The Law of Comparative Advantage

chapter 2

LEARNING GOALS:

After reading this chapter, you should be able to:

- Understand the law of comparative advantage
- Understand the relationship between opportunity costs and relative commodity prices
- Explain the basis for trade and show the gains from trade under constant costs conditions

2.1 Introduction

In this chapter, we examine the development of trade theory from the seventeenth century through the first part of the twentieth century. This historical approach is useful not because we are interested in the history of economic thought as such, but because it is a convenient way of introducing the concepts and theories of international trade from the simple to the more complex and realistic.

The basic questions that we seek to answer in this chapter are:

1. What is the basis for trade and what are the gains from trade? Presumably (and as in the case of an individual), a nation will voluntarily engage in trade only if it benefits from trade. But how are gains from trade generated? How large are the gains and how are they divided among the trading nations?
2. What is the pattern of trade? That is, what commodities are traded and which commodities are exported and imported by each nation?

We begin with a brief discussion of the economic doctrines known as mercantilism that prevailed during the seventeenth and eighteenth centuries. We then go on to discuss the theory of absolute advantage, developed by Adam Smith. It remained, however, for David Ricardo, writing some 40 years after Smith, to truly explain the pattern of and the gains from trade with his law of comparative advantage. The law of comparative advantage is one of the most important laws of economics, with applicability to nations as well as to individuals and useful for exposing many serious fallacies in apparently logical reasoning.

One difficulty remained. Ricardo had based his explanation of the law of comparative advantage on the labor theory of value, which was subsequently rejected. In the first part of the twentieth century, Gottfried Haberler came to Ricardo's "rescue" by explaining the law of comparative advantage in terms of the opportunity cost theory, as reflected in production possibility frontiers, or transformation curves.

For simplicity, our discussion will initially refer to only two nations and two commodities. In the appendix to this chapter, the conclusions will be generalized to trade in more than two commodities and among more than two nations. It must also be pointed out that while comparative advantage is the cornerstone of international trade theory, trade can also be based on other reasons, such as economies of large-scale production and product differentiation. These are examined in Chapter 6. Furthermore, the comparative advantage of nations can change over time, especially as a result of technological change, as explained in Chapter 7.

2.2 The Mercantilists' Views on Trade

Economics as an organized science can be said to have originated with the publication in 1776 of *The Wealth of Nations* by Adam Smith. However, writings on international trade preceded this date in such countries as England, Spain, France, Portugal, and the Netherlands as they developed into modern national states. Specifically, during the seventeenth and eighteenth centuries a group of men (merchants, bankers, government officials, and even philosophers) wrote essays and pamphlets on international trade that advocated an economic philosophy known as mercantilism. Briefly, the mercantilists maintained that the way for a nation to become rich and powerful was to export more than it imported. The resulting export surplus would then be settled by an inflow of bullion, or precious metals, primarily gold and silver. The more gold and silver a nation had, the richer and more powerful it was. Thus, the government had to do all in its power to stimulate the nation's exports and discourage and restrict imports (particularly the import of luxury consumption goods). However, since all nations could not simultaneously have an export surplus and the amount of gold and silver was fixed at any particular point in time, one nation could gain only at the expense of other nations. The mercantilists thus preached economic nationalism, believing as they did that national interests were basically in conflict (see Case Study 2-1).

Note that the mercantilists measured the wealth of a nation by the stock of precious metals it possessed. In contrast, today we measure the wealth of a nation by its stock of human, man-made, and natural resources available for producing goods and services. The greater this stock of useful resources, the greater is the *flow* of goods and services to satisfy human wants, and the higher the standard of living in the nation.

At a more sophisticated level of analysis, there were more rational reasons for the mercantilists' desire for the accumulation of precious metals. This can be understood if it is remembered that the mercantilists were writing primarily for rulers and to enhance national power. With more gold, rulers could maintain larger and better armies and consolidate their power at home; improved armies and navies also made it possible for them to acquire more colonies. In addition, more gold meant more money (i.e., more gold coins) in circulation and greater business activity. Furthermore, by encouraging exports and restricting imports, the government would stimulate national output and employment.

CASE STUDY 2-1 Munn's Mercantilistic Views on Trade

Thomas Munn (1571–1641) was perhaps the most influential of the mercantilist writers, and his *England's Treasure by Foreign Trade* was the outstanding exposition of mercantilist thought on trade. Indeed, Adam Smith's attacks on mercantilist views on trade (see the next section) were directed primarily at Munn. Following is an excerpt from Munn's writing:

> *Although a Kingdom may be enriched by gifts received, or by purchase taken from some other Nations, yet these are things uncertain and of small consideration when they happen. The ordinary means therefore to encrease our wealth and treasure is by* Foreign Trade*, wherein we must ever observe this rule; to sell more to strangers yearly than we consume of theirs in value. For . . . that part of our stock [exports] which is not returned to us in wares [imports] must necessarily be brought home in treasure [bullion]. . . .*
>
> *We may . . . diminish our importations, if we would soberly refrain from excessive consumption of foreign wares in our diet and rayment [dress]. . . . In our exportations we must not only regard our superfluities, but also we must consider our neighbours necessities, that so . . . we may . . . gain so much of the manufacture as we can, and also endeavour to sell them dear, so far forth as the high price cause not a less vent in the quantity [of our exports]. But the superfluity of our commodities which strangers use, and may also have the same from other Nations, or may abate their vent by the use of some such like wares from other places, and with little inconvenience; we must in this case strive to sell as cheap as possible we can, rather than to lose the utterance [the sale] of such wares. . . .*

Source: Thomas Munn, *England's Treasure by Foreign Trade* (Reprinted, Oxford: Basil Blackwell, 1928). The words in brackets have been added to clarify the meaning.

In any event, mercantilists advocated strict government control of all economic activity and preached economic nationalism because they believed that a nation could gain in trade only at the expense of other nations (i.e., trade was a zero-sum game). These views are important for two reasons. First, the ideas of Adam Smith, David Ricardo, and other classical economists can best be understood if they are regarded as reactions to the mercantilists' views on trade and on the role of the government. Second, today there seems to be a resurgence of neo-mercantilism, as nations plagued by high levels of unemployment seek to restrict imports in an effort to stimulate domestic production and employment (this is examined in detail in Chapter 9). In fact, aside from England during the period 1815–1914, no Western nation has ever been completely free of mercantilist ideas (see Case Study 2-2).

CASE STUDY 2-2 Mercantilism Is Alive and Well in the Twenty-first Century

Although most nations claim to be in favor of free trade, most of them continue to impose many restrictions on international trade. Most industrial nations restrict imports of agricultural commodities, textiles, shoes, steel, and many other products in order to protect domestic employment. They also provide subsidies to some of their hi-tech industries, such as computers and telecommunications, deemed essential for the international competitiveness of the nation and its future growth. Developing countries are even more protective of domestic industries. As some forms of overt protection (such as tariffs and quotas) on some products have been reduced or eliminated over the years through

(continued)

CASE STUDY 2-2 Continued

multilateral negotiations, other less explicit types of protection (such as tax benefits and research and development subsidies) have been increased. This is evidenced by the numerous trade disputes that have arisen over time.

During the past few years, there have been disputes between the United States and the European Union (EU) on the latter's prohibition of U.S. beef exports from cattle raised with hormones; on the EU preferences for banana imports from African countries at the expense of bananas from Central American plantations (owned by American business interests); on EU subsidies to Airbus Industrie for the development of its new super-jumbo jet that takes sales away from Boeing's 747; on the tax rebates that the U.S. government was providing some exporters; and on the U.S. tariffs on imported steel. There are similarly many other trade disputes between the United States, Japan, other developed and developing countries, and among all these countries with one another. Indeed, the list of protected products is long and varied. Trade restrictions are demanded to protect domestic jobs from foreign competition and to encourage domestic high-tech industries—all classic mercantilist arguments. Mercantilism, though declining, is alive and well in the twenty-first century.

Sources: A. Krueger, "The Struggle to Convince the Free Trade Skeptics," *IMF Survey*, July 12, 2004, pp. 204–205; J. N. Bhagwati, *Free Trade Today* (Princeton, N.J.: Princeton University Press, 2002); D. A. Irwin, *Free Trade under Fire* (Princeton, N.J.: Princeton University Press, 2002); D. Salvatore, ed., *Protectionism and World Welfare* (New York: Cambridge University Press, 1993); and D. Salvatore, "The Challenges to the Liberal Trading System," *Journal of Policy Modeling,* July/August 2009, pp. 593–599.

2.3 Trade Based on Absolute Advantage: Adam Smith

Smith started with the simple truth that for two nations to trade with each other *voluntarily*, both nations must gain. If one nation gained nothing or lost, it would simply refuse to trade. But how does this *mutually beneficial* trade take place, and from where do these gains from trade come?

2.3A Absolute Advantage

According to Adam Smith, trade between two nations is based on absolute advantage. When one nation is more efficient than (or has an absolute advantage over) another in the production of one commodity but is less efficient than (or has an absolute disadvantage with respect to) the other nation in producing a second commodity, then both nations can gain by each *specializing* in the production of the commodity of its absolute advantage and exchanging part of its output with the other nation for the commodity of its absolute disadvantage. By this process, resources are utilized in the most efficient way and the output of *both* commodities will rise. This increase in the output of both commodities measures the gains from specialization in production available to be divided between the two nations through trade.

