

year. These cost savings helped U.S. businesses *reduce* unit labor costs by 0.4 percent a year in the 1990s. As the accompanying World View confirms, those gains widened the United States' lead in the ongoing race for global competitiveness. To maintain that leading position in the economy tomorrow, U.S. productivity must continue to advance at a brisk pace.

SUMMARY



- A production function indicates the maximum amount of output that can be produced with different combinations of inputs. It's a technological relationship and changes (shifts) when new technology or management techniques are discovered. LO1
- In the short run, some inputs (e.g., land and capital) are fixed in quantity. Increases in (short-run) output result from more use of variable inputs (e.g., labor). LO1
- The contribution of a variable input to total output is measured by its marginal physical product (MPP). This is the amount by which *total* output increases when one more unit of the input is employed. LO1
- The MPP of a factor tends to decline as more of it is used in a given production facility. Diminishing marginal returns result from crowding more of a variable input (e.g., labor) into a production process, reducing the amount of fixed inputs *per unit* of variable input. LO2
- Marginal cost is the increase in total cost that results when output is increased by one unit. Marginal cost increases whenever marginal physical product diminishes. LO2
- Not all costs go up when the rate of output is increased. Fixed costs such as space and equipment leases don't vary with the rate of output. Only variable costs such as labor and material go up when output is increased. LO3
- Average total cost (ATC) equals total cost divided by the quantity of output produced. ATC declines whenever marginal cost (MC) is less than average cost and rises when MC exceeds it. The MC and ATC curves intersect at minimum ATC (the bottom of the U). That intersection represents least-cost production. LO3
- The economic costs of production include the value of *all* resources used. Accounting costs typically include only those dollar costs actually paid (explicit costs). LO3
- In the long run there are no fixed costs; the size (scale) of production can be varied. The long-run ATC curve indicates the lowest cost of producing output with facilities of appropriate size. LO3
- Economies of scale refer to reductions in *minimum* average cost attained with larger plant size (scale). If minimum ATC rises with plant size, diseconomies of scale exist. LO3
- Global competitiveness and domestic living standards depend on productivity advances. Improvements in productivity shift production functions up and push cost curves down. LO1

Key Terms

factors of production
production function
productivity
efficiency
opportunity cost
short run

marginal physical product (MPP)
law of diminishing returns

profit
marginal cost (MC)
total cost
fixed costs
variable costs
average total cost (ATC)
average fixed cost (AFC)
average variable cost (AVC)

explicit cost
implicit cost
economic cost
long run
economies of scale
constant returns to scale
unit labor cost

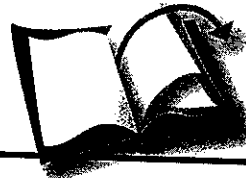
Questions for Discussion

1. What are the production costs of your economics class? What are the fixed costs? The variable costs? What's the marginal cost of enrolling more students? LO1
2. Suppose all your friends offered to help wash your car. Would marginal physical product decline as more friends helped? Why or why not? LO2
- How many cars *can* GM produce in China? (See World View, page 133.) How many cars will GM *want* to produce? LO1
4. Owner/operators of small gas stations rarely pay themselves an hourly wage. How does this practice affect the economic cost of dispensing gasoline? LO3
5. Corporate funeral giants have replaced small family-run funeral homes in many areas, in large part because of the lower costs they achieve. (See News, page 135.) What kind of economies of scale exist in the funeral business? Why doesn't someone build one colossal funeral home and drive costs down further? LO3

6. Are colleges subject to economies of scale or diseconomies? LO3
7. Why don't more U.S. firms move to Mexico to take advantage of low wages there? Would an *identical* plant in Mexico be as productive as its U.S. counterpart? LO1
8. How would your productivity in completing course work be measured? Has your productivity changed since you began college? What caused the productivity changes? How could you increase productivity further? LO1
9. What is the economic cost of doing this homework? LO1

problems

The Student Problem Set at the back of this book contains numerical and graphing problems for this chapter.



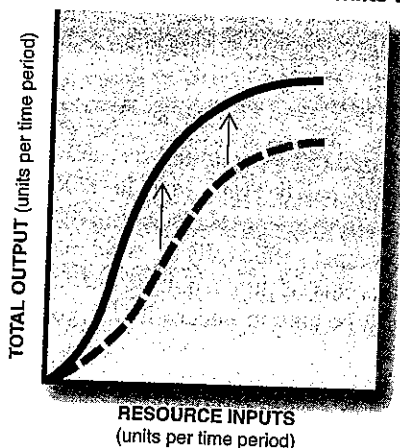
web activities

to accompany this chapter can be found on the Online Learning Center:
<http://www.mhhe.com/economics/schiller11e>

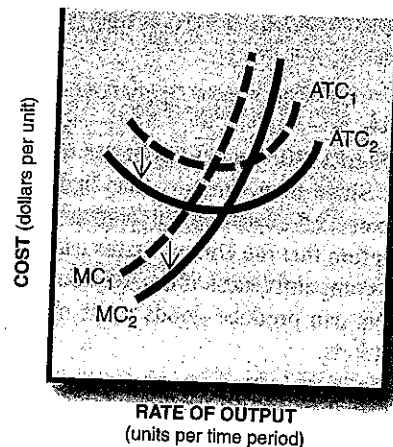
FIGURE 6.11
Improvements in Productivity Reduce Costs

Advances in technological or managerial knowledge increase our productive capability. This is reflected in upward shifts of the production function (part a) and downward shifts of production cost curves (part b).

