit curve that is consistent with Dr. Kochi's opinion.

(iii) Identify the quantity of malaria eradicated that achieves allocative efficiency.

31. **Lots of Little Screens**
Inexpensive broadband access has created a generation of television producers for whom the Internet is their native medium. As they redirect the focus from TV to computers, cell phones, and iPods, the video market is developing into an open digital network.
Source: *The New York Times,* December 2, 2007

a. How has inexpensive broadband changed the production possibilities of video entertainment and other goods and services?

b. Sketch a *PPF* for video entertainment and other goods and services before broadband.

c. Show how the arrival of inexpensive broadband has changed the *PPF*.

d. Sketch a marginal benefit curve for video entertainment.

e. Show how the new generation of TV producers for whom the Internet is their native medium might have changed the marginal benefit from video entertainment.

f. Explain how the efficient quantity of video entertainment has changed.

Use the following information to work Problems 32 and 33.

Before the Civil War, the South traded with the North and with England. The South sold cotton and bought manufactured goods and food. During the war, one of President Lincoln's first actions was to blockade the ports and prevent this trade. The South increased its production of munitions and food.

32. In what did the South have a comparative advantage?

33. a. Draw a graph to illustrate production, consumption, and trade in the South before the Civil War.

b. Was the South consuming inside, on, or outside its *PPF*? Explain your answer.

c. Draw a graph to show the effects of the Civil War on consumption and production in the South.

d. Did the Civil War change any opportunity costs in the South? If so, did the opportunity cost of everything increase? Did the opportunity cost of any items decrease? Illustrate your answer with appropriate graphs.

Use the following information to work Problems 34 and 35.

He Shoots! He Scores! He Makes Movies!

NBA All-star Baron Davis and his school friend, Cash Warren, premiered their first movie *Made in America* at the Sundance Festival in January 2008. The movie, based on gang activity in South Central Los Angeles, received good reviews.
Source: *The New York Times,* February 24, 2008

34. a. Does Baron Davis have an absolute advantage in basketball and movie directing and is this the reason for his success in both activities?

b. Does Baron Davis have a comparative advantage in basketball or movie directing or both and is this the reason for his success in both activities?

35. a. Sketch a *PPF* between playing basketball and producing other goods and services for Baron Davis and for yourself.

b. How do you (and people like you) and Baron Davis (and people like him) gain from specialization and trade?

Your Economic Revolution

PART ONE

UNDERSTANDING THE SCOPE OF ECONOMICS

Three periods in human history stand out as ones of economic revolution. The first, the *Agricultural Revolution,* occurred 10,000 years ago. In what is today Iraq, people learned to domesticate animals and plant crops. People stopped roaming in search of food and settled in villages, towns, and cities where they specialized in the activities in which they had a comparative advantage and developed markets in which to exchange their products. Wealth increased enormously.

You are studying economics at a time that future historians will call the *Information Revolution*. Over the entire world, people are embracing new information technologies and prospering on an unprecedented scale.

Economics was born during the *Industrial Revolution,* which began in England during the 1760s. For the first time, people began to apply science and create new technologies for the manufacture of textiles and iron, to create steam engines, and to boost the output of farms.

During all three economic revolutions, many have prospered but many have been left behind. It is the range of human progress that poses the greatest question for economics and the one that Adam Smith addressed in the first work of economic science: What causes the differences in wealth among nations?

Many people had written about economics before **Adam Smith**, *but he made economics a science. Born in 1723 in Kirkcaldy, a small fishing town near Edinburgh, Scotland, Smith was the only child of the town's customs officer. Lured from his professorship (he was a full professor at 28) by a wealthy Scottish duke who gave him a pension of £300 a year—ten times the average income at that time—Smith devoted ten years to writing his masterpiece:* An Inquiry into the Nature and Causes of the **Wealth of Nations**, *published in 1776.*

Why, Adam Smith asked , are some nations wealthy while others are poor? He was pondering these questions at the height of the Industrial Revolution, and he answered by emphasizing the role of the division of labor and free markets.

To illustrate his argument, Adam Smith described two pin factories. In the first, one person, using the hand tools available in the 1770s, could make 20 pins a day. In the other, by using those same hand tools but breaking the process into a number of individually small operations in which people specialize—by the division of labor*—ten people could make a staggering 48,000 pins a day. One draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it. Three specialists make the head, and a fourth attaches it. Finally, the pin is polished and packaged.*

But a large market is needed to support the division of labor: One factory employing ten workers would need to sell more than 15 million pins a year to stay in business!

"It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest."

ADAM SMITH
The Wealth of Nations

Professor Bhagwati, what attracted you to economics?

