three-minute phone call from New York to London fell to $0.24 in 2002 from $315 in 1930 (adjusting the 1930 prices for general inflation). Use of e-mail and access to the Internet, unheard of in 1930, reduce costs even further.

The most important reason that trade has expanded so rapidly, however, is that government restrictions on trade between countries have come down. Western European countries are integrating into a single market. Canada, Mexico, and the United States have agreed to integrate their economies into a free trade area, where the term free indicates the elimination of restrictions on trade. Previously closed economies have opened themselves to world trade through major political and economic reforms. The formerly closed economies in Eastern Europe, the Russian Federation, and, especially, China have joined the world trading system. Export-oriented countries in Asia are growing rapidly, and governments in South America such as Argentina and Chile are opening their economies to competition and foreign trade. These countries are making these changes in an effort to help people. But how do people gain from international trade? Let us now consider that question.

**REVIEW**

- The basic principles of economics apply to international trade between people in different countries.
- Governments have a greater tendency to interfere with trade between countries than with trade within their own country.
- International trade has grown rapidly in recent years because of reduced transportation and communication costs and, especially, lower government barriers to trade.

**Comparative Advantage**

According to the theory of comparative advantage, a country can improve the income of its citizens by allowing them to trade with people in other countries, even if the people of the country are less efficient at producing all items.

**Getting a Gut Feeling for Comparative Advantage**

First, consider a parable that conveys the essence of comparative advantage. Rose is a highly skilled computer programmer who writes computer-assisted drawing programs. Rose owns a small firm that sells her programs to architects. She has hired an experienced salesman, Sam, to contact the architects and sell her software. Thus, Rose specializes in programming, and Sam specializes in sales.

You need to know a little more about Rose. Rose is a friendly, outgoing person, and because she knows her product better than Sam does, she is better than Sam at sales. We say that Rose has an absolute advantage over Sam in both programming and sales because she is better at both jobs. But it still makes sense for Rose to hire Sam because her efficiency at programming compared with Sam’s is greater than her efficiency at sales compared with Sam’s. We say that Rose has a comparative advantage over Sam in programming rather than in sales. If Rose sold her programs, then she would have to sacrifice her programming time, and her profits would fall. Thus, even though Rose is better at both programming and sales, she hires Sam to do the selling so that she can program full time.

All this seems sensible. One additional part of the terminology, however, may at first seem confusing but is important. We said that Rose has the comparative advantage in
programming, not in sales. But who does have the comparative advantage in sales? Sam does. Even though Sam is less efficient at both sales and programming, we say that he has a comparative advantage in sales because, compared with Rose, he does relatively better at sales than he does at programming. A person cannot have a comparative advantage in both of only two activities.

**Opportunity Cost, Relative Efficiency, and Comparative Advantage**

The idea of comparative advantage also can be explained in terms of opportunity cost. The opportunity cost of Rose or Sam spending more time selling is that she or he can produce fewer programs. Similarly, the opportunity cost of Rose or Sam spending more time writing programs is that she or he can make fewer sales.

Observe that, in the example, Sam has a lower opportunity cost of spending his time selling than Rose does; thus, it makes sense for Sam to do the selling rather than Rose. In contrast, Rose has a lower opportunity cost of spending her time writing computer programs than Sam does; thus, it makes sense for Rose to write computer programs rather than Sam.

Opportunity costs give us a way to define comparative advantage. A person with a lower opportunity cost of producing a good than another person has a comparative advantage in that good. Thus, Rose has a comparative advantage in computer programming, and Sam has a comparative advantage in sales.

Comparative advantage also can be explained in terms of relative efficiency. A person who is relatively more efficient at producing good X than good Y, compared with another person, has a comparative advantage in good X. Thus, again, we see that Rose has a comparative advantage in computer programming because she is relatively more efficient at producing computer programs than at making sales compared with Sam.

**From People to Countries** Why is this story about Rose and Sam a parable? Because we can think of Rose and Sam as two countries that differ in efficiency at producing one product versus another. In the parable, Rose has a comparative advantage over Sam in programming, and Sam has a comparative advantage over Rose in sales. In general, country A has a comparative advantage over country B in the production of a good if the opportunity cost of producing the good in country A is less than in country B, or, alternatively but equivalently stated, if country A can produce the good relatively more efficiently than other goods compared with country B. Thus, if you understand the Rose and Sam story, you should have no problem understanding comparative advantage in two countries, which we now examine in more detail.

