Microeconomics with Ethics

by Steven Suranovic (2022) – George Washington University

Chapter 5

Production, Trade and Comparative Advantage

In the previous chapter we assumed that two individuals, Smith and Jones, were endowed with a fixed amount of oranges and apples, respectively. Where those oranges and apples came from, we did not ask. We also did not give Smith or Jones an option as to whether he would get oranges or apples. Instead, we simply asserted they were endowed with these products.

In this chapter we introduce production. Now we will imagine that Smith and Jones must produce the oranges and apples, rather than simply be given them. After describing simple production functions for the two goods, we shall derive an individual production possibilities frontier and define the economic concept of opportunity cost. Next we will investigate production decisions under two scenarios; first, when the individual produces only for himself and second when two individuals produce and then trade.

The possibility of trade affects the production decisions when we assume that producers maximize profit and individuals maximize utility. Individuals are led to produce the goods in which they have a comparative advantage and trade it with the other. Comparative advantage is defined as the good that an individual can produce at a lower opportunity cost. Equivalently, comparative advantage is defined as the good a person is relatively best at producing in comparison to others. We will show that specialization in the comparative advantage good followed by trade can raise overall welfare.

Finally, we will use the production possibilities framework to discuss several other production features. First will illustrate the derivation of a convex aggregate production frontier by assuming an economy has several different production options with varying opportunity costs in production. Second, we will discuss how changes in the endowments of resources affects an economy's production possibilities.

5.1 Production Possibilities

Learning Objectives

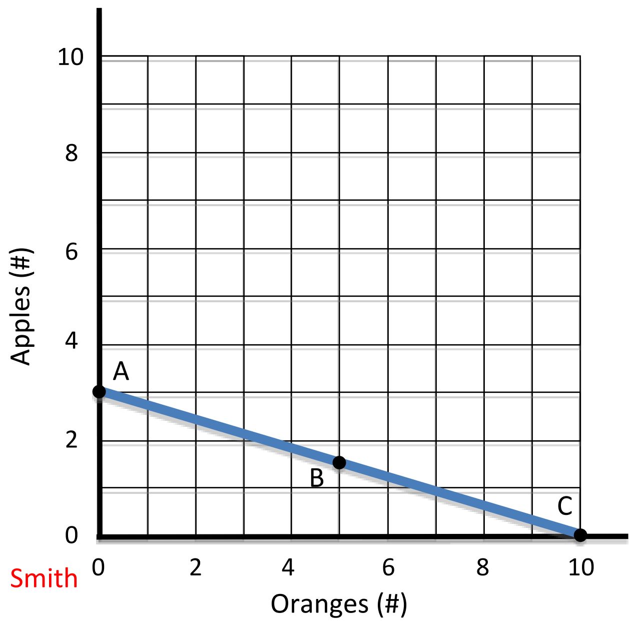
1. Learn the definitions of terms used to describe the production process including labor productivity and unit-labor requirements
2. Learn how to plot and interpret a simple production possibility curve

Production is often a complicated process. To produce a fruit product, like apples and oranges, requires land that has fruit trees growing on them; it requires workers to tend the fruit trees, harvest the crop and manage the process; it requires capital equipment like baskets to collect the fruit in and trucks to transport the product to market. Modern production requires telephones, computers and software for communication, accounting, design and marketing.

In order to highlight some basic economic principles it is not necessary to conceive of the production process in such a complicated way though. Instead we will simplify the process to its barest essentials by assuming that production of products requires nothing more than the time and effort of individual workers. This is the most basic way to mimic the transformative production process converting an input into an output. Also, human effort is a necessary component in every production process, and it is the workers who earn income that is subsequently used to make purchases in the market.

Imagine that Smith can spend his day producing either oranges or apples, or both. Suppose the production process in this example consists of spending one hour of time during the day looking for and gathering ripe fruit. The amount of fruit he can collect, or "produce," in an hour is described in Figure 5.1.

Figure 5.1 Smith's PPF



If he spends the entire hour collecting apples, suppose he can collect 3 apples. But in that case he devotes no time to orange collection and therefore gets zero oranges. Thus the point A, 0 oranges and 3 apples, is a production possibility for Smith and it is marked on the graph.

If Smith instead spends the entire hour collecting oranges, suppose he can collect 10. But in this case he devotes no time to apple collection and therefore gets zero apples. This means the point C, 10 oranges and 0 apples, is another production possibility for Smith and it is also marked on the graph.

Of course, Smith can also split his one hour between apple and orange production and spend 20 or 30 or 40 minutes collecting apples and 40, 30 and 20 minutes collecting oranges. If he spends 30 minutes collecting apples and oranges at collects at the same rate as before, then he will produce 5 oranges and 1.5 apples, plotted as point B, which is another production possibility.

If he splits his time differently, then it would be possible for him to produce any combination of apples and oranges along the line drawn in Figure 5.1. This line is his production possibility frontier (PPF).

The intercept of the PPF on the apple axis is Smith's labor productivity in apples; it is the quantity of apples he can produce in a unit of time, in this case one hour. We can define a variable PR^S_A = 3 apples/hr as Smith's apple productivity. Likewise, the intercept of the PPF on the orange axis is Smith's labor productivity in oranges; it is the quantity of oranges he can produce in a unit of time. We can define a variable PR^S_O = 10 oranges/hr as Smith's orange productivity.

We can now define the production functions for apples and oranges.

