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## Firms in Competitive Markets



# 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		\$10

# 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			
1	10	9	1	\$10	\$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  $Q_a$ ,  $MC < MR$ .

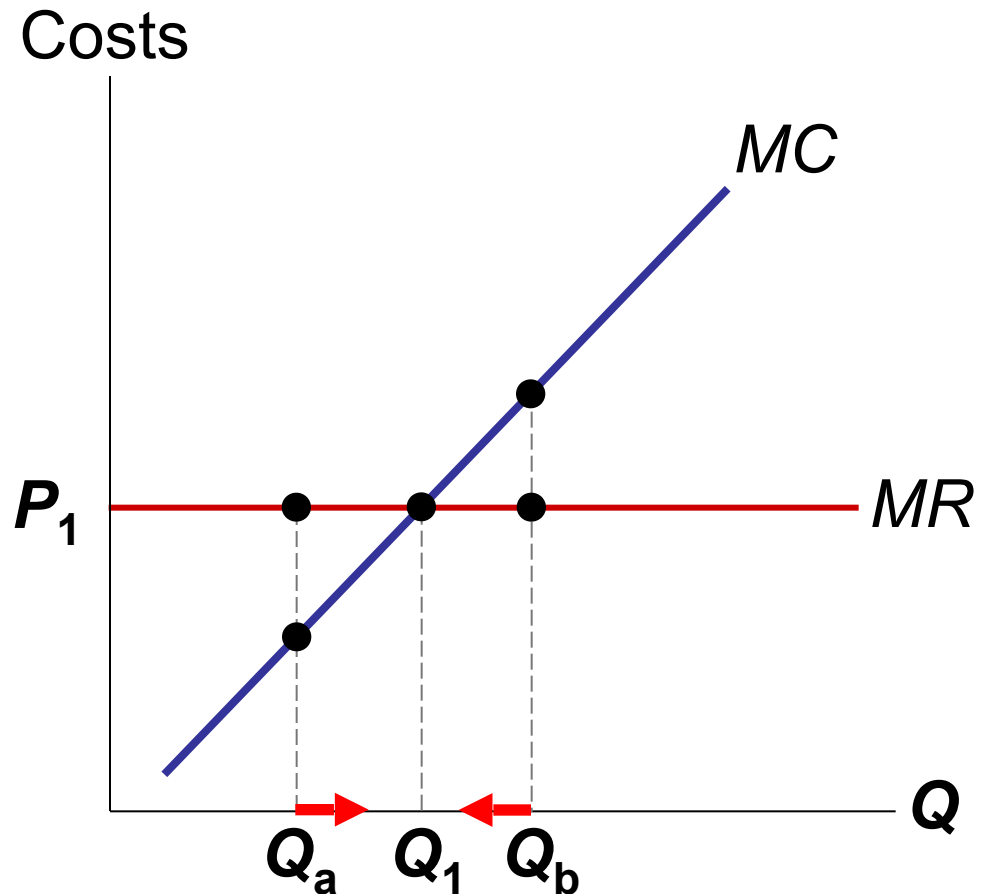
So, increase  $Q$   
to raise profit.

At  $Q_b$ ,  $MC > MR$ .

So, reduce  $Q$   
to raise profit.

At  $Q_1$ ,  $MC = MR$ .

Changing  $Q$   
would lower profit.



