During a stint as a volunteer teacher in rural Nepal, a young economic naturalist employed a cook named Birkhaman, who came from a remote Himalayan village in neighbouring Bhutan. Although Birkhaman had virtually no formal education, he was spectacularly resourceful. His primary duties, to prepare food and maintain the kitchen, he performed with competence and dispatch. But he also had many other skills. He could thatch a roof, butcher a goat, and repair shoes. An able tinsmith and a good carpenter, he could sew, fix a broken alarm clock, and plaster walls. On top of all that, he was a local authority on home remedies.

Birkhaman’s range of skills was broad even by Nepalese standards. But even the least skilled Nepalese villager can perform a wide range of services that most North Americans hire others to perform. The alternative to a system in which everyone is a jack of all trades is one in which people specialize in particular goods and services, and then satisfy their needs by trading among themselves. Economic systems based on specialization and the exchange of goods and services are generally far more productive than those with less specialization, and this is a large part of the reason why income per person in Nepal is less than 6 percent of that in Canada. Our task in this chapter is to investigate why exchange and specialization can increase economic output. In doing so we will explore why people choose to exchange goods and services in the first place, rather than having each person produce his own food, cars, clothing, shelter, and the like. We will focus first on trade between individuals and then discuss international trade.

A major focus of this chapter is what economists call comparative advantage. Roughly, a person has a comparative advantage at producing a particular good or service, let’s say haircuts, if that person is relatively more efficient at producing haircuts than at producing other goods or services. We will see that we can all consume more of every good and service if each of us specializes in the activities at which we have a comparative advantage.
This chapter will also introduce the production possibilities curve, which is a graphical method of describing the combinations of goods and services that an economy can produce. The development of this tool will allow us to see much more precisely how specialization enhances the productive capacity of even the simplest economy.

2.1 EXCHANGE AND OPPORTUNITY COST

The scarcity problem (see Chapter 1) reminds us that the opportunity cost of spending more time on any one activity is having less time available to spend on others. As the following example makes clear, this helps explain why everyone can do better by concentrating on those activities at which she performs best relative to others.

**Will Eddie Greenspan be better off if he writes his own will?**

Eddie Greenspan graduated from Osgoode Hall Law School in 1968 and was called to the bar in 1970. Today, he is one of Canada’s top criminal defence lawyers. Greenspan has defended against charges ranging from drunk driving to murder, and his client list includes notables such as Garth Drabinsky and Conrad Black. Passionate about criminal law, Greenspan says, “I defend only innocent people because until they’re convicted, everybody is presumed to be innocent,” and “If they say they’re innocent, they’re innocent.”1 If you ever find yourself to be the underdog charged with a felony and up against a tough crown prosecutor, you will rest a little easier if Eddie Greenspan is conducting your defence.

Although Greenspan spends virtually all of his working hours defending people accused of crimes, he also is competent to perform a much broader range of legal services. Suppose, for example, that he could prepare his own will in two hours, only half as long as it would take any other lawyer. Does that mean that Greenspan will be better off if he prepares his own will?

On the strength of his talent as a litigator, Greenspan probably earns several million dollars a year, which means that the opportunity cost of any time he spends preparing his will would be more than $1000 per hour. Lawyers who specialize in property law typically earn far less than that amount. Greenspan would have little difficulty engaging a competent property lawyer who could prepare his will for him for less than $800. So even though Greenspan’s considerable skills would enable him to perform this task more quickly than another lawyer, it would not be in his interest to prepare his own will.

In the preceding example, economists would say that Greenspan has an absolute advantage at preparing his will but a comparative advantage at trial work. He has an absolute advantage at preparing his will because he can perform that task in less time than a property lawyer could. Even so, the property lawyer has a comparative advantage at preparing wills because his opportunity cost of performing that task is lower than Greenspan’s.

The point of Example 2.1 is not that people whose time is valuable should never perform their own services. That example made the implicit assumption that Greenspan would have been equally happy to spend an hour preparing his will or preparing for a trial. If he was tired of trial preparation and felt it might be enjoyable to refresh his knowledge of property law, preparing his own will might

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then have made perfect sense! But unless he expected to gain special satisfaction from performing that task, he would almost certainly do better to hire a property lawyer. The property lawyer would also benefit, or else she would not have offered to prepare wills for the stated price.

THE PRINCIPLE OF COMPARATIVE ADVANTAGE

One of the most important insights of economics is that when two people (or two nations) have different opportunity costs of performing various tasks, they can increase the total value of available goods and services by trading with one another. The following simple example captures the logic behind this insight.

EXAMPLE 2.2

Will Rikke be better off if she updates her own Web page?

Consider the case of Rikke and Beth. Rikke can update a Web page in 20 minutes or repair a bicycle in 10 minutes. Beth can update a Web page in 30 minutes or repair a bicycle in 30 minutes. Table 2.1 summarizes the data: Rikke clearly possesses an absolute advantage over Beth in both activities.

<table>
<thead>
<tr>
<th></th>
<th>Time to update a Web page</th>
<th>Time to complete a bicycle repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rikke</td>
<td>20 minutes</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Beth</td>
<td>30 minutes</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>

Time used to update a Web page cannot be used to repair a bicycle, and vice versa. Thus each woman incurs an opportunity cost whenever she updates a Web page instead of repairing a bicycle. If Rikke spends 20 minutes updating a Web page, she sacrifices the opportunity to use the same 20 minutes for repairing two bicycles. The opportunity cost of each Web page that Rikke updates is therefore two bicycle repairs. If Beth were to use 30 minutes to update a Web page, she sacrifices the opportunity to use the same 30 minutes to repair a bicycle. The opportunity cost of each Web page that Beth updates is only one bicycle repair. Table 2.2 summarizes the data on the opportunity costs. The left-hand column shows that Beth’s opportunity cost of updating a Web page is half the amount of Rikke’s. Like the property lawyer who has a comparative advantage over the trial lawyer in writing wills, Beth has a comparative advantage over Rikke in updating Web pages.

<table>
<thead>
<tr>
<th></th>
<th>Opportunity cost of updating a Web page</th>
<th>Opportunity cost of a bicycle repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rikke</td>
<td>2 bicycle repairs</td>
<td>0.5 Web page update</td>
</tr>
<tr>
<td>Beth</td>
<td>1 bicycle repair</td>
<td>1 Web page update</td>
</tr>
</tbody>
</table>
The same reasoning will provide each woman’s opportunity cost of repairing bicycles. Since it takes Rikke 20 minutes to update a Web page and only 10 minutes to fix a bicycle, each bicycle repair she does prevents Rikke from updating one half of a Web page; that is, the opportunity cost of each bicycle that Rikke repairs is half a Web-page update. Similarly, the opportunity cost of each bicycle that Beth repairs is one Web-page update. For each woman, the opportunity cost of one bicycle repair is the reciprocal of her opportunity cost of updating a Web page. The right-hand column of Table 2.2 shows each woman’s opportunity cost of one bicycle repair. Notice that Rikke has a comparative advantage over Beth in bicycle repairs.

Suppose that the community where Rikke and Beth live wants 16 Web page updates per day. If neither person specializes, and Rikke spends one half of her eight-hour workday repairing bicycles and one half updating Web pages, she can update 12 Web pages and repair 24 bicycles. Suppose Beth provides four more updates by spending two hours on Web pages, for a total 16 updates per day between them. With her remaining six hours, Beth can repair 12 bicycles. Together, Rikke and Beth repair 36 bicycles per eight-hour day. These data are summarized in Part A of Table 2.3.

<table>
<thead>
<tr>
<th>TABLE 2.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Gains When Rikke and Beth Specialize</td>
</tr>
</tbody>
</table>

**Part A: Without Specialization**

<table>
<thead>
<tr>
<th>Time spent updating Web pages</th>
<th>Number of updated Web pages</th>
<th>Time spent repairing bicycles</th>
<th>Number of bicycles repaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rikke</td>
<td>4 hours</td>
<td>12</td>
<td>4 hours</td>
</tr>
<tr>
<td>Beth</td>
<td>2 hours</td>
<td>4</td>
<td>6 hours</td>
</tr>
<tr>
<td>Total output</td>
<td></td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

**Part B: With Specialization According to Comparative Advantage**

<table>
<thead>
<tr>
<th>Time spent updating Web pages</th>
<th>Number of updated Web pages</th>
<th>Time spent repairing bicycles</th>
<th>Number of bicycles repaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rikke</td>
<td>0 hours</td>
<td>0</td>
<td>8 hours</td>
</tr>
<tr>
<td>Beth</td>
<td>8 hours</td>
<td>16</td>
<td>0 hours</td>
</tr>
<tr>
<td>Total output</td>
<td></td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Net gain with specialization</td>
<td></td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

Suppose each woman had specialized according to comparative advantage. In eight hours Beth would update 16 Web pages and Rikke would repair 48 bicycles. Part B of Table 2.3 summarizes these data. With specialization, 12 more bicycles are repaired, and there is no reduction in the number of Web page updates. Specialization reduces the opportunity cost of the 16 Web page updates the community wants. Therefore, specialization creates 12 additional bicycle repairs!

