



# THIRD EDITION ECONOMICS and MICROECONOMICS

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## Chapter 12 Perfect Competition and the Supply Curve

## **WHAT YOU WILL LEARN IN THIS CHAPTER**

- What a perfectly competitive market is and the characteristics of a perfectly competitive industry
- How a price-taking producer determines its profit-maximizing quantity of output
- How to assess whether a producer is profitable and why an unprofitable producer may continue to operate in the short run
- Why industries behave differently in the short run than in the long run
- What determines the industry supply curve in both the short run and the long run



# Perfect Competition

- A **price-taking producer** is a producer whose actions have no effect on the market price of the good it sells.
- A **price-taking consumer** is a consumer whose actions have no effect on the market price of the good he or she buys.
- A **perfectly competitive market** is a market in which all market participants are price-takers.
- A **perfectly competitive industry** is an industry in which producers are price-takers.



## Two Necessary Conditions for Perfect Competition

- 1) For an industry to be perfectly competitive, it must contain many producers, none of whom have a large **market share**.
  - A producer's **market share** is the fraction of the total industry output accounted for by that producer's output.
- 2) An industry can be perfectly competitive only if consumers regard the products of all producers as equivalent.
  - A good is a **standardized product**, also known as a **commodity**, when consumers regard the products of different producers as the same good.





# FOR INQUIRING MINDS

## What's a Standardized Product?

- A perfectly competitive industry must produce a standardized product. People must think that these products are the same.
- Producers often go to great lengths to convince consumers that they have a distinctive, or differentiated, product even when they don't.
- So, is an industry perfectly competitive if it sells products that are indistinguishable (except in name) but that consumers don't believe are standardized?
  - No. When it comes to defining the nature of competition, the consumer is always right.



# ECONOMICS IN ACTION

## The Pain of Competition

- Sometimes it is possible to see an industry become perfectly competitive.
- In the case of pharmaceuticals, the conditions for perfect competition are often met as soon as the patent on a popular drug expires.
- The field is then open for other companies to sell their own versions of the drug—marketed as “generics” and sold under the medical name of the drug.
  - Generics are standardized products, much like aspirin, and are often sold by many producers.
- The shift to perfect competition is accompanied by a sharp fall in market price.



# Free Entry and Exit

- There is **free entry and exit** into and from an industry when new producers can easily enter into or leave that industry.
- Free entry and exit ensure:
  - the number of producers in an industry can adjust to changing market conditions; and
  - producers in an industry cannot artificially keep other firms out.

# Production and Profits

**TABLE 12-1** Profit for Jennifer and Jason's Farm When Market Price Is \$18

Quantity of tomatoes $Q$ (bushels)	Total revenue $TR$	Total cost $TC$	Profit $TR - TC$
0	\$0	\$14	-\$14
1	18	30	-12
2	36	36	0
3	54	44	10
4	72	56	16
5	90	72	18
6	108	92	16
7	126	116	10



## Using Marginal Analysis to Choose the Profit-Maximizing Quantity of Output

- **Marginal revenue** is the change in total revenue generated by an additional unit of output.

$$\text{Marginal revenue} = \frac{\text{Change in total revenue}}{\text{Change in output}} = \frac{\text{Change in total revenue generated by one additional unit of output}}{\text{Change in output}}$$

$$\mathbf{MR = \Delta TR / \Delta Q}$$

# The Optimal Output Rule

- The **optimal output rule** says that profit is maximized by producing the quantity of output at which the marginal cost of the last unit produced is equal to its marginal revenue.

# Short-Run Costs for Jennifer and Jason's Farm

**TABLE 12-2** Short-Run Costs for Jennifer and Jason's Farm

Quantity of tomatoes <i>Q</i> (bushels)	Variable cost <i>VC</i>	Total cost <i>TC</i>	Marginal cost of bushel $MC = \Delta TC / \Delta Q$	Marginal revenue of bushel <i>MR</i>	Net gain of bushel = $MR - MC$
0	\$0	\$14			
1	16	30	\$16	\$18	\$2
2	22	36	6	18	12
3	30	44	8	18	10
4	42	56	12	18	6
5	58	72	16	18	2
6	78	92	20	18	-2
7	102	116	24	18	-6



# Pitfalls

## What if Marginal Revenue and Marginal Cost Aren't Exactly Equal?

- The optimal output rule says that to maximize profit, you should produce the quantity at which marginal revenue is equal to marginal cost.
- But what do you do if there's no output level at which marginal revenue equals marginal cost? In that case, you produce the largest quantity for which marginal revenue exceeds marginal cost.
- When production involves large numbers, marginal cost comes in small increments and there is always a level of output at which marginal cost almost exactly equals marginal revenue.

