

N. Gregory Mankiw

Principles of  
**Economics**  
Sixth Edition



14

Firms in Competitive Markets

Premium  
PowerPoint  
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## The Big Picture

- Chapter 13: The **cost** of production
  - Now, we will look at firm's **revenue**
    - But revenue depends on market structure
1. **Competitive market** (this chapter)
  2. **Monopoly** (chapter 15)
  3. **Monopolistic Competition** (chapter 16)
  4. **Oligopoly** (chapter 17)
    - Are there other types of markets? Yes, not now

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## Competitive Market Experiment

- 2 students form a group, each group will be either Ace group or Beta group
- Ace groups each have 44 Black (Green) stickers, 9 Purple (Red) stickers
- Beta groups each have 6 Black (Green) stickers, 41 Purple (Red) stickers
- Earnings Table (A or B) is provided

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## Competitive Market Experiment

- In round 1, you may only trade with "the other group" (1A with 1B, 2A with 2B, etc.)
- In round 2, you may walk around bargain and trade with any group you like
- Record your trade and "current" portfolio on the record sheet after each trade
- NOTE: Please double-check your trade with the other group---you will earn ZERO points if they don't match!!!

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### 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?

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## 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.

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## Characteristics of Perfect Competition

**Perfect Competition:** There are **Perfect Substitutes** (if don't buy from you, can buy from her instead)

This is typically resulted from:

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.

Q	P	TR	AR	MR
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	\$20	\$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		6	4
3	30	23	7	10	8	2
4	40	33	7		10	0
5	50	45	5	10	12	-2

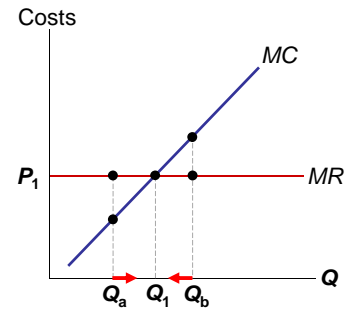
### MC and the Firm's Supply Decision

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.



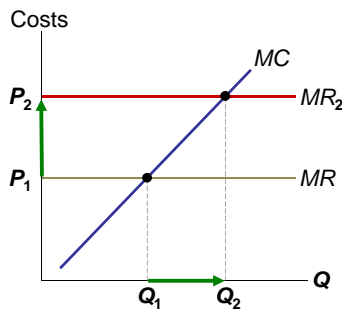
### MC and the Firm's Supply Decision

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:

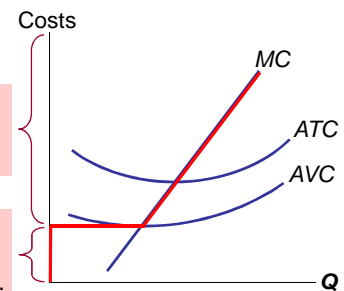
Shut down if  $P < AVC$

### A Competitive Firm's SR Supply Curve

The firm's SR supply curve is the portion of its  $MC$  curve above  $P = AVC$ .

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  $P < ATC$

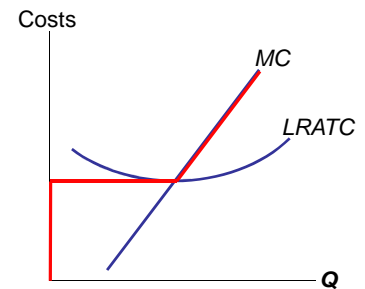
### A New Firm's Decision to Enter Market

- 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

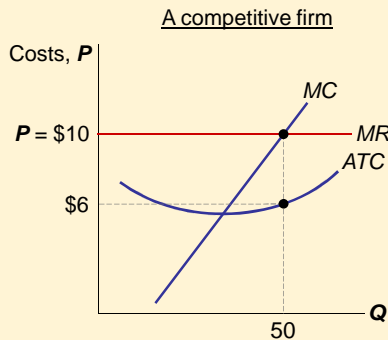
The firm's LR supply curve is the portion of its *MC* curve above *LRATC*.



### ACTIVE LEARNING 2 Identifying a firm's profit

Determine this firm's total profit.

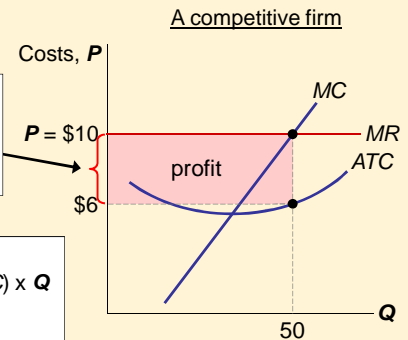
Identify the area on the graph that represents the firm's profit.



