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# Principles of Economics

Sixth Edition

14

## Firms in Competitive Markets



*Premium  
PowerPoint  
Slides by  
Ron Cronovich  
2012 UPDATE*

***In this chapter,  
look for the answers to these questions:***

- What is a perfectly competitive market?
- What is marginal revenue? How is it related to total and average revenue?
- How does a competitive firm determine the quantity that maximizes profits?
- When might a competitive firm shut down in the short run? Exit the market in the long run?
- What does the market supply curve look like in the short run? In the long run?

# Introduction: A Scenario

- Three years after graduating, you run your own business.
- You must decide how much to produce, what price to charge, how many workers to hire, etc.
- What factors should affect these decisions?
  - Your costs (studied in preceding chapter)
  - How much competition you face
- We begin by studying the behavior of firms in perfectly competitive markets.

# Characteristics of Perfect Competition

1. Many buyers and many sellers.
  2. The goods offered for sale are largely the same.
  3. Firms can freely enter or exit the market.
- Because of 1 & 2, each buyer and seller is a “**price taker**” – takes the price as given.

# The Revenue of a Competitive Firm

- Total revenue ( $TR$ )

$$TR = P \times Q$$

- **Average revenue ( $AR$ )**

$$AR = \frac{TR}{Q} = P$$

- **Marginal revenue ( $MR$ ):**

The change in  $TR$  from selling one more unit.

$$MR = \frac{\Delta TR}{\Delta Q}$$

# ACTIVE LEARNING 1

## Calculating *TR*, *AR*, *MR*

Fill in the empty spaces of the table.

| <i>Q</i> | <i>P</i> | <i>TR</i> | <i>AR</i> | <i>MR</i> |
|----------|----------|-----------|-----------|-----------|
| 0        | \$10     |           | n/a       |           |
| 1        | \$10     |           | \$10      |           |
| 2        | \$10     |           |           |           |
| 3        | \$10     |           |           |           |
| 4        | \$10     | \$40      |           |           |
| 5        | \$10     | \$50      |           |           |

# ACTIVE LEARNING 1

## Answers

Fill in the empty spaces of the table.

| $Q$ | $P$  | $TR = P \times Q$ | $AR = \frac{TR}{Q}$ | $MR = \frac{\Delta TR}{\Delta Q}$ |
|-----|------|-------------------|---------------------|-----------------------------------|
| 0   | \$10 | \$0               | n/a                 |                                   |
| 1   | \$10 | \$10              | \$10                | \$10                              |
| 2   | \$10 |                   |                     | \$10                              |
| 3   | \$10 | \$30              | \$10                | \$10                              |
| 4   | \$10 | \$40              | \$10                | \$10                              |
| 5   | \$10 | \$50              | \$10                | \$10                              |

Notice that  
 $MR = P$

# **$MR = P$ for a Competitive Firm**

- A competitive firm can keep increasing its output without affecting the market price.
- So, each one-unit increase in  $Q$  causes revenue to rise by  $P$ , i.e.,  $MR = P$ .

**$MR = P$  is only true for firms in competitive markets.**



# Profit Maximization

- What  $Q$  maximizes the firm's profit?
- To find the answer, “*think at the margin.*”  
If increase  $Q$  by one unit,  
revenue rises by  $MR$ ,  
cost rises by  $MC$ .
- If  $MR > MC$ , then increase  $Q$  to raise profit.
- If  $MR < MC$ , then reduce  $Q$  to raise profit.

# Profit Maximization

*(continued from earlier exercise)*

At any  $Q$  with  
 $MR > MC$ ,  
increasing  $Q$   
raises profit.

At any  $Q$  with  
 $MR < MC$ ,  
reducing  $Q$   
raises profit.

| $Q$ | $TR$ | $TC$ | Profit | $MR$ | $MC$ | $\Delta\text{Profit} = MR - MC$ |
|-----|------|------|--------|------|------|---------------------------------|
| 0   | \$0  | \$5  | -\$5   | \$10 |      |                                 |
| 1   | 10   | 9    | 1      |      | \$4  | \$6                             |
| 2   | 20   | 15   | 5      | 10   | 6    | 4                               |
| 3   | 30   | 23   | 7      | 10   | 8    | 2                               |
| 4   | 40   | 33   | 7      | 10   | 10   | 0                               |
| 5   | 50   | 45   | 5      | 10   | 12   | -2                              |
|     |      |      |        |      |      |                                 |

# MC and the Firm's Supply Decision

Rule:  $MR = MC$  at the profit-maximizing  $Q$ .

At  $Q_a$ ,  $MC < MR$ .

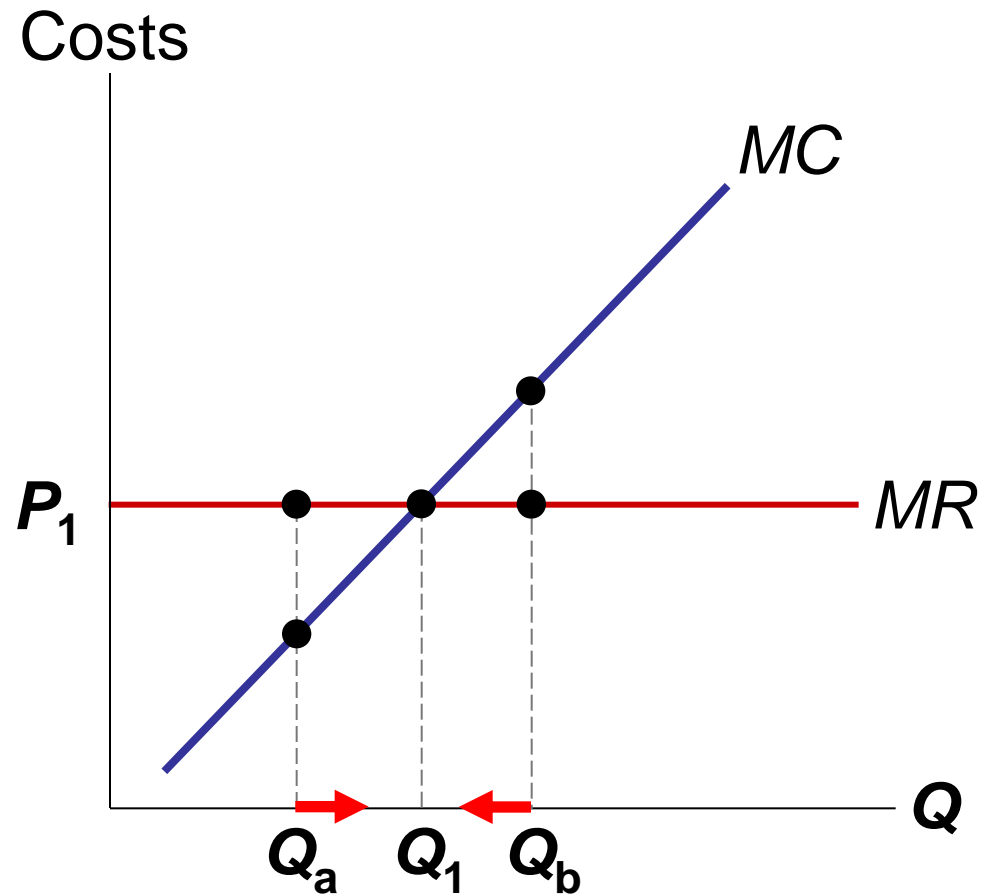
So, increase  $Q$   
to raise profit.

