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Solutions for Chapter 2, Confronting Scarcity—Choices in Production

Concept Problems

1. Human capital is the skill a worker has as a result of education, training, or experience that can be used in production. A college education provides additional training in the areas of verbal, writing, speaking, computing, and analytical skills. In addition, a college education provides opportunity for students to work in teams, an element of human capital very much in demand in the modern, global economy.

2. A downward-sloping production possibilities curve shows that in order to obtain more of one good (or service), another must be forgone. That is the meaning of scarcity—the situation where we are forced to choose among alternatives.

3. The law of increasing opportunity costs holds that as an economy moves along its production possibilities curve in the direction of producing more of a particular good, the opportunity cost of additional units of that good will increase. That is what is shown on a bowed-out production possibilities curve—its slope gets steeper and steeper. To get additional units of one good, more and more of the other good must be given up.

4. When resources are allocated according to comparative advantage, specialized resources are allocated to the production of a specific good. If more of that good is produced, less specialized resources, with comparative advantage in other goods, will have to be used. This necessarily means that the cost of producing additional units will increase, just as the law of increasing opportunity costs predicts.

5. The opportunity cost of producing good B is given by the absolute value of the slope of the production possibilities curve. The opportunity cost of producing good B is increased as indicated by the greater slope of curve ST at point E' than was the slope (in absolute value) on curve RT at point E.

6. Two approaches could be taken to this problem. One would be to recognize that blue-eyed people are capable of working but are barred from doing so by an arbitrary law. That would imply no change in the curve itself, but a choice of a solution inside the curve. Alternatively, one could regard the law as part of the determination of society's resources and treat it as an inward shift in the production possibilities curve. The law is a form of economic discrimination and has the effect on production that economic discrimination always has: It limits society's choices in production.

7. The statement is a normative one that can't be either proved or disapproved. In general, policies to promote growth involve a sacrifice in present consumption. Whether such policies are desirable depends on whether one regards the benefits of future increases in consumption as worth the cost of forgone current consumption.

8. The cost of producing additional footballs generally lower in Sportsland than in Foodland because Sportsland's production possibilities curve is generally flatter. If,

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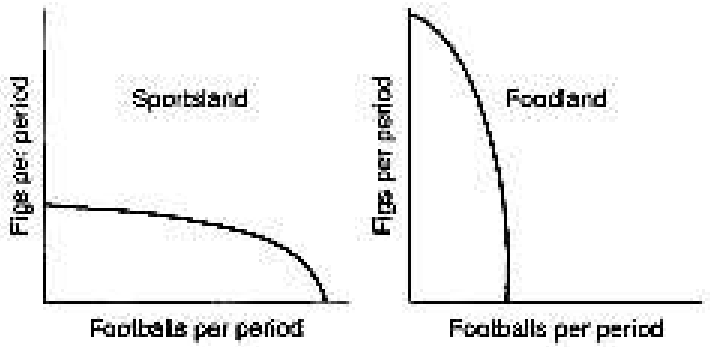
however, Sportsland is operating close to the intersection of its production possibilities curve and the horizontal axis and Foodland is operating close to the intersection of its curve and the vertical axis, than the cost of one more football could be greater in Sportsland.



9. It would be bowed in.

10. Assuming that states imposed the restrictions, U.S. output would go down. It would reduce production by blocking the allocation of resources according to comparative advantage.

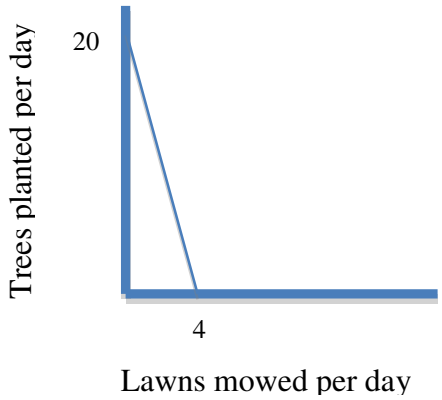
11. By allowing resources to be allocated on the basis of comparative advantage, the elimination of trade barriers within the European Union tended to increase total output as the EU moved closer to the combined production possibilities curve for the member nations.

12. The production possibilities curve shifted outward.

Numerical Problems

1. a. The production possibilities curve is a straight line from a point at twenty trees per day on the vertical axis to four lawns per day on the horizontal axis.
b. Nathan must forgo 1/5 of a lawn mowed for each tree he plants.
c. Mowing a lawn requires that Nathan give up planting 5 trees.

Figure 2-1a



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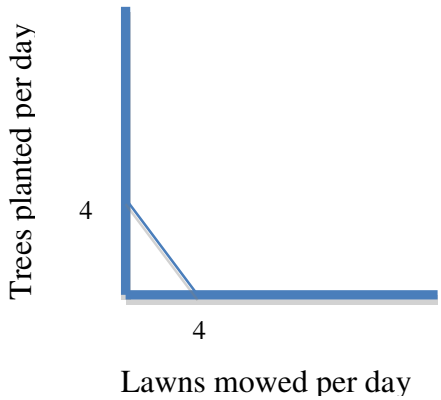
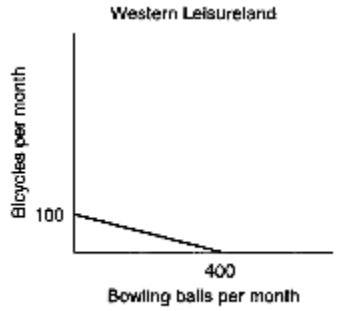
2. a. The production possibilities curve is a straight line drawn from four trees planted per day on the vertical axis to four lawns mowed per day on the horizontal axis.
b. The opportunity cost of planting a tree is mowing one lawn per day.
c. The opportunity cost of mowing one lawn is planting one tree.

Figure 2-2a



3. Nathan's opportunity cost of planting one tree per day is 1/5 of a lawn mowed, while David's cost per tree planted per day is one lawn mowed per day. Nathan has the comparative advantage in planting trees. David's opportunity cost for mowing one lawn is planting one tree; Nathan's opportunity cost for mowing one lawn is planting five trees. David has the comparative advantage for mowing lawns.

4. a. The slope of Germany's production possibilities curve is −(1/3).
b. The slope of Turkey's production possibilities curve is −2.
c. The opportunity cost of a T-shirt in Germany is 1/3 of an optical instrument.
d. The opportunity cost of a T-shirt in Turkey is 2 optical instruments.
e. The opportunity cost of producing an optical instrument in Germany is three T-shirts per year.
f. The opportunity cost of producing an optical instrument in Turkey is 1/2 a T-shirt per year.
g. Germany has a comparative advantage in the production of T-shirts.
h. Turkey has a comparative advantage in the production of optical instruments.



5. a.

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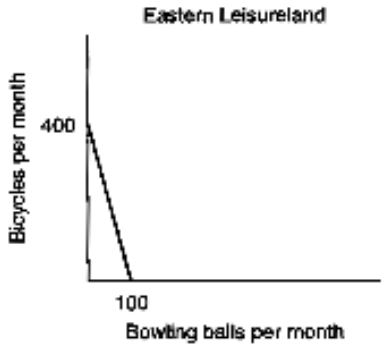
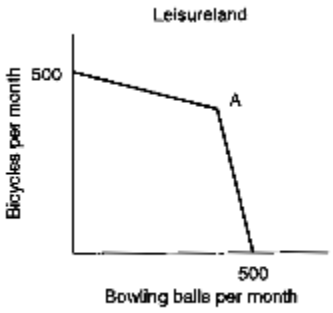
b. To produce one additional bowling ball per month requires reducing production of bicycles by 1/4 of a bicycle per month so the opportunity cost of an additional bowling ball is 1/4 of a bicycle.
c.



d. The opportunity cost of producing one more bowling ball per month in Eastern Leisureland is the production of 4 bicycles per month.
e. Western Leisureland has a comparative advantage in bowling ball production because it costs less to produce them there. Eastern Leisureland has a comparative advantage in producing bicycles.
f.



g. 400 bowling balls per month can be produced.
h. Bowling balls will be produced in Western Leisureland, and bicycles will be produced in Eastern Leisureland.