For example, because of climatic conditions, Canada is efficient in growing wheat but inefficient in growing bananas (hothouses would have to be used). On the other hand, Nicaragua is efficient in growing bananas but inefficient in growing wheat. Thus, Canada has an absolute advantage over Nicaragua in the cultivation of wheat but an absolute disadvantage in the cultivation of bananas. The opposite is true for Nicaragua.

Under these circumstances, both nations would benefit if each specialized in the production of the commodity of its absolute advantage and then traded with the other nation. Canada would specialize in the production of wheat (i.e., produce more than needed domestically) and exchange some of it for (surplus) bananas grown in Nicaragua. As a result, both more wheat and more bananas would be grown and consumed, and both Canada and Nicaragua would gain.

In this respect, a nation behaves no differently from an individual who does not attempt to produce all the commodities she or he needs. Rather, the individual produces only that commodity that he or she can produce most efficiently and then exchanges part of the output for the other commodities she or he needs or wants. This way, total output and the welfare of all individuals are maximized.

Thus, while the mercantilists believed that one nation could gain only at the expense of another nation and advocated strict government control of all economic activity and trade, Adam Smith (and the other classical economists who followed him) believed that all nations would gain from free trade and strongly advocated a policy of laissez-faire (i.e., as little government interference with the economic system as possible). Free trade would cause world resources to be utilized most efficiently and would maximize world welfare. There were to be only a few exceptions to this policy of laissez-faire and free trade. One of these was the protection of industries important for national defense.

In view of this belief, it seems paradoxical that today most nations impose many restrictions on the free flow of international trade. Trade restrictions are invariably rationalized in terms of national welfare. In reality, trade restrictions are advocated by the few industries and their workers who are hurt by imports. As such, trade restrictions benefit the few at the expense of the many (who will have to pay higher prices for competing domestic goods). These issues will be examined in detail in Part Two.

Also to be noted is that Smith's theory served the interest of factory owners (who were able to pay lower wages because of cheaper food imports) and harmed landowners in England (because food became less scarce due to cheaper imports), and it shows the link between social pressures and the development of new economic theories to support them.

2.3B Illustration of Absolute Advantage

We will now look at a *numerical* example of absolute advantage that will serve to establish a frame of reference for presenting the more challenging theory of comparative advantage in the next section.

Table 2.1 shows that one hour of labor time produces six bushels of wheat in the United States but only one in the United Kingdom. On the other hand, one hour of labor time produces five yards of cloth in the United Kingdom but only four in the United States. Thus, the United States is more efficient than, or has an absolute advantage over, the United

TABLE 2.1. Absolute Advantage

	U.S.	U.K.
Wheat (bushels/hour)	6	1
Cloth (yards/hour)	4	5

Kingdom in the production of wheat, whereas the United Kingdom is more efficient than, or has an absolute advantage over, the United States in the production of cloth. With trade, the United States would specialize in the production of wheat and exchange part of it for British cloth. The opposite is true for the United Kingdom.

If the United States exchanges six bushels of wheat (6W) for six yards of British cloth (6C), the United States gains 2C or saves ½ hour or 30 minutes of labor time (since the United States can only exchange 6W for 4C domestically). Similarly, the 6W that the United Kingdom receives from the United States is equivalent to or would require six hours of labor time to produce in the United Kingdom. These same six hours can produce 30C in the United Kingdom (6 hours times 5 yards of cloth per hour). By being able to exchange 6C (requiring a little over one hour to produce in the United Kingdom) for 6W with the United States, the United Kingdom gains 24C, or saves almost five labor - hours.

The fact that the United Kingdom gains much more than the United States is not important at this time. What is important is that *both* nations can gain from specialization in production and trade. (We will see in Section 2.6B how the rate at which commodities are exchanged for one another is determined, and we will also examine the closely related question of how the gains from trade are divided among the trading nations.)

Absolute advantage, however, can explain only a very small part of world trade today, such as some of the trade between developed and developing countries. Most of world trade, especially trade among developed countries, could not be explained by absolute advantage. It remained for David Ricardo, with the law of comparative advantage, to truly explain the basis for and the gains from trade. Indeed, absolute advantage will be seen to be only a special case of the more general theory of comparative advantage.

2.4 Trade Based on Comparative Advantage: David Ricardo

In 1817, Ricardo published his *Principles of Political Economy and Taxation*, in which he presented the law of comparative advantage. This is one of the most important and still unchallenged laws of economics, with many practical applications. In this section, we will first define the law of comparative advantage; then we will restate it with a simple numerical example; finally, we will prove it by demonstrating that both nations can indeed gain by each specializing in the production and exportation of the commodity of its comparative advantage. In Section 2.6A, we will prove the law *graphically*.

2.4A The Law of Comparative Advantage

According to the law of comparative advantage, even if one nation is less efficient than (has an absolute disadvantage with respect to) the other nation in the production of *both* commodities, there is still a basis for mutually beneficial trade. The first nation should specialize in the production and export of the commodity in which its absolute disadvantage is smaller (this is the commodity of its *comparative advantage*) and import the commodity in which its absolute disadvantage is greater (this is the commodity of its *comparative disadvantage*).

■ TABLE 2.2. Comparative Advantage

	U.S.	U.K.
Wheat (bushels/hour)	6	1
Cloth (yards/hour)	4	2

The statement of the law can be clarified by looking at Table 2.2. The only difference between Tables 2.2 and 2.1 is that the United Kingdom now produces only two yards of cloth per hour instead of five. Thus, the United Kingdom now has an absolute disadvantage in the production of *both* wheat and cloth with respect to the United States.

However, since U.K. labor is half as productive in cloth but six times less productive in wheat with respect to the United States, *the United Kingdom has a comparative advantage in cloth*. On the other hand, the United States has an absolute advantage in both wheat and cloth with respect to the United Kingdom, but since its absolute advantage is greater in wheat (6:1) than in cloth (4:2), *the United States has a comparative advantage in wheat*. To summarize, the U.S. absolute advantage is greater in wheat, so its comparative advantage lies in wheat. The United Kingdom's absolute disadvantage is smaller in cloth, so its comparative advantage lies in cloth. According to the law of comparative advantage, both nations can gain if the United States specializes in the production of wheat and exports some of it in exchange for British cloth. (At the same time, the United Kingdom is specializing in the production and exporting of cloth.)

Note that in a two-nation, two-commodity world, once it is determined that one nation has a comparative advantage in one commodity, then the other nation *must* necessarily have a comparative advantage in the other commodity.

2.4B The Gains from Trade

So far, we have stated the law of comparative advantage in words and then restated it with a simple numerical example. However, we have not yet proved the law. To do so, we must be able to show that the United States and the United Kingdom can both gain by each specializing in the production and exporting of the commodity of its comparative advantage.

To start with, we know that the United States would be indifferent to trade if it received only 4C from the United Kingdom in exchange for 6W, since the United States can produce exactly 4C domestically by utilizing the resources released in giving up 6W (see Table 2.2). And the United States would certainly not trade if it received less than 4C for 6W. Similarly, the United Kingdom would be indifferent to trade if it had to give up 2C for each 1W it received from the United States, and it certainly would not trade if it had to give up more than 2C for 1W.

To show that both nations can gain, suppose the United States could exchange 6W for 6C with the United Kingdom. The United States would then gain 2C (or save ½ hour of labor time) since the United States could only exchange 6W for 4C domestically. To see that the United Kingdom would also gain, note that the 6W that the United Kingdom receives from the United States would require six hours to produce in the United Kingdom. The United

Kingdom could instead use these six hours to produce 12C and give up only 6C for 6W from the United States. Thus, the United Kingdom would gain 6C or save three hours of labor time. Once again, the fact that the United Kingdom gains more from trade than the United States is not important at this point. What is important is that both nations can gain from trade even if one of them (in this case the United Kingdom) is less efficient than the other in the production of both commodities.

We can convince ourselves of this by considering a simple example from everyday life. Suppose a lawyer can type twice as fast as his secretary. The lawyer then has an absolute advantage over his secretary in both the practice of law and typing. However, since the secretary cannot practice law without a law degree, the lawyer has a greater absolute advantage or a comparative advantage in law, and the secretary has a comparative advantage in typing. According to the law of comparative advantage, the lawyer should spend all of his time practicing law and let his secretary do the typing. For example, if the lawyer earns $100 per hour practicing law and must pay his secretary $10 per hour to do the typing, he would actually lose $80 for each hour that he typed. The reason for this is that he would save $20 (since he can type twice as fast as his secretary) but forgo earning $100 in the practice of law.

