SOLUTIONS MANUAL

EIGHTH EDITION

MACROECONOMICS
PARKIN

C h a p t e r 2   THE ECONOMIC PROBLEM

C h a p t e r   K e y   I d e a s

Good, Better, Best!

A. For many people, life is good and getting better, but we all face costs and must choose what we think is best for us.

B. This chapter sharpens the concepts of scarcity and opportunity cost, introduces the idea of economic efficiency, and explains how we can expand production by accumulating capital and specializing and trading with each other.

O u t l i n e

**I. Production Possibilities and Opportunity Cost**

A. **Production Possibilities Frontier**

1. The **production possibilities frontier** (*PPF*) is the boundary between those combinations of goods and services that can be produced and those that cannot (*ceteris paribus*).

2. The *PPF* in Figure 2.1 shows the combinations of "CDs" and "pizza" (standing for *any* pair of goods and services) that can be produced *ceteris paribus*.

3. Points *inside* and *on* the frontier are attainable and points *outside* the frontier are unattainable.

B. **Production Efficiency**

1. We achieve **production efficiency** if we cannot produce more of one good without producing less of some other good.

2. Points *on* the frontier utilize *all* the available resources and are production efficient.

3. Any point inside the frontier, such as point *Z*, is inefficient because at

FIGURE 2.1   Production Possibilities Frontier
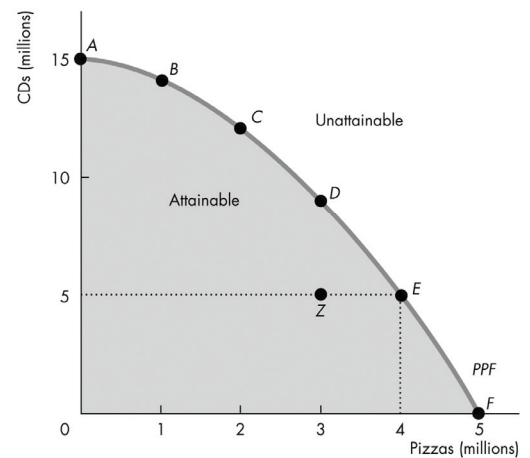
Possibility	Pizzas (millions)		CDs (millions)
A	0	and	15
B	1	and	14
C	2	and	12
D	3	and	9
E	4	and	5
F	5	and	0

such a point it is possible to produce more of one good without producing less of the other good. At Z, resources are either *unemployed* or *misallocated*.

C. **Tradeoff Along the *PPF***

   1. When we operate efficiently along the *PPF*, we face a *tradeoff* because we must give up something to get more of something else.

D. **Opportunity Cost**

   1. The *opportunity cost* of an action is the highest-valued alternative forgone. Moving along the *PPF* has an opportunity cost.

      a) As we move along the *PPF* and produce more pizza (for example a move from *C* to *D* in Figure 2.1), the opportunity cost of the additional pizzas is the decrease in CD production. The production of CDs decreases from 12 million to 9 million, a decrease of 3 million; the production of pizza increases from 2 million to 3 million, an increase of 1 million. So the opportunity cost of a pizza is 3 million CDs/1 million pizzas or 3 CDs per pizza.

      b) As we move along the *PPF* in the and produce more CDs (for example a move from *D* to *C* in Figure 2.1), the opportunity cost of the additional CDs is the decrease in pizza production. The production of pizza decreases from 3 million to 2 million, a decrease of 1 million; the production of CDs increases from 9 million to 12 million, an increase of 3 million. So the opportunity cost of a CD is 1 million pizza/3 million CDs or 1/3 of a pizza per CD.

   2. Opportunity cost is a ratio.

      a) Opportunity cost is the decrease in the quantity produced of one good divided by the increase in the quantity produced of the other good.

      b) Because the opportunity cost is a ratio, the opportunity cost of producing an additional CD is equal to the inverse of the opportunity cost of producing an additional pizza.

   3. Because resources are not all equally productive in all activities, the *PPF* bows outward. The outward bow of the *PPF* means that as the quantity produced of each good increases, so does its opportunity cost. Increasing opportunity cost is a widespread phenomenon.

II. **Using Resources Efficiently**

A. All the points along the *PPF* are production efficient. To determine which of the alternative efficient quantities to produce, we compare costs and benefits.

B. **The *PPF* and Marginal Cost**

   1. The *PPF* determines opportunity cost.

2. The **marginal cost** of each good or service is the opportunity cost of producing one more unit of it. Moving along the *PPF* determines the marginal cost. Figure 2.2 illustrates the marginal cost of pizza.

    a) As we move along the *PPF* in part (a), the opportunity cost and the marginal cost of pizza increases.

   b) In part (b), upward-sloping *MC* curve shows the increasing marginal cost of each additional pizza produced.

C. **Preferences and Marginal Benefit**

    1. **Preferences** are a description of a person's likes and dislikes. We can describe preferences by using the concepts of marginal benefit.

    2. The **marginal benefit** of a good is the benefit received by an individual from consuming one more unit of that good.

        a) We measure marginal benefit by what a person is *willing to pay* for an additional unit of a good.

    3. The **marginal benefit curve** shows the relationship between the marginal benefit of a good and the quantity of that good consumed.

        a) The willingness to pay for any good decreases as the quantity consumed of that good increases, which reflects the *principle of decreasing marginal benefit.*

        b) A marginal benefit curve slopes downward to reflect the principle of decreasing marginal benefit.

FIGURE 2.2   The *PPF* and Marginal Cost
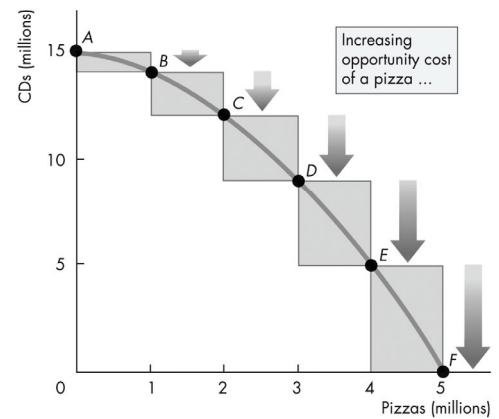

(a) *PPF and opportunity cost*
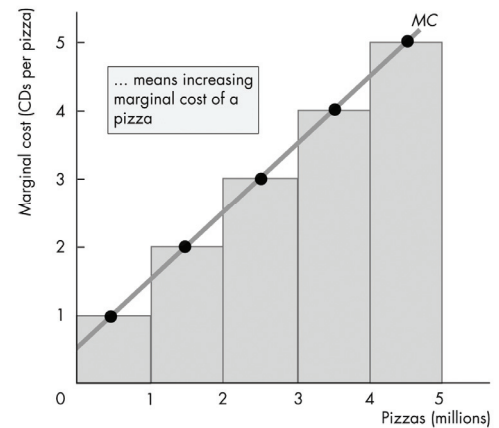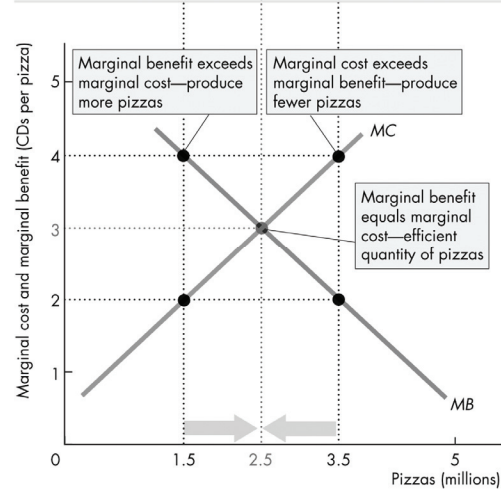

(b) **Marginal cost**

D. **Efficient Use of Resources**

1. **Allocative efficiency** occurs when we cannot produce more of one good or service without producing less of another good or service that we *value more highly*—when we produce at the point on the *PPF* that we prefer above all other points.