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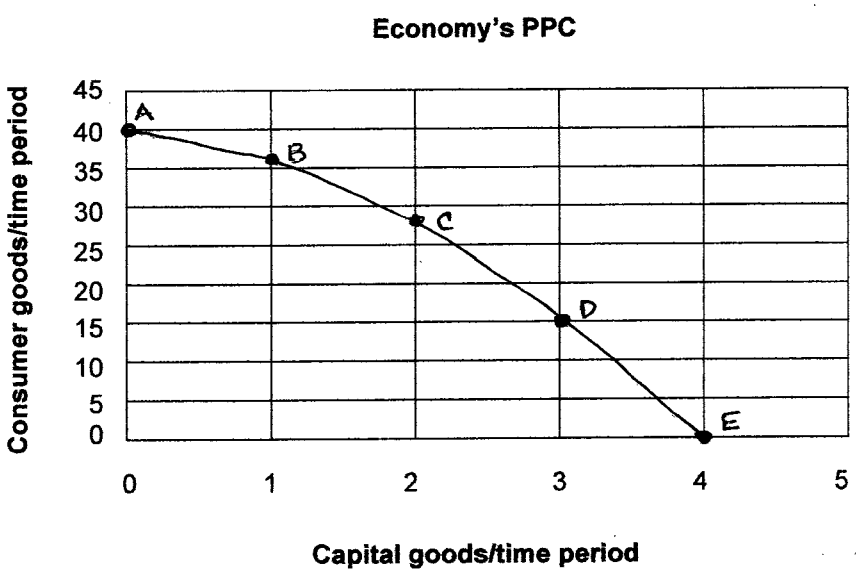

6. a.
b. The cost of producing one more unit of capital goods per period by moving from Point B to Point C is 8 units of consumer goods per period.
c. Moving from Point C to Point D requires giving up the production of 12 units of consumer goods per period.
d. It is possible to produce 30 units of consumer goods per period while producing 1 unit of capital goods per period, but since the economy could produce 36 units of consumer goods, producing only 30 implies either an inefficient allocation of resources or a failure to employ resources fully.
e. Point C involves the production of more capital goods and should therefore lead to more economic growth.

7. a. (0.94+0.56)/2.92 = 51.3%
b. (0.40+0.66)/2.92 = 36.3%
c. The increase in the quantity of labor to overall growth made the largest contribution in the 1973-1982 subperiod since the ratio of the contribution of the increase in the quantity of labor to overall growth, 0.66/1.55 = 42.5%, is higher than in any other of the subperiods.
d. Technological change made the largest contribution to overall growth in the 1948-1973 subperiod since the ratio of the contribution of technological change to overall growth, 1.09/3.70 = 29.5%, is higher than in any other of the subperiods.

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Chapter 2

Confronting Scarcity: Choices in Production

Overview

Economics deals with choices. In this chapter we have examined more carefully the range of choices in production that must be made in any economy. In particular, we looked at choices involving the allocation of an economy's factors of production: labor, capital, and natural resources.

In addition, in any economy, the level of technology plays a key role in determining how productive the factors of production will be. In a market economy, entrepreneurs organize factors of production and act to introduce technological change.

The production possibilities model is a device that assists us in thinking about many of the choices about resource allocation in an economy. The model assumes that the economy has factors of production that are fixed in both quantity and quality. When illustrated graphically, the production possibilities model typically limits our analysis to two goods. Given the economy's factors of production and technology, the economy can produce various combinations of the two goods. If it uses its factors of production efficiently and has full employment, it will be operating on the production possibilities curve.

Two characteristics of the production possibilities curve are particularly important. First, it is downward sloping. This reflects the scarcity of the factors of production available to the economy; producing more of one good requires giving up some of the other. Second, the curve is bowed out. Another way of saying this is to say that the curve gets steeper as we move from left to right; the absolute value of its slope is increasing. Producing each additional unit of the good on the horizontal axis requires a greater sacrifice of the good on the vertical axis than did the previous units produced. This fact, called the law of increasing opportunity cost, is the inevitable result of efficient choices in production—choices based on comparative advantage.

The production possibilities model has important implications for international trade. It suggests that free trade will allow countries to specialize in the production of goods and services in which they have a comparative advantage. This specialization increases the production of all goods and services.

Increasing the quantity or quality of factors of production and/or improving technology will shift the production possibilities curve outward. This process is called economic growth. In the last 50 years, economic growth in the United States has resulted chiefly from increases in human capital and from technological advance.

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Choices concerning the use of scarce resources take place within the context of a set of institutional arrangements that define an economic system. The principal distinctions between systems lie in the degree to which ownership of capital and natural resources and decision making authority over scarce resources are held by government or by private individuals. Economic systems include market capitalist, mixed, and command socialist economies. An increasing body of evidence suggests that market capitalist economies tend to be most productive; many command socialist and mixed economies are moving in the direction of market capitalist systems.

The presumption in favor of market-based systems does not preclude a role for government. Government is necessary to provide the system of laws on which market systems are founded. It may also be used to provide certain goods and services, to help individuals in need, and to regulate the actions of individuals and firms.

Learning Objectives

1. Define the three factors of production—labor, capital, and natural resources.
2. Explain the role of technology and entrepreneurs in the utilization of the economy's factors of production.
3. Explain the concept of the production possibilities curve and understand the implications of its downward slope and bowed-out shape.
4. Use the production possibilities model to distinguish between full employment and situations of idle factors of production and between efficient and inefficient production.
5. Understand specialization and its relationship to the production possibilities model and comparative advantage.
6. Understand the argument for unrestricted international trade in terms of economic specialization and comparative advantage.
7. Define economic growth in terms of the production possibilities model and discuss factors that make such growth possible.
8. Explain the classification of economic systems, the role of government in different economic systems, and the strengths and weaknesses of different systems.

Common Student Difficulties

1. Chapter 2 provides the first use of graphing skills presented in the first chapter for economic theory building. For this reason, when developing the production possibilities curve from the information about Christie Ryder's plants, do not assume that the material from Chapter 1 has been mastered. Carefully graph the data in class; show how to get the slope of the negatively sloped lines for the different products; and repeatedly ask questions which make the students interpret the meaning of the graph at each point in the process. Spending time early in the semester to enable students to understand how to read and interpret graphs and providing ample practice will make it easier to present far more complex concepts of either micro or macro graphically later on.

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2. The authors have purposely chosen to present only the concept of comparative advantage in this chapter and to save the contrast to absolute advantage until later in the text when international trade is discussed more fully. It is probably best not to make the distinction at this stage of the course. There are already enough fundamental concepts to be assimilated without adding one that is a detour from the main thrust of the chapter. Therefore resist the temptation to overwhelm the class with distinctions that can be handled well later. Do be careful, however, to use the text definitions exactly, since they are correct. That will assure that in future chapters, the definitions will not be inconsistent, only expanded and inclusive of more detail.