Returning to the United States and the United Kingdom, we see that both nations would gain by exchanging 6W for 6C. However, this is not the only rate of exchange at which mutually beneficial trade can take place. Since the United States could exchange 6W for 4C domestically (in the sense that both require 1 hour to produce), the United States would gain if it could exchange 6W for more than 4C from the United Kingdom. On the other hand, in the United Kingdom 6W = 12C (in the sense that both require 6 hours to produce). Anything less than 12C that the United Kingdom must give up to obtain 6W from the United States represents a gain from trade for the United Kingdom. To summarize, the United States gains to the extent that it can exchange 6W for more than 4C from the United Kingdom. The United Kingdom gains to the extent that it can give up less than 12C for 6W from the United States. Thus, the range for mutually advantageous trade is

$$4C < 6W < 12C$$

The spread between 12C and 4C (i.e., 8C) represents the total gains from trade available to be shared by the two nations by trading 6W. For example, we have seen that when 6W are exchanged for 6C, the United States gains 2C and the United Kingdom 6C, making a total of 8C. The closer the rate of exchange is to 4C = 6W (the *domestic*, or *internal*, rate in the United States—see Table 2.2), the smaller is the share of the gain going to the United States and the larger is the share of the gain going to the United Kingdom. On the other hand, the closer the rate of exchange is to 6W = 12C (the domestic, or internal, rate in the United Kingdom), the greater is the gain of the United States relative to that of the United Kingdom.

For example, if the United States exchanged 6W for 8C with the United Kingdom, both nations would gain 4C, for a total gain of 8C. If the United States could exchange 6W for 10C, it would gain 6C and the United Kingdom only 2C. (Of course, the gains from trade are proportionately greater when more than 6W are traded.) In Section 2.6B, we will see how this rate of exchange is actually determined in the real world by demand as well as supply considerations. The rate of exchange will also determine how the total gains from trade are actually shared by the trading nations. Up to this point, all we have wanted to do

is to prove that mutually beneficial trade can take place even if one nation is less efficient than the other in the production of both commodities.

So far, the gains from specialization in production and trade have been measured in terms of cloth. However, the gains from trade could also be measured exclusively in terms of wheat or, more realistically, in terms of both wheat and cloth. This will be done in the graphical presentation of the law of comparative advantage in Section 2.6A.

2.4C The Case of No Comparative Advantage

There is one (not very common) case where there is *no comparative advantage*. This occurs when the absolute disadvantage that one nation has with respect to another nation is the *same* in both commodities. For example, if one hour produced 3W instead of 1W in the United Kingdom (see Table 2.2), the United Kingdom would be exactly half as productive as the United States in both wheat and cloth. The United Kingdom (and the United States) would then have a comparative advantage in neither commodity, and no mutually beneficial trade could take place.

The reason for this is that (as earlier) the United States will trade only if it can exchange 6W for more than 4C. However, now the United Kingdom is not willing to give up more than 4C to obtain 6W from the United States because the United Kingdom can produce either 6W or 4C with two hours domestically. Under these circumstances, no mutually beneficial trade can take place.

This requires slightly modifying the statement of the law of comparative advantage to read as follows: Even if one nation has an absolute disadvantage with respect to the other nation in the production of both commodities, there is still a basis for mutually beneficial trade, *unless the absolute disadvantage (that one nation has with respect to the other nation) is in the same proportion for the two commodities*. Although it is important to note this case, its occurrence is rare and a matter of coincidence, so the applicability of the law of comparative advantage is not greatly affected. Furthermore, natural trade barriers such as transport costs can preclude trade even when some comparative advantage exists. At this point, however, we assume that no such natural or artificial (such as tariffs) barriers exist.

2.4D Comparative Advantage with Money

According to the law of comparative advantage (and disregarding the exception noted earlier), even if one nation (the United Kingdom in this case) has an absolute disadvantage in the production of both commodities with respect to the other nation (the United States), there is still a basis for mutually beneficial trade. But how, you may ask, can the United Kingdom export anything to the United States if it is less efficient than the United States in the production of both commodities? The answer is that wages in the United Kingdom will be sufficiently lower than wages in the United States so as to make the price of cloth (the commodity in which the United Kingdom has a comparative advantage) lower in the United Kingdom, and the price of wheat lower in the United States *when both commodities are expressed in terms of the currency of either nation*. Let us see how this works.

Suppose that the wage rate in the United States is \$6 per hour. Since one hour produces 6W in the United States (see Table 2.2), the price of a bushel of wheat is $P_W = \$1$. On the other hand, since one hour produces 4C, $P_C = \$1.50$ (from \$ ¾C). Suppose that at the same

time the wage rate in England is £1 per hour (the symbol "£" stands for pound, the U.K. currency). Since one hour produces 1W in the United Kingdom (see Table 2.2), $P_W = £1$ in the United Kingdom. Similarly, since one hour produces 2C, $P_C = £0.5$. If the exchange rate between the pound and the dollar is £1 = $2, then $P_W = £1 = \$2$ and $P_C = £0.5 = \$1$ in the United Kingdom. Table 2.3 shows the dollar price of wheat and cloth in the United States and the United Kingdom at the exchange rate of £1 = $2.

From Table 2.3 we can see that the dollar price of wheat (the commodity in which the United States has a comparative advantage) is lower in the United States than in the United Kingdom. On the other hand, the dollar price of cloth (the commodity in which the United Kingdom has a comparative advantage) is lower in the United Kingdom. (The result would be the same if the price of both commodities had been expressed in pounds.)

With the dollar price of wheat lower in the United States, businesspeople would buy wheat there and sell it in the United Kingdom, where they would buy cloth to sell in the United States. Even though U.K. labor is half as productive as U.S. labor in cloth production (see Table 2.2), U.K. labor receives only one-third of the U.S. wage rate (£1 = $2 as opposed to $6 in the United States), so that the dollar price of cloth is lower in the United Kingdom. To put it differently, the inefficiency of U.K. labor relative to U.S. labor in cloth production is more than compensated for by the lower wages in the United Kingdom. As a result, the dollar price of cloth is less in the United Kingdom, so the United Kingdom can export cloth to the United States. This is always the case as long as the U.K. wage rate is between ⅙ and ½ of the U.S. wage rate (the same as the productivity difference between the United Kingdom and the United States in the production of wheat and cloth).

If the exchange rate between the dollar and the pound were instead £1 = $1 (so that the U.K. wage rate was exactly ⅙ the U.S. wage rate), then the dollar price of wheat in the United Kingdom would be $P_W = £1 = \$1$. Since this is the same price as in the United States (see Table 2.3), the United States could not export wheat to the United Kingdom at this exchange rate. At the same time, $P_C = £0.5 = \$0.50$ in the United Kingdom, and the United Kingdom would export even more cloth than before to the United States. Trade would be unbalanced in favor of the United Kingdom, and the exchange rate between the dollar and the pound (i.e., the dollar price of the pound) would have to rise.

On the other hand, if the exchange rate were £1 = $3 (so that the U.K. wage rate was exactly ½ the U.S. wage rate), the price of cloth in the United Kingdom would be $P_C = £0.5 = \$1.50$ (the same as in the United States—see Table 2.3). As a result, the United Kingdom could not export cloth to the United States. Trade would be unbalanced in favor of the United States, and the exchange rate would have to fall. The rate of exchange between the dollar and the pound will eventually settle at the level that will result in balanced trade (in the absence of any interferences or other international transactions). We will return to this point in the appendix to this chapter and in much greater detail in Parts Three and Four, which deal with international finance.

TABLE 2.3. Dollar Price of Wheat and Cloth in the United States and United Kingdom at £1 = $2

	U.S.	U.K.
Price of one bushel of wheat	$1.00	$2.00
Price of one yard of cloth	1.50	1.00

CASE STUDY 2-3 The Petition of the Candlemakers

Sometimes satire and ridicule are more effective than theory and logic in influencing public opinion. For example, exasperated by the spread of protectionism under the prevailing mercantilist philosophy of the time, French economist Frédéric Bastiat (1801–1851) overwhelmed the proponents of protectionism by satirically extending their arguments to their logical and absurd conclusions. Nowhere is this more brilliantly accomplished than in the fictitious petition of the French candlemakers, written by Bastiat in 1845, and excerpted here:

> *We are suffering from the intolerable competition of a foreign rival, placed, it would seem, in a condition so far superior to ours for the production of light, that he absolutely* inundates *our* national market *at a price fabulously reduced. The moment he shows himself, our trade leaves us—all of our consumers apply to him; and a branch of native industry, having countless ramifications, is all at once rendered completely stagnant. This rival . . . is not other than the sun.*
>
> *What we pray for is, that it may please you to pass a law ordering the shutting up of all windows, sky-lights, dormerwindows, curtains, blinds, bull's eyes; in a word all openings, holes, chinks, clefts, and fissures, by or through which the light of the sun has been in use to enter houses, to the prejudice of the meritorious manufactures with which we flatter ourselves we have accommodated our country,—a country which, in gratitude, ought not to abandon us now to a strife so unequal. . . .*
>
> *Does it not argue to the greatest inconsistency to check as you do the importation of coal, iron, cheese, and goods of foreign manufacture, merely because and even in proportion as their price approaches zero, while at the same time you freely admit, and without limitation, the light of the sun, whose price is during the whole day at* zero?
>
> *If you shut up as much as possible all access to natural light, and create a demand for artificial light, which of our French manufactures will not be encouraged by it? If more tallow is consumed, then there must be more oxen and sheep; and, consequently, we shall behold the multiplication of artificial meadows, meat, wool, hides, and above all, manure, which is the basis and foundation of all agricultural wealth.*

Source: Frédéric Bastiat, *Economic Sophisms* (Edinburgh: Oliver and Boyd, 1873), pp. 49–53, abridged.