Rikke is not better off if she updates her own Web page, even though she is a better programmer than Beth. Because she has a comparative advantage in repairing bicycles, Rikke will be better off if she specializes in repairing bicycles and hires Beth to update her Web page.
The details of Example 2.2 include the number of minutes each person needs to complete each task. However, the information necessary to compute the opportunity cost of one good in terms of another can be presented as each person’s productivity in each task. Productivity is units of output per hour divided by units of input per hour. Because the information can be presented in either of these two ways, one must pay careful attention to the form in which it is presented.

Exercise 2.1 below provides data on the labour productivity of Mina and Barb. Like Beth and Rikke of Example 2.2, both have skills as computer programmers and bicycle mechanics. Each woman’s labour is an input to a production process. Her labour productivity is her output per hour of labour time. Thus Barb’s productivity when she repairs bicycles is three repairs per hour. Barb also can update three Web pages per hour. Barb has a greater productivity in both tasks that gives her an absolute advantage over Mina in both tasks: greater productivity confers an absolute advantage. However, Barb has a comparative advantage in only one task because she has a lower opportunity cost than Mina does in only one task. A lower opportunity cost confers a comparative advantage. Work through Exercise 2.1 to see how to proceed when information is presented in this alternative format.

**EXERCISE 2.1**

Will Barb be better off if she updates her own Web page?

The following table shows the productivity rates for Barb and Mina in HTML programming and repairing bicycles. Does the fact that Barb can program faster than Mina imply that Barb will be better off if she updates her own Web page?

<table>
<thead>
<tr>
<th></th>
<th>Productivity in programming</th>
<th>Productivity in bicycle repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mina</td>
<td>2 Web page updates per hour</td>
<td>1 repair per hour</td>
</tr>
<tr>
<td>Barb</td>
<td>3 Web page updates per hour</td>
<td>3 repairs per hour</td>
</tr>
</tbody>
</table>

The principle illustrated by Examples 2.1 and 2.2 is so important that we state it formally as one of the core ideas of the course:

**The Principle of Comparative Advantage:** Total output is largest when each person (or each country) concentrates on the activities for which his or her opportunity cost is lowest.
Indeed, the gains made possible from specialization based on comparative advantage constitute the rationale for market exchange. They explain why each person does not devote 10 percent of his time to producing cars, 5 percent to growing food, 25 percent to building housing, 0.0001 percent to performing brain surgery, and so on. By concentrating on those tasks at which we are relatively most productive, together we can produce vastly more than if we all tried to be self-sufficient.

This insight brings us back to Birkhaman the cook. Though Birkhaman’s versatility was marvellous, he was not nearly as good a doctor as someone who has been trained in medical school nor as good a repairman as someone who spends each day fixing things. If several people with Birkhaman’s talents had joined together, each of them specializing in one or two tasks, together they would have enjoyed more and better goods and services than each could possibly have produced on his own. Although there is much to admire in the resourcefulness of people who have learned through necessity to rely on their own skills, that path is no route to economic prosperity.

**SOURCES OF COMPARATIVE ADVANTAGE**

At the individual level, comparative advantage often appears to be the result of inborn talent. For instance, some people seem to be naturally gifted at programming computers, while others seem to have a special knack for fixing bicycles. But nobody is born knowing how to fix bicycles. Actual ability, at a particular point in time, is always the result of innate ability plus education, training, and experience. To understand why some people, such as Eddie Greenspan, are so good at law while others are better at carpentry, we have to examine how those skills were developed. Similarly, comparative advantage at the national level may derive from differences in natural resources or from differences in society, culture, or institutions. Canada, which has one of the world’s highest per capita endowments of farm and forest land, has a comparative advantage in the production of agricultural and forestry products. Likewise, topography and climate explain why Canada produces so much wheat while New Zealand has so many sheep.

Seemingly noneconomic factors can also give rise to comparative advantage. For instance, the emergence of English as the de facto world language gives English-speaking countries a comparative advantage over non-English-speaking nations in the production of books, movies, and popular music. Technological change and governmental policies can also play a role.

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**ECONOMIC NATURALIST 2.1** How does comparative advantage arise and why might countries not take advantage of it?

In 1890, Canadian pulp and paper was a small, insignificant industry with very limited access to the American market. Forty years later, Canada was the world’s largest papermaker and exported much of its product to the United States. Today, pulp and paper remains one of Canada’s most important industries. How did Canada “create” a pulp and paper industry? How is this case relevant to today’s trade disputes?

In the mid-nineteenth century, paper was produced in costly, small-scale operations. Rags, grasses, and straw provided the raw material. Beginning in 1851, a series of technological advances allowed cellulose to be isolated from wood and used as the raw material for paper. The new processes operated on a much larger scale and required large amounts of electricity. The new technology gave Canada, with its vast forests and large potential to produce hydroelectricity, a comparative advantage in the manufacture of paper. However, it was not clear that Canada would be able to benefit from its comparative advantage.

By 1900, the United States could not satisfy its growing demand for newsprint. The United States protected its pulp and paper industry from Canadian competition with high tariffs on imported pulp and paper and by imposing no duties on raw, imported pulpwood. This enabled the American pulp and paper industry to obtain inexpensive pulpwood from Canada and then to manufacture it into pulp and paper that it sold in the United States.

Under Canadian federalism, the provinces have the right to manage their natural resources. In 1902, Ontario
placed an embargo on the export of pulpwood harvested from Crown lands. The embargo prevented pulpwood from being exported to the United States. No restrictions were imposed on the export of pulp and paper. The purpose was to encourage pulp and paper manufactured in Ontario to be exported to the United States. By 1915, all other provinces had taken similar measures.

The United States responded to pressure from its own pulp and paper industry by increasing its tariffs on Canadian pulp and paper. This made the Canadian product more expensive to Americans and might have defeated efforts to develop a Canadian industry by causing the Americans to buy pulp and paper elsewhere. But there was nowhere else to buy it. The higher tariffs simply caused American newspapers to pay more for Canadian newsprint. In 1913, the interests of the American newspaper industry prevailed over the interests of the American pulp and paper industry, and Congress removed the tariffs against Canadian pulp and newsprint. By 1929, Canada was producing more than twice as much newsprint as the United States and was the world’s largest papermaker.

Comparative advantage obviously facilitated the creation of a Canadian pulp and paper industry, but other factors played a role, too. American demand for Canadian newsprint was growing rapidly, and the American newspaper industry’s desire for access to inexpensive Canadian newsprint aligned with the interests of Canadian pulp and paper. Provincial governments undertook trade policies that capitalized on these factors. The United States removed its trade barriers to Canadian pulp and paper, and the Canadian industry flourished.2

For many years, Canada and the United States have engaged in a series of trade disputes over another forest product, softwood lumber. Maine and New Brunswick first disagreed about trade in softwood lumber during the 1820s, and disputes have flared periodically since then. The Softwood Lumber Agreement of 2006 ended the most recent dispute when it came into effect on October 12, 2006. Canada provides the United States with about 35 percent of its softwood lumber.

Restrictions on the importation of Canadian lumber serve the interests of the American lumber industry, but they can cost the American construction industry billions of dollars annually because they increase U.S. lumber prices.3 The interests of Canadian lumber and American construction converge in ways that can prove useful to Canadian negotiators. However, for 20 years prior to the new agreement, the political influence of U.S. lumber producers was sufficient to cause the U.S. to take repeated trade actions against Canadian softwood lumber. The dispute provides an example of a failure to take advantage of comparative advantage due to protectionism. Some people (in this case, U.S. lumber producers) lose from greater trade, even if the potential gains from greater trade (in this case, for the U.S. construction industry) are larger than the total losses. If the losers from greater trade are not compensated for their losses, they have a self-interested reason to propose restraints on trade, and sometimes can do so successfully. The Softwood Lumber Agreement of 2006 provides that after it has been in effect for 18 months either party may terminate it with six months’ notice. The dispute could flare again.4

**EXCHANGE AND OPPORTUNITY COST**

Gains from exchange are possible if trading partners have comparative advantages in producing different goods and services. An individual has a comparative advantage when his or her opportunity cost—measured in terms of other production opportunities foregone—is smaller than the corresponding opportunity costs of his or her trading partners. Maximum production is achieved if each person specializes by producing the good or service in which she has the lowest opportunity cost (the principle of comparative advantage). Comparative advantage makes specialization worthwhile even if one trading partner has an absolute advantage in every activity.

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Comparative advantage and specialization allow an economy to produce more than if each person tries to produce a little of everything. In this section we gain further insight into the advantages of specialization by first examining an imaginary economy with only one person and then noting how economic possibilities change as new people join the economy. Along the way, we will introduce a useful graph called the production possibilities curve, which can be used to describe the combinations of goods and services that a particular economy can produce.