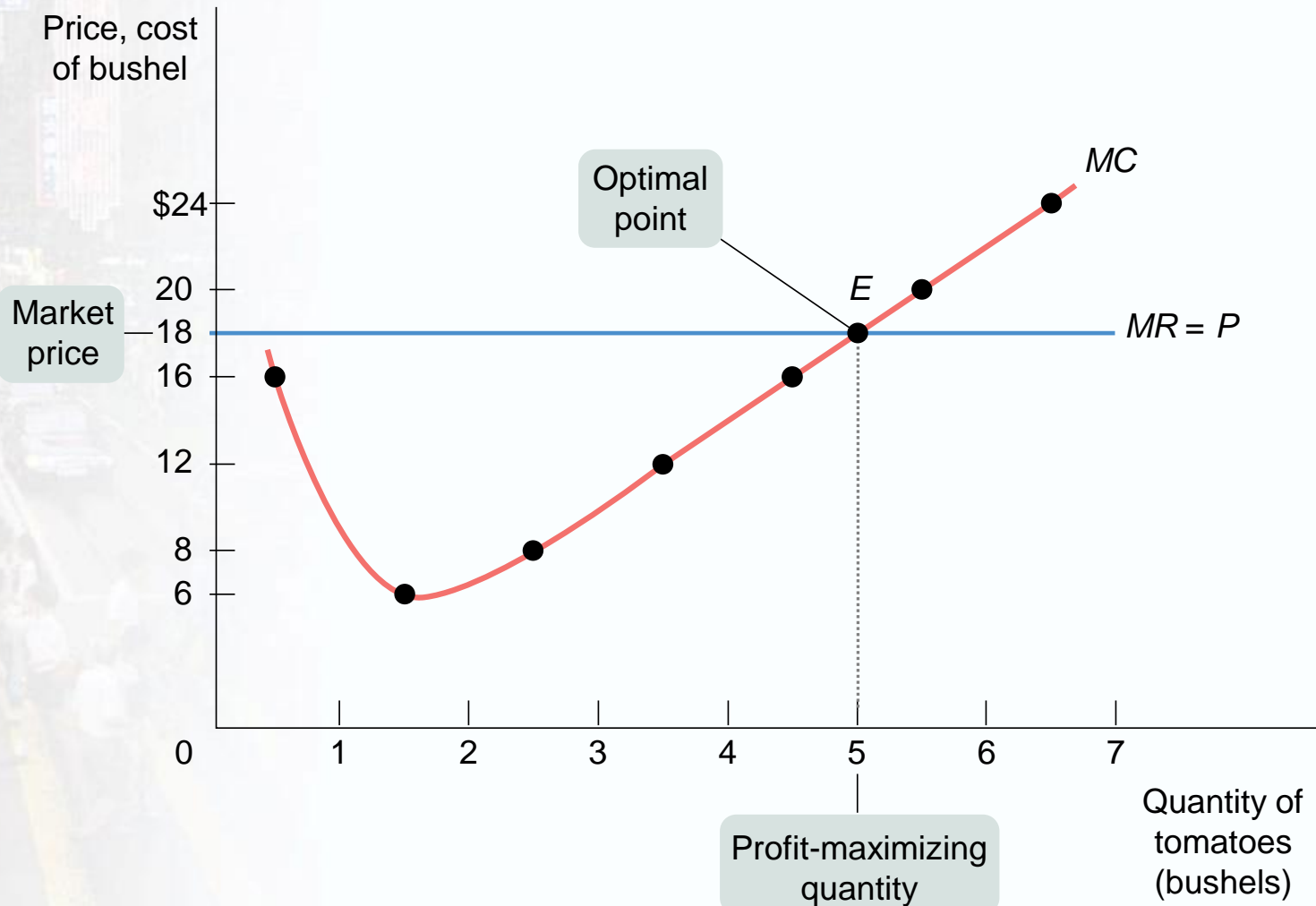




## Marginal Analysis Leads to Profit-Maximizing Quantity of Output

- The **price-taking firm's optimal output rule** says that a price-taking firm's profit is maximized by producing the quantity of output at which the marginal cost of the last unit produced is equal to the market price.
- The **marginal revenue curve** shows how marginal revenue varies as output varies.

# The Price-Taking Firm's Profit-Maximizing Quantity of Output



The profit-maximizing point is where  $MC$  crosses the  $MR$  curve (horizontal line at the market price): at an output of 5 bushels of tomatoes (the output quantity at point  $E$ ).

# When Is Production Profitable?

- If  $TR > TC$ , the firm is *profitable*.
- If  $TR = TC$ , the firm *breaks even*.
- If  $TR < TC$ , the firm *incurs a loss*.