(a) When the production function shifts up ...



(b) Cost curves shift down



MC and ATC curves. These downward shifts imply that we can get more of the goods and services we desire with available resources. We can also compete more effectively in global markets.

Internet-Driven Gains. The Internet has been an important source of productivity gains in the last 10 years. Although the Internet originated over 30 years ago, its commercial potential emerged with the creation of the World Wide Web around 1990. As recently as 1995 there were only 10,000 Web sites. Now there are over 100 million sites. This vastly expanded spectrum of information has helped businesses cut costs in many ways. The cost of gathering information about markets and inputs has been reduced. With the reach of the Internet, firms can engage in greater specialization. Firms can also manage their inventories and supply chains much more efficiently. Transaction and communications costs are reduced as well. All of these productivity improvements are cutting U.S. production costs by \$100–250 billion a

WORLD VIEW

United States Gains Cost Advantage

Productivity is increasing faster than wages in U.S. manufacturing, giving the U.S. an edge in the race for global competitiveness. In the last 10 years, the cost of producing a widget has fallen by nearly 10 percent in the U.S., but risen by nearly 17 percent in Japan. Other contenders:

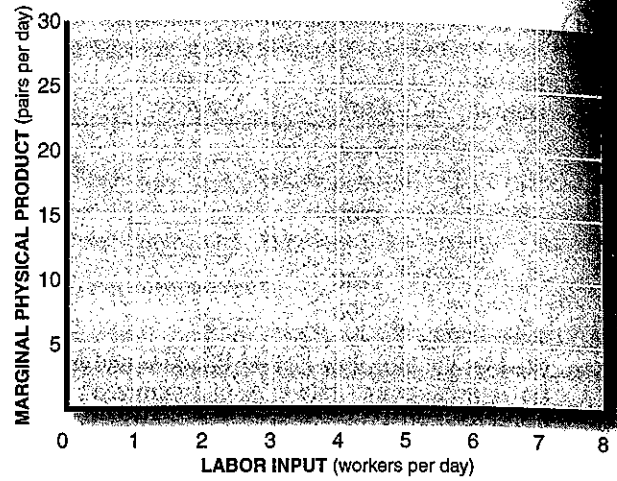
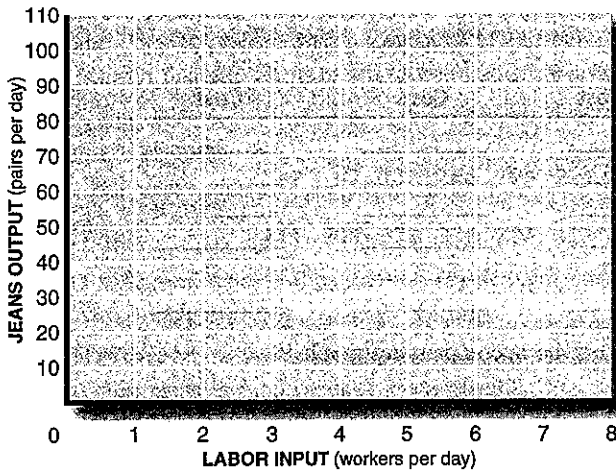
Country	Change in Unit Labor Costs, 1995–2005
Italy	31.9
Denmark	24.2
Japan	16.8
United Kingdom	16.5
Canada	1.6
Korea	-9.1
United States	-9.8
France	-11.8
Taiwan	-26.7

Source: U.S. Bureau of Labor Statistics. www.bls.gov

Analysis: Global competitiveness depends on unit labor costs. U.S. unit labor costs have declined in the last decade or so, increasing America's competitiveness in world markets.