**PRODUCTION POSSIBILITIES IN A ONE-PERSON ECONOMY**

We begin with a hypothetical economy consisting of a single worker who can produce two goods, sugar cane and Macadamia nuts. The worker lives on a small island, and “production” consists either of cutting sugar cane that grows on the island’s central valley floor or picking Macadamia nuts that grow on trees on the hillsides overlooking the valley. The more time the worker spends cutting sugar cane, the less time she has available for picking nuts. If she wants more sugar cane, then she must make do with a smaller amount of nuts. Knowing how productive she is at each activity, we can easily summarize the various combinations of sugar cane and nuts she can harvest each day if she makes full use of her available working time. This menu of possibilities is known as the production possibilities curve.

As the following example illustrates, constructing the production possibilities curve for a one-person economy is a straightforward matter.

**What is the production possibilities curve for an economy in which Susan is the only worker?**

Consider a society consisting only of Susan, who allocates her production time between sugar cane and nuts. Each hour per day she devotes to cutting sugar cane yields 1.5 kg of cane, and each hour she devotes to harvesting nuts yields 3 kg of nuts. If Susan works a total of eight hours per day, describe her production possibilities curve, the graph that displays, for each level of sugar cane she cuts, the maximum amount of nuts that Susan can pick.

The vertical axis in Figure 2.1 shows Susan’s daily production of sugar cane, and the horizontal axis shows her daily production of nuts. Let’s begin by looking at two extreme allocations of her time. First, suppose she employs her entire workday (eight hours per day) cutting sugar cane. In that case, since she can cut 1.5 kg of sugar cane per hour, she would pick \((8 \text{ hours/day})(1.5 \text{ kg/hour}) = 12 \text{ kg per day of sugar cane and 0 kg of nuts. That combination is represented by point A in Figure 2.1, the vertical intercept of Susan’s production possibilities curve.}\)

Now suppose, instead, that Susan devotes all her time to picking nuts. Since she can pick 3 kg of nuts per hour, her total daily production would be \((8 \text{ hours/day})(3 \text{ kg/hour}) = 24 \text{ kg of nuts. That combination is represented by point B in Figure 2.1, the horizontal intercept of Susan’s production possibilities curve.}\)

Because Susan’s production of each good is exactly proportional to the amount of time she devotes to that good, the remaining points along her production possibilities curve will lie on the straight line that joins A and B.

For example, suppose that Susan devotes six hours each day to cutting sugar cane and two hours to picking nuts. She will then produce \((6 \text{ hours/day})(1.5 \text{ kg/hour}) = 9 \text{ kg of sugar cane and (2 hours/day})(3 \text{ kg/hour}) = 6 \text{ kg of nuts per day.}\)
This is the point labelled C in Figure 2.1. Alternatively, if she devotes two hours to sugar cane and six hours to nuts, she will get
\[(2 \text{ hours/day})(1.5 \text{ kg/hour}) = 3 \text{ kg of sugar cane and (6 hours/day)(3 kg/hour)} = 18 \text{ kg of nuts per day. This alternative combination is represented by point D in Figure 2.1.}

Since Susan’s production possibilities curve (PPC) is a straight line, its slope is constant. The absolute value of the slope of Susan’s PPC is the ratio of its vertical intercept to its horizontal intercept: \((12 \text{ kg of sugar cane/day})/(24 \text{ kg of nuts/day}) = 1/2 \text{ kg of sugar cane/1 kg of nuts. (Be sure to keep track of the units of measure on each axis when computing this ratio.)} This ratio means that Susan’s opportunity cost of an additional kilogram of nuts is 1/2 kilogram of sugar cane.

Note that Susan’s opportunity cost of nuts can also be expressed as the following simple formula:

\[
OC_{\text{nuts}} = \frac{\text{loss in sugar cane}}{\text{gain in nuts}},
\]

where loss in sugar cane means the amount of sugar cane given up and gain in nuts means the corresponding increase in nuts. Likewise, Susan’s opportunity cost of sugar cane is expressed by this formula:

\[
OC_{\text{sugar cane}} = \frac{\text{loss in nuts}}{\text{gain in sugar cane}}.
\]

To say that Susan’s opportunity cost of an additional kilogram of nuts is 1/2 kg of sugar cane is equivalent to saying that her opportunity cost of 1 kg of sugar cane is 2 kg of nuts.

The production possibilities curve shown in Figure 2.1 illustrates the scarcity problem—the fact that, because our resources are limited, having more of one good or service generally means having to settle for less of another (see Chapter 1). Although we generally specify the “price” of a commodity in dollar terms, economists think of the concept of price in more general terms—what a person has to give up in order to get something. If Susan wants an additional kilogram of sugar cane she can have it, but only if she is willing to give up 2 kg of nuts. If Susan is the only person in the economy, her opportunity cost of producing a
good becomes, in effect, its price. Thus, the price she has to pay for an additional kilogram of sugar cane is 2 kg of nuts; or equivalently, the price she has to pay for an additional kilogram of nuts is 1/2 kg of sugar cane.

Any point that lies either on the production possibilities curve or to the left of it is said to be an attainable point, meaning that it can be produced with currently available resources. In Figure 2.2, for example, points A, B, C, D, and E are attainable points. Points that lie to the right of the production possibilities curve are said to be unattainable because they cannot be produced using currently available resources. In Figure 2.2, F is an unattainable point because Susan cannot produce 9 kg of sugar cane per day and 15 kg of nuts. Points that lie within the curve are said to be inefficient, because existing resources would allow for production of more of at least one good without sacrificing the production of any other good. At E, for example, Susan is producing only 3 kg of sugar cane per day and 6 kg of nuts, which means that she could increase her harvest of sugar cane by 6 kg per day without giving up any nuts (moving from E to C). Alternatively, Susan could pick as many as 12 additional kilograms of nuts each day without giving up any sugar cane (moving from E to D). An efficient point is one that lies on the production possibilities curve. At any such point, more of one good can be produced only by producing less of the other.

Why might Susan be at point E? Perhaps she has been using a glove, which slows her down—in economic terms, she is at point E because she is using an inefficient technique. By switching to an efficient technique, she gets more of both goods.

**FACTORS THAT INFLUENCE THE PRODUCTION POSSIBILITIES CURVE**

To see how the slope and position of the production possibilities curve depend on an individual’s productivity, let’s compare Susan’s PPC to that of a person who is less productive in both activities.
EXAMPLE 2.4

How do changes in productivity affect the opportunity cost of nuts?

Suppose Tom can harvest 0.75 kg of nuts for each hour he devotes to picking nuts and 0.75 kg of sugar cane for each hour he spends cutting sugar cane. If Tom is the only person in the economy, describe the economy’s production possibilities curve.

We can construct Tom’s PPC the same way we did Susan’s. Note first that if Tom devotes an entire workday (8 hours/day) to cutting sugar cane, he harvests $(8 \text{ hours/day})(0.75 \text{ kg/hour}) = 6 \text{ kg of sugar cane per day and 0 kg of nuts}$. Therefore, the vertical intercept of Tom’s PPC is $A$ in Figure 2.3. If instead he devotes all his time to picking nuts, he gets $(8 \text{ hours/day})(0.75 \text{ kg/hour}) = 6 \text{ kg of nuts per day and no sugar cane}$. That means the horizontal intercept of his PPC is $B$ in Figure 2.3. As before, because Tom’s production of each good is proportional to the amount of time he devotes to it, the remaining points on his PPC will lie along the straight line that joins these two extreme points.

How does Tom’s PPC compare with Susan’s? Note that because Tom is less productive than Susan at both activities, the horizontal and vertical intercepts of Tom’s PPC lie closer to the origin than do Susan’s (see Figure 2.4). For Tom, the opportunity cost of an additional kilogram of nuts is 1 kg of sugar cane, which is twice Susan’s opportunity cost of nuts. This difference in opportunity costs shows up as a difference in the slopes of their PPCs: the absolute value of the slope of Tom’s PPC is 1, whereas Susan’s is $1/2$. 

**FIGURE 2.3**

**Tom’s Production Possibilities Curve**
The less productive a person is, the closer to the origin is his PPC.

**FIGURE 2.4**

**Individual Production Possibilities Curves Compared**
Though Tom is less productive in both activities than Susan, Tom’s opportunity cost of cutting sugar cane is only half Susan’s.
But note, too, that while Tom is absolutely less efficient than Susan at harvesting sugar cane, his opportunity cost of sugar cane is only half Susan’s. Whereas Susan must give up 2 kg of nuts to pick an additional kilogram of sugar cane, Tom must give up only 1 kg. This difference in opportunity costs is another example of the concept of comparative advantage. Although Tom is absolutely less efficient than Susan at harvesting sugar cane, he is relatively more efficient. That is, Susan has an absolute advantage in both sugar cane and nuts, but Tom has a comparative advantage in sugar cane because, relative to Susan, he is even worse at picking nuts. Susan’s comparative advantage is in nuts.

Notice that the principle of comparative advantage is a relative concept—one that makes sense only when the relative productivities of two or more people (or countries) are being compared. To cement this idea, work through the following exercise.

