

Principles of Economics, 10e

Chapter 14: The Costs of Production

Chapter Objectives (1 of 3)

By the end of this chapter, you should be able to:

- Calculate total revenue, given price and production data.
- Calculate total cost, given input costs and production data.
- Calculate profit, given price, input costs, and production data.
- Compare economic profit and accounting profit, given data on total revenue, implicit costs, and explicit costs.
- Categorize a cost as explicit or implicit, given a scenario.
- Classify a firm's costs as fixed or variable.

Chapter Objectives (2 of 3)

- Given a graph of the production function and input costs, derive the firm's total-cost curve.
- Derive total product, average product, and marginal product, given data on a firm's production technology.
- Explain the concept of diminishing marginal product using a production function.
- Plot a production function for a firm, given its production data.
- Calculate a firm's various average costs at different quantities, given data on that firm's cost structure.

Chapter Objectives (3 of 3)

- Calculate a firm's marginal cost at different quantities, given data on that firm's cost structure.
- Explain the shapes of the ATC , AVC , AFC , and MC curves.
- Explain why a firm's marginal cost curve intersects the average-total-cost curve at its minimum.
- Explain the relationship between short-run and long-run average total costs.
- Given a graph of the average-total-cost curve in the long run, identify the regions that represent economies of scale, constant returns to scale, and diseconomies of scale.

14-1

What Are Costs?

Total Revenue, Total Cost, and Profit

- **Total revenue***
 - The amount a firm receives for the sale of its output
- **Total cost***
 - The market value of the inputs a firm uses in production
- **Profit***
 - Total revenue minus total cost

*Words accompanied by an asterisk are key terms from the chapter.

Why Opportunity Costs Matter

- Opportunity cost
 - The cost of something is what you give up to get it
- Firm's cost of production
 - Includes all the opportunity costs of making its output of goods and services

Explicit and Implicit Costs

- **Explicit costs***
 - Input costs that require an outlay of money by the firm
- **Implicit costs***
 - Input costs that do not require an outlay of money by the firm
- Total Costs = Explicit costs + Implicit costs

*Words accompanied by an asterisk are key terms from the chapter.

The Cost of Capital Is An Opportunity Cost

- Implicit cost of almost every business is the opportunity cost of the money (financial capital) that has been invested in it
 - For example, economists view interest income given up as an implicit cost
 - Accountants will not show this as a cost because no money flows out of the business to pay for it

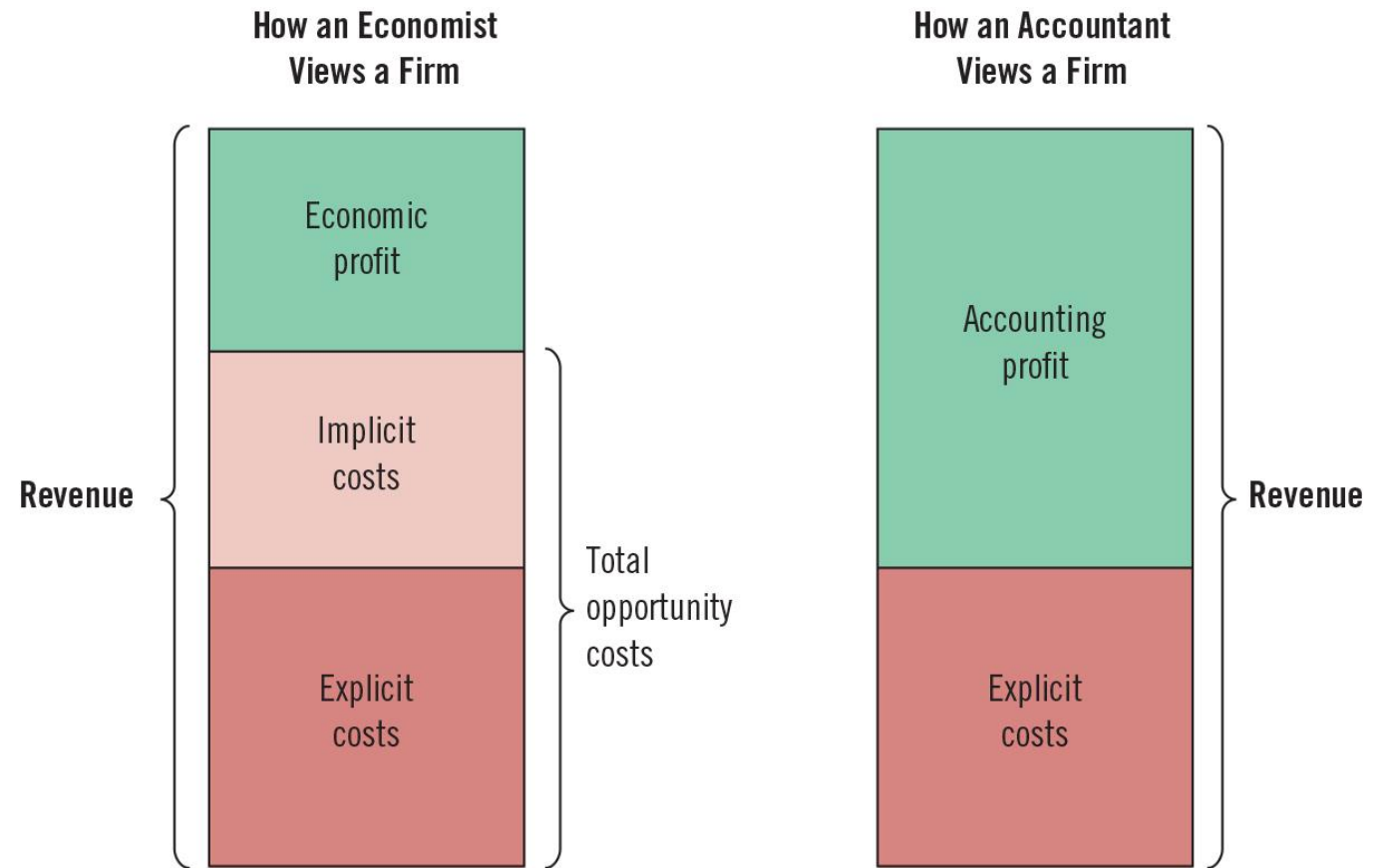
Economists and Accountants Measure Profit Differently

- **Economic profit***
 - Total revenue minus total cost, including both explicit and implicit costs
- **Accounting profit***
 - Total revenue minus total explicit cost

*Words accompanied by an asterisk are key terms from the chapter.

Figure 1 Economists versus Accountants

- Because economists include all opportunity costs when analyzing a firm, while accountants measure only explicit costs, economic profit is smaller than accounting profit.



Active Learning 1: Economic vs. Accounting Profit

- The equilibrium rent on office space has just increased by \$500/month. Determine the effects on accounting profit and economic profit if:
 - A. You rent your office space (you pay \$500/month)
 - B. You own your office space

Active Learning 1: Answers

A. You rent your office space

- Explicit costs increase \$500/month
- Accounting and economic profit each fall by \$500/month

B. You own your office space

- Explicit costs do not change, so accounting profit does not change
- Implicit costs increase \$500/month, so economic profit falls by \$500/month

14-2

Production and Costs

The Production Function

- **Production function***
 - Relationship between the quantity of inputs used to make a good and the quantity of output of that good
- **Marginal product***
 - The increase in output that arises from an additional unit of input

*Words accompanied by an asterisk are key terms from the chapter.

Diminishing Marginal Product

- **Diminishing marginal product***
 - The property whereby the marginal product of an input declines as the quantity of the input increases
- Production function gets flatter as more inputs are being used
- The slope of the production function decreases

*Words accompanied by an asterisk are key terms from the chapter.

Table 1 A Production Function and Total Cost: Chloe's Cookie Factory

(1) Number of Workers	(2) Output (quantity of cookies produced per hour)	(3) Marginal Product of Labor	(4) Cost of Factory	(5) Cost of Workers	(6) Total Cost of Inputs (cost of factory plus cost of workers)
0	0		\$30	\$0	\$30
1	50	50	30	10	40
2	90	40	30	20	50
3	120	30	30	30	60
4	140	20	30	40	70
5	150	10	30	50	80
6	155	5	30	60	90

Figure 2 Chloe's Production Function and Total-Cost Curve (1 of 2)

- The production function in panel (a) shows the relationship between the number of workers hired and the quantity of output produced.
- Here, the number of workers hired (on the horizontal axis) is from column (1) in Table 1, and the quantity of output (on the vertical axis) is from column (2).
- The production function gets flatter as the number of workers increases, reflecting diminishing marginal product.

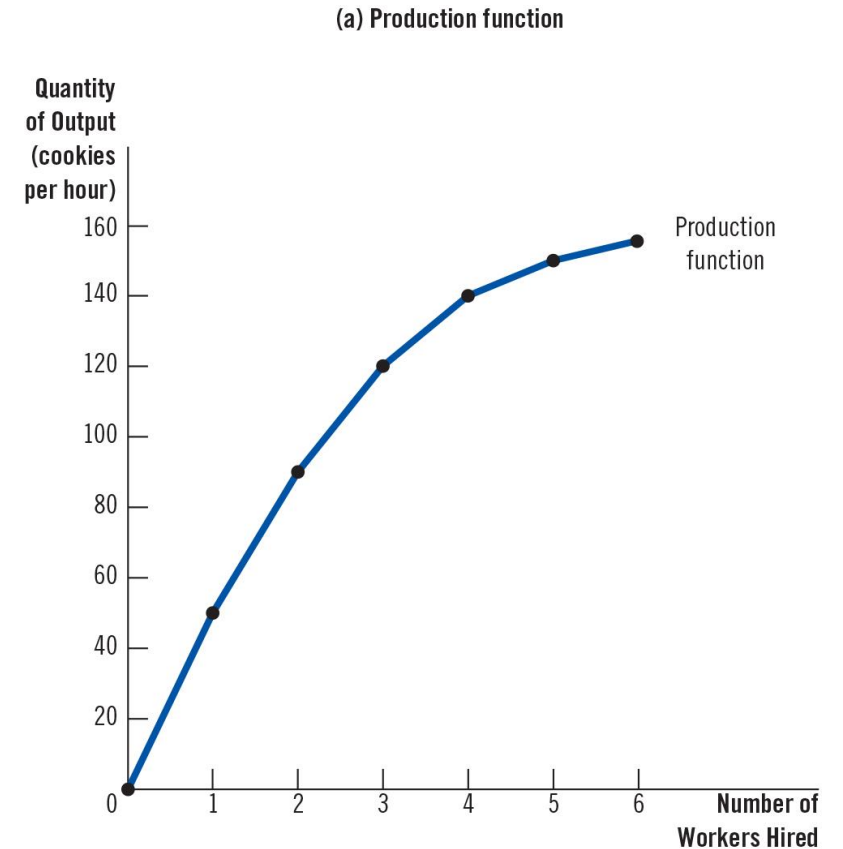
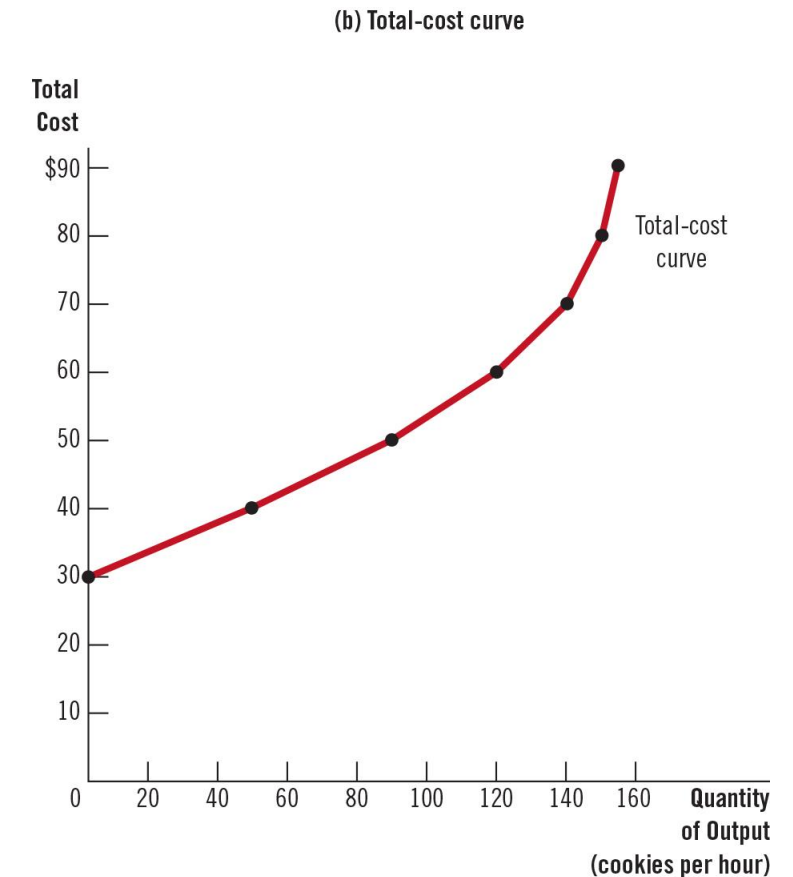


Figure 2 Chloe's Production Function and Total-Cost Curve (2 of 2)

- The total-cost curve in panel (b) shows the relationship between the quantity of output and total cost of production.
- Here, the quantity of output produced (on the horizontal axis) is from column (2) in Table 1, and the total cost (on the vertical axis) is from column (6).
- The total-cost curve gets steeper as the quantity of output increases because of diminishing marginal product.



From the Production Function to the Total-Cost Curve

- Total-cost curve
 - Relationship between quantity produced and total costs
- As production rises
 - Total-cost curve grows steeper
 - Production function becomes flatter

Active Learning 2: Diminishing MPL

Number of Workers	Output	<i>MPL</i>
0	0	
1	45	
2	85	
3	115	
4	135	
5	145	

- A. What is the marginal product of the second worker?
- B. What is the marginal product of the fourth worker?
- C. Does this production function exhibit diminishing marginal returns?

14-3

The Many Measures of Cost

Fixed and Variable Costs

- **Fixed costs***
 - Costs that do not vary with the quantity of output produced
- **Variable costs***
 - Costs that vary with the quantity of output produced
- Total cost = Fixed costs + Variable costs

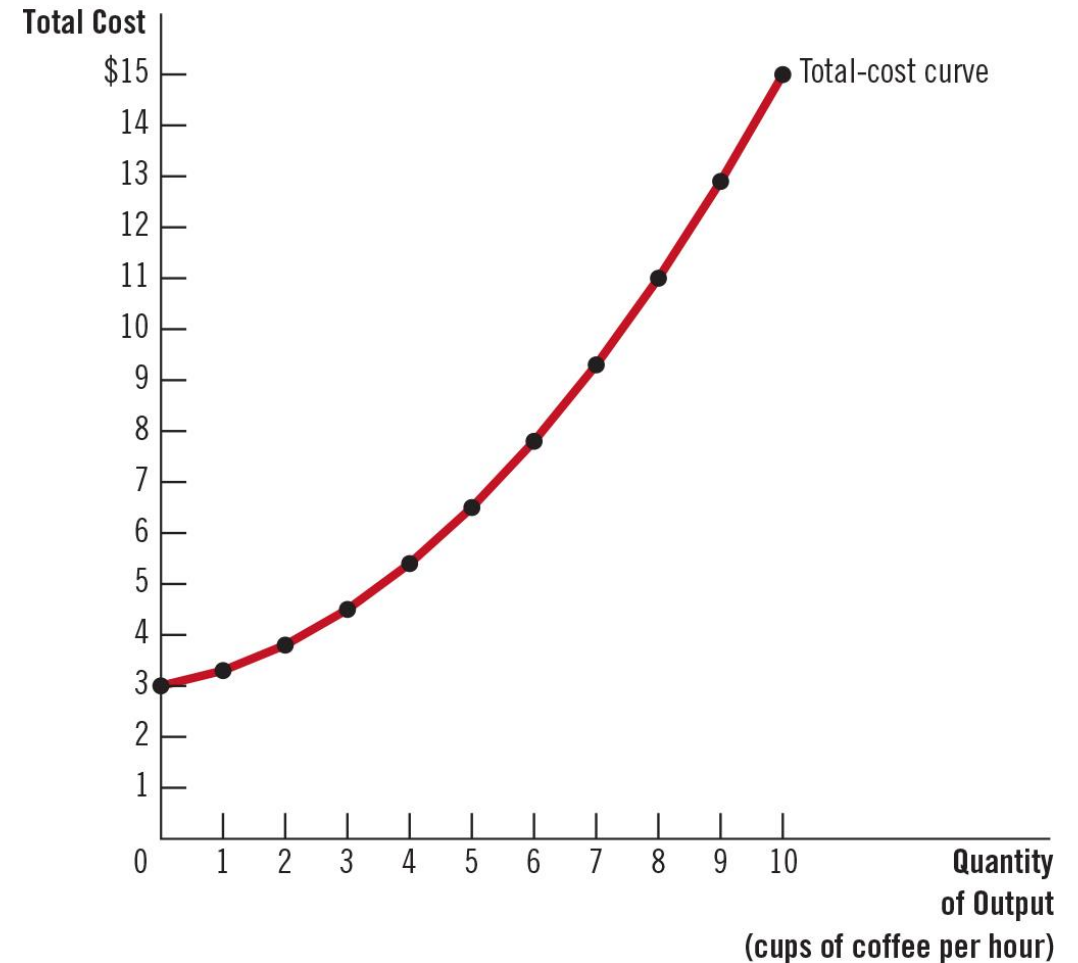
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Table 2 The Various Measures of Cost: Caleb's Coffee Shop

(1) Output (cups of coffee per hour)	(2) Total Cost	(3) Fixed Cost	(4) Variable Cost	(5) Average Fixed Cost	(6) Average Variable Cost	(7) Average Total Cost	(8) Marginal Cost
0	\$3.00	\$3.00	\$0.00				
1	3.30	3.00	0.30	\$3.00	\$0.30	\$3.30	\$0.30
2	3.80	3.00	0.80	1.50	0.40	1.90	0.50
3	4.50	3.00	1.50	1.00	0.50	1.50	0.70
4	5.40	3.00	2.40	0.75	0.60	1.35	0.90
5	6.50	3.00	3.50	0.60	0.70	1.30	1.10
6	7.80	3.00	4.80	0.50	0.80	1.30	1.30
7	9.30	3.00	6.30	0.43	0.90	1.33	1.50
8	11.00	3.00	8.00	0.38	1.00	1.38	1.70
9	12.90	3.00	9.90	0.33	1.10	1.43	1.90
10	15.00	3.00	12.00	0.30	1.20	1.50	2.10

Figure 3 Caleb's Total-Cost Curve

- Here, the quantity of output produced (on the horizontal axis) is from column (1) in Table 2, and the total cost (on the vertical axis) is from column (2).
- As in Figure 2, the total-cost curve gets steeper as the quantity of output increases, reflecting diminishing marginal product.



Average and Marginal Cost (1 of 2)

- **Average total cost***

- Total cost divided by the quantity of output

$$ATC = TC/Q$$

- **Average fixed cost***

- Fixed cost divided by the quantity of output

- **Average variable cost***

- Variable cost divided by the quantity of output

*Words accompanied by an asterisk are key terms from the chapter.

Average and Marginal Cost (2 of 2)

- **Marginal cost***

- The increase in total cost that arises from an extra unit of production
- Marginal cost = Change in total cost/Change in quantity

$$MC = \Delta TC / \Delta Q$$

*Words accompanied by an asterisk are key terms from the chapter.

Table 2 The Various Measures of Cost: Caleb's Coffee Shop

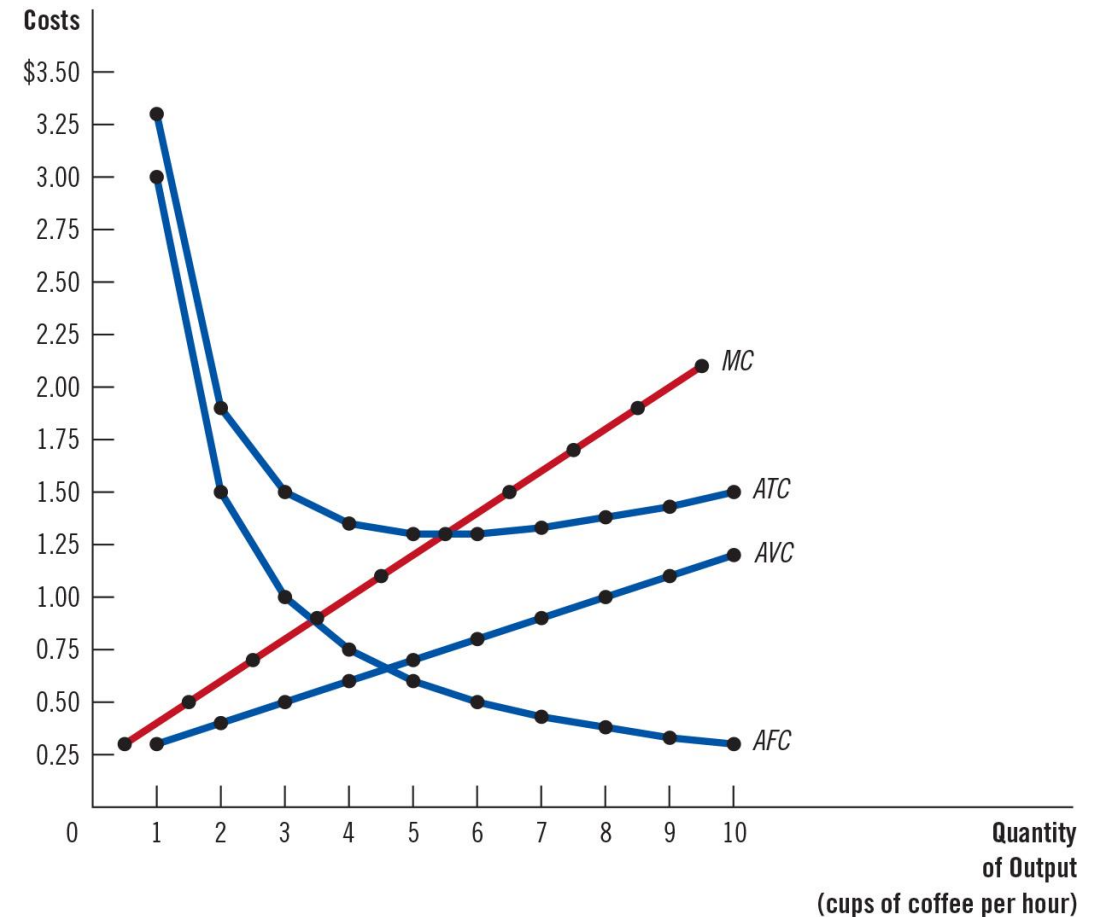
(1) Output (cups of coffee per hour)	(2) Total Cost	(3) Fixed Cost	(4) Variable Cost	(5) Average Fixed Cost	(6) Average Variable Cost	(7) Average Total Cost	(8) Marginal Cost
0	\$3.00	\$3.00	\$0.00				
1	3.30	3.00	0.30	\$3.00	\$0.30	\$3.30	\$0.30
2	3.80	3.00	0.80	1.50	0.40	1.90	0.50
3	4.50	3.00	1.50	1.00	0.50	1.50	0.70
4	5.40	3.00	2.40	0.75	0.60	1.35	0.90
5	6.50	3.00	3.50	0.60	0.70	1.30	1.10
6	7.80	3.00	4.80	0.50	0.80	1.30	1.30
7	9.30	3.00	6.30	0.43	0.90	1.33	1.50
8	11.00	3.00	8.00	0.38	1.00	1.38	1.70
9	12.90	3.00	9.90	0.33	1.10	1.43	1.90
10	15.00	3.00	12.00	0.30	1.20	1.50	2.10

Cost Curves and Their Shapes

- Rising marginal cost
 - Marginal cost rises as the quantity of output produced increases
 - Upward slope reflects diminishing marginal product

Figure 4 Caleb's Average-Cost and Marginal-Cost Curves

- This figure shows the average total cost (ATC), average fixed cost (AFC), average variable cost (AVC), and marginal cost (MC) for Caleb's Coffee Shop.
- These curves are all obtained by graphing the data in Table 2. They show three common features:
 - (1) Marginal cost rises with the quantity of output.
 - (2) The average-total-cost curve is U-shaped.
 - (3) The marginal-cost curve crosses the average-total-cost curve at the minimum of average total cost.



U-Shaped Average Total Cost

- Bottom of the U-shape occurs at the quantity that minimizes average total cost
- This quantity is sometimes called the **efficient scale*** of the firm
 - When $MC < ATC$: Average total cost is falling
 - When $MC > ATC$: Average total cost is rising
- The marginal-cost curve crosses the average-total-cost curve at its minimum

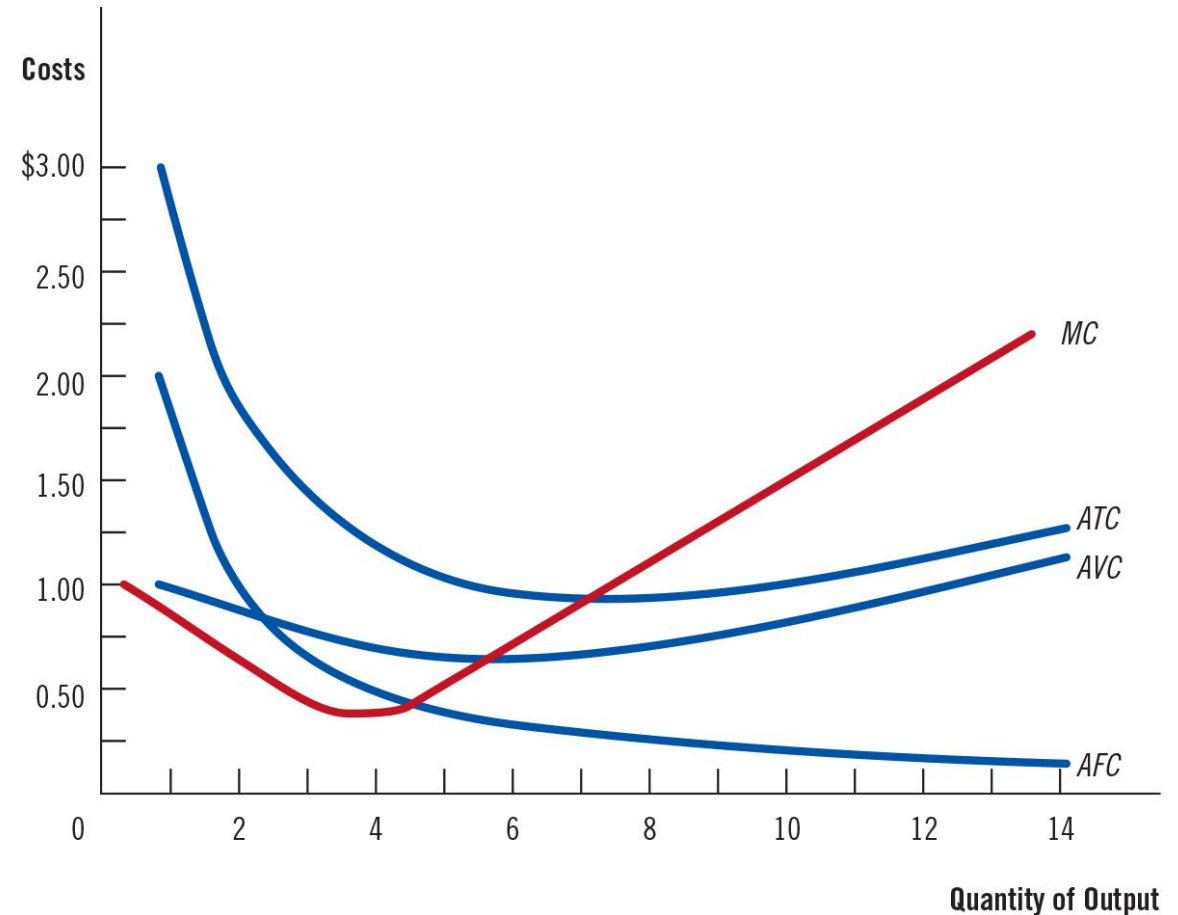
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Typical Cost Curves

- In many businesses, marginal product does not start to fall immediately after the first worker is hired
- The second or third worker might have a higher marginal product than the first because a team of workers can divide tasks and work more productively than one person
- Marginal cost eventually rises with the quantity of output
- Average-total-cost curve is U-shaped
- Marginal-cost curve crosses the average-total-cost curve at the minimum of average total cost

Figure 5 Cost Curves for a Typical Firm

- Many firms experience increasing marginal product before diminishing marginal product. As a result, they have cost curves shaped like those in this figure.
- Notice that marginal cost and average variable cost fall for a while before starting to rise.



Active Learning 3: Calculating Costs

<i>Q</i>	<i>TC</i>	<i>VC</i>	<i>AFC</i>	<i>AVC</i>	<i>ATC</i>	<i>MC</i>
0		\$50	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	
1	10			\$10	\$60.00	\$10
2	30	80				
3			16.67	20	36.67	30
4	100	150	12.50		37.50	
5	150			30		
6	210	260	8.33	35	43.33	60

Active Learning 3: Answers

<i>Q</i>	<i>TC</i>	<i>VC</i>	<i>AFC</i>	<i>AVC</i>	<i>ATC</i>	<i>MC</i>
0	\$0	\$50	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	
1	10	60	\$50.00	\$10	\$60.00	\$10
2	30	80	25.00	15	40.00	20
3	60	110	16.67	20	36.67	30
4	100	150	12.50	25	37.50	40
5	150	200	10.00	30	40.00	50
6	210	260	8.33	35	43.33	60

14-4

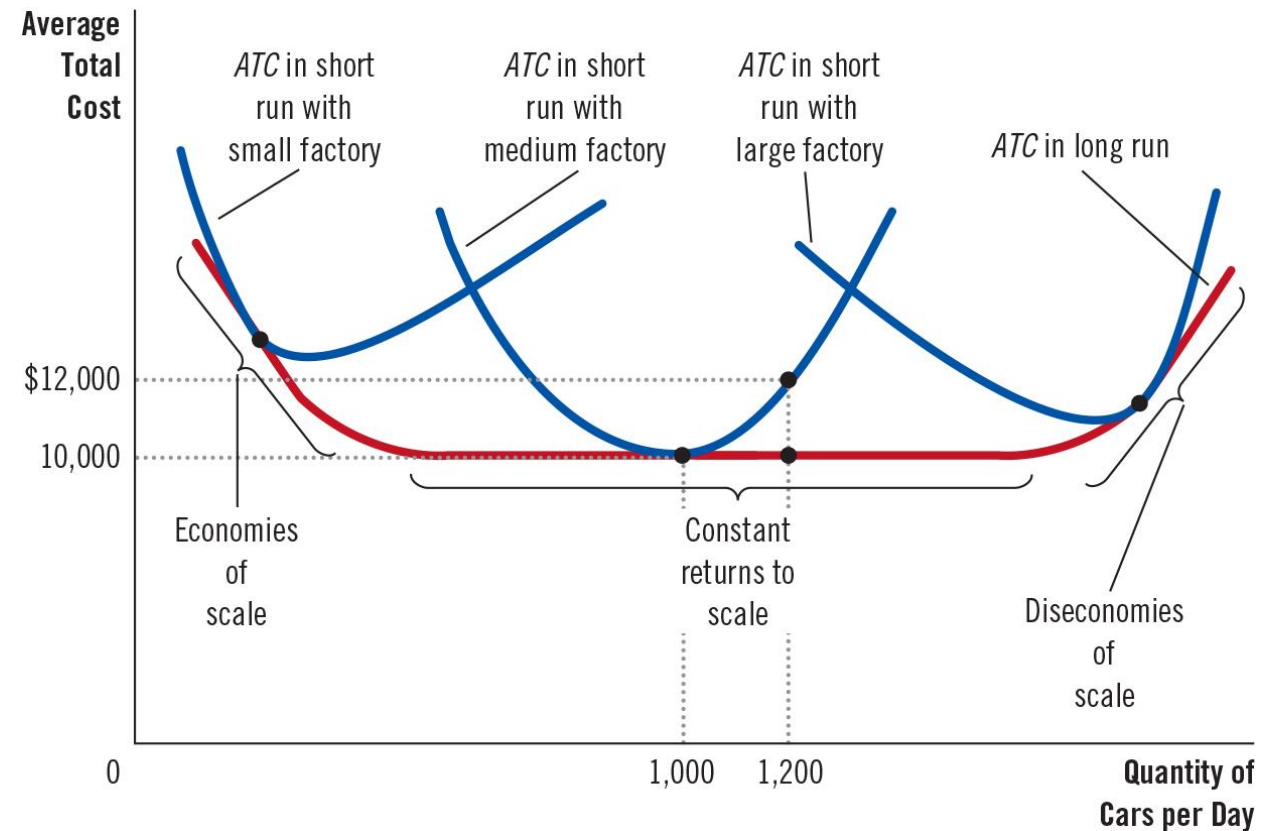
Costs in the Short Run and in the Long Run

The Relationship between Short-Run and Long-Run Average Total Cost

- Many decisions are
 - Fixed in the short run
 - Variable in the long run
- Firms have greater flexibility in the long-run
- Long-run cost curves differ from short-run cost curves
 - Much flatter than short-run cost curves
- Short-run cost curves
 - Lie on or above the long-run cost curves

Figure 6 Average Total Cost in the Short and Long Runs

- This graph shows how short-run and long-run costs are related
- As Ford moves along the long-run curve, it adjusts the size of the factory to the quantity of production
- In the long run, Ford gets to choose which short-run curve it wants. But in the short run, it has to use whatever short-run curve it already has, determined by decisions made in the past



Economies and Diseconomies of Scale (1 of 2)

- The shape of the long-run average-total-cost curve tells us how costs vary with the **scale** (size) of a firm's operations
- **Economies of scale***
 - Long-run average total cost falls as the quantity of output increases
- **Constant returns to scale***
 - Long-run average total cost stays the same as the quantity of output changes
- **Diseconomies of scale***
 - Long-run average total cost rises as the quantity of output increases

Economies and Diseconomies of Scale (2 of 2)

- Economies of scale often arise because higher production levels allow **specialization** among workers
 - If Ford hires a large number of workers and produces many cars, it can reduce costs using modern assembly-line production
- Diseconomies of scale can arise because of **coordination problems** that often occur in large organizations
 - The more cars Ford produces, the more stretched the management team becomes, and the less effective the managers become at keeping costs down
- Hence long-run average-total-cost curves are often **U-shaped**

14-5

Conclusion

Table 3 The Many Types of Cost: A Summary (1 of 2)

Term	Definition	Mathematical Description
Explicit costs	Costs that require an outlay of money by the firm	
Implicit costs	Costs that do not require an outlay of money by the firm	
Fixed costs	Costs that do not vary with the quantity of output produced	FC
Variable costs	Costs that vary with the quantity of output produced	VC
Total cost	The market value of all the inputs that a firm uses in production	$TC = FC + VC$

Table 3 The Many Types of Cost: A Summary (2 of 2)

Term	Definition	Mathematical Description
Average fixed cost	Fixed cost divided by the quantity of output	$AFC = FC/Q$
Average variable cost	Variable cost divided by the quantity of output	$AVC = VC/Q$
Average total cost	Total cost divided by the quantity of output	$ATC = TC/Q$
Marginal cost	The increase in total cost that arises from an extra unit of production	$MC = \Delta TC / \Delta Q$

Think-Pair-Share Activity

Your neighbor has a back-yard garden and grows fresh fruit and vegetables to be sold at a local “farmer’s market.” He comments, “I hired a college student who was on summer vacation to help me this summer and my production more than doubled. Next summer, I think I’ll hire three helpers and my output should go up more than three- or fourfold.”

- A. What can explain why the production more than doubled when your neighbor hired a helper?
- B. Will production increase three- or fourfold if your neighbor hires 3 helpers next summer?

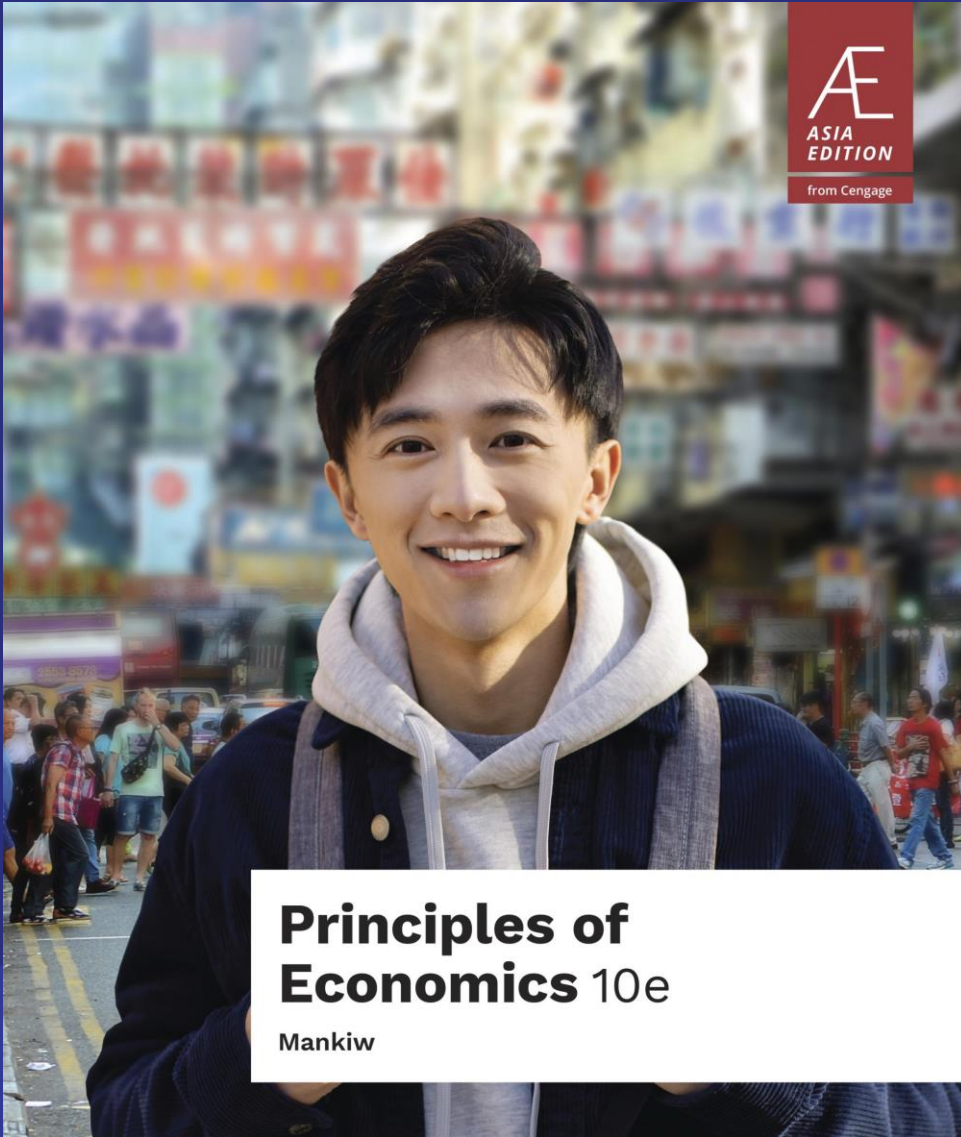
Self-Assessment

- When analyzing a firm's behavior, why is it important to include all the opportunity costs of production?

Summary

Click the link to review the objectives for this presentation.

[Link to Objectives](#)



Principles of Economics, 10e

Chapter 15: Firms in Competitive Markets

Chapter Objectives (1 of 2)

By the end of this chapter, you should be able to:

- Graph a firm's supply curve for a good, given a graph of a competitive firm's marginal cost curve.
- Describe the characteristics of a perfectly competitive market.
- Identify a market as perfectly competitive, monopolistically competitive, monopolistic, or oligopolistic.
- Given the market price of a good, compute a competitive firm's average revenue at various quantities.
- Compute a competitive firm's marginal revenue at various quantities using the market price of a good.

Chapter Objectives (2 of 2)

- Determine the profit-maximizing outcome of a competitive firm using the market price and the firm's production costs.
- Determine the shutdown price in the short run for a competitive firm, given a graph of the firm's production costs.
- Indicate the area on a graph that represents a competitive firm's profit or loss.
- Given a graph of a competitive firm's marginal cost curve, derive the firm's supply curve for that good.
- Explain why the long-run supply curve in a competitive market is more elastic than the short-run supply curve.

15-1

What Is a Competitive Market?

The Meaning of Competition

- **Competitive market***
 - A market with many buyers and sellers trading identical products so that each buyer and seller is a price taker
- Characteristics
 - Market has many buyers and many sellers
 - Goods offered by the various sellers are identical
 - Firms can freely enter or exit the market

*Words accompanied by an asterisk are key terms from the chapter.

The Revenue of a Competitive Firm (1 of 2)

- Firm aims to maximize profit
- **Average revenue***
 - Total revenue divided by the quantity sold
- **Marginal revenue***
 - Change in total revenue from an additional unit sold

*Words accompanied by an asterisk are key terms from the chapter.

The Revenue of a Competitive Firm (2 of 2)

- For all types of firms, average revenue equals the price of the good
- For competitive firms,
 - Total revenue is $P \times Q$, and P is fixed
 - When Q rises by 1 unit, total revenue rises by P dollars
 - Therefore, marginal revenue equals the price of the good

Table 1 Total, Average, and Marginal Revenue for a Competitive Firm

(1) Quantity (Q)	(2) Price (P)	(3) Total Revenue ($TR = P \times Q$)	(4) Average Revenue ($AR = TR / Q$)	(5) Marginal Revenue ($MR = \Delta TR / \Delta Q$)
1 gallon	\$6	\$6	\$6	
				\$6
2	6	12	6	
				6
3	6	18	6	
				6
4	6	24	6	
				6
5	6	30	6	
				6
6	6	36	6	
				6
7	6	42	6	
				6
8	6	48	6	

15-2

Profit Maximization and the Competitive Firm's Supply Curve

Rules for Profit Maximization (1 of 2)

- Goal of a firm: Maximize profit = $TR - TC$
 - $TR = P \times Q$ and $TC = FC + VC$
- Find Q by comparing marginal revenue and marginal cost of each unit produced
 - If $MR > MC$, the firm should increase its output
 - If $MC > MR$, the firm should decrease its output
 - At the profit-maximizing level of output, $MR = MC$

Rules for Profit Maximization (2 of 2)

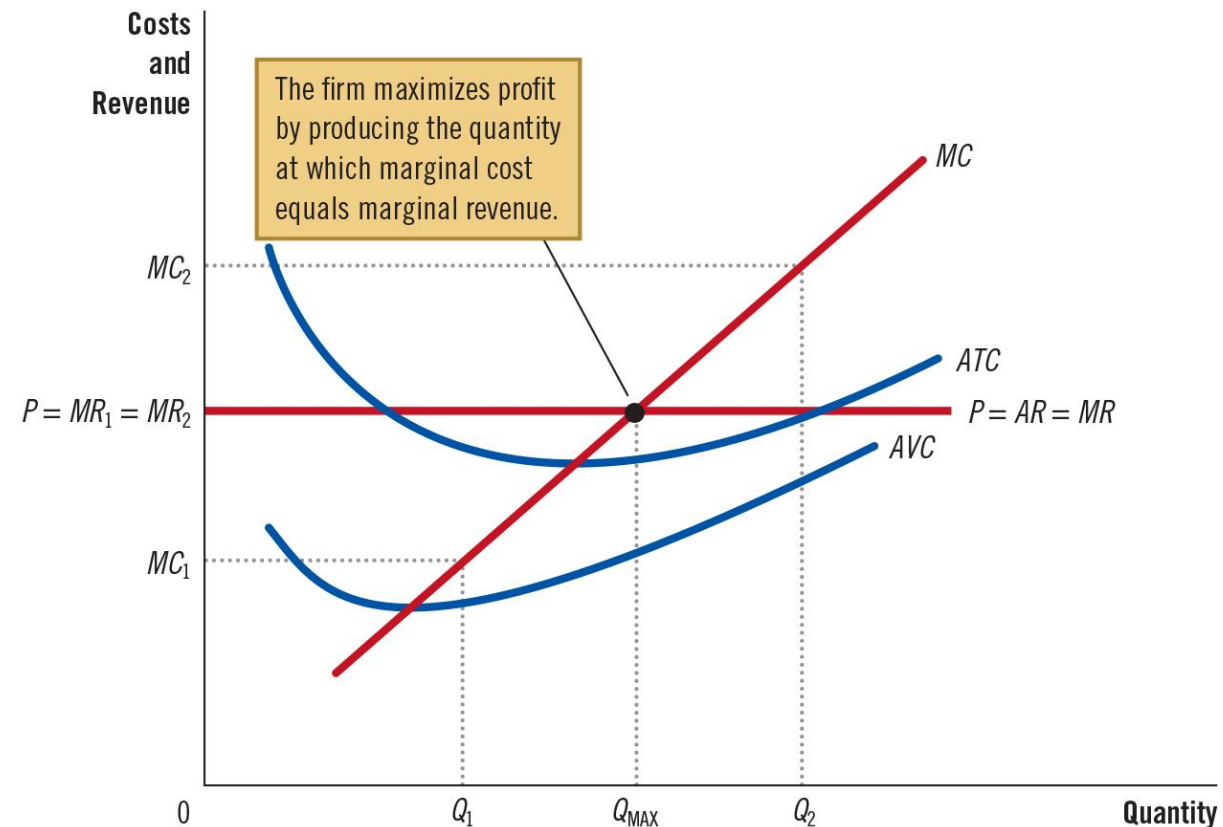
- Marginal-cost curve
 - Determines the quantity of the good the firm is willing to supply at any price, is also the supply curve

Table 2 Profit Maximization: A Numerical Example

(1) Quantity (Q)	(2) Total Revenue ($TR = P \times Q$)	(3) Total Cost (TC)	(4) Profit ($TR - TC$)	(5) Marginal Revenue ($MR = \Delta TR / \Delta Q$)	(6) Marginal Cost ($MC = \Delta TC / \Delta Q$)	(7) Change in Profit ($MR - MC$)
0 gallons	\$0	\$3	-\$3			
				\$6	\$2	\$4
1	6	5	1			
				6	3	3
2	12	8	4			
				6	4	2
3	18	12	6			
				6	5	1
4	24	17	7			
				6	6	0
5	30	23	7			
				6	7	-1
6	36	30	6			
				6	8	-2
7	42	38	4			
				6	9	-3
8	48	47	1			

Figure 1 Profit Maximization for a Competitive Firm

- This figure shows the marginal-cost curve (MC), the average-total-cost curve (ATC), and the average-variable-cost curve (AVC). It also shows the market price (P), which for a competitive firm equals both marginal revenue (MR) and average revenue (AR).
- At the quantity Q_1 , marginal revenue MR_1 exceeds marginal cost MC_1 , so raising production increases profit. At the quantity Q_2 , marginal cost MC_2 is above marginal revenue MR_2 , so reducing production increases profit. The profit-maximizing quantity, Q_{MAX} , is found where the horizontal line representing the price intersects the marginal-cost curve.

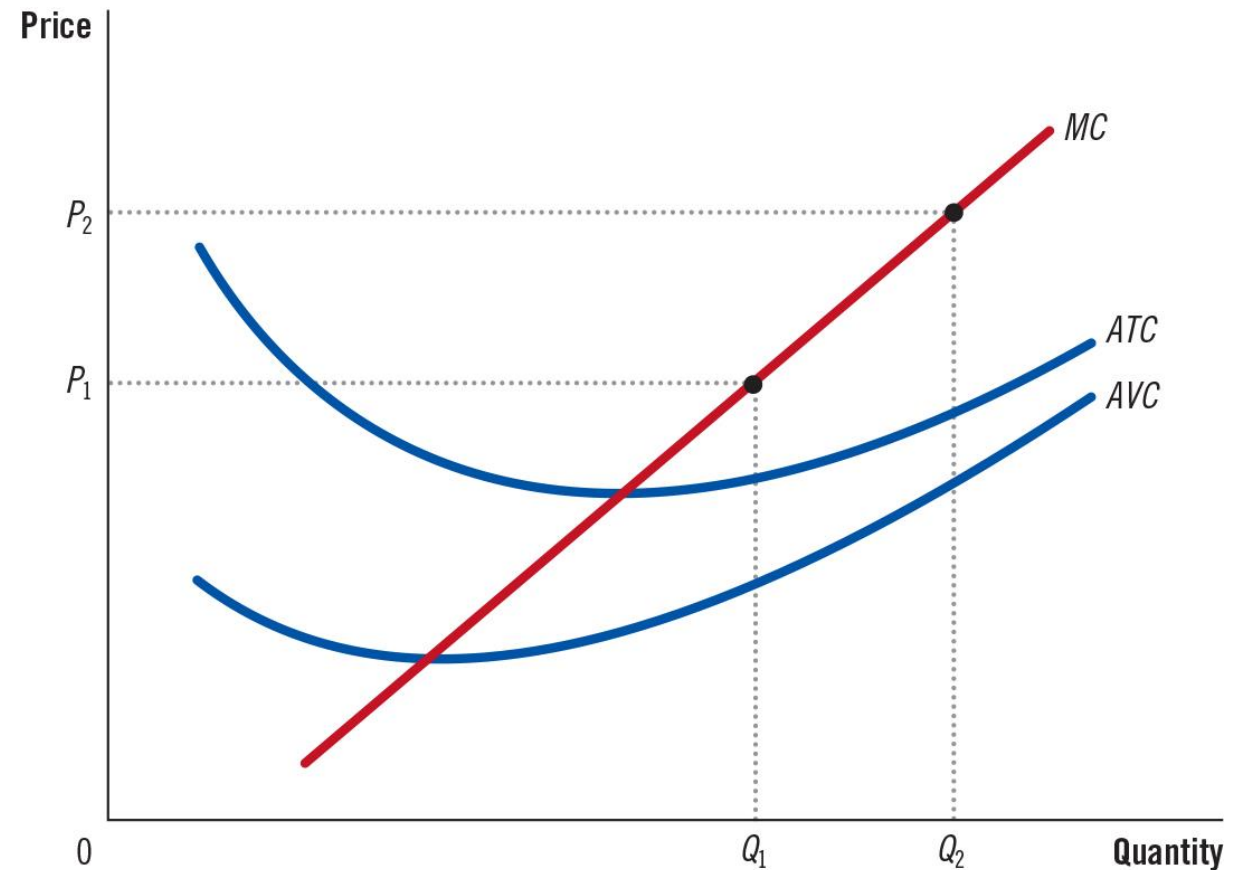


The Marginal-Cost Curve and the Firm's Supply Decision

- The marginal-cost curve and the firm's supply decision
 - MC curve is upward sloping
 - ATC curve is U-shaped
 - MC curve crosses the ATC curve at the minimum of ATC curve
 - $P = AR = MR$

Figure 2 Marginal Cost as the Competitive Firm's Supply Curve

- An increase in the price from P_1 to P_2 leads to an increase in the firm's profit-maximizing quantity from Q_1 to Q_2 .
- Because the marginal-cost curve shows the quantity supplied at any price, it is the firm's supply curve.



The Firm's Short-Run Decision to Shut Down

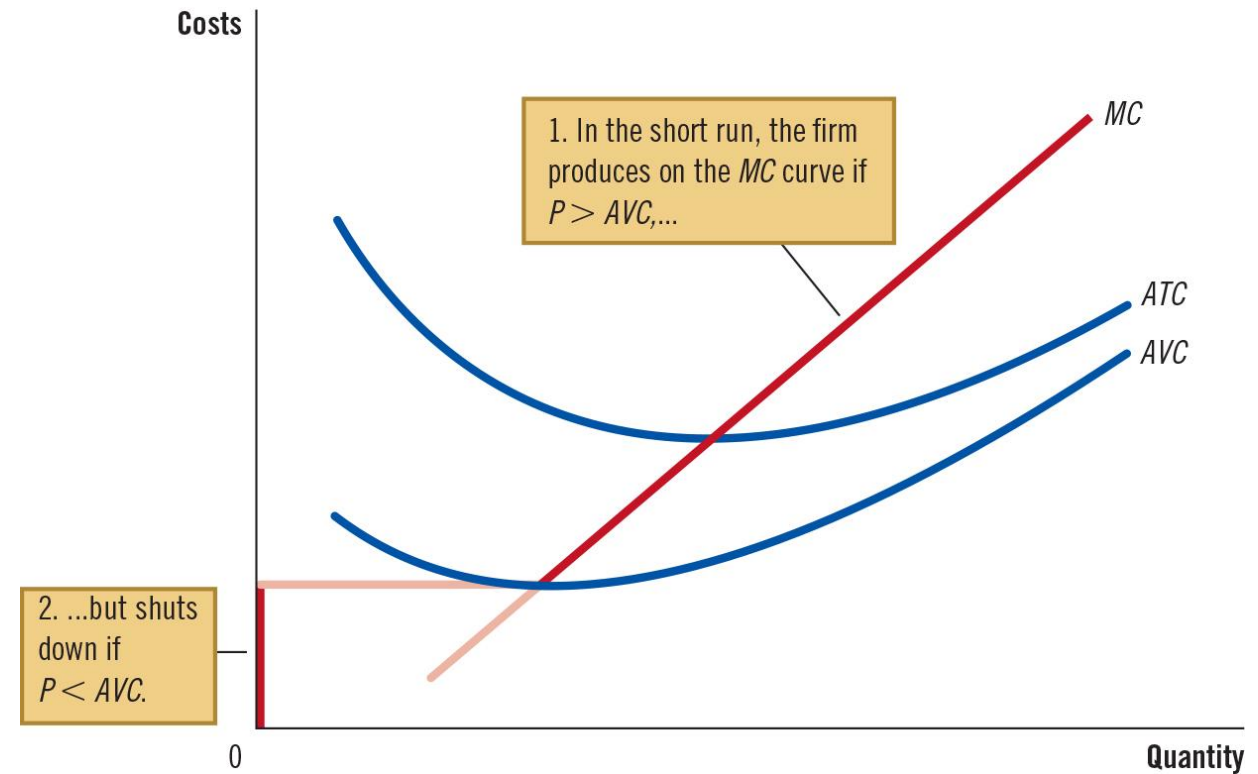
- Shutdown
 - Short-run decision not to produce anything during a specific period of time because of current market conditions
 - Firm has to pay fixed costs
- Exit
 - Long-run decision to leave the market
 - Firm has zero costs

Shut Down

- Cost of shutting down
 - Revenue loss = TR
- Benefit of shutting down
 - Cost savings = VC
- The firm's short-run decision
 - Shut down if $TR < VC$ (or $P < AVC$)
- Short-run supply curve is portion of its marginal-cost curve that is above the average variable cost

Figure 3 The Competitive Firm's Short-Run Supply Curve

- In the short run, the competitive firm's supply curve is the portion of its marginal-cost curve (MC) that lies above its average-variable-cost curve (AVC).
- If the price falls below average variable cost, the firm is better off shutting down temporarily.



Spilt Milk and Other Sunk Costs

- **Sunk cost***
 - A cost that has already been committed and cannot be recovered
 - Should be ignored when making decisions
 - In the short run, fixed costs are sunk costs
 - FC should not matter in the decision to shut down

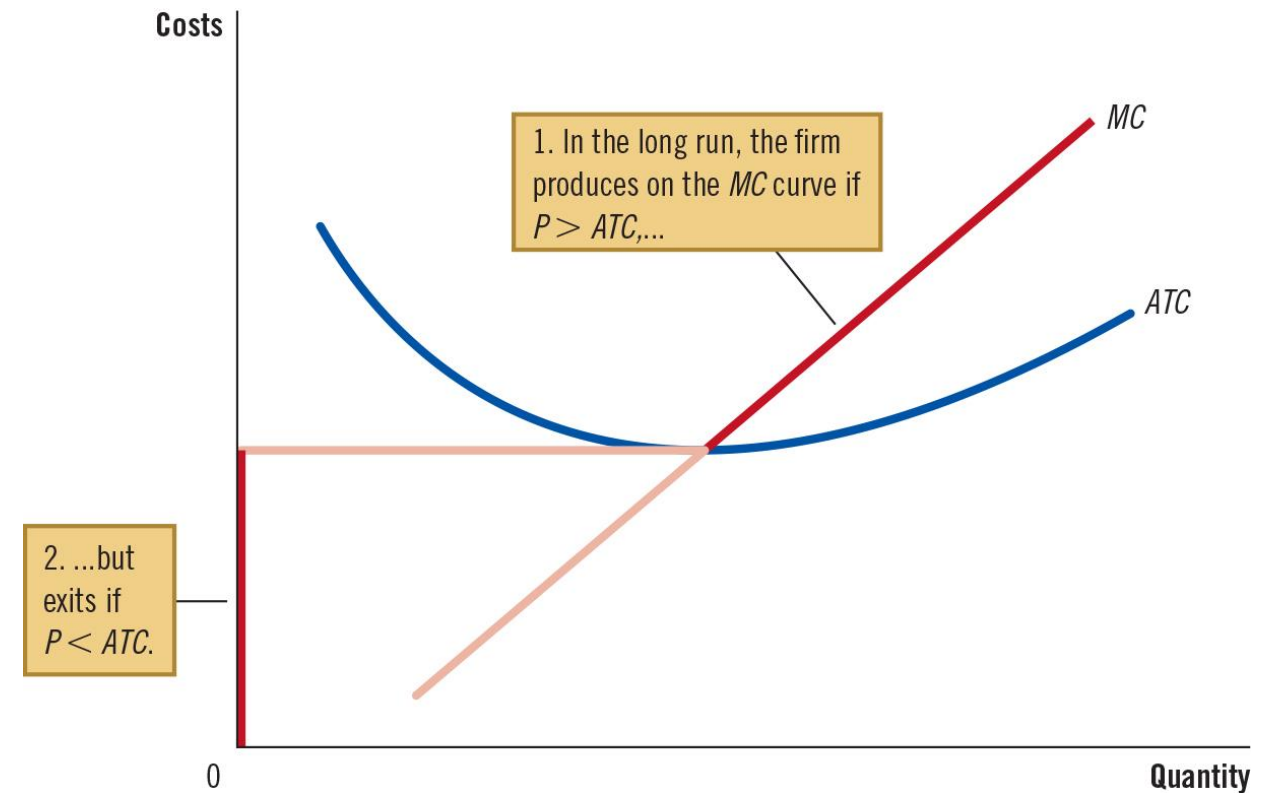
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The Firm's Long-Run Decision to Exit or Enter a Market

- Cost of exiting market = Revenue loss = TR
- Benefit of exiting market = Cost savings = TC
- The firm's long-run decision
 - Exit if $TR < TC$ (or $P < ATC$)
 - Enter if $TR > TC$ (or $P > ATC$)
- Long-run supply curve is portion of its marginal-cost curve that is above the average-total-cost curve

Figure 4 The Competitive Firm's Long-Run Supply Curve

- In the long run, the competitive firm's supply curve is the portion of its marginal-cost curve (MC) that lies above its average-total-cost curve (ATC).
- If the price falls below average total cost, the firm is better off exiting the market.



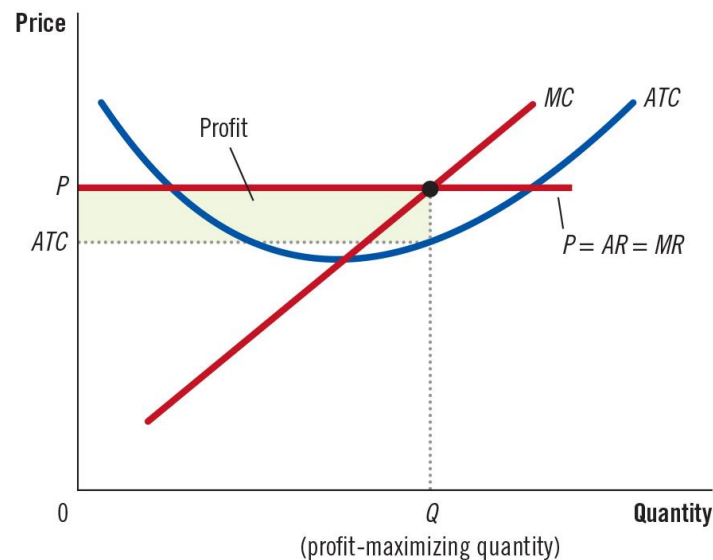
Measuring Profit in Our Graph for the Competitive Firm

- Maximizing profit
 - If $P > ATC$
 - Profit = $TR - TC = (P - ATC) \times Q$
- Minimizing losses
 - If $P < ATC$
 - Loss = $TC - TR = (ATC - P) \times Q$

Figure 5 Profit as the Area between Price and Average Total Cost

The area of the shaded box between price and average total cost represents the firm's profit. The height of this box is price minus average total cost ($P - ATC$), and the width of the box is the quantity of output (Q). In panel (a), price is greater than average total cost, so the firm has positive profit. In panel (b), price is less than average total cost, so the firm incurs a loss.

(a) A Firm with Profits



(b) A Firm with Losses

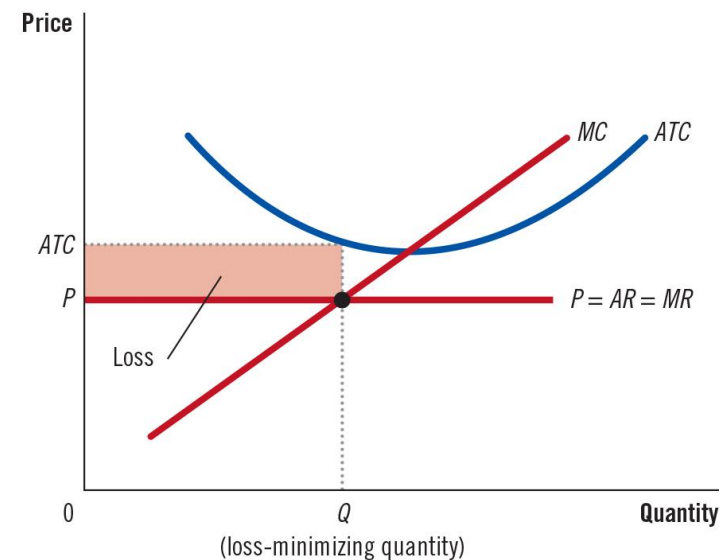
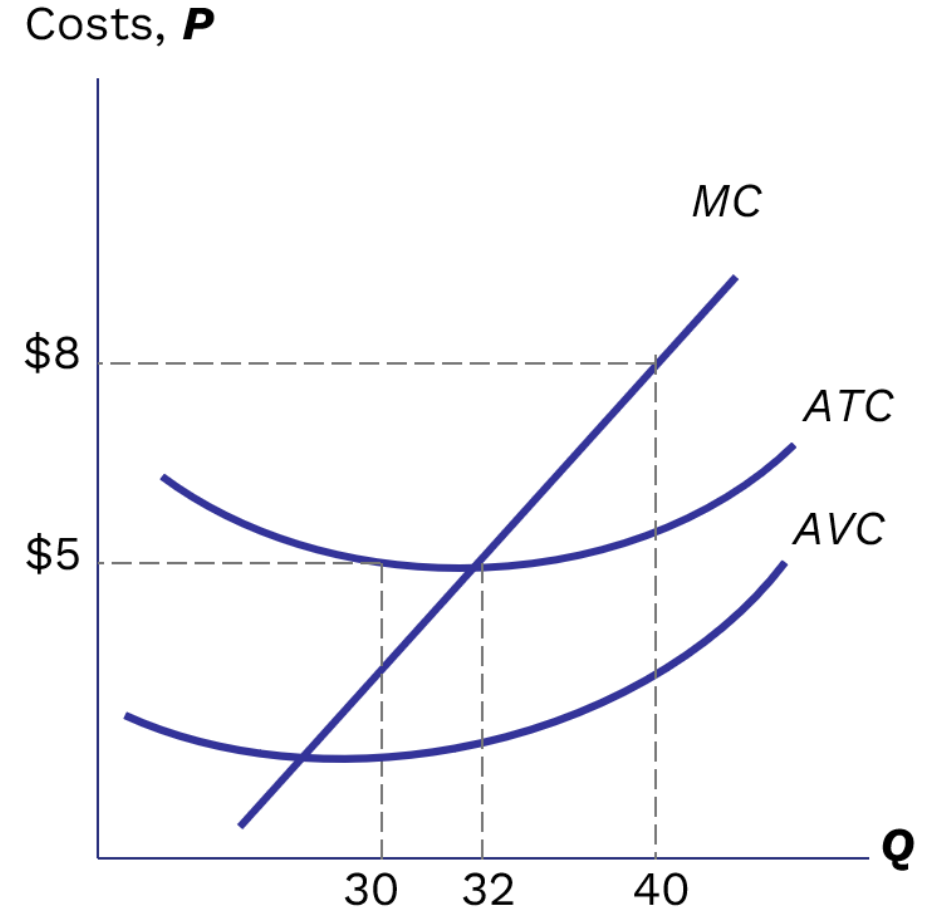


Table 3 Profit-Maximizing Rules for a Competitive Firm

1. Find Q at which $P = MC$
2. If $P < AVC$, shut down immediately and remain out of business
3. If $AVC < P < ATC$, operate in the short run but exit in the long run
4. If $ATC < P$, stay in business and enjoy your profits!

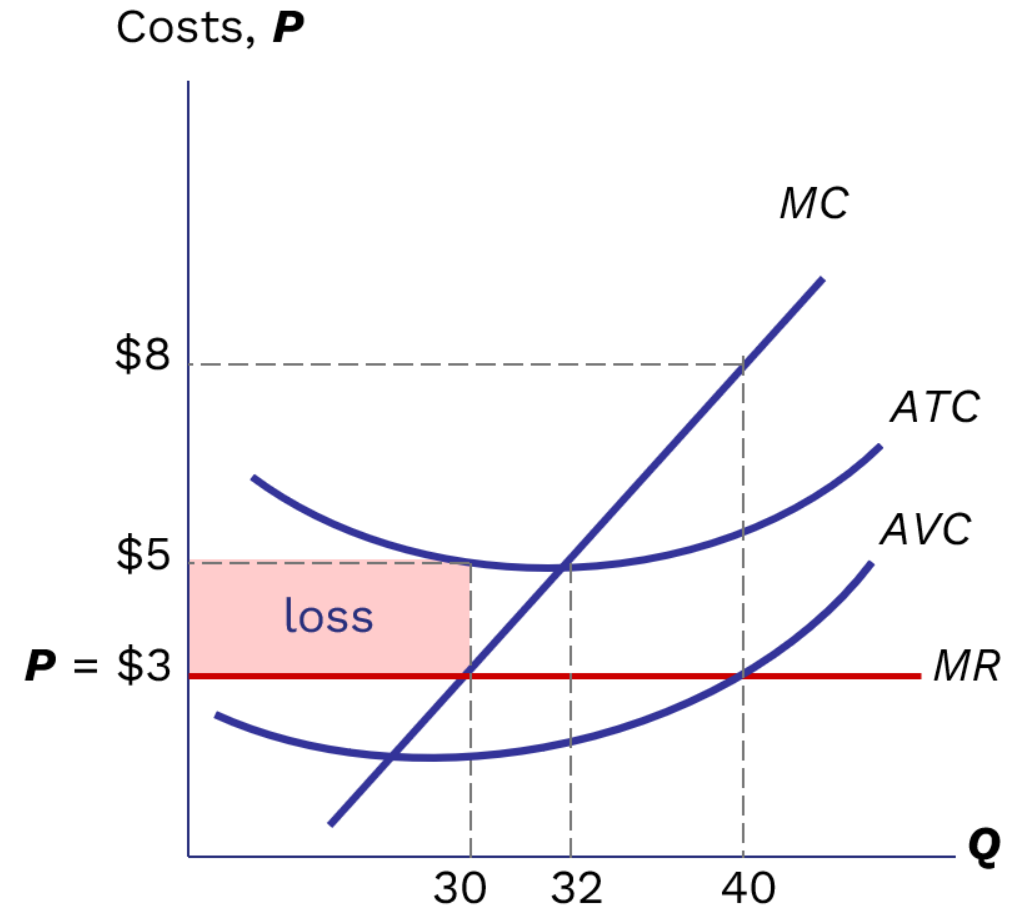
Active Learning 1: Identifying Profit or Loss

- Determine this firm's profit or loss
 - Calculate TR , TC
 - Calculate profit (or loss)
 - Identify the profit or loss area on the graph



Active Learning 1: Answers

- Find Q where $MR = MC$
- For $Q = 30$, $ATC = \$5$
- $P < ATC$, it's a loss
- $P > AVC$: keep producing
- Loss = $(ATC - P) \times Q = \$60$



15-3

The Supply Curve in a Competitive Market

The Short Run: Market Supply with a Fixed Number of Firms

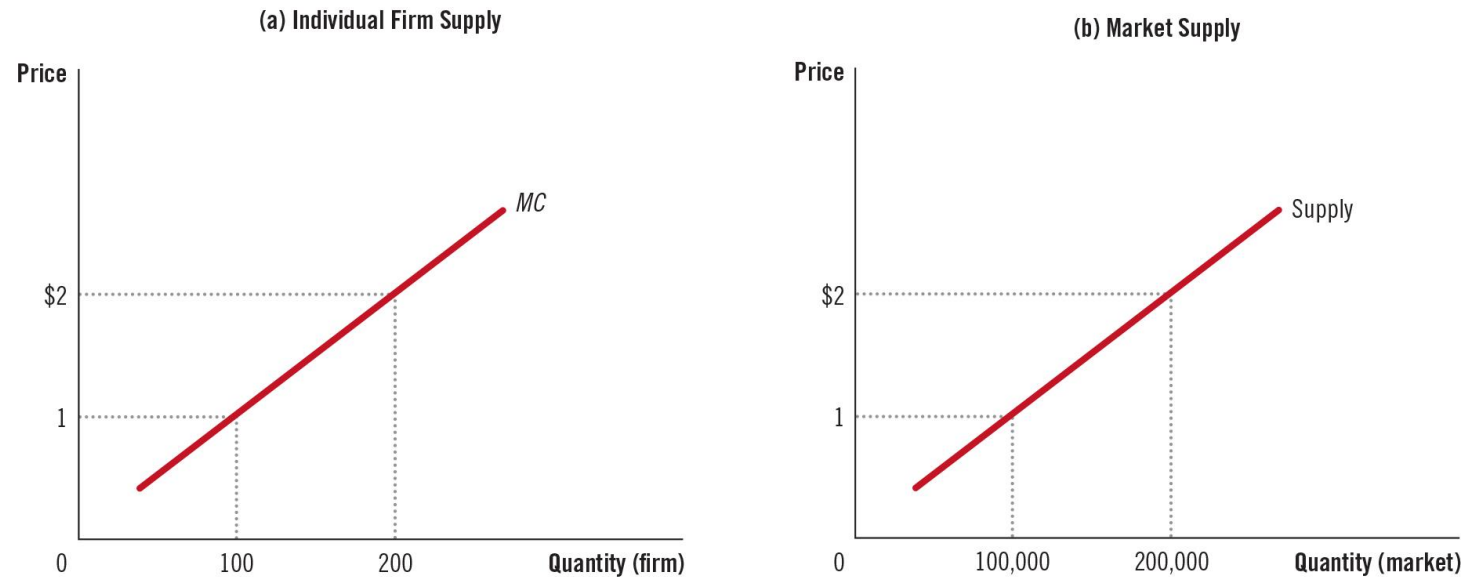
- Assumptions
 - All existing firms and potential entrants have identical cost curves
 - Each firm's costs do not change as other firms enter or exit the market
- Number of firms
 - Fixed in the short run (due to fixed costs)
 - Variable in the long run (due to free entry and exit)

Short Run Market Supply Curve

- As long as $P > AVC$
 - Each firm will produce its profit-maximizing quantity, where $MR = MC$
- For $P > AVC$: Supply curve is MC curve

Figure 6 Short-Run Market Supply

In the short run, the number of firms in the market is fixed. As a result, the market supply curve, shown in panel (b), reflects the sum of individual firms' marginal-cost curves, shown in panel (a). Here, in a market of 1,000 identical firms, the quantity of output supplied to the market is 1,000 times the quantity supplied by each firm.



The Long Run: Market Supply with Entry and Exit (1 of 2)

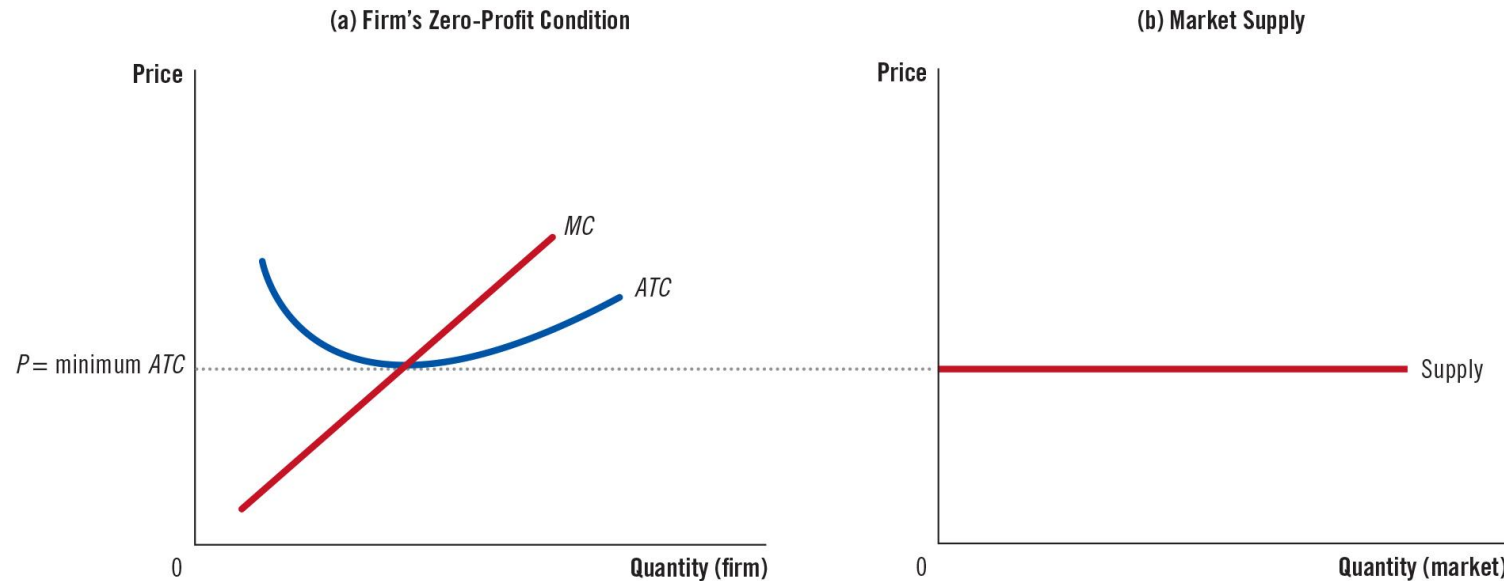
- Firms can enter and exit the market
- If $P > ATC$, firms make positive profit
 - New firms enter the market
- If $P < ATC$, firms make negative profit
 - Firms exit the market

The Long Run: Market Supply with Entry and Exit (2 of 2)

- Process of entry and exit ends when
 - Firms still in market make zero economic profit
 - When price and average total cost are driven to equality
 - In the long run, $P = \min ATC$
- In the long-run equilibrium of a competitive market with free entry and exit, firms operate at their efficient scale

Figure 7 Long-Run Market Supply

In the long run, firms will enter or exit the market until profit is driven to zero. As a result, price equals the minimum of average total cost, as shown in panel (a). The number of firms adjusts to ensure that all demand is satisfied at this price. The long-run market supply curve is horizontal at this price, as shown in panel (b).



Why Do Competitive Firms Stay in Business If They Make Zero Profit?

- Profit = Total revenue – Total cost
- Total cost includes all opportunity costs
- Zero-profit equilibrium
 - Economic profit is zero
 - Accounting profit is positive

A Shift in Demand in the Short Run and Long Run (1 of 2)

- Long-run equilibrium: $P = \text{minimum } ATC$
- Increase in demand
 - Demand curve shifts outward
- Short run
 - Higher quantity
 - Higher price: $P > ATC$, positive economic profit

A Shift in Demand in the Short Run and Long Run (2 of 2)

- Long run
 - Firms enter the market
 - Short run supply curve shifts right
 - Price decreases back to *minimum ATC*
 - Quantity increases
- Because firms can enter and exit more easily in the long run than in the short run, the long-run supply curve is typically more elastic than the short-run supply curve

Figure 8 An Increase in Demand in the Short Run and Long Run (1 of 3)

Panel (a) shows a market in a long-run equilibrium at point A. In this equilibrium, each firm makes zero profit, and the price equals the minimum average total cost.

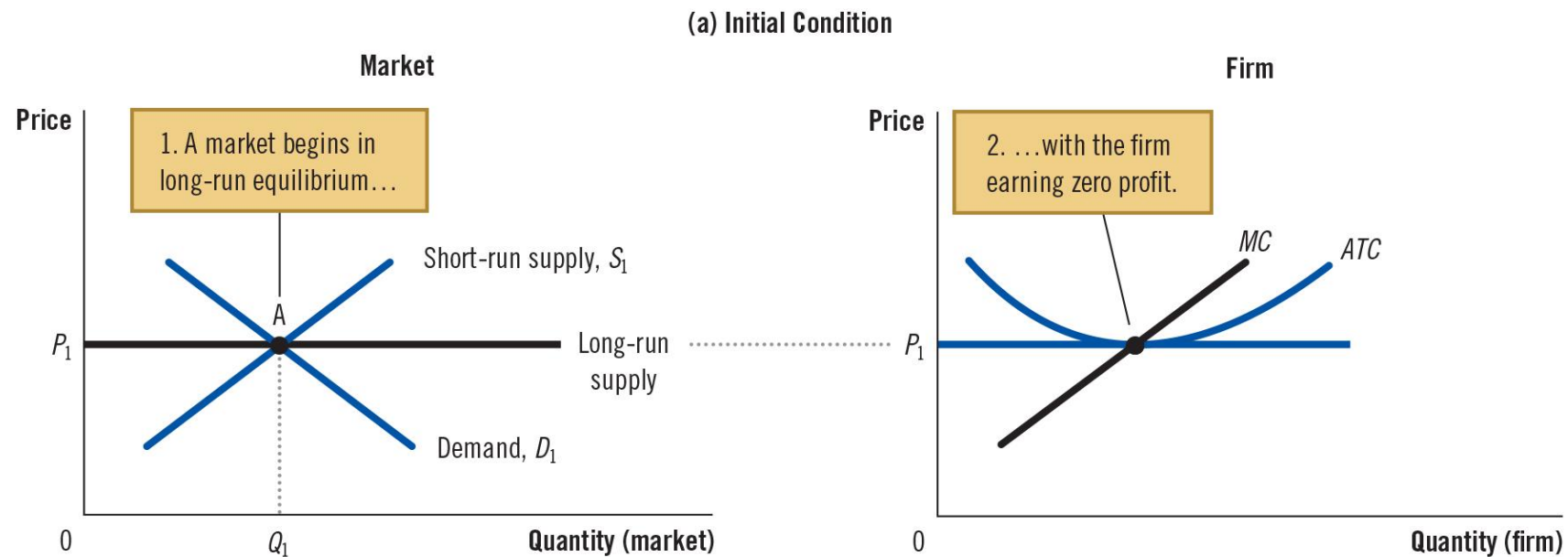


Figure 8 An Increase in Demand in the Short Run and Long Run (2 of 3)

Panel (b) shows what happens in the short run when demand rises from D_1 to D_2 . The equilibrium goes from point A to point B, price rises from P_1 to P_2 , and the quantity sold in the market rises from Q_1 to Q_2 . Because price now exceeds average total cost, each firm now makes a profit, which, over time, encourages new firms to enter the market.

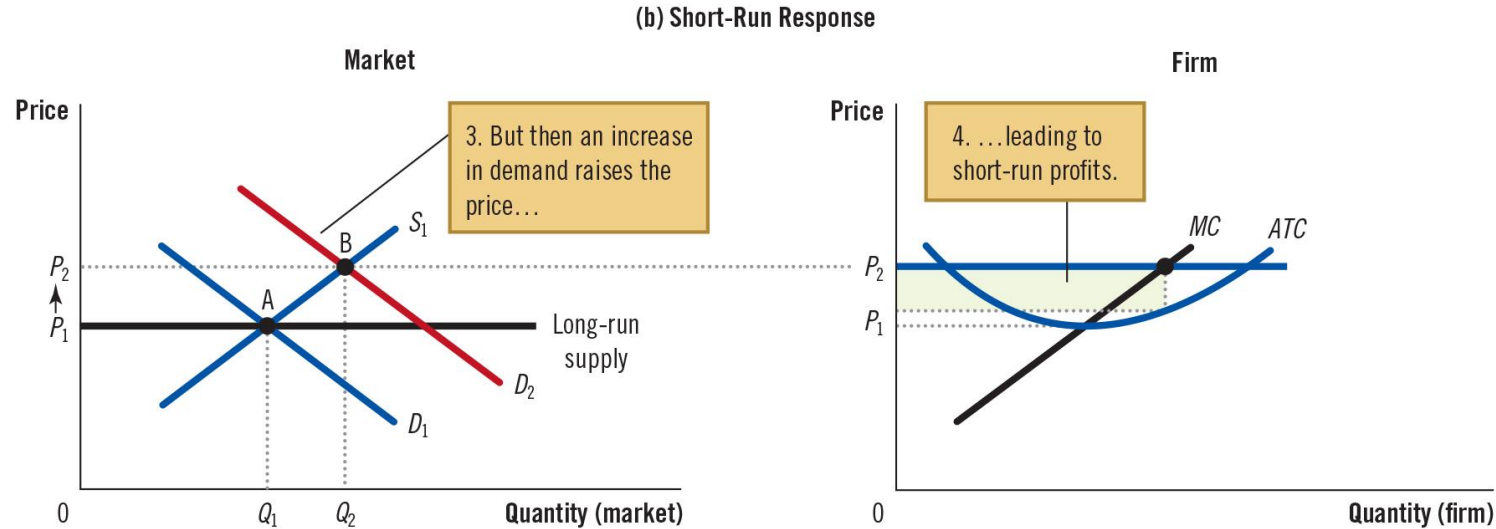
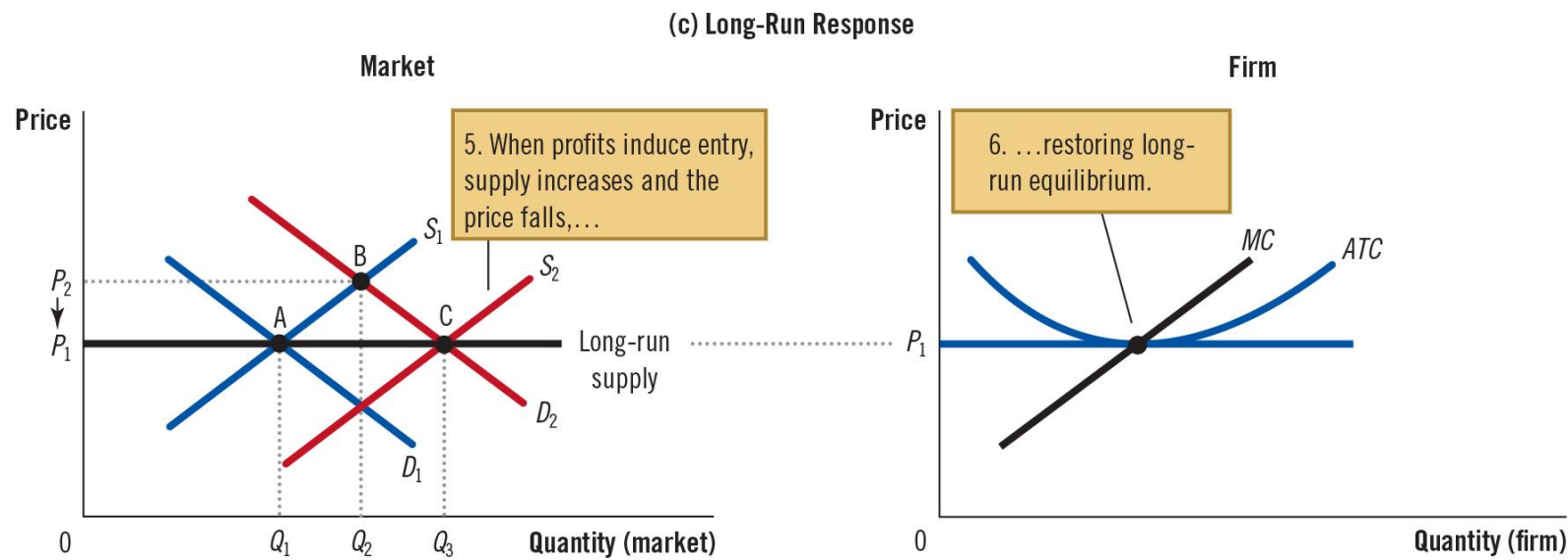


Figure 8 An Increase in Demand in the Short Run and Long Run (3 of 3)

Panel (c) shows how this entry shifts the short-run supply curve to the right from S_1 to S_2 . In the new long-run equilibrium, point C, price has returned to P_1 , but the quantity sold has increased to Q_3 . Profits are again zero, and price is back to the minimum of average total cost, but the market has more firms to satisfy the greater demand.



Why the Long-Run Supply Curve Might Slope Upward

- Long-run supply curve is horizontal if
 - All firms have identical costs
 - And costs do not change as other firms enter or exit the market
- Long-run supply curve might slope upward if
 - Firms have different costs
 - Or costs rise as firms enter the market

Long-Run Supply Curve (1 of 2)

- Costs rise as firms enter the market
 - In some industries, the supply of a key input is limited (e.g., amount of land suitable for farming is fixed)
 - The entry of new firms increases demand for this input, causing its price to rise
 - This increases all firms' costs
- Hence, an increase in P is required to increase the market quantity supplied, so the supply curve is upward-sloping

Long-Run Supply Curve (2 of 2)

- Firms have different costs
 - As P rises, firms with lower costs enter the market before those with higher costs.
 - Further increases in P make it worthwhile for higher-cost firms to enter the market, which increases market quantity supplied
 - Hence, long-run market supply curve slopes upward

15-4

Conclusion: Behind the Supply Curve

Conclusion

- Many of the tools developed here are also useful for studying firms in less competitive markets
- The next chapter examines the behavior of firms with market power
- Marginal analysis will again be useful, but it will have very different implications for a firm's production decisions and for the nature of market outcomes

Think-Pair-Share Activity

Walking into a Walmart store at 2:00 a.m. with a friend to buy some cat food, your friend says, “I can’t believe that these stores stay open all night. There are 10 shoppers in this store, and only one checkout lane is open. It doesn’t make any sense for this store to be open all night.”

- A. Why do you think this Walmart is open all night?
- B. Are the costs of rent, equipment, fixtures, salaries of management, and so on relevant when Walmart makes the decision whether to stay open all night?
- C. If Walmart had 10 customers during its daytime hours, do you think it would continue to operate?

Self-Assessment

- Are market supply curves typically more elastic in the short run or in the long run? Explain

Summary

Click the link to review the objectives for this presentation.

[Link to Objectives](#)