Discussion #2
Handouts

Offshoring of Goods and Services

One facet of increased services trade is the increased use of offshore outsourcing in which a company relocates labor-intensive service-industry functions to another country. . . . When a good or service is produced more cheaply abroad, it makes more sense to import it than to make or provide it domestically.

Economic Report of the President, 2004, p. 229

Increasing numbers of Americans . . . perceive offshoring . . . as an actual or potential threat to their jobs or to their wages even if they hold onto their jobs.

Jagdish Bhagwati and Alan S. Blinder, 2007, *Offshoring of American Jobs*

The American people deserve a tax code that . . . lowers incentives to move jobs overseas, and lowers tax rates for businesses and manufacturers that are creating jobs right here in the United States of America. That's what tax reform can deliver.

President Barack Obama, State of the Union address, February 12, 2013

If you take the battery out of your cell phone to see where the phone was produced, you will likely see several countries listed inside. Motorola, for example, is a U.S. company that produces some of its cell phones in Singapore using batteries and a battery charger made in China. Nokia is a Finnish company that produces some of its American-sold cell phones in the United States using batteries made in Japan and software that was written in India. Apple produces its iPhone in facilities found in China, Taiwan, Thailand, Malaysia, Singapore, South Korea, the Czech Republic, Philippines, and the United States. A vast array of products, including simple toys like the Barbie doll and sophisticated items like airplanes and personal computers, consist of materials, parts, components, and services that are produced in numerous countries. The following excerpt from a *New York Times* article illustrates this observation:[1]

[1] Louis Uchitelle, "Why Hasn't a Weak Dollar Slowed Imports?" *New York Times*, April 8, 2005, online edition.

> General Electric in the United States and Snechma of France . . . jointly manufacture the jet engine for Boeing's 737 and Airbus's 320. G.E. makes the "hot section" at its plant in Cincinnati, while Snechma manufactures the giant fans in France. They ship these components to each other and each partner does the final assembly of the engines for its customers. In addition, G.E. makes smaller jet engines for the commuter planes that Bombardier makes in Canada and Embraer makes in Brazil. The engines are exported to those countries, but 24 percent of the value of the engines comes from components imported from Japan.

The provision of a service or the production of various parts of a good in different countries that are then used or assembled into a final good in another location is called **foreign outsourcing** or, more simply, **offshoring.** We will not worry about the subtle distinction between these two terms in this chapter (see **Side Bar: "Foreign Outsourcing" Versus "Offshoring"**); we'll use "offshoring" because it has become most commonly used by economists.[2]

Offshoring is a type of international trade that differs from the type of trade analyzed in the Ricardian and Heckscher-Ohlin models; the goods traded in those models were final goods. Offshoring is trade in *intermediate inputs*, which can sometimes cross borders several times before being incorporated into a final good that can be sold domestically or abroad. Offshoring is a relatively new phenomenon in world trade.[3] The amount of world trade relative to the GDPs of countries was high even in the late nineteenth and early twentieth centuries. But it is unlikely that a good would have crossed borders multiple times at several stages of production because the costs of transportation and communication were too high. Today, however, these costs have fallen so much that it is now economical to combine the labor and capital resources of several countries to produce a good or service. Indeed, if you have ever called for help with your laptop, chances are that you have spoken with someone at a call center in India, which shows just how low the costs of communication have become!

Is offshoring different from the type of trade examined in the Ricardian and Heckscher-Ohlin models? From one point of view, the answer is no. Offshoring allows a company to purchase inexpensive goods or services abroad, just as consumers can purchase lower-priced goods from abroad in the Ricardian and Heckscher-Ohlin models. This is what the quote from the *Economic Report of the President* at the beginning of the chapter suggests: with offshoring we import those goods and services that are cheaper to produce abroad. From another point of view, however, offshoring is different. Companies now have the opportunity to send *a portion* of their activities to other countries. The jobs associated with those activities leave the United States, and by paying lower wages abroad, U.S. firms lower their costs and pass on these savings to consumers. Offshoring results in lower prices but changes the mix of jobs located in the United States. Higher-skilled workers in the United States, engaged in activities

[2] Both "foreign outsourcing" and "offshoring" have been coined recently to describe this new type of international trade. The earliest known use of the word "outsourcing" is a quotation from an American auto executive in the *Journal of the Royal Society of Arts*, 1979, who said, "We are so short of professional engineers in the motor industry that we are having to outsource design work to Germany" (William Safire, "On Language," *New York Times Magazine*, March 21, 2004, p. 30).

[3] There is also the concept of *domestic outsourcing*, which occurs when a company decides to shift some of its production activities from one location to another within the same country. In this text, outsourcing always means *foreign outsourcing*.

SIDE BAR

"Foreign Outsourcing" Versus "Offshoring"

In discussions of foreign outsourcing, we often hear the term "offshoring." The quote from the *Economic Report of the President* at the beginning of the chapter combined these terms as "offshore outsourcing." Is there a difference between "foreign outsourcing" and "offshoring"?

The term "offshoring" is sometimes used to refer to a company moving some of its operations overseas but retaining ownership of those operations. In other words, the company moves some operations offshore but does not move production outside of its own firm. Intel, for example, produces microchips in China and Costa Rica using subsidiaries that it owns. Intel has engaged in foreign direct investment (FDI) to establish these offshore subsidiaries.

Mattel, on the other hand, arranges for the production of the Barbie doll in several different countries. Unlike Intel, however, Mattel does not actually own the firms in those countries. Furthermore, Mattel lets these firms purchase their inputs (like the hair and cloth for the dolls) from whichever sources are most economical. Mattel is engaging in foreign outsourcing as it contracts with these firms abroad but has not done any FDI.

Dell is an intermediate case. Dell assembles its computers overseas in firms it does not own, so it is outsourcing rather than offshoring the assembly. However, Dell exercises careful control over the inputs (such as computer parts) that these overseas firms use. Dell outsources the assembly but monitors the overseas firms closely to ensure the high quality of the computers being assembled.

In this chapter, we will not worry about the distinction between "offshoring" and "foreign outsourcing"; we'll use the term "offshoring" whenever the components of a good or service are produced in several countries, regardless of who owns the plants that provide the components or services.

such as marketing and research, will be combined with less skilled workers abroad, engaged in assembling products. In a sense, offshoring is similar to immigration in that U.S. firms are able to employ foreign workers, even though those workers do not have to leave their home countries.

The first goal of this chapter is to examine in detail the phenomenon of offshoring and describe in what ways it differs from trade in final products. We discuss how offshoring affects the demand for high-skilled and low-skilled labor and the wages paid to those workers. Since the early 1980s, there has been a significant change in the pattern of wage payments in the United States and other countries—the wages of skilled workers have been rising relative to those of less skilled workers. We examine whether this change in relative wages is the result of offshoring or whether there are other explanations for it.

A second goal of the chapter is to discuss the gains from offshoring. We argue that offshoring creates gains from trade, similar to those seen from the trade of final goods in the Ricardian or Heckscher-Ohlin models. But having overall gains from trade for a country does not necessarily mean that every person in the country gains. As the second quote at the beginning of the chapter shows, many workers are fearful that their jobs and wages are threatened by offshoring. We focus attention on how offshoring affects high-skilled versus low-skilled workers.

A third goal of the chapter is to examine the response to offshoring in the United States. The final quotation at the beginning of the chapter, from the 2013 State of the Union address by President Obama, indicates that he proposes to limit tax breaks to companies engaged in offshoring. Many economists would disagree with this proposal, and argue instead that offshoring has overall benefits. We examine these arguments and also discuss the newest trend of "inshoring" activities back into the United States.

1 A Model of Offshoring

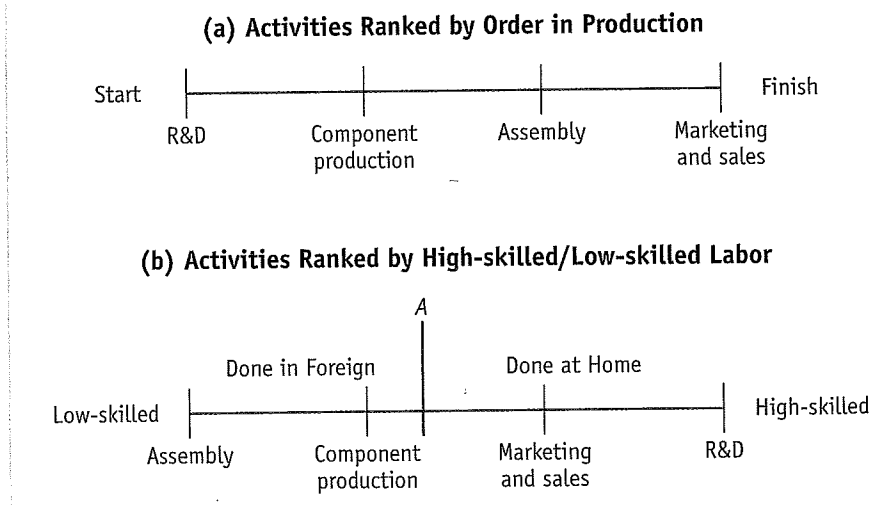
To develop a model of offshoring, we need to identify all the activities involved in producing and marketing a good or service. These activities are illustrated in Figure 7-1. Panel (a) describes the activities in the order in which they are performed (starting with research and development [R&D] and ending with marketing and after-sales service). For instance, in producing a television, the design and engineering are developed first; components such as wiring, casing, and screens are manufactured next; and finally the television is assembled into its final version and sold to consumers.

For the purpose of building a model of offshoring, however, it is more useful to line up the activities according to the ratio of high-skilled/low-skilled labor used, as in panel (b). We start with the less skilled activities, such as the manufacture and assembly of simple components (like the case or the electric cord for the television), then move to more complex components (like the screen). Next are the supporting service activities such as accounting, order processing, and product service (sometimes called "back-office" activities because the customer does not see them). Finally, we come to activities that use more skilled labor, such as marketing and sales ("front-office" activities), and those that use the most skilled labor such as R&D.

Value Chain of Activities

The whole set of activities that we have illustrated in Figures 7-1(a) and 7-1(b) is sometimes called the **value chain** for the product, with each activity adding more

FIGURE 7-1



The Value Chain of a Product Any product has many different activities involved in its manufacture. Panel (a) lists some of these activities for a given product in the order in which they occur. The value chain in (b) lists these same activities in order of the amount of high-skilled/low-skilled labor used in each. In panel (b), the assembly activity, on the left, uses the least skilled labor, and R&D, on the right, uses the most skilled labor. Because we assume that the relative wage of skilled labor is higher at Home and that trade and capital costs are uniform across activities, there is a point on the value chain, shown by line A, below which all activities are offshored to Foreign and above which all activities are performed at Home.

value to the combined product. All these activities do not need to be done in one country—a firm can transfer some of these activities abroad by offshoring them when it is more economical to do so. By lining up the activities in terms of the relative amount of skilled labor they require, we can predict which activities are likely to be transferred abroad. This prediction depends on several assumptions, which follow.

Relative Wage of Skilled Workers Let W_L be the wage of low-skilled labor in Home and W_H the wage of high-skilled labor. Similarly, let W^*_L and W^*_H be the wages of low-skilled and high-skilled workers in Foreign. Our first assumption is that Foreign wages are less than those at Home, $W^*_L < W_L$ and $W^*_H < W_H$, and that the *relative wage* of low-skilled labor is lower in Foreign than at Home, so $W^*_L/W^*_H < W_L/W_H$. This assumption is realistic because low-skilled labor in developing countries receives especially low wages.

Costs of Capital and Trade As the firm considers sending some activities abroad, it knows that it will lower its labor costs because wages in Foreign are lower. However, the firm must also take into account the extra costs of doing business in Foreign. In many cases, the firm pays more to capital through (1) higher prices to build a factory or higher prices for utilities such as electricity and fuel; (2) extra costs involved in transportation and communication, which will be especially high if Foreign is still developing roads, ports, and telephone capabilities; and (3) the extra costs from tariffs if Foreign imposes taxes on goods (such as component parts) when they come into the country. We lump together costs 2 and 3 into what we call "trade costs."