PROBLEMS FOR CHAPTER 6 (cont'd)

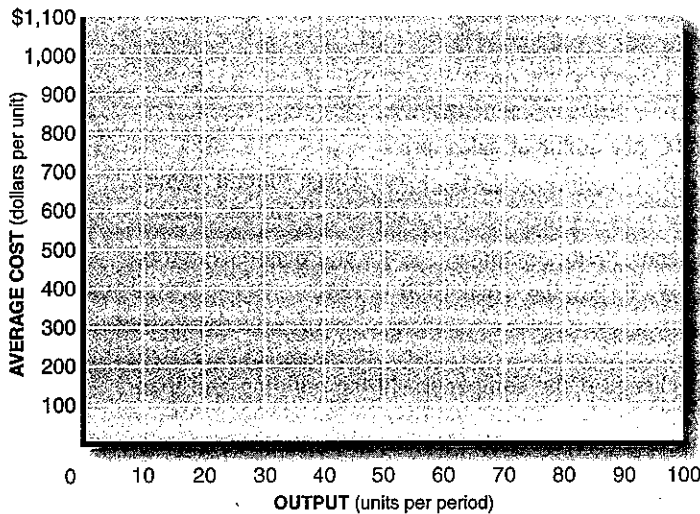
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LO3 (5) The following table indicates the average total cost of producing varying quantities of output from three different plants:

Rate of output	10	20	30	40	50	60	70	80	90	100
Average total cost										
Small firm	\$ 600	\$500	\$400	\$500	\$600	\$700	\$800	\$900	\$1,000	\$1,100
Medium firm	800	650	500	350	200	300	400	500	600	700
Large firm	1,000	900	800	700	600	500	400	300	400	500

- (a) Plot the ATC curves for all three firms on the graph.
- (b) Which plant(s) should be used to produce 40 units? _____
- (c) Which plant(s) should be used to produce 100 units? _____
- (d) Are there economies of scale in these plant-size choices? _____



LO3 (6) According to the World View on page 138, which nation had the biggest loss of competitive position in years 1995–2005? _____

LO3 (7) Suppose (A) the hourly wage rate is \$16 in the United States and \$1 in China, and (B) productivity is 20 units per hour in the U.S. and 1 unit per hour in China. What are unit labor costs in

- (a) The United States? _____
- (b) China? _____

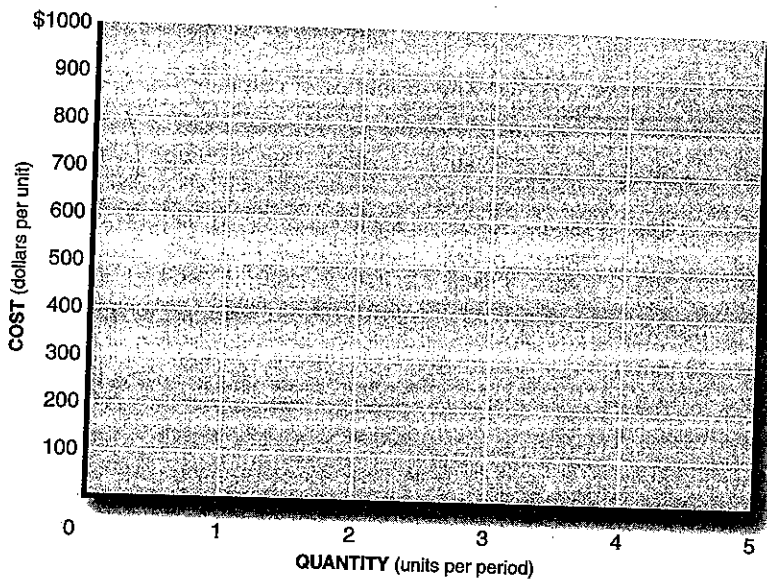
PROBLEMS FOR CHAPTER 6

Name: _____

LO3 (1) (a) Complete the following cost schedule:

Rate of Output	Total Cost	Marginal Cost	Average Fixed Cost	Average Variable Cost	Average Total Cost
0	\$1000	_____	_____	_____	_____
1	1100	_____	_____	_____	_____
2	1300	_____	_____	_____	_____
3	1650	_____	_____	_____	_____
4	2200	_____	_____	_____	_____
5	3000	_____	_____	_____	_____

- (b) Use the cost data to plot the ATC and MC curves on the accompanying graph.
 (c) At what output rate is ATC minimized?



LO3 (2) Based on the News on page 135, what is the ATC per dollar of sales at a

- (a) Large funeral home? _____
 (b) Small funeral home? _____

LO3 (3) Suppose a company incurs the following costs: labor, \$600; equipment, \$200; and materials, \$100. The company owns the building, so it doesn't have to pay the usual \$800 in rent.

- (a) What is the total accounting cost? _____
 (b) What is the total economic cost? _____
 (c) How would accounting and economic costs change if the company sold the building and then leased it back? _____

LO1 LO2 4. Refer to the production table for jeans (Table 6.1). Suppose a firm had three sewing machines and could vary only the amount of labor input.

- (a) Graph the production function for jeans given the three sewing machines. _____
 (b) Compute and graph the marginal physical product curve. _____
 (c) At what amount of labor input does the law of diminishing returns first become apparent in your graph of marginal physical product? _____
 (d) Is total output still increasing when MPP begins to diminish? _____
 (e) When total output stops increasing, what is the value of MPP? _____