3. Students usually find information on different economic systems inherently interesting. They lack sufficient knowledge, though, of their own system to fully appreciate the differences. A common mistake students make is to assume that any command system must be tied to a dictatorship as a political system. Of course, this is often true, but the two are not the same. Be sure to distinguish the political system from the economic system. In theory, those in government who make the command decisions in command socialism could be elected in free, open, secret ballot elections—in essence, a command economy paired with a democratic government. Similarly, free markets do not guarantee political freedom. There is, of course, considerable literature on the connections between economic and political freedom. Even if you wish to present some of this information to the class, their appreciation and understanding of it will probably be enhanced if you wait until the end of the course with the formal discussion of alternative economic systems in the last chapter of the text. If you wish to present the material earlier, at least complete Chapter 3 before inserting the last chapter on systems.

Suggestions for Active Learning

Micro Essays

1. Leisure time is of economic value since people have to give up other activities including paid work to participate. Draw a production possibilities curve between goods and services on one axis and leisure time on the other. Compare and contrast the shape of this curve with the ones found in the chapter. Explain any differences.

2. Do increases in any kind of education increase economic growth? How dependent is your answer on the definition of economic growth given in Chapter 2?

3. Do changes in factors that increase economic growth affect all outputs identically (cause a parallel shift in the PPC)? Why or why not?

Group Activities

(See Group Activities in Preface for suggestions on how to make the group processes work more effectively.)

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Use groups to work sample problems or to discuss the micro essays assigned. Practicing concepts and technical material in groups helps improve learning. The micro essays can also be used as group quizzes. (See Chapter 1.)

In-Class Activities

Parliamentary Debate: Select a few students (perhaps only two in a small class) to represent each side of a controversial issue. Provide them with short (instructor-edited or written) readings which summarize a particular position. Give them at least one class period to prepare a presentation for the class. On the debate day, read the controversial statement and ask students to move to one side of the room to sit if they agree with it and to the other side of the room if they disagree. Then have each student group present the view they were assigned. Allow students to move from one side of the room to the other and back again as they are persuaded one way or the other by the presentations. (This is a way to encourage students who are not presenting to pay attention and to become actively involved in other students' reports.) Allow presenters to respond to each other and class members to comment on the arguments made while the rest continue to move into different seats. At the end, allow time to summarize the results of the activity. Require all class members to choose a side and to identify the one best argument made for that position which persuaded them in a brief written statement to be handed in. This activity will aid students in understanding rational arguments and illustrate how and why people can disagree. This is an important step in learning abstract and disciplined thinking.

Sample Topics:

1. Technological change should not be encouraged because it destroys jobs and causes hardship.

2. The United States should encourage trade with China because the enormous population of China could provide important markets for U.S. goods.

For references and readings on a variety of economic topics, there are a number of published texts. Some recommended ones follow:

Lecture Extensions

Restrictions on Using Factors: In the early history of economic development, all the factors of production were available for use virtually without restriction. Children could be put to work at ages as young as four or five. Working conditions could be horrible and the hours very long. Advertisements in newspapers during the Industrial Revolution in England claimed that some weaving and spinning machines were so easy to run that a five-year-old could pay for his own keep by using them. Labor was the first factor of production to be restricted in use. Reaction to the excesses of the Industrial Revolution led to child labor laws, regulations on working conditions, and restrictions on the number of hours worked. The modern model of production

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possibilities predicts that output should fall and the PPC shift inward from the reduction in the labor factor available when these restrictions were first enacted. This might not be the case, however. The improvements in health and safety from the restrictions might make workers more productive thereby offsetting the reduction in labor available. In fact, that is exactly what happened in Robert Owen's factory in Scotland when he voluntarily initiated the reforms that later became law. This is an example in which increases in human capital offset a decline in the quantity of labor.

A more recent set of restrictions has been initiated over the use of natural resources. Concern for lack of economic sustainability if natural resources are depleted and for the destruction of the environment underlies these newer regulations. Once again, the modern model of production possibilities would predict a reduction in possible output and an inward shift in the PPC in response to limiting the natural resources available for the production of goods and services. In this case, however, it is not as easy to see how such restrictions might enhance the goods and services available as they have been defined. An unspoiled environment, however, is an economic good. Many people are willing to pay for natural beauty and wilderness areas. They are also willing to pay to not mine coal and other minerals because of the damage to the earth. Everyone doesn't feel this way, but just as everyone doesn't like brussel sprouts, some do. By including an unspoiled natural environment as one of the goods and services provided by an economy, it may be possible to show that the restrictions enhance the production possibilities. This example shows the importance of definitions to the results of economic models.

Labor Saving versus Capital Saving Factor Change: A further development of the production possibilities curve analysis of growth allows for technological change that does not affect all outputs identically. The concept of specialization and the law of increasing opportunity cost demonstrate that some goods rely more heavily on one kind of input than other goods do. Therefore, technological change which affects one particular kind of input more than other inputs will also affect the production of goods which use that input intensively more than other goods. The graphs used to illustrate growth in Chapter 2 show parallel shifts in the production possibilities curve. This kind of shift is called a "neutral technological change." Such a shift assumes that all inputs (and therefore all outputs) are affected in exactly the same way by whatever factor has changed. In reality, parallel shifts are not likely. All inputs (and therefore all outputs) are not usually affected by a factor change in exactly the same way.

Consider the case of technological change that reduces the amount of labor required to produce products. This will affect those products that already use a lot of labor more than those products that already use very little. It allows more labor for the labor-intensive products and therefore increases the maximum amount of labor-intensive production more than the increase in capital-intensive production. As a result, the production possibilities curve shifts outward but in a way which favors the labor-intensive good. Just the opposite happens when technological change expands the productivity of capital. The capital-intensive products will gain more from this

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change than will labor-intensive products. Again the growth shift in the production possibilities curve will not be a parallel shift.

Questions for Cases in Point in the Text

Case 1: Technology Cuts Costs, Boosts Productivity, Profits, and Utility

1. Explain how worker productivity can increase if workers are exactly the same themselves as they were before the technological change.
2. Explain why some workers and some producers have sought to limit technological change if there are so many benefits from it.

Case 2: The Cost of the Great Depression

1. Why do you think it took so long for resources to be fully utilized again?
2. Do you think there were other costs beside the cost of the lost output during the Depression? Why?

Case 3: Economic Growth: What to Expect

1. Why does Robert Gordon argue that future growth is likely to be lackluster? Discuss arguments before and against this proposition.
2. Why should we care about the pace of economic growth?