Higher capital and trade costs in Foreign can prevent a Home firm from offshoring all its activities abroad. In making the decision of what to offshore, the Home firm will balance the savings from lower wages against the extra costs of capital and trade.

Our second assumption is that these extra costs apply *uniformly* across all the activities in the value chain; that is, these extra costs add, say, 10% to each and every component of operation in Foreign as compared with Home. Unlike our assumption about relative wages in Home and Foreign, this assumption is a bit unrealistic. For instance, the extra costs of transportation versus those of communication are quite different in countries such as China and India; good roads for transport have developed slowly, while communications technology has developed rapidly. As a result, technology in telephones is advanced in those countries, so cell phones are often cheaper there than in the United States and Europe. In this case, the higher infrastructure costs will affect the activities that rely on transportation more than activities that rely on communication.

Slicing the Value Chain Now suppose that the Home firm with the value chain in Figure 7-1, panel (b), considers transferring some of these activities from Home to Foreign. Which activities will be transferred? Based on our assumptions that $W^*_L/W^*_H < W_L/W_H$ and that the extra costs of capital and trade apply uniformly, it makes sense for the firm to send abroad the activities that are the least skilled and labor-intensive and keep at Home the activities that are the most skilled and labor-intensive. Looking at Figure 7-1, all activities to the left of the vertical line A might be done in Foreign, for example, whereas those activities to the right of the vertical line will be done in Home. We can refer to this transfer of activities as "slicing the value chain."[4]

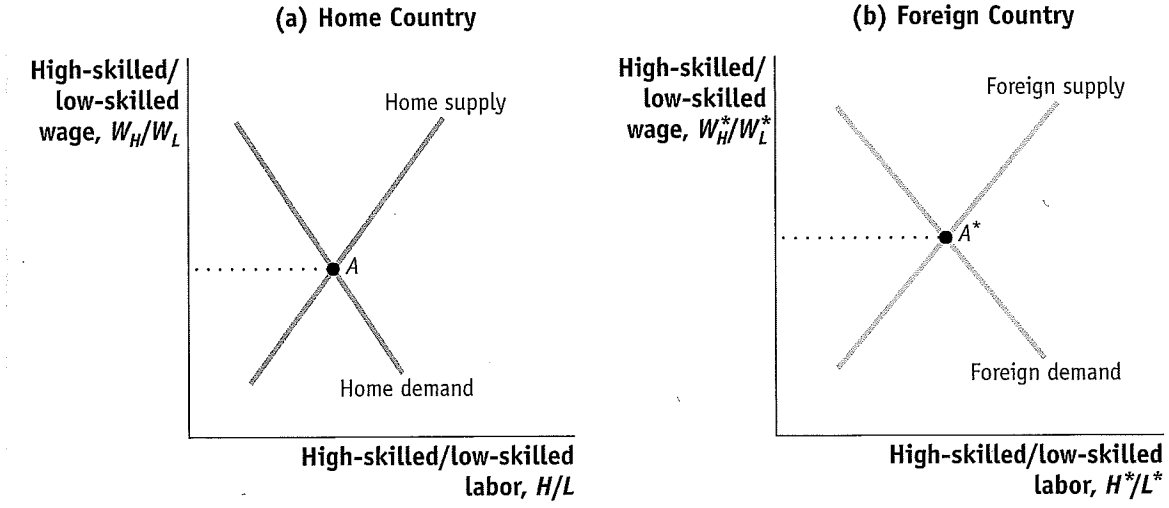
[4] This term is drawn from Paul Krugman, 1995, "Growing World Trade: Causes and Consequences," *Brookings Papers on Economic Activity*, 1.

Activities to the left of line A are sent abroad because the cost savings from paying lower wages in Foreign are greatest for activities that require less skilled labor. Because the extra costs of capital and trade are uniform across activities, the cost savings on wages are most important in determining which activities to transfer and which to keep at Home.

Relative Demand for Skilled Labor Now that we know the division of activities between Home and Foreign, we can graph the demand for labor in each country, as illustrated in Figure 7-2. For Home, we add up the demand for high-skilled labor H and low-skilled labor L for all the activities to the right of line A in Figure 7-1, panel (b). Taking the ratio of these, in panel (a) we graph the relative demand for skilled labor at Home H/L against the relative wage W_H/W_L. This relative demand curve slopes downward because a higher relative wage for skilled labor would cause Home firms to substitute less skilled labor in some activities. For example, if the relative wage of skilled labor increased, Home firms might hire high school rather than college graduates to serve on a sales force and then train them on the job.

In Foreign, we add up the demand for high-skilled labor H^* and for low-skilled labor L^* for all the activities to the left of line A^*. Panel (b) graphs the relative demand for skilled labor in Foreign H^*/L^* against the relative wage W_H^*/W_L^*. Again, this curve slopes downward because a higher relative wage for skilled labor would cause Foreign firms to substitute less skilled labor in some activities. In each country, we can add a relative supply curve to the diagram, which is upward-sloping because a higher relative wage for skilled labor causes more skilled individuals to enter this industry. For instance, if the high-skilled wage increases relative to the low-skilled wage in either

FIGURE 7-2



Relative Demand and Supply for High-Skilled/Low-Skilled Labor In panel (a), we show the relative demand and supply for skilled labor at Home, H/L, depending on the relative wage, W_H/W_L. The equilibrium relative wage at Home is determined at A. In panel (b), we show the relative demand and supply for skilled labor in Foreign, H^*/L^*, depending on the relative wage, W_H^*/W_L^*. The Foreign equilibrium is at point A^*.

country, then individuals will invest more in schooling to equip themselves with the skills necessary to earn the higher relative wage.

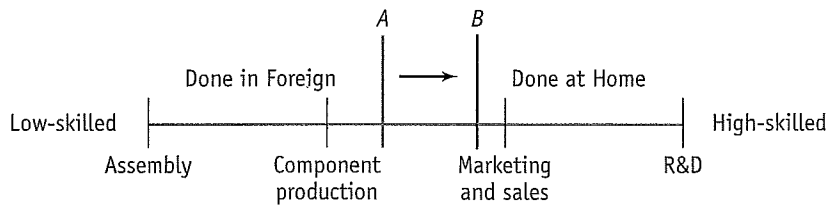
The intersection of the relative demand and relative supply curves, at points A and A^*, gives the equilibrium relative wage in this industry in each country and the equilibrium relative employment of high-skilled/low-skilled workers. Starting at these points, next we study how the equilibrium changes as Home offshores more activities to Foreign.

Changing the Costs of Trade

Suppose now that the costs of capital or trade in Foreign fall. For example, the North American Free Trade Agreement (NAFTA) lowered tariffs charged on goods crossing the U.S.–Mexico border. This fall in trade costs made it easier for U.S. firms to offshore to Mexico. And even before NAFTA, Mexico had liberalized the rules concerning foreign ownership of capital there, thereby lowering the cost of capital for U.S. firms. Another example is India, which in 1991 eliminated many regulations that had been hindering businesses, communications, and foreign investment. Before 1991 it was difficult for a new business to start, or even to secure a phone or fax line in India; after 1991 the regulations on domestic and foreign-owned business were simplified, and communication technology improved dramatically with cell phones and fiber-optic cables. These policy changes made India more attractive to foreign investors and firms interested in offshoring.

Change in Home Labor Demand and Relative Wage When the costs of capital or trade decline in Foreign, it becomes desirable to shift more activities in the value chain from Home to Foreign. Figure 7-3 illustrates this change with the shift of the dividing line from A to B. The activities between A and B, which used to be done at Home, are now done in Foreign. As an example, consider the transfer of television production from the United States to Mexico. As U.S. firms first shifted manufacturing to Mexico, the chassis of the televisions were constructed there. Later on, electronic circuits were constructed in Mexico, and later still the picture tubes were manufactured there.[5]

FIGURE 7-3



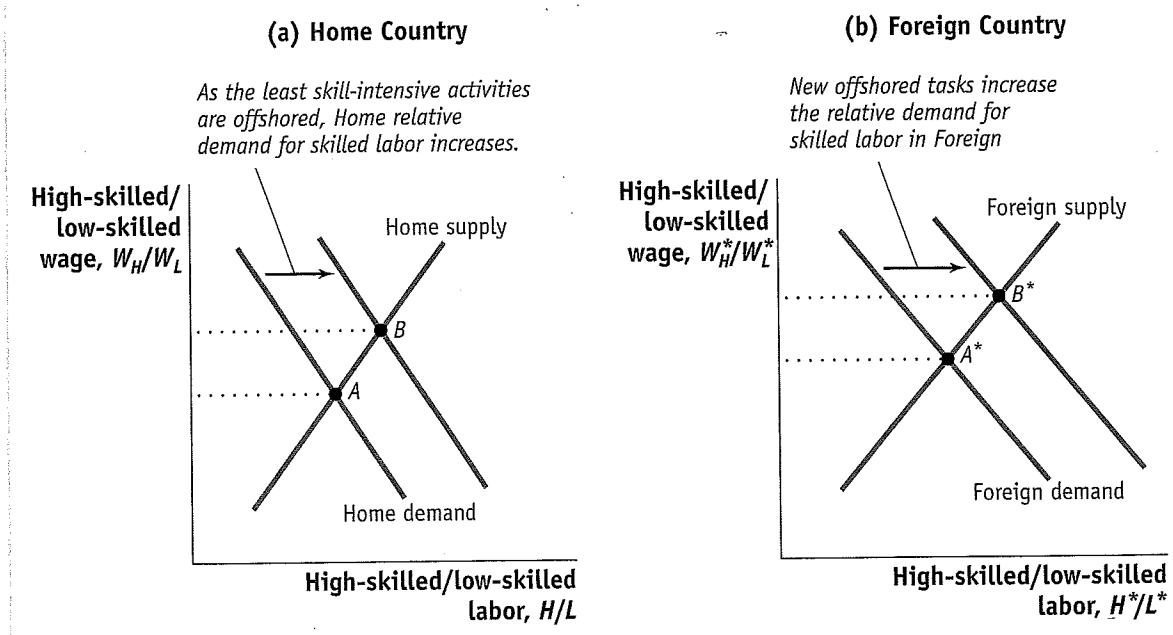
Offshoring on the Value Chain As the costs of capital or trade fall in the Foreign country, a Home firm will find it profitable to offshore more activities. Offshoring shifts the dividing line between Home and Foreign production from A to B. The activities between A and B, which formerly were done at Home, are now done in Foreign. Notice that these activities are more skill-intensive than the activities formerly done in Foreign (to the left of A) but less skill-intensive than the activities now done at Home (to the right of B).

[5] Martin Kenney and Richard Florida, 1994, "Japanese Maquiladoras: Production Organization and Global Commodity Chains," *World Development*, 22(1), 27–44.

How does this increase in offshoring affect the relative demand for skilled labor in each country? First consider the Home country. Notice that the activities no longer performed at Home (i.e., those between A and B) are *less* skill-intensive than the activities still done there (those to the right of B). This means that the activities now done at Home are more skilled and labor-intensive, on average, than the activities formerly done at Home. For this reason, the relative demand for skilled labor at Home will increase, and the Home demand curve will shift to the right, as shown in Figure 7-4, panel (a). Note that this diagram does not show the *absolute* quantity of labor demanded, which we expect would fall for both high-skilled and low-skilled labor when there is more offshoring; instead, we are graphing the *relative* demand for high-skilled/low-skilled labor, which increases because the activities still done at Home are more skill-intensive than before the decrease in trade and capital costs. With the increase in the relative demand for skilled labor, the equilibrium will shift from point A to point B at Home; that is, the relative wage of skilled labor will increase because of offshoring.