### ACTIVE LEARNING 2 Answers

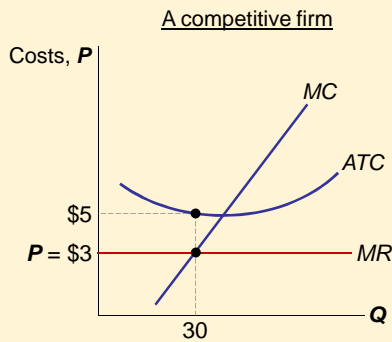
Profit per unit  
 $= P - ATC$   
 $= \$10 - 6$   
 $= \$4$

Total profit  
 $= (P - ATC) \times Q$   
 $= \$4 \times 50$   
 $= \$200$



### ACTIVE LEARNING 3 Identifying a firm's loss

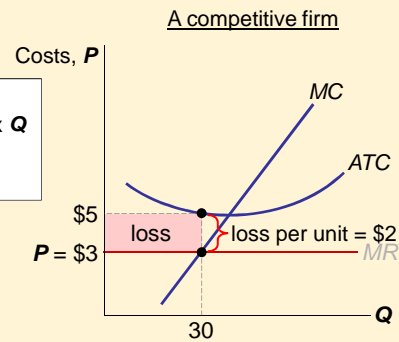
Determine this firm's total loss, assuming  $AVC < \$3$ .  
Identify the area on the graph that represents the firm's loss.



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### ACTIVE LEARNING 3 Answers

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



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### 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)

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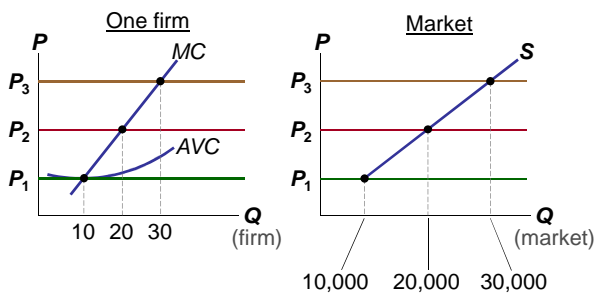
### The SR Market Supply Curve

- 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.

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### The SR Market Supply Curve

Example: 1000 identical firms  
At each  $P$ , market  $Q^s = 1000 \times$  (one firm's  $Q^s$ )



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### 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.

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

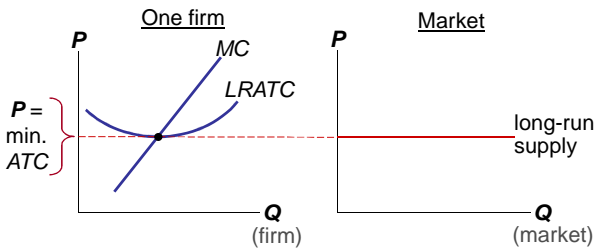
### Why Do Firms Stay in Business if Profit = 0?

- 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

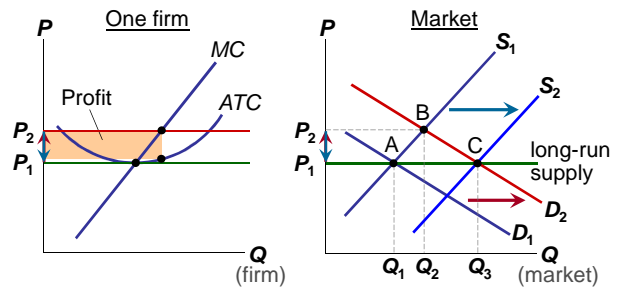
In the long run, the typical firm earns zero profit.

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



### SR & LR Effects of an Increase in Demand

A firm begins in  $P_1$  but then an increase in demand leads to a higher price  $P_2$  driving profits to zero. This causes entry, increasing supply and restoring long-run equilibrium at  $P_1$ , reducing  $P_2$  to  $P_1$ .



### 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.

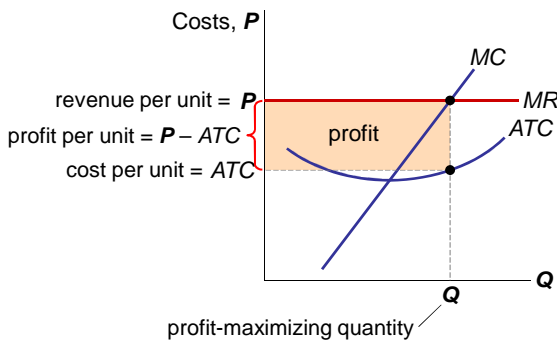
## SUMMARY

- 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  $P = \text{minimum } ATC$ .

## Perfect Competition

- Products are **Perfect Substitutes**
- Result: **Price Taking**
- $P = MR = MC$
- **SR:** Will operate if  $P > AVC$  (FC is sunk)
- **LR:** Will operate at  $P = ATC$ 
  - Firms enter if  $P > ATC$ ; exit if  $P < ATC$
- Homework: Mankiw, Ch.14, pp. 296-298, Problem 1, 4, 5, 10, 11, 12.

## A Firm With Profits



## A Firm With Losses