2. Figure 2.4 illustrates the allocatively efficient quantity of pizza.

    a) At a low production of pizza, such as 1.5 million pizzas, the marginal benefit of another pizza exceeds the marginal cost of producing another pizza so that people value an additional pizza more than it costs to produce. In this case, we are better off producing more pizza.

    b) At a high production of pizza, such as 2.5 million pizzas, the marginal cost of producing another pizza exceeds the marginal benefit of another pizza so that people value an additional pizza less than it costs to produce. In this case, we are better off producing less pizza.

    c) Allocative efficiency occurs when the quantity of pizza produced is such that the marginal benefit equals the marginal cost, which in the figure is 2.5 million pizza.

FIGURE 2.4   Efficient Use of Resources
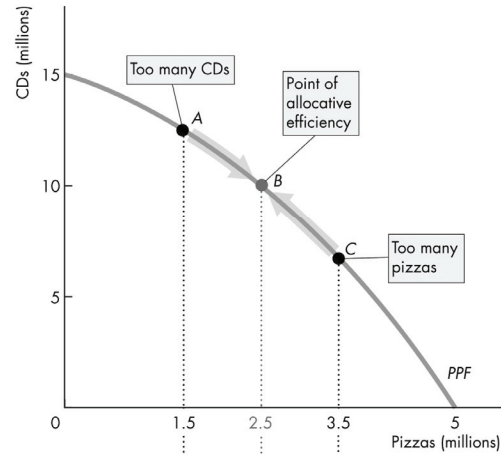
(a) **On the PPF**

(b) **Marginal benefit equals marginal cost**

III. Economic Growth

A. The expansion of production possibilities—and increase in the *standard of living*—is called **economic growth**. To make our economy grow, we face a standard of living tradeoff

B. The Cost of Economic Growth

1. Two key factors influence economic growth:

a) **technological change**, which is the development of new goods and better ways of producing goods and services; and

b) **capital accumulation**, which is the growth of capital resources, including *human capital*.

2. To use resources in research and development and to produce new capital, we must decrease our production of consumption goods and services. Figure 2.5 illustrates this tradeoff, using the example of pizza and pizza ovens. By using some resources to produce pizza ovens, the *PPF* shifts outward in the future.

**FIGURE 2.5**   Economic Growth
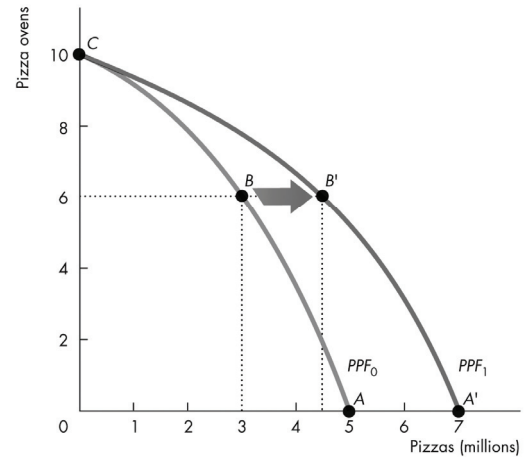
C. **Economic Growth in the United States and Hong Kong**

1. Some nations, such as Hong Kong, have chosen faster capital accumulation at the expense of current consumption and so have experienced faster economic growth.

2. Figure 2.6 illustrates and compares Hong Kong and the United States. The United States has chosen more current consumption and so has grown more slowly than Hong Kong.

FIGURE 2.6   Economic Growth in the United States and Hong Kong
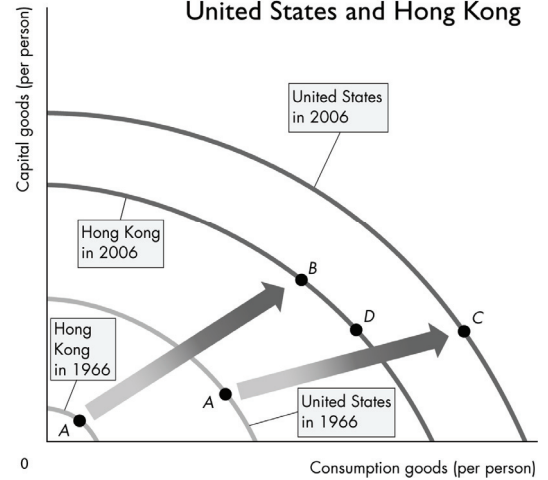
IV. Gains from Trade

A. **Comparative Advantage and Absolute Advantage**

1. A person has a **comparative advantage** in an activity if that person can perform the activity at a lower opportunity cost than anyone else. A person has an **absolute advantage** if that person is more productive than others.

a)   Table 2.1 shows Liz's production possibilities for smoothies and salads. Liz's opportunity cost of producing 1 smoothie is 1 salad and her opportunity cost of producing 1 salad is 1 smoothie.

TABLE 2.1	Liz's Production Possibilities	
Item	**Minutes to produce 1**	**Quantity per hour**
Smoothies	1.5	40
Salads	1.5	40

b)   Table 2.2 shows Joe's production possibilities for smoothies and salads. Joe's opportunity cost of producing 1 smoothie is 5 salads and his opportunity cost of producing 1 salad is 1/5 of a smoothie.

TABLE 2.2	Joe's Production Possibilities	
Item	**Minutes to produce 1**	**Quantity per hour**
Smoothies	10	6
Salads	2	30

c)   Liz has an absolute advantage because she is more productive than Joe in producing both smoothies and salads.

d)   Because Liz's opportunity cost of producing a smoothie is less than Joe's opportunity cost, she has a comparative advantage in producing smoothies. And because Joe's opportunity cost of producing a salad is less than Liz's, he has a comparative advantage in producing salads.

B.   **Achieving the Gains from Trade**

1.   If Liz and Joe produce smoothies and salads *independently*, in an hour Liz might produce 20 smoothies and 20 salads and Joe might produce 5 smoothies and 5 salads. These productions are at point *A* in Figure 2.7.