Change in Foreign Labor Demand and Relative Wage Now let's look at what happens in Foreign when Home offshores more of its production activities to Foreign. How will offshoring affect the relative demand for labor and relative wage in Foreign? As we saw in Figure 7-3, the activities that are newly offshored to Foreign (those between A and B) are *more* skill-intensive than the activities that were initially

FIGURE 7-4



Change in the Relative Demand for High-Skilled/Low-Skilled Labor With greater offshoring from Home to Foreign, some of the activities requiring less skill that were formerly done at Home are now done abroad. It follows that the relative demand for skilled labor at Home increases, and the relative wage rises from point A to point B. The relative demand for skilled labor in Foreign also increases because the activities shifted to Foreign are more skill-intensive than those formerly done there. It follows that the relative wage for skilled labor in Foreign also rises, from point A^* to point B^*.

offshored to Foreign (those to the left of A). This means that the range of activities now done in Foreign is more skilled and labor-intensive, on average, than the set of activities formerly done there. For this reason, the relative demand for skilled labor in Foreign also increases, and the Foreign demand curve shifts to the right, as shown in panel (b) of Figure 7-4. With this increase in the relative demand for skilled labor, the equilibrium shifts from point A^* to point B^*. As a result of Home's increased offshoring to Foreign, then, the relative wage of skilled labor increases in Foreign. The conclusion from our model is that both countries experience an increase in the relative wage of skilled labor because of increased offshoring.

It might seem surprising that a shift of activities from one country to the other can increase the relative demand for skilled labor in *both* countries. An example drawn from your classroom experience might help you to understand how this can happen. Suppose you have a friend who is majoring in physics but is finding it difficult: she is scoring below average in a physics class that she is taking. So you invite her to join you in an economics class, and it turns out that your friend has a knack for economics: she scores above average in that class. How does your friend's transfer from physics to economics affect the class averages? Because she was performing below average in the physics class, when she leaves the class, her departure raises the class average (computed now using the students still there, not including her). Because your friend performs better than average in the economics class, her arrival raises the class average there, too (computed using everyone, including your friend). Thus, your friend's move from one class to another raises the average in both classes.

This result is just like the logic of the offshoring model: as activities in the middle of the value chain are shifted from Home to Foreign, they raise the relative demand for skilled labor in both countries because these activities are the *least* skill-intensive of those formerly done at Home but the *most* skill-intensive of tasks done in Foreign. That is why the relative demand for skilled labor increases in both countries, along with the relative wage of skilled labor. This result is one of the most important predictions from our offshoring model and it would not occur in our earlier models of trade, such as the Heckscher-Ohlin model.[6] We now turn to evidence from the United States and Mexico to see whether this prediction is borne out.

APPLICATION

Change in Relative Wages Across Countries

Since the early 1980s, the wages of high-skilled workers have risen relative to those of low-skilled workers in many countries. The relative wage of skilled workers in industrial countries (such as the United States, Australia, Canada, Japan, Sweden, and the United Kingdom) and in developing countries (such as Hong Kong, Chile, and Mexico) has increased. Our offshoring model predicts that the relative wage of skilled workers will rise in *both* the country doing the offshoring and the country receiving the new activities. At first glance, that prediction seems to be consistent with the change in wages that has actually occurred. Let us dig more deeply, however, using evidence from the United States and Mexico, to see what the change in wages has been and whether it is due to offshoring.

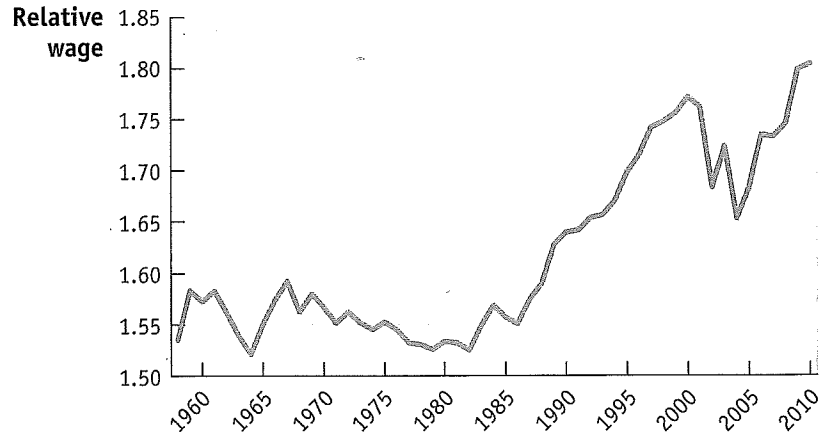
[6] The Heckscher-Ohlin model tells us that the factor prices in the two countries will move toward equality when they open trade. So the wage relative to the capital rental will move in different directions in the two countries due to the opening of trade, not in the same direction.

Change in Relative Wages in the United States

To measure the wages of skilled and low-skilled workers, we can use data from the manufacturing sector on "production" and "nonproduction" workers. As their name suggests, production workers are involved in the manufacture and assembly of goods, whereas nonproduction workers are involved in supporting service activities. Firms are required to report wages for both types of workers. We could also call these two types of workers "blue collar" and "white collar." Generally, nonproduction workers require more education, and so we will treat these workers as "high-skilled," whereas the production workers are treated here as "low-skilled" workers.[7]

Relative Wage of Nonproduction Workers Figure 7-5 shows the average annual earnings of nonproduction workers relative to production workers (analogous to the ratio of high-skilled to low-skilled wages, or W_H/W_L) in U.S. manufacturing from 1958 to 2010. We see that relative earnings moved erratically from 1958 to 1967, and that from 1968 to about 1982, relative wages were on a downward trend. It is generally accepted that the relative wage fell during this period because of an increase in the supply of college graduates, skilled workers who moved into nonproduction jobs (the increase in supply would bring down the nonproduction wage, so the relative wage would also fall).

FIGURE 7-5



Relative Wage of Nonproduction/Production Workers, U.S. Manufacturing This diagram shows the average wage of nonproduction workers divided by the average wage of production workers in U.S. manufacturing. This ratio of wages moved erratically during the 1960s and 1970s, although showing some downward trend. This trend reversed itself during the 1980s and 1990s, when the relative wage of nonproduction workers increased until 2000. This trend means that the relative wage of production, or low-skilled, workers fell during the 1980s and 1990s. In more recent years, the relative wage has become quite volatile, falling erratically until 2004, then rising to 2010.

Source: Annual Survey of Manufactures and National Bureau of Economic Research (NBER) productivity database, updated from U.S. Bureau of the Census.

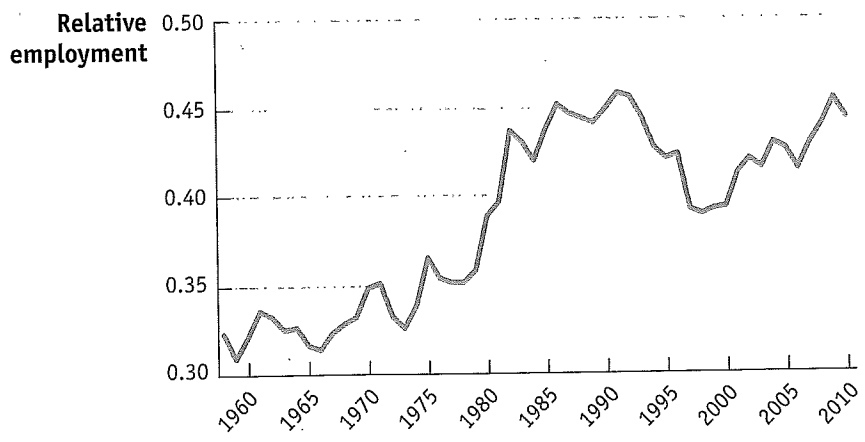
[7] This distinction is far from perfect, however. Nonproduction workers include clerical and custodial staff, for example, who may be less skilled than some production workers.

Starting in 1982, however, this trend reversed itself and the relative wage of nonproduction workers increased steadily to 2000. Since that time the relative wage fell erratically until 2004, and then rose again to 2010.

Relative Employment of Nonproduction Workers In Figure 7-6, we see that there was a steady increase in the ratio of nonproduction to production workers employed in U.S. manufacturing until about 1992. Such a trend indicates that firms were hiring fewer production, or low-skilled workers, relative to nonproduction workers. During the 1990s the ratio of nonproduction to production workers fell until 1998, after which relative employment rose again.

The increase in the relative supply of college graduates from 1968 to 1982 is consistent with the reduction in the relative wage of nonproduction workers, as shown in Figure 7-5, and with the increase in their relative employment, as shown in Figure 7-6. After 1982, however, the story changes. We would normally think that the rising relative wage of nonproduction workers should have led to a shift in employment *away* from nonproduction workers, but it did not; as shown in Figure 7-6, the relative employment of nonproduction workers continued to rise from 1980 to about 1992, then fell until 1998. How can there be both an increase in the relative wage and an increase in the relative employment of nonproduction workers? The only explanation consistent with these facts is that during the 1980s there was an *outward shift* in the relative demand for nonproduction (skilled)

FIGURE 7-6



Relative Employment of Nonproduction/Production Workers, U.S. Manufacturing This diagram shows the employment of nonproduction workers in U.S. manufacturing divided by the employment of production workers. There was a steady increase in the ratio of nonproduction to production workers employed in U.S. manufacturing until the early 1990s. That trend indicates firms were hiring fewer production workers relative to nonproduction workers. During the 1990s there was a fall in the ratio of nonproduction to production workers until 1998, and then a rise again thereafter.

Source: Annual Survey of Manufactures and NBER productivity database, updated from U.S. Bureau of the Census.

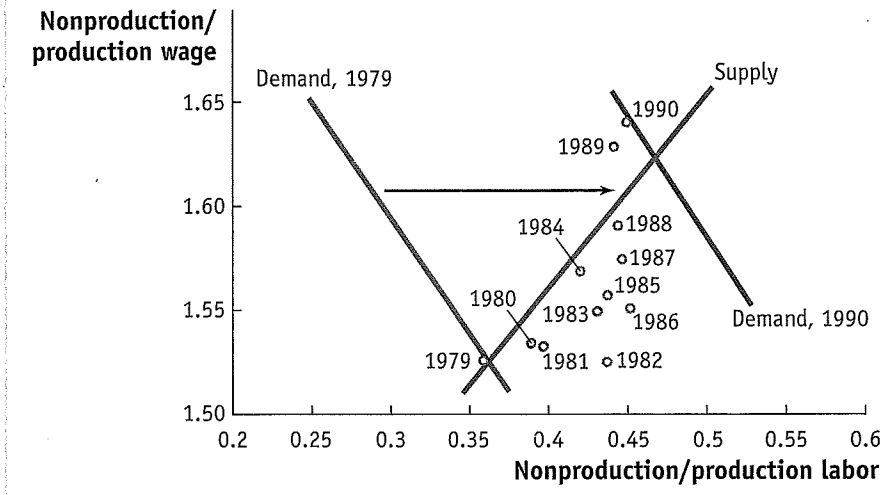
workers, which led to a simultaneous increase in their relative employment *and* in their wages.

This conclusion is illustrated in Figure 7-7, in which we plot the relative wage of nonproduction workers and their relative employment from 1979 to 1990. As we have already noted, both the relative wage and relative employment of nonproduction workers rose during the 1980s. The only way this pattern can be consistent with a supply and demand diagram is if the relative demand curve for skilled labor increases, as illustrated. This increased demand would lead to an increase in the relative wage for skilled labor and an increase in its relative employment, the pattern seen in the data for the United States.

Explanations What factors can lead to an increase in the relative demand for skilled labor? One explanation is offshoring. An increase in demand for high-skilled workers, at the expense of low-skilled workers, can arise from offshoring, as shown by the rightward shift in the relative demand for skilled labor in Figure 7-4, panel (a). The evidence from the manufacturing sector in the United States is strongly consistent with our model of offshoring.

There is, however, a second possible explanation for the increase in the relative demand for skilled workers in the United States. In the 1980s personal computers began to appear in the workplace. The addition of computers in the workplace can increase the demand for skilled workers to operate them. The shift in relative demand

FIGURE 7-7



Supply and Demand for Nonproduction/ Production Workers in the 1980s This diagram shows the average wage of nonproduction workers divided by the average wage of production workers on the vertical axis, and on the horizontal axis the employment of nonproduction workers divided by the employment of production workers. Both the relative wage and the relative employment of nonproduction, or skilled, workers rose in U.S. manufacturing during the 1980s, indicating that the relative demand curve must have shifted to the right.