**Productivity in Two Countries**

Consider the following two goods: (1) vaccines and (2) television sets. Different skills are required for the production of vaccines and television sets. Vaccine production requires knowledge of chemistry and biology, and the marketing of products for which doctors make most of the choices. Producing television sets requires knowledge of electrical engineering and microcircuitry, and the marketing of goods for which consumers make most of the choices.

Table 29-1 provides an example of productivity differences in the production of vaccines and television sets in two different countries, the United States and Korea. Productivity is measured by the amount of each good that can be produced by a worker per day of work. To be specific, let us suppose that the vaccines are measured in vials, that the televisions are measured in numbers of television sets, and that labor is the only factor of production in making vaccines and television sets. The theory of comparative advantage does not depend on any of these assumptions, but they make the exposition much easier.
According to Table 29-1, in the United States, it takes a worker one day of work to produce six vials of vaccine or three television sets. In Korea, one worker can produce one vial of vaccine or two television sets. Thus, the United States is more productive than Korea in producing both vaccines and television sets. We say that a country has an absolute advantage over another country in the production of a good if it is more efficient at producing that good. In this example, the United States has an absolute advantage in both vaccine and television set production.

The United States, however, has a comparative advantage over Korea in the production of vaccines rather than television sets. To see this, note that a worker in the United States can produce six times as many vials of vaccine as a worker in Korea but only 1.5 times as many television sets. In other words, the United States is relatively more efficient in vaccines than in television sets compared with Korea. Korea, being able to produce television sets relatively more efficiently than vaccines compared with the United States, has a comparative advantage in television sets.

Observe also how opportunity costs determine who has the comparative advantage. To produce three more television sets, the United States must sacrifice six vials of vaccine; in other words, in the United States, the opportunity cost of one more television set is two vials of vaccine. In Korea, to produce two more television sets, the Koreans must sacrifice one vial of vaccine; in other words, in Korea, the opportunity cost of one more television set is only one-half vial of vaccine. Thus, we see that the opportunity cost of producing television sets in Korea is lower than in the United States. By examining opportunity costs, we again see that Korea has a comparative advantage in television sets.

### Table 29-1

<table>
<thead>
<tr>
<th></th>
<th>Output per Day of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vials of Vaccine</td>
</tr>
<tr>
<td>United States</td>
<td>6</td>
</tr>
<tr>
<td>Korea</td>
<td>1</td>
</tr>
</tbody>
</table>

Electronics versus Pharmaceuticals

In the example used in this chapter, Korea has a comparative advantage in an electronic good (television sets), and the United States has a comparative advantage in a pharmaceutical (vaccines). Thus, with trade, the electronic good will be produced in Korea, as shown in the left-hand photo, and the pharmaceutical good will be produced in the United States, as shown in the right-hand photo.
An American Worker’s View  Because labor productivity in both goods is higher in the United States than in Korea, wages are higher in the United States than in Korea in the example. Now think about the situation from the point of view of U.S. workers who are paid more than Korean workers. They might wonder how they can compete with Korea. The Korean workers’ wages seem very low compared with theirs. It does not seem fair. But as we will see, comparative advantage implies that U.S. workers can gain from trade with the Koreans.

A Korean Worker’s View  It is useful to think about Table 29-1 from the perspective of a Korean worker as well as that of a U.S. worker. From the Korean perspective, it might be noted that Korean workers are less productive in both goods. Korean workers might wonder how they can ever compete with the United States, which looks like a productive powerhouse. Again, it does not seem fair. As we will see, however, the Koreans also can gain from trade with the Americans.

Finding the Relative Price  To measure how much the Koreans and Americans can gain from trade, we need to consider the relative price of vaccines and televisions in Korea and the United States. The relative price determines how much vaccine can be traded for televisions and, therefore, how much each country can gain from trade. For example, suppose the price of a television set is $200 and the price of a vial of vaccine is $100. Then two vials of vaccine cost the same as one television set; we say the relative price is two vials of vaccine per television set.

Relative Price without Trade  First, let us find the relative price with no trade between the countries. The relative price of two goods should depend on the relative costs of production. A good for which the cost of producing an additional quantity is relatively low will have a relatively low price.