2.   Figure 2.7 shows what can happen if Liz and Joe specialize in the good for which they have a comparative advantage and trade with each other.

FIGURE 2.7   The Gains from Trade

(a) Joe   **(b) Liz**
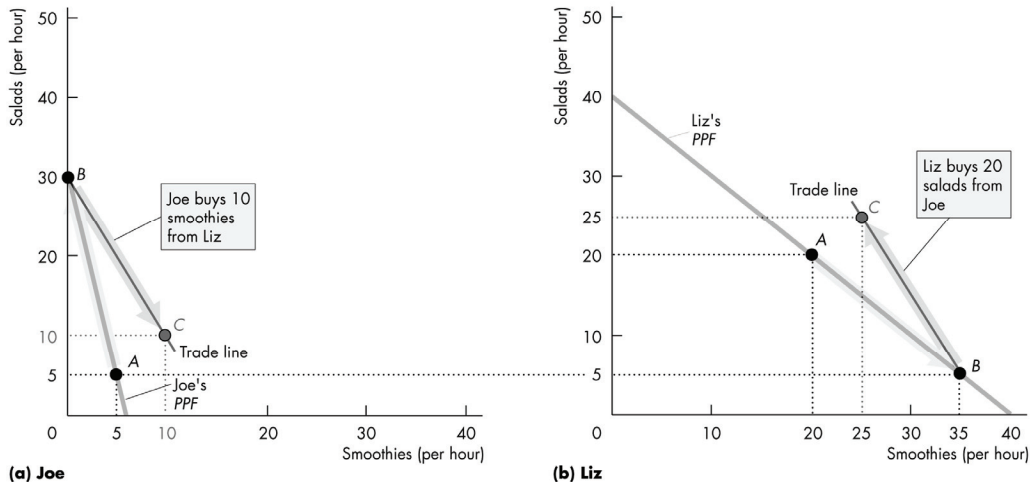
a)   Liz produces 35 smoothies and 5 salads and Joe produces 0 smoothies and 30 salads.

b)   If Liz and Joe exchange smoothies and salads at two salads per smoothie they exchange along the *Trade line*. Liz ends up with up 25 smoothies and 25 salads and Joe ends up

with 10 smoothies and 10 salads. Each has 5 more smoothies and 5 more salads than their initial production.

    c) Liz and Joe have gained specialization and trade.

2. Nations can gain from specialization and trade, just like Liz and Joe can.

C. **Dynamic Comparative Advantage**

1. **Learning-by-doing** occurs when a person repeatedly produces a particular good or service and thereby becomes more productive in that activity. Such learning-by-doing means that the opportunity cost of producing the good falls over time.

2. **Dynamic comparative advantage** occurs when a person (or country) gains a comparative advantage from learning-by-doing.

V. Economic Coordination

A. **Firms**

A **firm** is an economic unit that hires and organizes factors to produce and sell goods and services.

B. **Markets**

A **market** is any arrangement that enable buyers and sellers to get information and to do business with each other.

B. **Property Rights**

Property rights, which are the social arrangements that govern the ownership, use, and disposal of resources, goods or services, allow markets to work.

D. **Money**

Money is any commodity or token that is generally accepted as a means of payment.

C. **Circular Flows through Markets**

1. A circular flow diagram, like Figure 2.8, illustrates how households and firms interact in the goods markets and the factor markets.

2. The diagram reflects the circular flow of goods and services and factors of production in one direction, and the flow of money in the opposite direction.

3. Prices coordinate decisions in markets.

FIGURE 2.8   Circular Flows in the Market Economy
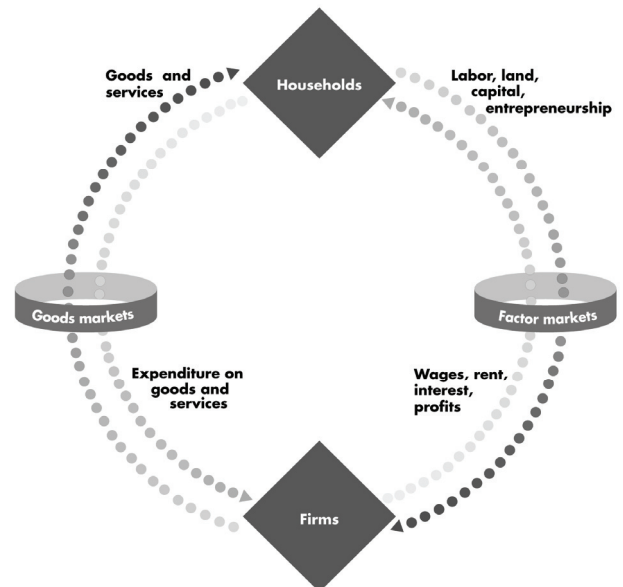
Reading Between the Lines

A news article explores the *PPF* for high school graduates, college graduates, and business school MBA graduates. The essence of the analysis is that each successive graduation increases the person's production possibilities by making the person more productive. However, increasing education also means giving up current consumption of goods and services, so more education is not free—it has an opportunity cost.

New in the Eighth Edition

The definition of absolute advantage is changed slightly. The new definition is that a person who is more productive than others has an absolute advantage. The example in the text illustrating comparative advantage and the gains from trade has been changed from Tom and Nancy producing CDs and CD cases to Liz and Joe producing smoothies and salads. In addition to figures that demonstrate the gains from trade, the eighth edition also has tables showing Liz's and Joe's production possibilities and the gains from trade after each specializes and trades.

Teaching Suggestions

Chapter 1 *talks about* economics but Chapter 2 starts to *do* economics. Emphasize that *doing* economics requires *practice*. Tell the students that doing economics is like doing aerobics. Coming to class and watching you solve problems will provide the same benefits as going to the gym and watching the aerobics instructor go through some routines. Learning economics is like keeping fit. You must do the exercises—and the repeats.

1. *Production Possibilities and Opportunity Cost*

   The production possibility frontier (*PPF*) is the first economic model the students see. Your first challenge it to ensure that the students understand the mechanics of the model. You can provide some help in the classroom but your main goal must be to get the student working—to develop good work habits. Encourage them to work the end-of-chapter problems, study guide questions, and use the web page so that they are comfortable with the mechanics of this chapter.

   Your second challenge is to help the students begin to use the *PPF* model and to start thinking like economists. Thinking about everyday events in terms of graphs and tables of numbers is hard for most students. You can help them to appreciate *economic models* in general and the *PPF model* in particular by using the model to describe the tradeoff between studying and a social life faced every day by each student.

   Why do some of the brightest students not get a 4.0 GPA? After sleeping, attending classes, and performing the mundane tasks of life, a student has 8 hours a day available for study and recreation. If the student spends all 8 hours studying, he/she will get a 4.0 GPA. But each hour of recreation lowers the GPA.