When you come from India, where poverty hits the eye, it is easy to be attracted to economics, which can be used to bring prosperity and create jobs to pull up the poor into gainful employment.

I learned later that there are two broad types of economist: those who treat the subject as an arid mathematical toy and those who see it as a serious social science.

If Cambridge, where I went as an undergraduate, had been interested in esoteric mathematical economics, I would have opted for something else. But the Cambridge economists from whom I learned—many among the greatest figures in the discipline—saw economics as a social science. I therefore saw the power of economics as a tool to address India's poverty and was immediately hooked.

Who had the greatest impact on you at Cambridge?

Most of all, it was Harry Johnson, a young Canadian of immense energy and profound analytical gifts. Quite unlike the shy and reserved British dons, Johnson was friendly, effusive, and supportive of students who flocked around him. He would later move to Chicago, where he became one of the most influential members of the market-oriented Chicago school. Another was Joan Robinson, arguably the world's most impressive female economist.

When I left Cambridge for MIT, going from one Cambridge to the other, I was lucky to transition from one phenomenal set of economists to another. At MIT, I learned much from future Nobel laureates Paul Samuelson and Robert Solow. Both would later become great friends and colleagues when I joined the MIT faculty in 1968.

After Cambridge and MIT, you went to Oxford and then back to India. What did you do in India?

I joined the Planning Commission in New Delhi, where my first big job was to find ways of raising the bottom 30 percent of India's population out of poverty to a "minimum income" level.

And what did you prescribe?

My main prescription was to "grow the pie." My research suggested that the share of the bottom 30 percent of the pie did not seem to vary dramatically with differences in economic and political systems.

So growth in the pie seemed to be the principal (but not the only) component of an anti-poverty strategy. To supplement growth's good effects on the poor, the Indian planners were also dedicated to education, health, social reforms, and land reforms. Also, the access of the lowest-income and socially disadvantaged groups to the growth process and its benefits was to be improved in many ways, such as extension of credit without collateral.

My main prescription was to "grow the pie" … Much empirical work shows that where growth has occurred, poverty has lessened.

Today, this strategy has no rivals. Much empirical work shows that where growth has occurred, poverty has lessened. It is nice to know that one's basic take on an issue of such central importance to humanity's well-being has been borne out by experience!

You left India in 1968 to come to the United States and an academic job at MIT. Why?

While the decision to emigrate often reflects personal factors—and they were present in my case—the offer of a professorship from MIT certainly helped me

JAGDISH BHAGWATI is University Professor at Columbia University. Born in India in 1934, he studied at Cambridge University in England, MIT, and Oxford University before returning to India. He returned to teach at MIT in 1968 and moved to Columbia in 1980. A prolific scholar, Professor Bhagwati also writes in leading newspapers and magazines throughout the world. He has been much honored for both his scientific work and his impact on public policy. His greatest contributions are in international trade but extend also to developmental problems and the study of political economy.

Michael Parkin talked with Jagdish Bhagwati about his work and the progress that economists have made in understanding the benefits of economic growth and international trade since the pioneering work of Adam Smith.

make up my mind. At the time, it was easily the world's most celebrated department. Serendipitously, the highest-ranked departments at MIT were not in engineering and the sciences but in linguistics (which had Noam Chomsky) and economics (which had Paul Samuelson). Joining the MIT faculty was a dramatic breakthrough: I felt stimulated each year by several fantastic students and by several of the world's most creative economists.

We hear a lot in the popular press about fair trade and level playing fields. What's the distinction between free trade and fair trade? How can the playing field be unlevel?

Free trade simply means allowing no trade barriers such as tariffs, subsidies, and quotas. Trade barriers make domestic prices different from world prices for traded goods. When this happens, resources are not being used efficiently. Basic economics from the time of Adam Smith tells us why free trade is good for us and why barriers to trade harm us, though our understanding of this doctrine today is far more nuanced and profound than it was at its creation.

Fair trade, on the other hand, is almost always a sneaky way of objecting to free trade. If your rivals are hard to compete with, you are not likely to get protection simply by saying that you cannot hack it. But if you say that your rival is an "unfair" trader, that is an easier sell! As international competition has grown fiercer, cries of "unfair trade" have therefore multiplied. The lesser rogues among the protectionists ask for "free and fair trade," whereas the worst ones ask for "fair, not free, trade."

Fair trade … is almost always a sneaky way of objecting to free trade.

At the end of World War II, the General Agreement on Tariffs and Trade (GATT) was established and there followed several rounds of multilateral trade negotiations and reductions in barriers to trade. How do you assess the contribution of GATT and its successor, the World Trade Organization (WTO)?