If Q^S_A is the number of apples produced by Smith, L^S_A is the amount of time Smith spends producing apples and PR^S_A is Smith's apple productivity, then

$$Q^S_A = PR^S_A \text{ x } L^S_A$$

Sometimes, instead of using productivity, economists prefer to use a variable that indicates how much labor input is used to product a unit of output. The unit-labor requirement indicates the amount of time needed to produce one apple and is given as the reciprocal of labor productivity. For example, since Smith's apple productivity is 3 apples per hour, Smith's unit labor requirement in apples is 1/3 hour per apple. We define the variable a^S_{LA} as Smith's unit-labor requirement in apples and note that $a^S_{LA} = 1/PR^S_A$. Also, $PR^S_A = 1/a^S_{LA}$. We can also rewrite the equivalent production function using the unit-labor requirement as follows:

$$Q^S_A = \frac{L^S_A}{a^S_{LA}}$$

Smith takes 1/10th hour to produce one orange and if he spends one hour working, then he can produce: $Q^S_O = 1/(1/10) = 10$ oranges. The value for the unit-labor requirement is assumed to be exogenous, meaning that its value is determined external to the model. In contrast, some variables are called endogenous, meaning that their values are determined as an outcome in the model. In this equation, the labor input and the output quantities are endogenous variables.

Suppose Smith has a similar production function for oranges written as:

$$Q^S_O = PR^S_O \text{ x } L^S_O \quad \text{or} \quad Q^S_O = \frac{L^S_O}{a^S_{LO}}$$

where

Q^S_O is the number of oranges produced by Smith,

L^S_O is the amount of time Smith spends producing oranges,

PR^S_O is Smith's orange productivity (PR^S_O = 10 oranges/hr in the example) and

a^S_{LO} is Smith's unit-labor requirement in oranges (a^S_{LO} = (1/10) hr/orange).

Next we can derive an equation for Smith's PPF by noting that Smith's time is limited. We formalize that limitation by writing Smith's labor constraint:

$$L^S_A + L^S_O = L$$

where L represents Smith's labor endowment, or the number of hours Smith has available to work. To simplify we assume that the labor endowment is exogenous, meaning it has a fixed value determined external to the model (In the example we have set L = 1 hour). We assume that Smith is free to allocate his work time between the two production processes as he sees fit. He may choose to devote all of his time to orange production, or to apple production, or he may split his time between the two.

An alternative way to write the labor constraint is by substituting the production functions into the equation above. Rearranging the apple production function yields: $L^S_A = a^S_{LA}Q^S_A$. Rearranging the orange production function yields: $L^S_O = a^S_{LO}Q^S_O$. Plugging these in for the labor supplies gives:

$$a^S_{LA}Q^S_A + a^S_{LO}Q^S_O = L$$

Plugging in the values for the unit-labor requirements from above and the one hour of labor endowment yields the following equation for Smith's PPF:

$a^S_{LA} = \frac{1}{3}$ hr/apple	$a^S_{LO} = \frac{1}{10}$ hr/orange	L = 1 hour

Smith's labor constraint can now be written as:

$$\frac{1}{3}Q^S_A + \frac{1}{10}Q^S_O = 1$$

If the exercise begins with this equation, the simplest way to plot Smiths PPF is by calculating the intercepts. If Smith devotes all his time to orange production, then $Q^S_A = 0$, $\frac{1}{10} Q^S_O = 1$ and $Q^S_O = 10$. If instead Smith devotes all his time to apple production, then $Q^S_O = 0$, $\frac{1}{3} Q^S_A = 1$ and $Q^S_A = 3$.

The equation generates the PPF drawn in Figure 5.1 In general, the PPF describes all combinations of the goods that can be efficiently produced with the available endowment of labor. Efficiency requires that labor is fully employed and used at its maximum productivity. For example, if Smith were lazy one day and only collected 5 oranges in an hour (and 0 apples) even though he could have collected 10 oranges, then we would say Smith is producing inefficiently. Because production is inefficient, the combination (5,0) is also not on his PPF.

The graph also depicts all output combinations within Smith's production set (PPS). In general, the production possibilities set are all combinations of output that are feasible, or possible to produce. For Smith, the PPS is given by all output combinations within the triangular area including the boundaries. Thus all points on the PPF are also contained within the PPS. Points such as (3,1), (1.2), (8,0) and (0,2) are also feasible and are contained within the PPS. However since these points would not require all of the labor available, or would not use it most effectively, we could call them "inefficient" output combinations. In general, the inefficient points are those within the PPS minus those in the PPF, or {PPS} – {PPF}. [Note that the notation {.} means a set of points, therefore {PPF} is the set of all points contained within the PPF]

All points outside the triangular region are the infeasible points. In general, infeasible points are combinations for which there are insufficient resources, or insufficient technology, to produce. These are the points that lie beyond the PPF. For Smith combinations like (5, 5), (1, 6) and (10, 10) are infeasible.

Key Takeaways

1. Labor productivity is the quantity of a good that can be produced per unit of labor input.
2. The unit-labor requirement is the reciprocal of labor productivity. It is the amount of labor input needed to produce one unit of output of a good.
3. A variable is exogenous if it's value is determined external to the model.
4. A variable is endogenous if it's value is determined after the model is solved.
5. The production possibilities frontier (PPF) describes all combinations of the goods that can be efficiently produced with the available endowment.
6. Efficient production requires that all available resources are employed and used at full capability.
7. The PPF is the plot of the labor constraint in the Ricardian model described in this chapter.

5.2 The Opportunity Cost of Production

Learning Objectives

1. Learn the opportunity cost of production in a two good production model.
2. Learn how to identify and compute the opportunity cost on a production possibility frontier.

Opportunity cost measures the value, or cost, of what must be given up in order to do something else. It represents a method of quantifying the limited nature of resources and production. We can't have an unlimited amount of everything we may like because resources are scarce. When we are using resources fully and completely, to do more of one thing means we must do less of another. The value of the next best opportunity is what economists call the opportunity cost.

In this simple model Smith has only two things he can produce, oranges and apples. If he uses all of his time, or labor endowment, fully and completely then he will produce somewhere on his PPF. To produce more oranges, Smith must shift his time away from apple production. To produce more apples, Smith must shift his time away from orange production. Thus, the opportunity cost of orange production is the value of the apples that must be given up to produce another orange. Likewise, the opportunity cost of apples is the value of the oranges that must be given up to produce another apples.