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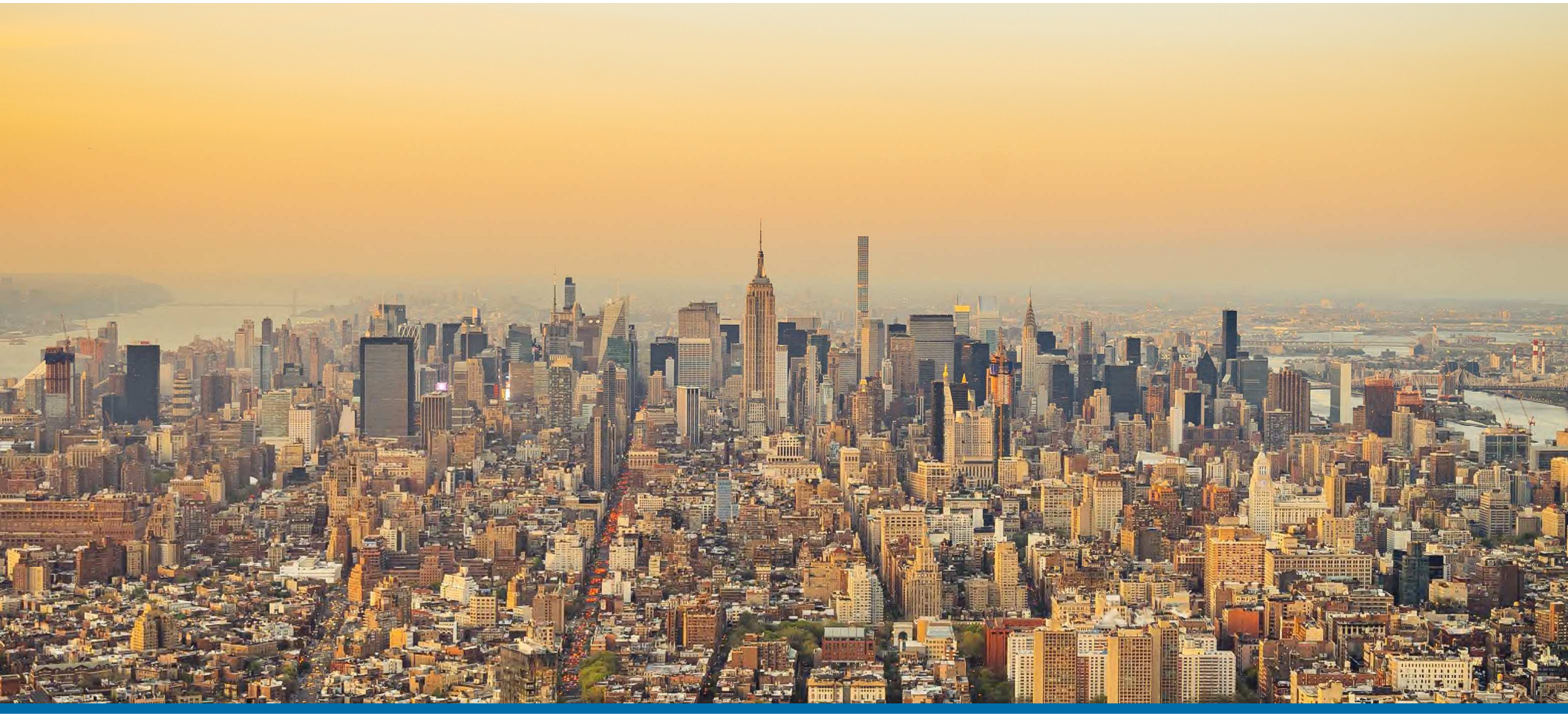

Principles of Microeconomics, Version 3.0

Libby Rittenberg & Tim Tregarthen

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CHAPTER 2

Confronting Scarcity: Choices in Production

Confronting Scarcity: Choices in Production

- The **production possibilities model** shows the goods and services that an economy is capable of producing – its opportunities – given the factors of production and the technology it has available.
- An **economic system** is the set of rules that define how an economy's resources are to be owned and how decisions about their use are to be made.

1. Factors of Production

Learning Objectives

1. Define the three factors of production– labor, capital, and natural resources.
2. Explain the role of technology and entrepreneurs in the utilization of the economy's factors of production.

1. Factors of Production

- **Factors of production** are the resources available to the economy for the production of goods and services.
- **Utility** is the value, or satisfaction, that people derive from the goods and services they consume and the activities they pursue.
- **Labor** is the human effort that can be applied to the production of goods and services.
  - **Human capital** are the skills a worker has as a result of education, training, or experience that can be used in production.

1. Factors of Production

- **Capital** is a factor of production that has been produced for use in the production of other goods and services.
  - **Financial capital** includes money and other “paper “ assets (such as stocks and bonds) that represent claims on future payments.
  - Tools such as hammers, screwdrivers, and wrenches are also capital.
- **Natural resources** are the resources of nature that can be used for the production of goods and services.

1.4 Technology and the Entrepreneur

- The following play a crucial role in putting factors of production to work
  - **Technology** is the knowledge that can be applied to the production of goods and services.
  - An **entrepreneur** is a person who, operating within the context of a market economy, assumes various risks in the hopes of earning profits by finding new ways to organize factors of production.

2. The Production Possibilities Curve

Learning Objectives

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

2. Production Possibilities Curve

Production Possibilities Curve

- A graphical representation of the alternative combinations of goods and services an economy can produce.
- It describes opportunity costs and tradeoffs.

