

LESSON 23

BIGGER IS BETTER: THE ECONOMICS OF MASS PRODUCTION

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LESSON DESCRIPTION

The students examine a series of visuals that explain economies of scale. Volunteers are asked to do calculations regarding levels of production.

The character of the United States economy changed late in the nineteenth century. Manufacturing, rather than agriculture, became its central feature. This lesson discusses the characteristics of mass production and demonstrates that increasing output lowers the cost of producing most goods.

MYSTERY

The United States economy changed dramatically in the period following the Civil War. The average standard of living more than doubled between 1870 and 1910. Business itself changed during this time. Various ways were tried to increase the size of businesses, including trusts and holding companies. Size appears to be important, but why? Why were big businesses able to produce many kinds of goods and services more cheaply than small businesses?

ECONOMIC HISTORY

The rise of big businesses after the Civil War benefited the American economy when those large firms produced more goods and services at lower costs. Because they were efficient, they could sell their products at lower prices; as a consequence, the standard of living rose. The decline in costs of industrial production during the latter part of the nineteenth century and beyond can be explained to a large extent by the introduction of techniques of mass production.

CONCEPTS

- Capital
- Costs of production
- Division of labor
- Economies of scale
- Financial capital

- Fixed costs
- Mass production
- Variable costs

OBJECTIVES

Students will:

1. Explain how economies of scale are determined.
2. Identify examples of mass production methods used by Andrew Carnegie to lower the costs of producing steel.

CONTENT STANDARDS

Economics

- Investment in factories, machinery, new technology, and the health, education and training of people can raise future standards of living. (NCEE Content Standard 15)

History

- How the rise of corporations, heavy industry, and mechanized farming transformed the American people. (Era 6, Standard 1, National Standards for History)

TIME REQUIRED

45 minutes

MATERIALS

- A transparency of Visuals 23.1, 23.2, 23.3 and 23.4
- A copy of Activity 23.1 for each student.

PROCEDURE

1. Tell the students that the purpose of this lesson is to explain how the American economy became more productive late in the nineteenth century. The average standard of living for Americans more than doubled between 1870 and 1910. A major

- factor in this increase was the rise of big businesses and the widespread use of mass production.
2. Display Visual 23.1. Tell the students that large businesses can often produce goods and services more cheaply than small businesses. This benefits consumers because lower costs enable firms to reduce the prices they charge without reducing their profits.
 3. Explain that the large firms that became more common after the Civil War were able to lower their costs by using techniques of mass production. These techniques enabled firms to produce a large number of products, referred to in this lesson as *units*, at an increasingly low cost per unit. *Cost per unit* refers to the average cost of producing each product in a line of products.
 4. Display Visual 23.2. Tell the students that, in order to understand how costs can be lowered by increasing the number of units produced, they must understand that a business firm has two kinds of costs: fixed costs and variable costs. Fixed costs do not change, whether the producer makes 100 units or 1,000 units. The major fixed cost is usually capital.
 5. Explain that the word *capital*, when used by economists, does not refer to money or stocks and bonds. (Economists call these assets *financial capital*.) *Capital* as used here refers to goods that are used to produce other goods and services — for example, buildings, machinery and equipment, and normal profit. Buying or renting a factory generates a cost for a business firm, but the cost may be the same — that is, fixed — whether the factory is used to produce 100 units or 1,000 units. On the other hand, variable costs are likely to be greater if 1,000 units are produced rather than 100 units. The most common variable costs are labor and raw materials. To produce 1,000 units, a firm will need approximately 10 times more labor and materials than it needs to produce 100 units.
 6. As an example, ask the students to imagine that they are managing a new business firm in the 1870s that will produce canned tomatoes — a new idea at the time. Ask them what their major fixed costs will be; list the fixed costs on the chalkboard as they answer. (*The fixed costs would include the costs of a building, cookers, canning machinery and a power source like electricity to light the factory and operate the machinery. If a student suggests that the firm will need more electricity to operate the machinery if 1,000 units are produced, rather than 100 units, acknowledge the point: Some costs fall between the two categories of fixed and variable. An electricity bill would not increase for every additional unit produced, but it would increase if the factory were running two shifts instead of one.*)
 7. Ask the students what the major variable costs will be for the tomato canning firm; list the responses. (*Variable costs would include workers' wages and the cost of tomatoes and cans.*)
 8. Display Visual 23.3. Ask a student with a calculator to come to the front of the class to make calculations. Tell the students that the canned tomato factory is going to begin by producing a relatively small amount in its first week of operations. Fill in the blanks on Visual 23.3 as follows: Weekly output will be 100 cans, the Total Variable Cost will be \$25, the Total Cost will be \$10,025, you will divide by 100 cans, and Cost Per Unit will be \$1,025. Ask: How high a price would you have to charge for each can in order to cover all your costs of production? (*\$100.25 per can.*) Ask the students how many cans they could expect to sell at that price. (*None!*)
 9. Erase your entries on the visual and tell the students that if they increase the number of cans produced in a week, they might be able to get that cost per unit down. Fill in the blanks as follows: Weekly output will be 1,000 cans, the Total Variable Cost will be \$250, the Total Cost will be

