

15.4: Comparative Advantage and the Gains from Trade

Learning Objectives

- Calculate absolute and comparative advantage

Production Possibilities and Comparative Advantage

Consider the example of trade in two goods, shoes and refrigerators, between the United States and Mexico. These goods are homogeneous, meaning that consumers and producers cannot differentiate between shoes from Mexico and shoes from the U.S.; nor can they differentiate between Mexican or American refrigerators.

From Table 1, we can see that it takes four U.S. workers to produce 1,000 pairs of shoes, but it takes five Mexican workers to do so. It takes one U.S. worker to produce 1,000 refrigerators, but it takes four Mexican workers to do so. The United States has an absolute advantage in producing both shoes and refrigerators; that is, it takes fewer workers in the United States than in Mexico to produce both a given number of shoes and a given number of refrigerators.

Table 1. Resources Needed to Produce Shoes and Refrigerators

| Country | Number of Workers needed to produce 1,000 units — Shoes | Number of Workers needed to produce 1,000 units — Refrigerators |
|---------------|---|---|
| United States | 4 workers | 1 worker |
| Mexico | 5 workers | 4 workers |

Absolute advantage simply compares the *productivity* of a worker between countries. It answers the question, “How many inputs do I need to produce shoes in Mexico?” Comparative advantage asks this same question slightly differently. Instead of comparing how many workers it takes to produce a good, it asks, “How much am I giving up to produce this good in this country?” Another way of looking at this is that comparative advantage identifies the good for which the producer’s absolute advantage is relatively larger, or where the producer’s absolute productivity disadvantage is relatively smaller. The United States can produce 1,000 shoes with four-fifths as many workers as Mexico (four versus five), but it can produce 1,000 refrigerators with only one-quarter as many workers (one versus four). So, the comparative advantage of the United States, where its absolute productivity advantage is relatively greatest, lies with refrigerators, and Mexico’s comparative advantage, where its absolute productivity disadvantage is least, is in the production of shoes.

Mutually Beneficial Trade with Comparative Advantage

When nations increase production in their area of comparative advantage and trade with each other, both countries can benefit. The production possibilities frontier is a useful tool to visualize this benefit. Recall from earlier readings that the production possibilities frontier shows the maximum amount that each country can produce given its limited resources, in this case workers.

Consider a situation where the United States and Mexico each have 40 workers. For example, as Table 2 shows, if the United States divides its labor so that 40 workers are making shoes, then, since it takes four workers in the United States to make 1,000 shoes, a total of 10,000 shoes will be produced. (If four workers can make 1,000 shoes, then 40 workers will make 10,000 shoes). If the 40 workers in the United States are making refrigerators, and each worker can produce 1,000 refrigerators, then a total of 40,000 refrigerators will be produced.

Table 2. Production Possibilities before Trade

| Country | Shoe Production — using 40 workers | | Refrigerator Production — using 40 workers |
|---------------|------------------------------------|----|--|
| United States | 10,000 shoes | or | 40,000 refrigerators |
| Mexico | 8,000 shoes | or | 10,000 refrigerators |

As always, the slope of the production possibility frontier for each country is the opportunity cost of one refrigerator in terms of foregone shoe production—when labor is transferred from producing the latter to producing the former (see Figure 1).

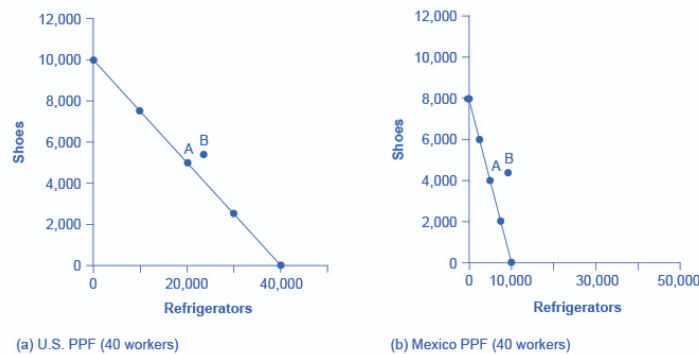


Figure 1. Production Possibility Frontiers. (a) With 40 workers, the United States can produce either 10,000 shoes and zero refrigerators or 40,000 refrigerators and zero shoes. (b) With 40 workers, Mexico can produce a maximum of 8,000 shoes and zero refrigerators, or 10,000 refrigerators and zero shoes. All other points on the production possibility line are possible combinations of the two goods that can be produced given current resources. Point A on both graphs is where the countries start producing and consuming before trade. Point B is where they end up after trade.