At  $Q_b$ ,  $MC > MR$ .

So, reduce  $Q$   
to raise profit.

At  $Q_1$ ,  $MC = MR$ .

Changing  $Q$   
would lower profit.



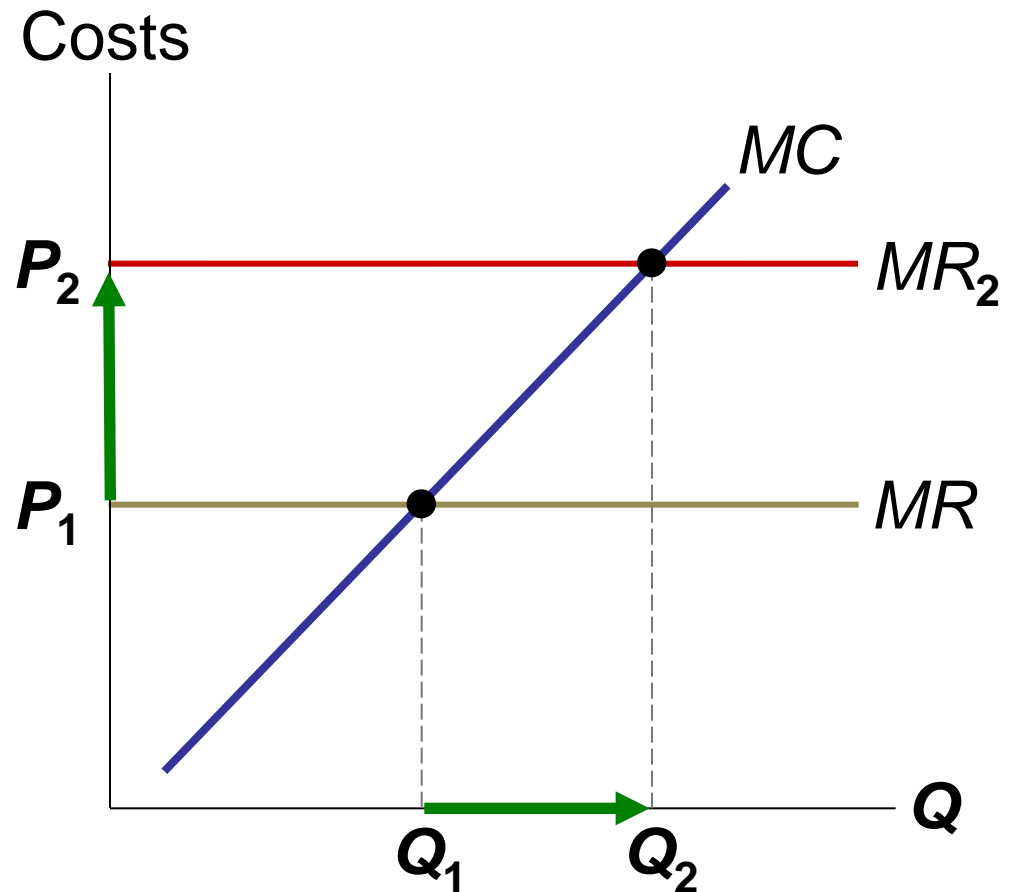
# MC and the Firm's Supply Decision

If price rises to  $P_2$ ,  
then the profit-maximizing quantity  
rises to  $Q_2$ .

The  $MC$  curve  
determines the  
firm's  $Q$  at any price.

Hence,

the  $MC$  curve is the  
firm's supply curve.



# Shutdown vs. Exit

- **Shutdown:**

A short-run decision not to produce anything because of market conditions.

- **Exit:**

A long-run decision to leave the market.

- A key difference:

- If shut down in SR, must still pay  $FC$ .
- If exit in LR, zero costs.

# A Firm's Short-run Decision to Shut Down

- Cost of shutting down: revenue loss =  $TR$
- Benefit of shutting down: cost savings =  $VC$   
(firm must still pay  $FC$ )
- So, shut down if  $TR < VC$
- Divide both sides by  $Q$ :  $TR/Q < VC/Q$
- So, firm's decision rule is:

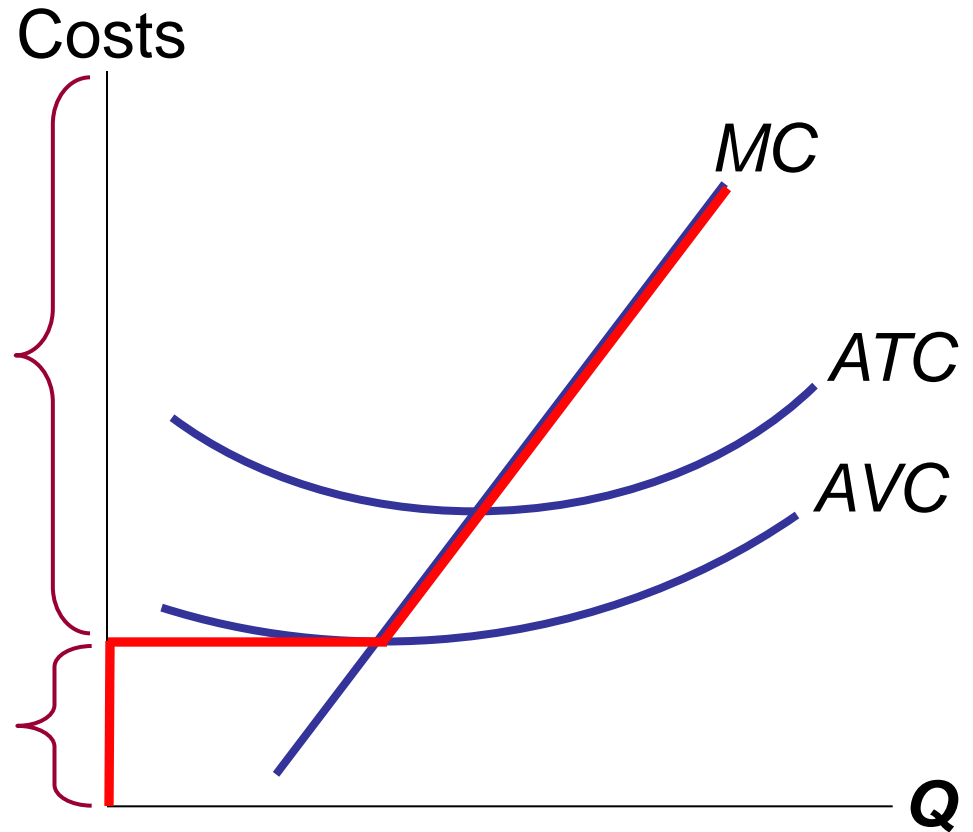
Shut down if  $P < AVC$

# A Competitive Firm's SR Supply Curve

The firm's SR supply curve is the portion of its  $MC$  curve above

If  $P > AVC$ , then firm produces  $Q$  where  $P = MC$ .

If  $P < AVC$ , then firm shuts down (produces  $Q = 0$ ).



# The Irrelevance of Sunk Costs

- **Sunk cost:** a cost that has already been committed and cannot be recovered
- Sunk costs should be irrelevant to decisions; you must pay them regardless of your choice.
- $FC$  is a sunk cost: The firm must pay its fixed costs whether it produces or shuts down.
- So,  $FC$  should not matter in the decision to shut down.



# A Firm's Long-Run Decision to Exit

- Cost of exiting the market: revenue loss =  $TR$
- Benefit of exiting the market: cost savings =  $TC$   
(zero  $FC$  in the long run)
- So, firm exits if  $TR < TC$
- Divide both sides by  $Q$  to write the firm's decision rule as:

$$\text{Exit if } P < ATC$$

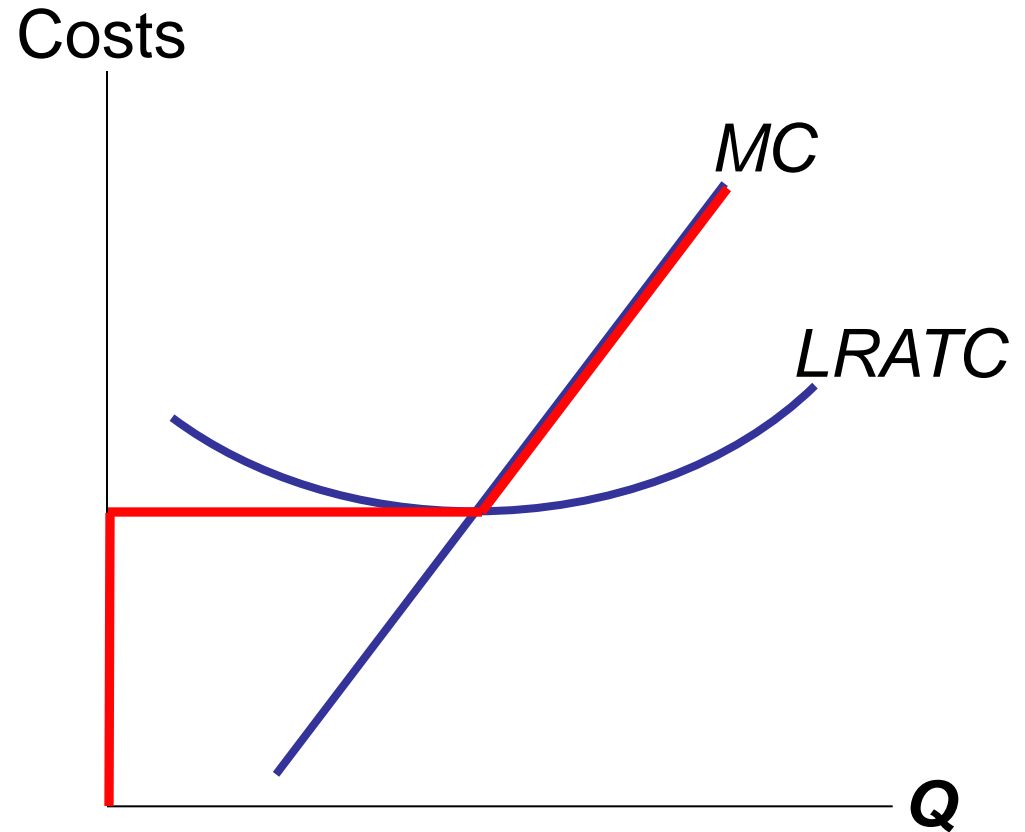
# A New Firm's Decision to Enter Market

- In the long run, a new firm will enter the market if it is profitable to do so: if  $TR > TC$ .
- Divide both sides by  $Q$  to express the firm's entry decision as:

Enter if  $P > ATC$

# The Competitive Firm's Supply Curve

The firm's LR supply curve is the portion of its  $MC$  curve above  $LRATC$ .



