

Lesson by

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Lesson Description

In this lesson, students develop the production possibilities frontier model while discussing the value of models in general in explaining complex ideas. They see what movement along the production possibilities curve entails—on both the constant-cost curve and a bowed curve indicating increasing costs. They discuss ways a society can consume beyond the limits of its production possibilities through specialization and trade, as well as through an increase in resources, capital investment, and technological advance.

Time Required

90 minutes

Content Standards

National Standards in Economics

- **Standard 3:** Allocation
Different methods can be used to allocate goods and services. People acting individually or collectively must choose which methods to use to allocate different kinds of goods and services.
 - Benchmark 3, Grade 8: “People in all economies must address three basic questions: What goods and services will be produced? How will these goods and services be produced? Who will consume them? ”
 - Benchmark 5, Grade 8: “As consumers, people use resources in different ways to satisfy different wants. Productive resources can be used in different ways to produce different goods and services. ”
- **Standard 15:** Economic Growth
Investment in factories, machinery, new technology, and in the health, education, and training of people stimulates economic growth and can raise future standards of livings.
 - Benchmark 1, Grade 12: “Economic growth is a sustained rise in a nation’s production of goods and services. Long term growth in output...varies across countries because of differences in investments in human and physical capital, research and development, technological change, and from alternative institutional arrangements and incentives. ”
 - Benchmark 3, Grade 12: “Investing in new physical or human capital can increase future productivity and consumption, but such investments require the sacrifice of current consumption and entail economic risks.”

Concepts

Production possibilities frontier
Economic models
Opportunity cost
Economic growth
Technological advance
Capital investment
Capital goods
Consumer goods

Objectives

Students will:

- Define production possibilities frontier.
- Explain the function of economic models.
- Describe the trade-off between capital goods and consumption goods.
- Define opportunity cost.
- Describe the difference between a constant-cost curve and a curve depicting increasing costs.
- Explain why societies face increasing costs as they attempt to move resources from one use to another.
- Identify the means by which a society can experience economic growth.

Materials

- Interactive Whiteboard slides (PPC)
- A copy of Handout 1 for each student (optional)
- A copy of Handout 2 for each student

Procedure

1. Begin the lesson by reviewing scarcity. Explain that there are not enough resources to fulfill everyone's wants. This applies to individuals and societies. For individuals, scarcity means that we must make choices about the goods and services we want to consume. Societies must make consumption choices, too. In fact, at the core of a society's consumption choices are its decisions about production. Explain that the **Production Possibilities Frontier (PPF)** is an **economic model** used to illustrate how societies make decisions about what to produce. Economists use models for a couple of reasons.
 - Display slide 2 and explain that, first, models allow economists to study economic events without the economy suffering through the events. Economists find it difficult to conduct experiments because it is difficult for economists to replicate reality. For example, if economists want to study the effects of a 20 percent unemployment rate, they must look at past occurrences of unemployment and build models using past and current data. An alternative to using a model would be to ask all employers to lay off 20 percent of their workers so that economists could observe the unemployed workers' behaviors.
 - Display slide 3 and explain that models can simplify complex ideas. Even the most primitive society can produce many goods and services, and figuring out why a society produces the hundreds of goods it produces in the quantities it produces would be overwhelming. Ask the following questions:
 - What are some examples of models? (*model cars, model trains, model dinosaurs, the model of the solar system elementary grade kids submit to the Science Fair*)
 - In what ways does a model car increase your knowledge of the car the model depicts? (*The model car shows the style of the car, it shows how the car can be distinguished from other cars, it shows the type and size of the engine that runs the car.*)
 - In what ways does the solar system model increase your knowledge of the solar system? (*The model shows the order of the planets, it shows the relative size of the planets, it depicts the distance each planet is from the sun.*)
2. Display slide 4 and explain that the Production Possibilities Frontier model depicts why a society must make choices about what it will produce. The model is designed to explain reality, but what makes it useful is its simplicity. Discuss the assumptions of the model as follows:
 - **A society that produces only two goods:** In a two-dimensional space, we can illustrate two products, rather than the hundreds of products a society is likely to produce. Often economists use examples that represent broad categories of goods—consumer goods and capital goods.
 - **The efficient use and full employment of resources:** An efficient production outcome has been achieved when no more of the product can be produced without reducing the amount of an alternative product. All resources are

in use so that producing more of product A would necessitate moving resources from producing product B and, therefore, reducing the amount of product B produced.