Thus, the argument that could be advanced in the United States that it needs to protect the high wages and standard of living of its workers against cheap British labor is generally false. Similarly faulty is the opposing argument that could be advanced in the United Kingdom that its labor needs protection against more efficient U.S. labor. These arguments are certainly inconsistent, and both are basically false (see Case Study 2-3).

2.5 Comparative Advantage and Opportunity Costs

Ricardo based his law of comparative advantage on a number of simplifying assumptions: (1) only two nations and two commodities, (2) free trade, (3) perfect mobility of labor within each nation but immobility between the two nations, (4) constant costs of production, (5) no transportation costs, (6) no technical change, and (7) the labor theory of value. Although assumptions one through six can easily be relaxed, assumption seven (i.e., that the labor theory of value holds) is not valid and should not be used for *explaining* comparative advantage.

2.5A Comparative Advantage and the Labor Theory of Value

Under the labor theory of value, the value or price of a commodity depends exclusively on the amount of labor going into the production of the commodity. This implies (1) that either

labor is the only factor of production or labor is used in the *same* fixed proportion in the production of all commodities and (2) that labor is homogeneous (i.e., of only one type). Since neither of these assumptions is true, we cannot base the explanation of comparative advantage on the labor theory of value.

Specifically, labor is not the only factor of production, nor is it used in the same fixed proportion in the production of all commodities. For example, much more capital equipment per worker is required to produce some products (such as steel) than to produce other products (such as textiles). In addition, there is usually some possibility of substitution between labor, capital, and other factors in the production of most commodities. Furthermore, labor is obviously not homogeneous but varies greatly in training, productivity, and wages. At the very least, we should allow for different productivities of labor. Indeed, this is how the Ricardian theory of comparative advantage has been tested empirically (see Section 2.7). In any event, the theory of comparative advantage need not be based on the labor theory of value but can be explained on the basis of the opportunity cost theory (which is acceptable). To be noted is that Ricardo himself did not believe in the labor theory of value and used it only as a simple way to explain the law of comparative advantage.

2.5B The Opportunity Cost Theory

It was left for Haberler in 1936 to explain or base the theory of comparative advantage on the opportunity cost theory. In this form, the law of comparative advantage is sometimes referred to as the *law of comparative cost*.

According to the opportunity cost theory, the cost of a commodity is the amount of a second commodity that must be given up to release just enough resources to produce one additional unit of the first commodity. No assumption is made here that labor is the only factor of production or that labor is homogeneous. Nor is it assumed that the cost or price of a commodity depends on or can be inferred exclusively from its labor content. Consequently, the nation with the lower opportunity cost in the production of a commodity has a comparative advantage in that commodity (and a comparative disadvantage in the second commodity).

For example, if in the absence of trade the United States must give up two-thirds of a unit of cloth to release just enough resources to produce one additional unit of wheat domestically, then *the opportunity cost of wheat is two-thirds of a unit of cloth* (i.e., $1W = \frac{2}{3}C$ in the United States). If $1W = 2C$ in the United Kingdom, then the opportunity cost of wheat (in terms of the amount of cloth that must be given up) is lower in the United States than in the United Kingdom, and the United States would have a comparative (cost) advantage over the United Kingdom in wheat. In a two-nation, two-commodity world, the United Kingdom would then have a comparative advantage in cloth.

According to the law of comparative advantage, the United States should specialize in producing wheat and export some of it in exchange for British cloth. This is exactly what we concluded earlier with the law of comparative advantage based on the labor theory of value, but now our explanation is based on the opportunity cost theory.

2.5C The Production Possibility Frontier under Constant Costs

Opportunity costs can be illustrated with the production possibility frontier, or transformation curve. The production possibility frontier is a curve that shows the *alternative* combinations

■ TABLE 2.4. Production Possibility Schedules for Wheat and Cloth in the United States and the United Kingdom

United States		United Kingdom	
Wheat	Cloth	Wheat	Cloth
180	0	60	0
150	20	50	20
120	40	40	40
90	60	30	60
60	80	20	80
30	100	10	100
0	120	0	120

of the two commodities that a nation can produce by fully utilizing all of its resources with the best technology available to it.

Table 2.4 gives the (hypothetical) production possibility schedules of wheat (in million bushels/year) and cloth (in million yards/year) for the United States and the United Kingdom. We see that the United States can produce 180W and 0C, 150W and 20C, or 120W and 40C, down to 0W and 120C. For each 30W that the United States gives up, just enough resources are released to produce an additional 20C. That is, 30W = 20C (in the sense that both require the same amount of resources). Thus, the opportunity cost of one unit of wheat in the United States is 1W = $\frac{2}{3}$C (the same as in Table 2.2) and remains constant. On the other hand, the United Kingdom can produce 60W and 0C, 50W and 20C, or 40W and 40C, down to 0W and 120C. It can increase its output by 20C for each 10W it gives up. Thus, the opportunity cost of wheat in the United Kingdom is 1W = 2C and remains constant.

The United States and United Kingdom production possibility schedules given in Table 2.4 are graphed as production possibility frontiers in Figure 2.1. Each point on a frontier represents one combination of wheat and cloth that the nation can produce. For example, at point A, the United States produces 90W and 60C. At point A', the United Kingdom produces 40W and 40C.

Points inside, or below, the production possibility frontier are also possible but are inefficient, in the sense that the nation has some idle resources and/or is not using the best technology available to it. On the other hand, points above the production frontier cannot be achieved with the resources and technology currently available to the nation.

The downward, or negative, slope of the production possibility frontiers in Figure 2.1 indicates that if the United States and the United Kingdom want to produce more wheat, they must give up some of their cloth production. The fact that the production possibility frontiers of both nations are straight lines reflects the fact that their opportunity costs are constant. That is, for each additional 1W to be produced, the United States must give up $\frac{2}{3}$C and the United Kingdom must give up 2C, *no matter from which point on its production possibility frontier the nation starts*.

Constant opportunity costs arise when (1) resources or factors of production are either perfect substitutes for each other or used in fixed proportion in the production of both commodities and (2) all units of the same factor are homogeneous or of exactly the same quality. Then, as each nation transfers resources from the production of cloth to the production of wheat, it will not have to use resources that are less and less suited to wheat production, no

matter how much wheat it is already producing. The same is true for the production of more cloth. Thus, we have constant costs in the sense that the same amount of one commodity must be given up to produce each additional unit of the second commodity.

Although opportunity costs are constant in each nation, they differ among nations, providing the basis for trade. Constant costs are not realistic, however. They are discussed only because they serve as a convenient introduction to the more realistic case of increasing costs, discussed in the next chapter.

2.5D Opportunity Costs and Relative Commodity Prices

We have seen that the opportunity cost of wheat is equal to the amount of cloth that the nation must give up to release just enough resources to produce one additional unit of wheat. This is given by the (absolute) slope of the production possibility frontier, or transformation curve, and is sometimes referred to as the *marginal rate of transformation*.

Figure 2.1 shows that the (absolute) slope of the U.S. transformation curve is $^{120}/_{180} = {}^{2}/_{3}$ = opportunity cost of wheat in the United States and remains constant. The slope of the U.K. transformation curve is $^{120}/_{60} = 2$ = opportunity cost of wheat in the United Kingdom and remains constant. On the assumptions that prices equal costs of production and that the nation does produce both some wheat and some cloth, the opportunity cost of wheat is equal to the price of wheat relative to the price of cloth (P_W/P_C).

Thus, $P_W/P_C = {}^{2}/_{3}$ in the United States, and inversely $P_C/P_W = {}^{3}/_{2} = 1.5$. In the United Kingdom, $P_W/P_C = 2$, and $P_C/P_W = {}^{1}/_{2}$. The lower P_W/P_C in the United States ($^{2}/_{3}$ as opposed to 2) is a reflection of its comparative advantage in wheat. Similarly, the lower P_C/P_W in the United Kingdom ($^{1}/_{2}$ as opposed to $^{2}/_{3}$) reflects its comparative advantage in cloth. Note that under constant costs, P_W/P_C is determined exclusively by production, or supply, considerations in each nation. Demand considerations do not enter at all in the determination of relative commodity prices.

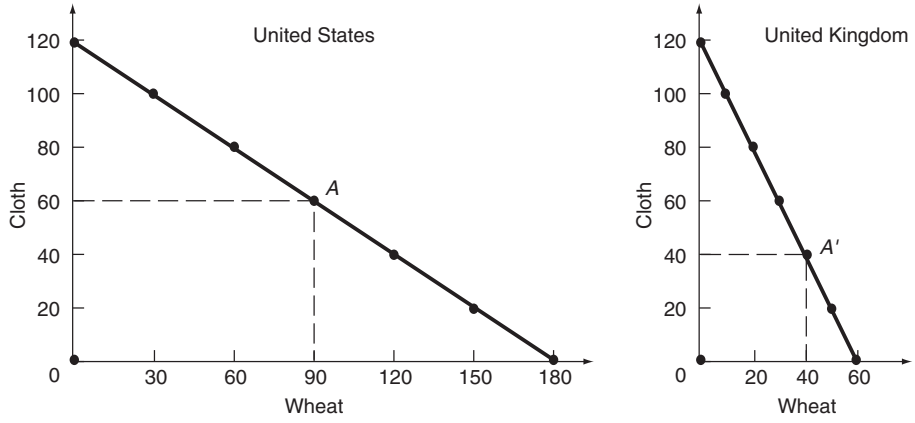

FIGURE 2.1. The Production Possibility Frontiers of the United States and the United Kingdom. The U.S. and U.K. production frontiers are obtained by plotting the values in Table 2.4. The frontiers are downward, or negatively sloped, indicating that as each nation produces more wheat, it must give up some cloth. Straight-line production possibility frontiers reflect constant opportunity costs.