**EXERCISE 2.2**

Suppose Susan can harvest 1.5 kg of sugar cane per hour or 3 kg of nuts per hour while Tom can pick 0.75 kg of sugar cane per hour and 2.25 kg of nuts per hour. What is Susan’s opportunity cost of picking a kilogram of nuts? What is Tom’s opportunity cost of picking a kilogram of nuts? Where does Susan’s comparative advantage now lie?

**PRODUCTION POSSIBILITIES IN A TWO-PERSON ECONOMY**

Why have we spent so much time defining comparative advantage? As the next examples illustrate, a comparative advantage arising from disparities in individual opportunity costs can create gains for everyone.

**How does the one-person economy’s PPC change when a second person is added?**

Suppose Susan can harvest 1.5 kg of sugar cane or 3 kg of nuts per hour and Tom can harvest 0.75 kg of sugar cane or 0.75 kg of nuts per hour. If Susan and Tom are the only two people in the economy and each works eight hours per day, describe the production possibilities curve for the economy as a whole.

To construct the PPC for a two-person economy, we use an approach similar to the one we used for a one-person economy. To find the vertical intercept of the PPC, we ask how much sugar cane they would have if both Susan and Tom worked full-time harvesting sugar cane. The answer is 18 kg per day (12 kg from Susan and 6 kg from Tom), so point A in Figure 2.5 is the vertical intercept of the PPC. Similarly, if Susan and Tom both worked full-time picking nuts, they would pick 30 kg of nuts per day (24 kg from Susan and 6 from Tom). Thus point B in Figure 2.5 is the horizontal intercept of the PPC.

In contrast to the PPC for the one-person economy, however, the PPC for the two-person economy is not a straight line joining the two extreme points. To see why, suppose Susan and Tom were initially devoting all their time to harvesting sugar cane when they decided they wanted some nuts. How would they launch the production of nuts? They would want Susan to pick nuts, because her opportunity cost of picking nuts is only half Tom’s. Thus, if Susan spent two hours picking nuts while Tom continued to devote all his time to sugar cane, they would lose 3 kg of sugar cane but gain 6 kg of nuts each day. Point C in Figure 2.5 represents this combination.
EXAMPLE 2.6

If Susan devotes all her time to picking nuts while Tom continues to spend all his time on sugar cane, they will be at point D in Figure 2.5, which represents 6 kg of sugar cane and 24 kg of nuts per day. If they want to expand nut production any further, Tom will have to take some of his time away from sugar cane. But in doing so, they gain only one additional kilogram of nuts for each kilogram of sugar cane they lose. Notice in Figure 2.5 how the slope of the PPC changes at point D. To the right of point D, the slope of the PPC reflects Tom’s opportunity cost of sugar cane rather than Susan’s.

EXERCISE 2.3

To the left of point D in Figure 2.5, what is the slope of the production possibilities curve, and what opportunity cost does this slope represent?

The PPC for the two-person economy bends outward (is concave to the origin) because of individual differences in opportunity costs. As the following example shows, this distinctive shape represents expanded opportunities for both Susan and Tom.

EXAMPLE 2.6

What is the best way to achieve a given production goal?

Tom and Susan want 12 kg of sugar cane per day and 12 kg of nuts. If their productive abilities are as described in Example 2.5, what is the most effective way of dividing their labour?

Though Tom has a comparative advantage in harvesting sugar cane, even if he spends all his time harvesting sugar cane, he can cut only \((8 \text{ hours/day})(0.75 \text{ kg/hour}) = 6 \text{ kg per day.}

So Susan will have to harvest the additional 6 kg of sugar cane to achieve their production target of 12 kg. Since Susan is capable of harvesting \((8 \text{ hours/day})(1.5 \text{ kg/hour}) = 12 \text{ kg of sugar cane per day, she will need only four hours per day to harvest 6 kg. She can spend the remaining four hours picking nuts, which is exactly the amount of time she needs to pick their production target of 12 kg. In terms of their two-person production possibilities curve, this allocation of labour puts Susan and Tom at point E in Figure 2.6.}
Example 2.6 illustrates the general principle that when more than one opportunity is available, we are best off if we exploit the best opportunity first.

**The Principle of Increasing Opportunity Cost:** In expanding the production of any good, first employ those resources with the lowest opportunity cost. Only when all of the lowest cost resources are employed does it make economic sense to use resources that have higher opportunity costs.

**HOW MUCH DOES SPECIALIZATION MATTER?**

In Example 2.6, Tom specialized completely in sugar cane, his area of comparative advantage (lowest opportunity cost). Susan did not specialize completely in picking nuts because if she had, the two would have harvested twice the nuts and half the sugar cane they wanted. Given what they wanted, Tom and Susan still did better through partial specialization than they could have if neither had specialized, as the following example demonstrates.

**How much does specialization expand opportunity?**

Suppose that in Example 2.6 Susan and Tom had divided their time so that each person’s output consisted of half nuts and half sugar cane. How much worse off would they have been?

Tom can harvest equal quantities of both goods by spending four hours per day on the production of each, which yields (4 hours/day)(0.75 kg/hour) = 3 kg of sugar cane and (4 hours/day)(0.75 kg/hour) = 3 kg of nuts. Since Susan can harvest twice as many kilograms of nuts in an hour as she can sugar cane, to get equal quantities of both goods she must devote twice as many hours to sugar cane as to nuts. Thus, she will need to spend two-thirds of a workday (5.33 hours/day) harvesting sugar cane and one-third of a workday (2.67 hours/day) picking nuts. Her output will be (5.33 hours/day)(1.5 kg/hour) = 8 kg of sugar cane per day and (2.67 hours/day)(3 kg/hour) = 8 kg of nuts. Their combined daily production will be only 11 kg of sugar cane and 11 kg of nuts—1 kg less of each good than when they specialized.
The gains from specialization that arise in Example 2.7 are relatively small. One extra kilogram of each of two goods is worth having, but it hardly seems sufficient to account for the dramatic differences in living standards between rich and poor nations. Average income in the 20 richest countries of the world in the year 2000, for example, was over $27,000 per person compared to only $211 per person in the 20 poorest countries.\(^5\) We will return to the role specialization plays in explaining these differences, but first we will construct a PPC for an entire economy. We also will consider factors that can cause a PPC to shift.

**A PRODUCTION POSSIBILITIES CURVE FOR A MANY-PERSON ECONOMY**

The process of constructing a production possibilities curve for an economy with millions of workers is really no different from the process for a one-person economy. Consider again an economy in which the only two goods are sugar cane and nuts, with sugar cane again on the vertical axis and nuts on the horizontal axis. The vertical intercept of the economy’s PPC is the total amount of sugar cane that could be picked if all available workers worked full-time picking sugar cane. Thus, the maximum attainable amount of sugar cane production is shown for the hypothetical economy in Figure 2.7 as 100,000 kg per day (an amount chosen arbitrarily, for illustrative purposes). The horizontal intercept of the PPC is the amount of nuts that could be gathered if all available workers worked full-time gathering nuts, shown for this same economy as 80,000 kg per day (also an amount chosen arbitrarily). Notice that unlike the earlier examples involving one or two workers, the PPC shown in Figure 2.7 is not composed of straight line. It is a smooth curve that is bowed out from the origin.

We will say more in a moment about the reasons for this shape. But first note that a bow-shaped PPC means that the opportunity cost of producing nuts increases as the economy produces more of them. Notice, for example, that when

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the economy moves from A, where it is producing only sugar cane, to B, it gets 20,000 kg of nuts per day by giving up only 5000 kg per day of sugar cane. When nut production is increased still further, however—for example, by moving from B to C—the economy again gives up 5000 kg per day of sugar cane, yet this time gets only 10,000 additional kilograms of nuts. This pattern of increasing opportunity cost persists over the entire length of the PPC. For example, note that in moving from D to E, the economy again gives up 5000 kg per day of sugar cane but now gains only 2000 kg of nuts per day. Note, finally, that the same pattern of increasing opportunity cost applies to sugar cane. Thus, as more sugar cane is produced, the opportunity cost of producing additional sugar cane, as measured by the amount of nuts that must be sacrificed, also rises.

Why is the PPC for the multiperson economy bow shaped? The answer lies in the fact that some resources are relatively well-suited for gathering nuts while others are relatively well-suited for cutting sugar cane. If the economy is initially producing only sugar cane and wants to begin producing some nuts, which workers will it reassign? Recall Susan and Tom, the two workers discussed in Example 2.5. Tom’s comparative advantage was cutting sugar cane and Susan’s comparative advantage was picking nuts. If both workers were currently cutting sugar cane and you wanted to reassign one of them to gather nuts instead, whom would you send? Susan would be the clear choice, because her departure would cost the economy only half as much sugar cane as Tom’s and would augment nut production by twice as much.

The principle is the same in any large multiperson economy, except that the range of differences in opportunity cost across workers is even greater than in the earlier two-worker example (Example 2.5). As we keep reassigning workers from cutting sugar cane to picking nuts, sooner or later we must withdraw even sugar specialists like Tom from cutting sugar cane. Indeed, we must eventually reassign others whose opportunity cost of producing nuts is far higher than his.