- \$10,250. Divide by 1,000 cans. The Cost Per Unit will be \$10.25 per can. Ask: How high a price would you have to charge for each can now in order to cover all your costs of production? (*\$10.25*) Will you sell many cans at that price? (*No.*) Ask the students what they could do to make the price more reasonable. (*Produce more units per week.*)
10. Erase your entries on the visual again. Now calculate the cost at an output of 25,000 cans. (*Total Variable Cost, \$6,250, Total Cost, \$16,250, Cost Per Unit, 65 cents a can.*) Sixty-five cents a can is a pretty reasonable price.
 11. Ask the students why the cost per unit keeps falling as the number of units produced increases. (*Fixed costs are spread over a larger and larger number of units.*) Tell the students that this approach to reducing costs is often referred to as *economies of scale*.
 12. Display Visual 23.4. Explain the definition of *economies of scale*.
 13. Display Visual 21.1 again. Tell the students that, for some products, maximum economies of scale cannot be achieved without large amounts of capital. Automobile production is one example. The need for high levels of capital investment explains why there are only a few automobile companies in the United States today; it takes massive amounts of capital to produce the number of automobiles necessary to bring the price of cars down to affordable levels, and it takes huge amounts of financial capital to buy the necessary buildings and equipment. On the other hand, producing clothing takes relatively small amounts of capital; many small firms produce clothing because it doesn't take much financial capital to set up a clothing manufacturing business.
 14. Tell the students that typically, in mass production manufacturing, each worker performs only one small part of the total production process. This is known as division of labor. The work done on an assembly line provides a good example of division of labor.
 15. Tell the students that some elements of mass production were in use long before the Civil War. For example, textile firms made extensive uses of division of labor. However, many of the new industries that arose later in the nineteenth century were suited to new methods of production that took full advantage of economies of scale. One of the first of these was the steel industry.
 16. Keep Visual 23.1 on display. Distribute a copy of Activity 23.1 to each student. Organize the students into small groups and tell each group to find and write down examples of each of the characteristics of mass production described in the reading. Give the groups 10 to 15 minutes for this activity. Ask: Which characteristics of mass production are identified in this reading? (*Large number of units produced: Carnegie was the largest producer of steel in the world. Low cost per unit: Carnegie used tools of accounting, such as understanding fixed and variable costs, to help reduce costs. Large amounts of capital: Carnegie switched from the Bessemer converter to open-hearth furnaces even though he had invested heavily in the Bessemer process. Coordinated work force: Carnegie organized a system of foremen on the factory floor to help coordinate work tasks. Division of labor: Jobs were carefully sequenced so that workers could specialize in performing certain tasks.*)
 17. Ask the students to think of industries that would have used large amounts of steel late in the nineteenth century. (*Railroads and the construction industry were heavy users of steel.*) Tell the students that these industries could afford to lower their prices if they could buy steel at lower prices. But why would they choose to do so? Why not continue to charge higher prices in order to make higher profits? (*The answer has to do with competition. The railroads and construction were highly competitive industries in these years, although the railroads were not always competitive in isolated markets.*)

CLOSURE

Review the idea that producing more units lowers the cost of producing each one. If costs are lower, then lower prices can be charged. At lower prices, consumers can afford to buy more and better products, and standards of living improve accordingly. Ask the students why making more units of a product usually lowers the cost. (*Fixed costs per unit go down.*)

ASSESSMENT**Multiple-Choice Questions**

1. In the late nineteenth century, prices of many products kept falling, which raised the average standard of living for Americans. Which of the following best explains this?
 - A. The United States was importing more cheap foreign goods.
 - B. Mass production methods were lowering the cost of producing many goods.**
 - C. Government regulations put price ceilings on the amount that could be charged for many goods.
 - D. In order to gain more customers, business firms lowered the profits they made on their goods.
2. Andrew Carnegie made his huge fortune by
 - A. producing steel at lower costs than his competitors could.**
 - B. achieving a monopoly in steel and charging high prices.
 - C. inheriting wealth on his mother's side of the family.
 - D. being the first businessman to introduce division of labor into the production process.