Consider the United States. In this example, a day of work can produce either six vials of vaccine or three television sets. With labor as the only factor of production, six vials of vaccine cost the same to produce as three television sets; that is, two vials of vaccine cost the same to produce as one television set. Therefore, the relative price should be two vials of vaccine per television set.

Now consider Korea. Electronic goods should have a relatively low price in Korea because they are relatively cheap to produce. A day of work can produce either one vial of vaccine or two television sets; thus one vial of vaccine costs the same to produce as two television sets in Korea. Therefore, the relative price is one-half vial of vaccine per television set.

Relative Price with Trade  Now consider what happens when the two countries trade without government restrictions. If transportation costs are negligible and markets are competitive, then the price of a good must be the same in the United States and Korea. Why? Because any difference in price would quickly be eliminated by trade; if the price of television sets is much less in Korea than in the United States, then traders will buy television sets in Korea and sell them in the United States and make a profit; by doing so, however, they reduce the supply of television sets in Korea and increase the supply in the United States. This will drive up the price in Korea and drive down the price in the United States until the price of television sets in the two countries is the same. Thus, with trade, the price of vaccines and the price of television sets will converge to the same levels in both countries. The relative price therefore will converge to the same value in both countries.

If the relative price is going to be the same in both countries, then we know the price must be somewhere between the prices in the two countries before trade. That is,
the price must be between two vials of vaccine per television set (the U.S. relative price) and one-half vial of vaccine per television set (the Korean relative price). We do not know exactly where the price will fall between one-half and two. It depends on the demand for vaccines and television sets in Korea and the United States. Let us assume that the relative price is one vial of vaccine per television set after trade, which is between one-half and two and is a nice, easy number for making computations. The calculation of the price with trade is summarized in Table 29-2.

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### Measuring the Gains from Trade

How large are the gains from trade because of comparative advantage? First, consider some examples.

**One Country’s Gain** Suppose that 10 U.S. workers move out of electronics production and begin producing pharmaceuticals. We know from Table 29-1 that these 10 U.S. workers can produce 60 vials of vaccine per day. Formerly, the 10 U.S. workers were producing 30 television sets per day. But their 60 vials of vaccine can be traded for television sets produced in Korea. With the relative price of one vial per television set, Americans will be able to exchange these 60 vials of vaccine for 60 television sets. Thus, Americans gain 30 more television sets by moving 10 more workers into vaccine production. This gain from trade is summarized in Table 29-3.

**The Other Country’s Gain** The same thing can happen in Korea. A Korean manufacturer can now hire 30 workers who formerly were working in vaccine production to

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### Table 29-2

<table>
<thead>
<tr>
<th>The Relative Price (The relative price—vials of vaccine per television set—must be the same in both countries with trade.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>United States</strong></td>
</tr>
<tr>
<td>Relative price before trade:</td>
</tr>
<tr>
<td>Relative price range after trade:</td>
</tr>
<tr>
<td>Relative price assumption:</td>
</tr>
</tbody>
</table>

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### Table 29-3

<table>
<thead>
<tr>
<th>Changing Production and Gaining from Trade in the United States and Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>United States (10 workers)</strong></td>
</tr>
<tr>
<td><strong>Vaccines</strong></td>
</tr>
<tr>
<td>Change in Production</td>
</tr>
<tr>
<td>Up 60 vials</td>
</tr>
<tr>
<td>Down 30 sets</td>
</tr>
</tbody>
</table>

| **Korea (30 workers)** |
| **Vaccines** | **Television sets** |
| Change in Production | Amount Traded | Net Gain from Trade |
| Down 30 vials | Import 60 vials | 30 vials |
| Up 60 sets | Export 60 sets | 0 |
produce television sets. Vaccine production declines by 30 vials, but television production increases by 60 sets. These 60 television sets can be traded with Americans for 60 vials of vaccine. The reduction in the production of vaccine of 30 vials results in an import of vaccine of 60 vials; thus, the gain from trade is 30 vials of vaccine. The Koreans, by moving workers out of vaccine production and into television set production, are getting more vaccine. This gain from trade for Korea is summarized in Table 29-3. Observe that the exports of television sets from Korea equal the imports of television sets to the United States.

**Just Like a New Discovery**  International trade is like the discovery of a new idea or technique that makes workers more productive. It is as if workers in the United States figured out how to produce more television sets with the same amount of effort. Their trick is that they actually produce vaccines, which then are traded for the television sets. Like any other new technique, international trade improves the well-being of Americans. International trade also improves the well-being of the Koreans; it is as if they discovered a new technique, too.