   The Economics of Campus Life 101. First, assume a constant opportunity cost of recreation equal to a 0.333 drop in the GPA for each hour spent not studying. The highest GPA possible is 4.0, the lowest is 1.333, and the negatively sloped *PPF* curve is a straight line. Ask the students to draw the graph based on your description. Help them to interpret the *PPF* graph: the *intercept points* reveal the maximum GPA and the maximum recreation hours possible, and the *negative slope* quantifies the tradeoff the student faces. Points on the curve represent *production efficiency* and points inside the

curve represent a misallocation of the student's time where opportunities for increases in recreation and/or GPA points are wasted.

Then show that the opportunity cost of each additional hour of recreation (lost GPA points) is *constant*. Ask the students why.

The Economics of Campus Life 102. Now ask the students whether they find the second hour of study as productive as the first and the third as productive as the second, and so on. With a bit of help, they will tell you that the effect on the GPA of an extra hour a day of study gets smaller the more hours per day the student studies.

Now give them a table similar to that in *Figure 2.1* that captures this observation. Here is an example:

Possibility	Recreation (hours per day)		GPA (points)
A	0	and	4.0
B	1	and	3.9
C	2	and	3.7
D	3	and	3.4
E	4	and	3.0
F	5	and	2.5
G	6	and	1.9
H	7	and	1.2
I	8	and	0.4

Ask the students to use the data in this table to draw the *PPF* graph and to calculate the *opportunity cost* of each successive hour recreation. Note that the opportunity cost of recreation is now increasing. Ask them if this case looks more "realistic."

2. ***Using Resources Efficiently***

Return to the question: ***Why do some of the brightest students not get a 4.0 GPA?*** The answer—because it doesn't achieve allocative efficiency—can now be approached. The next step is to derive the marginal cost curve from the *PPF*. The following table provides eight points on the *MC* curve. Use this opportunity to explain why we plot marginal values at the midpoints of changes because the marginal cost at the midpoint approximately equals the average of the opportunity costs across the interval.

Recreation (hours per day)	Marginal cost (GPA points per hour)
0.5	0.1
1.5	0.2
2.5	0.3
3.5	0.4
4.5	0.5
5.5	0.6
6.5	0.7
7.5	0.8

The students must now think about *preferences* for recreation and study. You'll be surprised how many students want to derive preferences from the *PPF!* Explain that the *PPF* provides the

constraint—what is feasible—and preferences provide the objective—what is desirable in the opinion of the chooser.

Each additional hour of recreation likely yields a smaller marginal benefit to the student. Translate this to the proposition that the student's willingness to give up GPA points for additional hours of recreation decreases and provide a table similar to that in Figure 2.3 that captures this observation. Here is an example that works:

Recreation (hours per day)	**Willingness to pay** (GPA points per hour)
0.5	0.7
1.5	0.6
2.5	0.5
3.5	0.4
4.5	0.3
5.5	0.2
6.5	0.1
7.5	0

To study or not to study a little bit longer? That is the question. Walk the student through the thought experiment:

1. If I study for 8 hours a day I get a 4.0, but I am willing to pay much more than I will pay if a take a bit of time off studying and have some fun. So I will be better off if study less and take more recreation time.

2. If I don't study at all I get a 0.4, and I am paying much more in lost GPA than I am willing to pay for the last bit of fun. So I will be better off if I study more and take less recreation time.

3. The only allocation at which I can't become better off by studying a little bit more or a little bit less is where I am just willing to pay what the last bit of recreation costs—where marginal cost equals marginal benefit.

In this example, the student studies for 4.5 hours and takes 3.5 hours a week of recreation time.

Explain that there is nothing strange or wrong with the fact that the student gets no net benefit from the last seconds-worth of recreation time. He/she is just willing to pay what it costs him/her.

3. *Economic Growth*

   You can have some fun and generate some discussion by getting the students to think about what life might be like after another 200 years of economic growth. Provide some numbers: In 2002, income per person in the United States was about $100 a day. In 1802 it was about 70¢ a day, and if the past growth rate prevails for another 200 years, in 2202 it will be $14,000 a day. Emphasize the magic of compound growth. If they think that $14,000 a day is a big income, get them to do a ballpark estimate of the daily income of Bill Gates (about $14 *million*!). Encourage a discussion of why scarcity is still present even at these large incomes.

   If you wish, connect the discussion of efficiency with that of growth. Ask the students to explain what determines the efficient growth rate (not in text).

4. *Gains from Trade*

   The gain from trade is a real eye-opener for students. Their first reaction is one of skepticism. Convincing students of the power of trade to raise living standards and the costs of trade restriction is one of the most productive things we will ever do.

Here are some ideas to drive home the idea of comparative advantage:

Why didn't Billy Sunday do his own typing? Billy Sunday, an evangelist in the 1930s, was reputed to be the world's fastest typist. Nonetheless, he employed a secretary who was a slower typist than he. Why? Because in one hour of preaching, Billy could raise several times the revenue that he could raise by typing for an hour. So Billy plays to his comparative advantage.

Why doesn't Martha Stewart bake her own bread? Martha Stewart is probably a better cook than most people, but she is an even better writer and TV performer on the subject of food. So Martha plays to her comparative advantage and writes about baking bread but buys her bread.

Why doesn't Vinnie Jones play soccer? Vinnie Jones was one of the world's best soccer players. But he stopped playing soccer and started making movies some years ago. Why? Because, as he once said, "You go to the bank more often when you're in movies." Vinnie's comparative advantage turned out to be in acting.

The costs of trade restrictions need to be driven home. For example, steel tariffs cost everyone who buys products made out of steel. While domestic steel producers benefit from the tariffs, other domestic firms that use steel to produce consumer goods such as cars and motorcycles oppose tariffs for the simple reason that they raise their costs of production. Likewise, the housing construction industry opposes restrictions on imports of foreign lumber. Eliminating these trade restrictions would lower the costs of "big ticket" consumer goods as motorcycles, cars, and houses.

5. *Economic Coordination*

    The point of this short section is to lay the groundwork for the next chapter on demand and supply. You can cover it fast or you can use it as a peg on which to hang a discussion of some of the big-picture of the underpinnings of our subject. Some examples follow:

    The "Invisible Hand": How self-interested individuals promote prosperity for all. Explain that in economics, we take human nature as given (in contrast to political science, philosophy, and some other fields) and assume that people are self-interested. Note if you wish that self-interest does not mean selfish.

    If everyone is self-interested, how are people encouraged to specialize and exchange to promote prosperity for all? Building on the Tom and Nancy example in the chapter, you can explain how specialization and exchange achieves a higher standard of living than does self-sufficiency. So self-interest promotes specialization and exchange.

    But for specialization and exchange to work, people must be able to trade. That is why markets are so crucial.

    Property Rights and Markets: The key to promoting socially beneficial activity. To reap the gains from specialization, people need access to markets in which voluntary exchange can take place. Markets work only if property rights are established and enforced.