To conclude, we can say that the difference in relative commodity prices between the two nations (given by the difference in the slope of their transformation curves) is a reflection of their comparative advantage and provides the basis for mutually beneficial trade.

2.6 The Basis for and the Gains from Trade under Constant Costs

In the absence of trade, a nation can only consume the commodities that it produces. As a result, the nation's production possibility frontier also represents its *consumption frontier*. Which combination of commodities the nation actually chooses to produce and consume depends on the people's tastes, or demand considerations.

2.6A Illustration of the Gains from Trade

In the absence of trade, the United States might choose to produce and consume combination A (90W and 60C) on its production possibility frontier (see Figure 2.2), and the United Kingdom might choose combination A' (40W and 40C).

With trade possible, the United States would specialize in the production of wheat (the commodity of its comparative advantage) and produce at point B (180W and 0C) on its production possibility frontier. Similarly, the United Kingdom would specialize in the production of cloth and produce at B' (0W and 120C). If the United States then exchanges 70W for 70C with the United Kingdom, it ends up consuming at point E (110W and 70C), and the United Kingdom ends up consuming at E' (70W and 50C). Thus, the United States gains 20W and 10C from trade (compare point E with point A in Figure 2.2), and the United Kingdom gains 30W and 10C (compare point A' with point E').

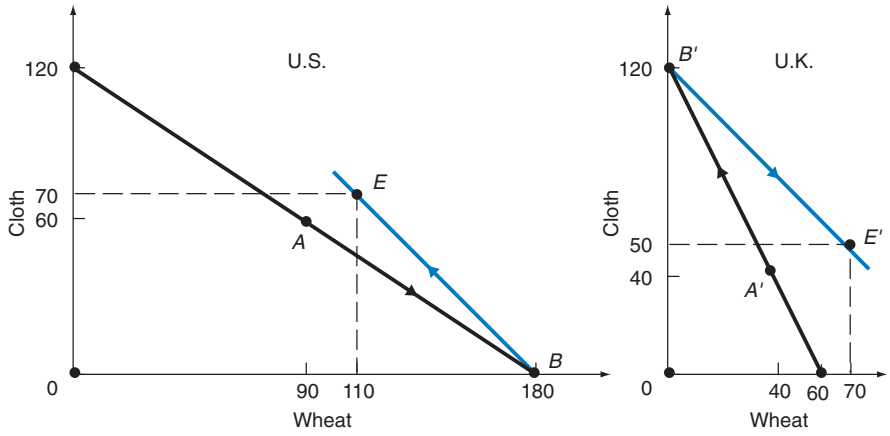

FIGURE 2.2. The Gains from Trade.
In the absence of trade, the United States produces and consumes at A, and the United Kingdom at A'. With trade, the United States specializes in the production of wheat and produces at B, while the United Kingdom specializes in the production of cloth and produces at B'. By exchanging 70W for 70C with the United Kingdom, the United States ends up consuming at E (and gains 20W and 10C), while the United Kingdom ends up consuming at E' (and gains 30W and 10C).

The increased consumption of both wheat and cloth in both nations was made possible by the increased output that resulted as each nation specialized in the production of the commodity of its comparative advantage. That is, in the absence of trade, the United States produced 90W and the United Kingdom 40W, for a total of 130W. With specialization in production and trade, 180W are produced (all in the United States). Similarly, in the absence of trade, the United States produced 60C and the United Kingdom 40C, for a total of 100C. With specialization in production and trade, 120C are produced (all in the United Kingdom).

It is this increase in output of 50W and 20C resulting from specialization in production that is shared by the United States and the United Kingdom and represents their gains from trade. Recall that in the absence of trade, the United States would not specialize in the production of wheat because it also wanted to consume some cloth. Similarly, the United Kingdom would not specialize in the production of cloth in the absence of trade because it also wanted to consume some wheat.

2.6B Relative Commodity Prices with Trade

We can gain a deeper understanding of our trade model by using the supply and demand curves for wheat and cloth shown in Figure 2.3. Figure 2.3 will also help us see how the equilibrium-relative commodity price with specialization in production and trade is determined.

In the left panel of Figure 2.3, $S_{W\,(US+UK)}$ is the combined supply curve of wheat of the United States and the United Kingdom if both countries used all of their resources to produce only wheat. Distance $0B = 180\text{W}$ represents the maximum quantity of wheat that the United States could produce with complete specialization in wheat production at the constant opportunity cost of $P_W/P_C = \frac{2}{3}$ (just as in the left panel of Figure 2.2). Distance

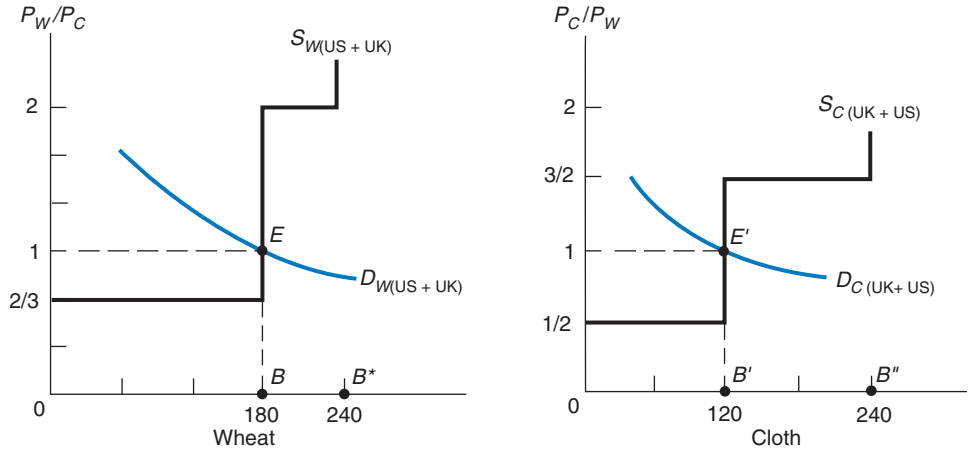

FIGURE 2.3. Equilibrium-Relative Commodity Prices with Demand and Supply.
In the left panel, $S_{W(US+UK)}$ is the combined U.S. and U.K. supply curve of wheat. It shows that the United States could produce a maximum of $180\text{W} = 0B$ at $P_W/P_C = \frac{2}{3}$, while the United Kingdom could produce a maximum of $60\text{W} = BB^*$ at $P_W/P_C = 2$. $D_{W(US+UK)}$ is the combined demand curve for wheat of the United States and the United Kingdom with trade. $D_{W(US+UK)}$ intersects $S_{W(US+UK)}$ at point E, resulting in the equilibrium quantity of 180W (all of which is produced in the United States) and equilibrium price of $P_W/P_C = 1$ with trade. The right panel shows equilibrium for cloth at the intersection of $D_{C(UK+US)}$ with $S_{C(UK+US)}$ at point E' with 120C (all of which is produced in the United Kingdom) and $P_C/P_W = 1$.

$BB^* = 60$W is the maximum quantity of wheat that the United Kingdom could produce at the constant opportunity cost of $P_W/P_C = 2$ (as in the right panel of Figure 2.2). Thus, 240W is the maximum combined total quantity of wheat that the United States and the United Kingdom could produce if both nations used all of their resources to produce wheat. As a result, the $S_{W(US+UK)}$ curve is vertical at 240W.

Suppose that, with trade, the combined demand curve for cloth of the United States and the United Kingdom is $D_{W(US+UK)}$, as shown in the left panel of Figure 2.3. $D_{W(US+UK)}$ intersects $S_{W(US+UK)}$ at point E, determining the equilibrium quantity of 180W and the equilibrium relative price of $P_W/P_C = 1$ with trade (the same as in the left panel of Figure 2.2). Note that, with trade, wheat is produced only in the United States, and the United States specializes completely in the production of wheat.

We can do the same for cloth. In the right panel of Figure 2.3, $S_{C(UK+US)}$ is the combined supply curve of cloth of the United Kingdom and the United States if both countries used all of their resources to produce only cloth. The United Kingdom can produce a maximum of $120\text{C} = 0B'$ at the constant $P_C/P_W = \frac{1}{2}$ and the United States can produce a maximum of another $120\text{C} = B'B''$ at the constant $P_C/P_W = \frac{3}{2}$ (as in Figure 2.2).

Suppose that, with trade, the combined demand for cloth of the United Kingdom and the United States is $D_{C(UK+US)}$, as shown in the right panel of Figure 2.3. $D_{C(UK+US)}$ intersects $S_{C(UK+US)}$ at point E', determining the equilibrium quantity of 120C and the equilibrium-relative price of $P_C/P_W = P_W/P_C = 1$ (the same as in the right panel of Figure 2.2). Note that, with trade, cloth is produced only in the United Kingdom, and the United Kingdom specializes completely in the production of cloth.