The shape of the production possibilities curve shown in Figure 2.7 illustrates the principle of increasing opportunity cost: when increasing the production of any good, first employ those resources with the lowest opportunity cost. This strategy will provide increased amounts of one good at the smallest possible sacrifice of other goods. In the context of our examples, using the principle of increasing opportunity cost allows each additional kilogram of nuts to be obtained with the smallest possible sacrifice of sugar cane, and vice versa.

The PPC of Figure 2.7 is a smooth curve, bowed outward from the origin, which is a contrast with the PPCs of Figures 2.5 and 2.6 which are made up of two straight lines. Each of the two straight lines has a different slope, and the slope of each line represents a set of opportunity costs associated with one worker. Consider, for example, Figure 2.5. Susan’s opportunity cost of nuts is lower than Tom’s and is represented by the slope of the longer line segment. Tom’s opportunity cost of nuts is represented by the slope of the shorter line segment. Because Susan’s opportunity cost of nuts is lower than Tom’s, the slope of her section of the PPC is shallower than Tom’s. Figure 2.7 is intended to represent an economy with many, perhaps millions, of workers. With many workers, individual segments of the PPC are indistinguishable. Therefore, the PPC in Figure 2.7 is a smooth curve.

**RECAP**

For an economy that produces two goods, the production possibilities curve describes the maximum amount of one good that can be produced for every possible level of production of the other good. Attainable points are those
CHAPTER 2  COMPARATIVE ADVANTAGE: THE BASIS FOR EXCHANGE

2.3 FACTORS THAT SHIFT THE ECONOMY’S PRODUCTION POSSIBILITIES CURVE

As its name implies, the production possibilities curve provides a summary of the production options open to any society. At any given moment, the PPC confronts society with a trade-off. The only way people can produce and consume more nuts is to produce and consume less sugar cane. In the long run, however, it is often possible to increase production of all goods. This is what is meant when people speak of economic growth. As shown in Figure 2.8, economic growth is an outward shift in the economy’s production possibilities curve. Economic growth maintained over long periods of time can greatly enhance standards of living. But this takes us back to the question we posed earlier: How do we account for the differences in living standards experienced by the world’s richest and poorest nations? Economic growth can result from increases in the amount of productive resources available or from improvements in knowledge or technology that can make these resources more productive.

What causes the quantity of productive resources to grow in an economy? One factor is investment in new factories and equipment embodying new and more productive technology. When workers have more and better equipment to work with, their productivity increases, often dramatically. This is surely an important factor behind the differences in living standards between rich and poor countries. According to one study, for example, the value of capital investment
per worker in the United States is about $16,200, while in Nepal the corresponding figure is less than $550.6

Such large differences in capital per worker do not occur all at once. They are a consequence of decades, even centuries, of differences in rates of saving and investment. Over time, even small differences in rates of investment can translate into extremely large differences in the amount of capital equipment available to each worker. Differences of this sort are often self-reinforcing: not only do higher rates of saving and investment cause income to grow, but the resulting higher income levels also make it easier to devote additional resources to savings and investment. Over time, then, even small initial productivity advantages from specialization can translate into very large income gaps.

Population growth also causes an economy’s PPC curve to shift outward and thus is often listed as one of the sources of economic growth. But because population growth also generates more mouths to feed, it cannot by itself raise a country’s standard of living. Indeed it may even cause a decline in the standard of living if existing population densities have already begun to put pressure on available land, water, and other scarce resources.

Perhaps the most important sources of economic growth are improvements in knowledge and technology. As economists have long recognized, such improvements often lead to higher output through increased specialization. Improvements in technology often occur spontaneously, but more frequently they are directly or indirectly the result of increases in education. They can be stimulated by opportunities in international trade.

We have shown that when individual differences in opportunity cost are present, specialization with trade will increase the quantities of the goods being produced. Our examples have been based on two individuals who produce and exchange only two goods. Real-world gains from specialization and trade often are far more spectacular than illustrated in the earlier examples. One reason is that specialization not only capitalizes on existing differences in individual skills but also deepens those skills through practice and experience. Moreover, it eliminates many of the switching and start-up costs people incur when they move back and forth among numerous tasks. These gains apply not only to people but also to the tools and equipment they use. Breaking a task down into simple steps, each of which can be performed by a different machine, greatly multiplies the productivity of individual workers.

Even in simple settings, these factors can combine to increase productivity many times over. Adam Smith, the Scottish philosopher who is remembered today as the founder of modern economics, was the first to recognize the enormousness of the gains made possible by the division and specialization of labour. Consider, for instance, his description of work in an eighteenth-century Scottish pin factory:

One man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations . . . I have seen a small manufactory of this kind where only ten men were employed . . . [who] could, when they exerted themselves, make among them about twelve pounds of pins in a day. There are in a pound upwards of four thousand pins of middling size. Those ten persons, therefore, could make among them upwards of forty-eight thousand pins in a day. Each person, therefore, making a tenth part of forty-eight thousand pins, might be considered as making four thousand eight hundred pins.

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in a day. But if they had all wrought separately and independently, and without any of them having been educated to this peculiar business, they certainly could not each of them have made twenty, perhaps not one pin in a day.  

The gains in productivity that result from specialization are indeed often prodigious. Specialization of labour enables two sorts of efficiency gains: the gain in absolute efficiency that comes from repetition (e.g., not having to switch tasks means not losing the time it takes to switch tools) and the gains from trade due to the relative efficiency of each worker specializing in the task in which they have a comparative advantage. Over time, these efficiency gains reinforce each other as experience deepens the specialized skills of each worker.

WHY HAVE SOME COUNTRIES BEEN SLOW TO SPECIALIZE?

You may be asking yourself, “If specialization is such a great thing, why don’t people in poor countries like Nepal just specialize?” If so, you are in good company. Adam Smith spent many years attempting to answer precisely the same question. He summarized his explanation by writing, “The division [i.e., specialization] of labour is limited by the extent of the market.” In a very small market, said Smith, no one has reason to dedicate himself entirely to one occupation because a small market provides very limited opportunities to engage in trade. Smith, ever the economic naturalist, observed that work tended to be far more specialized in the large cities of England in the eighteenth century than in the rural highlands of Scotland:

In the lone houses and very small villages which are scattered about in so desert a country as the Highlands of Scotland, every farmer must be butcher, baker and brewer for his own family. . . . A country carpenter . . . is not only a carpenter, but a joiner, a cabinet maker, and even a carver in wood, as well as a wheelwright, a ploughwright, a cart and waggon maker.

In contrast, each of these same tasks was performed by a different specialist in the large English and Scottish cities of Smith’s day. Scottish highlanders also would have specialized had they been able to, but the markets in which they participated were simply too small and fragmented. Smith went on to argue that economic growth would be most rapid in locations that provided easy access to ocean transportation. He also declared that the discovery of the New World and passage around the Cape of Good Hope to the east to be “the two greatest and most important events recorded in the history of mankind.”

What were Smith’s reasons for these statements? First, ocean transportation made the whole world accessible. Second, discovery of the New World and passage around the Cape of Good Hope made the worldwide market much larger. The small, inland villages of Scotland’s Highands were isolated from each other and from ocean transportation because overland transportation was limited to what could be provided by draft animals on very poor roads. Because the villages were isolated from all but tiny local markets, they provided extremely limited opportunities for specialization. Without specialization, the standard of living in these villages would remain where it had been for centuries.

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8 Ibid. Chapter III, pp. 17–21. The quotation is from the title of this chapter.
9 Ibid.
Nepal is one of the most remote and isolated countries on the planet. Specialization is further limited by Nepal’s rugged terrain. Exchanges of goods and services with residents of other villages can be difficult because in many cases the nearest village can be reached only after trekking hours, or even days, over treacherous Himalayan trails. Modern systems of communication and transportation have had only a limited effect in reducing this isolation. Thus the isolation of Nepal’s villages is similar to the isolation of the eighteenth-century villages of Scotland’s Highlands. Moreover, even though modern technology might be reducing Nepal’s isolation, the process is starting in Nepal more than two centuries later than it began in the Scottish Highlands.

China and India, the world’s two largest nations, provide vivid examples of how international trade and economic growth are intertwined. Since the early 1990s, both countries have experienced remarkable economic growth, and at the same time both have developed industries that send their products to markets throughout the world. A shopper who reads the labels on products sold in any retail outlet in Canada or any other country will discover that a huge variety of goods come from these two countries.

Specialization and investment are also intertwined. Without access to large markets there is little reason to invest in the specialization and productive capacity that is necessary to serve large markets. Without the capacity to serve large markets, one cannot compete in them.

**HOW DOES SPECIALIZATION ENHANCE STANDARDS OF LIVING?**

Specialization enhances standards of living in two ways. First, when productive activity is organized according to comparative advantage, the opportunity cost of a given amount of output is reduced, which implies that the amount of goods and services a society can obtain from its resources is increased. The greater the differences are in opportunity costs, the greater the gains are that comparative advantage and trade make available.