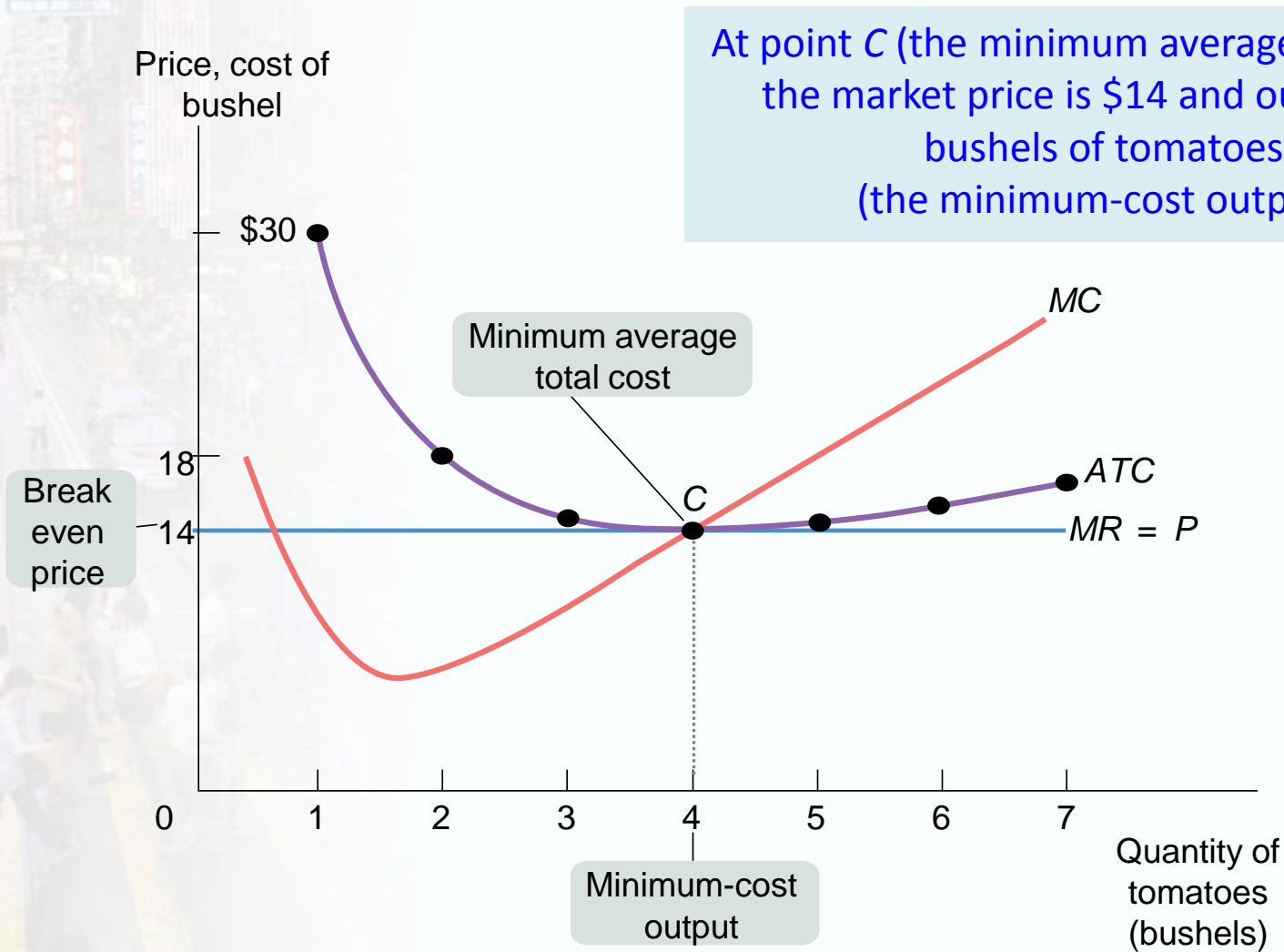
# Short-Run Average Costs

**TABLE 12-3** Short-Run Average Costs for Jennifer and Jason's Farm

Quantity of tomatoes $Q$ (bushels)	Variable cost $VC$	Total cost $TC$	Short-run average variable cost of bushel $AVC = VC/Q$	Short-run average total cost of bushel $ATC = TC/Q$
1	\$16.00	\$30.00	\$16.00	\$30.00
2	22.00	36.00	11.00	18.00
3	30.00	44.00	10.00	14.67
4	42.00	56.00	10.50	14.00
5	58.00	72.00	11.60	14.40
6	78.00	92.00	13.00	15.33
7	102.00	116.00	14.57	16.57



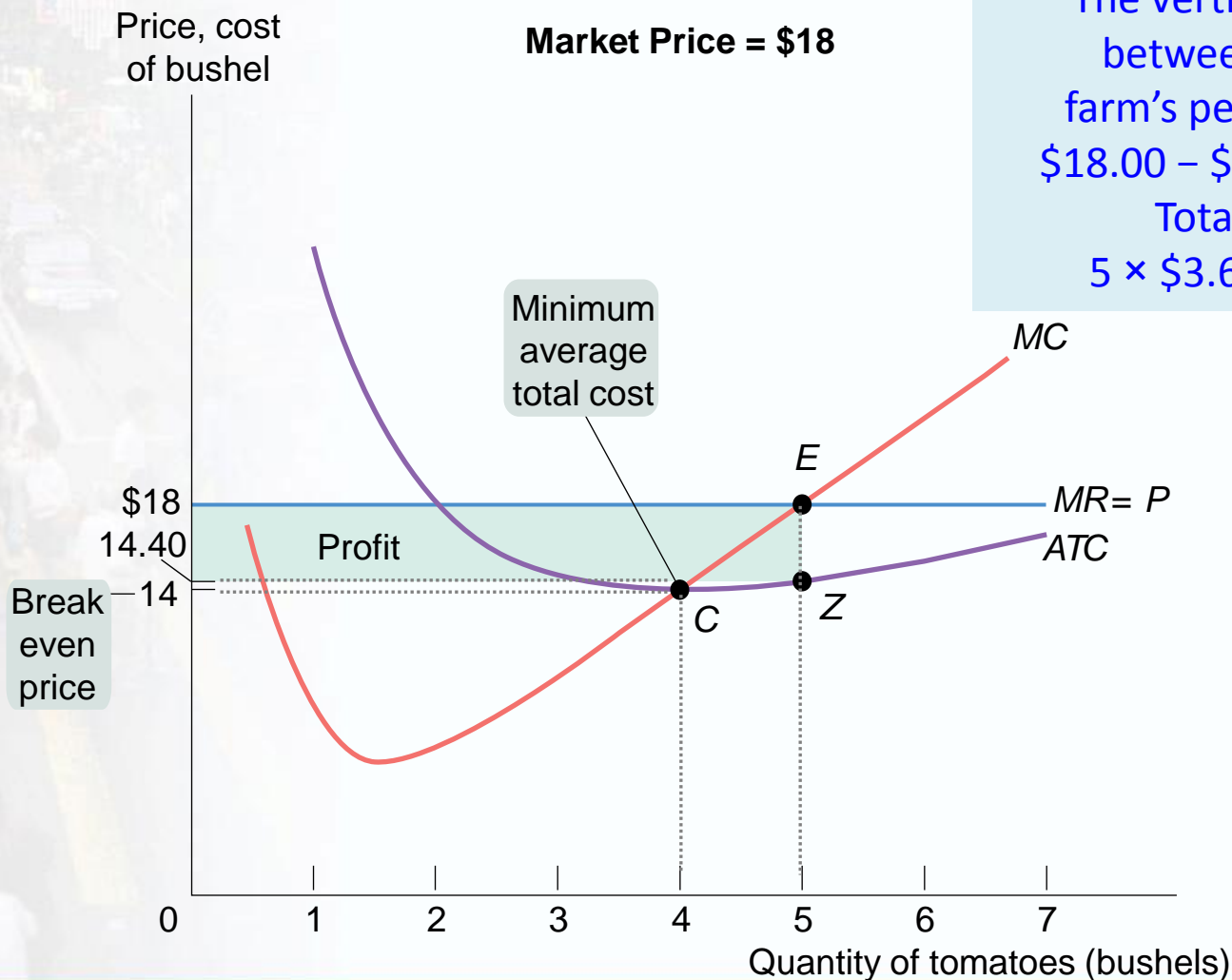
# Costs and Production in the Short Run



This is where *MC* cuts the *ATC* curve at its minimum.  
Minimum average total cost is equal to the firm's break-even price.