The Big Picture

Where we have been:

Chapter 1 introduced the economic reality that wants exceed the resources available to satisfy them—we face scarcity. Chapter 2 has reinforced the central themes of Chapter 1 by laying out the core economic model, the *PPF*, and using it to illustrate the concepts of tradeoff and opportunity cost. Chapter 2 has gone on to a deeper explanation, again with a model, of the concepts of marginal cost and marginal benefit, presented a first look at the concept of efficiency, and concluded with an explanation of the source of the gains from specialization and exchange and the roles of firms and markets in achieving those gains.

Where we are going:

The key concept of *opportunity cost* and the widespread tendency for the opportunity cost of a good to increase as the quantity produced of that good increases returns in Chapter 3 when we explain the supply curve and in Chapters 9 and 10 when we study a firm's costs and cost curves. Preferences return and are treated more rigorously when we explain marginal utility theory in Chapter 7 and indifference curves in Chapter 8. Efficiency returns in Chapter 5 when we study the efficiency of markets and first preview the impediments to efficiency. Economic growth receives an extensive coverage in Chapter 24 (Chapter 9 of Macroeconomics). The gains from trade are explored more completely in the context of international trade in Chapter 32 (Chapter 19 in Microeconomics and Chapter 17 of Macroeconomics). Finally, the role of markets and prices in allocating resources and coordinating activity is an ongoing theme throughout most of the rest of the text.

The next task, in Chapter 3, is to develop the central demand and supply model.

Additional Discussion Questions

1. *Using the PPF model to analyze an "Arms Race" between nations.* You might like to get the students to realize how useful even a simple economic model (such as the *PPF* model) is for helping us understand and interpret important political events in history. Draw a *PPF* for *military* goods and *civilian* goods production (or, simply, the traditional example of "guns versus butter"). Then draw another *PPF* for a country that is about twice the size of the first, but with the same degree of concavity as the *PPF* for the first country. Now assume that each country considers the other as a mortal "enemy," and that they engage in a costly "arms race." Each country picks a point on the *PPF* that produces an equal level of military output (in absolute terms).

   What would happen if the larger country decided to increase military production? Emphasize that while the distance on the military output axis at the point of production is *equal* for both countries, the resulting distance on the civilian output axis is (by definition) a smaller quantity for the smaller country. The large country can create significant economic and political pressures on the government of the small country by forcing the small country to *match* the increase in military production. The *PPF* reveals how much more additional civilian output is forgone by the citizens of the small economy relative to the citizens of the larger economy. Emphasize also that the *opportunity cost* of civilian goods is higher for the smaller country.

   What were the economic repercussions of the Cold War? History and political science majors quickly perceive that these two *PPF* models reflect the Cold War relationship between the United States and the U.S.S.R. during the early 1980s. The Reagan administration increased U.S. military expenditures during the early 1980s to a post–Viet Nam War peak of 6.6 percent of GDP (as compared to about 3.5 percent of GDP in the late 1990s). Many experts agree that this strategy contributed to the many political and economic pressures that ultimately lead to the dissolution of the U.S.S.R.

   "What are the implications for the next 50 years?" China is currently the world's third largest economy. It becomes the second in a few years and the biggest by mid-century. How does this development influence the strategic balance and the position of the United States?

2. *Using the PPF model to analyze global environmental agreements between nations.* This application of the *PPF* is a less "hawkish" and perhaps a more "green" perspective on a timely international policy issue. Compare a rich economy *PPF* to a poor economy *PPF*, each with the same degree of concavity. (Production levels are now measured as output per person.) The goods are now "cleaner air" and "other goods and services."

   What if the citizens of each country were required to make equal reductions in per-person greenhouse gas emissions? Show an equal quantity increase in per person output on the clean air axis

for both countries' PPF curves. Show how the opportunity cost of requiring additional pollution reduction (cleaner air) of equal amounts per person is much greater for the citizens of a poorer country than for the citizens of the richer country. This fact has been used to persuade developed countries (like the United States) to accept larger pollution reduction targets than developing countries (like China, India, and African nations).

Answers to the Review Quizzes

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1. The unattainable combinations of production that lie *beyond* the *PPF* curve illustrate the concept of *scarcity*. There simply are not enough resources to produce any of these combinations of outputs.

2. The combinations of outputs that lie on the *PPF* curve illustrate the concept of production efficiency. Points on the frontier indicate that increasing the production of one good requires decreasing the production of another good, which is the definition of production efficiency. Any point inside the frontier reflects production where one or both outputs may be increased without decreasing the other output level. Clearly, such points cannot be production efficient.

3. Movements along the *PPF* frontier illustrates that producing more of one good requires that less of the other good be produced. This is the *tradeoff* that must be made when producing output efficiently.

4. The negative slope of the production possibility curve illustrates the concept of *opportunity cost*. Moving along the production possibility frontier, producing additional units of a good requires that the output of another good must fall. This sacrifice is the opportunity cost of producing more of the first good.

5. The slope of the *PPF* is a *ratio* that expresses the quantity of lost production of one good when increasing the units of the other good produced. The steeper the slope, the greater ratio, and the greater is the opportunity cost of increasing the output of the good measured along the horizontal axis.

6. Some resources are better suited to produce one type of good or service, like pizza. Other resources are better suited to produce other goods or services, like DVDs. If society allocates resources wisely, it will use each resource to produce the kind of output for which it is best suited. A small increase in pizza output when pizza production is relatively *low* requires only small increases in the use of those resources still good at making pizza and not good at making DVDs. This yields a small decrease in DVD production for a large increase in pizza production, creating a relatively *low opportunity cost* reflected in the gentle slope of the *PPF* curve over this range of output. However, the same small increases in pizza output when pizza production is relatively *large* will require society to devote to pizza production those resources that are less suited to making pizza and more suited at making DVDs. This reallocation of resources yields a relatively small increase in pizza output for a large decrease in DVD output, creating a relatively *high opportunity cost* reflected in the steep slope of the *PPF* curve over this range of output. The opportunity cost of pizza production increases with the quantity of pizza produced as the slope of the *PPF* curve becomes ever steeper, creating the *bowed out* effect (the concavity of the *PPF* function).

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1. *Marginal cost* is the opportunity cost of producing *one more unit* of a good or service and is reflected in the slope of the *PPF* curve.

2. The *marginal benefit* of a good or service is the benefit received from the last unit consumed. It is measured by what an individual is willing to give up (or pay) for that last unit.

3. As the more of a good is consumed, the marginal benefit received from each unit is smaller than the marginal benefit received from the unit consumed immediately before it, and is larger than the marginal benefit from the unit consumed immediately after it. This is known as *decreasing marginal benefits* and is often assumed by economists to be a common characteristic of an individual's preferences over most goods and services in the economy.

4. *Production efficiency* occurs when production takes place at a point on the *PPF* curve. This indicates that all available resources are being used for production and society cannot produce additional units of one good or service without reducing the output of another good or service.

5. Resources are used efficiently when more of one good or service cannot be produced without producing less of some of another good or service that is *valued more highly*. This is known as *allocative efficiency* and it occurs when: 1) production efficiency is achieved, and 2) the marginal benefit received from the last unit produced is equal to the marginal cost for producing the last unit.