The opportunity cost value for oranges is given by the absolute value of slope of the PPF. The slope of Smith's linear PPF, with oranges plotted on the horizontal axis, can be found by taking the rise over the run between any two points. For example, consider the points on the two axes. When orange production is zero, Smith can produce a maximum of 3 apples; this is the rise. When apple production is zero, Smith can produce a maximum of 10 oranges; this is the run. Since the PPF is negatively sloped, its value is given as –(3/10) apples per orange. This means that for Smith to produce one more orange he must give up (3/10)ths of an apple. Positive (3/10)ths is Smith's opportunity cost of orange production. (Note, by calling it a "cost" we are taking account of the negative relationship between the two. That is to produce more of one good we must give up some of another. This is why we take the absolute value.)

Smith's opportunity cost of apples is either the slope of his PPF if apples were plotted on the horizontal axis, or the reciprocal of the current slope. That reciprocal is (10/3) or 3 (1/3)rd oranges per apple. In other words, to produce one more apple, Smith must give up 3 1/3rd orange.

In more general terms we can specify the slope of the PPF as a function of the underlying parameters. For example, starting with the PPF equation $a_{LO}^S Q_O^S + a_{LA}^S Q_A^S = L$, we can rewrite it in the standard linear equation form, y = mx + b. In that form y is the variable on the vertical axis (for Smith that is Q_A^S), x is the variable on the horizontal axis, (for Smith that is Q_O^S), m is the slope of the PPF and b is the value of the apple intercept. Rearranging the expression algebraically yields,

$$Q_A^S = -\left(\frac{a_{LO}^S}{a_{LA}^S}\right) Q_O^S + \frac{L}{a_{LA}^S}$$

This means that the slope of the line is $-\left(\frac{a_{LO}^S}{a_{LA}^S}\right)$, which is the ratio of the unit-labor requirements in production. The opportunity cost of orange production for Smith is the absolute value of the slope, given as $\left(\frac{a_{LO}^S}{a_{LA}^S}\right)$. Alternatively, we can write the opportunity cost as $\frac{1/a_{LA}^S}{1/a_{LO}^S} = \frac{Pr_A^S}{Pr_O^S}$. This form displays the ratio of the productivity of apples to the productivity of oranges. In both versions though, it is the amount of apples that must be given up to produce another orange.

For completeness the opportunity cost of apples is given by:

$\left(\frac{a_{LA}^S}{a_{LO}^S}\right)$ and $\frac{1/a_{LO}^S}{1/a_{LA}^S} = \frac{Pr_O^S}{Pr_A^S}$ both measured in oranges per apple.

Key Takeaways

1. The opportunity cost of oranges is measured as the quantity of apples that must be given up in production in order to produce another unit of oranges.
2. The opportunity cost of oranges is represented as the absolute value of the slope of a person's PFF when oranges are plotted on the horizontal axis.

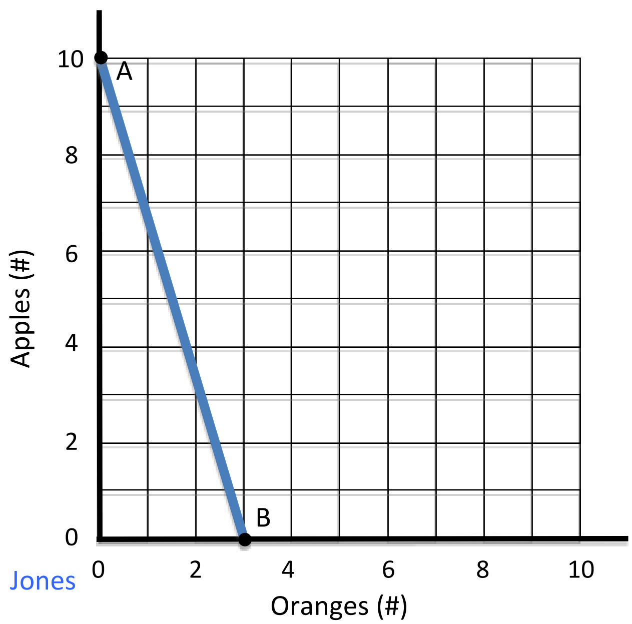
5.3 Absolute and Comparative Advantages

Learning Objective

1. Learn the two different methods to compare production capabilities between two people.

Next let's imagine a second individual called Jones who also has the ability to produce either oranges, apples or both, depending on how he allocates his time. Suppose Jones has the same type of production functions as Smith, but we'll assume that Jones' production capabilities are different. Let Jones have the PPF as in Figure 5.2 denoting his production possibilities for one hour of work.

Figure 5.2 Jones' PPF



Recall that the endpoints of the PPF represent his productivities. Thus PR_A^J= 10 apples/hr and PR_O^J= 3 oranges/hr. This also implies that Jones has different values for the unit-labor requirements. Suppose Jones' values for his exogenous variables are given as:

$a_{LO}^{J} = \frac{1}{3}$ hr/orange	$a_{LA}^{J} = \frac{1}{10}$ hr/apple	L = 1 hour

With these values Jones' PPF equation is written as:

$$\frac{1}{3}Q_O^J + \frac{1}{10}Q_A^J = 1$$

Jones' PPF is shown as the line connecting the endpoints 10 apples, and 3 oranges. Using the formula we can derive Jones' opportunity cost of orange production as

$\frac{a_{LO}^{J}}{a_{LA}^{J}} = \frac{1/3}{1/10} = \frac{10}{3}$ apples/orange . Similarly, Jones' opportunity cost for apples is

$\frac{a_{LA}^{J}}{a_{LO}^{J}} = \frac{1/10}{1/3} = \frac{3}{10}$ oranges/apple .