**A Graphic Measure of the Gains from Trade**

The gains from trade because of comparative advantage also can be found graphically with production possibilities curves, as shown in Figure 29-2. The figure has two graphs—one for the United States and the other for Korea. In both graphs, the horizontal axis has the number of television sets and the vertical axis has the number of vials of vaccine produced.

**Production Possibilities Curves without Trade**  The solid lines in the two graphs show the production possibilities curves for vaccines and television sets in the United States and in Korea before trade. To derive them, we assume, for illustrative purposes, that the United States has 10,000 workers and Korea has 30,000 workers who can make either vaccines or television sets.

If all the available workers in the United States produce vaccines, then total production will be 60,000 vials of vaccine \((6 \times 10,000)\) and zero television sets. Alternatively, if 5,000 workers produce vaccines in the United States and 5,000 workers produce television sets, then total production will be 30,000 vials of vaccine \((6 \times 5,000)\) and 15,000 television sets \((3 \times 5,000)\). The solid line in the graph on the left of Figure 29-2 shows these possibilities and all other possibilities for producing vaccines and television sets. It is the production possibilities curve without trade.

Korea’s production possibilities curve without trade is shown by the solid line in the graph on the right of Figure 29-2. For example, if all 30,000 Korean workers produce television sets, a total of 60,000 television sets can be produced \((2 \times 30,000)\). This and other possibilities are on the curve.

The slopes of the two production possibilities curves without trade in Figure 29-2 show how many vials of vaccine can be transformed into television sets in Korea and the United States. The production possibilities curve for the United States is steeper than that for Korea because an increase in production of one television set reduces vaccine production by two vials in the United States but by only one-half vial in Korea. The slope of the production possibilities curve is the opportunity cost; the opportunity cost of producing television sets in the United States is higher than it is in Korea.

**Production Possibilities Curves with Trade**  The dashed lines in the two graphs in Figure 29-2 show the different combinations of vaccine and television sets available in Korea and the United States when trade exists between the two countries at a relative price of one vial of vaccine for one television set. These dashed lines are labeled
"production possibilities curve with trade" to contrast them with the "production possibilities curve without trade" label on the solid line. The diagram shows that the production possibilities curves with trade are shifted out compared with the curves without trade.

To see how the production possibilities curve with trade is derived, consider how the United States could move from point A to point C in Figure 29-2. At point A, without trade, Americans produce and consume 15,000 television sets and 30,000 vials of vaccine by having 5,000 workers in each industry. Now suppose all U.S. workers move out of television set production into vaccine production, shifting U.S. production to zero television sets and 60,000 vials of vaccine, as shown by point B. Then by trading some of the vaccine, Americans can obtain television sets. As they trade more vaccine away, they move down the production possibilities curve with trade: one less vial of vaccine means one more television set along the curve. If they move to point C in the diagram, they have traded 30,000 vials of vaccine for 30,000 television sets. Americans now have 30,000 television sets and are left with 30,000 vials of vaccine. By producing more vaccine, the Americans get to purchase more television sets. The distance from point A (before trade) to point C (after trade) in Figure 29-2 is the gain from trade: 15,000 more television sets.

It would be possible, of course, to choose any other point on the production possibilities curve with trade. If Americans prefer more television sets and fewer vials of
Doing Politics and Economics

David Ricardo was a man of action. He went to work as a stockbroker at age 14 and eventually accumulated a vast fortune, including a beautiful country estate. He then became one of the most influential economists of all time. He also ran for and won a seat in the British Parliament from which to argue his economic position.

As an economist, Ricardo continued the tradition of Adam Smith. In fact, he became interested in economics after reading Smith’s *Wealth of Nations* during a vacation. But Ricardo greatly extended and improved on Smith’s theories and made them more precise. Along with Smith and Thomas Robert Malthus—who was Ricardo’s close friend but frequent intellectual opponent—Ricardo is considered by historians to be in the classical school, which argued for laissez-faire, free trade, and competitive markets in eighteenth- and nineteenth-century Britain.

Ricardo grappled with three of the most important policy issues in economics: inflation, taxes, and international trade. But Ricardo’s most famous contribution is to international trade—in particular, his theory of comparative advantage. Ricardo used this theory when he was in Parliament to argue for repeal of the restrictions on agricultural imports known as the corn laws.