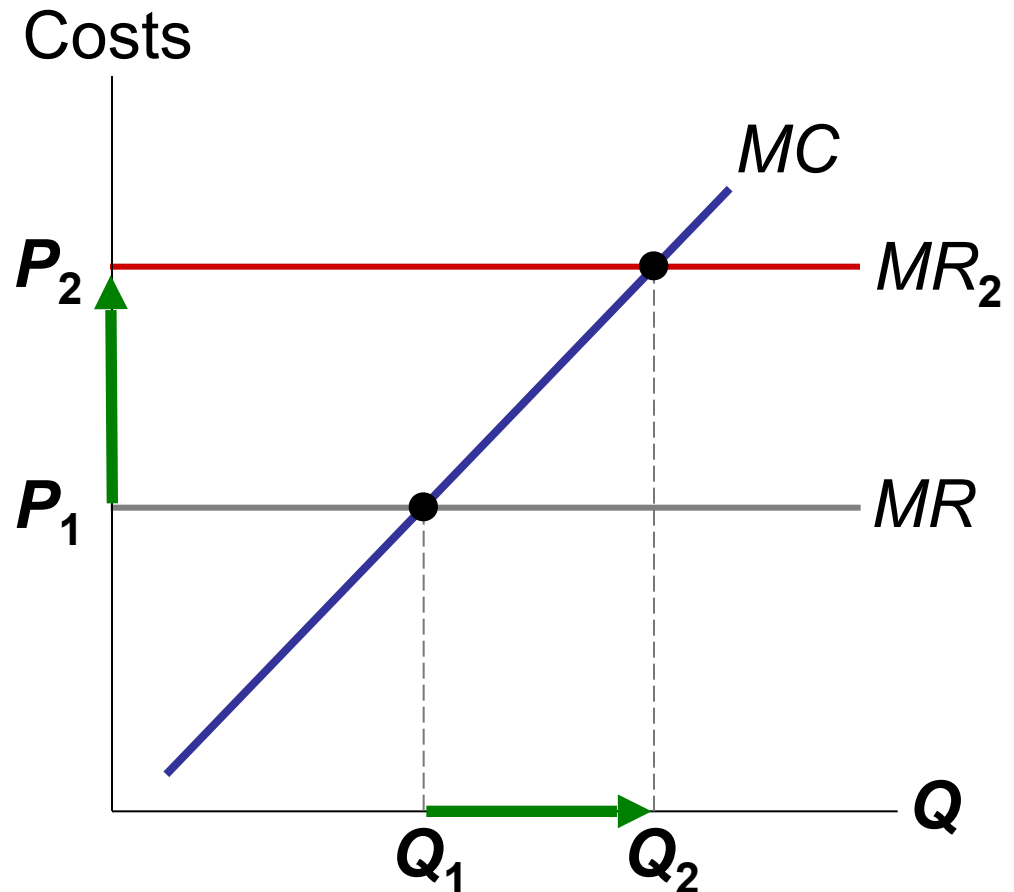
# MC and the Firm's Supply Decision

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:

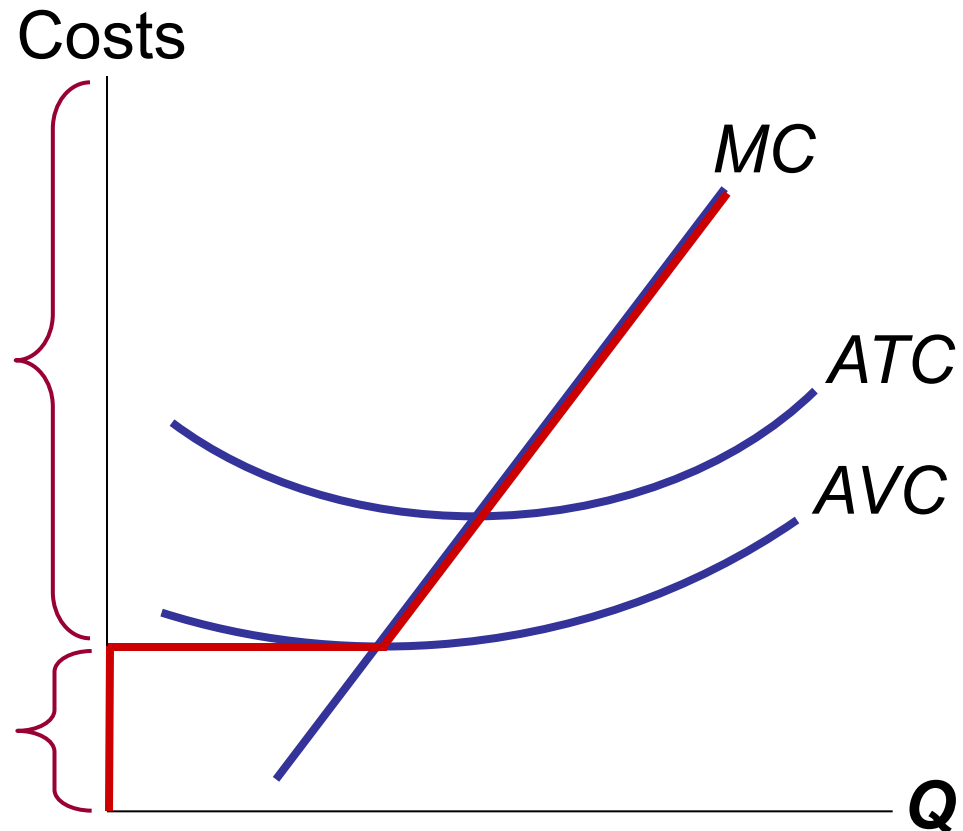
Shut down if  $P < AVC$

# A Competitive Firm's SR Supply Curve

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

above  $AVC$ . 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:

Exit if  $P < ATC$

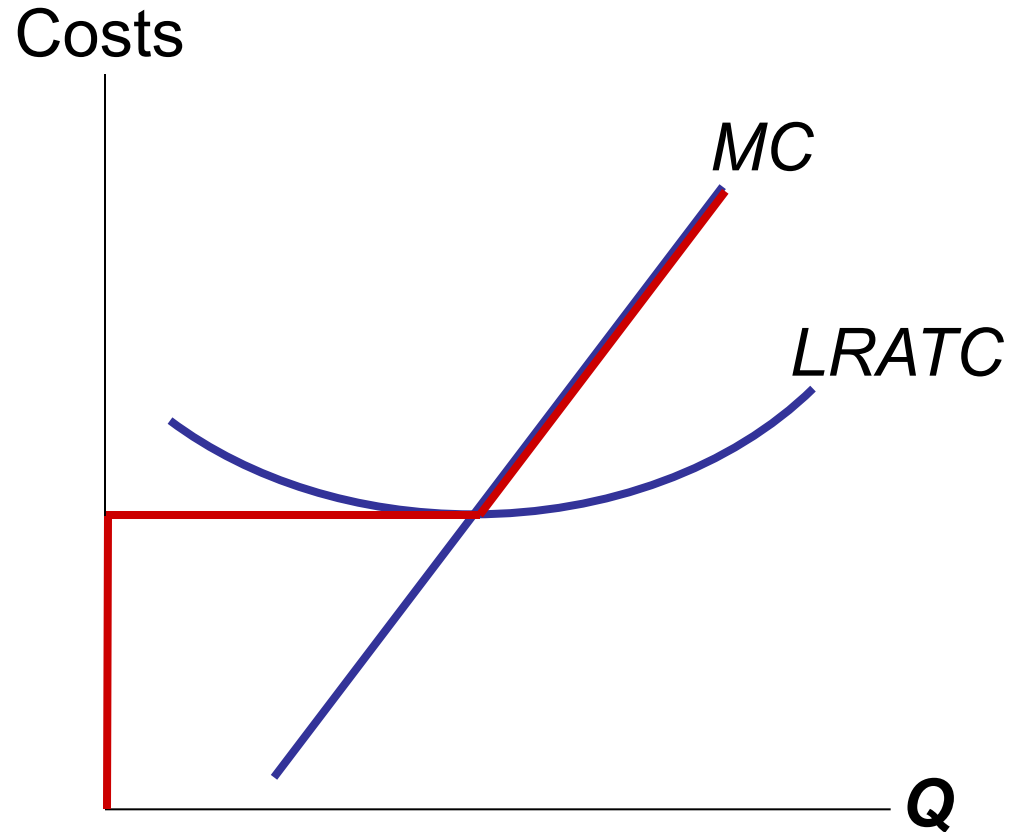
# A New Firm's Decision to Enter Market

- 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*.



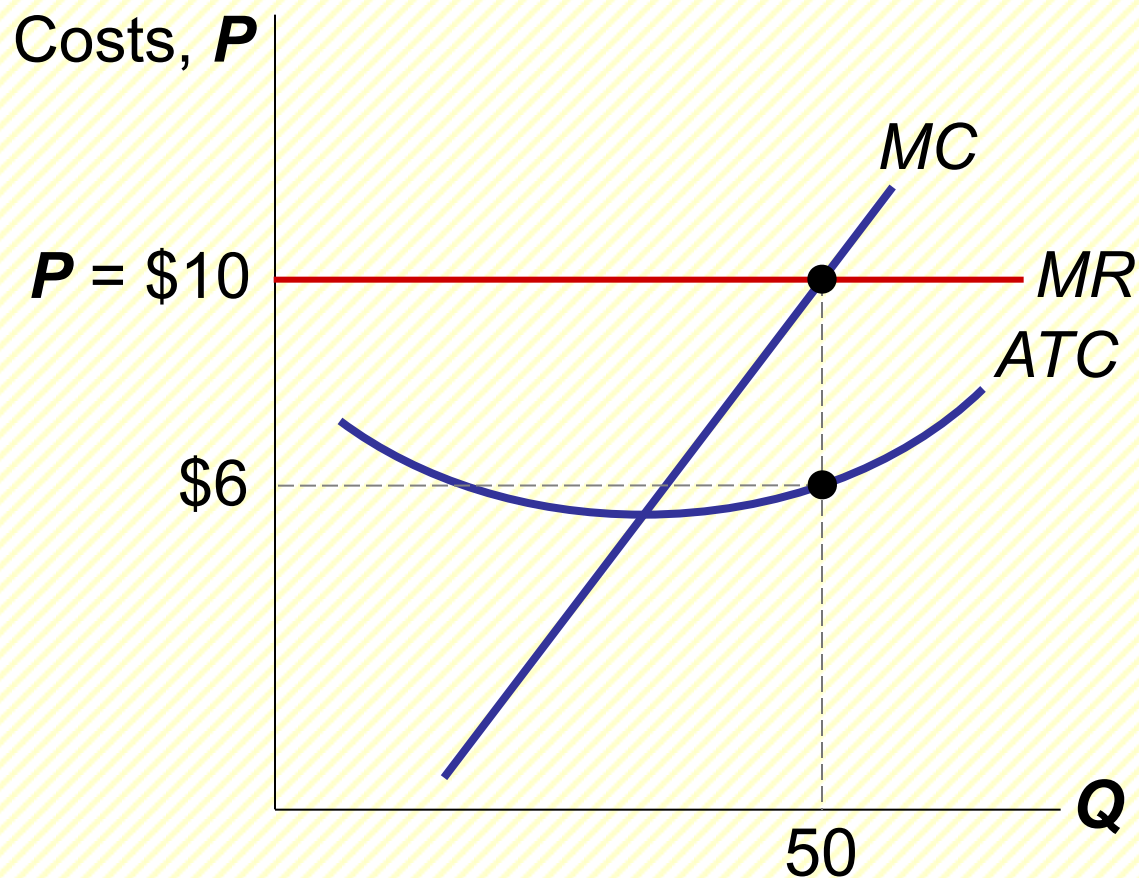
## ACTIVE LEARNING 2

# Identifying a firm's profit

Determine this firm's total profit.