This example is explicitly designed so that Jones' production capabilities are different from Smith's. Recall that Smith can produce 10 oranges but only 3 apples in an hour whereas Jones can produce 3 oranges or 10 apples. Clearly Smith is better at producing oranges while Jones is better at apple production.

We express that technically by saying that Smith has an **absolute advantage** in orange production because both of the following are true: his unit-labor requirement in oranges is lower, and, his labor productivity is higher. More formally, $a_{LO}^{S} < a_{LO}^{J}$ [(1/10) < (1/3)] which also implies that $\frac{1}{a_{LO}^{S}} > \frac{1}{a_{LO}^{J}}$ [10 >3].

Similarly, Jones has an absolute advantage in apples because $a_{LA}^{J} < a_{LA}^{S}$ [(1/10) < (1/3)] and $\frac{1}{a_{LA}^{J}} > \frac{1}{a_{LA}^{S}}$ [10 >3].

To have an absolute advantage means that it is cheaper to produce something (lower labor cost) and that one is more efficient in production (higher productivity).

There is a second, even better, way to compare production capabilities between Smith and Jones. That is by defining **comparative advantage**. A person has a comparative advantage in the production of a good if he can produce it at a lower opportunity cost. In the previous example with Smith and Jones, Smith has a comparative advantage in oranges because

$$\frac{a_{LO}^{S}}{a_{LA}^{S}} < \frac{a_{LO}^{J}}{a_{LA}^{J}}$$ ([(3/10) apples/orange < (10/3) apples/orange].

Interestingly, if one person has a comparative advantage in one good, then the other person must have the comparative advantage in the other. This is true in this specific case because,

$$\frac{a_{LA}^{J}}{a_{LO}^{J}} < \frac{a_{LA}^{S}}{a_{LO}^{S}}$$ ([(3/10) oranges/apple < (10/3) oranges/apple].

Comparative advantage is another way to describe a technological advantage, and it turns out to be the most appropriate way. One of the fundamental economic lessons we can now explain is that individuals can improve their well-being, i.e., they can become happier, if they specialize producing the good in which they have a comparative advantage and trade it with another.

Key Takeaways

1. Absolute advantage is one method used to compare production technologies between two people or countries, based on superior productivity in an industry or lower labor cost per unit of output.
2. Comparative advantage is a second method used to compare production technologies between two people or countries, based on lower opportunity cost in production of a product.

5.4 Gains from Specialization and Trade

Learning Objectives

1. Learn to identify the gains from trade and specialization in an Edgeworth box diagram
2. Learn how the profit motive (i.e., greed) inspires specialization and trade

Before we consider the motivation and effects of trade, let's first consider what Smith and Jones would choose to do in the situation in which they are not intending to meet in a market and trade with each other. In other words what if they are independent and produce only for themselves? The outcome in this situation is relevant because the gains from trade is based on a comparison to this base case when individuals do not trade.

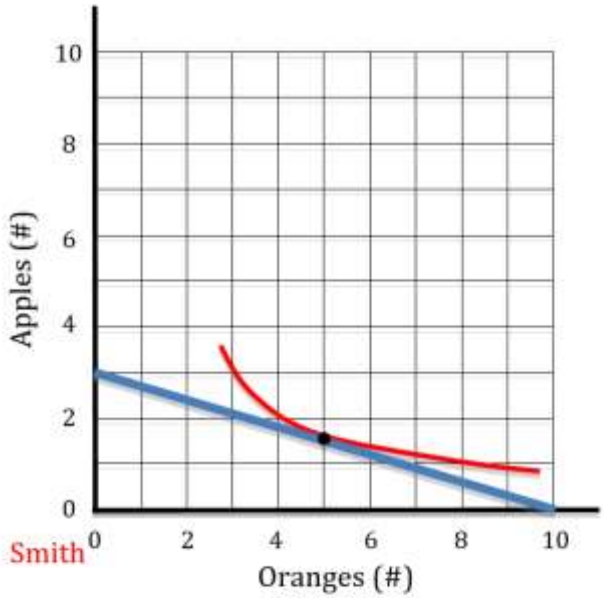
Smith's consumption choice will depend on Smith's preferences, or demands, for the two goods. If Smith loved oranges and hated apples then he might produce 10 oranges and zero apples. (point C in Figure 5.1) If he hates oranges but loves apples then he might choose to produce 3 apples and zero oranges. (point A in Figure 5.1) If he prefers more of both goods, to less, and if his preferences exhibit diminishing marginal utility then he will likely prefer to consume a variety of apples and oranges.

Suppose Smith has preferences that can be described with a set of indifference curves. Suppose he also chooses a feasible production/consumption bundle that maximizes his utility. That would occur at a point where an indifference curve is tangent to the production possibility frontier. To prove this, note that at any other point on Smith's PPF, which are the other efficient production possibilities, the associated indifference curve through that point must lie below the one depicted. Therefore the tangency point must be the maximum utility Smith can attain on his own. In Figure 5.3 that point is shown as 5 oranges and 1.5 apples. (To simplify the exposition, the indifference curve tangency is drawn at the midpoint of the PPF. This is drawn for convenience and is not a necessary outcome.)

As in the previous chapter, we will imagine that Jones exhibits some unusual behavior, always preferring to look at things upside down. So we'll draw his PPF with the origin in the upper right corner. As before, oranges increase to the left in the Figure while apples increase in the downward direction.

