18U MICROECONOMICS (1)
(CS) GR-1, GR-2, GR-3

Chapter 10

Pure Competition in the Short Run

Learning Objectives

LO10.1 **Give the names and summarize the main characteristics of the four basic market models.**

LO10.2 **List the conditions required for purely competitive markets.**

LO10.3 **Explain how demand is seen by a purely competitive seller.**

LO10.4 **Convey how purely competitive firms can use the total-revenue–total-cost approach to maximize profits or minimize losses in the short run.**

LO10.5 **Explain how purely competitive firms can use the marginal-revenue–marginal-cost approach to maximize profits or minimize losses in the short run.**

LO10.6 **Explain why a competitive firm's marginal cost curve is the same as its supply curve.**

In Chapter 6 we examined the relationship between product demand and total revenue, and in Chapter 9 we discussed production costs. Now we want to connect revenues and costs to see how a business decides what price to charge and how much output to produce. A firm's decisions concerning price and production depend greatly on the character of the industry in which it is operating. There is no "average" or "typical" industry. At one extreme is an industry in which a single producer dominates the market; at the other extreme are industries in which there are thousands of firms that each produce a tiny fraction of market supply. Between these extremes are many other types of industries.

Since we cannot examine each industry individually, we will focus on four basic *models* of **market structure.** Together, these models will help you understand how price and output are determined in the many product markets in the economy. They also will help you evaluate the efficiency or inefficiency of those markets. Finally, these four models will provide a crucial background for assessing public policies (such as antitrust policy) relating to certain firms and industries.

Four Market Models

LO10.1 Give the names and summarize the main characteristics of the four basic market models.

Economists group industries into four distinct market structures: pure competition, pure monopoly, monopolistic competition, and oligopoly. These four market models differ in several respects: the number of firms in the industry, whether

those firms produce a standardized product or try to differentiate their products from those of other firms, and how easy or how difficult it is for firms to enter the industry.

Very briefly the four models are as follows:

- **Pure competition** involves a very large number of firms producing a standardized product (that is, a product like cotton, for which each producer's output is virtually identical to that of every other producer.) New firms can enter or exit the industry very easily.
- **Pure monopoly** is a market structure in which one firm is the sole seller of a product or service (for example, a local electric utility). Since the entry of additional firms is blocked, one firm constitutes the entire industry. The pure monopolist produces a single unique product, so product differentiation is not an issue.
- **Monopolistic competition** is characterized by a relatively large number of sellers producing differentiated products (clothing, furniture, books). Present in this model is widespread *nonprice competition*, a selling strategy in which a firm does not try to distinguish its product on the basis of price but instead on attributes like design and workmanship (an approach called *product differentiation*). Either entry to or exit from monopolistically competitive industries is quite easy.
- **Oligopoly** involves only a few sellers of a standardized or differentiated product, so each firm is affected by the decisions of its rivals and must take those decisions into account in determining its own price and output.

Table 10.1 summarizes the characteristics of the four models for easy comparison and later reference. In discussing these market models, we will occasionally distinguish the characteristics of *pure competition* from those of the three other basic market structures, which together we will designate as **imperfect competition.**

Pure Competition: Characteristics and Occurrence

LO10.2 List the conditions required for purely competitive markets.

Although pure competition is relatively rare in the real world, this market model is highly relevant to several industries. In particular, we can learn much about markets for agricultural goods, fish products, foreign exchange, basic metals, and stock shares by studying the pure-competition model. Also, pure competition is a meaningful starting point for any discussion of price and output determination. Moreover, the operation of a purely competitive economy provides a standard, or norm, for evaluating the efficiency of the real-world economy.

Let's take a fuller look at pure competition, the focus of the remainder of this chapter:

- *Very large numbers* A basic feature of a purely competitive market is the presence of a large number of independently acting sellers, often offering their products in large national or international markets. Examples: markets for farm commodities, the stock market, and the foreign exchange market.
- *Standardized product* Purely competitive firms produce a standardized (identical or homogeneous) product. As long as the price is the same, consumers will be indifferent about which seller to buy the product from. Buyers view the products of firms B, C, D, and E as perfect substitutes for the product of firm A. Because purely competitive firms sell standardized products,

TABLE 10.1 Characteristics of the Four Basic Market Models

	Model			
	Pure competition	Monopolistic competition	Oligopoly	Pure monopoly
Number of firms	A very large number	Many	Few	One
Type of product	Standardized	Differentiated	Standardized or differentiated	Unique; no close substitutes
Control over price	None	Some, but within rather narrow limits	Limited by mutual interdependence; considerable with collusion	Considerable
Conditions of entry	Very easy, no obstacles	Relatively easy	Significant obstacles	Blocked
Nonprice competition	None	Considerable emphasis on advertising, brand names, trademarks	Typically a great deal, particularly with product differentiation	Mostly public relations advertising
Examples	Agriculture	Retail trade, dresses, shoes	Steel, automobiles, farm implements, many household appliances	Local utilities

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they make no attempt to differentiate their products and do not engage in other forms of nonprice competition.

- *"Price takers"* In a purely competitive market, individual firms do not exert control over product price. Each firm produces such a small fraction of total output that increasing or decreasing its output will not perceptibly influence total supply or, therefore, product price. In short, the competitive firm is a price taker: It cannot change market price; it can only adjust to it. That means that the individual competitive producer is at the mercy of the market. Asking a price higher than the market price would be futile. Consumers will not buy from firm A at $2.05 when its 9,999 competitors are selling an identical product, and therefore a perfect substitute, at $2 per unit. Conversely, because firm A can sell as much as it chooses at $2 per unit, it has no reason to charge a lower price, say, $1.95. Doing that would shrink its profit.
- *Free entry and exit* New firms can freely enter and existing firms can freely leave purely competitive industries. No significant legal, technological, financial, or other obstacles prohibit new firms from selling their output in any competitive market.

Demand as Seen by a Purely Competitive Seller

LO10.3 Explain how demand is seen by a purely competitive seller.

We begin by examining demand from a purely competitive seller's viewpoint to see how it affects revenue. This seller might be a wheat farmer, a strawberry grower, a sheep rancher, a foreign-currency broker, or some other pure competitor. Because each purely competitive firm offers only a negligible fraction of total market supply, it must accept the price determined by the market; it is a price taker, not a price maker.

Perfectly Elastic Demand

The demand schedule faced by the *individual firm* in a purely competitive industry is perfectly elastic at the market price, as demonstrated in Figure 10.1. As shown in column 1 of the table in Figure 10.1, the market price is $131. The firm represented cannot obtain a higher price by restricting its output, nor does it need to lower its price to increase its sales volume. Columns 1 and 2 show that the firm can produce and sell as many or as few units as it likes at the market price of $131.

We are *not* saying that *market* demand is perfectly elastic in a competitive market. Rather, market demand graphs as a downsloping curve. An entire industry (all firms producing a particular product) can affect price by changing industry output. For example, all firms, acting independently but simultaneously, can increase price by reducing output. But the individual competitive firm cannot do that because its output

For the individual competitive firm, the market price is therefore a fixed value at which it can sell as many or as few units as it cares to. Graphically, this implies that the individual competitive firm's demand curve will plot as a straight, horizontal line such as *D* in Figure 10.1.

Average, Total, and Marginal Revenue

The firm's demand schedule is also its average-revenue schedule. Price per unit to the purchaser is also revenue per unit, or average revenue, to the seller. To say that all buyers must pay $131 per unit is to say that the revenue per unit, or **average revenue** received by the seller, is $131. Price and average revenue are the same thing.

The **total revenue** for each sales level is found by multiplying price by the corresponding quantity the firm can sell. (Column 1 multiplied by column 2 in the table in Figure 10.1 yields column 3.) In this case, total revenue increases by a constant amount, $131, for each additional unit of sales. Each unit sold adds exactly its constant price—no more or no less—to total revenue.

When a firm is pondering a change in its output, it will consider how its total revenue will change as a result. **Marginal revenue** is the change in total revenue (or the extra revenue) that results from selling one more unit of output. In column 3 of the table in Figure 10.1, total revenue is zero when zero units are sold. The first unit of output sold increases total revenue from zero to $131, so marginal revenue for that unit is $131. The second unit sold increases total revenue from $131 to $262, and marginal revenue is again $131. Note in column 4 that marginal revenue is a constant $131, as is price. *In pure competition, marginal revenue and price are equal.*

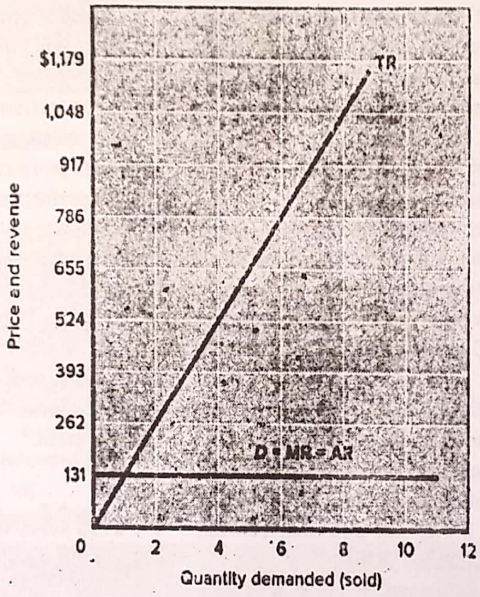
Figure 10.1 shows the purely competitive firm's total-revenue, demand, marginal-revenue, and average-revenue curves. Total revenue (TR) is a straight line that slopes upward to the right. Its slope is constant because each extra unit of sales increases TR by $131. The demand curve (*D*) is horizontal, indicating perfect price elasticity. The marginal-revenue (MR) curve coincides with the demand curve because the product price (and hence MR) is constant. The average revenue (AR) curve equals price and therefore also coincides with the demand curve.

QUICK REVIEW 10.1

- ✓ In a purely competitive industry a large number of firms produce a standardized product and there are no significant barriers to entry.
- ✓ The demand seen by a purely competitive firm is perfectly elastic—horizontal on a graph—at the market price.
- ✓ Marginal revenue and average revenue for a purely competitive firm coincide with the firm's demand curve; total revenue rises by the product price for

FIGURE 10.1 A purely competitive firm's demand and revenue curves. The demand curve (D) of a purely competitive firm is a horizontal line (perfectly elastic) because the firm can sell as much output as it wants at the market price (here, $131). Because each additional unit sold increases total revenue by the amount of the price, the firm's total-revenue (TR) curve is a straight upsloping line and its marginal-revenue (MR) curve coincides with the firm's demand curve. The average-revenue (AR) curve also coincides with the demand curve.

Firm's Demand Schedule		Firm's Revenue Data	
(1) Product Price (P) = Average Revenue (AR)	(2) Quantity Demanded (Q)	(3) Total Revenue (TR), (1) × (2)	(4) Marginal Revenue (MR)
$131	0	$ 0	
			$131
131	1	131	
			131
131	2	262	
			131
131	3	393	
			131
131	4	524	
			131
131	5	655	
			131
131	6	786	
			131
131	7	917	
			131
131	8	1048	
			131
131	9	1179	
			131
131	10	1310	



Profit Maximization in the Short Run: Total-Revenue–Total-Cost Approach

LO10.4 Convey how purely competitive firms can use the total-revenue–total-cost approach to maximize profits or minimize losses in the short run.

Because the purely competitive firm is a price taker, it cannot attempt to maximize its profit by raising or lowering the price it charges. With its price set by supply and demand in the overall market, the only variable that the firm can control is its output. As a result, the purely competitive firm attempts to maximize its economic profit (or minimize its economic loss) by adjusting its *output*. And, in the short run, the firm has a fixed plant. Thus it can adjust its output only through changes in the amount of variable resources (materials, labor) it uses. It adjusts its variable resources to achieve the output level that maximizes its profit or minimizes its loss.

There are two ways to determine the level of output at which a competitive firm will realize maximum profit or minimum loss. One method is to compare total revenue and

total cost; the other is to compare marginal revenue and marginal cost. Both approaches apply to all firms, whether they are pure competitors, pure monopolists, monopolistic competitors, or oligopolists.[1]

We begin by examining profit maximization using the total-revenue–total-cost approach. Confronted with the market price of its product, the competitive producer will ask three questions: (1) Should we produce this product? (2) If so, in what amount? (3) What economic profit (or loss) will we realize?

Let's demonstrate how a pure competitor answers these questions, given a particular set of cost data and a specific market price. Our cost data are already familiar because they are the fixed-cost, variable-cost, and total-cost data in Table 9.2, repeated in columns 1 to 4 of the table in Figure 10.2. (Recall that these data reflect explicit and implicit costs, including a normal profit.) Assuming that the market price is $131, the total revenue for each output level is found by multiplying output (total product) by price. Total-revenue data are in column 5. Then in column 6 we find the profit or loss at each output level by subtracting total cost, TC (column 4), from total revenue, TR (column 5).

Should the firm produce? Definitely. It can obtain a profit by doing so. How much should it produce? Nine units. Column 6 tells us that this is the output at which total economic profit is at a maximum. What economic profit (or loss) will it realize? A $299 economic profit—the difference between total revenue ($1,179) and total cost ($880).

Figure 10.2a compares total revenue and total cost graphically for this profit-maximizing case. Observe again that the total-revenue curve for a purely competitive firm is a straight line (Figure 10.1). Total cost increases with output because more production requires more resources. But the *rate* of increase in total cost varies with the efficiency of the firm, which in turn varies with the amount of variable inputs that are being combined with the firm's current amount of capital (which is fixed in the short run). Stated slightly differently, the cost data reflect Chapter 9's law of diminishing returns. From zero to four units of output, total cost increases at a decreasing rate as the firm temporarily experiences increasing returns. At higher levels of output, however, efficiency falls as crowding causes diminishing returns to set in. Once that happens, the firm's total cost increases at an increasing rate because each additional unit of input yields less output than the previous unit.

Total revenue and total cost are equal where the two curves in Figure 10.2a intersect (at roughly 2 units of output). Total revenue covers all costs (including a normal profit, which is included in the cost curve), but there is no economic profit. For this reason economists call this output a **break-even point:** an output at which a firm makes a *normal profit* but not an economic profit. If we extended the data beyond 10 units of output, another break-even point would occur where total cost catches up with total revenue, somewhere between 13 and 14 units of output in Figure 10.2a. Any output within the two break-even points identified in the figure will yield an economic profit. The firm achieves maximum profit, however, where the vertical distance between the total-revenue and total-cost curves is greatest. For our particular data, this is at 9 units of output, where maximum profit is $299.

The profit-maximizing output is easier to see in Figure 10.2b, where total profit is graphed for each level of output. Where the total-revenue and total-cost curves intersect in Figure 10.2a, economic profit is zero, as shown by the total-profit line in Figure 10.2b. Where the vertical distance between TR and TC is greatest in the upper graph, economic profit is at its peak ($299), as shown in the lower graph. This firm will choose to produce 9 units since that output maximizes its profit.

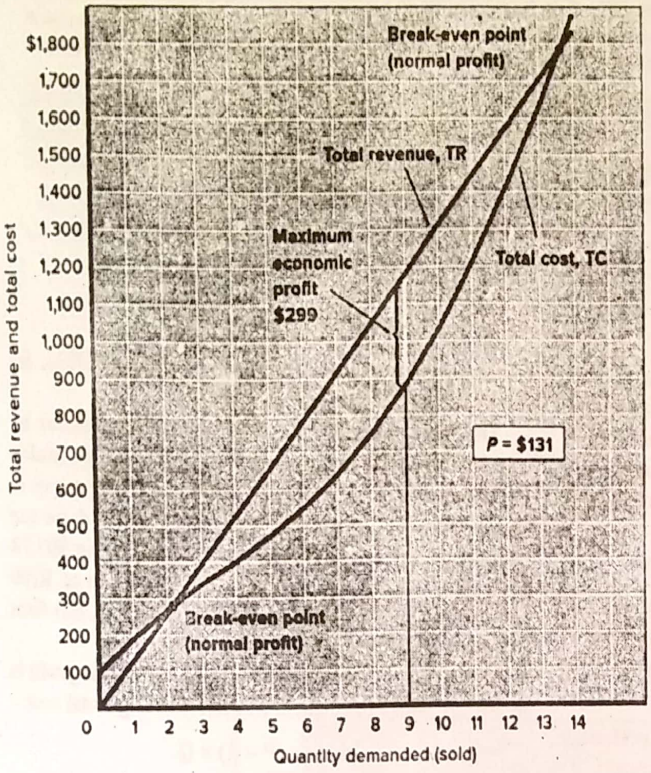
Profit Maximization in the Short Run: Marginal-Revenue–Marginal-Cost Approach

LO10.5 Explain how purely competitive firms can use the marginal-revenue–marginal-cost approach to maximize profits or minimize losses in the short run.

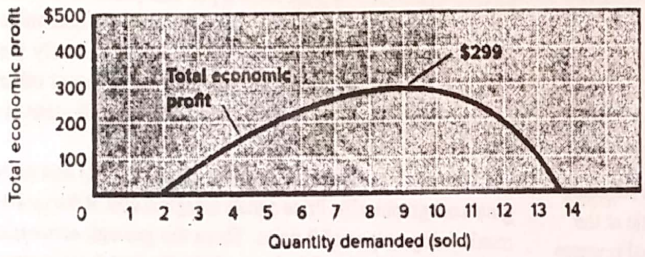
In the second approach, the firm compares the amounts that each *additional* unit of output would add to total revenue and to total cost. In other words, the firm compares the *marginal revenue* (MR) and the *marginal cost* (MC) of each successive unit of output. Assuming that producing is preferable to shutting down, the firm should produce any unit of output whose marginal revenue exceeds its marginal cost because the firm would gain more in revenue from selling that unit than it would add to its costs by producing it. Conversely, if the marginal cost of a unit of output exceeds its marginal revenue, the firm should not produce that unit. Producing it would add more to costs than to revenue, and profit would decline or loss would increase.

In the initial stages of production, where output is relatively low, marginal revenue will usually (but not always) exceed marginal cost. So it is profitable to produce through this range of output. But at later stages of production, where output is relatively high, rising marginal costs will exceed marginal revenue. Obviously, a profit-maximizing firm will want to avoid output levels in that range. Separating these two production ranges is a unique point at which marginal revenue

[1] To make sure you understand these two approaches, we will apply both of them to output determination under pure competition. But since we want to emphasize the marginal approach, we will limit our graphical application of the total-revenue approach to a situation where the firm maximizes profits. We will then use the marginal approach to examine three cases: profit maximization, loss minimization, and shutdown.



(a)
Profit-maximizing case



(b)
Total economic profit

FIGURE 10.2 **Total-revenue–total-cost approach to profit maximization for a purely competitive firm.** (a) The firm's profit is maximized at that output (9 units) where total revenue, TR, exceeds total cost, TC, by the maximum amount. (b) The vertical distance between TR and TC in (a) is plotted as a total-economic-profit curve. Maximum economic profit is $299 at 9 units of output.

(1) Total Product (Output) (Q)	(2) Fixed Cost (TFC)	(3) Total Variable Cost (TVC)	(4) Total Cost (TC)	(5) Total Revenue (TR)	(6) Profit (+) or Loss (−)
0	$100	$ 0	$ 100	$ 0	$−100
1	100	90	190	131	−59
2	100	170	270	262	−8
3	100	240	340	393	+53
4	100	300	400	524	+124
5	100	370	470	655	+185
6	100	450	550	786	+236
7	100	540	640	917	+277
8	100	650	750	1,048	+298
9	100	780	880	1,179	+299
10	100	930	1,030	1,310	+280

equals marginal cost. This point is the key to the output-determining rule: *In the short run, the firm will maximize profit or minimize loss by producing the output at which marginal revenue equals marginal cost (as long as producing is preferable to shutting down).* This profit-maximizing guide is known as the **MR = MC rule.**

Keep in mind these features of the MR = MC rule:

- For most sets of MR and MC data, MR and MC will be precisely equal at a fractional level of output. In such instances the firm should produce the last complete unit of output for which MR exceeds MC.
- As noted, the rule applies only if producing is preferable to shutting down. We will show shortly that if marginal revenue does not equal or exceed average variable cost, the firm will shut down rather than produce the amount of output at which MR = MC.
- The rule is an accurate guide to profit maximization for all firms whether they are purely competitive, monopolistic, monopolistically competitive, or oligopolistic.
- The rule can be restated as P = MC when applied to a purely competitive firm. Because the demand schedule faced by a competitive seller is perfectly elastic at the going market price, product price and marginal revenue are equal. So under pure competition (and only under pure competition) we may substitute P for MR in the rule: When producing is preferable to shutting down, the competitive firm that wants to maximize its profit or minimize its loss should produce at that point where price equals marginal cost ($P = MC$).

Now let's apply the MR = MC rule or, because we are considering pure competition, the P = MC rule, first using the same price as used in our total-revenue–total-cost approach to profit maximization. Then, by considering other prices, we will demonstrate two additional cases: loss minimization and shutdown. It is crucial that you understand the MR = MC analysis that follows since it reappears in Chapters 12 through 16.

Profit-Maximizing Case

The first five columns of the table in **Figure 10.3 (Key Graph)** reproduce the AFC, AVC, ATC, and MC data derived for our product in Table 9.2. It is the marginal-cost data of column 5 that we will compare with price (equals marginal revenue) for each unit of output. Suppose first that the market price, and therefore marginal revenue, is $131, as shown in column 6.

What is the profit-maximizing output? Every unit of output up to and including the ninth unit represents greater marginal revenue than marginal cost of output. Each of the first 9 units therefore adds to the firm's profit and should be produced. The tenth unit, however, should not be produced. It would add more to cost ($150) than to revenue ($131). So 9 units is the profit-maximizing output.

The economic profit realized by producing 9 units can be calculated by subtracting total cost from total revenue. Multiplying price ($131) by output (9), we find that total revenue is $1,179. From the average-total-cost data in column 4, we see that ATC is $97.78 at 9 units of output. Multiplying $97.78 by 9 gives us total cost of $880.[2] The difference of $299 (= $1,179 − $880) is the economic profit. Clearly, this firm will prefer to operate rather than shut down.

Perhaps an easier way to calculate the economic profit is to use this simple equation, in which A is average total cost:

$$\text{Profit} = (P - A) \times Q$$

So by subtracting the average total cost ($97.78) from the product price ($131), we obtain a per-unit profit of $33.22. Multiplying that amount by 9 units of output, we determine that the profit is $299. Take some time now to verify the numbers in column 7. You will find that any output other than that which adheres to the MR = MC rule will mean either profits below $299 or losses.

The graph in Figure 10.3 shows price (= MR) and marginal cost graphically. Price equals marginal cost at the profit-maximizing output of 9 units. There the per-unit economic profit is $P - A$, where P is the market price and A is the average total cost for an output of 9 units. The total economic profit is $9 \times (P - A)$, shown by the green rectangular area.

Note that the firm wants to maximize its total profit, not its per-unit profit. Per-unit profit is greatest at 7 units of output, where price exceeds average total cost by $39.57 (= $131 − $91.43). But by producing only 7 units, the firm would be forgoing the production of 2 additional units of output that would clearly contribute to total profit. The firm is happy to accept lower per-unit profits for additional units of output because they nonetheless add to total profit.

Loss-Minimizing Case

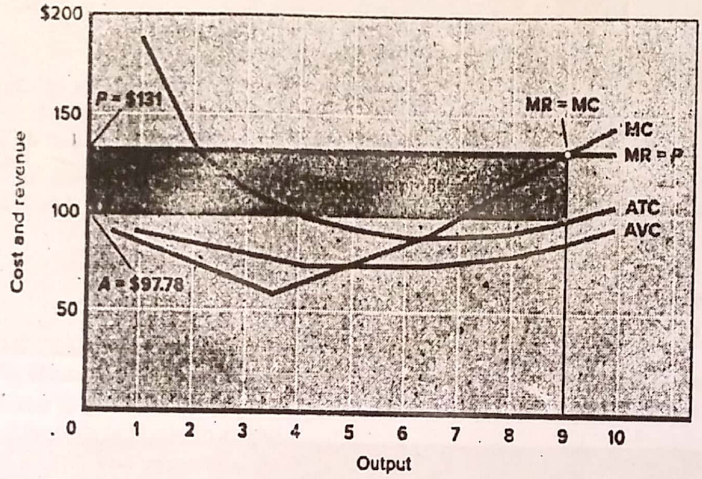
Now let's assume that the market price is $81 rather than $131. Should the firm still produce? If so, how much? And what will be the resulting profit or loss? The answers, respectively, are "Yes," "Six units," and "A loss of $64."

The first five columns of the table in Figure 10.4 are the same as the first five columns of the table in Figure 10.3. But column 6 of the table in Figure 10.4 shows the new price (equal to MR), $81. Comparing columns 5 and 6, we find that the first unit of output adds $90 to total cost but only $81 to total revenue. One might conclude: "Don't produce—close down!" But

[2] Most of the unit-cost data are rounded figures. Therefore, economic profits calculated from them will typically vary by a few cents from the profits determined in the total-revenue–total-cost approach. Here we simply ignore the few-cents differentials to make our answers consistent with the results of the total-revenue–total-cost approach.