Let's say that, in the situation before trade, each nation prefers to produce a combination of shoes and refrigerators that is shown at point A. Table 3 shows the output of each good for each country and the total output for the two countries.

Table 3. Production at Point A before Trade

| Country | Current Shoe Production | Current Refrigerator Production |
|---------------|-------------------------|---------------------------------|
| United States | 5,000 | 20,000 |
| Mexico | 4,000 | 5,000 |
| Total | 9,000 | 25,000 |

Continuing with this scenario, each country transfers some amount of labor toward its area of comparative advantage. For example, the United States transfers six workers away from shoes and toward producing refrigerators. As a result, U.S. production of shoes decreases by 1,500 units ($6/4 \times 1,000$), while its production of refrigerators increases by 6,000 (that is, $6/1 \times 1,000$). Mexico also moves production toward its area of comparative advantage, transferring 10 workers away from refrigerators and toward production of shoes. As a result, production of refrigerators in Mexico falls by 2,500 ($10/4 \times 1,000$), but production of shoes increases by 2,000 pairs ($10/5 \times 1,000$). Notice that when both countries shift production toward each of their comparative advantages (what they are relatively better at), their combined production of both goods rises, as shown in Table 4. The reduction of shoe production by 1,500 pairs in the United States is more than offset by the gain of 2,000 pairs of shoes in Mexico, while the reduction of 2,500 refrigerators in Mexico is more than offset by the additional 6,000 refrigerators produced in the United States.

Table 4. Shifting Production Toward Comparative Advantage
Raises Total Output

| Country | Shoe Production | Refrigerator Production |
|---------------|-----------------|-------------------------|
| United States | 3,500 | 26,000 |
| Mexico | 6,000 | 2,500 |
| Total | 9,500 | 28,500 |

This numerical example illustrates the remarkable insight of comparative advantage: even when one country has an absolute advantage in all goods and another country has an absolute disadvantage in all goods, both countries can still benefit from trade. Even though the United States has an absolute advantage in producing both refrigerators and shoes, it makes economic sense for it to specialize in the good for which it has a comparative advantage. The United States will export refrigerators and in return import shoes.

Try It

When you first met the production possibility frontier (PPF) in an earlier module, it was drawn with an outward-bending shape. This shape illustrated that as inputs were transferred from producing one good to another—like from education to health services—there were increasing opportunity costs. In the examples in this module, the PPFs are drawn as straight lines, which means that opportunity costs are constant. When a marginal unit of labor is transferred away from growing corn and toward producing oil, the decline in the quantity of corn and the increase in the quantity of oil is always the same. In reality this is possible only if the contribution of additional workers to output did not change as the scale of production changed. The linear production possibilities frontier is a less realistic model, but a straight line simplifies calculations. It also illustrates economic themes like absolute and comparative advantage just as clearly.

How Opportunity Cost Sets the Boundaries of Trade

This example shows that both parties can benefit from specializing in their comparative advantages and trading. By using the opportunity costs in this example, it is possible to identify the range of possible trades that would benefit each country.

Mexico started out, before specialization and trade, producing 4,000 pairs of shoes and 5,000 refrigerators. Then, in the numerical example given, Mexico shifted production toward its comparative advantage and produced 6,000 pairs of shoes but only 2,500 refrigerators. Thus, if Mexico can *export* no more than 2,000 pairs of shoes (giving up 2,000 pairs of shoes) in exchange for *imports* of at least 2,500 refrigerators (a gain of 2,500 refrigerators), it will be able to consume more of both goods than before trade. Mexico will be unambiguously better off. Conversely, the United States started off, before specialization and trade, producing 5,000 pairs of shoes and 20,000 refrigerators. In the example, it then shifted production toward its comparative advantage, producing only 3,500 shoes but 26,000 refrigerators. If the United States can export no more than 6,000 refrigerators in exchange for imports of at least 1,500 pairs of shoes, it will be able to consume more of both goods and will be unambiguously better off.

The range of trades that can benefit both nations is shown in Table 5. For example, a trade where the U.S. exports 4,000 refrigerators to Mexico in exchange for 1,800 pairs of shoes would benefit both sides, in the sense that both countries would be able to consume more of both goods than in a world without trade.

Table 5. The Range of Trades That Benefit Both the United States and Mexico

| The U.S. economy, after specialization, will benefit if it: | | The Mexican economy, after specialization, will benefit if it: | |
|---|--|--|--|
| Exports fewer than 6,000 refrigerators | | Imports at least 2,500 refrigerators | |
| Imports at least 1,500 pairs of shoes | | Exports no more than 2,000 pairs of shoes | |

Trade allows each country to take advantage of lower opportunity costs in the other country. If Mexico wants to produce more refrigerators without trade, it must face its domestic opportunity costs and reduce shoe production. If Mexico, instead, produces more shoes and then trades for refrigerators made in the United States, where the *opportunity cost* of producing refrigerators is lower, Mexico can in effect take advantage of the lower opportunity cost of refrigerators in the United States. Conversely, when the United States specializes in its comparative advantage of refrigerator production and trades for shoes produced in Mexico, international trade allows the United States to take advantage of the lower opportunity cost of shoe production in Mexico.