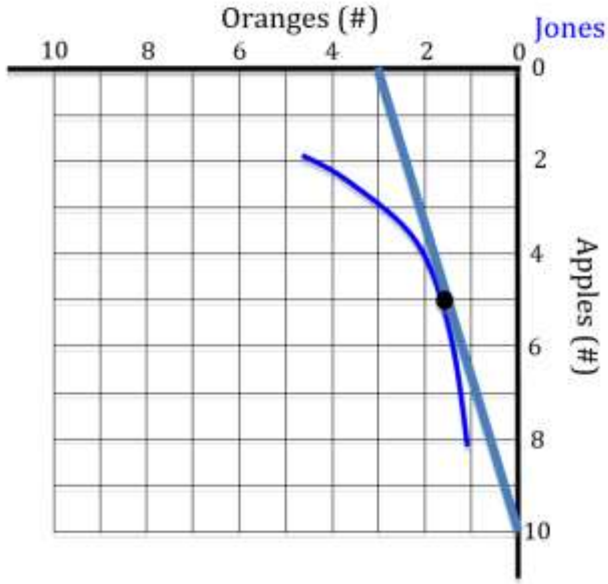
Assuming Jones has preferences resulting in an indifference curve as drawn, and if Jones maximizes utility then he will choose to produce at a point where an indifference curve is just tangent to the PPF.   In the Figure this would be at point with 1.5 oranges and 5 apples. (Also at the midpoint of his PPF for simplicity)

Figure 5.3 Smith's PPF and an Indifference Curve



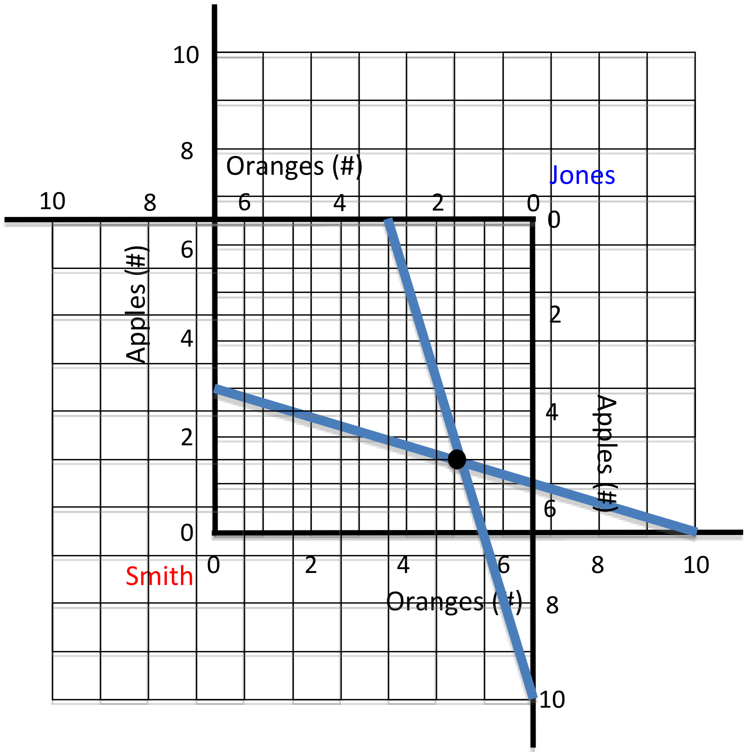
Next lets' consider what might happen if Smith and Jones produce for themselves independently, but, perhaps by chance, happen to meet each other during the day. That meeting place is called a market. Smith is carrying his production bundle with him, as is Jones, and neither has consumed anything yet.

Figure 5.4 Jones' upside-down PPF and an Indifference Curve



The individual production points on each person's PPF represents their initial endowment. Smith comes to the market endowed with 1.5 apples and 5 oranges, Jones arrives with 5 apples and 1.5 oranges. We can now construct and Edgeworth box diagram, Figure 5.5, by superimposing Jones' upside down PPF diagram on top of Smith's and overlapping their individual production points. Note that the length of the Edgeworth box is 6.5 oranges, which corresponds to the total combined production of oranges (5 + 1.5 = 6.5). The height of the box is also 6.5 and corresponds to the total combined production of apples.

Figure 5.5 Smith and Jones' Edgeworth Box before specialization



There is something immediately obvious by looking at the Edgeworth box: the endowment point is not an optimum for either Smith or Jones. Because their two indifference curves are not tangent to each other they form a lens to the upper left of the endowment point. This means there are trading possibilities in which they can trade to mutual advantage.

For example, suppose Smith were to offer one orange to Jones for one apple. In this case Smith would end up with 4 oranges and 2.5 apples (he started with 5 oranges and 1.5 apples). Jones would end up with 4 apples and 2.5 oranges. This new consumption point is clearly inside the lens formed by their indifference curves, which implies that both Smith and Jones would reach a higher indifference curve and thereby increase their utility. Happiness bursts could be created for both via trade!

However Smith and Jones could do even better for themselves by shifting their production if they plan to meet in the market again in the future. Indeed they will each have an incentive to do so once they recognize the following potential gains from trade.

Consider the previous trade pattern of one orange for one apple. This implies a terms of trade, or the price of oranges, is $(P_O/P_A) = 1$ apple per orange. If Smith is smart and a profit seeker then he should realize the following: if tomorrow he were to produce one additional orange and shift his time away from apple production, he would have to give up $3/10^{ths}$ apple. This is his opportunity cost of producing another orange ($= a_{LO}/a_{LA} = 3/10$). Suppose he assumes he can come to the market and trade with Jones one apple for every orange, or perhaps the market is bigger and everyday one could come to the market and trade as many oranges for as many apples as one wants at the one-to-one price.

Put another way, the price Smith gets for his oranges at the market is 1 apple, but the cost for Smith of producing another orange is 3/10 apple. , (i.e., $\frac{P_O}{P_A} > \frac{a^S_{LO}}{a^S_{LA}}$). Because price exceeds the cost it is profitable for Smith to produce more oranges. Continuing with this logic, because Smith is already producing 1.5 apples for himself, why not give up this apple production to produce more oranges and then trade the oranges with Jones at the better price. By shifting his time from apple production to orange production, Smith can produce 5 additional oranges giving up only 1.5 apples.