The GATT has made a huge contribution by overseeing massive trade liberalization in industrial goods among the developed countries. GATT rules, which "bind" tariffs to negotiated ceilings, prevent the raising of tariffs and have prevented tariff wars like those of the 1930s in which mutual and retaliatory tariff barriers were raised, to the detriment of everyone.

The GATT was folded into the WTO at the end of the Uruguay Round of trade negotiations, and the WTO is institutionally stronger. For instance, it has a binding dispute settlement mechanism, whereas the GATT had no such teeth. It is also more ambitious in its scope, extending to new areas such as the environment, intellectual property protection, and investment rules.

Running alongside the pursuit of multilateral free trade has been the emergence of bilateral trade agreements such as NAFTA and the European Union (EU). How do you view the bilateral free trade areas in today's world?

Unfortunately, there has been an explosion of bilateral free trade areas today. By some estimates, the ones in place and others being plotted approach 400! Each bilateral agreement gives preferential treatment to its trading partner over others. Because there are now so many bilateral agreements, such as those between the United States and Israel and between the United States and Jordan, the result is a chaotic pattern of different tariffs depending on where a product comes from. Also, "rules of origin" must be agreed upon to

determine whether a product is, say, Jordanian or Taiwanese if Jordan qualifies for a preferential tariff but Taiwan does not and Taiwanese inputs enter the Jordanian manufacture of the product.

I have called the resulting crisscrossing of preferences and rules of origin the "spaghetti bowl" problem. The world trading system is choking under these proliferating bilateral deals. Contrast this complexity with the simplicity of a multilateral system with common tariffs for all WTO members.

We now have a world of uncoordinated and inefficient trade policies. The EU makes bilateral free trade agreements with different non-EU countries, so the United States follows with its own bilateral agreements; and with Europe and the United States doing it, the Asian countries, long wedded to multilateralism, have now succumbed to the mania.

We now have a world of uncoordinated and inefficient trade policies.

Instead, if the United States had provided leadership by rewriting rules to make the signing of such bilateral agreements extremely difficult, this plague on the trading system today might well have been averted.

Is the "spaghetti bowl" problem getting better or worse?

Unquestionably it is getting worse. Multilateralism is retreating and bilateralism is advancing. The 2010 G-20 meeting in Canada was a disappointment. At the insistence of the United States, a definite date for completing the Doha Round was dropped and instead, unwittingly rubbing salt into the wound, President Barack Obama announced his administration's willingness to see the U.S.-South Korea free trade agreement through. There are distressing recent reports that the U.S. Commerce Department is exploring ways to strengthen the bite of anti-dumping actions, which are now generally agreed to be a form of discriminatory protectionism aimed selectively at successful exporting nations and firms. Equally distressing is Obama's decision to sign a bill that raises fees on some temporary work visas in order to pay for higher border-enforcement expenditures.Further, it was asserted that a tax on foreign workers would reduce the numbers coming in and "taking jobs away" from U.S. citizens. Many supporters of the proposal claimed, incoherently, that it would simultaneously discourage foreign workers from entering the United States and increase revenues.Obama's surrender exemplified the doctrine that one retreat often leads to another, with new lobbyists following in others' footsteps. Perhaps the chief mistake, as with recent "Buy American" provisions in U.S. legislation, was to allow the Employ American Workers Act (EAWA) to be folded into the stimulus bill. This act makes it harder for companies to get govern-mental support to hire skilled immigrants with H1(b) visas: They must first show that they have not laid off or plan to lay off U.S. workers in similar occupations. Whatever the shortcomings of such measures in economic-policy terms, the visa-fee-enhancement provision is de facto discriminatory, and thus violates WTO rules against discrimination between domestic and foreign firms, or between foreign firms from different WTO countries. While the visa-fee legislation is what lawyers call "facially" non-discriminatory, its design confers an advantage on U.S. firms vis-à-vis foreign firms.Such acts of discrimination in trade policies find succor in the media and in some of America's prominent think tanks. For example, in the wake of the vast misery brought by flooding to the people of Pakistan, the U.S. and other governments have risen to the occasion with emergency aid. But there have also been proposals to grant duty-free access to Pakistan's exports. But this would be discriminatory toward developing countries that do not have duty-free access, helping Pakistan at their expense.

What advice do you have for a student who is just starting to study economics? Is economics a good subject in which to major?

I would say: enormously so. In particular, we economists bring three unique insights to good policy making.

First, economists look for second- and subsequent-round effects of actions.

Second, we correctly emphasize that a policy cannot be judged without using a counterfactual. It is a witticism that an economist, when asked how her husband was, said, "compared to what?"

Third, we uniquely and systematically bring the principle of social cost and social benefit to our policy analysis.