- **Fixed technology:** The society is applying a certain, unchanged level of technology. There has been no new innovation or invention to push production forward.
- **A single snapshot in time:** In reality, changes take place in resource availability, consumer preferences, and the production of goods and services in all societies. This simple model cannot depict every movement in a dynamic economy, and it isn't necessary that it do so.

3. Display slide 5 and explain that this table shows combinations of potatoes and apples that can be produced with the resources available to this society. For example, this society has sufficient resources to produce six units of potatoes, but it would then have no resources left to produce apples. If the society were to produce one unit of apples, it would have enough resources left to produce five units of potatoes. Notice that to increase the production of apples by one unit, it would be necessary to give up one unit of potatoes. The opportunity cost of increasing the production of apples by one unit is one unit of potatoes. **Opportunity cost** is whatever item is given up when a different item is chosen. The society must incur this cost because it has limited resources.
4. Display slide 6 and ask the following questions:
 - What number of potatoes and apples can be produced at combination D? (*three units of potatoes and three units of apples*)
 - What number of potatoes and apples can be produced at combination A? (*six units of potatoes and zero units of apples*)
 - If the society were to move from production combination B to combination E, what would it gain? (*three units of apples*)
 - What would be the opportunity cost of a move from combination B to combination E? (*three units of potatoes*)
5. Display slide 7 and invite students to construct the production possibilities table. Use the "undo" button to correct mistakes.
6. Display slide 8 and discuss the construction of the graph as follows. This is a graph of the production possibilities frontier data. Units of potatoes are placed on the Y axis and units of apples are placed on the X axis (Of course you could place them on the opposite axes and show the same information.). The word "units" is simply a term of measurement and could mean anything from bags to bushels to tons.
7. Display slide 9. Point out that this slide shows both the table and the graph illustrating this society's production possibilities. Point out that the graph is referred to as the Production Possibilities Frontier (curve). Explain that it is a frontier because it is

the limit to what can be produced. Draw students' attention to the combinations in the table and click through the slide to illustrate the combinations A through G on the graph. Explain that there are other possible combinations that lie between the points depicted on the graph. For example, you could place a point half of the distance between points A and B. Ask students how many units of potatoes and apples that point would represent. (*5.5 units of potatoes and .5 units of apples*)

8. Display slide 10. Explain that the line, or curve, represents all possible combinations of potatoes and apples that can be produced by this society. It also represents the limit of production, meaning that the society cannot produce any combination to the right of the curve (frontier). It also represents the society's total resources available for production. Finally, it represents the efficient use of resources. A production combination is efficient when it is impossible to gain more of one good without losing some amount of the other good. Ask the following questions:
 - At combination A, is it possible to gain one unit of apples and maintain six units of potatoes? (*No.*)
 - At combination E, is it possible to gain one unit of potatoes and have four units of apples? (*No.*)
 - If this society moves from combination F to combination E, what is gained? (*one unit of potatoes*) What is the opportunity cost of this move? (*one unit of apples*)
 - If this society moves from combination D to combination C, what is gained? (*one unit of potatoes*) What is the opportunity cost of this move? (*one unit of apples*)
9. Display slide 11 and explain that in this graph of potatoes and apples, the gain of one unit of one good causes the loss of one unit of the other good. With each gain of one unit, there is a loss of one unit. This can also be seen in the table.
10. Display slide 12. Explain that in this society, one unit of apples costs one unit of potatoes and one unit of potatoes costs one unit of apples regardless of where the society is producing along the curve. Explain that this is referred to as a constant cost curve. Each gain results in the same (or constant) cost.
11. Display slide 13 and ask the following questions:
 - If this society moves from combination A to combination B, what is gained? (*one unit of apples*) What is the opportunity cost of this move? (*two units of potatoes*)
 - If this society moves from combination C to combination D, what is gained? (*one unit of apples*) What is the opportunity cost of this move? (*two units of potatoes*)
 - What does it cost this society to produce one unit of apples? (*two units of potatoes*)
 - What does it cost this society to produce one unit of potatoes? (*.5 units of apples*)