Source: NBER productivity database.

toward skilled workers because of the use of computers and other high-tech equipment is called **skill-biased technological change.** Given these two potential explanations for the same observation, how can we determine which of these factors was most responsible for the actual change in wages?

Answering this question has been the topic of many research studies in economics. The approach that most authors take is to measure skill-biased technological change and offshoring in terms of some underlying variables. For skill-biased technological change, for example, we might use the amount of computers and other high-technology equipment used in manufacturing industries. For offshoring, we could use the imports of intermediate inputs into manufacturing industries. By studying how the use of high-tech equipment and the imports of intermediate inputs have grown and comparing this with the wage movements in industries, we can determine the contribution of each factor toward explaining the wage movements.

The results from one study of this type are shown in Table 7-1. The goal of this study was to explain two observations. First, it sought to explain the increase in the share of **total wage payments** going to nonproduction (high-skilled) labor in U.S. manufacturing industries from 1979 to 1990 (part A). Because wage payments equal the wage times the number of workers hired, this statistic captures both the rising relative wage and the rising relative employment of skilled workers. Second, the study analyzed the increase in the *relative wage* of nonproduction labor in particular over the same period (part B).[8]

The study considered two possible explanations for the two observations: offshoring and the use of high-tech equipment such as computers. Offshoring was measured as the intermediate inputs imported by each industry. For example, the U.S. auto industry builds seats, dashboards, and other car parts in Mexico and then imports these for assembly in the United States. In addition, high-technology equipment can be measured in two ways: either as a fraction of the total capital equipment installed in each industry or as a fraction of new investment in capital that is devoted to computers and other high-tech devices. In the first method, high-tech equipment is measured as a fraction of the capital *stock*, and in the second method, high-tech equipment is measured as a fraction of the annual *flow* of new investment. In the early 1980s a large portion of the flow of new investment in some industries was devoted to computers and other high-tech devices, but a much smaller fraction of the capital stock consisted of that equipment. In Table 7-1, we report results from both measures because the results differ depending on which measure is used.

Using the first measure of high-tech equipment (as a fraction of the capital stock), the results in the first row of part A show that between 20% and 23% of the increase in the share of wage payments going to the nonproduction workers can be explained by offshoring, and between 8% and 12% of that increase can be explained by the growing use of high-tech capital. The remainder is unexplained by these two factors. Thus, using the first measure of high-tech equipment, it appears that offshoring was more important than high-tech capital in explaining the change in relative demand for skilled workers.

[8] To illustrate the distinction between parts A and B, consider the following example. If nonproduction workers earn $25 per hour and 5 are hired, and production workers earn $10 per hour and 20 are hired, then the total wage payments are $25 • 5 + $10 • 20 = $325, and the relative wage of nonproduction labor is $25/$10 = 2.5. In contrast, the share of total wage payments going to nonproduction workers is then $125/$325 = 38%, which equals the actual, average share of wages going to nonproduction workers in U.S. manufacturing from 1979 to 1990.

TABLE 7-1

Increase in the Relative Wage of Nonproduction Labor in U.S. Manufacturing, 1979–1990 This table shows the estimated effects of offshoring and the use of high-technology equipment on the wages earned by nonproduction (or skilled) workers. Part A focuses on how these two variables affect the share of wage payments going to nonproduction workers. Part B shows how these two variables affect the relative wage of nonproduction workers.

	PERCENT OF TOTAL INCREASE EXPLAINED BY EACH FACTOR	
	Offshoring	**High-Technology Equipment**
Part A: Share of Wage Payments Going to Nonproduction Workers		
Measurement of high-tech equipment:		
As a share of the capital stock	20–23	8–12
As a share of capital flow (i.e., new investment)	13	37
Part B: Relative Wage of Nonproduction/Production Workers		
Measurement of high-tech equipment:		
As a share of the capital stock	21–27	29–32
As a share of capital flow (i.e., new investment)	12	99

Source: Robert C. Feenstra and Gordon H. Hanson, August 1999, "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979–1990," Quarterly Journal of Economics, *114(3), 907–940.*

The story is different, however, if we instead use offshoring and the second measure of high-tech equipment (a fraction of new investment), as shown in the second row of part A. In that case, offshoring explains only 13% of the increase in the nonproduction share of wages, whereas high-tech investment explains 37% of that increase. So we see from these results that both offshoring and high-tech equipment are important explanations for the increase in the relative wage of skilled labor in the United States, but which one is *most* important depends on how we measure the high-tech equipment.

In part B, we repeat the results but now try to explain the increase in the relative wage of nonproduction workers. Using the first measure of high-tech equipment (a fraction of the capital stock), the results in the first row of part B show that between 21% and 27% of the increase in the relative wage of nonproduction workers can be explained by offshoring, and between 29% and 32% of that increase can be explained by the growing use of high-tech capital. In the second row of part B, we use the other measure of high-tech equipment (a fraction of new investment). In that case, the large spending on high-tech equipment in new investment can explain *nearly all* (99%) of the increased relative wage for nonproduction workers, leaving little room for offshoring to play much of a role (it explains only 12% of the increase in the relative wage). These results are lopsided enough that we might be skeptical of using new investment to measure high-tech equipment and therefore prefer the results in the first rows of parts A and B, using the capital stocks.

Summing up, we conclude that both offshoring and high-tech equipment explain the increase in the relative wage of nonproduction/production labor in U.S. manufacturing, but it is difficult to judge which is more important because the results depend on how we measure the high-tech equipment.

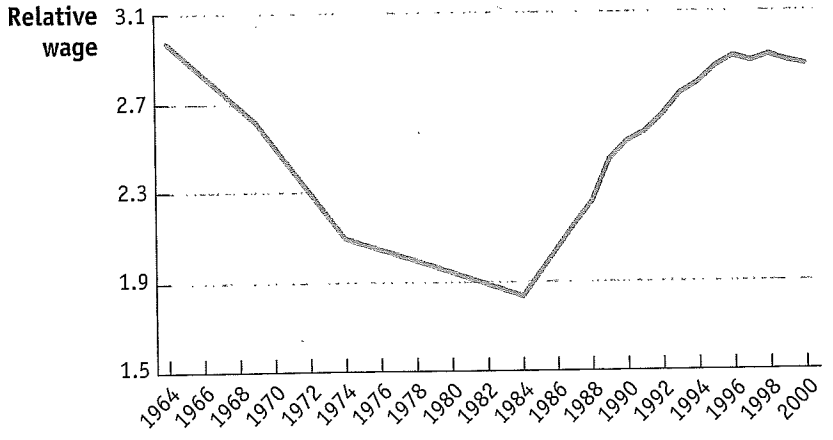
Change in Relative Wages in Mexico

Our model of offshoring predicts that the relative wage of skilled labor will rise in *both* countries. We have already seen (in Figure 7-5) that the relative wage of nonproduction (skilled) labor rises in the United States. But what about for Mexico?

In Figure 7-8, we show the relative wage of nonproduction/production labor in Mexico from 1964 to 2000. The data used in Figure 7-8 come from the census of industries in Mexico, which occurred infrequently, so there are only a few turning points in the graph in the early years. We can see that the relative wage of nonproduction workers fell from 1964 to 1984, then rose until 1996, leveling out thereafter. The fall in the relative wage from 1964 to 1984 is similar to the pattern in the United States and probably occurred because of an increased supply of skilled labor in the workforce. More important, the rise in the relative wage of nonproduction workers from 1984 to 1996 is also similar to what happened in the United States and illustrates the prediction of our model of offshoring: that relative wages move in the *same* direction in both countries.

The leveling off of the relative wage of nonproduction workers in Mexico occurred in 1996, two years after the North American Free Trade Agreement (NAFTA) established free trade between the United States, Canada, and Mexico. The tariff reductions on imports from Mexico to the United States began in 1994 and were phased in over the next ten years. Tariffs on imports from the United States and other countries

FIGURE 7-8



Relative Wage of Nonproduction/Production Workers, Mexico Manufacturing This diagram shows the wage of nonproduction workers in the manufacturing sector of Mexico divided by the wage of production workers. After declining during the 1960s and 1970s, this relative wage began to move upward in the mid-1980s, at the same time that the relative wage of nonproduction workers was increasing in the United States (see Figure 7-5). The relative wage in Mexico continued to rise until 1996, two years after NAFTA began, and then leveled out.

Sources: Robert C. Feenstra and Gordon H. Hanson, May 1997, "Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras," Journal of International Economics, 4, 371–393; and Gerardo Esquivel and José Antonio Rodríguez-López, 2003, "Technology, Trade, and Wage Inequality in Mexico Before and After NAFTA," Journal of Development Economics, 72, 543–565.

into Mexico had been reduced much earlier, however—right around the 1984 turning point that we see in Figure 7-8. According to one study:[9]

> In 1985, in the midst of the debt crisis and as a result of the collapse of the oil price, Mexico initiated an important process of trade liberalization. In that year, Mexico implemented a considerable unilateral reduction in trade barriers and announced its intention to participate in the General Agreement on Tariffs and Trade (GATT).

The average tariff charged by Mexico fell from 23.5% in 1985 to 11.0% in 1988, and the range of goods subject to tariffs was reduced. After 1985, Mexico also became much more open to the establishment of manufacturing plants by foreign (especially American) firms.

Summing up, the changes in relative prices in the United States and Mexico match each other during the period from 1964 to 1984 (with relative wages falling) and during the period from 1984 to 1996 (with relative wages rising in both countries). Offshoring from the United States to Mexico rose from 1984 to 1996, so the rise in relative wages matches our prediction from the model of offshoring. ■

2 The Gains from Offshoring

We have shown that offshoring can shift the relative demand for labor and therefore raise the relative wage for skilled workers. Because the relative wage for low-skilled workers is the reciprocal of the high-skilled relative wage, it falls in both countries. High-skilled labor gains and low-skilled labor loses in relative terms. On the other hand, the ability of firms to relocate some production activities abroad means that their costs are reduced. In a competitive market, lower costs mean lower prices, so offshoring benefits consumers. Our goal in this section is to try to balance the potential losses faced by some groups (low-skilled labor) with the gains enjoyed by others (high-skilled labor and consumers). Our argument in previous chapters on the Ricardian and Heckscher-Ohlin models has been that international trade generates more gains than losses. Now we have to ask whether the same is true for offshoring.

One answer to this question comes from a surprising source. The Nobel laureate Paul Samuelson has been among the foremost proponents of global free trade, but in 2004 he had the following to say about the gains from foreign outsourcing:[10]

> Most noneconomists are fearful when an emerging China or India, helped by their still low real wages, outsourcing and miracle export-led developments, cause layoffs from good American jobs. This is a hot issue now, and in the coming decade, it will not go away. Prominent and competent mainstream economists enter in the debate to educate and correct warm-hearted protestors who are against globalization. Here is a fair paraphrase of the argumentation that has been used. . . .
>
> Yes, good jobs may be lost here in the short run. But still total U.S. net national product *must, by the economic laws of comparative advantage, be raised in the long run (and in China, too)*. The gains of the winners from free trade, properly measured,

[9] Gerardo Esquivel and José Antonio Rodríguez-López, 2003, "Technology, Trade, and Wage Inequality in Mexico Before and After NAFTA," *Journal of Development Economics*, 72, pp. 546–547.
[10] Paul Samuelson, Summer 2004, "Where Ricardo and Mill Rebut and Confirm Arguments of Mainstream Economists Supporting Globalization," *Journal of Economic Perspectives*, 18(3), 135–146.

> work out to exceed the losses of the losers. . . . Correct economic law recognizes that some American groups can be hurt by dynamic free trade. But correct economic law vindicates the word "creative" destruction by its proof that the gains of the American winners are big enough to more than compensate the losers.

Does this paraphrase by Samuelson sound familiar? You can find passages much like it in this chapter and earlier ones, saying that the gains from trade exceed the losses. But listen to what Samuelson says next:

> The last paragraph can be only an innuendo. For it is dead wrong about [the] *necessary* surplus of winnings over losings.

So Samuelson seems to be saying that the winnings for those who gain from trade *do not necessarily* exceed the losses for those who lose. How can this be? His last statement seems to contradict much of what we have learned in this book. Or does it?