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

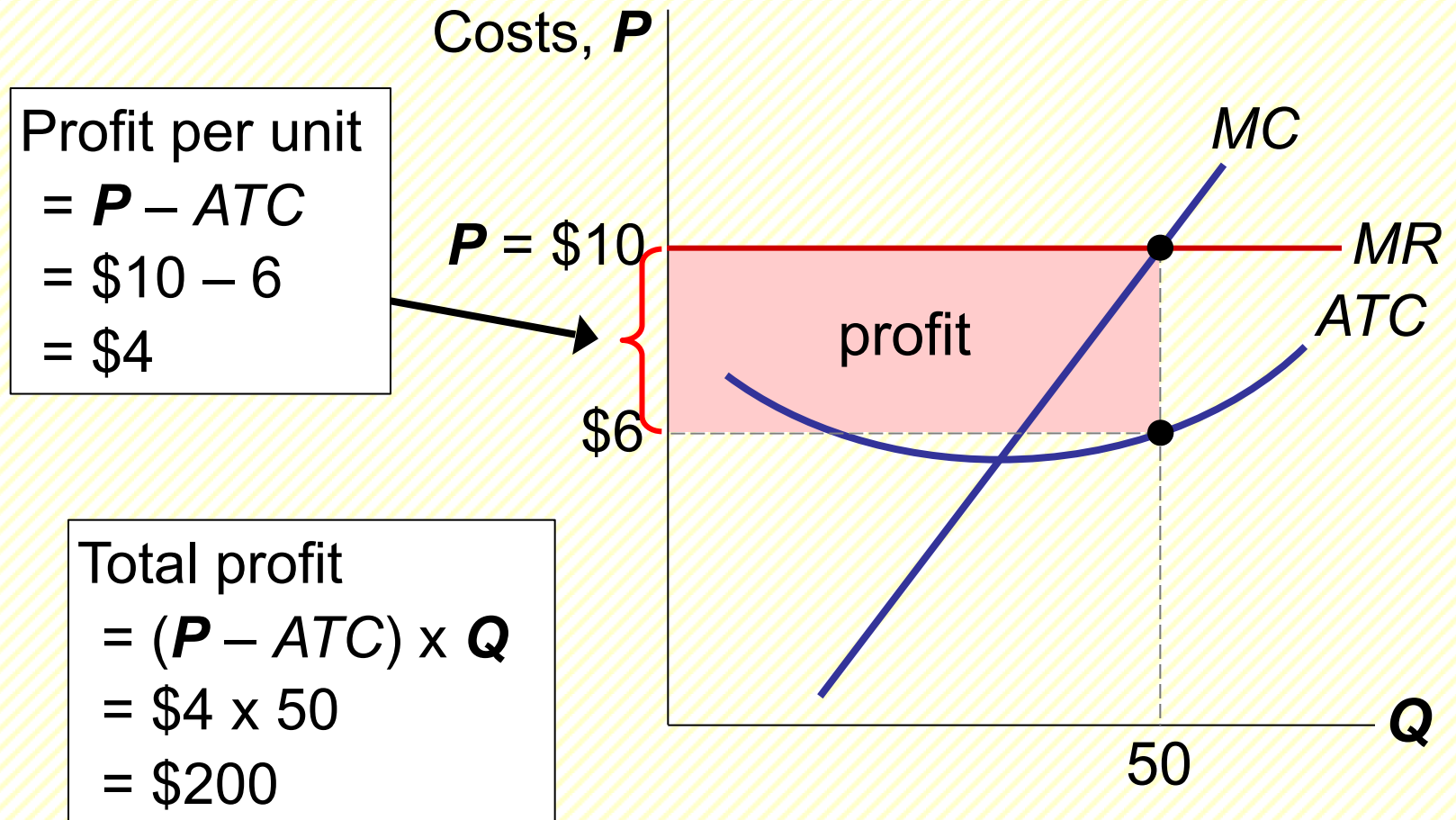
A competitive firm



# ACTIVE LEARNING 2

## Answers

### A competitive firm

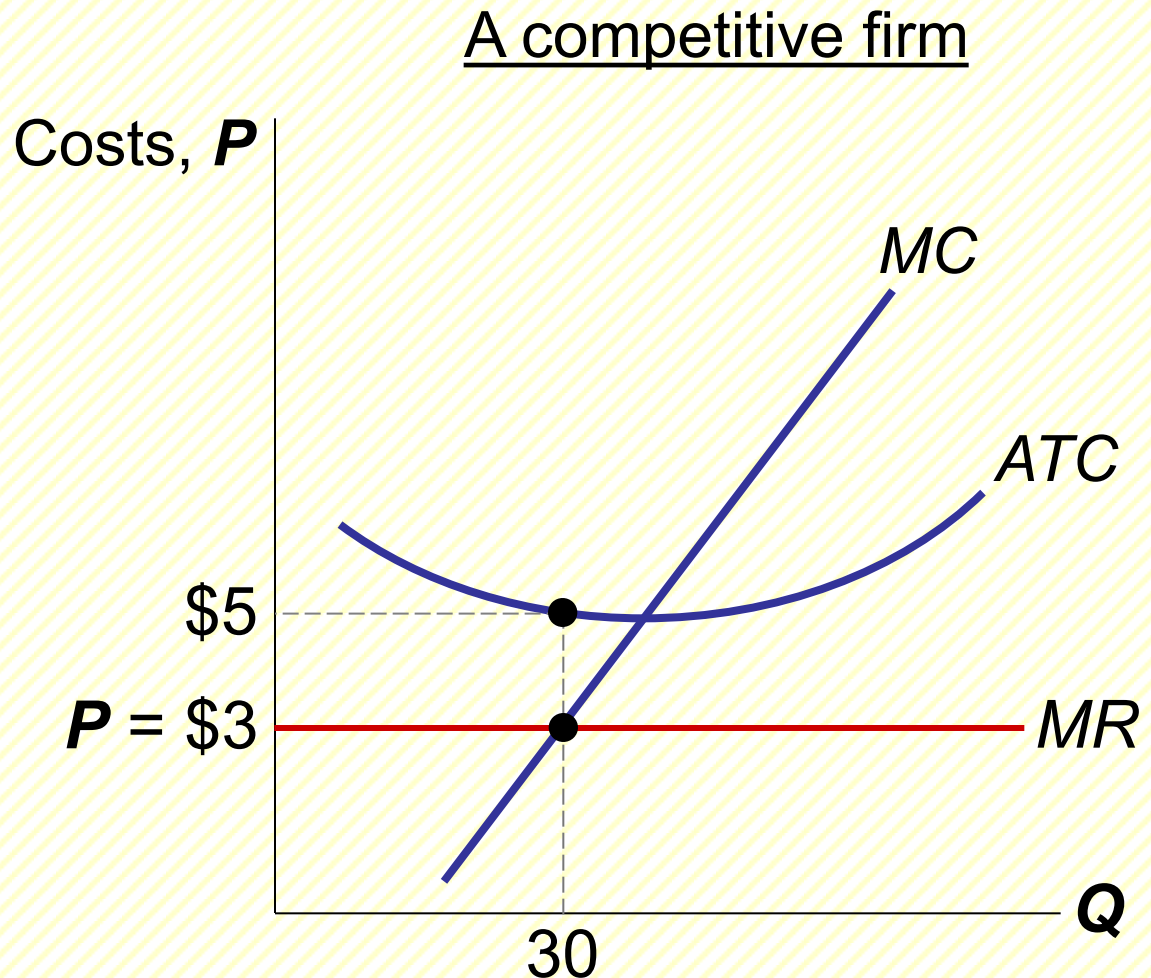


# ACTIVE LEARNING 3

## 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.



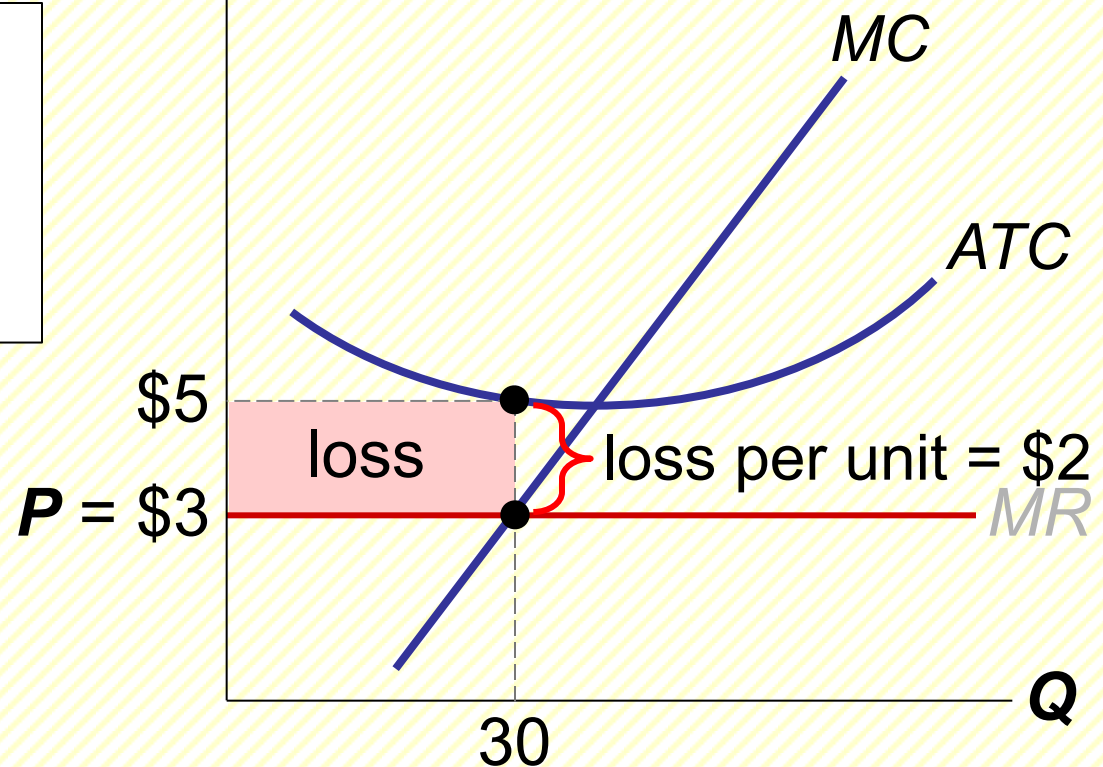
# ACTIVE LEARNING 3

## Answers

### A competitive firm

Costs,  $P$

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



# 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)



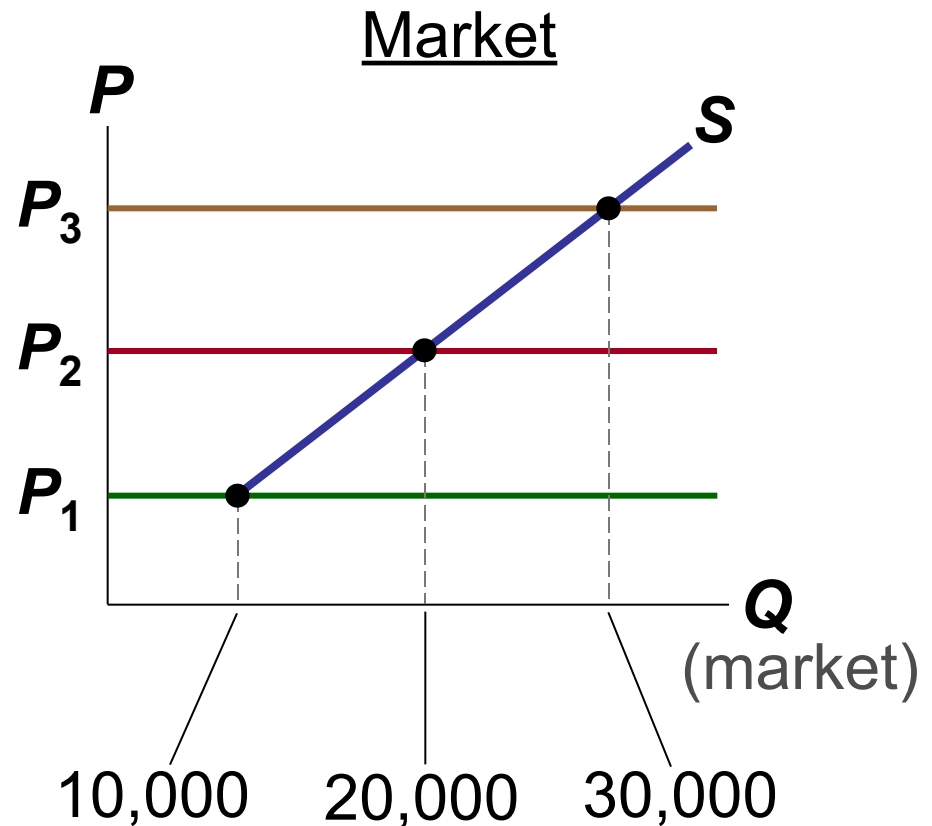
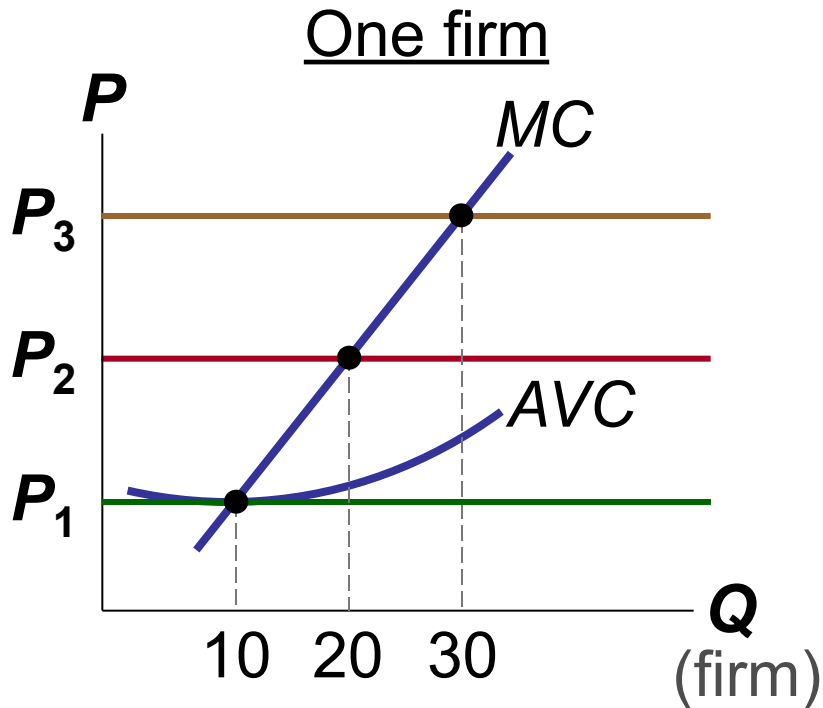
# The SR Market Supply Curve

- 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  $Q^s = 1000 \times$  (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,  $P = \text{minimum } ATC$ .

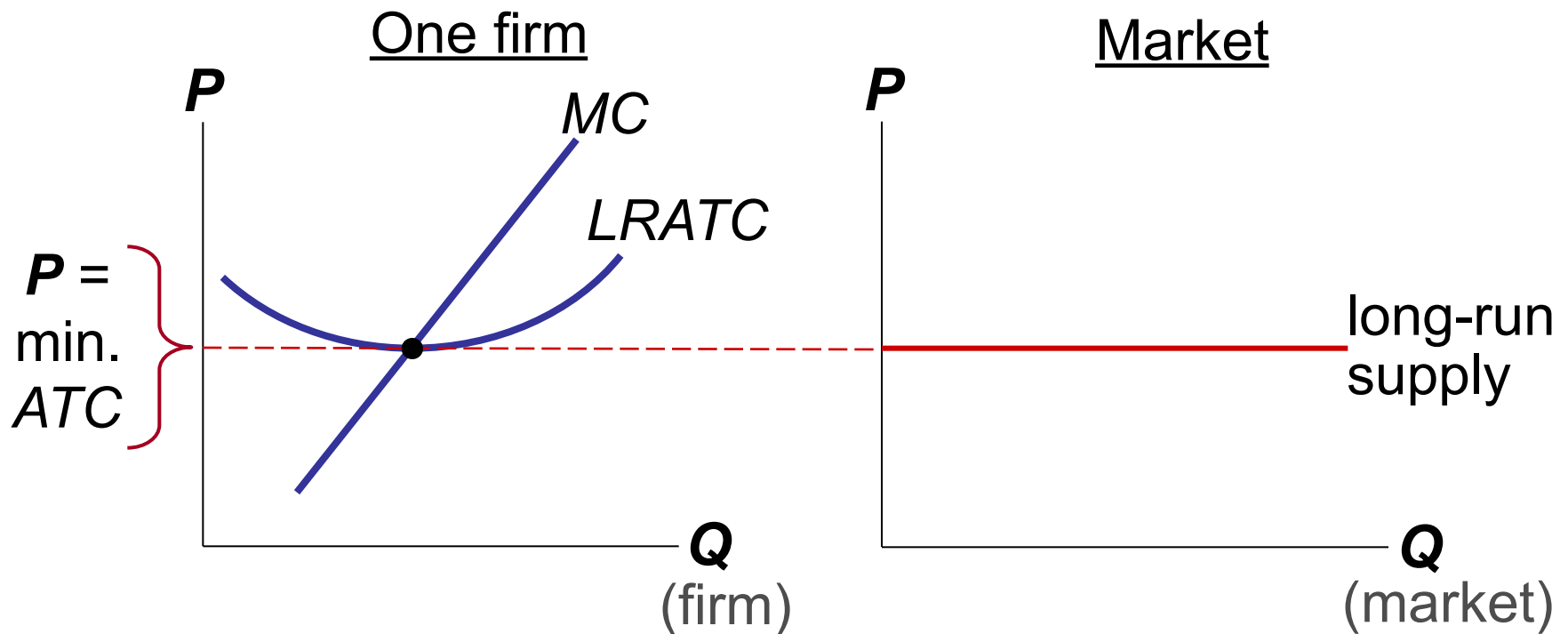
# Why Do Firms Stay in Business if Profit = 0?