Ricardo’s theory of comparative advantage is a good example of how he improved on the work of Adam Smith.

Smith used commonsense analogies to illustrate the gains from trade; one of his examples was “The tailor does not attempt to make his own shoes, but buys them from the shoemaker.” As with this tailor and shoemaker example, Smith focused on cases in which one person had an absolute advantage in one good and the other person had an absolute advantage in the other good. But Ricardo showed how gains could be achieved from trade even if one person was better at producing both goods. Here is how Ricardo put it way back in 1817:

Two men can both make shoes and hats, and one is superior to the other in both employments; but in making hats, he can only exceed his competitor by one-fifth or 20 per cent., and in making shoes he can excel him by one-third or 33 per cent.;—will it not be for the interest of both that the superior man should employ himself exclusively in making shoes, and the inferior man in making hats?

David Ricardo, 1772–1823

**Born:** London, 1772

**Education:** Never attended college

**Jobs:** Stockbroker, 1786–1815
Member of Parliament, 1819–1823

**Major Publications:** *The High Price of Bullion*, 1810; *On the Principles of Political Economy and Taxation*, 1817; *A Plan for a National Bank*, 1824

vaccine, they can move down along that dashed line, trading more of their vaccine for more television sets. In general, the production possibilities curve *with* trade is further out than the production possibilities curve *without* trade, indicating the gain from trade.

Observe that the slope of the production possibilities curve with trade is given by the relative price: the number of vials of vaccine that can be obtained for a television set.
When the relative price is one vial per television set, the slope is negative one because one less vial gives one more television set. If the relative price were one-half vial per television set, then the production possibilities curve with trade would be flatter.

The gains to Korea from trade are illustrated in the right-hand graph of Figure 29-2. For example, at point $D$, without trade, Koreans produce 20,000 television sets with 10,000 workers and, with the remaining 20,000 workers, produce 20,000 vials of vaccine. With trade, they shift all production into television sets, as at point $E$ on the right graph. Then they trade the television sets for vaccine. Such trade allows more consumption of vaccine in Korea. At point $F$ in the right diagram, the Koreans could consume 30,000 vials of vaccine and 30,000 television sets, which would be 10,000 more of each than before trade at point $D$. As in the case of the United States, the production possibilities curve shifts out with trade, and the size of the shift represents the gain from trade.

This example of Americans and Koreans consuming more than they were before trade illustrates the principle of comparative advantage: By specializing in producing products in which they have a comparative advantage, countries can increase the amount of goods available for consumption. Trade increases the amount of production in the world; it shifts out the production possibilities curves.

**Increasing Opportunity Costs: Incomplete Specialization** One of the special assumptions in the example we have used in Table 29-2 and Figure 29-2 to illustrate the theory of comparative advantage is that opportunity costs are constant rather than increasing. It is because of this assumption that the production possibilities curves without trade in Figure 29-2 are straight lines rather than the bowed-out lines that we studied in Chapter 1. With increasing opportunity costs, the curves would be bowed out.

The straight-line production possibilities curves are the reason for complete specialization, with Korea producing no vaccines and the United States producing no television sets. If opportunity costs were increasing, as in the more typical example of the production possibilities curve, then complete specialization would not occur. With increasing opportunity costs, as more and more workers are moved into the production of vaccine in the United States, the opportunity cost of producing more vaccine will rise. And as workers are moved out of vaccine production in Korea, the opportunity cost of vaccine production in Korea will fall. At some point, the U.S. opportunity cost of vaccine production may rise to equal Korea’s, at which point further specialization in vaccine production would cease in the United States. Thus, with increasing opportunity costs and bowed-out production possibilities curves, specialization most likely will be incomplete. But increasing opportunity cost does not change the principle of comparative advantage. By specializing to some degree in the goods for which they have a comparative advantage, countries can increase world production. Substantial gains are realized from trade, whether between Rose and Sam or between America and Korea.

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**REVIEW**

- Comparative advantage shows that a country can gain from trade even if it is more efficient at producing every product than another country. A country has a comparative advantage in a product if it is relatively more efficient at producing that product than the other country.
- The theory of comparative advantage predicts that gains from trade can be realized from increasing production of the good for which a country has a comparative advantage and from reducing production of the other good. By exporting the good for which it has a comparative advantage, a country can increase consumption of both goods.
- Comparative advantage is like a new technology in which the country effectively produces more by having some goods produced in another country.