Figure 2.1 A Production Possibilities Curve

	Pairs of skis per month	Snowboards per month
A	200	0
B	100	50
C	0	100

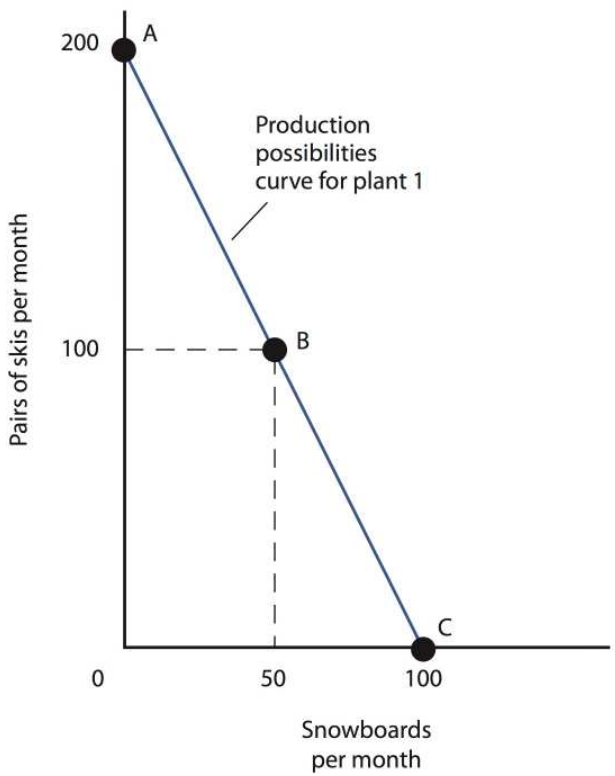


Figure 2.2 The Slope of a Production Possibilities Curve

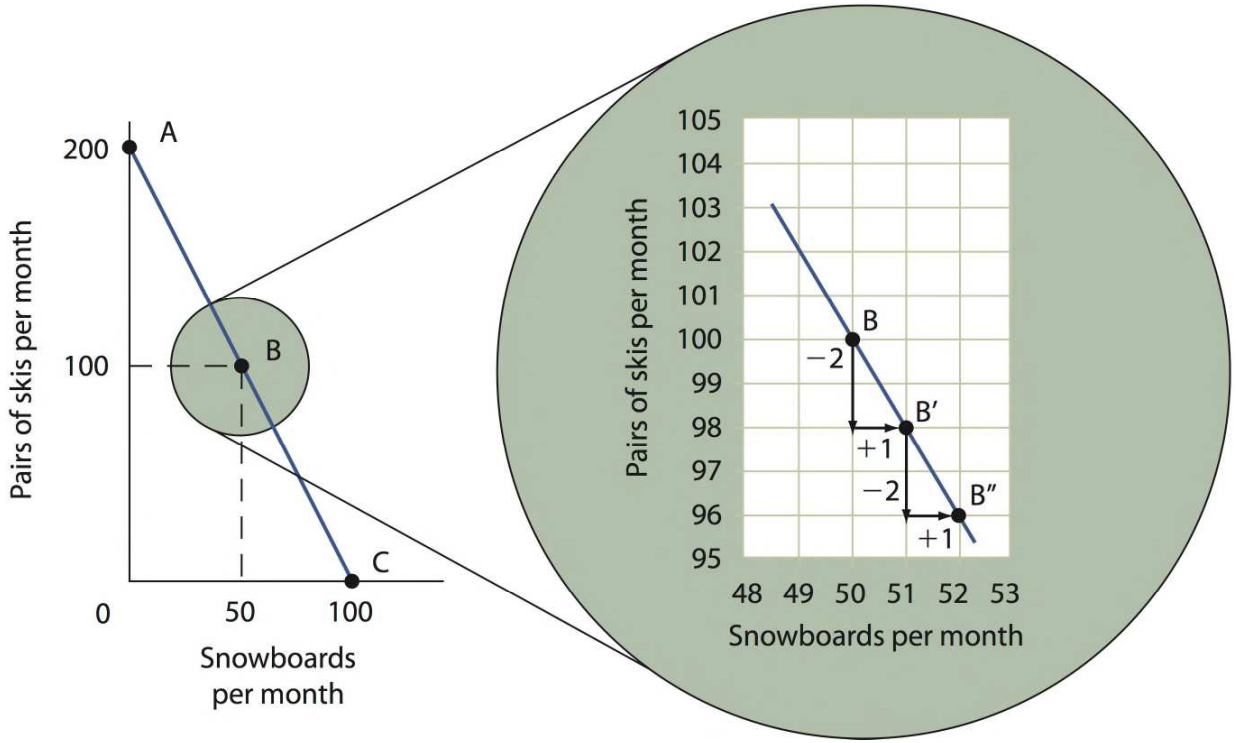
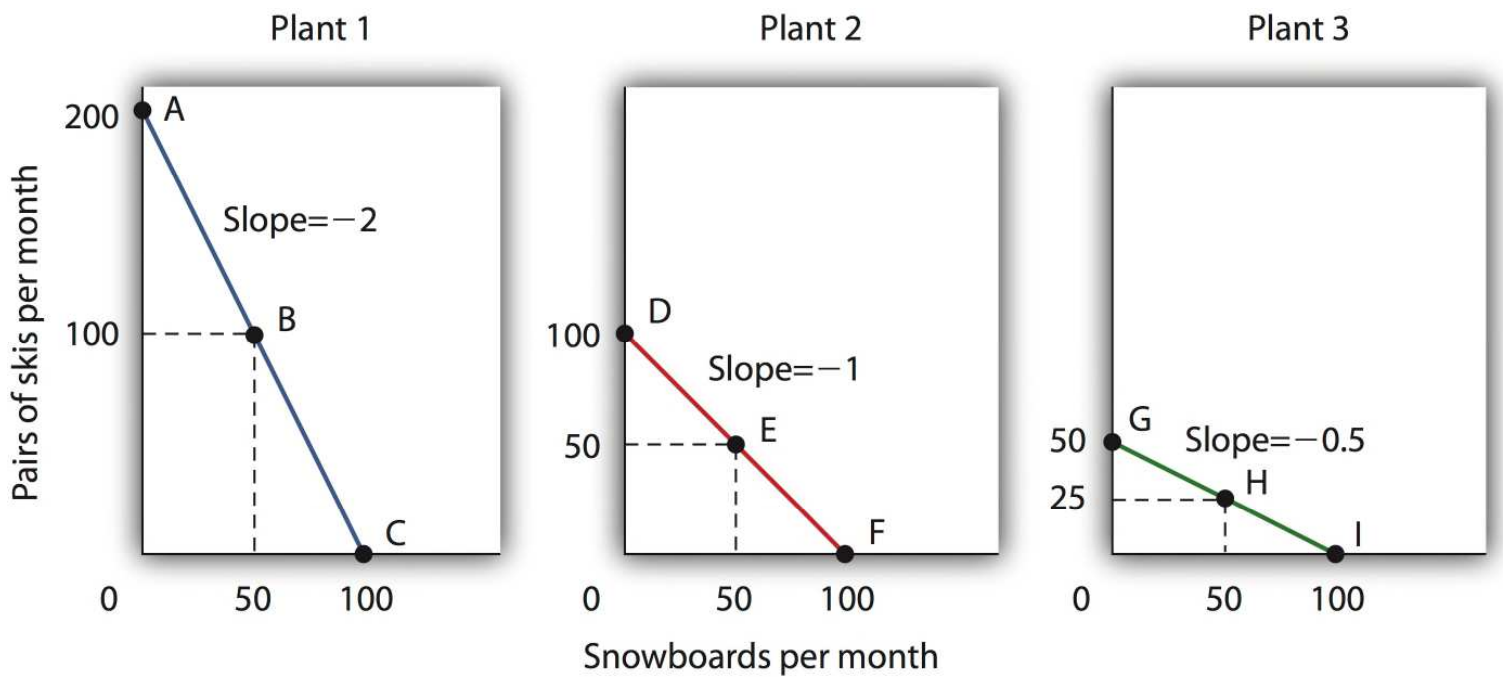


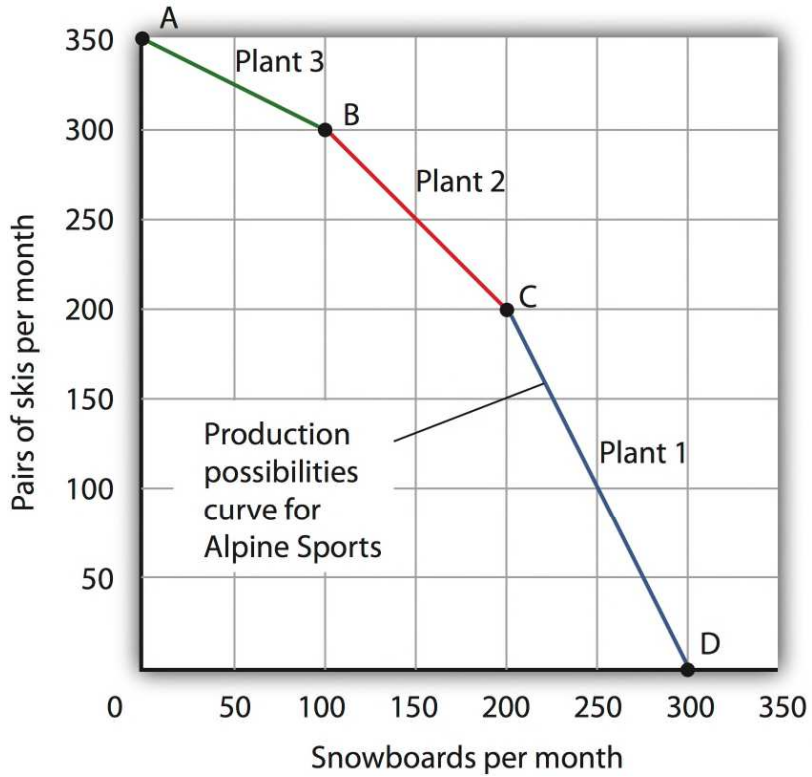
Figure 3.3 Production Possibilities at Three Plants



2.2 Comparative Advantage and the Production Possibilities Curve

- A **comparative advantage** in producing a good or service is the situation that occurs if the opportunity cost of producing that good or service is lower for that economy than for any other.