In a similar vein, Jones will discover that the price of apples in the market (P_A/P_O = 1 orange per apple) is greater than his opportunity cost of producing apples (= a_{LA}/a_{LO} = 3/10 orange per apple), that is,

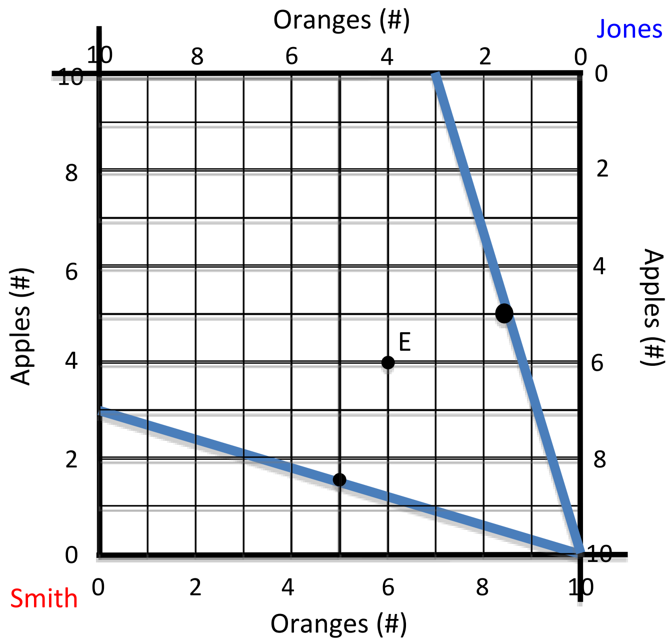
$$\frac{P_A}{P_O} > \frac{a^J_{LA}}{a^J_{LO}},$$

This means it is profitable for Jones to produce more apples.

But what happens after they specialize?

The shift in production changes the size of the Edgeworth box as shown in Figure 3.6. The production point is now in the lower right corner with Smith producing 10 oranges and 0 apples and Jones producing 10 apples and 0 oranges. The first thing to note is that the Edgeworth box itself has grown in overall size. Before specialization Smith and Jones together produced 6.5 oranges and 6.5 apples. With specialization, Smith and Jones combined produce 10 oranges and 10 apples. Specialization in the comparative advantage goods generates more oranges and more apples! Indeed this is one of the most important features of comparative advantage: the improvement in world productive efficiency, meaning the increase in output for the same overall level of inputs. Without labor being added to the economy, and simply by rearranging production, Smith and Jones are able to expand overall output of the two goods.

Figure 5.6 Smith and Jones' Edgeworth box after specialization



After specialization, a second action must occur to distribute the surplus: namely trade. For example, suppose Smith and Jones trade to point E in Figure 5.6. The resulting trade pattern would be 4 oranges from Smith for 4 apples from Jones generating a terms of trade of $P_O/P_A = 1$ apple per orange. By looking at the diagram it easy to see that both Smith and Jones would reach a higher indifference curve thereby increasing their overall utility. More specifically though, point E gives Smith 6 oranges and 4 apples as opposed to 5 oranges and 1.5 apples before specialization and trade. Since Smith has more of both goods he must be happier. Likewise Jones now has 4 oranges and 6 apples which is more than the 1.5 oranges and 5 apples he had before specialization and trade. Thus Jones must also be happier.

If point E is the optimum then Smith and Jones' indifference curves will be tangent to each other and both will achieve the condition that the terms of trade equals their marginal rate of substitution.

This example demonstrates the advantages that arise from the division of labor. Smith and Jones have two options really; either produce both goods for themselves, or specialize in producing one of the two goods and trade for the other. By doing the latter, by dividing labor and concentrating on what one is best at producing, the two can expand their overall consumption of both goods. Specialization in one's comparative advantage good creates surplus value; trade distributes the surplus between the two parties. Specialization and trade … the division of labor and trade … generates happiness bursts all around! There are gains from trade for everyone.

It is especially worth noting that by pursuing profit, Smith and Jones are led to specialize in the good in which they have a comparative advantage. Following on Adam Smith we might say they are led, as if by an "invisible hand" to specialize in the good in which they have a comparative advantage. Economists today might say they are led by the profit motive in a free market. In either case, it is the desire to do better for themselves that enables both to become better-off.

Key Takeaways

1. If two individuals producing for themselves with different production capabilities come together in the market, there is an incentive to trade to their mutual advantage.
2. When the terms of trade of a good exceeds the opportunity cost of the same good, the resulting profit will induce an individual to specialize in the production of that good..
3. Because of the pursuit of profit, individuals are led, as if by an "invisible hand," to specialize in their comparative advantage good and trade it in the market to mutual advantage.

5.5 David Ricardo and Comparative Advantage

Learning Objectives

1. Learn about David Ricardo's "discovery" of Comparative advantage.
2. Learn the implications if one person has an absolute advantage in both goods.

In the example above the numbers were chosen so that Smith had an absolute advantage in orange production and Jones had an absolute advantage in apple production. This means that Smith is technologically better than Jones in orange production while Jones is technologically better than Smith in apples. Later we derived opportunity costs to show that Smith also had a comparative advantage in orange production and Jones a comparative advantage in apple production. All of this might suggest that for someone to have a comparative advantage, he must be technologically superior in the production of something. However, this conclusion is not only wrong, but it also leads to common misunderstandings of comparative advantage.

David Ricardo first presented the theory of comparative advantage in his book the Principles of Political Economy and Taxation in 1817. In a famous example about international trade, he showed that a national absolute advantage in production was not necessary for specialization and trade to be advantageous for both countries. In that example he began with an alternative assumption; namely that one country had an absolute advantage in the production of both products, and therefore that the other country had no technological advantage at all. What would happen in this instance? Casual observation might lead one to conclude that trade would not occur. However, Ricardo showed that trade was still likely in almost all circumstances.

To demonstrate why, suppose Smith and Jones have the following values for their exogenous variables.