Finally, note that with complete specialization in production in both countries, the equilibrium-relative commodity price of each commodity is between the pretrade relative commodity price in each nation (see both panels of Figure 2.3). However, if in the left panel of Figure 2.3 $D_{W(US+UK)}$ were lower and intersected $S_{W(US+UK)}$ between points 0 and B on the horizontal portion of $S_{W(US+UK)}$ at $P_W/P_C = \frac{2}{3}$, trade would take place at the pretrade relative commodity price of wheat of $P_W/P_C = \frac{2}{3}$ in the United States and the United Kingdom would receive all the gains from trade. This would occur if the United Kingdom were a small country that specialized completely in the production of cloth and the United States were larger and did not specialize completely in the production of wheat (see Problem 10, with answer at www.wiley.com/college/salvatore). This is known as the small-country case and shows the "importance of being unimportant." This benefit, however, is not without cost since the small nation (here, the United Kingdom) faces the risk of a possible future reduction in demand for the only commodity it produces.

2.7 Empirical Tests of the Ricardian Model

We now examine the results of empirical tests of the Ricardian trade model. We will see that if we allow for different labor productivities in various industries in different nations, the Ricardian trade model does a reasonably good job at explaining the pattern of trade.

The first such empirical test of the Ricardian trade model was conducted by *MacDougall* in 1951 and 1952, using labor productivity and export data for 25 industries in the United States and the United Kingdom for the year 1937.

Since wages were twice as high in the United States as in the United Kingdom, MacDougall argued that costs of production would be lower in the United States in those industries where American labor was more than twice as productive as British labor. These

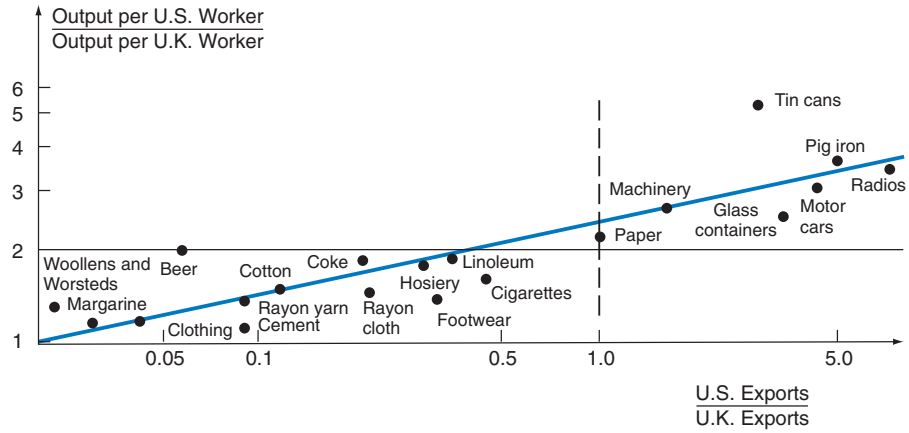

FIGURE 2.4. Relative Labor Productivities and Comparative Advantage—United States and United Kingdom.
The figure shows a positive relationship between labor productivity and export shares for 20 industries in the United States and the United Kingdom, thus confirming the Ricardian trade model.
Source: Adapted from G. D. A. MacDougall, "British and American Exports: A Study Suggested by the Theory of Comparative Costs," *Economic Journal*, December 1951, p. 703.

would be the industries in which the United States had a comparative advantage with respect to the United Kingdom and in which it would undersell the United Kingdom in third markets (i.e., in the rest of the world). On the other hand, the United Kingdom would have a comparative advantage and undersell the United States in those industries where the productivity of British labor was more than one-half the productivity of American labor.

In his test MacDougall excluded trade between the United States and the United Kingdom because tariffs varied widely from industry to industry, tending to offset the differences in labor productivity between the two nations. At the same time, both nations faced generally equal tariffs in third markets. The exclusion of trade between the United States and the United Kingdom did not bias the test because their exports to each other constituted less than 5 percent of their total exports.

Figure 2.4 summarizes MacDougall's results. The vertical axis measures the ratio of output per U.S. worker to output per U.K. worker. The higher this ratio, the greater the relative productivity of U.S. labor. The horizontal axis measures the ratio of U.S. to U.K. exports to third markets. The higher this ratio, the larger are U.S. exports in relation to U.K. exports to the rest of the world. Note that the scales are logarithmic (so that equal distances refer to equal *percentage* changes) rather than arithmetic (where equal distances would measure equal *absolute* changes).

The points in the figure exhibit a clear *positive* relationship (shown by the colored line) between labor productivity and exports. That is, those industries where the productivity of labor is relatively higher in the United States than in the United Kingdom are the industries with the higher ratios of U.S. to U.K. exports. This was true for the 20 industries shown in the figure (out of the total of 25 industries studied by MacDougall). The positive relationship between labor productivity and exports for the United States and the United Kingdom was confirmed by subsequent studies by *Balassa* using 1950 data and *Stern* using 1950 and 1959 data. Additional and more recent confirmation of the Ricardian trade model is provided by *Golub* (see Case Study 2-4).

CASE STUDY 2-4 Relative Unit Labor Costs and Relative Exports—United States and Japan

In a 1995 study of the Ricardian trade model, Golub examined relative unit labor costs (the ratio of wages to unit labor productivity) and the exports of the United States relative to those of the United Kingdom, Japan, Germany, Canada, and Australia and found that, in general, relative unit labor costs and exports were inversely related. That is, the higher the relative unit labor costs in the nation, the lower the relative exports of the nation, and vice versa. This relationship is particularly strong for U.S.-Japanese trade.

The colored line in Figure 2.5 shows a clear negative correlation between relative unit labor costs and relative exports for the 33 industries that Golub studied for trade between the United States and Japan for 1990, thus lending additional support to the Ricardian trade model. Note that the relationship between relative unit labor *costs* and relative exports is negative in Figure 2.5, whereas the relationship between relative unit labor *productivities* and exports shares is positive in Figure 2.4 because relative unit labor costs are the inverse of relative unit labor productivities. The above results were confirmed in a 2000 study by Golub and Hsieh for trade in the products of 39 sectors between the United States and nine other countries (Japan, Germany, the United Kingdom, France, Italy, Canada, Australia, Mexico, and Korea) from 1972 to 1991.

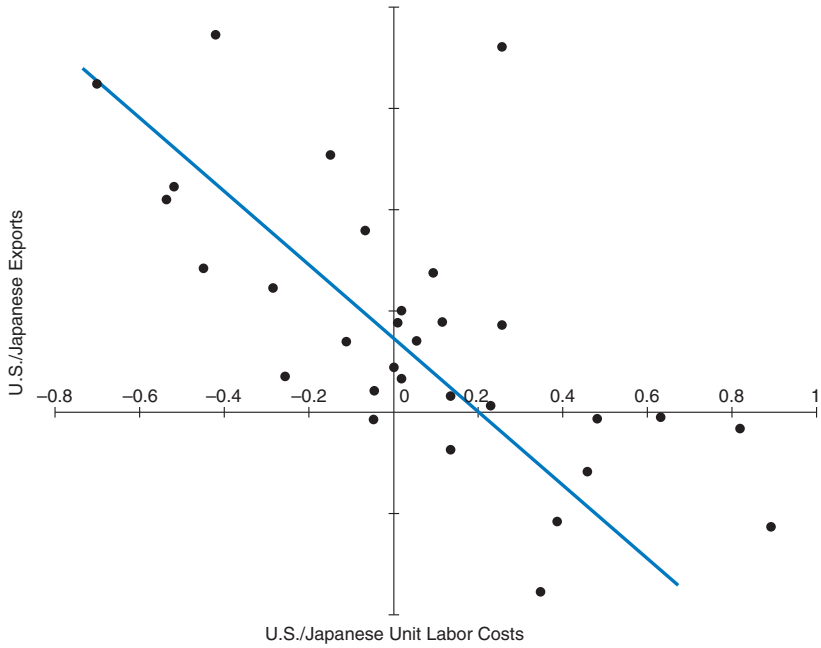

FIGURE 2.5. Relative Exports and Relative Unit Costs—United States and Japan.
The figure shows a clear negative correlation between relative exports and relative unit labor costs for 33 industries between the United States and Japan. It shows that the higher are U.S. relative labor costs, the lower are its exports in relation to Japan, thus supporting the Ricardian trade model.
Source: Adapted from S. S. Golub. *Comparative and Absolute Advantage in the Asia-Pacific Region* (San Francisco: Federal Reserve Bank of San Francisco, Center for Pacific Basin Monetary and Economic Studies, 1995). p. 46; and S. S. Golub and C. T. Hsieh, ''The Classical Ricardian Theory of Comparative Advantage Revisited,'' *Review of International Economics*, May 2000, pp. 221–234.

These empirical studies all seem to support the Ricardian theory of comparative advantage. That is, the actual pattern of trade seems to be based on the different labor productivities in different industries in the two nations. Production costs other than labor costs, demand considerations, political ties, and various obstructions to the flow of international trade did not break the link between relative labor productivity and export shares.