(Possible answer: A business firm has both fixed costs and variable costs. When the firm increases the number of units it produces, total variable costs rise but fixed costs remain the same. Total fixed costs are spread over a larger number of units, thus reducing the amount of fixed cost that has to be covered by each unit of the product. As a result, the average cost of each unit is reduced, and a lower price can be charged for the product in question without reducing profits.)

2. What methods did Andrew Carnegie use to become the leading steel producer in the United States?

(Possible answer: He was able to charge lower prices because he constantly lowered costs of production. He did this by employing mass production methods such as purchasing the newest and most efficient capital, using division of labor and better methods of management, and producing as much of the product as possible in order to achieve maximum economies of scale.)

ESSAY QUESTIONS

1. Explain how economies of scale make it possible for manufacturers to lower the prices they charge for their products. In your answer, use the concepts of fixed costs and variable costs.

VISUAL 23.1

CHARACTERISTICS OF MASS PRODUCTION

- Large Number of Units Produced
- Low Cost Per Unit
- Large Amount of Capital (plants and machines)
- Coordinated Work Force (organized often in an assembly-line fashion)
- Division of Labor

VISUAL 23.2

FIXED COSTS, VARIABLE COSTS AND THEIR RELATIONSHIP TO COST PER UNIT

1. **Fixed costs** are costs that do not change when the number of units produced increases or decreases. For most business firms, fixed costs include the following:
 - Capital
 - Utilities
 - Property taxes
2. **Variable costs** are costs that change when the number of units produced increases or decreases. For many business firms, variable costs include the following:
 - Labor
 - Raw materials
3. Total fixed costs plus total variable costs equal **total cost**.
4. Total cost divided by the number of units produced equals **cost per unit**.

VISUAL 23.3
FIGURING THE COSTS

Weekly output: _____ cans

Total fixed cost: \$10,000 a week

Variable cost per unit: 25 cents per can

Total variable cost: _____

Total cost: _____

Divided by _____ cans

Cost per unit: _____

VISUAL 23.4
ECONOMIES OF SCALE

The situation where the average total cost of making a product declines as production increases in the long run.

ACTIVITY 23.1

ANDREW CARNEGIE AND THE AMERICAN STEEL INDUSTRY

An economic revolution took place in the 1870s when steel replaced iron as an industrial material. Steel was stronger and less brittle than iron. It produced superior rails, tools and machinery, and made possible the construction of the tall buildings that soon came to characterize the great cities of the United States.

The leading figure in the steel revolution was Andrew Carnegie, a poor Scottish immigrant who began his career as a bobbin boy in a textile factory. By the time he reached his mid-20s, he was a top executive for the Pennsylvania Railroad. He invested in several other firms, including the Keystone Bridge Company, and became a wealthy man. He resigned from the railroad in 1865 and spent the next few years raising financial capital for Keystone and other enterprises in which he was involved. He also became the dominant partner in the Union Iron Works. In 1872 he formed a partnership to build a steel mill near Pittsburgh, Pennsylvania. Acquiring other steel companies and building new facilities, he eventually became the world's largest manufacturer.

In all the companies that he controlled, Carnegie cut costs to the bone. This allowed him to undersell his competitors and still make handsome profits. In his youth, Carnegie had attended night classes to learn accounting. As a businessman, he introduced the concepts of fixed and variable costs into the accounting systems of the firms he managed and strove always to increase the number of units produced in order to take maximum advantage of fixed capital. He searched for new and better machinery, often discarding recently purchased equipment to replace it with something that was more efficient. When open-hearth furnaces were shown to produce steel more economically than Bessemer converters, he installed six open-hearth furnaces at his Pittsburgh plant even though he had already invested heavily in the older Bessemer process. His expertise in finance allowed him to find the funds to buy the massive amounts of capital equipment necessary to produce more and more steel at lower and lower prices.

In Carnegie's factories, workers and machines were sequenced to assure that each unit flowed smoothly and quickly through the production process. Each worker performed one task and then sent the product on to the next machine and the next workers. Managers were organized — from the foremen on the factory floor to factory managers to the top partners of the enterprise and the dominant partner, Carnegie himself. At every level, workers and managers were pressed to find ways to lower costs.

In 1901 Carnegie retired and spent the rest of his life giving away most of his fortune to charitable causes. But his greatest contribution was to the growth of the United States economy in making low-cost, high-quality steel available to American enterprises.

QUESTION FOR DISCUSSION

Provide an example of how Carnegie took advantage of each characteristic of mass production.

- Large number of units produced:
- Low cost per unit:
- Large amount of capital:
- Coordinated work force:
- Division of labor: