Determining Comparative Advantage

Voluntary trade between two individuals or two countries occurs if both parties feel that they will benefit. Producers have an incentive to make products for which they have a lower opportunity cost than other producers. When both producers specialize according to their *comparative advantage*, they increase the total amount of goods and services that are available for consumption. To determine who has a comparative advantage in producing a particular item, we need to calculate each producer's opportunity costs of creating the items. The way we calculate opportunity cost depends on how the productivity data are expressed.

There are two ways to measure productivity: the "input method" and the "output method." We can calculate the quantity of output produced from a given amount of inputs, or we can measure the amount of inputs necessary to create one unit of output. Examples of output are tons of wheat per acre, miles per gallon, words per minute, apples per tree, and televisions produced per hour. Examples of input are number of hours to do a job, number of gallons of paint to paint a house, and number of acres to feed a horse. We will work through an example that expresses productivity from the perspectives of an input measure and an output measure.

Part A: Two Approaches to Comparative Advantage

Student Alert: **In using these models to determine the lower opportunity costs from both an input and output viewpoint, you must pay attention to the format of the chart. It makes a difference!**

Input Method

The "input method" provides data on the amount of resources needed to produce one unit of output. Table 1-3.1 gives productivity information for Ted and Nancy.

Table 1-3.1
Productivity Data Using the Input Method

	Time required to produce one radio	Time required to produce one bushel of wheat
Ted	20 minutes	5 minutes
Nancy	30 minutes	15 minutes

Ted has an *absolute advantage* in the production of both radios and wheat because he uses fewer resources (time) to produce each item than does Nancy. Even though this might suggest that Ted cannot benefit from trade with Nancy, our examination of the opportunity costs of production will show that is not the case.

Table 1-3.2 shows the opportunity costs for each producer. To find the opportunity cost of producing one radio, the amount of resources it takes to produce a radio goes *above* the amount of resources that it takes to produce a bushel of wheat.

Table 1-3.2

Opportunity Cost of Producing Radios and Wheat

	Opportunity cost of producing one radio	Opportunity cost of producing one bushel of wheat
Ted	$1 \text{ radio} = \frac{20 \text{ minutes}}{5 \text{ minutes}} = 4 \text{ bushels}$	$1 \text{ wheat} = \frac{5 \text{ minutes}}{20 \text{ minutes}} = \frac{1}{4} \text{ radio}$
Nancy	$1 \text{ radio} = \frac{30 \text{ minutes}}{15 \text{ minutes}} = 2 \text{ bushels}$	$1 \text{ wheat} = \frac{15 \text{ minutes}}{30 \text{ minutes}} = \frac{1}{2} \text{ radio}$

In the 20 minutes it takes Ted to produce one radio, he instead could have produced four bushels of wheat. Instead of producing one radio in 30 minutes, Nancy could have produced two bushels of wheat. The fact that Nancy has the lower opportunity cost of producing radios means she has the comparative advantage in radios.

In the five minutes he needs to produce one bushel of wheat, Ted could have made ¼ of a radio. Nancy's opportunity cost of producing one bushel of wheat is ½ of a radio. Because his sacrifice in producing a radio is less than Nancy's, Ted has the comparative advantage in wheat production.

If Ted specializes in wheat production while Nancy specializes in radio production, their combined output of radios and wheat will be larger than it would be if each person produced both products.

Output Method

The "output method" gives data on the amount of output that can be produced with a given amount of an input. Now let's take this same set of productivity data and turn it into an output format. To do this, we ask how many units of an item the producers can create with a given amount of resources. Let's suppose that both producers have one hour to produce each product. Table 1-3.3 shows how many radios and how many bushels of wheat each producer can make in one hour. From this output viewpoint, you once again see that Ted has the absolute advantage in the production of both products. With the same amount of resources (one hour of labor), he can produce more radios and more wheat than Nancy.

Table 1-3.3

Productivity Data Using the Output Method

	Radios produced per hour	Wheat produced per hour
Ted	$\frac{60 \text{ minutes}}{20 \text{ minutes}} = 3 \text{ radios}$	$\frac{60 \text{ minutes}}{5 \text{ minutes}} = 12 \text{ bushels}$
Nancy	$\frac{60 \text{ minutes}}{30 \text{ minutes}} = 2 \text{ radios}$	$\frac{60 \text{ minutes}}{15 \text{ minutes}} = 4 \text{ bushels}$

But what about the opportunity cost to produce each item? Check out Table 1-3.4, which shows how to calculate each producer's opportunity cost of the two items. To find Ted's opportunity cost of producing one radio, the number of radios he can produce in one hour goes *under* the number of bushels of wheat he can produce in that same time frame.

Table 1-3.4
Opportunity Cost of Producing Radios and Wheat

	Opportunity cost of producing one radio	Opportunity cost of producing one bushel of wheat
Ted	3 radios = 1 hour = 12 bushels 1 radio = 12/3 = 4 bushels	12 bushels = 1 hour = 3 radios 1 bushel = 3/12 = ¼ radio
Nancy	2 radios = 1 hour = 4 bushels 1 radio = 4/2 = 2 bushels	4 bushels = 1 hour = 2 radios 1 bushel = 2/4 = ½ radio

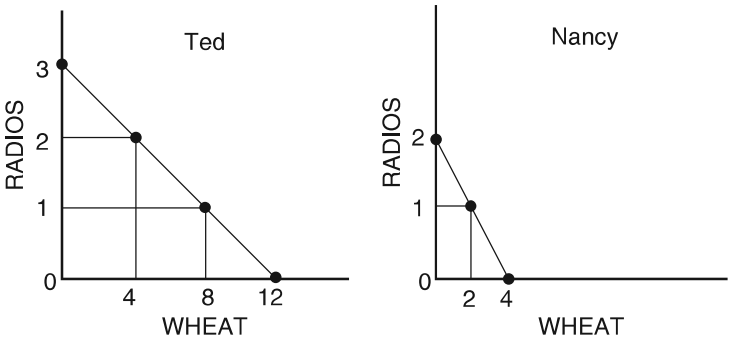
Because Ted's cost per radio is four bushels of wheat, whereas Nancy's cost is only two bushels, we know Nancy has the comparative advantage in producing radios. Ted has the comparative advantage in wheat production since he has the lower opportunity cost of producing a bushel of wheat (¼ radio compared to Nancy's ½ radio). Does this sound familiar? This is the same result we reached using the input method.

The differences in opportunity costs define the limits of a trade in which both parties will benefit. If Nancy specializes in radio production, she will accept no less than two bushels of wheat for one radio. Ted will pay no more than four bushels of wheat per radio. Thus, the "terms of trade" acceptable to both producers must lie in the range between two bushels for one radio and four bushels for one radio. For example, suppose they agree to trade one radio for three bushels of wheat. By producing and trading one radio to Ted, Nancy will have a net gain of one bushel. Her opportunity cost of producing the radio is two bushels and she receives three bushels in return for the radio. Because his opportunity cost of producing one bushel is ¼ radio, Ted's opportunity cost of producing the three bushels, which he trades to Nancy, is ¾ radio. Thus, the trade gives Ted a net gain of ¼ radio. Both producers gain by specializing according to their comparative advantage.

When it comes to producing wheat, Ted would have to receive at least ¼ of a radio in trade for a bushel of wheat. Nancy would require at least ½ of a radio before she would trade a bushel of wheat. The acceptable terms of trade would be found between ¼ radio and ½ radio per bushel of wheat.

The output data in Table 1-3.3 can be used to create production possibility frontiers for Ted and Nancy to show the combinations of radios and wheat each can produce in one hour of work. See Figure 1-3.1.

Figure 1-3.1
Production Possibilities Curves for Ted and Nancy



Part B: Comparative Advantage Exercises

For each of the following scenarios, answer the questions following the chart. The first problem is answered for you.

1. Anna and Barry can grow the following amounts of potatoes and cabbage with a week of labor.

	Potatoes per week	Cabbage per week
Anna	100 units	200 units
Barry	120 units	150 units

(A) Is this an example of an *input* problem or an *output* problem?
This is an output problem because it shows how much output each producer can create with a given amount of resources (one week of labor).

(B) What is the opportunity cost for each producer in making these products?

(1) Anna's opportunity cost of producing a unit of potatoes is *2.0* units of cabbage.

$$100\ P = 1\ \text{week} = 200\ C, \qquad \frac{100}{100}P = \frac{200}{100}C, \qquad 1\ P = 2\ C.$$

(2) Barry's opportunity cost of producing a unit of potatoes is *1.25* units of cabbage.

$$120\ P = 1\ \text{week} = 150\ C, \qquad \frac{120}{120}P = \frac{150}{120}C, \qquad 1\ P = 1\tfrac{1}{4}\ C = 1.25\ C.$$

(3) Anna's opportunity cost of producing a unit of cabbage is *0.5* units of potatoes.