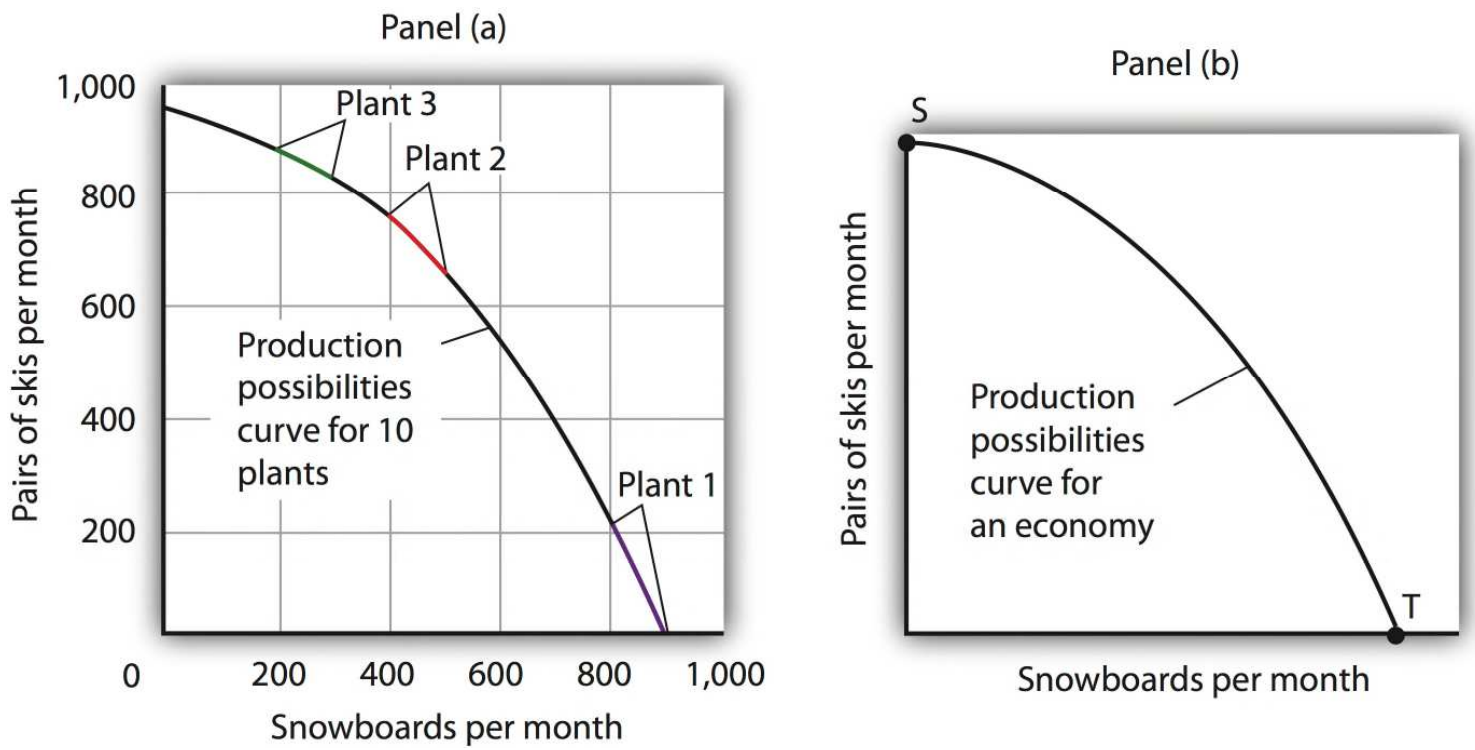
Figure 2.4 The Combined Production Possibilities Curve for Alpine Sports



2.3 The Law of Increasing Opportunity Cost

- The **law of increasing opportunity cost** states that as an economy moves along its production possibilities curve in the direction of producing more of a particular good, the opportunity cost of additional units of that good will increase.

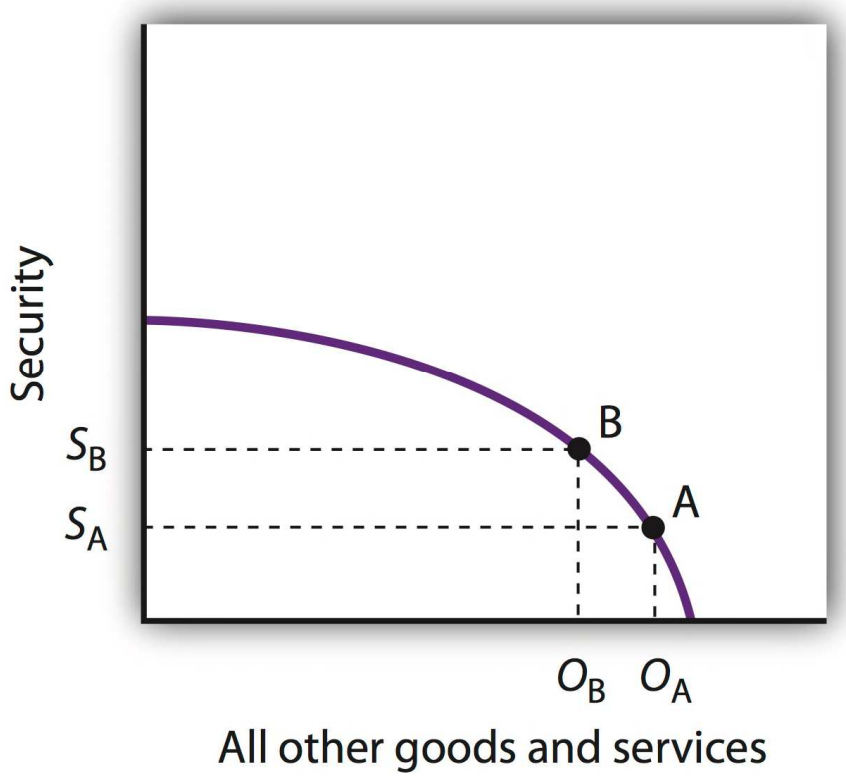
Figure 2.5 Production Possibilities for the Economy



Movements along the Production Possibilities Curve

- We can use the production possibilities model to examine choices in the production of goods and services.
- In applying the model, we assume that:
  - The economy can produce two goods.
  - Technology and the factors of production available to the economy remain unchanged.