- 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

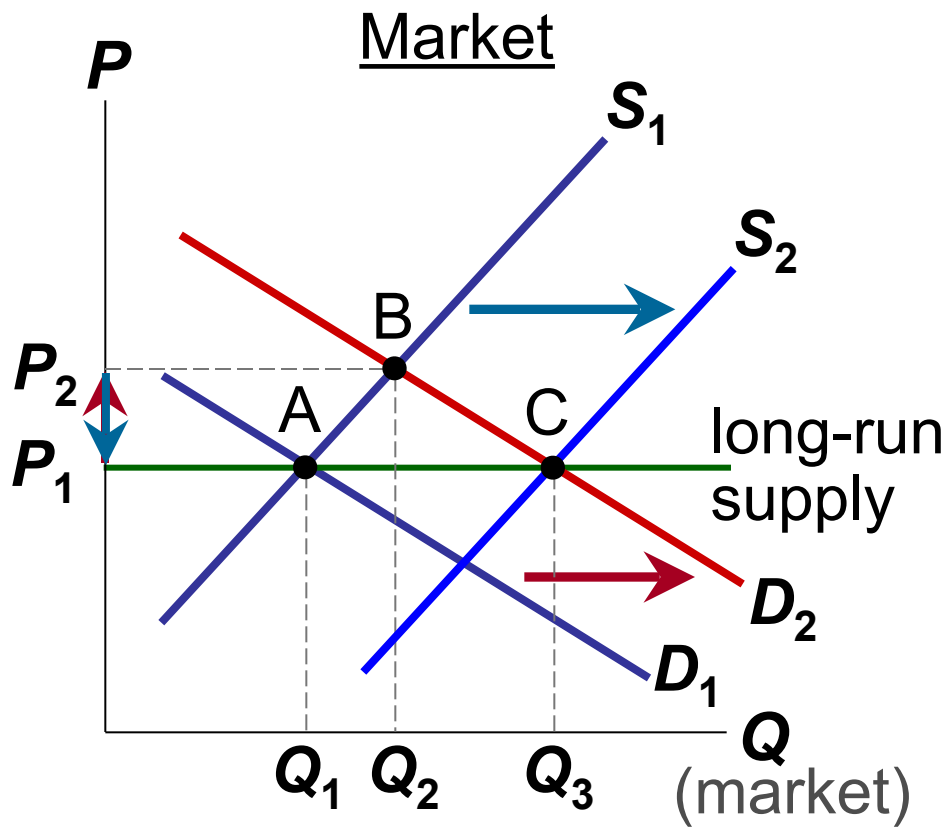
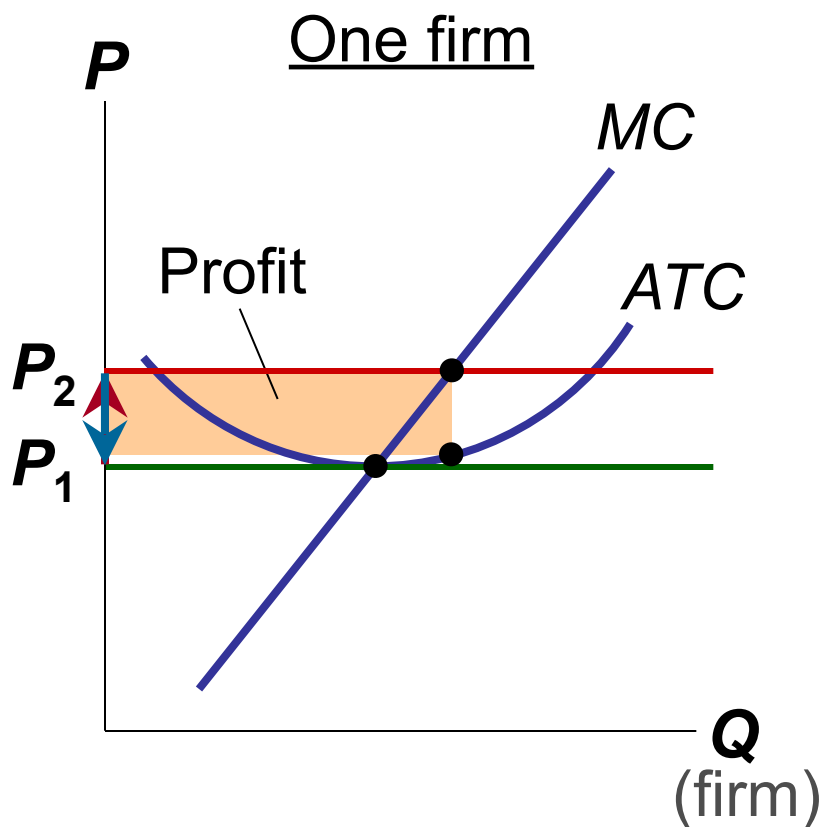
In the long run, the typical firm earns zero profit.

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 equilibrium at  $P_2$  and  $Q_2$ , driving profits to zero. In the long run, the increase in demand causes entry, which increases supply and reduces price to  $P_1$  and quantity to  $Q_3$ , restoring long-run equilibrium.



# 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 & production decisions, deadweight loss, regulation.

# CHAPTER 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  $P = \text{minimum } ATC$ .