One possible question remained. Why did the United States not capture the entire export market from the United Kingdom (rather than only a rising share of exports) in those industries where it enjoyed a cost advantage (i.e., where the ratio of the productivity of U.S. labor to U.K. labor was greater than 2)? MacDougall answered that this was due mainly to product differentiation. That is, the output of the same industry in the United States and the United Kingdom is not homogeneous. An American car is not identical to a British car. Even if the American car is cheaper, some consumers in the rest of the world may still prefer the British car. Thus, the United Kingdom continues to export some cars even at a higher price. However, as the price difference grows, the United Kingdom's share of car exports can be expected to decline. The same is true for most other products. Similarly, the United States continues to export to third markets some commodities in which it has a cost disadvantage with respect to the United Kingdom. We return to this important point in Section 6.4A.

Even though the simple Ricardian trade model has been empirically verified to a large extent, it has a serious shortcoming in that it assumes rather than explains comparative advantage. That is, Ricardo and classical economists in general provided no explanation for the difference in labor productivity and comparative advantage between nations, and they could not say much about the effect of international trade on the earnings of factors of production. By providing answers to both of these important questions, the Heckscher-Ohlin model (discussed in Chapter 5) theoretically improves on and extends the Ricardian model.

SUMMARY

1. This chapter examined the development of trade theory from the mercantilists to Smith, Ricardo, and Haberler and sought to answer two basic questions: (a) What is the basis for and what are the gains from trade? and (b) What is the pattern of trade?
2. The mercantilists believed that a nation could gain in international trade only at the expense of other nations. As a result, they advocated restrictions on imports, incentives for exports, and strict government regulation of all economic activities.
3. According to Adam Smith, trade is based on absolute advantage and benefits both nations. (The discussion assumes a two-nation, two-commodity world.) That is, when each nation specializes in the production of the commodity of its absolute advantage and exchanges part of its output for the commodity of its absolute disadvantage, both nations end up consuming more of both commodities. Absolute advantage, however, explains only a small portion of international trade today.
4. David Ricardo introduced the law of comparative advantage. This postulates that even if one nation is less efficient than the other nation in the production of both commodities, there is still a basis for mutually beneficial trade (as long as the absolute disadvantage that the first nation has with respect to the second is not in the same proportion in both commodities). The less efficient nation should specialize in the production and export of the commodity in which its absolute disadvantage is smaller. (This is the commodity of its comparative advantage.) Ricardo, however, explained the law of comparative advantage in terms of the labor theory of value, which is unacceptable.
5. Gottfried Haberler came to the "rescue" by explaining the law of comparative advantage in terms of the

opportunity cost theory. This states that the cost of a commodity is the amount of a second commodity that must be given up to release just enough resources to produce one additional unit of the first commodity. The opportunity cost of a commodity is equal to the relative price of that commodity and is given by the (absolute) slope of the production possibility frontier. A straight-line production possibility frontier reflects constant opportunity costs.

6. In the absence of trade, a nation's production possibility frontier is also its consumption frontier. With trade, each nation can specialize in producing the commodity of its comparative advantage and exchange part of its output with the other nation for the commodity of its comparative disadvantage. By so doing, both nations end up consuming more of both commodities than without trade. With complete specialization, the equilibrium-relative commodity prices will be between the pretrade-relative commodity prices prevailing in each nation.

7. The first empirical test of the Ricardian trade model was conducted by MacDougall in 1951 and 1952 using 1937 data. The results indicated that those industries where labor productivity was relatively higher in the United States than in the United Kingdom were the industries with the higher ratios of U.S. to U.K. exports to third markets. These results were confirmed by Balassa using 1950 data, Stern using 1950 and 1959 data, Golub using 1990 data, and Golub and Hsieh using 1972–1991 data. Thus, it can be seen that comparative advantage seems to be based on a difference in labor productivity or costs, as postulated by Ricardo. However, the Ricardian model explains neither the reason for the difference in labor productivity or costs across nations nor the effect of international trade on the earnings of factors.

A LOOK AHEAD

In Chapter 3, we examine the basis for and the gains from trade, as well as the pattern of trade in the more realistic case of increasing costs. Our model will then be completed in Chapter 4, where we see formally how the rate at which commodities are exchanged in international trade is actually determined. This will also determine how the gains from trade are in fact divided between the two trading nations.

KEY TERMS

Absolute advantage, p. 34
Basis for trade, p. 31
Complete specialization, p. 47
Constant opportunity costs, p. 43
Gains from trade, p. 31
Labor theory of value, p. 41
Laissez-faire, p. 35
Law of comparative advantage, p. 36
Mercantilism, p. 32
Opportunity cost theory, p. 42
Pattern of trade, p. 31
Production possibility frontier, p. 42
Relative commodity prices, p. 44
Small-country case, p. 47

QUESTIONS FOR REVIEW

1. What are the basic questions that we seek to answer in this chapter? In what way is the model presented in this chapter an abstraction or a simplification of the real world? Can the model be generalized?
2. What were the mercantilists' views on trade? How does their concept of national wealth differ from today's view?
3. Why is it important to study the mercantilists' views on trade? How were their views different from those of Adam Smith? What is the relevance of all this today?
4. What was the basis for and the pattern of trade according to Adam Smith? How were gains from trade generated? What policies did Smith advocate

in international trade? What did he think was the proper function of government in the economic life of the nation?

5. In what way was Ricardo's law of comparative advantage superior to Smith's theory of absolute advantage? How do gains from trade arise with comparative advantage? How can a nation that is less efficient than another nation in the production of all commodities export anything to the second nation?

6. What is the exception to the law of comparative advantage? How prevalent is it?

7. Why is Ricardo's explanation of the law of comparative advantage unacceptable? What acceptable theory can be used to explain the law?

8. What is the relationship between opportunity costs and the production possibility frontier of a nation? How does the production possibility frontier look under constant opportunity costs? What is the relationship between the opportunity cost of a commodity and the relative price of that commodity? How can they be visualized graphically?

9. Why is a nation's production possibility frontier the same as its consumption frontier in the absence of trade? How does the nation decide how much of each commodity to consume in the absence of trade?

10. What is meant by complete specialization? by incomplete specialization? Why do both nations gain from trade in the first instance but only the small nation in the second?

11. How is the combined supply curve of both nations for each of the traded commodities determined? How is the equilibrium-relative commodity price determined with trade?

12. What are the results of empirical testing of the Ricardian model?

PROBLEMS

1. Table 2.5 shows bushels of wheat and yards of cloth that the United States and the United Kingdom can produce with one hour of labor time under four different hypothetical situations. In each case, identify the commodity in which the United States and the United Kingdom have an absolute advantage or disadvantage.

***2.** With respect to Table 2.5, indicate in each case the commodity in which each nation has a comparative advantage or disadvantage.

3. With respect to Table 2.5, indicate in each case whether or not trade is possible and the basis for trade.

***4.** Suppose that in Case B in Table 2.5 the United States exchanges 4W for 4C with the United Kingdom.

(a) How much does the United States gain in terms of cloth?

(b) How much does the United Kingdom gain in terms of cloth?

(c) What is the range for mutually beneficial trade?

(d) How much would each nation gain if they exchanged 4W for 6C instead?

5. Use the information for Case B in Table 2.5 and assume that labor is the only factor of production and is homogeneous (i.e., all of one type).

(a) What is the cost *in terms of labor content* of producing wheat and cloth in the United States and the United Kingdom?

TABLE 2.5. Production Possibilities in the United States and the United Kingdom

	Case A		Case B		Case C		Case D	
	U.S.	U.K.	U.S.	U.K.	U.S.	U.K.	U.S.	U.K.
Wheat (bushels/hour)	4	1	4	1	4	1	4	2
Cloth (yards/hour)	1	2	3	2	2	2	2	1

(b) What is the dollar price of wheat and cloth in the United States if the wage rate is $6?

(c) What is the pound price of wheat and cloth in the United Kingdom if the wage rate is £1?

6. Answer the following questions with reference to Problem 5.

(a) What is the dollar price of wheat and cloth in the United Kingdom if the exchange rate between the pound and the dollar is £1 = $2? Would the United States be able to export wheat to the United Kingdom at this exchange rate? Would the United Kingdom be able to export cloth to the United States at this exchange rate?

(b) What if the exchange rate between the dollar and the pound were £1 = $4?

(c) What if the exchange rate were £1 = $1?

(d) What is the *range* of exchange rates that will allow the United States to export wheat to the United Kingdom and the United Kingdom to export cloth to the United States?

7. Assume that the data in Case B in Table 2.5 refer to millions of bushels of wheat and millions of yards of cloth.

(a) Plot on graph paper the production frontiers of the United States and the United Kingdom.

(b) What is the relative price of wheat (i.e., P_W/P_C) in the United States and in the United Kingdom in autarky (no trade)?

(c) What is the relative price of cloth (i.e., P_C/P_W) in the United States and in the United Kingdom in autarky?

8. Using the United States and United Kingdom production frontiers from Problem 7, assume that the no-trade or autarky point is 3W and ¾C (in million units) in the United States and ½W and 1C in the United Kingdom. Also assume that with the opening of trade the United States exchanges 1W for 1C with the United Kingdom. Show graphically for the United States and the United Kingdom the autarky (or no-trade) point of production and consumption, the point of production and consumption with trade, and the gains from trade.