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1. The two key factors that generate economic growth are *technological change* and *capital accumulation*. Technological change allows an economy to produce more with the same amount of limited resources, but in a new way that increases output. Capital accumulation means that an economy actually has increased its available resources for production (capital is one of the four limited resources).

2. Economic growth shifts the *PPF* rightward. Persistent rightward shifts in the production possibility frontier—economic growth—are caused by the accumulation of resources (more capital equipment, more labor, and so on) and/or by the development of new technology.

3. When a society devotes more of its scarce resources to research and development of new technologies, or devotes additional resources to produce more capital equipment, both decisions lead to increased consumption opportunities in future periods at the cost of less consumption today. This is the opportunity cost borne by society for creating economic growth.

4. Hong Kong chose to devote a greater proportion of its available resources to the production of capital than the United States. This allowed Hong Kong to grow at a faster rate (at least until recently). By foregoing consumption and producing a greater proportion of capital goods over the last few decades, Hong Kong was able to achieve levels of output per person comparable to the United States.

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1. A person has a comparative advantage in production when he or she gives up the *least amount* of production of another good or service than anyone else when producing one unit of another good or service.

2. A person has a *comparative advantage* in producing a good when he or she has the lowest opportunity cost of producing it. *Comparative advantage is based on the output forgone.* A person has an *absolute advantage* in production when he or she uses the least amount of *time or resources* to produce one unit of that particular good or service. *Absolute advantage is a measure of productivity in using inputs.*

3. People can compare consumption possibilities from producing all goods and services through *self-sufficiency* against specializing in producing only those goods and services that are to their comparative advantage and trading their output with others who do the same. People can then see that the consumption possibilities from specialization and trade are greater and more complex than under self-sufficiency. Therefore it is in people's own *self-interest* to specialize. It was Adam Smith who first pointed out in the *Wealth of Nations* how individuals *voluntarily* engage in this socially beneficial and cooperative activity through the pursuit of their own self-interest, rather than for society's best interests.

4. From society's standpoint, the total output of goods and services available for consumption is greater with specialization and exchange. From an individual's perspective, each person who

        specializes enjoys being able to consume a more complex and larger bundle of goods and services after trading with others who have also specialized, than would otherwise be possible under self-sufficiency. These increases are the gains from specialization and trade for society and for individuals.

5.   Because everyone is specializing in producing the good or service at which they have a comparative advantage, each person pays the minimum possible opportunity cost of production. Total output is higher than if each individual produced goods and services under self-sufficiency. This increase in output is the gains from trade.

6.   A person or country achieves a *dynamic comparative advantage* when that person or country gains a comparative advantage from *learning-by-doing*. Learning-by-doing occurs when a person or country pursues specialization vigorously, resulting in a declining opportunity cost (and therefore a rising comparative advantage) over time for producing a particular good or service.

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1.   In order for a society to enjoy the fruits of specialization and exchange, the individuals who comprise that society must voluntarily desire to specialize in the first place. Discovering trade opportunities after a person has specialized in his or her comparative advantage in production is what allows that person to gain from his or her own specialization efforts. Trading opportunities can only take place if a *market* exists where people observe *prices* to discover available trade opportunities. Also, people must enjoy social recognition of and government protection of *property rights* to have confidence that their commitments to trade arrangements will be respected by everyone in the market.

2.   Markets are necessary to coordinate consumer choices over resource allocation decisions with those of firms (producers). The mechanism that promotes such coordination of decisions is the *price* mechanism. Unmet demand for a product generates higher prices for a good or service, which causes consumers to demand less and firms to produce more of that good or service. Overstocks create lower prices for a good or service, which causes consumers to demand more and firms to produce less of that good or service.

3.   On the real side of the economy, goods and services flow from firms to households. On the monetary side of the economy, payments for factors of production, wages, rent, interest, and profits, flow from firms to households. Flowing from households to firms on the monetary side of the economy are the expenditures on goods and services and on the real side are the factors of production, labor, land, capital, and entrepreneurship.

Answers to the Problems

1. a. Wendell's opportunity cost of an hour of tennis is 2.5 percentage points.
   When Wendell increases the time he plays tennis from 4 hours to 6 hours, his grade in economics falls from 75 percent to 70 percent. His opportunity cost of 2 hours of tennis is 5 percentage points. So his opportunity cost of 1 hour of tennis is 2.5 percentage points.

   b. Wendell's opportunity cost of an hour of tennis is 5 percentage points.
   When Wendell increases the time he plays tennis from 6 hours to 8 hours, his grade in economics falls from 70 percent to 60 percent. His opportunity cost of 2 hours of tennis is 10 percentage points. So his opportunity cost of 1 hour of tennis is 5 percentage points.

2. a. Wendell's grade in economics is 66 percent.
   When Wendell increases the time he plays tennis from 4 hours to 6 hours, his opportunity cost of the additional 2 hours of tennis is 5 percentage points. So his opportunity cost of an additional 1 hour is 2.5 percentage points. Plot this opportunity cost at 5 hours on the graph (the midpoint between 4 and 6 hours). When he increases the time he plays tennis from 6 hours to 8 hours, his opportunity cost of the additional 2 hours of tennis is 10 percentage points. So his opportunity cost of the additional 1 hour of tennis is 5 percentage points. Plot this opportunity cost at 7 hours on the graph (the midpoint between 6 and 8 hours). When he increases the time he plays tennis from 8 hours to 10 hours, his opportunity cost of the additional 2 hours of tennis is 20 percentage points. So his opportunity cost of the additional 1 hour of tennis is 10 percentage points. Plot this opportunity cost at 9 hours on the graph (the midpoint between 8 and 10 hours). Wendell's opportunity cost of playing tennis increases as he spends more time on tennis. Join the points plotted. This curve is Wendell's marginal cost of a additional hour of tennis.
   Wendell uses his time efficiently if he plays tennis for 7 hours a week because when he plays 7 hours a week his marginal benefit from tennis equals its marginal cost. Wendell's marginal benefit is 5 percentage points and his marginal cost is 5 percentage points. When Wendell plays 7 hours of tennis, his grade in economics (from his *PPF*) is 66 percent.

   b. If Wendell studied for enough hours to get a higher grade, he would have fewer hours to play tennis. Wendell's marginal benefit from tennis would be greater than his marginal cost, so he would be more efficient (better off) if he played more hours of tennis and took a lower grade.