200 C = 1 week = 100 P, $\frac{200}{200}$ C = $\frac{100}{200}$ P, 1 C = ½ P = 0.5 P.

(4) Barry's opportunity cost of producing a unit of cabbage is *0.8* units of potatoes.

150 C = 1 week = 120 P, $\frac{150}{150}$ C = $\frac{120}{150}$ P, 1 C = $^4/_5$ P = 0.8 P.

(C) Who has the comparative advantage in producing potatoes? *Barry*

(D) Who has the comparative advantage in producing cabbage? *Anna*

Note: In this example, each producer has the absolute advantage in producing one item: Barry in potatoes and Anna in cabbage. That might not be the case in the other examples.

2. Henry and John are fishermen who catch bass and catfish. This chart shows how many of each type of fish they can catch in one day.

	Bass	Catfish
Henry	4 bass	6 catfish
John	24 bass	12 catfish

(A) Is this an example of an *input* problem or an *output* problem?

(B) What is the opportunity cost for each person in catching these fish?

(1) Henry's opportunity cost of catching 1 bass is _____ catfish.

(2) John's opportunity cost of catching 1 bass is _____ catfish.

(3) Henry's opportunity cost of catching 1 catfish is _____ bass.

(4) John's opportunity cost of catching 1 catfish is _____ bass.

(C) Who has the comparative advantage in catching bass? _____

(D) Who has the comparative advantage in catching catfish? _____

3. This chart shows how many days it takes the ABC Corporation and the XYZ Corporation to produce one unit of cars and one unit of planes.

	Cars	Planes
ABC Corp.	8 days	10 days
XYZ Corp.	15 days	12 days

(A) Is this an example of an *input* problem or an *output* problem?

(B) What is the opportunity cost for each corporation in producing these goods?

(1) ABC's opportunity cost of producing a unit of cars is _____ units of planes.

(2) XYZ's opportunity cost of producing a unit of cars is _____ units of planes.

(3) ABC's opportunity cost of producing a units of planes is _____ units of cars.

(4) XYZ's opportunity cost of producing a unit of planes is _____ units of cars.

(C) Who has the comparative advantage in producing cars? _____

(D) Who has the comparative advantage in producing planes? _____

4. Here are the numbers of acres needed in India and China to produce 100 bushels of corn or 100 bushels of rice each month.

	India	China
Corn	9 acres	8 acres
Rice	3 acres	2 acres

(A) Is this an example of an *input* problem or an *output* problem?

(B) What is the opportunity cost for each country in producing these goods?

(1) India's opportunity cost of growing 100 bushels of corn is _____ bushels of rice.

(2) China's opportunity cost of growing 100 bushels of corn is _____ bushels of rice.

(3) India's opportunity cost of growing 100 bushels of rice is _____ bushels of corn.

(4) China's opportunity cost of growing 100 bushels of rice is _____ bushels of corn.

(C) Who has the comparative advantage in growing corn? _____

(D) Who has the comparative advantage in growing rice? _____

5. This chart shows how many cans of olives and bottles of olive oil can be produced in Zaire and Colombia from one ton of olives.

	Zaire	Colombia
Olives	60 cans	24 cans
Olive oil	10 bottles	8 bottles

(A) Is this an example of an *input* problem or an *output* problem?

(B) What is the opportunity cost for each country in producing these goods?

(1) Zaire's opportunity cost of producing 1 can of olives is _____ bottles of olive oil.

(2) Colombia's opportunity cost of producing 1 can of olives is _____ bottles of olive oil.

(3) Zaire's opportunity cost of producing 1 bottle of olive oil is _____ cans of olives.

(4) Colombia's opportunity cost of producing 1 bottle of olive oil is _____ cans of olives.

(C) Who has the comparative advantage in producing olives? _____

(D) Who has the comparative advantage in producing olive oil? _____

6. Here are the numbers of hours needed in Redland and Blueland to produce a unit of televisions and a unit of computers.

	Televisions	Computers
Redland	18 hours	6 hours
Blueland	16 hours	4 hours

(A) Is this an example of an *input* problem or an *output* problem?

(B) What is the opportunity cost for each country in producing these goods?

(1) Redland's opportunity cost of producing 1 unit of televisions is _____ units of computers.

(2) Blueland's opportunity cost of producing 1 unit of televisions is _____ units of computers.

(3) Redland's opportunity cost of producing 1 unit of computers is _____ units of televisions.

(4) Blueland's opportunity cost of producing 1 unit of computers is _____ units of televisions.

(C) Who has the comparative advantage in producing televisions? _____

(D) Who has the comparative advantage in producing computers? _____