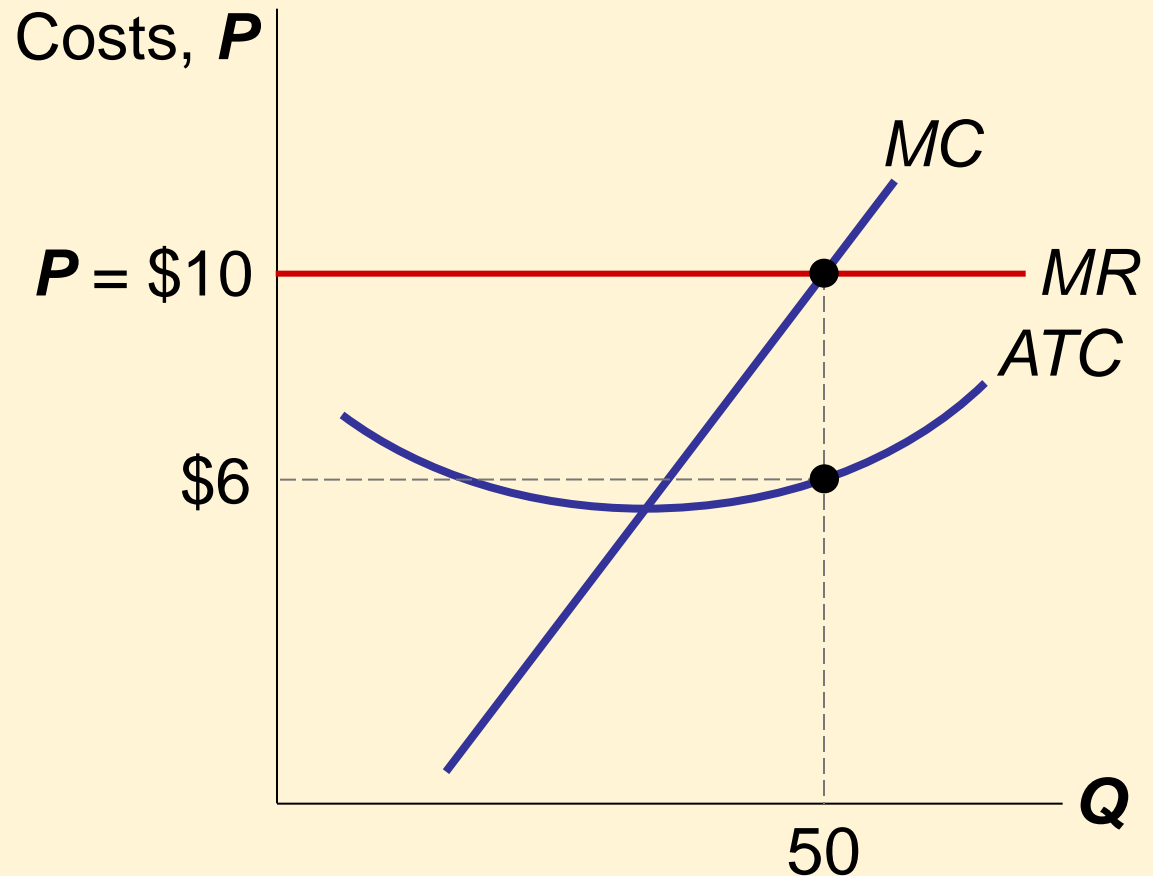
## ACTIVE LEARNING 2

# Identifying a firm's profit

Determine this firm's total profit.

Identify the area on the graph that represents the firm's profit.

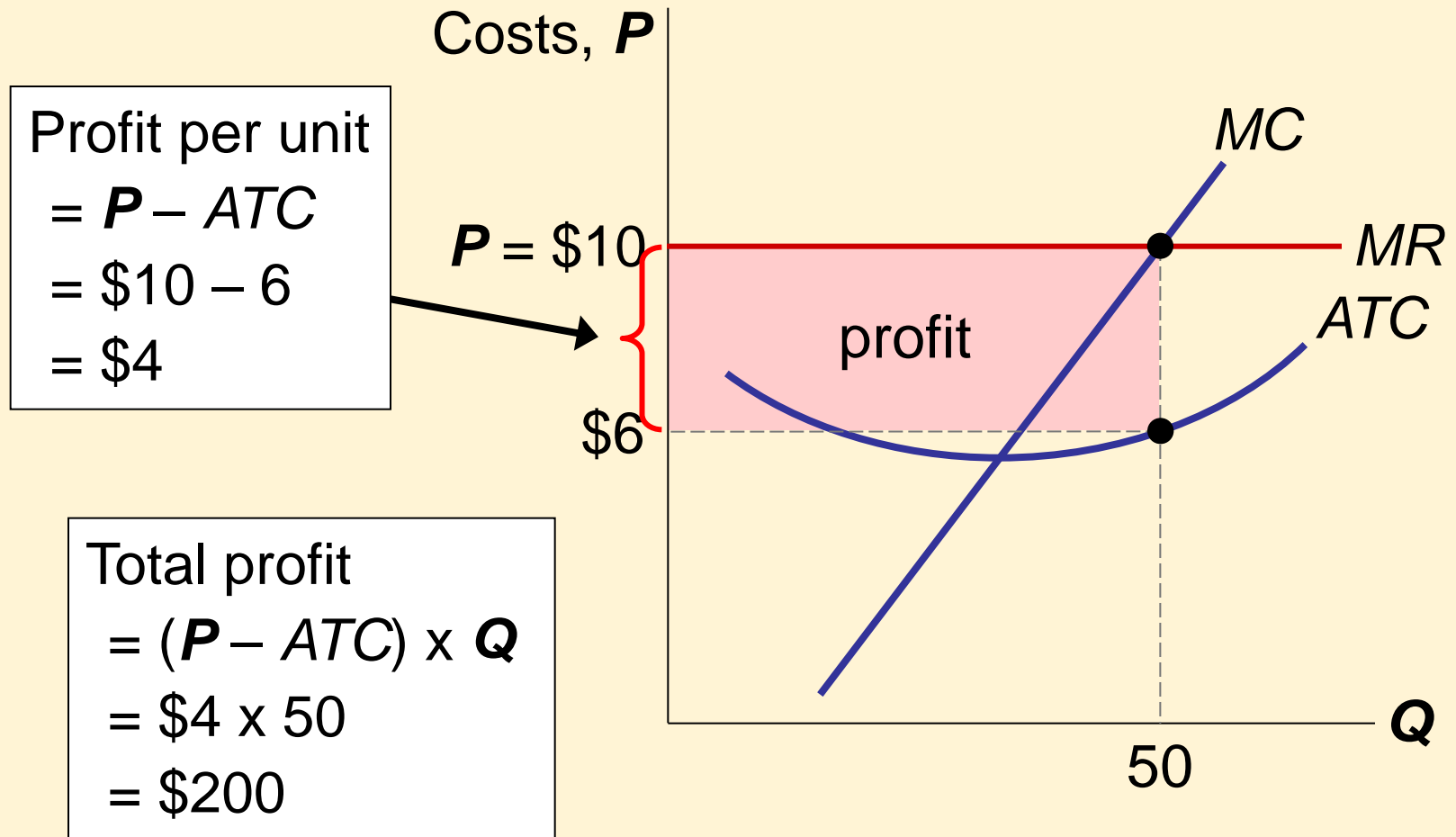
A competitive firm



# ACTIVE LEARNING 2

## Answers

### A competitive firm



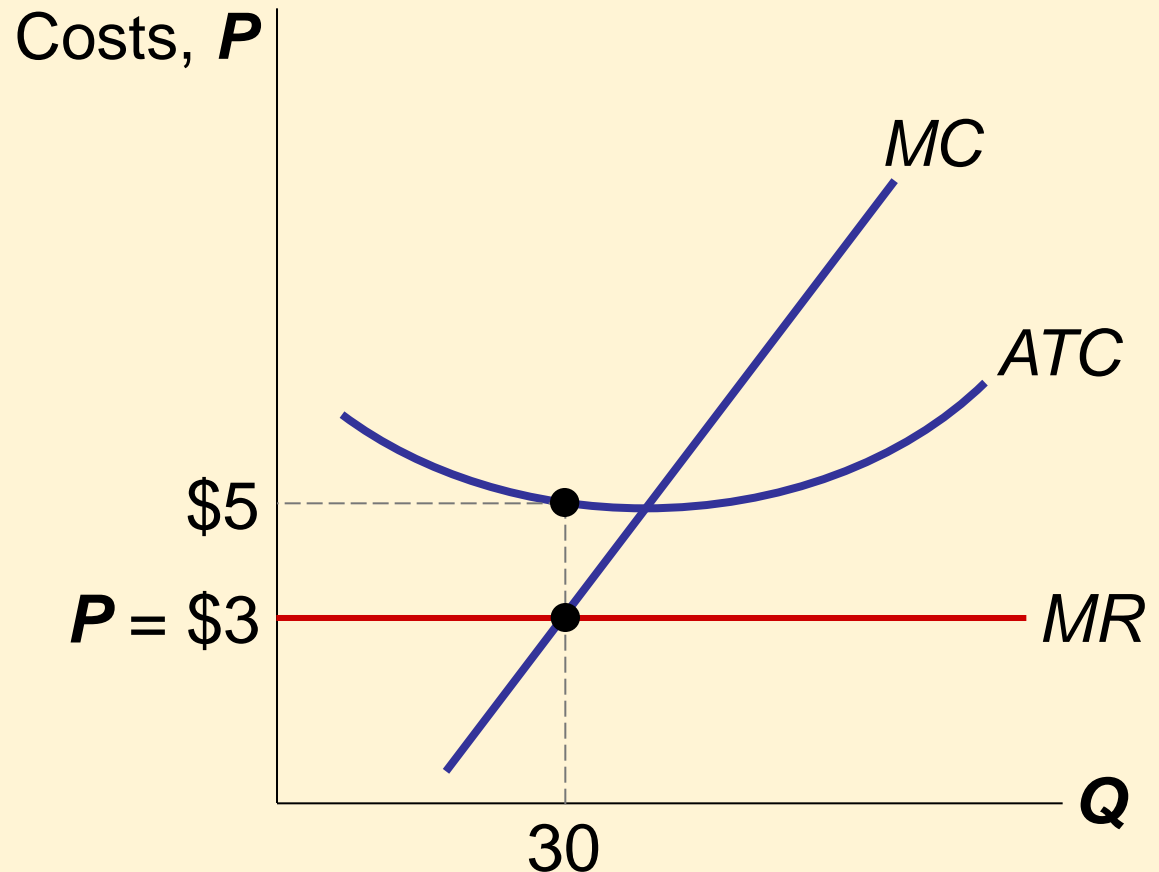
## ACTIVE LEARNING 3

# Identifying a firm's loss

Determine this firm's total loss, assuming  $AVC < \$3$ .

Identify the area on the graph that represents the firm's loss.

A competitive firm

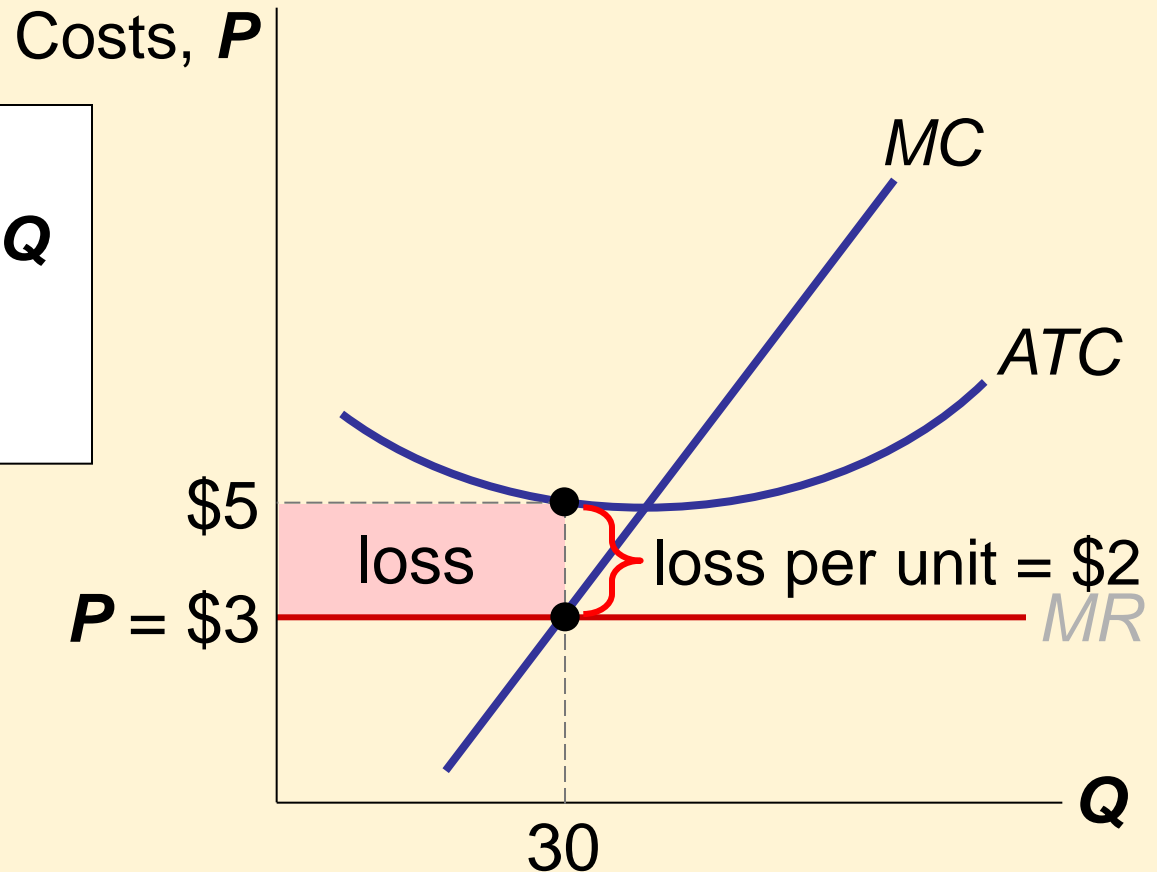


# ACTIVE LEARNING 3

## Answers

A competitive firm

$$\begin{aligned}\text{Total loss} &= (ATC - P) \times Q \\ &= \$2 \times 30 \\ &= \$60\end{aligned}$$



# Market Supply: Assumptions

- 1) All existing firms and potential entrants have identical costs.
- 2) Each firm's costs do not change as other firms enter or exit the market.
- 3) The number of firms in the market is
  - fixed in the short run  
(due to fixed costs)
  - variable in the long run  
(due to free entry and exit)



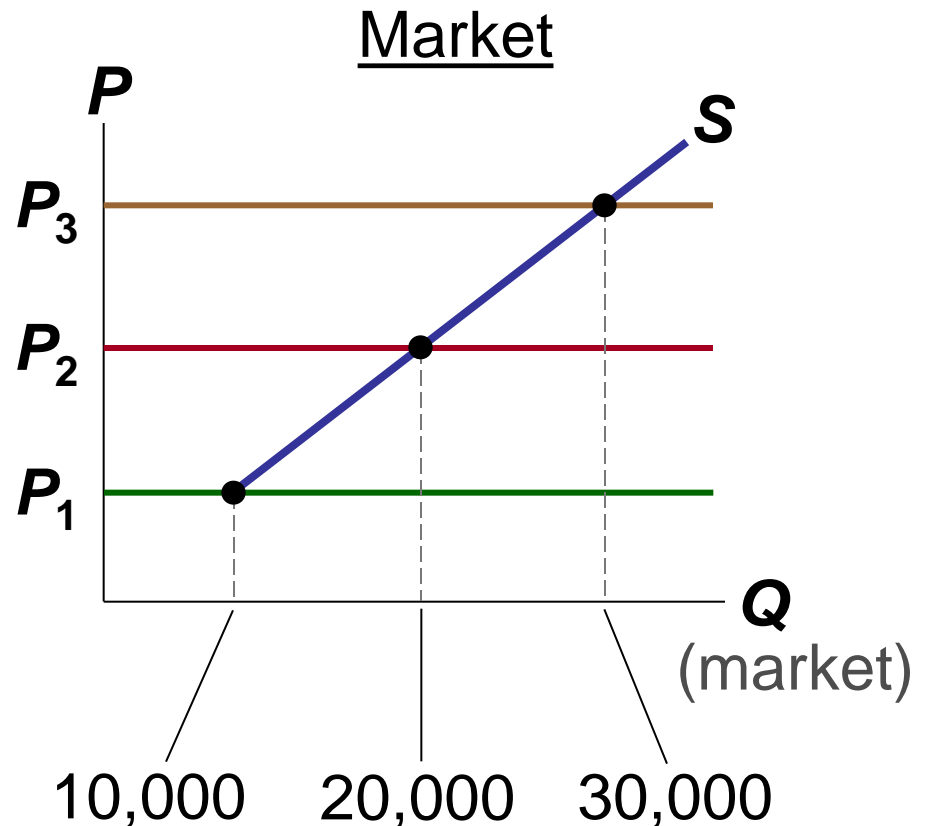
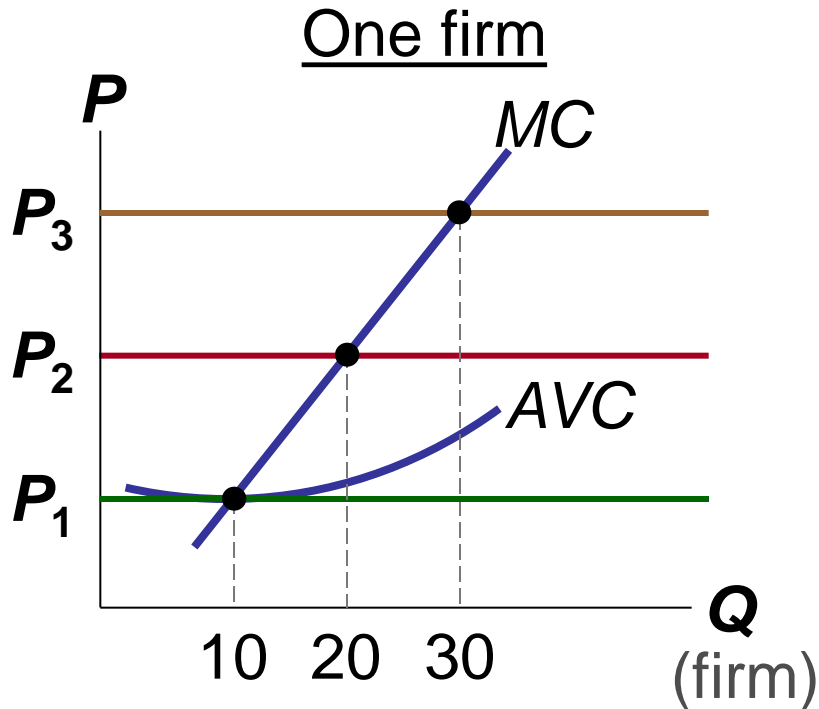
# The SR Market Supply Curve

- As long as  $P \geq AVC$ , each firm will produce its profit-maximizing quantity, where  $MR = MC$ .
- Recall from Chapter 4:  
At each price, the market quantity supplied is the sum of quantities supplied by all firms.

# The SR Market Supply Curve

Example: 1000 identical firms

At each  $P$ , market  $Q^s = 1000 \times (\text{one firm's } Q^s)$



# Entry & Exit in the Long Run

- In the LR, the number of firms can change due to entry & exit.
- If existing firms earn positive economic profit,
  - new firms enter, SR market supply shifts right.
  - $P$  falls, reducing profits and slowing entry.
- If existing firms incur losses,
  - some firms exit, SR market supply shifts left.
  - $P$  rises, reducing remaining firms' losses.

# The Zero-Profit Condition

- **Long-run equilibrium:**  
The process of entry or exit is complete—remaining firms earn zero economic profit.
- Zero economic profit occurs when  $P = ATC$ .
- Since firms produce where  $P = MR = MC$ , the zero-profit condition is  $P = MC = ATC$ .
- Recall that  $MC$  intersects  $ATC$  at minimum  $ATC$ .
- Hence, in the long run,  $P = \text{minimum } ATC$ .

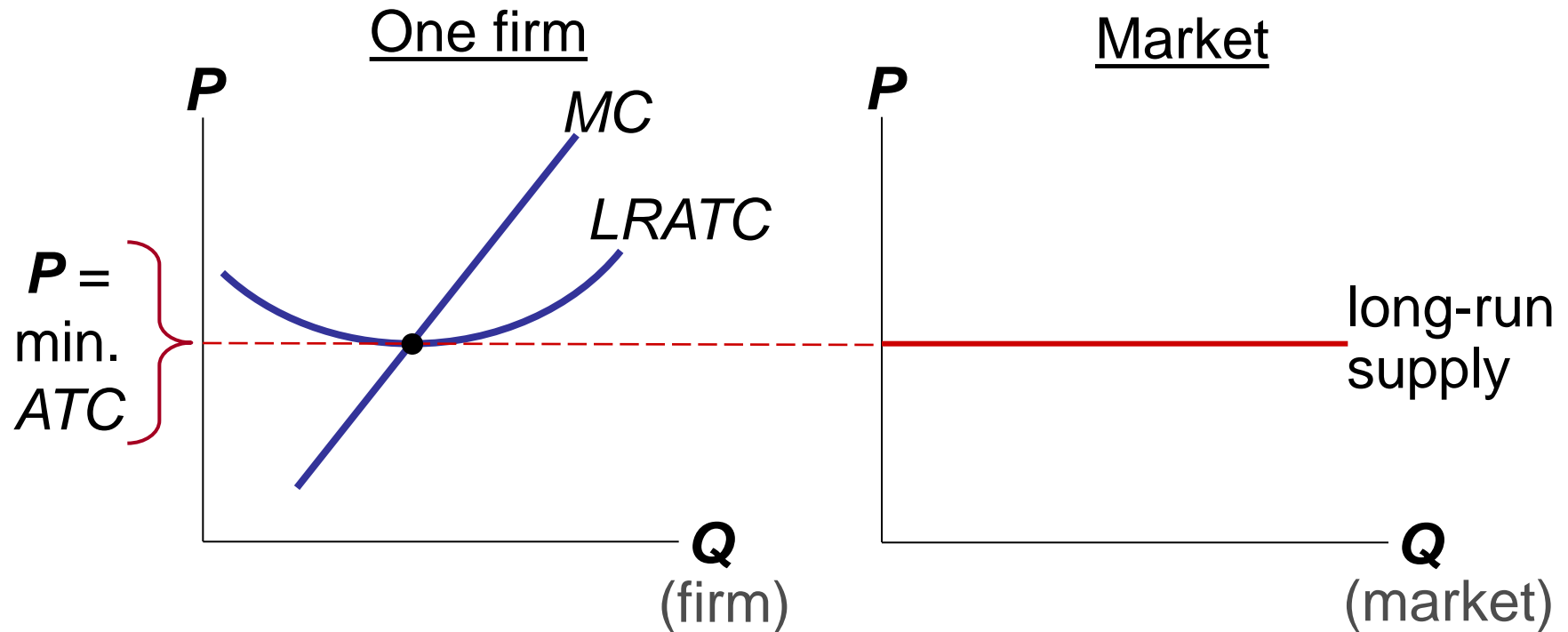
# Why Do Firms Stay in Business if Profit = 0?

- Recall, economic profit is revenue minus all costs, including implicit costs like the opportunity cost of the owner's time and money.
- In the zero-profit equilibrium,
  - firms earn enough revenue to cover these costs
  - accounting profit is positive

# The LR Market Supply Curve

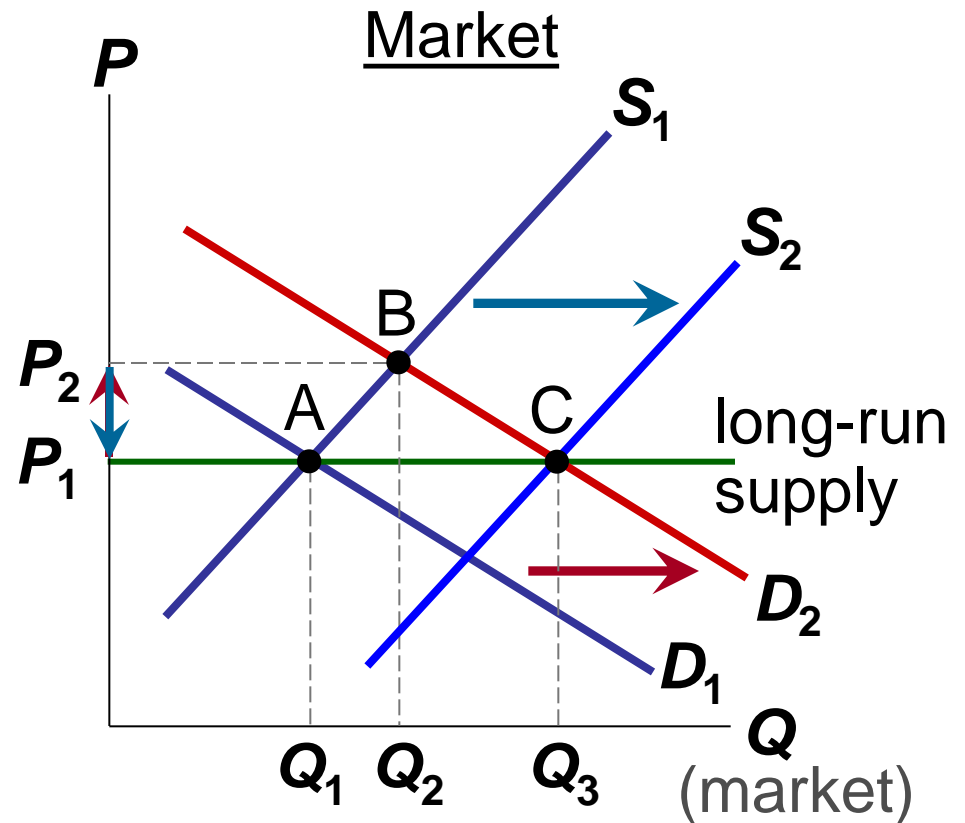
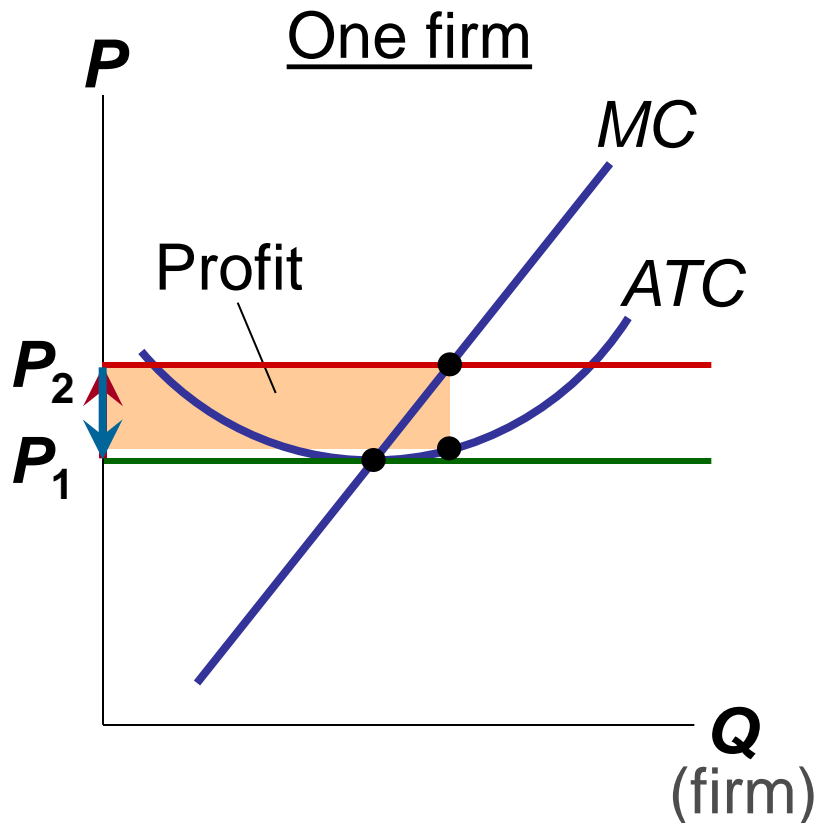
In the long run, the typical firm earns zero profit.

The LR market supply curve is horizontal at  $P = \text{minimum } ATC$ .



# SR & LR Effects of an Increase in Demand

A firm begins in short-run equilibrium at  $P_1$  and  $Q_1$  but then an increase in demand leads to a short-run increase in price to  $P_2$  and quantity to  $Q_2$ , driving profits to zero. This short-run increase in price and quantity leads to new entry, which increases the long-run supply curve, shifting it rightward from  $S_1$  to  $S_2$ . This new long-run supply curve intersects the new demand curve  $D_2$  at the long-run equilibrium point  $C$ , restoring long-run equilibrium at  $P_1$  and  $Q_3$ . The short-run increase in price and quantity is shown by the red arrow from  $P_1$  to  $P_2$  and the blue arrow from  $Q_1$  to  $Q_2$ . The long-run increase in quantity is shown by the red arrow from  $Q_2$  to  $Q_3$ .



# Why the LR Supply Curve Might Slope Upward

- The LR market supply curve is horizontal if
  - 1) all firms have identical costs, and
  - 2) costs do not change as other firms enter or exit the market.
- If either of these assumptions is not true, then LR supply curve slopes upward.



# 1) 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, LR market supply curve slopes upward.
- At any  $P$ ,
  - For the marginal firm,  $P = \text{minimum } ATC$  and profit = 0.
  - For lower-cost firms, profit  $> 0$ .

## 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.

# CONCLUSION:

## The Efficiency of a Competitive Market

- Profit-maximization:  $MC = MR$
- Perfect competition:  $P = MR$
- So, in the competitive eq'm:  $P = MC$
- Recall,  $MC$  is cost of producing the marginal unit.  
 $P$  is value to buyers of the marginal unit.
- So, the competitive eq'm is efficient, maximizes total surplus.
- In the next chapter, monopoly: pricing and production decisions, deadweight loss, regulation.

# SUMMARY

- For a firm in a perfectly competitive market, price = marginal revenue = average revenue.
- If  $P > AVC$ , a firm maximizes profit by producing the quantity where  $MR = MC$ . If  $P < AVC$ , a firm will shut down in the short run.
- If  $P < ATC$ , a firm will exit in the long run.
- In the short run, entry is not possible, and an increase in demand increases firms' profits.
- With free entry and exit, profits = 0 in the long run, and  $P = \text{minimum } ATC$ .