12. Display slide 14 and point out that this is also a constant-cost curve. The cost is the same regardless of the point from which you move along the curve.
13. Display slide 15 and point out that this is another example of a constant-cost curve. Ask:
 - How much does a unit of apples cost? (*.5 units of potatoes*)
 - How much does a unit of potatoes cost? (*two units of apples*)
14. Display slide 16 to verify student response.
15. Display slide 17 and ask the following questions.
 - Can this society produce four units of apples and four units of potatoes? (*No.*)
 - What combination point represents four units of apples and four units of potatoes? (*combination I*)
 - Why is this curve referred to as a frontier? (*Answers will vary, but students should recognize that one definition of frontier is the limit of what is known; in the same way, the frontier in the model represents the limit of production. The resources necessary to produce beyond the curve do not exist.*)

Economic Growth

16. Reiterate that production beyond the curve is impossible by asking students if this society can produce at combination I. (*No. This point lies outside the production possibilities frontier.*)
17. Display slide 18 and ask students if this society can produce at combination H. (*Yes.*) Explain that, although it is possible to produce at combination H, it would be undesirable. Producing at combination H is inefficient because it is possible to produce an additional unit of one good without losing some amount of the other good. Demonstrate this by moving point H to three units of potatoes and two units of apples. Explain that any combination that lies to the left of the curve is inefficient because resources are going unused. Points within the curve could be thought of as representing unemployment or underemployment of resources, such as idle workers, empty factories and unused equipment.
18. Explain that the goal of society is to experience **economic growth**—to produce increasing amounts of goods and services, reaching combination I and beyond. However, a society cannot accomplish an increase in production beyond the existing frontier unless a change takes place.
19. Display slide 19. Pull the shade to reveal “technological advance” and “railcars, refrigeration, computers.” Define **technological advance** as forward movement in the body of knowledge. Point out that the intercontinental railroad allowed people on the coasts to develop new markets and produce more goods. Refrigeration allowed the transportation of perishable goods to new markets. Computers

allow people to perform previously time-consuming calculations in just seconds. Ask students for other examples of technological advances that allowed societies to produce more goods and services. *(Answers will vary, but students might mention the automobile, television, and telephone.)*