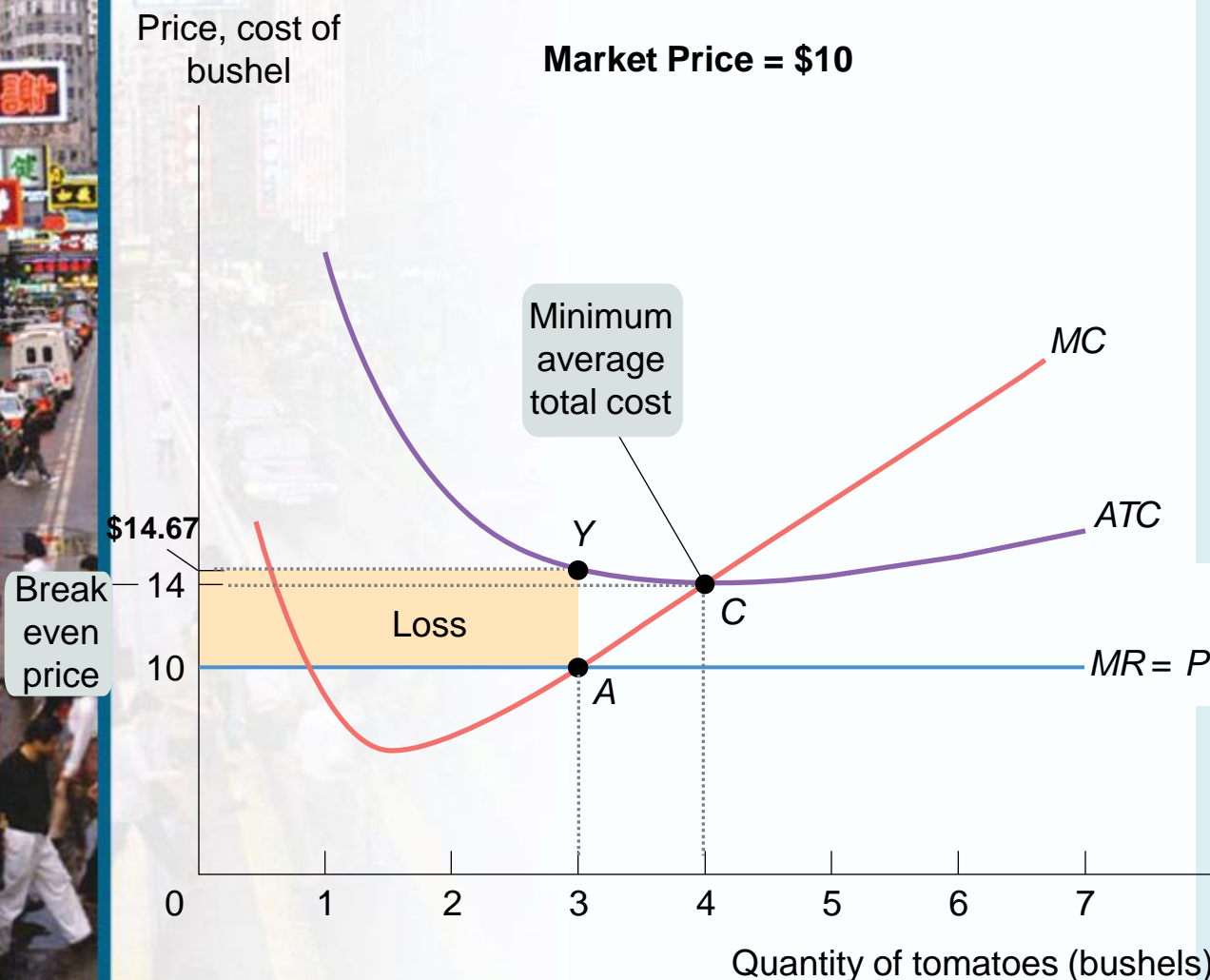
# Profitability and the Market Price

The farm is profitable because price exceeds minimum average total cost, the break-even price, \$14. The farm's optimal output choice is ( $E$ )  $\rightarrow$  output of 5 bushels. The average total cost of producing bushels is ( $Z$  on the  $ATC$  curve)  $\rightarrow$  \$14.40.



The vertical distance between  $E$  and  $Z$ :  
farm's per unit profit,  
 $\$18.00 - \$14.40 = \$3.60$   
Total profit:  
 $5 \times \$3.60 = \$18.00$

# Profitability and the Market Price



The farm is unprofitable because the price falls below the minimum average total cost, \$14.

The farm's optimal output choice is

(A) → output of 3 bushels.

The average total cost of producing bushels is (Y on the ATC curve) → \$14.67.

The vertical distance between A and Y:  
farm's per unit loss,  
 $\$14.67 - \$10.00 = \$4.67$   
Total profit:  
 $3 \times \$4.67 = \sim \$14.00$



# Profit, Break Even, or Loss

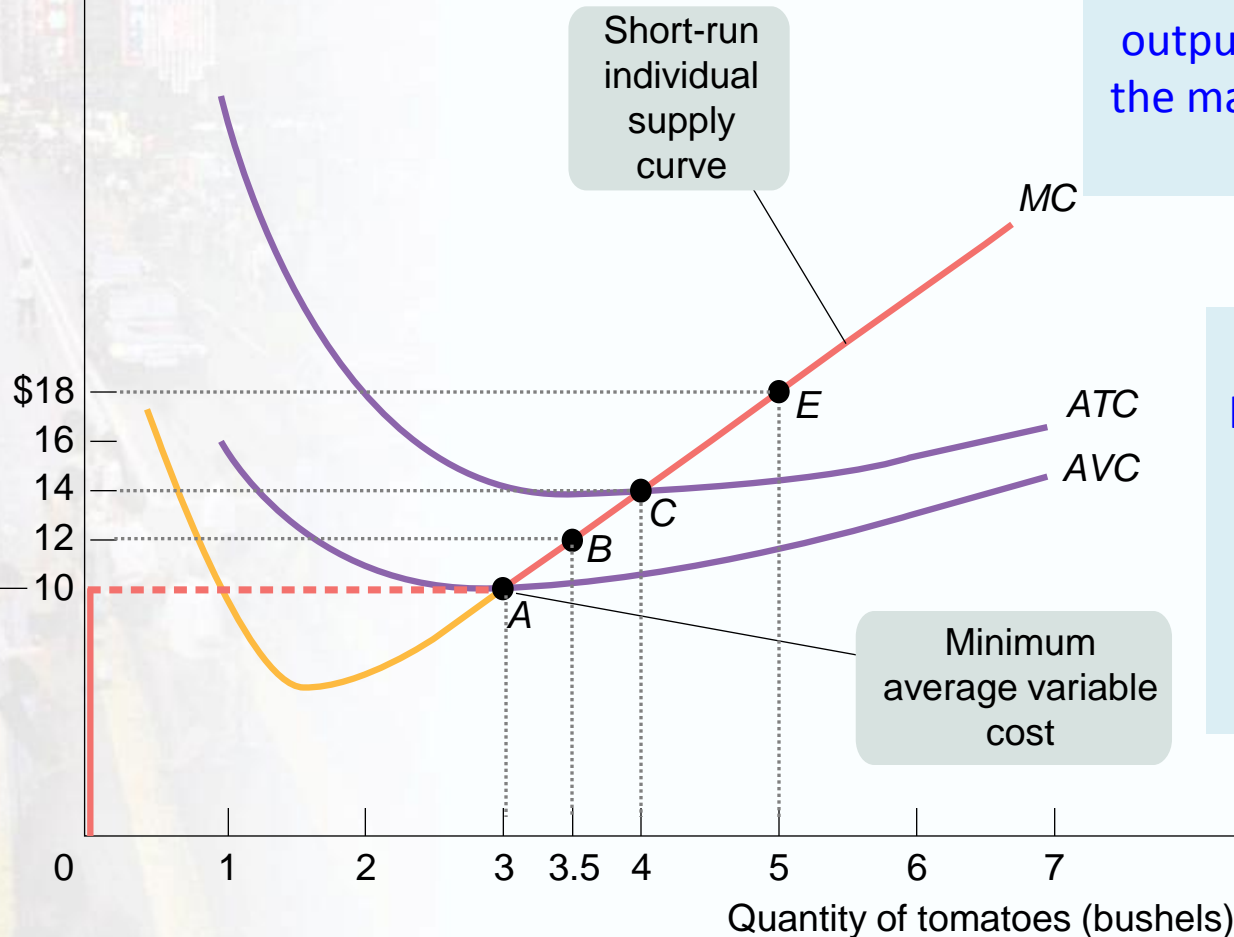
- The **break-even price** of a price-taking firm is the market price at which it earns zero profits.
- Whenever market price exceeds minimum average total cost, the producer is profitable.
- Whenever the market price equals minimum average total cost, the producer breaks even.
- Whenever market price is less than minimum average total cost, the producer is unprofitable.