$a^S_{LO} = \frac{1}{10}$ hr/orange	$a^S_{LA} = \frac{1}{6}$ hr/apple	L = 1 hour
$a^J_{LO} = \frac{1}{5}$ hr/orange	$a^J_{LA} = \frac{1}{5}$ hr/apple	L = 1 hour

Because, $a^S_{LO} < a^J_{LO}$ [(1/10) < (1/5)] and $a^S_{LA} < a^J_{LA}$ [(1/6) < (1/5)], Smith has an absolute advantage in the production of both oranges and apples. However, calculating opportunity costs reveals that Smith's opportunity cost of oranges is: $\frac{a^S_{LO}}{a^S_{LA}} = \frac{(1/10)}{(1/6)} = \frac{6}{10} = \frac{3}{5}$ apple/orange

while Jones' opportunity cost is:

$$\frac{a^J_{LO}}{a^J_{LA}} = \frac{(1/5)}{(1/5)} = 1 \text{ apple/orange}.$$

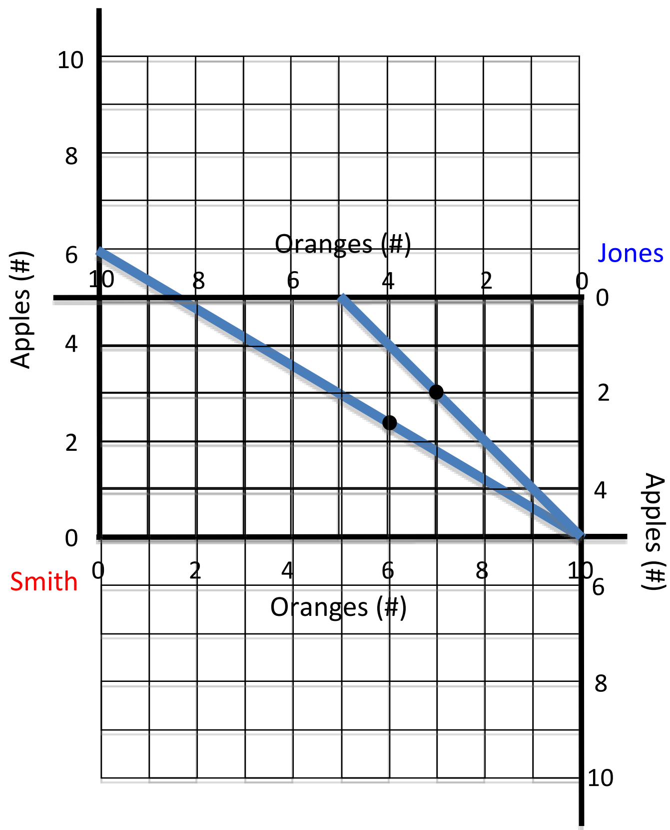
Because Smith has a lower opportunity cost for oranges, Smith has a comparative advantage in oranges relative to Jones. Also because,

$$\frac{a^J_{LA}}{a^J_{LO}} = \frac{(1/5)}{(1/5)} = 1 < \frac{a^S_{LA}}{a^S_{LO}} = \frac{(1/6)}{(1/10)} = \frac{5}{3}$$

Jones has a comparative advantage in apple production.

Notice that although Smith is absolutely better producing both oranges and apples relative to Jones, Jones still has a comparative advantage in apples. Ricardo showed that even in this circumstance, specialization in one's comparative advantage good followed by trade could result in benefits for both individuals. We demonstrate that outcome in Figure 5.7. The Figure depicts the Edgeworth box formed by Smith's and Jones' PPFs . The PPFs overlap at the point representing specialization in one's comparative advantage good. Thus Smith produces at the point 10 oranges and 0 apples, while Jones produces 5 apples and 0 oranges.

Figure 5.7 An Edgeworth box where Jones has no absolute advantage



Suppose the black points on each PPF represents the optimal consumption choice for Smith and Jones without trade. Suppose the tangency between the two indifference curves is the optimal consumption point with specialization and trade. Clearly the consumption point with specialization and trade allows both Smith and Jones to reach a higher indifference curve compared to no trade. Thus, specialization and trade can raise both Smith's and Jones' utility even though Jones is worse at producing both goods. The key, as Ricardo showed, is that you produce the good in which you have a comparative advantage.

Key Takeaways

1. David Ricardo popularized the concept of comparative advantage in his 1817 book, the Principles of Political Economy and Taxation
2. Ricardo introduced a numerical example in which one country (or person) has an absolute advantage in both goods.
3. Ricardo's example demonstrated that comparative advantage is more important than absolute advantage in determining production.
4. Ricardo demonstrated that both countries can gain from trade if each specializes in their comparative advantage good.
5. Ricardo's result implies that a country (or person) that is worse at producing both goods may still have a comparative advantage in one of the goods and can gain from specialization and trade.
6. Ricardo's result also implies that a country (or person) that is better at producing both goods may still have a comparative advantage in only one of the goods and can gain from

specialization and trade.

5.6 A Second Method of Defining Comparative Advantage

Learning Objectives

1. Learn a different way to measure comparative advantage: by calculating relative productivities and comparing them between the two traders.

As was defined earlier, a person has a comparative advantage in the good that he can produce at a lower opportunity cost. But opportunity cost is a complicated way to measure cost because it involves comparison of two production processes. It also does not lend itself well to intuition. Thus, an alternative way to define comparative advantage is in terms of relative productivities. For instance, in this example Smith is absolutely better at producing both oranges and apples.