The theory of comparative advantage explains why countries trade: they have different comparative advantages. It shows that the gains from international trade result from pursuing comparative advantage and producing at a lower opportunity cost. The following feature shows how to calculate absolute and comparative advantage and the way to apply them to a country's production.

Calculating Absolute and Comparative Advantage

In Canada a worker can produce 20 barrels of oil or 40 tons of lumber. In Venezuela, a worker can produce 60 barrels of oil or 30 tons of lumber.

Table 6. Oil and Lumber Production in Canada and Venezuela

| Country | Oil (barrels) | | Lumber (tons) | |
|-----------|---------------|----|---------------|--|
| Canada | 20 | or | 40 | |
| Venezuela | 60 | or | 30 | |

1. Who has the absolute advantage in the production of oil or lumber? How can you tell?
2. Which country has a comparative advantage in the production of oil?
3. Which country has a comparative advantage in producing lumber?
4. In this example, is absolute advantage the same as comparative advantage, or not?
5. In what product should Canada specialize? In what product should Venezuela specialize?

Step 1. Make a table like Table 6.

Step 2. To calculate absolute advantage, look at the larger of the numbers for each product. One worker in Canada can produce more lumber (40 tons versus 30 tons), so Canada has the absolute advantage in lumber. One worker in Venezuela can produce 60 barrels of oil compared to a worker in Canada who can produce only 20.

Step 3. To calculate comparative advantage, find the opportunity cost of producing one barrel of oil in both countries. The country with the lowest opportunity cost has the comparative advantage. With the same labor time, Canada can produce either 20 barrels of oil or 40 tons of lumber.

So in effect, 20 barrels of oil is equivalent to 40 tons of lumber: $20 \text{ oil} = 40 \text{ lumber}$. Divide both sides of the equation by 20 to calculate the opportunity cost of one barrel of oil in Canada. $20/20 \text{ oil} = 40/20 \text{ lumber}$. $1 \text{ oil} = 2 \text{ lumber}$. To produce one additional barrel of oil in Canada has an opportunity cost of 2 lumber.

Calculate the same way for Venezuela: $60 \text{ oil} = 30 \text{ lumber}$. Divide both sides of the equation by 60. One oil in Venezuela has an opportunity cost of $1/2$ lumber. Because $1/2 \text{ lumber} < 2 \text{ lumber}$, Venezuela has the comparative advantage in producing oil.

Step 4. Calculate the opportunity cost of one lumber by reversing the numbers, with lumber on the left side of the equation. In Canada, 40 lumber is equivalent in labor time to 20 barrels of oil: $40 \text{ lumber} = 20 \text{ oil}$. Divide each side of the equation by 40. The opportunity cost of one lumber is $1/2$ oil.

In Venezuela, the equivalent labor time will produce 30 lumber or 60 oil: $30 \text{ lumber} = 60 \text{ oil}$. Divide each side by 30. One lumber has an opportunity cost of two oil. Canada has the lower opportunity cost in producing lumber.

Step 5. In this example, absolute advantage is the same as comparative advantage. Canada has the absolute and comparative advantage in lumber; Venezuela has the absolute and comparative advantage in oil.

Step 6. Canada should specialize in what it has a relative lower opportunity cost, which is lumber, and Venezuela should specialize in oil. Canada will be exporting lumber and importing oil, and Venezuela will be exporting oil and importing lumber.

Try It

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Trade and Incomes

Incomes depend on labor productivity. A country with an absolute advantage in some product has higher labor productivity than another country does *in the production of that product*. If a country has an absolute advantage in producing both goods, it has higher labor productivity in both and its workers will earn higher incomes than those in the other country. Thus, the average income in a country depends on its average labor productivity. Now consider comparative advantage. If a country specializes production in the product in which it has a comparative advantage, it raises its average labor productivity and raises its average income. Thus, comparative advantage is more important than absolute advantage in understanding which country should trade which product in order to maximize the standard of living in both countries.

Watch It

Watch this video to review the ways that comparative advantage benefits all the parties involved.

A link to an interactive elements can be found at the bottom of this page.

For additional practice and review using numbers, watch [this video](#) from ACDC economics.

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