# The Short-Run Individual Supply Curve

Price, cost  
of bushel

Shut-down  
price



The **short-run individual supply curve** shows how an individual producer's optimal output quantity depends on the market price, taking fixed cost as given.

A firm will cease production in the short run if the market price falls below the **shut-down price**, which is equal to minimum average variable cost.

# Summary of the Competitive Firm's Profitability and Production Conditions

**TABLE 12-4** Summary of the Perfectly Competitive Firm's Profitability and Production Conditions

<b>Profitability condition (minimum <math>ATC</math> = break-even price)</b>	<b>Result</b>
$P > \text{minimum } ATC$	Firm profitable. Entry into industry in the long run.
$P = \text{minimum } ATC$	Firm breaks even. No entry into or exit from industry in the long run.
$P < \text{minimum } ATC$	Firm unprofitable. Exit from industry in the long run.
<b>Production condition (minimum <math>AVC</math> = shut-down price)</b>	<b>Result</b>
$P > \text{minimum } AVC$	Firm produces in the short run. If $P < \text{minimum } ATC$ , firm covers variable cost and some but not all of fixed cost. If $P > \text{minimum } ATC$ , firm covers all variable cost and fixed cost.
$P = \text{minimum } AVC$	Firm indifferent between producing in the short run or not. Just covers variable cost.
$P < \text{minimum } AVC$	Firm shuts down in the short run. Does not cover variable cost.

# ECONOMICS IN ACTION

## Prices Are Up... But So Are Costs

- In 2005, Congress passed the Energy Policy Act: By the year 2012, 7.5 billion gallons of alternative oil—mostly corn-based ethanol—must be added to the American fuel supply with the goal of reducing gasoline consumption.
- One farmer increased his corn acreage by 40% after demand for corn increased, which drove corn prices up.
  - Even though the price of corn increased, so did the raw materials needed to grow the corn.

# ECONOMICS IN ACTION

## Prices Are Up... But So Are Costs

- Farmers will increase their corn acreage until the marginal cost of producing corn is approximately equal to the market price of corn—which shouldn't come as a surprise because corn production satisfies all the requirements of a perfectly competitive industry.