Second, specialization deepens existing skills through practice and experience, and it eliminates the switching and start-up costs incurred when people have to move back and forth among numerous tasks. These gains apply both to people and the tools or equipment they use. Specialization depends on investment in machinery and education, because highly skilled workers often need specialized equipment and education to carry out their tasks. Because only large markets can absorb the quantities of goods and services these workers can produce, specialization depends on access to such markets. Conversely, isolation, through its reduced access to large markets, greatly reduces specialization possibilities.

**CAN WE HAVE TOO MUCH SPECIALIZATION?**

As in any issue in economics, however, we should think about both costs and benefits if we want to analyze specialization. The mere fact that specialization boosts productivity does not mean that more specialization is always better than less, for specialization also entails costs. For example, most people appear to enjoy variety in the work they do, but variety tends to be one of the first casualties as workplace tasks become ever more narrowly specialized.

Indeed, Karl Marx argued forcefully that the fragmentation of workplace tasks often exacts a heavy psychological toll on workers. Thus, he wrote, “[A]ll means for the development of production . . . mutilate the laborer into a fragment of a man, degrade him to the level of an appendage of a machine, destroy every remnant of charm in his work and turn it into hated toil.”

Charlie Chaplin’s 1936 film, *Modern Times*, paints a vivid portrait of the psychological costs of repetitive factory work. As an assembly worker, Chaplin’s only task, all day every day, is to tighten the nuts on two bolts as they pass before him on the assembly line. Finally he snaps and walks zombie-like from the factory, wrenches in hand, tightening every nut-like protuberance he encounters.

*Modern Times* was filmed nearly seventy years ago, and since then industrial engineers have realized that good job design involves finding the right balance between the benefits and costs of specialization. The engineers and programmers who design and produce industrial robots that now do much of the work described by Chaplin’s *Modern Times* are highly specialized but they perform a variety of tasks. If you ever need brain surgery, you will be comforted if you know that, before the surgeon opens your skull, he has already exposed and successfully treated a thousand other brains. Many people make interesting and challenging careers out of highly specialized work. Besides, failure to specialize imposes its own substantial costs.

We can expect to meet life’s financial obligations in the shortest time, thereby freeing up more time to do whatever else we want, if we concentrate at least a significant proportion of our efforts on those tasks that we have a comparative advantage in.

**SPECIALIZATION, EXCHANGE, AND THE CIRCULAR FLOW OF INCOME AND EXPENDITURE**

Specialization and exchange go together. If your professor spends most of her time teaching, she must depend on someone else to grow her food. An accountant will usually depend on someone else to make his clothes, and so on. In rich nations, because we all are highly specialized in our work, we all depend on the cooperation of many other individuals in obtaining the things we need and desire. Most of us do this by selling our labour in return for wages or salaries that we receive as money and which we can then spend to obtain the goods and services we want.

Figure 2.9 represents a very simple economy that has no government and does not engage in foreign trade. Labour is the only input used in this economy to produce goods and services. Simple though it is, Figure 2.9 is sufficient to represent the circular flow of expenditure and exchange. Households, composed of individuals, sell labour services to firms. Firms use the labour they hire to produce goods and services that they sell to households. The blue arrows in the upper half of Figure 2.9 indicate the flow of labour through the labour market to firms.
The blue arrows in the lower half indicate the flow of goods and services from firms through markets for goods and services to households. Thus, the blue inner arrows indicate a flow of real (or physical) units.

Firms pay wages and salaries to households for their labour. As indicated by the red arrows in the upper half of Figure 2.9, wages and salaries are expenditures that flow from firms through the labour market to households, where they are received as income. Red arrows in the lower half show payments flowing from households through markets for goods and services to firms. The expenditures of households are the income of firms. The red outer arrows represent monetary flows in the economy. In general, one party’s expenditure is another’s income.

Figure 2.9 becomes much more complicated in appearance if we make it more realistic and add boxes to represent capital markets, government, and foreign trade, and arrows to represent the flows of expenditure on, and goods received from, each. However, a simple principle remains—every transaction has both a buyer and a seller, so one person’s sale is another person’s purchase.

In general, every transaction can be seen from either person’s point of view—either as a sale, or as a purchase. A seller will agree to a voluntary transaction only if she thinks the transaction will make her better off. The buyer also must think the transaction will make him better off. Thus, a voluntary transaction must improve the expected well-being of both parties. Comparative advantage and the gains from voluntary exchange underlie the ability of modern market economies to improve human well-being.

**FACTORS THAT SHIFT THE ECONOMY’S PRODUCTION POSSIBILITIES CURVE**

Economic growth can be represented by an outward shift of the production possibilities curve. It can arise from an increase in the amount of productive resources available to an economy, from improvements in knowledge and technology, and from investment in capital equipment. Small differences in investment sustained by different countries over long periods of time can
result in large differences in capital equipment, which contributes to large differences in material standards of living.

Specialization, investment, economic growth, and the size of markets are intertwined. While specialization enhances productivity of labour and capital equipment, it can also mean that each person becomes more dependent on fellow human beings for the goods and services that he needs or wants. Specialization also depends on access to large markets because only large markets can absorb the goods and services produced by highly specialized workers.

### 2.4 COMPARATIVE ADVANTAGE AND INTERNATIONAL TRADE

The same logic that leads the individuals in an economy to specialize and exchange goods with one another also leads nations to specialize and trade among themselves. As with individuals, each trading partner can benefit from exchange, even though one may be more productive than the other in absolute terms.

**EXAMPLE 2.8**

**Can a poor nation prosper by trading?**

Susan and Tom are the only two workers in Islandia, a small island nation, and their production possibilities curve is as shown in Figure 2.10. For simplicity, we will assume that each of them can produce 100 kg of nuts or 100 kg of sugar cane per hour. How does the opportunity to trade affect consumption opportunities in Islandia?

**FIGURE 2.10**

*Production Possibilities Curve for Islandia*

Millions of workers live in the rest of the world where the opportunity cost of a kilogram of sugar cane is 1 kg of nuts. The market price of 1 kg of sugar cane will therefore be 1 kg of nuts. (If someone tried to charge, say, 1.5 kg of nuts for a kilogram of sugar cane, consumers could simply reduce their own nut harvest by a kilogram and harvest an extra kilogram of sugar cane instead.) Because Islandia is tiny relative to the rest of the world, 1 kg of sugar cane will exchange for exactly 1 kg of nuts in a market consisting of Islandia and the rest of the world. The opportunity to trade with Islandia therefore has no perceptible impact on the rest of the world.

But it has a profound impact on Susan and Tom. Suppose they were initially at point $E$ on their PPC (Figure 2.10). Without the opportunity to trade, they would have to give up 7 kg of nuts to increase sugar cane by 1 kg. But with the opportunity to trade, they can purchase 1 kg of sugar cane in exchange for only
1 kg of nuts. If Islandians started at $E$ and sold their entire 56 kg of nuts in the world market, they could buy an additional 56 kg of sugar cane, for a total of $56 + 56 = 112$ kg of sugar cane and $56 - 56 = 0$ kg of nuts. So point $A$ in Figure 2.11 represents their maximum possible daily consumption of sugar cane once they can engage in trade.

Similarly, if they were initially at point $E$ on their PPC and lacked the opportunity to trade, they would have to sacrifice 7 kg of sugar cane to obtain an additional kilogram of nuts. But if they could trade, they could get an extra kilogram of nuts at a cost of just 1 kg of sugar cane. If Islandians started at $E$ and sold their entire 56 kg of sugar cane to the rest of the world, they could buy an additional 56 kilograms of nuts, for a total of $56 + 56 = 112$ kg of nuts and $56 - 56 = 0$ kg of sugar cane. So point $A$ in Figure 2.11 represents the maximum possible sugar cane consumption, and point $B$ represents their maximum possible nut consumption once they can engage in trade.

**FIGURE 2.11**
How Trade Expands Islandia’s Menu of Possibilities
The opportunity to trade with the rest of the world greatly expands the consumption opportunities of a smaller nation.

$A$ and $B$ represent the two extreme points on Islandia’s new menu of possibilities. By trading lesser quantities of sugar cane or nuts, it is also possible for Islandians to achieve any point along the straight line joining $A$ and $B$. For example, if Islandians started at point $E$ and sold 40 kg of nuts, they could buy an additional 40 kg of sugar cane, which would move them to point $D$, which has $56 + 40 = 96$ kg of sugar cane and $56 - 40 = 16$ kg of nuts. The opportunity to trade thus transforms Islandia’s menu of possibilities from the PPC shown in Figure 2.10 to the one labelled $AB$ in Figure 2.11. Trade gives Islandia the ability to consume outside its own production possibilities curve.

**Exercise 2.4**
Refer to Example 2.8. What would Islandia’s new menu of possibilities look like if each citizen in the rest of the world could harvest 100 kg of sugar cane per day, as before, but only 50 kg of nuts?

How much does trade benefit the citizens of Islandia? The answer depends on which particular combination of sugar cane and nuts Islandians most prefer. Suppose, for example, that they most prefer the combination at point $E$ in Figure 2.12 on the next page: 56 kg of sugar cane per day and 56 kg of nuts. The opportunity to trade would then be of no benefit to them, since that combination was available to them before trade became possible (see Figure 2.10).