20. Continue to display slide 19 and pull the shade to reveal “An increase in human or natural resources” and “population increase, discovery of a new oil field.” Explain that when there are more people to perform work, it is possible to increase production. An example of this is the intercontinental railroad. An increase in immigration allowed the rail line to be completed. Refer back to natural resources and ask students how a new oil field discovered under seven Midwest states might change production in the United States. *(It would be cheaper to produce all goods and services that use oil, so more could be produced.)*
21. Reveal the rest of slide 19 and explain that **capital investment** includes investment in the purchase of new tools and equipment that can aid production, and development of human capital—educating and training the labor force to aid production. Imagine a carpenter trying to build a house by driving nails into wood using a rock. Think about the increase in production if the carpenter had a hammer. Then, think about the increase in production if the carpenter had an electric hammer. Explain that governments also invest in capital when they build roads, bridges, and sewers. Those improvements in infrastructure increase productivity.
22. Display slide 20 and have students read the story or provide each student with a copy of handout 1. When students have read the story, display slide 21. Point out that, in this graph, units of capital goods are on the Y axis and units of consumer goods are on the X axis. **Capital goods** are man-made goods that are used in the production of goods and services. So, anything that serves as a tool is a capital good. **Consumer goods** are goods and services that are used for current consumption. Ask the following questions.
 - In the story, what are the capital goods? *(the mats)*
 - In the story, what are the consumer goods? *(the coconuts)*
 - What combination of capital goods and consumer goods were being produced before Frick and Frack became ill? *(G, 0 units of capital goods and 6 units of consumer goods)*
 - What combination of capital goods and consumer goods might be produced now that Frick and Frack are continuing to make mats? *(Answers will vary, but students should recognize that the society will now produce some level of capital goods.)*
 - If the society moves from combination G to combination F, what is the opportunity cost? *(one unit of consumer goods)*
23. Display slide 22. Point out that for society to have capital investment, it must be willing to give up some consumer goods.

24. Display slide 23. Explain that capital investment or technological advance or an increase in human or natural resources will allow this society to move its production possibilities frontier to I and even beyond. In that case, the society will be able to have more consumer goods and more capital goods.

Increasing Opportunity Cost

25. Display slide 24 and explain that economists think that the model of the Production Possibilities Frontier should be convex—curve outward—because this shape better illustrates the true costs of moving from the production of one good to its alternative.
26. Display slide 25 to illustrate how this society can move from producing 0 units of apples to one unit of apples, pointing out that a small fraction of one unit of potatoes is foregone.
27. Display slide 26 to show movement from one unit of apples to two units of apples. A close look will reveal that more potatoes were given up for the second unit of apples than were given up for the first.
28. Display slides 27 through 30 drawing students' attention to the difference in the opportunity cost with each successive unit of apples. When the first unit of apples was produced, society gave up a tiny fraction of a unit of potatoes, as depicted in red. When an additional unit of apples was produced, as depicted in green, only a fraction of potatoes was given up, but the fraction of potatoes given up this time was larger than the fraction of potatoes given up with the last unit of apples.
29. Explain that the opportunity cost in potatoes becomes greater and greater until finally, as depicted in dark green, an additional unit of apples, costs more than three units of potatoes. Help students conclude that apples become increasingly costly as society tries to produce more of them. Explain that this would also be the case for potatoes. Apples would become more and more costly as potato production increased.
30. Use the following story to explain that increasing costs occur because resources are not perfectly transferable among uses. Start at slide 24 to illustrate the points in the story.

In the land of Ronton, people produced potatoes. Everyone worked in the potato fields, and all resources were devoted to potato production. But, the people longed to eat something else. Potatoes were so boring! So, they dug up some of their least productive potato plants and they took some of their tallest human resources and began a small apple orchard. The unproductive potato plants hadn't been planted in good locations, and the tall people got back aches digging potatoes from under the ground.

Display slide 25. When apple production began, there was a reduction in potato production, but it was so small, the people of Ronton barely noticed it, and they were certainly enjoying their new crop of apples.

As apples became more popular, it became apparent to the people of Ronton that they would have to devote more resources to apple production. So, they dug up more potato plants to make room for more apples trees. They couldn't dig up the least productive potato plants because they had already done that to get their first crop of apples. However, the plants they dug up this time were the least productive of the plants they had left. They transferred more tall human resources to the production of apples. These weren't the tallest – those people were already working in the apple orchard. However, these were the next tallest.

Display slide 26. The people gained a whole additional unit of apples, and gave up just a fraction of a unit of apples. However, one wise member of Ronton society pointed out that the number of potatoes they gave up was increasing. But, no one listened to her.

Display slide 27. The people's taste for apples soared. And, as they tried to increase production, they had to dig up more productive potato plants than the first groups of plants they destroyed. They had to take shorter and shorter human resources from potato production. Now, they were giving up even greater amounts of potatoes, and the shorter workers began to complain that their shoulders hurt from stretching to reach the apples. The wise member of Ronton pointed out that apples were becoming increasingly costly.

Display slides 28 and 29 and point out the opportunity cost of five units of apples.

Display slide 30 and continue the story. But the people's tastes for apples could not be satisfied. They soon devoted the rest of their resources to the production of apples; but, as their wisest citizen noted, they gave up more than three units of potatoes to gain that last unit of apples.

In the end, they learned that human resources cannot do all work equally well. They also learned that some soils are better for potato growing and some are better for apple growing. In general, not all resources are suitable for all production.

Closure

31. Place students in groups of five. Provide each group with a copy of Handout 2 and two blank sheets of paper—one for graphing and one for writing answers to questions. The answer to the graphing activity is shown on Slide 31. The answers to the questions are as follows:
- What is the production possibilities frontier? *(It is a model depicting why a society must make choices about what it will produce.)*
 - Why do economists use models? *(Models allow economists to study economic events in the absence of the event actually taking place. Models can simplify complex ideas.)*
 - How does a society benefit from the production of capital goods? *(An investment in capital goods can expand the production possibilities frontier, providing more consumption goods in the future.)*
 - What is the opportunity cost to a society of investing in capital? *(It must give up some current consumption.)*
 - Why do economists consider the bowed production possibilities curve to be more realistic? *(The bowed curve illustrates increasing costs associated with increasing units of each good, indicating that resources are not perfectly suited to all uses.)*
 - How can societies achieve economic growth? *(Societies can achieve economic growth through capital investment, technological advance, and an increase in resources)*

Handout 1

Once upon a time on the tiny island of Nor, all of the people were involved in their daily labor: knocking coconuts out of trees, carrying them to a pick-up point, and delivering them from the pick-up point to the market. All of the people, except Frick and Frack, that is. Frick and Frack weren't feeling well on this day and were sitting, listless, under a palm tree. As they sat, Frick was, almost subconsciously, picking up palm leaves and weaving them together, in and out, in and out. Frack glanced down at Frick's work and asked, "What are you making there?" Frick looked down and puzzled, "I'm not really makin' nothing'."

But, actually, he had made something. It was a small mat. Frack said, "Keep going." Pretty soon, the mat was about a square foot. The two of them pondered what could be done with this collection of palm leaves when, suddenly, Frack said, "Keep going, but start weaving the leaves tighter." As Frick progressed, the sides of the mat began to turn up, and the mat was slowly turning into a large basket. When the mat got to be about two feet in diameter, Frack said, "That should be enough." And, with that said, he began to place coconuts onto the mat. It held 18. Frack said, "Can you imagine how much easier it will be to carry coconuts with this?" Frick could imagine it!

Frick and Frack took their good idea to their supervisor, Frock, who immediately ordered that they remain under the tree and continue to make mats.

Handout 2

Use the following information to complete this assignment.

	A	B	C	D	E	F	G
Units of capital goods	6	5	4	3	2	1	0
Units of consumer goods	0	1	2	3	4	5	6

Begin with the person reading this piece of paper and move clockwise through the steps to complete a production possibilities curve. If a member of your group does not know how to proceed or begins to make an error, other members of the group may correct him or her. Then, on a separate sheet of paper, answer the questions that follow.

- Step 1: Draw the Y and X axes and number the units.
- Step 2: Label the Y and X axes and title the graph.
- Step 3: Plot the production combinations.
- Step 4: Draw the curve.
- Step 5: Note the opportunity cost of each variable in terms of the other.

Answer the following questions:

What is the production possibilities frontier?

Why do economists use models?

How does a society benefit from the production of capital goods?

What is the opportunity cost to the society of investing in capital?

Why do economists consider the bowed production possibilities curve to be more realistic?

How can societies achieve economic growth?