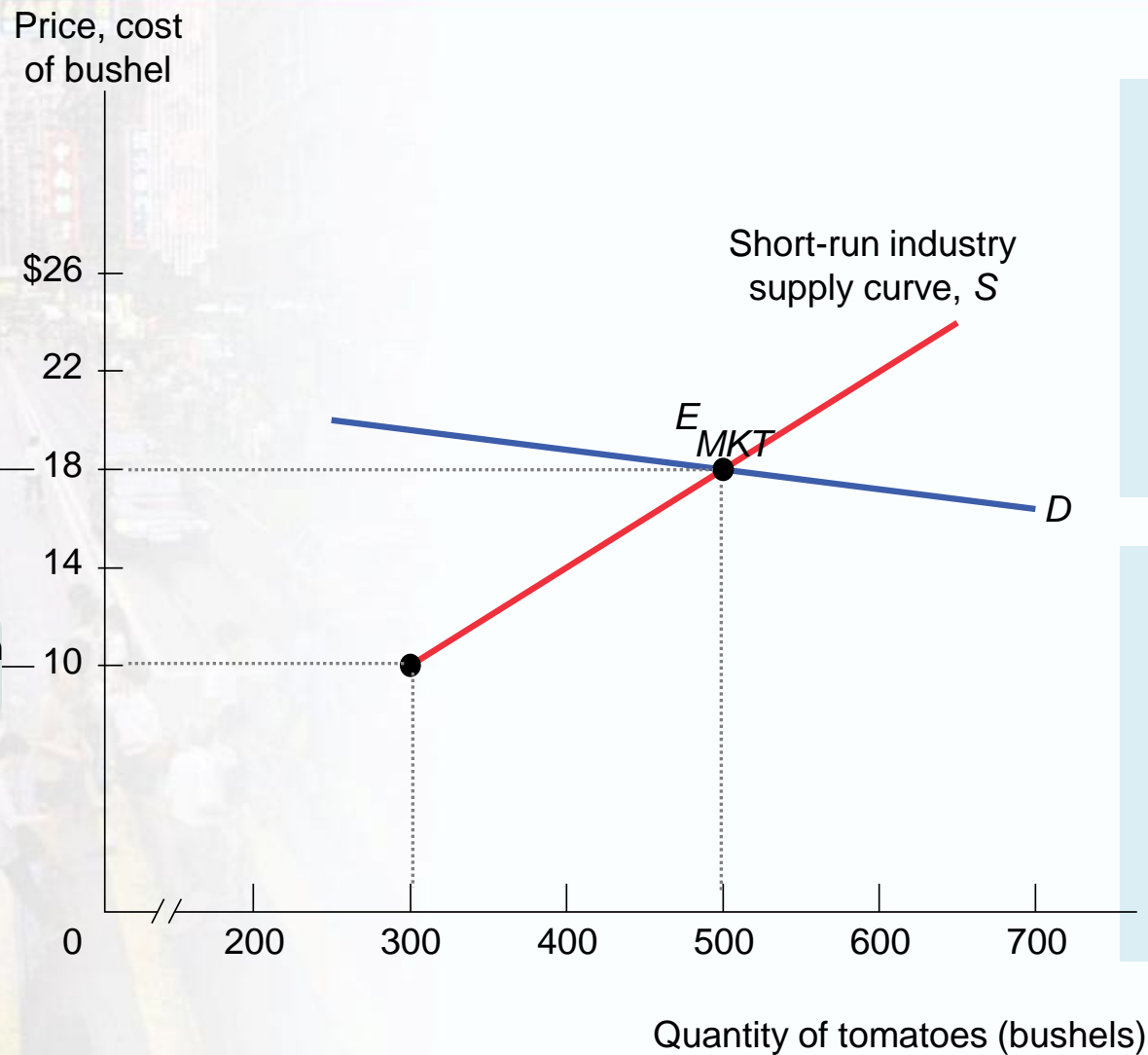
# Industry Supply Curve

- The **industry supply curve** shows the relationship between the price of a good and the total output of the industry as a whole.
- The short-run industry supply curve shows how the quantity supplied by an industry depends on the market price given a fixed number of producers.
- There is a **short-run market equilibrium** when the quantity supplied equals the quantity demanded, taking the number of producers as given.

# The Long-Run Industry Supply Curve

- A market is in **long-run market equilibrium** when the quantity supplied equals the quantity demanded, given that sufficient time has elapsed for entry into and exit from the industry to occur.

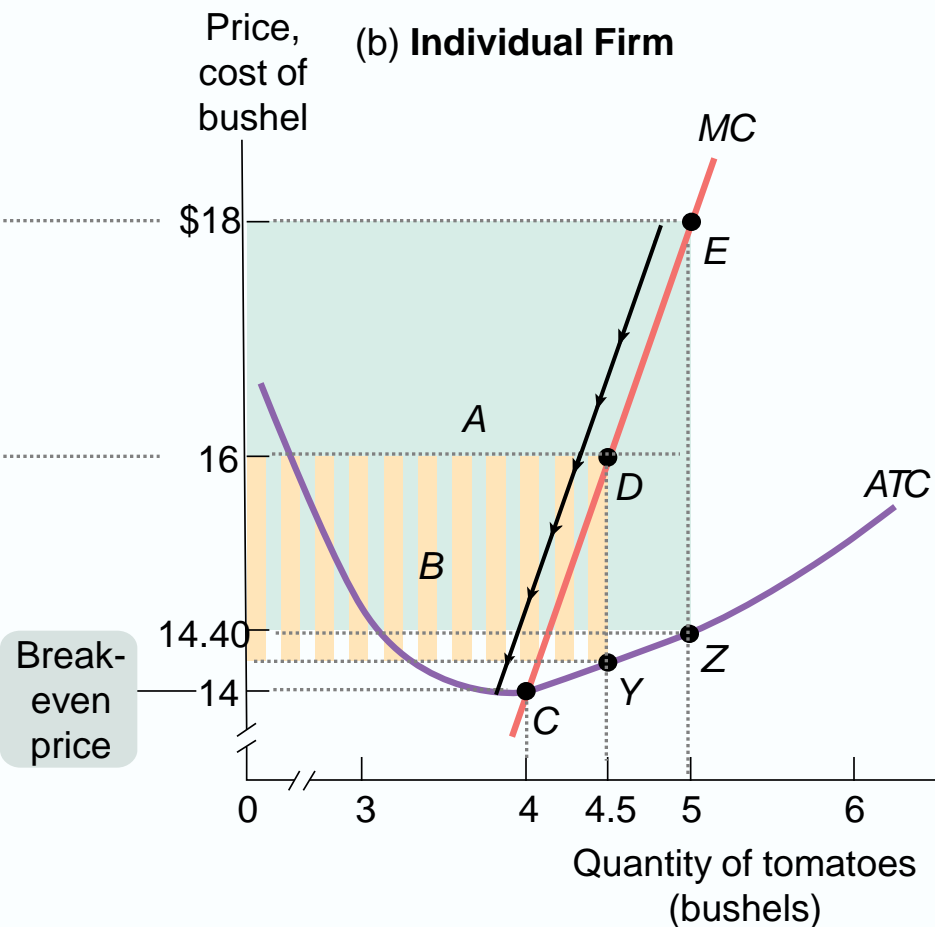
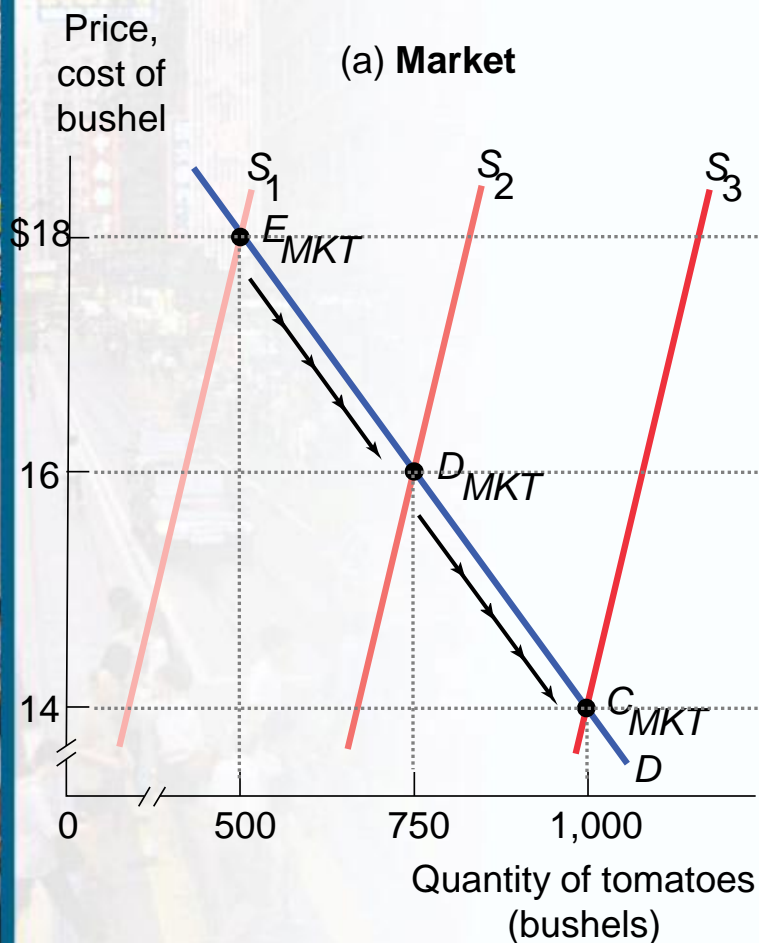
# The Short-Run Market Equilibrium



The **short-run industry supply curve** shows how the quantity supplied by an industry depends on the market price given a fixed number of producers.