Simplified Offshoring Model

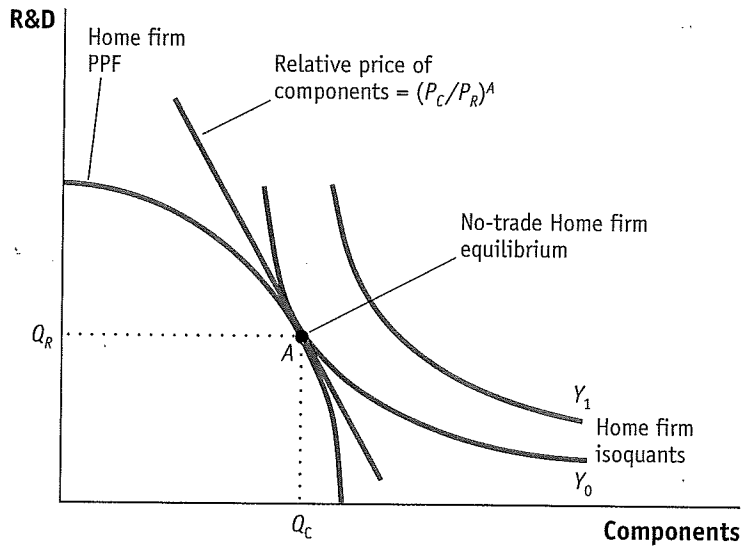
To understand Samuelson's comments, we can use a simplified version of the offshoring model we have developed in this chapter. Instead of having many activities involved in the production of a good, suppose that there are only *two* activities: components production and research and development (R&D). Each of these activities uses high-skilled and low-skilled labor, but we assume that components production uses low-skilled labor intensively and that R&D uses skilled labor intensively. As in our earlier model, we assume that the costs of capital are equal in the two activities and do not discuss this factor. Our goal will be to compare a no-trade situation with an equilibrium with trade through offshoring, to determine whether there are overall gains from trade.

Suppose that the firm has a certain amount of high-skilled (H) and low-skilled (L) labor to devote to components and R&D. It is free to move these workers between the two activities. For example, scientists could be used in the research lab or could instead be used to determine the best method to produce components; similarly, workers who are assembling components can instead assist with the construction of full-scale models in the research lab. Given the amount of high-skilled and low-skilled labor used in total, we can graph a production possibilities frontier (PPF) for the firm between components and R&D activities, as shown in Figure 7-9. This PPF looks just like the production possibilities frontier for a country, except that now we apply it to a single firm. Points on the PPF, such as A, correspond to differing amounts of high-skilled and low-skilled labor used in the components and R&D activities. Moving left from point A to another point on the PPF, for example, would involve shifting some high-skilled and low-skilled labor from the production of components into the research lab.

Production in the Absence of Offshoring

Now that we have the PPF for the firm, we can analyze an equilibrium for the firm, just as we have previously done for an entire economy. Suppose initially that the firm cannot engage in offshoring of its activities. This assumption means that the component production and R&D done at Home are used to manufacture a final product at

FIGURE 7-9



No-Trade Equilibrium for the Home Firm The PPF shows the combinations of components and R&D that can be undertaken by a firm with a given amount of labor and capital. In the absence of offshoring, the firm produces at *A*, using quantities Q_C of components and Q_R of R&D to produce amount Y_0 of the final good. The line tangent to the isoquant through point *A* measures the value that the firm puts on components relative to R&D, or their relative price, $(P_C/P_R)^A$. Amount Y_1 of the final good cannot be produced in the absence of offshoring because it lies outside the PPF for the firm.

Home: it cannot assemble any components in Foreign, and likewise, it cannot send any of its R&D results abroad to be used in a Foreign plant.

The two production activities are used to produce a final good. To determine how much of the final good is produced, we can use **isoquants.** An isoquant is similar to a consumer's indifference curve, except that instead of utility, it illustrates the production of the firm; it is a curve along which the output of the firm is constant despite changing combinations of inputs. Two of these isoquants are labeled as Y_0 and Y_1 in Figure 7-9. The quantity of the final good Y_0 can be produced using the quantity Q_C of components and the quantity Q_R of R&D, shown at point *A* in the figure. Notice that the isoquant Y_0 is tangent to the PPF at point *A*, which indicates that this isoquant is the highest amount of the final good that can be produced using any combination of components and R&D on the PPF. The quantity of the final good Y_1 cannot be produced in the absence of offshoring because it lies outside the PPF. Thus, point *A* is the amount of components and R&D that the firm chooses in the absence of offshoring or what we will call the "no-trade" or "autarky" equilibrium for short.

Through the no-trade equilibrium *A* in Figure 7-9, we draw a line with the slope of the isoquant at point *A*. The slope of the isoquant measures the value, or price, that the firm puts on components relative to R&D. We can think of these prices as internal to the firm, reflecting the marginal costs of production of the two activities. An automobile company, for example, would be able to compute the extra labor and other inputs needed to produce some components of a car and that would be its internal price of components P_C. Similarly, it could compute the marginal cost of developing one more prototype of a new vehicle, which is the internal price of R&D or P_R. The slope of the price line through point *A* is the price of components relative to the price of R&D, $(P_C/P_R)^A$, in the absence of offshoring.[11]

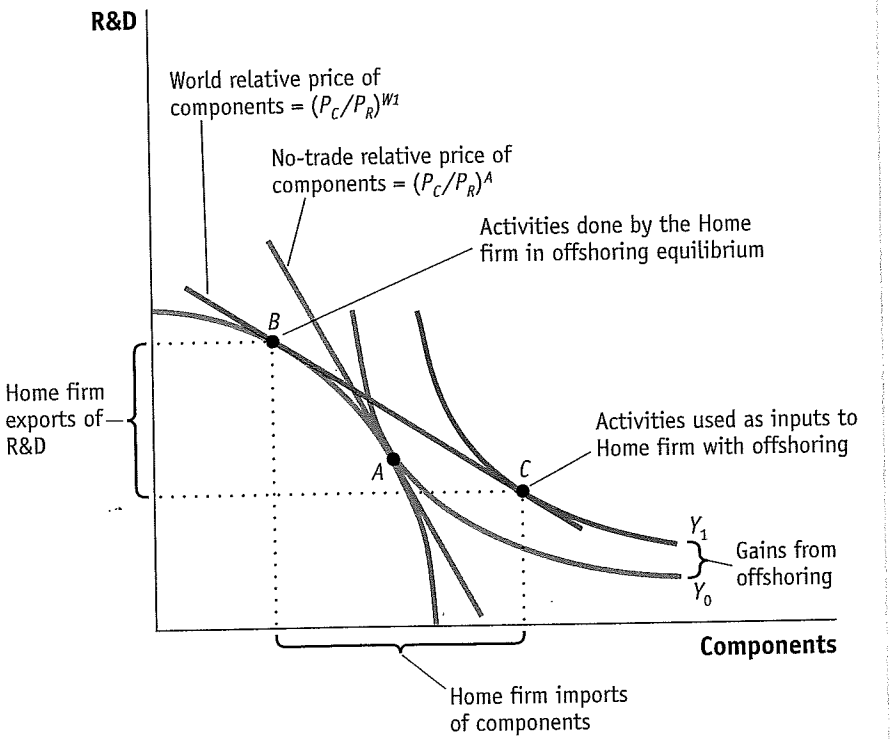
[11] Recall that the slope of a price line is the relative price of the good on the horizontal axis, which is Components in Figure 7-9.

Equilibrium with Offshoring Now suppose that the firm can import and export its production activities through offshoring. For example, some of the components could be done in a Foreign plant and then imported by the Home firm. Alternatively, some R&D done at Home can be exported to a Foreign plant and used there. In either case, the quantity of the final good is no longer constrained by the Home PPF. Just as in the Ricardian and Heckscher-Ohlin models, in which a higher level of utility (indifference curve) can be obtained if countries specialize and trade with each other, here a higher level of production (isoquant) is possible by trading intermediate activities.

We refer to the relative price of the two activities that the Home firm has available through offshoring as the world relative price or $(P_C/P_R)^{W1}$. Let us assume that the world relative price of components is cheaper than Home's no-trade relative price, $(P_C/P_R)^{W1} < (P_C/P_R)^A$. That assumption means the Home firm can import components at a lower relative price than it can produce them itself. The assumption that $(P_C/P_R)^{W1} < (P_C/P_R)^A$ is similar to the assumption we made in the previous section, that the relative wage of low-skilled labor is lower in Foreign, $W_L^*/W_H^* < W_L/W_H$. With a lower relative wage of low-skilled labor in Foreign, the components assembly will also be cheaper in Foreign. It follows that Home will want to offshore components, which are cheaper abroad, while the Home firm will be exporting R&D (i.e., offshoring it to Foreign firms), which is cheaper at Home.

The Home equilibrium with offshoring is illustrated in Figure 7-10. The world relative price of components is tangent to the PPF at point *B*. Notice that the world

FIGURE 7-10



Offshoring Equilibrium for the Home Firm In the presence of offshoring, the Home firm will do more R&D and less component production, at point *B*. The Home firm then exports R&D activities and imports components at the world relative price of components, which allows it to produce the amount Y_1 of the final good. The difference between Y_0 and Y_1 represents the gains to the Home firm from offshoring.

relative price line is *flatter* than the no-trade relative price line at Home. The flattening of the price line reflects the lower world relative price of components as compared with the no-trade relative price at Home. As a result of this fall in the relative price of components, the Home firm undertakes more R&D and less component production, moving from point A to point B on its PPF.

Starting at point B on its PPF, the Home firm now exports R&D and imports components, moving along the relative price line to point C. Therefore, through offshoring the firm is able to move off of its PPF to point C. At that point, the isoquant labeled Y_1 is tangent to the world price line, indicating that the maximum amount of the final good Y_1 is being produced. Notice that this production of the final good exceeds the amount Y_0 that the Home produced in the absence of offshoring.

Gains from Offshoring Within the Firm The increase in the amount of the final good produced—from Y_0 to Y_1—is a measure of the gains from trade to the Home firm through offshoring. Using the same total amount of high-skilled and low-skilled labor at Home as before, the company is able to produce more of the final good through its ability to offshore components and R&D. Because more of the final good is produced with the same overall amount of high-skilled and low-skilled labor available in Home, the Home company is more productive. Its costs of production fall, and we expect that the price of its final product also falls. The gains for this company are therefore spread to consumers, too.

For these reasons, we agree with the quote about offshoring at the beginning of the chapter: "When a good or service is produced more cheaply abroad, it makes more sense to import it than to make or provide it domestically." In our example, component production is cheaper in Foreign than in Home, so Home imports components from Foreign. There are overall gains from offshoring. That is our first conclusion: *when comparing a no-trade situation to the equilibrium with offshoring, and assuming that the world relative price differs from that at Home, there are always gains from offshoring.*

To see how this conclusion is related to the earlier quotation from Samuelson, we need to introduce one more feature into our discussion. Rather than just comparing the no-trade situation with the offshoring equilibrium, we need to also consider the impact of offshoring on a country's *terms of trade.*

Terms of Trade

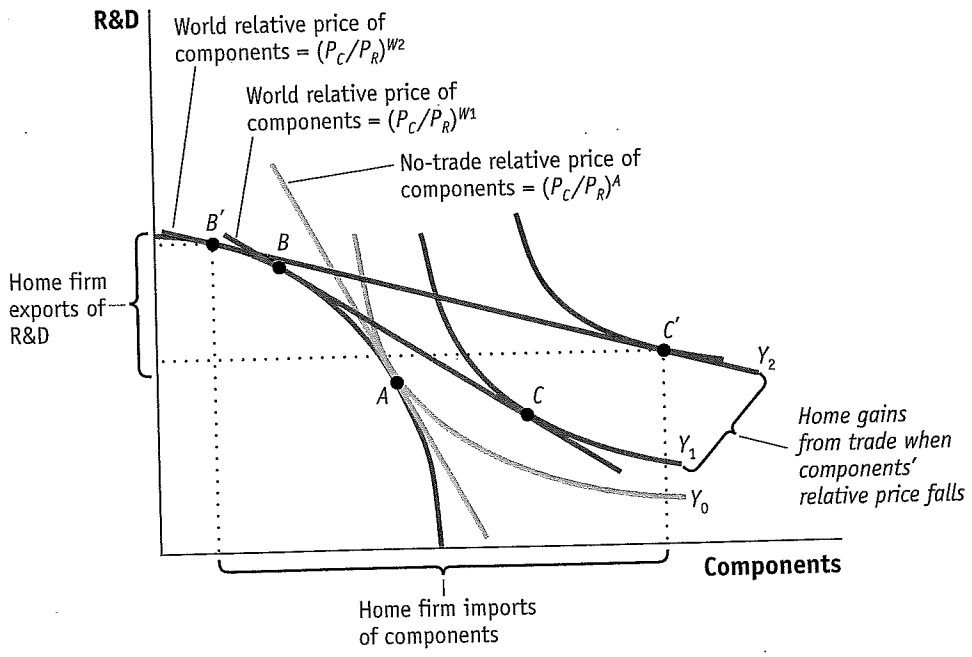
As explained in Chapters 2 and 3, the terms of trade equal the price of a country's exports divided by the price of its imports. In the example we are discussing, the Home terms of trade are $(P_R/P_C)^{W1}$, because Home is exporting R&D and importing components. A rise in the terms of trade indicates that a country is obtaining a higher price for its exports, or paying a lower price for its imports, both of which benefit the country. Conversely, a fall in the terms of trade harms a country because it is paying more for its imports or selling its exports for less.