FIGURE 10.3 Short-run profit maximization for a purely competitive firm. The MR = MC output enables the purely competitive firm to maximize profits or to minimize losses. In this case MR (= P in pure competition) and MC are equal at an output Q of 9 units. There, P exceeds the average total cost A = $97.78 so the firm realizes an economic profit of $P - A$ per unit. The total economic profit is represented by the green rectangle and is $9 \times (P - A)$.

(1) Total Product (Output)	(2) Average Fixed Cost (AFC)	(3) Average Variable Cost (AVC)	(4) Average Total Cost (ATC)	(5) Marginal Cost (MC)	(6) Price = Marginal Revenue (MR)	(7) Total Economic Profit (+) or Loss (−)
0						$−100
1	$100.00	$90.00	$190.00	$ 90	$131	−59
2	50.00	85.00	135.00	80	131	−8
3	33.33	80.00	113.33	70	131	+53
4	25.00	75.00	100.00	60	131	+124
5	20.00	74.00	94.00	70	131	+185
6	16.67	75.00	91.67	80	131	+236
7	14.29	77.14	91.43	90	131	+277
8	12.50	81.25	93.75	110	131	+298
9	11.11	86.67	97.78	130	131	+299
10	10.00	93.00	103.00	150	131	+280

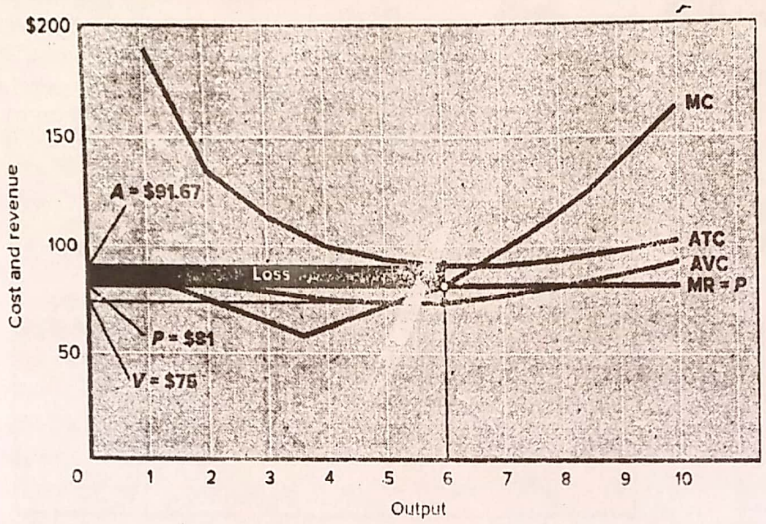


QUICK QUIZ FOR FIGURE 10.3

1. Curve MR is horizontal because:
   a. product price falls as output increases.
   b. the law of diminishing marginal utility is at work.
   c. the market demand for this product is perfectly elastic.
   d. the firm is a price taker.
2. At a price of $131 and 7 units of output:
   a. MR exceeds MC, and the firm should expand its output.
   b. total revenue is less than total cost.
   c. AVC exceeds ATC.
   d. the firm would earn only a normal profit.
3. In maximizing profits at 9 units of output, this firm is adhering to which of the following decision rules?
   a. Produce where MR exceeds MC by the greatest amount.
   b. Produce where P exceeds ATC by the greatest amount.
   c. Produce where total revenue exceeds total cost by the greatest amount.
   d. Produce where average fixed costs are zero.
4. Suppose price declined from $131 to $100. This firm's:
   a. marginal-cost curve would shift downward.
   b. economic profit would fall to zero.
   c. profit-maximizing output would decline.
   d. total cost would fall by more than its total revenue.

Answers: 1. d; 2. a; 3. c; 4. c

FIGURE 10.4 Short-run loss minimization for a purely competitive firm. If price P exceeds the minimum AVC (here, $74 at $Q = 5$) but is less than ATC, the MR = MC output (here, 6 units) will permit the firm to minimize its losses. In this instance the loss is $A - P$ per unit, where A is the average total cost at 6 units of output. The total loss is shown by the red area and is equal to $6 \times (A - P)$.



Quantity	Average Fixed Cost (AFC)	Average Variable Cost (AVC)	Average Total Cost (ATC)	Marginal Cost (MC)	Loss-Minimizing Case: ($81 Price = Marginal Revenue (MR))	Loss-Minimizing Case: (7) Profit (+) or Loss (−), $81 Price	Shutdown Case: ($71 Price = Marginal Revenue (MR))	Shutdown Case: (9) Profit (+) or Loss (−), $71 Price
0						$−100		$−100
1	$100.00	$90.00	$190.00	$ 90	$81	−109	$71	−119
2	50.00	85.00	135.00	80	81	−108	71	−128
3	33.33	80.00	113.33	70	81	−97	71	−127
4	25.00	75.00	100.00	60	81	−76	71	−116
5	20.00	74.00	94.00	70	81	−65	71	−115
6	16.67	75.00	91.67	80	81	−64	71	−124
7	14.29	77.14	91.43	90	81	−73	71	−143
8	12.50	81.25	93.75	110	81	−102	71	−182
9	11.11	86.67	97.78	130	81	−151	71	−241
10	10.00	93.00	103.00	150	81	−220	71	−320

that would be hasty. Remember that in the very early stages of production, marginal product is low, making marginal cost unusually high. The price–marginal cost relationship improves with increased production. For units 2 through 6, price exceeds marginal cost. Each of these 5 units adds more to revenue than to cost, and as shown in column 7, they decrease the total loss. Together they more than compensate for the "loss" taken on the first unit. Beyond 6 units, however, MC exceeds MR (= P). The firm should therefore produce 6 units. In general, the profit-seeking producer should always compare marginal revenue (or price under pure competition) with the rising portion of the marginal-cost schedule or curve.

Will production be profitable? No, because at 6 units of output the average total cost of $91.67 exceeds the price of $81 by $10.67 per unit. If we multiply that by the 6 units of output, we find the firm's total loss is $64. Alternatively, comparing the total revenue of $486 (= 6 × $81) with the total cost of $550 (= 6 × $91.67), we see again that the firm's loss is $64.

Then why produce? Because this loss is less than the firm's $100 of fixed costs, which is the $100 loss the firm would incur in the short run by closing down. The firm receives enough revenue per unit ($81) to cover its average variable costs of $75 and also provide $6 per unit, or a total of $36, to apply against fixed costs. Therefore, the firm's loss is only $64 (= $100 − $36), not $100.

This loss-minimizing case is illustrated in the graph in Figure 10.4. Wherever price P exceeds average variable cost

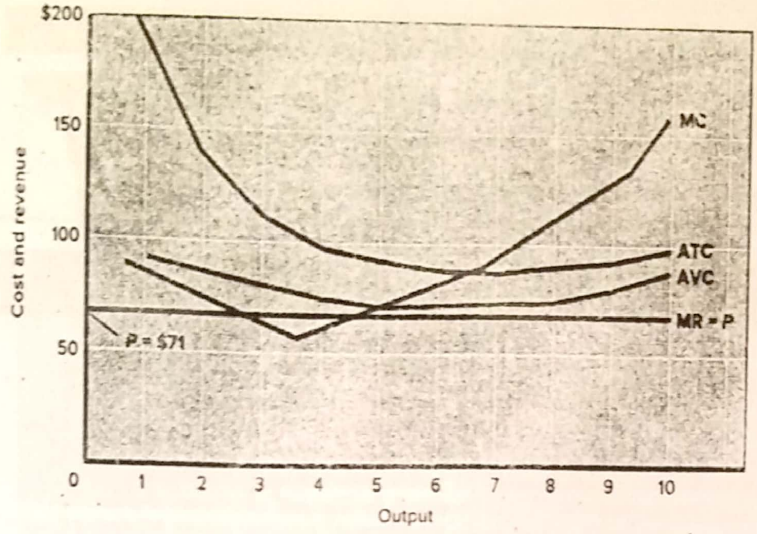


FIGURE 10.5 **The short-run shutdown case for a purely competitive firm.** If price P falls below the minimum AVC (here, $74 at $Q = 5$), the competitive firm will minimize its losses in the short run by shutting down. There is no level of output at which the firm can produce and incur a loss smaller than its total fixed cost.

AVC but is less than ATC, the firm can pay part, but not all, of its fixed costs by producing. The loss is minimized by producing the output at which MC = MR (here, 6 units). At that output, each unit contributes $P - V$ to covering fixed cost, where V is the AVC at 6 units of output. The per-unit loss is $A - P = \$10.67$, and the total loss is $6 \times (A - P)$, or $64, as shown by the red area.

Shutdown Case

Suppose now that the market yields a price of only $71. Should the firm produce? No, because at every output level the firm's average variable cost is greater than the price (compare columns 3 and 8 of the table in Figure 10.4). The smallest loss it can incur by producing is greater than the $100 fixed cost it will lose by shutting down (as shown by column 9). The best action is to shut down.

You can see this shutdown situation in Figure 10.5. Price comes closest to covering average variable costs at the MR (= P) = MC output of 5 units. But even here, price or revenue per unit would fall short of average variable cost by $3 (= $74 − $71). By producing at the MR (= P) = MC output, the firm would lose its $100 worth of fixed cost plus $15 ($3 of variable cost on each of the 5 units), for a total loss of $115. This compares unfavorably with the $100 fixed-cost loss the firm would incur by shutting down and producing no output. So it will make sense for the firm to shut down rather than produce at a $71 price—or at any price less than the minimum average variable cost of $74.

The shutdown case reminds us of the qualifier to our MR (= P) = MC rule. A competitive firm will maximize profit or minimize loss in the short run by producing that output at which MR (= P) = MC, *provided that market price exceeds minimum average variable cost.*

QUICK REVIEW 10.2

- ✓ A firm will choose to produce if it can at least break even and generate a normal profit.
- ✓ Profit is maximized, or loss minimized, at the output at which marginal revenue (or price in pure competition) equals marginal cost, provided that price exceeds variable cost.
- ✓ If the market price is below the minimum average variable cost, the firm will minimize its losses by shutting down.

Marginal Cost and Short-Run Supply

LO10.6 Explain why a competitive firm's marginal cost curve is the same as its supply curve.

In the preceding section we simply selected three different prices and asked what quantity the profit-seeking competitive firm, faced with certain costs, would choose to offer in the market at each price. This set of product prices and corresponding quantities supplied constitutes part of the supply schedule for the competitive firm.

Table 10.2 summarizes the supply schedule data for those three prices ($131, $81, and $71) and four others. This table confirms the direct relationship between product price and quantity supplied that we identified in Chapter 3. Note first that the firm will not produce at price $61 or $71 because both are less than the $74 minimum AVC. Then note that quantity supplied increases as price increases. Observe finally that economic profit is higher at higher prices.

KEY GRAPH

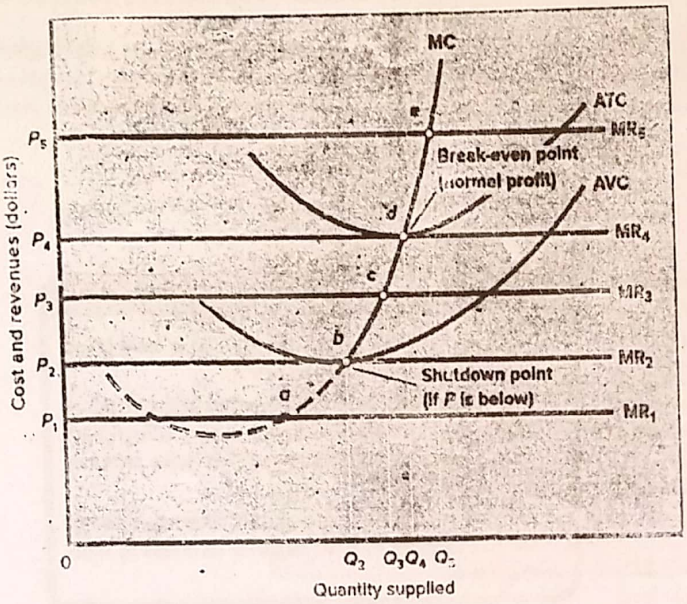


FIGURE 10.6 The P = MC rule and the competitive firm's short-run supply curve. Application of the P = MC rule, as modified by the shutdown case, reveals that the (solid) segment of the firm's MC curve that lies above AVC is the firm's short-run supply curve. More specifically, at price P_1, P = MC at point *a*, but the firm will produce no output because P_1 is less than minimum AVC. At price P_2 the firm will operate at point *b*, where it produces Q_2 units and incurs a loss equal to its total fixed cost. At P_3 it operates at point *c*, where output is Q_3 and the loss is less than total fixed cost. With the price of P_4, the firm operates at point *d*; in this case the firm earns a normal profit because at output Q_4 price equals ATC. At price P_5 the firm operates at point *e* and maximizes its economic profit by producing Q_5 units.

QUICK QUIZ FOR FIGURE 10.6

1. Which of the following might increase product price from P_3 to P_5?
   a. An improvement in production technology.
   b. A decline in the price of a substitute good.
   c. An increase in the price of a complementary good.
   d. Rising incomes if the product is a normal good.
2. An increase in price from P_3 to P_5 would:
   a. shift this firm's MC curve to the right.
   b. mean that MR_5 exceeds MC at Q_3 units, inducing the firm to expand output to Q_5.
   c. decrease this firm's average variable costs.
   d. enable this firm to obtain a normal, but not an economic, profit.
3. At P_4:
   a. this firm has no economic profit.
   b. this firm will earn only a normal profit and thus will shut down.
   c. MR_4 will be less than MC at the profit-maximizing output.
   d. the profit-maximizing output will be Q_5.
4. Suppose P_4 is \$10, P_5 is \$15, Q_4 is 8 units, and Q_5 is 10 units. This firm's:
   a. supply curve is elastic over the Q_4–Q_5 range of output.
   b. supply curve is inelastic over the Q_4–Q_5 range of output.
   c. total revenue will decline if price rises from P_4 to P_5.
   d. marginal-cost curve will shift downward if price falls from P_5 to P_4.

Answers: 1. d; 2. b; 3. c; 4. b

TABLE 10.2 The Supply Schedule of a Competitive Firm Confronted with the Cost Data in the Table in Figure 10.3

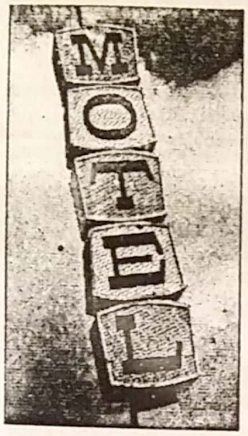
Price		Maximum Profit (+) or Minimum Loss (−)
$151	10	$+480
131	9	+299
111	8	+138
91	7	−3
81	6	−64
71	0	−100
51	0	−100

Generalized Depiction

Figure 10.6 (Key Graph) generalizes the MR = MC rule and the relationship between short-run production costs and the firm's supply behavior. The ATC, AVC, and MC curves are shown, along with several marginal-revenue lines drawn at possible market prices. Let's observe quantity supplied at each of these prices:

- Price P_1 is below the firm's minimum average variable cost, so at this price the firm won't operate at all. Quantity supplied will be zero, as it will be at all other prices below P_2.

CONSIDER THIS...



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The "Still There" Motel

Have you ever driven by a poorly maintained business facility and wondered why the owner does not either fix up the property or go out of business? The somewhat surprising reason is that it may be unprofitable to improve the facility yet profitable to continue to operate the business as it deteriorates. Seeing why will aid your understanding of the "stay open or shut down" decision facing firms experiencing declining demand.

Consider the story of the Still There Motel on Old Highway North, Anytown, USA. The owner built the motel on the basis of traffic patterns and competition existing several decades ago. But as interstate highways were built, the motel found itself located on a relatively untraveled stretch of road. Also, it faced severe competition from "chain" motels located much closer to the interstate highway.

As demand and revenue fell, Still There moved from profitability to loss ($P <$ ATC). But at first its room rates and annual revenue were sufficient to cover its total variable costs and contribute some to the payment of fixed costs such as insurance and property taxes ($P >$ AVC). By staying open, Still There lost less than it would have if it shut down. But since its total revenue did not cover its total costs (or $P <$ ATC), the owner realized that something must be done in the long run. The owner decided to lower total costs by reducing annual maintenance. In effect, the owner opted to allow the motel to deteriorate as a way of temporarily regaining profitability.

This renewed profitability of Still There cannot last because in time no further reduction of maintenance costs will be possible. The deterioration of the motel structure will produce even lower room rates, and therefore even less total revenue. The owner of Still There knows that sooner or later total revenue will again fall below total cost (or P will again fall below ATC), even with an annual maintenance expense of zero. When that occurs, the owner will close down the business, tear down the structure, and sell the vacant property. But, in the meantime, the motel is still there—open, deteriorating, and profitable.

- Price P_2 is just equal to the minimum average variable cost. The firm will supply Q_2 units of output (where $MR_2 = MC$) and just cover its total variable cost. Its loss will equal its total fixed cost. (Actually, the firm would be indifferent as to shutting down or supplying Q_2 units of output, but we assume it produces.)
- At price P_3 the firm will supply Q_3 units of output to minimize its short-run losses. At any of the other prices between P_2 and P_4 the firm will also minimize its losses by producing and supplying the quantity at which MR $(= P) =$ MC.
- The firm will just break even at price P_4. There it will supply Q_4 units of output (where $MR_4 = MC$), earning a normal profit but not an economic profit. Total revenue will just cover total cost, including a normal profit, because the revenue per unit ($MR_4 = P_4$) and the total cost per unit (ATC) are the same.
- At price P_5 the firm will realize an economic profit by producing and supplying Q_5 units of output. In fact, at any price above P_4 the firm will obtain economic profit by producing to the point where MR $(= P) =$ MC.

Note that each of the MR $(= P) =$ MC intersection points labeled b, c, d, and e in Figure 10.6 indicates a possible product price (on the vertical axis) and the corresponding quantity that the firm would supply at that price (on the horizontal axis). Thus, points such as these are on the upsloping supply curve of the competitive firm. Note, too, that quantity supplied would be zero at any price below the minimum average variable cost (AVC). *We can conclude that the portion of the firm's marginal-cost curve lying above its average-variable-cost curve is its short-run supply curve.* In Figure 10.6, the solid segment of the marginal-cost curve MC is this firm's **short-run supply curve.** It tells us the amount of output the firm will supply at each price in a series of prices.

Table 10.3 summarizes the MR = MC approach to determining the competitive firm's profit-maximizing output level. It also shows the equivalent analysis in terms of total revenue and total cost.

TABLE 10.3 Output Determination in Pure Competition in the Short Run

Question	Answer
Should this firm produce?	Yes, if price is equal to, or greater than, minimum average variable cost. This means that the firm is profitable or that its losses are less than its fixed cost.
What quantity should this firm produce?	Produce where MR $(= P) =$ MC; there, profit is maximized (TR exceeds TC by a maximum amount) or loss is minimized.
Will production result in economic profit?	Yes, if price exceeds average total cost (so that TR exceeds TC). No, if average total cost exceeds price (so that TC exceeds TR).

LAST WORD

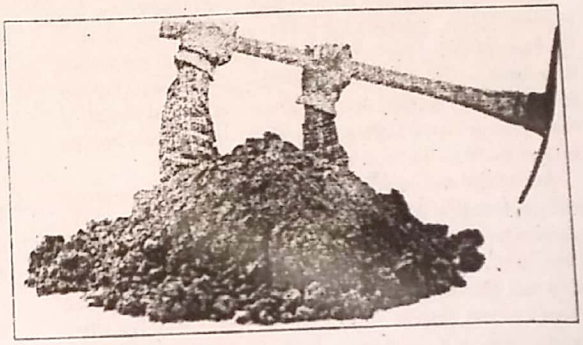
Fixed Costs: Digging Yourself Out of a Hole

For Firms Facing Losses Due to Fixed Costs, Shutting Down in the Short Run Does Not Mean Shutting Down Forever.

A firm with fixed costs starts each month standing at the bottom of a deep financial hole. The depth of that "money pit" is equal to the dollar value of all the payments that the firm is legally obligated to make even if it is producing nothing. These fixed costs include contractually guaranteed salaries, interest payments on loans, and equipment rental fees that are locked in by long-term contracts. As the firm stands at the bottom of this fixed-cost financial hole and stares upward looking for a way out, it has to ask itself the following question: Will producing output make the hole even deeper?

Naturally, the firm hopes that producing output will generate positive cash flows that will offset its fixed costs and start filling in the hole. If those positive flows are large enough, they may completely offset the firm's fixed costs and fill up the hole, thereby allowing the firm to break even. And if they are just a bit larger, they will not only fill up the hole but also accumulate a nice little pile of profits above ground.

But those are just the firm's hopes. The firm's reality may be quite unpleasant. In particular, the firm may be facing a situation in which producing output would make its financial situation worse rather than better. As explained in this chapter, if the price of the firm's output falls too low, then producing output will yield cash flows that are negative rather than positive because revenues will be less than variable costs. If that happens,



Source: © pixhook/Getty RF

Diminishing Returns, Production Costs, and Product Supply

We have now identified the links between the law of diminishing returns (Chapter 9), production costs, and product supply in the short run. Because of the law of diminishing returns, marginal costs eventually rise as more units of output are produced. And because marginal costs rise with output, a purely competitive firm must get successively higher prices to motivate it to produce additional units of output.

Viewed alternatively, higher product prices and marginal revenue encourage a purely competitive firm to expand output. As its output increases, the firm's marginal costs rise as a result of the law of diminishing returns. At some now greater output, the higher MC equals the new product price and MR. Profit once again is maximized, but at a greater total amount. Quantity supplied has increased in direct response to an increase in product price and the desire to maximize profit.

Changes in Supply

In Chapter 9 we saw that changes in such factors as the prices of variable inputs or in technology will alter costs and shift the marginal-cost or short-run supply curve to a new location. All else equal, for example, a wage increase would increase marginal cost and shift the supply curve in Figure 10.6 upward as viewed from the horizontal axis (leftward as viewed from the vertical axis). That is, supply would decrease. Similarly, technological progress that increases the productivity of labor would reduce marginal cost and shift the marginal-cost or supply curve downward as viewed from the horizontal axis (rightward as viewed from the vertical axis). This represents an increase in supply.

Firm and Industry: Equilibrium Price

In the preceding section we established the competitive firm's short-run supply curve by applying the MR (= P) = MC rule. But which of the various possible prices will actually be the market equilibrium price?

producing output will lose money for the firm so that the firm would be better off shutting down production rather than producing output. By shutting down, it will lose only its fixed costs. By shutting down, its financial hole won't get even deeper.

A crucial thing to understand, however, is that the low prices that cause firms to shut down production are often temporary—so that shutdowns are also often temporary. Just because a firm shuts down at a given moment to prevent its financial hole from getting any deeper does not mean that the firm will go out of business forever. To the contrary, many industries are characterized by firms that regularly switch production on and off depending upon the market price they can get for their output and, consequently, whether producing output will generate positive or negative cash flows.

Oil production is a good example. Different wells have different variable production costs. If the price of oil drops below a given well's variable costs, then it would be better to halt production on that well and just lose the value of its fixed costs rather than pumping oil whose variable cost exceeds the revenue that it generates when sold.

Seasonal resorts are another good example of turning production on and off depending on the price. The demand for hotel rooms near ski resorts in New Hampshire, for instance, is much higher during the winter ski season than it is during the summer. As a result, the market price of hotel rooms falls so low during the summer that many inns and resorts close during the warmer months. They have all sorts of fixed costs, but it makes more sense for them to shut down rather than remain open because operating in the summer would cost more in variable costs than it would generate in revenues. Better to lose only their fixed costs.

Numerous other examples of temporary shutdowns occur during recessions, the occasional economy-wide economic slowdowns during which demand declines for nearly all goods and services. The 2007–2009 recession in the United States, for instance, saw many manufacturing companies temporarily shut down and mothball their production facilities. The recession witnessed the mothballing of electric generating plants, factories that make fiber optic cable, automobile factories, chemical plants, textile mills, and even the plant in McIntosh, Alabama, that makes the artificial sweetener Splenda. Many other firms also shut down production to wait out the recession—so many, in fact, that there was a mini-boom for consulting firms that specialized in helping firms mothball their factories (the main problem being how to properly store idle machinery so that it will work again when it is eventually brought back into service).

Firms that mothball factories or equipment during a recession do so expecting to eventually turn them back on. But the lengths of recessions vary, as do the specific circumstances of individual firms. So while many firms shut down in the short run with the expectation of reopening as soon as their particular business conditions improve, sometimes their business conditions do not improve. Sometimes the only way to terminate fixed costs is to terminate the firm.

From Chapter 3 we know that the market equilibrium price will be the price at which the total quantity supplied of the product equals the total quantity demanded. So to determine the equilibrium price, we first need to obtain a total supply schedule and a total demand schedule. We find the total supply schedule by assuming a particular number of firms in the industry and supposing that each firm has the same individual supply schedule as the firm represented in Figure 10.6. Then we sum the quantities supplied at each price level to obtain the total (or market) supply schedule. Columns 1 and 3 in Table 10.4 repeat the supply schedule for the individual competitive firm, as derived in Table 10.2. Suppose 1,000 firms compete in this industry, all having the same total and unit costs as the single firm we discussed. This lets us calculate the market supply schedule (columns 2 and 3) by multiplying the quantity-supplied figures of the single firm (column 1) by 1,000.

Market Price and Profits To determine the equilibrium price and output, these total-supply data must be compared with total-demand data. Let's assume that total demand is as shown in columns 3 and 4 in Table 10.4. By comparing the total quantity supplied and the total quantity demanded at the seven possible prices, we determine that the equilibrium price

TABLE 10.4 Firm and Market Supply and Market Demand

(1) Quantity supplied, single firm	(2) Total quantity supplied	(3) Price	(4) Total quantity demanded
10	10,000	$151	4,000
9	9,000	131	6,000
8	8,000	111	8,000
7	7,000	91	9,000
6	6,000	81	11,000
0	0	71	13,000
0	0	61	16,000

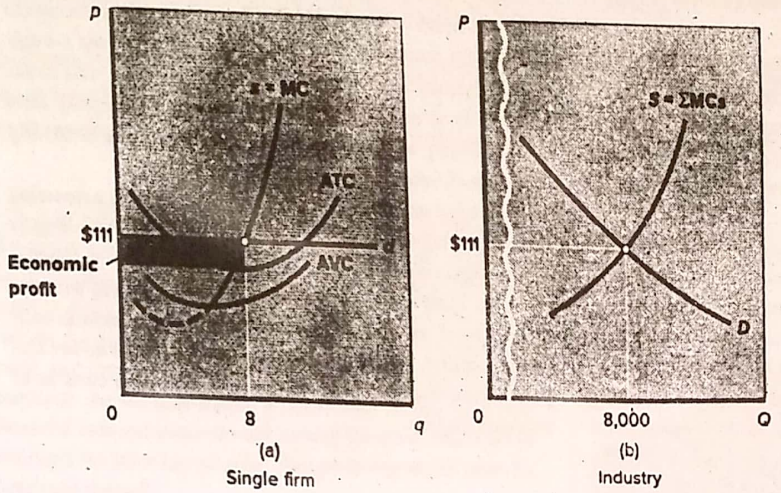


FIGURE 10.7 **Short-run competitive equilibrium for (a) a firm and (b) the industry.** The horizontal sum of the 1,000 firms' individual supply curves (*s*) determines the industry supply curve (*S*). Given industry demand (*D*), the short-run equilibrium price and output for the industry are $111 and 8,000 units. Taking the equilibrium price as given, the individual firm establishes its profit-maximizing output at 8 units and, in this case, realizes the economic profit represented by the green area.

is $111 and the equilibrium quantity is 8,000 units for the industry—8 units for each of the 1,000 identical firms.

Will these conditions of market supply and demand make this a profitable or unprofitable industry? Multiplying product price ($111) by output (8 units), we find that the total revenue of each firm is $888. The total cost is $750, found by looking at column 4 of the table in Figure 10.2. The $138 difference is the economic profit of each firm. For the industry, total economic profit is $138,000. This, then, is a profitable industry.

Another way of calculating economic profit is to determine per-unit profit by subtracting average total cost ($93.75) from product price ($111) and multiplying the difference (per-unit profit of $17.25) by the firm's equilibrium level of output (8). Again we obtain an economic profit of $138 per firm and $138,000 for the industry.

Figure 10.7 shows this analysis graphically. The individual supply curves of each of the 1,000 identical firms—one of which is shown as $s = MC$ in Figure 10.7a—are summed horizontally to get the total-supply curve $S = SMC$ of Figure 10.7b. With total-demand curve D, it yields the equilibrium price $111 and equilibrium quantity (for the industry) 8,000 units. This equilibrium price is given and unalterable to the individual firm; that is, each firm's demand curve is perfectly elastic at the equilibrium price, as indicated by d in Figure 10.7a. Because the individual firm is a price taker, the marginal-revenue curve coincides with the firm's demand curve d. This $111 price exceeds the average total cost at the firm's equilibrium MR = MC output of 8 units, so the firm earns an economic profit represented by the green area in Figure 10.7a.

Assuming no changes in costs or market demand, these diagrams reveal a genuine equilibrium in the short run. No shortages or surpluses occur in the market to cause price or total quantity to change. Nor can any firm in the industry increase its profit by altering its output. Note, too, that higher unit and marginal costs, on the one hand, or weaker market demand, on the other, could change the situation so that Figure 10.7a resembles Figure 10.4 or Figure 10.5.

Firm versus Industry Figure 10.7 underscores a point made earlier: Product price is a given fact to the *individual* competitive firm, but the supply plans of all competitive producers *as a group* are a basic determinant of product price. If we recall the fallacy of composition (Last Word, Chapter 1), we find there is no inconsistency here. Although one firm, supplying a negligible fraction of total supply, cannot affect price, the sum of the supply curves of all the firms in the industry constitutes the industry supply curve, and that curve does have an important bearing on price.

QUICK REVIEW 10.3

- ✓ A competitive firm's short-run supply curve is the portion of its marginal cost (MC) curve that lies above its average variable cost (AVC) curve.
- ✓ If price P is greater than minimum average variable cost, the firm will produce the amount of output where MR (= P) = MC in order to either maximize its profit (if price exceeds minimum ATC) or minimize its loss (if price lies between minimum AVC and minimum ATC).
- ✓ Market supply in a competitive industry is the horizontal sum of the individual supply curves of all of the firms in the industry. The market equilibrium price is determined by where the industry's market supply curve intersects the industry's market demand curve.

SUMMARY

LO10.1 Give the names and summarize the main characteristics of the four basic market models.

Economists group industries into four models based on their market structures: (*a*) pure competition, (*b*) pure monopoly, (*c*) monopolistic competition, and (*d*) oligopoly.

LO10.2 List the conditions required for purely competitive markets.

A purely competitive industry consists of a large number of independent firms producing a standardized product. Pure competition assumes that firms and resources are mobile among different industries.

LO10.3 Explain how demand is seen by a purely competitive seller.

In a competitive industry, no single firm can influence market price. This means that the firm's demand curve is perfectly elastic and price equals marginal revenue.

LO10.4 Convey how purely competitive firms can use the total-revenue–total-cost approach to maximize profits or minimize losses in the short run.

We can analyze short-run profit maximization by a competitive firm by comparing total revenue and total cost or by applying marginal analysis. A firm maximizes its short-run profit by producing the output at which total revenue exceeds total cost by the greatest amount.

LO10.5 Explain how purely competitive firms can use the marginal-revenue–marginal-cost approach to maximize profits or minimize losses in the short run.

Provided price exceeds minimum average variable cost, a competitive firm maximizes profit or minimizes loss in the short run by producing the output at which price or marginal revenue equals marginal cost.

If price is less than minimum average variable cost, a competitive firm minimizes its loss by shutting down. If price is greater than average variable cost but is less than average total cost, a competitive firm minimizes its loss by producing the $P = MC$ amount of output. If price also exceeds average total cost, the firm maximizes its economic profit at the $P = MC$ amount of output.

LO10.6 Explain why a competitive firm's marginal cost curve is the same as its supply curve.

Applying the MR ($= P$) = MC rule at various possible market prices leads to the conclusion that the segment of the firm's short-run marginal-cost curve that lies above the firm's average-variable-cost curve is its short-run supply curve.

A competitive firm shuts down production at least temporarily if price is less than minimum average variable cost because, in those situations, producing any amount of output will always result in variable costs exceeding revenues. Shutting down therefore results in a smaller loss because the firm will lose only its fixed cost, whereas, if it operated, it would lose its fixed cost plus whatever money is lost due to variable costs exceeding revenues.

Competitive firms choose to operate rather than shut down whenever price is greater than average variable cost but less than average total cost because, in those situations, revenues will always exceed variable costs. The amount by which revenues exceed variable costs can be used to help pay down some of the firm's fixed costs. Thus, the firm loses less money by operating (and paying down some of its fixed costs) than it would if it shut down (in which case it would suffer a loss equal to the full amount of its fixed costs).

TERMS AND CONCEPTS

market structure
pure competition
pure monopoly
monopolistic competition
oligopoly
imperfect competition
price taker
average revenue
total revenue
marginal revenue
break-even point
MR = MC rule
short-run supply curve

The following and additional problems can be found in connect

DISCUSSION QUESTIONS

1. Briefly state the basic characteristics of pure competition, pure monopoly, monopolistic competition, and oligopoly. Under which of these market classifications does each of the following most accurately fit? (*a*) a supermarket in your hometown; (*b*) the steel industry; (*c*) a Kansas wheat farm; (*d*) the commercial bank in which you or your family has an account; (*e*) the automobile industry. In each case, justify your classification. LO10.1
2. Strictly speaking, pure competition is relatively rare. Then why study it? LO10.2

"Even if a firm is losing money, it may be better to stay in business in the short run." Is this statement ever true? Under what condition(s)? LO10.5

Consider a firm that has no fixed costs and that is currently losing money. Are there any situations in which it would want to stay open for business in the short run? If a firm has no fixed costs, is it sensible to speak of the firm distinguishing between the short run and the long run? LO10.5

Why is the equality of marginal revenue and marginal cost essential for profit maximization in all market structures? Explain why price can be substituted for marginal revenue in the MR = MC rule when an industry is purely competitive. LO10.5

6. "That segment of a competitive firm's marginal-cost curve that lies above its average-variable-cost curve constitutes the short-run supply curve for the firm." Explain using a graph and words. LO10.5
7. LAST WORD If a firm's current revenues are less than its current variable costs, when should it shut down? If the firm decides to shut down, should we expect that decision to be final? Explain using an example that is not in the book.

REVIEW QUESTIONS

Suppose that the paper clip industry is perfectly competitive. Also assume that the market price for paper clips is 2 cents per paper clip. The demand curve faced by each firm in the industry is: LO10.3

a. A horizontal line at 2 cents per paper clip.
b. A vertical line at 2 cents per paper clip.
c. The same as the market demand curve for paper clips.
d. Always higher than the firm's MC curve.

Use the following demand schedule to determine total revenue and marginal revenue for each possible level of sales: LO10.3

a. What can you conclude about the structure of the industry in which this firm is operating? Explain.

Product Price	Quantity Demanded	Total Revenue	Marginal Revenue
$2	0	$_____	$_____
2	1	_____	_____
2	2	_____	_____
2	3	_____	_____
2	4	_____	_____
2	5	_____	

b. Graph the demand, total-revenue, and marginal-revenue curves for this firm.
c. Why do the demand and marginal-revenue curves coincide?
d. "Marginal revenue is the change in total revenue associated with additional units of output." Explain verbally and graphically, using the data in the table.

3. A purely competitive firm whose goal is to maximize profit will choose to produce the amount of output at which: LO10.4
   a. TR and TC are equal.
   b. TR exceeds TC by as much as possible.
   c. TC exceeds TR by as much as possible.
   d. none of the above.
4. If it is possible for a perfectly competitive firm to do better financially by producing rather than shutting down, then it should produce the amount of output at which: LO10.5
   a. MR < MC.
   b. MR = MC.
   c. MR > MC.
   d. none of the above.
5. A perfectly competitive firm that makes car batteries has a fixed cost of $10,000 per month. The market price at which it can sell its output is $100 per battery. The firm's minimum AVC is $105 per battery. The firm is currently producing 500 batteries a month (the output level at which MR = MC). This firm is making a _____ and should _____ production LO10.5
   a. profit; increase
   b. profit; shut down
   c. loss; increase
   d. loss; shut down
6. Consider a profit-maximizing firm in a competitive industry. For each of the following situations, indicate whether the firm should shut down production or produce where MR = MC. LO10.5
   a. P < minimum AVC.
   b. P > minimum ATC.
   c. Minimum AVC < P < minimum ATC.

PROBLEMS

1. A purely competitive firm finds that the market price for its product is $20. It has a fixed cost of $100 and a variable cost of $10 per unit for the first 50 units and then $25 per unit for all successive units. Does price exceed average variable cost for the first 50 units? What about for the first 100 units? What is the marginal cost per unit for the first 50 units? What about for units 51 and higher? For each of the first 50 units, does MR exceed MC? What about for units 51 and higher? What output level will yield the largest possible profit for this purely competitive firm? (Hint: Draw a graph similar to Figure 10.2 using data for this firm.) LO10.5

2. A purely competitive wheat farmer can sell any wheat he grows for $10 per bushel. His five acres of land show diminishing returns because some are better suited for wheat production than others. The first acre can produce 1,000 bushels of wheat, the second acre 900, the third 800, and so on. Draw a table with multiple columns to help you answer the following questions. How many bushels will each of the farmer's five acres produce? How much revenue will each acre generate? What are the TR and MR for each acre? If the marginal cost of planting and harvesting an acre is $7,000 per acre for each of the five acres, how many acres should the farmer plant and harvest? LO10.5
3. Karen runs a print shop that makes posters for large companies. It is a very competitive business. The market price is currently $1 per poster. She has fixed costs of $250. Her variable costs are $1,000 for the first thousand posters, $800 for the second thousand, and then $750 for each additional thousand posters. What is her AFC per poster (not per thousand!) if she prints 1,000 posters? 2,000? 10,000? What is her ATC per poster if she prints 1,000? 2,000? 10,000? If the market price fell to 70 cents per poster, would there be *any* output level at which Karen would *not* shut down production immediately? LO10.5
4. Assume that the cost data in the following table are for a purely competitive producer: LO10.5

Output	Average Variable Cost	Average Total Cost	Marginal Cost
0			
1	$60.00	$45.00	$105.00
2	30.00	42.50	72.50
3	20.00	40.00	60.00
4	15.00	37.50	52.50
5	12.00	37.00	49.00
6	10.00	37.50	47.50
7	8.57	38.57	47.14
8	7.50	40.63	48.13
9	6.67	43.33	50.00
10	6.00	46.50	52.50

   a. At a product price of $56, will this firm produce in the short run? If it is preferable to produce, what will be the profit-maximizing or loss-minimizing output? What economic profit or loss will the firm realize per unit of output?
   b. Answer the questions of 4a assuming product price is $41.
   c. Answer the questions of 4a assuming product price is $32.
   d. In the following table, complete the short-run supply schedule for the firm (columns 1 and 2) and indicate the profit or loss incurred at each output (column 3).

(1) Price	(2) Quantity Supplied, Single Firm	(3) Profit (+) or Loss (−)	(4) Quantity Supplied 1,500 Firms
$26	_____	$_____	_____
32	_____	_____	_____
38	_____	_____	_____
41	_____	_____	_____
46	_____	_____	_____
56	_____	_____	_____
66	_____	_____	_____

   e. Now assume that there are 1,500 identical firms in this competitive industry; that is, there are 1,500 firms, each of which has the cost data shown in the table. Complete the industry supply schedule (column 4).
   f. Suppose the market demand data for the product are as follows:

Price	Total Quantity Demanded
$26	17,000
32	15,000
38	13,500
41	12,000
46	10,500
56	9,500
66	8,000

   What will be the equilibrium price? What will be the equilibrium output for the industry? For each firm? What will profit or loss be per unit? Per firm? Will this industry expand or contract in the long run?

(20)

Chapter 11

Pure Competition in the Long Run

Learning Objectives

LO11.1 **Explain how the long run differs from the short run in pure competition.**

LO11.2 **Describe how profits and losses drive the long-run adjustment process of pure competition.**

LO11.3 **Explain the differences between constant-cost, increasing-cost, and decreasing-cost industries.**

LO11.4 **Show how long-run equilibrium in pure competition produces an efficient allocation of resources.**

LO11.5 **Discuss creative destruction and the profit incentives for innovation.**

The previous chapter discussed how pure competition operates in the short run, the time period during which the individual firms in an industry are stuck with their current plant sizes and fixed-cost commitments. As you know, pure competitors shut down production if prices are too low or, if prices are high enough, produce where MR = MC to minimize their losses or maximize their profits. Whether they make a profit or a loss depends on how high the market price is relative to their costs.

That being said, profits and losses cannot be the end of the pure competition story because one of the key characteristics of pure competition is the freedom of firms to enter or exit the industry. We know from Chapter 2 that profits attract entry and losses prompt exit.

In this chapter, we are keenly interested in how entry and exit relate to allocative and productive efficiency. We are also interested in how continuing competition leads to new products and new business methods replacing older products and older business methods through a process aptly referred to as *creative destruction*.

The Long Run in Pure Competition

LO11.1 Explain how the long run differs from the short run in pure competition.

The entry and exit of firms in our market models can only take place in the long run. In the short run, the industry is composed of a specific number of firms, each with a plant size that is fixed and unalterable in the short run. Firms may shut down in the sense that they can produce zero units of output in the short run, but they do not have sufficient time to liquidate their assets and go out of business.

In the long run, by contrast, the firms already in an industry have sufficient time to either expand or contract their capacities. More important, the number of firms in the industry may either increase or decrease as new firms enter or existing firms leave.

The length of time constituting the long run varies substantially by industry, however, so that you should not fix in your mind any specific number of years, months, or days. Instead, focus your attention on the incentives provided by profits and losses for the entry and exit of firms into any purely competitive industry and, later in the chapter, on how those incentives lead to productive and allocative efficiency. The time horizons are far less important than the process by which profits and losses guide business managers toward the efficient use of society's resources.

Profit Maximization in the Long Run

The first part of the pure competition story (Chapter 10) was about profit, loss, and shutdown in the short run. The rest of the story (this chapter) is about entry and exit and their effects on industry size and allocative and productive efficiency in the long run.

To tell the rest of story well, we need to return to our graphical analysis and examine profit maximization by pure competitors in the long run. Several assumptions, none of which affect our conclusions, will keep things simple:

- ***Entry and exit only*** The only long-run adjustment in our graphical analysis is caused by the entry or exit of firms. Moreover, we ignore all short-run adjustments in order to concentrate on the effects of the long-run adjustments.
- ***Identical costs*** All firms in the industry have identical cost curves. This assumption lets us discuss an "average," or "representative," firm, knowing that all other firms in the industry are similarly affected by any long-run adjustments that occur.
- ***Constant-cost industry*** The industry is a constant-cost industry. This means that the entry and exit of firms does not affect resource prices or, consequently, the locations of the average-total-cost curves of individual firms.

The Long-Run Adjustment Process in Pure Competition

LO11.2 Describe how profits and losses drive the long-run adjustment process of pure competition.

The basic conclusion we seek to explain is this: After all long-run adjustments are completed in a purely competitive industry, product price will be exactly equal to, and production will occur at, each firm's minimum average total cost.

This conclusion follows from two basic facts: (1) Firms seek profits and shun losses, and (2) under pure competition, firms are free to enter and leave an industry. If market price initially exceeds minimum average total cost, the resulting economic profit will attract new firms to the industry. But this industry expansion will increase supply until price is brought back down to equality with minimum average total cost. Conversely, if price is initially less than minimum average total cost, the resulting loss will cause firms to leave the industry. As they leave, total supply will decline, bringing the price back up to equality with minimum average total cost.

Long-Run Equilibrium

Consider the average firm in a purely competitive industry that is initially in long-run equilibrium. This firm is represented in Figure 11.1a, where MR = MC and price and minimum average total cost are equal at $50. Economic profit here is zero; the industry is in equilibrium or "at rest" because there is no tendency for firms to enter or to leave. The existing firms are earning normal profits, which means that their accounting profits are equal to those that the owners of these

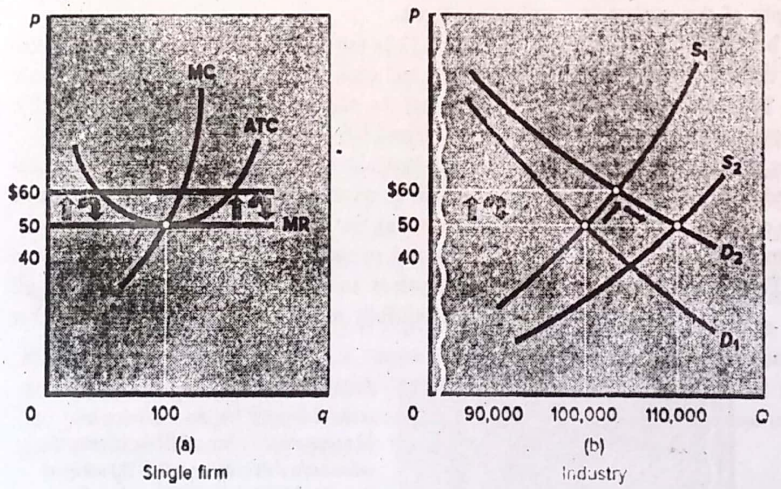


FIGURE 11.1 **Temporary profits and the reestablishment of long-run equilibrium in (a) a representative firm and (b) the industry.** A favorable shift in demand (D_1 to D_2) will upset the original industry equilibrium and produce economic profits. But those profits will entice new firms to enter the industry, increasing supply (S_1 to S_2) and lowering product price until economic profits are once again zero.

firms could expect to receive on average in other industries. It is because their current profits are the same as they could expect to earn elsewhere that there is no tendency for firms to enter or leave the industry. The $50 market price is determined in Figure 11.1b by market or industry demand D_1 and supply S_1. (S_1 is a short-run supply curve; we will develop the long-run industry supply curve in our discussion.) And remember that normal profits earned by these firms are considered an opportunity cost and, therefore, are included in the firms' cost curves.

As shown on the quantity axes of the two graphs, equilibrium output in the industry is 100,000 while equilibrium output for the single firm is 100. If all firms in the industry are identical, there must be 1,000 firms (= 100,000/100).

Entry Eliminates Economic Profits Let's upset the long-run equilibrium in Figure 11.1 and see what happens. Suppose a change in consumer tastes increases product demand from D_1 to D_2. Price will rise to $60, as determined at the intersection of D_2 and S_1, and the firm's marginal-revenue curve will shift upward to $60. This $60 price exceeds the firm's average total cost of $50 at output 100, creating an economic profit of $10 per unit. This economic profit will lure new firms into the industry. Some entrants will be newly created firms; others will shift from less prosperous industries.

As firms enter, the market supply of the product increases, pushing the product price below $60. Economic profits persist, and entry continues until short-run supply increases to S_2. Market price falls to $50, as does marginal revenue for the firm. Price and minimum average total cost are again equal at $50. The economic profits caused by the boost in demand have been eliminated, and, as a result, the previous incentive for more firms to enter the industry has disappeared because the firms that remain are earning only a normal profit (zero economic profit). Entry ceases and a new long-run equilibrium is reached.

Observe in Figure 11.1a and 11.1b that total quantity supplied is now 110,000 units and each firm is producing 100 units. Now 1,100 firms rather than the original 1,000 populate the industry. Economic profits have attracted 100 more firms.

Exit Eliminates Losses Now let's consider a shift in the opposite direction. We begin in Figure 11.2b with curves S_1 and D_1 setting the same initial long-run equilibrium situation as in our previous analysis, including the $50 price.

Suppose consumer demand declines from D_1 to D_3. This forces the market price and marginal revenue down to $40, making production unprofitable at the minimum ATC of $50. In time the resulting economic losses will induce firms to leave the industry. Their owners will seek a normal profit elsewhere rather than accept the below-normal profits (losses) now confronting them. As this exodus of firms proceeds, however, industry supply decreases, pushing the price up from $40 toward $50. Losses continue and more firms leave the industry until the supply curve shifts to S_3. Once this happens, price is again $50, just equal to the minimum average total cost. Losses have been eliminated so that the firms that remain are earning only a normal profit (zero economic profit). Since this is no better or worse than entrepreneurs could expect to earn in other business ventures, there is no longer any incentive to exit the industry. Long-run equilibrium is restored.

In Figure 11.2a and 11.2b, total quantity supplied is now 90,000 units and each firm is producing 100 units. Only 900 firms, not the original 1,000, populate the industry. Losses have forced 100 firms out.

You may have noted that we have sidestepped the question of which firms will leave the industry when losses occur by assuming that all firms have identical cost curves. In the real world, of course, managerial talents differ. Even if resource prices and technology are the same for all firms, less skillfully managed firms tend to incur higher

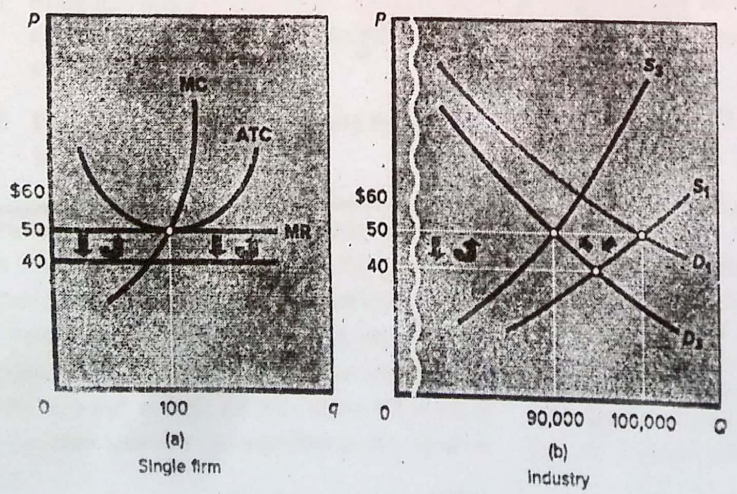


FIGURE 11.2 **Temporary losses and the reestablishment of long-run equilibrium in (a) a representative firm and (b) the industry.** An unfavorable shift in demand (D_1 to D_3) will upset the original industry equilibrium and produce losses. But those losses will cause firms to leave the industry, decreasing supply (S_1 to S_3) and increasing product price until all losses have disappeared.

costs and therefore are the first to leave an industry when demand declines. Similarly, firms with less productive labor forces or higher transportation costs will be higher-cost producers and likely candidates to quit an industry when demand decreases.

We have now reached an intermediate goal: Our analysis verifies that competition, reflected in the entry and exit of firms, eliminates economic profits or losses by adjusting price to equal minimum long-run average total cost. In addition, this competition forces firms to select output levels at which average total cost is minimized.

Long-Run Supply Curves

LO11.3 Explain the differences between constant-cost, increasing-cost, and decreasing-cost industries.

Although our analysis has dealt with the long run, we have noted that the market supply curves in Figures 11.1b and 11.2b are short-run curves. What then is the character of the **long-run supply curve** of a competitive industry? Our analysis points us toward an answer. The crucial factor here is the effect, if any, that changes in the number of firms in the industry will have on costs of the individual firms in the industry.

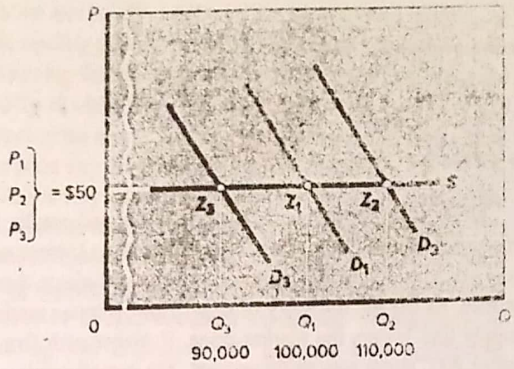
Long-Run Supply for a Constant-Cost Industry

In our analysis of long-run competitive equilibrium we assumed that the industry under discussion was a **constant-cost industry.** This means that industry expansion or contraction will not affect resource prices and therefore production costs. Graphically, it means that the entry or exit of firms does not shift the long-run ATC curves of individual firms. This is the case when the industry's demand for resources is small in relation to the total demand for those resources. Then the industry can expand or contract without significantly affecting resource prices and costs.

What does the long-run supply curve of a constant-cost industry look like? The answer is contained in our previous analysis. There we saw that the entry and exit of firms changes industry output but always brings the product price back to its original level, where it is just equal to the constant minimum ATC. Specifically, we discovered that the industry would supply 90,000, 100,000, or 110,000 units of output, all at a price of $50 per unit. In other words, the long-run supply curve of a constant-cost industry is perfectly elastic.

This is demonstrated graphically in Figure 11.3, which uses data from Figures 11.1 and 11.2. Suppose industry demand is originally D_1, industry output is Q_1 (100,000 units), and product price is P_1 ($50). This situation, from Figure 11.1, is one of long-run equilibrium. We saw that when

FIGURE 11.3 The long-run supply curve for a constant-cost industry. In a constant-cost industry, the entry and exit of firms do not affect resource prices, or, therefore, unit costs. So an increase in demand (D_1 to D_2) raises industry output (Q_1 to Q_2) but not price ($50). Similarly, a decrease in demand (D_1 to D_3) reduces output (Q_1 to Q_3) but not price. Thus, the long-run industry supply curve (S) is horizontal through points Z_1, Z_2, and Z_3.



demand increases to D_2, upsetting this equilibrium, the resulting economic profits attract new firms. Because this is a constant-cost industry, entry continues and industry output expands until the price is driven back down to the level of the unchanged minimum ATC. This is at price P_2 ($50) and output Q_2 (110,000).

From Figure 11.2, we saw that a decline in market demand from D_1 to D_3 causes an exit of firms and ultimately restores equilibrium at price P_3 ($50) and output Q_3 (90,000 units). The points Z_1, Z_2, and Z_3 in Figure 11.3 represent these three price-quantity combinations. A line or curve connecting all such points shows the various price-quantity combinations that firms would produce if they had enough time to make all desired adjustments to changes in demand. This line or curve is the industry's long-run supply curve. In a constant-cost industry this curve (straight line) is horizontal, as in Figure 11.3, thus representing perfectly elastic supply.

Long-Run Supply for an Increasing-Cost Industry

Constant-cost industries are a special case. Most industries are **increasing-cost industries,** in which firms' ATC curves shift upward as the industry expands and downward as the industry contracts. Usually, the entry of new firms will increase resource prices, particularly in industries using specialized resources whose long-run supplies do not readily increase in response to increases in resource demand. Higher resource prices result in higher long-run average total costs for all firms in the industry. These higher costs cause upward shifts in each firm's long-run ATC curve.

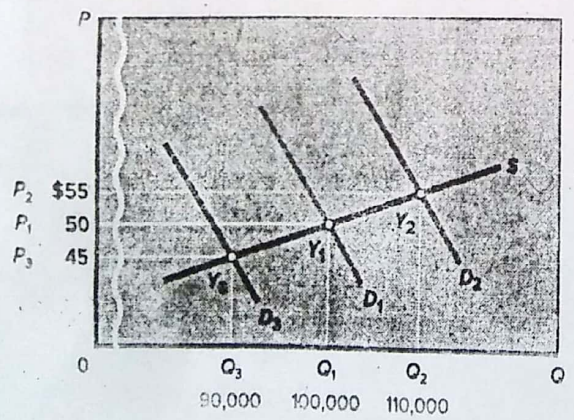
Thus, when an increase in product demand results in economic profits and attracts new firms to an increasing-cost industry, a two-way squeeze works to eliminate those profits. As before, the entry of new firms increases market supply and lowers the market price. But now each firm's entire ATC curve also shifts upward. The overall result is a higher-than-original equilibrium price. The industry produces a larger output at a higher product price because the industry expansion has increased resource prices and the minimum average total cost.

Since greater output will be supplied at a higher price, the long-run industry supply curve is upsloping. Instead of supplying 90,000, 100,000, or 110,000 units at the same price of $50, an increasing-cost industry might supply 90,000 units at $45, 100,000 units at $50, and 110,000 units at $55. A higher price is required to induce more production because costs per unit of output increase as production rises.

Figure 11.4 nicely illustrates the situation. Original market demand is D_1 and industry price and output are P_1 ($50) and Q_1 (100,000 units), respectively, at equilibrium point Y_1. An increase in demand to D_2 upsets this equilibrium and leads to economic profits. New firms enter the industry, increasing both market supply and the production costs of individual firms. A new price is established at point Y_2, where P_2 is $55 and Q_2 is 110,000 units.

Conversely, a decline in demand from D_1 to D_3 makes production unprofitable and causes firms to leave the industry. The resulting decline in resource prices reduces the minimum average total cost of production for firms that stay. A new equilibrium price is established at some level below the original price, say, at point Y_3, where P_3 is $45 and Q_3 is 90,000 units. Connecting these three equilibrium positions, we derive the upsloping long-run supply curve S in Figure 11.4.

FIGURE 11.4 The long-run supply curve for an increasing-cost industry. In an increasing-cost industry, the entry of new firms in response to an increase in demand (D_3 to D_1 to D_2) will bid up resource prices and thereby increase unit costs. As a result, an increased industry output (Q_3 to Q_1 to Q_2) will be forthcoming only at higher prices ($45 < $50 < $55). The long-run industry supply curve (S) therefore slopes upward through points Y_3, Y_1, and Y_2.



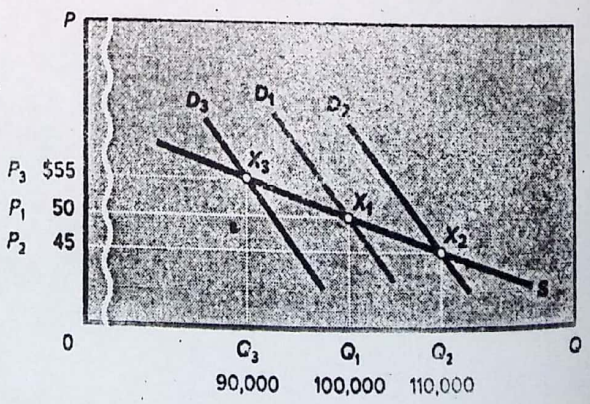
Long-Run Supply for a Decreasing-Cost Industry

In decreasing-cost industries, firms experience lower costs as their industry expands. The personal computer industry is an example. As demand for personal computers increased, new manufacturers of computers entered the industry and greatly increased the resource demand for the components used to build them (for example, memory chips, hard drives, monitors, and operating software). The expanded production of the components enabled the producers of those items to achieve substantial economies of scale. The decreased production costs of the components reduced their prices, which greatly lowered the computer manufacturers' average costs of production. The supply of personal computers increased by more than demand, and the price of personal computers declined.

Unfortunately, however, the industries that show decreasing costs when output expands also show increasing costs if output contracts. A good example is the American shoe-manufacturing industry as it contracted due to foreign competition. Back when the industry was doing well and there were many shoemaking firms, the cost of specialized technicians who repair shoemaking machinery could be spread across many firms. This was because the repairmen worked as independent contractors going from one firm's factory to another firm's factory on a daily basis as various pieces of equipment at different factories needed repairs. But as the demand for American footwear fell over time, there were fewer and fewer factories, so the cost of a repair technician had to be spread over fewer and fewer firms. Thus, costs per firm and per unit of output increased.

Figure 11.5 illustrates the situation. The original market demand is D_1 and industry price and output are P_1 ($50) and Q_1 (100,000 units), respectively, at equilibrium point X_1. An increase in demand to D_2 upsets this equilibrium and leads to

FIGURE 11.5 The long-run supply curve for a decreasing-cost industry. In a decreasing-cost industry, the entry of new firms in response to an increase in demand (D_3 to D_1 to D_2) will lead to decreased input prices and, consequently, decreased unit costs. As a result, an increase in industry output (Q_3 to Q_1 to Q_2) will be accompanied by lower prices ($55 > $50 > $45). The long-run industry supply curve (S) therefore slopes downward through points X_3, X_1, and X_2.



economic profits. New firms enter the industry, increasing market supply but decreasing the production costs of individual firms. A new price is established at point X_2, where P_2 is $45 and Q_2 is 110,000 units.

Conversely, a decline in demand from D_1 to D_3 makes production unprofitable and causes firms to leave the industry. The resulting increase in input prices increases the minimum average total cost of production for the firms that remain. A new equilibrium price is established at some level above the original price, say at point X_3, where P_3 is $55 and Q_3 is 90,000 units. Connecting these three equilibrium positions in Figure 11.5, we derive the downsloping long-run supply curve S for this decreasing-cost industry.

QUICK REVIEW 11.1

- ✓ In pure competition, entrepreneurs remove resources from industries and firms that are generating economic losses in order to transfer them to industries and firms that are generating economic profits.
- ✓ In the long run, the entry of firms into an industry will compete away any economic profits, and the exit of firms will eliminate economic losses, so price and minimum average total cost are equal. Entry and exit cease when the firms in the industry return to making a normal profit (zero economic profit).
- ✓ The long-run supply curves of constant-, increasing-, and decreasing-cost industries are horizontal, upsloping, and downsloping, respectively.

Pure Competition and Efficiency

LO11.4 Show how long-run equilibrium in pure competition produces an efficient allocation of resources.

Figure 11.6 (Key Graph) demonstrates the efficiency characteristics of the individual firms (Figure 11.6a) and the market (Figure 11.6b) after long-run adjustments in pure competition. Assuming a constant- or increasing-cost industry, the final long-run equilibrium positions of all firms have the same basic efficiency characteristics. As shown in Figure 11.6a, price (and marginal revenue) will settle where it is equal to minimum average total cost: P (and MR) = minimum ATC. Moreover, since the marginal-cost curve intersects the average-total-cost curve at its minimum point, marginal cost and average total cost are equal: MC = minimum ATC. So in long-run equilibrium a triple equality occurs: P (and MR) = MC = minimum ATC. Thus, in long-run equilibrium, each firm produces at the output level Q_f that is associated with this triple equality.[1]

[1]This triple equality does not always hold for decreasing-cost industries in which individual firms produce a large fraction of the total market output. In such cases, MC may remain below ATC if average costs are decreasing. We will discuss this situation of "natural monopoly" in Chapter 12.

The triple equality tells us two very important things about long-run equilibrium. First, it tells us that although a competitive firm may realize economic profit or loss in the short run, it will earn only a normal profit by producing in accordance with the MR (= P) = MC rule in the long run. Second, the triple equality tells us that in long-run equilibrium, the profit-maximizing decision rule that leads each firm to produce the quantity at which P = MR also implies that each firm will produce at the output level Q_f that is associated with the minimum point on each identical firm's ATC curve.

This is very important because it suggests that pure competition leads to the most efficient possible use of society's resources. Indeed, subject only to Chapter 4's qualifications relating to public goods and externalities, an idealized purely competitive market economy composed of constant- or increasing-cost industries will generate both productive efficiency and allocative efficiency.

Productive Efficiency: P = Minimum ATC

Productive efficiency requires that goods be produced in the least costly way. In the long run, pure competition forces firms to produce at the minimum average total cost of production and to charge a price that is just consistent with that cost. This is true because firms that do not use the best available (least-cost) production methods and combinations of inputs will not survive.

To see why that is true, let's suppose that Figure 11.6 has to do with pure competition in the cucumber industry. In the final equilibrium position shown in Figure 11.6a, suppose each firm in the cucumber industry is producing 100 units (say, truckloads) of cucumbers by using $5,000 (equal to average total cost of $50 × 100 units) worth of resources. If any firm produced that same amount of output at any higher total cost, say $7,000, it would be wasting resources because all of the other firms in the industry are able to produce that same amount of output using only $5,000 of resources. Society would be faced with a net loss of $2,000 worth of alternative products. But this cannot happen in pure competition; this firm would incur a loss of $2,000, requiring it to either reduce its costs or go out of business.

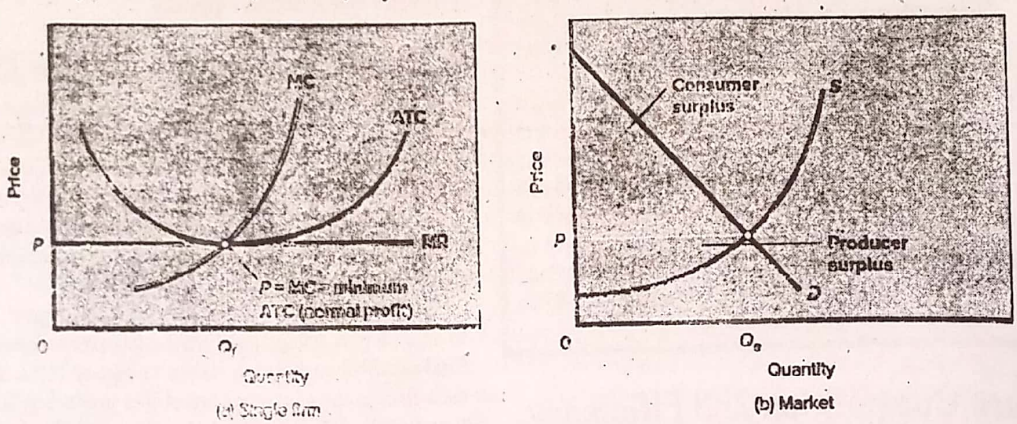
Note, too, that consumers benefit from productive efficiency by paying the lowest product price possible under the prevailing technology and cost conditions. And the firm receives only a normal profit, which is part of its economic costs and thus incorporated in its ATC curve.

Allocative Efficiency: P = MC

Long-run equilibrium in pure competition guarantees productive efficiency, such that output will be produced in the least-cost way. But productive efficiency by itself does not guarantee that anyone will want to buy the items that are being produced in the least-cost manner. For all

KEY GRAPH

FIGURE 11.6 Long-run equilibrium: a competitive firm and market. (a) The equality of price (P), marginal cost (MC), and minimum average total cost (ATC) at output Q_f indicates that the firm is achieving productive efficiency and allocative efficiency. It is using the most efficient technology, charging the lowest price, and producing the greatest output consistent with its costs. It is receiving only a normal profit, which is incorporated into the ATC curve. The equality of price and marginal cost indicates that society allocated its scarce resources in accordance with consumer preferences. (b) In the purely competitive market, allocative efficiency occurs at the market equilibrium output Q_e. The sum of consumer surplus (green area) and producer surplus (blue area) is maximized.



QUICK QUIZ FOR FIGURE 11.6

1. We know the firm is a price taker because:
   a. its MC curve slopes upward.
   b. its ATC curve is U-shaped.
   c. its MR curve is horizontal.
   d. MC and ATC are equal at the profit-maximizing output.
2. At this firm's profit-maximizing output:
   a. total revenue equals total cost.
   b. it is earning an economic profit.
   c. allocative, but not necessarily productive, efficiency is achieved.
   d. productive, but not necessarily allocative, efficiency is achieved.
3. The equality of P, MC, and minimum ATC:
   a. occurs only in constant-cost industries.
   b. encourages entry of new firms.
   c. means that the "right goods" are being produced in the "right ways."
   d. results in a zero accounting profit.
4. When $P = MC =$ lowest ATC for individual firms, in the market:
   a. consumer surplus necessarily exceeds producer surplus.
   b. consumer surplus plus producer surplus is at a maximum.
   c. producer surplus necessarily exceeds consumer surplus.
   d. supply and demand are identical.

Answers: 1. c 2. a 3. c 4. b

we know, consumers might prefer that the resources used to produce those items be redirected toward producing other products instead.

Fortunately, long-run equilibrium in pure competition also guarantees **allocative efficiency**, so we can be certain that society's scarce resources are directed toward producing the goods and services that people most want to consume. Stated formally, allocative efficiency occurs when it is impossible to produce any net gains for society by altering the combination of goods and services that are produced from society's limited supply of resources.

To understand how pure competition leads to allocative efficiency, recall the concept of opportunity cost while looking at Figure 11.6b, where Q_e total units are being produced in equilibrium by the firms in a purely competitive industry. For every unit up to Q_e, market demand curve D lies above market supply curve S. Recall from Chapter 4 what this means in terms of marginal benefits and marginal costs.

- For each unit of output on the horizontal axis, the point directly above it on demand curve D shows how many dollars' worth of other goods and services consumers are willing to give up to obtain that unit of output. Consequently, the demand curve shows the dollar value of the marginal benefit that consumers place on each unit.
- For each unit of output on the horizontal axis, the point directly above it on supply curve S shows how many dollars' worth of other products have to be sacrificed in order to direct the underlying resources toward producing each unit of this product. Consequently, supply curve S shows the dollar value of the marginal opportunity cost of each unit.

Keeping these definitions in mind, the fact that the demand curve lies above the supply curve for every unit up to Q_e means that marginal benefit exceeds marginal cost for every one of these units. Stated slightly differently, producing and consuming these units brings net benefits because consumers are willing to give up more of other goods to obtain these units than must actually be forgone to produce them. Furthermore, because the supply curve includes the opportunity cost of the other goods that must be given up when resources are directed to producing these units, we can be certain that consumers prefer to have the necessary resources directed toward producing these units rather than anything else. In other words, allocative efficiency has been achieved because redirecting the necessary resources toward producing anything else would make people less happy.

The fact that pure competition yields allocative efficiency can also be understood by looking at the situation facing each individual firm in long-run equilibrium. To see this, take the market equilibrium price P that is determined in Figure 11.6b and see how it affects the behavior of the individual firm shown in Figure 11.6a. This profit-maximizing firm takes P as fixed and produces Q_f units, the output level at which $P = MC$.

By comparing the horizontal line at P with the upsloping MC curve, it is clear that for every unit up to Q_f, the price at which each unit can be sold exceeds the marginal cost of producing it. That is equivalent to saying that these units are worth more to consumers than they cost to make. Why? Because consumers are willing to forgo P dollars' worth of other goods and services when they pay P dollars for these units, but at the same time the firm only has to use less than P dollars' worth of resources to produce them. Thus, if these units are produced and consumed, there are net benefits and society comes out ahead. And, as with our previous analysis, allocative efficiency also obtains because by spending their P dollars per unit on these units rather than anything else, consumers are indicating that they would rather have the necessary resources directed toward producing these units rather than anything else.

Maximum Consumer and Producer Surplus

We confirm the existence of allocative efficiency in Figure 11.6b, where we see that pure competition maximizes the sum of the "benefit surpluses" to consumers and producers. Recall from Chapter 4 that **consumer surplus** is the difference between the maximum prices that consumers are willing to pay for a product (as shown by the demand curve) and the market price of the product. In Figure 11.6b, consumer surplus is the green triangle, which is the sum of the vertical distances between the demand curve and equilibrium price. In contrast, **producer surplus** is the difference between the minimum prices that producers are willing to accept for a product (as shown by the supply curve) and the market price of the product. Producer surplus is the sum of the vertical distances between the equilibrium price and the supply curve. Here producer surplus is the blue area.

At the equilibrium quantity Q_e, the combined amount of consumer surplus and producer surplus is maximized. Allocative efficiency occurs because, at Q_e, marginal benefit, reflected by points on the demand curve, equals marginal cost, reflected by points on the supply curve. Alternatively, the maximum willingness of consumers to pay for unit Q_e equals the minimum acceptable price of that unit to producers. At any output less than Q_e, the sum of consumer and producer surplus—the combined size of the green and blue area—would be less than that shown. At any output greater than Q_e, an efficiency loss (deadweight loss) would subtract from the combined consumer and producer surplus shown by the green and blue area.

After long-run adjustments, pure competition produces both productive and allocative efficiency. It yields a level of output at which $P = MC =$ lowest ATC, marginal benefit = marginal cost, maximum willingness to pay for the last unit = minimum acceptable price for that unit, and combined consumer and producer surplus are maximized.

Dynamic Adjustments

A further attribute of purely competitive markets is their ability to restore the efficiency just described when disrupted by changes in the economy. A change in consumer tastes, resource supplies, or technology will automatically set in motion the appropriate realignments of resources. For example, suppose that cucumbers and pickles become dramatically more popular. First, the demand for cucumbers will increase in the market, increasing the price of cucumbers. So, at current output, the price of cucumbers will exceed their marginal cost. At this point efficiency will be lost, but the higher price will create economic profits in the cucumber industry and stimulate its expansion. The profitability of cucumbers will permit the industry to bid resources away from now-less-pressing uses, say, watermelons. Expansion of the industry will end only when the supply of cucumbers has expanded such that the price of cucumbers and their marginal cost are equal—that is, when allocative efficiency has been restored.

Similarly, a change in the supply of a particular resource—for example, the field laborers who pick cucumbers—or in a production technique will upset an existing price–marginal-cost equality by either raising or lowering marginal cost. The resulting inequality of MC and P will cause producers, in either pursuing profit or avoiding loss, to reallocate resources until product supply is such that price once again equals marginal cost. In so doing, they will correct any inefficiency in the allocation of resources

LAST WORD

A Patent Failure?

Patents May Hinder Creative Destruction. If So, Should We Consider Abolishing Patents?

Patents give inventors the sole legal right to market and sell their new ideas for a period of 20 years. So when considering the pluses and minuses of the patent system, it is important to begin with the fact that the possibility of obtaining a patent gives inventors a strong financial incentive to bear the research and development (R&D) costs necessary to come up with innovative solutions to old problems.

At the same time, however, the patent system also gives patent holders the ability to stifle the creative energies of other inventors by suing or threating to sue any individual or firm that they believe is "infringing" on their patent by producing or utilizing their invention without permission.

The problem is most acute for products like cell phones that incorporate thousands of different technologies into a single product. That's because each of those technologies might possibly infringe on one or more patents. If so, a single lawsuit filed over just one of those patents could halt the production and sale of the entire product. The alleged infringement may be totally unintentional or a matter of honest dispute. But if a patent holder believes that some part of the phone is infringing on his patent, he can threaten to sue the manufacturer and demand the shutdown of all production unless he receives royalty payments in compensation.

Consider Microsoft, which 30 years ago was a successful innovator thanks to its Windows operating system. Over the last 10 years, however, its Windows-based cell phones have been a failure. Yet Microsoft CEO Steve Balmer threatened to shut down the production of all Android phones because the Android software used to run those extremely popular phones happens to incorporate the ability to schedule a meeting. That is a feature that most Android users don't even know about. But it is a functionality over which Microsoft holds a patent for mobile devices. So to avoid a lawsuit that could have shut down the production of all Android phones, Android's parent company, Google, is now paying Microsoft a licensing fee on each and every Android phone.

That situation is very problematic for creative destruction because the patent system is being used to help an old company that hasn't had a successful product in many years to effectively tax and benefit from the successful innovations of a young rival. That ability to tax is a form of life support that allows stodgy old firms to survive longer than they should against innovative rivals and the pressures of creative destruction.

Even worse, companies known as "patent trolls" have been created to buy up patents simply for the chance to sue other companies and collect royalties. The patent trolls invent nothing and produce nothing. But they are free under the current system to make billions of dollars every year by suing innovative companies.

In response, some economists have begun to argue that the net benefits of the patent system have been overstated and that innovation might proceed faster in certain industries if patents were abolished. Their key insight is that the net benefits of patents depend upon how easy it is for rivals to successfully copy and market an innovative product.

that the original change may have temporarily imposed on the economy.

"Invisible Hand" Revisited

The highly efficient allocation of resources that a purely competitive economy promotes comes about because businesses and resource suppliers seek to further their self-interest. For private goods with no externalities (Chapter 4), the "invisible hand" (Chapter 2) is at work. The competitive system not only maximizes profits for individual producers but also, at the same time, creates a pattern of resource allocation that maximizes consumer satisfaction. The invisible hand thus organizes the private interests of producers in a way that is fully in sync with society's interest in using scarce resources efficiently. Striving to obtain a profit produces highly desirable economic outcomes.

Technological Advance and Competition

LO11.5 Discuss creative destruction and the profit incentives for innovation.

In explaining the model of pure competition, we assumed for simplicity that all the firms in an industry had the same cost curves. Competition, as a result, only involved entrepreneurs entering and exiting industries in response to changes in profits caused by changes in the market price. This form of competition is important, but it is just a game of copycat because firms entering an industry simply duplicate the production methods and cost curves of existing firms in order to duplicate their above-normal profits. In this type of competition, there is no dynamism and no innovation, just more of the same.

Consider pharmaceuticals. Once the chemical formula for a new drug becomes known, it is very easy for rivals to make chemically identical versions that will be easy to market because they will be just as effective as the version sold by the firm that invented the drug. At the same time, competition is so fierce in the pharmaceutical industry that without patent protection the price of the new drug would be driven down almost immediately to its marginal production cost. That is highly problematic because the market price would be too low to ever recoup the large R&D costs necessary to identify and develop effective new medications. Thus, without patent protection, R&D would cease and no new drugs would be developed.

So for industries like pharmaceuticals that have easy-to-copy products, patents should continue to exist as they are the only way to provide the financial incentive necessary to get firms to invest the R&D monies that must be spent if you want innovation and creative destruction.

Things are very different, however, for complicated consumer products that are made up of thousands of separate technologies that are each difficult to copy and market. As an example, even if Apple's rivals obtained the blueprints for the iPhone, it would still be extremely costly for them to build the factories necessary to make copies. And even if they did that, they would still have to convince consumers that their copycat iPhones were as good as the original. Thus, unlike pharmaceuticals, patents are not necessary to provide the firms that produce complicated consumer goods with an incentive to develop new products and invest in R&D.

On the other hand, society would likely see great benefits if patents were eliminated for complicated consumer goods like cell phones and automobiles because creative destruction would likely increase as innovative companies would no longer fear patent-infringement lawsuits and old rivals could no longer delay their own demise by taxing innovators.

Source: © Seattle Times/McClatchy-Tribune/Getty Images

As a result, some economists now argue that patents should only be available for industries with simple products that are easy to copy and market. For industries with complicated products that are hard to copy and market, patents should be eliminated.

By contrast, the most dynamic and interesting parts of competition are the fights between firms over the creation of new production technologies and new products. As we explain in detail in Chapter 15, firms have a strong profit incentive to develop both improved ways of making existing products as well as totally new products. To put that incentive in context, recall one fact that you just learned about long-run equilibrium in perfect competition. When each firm in a purely competitive industry has the same productive technology and therefore the same cost structure for producing output, entry and exit assure that in the long run every firm will make the exact same normal profit.

Entrepreneurs, of course, would like to earn more than a normal profit. As a result, they are constantly attempting two different strategies for increasing their profits. The first involves attempting to lower the production costs of existing products through better technology or improved business organization. Because pure competition implies that individual firms cannot affect the market price, anything that lowers an innovating firm's production costs will result in higher profits, since the innovating firm's revenues per unit (which are equal to the market price per unit) will stay the same while its costs per unit fall due to its improved production technology.

The second strategy for earning a rate of return greater than a normal profit is to try to develop a totally new product that is popular with consumers. If a firm is first-to-market with a popular new product, it will face no competition, as it is the only producer. As long as the product remains popular and the firm remains the only producer, it will be able to charge prices that are higher than production costs, thereby allowing it to earn above-normal profits. (We say much more about this in the next chapter, which covers pure monopoly.)

CONSIDER THIS . . .

Source: © Katrin Thomas/Getty Images RF

Running a Company Is Hard Business

The life expectancy of a U.S. business is just 10.2 years. About 9.5 percent of U.S. firms go out of business each year. In addition, 22 percent of new start-up firms go bankrupt within 2 years, 53 percent within 5 years, and nearly 65 percent within 10 years.

These numbers testify to the ability of competition to quickly dispose of firms that have high production costs or unpopular products. In a competitive environment, such firms quickly prove unprofitable and are shut down by their owners.

Balancing out the dying firms are start-ups that hope to use the resources freed up by the closed firms to deliver better products or lower costs. In a typical year, more than 650,000 new businesses are started in the United States. Most of these new firms will themselves eventually fall victim to creative destruction and the pressures of competition, but one of them may just be the next Google, Starbucks, or Walmart.

Notably, however, any advantages that innovative firms gain either by lowering the production costs of existing products or by introducing entirely new products will not normally persist. An innovative entrepreneur may put some of her current rivals out of business, but there are always other entrepreneurs with new ideas so that soon it may be *her* firm that is going out of business due to innovations made by others. The nearby Consider This box shows just how rapidly new firms are created and destroyed.

Creative Destruction

The innovations that firms achieve thanks to competition are considered by many economists to be the driving force behind economic growth and rising living standards. The transformative effects of competition are often referred to as **creative destruction** to capture the idea that the creation of new products and new production methods destroys the market positions of firms committed to existing products and old ways of doing business. In addition, just the *threat* that a rival may soon come out with a new technology or product can cause other firms to innovate and thereby replace or rectify their old ways of doing business. As argued decades ago by Harvard economist Joseph Schumpeter, the most important type of competition is

> competition from the new commodity, the new technology, the new source of supply, the new type of business organization—competition which commands a decisive cost or quality advantage and which strikes not at the margins of profits of the existing firms but at their foundation and their very lives. This kind of competition is . . . so . . . important that it becomes a matter of comparative indifference whether competition in the ordinary [short-run or long-run] sense functions more or less promptly. . . .
>
> . . . Competition of the kind we now have in mind acts not only when in being but also when it is merely an ever-present threat. It disciplines before it attacks. The businessman feels himself to be in a competitive situation even if he is alone in his field.[2]

There are many examples of creative destruction. In the 1800s wagons, ships, and barges were the only means of transporting freight until the railroads broke up their monopoly; the dominant market position of the railroads was, in turn, undermined by trucks and, later, by airplanes. Movies brought new competition to live theater, at one time the "only show in town." But movies were later challenged by broadcast television, which was then challenged by cable TV. Both are now challenged by Netflix, Amazon Instant Video, and other online video-on-demand services. Cassettes replaced records before being supplanted in turn by compact discs. Then compact discs were done in by iPods and MP3 players, which in turn were done in by the availability of smartphones to play music—including music streamed (instead of purchased) via services like Spotify and Pandora. Electronic communications—including faxes and e-mails—have pushed the U.S. Postal Service toward bankruptcy, including a $5.1 billion loss in 2015. And online retailers like Amazon.com have stolen substantial business away from brick-and-mortar retailers.

The "creative" part of "creative destruction" leads to new products and lower-cost production methods that are of great benefit to society because they allow for a more efficient use of society's scarce resources. Keep in mind, however, that the "destruction" part of "creative destruction" can be hard on workers in the industries being displaced by new technologies. A worker at a CD-making factory may see her job eliminated as consumers switch to online music downloads. The U.S. Postal Service cut 213,000 jobs (30 percent of its workforce) between 2005 and 2015 partly because of the impact that e-mail has had on the demand for postal services. And many jobs in retail have been eliminated due to competition with Amazon.com and other online retailers.

Normally, the process of creative destruction goes slowly enough that workers at firms being downsized can transition smoothly to jobs in firms that are expanding. But sometimes

[2] Joseph A. Schumpeter, *Capitalism, Socialism, and Democracy*, 3d ed. (New York: Harper & Row, 1950), pp. 84–85.

the change is too swift for all of them to find new jobs easily. And in other instances, such as a town with only one major employer—like a rural coal-mining town or a small town with a large auto factory—the loss of that one major employer can be devastating because there are not enough other firms in the local area to employ the workers laid off by the major employer.

While the net effects of creative destruction are indisputably positive—including ongoing economic growth and rising living standards—creative destruction involves costs as well as benefits. And while the benefits are widespread, the costs tend to be borne almost entirely by the relatively few workers in declining industries who are not positioned to make easy transitions to new jobs.

SUMMARY

LO11.1 Explain how the long run differs from the short run in pure competition.

In the short run, when plant and equipment are fixed, the firms in a purely competitive industry may earn profits or suffer losses. In the long run, when plant and equipment are adjustable, profits will attract new entrants, while losses will cause existing firms to leave the industry.

LO11.2 Describe how profits and losses drive the long-run adjustment process of pure competition.

The entry or exit of firms will change industry supply. Entry or exit will continue until the market price determined by industry supply interacting with market demand generates a normal profit for firms in the industry. With firms earning a normal profit, there will be no incentive to either enter or exit the industry. This situation constitutes long-run equilibrium in a purely competitive industry.

Entry and exit help to improve resource allocation. Firms that exit an industry due to low profits release their resources to be used more profitably in other industries. Firms that enter an industry chasing higher profits bring with them resources that were less profitably used in other industries. Both processes increase allocative efficiency.

In the long run, the market price of a product will equal the minimum average total cost of production. At a higher price, economic profits will cause firms to enter the industry until those profits have been competed away. At a lower price, losses will force the exit of firms from the industry until the product price rises to equal average total cost.

LO11.3 Explain the differences between constant-cost, increasing-cost, and decreasing-cost industries.

The long-run supply curve is horizontal for a constant-cost industry, upsloping for an increasing-cost industry, and downsloping for a decreasing-cost industry.

LO11.4 Show how long-run equilibrium in pure competition produces an efficient allocation of resources.

The long-run equality of price and minimum average total cost means that competitive firms will use the most efficient known technology and charge the lowest price consistent with their production costs. That is, the purely competitive firms will achieve productive efficiency.

The long-run equality of price and marginal cost implies that resources will be allocated in accordance with consumer tastes. Allocative efficiency will occur. In the market, the combined amount of consumer surplus and producer surplus will be at a maximum.

The competitive price system will reallocate resources in response to a change in consumer tastes, in technology, or in resource supplies and will thereby maintain allocative efficiency over time.

LO11.5 Discuss creative destruction and the profit incentives for innovation.

Competition involves never-ending attempts by entrepreneurs and managers to earn above-normal profits by either creating new products or developing lower-cost production methods for existing products. These efforts cause creative destruction, the financial undoing of the market positions of firms committed to existing products and old ways of doing business by new firms with new products and innovative ways of doing business.

TERMS AND CONCEPTS

long-run supply curve
constant-cost industry
increasing-cost industry
decreasing-cost industry
productive efficiency
allocative efficiency
consumer surplus
producer surplus
creative destruction

The following and additional problems can be found in connect

DISCUSSION QUESTIONS

1. Explain how the long run differs from the short run in pure competition. LO11.1
2. Relate opportunity costs to why profits encourage entry into purely competitive industries and how losses encourage exit from purely competitive industries. LO11.2
3. How do the entry and exit of firms in a purely competitive industry affect resource flows and long-run profits and losses? LO11.2
4. In long-run equilibrium, P = minimum ATC = MC. Of what significance for economic efficiency is the equality of P and minimum ATC? The equality of P and MC? Distinguish between productive efficiency and allocative efficiency in your answer. LO11.4
5. The basic model of pure competition reviewed in this chapter finds that in the long run all firms in a purely competitive industry will earn normal profits. If all firms will only earn a normal profit in the long run, why would any firms bother to develop new products or lower-cost production methods? Explain. LO11.5
6. "Ninety percent of new products fail within two years—so you shouldn't be so eager to innovate." Do you agree? Explain why or why not. LO11.5
7. LAST WORD How can patents speed up the process of creative destruction? How can patents slow down the process of creative destruction? How do differences in manufacturing costs affect which industries would be most likely to be affected by the removal of patents?

REVIEW QUESTIONS

1. When discussing pure competition, the term *long run* refers to a period of time long enough to allow: LO11.1
   a. Firms already in an industry to either expand or contract their capacities.
   b. New firms to enter or existing firms to leave.
   c. Both *a* and *b*.
   d. None of the above.
2. Suppose that the pen-making industry is perfectly competitive. Also suppose that each current firm and any potential firms that might enter the industry all have identical cost curves, with minimum ATC = $1.25 per pen. If the market equilibrium price of pens is currently $1.50, what would you expect it to be in the long run? LO11.2
   a. $0.25.
   b. $1.00.
   c. $1.25.
   d. $1.50.
3. Suppose that as the output of mobile phones increases, the cost of touch screens and other component parts decreases. If the mobile phone industry features pure competition, we would expect the long-run supply curve for mobile phones to be: LO11.3
   a. Upward sloping.
   b. Downward sloping.
   c. Horizontal.
   d. U-shaped.
4. Using diagrams for both the industry and a representative firm, illustrate competitive long-run equilibrium. Assuming constant costs, employ these diagrams to show how (*a*) an increase and (*b*) a decrease in market demand will upset that long-run equilibrium. Trace graphically and describe verbally the adjustment processes by which long-run equilibrium is restored. Now rework your analysis for increasing- and decreasing-cost industries and compare the three long-run supply curves. LO11.3
5. Suppose that purely competitive firms producing cashews discover that P exceeds MC. Is their combined output of cashews too little, too much, or just right to achieve allocative efficiency? In the long run, what will happen to the supply of cashews and the price of cashews? Use a supply and demand diagram to show how that response will change the combined amount of consumer surplus and producer surplus in the market for cashews. LO11.4

PROBLEMS

1. A firm in a purely competitive industry has a typical cost structure. The normal rate of profit in the economy is 5 percent. This firm is earning $5.50 on every $50 invested by its founders. What is its percentage rate of return? Is the firm earning an economic profit? If so, how large? Will this industry see entry or exit? What will be the rate of return earned by firms in this industry once the industry reaches long-run equilibrium? LO11.2
2. A firm in a purely competitive industry is currently producing 1,000 units per day at a total cost of $450. If the firm produced 800 units per day, its total cost would be $300, and if it produced 500 units per day, its total cost would be $275.

What are the firm's ATC per unit at these three levels of production? If every firm in this industry has the same cost structure, is the industry in long-run competitive equilibrium? From what you know about these firms' cost structures, what is the highest possible price per unit that could exist as the market price in long-run equilibrium? If that price ends up being the market price and if the normal rate of profit is 10 percent, then how big will each firm's accounting profit per unit be? **LO11.4**

3. There are 300 purely competitive farms in the local dairy market. Of the 300 dairy farms, 298 have a cost structure that generates profits of $24 for every $300 invested. What is their percentage rate of return? The other two dairies have a cost structure that generates profits of $22 for every $200 invested. What is their percentage rate of return? Assuming that the normal rate of profit in the economy is 10 percent, will there be entry or exit? Will the change in the number of firms affect the two that earn $22 for every $200 invested? What will be the rate of return earned by most firms in the industry in long-run equilibrium? If firms can copy each other's technology, what will be the rate of return eventually earned by all firms? **LO11.4**

12 Chapter

Pure Monopoly

Learning Objectives

LO12.1 List the characteristics of pure monopoly.

LO12.2 List and explain the barriers to entry that shield pure monopolies from competition.

LO12.3 Explain how demand is seen by a pure monopoly.

LO12.4 Explain how a pure monopoly sets its profit-maximizing output and price.

LO12.5 Discuss the economic effects of monopoly.

LO12.6 Describe why a monopolist might prefer to charge different prices in different markets.

LO12.7 Distinguish among the monopoly price, the socially optimal price, and the fair-return price of a government-regulated monopoly.

We turn now from pure competition to pure monopoly, which is at the opposite end of the spectrum of industry structures listed in Table 10.1. You deal with monopolies more often than you might think. If you see the logo for Microsoft's Windows on your computer, you are dealing with a monopoly (or, at least, a near-monopoly). When you purchase certain prescription drugs, you are buying monopolized products. When you make a local telephone call, turn on your lights, or subscribe to cable TV, you may be patronizing a monopoly, depending on your location.

What precisely do we mean by pure monopoly, and what conditions enable it to arise and survive? How does a pure monopolist determine its profit-maximizing price and output? Does a pure monopolist achieve the efficiency associated with pure competition? If not, what, if anything, should the government do about it? A simplified model of pure monopoly will help us answer these questions. It will be the first of three models of imperfect competition.

An Introduction to Pure Monopoly

LO12.1 List the characteristics of pure monopoly.

Pure monopoly exists when a single firm is the sole producer of a product for which there are no close substitutes. Here are the main characteristics of pure monopoly:

- ***Single seller*** **A pure, or absolute, monopoly is an industry in which a single firm is the sole producer of a specific good or the sole supplier of a service; the firm and the industry are synonymous.**

- ***No close substitutes*** A pure monopoly's product is unique in that there are no close substitutes. The consumer who chooses not to buy the monopolized product must do without it.
- ***Price maker*** The pure monopolist controls the total quantity supplied and thus has considerable control over price; it is a *price maker* (unlike a pure competitor, which has no such control and therefore is a *price taker*). The pure monopolist confronts the usual downsloping product demand curve. It can change its product price by changing the quantity of the product it produces. The monopolist will use this power whenever it is advantageous to do so.
- ***Blocked entry*** A pure monopolist has no immediate competitors because certain barriers keep potential competitors from entering the industry. Those barriers may be economic, technological, legal, or of some other type. But entry is totally blocked in pure monopoly.
- ***Nonprice competition*** The product produced by a pure monopolist may be either standardized (as with natural gas and electricity) or differentiated (as with Windows or Frisbees). Monopolists that have standardized products engage mainly in public relations advertising, whereas those with differentiated products sometimes advertise their products' attributes.

Examples of Monopoly

Examples of *pure* monopoly are relatively rare, but there are many examples of less pure forms. In most cities, government-owned or government-regulated public utilities—natural gas and electric companies, the water company, the cable TV company, and the local telephone company—are all monopolies or virtually so.

There are also many "near-monopolies" in which a single firm has the bulk of sales in a specific market. Intel, for example, produces 80 percent of the central microprocessors used in personal computers. First Data Corporation, via its Western Union subsidiary, accounts for 80 percent of the market for money order transfers. Brannock Device Company has an 80 percent market share of the shoe sizing devices found in shoe stores. Wham-O, through its Frisbee brand, sells 90 percent of plastic throwing disks. Google executes nearly 70 percent of all U.S. Internet searches and consequently controls nearly 75 percent of all the revenue generated by search ads in the United States.

Professional sports teams are, in a sense, monopolies because they are the sole suppliers of specific services in large geographic areas. With a few exceptions, a single major-league team in each sport serves each large American city. If you want to see a live Major League Baseball game in St. Louis or Seattle, you must patronize the Cardinals or the Mariners, respectively. Other geographic monopolies exist. For example, a small town may be served by only one airline or railroad. In a small, isolated community, the local barber shop, dry cleaner, or grocery store may approximate a monopoly. And in the skies above, airlines control the only Internet access that is available to the passengers flying on their planes.

Of course, there is almost always some competition. Satellite television is a substitute for cable, and amateur softball is a substitute for professional baseball. The Linux operating system can substitute for Windows, and so on. But such substitutes are typically either more costly or in some way less appealing.

Dual Objectives of the Study of Monopoly

Monopoly is worth studying both for its own sake and because it provides insights about the more common market structures of monopolistic competition and oligopoly (Chapters 13 and 14). These two market structures combine, in differing degrees, characteristics of pure competition and pure monopoly.

Barriers to Entry

LO12.2 List and explain the barriers to entry that shield pure monopolies from competition.

The factors that prohibit firms from entering an industry are called **barriers to entry**. In pure monopoly, strong barriers to entry effectively block all potential competition. Somewhat weaker barriers may permit oligopoly, a market structure dominated by a few firms. Still weaker barriers may permit the entry of a fairly large number of competing firms giving rise to monopolistic competition. And the absence of any effective entry barriers permits the entry of a very large number of firms, which provide the basis of pure competition. So barriers to entry are pertinent not only to the extreme case of pure monopoly but also to other market structures in which there are monopoly-like characteristics or monopoly-like behaviors.

We now discuss the four most prominent barriers to entry.

Economies of Scale

Modern technology in some industries is such that economies of scale—declining average total cost with added firm size—are extensive. In such cases, a firm's long-run average-cost schedule will decline over a wide range of output. Given market demand, only a few large firms or, in the extreme, only a single large firm can achieve low average total costs.

Figure 12.1 indicates economies of scale over a wide range of outputs. If total consumer demand is within that output range, then only a single producer can satisfy demand at least cost. Note, for example, that a monopolist can produce

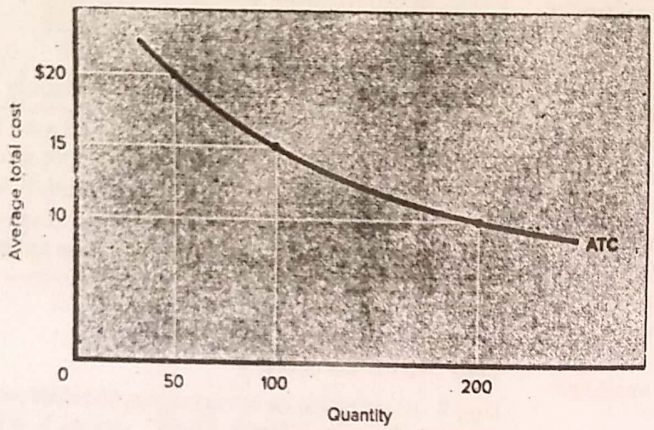


FIGURE 12.1 Economies of scale: the natural monopoly case. A declining long-run average-total-cost curve over a wide range of output quantities indicates extensive economies of scale. A single monopoly firm can produce, say, 200 units of output at lower cost ($10 each) than could two or more firms that had a combined output of 200 units.

200 units at a per-unit cost of $10 and a total cost of $2,000. If the industry has two firms and each produces 100 units, the unit cost is $15 and total cost rises to $3,000 (= 200 units × $15). A still more competitive situation with four firms each producing 50 units would boost unit and total cost to $20 and $4,000, respectively. Conclusion: When long-run ATC is declining, only a single producer, a monopolist, can produce any particular amount of output at minimum total cost.

If a pure monopoly exists in such an industry, economies of scale will serve as an entry barrier and will protect the monopolist from competition. New firms that try to enter the industry as small-scale producers cannot realize the cost economies of the monopolist. They therefore will be undercut and forced out of business by the monopolist, which can sell at a much lower price and still make a profit because of its lower per-unit cost associated with its economies of scale. A new firm might try to start out big, that is, to enter the industry as a large-scale producer so as to achieve the necessary economies of scale. But the massive expense of the plant facilities along with customer loyalty to the existing product would make the entry highly risky. Therefore, the new and untried enterprise would find it difficult to secure financing for its venture. In most cases the risks and financial obstacles to "starting big" are prohibitive. This explains why efforts to enter such industries as computer operating software, commercial aircraft, and household laundry equipment are so rare.

A monopoly firm is referred to as a *natural monopoly* if the market demand curve intersects the long-run ATC curve at any point where average total costs are declining. If a natural monopoly were to set its price where market demand intersects long-run ATC, its price would be lower than if the industry were more competitive. But it will probably set a higher price. As with any monopolist, a natural monopolist may, instead, set its price far above ATC and obtain substantial economic profit. In that event, the lowest-unit-cost advantage of a natural monopolist would accrue to the monopolist as profit and not as lower prices to consumers. That is why the government regulates some natural monopolies, specifying the price they may charge. We will say more about that later.

Legal Barriers to Entry: Patents and Licenses

Government also creates legal barriers to entry by awarding patents and licenses.

Patents A *patent* is the exclusive right of an inventor to use, or to allow another to use, her or his invention. Patents and patent laws aim to protect the inventor from rivals who would use the invention without having shared in the effort and expense of developing it. At the same time, patents provide the inventor with a monopoly position for the life of the patent. The world's nations have agreed on a uniform patent length of 20 years from the time of application. Patents have figured prominently in the growth of modern-day giants such as IBM, Pfizer, Intel, Xerox, General Electric, and DuPont.

Research and development (R&D) is what leads to most patentable inventions and products. Firms that gain monopoly power through their own research or by purchasing the patents of others can use patents to strengthen their market position. The profit from one patent can finance the research required to develop new patentable products. In the pharmaceutical industry, patents on prescription drugs have produced large monopoly profits that have helped finance the discovery of new patentable medicines. So monopoly power achieved through patents may well be self-sustaining, even though patents eventually expire and generic drugs then

compete with the original brand. (Chapter 11's Last Word has more on the costs and benefits of patents.)

Licenses Government may also limit entry into an industry or occupation through *licensing*. At the national level, the Federal Communications Commission licenses only so many radio and television stations in each geographic area. In many large cities one of a limited number of municipal licenses is required to drive a taxicab. The consequent restriction of the supply of cabs creates economic profit for cab owners and drivers. New cabs cannot enter the industry to drive down prices and profits. In a few instances the government might "license" itself to provide some product and thereby create a public monopoly. For example, in some states only state-owned retail outlets can sell liquor. Similarly, many states have "licensed" themselves to run lotteries.

Ownership or Control of Essential Resources

A monopolist can use private property as an obstacle to potential rivals. For example, a firm that owns or controls a resource essential to the production process can prohibit the entry of rival firms. At one time the International Nickel Company of Canada (now called Vale Canada Limited) controlled 90 percent of the world's known nickel reserves. A local firm may own all the nearby deposits of sand and gravel. And it is very difficult for new sports leagues to be created because existing professional sports leagues have contracts with the best players and have long-term leases on the major stadiums and arenas.

Pricing and Other Strategic Barriers to Entry

Even if a firm is not protected from entry by, say, extensive economies of scale or ownership of essential resources, entry may effectively be blocked by the way the monopolist responds to attempts by rivals to enter the industry. Confronted with a new entrant, the monopolist may "create an entry barrier" by slashing its price, stepping up its advertising, or taking other strategic actions to make it difficult for the entrant to succeed.

Some examples of entry deterrence: In 2005 Dentsply, the dominant American maker of false teeth (80 percent market share) was found to have unlawfully precluded independent distributors of false teeth from carrying competing brands. The lack of access to the distributors deterred potential foreign competitors from entering the U.S. market. As another example, in 2015 American Express was found guilty of an unlawful restraint of trade because it prohibited any merchant who had signed up to accept American Express credit cards from promoting rival credit cards—such as Visa or MasterCard—to their customers.

Monopoly Demand

LO12.3 Explain how demand is seen by a pure monopoly.

Now that we have explained the sources of monopoly, we want to build a model of pure monopoly so that we can analyze its price and output decisions. Let's start by making three assumptions:

- Patents, economies of scale, or resource ownership secures the firm's monopoly.
- No unit of government regulates the firm.
- The firm is a single-price monopolist; it charges the same price for all units of output.

The crucial difference between a pure monopolist and a purely competitive seller lies on the demand side of the market. The purely competitive seller faces a perfectly elastic demand at the price determined by market supply and demand. It is a price taker that can sell as much or as little as it wants at the going market price. Each additional unit sold will add the amount of the constant product price to the firm's total revenue. That means that marginal revenue for the competitive seller is constant and equal to product price. (Refer to the table and graph in Figure 10.1 for price, marginal-revenue, and total-revenue relationships for the purely competitive firm.)

The demand curve for the monopolist (and for any imperfectly competitive seller) is quite different from that of the pure competitor. Because the pure monopolist *is* the industry, its demand curve *is* the market demand curve. And because market demand is not perfectly elastic, the monopolist's demand curve is downsloping. Columns 1 and 2 in Table 12.1 illustrate this concept. Note that quantity demanded increases as price decreases.

In Figure 10.7 we drew separate demand curves for the purely competitive industry and for a single firm in such an industry. But only a single demand curve is needed in pure monopoly because the firm and the industry are one and the same. We have graphed part of the demand data in Table 12.1 as demand curve D in Figure 12.2. This is the monopolist's demand curve *and* the market demand curve. The downsloping demand curve has three implications that are essential to understanding the monopoly model.

Marginal Revenue Is Less Than Price

With a fixed downsloping demand curve, the pure monopolist can increase sales only by charging a lower price. Consequently, marginal revenue—the change in total revenue associated with a one-unit change in output—is less than price (average revenue) for every unit of output except the first. Why so? The reason is that the lower price of the extra unit of output also applies to all prior units of output. The

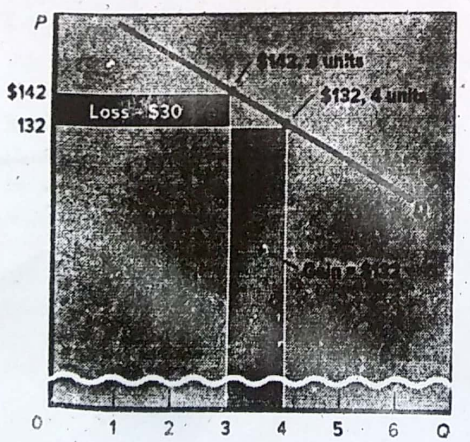
TABLE 12.1 Revenue and Cost Data of a Pure Monopolist

(1) Quantity Demanded	(2) Price	(3) Total Revenue	(4) Marginal Revenue	(5) Total Cost	(6) Marginal Cost	(7) Profit (+) or Loss (−)
0	$172	$ 0				
			$162		$ 100	
1	162	162		$190.00		−28
			142		90	
2	152	304		135.00	80	+34
			122		70	
3	142	426		113.33	60	+86
			102		70	
4	132	528		100.00	70	+128
			82		80	
5	122	610		94.00	90	+116
			62		110	
6	112	672		91.67	130	+122
			42		150	
7	102	714		91.43	190	+74
			22		270	
8	92	736		93.75	340	−14
			2		400	
9	82	738		97.78	470	−92
			−18		550	
10	72	720		103.00	640	−310
					750	
					880	
					1030	

monopolist could have sold these prior units at a higher price if it had not produced and sold the extra output. Each additional unit of output sold increases total revenue by an amount equal to its own price less the sum of the price cuts that apply to all prior units of output.

Figure 12.2 confirms this point. There, we have highlighted two price-quantity combinations from the monopolist's demand curve. The monopolist can sell 1 more unit at $132 than it can at $142 and that way obtain $132 (the blue area) of extra revenue. But to sell that fourth unit for $132, the monopolist must also sell the first 3 units at $132 rather than $142. The $10 reduction in revenue on 3 units results in a $30 revenue loss (the red area). Thus, the net difference in total revenue from selling a fourth unit is $102: the $132 gain from the fourth unit minus the $30 forgone on the first 3 units. This net gain (marginal revenue) of $102 from the fourth unit is clearly less than the $132 price of the fourth unit.

FIGURE 12.2 Price and marginal revenue in pure monopoly. A pure monopolist, or any other imperfect competitor with a downsloping demand curve such as D, must set a lower price in order to sell more output. Here, by charging $132 rather than $142, the monopolist sells an extra unit (the fourth unit) and gains $132 from that sale. But from this gain must be subtracted $30, which reflects the $10 less the monopolist charged for each of the first 3 units. Thus, the marginal revenue of the fourth unit is $102 (= $132 − $30), considerably less than its $132 price.



Column 4 in Table 12.1 shows that marginal revenue is always less than the corresponding product price in column 2, except for the first unit of output. Because marginal revenue is the change in total revenue associated with each additional unit of output, the declining amounts of marginal revenue in column 4 mean that total revenue increases at a diminishing rate (as shown in column 3).

We show the relationship between the monopolist's marginal-revenue curve and total-revenue curve in Figure 12.3. For this figure, we extended the demand and revenue data of columns 1 through 4 in Table 12.1, assuming that each successive $10 price cut elicits 1 additional unit of sales. That is, the monopolist can sell 11 units at $62, 12 units at $52, and so on.

Note that the monopolist's MR curve lies below the demand curve, indicating that marginal revenue is less than price at every output quantity but the very first unit. Observe also the special relationship between total revenue (shown in the lower graph) and marginal revenue (shown in the top graph). Because marginal revenue is the change in total revenue, marginal revenue is positive while total revenue is increasing. When total revenue reaches its maximum, marginal revenue is zero. When total revenue is diminishing, marginal revenue is negative.

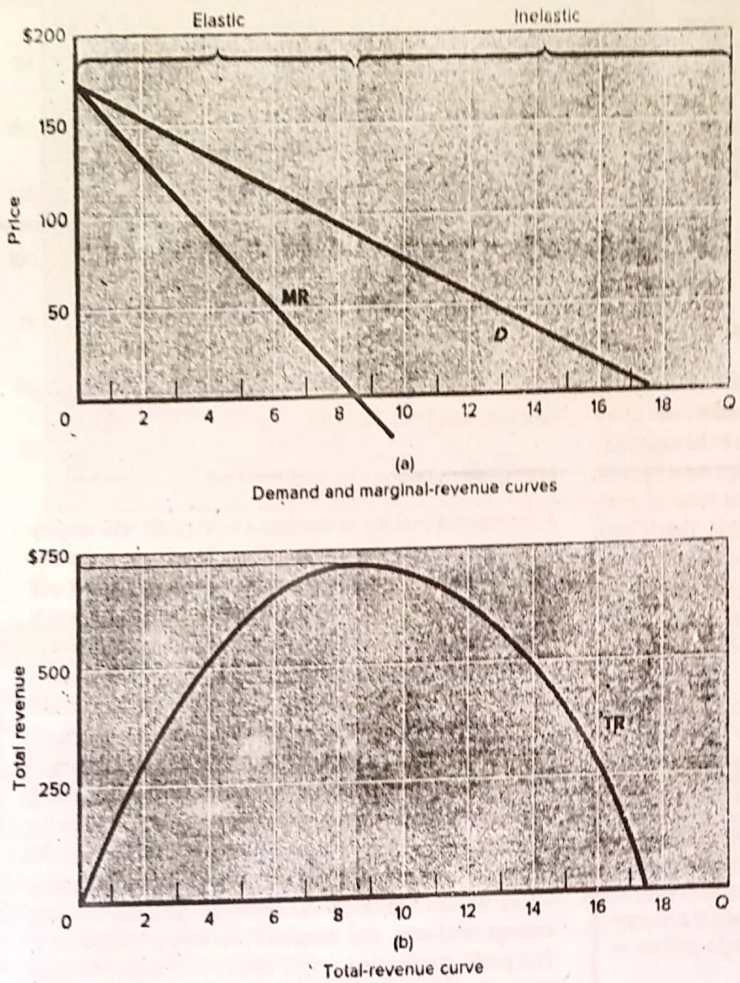


FIGURE 12.3 Demand, marginal revenue, and total revenue for a pure monopolist. (a) Because it must lower price on all units in order to increase its sales, an imperfectly competitive firm's marginal-revenue curve (MR) lies below its downsloping demand curve (D). The elastic and inelastic regions of demand are highlighted. (b) Total revenue (TR) increases at a decreasing rate, reaches a maximum, and then declines. Note that in the elastic region, TR is increasing and hence MR is positive. When TR reaches its maximum, MR is zero. In the inelastic region of demand, TR is declining, so MR is negative.

The Monopolist Is a Price Maker

All imperfect competitors, whether pure monopolists, oligopolists, or monopolistic competitors, face downsloping demand curves. As a result, any change in quantity produced causes a movement along their respective demand curves and a change in the price they can charge for their respective products. Economists summarize this fact by saying that firms with downsloping demand curves are *price makers*.

This is most evident in pure monopoly, where an industry consists of a single monopoly firm so that total industry output is exactly equal to whatever the single monopoly firm chooses to produce. As we just mentioned, the monopolist faces a downsloping demand curve in which each amount of output is associated with some unique price. Thus, in deciding on the quantity of output to produce, the monopolist is also determining the price it will charge. Through control of output, it can "make the price." From columns 1 and 2 in Table 12.1 we find that the monopolist can charge a price of $72 if it produces and offers for sale 10 units, a price of $82 if it produces and offers for sale 9 units, and so forth.

The Monopolist Sets Prices in the Elastic Region of Demand

The total-revenue test for price elasticity of demand is the basis for our third implication. Recall from Chapter 6 that the total-revenue test reveals that when demand is elastic, a decline in price will increase total revenue. Similarly, when demand is inelastic, a decline in price will reduce total revenue. Beginning at the top of demand curve *D* in Figure 12.3a, observe that as the price declines from $172 to approximately $82, total revenue increases (and marginal revenue therefore is positive). This means that demand is elastic in this price range. Conversely, for price declines below $82, total revenue decreases (marginal revenue is negative), indicating that demand is inelastic there.

The implication is that a monopolist will never choose a price-quantity combination where price reductions cause total revenue to decrease (marginal revenue to be negative). The profit-maximizing monopolist will always want to avoid the inelastic segment of its demand curve in favor of some price-quantity combination in the elastic region. Here's why: To get into the inelastic region, the monopolist must lower price and increase output. In the inelastic region a lower price means less total revenue. And increased output always means increased total cost. Less total revenue and higher total cost yield lower profit.

QUICK REVIEW 12.1

- ✓ A pure monopolist is the sole supplier of a product or service for which there are no close substitutes.
- ✓ A monopoly survives because of entry barriers such as economies of scale, patents and licenses, the ownership of essential resources, and strategic actions to exclude rivals.
- ✓ The monopolist's demand curve is downsloping and its marginal-revenue curve lies below its demand curve.
- ✓ The downsloping demand curve means that the monopolist is a price maker.
- ✓ The monopolist will operate in the elastic region of demand since in the inelastic region it can increase total revenue and reduce total cost by reducing output.

Output and Price Determination

LO12.4 Explain how a pure monopoly sets its profit-maximizing output and price.

At what specific price-quantity combination will a profit-maximizing monopolist choose to operate? To answer this question, we must add production costs to our analysis.

Cost Data

On the cost side, we will assume that although the firm is a monopolist in the product market, it hires resources competitively and employs the same technology and, therefore, has the same cost structure as the purely competitive firm that we studied in Chapters 10 and 11. By using the same cost data that we developed in Chapter 9 and applied to the competitive firm in Chapters 10 and 11, we will be able to directly compare the price and output decisions of a pure monopoly with those of a pure competitor. This will help us demonstrate that the price and output differences between a pure monopolist and a pure competitor are not the result of two different sets of costs. Columns 5 through 7 in Table 12.1 restate the pertinent cost data from Table 9.2.

MR = MC Rule

A monopolist seeking to maximize total profit will employ the same rationale as a profit-seeking firm in a competitive industry. If producing is preferable to shutting down, it will produce up to the output at which marginal revenue equals marginal cost (MR = MC).

A comparison of columns 4 and 7 in Table 12.1 indicates that the profit-maximizing output is 5 units because the fifth unit is the last unit of output whose marginal revenue exceeds its marginal cost. What price will the monopolist charge? The demand schedule shown as columns 1 and 2 in Table 12.1 indicates there is only one price at which 5 units can be sold: $122.

This analysis is shown in **Figure 12.4 (Key Graph)**, where we have graphed the demand, marginal-revenue, average-total-cost, and marginal-cost data of Table 12.1. The profit-maximizing output occurs at 5 units of output (Q_m), where the marginal-revenue (MR) and marginal-cost (MC) curves intersect. There, MR = MC.

To find the price the monopolist will charge, we extend a vertical line from Q_m up to the demand curve D. The unique price P_m at which Q_m units can be sold is $122. In this case, $122 is the profit-maximizing price. So the monopolist sets the quantity at Q_m to charge its profit-maximizing price of $122.

Columns 2 and 5 in Table 12.1 show that at 5 units of output, the product price ($122) exceeds the average total cost ($94). The monopolist thus obtains an economic profit of $28 per unit, and the total economic profit is $140 (= 5 units × $28). In Figure 12.4, per-unit profit is $P_m - A$, where A is the average total cost of producing Q_m units. Total economic profit—the green rectangle—is found by multiplying this per-unit profit by the profit-maximizing output Q_m.

Another way to determine the profit-maximizing output is by comparing total revenue and total cost at each possible level of production and choosing the output with the greatest positive difference. Use columns 3 and 6 in Table 12.1 to verify that 5 units is the profit-maximizing output. An accurate graphing of total revenue and total cost against output would also show the greatest difference (the maximum profit) at 5 units of output. Table 12.2 summarizes the process for determining the profit-maximizing output, profit-maximizing price, and economic profit in pure monopoly.

No Monopoly Supply Curve

Recall that MR equals P in pure competition and that the supply curve of a purely competitive firm is determined by applying the MR (= P) = MC profit-maximizing rule. At any specific market-determined price, the purely competitive seller

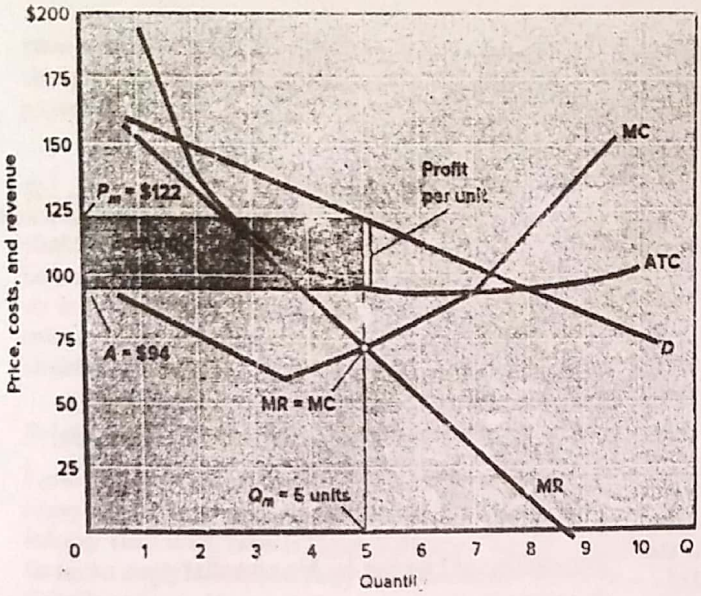


FIGURE 12.4 Profit maximization by a pure monopolist. The pure monopolist maximizes profit by producing at the MR = MC output, here $Q_m = 5$ units. Then, as seen from the demand curve, it will charge price $P_m = \$122$. Average total cost will be $A = \$94$, meaning that per-unit profit is $P_m - A$ and total profit is $5 \times (P_m - A)$. Total economic profit is thus represented by the green rectangle.

QUICK QUIZ FOR FIGURE 12.4

1. The MR curve lies below the demand curve in this figure because the:
   a. demand curve is linear (a straight line).
   b. demand curve is highly inelastic throughout its full length.
   c. demand curve is highly elastic throughout its full length.
   d. gain in revenue from an extra unit of output is less than the price charged for that unit of output.
2. The area labeled "Economic profit" can be found by multiplying the difference between P and ATC by quantity. It also can be found by:
   a. dividing profit per unit by quantity.
   b. subtracting total cost from total revenue.
   c. multiplying the coefficient of demand elasticity by quantity.
   d. multiplying the difference between P and MC by quantity.
3. This pure monopolist:
   a. charges the highest price that it could achieve.
   b. earns only a normal profit in the long run.
   c. restricts output to create an insurmountable entry barrier.
   d. restricts output to increase its price and total economic profit.
4. At this monopolist's profit-maximizing output:
   a. price equals marginal revenue.
   b. price equals marginal cost.
   c. price exceeds marginal cost.
   d. profit per unit is maximized.

Answers: 1. d; 2. b; 3. d; 4. c

TABLE 12.2 Steps for Graphically Determining the Profit-Maximizing Output, Profit-Maximizing Price, and Economic Profit (if Any) in Pure Monopoly

Step 1.	Determine the profit-maximizing output by finding where MR = MC.
Step 2.	Determine the profit-maximizing price by extending a vertical line upward from the output determined in step 1 to the pure monopolist's demand curve.
Step 3.	Determine the pure monopolist's economic profit using one of two methods:
Method 1.	Find profit per unit by subtracting the average total cost of the profit-maximizing output from the profit-maximizing price. Then multiply the difference by the profit-maximizing output to determine economic profit (if any).
Method 2.	Find total cost by multiplying the average total cost of the profit-maximizing output by that output. Find total revenue by multiplying the profit-maximizing output by the profit-maximizing price. Then subtract total cost from total revenue to determine economic profit (if any).

will maximize profit by supplying the quantity at which MC is equal to that price. When the market price increases or decreases, the competitive firm produces more or less output. Each market price is thus associated with a specific output, and all such price-output pairs define the supply curve. This supply curve turns out to be the portion of the firm's MC curve that lies above the average-variable-cost curve (see Figure 10.6).

At first glance we would suspect that the pure monopolist's marginal-cost curve would also be its supply curve. But that is *not* the case. *The pure monopolist has no supply curve.* There is no unique relationship between price and quantity supplied for a monopolist. Like the competitive firm, the monopolist equates marginal revenue and marginal cost to determine output, but for the monopolist marginal revenue is less than price. Because the monopolist does not equate marginal cost to price, it is possible for different demand conditions to bring about different prices for the same output. To understand this point, refer to Figure 12.4 and pencil in a new, steeper marginal-revenue curve that intersects the marginal-cost curve at the same point as does the present marginal-revenue curve. Then draw in a new demand curve that is roughly consistent with your new marginal-revenue curve. With the new curves, the same MR = MC output of 5 units now means a higher profit-maximizing price. Conclusion: There is no single, unique price associated with each output level Q_m, and so there is no supply curve for the pure monopolist.

Misconceptions Concerning Monopoly Pricing

Our analysis exposes two fallacies concerning monopoly behavior.

Not Highest Price Because a monopolist can manipulate output and price, people often believe it "will charge the highest price possible." That is incorrect. There are many prices above P_m in Figure 12.4, but the monopolist shuns them because they yield a smaller-than-maximum total profit. The monopolist seeks maximum total profit, not maximum price. Some high prices that could be charged would reduce sales and total revenue too severely to offset any decrease in total cost.

Total, Not Unit, Profit The monopolist seeks maximum *total* profit, not maximum *unit* profit. In Figure 12.4 a careful comparison of the vertical distance between average total cost and price at various possible outputs indicates that per-unit profit is greater at a point slightly to the left of the profit-maximizing output Q_m. This is seen in Table 12.1, where the per-unit profit at 4 units of output is \$32 (= \$132 − \$100) compared with \$28 (= \$122 − \$94) at the profit-maximizing output of 5 units. Here the monopolist accepts a lower-than-maximum per-unit profit because additional sales more than compensate for the lower unit profit. A monopolist would rather sell 5 units at a profit of \$28 per unit (for a total profit of \$140) than 4 units at a profit of \$32 per unit (for a total profit of only \$128).

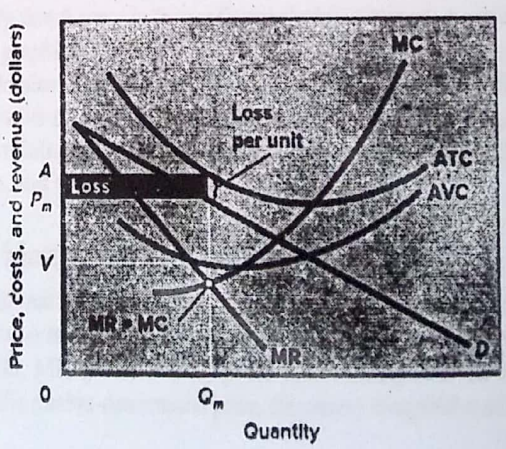
Possibility of Losses by Monopolist

The likelihood of economic profit is greater for a pure monopolist than for a pure competitor. In the long run the pure competitor is destined to have only a normal profit, whereas barriers to entry mean that any economic profit realized by the monopolist can persist. In pure monopoly there are no new entrants to increase supply, drive down price, and eliminate economic profit.

But pure monopoly does not guarantee profit. The monopolist is not immune from changes in tastes that reduce the demand for its product. Nor is it immune from upward-shifting cost curves caused by escalating resource prices. If the demand and cost situation faced by the monopolist is far less favorable than that in Figure 12.4, the monopolist will incur losses in the short run. Consider the monopoly enterprise shown in Figure 12.5. Despite its dominance in the market (as, say, a seller of home sewing machines), it suffers a loss, as shown, because of weak demand and relatively high costs. Yet it continues to operate for the time being because its total loss is less than its fixed cost. More precisely, at output Q_m the monopolist's price P_m exceeds its average variable cost V. Its loss per unit is $A - P_m$, and the total loss is shown by the red rectangle.

Like the pure competitor, the monopolist will not persist in operating at a loss. Faced with continuing losses, in the long run the firm's owners will move their resources to alternative industries that offer better profit opportunities. A

FIGURE 12.5 The loss-minimizing position of a pure monopolist. If demand D is weak and costs are high, the pure monopolist may be unable to make a profit. Because P_m exceeds V, the average variable cost at the MR = MC output Q_m, the monopolist will minimize losses in the short run by producing at that output. The loss per unit is $A - P_m$, and the total loss is indicated by the red rectangle.



monopolist such as the one depicted in Figure 12.5 must obtain a minimum of a normal profit in the long run or it will go out of business.

Economic Effects of Monopoly

LO12.5 Discuss the economic effects of monopoly.

Let's now evaluate pure monopoly from the standpoint of society as a whole. Our reference for this evaluation will be the outcome of long-run efficiency in a purely competitive market, identified by the triple equality $P = MC =$ minimum ATC.

Price, Output, and Efficiency

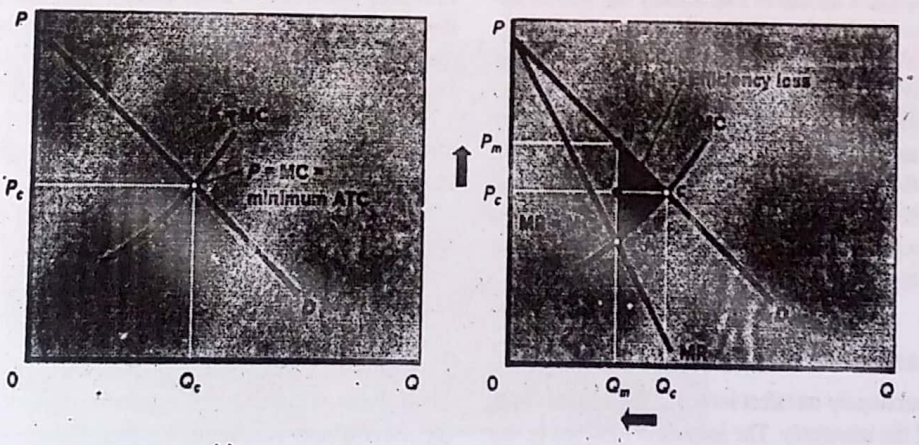
Figure 12.6 graphically contrasts the price, output, and efficiency outcomes of pure monopoly and a purely competitive *industry*. The $S = MC$ curve in Figure 12.6a reminds us that the market supply curve S for a purely competitive industry is the horizontal sum of the marginal-cost curves of all the firms in the industry. Suppose there are 1,000 such firms. Comparing their combined supply curves S with market demand D, we see that the purely competitive price and output are P_c and Q_c.

Recall that this price-output combination results in both productive efficiency and allocative efficiency. *Productive efficiency* is achieved because free entry and exit force firms to operate where average total cost is at a minimum. The sum of the minimum-ATC outputs of the 1,000 pure competitors is the industry output, here, Q_c. Product price is at the lowest level consistent with minimum average total cost. The *allocative efficiency* of pure competition results because production occurs up to that output at which price (the measure of a product's value or marginal benefit to society) equals marginal cost (the worth of the alternative products forgone by society in producing any given commodity). In short: $P = MC =$ minimum ATC.

Now let's suppose that this industry becomes a pure monopoly (Figure 12.6b) as a result of one firm acquiring all its competitors. We also assume that no changes in costs or market demand result from this dramatic change in the industry structure. What formerly were 1,000 competing firms is now a single pure monopolist consisting of 1,000 noncompeting branches.

The competitive market supply curve S has become the marginal-cost curve (MC) of the monopolist, the summation of the individual marginal-cost curves of its many branch plants. (Since the monopolist does not have a supply curve, as such, we have removed the S label.) The important change, however, is on the demand side. From the viewpoint of each of the 1,000 individual competitive firms, demand was perfectly elastic, and marginal revenue was therefore equal to the market equilibrium price P_c. So each firm equated its marginal revenue of P_c dollars per unit with its individual marginal cost curve to maximize profits. But market demand and individual demand are the same to the pure monopolist. The firm *is* the industry, and thus the monopolist sees the downsloping demand curve D shown in Figure 12.6b.

FIGURE 12.6 **Inefficiency of pure monopoly relative to a purely competitive industry.** (a) In a purely competitive industry, entry and exit of firms ensure that price (P_c) equals marginal cost (MC) and that the minimum average-total-cost output (Q_c) is produced. Both productive efficiency (P = minimum ATC) and allocative efficiency ($P = MC$) are obtained. (b) In pure monopoly, the MR curve lies below the demand curve. The monopolist maximizes profit at output Q_m, where MR = MC, and charges price P_m. Thus, output is lower (Q_m rather than Q_c) and price is higher (P_m rather than P_c) than they would be in a purely competitive industry. Monopoly is inefficient, since output is less than that required for achieving minimum ATC (here, at Q_c) and because the monopolist's price exceeds MC. Monopoly creates an efficiency loss (here, of triangle *abc*). There is also a transfer of income from consumers to the monopoly (here, of rectangle P_cP_mbd).



This means that marginal revenue is less than price, that graphically the MR curve lies below demand curve D. In using the MR = MC rule, the monopolist selects output Q_m and price P_m. A comparison of both graphs in Figure 12.6 reveals that the monopolist finds it profitable to sell a smaller output at a higher price than do the competitive producers.

Monopoly yields neither productive nor allocative efficiency. The lack of productive efficiency can be understood most directly by noting that the monopolist's output Q_m is less than Q_c, the output at which average total cost is lowest. In addition, the monopoly price P_m is higher than the competitive price P_c that we know in long-run equilibrium in pure competition equals minimum average total cost. Thus, the monopoly price exceeds minimum average total cost, thereby demonstrating in another way that the monopoly will not be productively efficient.

The monopolist's underproduction also implies allocative inefficiency. One way to see this is to note that at the monopoly output level Q_m, the monopoly price P_m that consumers are willing to pay exceeds the marginal cost of production. This means that consumers value additional units of this product more highly than they do the alternative products that could be produced from the resources that would be necessary to make more units of the monopolist's product.

The monopolist's allocative inefficiency can also be understood by noting that for every unit between Q_m and Q_c, marginal benefit exceeds marginal cost because the demand curve lies above the supply curve. By choosing not to produce these units, the monopolist reduces allocative efficiency because the resources that should have been used to make these units will be redirected instead toward producing items that bring lower net benefits to society. The total dollar value of this efficiency loss (or *deadweight loss*) is equal to the area of the gray triangle labeled *abc* in Figure 12.6b.

Income Transfer

In general, a monopoly transfers income from consumers to the owners of the monopoly. The income is received by the owners as revenue. Because a monopoly has market power, it can charge a higher price than would a purely competitive firm with the same costs. So the monopoly in effect levies a "private tax" on consumers. This private tax can often generate substantial economic profits that can persist because entry to the industry is blocked.

The transfer from consumers to the monopolist is evident in Figure 12.6b. For the Q_m units of output demanded, consumers pay price P_m rather than the price P_c that they would pay to a pure competitor. The total amount of income transferred from consumers to the monopolist is $P_m - P_c$ multiplied by the number of units sold, Q_m. So the total transfer is the dollar amount of rectangle P_cP_mbd. What the consumer loses, the monopolist gains. In contrast, the efficiency loss *abc* is a *deadweight* loss—society totally loses the net benefits of the Q_c minus Q_m units that are not produced.

Cost Complications

Our evaluation of pure monopoly has led us to conclude that, given identical costs, a purely monopolistic industry will charge a higher price, produce a smaller output, and allocate economic resources less efficiently than a purely competitive industry. These inferior results are rooted in the entry barriers characterizing monopoly.

Now we must recognize that costs may not be the same for purely competitive and monopolistic producers. The unit cost incurred by a monopolist may be either larger or smaller than that incurred by a purely competitive firm. There are four reasons costs may differ: (1) economies of scale, (2) a factor called "X-inefficiency," (3) the need for monopoly-preserving expenditures, and (4) the "very long run" perspective, which allows for technological advance.

Economies of Scale Once Again Where economies of scale are extensive, market demand may not be sufficient to support a large number of competing firms, each producing at minimum efficient scale. In such cases, an industry of one or two firms would have a lower average total cost than would the same industry made up of numerous competitive firms. At the extreme, only a single firm—a natural monopoly—might be able to achieve the lowest long-run average total cost.

Some firms relating to new information technologies—for example, computer software, Internet service, and wireless communications—have displayed extensive economies of scale. As these firms have grown, their long-run average total costs have declined because of greater use of specialized inputs, the spreading of product development costs, and learning by doing. Also, *simultaneous consumption* and *network effects* have reduced costs.

A product's ability to satisfy a large number of consumers at the same time is called **simultaneous consumption** (or *nonrivalrous consumption*). Dell Computers needs to produce a personal computer for each customer, but Microsoft needs to produce its Windows program only once. Then, at very low marginal cost, Microsoft delivers its program by disk or Internet to millions of consumers. A similarly low cost of delivering product to additional customers is true for Internet service providers, music producers, and wireless communication firms. Because marginal costs are so low, the average total cost of output declines as more customers are added.

Network effects are present if the value of a product to each user, including existing users, increases as the total number of users rises. Good examples are computer software, cell phones, and website like Facebook where the content is

provided by users. When other people have Internet service and devices to access it, a person can conveniently send e-mail messages to them. And when they have similar software, various documents, spreadsheets, and photos can be attached to the e-mail messages. The greater the number of persons connected to the system, the more the benefits of the product to each person are magnified.

Such network effects may drive a market toward monopoly because consumers tend to choose standard products that everyone else is using. The focused demand for these products permits their producers to grow rapidly and thus achieve economies of scale. Smaller firms, which either have higher-cost "right" products or "wrong" products, get acquired or go out of business.

Economists generally agree that some new information firms have not yet exhausted their economies of scale. But most economists question whether such firms are truly natural monopolies. Most firms eventually achieve their minimum efficient scale at less than the full size of the market. That means competition among firms is possible.

But even if natural monopoly develops, the monopolist is unlikely to pass cost reductions along to consumers as price reductions. So, with perhaps a handful of exceptions, economies of scale do not change the general conclusion that monopoly industries are inefficient relative to competitive industries.

X-Inefficiency In constructing all the average-total-cost curves used in this book, we have assumed that the firm uses the most efficient existing technology. This assumption is only natural because firms cannot maximize profits unless they are minimizing costs. **X-inefficiency** occurs when a firm produces output at a higher cost than is necessary to produce it. In Figure 12.7 X-inefficiency is represented by operation at points X and X' above the lowest-cost ATC curve. At these points, per-unit costs are ATC_X (as opposed to ATC_1) for output Q_1 and $ATC_{X'}$ (as opposed to ATC_2) for output Q_2. Producing at any point above the average-total-cost curve in Figure 12.7 reflects inefficiency or "bad management" by the firm.

Why is X-inefficiency allowed to occur if it reduces profits? The answer is that managers may have goals, such as expanding power, an easier work life, avoiding business risk, or giving jobs to incompetent relatives, that conflict with cost minimization. Or X-inefficiency may arise because a firm's workers are poorly motivated or ineffectively supervised. Or a firm may simply become lethargic and inert, relying on rules of thumb in decision making as opposed to careful calculations of costs and revenues.

For our purposes the relevant question is whether monopolistic firms tend more toward X-inefficiency than competitive producers do. Presumably they do. Firms in competitive industries are continually under pressure from rivals, forcing them to be internally efficient to survive. But monopolists are sheltered from such competitive forces by entry barriers. That lack of pressure may lead to X-inefficiency.

Rent-Seeking Expenditures **Rent-seeking behavior** is any activity designed to transfer income or wealth to a particular firm or resource supplier at someone else's, or even society's, expense. We have seen that a monopolist can obtain an economic profit even in the long run. Therefore, it is no surprise that a firm may go to great expense to acquire or maintain a monopoly granted by government through legislation or an exclusive license. Such rent-seeking expenditures add nothing to the firm's output, but they clearly increase its costs. Taken alone, rent seeking implies that monopoly involves even higher costs and even less efficiency than suggested in Figure 12.6b.

Technological Advance In the very long run, firms can reduce their costs through the discovery and implementation of new technology. If monopolists are more likely than

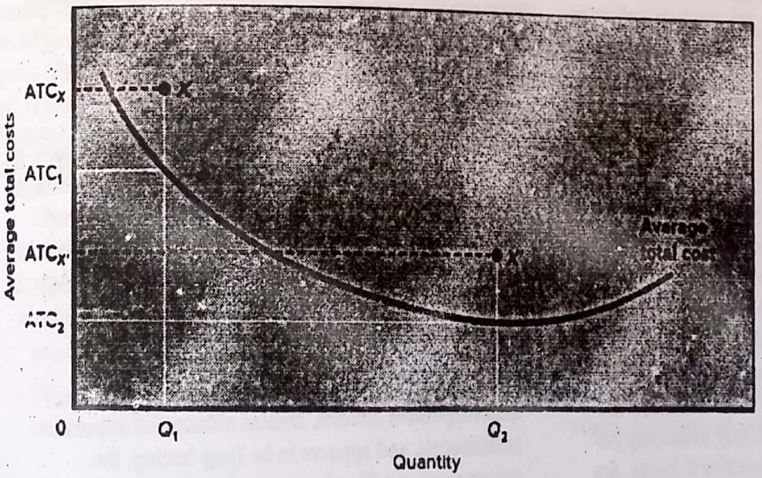


FIGURE 12.7 **X-inefficiency.** The average-total-cost curve (ATC) is assumed to reflect the minimum cost of producing each particular level of output. Any point above this "lowest-cost" ATC curve, such as X or X', implies X-inefficiency: operation at greater than lowest cost for a particular level of output.

competitive producers to develop more efficient production techniques over time, then the inefficiency of monopoly might be overstated. Because research and development (R&D) is the topic of Chapter 15, we will provide only a brief assessment here.

The general view of economists is that a pure monopolist will not be technologically progressive. Although its economic profit provides ample means to finance research and development, it has little incentive to implement new techniques (or products). The absence of competitors means that there is no external pressure for technological advance in a monopolized market. Because of its sheltered market position, the pure monopolist can afford to be complacent and lethargic. There simply is no major penalty for not being innovative.

One caveat: Research and technological advance may be one of the monopolist's barriers to entry. Thus, the monopolist may continue to seek technological advance to avoid falling prey to new rivals. In this case technological advance is essential to the maintenance of monopoly. But then it is *potential* competition, not the monopoly market structure, that is driving the technological advance. By assumption, no such competition exists in the pure monopoly model; entry is completely blocked.

Assessment and Policy Options

Monopoly is a legitimate concern. Monopolists can charge higher-than-competitive prices that result in an underallocation of resources to the monopolized product. They can stifle innovation, engage in rent-seeking behavior, and foster X-inefficiency. Even when their costs are low because of economies of scale, there is no guarantee that the price they charge will reflect those low costs. The cost savings may simply accrue to the monopoly as greater economic profit.

Fortunately, however, monopoly is not widespread in the United States. Barriers to entry are seldom completely successful. Although research and technological advance may strengthen the market position of a monopoly, technology may also undermine monopoly power. Over time, the creation of new technologies may work to destroy monopoly positions. For example, the development of courier delivery, fax machines, and e-mail has eroded the monopoly power of the U.S. Postal Service. Similarly, cable television monopolies are now challenged by satellite TV and by technologies that permit the transmission of audio and video over the Internet.

Patents eventually expire; and even before they do, the development of new and distinct substitutable products often circumvents existing patent advantages. New sources of monopolized resources sometimes are found and competition from foreign firms may emerge. (See Global Perspective 12.1.) Finally, if a monopoly is sufficiently fearful of future competition from new products, it may keep its prices relatively low so as to discourage rivals from developing such products. If so, consumers may pay nearly competitive prices even though competition is currently lacking.

So what should government do about monopoly when it arises in the real world? Economists agree that government needs to look carefully at monopoly on a case-by-case basis. Three general policy options are available:

- If the monopoly is achieved and sustained through anticompetitive actions, creates substantial economic inefficiency, and appears to be long-lasting, the government can file charges against the monopoly under the antitrust laws. If found guilty of monopoly abuse, the firm can either be expressly prohibited from engaging in certain business activities or be broken into two or more competing firms. An example of the breakup approach was the dissolution of Standard Oil into several competing firms in 1911. In contrast, in 2001 an appeals court overruled a lower-court decision to divide Microsoft into two firms. Instead, Microsoft was prohibited from engaging in a number of specific anticompetitive business activities. (We discuss the antitrust laws and the Microsoft case in Chapter 21.)

GLOBAL PERSPECTIVE 12.1

Competition from Foreign Multinational Corporations

Competition from foreign multinational corporations diminishes the market power of firms in the United States. Here are just a few of the hundreds of foreign multinational corporations that compete strongly with U.S. firms in certain American markets.

Company (Country)	Main Products
Bayer (Germany)	chemicals
Daimler (Germany)	automobiles
[illegible]	[illegible]
[illegible]	[illegible]
Nestlé (Switzerland)	food products
Nokia (Finland)	wireless phones
Panasonic (Japan)	electronics
Petrobras (Brazil)	gasoline
Royal Dutch Shell (Netherlands)	gasoline
Samsung (South Korea)	electronics
Toyota (Japan)	automobiles

Source: Compiled from the Fortune 500 listing of the world's largest firms, "FORTUNE Global 500," 2016, www.fortune.com.

- If the monopoly is a natural monopoly, society can allow it to continue to expand. If no competition emerges from new products, government may then decide to regulate its prices and operations. (We discuss this option later in this chapter and also in Chapter 21.)
- If the monopoly appears to be unsustainable because of emerging new technology, society can simply choose to ignore it. In such cases, society simply lets the process of creative destruction (discussed in Chapter 11) do its work. In Chapter 15, we discuss in detail the likelihood that real-world monopolies will collapse due to creative destruction and competition brought on by new technologies.

QUICK REVIEW 12.2

- ✓ The monopolist maximizes profit (or minimizes loss) at the output where MR = MC and charges the price that corresponds to that output on its demand curve.
- ✓ The monopolist has no supply curve, since any of several prices can be associated with a specific quantity of output supplied.
- ✓ Assuming identical costs, a monopolist will be less efficient than a purely competitive industry because it will fail to produce units of output for which marginal benefits exceed marginal costs.
- ✓ The inefficiencies of monopoly may be offset or lessened by economies of scale and, less likely, by technological progress, but they may be intensified by the presence of X-inefficiency and rent-seeking expenditures.

Price Discrimination

LO12.6 Describe why a monopolist might prefer to charge different prices in different markets.

We have assumed in this chapter that the monopolist charges a single price to all buyers. But under certain conditions the monopolist can increase its profit by charging different prices to different buyers. In so doing, the monopolist is engaging in **price discrimination**, the practice of selling a specific product at more than one price when the price differences are not justified by cost differences. Price discrimination can take three forms:

- Charging each customer in a single market the maximum price she or he is willing to pay.
- Charging each customer one price for the first set of units purchased and a lower price for subsequent units purchased.
- Charging some customers one price and other customers another price.

Conditions

The opportunity to engage in price discrimination is not readily available to all sellers. Price discrimination is possible when the following conditions are met:

- ***Monopoly power*** The seller must be a monopolist or, at least, must possess some degree of monopoly power, that is, some ability to control output and price.
- ***Market segregation*** At relatively low cost to itself, the seller must be able to segregate buyers into distinct classes, each of which has a different willingness or ability to pay for the product. This separation of buyers is usually based on different price elasticities of demand, as the examples below will make clear.
- ***No resale*** The original purchaser cannot resell the product or service. If buyers in the low-price segment of the market could easily resell in the high-price segment, the monopolist's price-discrimination strategy would create competition in the high-price segment. This competition would reduce the price in the high-price segment and undermine the monopolist's price-discrimination policy. This condition suggests that service industries such as the transportation industry or legal and medical services, where resale is impossible, are good candidates for price discrimination.

Examples of Price Discrimination

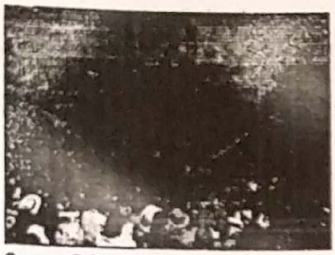
Price discrimination is widely practiced in the U.S. economy. For example, we noted in Chapter 6's Last Word that airlines charge high fares to business travelers, whose demand for travel is inelastic, and offer lower, highly restricted, nonrefundable fares to attract vacationers and others whose demands are more elastic.

Electric utilities frequently segment their markets by end uses, such as lighting and heating. The absence of reasonable lighting substitutes means that the demand for electricity for illumination is inelastic and that the price per kilowatt-hour for such use is high. But the availability of natural gas and petroleum for heating makes the demand for electricity for this purpose less inelastic and the price lower.

Movie theaters and golf courses vary their charges on the basis of time (for example, higher evening and weekend rates) and age (for example, lower rates for children, senior discounts). Railroads vary the rate charged per ton-mile of freight according to the market value of the product being shipped. The shipper of 10 tons of television sets or refrigerators is charged more than the shipper of 10 tons of gravel or coal.

The issuance of discount coupons, redeemable at purchase, is a form of price discrimination. It enables firms to

CONSIDER THIS . . . .



Source: © Stephen Dunn/Getty Images

Some Price Differences at the Ballpark

Take me out to the ball game...

Buy me some peanuts and Cracker Jack...

Professional baseball teams earn substantial revenues through ticket sales. To maximize profit, they offer significantly lower ticket prices for children (whose demand is elastic) than for adults (whose demand is inelastic). This discount may be as much as 50 percent.

If this type of price discrimination increases revenue and profit, why don't teams also price discriminate at the concession stands? Why don't they offer half-price hot dogs, soft drinks, peanuts, and Cracker Jack to children?

The answer involves the three requirements for successful price discrimination. All three requirements are met for game tickets: (1) The team has monopoly power; (2) it can segregate ticket buyers by age group, each group having a different elasticity of demand; and (3) children cannot resell their discounted tickets to adults.

It's a different situation at the concession stands. Specifically, the third condition is *not* met. If the team had dual prices, it could not prevent the exchange or "resale" of the concession goods from children to adults. Many adults would send children to buy food and soft drinks for them: "Here's some money, Billy. Go buy *six* hot dogs." In this case, price discrimination would reduce, not increase, team profit. Thus, children and adults are charged the same high prices at the concession stands. (These prices are high relative to those for the same goods at the local convenience store because the stadium sellers have a captive audience and thus considerable monopoly power.)

give price discounts to their most price-sensitive customers who have elastic demand. Less price-sensitive consumers who have less elastic demand are not as likely to take the time to clip and redeem coupons. The firm thus makes a larger profit than if it had used a single-price, no-coupon strategy.

Finally, price discrimination often occurs in international trade. A Russian aluminum producer, for example, might sell aluminum for less in the United States than in Russia. In the United States, this seller faces an elastic demand because several substitute suppliers are available. But in Russia, where the manufacturer dominates the market and trade barriers impede imports, consumers have fewer choices and thus demand is less elastic.

Graphical Analysis

Figure 12.8 demonstrates graphically the most frequently seen form of price discrimination—charging different prices to different classes of buyers. The two side-to-side graphs are for a single pure monopolist selling its product, say, software, in two segregated parts of the market. Figure 12.8a illustrates demand for software by small-business customers; Figure 12.8b, the demand for software by students. Student versions of the software are identical to the versions sold to businesses but are available (1 per person) only to customers with a student ID. Presumably, students have lower ability to pay for the software and are charged a discounted price.

The demand curve D_b in the graph to the left indicates a relatively inelastic demand for the product on the part of business customers. The demand curve D_s in the right-hand graph reflects the more elastic demand of students. The marginal revenue curves (MR_b and MR_s) lie below their respective demand curves, reflecting the demand–marginal revenue relationship previously described.

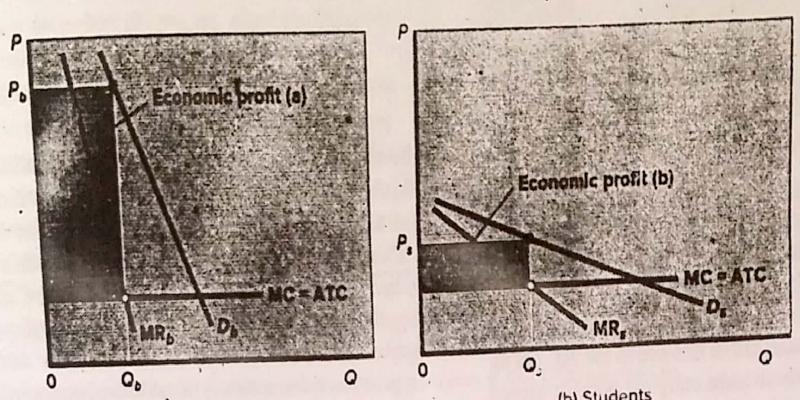
For visual clarity we have assumed that average total cost (ATC) is constant. Therefore marginal cost (MC) equals average total cost (ATC) at all quantities of output. These costs are the same for both versions of the software and therefore appear as the identical straight lines labeled "MC = ATC."

What price will the pure monopolist charge to each set of customers? Using the MR = MC rule for profit maximization, the firm will offer Q_b units of the software for sale to small businesses. It can sell that profit-maximizing output by charging price P_b. Again using the MR = MC rule, the monopolist will offer Q_s units of software to students. To sell those Q_s units, the firm will charge students the lower price P_s.

Firms engage in price discrimination because it enhances their profit. The numbers (not shown) behind the curves in Figure 12.8 would clearly reveal that the sum of the two profit rectangles shown in green exceeds the single profit rectangle the firm would obtain from a single monopoly price. How do consumers fare? In this case, students clearly benefit by paying a lower price than they would if the firm charged a single monopoly price; in contrast, the price discrimination results in a higher price for business customers. Therefore, compared to the single-price situation, students buy more of the software and small businesses buy less.

Such price discrimination is widespread in the economy and is illegal only when it is part of a firm's strategy to lessen or eliminate competition. We will discuss illegal price discrimination in Chapter 21, which covers antitrust policy.

FIGURE 12.8 Price discrimination to different groups of buyers. The price-discriminating monopolist represented here maximizes its total profit by dividing the market into two segments based on differences in elasticity of demand. It then produces and sells the MR = MC output in each market segment. (For visual clarity, average total cost, ATC, is assumed to be constant. Therefore, MC equals ATC at all output levels.) (a) The price-discriminating monopolist charges a high price (here P_b) to small-business customers because they have a relatively inelastic demand curve for the product. (b) The firm charges a low price (here P_s) to students because their demand curve is relatively elastic. The firm's total profit from using price discrimination (here, the sum of the two green rectangles) exceeds the profit (not shown) that would have occurred if the monopolist had charged the same price to all customers.



Regulated Monopoly

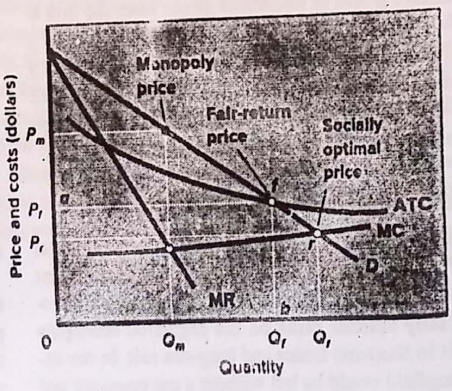
LO12.7 Distinguish among the monopoly price, the socially optimal price, and the fair-return price of a government-regulated monopoly.

Natural monopolies traditionally have been subject to *rate regulation* (price regulation), although the recent trend has been to deregulate wherever competition seems possible. For example, long-distance telephone calls, natural gas distribution, wireless communications, cable television, and long-distance electricity transmission have been, to one degree or another, deregulated over the past several decades. And regulators in some states are beginning to allow new entrants to compete with existing local telephone and electricity providers. Nevertheless, state and local regulatory commissions still regulate the prices that most local natural gas distributors, regional telephone companies, and local electricity suppliers can charge. These locally regulated monopolies are commonly called "public utilities."

Let's consider the regulation of a local natural monopoly. Our example will be a single firm that is the only seller of natural gas in the town of Springfield. Figure 12.9 shows the demand and the long-run cost curves facing our firm. Because of extensive economies of scale, the demand curve cuts the natural monopolist's long-run average-total-cost curve at a point where that curve is still falling. It would be inefficient to have several firms in this industry because each would produce a much smaller output, operating well to the left on the long-run average-total-cost curve. In short, each firm's lowest average total cost would be substantially higher than that of a single firm. So efficient, lowest-cost production requires a single seller.

We know by application of the MR = MC rule that Q_m and P_m are the profit-maximizing output and price that an unregulated monopolist would choose. Because price exceeds average total cost at output Q_m, the monopolist enjoys a substantial economic profit. Furthermore, price exceeds marginal cost, indicating an underallocation of resources to this product or service. Can government regulation bring about better results from society's point of view?

FIGURE 12.9 Regulated monopoly. The socially optimal price P_r, found where D and MC intersect, will result in an efficient allocation of resources but may entail losses to the monopoly. The fair-return price P_f will allow the monopolist to break even but will not fully correct the underallocation of resources.



Socially Optimal Price: $P = MC$

One sensible goal for regulators would be to get the monopoly to produce the allocatively efficient output level. For our monopolist in Figure 12.9, this is output level Q_r, determined by where the demand curve D intersects the MC curve. Q_r is the allocatively efficient output level because for each unit of output up to Q_r, the demand curve lies above the MC curve, indicating that for all of these units marginal benefits exceed marginal costs.

But how can the regulatory commission actually motivate the monopoly to produce this output level? The trick is to set the regulated price P_r at a level such that the monopoly will be led by its profit-maximizing rule to voluntarily produce the allocatively efficient level of output. To see how this works, note that because the monopoly will receive the regulated price P_r for all units that it sells, P_r becomes the monopoly's marginal revenue per unit. Thus, the monopoly's MR curve becomes the horizontal white line moving rightward from price P_r on the vertical axis.

The monopoly will at this point follow its usual rule for maximizing profits or minimizing losses: It will produce where marginal revenue equals marginal cost. As a result, the monopoly will produce where the horizontal white MR ($= P_r$) line intersects the MC curve at point r. That is, the monopoly will end up producing the socially optimal output Q_r not because it is socially minded but because Q_r happens to be the output that either maximizes profits or minimizes losses when the firm is forced by the regulators to sell all units at the regulated price P_r.

The regulated price P_r that achieves allocative efficiency is called the **socially optimal price.** Because it is determined by where the MC curve intersects the demand curve, this type of regulation is often summarized by the equation $P = MC$.

Fair-Return Price: $P = ATC$

The socially optimal price suffers from a potentially fatal problem. P_r may be so low that average total costs are not covered, as is the case in Figure 12.9. In such situations, forcing the socially optimal price on the regulated monopoly would result in short-run losses and long-run exit. In our example, Springfield would be left without a gas company and its citizens without gas.

What can be done to rectify this problem? One option is to provide a public subsidy to cover the loss that the socially optimal price would entail. Another possibility is to condone price discrimination, allow the monopoly to charge some customers prices above P_r, and hope that the additional revenue that the monopoly gains from price discrimination will be enough to permit it to break even.

In practice, regulatory commissions in the United States have often pursued a third option that abandons the goal of producing every unit for which marginal benefits exceed marginal costs but that guarantees that regulated monopolies will be able to break even and continue in operation. Under this third option, regulators set a regulated price that is high enough for monopolists to break even and continue in operation. This price has come to be referred to as a **fair-return** price because of a ruling in which the Supreme Court held that regulatory agencies must permit regulated utility owners to enjoy a "fair return" on their investments.

In practice, a fair return is equal to a normal profit. That is, a fair return is an accounting profit equal in size to what the owners of the monopoly would on average receive if they entered another type of business.

The regulator determines the fair-return price P_f by where the average total cost curve intersects the demand curve at point f. As we will explain, setting the regulated price at this level will cause the monopoly to produce Q_f units while guaranteeing that it will break even and not wish to exit the industry. To see why the monopoly will voluntarily produce Q_f units, note that because the monopoly will receive P_f dollars for each unit it sells, its marginal revenue per unit becomes P_f dollars so that the horizontal line moving rightward from P_f on the vertical axis becomes the regulated monopoly's MR curve. Because this horizontal MR curve is always higher than the monopoly's MC curve, it is obvious that marginal revenues will exceed marginal costs for every possible level of output shown in Figure 12.9. Thus, the monopoly should be willing to supply whatever quantity of output is demanded by consumers at the regulated price P_f. That quantity is, of course, given by the demand curve. At price P_f consumers will demand exactly Q_f units. Thus, by setting the regulated price at P_f, the regulator gets the monopoly to voluntarily supply exactly Q_f units.

Even better, the regulator also guarantees that the monopoly firm will earn exactly a normal profit. This can be seen in Figure 12.9 by noting that the rectangle $0afb$ is equal to both the monopoly's total cost and its total revenue. Its economic profit is therefore equal to zero, implying that it must be earning a normal accounting profit for its owners.

One final point about allocative efficiency: By choosing the fair-return price P_f, the regulator leads the monopoly to produce Q_f units. This is less than the socially optimal quantity Q_r, but still more than the Q_m units that the monopolist would produce if left unregulated. So while fair-return pricing does not lead to full allocative efficiency, it is still an improvement on what the monopoly would do if left to its own devices.

Dilemma of Regulation

Comparing results of the socially optimal price ($P = MC$) and the fair-return price ($P = ATC$) suggests a policy dilemma, sometimes termed the *dilemma of regulation.* When its price is set to achieve the most efficient allocation of resources ($P = MC$), the regulated monopoly is likely to suffer losses. Survival of the firm would presumably depend on permanent public

LAST WORD

Personalized Pricing

The Potential Perils of Online Price Discrimination

51

Internet retailers collect vast amounts of data about their customers. They know what you buy, who your friends are, what posts you like on Facebook, what websites you visit, and—by connecting that information with other data—how old you are, where you live, your credit history, and so on.

This huge collection of "Big Data" can be used by retailers with monopoly power to engage in an individually tailored form of price discrimination known as personalized pricing. As discussed in this chapter, price discrimination involves selling the same product to different buyers at different prices when the price differences are not justified by cost differences.

Traditionally, price discrimination has operated at the group level with, for example, senior citizens getting discounts at restaurants and children under 12 getting discounts on movie tickets. Groups with relatively inelastic demand get charged higher prices while groups with relatively elastic demand get charged lower prices.

The trick behind personalized pricing is that online retailers now have the ability to set individualized prices for most patrons. When that is possible, a firm with monopoly power can set the very lowest price for the person with the most elastic demand, a slightly higher price for the person with the next-most elastic demand, and so on all the way up to the highest price being presented to the person with the most *in*elastic demand.

By proceeding in this manner, the monopoly seller can attempt to set a price for each individual that is just below his or her reservation price. Doing so allows the monopoly seller to squeeze out as much revenue as possible from each customer while still leaving him or her with a bit of consumer surplus (and thus with a motive to still buy the product).

For an offline example of how personalized pricing works, think about car dealerships, where the final price paid by a buyer is usually the result of a negotiation. In particular, keep in mind that a car salesman will negotiate much more aggressively if you drive up in a fancy BMW rather than an average Hyundai. The salesman will try to tailor the final price to your perceived ability to pay. Big Data allows the same tactic to be used online. The more online retailers know about your buying habits, background, and preferences, the more they can attempt to set a price tailored to maximize how much they think they can get from you.

But personalized pricing has its limits. Most importantly, very few firms actually have any substantial monopoly power. As just one example, car dealers have to compete with each other. So a dealership that is driving too hard a bargain will drive customers toward rival dealers. That competitive pressure is probably even stronger online, where search engines and vast digital retail sites like eBay and Amazon often list multiple competing sellers for every item.

Source: © Miss Ty/Shutterstock.com

But even if a seller were to have monopoly power online, it would still confront another problem. Even with Big Data, it is hard for sellers to figure out what each potential buyer's reservation price is. So even if a firm with monopoly power wished to attempt personalized pricing, it probably wouldn't ever be able to figure out how to set a customized price for each individual.

On the other hand, online shoppers give up all their advantages if they fail to comparison shop. If they treat the first seller that they deal with as the only seller, they are implicitly giving that seller monopoly power over them. In those situations, online merchants can run wild with personalized pricing. In 2014, for example, Allstate Insurance admitted to Wisconsin insurance regulators that its personalized pricing computer algorithms had presented essentially identical online customers with insurance prices that varied massively, in some cased by more than 800 percent. In many instances, the differences were driven by factors as trivial as one customer having a birthdate of January 12, 1968, and another having a birthdate of April 9, 1968.

Allstate customers who failed to shop around left themselves open to paying much more than they had to. Online shopping is speedy and convenient—but it still pays to shop around.

subsidies out of tax revenues. On the other hand, although a fair-return price (P = ATC) allows the monopolist to cover costs, it only partially resolves the underallocation of resources that the unregulated monopoly price would foster. Despite this dilemma, regulation can improve on the results of monopoly from the social point of view. Price regulation (even at the fair-return price) can simultaneously reduce price, increase output, and reduce the economic profit of monopolies.

That said, we need to provide an important caution: "Fair-price" regulation of monopoly looks rather simple in theory but is amazingly complex in practice. In the actual economy, rate regulation is accompanied by large, expensive rate-setting bureaucracies and maze-like sets of procedures. Also, rate decisions require extensive public input via letters and through public hearings. Rate decisions are subject to lengthy legal challenges. Further, because regulatory commissions must set prices sufficiently above costs to create fair returns, regulated monopolists have little incentive to minimize average total costs. When these costs creep up, the regulatory commissions must set higher prices.

Regulated firms therefore are noted for higher-than-competitive wages, more managers and staff than necessary, nicer-than-typical office buildings, and other forms of X-inefficiency. These inefficiencies help explain the trend of federal, state, and local governments abandoning price regulation where the possibility of competition looks promising.

QUICK REVIEW 12.3

- ✓ Price discrimination occurs when a firm sells a product at different prices that are not based on cost differences.
- ✓ The conditions necessary for price discrimination are (a) monopoly power, (b) the ability to segregate buyers on the basis of demand elasticities, and (c) the inability of buyers to resell the product.
- ✓ Compared with single pricing by a monopolist, perfect price discrimination results in greater profit and greater output. Many consumers pay higher prices, but other buyers pay prices below the single price.
- ✓ Monopoly price can be reduced and output increased through government regulation.
- ✓ The socially optimal price (P = MC) achieves allocative efficiency but may result in losses; the fair-return price (P = ATC) yields a normal profit but fails to achieve allocative efficiency.

SUMMARY

LO12.1 List the characteristics of pure monopoly.

A pure monopolist is the sole producer of a commodity for which there are no close substitutes.

LO12.2 List and explain the barriers to entry that shield pure monopolies from competition.

The existence of pure monopoly and other imperfectly competitive market structures is explained by barriers to entry in the form of (*a*) economies of scale, (*b*) patent ownership and research, (*c*) ownership or control of essential resources, and (*d*) pricing and other strategic behavior.

LO12.3 Explain how demand is seen by a pure monopoly.

The pure monopolist's market situation differs from that of a competitive firm in that the monopolist's demand curve is downsloping, causing the marginal-revenue curve to lie below the demand curve. Like the competitive seller, the pure monopolist will maximize profit by equating marginal revenue and marginal cost. Barriers to entry may permit a monopolist to acquire economic profit even in the long run. However, (*a*) the monopolist does not charge "the highest price possible," (*b*) the price that yields maximum total profit to the monopolist rarely coincides with the price that yields maximum unit profit, (*c*) high costs and a weak demand may prevent the monopolist from realizing any profit at all, and (*d*) the monopolist avoids the inelastic region of its demand curve.

LO12.4 Explain how a pure monopoly sets its profit-maximizing output and price.

With the same costs, the pure monopolist will find it profitable to restrict output and charge a higher price than would sellers in a purely competitive industry. This restriction of output causes resources to be misallocated, as is evidenced by the fact that price exceeds marginal cost in monopolized markets. Monopoly creates an efficiency loss (or deadweight loss) for society.

Monopoly transfers income from consumers to monopolists because a monopolist can charge a higher price than would a purely competitive firm with the same costs. So monopolists in effect levy a "private tax" on consumers and, if demand is strong enough, obtain substantial economic profits.

LO12.5 Discuss the economic effects of monopoly.

The costs monopolists and competitive producers face may not be the same. On the one hand, economies of scale may make lower unit

costs available to monopolists but not to competitors. Also, pure monopoly may be more likely than pure competition to reduce costs via technological advance because of the monopolist's ability to realize economic profit, which can be used to finance research. On the other hand, X-inefficiency—the failure to produce with the least costly combination of inputs—is more common among monopolists than among competitive firms. Also, monopolists may make costly expenditures to maintain monopoly privileges that are conferred by government. Finally, the blocked entry of rival firms weakens the monopolist's incentive to be technologically progressive.

LO12.6 Describe why a monopolist might prefer to charge different prices in different markets.

A monopolist can increase its profit by practicing price discrimination, provided (*a*) it can segregate buyers on the basis of elasticities of demand and (*b*) its product or service cannot be readily transferred between the segregated markets.

LO12.7 Distinguish among the monopoly price, the socially optimal price, and the fair-return price of a government-regulated monopoly.

Price regulation can be invoked to eliminate wholly or partially the tendency of monopolists to underallocate resources and to earn economic profits. The socially optimal price is determined where the demand and marginal-cost curves intersect; the fair-return price is determined where the demand and average-total-cost curves intersect.

TERMS AND CONCEPTS

pure monopoly
barriers to entry
simultaneous consumption
network effects
X-inefficiency
rent-seeking behavior
price discrimination
socially optimal price
fair-return price

The following and additional problems can be found in connect

DISCUSSION QUESTIONS

1. "No firm is completely sheltered from rivals; all firms compete for consumer dollars. If that is so, then pure monopoly does not exist." Do you agree? Explain. How might you use Chapter 6's concept of cross elasticity of demand to judge whether monopoly exists? **LO12.1**
2. Discuss the major barriers to entry into an industry. Explain how each barrier can foster either monopoly or oligopoly. Which barriers, if any, do you feel give rise to monopoly that is socially justifiable? **LO12.2**
3. How does the demand curve faced by a purely monopolistic seller differ from that confronting a purely competitive firm? Why does it differ? Of what significance is the difference? Why is the pure monopolist's demand curve not perfectly inelastic? **LO12.3**
4. Assume that a pure monopolist and a purely competitive firm have the same unit costs. Contrast the two with respect to (*a*) price, (*b*) output, (*c*) profits, (*d*) allocation of resources, and (*e*) impact on income transfers. Since both monopolists and competitive firms follow the MC = MR rule in maximizing profits, how do you account for the different results? Why might the costs of a purely competitive firm and those of a monopolist be different? What are the implications of such a cost difference? **LO12.5**
5. Critically evaluate and explain each statement: **LO12.5**
   a. Because they can control product price, monopolists are always assured of profitable production by simply charging the highest price consumers will pay.
   b. The pure monopolist seeks the output that will yield the greatest per-unit profit.
   c. An excess of price over marginal cost is the market's way of signaling the need for more production of a good.
   d. The more profitable a firm, the greater its monopoly power.
   e. The monopolist has a pricing policy; the competitive producer does not.
   f. With respect to resource allocation, the interests of the seller and of society coincide in a purely competitive market but conflict in a monopolized market.
6. Assume a monopolistic publisher has agreed to pay an author 10 percent of the total revenue from the sales of a text. Will the author and the publisher want to charge the same price for the text? Explain. **LO12.5**
7. U.S. pharmaceutical companies charge different prices for prescription drugs to buyers in different nations, depending on elasticity of demand and government-imposed price ceilings. Explain why these companies, for profit reasons, oppose laws allowing re-importation of drugs to the United States. **LO12.6**

8. Explain verbally and graphically how price (rate) regulation may improve the performance of monopolies. In your answer distinguish between (*a*) socially optimal (marginal-cost) pricing and (*b*) fair-return (average-total-cost) pricing. What is the "dilemma of regulation"? LO12.7
9. It has been proposed that natural monopolists should be allowed to determine their profit-maximizing outputs and prices and then government should tax their profits away and distribute them to consumers in proportion to their purchases from the monopoly. Is this proposal as socially desirable as requiring monopolists to equate price with marginal cost or average total cost? LO12.7
10. LAST WORD Using Big Data to set personalized prices cannot be done with 100 percent precision. What would happen if personalized prices were set higher than customers' reservation prices? Would this possibility reduce the incentive to set the highest possible personalized prices? How can consumers protect themselves from personalized prices?

REVIEW QUESTIONS

1. Which of the following could explain why a firm is a monopoly? Select one or more answers from the choices shown. LO12.2
   a. Patents.
   b. Economies of scale.
   c. Inelastic demand.
   d. Government licenses.
   e. Downsloping market demand.
2. The MR curve of a perfectly competitive firm is horizontal. The MR curve of a monopoly firm is: LO12.3
   a. Horizontal, too.
   b. Upsloping.
   c. Downsloping.
   d. It depends.
3. Use the following demand schedule to calculate total revenue and marginal revenue at each quantity. Plot the demand, total-revenue, and marginal-revenue curves, and explain the relationships between them. Explain why the marginal revenue of the fourth unit of output is $3.50, even though its price is $5. Use Chapter 6's total-revenue test for price elasticity to designate the elastic and inelastic segments of your graphed demand curve. What generalization can you make as to the relationship between marginal revenue and elasticity of demand? Suppose the marginal cost of successive units of output was zero. What output would the profit-seeking firm produce? Finally, use your analysis to explain why a monopolist would never produce in the inelastic region of demand. LO12.3

Price (*P*)	Quantity Demanded (*Q*)	Price (*P*)	Quantity Demanded (*Q*)
$7.00	0	$4.50	5
6.50	1	4.00	6
6.00	2	3.50	7
5.50	3	3.00	8
5.00	4	2.50	9

4. How often do *perfectly competitive* firms engage in price discrimination? LO12.6
   a. Never.
   b. Rarely.
   c. Often.
   d. Always.
5. Suppose that a monopolist can segregate his buyers into two different groups to which he can charge two different prices. In order to maximize profit, the monopolist should charge a higher price to the group that has: LO12.6
   a. The higher elasticity of demand.
   b. The lower elasticity of demand.
   c. Richer members.
6. The socially optimal price (P = MC) is socially optimal because: LO12.7
   a. It reduces the monopolist's profit.
   b. It yields a normal profit.
   c. It minimizes ATC.
   d. It achieves allocative efficiency.
7. The main problem with imposing the socially optimal price (P = MC) on a monopoly is that the socially optimal price: LO12.7
   a. May be so low that the regulated monopoly can't break even.
   b. May cause the regulated monopoly to engage in price discrimination.
   c. May be higher than the monopoly price.

PROBLEMS

1. Suppose a pure monopolist is faced with the following demand schedule and the same cost data as the competitive producer discussed in problem 4 at the end of Chapter 10. Calculate the missing total-revenue and marginal-revenue amounts, and determine the profit-maximizing price and profit-maximizing output for this monopolist. What is the monopolist's profit? Verify your answer graphically and by comparing total revenue and total cost. LO12.4

Price	Quantity Demanded	Total Revenue	Marginal Revenue
$115	0	$_____	
100	1	_____	$_____
83	2	_____	_____
71	3	_____	_____
63	4	_____	_____
55	5	_____	_____
48	6	_____	_____
42	7	_____	_____
37	8	_____	_____
33	9	_____	_____
29	10	_____	_____

2. Suppose that a price-discriminating monopolist has segregated its market into two groups of buyers. The first group is described by the demand and revenue data that you developed for problem 1. The demand and revenue data for the second group of buyers is shown in the following table. Assume that MC is $13 in both markets and MC = ATC at all output levels. What price will the firm charge in each market? Based solely on these two prices, which market has the higher price elasticity of demand? What will be this monopolist's total economic profit? **LO12.6**

Price	Quantity Demanded	Total Revenue	Marginal Revenue
$71	0	$ 0	
63	1	63	$63
55	2	110	47
48	3	144	34
42	4	168	24
37	5	185	17
33	6	198	13
29	7	203	5

3. Assume that the most efficient production technology available for making vitamin pills has the cost structure given in the following table. Note that output is measured as the number of bottles of vitamins produced per day and that costs include a normal profit. **LO12.6**

Output	TC	MC
25,000	$100,000	$0.50
50,000	150,000	1.00
75,000	187,500	2.50
100,000	275,500	3.00

   a. What is ATC per unit for each level of output listed in the table?
   b. Is this a decreasing-cost industry? (Answer yes or no.)
   c. Suppose that the market price for a bottle of vitamins is $2.50 and that at that price the total market quantity demanded is 75,000,000 bottles. How many firms will there be in this industry?
   d. Suppose that, instead, the market quantity demanded at a price of $2.50 is only 75,000. How many firms do you expect there to be in this industry?
   e. Review your answers to parts *b*, *c*, and *d*. Does the level of demand determine this industry's market structure?

4. A new production technology for making vitamins is invented by a college professor who decides not to patent it. Thus, it is available for anybody to copy and put into use. The TC per bottle for production up to 100,000 bottles per day is given in the following table. **LO12.6**

Output	TC
25,000	$50,000
50,000	70,000
75,000	75,000
100,000	80,000

   a. What is ATC for each level of output listed in the table?
   b. Suppose that for each 25,000-bottle-per-day increase in production above 100,000 bottles per day, TC increases by $5,000 (so that, for instance, 125,000 bottles per day would generate total costs of $85,000 and 150,000 bottles per day would generate total costs of $90,000). Is this a decreasing-cost industry?
   c. Suppose that the price of a bottle of vitamins is $1.33 and that at that price the total quantity demanded by consumers is 75,000,000 bottles. How many firms will there be in this industry?
   d. Suppose that, instead, the market quantity demanded at a price of $1.33 is only 75,000. How many firms do you expect there to be in this industry?
   e. Review your answers to parts *b*, *c*, and *d*. Does the level of demand determine this industry's market structure?
   f. Compare your answer to part *d* of this problem with your answer to part d of problem 3. Do both production technologies show constant returns to scale?

5. Suppose you have been tasked with regulating a single monopoly firm that sells 50-pound bags of concrete. The firm has fixed costs of $10 million per year and a variable cost of $1 per bag no matter how many bags are produced. **LO12.7**
   a. If this firm kept on increasing its output level, would ATC per bag ever increase? Is this a decreasing-cost industry?
   b. If you wished to regulate this monopoly by charging the socially optimal price, what price would you charge? At that price, what would be the size of the firm's profit or loss? Would the firm want to exit the industry?
   c. You find out that if you set the price at $2 per bag, consumers will demand 10 million bags. How big will the firm's profit or loss be at that price?
   d. If consumers instead demanded 20 million bags at a price of $2 per bag, how big would the firm's profit or loss be?
   e. Suppose that demand is perfectly inelastic at 20 million bags, so that consumers demand 20 million bags no matter what the price is. What price should you charge if you want the firm to earn only a fair rate of return? Assume as always that TC includes a normal profit.