But suppose that in the absence of trade, Islandians would have chosen to harvest and consume only 28 kg of sugar cane and 60 kg of nuts per day (point $D$
in Figure 2.12). The opportunity to trade would then be very valuable indeed, for it would enable the Islandians almost to double their consumption of sugar cane without reducing their nut consumption (moving from $D$ to $G$ in Figure 2.12).

Or they could increase their nut consumption from 60 to 84 kg per day without giving up any sugar cane (moving from $D$ to $F$ in Figure 2.12). The gains from trade would also be valuable if the Islandians had initially chosen to produce at a point at which the opportunity cost of a kilogram of nuts was less than 1 kg of sugar cane—say, point $C$ in Figure 2.12. In fact, Islandia can obtain any combination on the straight line $AB$ by producing at $E$ and then trading with the rest of the world.

The patterns displayed in this example are at least roughly indicative of actual patterns of international trade. The volume of trade has grown substantially over time and, with some important exceptions, no single nation produces more than a small fraction of the total supply of any good or service. Thus the price at which one good exchanges for another on the world market is not much influenced by how much of a good a nation itself produces. The greater the difference between domestic opportunity costs and world opportunity costs, the more a nation benefits from the opportunity to trade with other nations.

**CAN EXCLUSION FROM TRADE HURT A SMALL, POOR NATION?**

The importance of trade and comparative advantage to a smaller trading partner may influence the foreign policy of the larger nation. For example, in 1959, the revolution led by Fidel Castro overthrew the government of Cuban dictator Fulgencio Batista. In 1960, while moving into the Soviet orbit, Castro expropriated all American business interests in Cuba. The United States responded early in 1961 by breaking diplomatic relations and ceasing all its trade with Cuba. Since then, the United States has not traded with Cuba, thereby maintaining economic pressure on Castro’s communist government. (Sugar is Cuba’s most important export.) Loss of trade with Cuba is of little consequence to the United States.

**EXERCISE 2.5**

Suppose that Figure 2.11 represents Islandia’s circumstances of trade with a superpower. After Islandia and the superpower have been trading for many years, a dispute between them causes trade to cease. Will this cause hardship for Islandia? How?
IF INTERNATIONAL TRADE IS BENEFICIAL, WHY ARE FREE-TRADE AGREEMENTS SO CONTROVERSIAL?

The North American Free Trade Agreement (NAFTA) is a treaty that greatly reduces trade barriers between Canada, the United States, and Mexico. NAFTA is a contentious political issue, and discussions among world leaders about global trading arrangements are just as contentious. If international specialization and trade are so beneficial, why would anyone oppose them?

It is possible to accept the logic of comparative advantage and oppose freer trade on other grounds. Although international trade can increase the total value of goods and services produced, it does not guarantee that everyone will participate in those benefits. Some opponents of NAFTA feared that it would help Mexico exploit its comparative advantage in the production of goods made with unskilled labour. Others thought Mexican farmers could grow produce more cheaply than farmers to the north, thus putting pressure on American and Canadian farmers. Some also feared that Mexico would not honour Canadian and U.S. labour standards and environmental policies. Consumers would benefit, but unskilled workers in Canada and the United States would confront the possibility of lower wages or unemployment, and global pollution might be aggravated. Also, both Canada and Mexico would be trading with a superpower. This raised concerns that the U.S. would use trade as an instrument of foreign policy, thereby reducing the sovereignty of its smaller partners. The issue of sovereignty may be closely linked to the distribution of trade benefits. If foreigners own a large part of the small country’s industry, much of the benefit of trade might flow to foreigners, not to the domestic population.

Opponents of trade agreements also fear that the agreements will lock existing patterns of comparative advantage into place, making it difficult to develop new, more desirable patterns. Recall the case of Canadian pulp and paper. The American pulp and paper industry would have preferred that Canada use its comparative advantage to supply pulpwood as raw material to the American industry. This would have been an obstacle to the development of a Canadian pulp and paper industry. Canadian provincial governments opted instead to use barriers to trade to support the development of a Canadian industry.

International trade provides access to worldwide markets and greatly increases the degree to which each of us relies on human beings living almost anywhere to provide goods and services. As an example, you might consider how many countries were involved in providing the food you will eat and the clothing you will wear in the next 24 hours. At the same time, international trade raises questions of how its benefits will be distributed among the citizens of the world, how those benefits will be used, how international trade will affect a nation’s domestic policies, and so on. Chapter 15 examines international trade in much more detail.

COMPARATIVE ADVANTAGE AND INTERNATIONAL TRADE

Nations, like individuals, can benefit from exchange, even though one trading partner may be more productive than the other in absolute terms. The greater the difference between domestic opportunity costs and world opportunity costs, the more a nation can potentially benefit from exchange with other nations. But expansions of exchange do not guarantee that each individual citizen will do better. Unskilled workers in high-wage countries may be hurt in the short run by the reduction of barriers to trade with low-wage nations. International trade may also raise issues about the distribution of benefits between trading partners, national sovereignty, and the extent to which an existing pattern of comparative advantage might change over time.
2.1 One person has an **absolute** advantage over another in the production of a good if she can produce more of that good than the other person. One person has a **comparative** advantage over another in the production of a good if she is relatively more efficient than the other person at producing that good, meaning that her opportunity cost of producing it is lower than her counterpart’s. Specialization based on comparative advantage is the basis for economic exchange. When each person specializes in the task at which she is relatively most efficient, the economic pie is maximized, making possible the largest slice for everyone.

2.1 At the individual level, comparative advantage may spring from differences in talent or ability or from differences in education, training, and experience. At the national level, sources of comparative advantage include these innate and learned differences, as well as differences in language, culture, institutions, climate, natural resources, and a host of other factors.

2.2 The production possibilities curve is a simple device for summarizing the possible combinations of output that a society can produce if it employs its resources efficiently. In a simple economy that produces only sugar cane and nuts, the PPC shows the maximum quantity of sugar cane production (vertical axis) possible at each level of nut production (horizontal axis). The slope of the PPC at any point represents the opportunity cost of nuts at that point, expressed in kilograms of sugar cane.

2.2 All production possibilities curves slope downward because of the scarcity problem, which implies that the only way to obtain more of one good is to accept less of another. In a nut/sugar cane economy whose workers have different opportunity costs of picking nuts, the slope of the PPC becomes steeper with increasing production of nuts and movement down the curve. This change in slope illustrates the principle of increasing opportunity cost, which states that in expanding the production of any good, a society minimizes its opportunity cost by first employing those resources that are relatively efficient at producing that good. Only when all of the lowest cost resources are employed does it make economic sense to use resources that have higher opportunity costs.

2.2 The same logic that prompts individuals to specialize in their production and to exchange goods with one another also leads nations to specialize and trade with one another. On both levels, each trading partner can benefit from an exchange, even though one may have an absolute advantage for each good. For both individuals and nations, the benefits of exchange tend to be larger the larger the differences are between the trading partners’ opportunity costs.

2.3 Though international trade can raise the total value of goods and services produced, it also raises questions: How will the benefits of those goods and services be distributed among trading partners? Will national sovereignty be compromised? Will trade agreements entrench patterns of comparative advantage or will they encourage change in comparative advantage over time?

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**SUMMARY**

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**CORE**

The Principle of Comparative Advantage

Total output is largest when each person (or each country) concentrates on the activities for which his or her opportunity cost is lowest.

The Principle of Increasing Opportunity Cost

In expanding the production of any good, first employ those resources with the lowest opportunity cost. Only when all of the lowest cost resources have been employed does it make economic sense to use resources that have higher opportunity costs.

**KEY TERMS**

- absolute advantage (33)
- attainable point (41)
- comparative advantage (33)
- efficient point (41)
- inefficient point (41)
- production possibilities curve (39)
- productivity (36)
- unattainable point (41)
REVIEW QUESTIONS

1. Explain what “having a comparative advantage” at producing a particular good or service means. What does “having an absolute advantage” at producing a good or service mean?

2. How will a reduction in the number of hours worked each day affect an economy’s production possibilities curve?

3. How will technological innovations that boost labour productivity affect an economy’s production possibilities curve?

4. Why does saying that people are poor because they do not specialize make more sense than saying that people perform their own services because they are poor?

5. What factors helped Canada to establish a pulp and paper industry?

6. What factors help Canada to be an exporter of grain?

7. What factors make it more difficult for Quebec to produce and sell movies, books, and popular music, compared to English-speaking Canada?

PROBLEMS

1. Consider a society whose only worker is Helen, who allocates her production time between cutting hair and baking bread. Each hour per day she devotes to cutting hair yields 4 haircuts, and each hour she devotes to baking bread yields 8 loaves of bread. If Helen works a total of 8 hours per day, graph her production possibilities curve.