In his paper, Samuelson contrasts two cases. In the first, the Foreign country improves its productivity in the good that it exports (components), thereby lowering the price of components; in the second, the Foreign country improves its productivity in the good that Home exports (R&D services), thereby lowering *that* price. These two cases lead to very different implications for the terms of trade and Home gains, so we consider each in turn.

Fall in the Price of Components Turning to Figure 7-11, let the Home country start at the equilibrium with offshoring shown by points B and C. From that situation, suppose there is a *fall* in the relative price of component production. That price might fall, for instance, if the Foreign country improves its productivity in components, thereby lowering the price paid by Home for this service. Because components are being imported by Home, a fall in their price is a *rise* in the Home terms of trade, to $(P_R/P_C)^{W2}$. Let us trace how this change in the terms of trade will affect the Home equilibrium.

Because of the fall in the relative price of components, the world price line shown in Figure 7-11 becomes *flatter*. Production will shift to point B', and by exporting R&D and importing components along the world price line, the firm ends up at point C'. Production of the final good at point C' is Y_2, which exceeds the production Y_1 in the initial equilibrium with offshoring.[12] Thus, the Home firm enjoys *greater* gains from offshoring when the price of components falls. This is the first case considered by Samuelson, and it reinforces our conclusions that offshoring leads to overall gains.

FIGURE 7-11



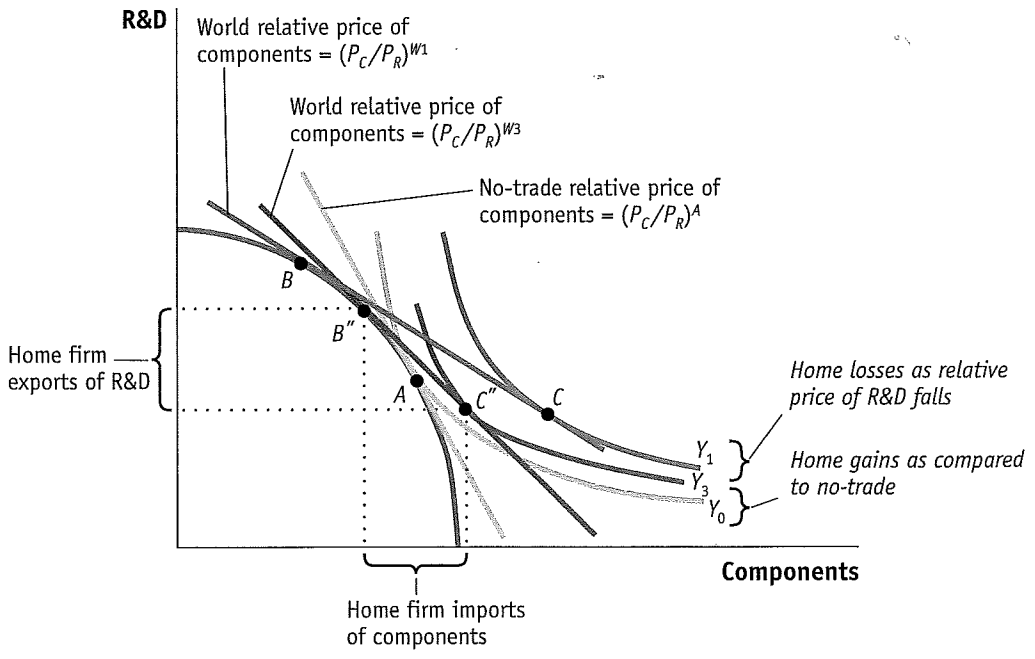
Fall in the Price of Component If the relative price of components falls from $(P_C/P_R)^{W1}$ to $(P_C/P_R)^{W2}$, then the Home firm will do even more R&D and less components production, at point B' rather than B. The increase in the terms of trade allows the Home firm to produce output Y_2 at point C', and the gains from trade are higher than in the initial offshoring equilibrium (points B and C).

[12] Notice that the fall in the relative price of components leads to an increase in the amount of components imported but that the amount of R&D exported from Home does not necessarily increase. You are asked to explore this case further in Problem 9 at the end of the chapter.

Fall in the Price of R&D We also need to consider the second case identified by Samuelson, and that is when there is a fall in the price of R&D services rather than components. This is what Samuelson has in mind when he argues that offshoring might allow developing countries, such as India, to gain a comparative advantage in those activities in which the United States formerly had comparative advantage. As Indian companies like Wipro (an information technology services company headquartered in Bangalore) engage in more R&D activities, they are directly competing with American companies exporting the same services. So this competition can lower the world price of R&D services.

In Figure 7-12, we reproduce Figure 7-10, including the Home no-trade equilibrium at point A and the Home production point B with offshoring. Starting at point B, a fall in the world relative price of R&D will lead to a *steeper* price line (because the slope of the price line is the world relative price of components, which increases when P_R *falls*). At the new price $(P_C/P_R)^{W3}$, Home shifts production to point B'' and, by exporting R&D and importing components, moves to point C''. Notice that final output has *fallen* from Y_1 to Y_3. Therefore, the fall in the price of R&D services leads to losses for the Home firm. To explain where the losses are coming from, notice that

FIGURE 7-12



A Fall in the Price of R&D A fall in the relative price of R&D makes the world price line steeper, $(P_C/P_R)^{W3}$. As a result, the Home firm reduces its R&D activities and increases its components activities, moving from B to B'' along the PPF. At the new world relative price, the Home firm faces a terms-of-trade loss and can no longer export each unit of R&D for as many components as it could in the initial offshoring equilibrium. The final good output is reduced from Y_1 to Y_3 at point C''. Notice that the final good output, Y_3, is still higher than output without trade, Y_0. After the fall in the relative price of R&D, there are still gains from trade relative to no-trade (point A) but losses relative to the initial offshoring equilibrium (points B and C).

Home is exporting R&D and importing components in the initial offshoring equilibrium (points B and C), so its terms of trade are the price of R&D divided by the price of components (P_R/P_C). With the fall in the price of R&D, the Home terms of trade have *worsened*, and Home is worse off compared with its initial offshoring equilibrium. Samuelson's point is that the United States *could* be worse off if China or India becomes more competitive in, and lowers the prices of, the products that the United States itself is exporting, such as R&D services. This is theoretically correct. Although it may be surprising to think of the United States being in this position, the idea that a country will suffer when its terms of trade fall is familiar to us from developing-country examples (such as the Prebisch-Singer hypothesis) in earlier chapters.

Furthermore, notice that final output of Y_3 is still higher than Y_0, the no-offshoring output. *Therefore, there are still Home gains from offshoring at C″ as compared with the no-trade equilibrium at A.* It follows that Home can never be worse off with trade as compared with no trade. Samuelson's point is that a country is worse off when its terms of trade fall, even though it is still better off than in the absence of trade. With the fall in the terms of trade, some factors of production will lose and others will gain, but in this case the gains of the winners are not enough to compensate the losses of the losers. Our simple model of offshoring illustrates Samuelson's point.

The offshoring that occurred from the United States in the 1980s and the 1990s often concerned manufacturing activities. But today, the focus is frequently one of the newer forms of offshoring, the offshoring of **business services** to foreign countries. Business services are activities such as accounting, auditing, human resources, order processing, telemarketing, and after-sales service, like getting help with your computer. Firms in the United States are increasingly transferring these activities to India, where the wages of educated workers are much lower than in the United States. This is the sort of competition that Samuelson had in mind when he spoke of China and India improving their productivity and comparative advantage in activities that the United States already exports. The next application discusses the magnitude of service exports and also the changes in their prices.

APPLICATION

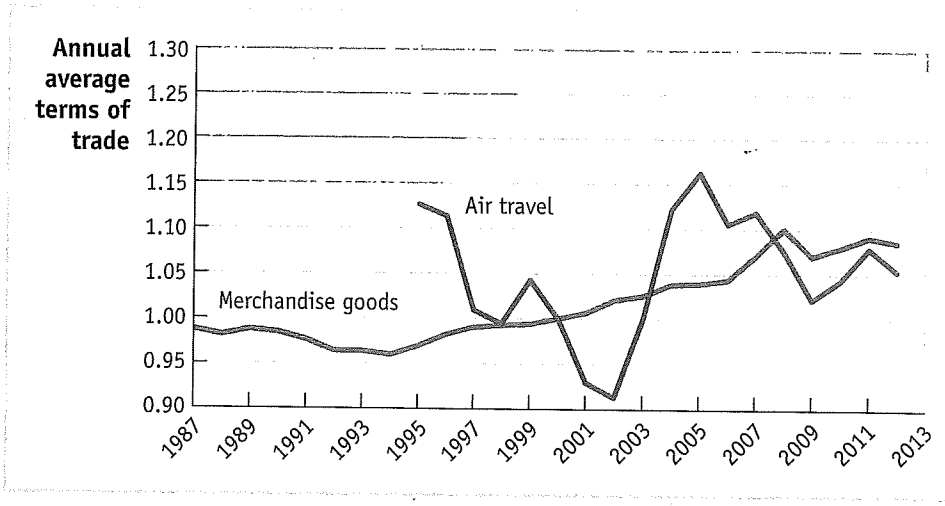
U.S. Terms of Trade and Service Exports

Because Samuelson's argument is a theoretical one, the next step is to examine the evidence for the United States. If the United States has been facing competition in R&D and the other skill-intensive activities that we export, then we would expect the terms of trade to fall. Conversely, if the United States has been offshoring in manufacturing, then the opportunity to import lower-priced intermediate inputs should lead to a rise in the terms of trade.

Merchandise Prices To evaluate these ideas, we make use of data on the terms of trade for the United States. In Figure 7-13, we first show the terms of trade for the United States for merchandise goods (excluding petroleum), which is the gold line.[13] The terms of trade for goods fell from 1990 to 1994 but then rose to 2008,

[13] Merchandise goods include agriculture, mining, and manufacturing. We have excluded petroleum because its world price is determined by conditions such as shortages and wars and behaves quite differently from the prices of other merchandise goods.

FIGURE 7-13



Terms of Trade for the United States, 1990–2012 Shown here are the U.S. terms of trade for merchandise goods (excluding petroleum) and for air travel services. The terms of trade for merchandise goods fell from 1990 to 1994 and then rose to 2008, with a dip in 2009 and rising slightly thereafter. The terms of trade for air travel services are more volatile, falling from 1995 to 2002, rising until 2005, falling again until 2009, and rising erratically thereafter. In sum, we do not see a pattern of declining terms of trade in either of these sectors.

Source: Bureau of Labor Statistics.

with a dip in 2009 and a slight rise thereafter. The overall improvement in the merchandise terms of trade shows that we are able to import intermediate inputs (and also import final goods) at lower prices over time. This rise in the terms of trade means that there are increasing gains from trade in merchandise goods for the United States.