3. a. Sunland's *PPF* is a straight line.
   To make a graph of Sunland's *PPF,* measure the quantity of one good on the *x*-axis and the quantity of the other good on the *y*-axis. Then plot the quantities in each row of the table and join the points.

   b. The opportunity cost of 1 pound of food is 1/2 gallon of sunscreen.
   The opportunity cost of the first 150 pounds of food is 75 gallons of sunscreen. To find the opportunity cost of the first 150 pounds of food, increase the quantity of food from 0 pounds to 150 pounds. In doing so, Sunland's production of sunscreen decreases from 150 gallons to 75 gallons. The opportunity cost of the first 150 pounds of food is 75 gallons of sunscreen. Similarly, the opportunity costs of producing the second 150 pounds of food is 75 gallons of sunscreen. So the opportunity cost of 1 pound of food is 75 gallons of sunscreen/150 pounds of food, or 1/2 gallon of sunscreen per pound of food.

   c. The opportunity cost of 1 gallon of sunscreen is 2 pounds of food.
   The opportunity cost of producing the first 75 gallons of sunscreen is 150 pounds of food. To calculate this opportunity cost, increase the quantity of sunscreen from 0 gallons to 75 gallons. Sunland's production of food decreases from 300 pounds to 150 pounds. Similarly, the opportunity cost of producing the second 75 gallons of sunscreen is 150 pounds of food. So the

opportunity cost of 1 gallon of sunscreen is 150 pounds of food/75 gallons of sunscreen, or 2 pounds of food per gallon of sunscreen.

4. a. The marginal benefit curve slopes downward.
        To draw the marginal benefit from sunscreen, plot the quantity of sunscreen on the *x*-axis and the willingness to pay for sunscreen (that is, the number of pounds of food that they are willing to give up to get a gallon of sunscreen) on the *y*-axis.
    b. The efficient quantity is 75 gallons a month.
        The efficient quantity to produce is such that the marginal benefit from the last gallon equals the opportunity cost of producing it. The marginal cost of a gallon of sunscreen is 2 pounds of food. The marginal benefit of the 75th gallon of sunscreen is 2 pounds of food. So the marginal benefit equals marginal cost when Sunland produces 75 gallons of sunscreen per month.

5. a. The *PPF* will have the quantity of wheat on one axis and the quantity of pork on the other axis. The *PPF* will be bowed outward from the origin.
    b. The *PPF* will shift outward so that the maximum quantity of pork increases but the maximum quantity of wheat does not change. The *PPF* will remain bowed outward from the origin.
    c. The opportunity cost of a ton of wheat has increased because the new technology means that more pork must be forgone for each ton of wheat. In the *PPF* diagram, if the quantity of wheat is measured along the horizontal axis, the opportunity cost of a ton of wheat equals the slope of the *PPF*. With the new technology, the *PPF* has shifted so that the magnitude of the slope is larger, which means that the opportunity cost of a ton of wheat is larger. If the quantity of wheat is measured along the horizontal axis, the opportunity cost of a ton of wheat equals the reciprocal of the slope. With the new technology, the *PPF* has shifted so that the magnitude of the slope is smaller, which means that the opportunity cost of a ton of wheat is larger.
    d. As long as the farm produces on its *PPF*, it is production efficient both before and after the change in technology. If the farm produces at a point within its *PPF*, then it is production inefficient both before and after the change in technology.

6. a. Tom's opportunity cost of producing a ball is 4 bats/40 balls, or 0.10 bats per ball.
    b. Tessa's opportunity cost of producing a ball is 4 bats/80 balls, or 0.05 bats per ball.
    c. Tessa has the comparative advantage in producing balls because her opportunity cost of a ball is lower than Tom's opportunity cost.
    d. Both Tom and Tessa gain from the specialization and trade.
        Tom specializes in producing bats and Tessa specializes in producing balls. Tom produces 4 bats per hour and Tessa produces 80 balls, for total production of 4 bats and 80 balls. If neither specialized and both spent half their time producing balls and the other half producing bats, Tom would produce 2 bats and 20 balls and Tessa would produce 2 bats and 40 balls. The total production would be 4 bats (2 from Tom and 2 from Tessa) and 60 balls (20 from Tom and 40 from Tessa). Specialization means that Tom can trade 2 bats for 30 balls and so have 2 bats and 30 balls, 10 more balls than the case without specialization and trade. Tessa would have 2 bats and 50 balls, (also) 10 more balls than the case without specialization and trade.
    e. Tessa has the comparative advantage in producing bats.
        Tom's opportunity cost of a bat is 40 balls/4 bats, or 10 balls per bat. Tessa's opportunity cost of a bat is 80 balls/20 bats or 4 balls per bat. Tessa has the comparative advantage in producing bats because her opportunity cost of producing a bat is lower than Tom's opportunity cost of producing a bat.
    f. Tom and Tessa can still gain from trade if each specializes in his or her comparative advantage (Tom in balls, Tessa in bats) and then trades.

g.   Tessa specializes in bats and is definitely willing to trade 1 bat for 15 balls because her opportunity cost of producing a bat is only 4 balls. Tom, however, is not willing to pay Tessa 15 balls for a bat because his cost of producing a bat is only 10 balls. Tom can produce bats at a lower cost than 15 balls per bat. The price of a bat will settle so that it is less than Tom's opportunity cost of producing a bat and more than Tessa's opportunity cost of producing a bat.

C r i t i c a l   T h i n k i n g

1.   a.   The allocatively efficient point on the *PPF* is the point where the marginal benefit of education goods and services equals the marginal cost of education goods and services.
The marginal cost of education goods and services can be derived from the *PPF* and equals the reciprocal of the magnitude of the slope of the PPF curve. The marginal benefit depends on the person's views about the marginal benefits from education. The allocatively efficient quantity of education is the point where the upward sloping marginal cost curve intersects the downward sloping marginal benefit curve.

   b.   If the cost of tuition rises, the *PPF*s shift downward so that the maximum quantity of consumption goods and services does not change but the maximum quantity of education goods and services decreases.
The *PPF*s become flatter, which indicates that the opportunity cost of education goods and services rises. The higher opportunity cost of education decreases the quantity of education goods and services people consume.

   c.   If a person reaps all the marginal benefits and pays all the marginal costs from education, then the person likely obtains an efficient quantity of education. But if the person does not reap all the benefits or if the person does not pay all of the marginal costs of if the person miscalculates either the marginal benefits or the marginal costs, then the quantity of education consumed is not efficient.

2.   a.   Before the war the South had a comparative advantage in producing cotton.

   b.   The *PPF* will have the quantity of cotton on one axis and the quantity of food and manufactured goods on the other axis. The production point has the South producing a great deal of cotton and very little food and manufactured goods; indeed, in the unlikely case that the South completely specialized, the production point is at the maximum quantity of cotton and zero food and manufactured goods. From the production point a trade line with a negative slope touches the *PPF* and extends beyond the *PPF*. The trade line shows that the South traded cotton for manufacturing goods and food and consumed at a point beyond its *PPF*.

   c.   Assuming that the Civil War did not affect the South's *PPF* (which was likely true only for the first part of the war) the North's blockade meant that the South could no longer trade with others. As a result, the South increased its production of manufacture goods (especially munitions) and food, which caused the South to decrease its production of cotton. The blockade forced the South's consumption point to lie on its *PPF*, so the South's consumption of manufactured goods and food decreased.

   d.   The Civil War increased the opportunity cost of food and manufactured goods. However it decreased the opportunity cost of cotton.
The opportunity cost of cotton decreased because the blockade lead the South to produce less cotton. Moving along a *PPF*, as less of a good is produced, its opportunity cost falls.