Figure 2.6 Spending More for Security



Producing on Versus Producing Inside the Production Possibilities Curve

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

Figure 2.7 Idle Factors and Production

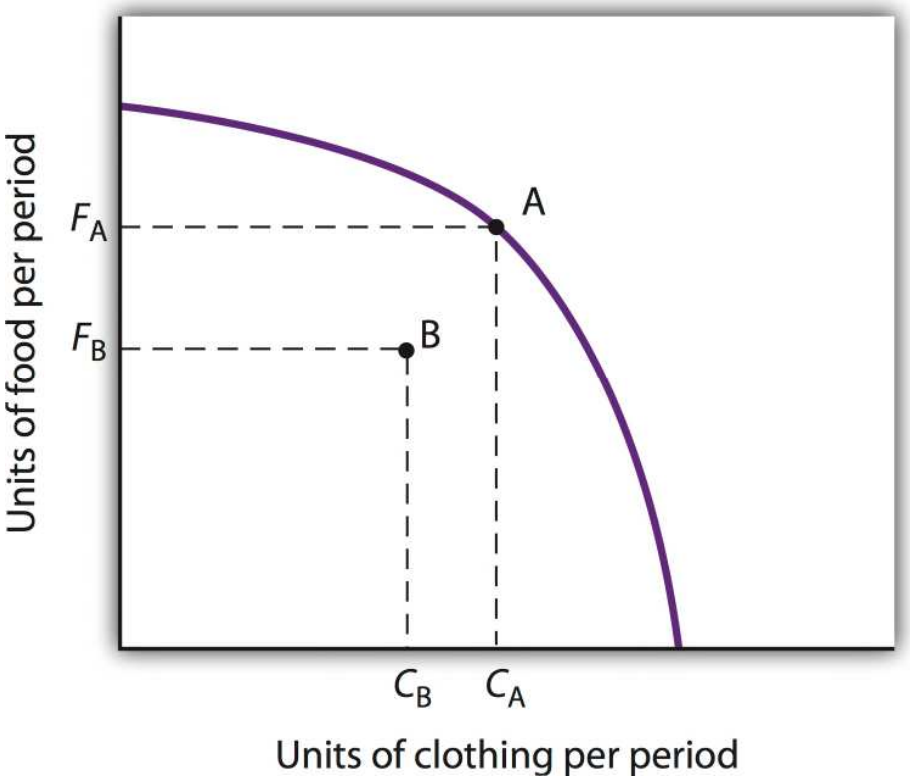
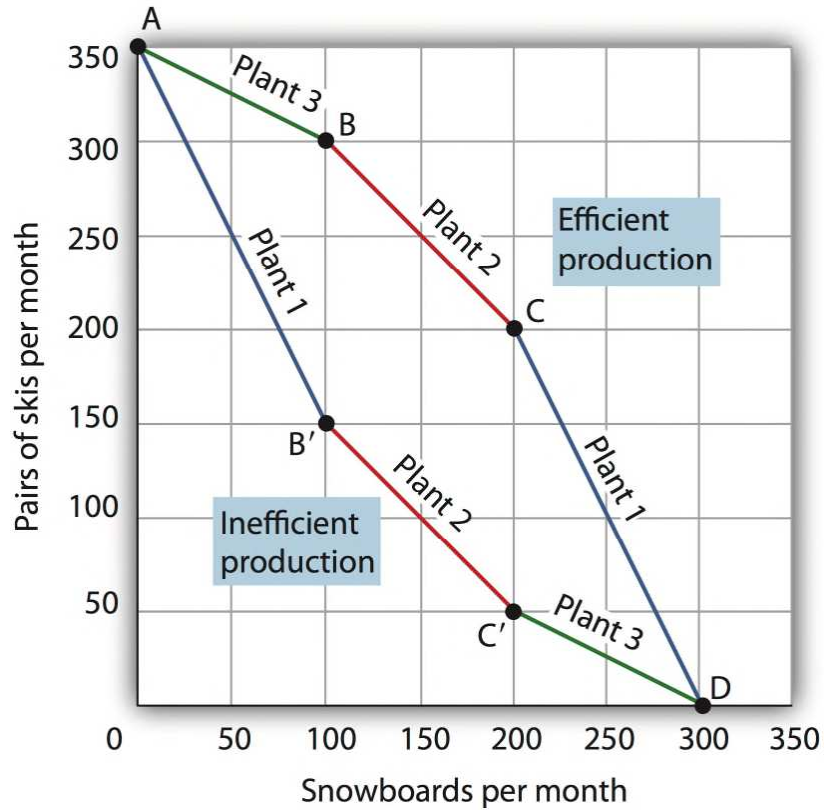


Figure 2.8 Efficient Versus Inefficient Production



Specialization

Specialization

- A situation in which an economy is producing the goods and services in which it has a comparative advantage

3. Applications of the Production Possibilities Model

Learning Objectives

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

Comparative Advantage and International Trade

- The most important implications of the concepts of comparative advantage and the production possibilities curve relates to international trade.

Figure 2.9 Production Possibilities Curves and Trade

Panel (a)
South America's Production Possibilities

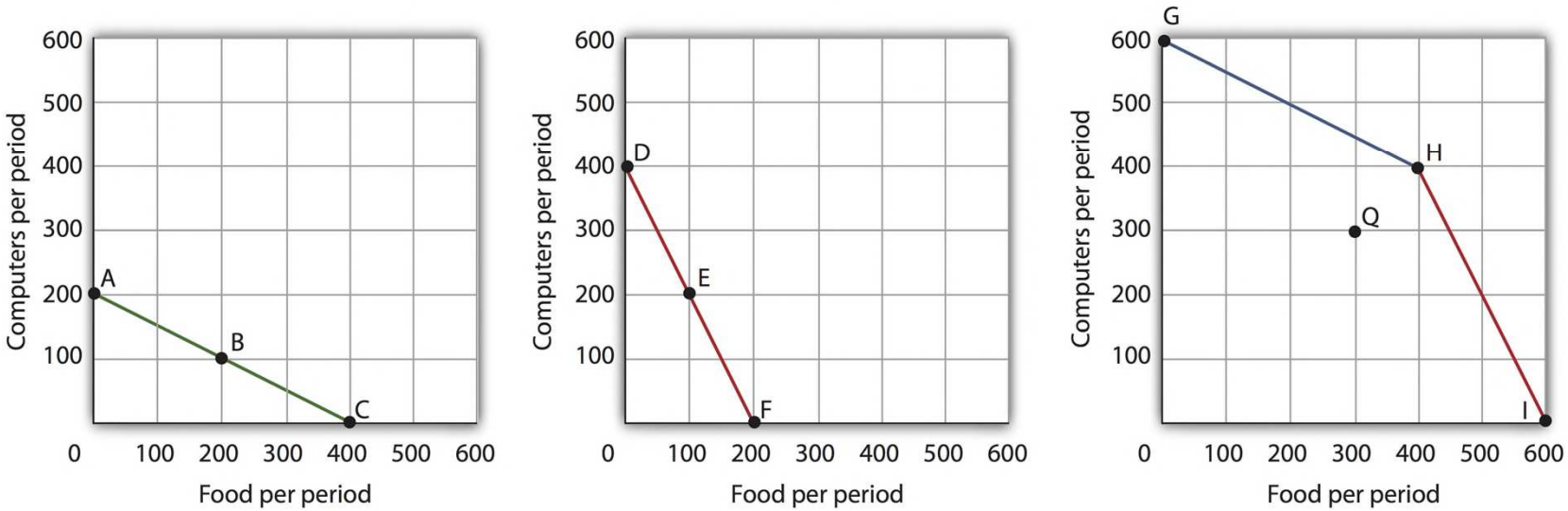
	Computers per period	Food per period
A	200	0
B	100	200
C	0	400

Panel (b)
Europe's Production Possibilities

	Computers per period	Food per period
D	400	0
E	200	100
F	0	200

Panel (c)
World Production Possibilities

	Computers per period	Food per period
G	600	0
H	400	400
I	0	600



Economic Growth

- An increase in the physical quantity or in the quality of factors of production available to an economy or a technological gain will allow the economy to produce more goods and services.
  - It will shift the economy's production possibilities curve outward.
- The process through which an economy achieves an outward shift in its production possibilities curve is called **economic growth**.