Service Prices For trade in services, such as finance, insurance, and R&D, it is very difficult to measure their prices in international trade. These services are tailored to the buyer and, as a result, there are not standardized prices. For this reason, we do not have an overall measure of the terms of trade in services. There is one type of service, however, for which it is relatively easy to collect international prices: air travel. The terms of trade in air travel equal the price that foreigners pay for travel on U.S. airlines (a service export) divided by the price that Americans pay on foreign airlines (a service import). In Figure 7-13, we also show the U.S. terms of trade in air travel that are available since 1995. The terms of trade in air travel are quite volatile, falling from 1995 to 2002, rising until 2005, falling again until 2009, and rising erratically thereafter. For this one category of services, the terms of trade improvement from 2002 to 2005 indicates growing gains from trade for the United States, the same result we found for merchandise goods. Summing up, there is no evidence to date that the falling terms of trade that Samuelson is concerned about have occurred for the United States.

Service Trade What about other traded services? Although standard prices are not available, data on the *amount* of service exports and imports for the United States are collected annually. These data are shown in Table 7-2 for 2011. The

United States runs a substantial surplus in services trade, with exports of $587 billion and imports of $393 billion. Categories of service exports that exceed imports include several types of business, professional, and technical services (but in computer and information services, the United States now runs a deficit); education (which is exported when a foreign student studies in the United States); financial services; travel; and royalties and license fees (which are collected from foreign firms when they use U.S. patents and trademarks or are paid abroad when we use foreign patents). The fact that exports exceed imports in many categories in Table 7-2 means that the United States has a comparative advantage in traded services. Indeed, the U.S. surplus in business, professional, and technical services is among the highest in the world, similar to that of the United Kingdom and higher than that of Hong Kong and India. London is a world financial center and competes with New York and other U.S. cities, which explains the high trade surplus of the United Kingdom, whereas Hong Kong is a regional hub for transportation and offshoring to China. The combined trade balance in computer and information services, insurance and financial services for the United States, the United Kingdom, and India since 1970 are graphed in Figure 7-14.

TABLE 7-2

U.S. Trade in Services, 2011 ($ millions) This table shows U.S. exports and imports in the major categories of services trade for 2011.

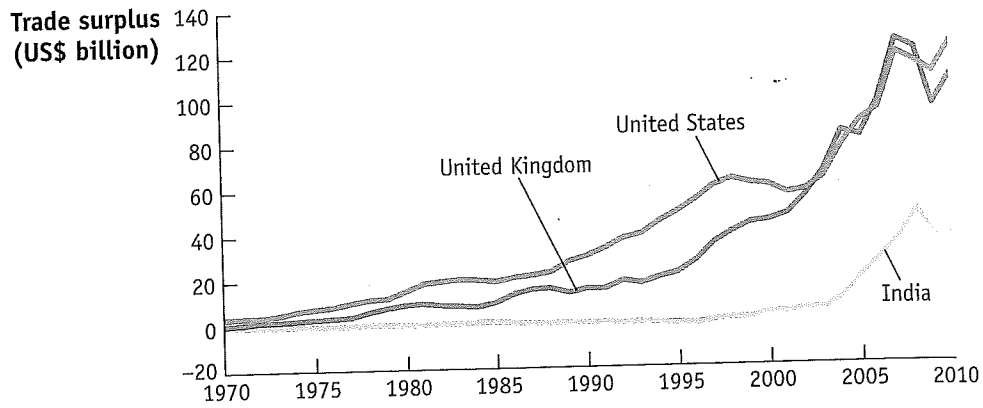
	Exports	Imports
Computer and information services	15,501	24,538
Management and consulting services	32,169	24,823
R&D and testing services	23,364	22,360
Operational leasing	7,142	1,922
Other business, professional, and technical services	56,240	31,130
Total business, professional, and technical services	$134,416	$104,773
Education	22,726	5,888
Financial services	74,055	16,207
Insurance services	15,477	56,619
Telecommunications	12,650	7,690
Total other private services	$270,193	$191,973
Travel	116,115	78,651
Passenger fares	36,631	31,109
Other transporation	43,064	54,711
Royalties and license fees	120,836	36,620
Other services	62,633	11,917
Total private services	$586,839	$393,065

Source: U.S. Bureau of Economic Analysis.

The U.S. surplus in these categories of services has been growing since about 1985, with an occasional dip, and exceeded the trade surplus of the United Kingdom, its chief competitor, up until about 2000. Since then the surpluses of the United Kingdom and of the United States have been quite similar. India's surplus began growing shortly after 2000 and derives entirely from its exports of computer and information services. In 2010 the combined U.S. surplus in computers, insurance, and financial services ($122 billion) was three times larger than that of India ($37 billion), and about the same as of the United Kingdom ($108 billion).

What will these surpluses look like a decade or two from now? It is difficult to project, but notice in Figure 7-14 that in approximately 2000, as the Indian surplus began growing, the U.S. surplus dipped to become more similar to that of the United Kingdom. The Indian trade surplus is entirely due to its exports of computer and information services—a category in which the United States also has strong net exports. So even though the Indian trade surplus is still much smaller than that of the United States, it appears to pose a competitive challenge to the United States. It is at least possible that in a decade or two, India's overall surplus in service exports could overtake that of the United States. Only time will tell whether the United States will eventually face the same type of competition from India in its service exports that it has already faced for many years from the United Kingdom. ■

FIGURE 7-14



Trade Surplus in Business Services This figure shows the combined trade surplus in computer and information services, insurance, and financial services for the United States, the United Kingdom, and India from 1970 to 2010. The U.S. surplus in these categories of services has been growing since about 1985, with an occasional dip, and exceeded the trade surplus of the United Kingdom, its chief competitor, up until about 2000. Since then the surpluses of the United Kingdom and of the United States have been similar. India's surplus began growing around 2000 and is based entirely on its exports of computer and information services.

Source: World Bank World Development Indicators.

3 The Politics and Future of Offshoring

Offshoring is controversial and is often the topic of political debate. In February 2004 the first quote at the beginning of this chapter appeared in the *Economic Report of the President*. The writer of that sentence, Harvard economist N. Gregory Mankiw, who was chairman of the Council of Economic Advisors, also said that "outsourcing is just a new way of doing international trade. More things are tradable than were tradable in the past, and that's a good thing." Those comments were widely criticized by the Democrats and Republicans alike, and Professor Mankiw later apologized in a letter to the House of Representatives, writing, "My lack of clarity left the wrong impression that I praised the loss of U.S. jobs."

In the Democratic primary elections of 2007 and in the presidential campaign of 2008, this topic came up again. Senators Barack Obama and Hillary Clinton both promised that, if elected, they would end tax breaks for companies earning profits overseas:[14]

> **Obama, Nov. 3, 2007:** When I am president, I will end the tax giveaways to companies that ship our jobs overseas, and I will put the money in the pockets of working Americans, and seniors, and homeowners who deserve a break.

[14] These quotations and some material that follows are taken from http://www.factcheck.org/2008/02/oil-and-gas-company-tax-breaks/ (accessed August 23, 2013).

Clinton, Nov. 19, 2007: And we are going to finally close the tax loopholes and stop giving tax breaks to companies that ship jobs overseas. Enough with outsourcing American jobs using taxpayer dollars.

To what tax breaks were Mr. Obama and Ms. Clinton referring? The United States taxes corporate profits at 35%, a high rate when compared with the corporate tax rates in other countries. Profit earned by overseas subsidiaries of U.S. companies, however, goes untaxed by the U.S. government provided that such a subsidiary stays overseas and does not appear on the books of the parent company in the United States. That tax provision gives U.S. multinational companies an incentive to use these funds overseas for further investment in the subsidiary, but it does not necessarily lead them to move jobs overseas in the first place. Eventually, when these profits are moved back to the parent company in the United States, they are taxed at the normal rate.

President Obama recently announced that he would follow through on his campaign pledge to end the tax break on overseas profits of multinational firms, as indicated by the quotation at the beginning of this chapter: "The American people deserve a tax code that . . . lowers incentives to move jobs overseas, and lowers tax rates for businesses and manufacturers that are creating jobs right here in the United States of America. That's what tax reform can deliver." That change in policy does not have much support from economists. One strongly worded response comes from Matthew Slaughter, Professor at Dartmouth College, in **Headlines: How to Destroy American Jobs.** He cites evidence that U.S. multinationals have added roughly as many jobs in the United States as they have added abroad, and argues that these jobs in the United States depend on the ability of the multinationals to offshore other jobs.

In addition to the employment statistics, Professor Slaughter also cites evidence that U.S. multinational firms conducted nearly 90% of all private-sector R&D in the United States, and that these firms account for the majority of U.S. productivity gains.

Direct evidence on the positive impact of offshoring on productivity comes from another source, a 2005 study of the offshoring of material inputs and services by U.S. manufacturing firms in the 1990s.[15] Over the eight years from 1992 to 2000, that study found that service offshoring can explain between 11% and 13% of the total increase in productivity within the U.S. manufacturing sector. In addition, the offshoring of material inputs explains between 3% and 6% of the increase in manufacturing productivity. Combining these effects, offshoring explains between 15% and 20% of overall productivity growth in the manufacturing sector. Evidence of this type makes economists reluctant to impose additional taxes on U.S. companies that engage in offshoring, because of the possible adverse effects on productivity here in the United States.

On the other hand, changes in economic conditions that lead firms to *voluntarily* bring some activities back home would be viewed favorably by most economists. There is some evidence that economic conditions have changed in that direction, as

[15] Mary Amiti and Shang-Jin Wei, 2005, "Service Offshoring, Productivity, and Employment: Evidence from the United States," International Monetary Fund, IMF Working Paper 05/238; and 2006, "Service Offshoring and Productivity: Evidence from the United States," National Bureau of Economic Research (NBER) Working Paper No. 11926.

HEADLINES

How to Destroy American Jobs

This article argues that offshoring by multinational companies supports an increase in jobs at home, and that these jobs would be lost by policies to restrict offshoring.

Deep in the president's budget released Monday [February 1, 2010] appear a set of proposals headed "Reform U.S. International Tax System." If these proposals are enacted, U.S.-based multinational firms will face $122.2 billion in tax increases over the next decade. This is a natural follow-up to President Obama's sweeping plan announced last May [2009] entitled "Leveling the Playing Field: Curbing Tax Havens and Removing Tax Incentives for Shifting Jobs Overseas."

The fundamental assumption behind these proposals is that U.S. multinationals expand abroad only to "export" jobs out of the country. Thus, taxing their foreign operations more would boost tax revenues here and create desperately needed U.S. jobs. This is simply wrong. These tax increases would not create American jobs, they would destroy them.

Academic research, including most recently that done by Harvard's Mihir Desai and Fritz Foley and University of Michigan's James Hines, has consistently found that expansion abroad by U.S. multinationals tends to support jobs based in the U.S. More investment and employment abroad are strongly associated with more investment and employment in American parent companies.

When parent firms based in the U.S. hire workers in their foreign affiliates, the skills and occupations of these workers are often complementary; they aren't substitutes. More hiring abroad stimulates more U.S. hiring. For example, as Wal-Mart has opened stores abroad, it has created hundreds of U.S. jobs for workers to coordinate the distribution of goods worldwide. The expansion of these foreign affiliates—whether to serve foreign customers, or to save costs—also expands the overall scale of multinationals.

Expanding abroad also allows firms to refine their scope of activities. For example, exporting routine production means that employees in the U.S. can focus on higher value-added tasks such as R&D, marketing and general management. The total impact of this process is much richer than an overly simplistic story of exporting jobs. But the ultimate proof lies in the empirical evidence.

Consider total employment spanning 1988 through 2007 (the most recent year of data available from the U.S. Bureau of Economic Analysis). Over that time, employment in affiliates rose by 5.3 million—to 11.7 million from 6.4 million. Over that same period, employment in U.S. parent companies increased by nearly as much—4.3 million—to 22 million from 17.7 million. Indeed, research repeatedly shows that foreign-affiliate expansion tends to expand U.S. parent activity. . . .