9. **(a)** What would be the equilibrium-relative commodity price of wheat if $D_{W(US+UK)}$ shifted up by one-third in the left panel of Figure 2.3? How much wheat and cloth would the United States and the United Kingdom then produce?

(b) What does the answer to part (a) imply for $D_{C(UK+US)}$ in the right panel of Figure 2.3?

***10.** What would happen if $D_{W(US+UK)}$ intersected the horizontal portion of $S_{W(US+UK)}$ at $P_W/P_C = \frac{2}{3}$ and 120W in the left panel of Figure 2.3? What would this imply for specialization in production and the distribution in the gains from trade between the two nations?

11. Draw a figure similar to Figure 2.2 showing that the United Kingdom is now a small country, half the size shown in the right panel of Figure 2.2, and trades 20C for 30W with the United States at $P_W/P_C = \frac{2}{3}$.

12. **(a)** How was the Ricardian trade model tested empirically?

(b) In what way can the results be said to confirm the Ricardian model?

(c) Why do we then need other trade models?

13. How would you counter the argument that the United States needs to restrict textile imports in order to save American jobs?

*= Answer provided at www.wiley.com/college/salvatore.

APPENDIX

We now extend the theory of comparative advantage first to the case of more than two commodities and then to the case of more than two nations. In each case, we will see that the theory of comparative advantage is easily generalized.

A2.1 Comparative Advantage with More Than Two Commodities

Table 2.6 shows the dollar and the pound cost, or price, of five commodities in the United States and the United Kingdom. (In economics, "cost" includes the return to all factors, including "normal profits"; thus, "cost" and "price" are used interchangeably here.)

TABLE 2.6. Commodity Prices in the United States and United Kingdom

Commodity	Price in the U.S.	Price in the U.K.
A	$2	£6
B	4	4
C	6	3
D	8	2
E	10	1

To determine which commodities will be exported and imported by the United States and the United Kingdom, we must first express all commodity prices in terms of the same currency and then compare prices in the two nations. For example, if the exchange rate between the dollar and the pound is £1 = $2, the *dollar* prices of the commodities in the United Kingdom would be

Commodity	A	B	C	D	E
Dollar price in the U.K.	12	8	6	4	2

At this exchange rate, the dollar prices of commodities A and B are lower in the United States than in the United Kingdom; commodity C is equally priced in the two nations; and the dollar prices of commodities D and E are lower in the United Kingdom. As a result, the United States will export commodities A and B to the United Kingdom and import commodities D and E from the United Kingdom. Commodity C will not be traded.

Now assume that the exchange rate between the dollar and the pound is £1 = $3. The dollar prices of the commodities in the United Kingdom would be:

Commodity	A	B	C	D	E
Dollar price in the U.K.	18	12	9	6	3

At this higher exchange rate, the dollar prices of commodities A, B, and C are lower in the United States, while the dollar prices of commodities D and E are lower in the United Kingdom. Thus, the United States would export commodities A, B, and C to the United Kingdom and import commodities D and E from the United Kingdom. Note that commodity C, which was not traded at the exchange rate of £1 = $2, is now exported by the United States at the exchange rate of £1 = $3.

Finally, if the exchange rate were £1 = $1, the dollar prices of the commodities in the United Kingdom would be:

Commodity	A	B	C	D	E
Dollar price in the U.K.	6	4	3	2	1

In this case, the United States would export only commodity A to the United Kingdom and import all other commodities, with the exception of commodity B (which would not be traded because it is now equally priced in the two nations).

The actual exchange rate between the dollar and the pound will settle at the level at which *the value of U.S. exports to the United Kingdom exactly equals the value of the U.S. imports from the United Kingdom* (in the absence of other international transactions). Once this equilibrium exchange rate is established, we will be able to determine exactly which commodities are exported by the United States and which are exported by the United Kingdom. Each nation will then have a comparative advantage in the commodities that it exports at the particular equilibrium exchange rate established. (We abstract here from the situation where the exchange rate remains out of equilibrium for long periods of time.)

What we can say on the basis of Table 2.6 is that the U.S. comparative advantage is greatest in commodity A, and the United States must export at least this commodity. For this to be possible, the exchange rate between the dollar and the pound must be £1 > \$0.33. The United Kingdom's comparative advantage is highest in commodity E, so that the United Kingdom must export at least commodity E. For this to be possible, the exchange rate between the dollar and the pound must be £1 < \$10. This discussion can be generalized to cover any number of commodities.

A2.2 Comparative Advantage with More Than Two Nations

Suppose that, instead of two nations and five commodities, we have two commodities (wheat and cloth) and five nations (A, B, C, D, and E). Table 2.7 ranks these nations from lowest to highest in terms of their internal P_W/P_C values. With trade, the equilibrium P_W/P_C will settle somewhere between 1 and 5. That is, $1 < P_W/P_C < 5$.

If the equilibrium $P_W/P_C = 3$ with trade, Nations A and B will export wheat to Nations D and E in exchange for cloth. Nation C will not engage in international trade in this case because its pretrade P_W/P_C equals the equilibrium P_W/P_C with trade. Given a trade equilibrium $P_W/P_C = 4$, Nations A, B, and C will export wheat to Nation E in exchange for cloth, and Nation D will not engage in international trade. If the equilibrium $P_W/P_C = 2$ with trade, Nation A will export wheat to all the other nations, with the exception of Nation B, in exchange for cloth.

This discussion can easily be extended to any number of countries. However, generalizing our analysis to many commodities *and* many nations at the same time becomes cumbersome and is unnecessary. What is important at this point is that the conclusions reached on the basis of our simple model with only two nations and two commodities *can* be generalized and are indeed applicable to the case of many nations and many commodities.

Problem Set up an example of trade with three commodities and three nations in such a way that each of the three nations exports one of the commodities to, and imports one of the commodities from, each of the other two nations.

■ TABLE 2.7. Ranking of Nations in Terms of Internal P_W/P_C

Nation	A	B	C	D	E
P_W/P_C	1	2	3	4	5

SELECTED BIBLIOGRAPHY

For a problem-solving approach to the material covered in this chapter, with many examples and solved problems, see:

- D. Salvatore, *Theory and Problems of International Economics*, 4th ed. (New York: McGraw-Hill, 1996), chs. 1, 2 (sects. 2.1 to 2.3).

A preclassical mercantilist view on international trade can be found in:

- E. F. Heckscher, *Mercantilism*, Vols. I and II (London: Allen & Unwin, 1935).
- P. C. Newman, A. D. Gayer, and M. H. Spencer, *Source Readings in Economic Thought* (New York: Norton, 1954), pp. 24–53.

For Smith's and Ricardo's views on international trade, see:

- A. Smith, *The Wealth of Nations* (New York: The Modern Library, 1937), Book I, ch. 3; Book IV, chs. 1–3, 6–8.
- D. Ricardo, *The Principles of Political Economy and Taxation* (Homewood, Ill.: Irwin, 1963), ch. 7.

An excellent exposition of the classical theory of comparative advantage can be found in:

- G. Haberler, *The Theory of International Trade* (London: W. Hodge & Co., 1936), chs. 9–10.
- J. Viner, *Studies in the Theory of International Trade* (New York: Harper & Brothers, 1937), ch. 7.

For a more advanced and definitive exposition of the theory of comparative advantage, see:

- J. N. Bhagwati, "The Pure Theory of International Trade: A Survey," *Economic Journal*, March 1964, pp. 1–84.
- J. S. Chipman, "A Survey of the Theory of International Trade," *Econometrica*, July 1965; Part I: pp. 477–519, Part II: pp. 685–760.

For an extension of the Ricardian model to many commodities, see:

- R. Dornbusch, S. Fischer, and P. Samuelson, "Comparative Advantage, Trade and Payments in a Ricardian Model," *American Economic Review*, December 1977, pp. 823–839.

For empirical tests of the Ricardian trade model, see:

- G. D. A. MacDougall, "British and American Exports: A Study Suggested by the Theory of Comparative Costs," *Economic Journal*, December 1951 (Part I: pp. 697–724) and September 1952 (Part II: pp. 487–521). Reprinted in R. E. Caves and H. G. Johnson, *Readings in International Economics* (Homewood, Ill.: Irwin, 1968), pp. 553–578.
- R. M. Stern, "British and American Productivity and Comparative Costs in International Trade," *Oxford Economic Papers*, October 1962, pp. 275–296.
- B. Balassa, "An Empirical Demonstration of Classical Comparative Cost Theory," *Review of Economics and Statistics*, August 1963, pp. 231–238.
- S. S. Golub and C. T. Hsieh, "The Classical Ricardian Theory of Comparative Advantage Revisited," *Review of International Economics*, May 2000.

INTERNet

For trade policies of all the member countries of the World Trade Organization, see:

http://www.wto.org

For information and description of new reports and analyses on international trade theory and policies, generally supporting a liberal trading system, published by the Institute for International Economics, see:

http://www.iie.com

The case against free trade is made by the Public Citizen Global Trade Watch, an organization created by Ralph Nader (the consumer advocate), which is found at:

http://www.citizen.org/trade