3.   a.   The United States does not have a comparative advantage in producing ethanol. In the United States, $1.00 worth of other goods and services must be forgone for a gallon of ethanol whereas in Brazil only $0.90 of other goods and services must be forgone for a gallon of ethanol.

b. If there are no technological changes in the production of ethanol so that the *PPF* between ethanol and other goods and services does not shift, then the opportunity cost of producing ethanol in the United States will increase as more ethanol is produced.

c. The United States could gain from trade with Brazil by importing ethanol from Brazil. Brazil produces ethanol at lower opportunity cost than the United States, so the opportunity cost to the United States of consuming ethanol would be lower if the United States consumed ethanol produced in Brazil.

4. a. The *PPF*s might be linear, though more realistic *PPF*s would be bowed out from the origin. The important point about the two *PPF*s is that the opportunity cost of producing tea is lower in India. If tea is measured along the horizontal axis, the magnitude of the slope of the *PPF* is equal to the opportunity cost of producing tea, so in this case the U.S. *PPF* would be steeper than the Indian *PPF*.

b. The downward sloping marginal benefit curve for tea has shifted rightward after more baby-boomers have started to appreciate tea.

c. The United States imports tea.

d. If the *PPF* in India between tea and other goods and services is bowed out from the origin, increasing the production of tea raises the opportunity cost of producing tea.
The opportunity cost of cotton decreased because the blockade lead the South to produce less cotton. Moving along a *PPF*, as less of a good is produced, its opportunity cost falls.

Web Activities

1. a. The *PPF* a student draws should be similar to those on page 49.
The *PPF* should show the quantity of consumption goods and services on one axis and the quantity of education goods and services on the other axis and should be bowed out from the origin.

b. Whether a particular student believes that the marginal benefit of an MBA exceeds his or her marginal cost depends on the marginal cost of the MBA program the student selected and the student's perception of an MBA degree from that program.

Additional Problems

1. Jane's Island's production possibilities are

Corn (pounds per month)		Cloth (yards per month)
3.0	and	0
2.0	and	2
1.0	and	4
0	and	6

   a. Draw a graph of the production possibility frontier on Jane's Island.

   b. What are Jane's opportunity costs of producing corn and cloth at each output in the table?

2. In problem 1, Jane is willing to give up 0.75 pounds of corn per yard of cloth if she has 2 yards of cloth; 0.50 pounds of corn per yard of cloth if she has 4 yards of cloth; and 0.25 pound of corn per yard of cloth if she has 6 yards of cloth.

   a. Draw a graph of Jane's marginal benefit from corn.

   b. What is Jane's efficient quantity of corn?

3. Joe's production possibilities are

Corn (pounds per month)		Cloth (yards per month)
6	and	0
4	and	1.0
2	and	2.0
0	and	3.0

   What are Joe's opportunity costs of producing corn and cloth at each output in the table?

4. In problems 1 and 2, Jane's Island produces and consumes 2 pounds of corn and 2 yards of cloth. Joe's Island produces and consumes 2 pounds of corn and 2 yard of cloth. Now the islands begin to trade.

   a. What good does Jane sell to Joe and what good does Jane buy from Joe?

   b. If Jane and Joe divide the total output of corn and cloth equally, what are the gains from trade?

Solutions to Additional Problems

1. a. Jane's Island's *PPF* is a straight line.
        To make a graph of Jane's Island's *PPF* measure the quantity of one good on the *x*-axis and the quantity of the other good on the *y*-axis. Plot the quantities in each row of the table.

    b. The opportunity cost of 1 pound of corn is 2 yards of cloth.
        The opportunity cost of the first pound of corn is 2 yards of cloth. To find the opportunity cost of the first pound of corn, increase the quantity of corn from 0 pounds to 1 pound. In doing so, Jane's Island's production of cloth decreases from 6 yards to 4 yards. The opportunity cost of the first pound of corn is 2 yards of cloth. Similarly, the opportunity costs of producing the second pound and the third pound of corn are 2 yards of cloth.

        The opportunity cost of 1 yard of cloth is 0.5 pound of corn. The opportunity cost of producing the first 2 yards of cloth is 1 pound of corn. To calculate this opportunity cost, increase the quantity of cloth from 0 yards to 2 yards. Jane's Island's production of corn decreases from 3 pounds to 2 pounds. Similarly, the opportunity cost of producing the second 2 yards and the third 2 yards of cloth are 1 pound of corn.

2. a. The marginal benefit curve slopes downward.
        To draw the marginal benefit from cloth, plot the quantity of cloth on the *x*-axis and the willingness to pay for cloth (that is, the number of pounds of corn that they are willing to give up to get a yard of cloth) on the *y*-axis.

    b. The efficient quantity is 4 yards a month.
        The efficient quantity to produce is such that the marginal benefit from the last yard equals the opportunity cost of producing it. The opportunity cost of a yard of cloth is 0.5 pound of corn. The marginal benefit of the fourth yard of cloth is 0.5 pound of corn. And the marginal cost of the fourth yard of cloth is 0.5 pound of corn.

3. Joe's Island's opportunity cost of a pound of corn is 1/2 yard of cloth, and its opportunity cost of a yard of cloth is 2 pounds of corn.

    When Joe's Island increases the corn it produces by 2 pounds a month, it produces 1 yard of cloth less. The opportunity cost of 1 pound of food is 1/2 yard of cloth. Similarly, when Joe's Island increases the cloth it produces by 1 yard a month, it produces 2 pounds of corn less. The opportunity cost of 1 yard of cloth is 2 pound of corn.

4. a. Jane's Island sells cloth and buys corn.
        Jane's Island sells the good in which it has a comparative advantage and buys the other good from Joe's Island. Jane's Island's opportunity cost of 1 yard of cloth is 1/2 pound of corn, while Joe's Island's opportunity cost of 1 yard of cloth is 2 pounds of corn. Jane's Island's opportunity cost of cloth is less than Joe's Island's, so Jane's Island has a comparative advantage in producing cloth.

        Jane's Island's opportunity cost of 1 pound of corn is 2 yards of cloth, while Joe's Island's opportunity cost of 1 pound of corn is 1/2 yard of cloth. Joe's Island's opportunity cost of corn is less than Jane's Island's, so Joe's Island has a comparative advantage in producing corn.

    b. The gains from trade for Jane's Island are an increase of 2 pounds of corn and a decrease of 1 yard of cloth. The gains from trade for Joe's Island are an increase of 2 yards of cloth and a decrease of 1 pound of corn.
        With specialization and trade, together they can produce 6 pounds of corn and 6 yards of cloth. So each will get 3 pounds of corn and 3 yards of cloth—an additional 1 pound of corn each and an additional 1 yard of cloth each