The major policy challenge facing the U.S. today is not just to create jobs, but to create high-paying private-sector jobs linked to investment and trade. Which firms can create these jobs? U.S.-based multinationals. They—along with similarly performing U.S. affiliates of foreign-based multinationals—have long been among the strongest companies in the U.S. economy.

These two groups of firms accounted for the majority of the post-1995 acceleration in U.S. productivity growth, the foundation of rising standards of living for everyone. They tend to create high-paying jobs—27.5 million in 2007. . . . And these firms also conducted $240.2 billion in research and development, a remarkable 89.2% of all U.S. private-sector R&D.

To climb out of the recession, we need to create millions of the kinds of jobs that U.S. multinationals tend to create. Economic policy on all fronts should be encouraging job growth by these firms. The proposed international-tax reforms do precisely the opposite.

Source: Matthew J. Slaughter, "How to Destroy American Jobs," Wall Street Journal, *February 3, 2010, p. A17.*

described in **Headlines: Caterpillar Joins "Onshoring" Trend.** In 2010, General Electric joined this trend by moving the manufacturing of a water heater from China to Louisville, Kentucky, and in late 2012 Apple Computer announced that it would be bringing some jobs back to the United States by building some Macintosh computers locally.[16] A combination of higher wages in China, higher transportation costs

[16] Charles Fishman, "The Insourcing Boom," *Atlantic Magazine*, December 2012, and Catherine Rampell and Nick Wingfield, "In Shift of Jobs, Apple Will Make Some Macs in U.S.," *New York Times*, December 6, 2012.

HEADLINES

Caterpillar Joins "Onshoring" Trend

Some American companies have found it advantageous to take activities they had previously shifted overseas and move them back home, in what is called "onshoring."

Caterpillar, Inc. is considering relocating some heavy-equipment overseas production to a new U.S. plant, part of a growing movement among manufacturers to bring more operations back home—a shift that will likely spark fierce competition among states for new manufacturing jobs. The trend, known as onshoring or reshoring, is gaining momentum as a weak U.S. dollar makes it costlier to import products from overseas. Manufacturers are also counting on White House jobs incentives, as well as their ability to negotiate lower prices from U.S. suppliers who were hurt by the downturn and willing to bargain.

After a decade of rapid globalization, economists say companies are seeing disadvantages of offshore production, including shipping costs, complicated logistics, and quality issues. Political unrest and theft of intellectual property pose additional risks. "If you want to keep your supply chain tight, it's hard to do that with a 16-hour plane ride from Shanghai to Ohio," said Cliff Waldman, an economist with the Manufacturers Alliance/MAPI, a public policy and economics research group in Arlington, Virginia.

General Electric Co. said last June it would move production of some water heaters from China to its facility in Louisville, Kentucky, starting in 2011. A GE spokeswoman said a 2005 labor agreement under which new employees would be paid $13 an hour, [instead of the] nearly $20 an hour [they once made], "enabled us to be more competitive."

Source: Kris Maher and Bob Tita, "Caterpillar Joins 'Onshoring' Trend," The Wall Street Journal, *March 11, 2010, p. A17. Reprinted with permission of The Wall Street Journal, Copyright © (2010) Dow Jones & Company, Inc. All Rights Reserved Worldwide.*

due to rising oil prices, and U.S. unions that are more willing to compromise with management, has led these and other companies to "onshore" their activities back to the United States. This trend has also occurred because companies are finding that communication with overseas suppliers can be slow and costly.

The Future of U.S. Comparative Advantage

Just as in our model of this chapter, the recent "onshoring" trend shows that companies usually avoid offshoring *all* activities from the United States: the extra communication and trade costs involved need to be balanced against the lower foreign wages to find the right amount of offshoring. Most often companies find it advantageous to keep some activities in the United States (such as those using more highly skilled labor or relying on close communication with customers) and move other activities abroad (using less skilled labor and involving more routine activities). The fear sometimes expressed in the popular press that offshoring threatens the elimination of most manufacturing and service jobs in the United States is overstated. The ability to offshore a portion of the production process allows other activities to remain in the United States.

A good example to illustrate this point is the offshoring of medical services. The transcription of doctors' notes from spoken to written form was one of the first service activities offshore to India. Since then, other types of medical services have also been offshored, and a *New York Times* article in 2003 identified the reading of X-rays—or radiology—as the next area that could shift overseas: "It turns out that even American radiologists, with their years of training and annual salaries of $250,000 or more, worry about their jobs moving to countries with lower wages, in much the same way

that garment knitters, blast-furnace operators and data-entry clerks do. . . . Radiology may just be the start of patient care performed overseas."[17]

It turns out, however, that the types of radiology jobs that can potentially be transferred overseas are very limited.[18] Radiology is a high-paying profession precisely because the reading of X-rays is difficult and takes years of training and practice to perfect. X-rays are normally analyzed in the same hospital where the patient is being treated. In a few cases of specific diseases, such as the reading of mammograms for breast cancer, it is possible that the work can be outsourced (i.e., performed outside the hospital), either domestically or offshore. Firms known as "nighthawks" already provide some outsourcing services to hospitals, principally during nighttime hours. Nighthawk firms are headquartered in the United States but have radiologists at offshore sites, including Australia, Israel, Spain, and India. These nighttime services allow smaller hospitals that cannot afford a full-time night radiologist to obtain readings during evening hours, and allow the nighthawk firms to keep their radiologists fully employed by combining the demand from multiple hospitals.

The offshoring to nighthawk firms is a natural response to the round-the-clock demand for hospital services but less-than-full-time demand for radiologists on-site. Often these nighttime services are used only for preliminary reads, leading to immediate treatment of patients; the X-ray image is then read again by the staff radiologist in the United States the next day. That is, in many cases, the services being outsourced are not directly competing for the daytime jobs but, instead, are complements to these U.S. jobs.

Radiology is under no imminent threat from outsourcing because the profession involves decisions that cannot be codified in written rules. Much of the radiologist's knowledge is gained from reading countless X-rays with complex images and shadows, and the ability to recognize patterns cannot easily be passed on to another person or firm. It follows that the work cannot be offshored except for the nighttime activities of nighthawk firms, which actually work in conjunction with the daytime activities in major hospitals.

In every profession there will always be jobs that cannot be performed by someone who is not on-site. For many of the service activities listed in Table 7-2, the United States will continue to have comparative advantage even while facing foreign competition. In many manufacturing industries, the United States will continue to maintain some activities at home, such as R&D and marketing, even while shifting a portion of the production process abroad. Finally, we should recognize that the ability to offshore to Mexico or India ultimately makes the U.S. companies involved more profitable and therefore better able to withstand foreign competition.

4 Conclusions

In this chapter, we have studied a type of trade that is becoming increasingly important: offshoring, by which we mean the shifting of some production activities to another country, while other production activities are kept at Home. Rather than

[17] Andrew Pollack, "Who's Reading Your X-Ray?" *New York Times*, November 16, 2003, section 3, pp. 1, 9.
[18] The material in the following paragraphs is drawn from Frank Levy and Ari Goelman, "Offshoring and Radiology," presented at the Brookings Institute Trade Forum, May 12–13, 2005.

trading final goods, like wheat for cloth as in the Ricardian model of Chapter 2, or computers for shoes as in the Heckscher-Ohlin model of Chapter 4, with offshoring each good can be produced in stages in several countries and then assembled in a final location.

In the model of offshoring we presented, because low-skilled labor is relatively cheap abroad, it makes sense for Home to offshore to the Foreign country those activities that are less skill-intensive, while keeping at Home those activities that are more skill-intensive. "Slicing" the value chain in this way is consistent with the idea of comparative advantage, because each country is engaged in the activities for which its labor is relatively cheaper. From *both* the Home and Foreign point of view, the ratio of high-skilled/low-skilled labor in value chain activities goes up. A major finding of this chapter, then, is that an increase in offshoring will raise the relative demand (and hence relative wage) for skilled labor in *both* countries.

In a simplified model in which there are only two activities, we found that a fall in the world price of the low-skilled and labor-intensive input will lead to gains to the Home firm from offshoring. But in contrast, a fall in the price of the skilled labor-intensive input would lead to losses to the Home firm, as compared with the prior trade equilibrium. Such a price change is a terms-of-trade loss for Home, leading to losses from the lower relative price of exports. So even though Home gains overall from offshoring (producing at least as much as it would in a no-offshoring equilibrium), it is still the case that competition in the input being exported by Home will make it worse off.

We concluded the chapter by exploring offshoring in service activities, a topic that has received much attention in the media recently. Offshoring from the United States to Mexico consists mainly of low-skilled jobs; offshoring from the United States to India consists of higher-skilled jobs performed by college-educated Indians. This new type of offshoring has been made possible by information and communication technologies (such as the Internet and fiber-optic cables) and has allowed cities like Bangalore, India, to establish service centers for U.S. companies. These facilities not only answer questions from customers in the United States and worldwide, they are also engaged in accounting and finance, writing software, R&D, and many other skilled business services.

The fact that it is not only *possible* to shift these activities to India but *economical* to do so shows how new technologies make possible patterns of international trade that would have been unimaginable a decade ago. Such changes show "globalization" at work. Does the offshoring of service activities pose any threat to white-collar workers in the United States? There is no simple answer. On the one hand, we presented evidence that service offshoring provides productivity gains, and therefore gains from trade, to the United States. But as always, having gains from trade does not mean that everyone gains: there can be winners and losers. For service offshoring, it is possible that skilled workers will see

a potential reduction in their wages, just as low-skilled labor bore the brunt of the impact from offshoring in the 1980s. Nevertheless, it is still the case that the United States, like the United Kingdom and other European countries, continues to have a comparative advantage in exporting various types of business services. Although India is making rapid progress in the area of computer and information services, there are still many types of service activities that need be done locally and cannot be outsourced. One likely prediction is that the activities in the United States that cannot be codified in written rules and procedures, and that benefit from face-to-face contact as well as proximity to other highly skilled individuals in related industries, will continue to have comparative advantage.

KEY POINTS

1. The provision of a service or the production of various parts of a good in different countries for assembly into a final good in another location is called foreign outsourcing or offshoring.
2. We can apply the same ideas that we developed for trade in final goods among countries to the trade of intermediate offshored activities. For instance, if low-skilled labor is relatively inexpensive in the Foreign country, then the activities that are least skill-intensive will be offshored there, and Home will engage in the activities that are more skill-intensive.
3. We can also predict what happens to relative wages of skilled labor when there is a change in trading costs and more offshoring. Our model predicts that the relative demand for skilled labor *increases in both countries*. This result helps to explain the observation that relative wages have been increasing in the United States and in other countries at the same time.
4. In an overall sense, there are gains from offshoring, because the specialization of countries in different production activities allows firms in both countries to produce a higher level of final goods. That increase in output represents a productivity gain, and the gains from trade.
5. With service offshoring, it is possible that a country like India will have rising productivity in activities in which the United States has comparative advantage, such as R&D. Rising productivity in India would lead to a fall in the price of R&D, which is a terms-of-trade loss for the United States. For that reason, the United States could lose due to service offshoring, though it still gains as compared with a situation of no offshoring at all.

KEY TERMS

foreign outsourcing, p. 198
offshoring, p. 198
value chain, p. 200
skill-biased technological change, p. 209
total wage payments, p. 209
isoquants, p. 214
business services, p. 219

PROBLEMS

1. Consider an offshoring model in which the hours of labor used in four activities in the United States and Mexico are as follows: Note that labor hours in Mexico are twice those in the United States, reflecting Mexico's lower productivity. Also note that the ratio of high-skilled to low-skilled labor used in each activity increases as we move to the right, from 1/5 in assembly, to 10/1 in R&D. Suppose that the wage of U.S. low-skilled workers is $10 per hour and that of high-skilled workers is $25 per hour, and that the wage of Mexican low-skilled workers is $1 per hour and that of high-skilled workers is $5 per hour (these values are made up to be convenient, not realistic). Also suppose that the trade costs are 25%, 30%, or 50%, which means that an additional 25%, 30%, or 50% is added to the costs of offshoring to Mexico.