But his productivity advantage in oranges is $\dfrac{\frac{1}{(1/10)}}{\frac{1}{(1/5)}} = \dfrac{(1/5)}{(1/10)} = \dfrac{1}{5} x \dfrac{10}{1} = 2$ times, while his productivity advantage in apples is $\dfrac{\frac{1}{(1/6)}}{\frac{1}{(1/5)}} = \dfrac{(1/5)}{(1/6)} = \dfrac{1}{5} x \dfrac{6}{1} = \dfrac{6}{5} = 1.2$ times. That both numbers exceed one means Smith has an absolute advantage in both goods, however, his advantage is twice as large in oranges and only 1.2 times larger in apples. His comparative advantage product, then, is the one that he is most better at producing, which is oranges.

In contrast Jones' relative productivities are the reciprocals of those above. We would say that Jones is ½ as good as Smith in orange production and $5/6^{th}$ as good in apple production. Since both numbers are less than one, Jones has an absolute disadvantage in both goods. However, we already know that Jones' comparative advantage is in apples. This corresponds to the good in which Jones is least worse at producing, which is also the good he is relatively best at producing.

Thus if an individual, or country, is absolutely better at producing both goods, then its comparative advantage good will be that in which its productivity advantage is largest. If an individual, or country, is absolutely worse at producing both goods, then its comparative advantage good will be that in which its productivity disadvantage is smallest. The lesson is intuitive really: everyone should work to achieve his or her own highest potential. If people do that it will maximize production given the limited resources available and can raise the welfare of all participants relative to the alternatives.

It is worth pointing out what a rare event it would be for potential gain from trade not to exist. In the model, the only time it is not advantageous to trade is when the opportunity costs in production are identical. If productivities could take on any value, and if they change over time, the chances the ratios would be identical between any two people is virtually zero. And furthermore, in a world with many goods and services, the chances are even lower. For example if someone could choose between 10 things to produce then the only way a comparative advantage is not present is if that person is, say, twice as good as the other in producing all ten items. Interestingly, this implies that as the world becomes more complex (e.g. with more products), the chances there are potential gains from trade by specializing in one's comparative advantage goods is virtually guaranteed.

Key Takeaways

1. If an individual, or country, is absolutely better at producing both goods, then its comparative advantage good will be that in which its productivity advantage is largest compared to the other trader.
2. If an individual, or country, is absolutely worse at producing both goods, then its comparative advantage good will be that in which its productivity disadvantage is smallest.

5.7 Misunderstandings about Comparative Advantage

Learning Objective

1. Learn some of the common misunderstandings about the principle of comparative advantage.

Sometimes when people think about trade between nations, they imagine that there are economically strong countries, like the United States, Germany, and other developed countries, and economically weak countries, such as the poor countries in Africa and other developing countries. If strong and the weak countries are allowed to compete and trade with each other in a free market, it is also sometimes presumed that the strong nations will take advantage of the weak; that the strong will benefit from trade at the expense of the weak countries. An analogy is sometimes made with competition in the natural world, which often results in the survival of the fittest at the expense of the weak and vulnerable.

Although this way of thinking is potentially valid in the context of military power, the theory of comparative advantage demonstrates why it is misguided with respect to economic power. In the model constructed in Section 5.4 above, we assumed that one country was technologically superior in the production of both goods. Consequently, the other country was assumed to be technologically inferior. In this circumstance, we can reasonably claim that one country is economically more powerful than the other weaker country. However, it is a fallacy to presume that greater "power" implies greater advantage. The Ricardian model shows that if firms pursue profit by seeking the best price to sell its products, it will be led by an invisible hand to specialize in its comparative advantage good and will trade that good with the other country to its own advantage. Despite having inferior economic "power," a country can still benefit from trade.

This result is quite remarkable and does not conform to most people's intuition. Perhaps this explains a tendency for people to believe that a country needs an absolute advantage in something in order for trade to be beneficial. Benefits from trade that derive from your country's "power" in producing something makes perfect sense and is highly intuitive. This notion isn't wrong, of course. This intuitive argument for advantageous trade based on absolute advantage is fully consistent with comparative advantage.

We can also reflect upon this result in the context of individuals instead of countries. Imagine a person that is inferior to all others in his or her productive capacity; perhaps an individual with physical or mental challenges. The theory of comparative advantage would suggest that such individuals can still participate, contribute and benefit by engaging in a free market system. The key is to discover that occupation in which one is relatively best at.

As an example, in Ithaca, NY there is a business called Challenge Industries. This company hires individuals that face barriers to employment, including individuals with physical and mental disabilities. It then identifies jobs in the community in which each individual is capable of achieving success. This is an example of comparative advantage in action. A community, a country and the world can maximize its productive potential by allocating its workforce and resources on the basis of what those resources are relatively best at producing; that is, on the basis of comparative advantage.

One last point worth mentioning is that comparative advantage, for individuals or countries, need not be unchangeable. In economic models we assume that the unit-labor requirements defining the technology is fixed. However, those variables are likely to change over time, and indeed can be induced to change in a particular way. For example, students in college will specialize in a particular major field. The knowledge they acquire in their major will make them relatively more knowledgeable than others about that subject and thus will shift their comparative advantage in that direction. A little education may not be enough to overturn their original advantage, but extended training in a discipline surely will.

In a similar way countries can transform their comparative advantage over time via education, investment and research into new technologies. For example, a country whose comparative advantage today is agricultural goods and raw materials can, over time, transform its advantage to heavy industry, electronics, or finance. Indeed, due to changes in technology, the migration of individuals, and the discovery and depletion of resources, comparative advantage is constantly in a state of flux even when countries do not make a concerted effort to change it. This means that producing on the basis of comparative advantage does not lock individuals or countries into a fixed production and trade pattern. Those patterns will change naturally over time and can be induced to change if so desired.

Key Takeaways

1. If one person, or country, has more economic power, in the sense of having higher productivity in all goods, it does not imply that the powerful agent gains while the weaker agent loses. Instead, through trade, both can gain.
2. Overall production is maximized when available resources are allocated on the basis of comparative advantage.
3. Comparative advantage can be expected to change over time for a country and for individuals because of education, investment and innovation.