2. Refer to Problem 1. Which of the points listed below is efficient? Which is attainable?
   a. 28 haircuts/day, 16 loaves/day
   b. 16 haircuts/day, 32 loaves/day
   c. 18 haircuts/day, 24 loaves/day

3. Determine whether the following statements are true or false, and briefly explain why.
   a. Toby can produce 5 L of apple cider or 70 g of feta cheese per hour. Kyle can produce 3 L of apple cider or 42 g of feta cheese per hour. Therefore, Toby and Kyle cannot benefit from specialization and trade.
   b. A doctor who can vacuum her office faster and more thoroughly than commercial cleaners is better off if she cleans her office herself.
   c. In an economy in which millions of workers each have different opportunity costs of producing two goods, the principle of comparative advantage implies that the slope of the production possibilities curve decreases in absolute value as more of the good on the horizontal axis is produced.

4. Nancy and Bill are auto mechanics. Nancy takes 4 hours to replace a clutch and 2 hours to replace a set of brakes. Bill takes 6 hours to replace a clutch and 2 hours to replace a set of brakes. If Bill and Nancy open a motor repair shop
   a. if Nancy works only on clutches, and Bill works only on brakes, both will be better off.
   b. Bill has a comparative advantage at replacing brakes.
   c. Nancy has an absolute advantage at replacing clutches.
   d. Nancy has a comparative advantage at replacing clutches.
   e. all but one of the above statements are correct.

5. Bob and Stella are a married couple. Bob takes 10 minutes to change a lightbulb and 2 minutes to fix a broken fuse. Stella takes 3 minutes to change a lightbulb and 30 seconds to fix a broken fuse. Which of the following statements is true?
   a. Stella has a comparative advantage at fixing fuses, because she can do it faster than Bob.
   b. Stella has a comparative advantage at changing lightbulbs and fixing fuses, because she can do both of them faster than Bob.
   c. Stella has an absolute advantage at changing lightbulbs and fixing fuses, because she can do both of them faster than Bob.
   d. Bob has a comparative advantage at fixing fuses, because Stella has a comparative advantage at changing lightbulbs.
   e. Stella has a comparative advantage at changing lightbulbs.

6. Kamal and Filipe are stranded together on a desert island. The raw materials on the island are suitable only for making beer and pizza, but their quantities are unlimited. What is scarce is labour. Filipe and Kamal each spend 10 hours a day making beer or pizza. The following table specifies how much beer and pizza Filipe and Kamal can produce per hour.

<table>
<thead>
<tr>
<th></th>
<th>Beer</th>
<th>Pizza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filipe</td>
<td>1 bottle per hour</td>
<td>0.2 pizzas per hour</td>
</tr>
<tr>
<td>Kamal</td>
<td>1.5 bottles per hour</td>
<td>0.5 pizzas per hour</td>
</tr>
</tbody>
</table>
a. Draw the daily production possibilities curves (PPCs) for Filipe and Kamal.
b. Who has an absolute advantage in making pizza? in brewing beer?
c. Who has a comparative advantage in making pizza? in brewing beer?

Now suppose their preferences are as follows: Filipe wants 2 beers and as much pizza as he can eat each day; Kamal wants 2 pizzas and as much beer as he can drink each day.
d. If each man is self-reliant, how much beer and pizza will Filipe and Kamal eat and drink?
e. Suppose the two men decide to trade with each other. Draw their joint PPC, and give an example of a trade that will make each of them better off.

7. Rework Problem 6 with the following changes:
a. Each individual’s productivity is shown in the table that follows, which specifies the number of hours each man needs to produce a single unit of beer and pizza.
b. Filipe wants 6 beers and as much pizza as he can eat each day, while Kamal wants 2 pizzas and as much beer as he can drink each day.

<table>
<thead>
<tr>
<th>Production time for 1 beer</th>
<th>Production time for 1 pizza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filipe</td>
<td>5/4 hours</td>
</tr>
<tr>
<td>Kamal</td>
<td>5 hours</td>
</tr>
<tr>
<td></td>
<td>5/3 hours</td>
</tr>
<tr>
<td></td>
<td>5/2 hours</td>
</tr>
</tbody>
</table>

8. Suppose Filipe and Kamal’s production possibilities curves from Problem 7 are combined. What would be the maximum number of pizzas available to Filipe and Kamal if they could buy or sell in a world market in which 1 beer could be exchanged for 1 pizza? What would be the maximum number of beers available to them?

9. Inlandia and Outlandia both can produce oranges and oil. Inlandia can produce up to 10 million tonnes of oranges per week or 5 million barrels of oil, or any combination of oil and oranges along a straight-line production possibilities curve linking those two points. Outlandia can produce up to 50 million tonnes of oranges per week or 1 million barrels of oil, or any combination along a straight-line production possibilities curve linking those points.
a. Does the principle of increasing opportunity cost apply in either of these two economies? Why or why not?
b. Suppose Inlandia and Outlandia sign a trade agreement in which each country will specialize in the production of either oil or oranges. According to the principle of comparative advantage, which country will specialize in which commodity?
c. If Inlandia and Outlandia are the only two economies in the world that are open to international trade, what are the maximum and minimum prices that can prevail on the world market for a tonne of oranges, in terms of barrels of oil?

10. Jay, Kay, and Dee are marooned alone on the Greek island of Skorpios. They must find a way to provide themselves with food and drinking water. The following table shows how many hours each person takes to produce one unit of food or one unit of water.

<table>
<thead>
<tr>
<th>Production time for 1 unit of food</th>
<th>Production time for 1 unit of drinking water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jay</td>
<td>1 hour</td>
</tr>
<tr>
<td>Kay</td>
<td>2 hours</td>
</tr>
<tr>
<td>Dee</td>
<td>4 hours</td>
</tr>
<tr>
<td></td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>6 hours</td>
</tr>
</tbody>
</table>

a. If each person can work for 12 hours a day and each person provides only for himself or herself, draw their individual PPCs.
b. Suppose Jay, Kay, and Dee decide to produce food and water cooperatively, so they can gain from trade. Draw their combined production possibilities curve.
c. If the trio wants, in aggregate, to consume 15 units of food and 12 units of water, who will specialize in food production? Who will specialize in water production? Will anyone divide his or her time between food and water production?
d. If the trio wants, in aggregate, to consume 6 units of water and as much food as possible, who will specialize in food and who will specialize in water? Will anyone divide his or her time between food and water production? How much food will be produced?
e. Suppose production is as in part (c). Dee suggests dividing the output equally among the three of them. Assuming that the amounts of food that Jay and Kay get under this arrangement are exactly what each would have chosen if he or she had lived and worked alone, is each of them strictly better off when they share? Explain.
2.1

<table>
<thead>
<tr>
<th>Productivity in programming</th>
<th>Productivity in bicycle repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mina</td>
<td>2 Web page updates per hour</td>
</tr>
<tr>
<td>Barb</td>
<td>3 Web page updates per hour</td>
</tr>
</tbody>
</table>

The entries in the table tell us that Barb has an absolute advantage over Mina in both activities. While Barb can update 3 Web pages per hour, Mina can update only 2. Barb’s absolute advantage over Mina is even greater in the task of fixing bicycles—3 repairs per hour versus Mina’s 1.

But, as in Example 2.2, the fact that Barb is a better programmer than Mina does not imply that Barb will be better off if she updates her own Web page. Barb’s opportunity cost of updating a Web page is 1 bicycle repair, whereas Mina must give up only half a bicycle repair to update a Web page. Mina has a comparative advantage over Barb at programming, and Barb has a comparative advantage over Mina at bicycle repair.

2.2 Susan’s opportunity cost of picking a kilogram of nuts is 1/2 kg of sugar cane. But Tom’s opportunity cost of picking a kilogram of nuts is now only 1/3 kg of sugar cane. So Tom has a comparative advantage at picking nuts, and Susan has a comparative advantage at cutting sugar cane.

2.3 The slope to the left of point D (in absolute value) is 1/2 kg of sugar cane per kilogram of nuts, which is Susan’s opportunity cost of picking nuts.

2.4 In the rest of the world, the opportunity cost of a kilogram of nuts is now 2 kg of sugar cane, not 1 kg. This means that Islandians can now buy or sell a kilogram of nuts for 2 kg of sugar cane and can buy or sell a kilogram of sugar cane for 1/2 kg of nuts. So if Islandians start at point E and sell all 56 kg of nuts they produce, they can buy an additional 112 kg of sugar cane, for a total of 168 kg of sugar cane. This would put them at point A in the diagram below. Alternatively, if they start at E and sell all 56 kg of sugar cane they produce, they can buy an additional 28 kg of nuts, for a total of 84 kg of nuts, which would put them at B. The straight line AB is their new menu of opportunities.

2.5 Loss of the opportunity to trade reduces Islandia’s menu of consumption possibilities from AB to its own production possibilities curve. If, when it was trading, Islandia selected a combination of nuts and sugar cane significantly different from the combination represented by point E in the graph above, loss of the opportunity to trade would cause Islandia significant hardship. (If, when it was trading, Islandia selected a point on AB quite close to E, loss of trade would cause Islandia only minor inconvenience.)