Figure 2.10 Economic Growth and the Production Possibilities Curve

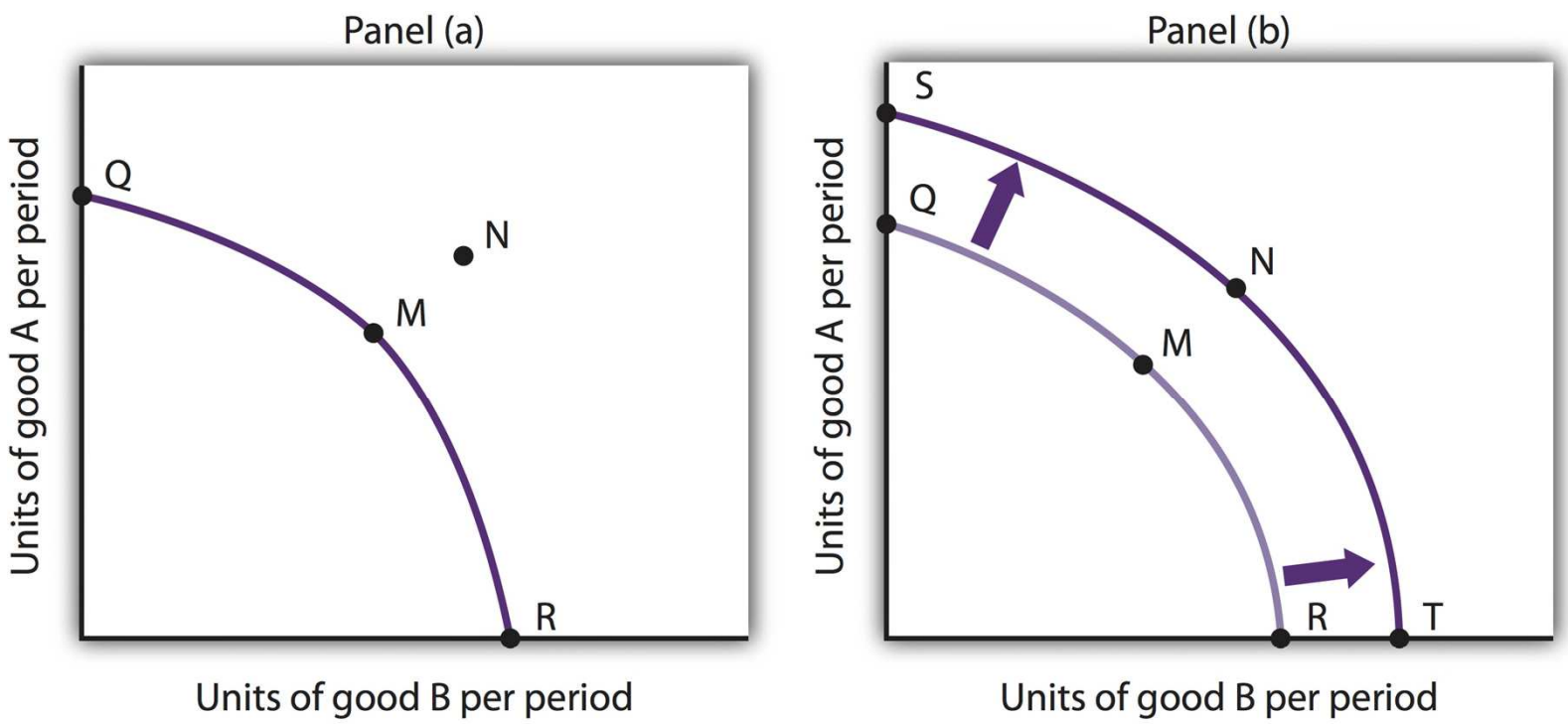


Table 2.1 Sources of U.S. Economic Growth, 1947-2012

Sources of Growth	% Contribution of Growth of Factor to Overall Growth rate of 3.05%
Increase in quantity of labor	0.58%
Increase in quantity of capital	1.24%
Increase in quality of labor	0.24%
Increase in quality of capital	0.38%
Improved technology	0.61%

Classifying Economic Systems

- **Market capitalist economy** - Economy in which resources are generally owned by private individuals who have the power to make decisions about their use.
- **Command socialist economy *(centrally planned)*** - Economy in which government is the primary owner of capital and natural resources and has broad power to allocate the use of factors of production.
- **Mixed economy** - Economy that combines elements of market capitalist and command socialist economic systems.

Figure 2.11 Economic Systems

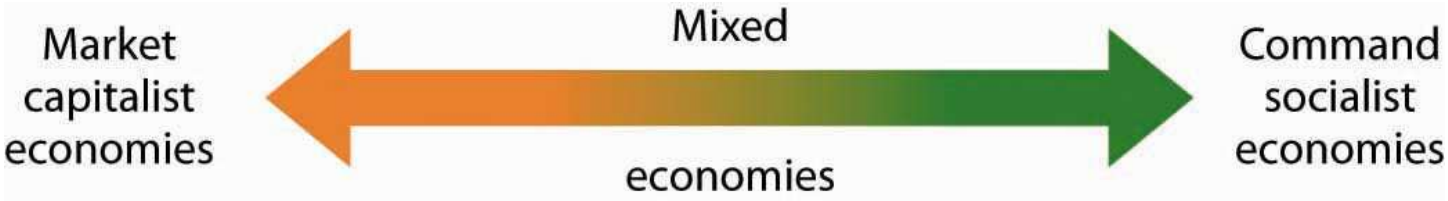
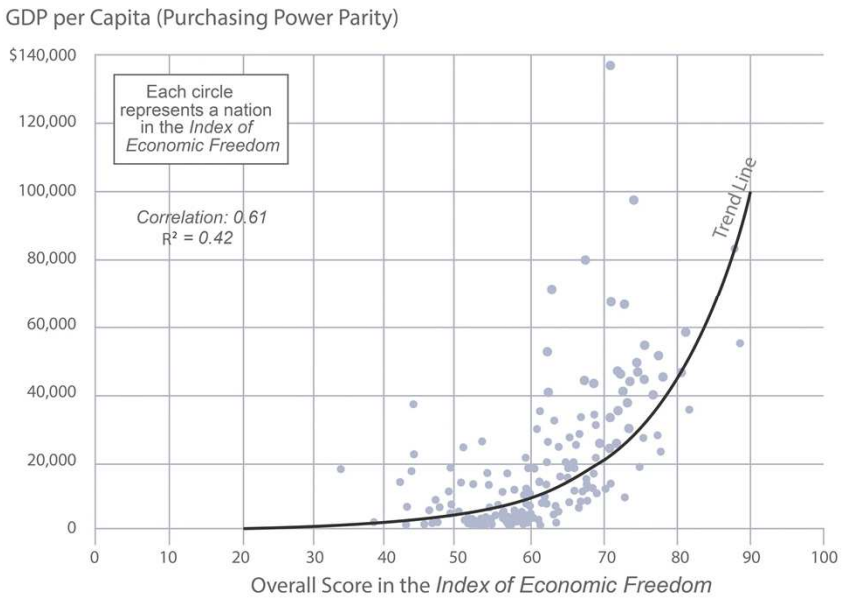
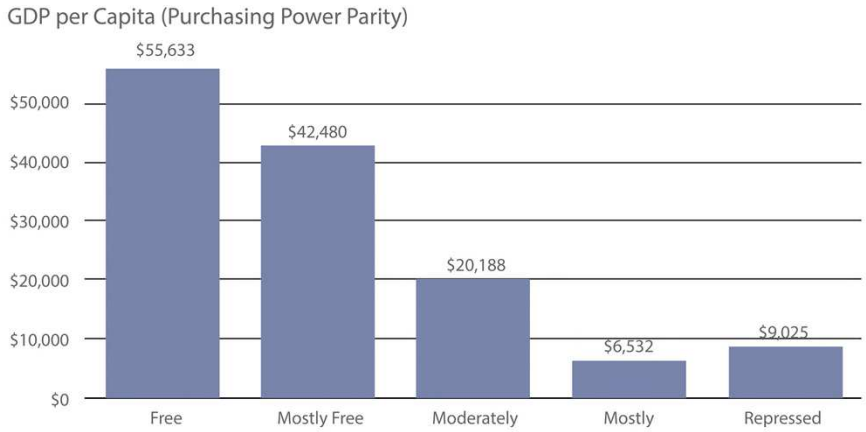


Figure 2.12 Economic Freedom and Income





3.4 Government in a Market Economy

- In a market economy interactions of individual buyers and sellers determine where on a production possibilities curve an economy will produce.
- Government plays a role as well
  - It may seek to encourage greater consumption of some goods and discourage consumption of others