There is a **short-run market equilibrium** when the quantity supplied equals the quantity demanded, taking the number of producers as given.

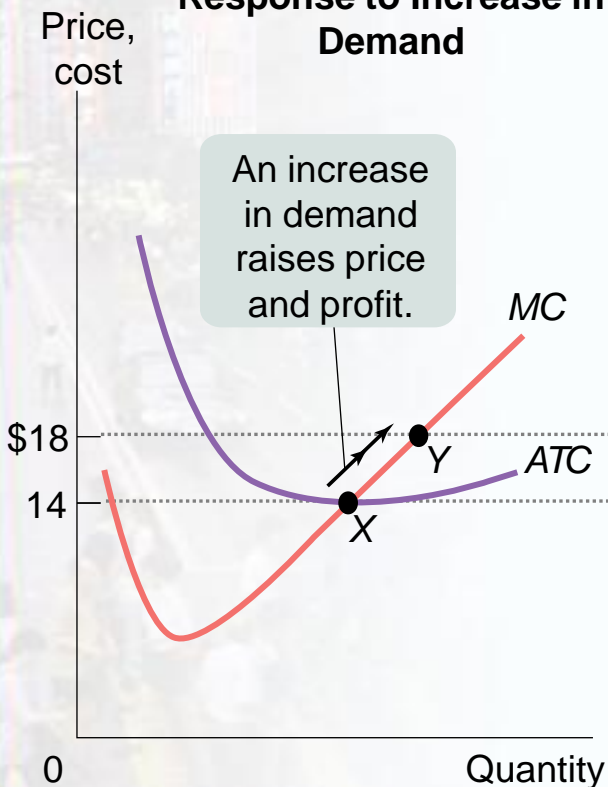
# The Long-Run Market Equilibrium



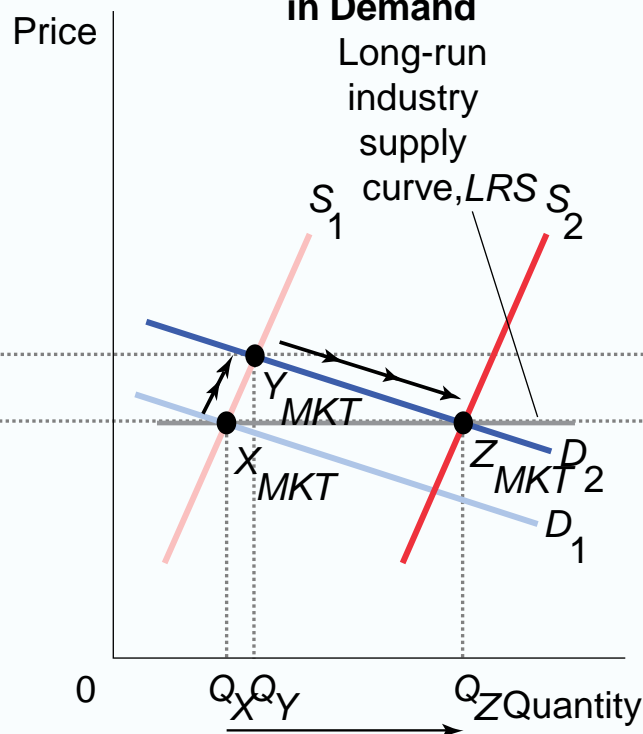
A market is in **long-run market equilibrium** when the quantity supplied equals the quantity demanded, given that sufficient time has elapsed for entry into and exit from the industry to occur.

# The Effect of an Increase in Demand in the Short Run and the Long Run

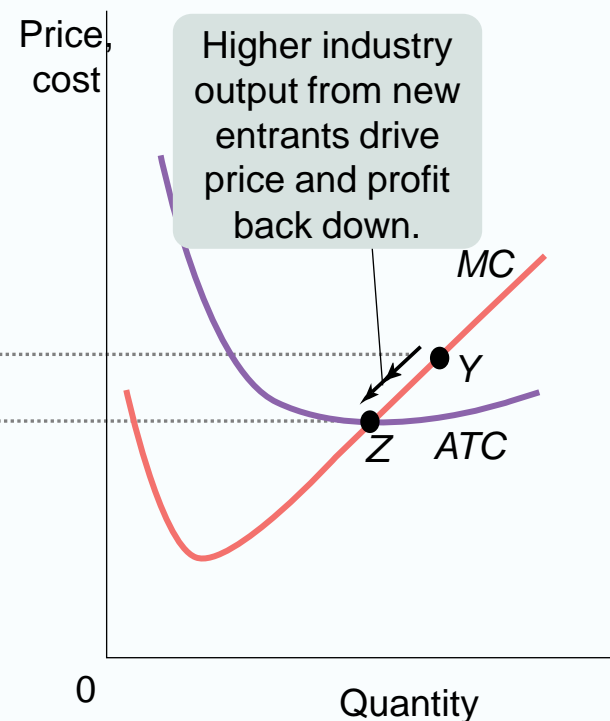
(a) Existing Firm Response to Increase in Demand



(b) Short-Run and Long-Run Market Response to Increase in Demand



(c) Existing Firm Response to New Entrants



The **LRS** shows how the quantity supplied responds to the price once producers have had time to enter or exit the industry.

Increase in output from new entrants

$D \uparrow \rightarrow P \uparrow \rightarrow \text{non-zero profits} \rightarrow \text{entry} \rightarrow S \uparrow \rightarrow P \downarrow \rightarrow \text{back to zero profit (on LRS curve)}$



# Comparing the Short-Run and Long-Run Industry Supply Curves

Price

Short-run industry  
supply curve,  $S$

Long-run  
industry supply  
curve,  $LRS$

The long-run industry supply curve is always flatter — more elastic — than the short-run industry supply curve.

Quantity

$LRS$  may slope upward, but it is always flatter—**more elastic**—than the short-run industry supply curve.

This is because of **entry and exit**:  
a higher price attracts new entrants in the long run, resulting in a rise in industry output and lower price;  
a fall in price induces existing producer to exit in the long run, generating a fall in industry output and a rise in price.

# Conclusions

- Three conclusions about the cost of production and efficiency in the long-run equilibrium of a perfectly competitive industry:
  - 1) In a perfectly competitive industry in equilibrium, the value of marginal cost is the same for all firms.
  - 2) In a perfectly competitive industry with free entry and exit, each firm will have zero economic profits in long-run equilibrium.
  - 3) The long-run market equilibrium of a perfectly competitive industry is efficient: no mutually beneficial transactions go unexploited.

# Pitfalls

## Economic Profit, Again

- Some readers may wonder why firms would enter an industry when they will do little more than break even. Wouldn't people prefer to go into other businesses that yield a better profit?
- The answer is that here, as always, when we calculate cost, we mean opportunity cost—the cost that includes the return a business owner could get by using his or her resources elsewhere.
- And so the profit that we calculate is economic profit; if the market price is above the break-even level, potential business owners can earn more in this industry than they could elsewhere.

# ECONOMICS IN ACTION

## BALEING IN, BAILING OUT

- Cotton prices tripled between early 2010 and early 2011. And farmers responded by planting more cotton.
- What was behind the price rise?
  - Partly it was caused by temporary factors, notably severe floods in Pakistan that destroyed much of that nation's cotton crop.
  - But there was also a big rise in demand, especially from China, whose burgeoning textile and clothing industries demanded ever more raw cotton to weave into cloth.
  - And all indications were that higher demand was here to stay.

# ECONOMICS IN ACTION

## BALEING IN, BAILING OUT

- So, is cotton farming going to be a highly profitable business from now on?
  - The answer is no, because when an industry becomes highly profitable, it draws in new producers, and that brings prices down.



# ECONOMICS IN ACTION

## BALEING IN, BAILING OUT

- By the summer of 2011 the entry of all these new producers was already having an effect.
  - By the end of July cotton prices were down 35% from their early-2011 peak.
  - This still left prices high by historical standards, leaving plenty of incentive to expand production.
  - But it was already clear that the cotton boom would eventually reach its limit – and that at some point in the not too distant future some of the farmers who rushed into the industry would leave it again.

# ECONOMICS IN ACTION

## A Crushing Reversal

- Starting in the mid-1990s, Americans began drinking a lot more wine.
- At first, the increase in wine demand led to sharply higher prices; between 1993 and 2000, the price of red wine rose approximately 50%, and California grape growers earned high profits.

# ECONOMICS IN ACTION

## A Crushing Reversal

- As a result, there was a rapid expansion of the industry. Between 1994 and 2002, production of red wine grapes almost doubled.
  - The result was predictable: the price of grapes fell as the supply curve shifted out.
  - As demand growth slowed in 2002, prices plunged by 17%.
  - The effect was to end the California wine industry's expansion.

# Summary

1. In a **perfectly competitive market** all producers are **price-taking producers** and all consumers are **price-taking consumers**—no one's actions can influence the market price.
2. There are two necessary conditions for a perfectly competitive industry: there are many producers, none of whom have a large **market share**, and the industry produces a **standardized product** or **commodity**—goods that consumers regard as equivalent.

A third condition is often satisfied as well: **free entry and exit** into and from the industry.

# Summary

3. A producer chooses output according to the **optimal output rule**: produce the quantity at which **marginal revenue** equals marginal cost.

For a price-taking firm, marginal revenue is equal to price and its **marginal revenue curve** is a horizontal line at the market price. It chooses output according to the **price-taking firm's optimal output rule**: produce the quantity at which price equals marginal cost.



# Summary

5. Fixed cost is irrelevant to the firm's optimal short-run production decision, which depends on its **shut-down price**—its minimum average variable cost—and the market price.

When the market price is equal to or exceeds the shut-down price, the firm produces the output quantity where marginal cost equals the market price.

When the market price falls below the shut-down price, the firm ceases production in the short run. This generates the firm's **short-run individual supply curve**.

# Summary

## 6. Fixed cost matters over time.

If the market price is *below* minimum average total cost for an extended period, firms will exit the industry in the long run.

If market price is *above* minimum average total cost, existing firms are profitable and new firms will enter the industry in the long run.

# Summary

4. A firm is profitable if total revenue exceeds total cost or, equivalently, if the market price exceeds its **break-even price**—the minimum average total cost.

If market price exceeds the break-even price, the firm is profitable; if it is less, the firm is unprofitable; if it is equal, the firm breaks even.

When profitable, the firm's per-unit profit is  $P - ATC$ ; when unprofitable, its per-unit loss is  $ATC - P$ .

# Summary

7. The **industry supply curve** depends on the time period.

The **short-run industry supply curve** is the industry supply curve given that the number of firms is fixed.

The **short-run market equilibrium** is given by the intersection of the short-run industry supply curve and the demand curve.



# Summary

8. The **long-run industry supply curve** is the industry supply curve given sufficient time for entry into and exit from the industry.

In the **long-run market equilibrium**—given by the intersection of the long-run industry supply curve and the demand curve—no producer has an incentive to enter or exit.

The long-run industry supply curve is often horizontal. It may slope upward if there is limited supply of an input. It is always more elastic than the short-run industry supply curve.

# Summary

9. In the long-run market equilibrium of a competitive industry, profit maximization leads each firm to produce at the same marginal cost, which is equal to market price.

Free entry and exit means that each firm earns zero economic profit—producing the output corresponding to its minimum average total cost. So the total cost of production of an industry's output is minimized.

The outcome is efficient because every consumer with a willingness to pay greater than or equal to marginal cost gets the good.

# KEY TERMS



- Price-taking producer
- Price-taking consumer
- Perfectly competitive market
- Perfectly competitive industry
- Market share
- Standardized product
- Commodity
- Free entry and exit
- Marginal revenue
- Optimal output rule
- Price-taking firm's optimal output rule
- Marginal revenue curve
- Break-even price
- Shut-down price
- Short-run individual supply curve
- Industry supply curve
- Short-run industry supply curve
- Short-run market equilibrium
- Long-run market equilibrium
- Long-run industry supply curve