## Principles of Economics

# Chapter 14:

# Firms in Competitive Markets

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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, see more advance courses in IO and firm competition

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## In This Chapter

- What is marginal revenue? How is it related to total and average revenue?
- What is a perfectly competitive market?
  - 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?

## What is a Competitive Market?

- In perfectly competitive markets, there exists Perfect Substitutes (Can buy from her if not from you), typically because of these characteristics:
  1. Market with many buyers and sellers
  2. Trading identical products
     - Because of the first two: each buyer and seller takes the market price as given (Price Takers)
  3. Firms can freely enter or exit the market

## The Revenue of a Competitive Firm

- Total Revenue, $TR = P \times Q$
- Average Revenue, $AR = TR / Q$
  - How much revenue does the firm receive for one unit produced
- Marginal Revenue, $MR = \Delta TR / \Delta Q$
  - Change in $TR$ from an additional unit sold
  - How much additional revenue does the firm receive if production increases 1 unit
- For competitive firms: $AR = P = MR$

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## Example: Amari's Apple Orchard

- Amari's apple orchard can produce up to 10 bushels of apples per year, and the current market price is $20 per bushel.
  - Calculate Amari's apple orchard's total revenue, average revenue, and marginal revenue

| Q | P | TR | AR | MR |
|---|---|---|---|---|
| 0 | $20 | | | |
| 1 | 20 | | | |
| 2 | 20 | | | |
| 3 | 20 | | | |
| 4 | 20 | | | |
| 5 | 20 | | | |
| 6 | 20 | | | |
| 7 | 20 | | | |
| 8 | 20 | | | |
| 9 | 20 | | | |
| 10 | 20 | | | |

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Amari's apple orchard can produce up to 10 bushels of apples per year, and the current market price is $20 per bushel.
Which of the following statement(s) are true about Amari's apple orchard's total revenue, average revenue, and marginal revenue?

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## Example: Amari's Apple Orchard

▶ Amari's apple orchard can produce up to 10 bushels of apples per year, and the current market price is $20 per bushel.

  ▸ Calculate Amari's apple orchard's total revenue, average revenue, and marginal revenue

| Q | P | TR | AR | MR |
|---|---|---|---|---|
| 0 | $20 | $0 | $20 | |
| | | | | $20 |
| 1 | 20 | 20 | 20 | |
| | | | | 20 |
| 2 | 20 | 40 | 20 | |
| | | | | 20 |
| 3 | 20 | 60 | 20 | |
| | | | | 20 |
| 4 | 20 | 80 | 20 | |
| | | | | 20 |
| 5 | 20 | 100 | 20 | |
| | | | | 20 |
| 6 | 20 | 120 | 20 | |
| | | | | 20 |
| 7 | 20 | 140 | 20 | |
| | | | | 20 |
| 8 | 20 | 160 | 20 | |
| | | | | 20 |
| 9 | 20 | 180 | 20 | |
| | | | | 20 |
| 10 | 20 | 200 | 20 | |

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## Profit Maximization

‣ Goal of a firm: maximize profit = $TR - TC$

  ‣ $TR = P \times Q$ and $TC = FC + VC$

‣ What $Q$ maximizes a firm's profit?

  ‣ Think at the margin: if $Q$ increases by one unit, revenue rises by $MR$ and cost rises by $MC$

‣ Comparing $MC$ with $MR$

  ‣ If $MR > MC$: increase $Q$ to raise profit

  ‣ If $MR < MC$: decrease $Q$ to raise profit

  ‣ Maximize profit for $Q$ where $MR = MC$

## Example: Amari's Apple Orchard: Profit

‣ Where is profit maximized?

‣ Is MR > MC or MR<MC at profit-maximizing Q?

| Q | TR | TC | Profit | MR | MC | Δ Profit = MR - MC |
|---|----|----|--------|----|----|--------------------|
| 0 | $0 | $6 | | | | |
| 1 | 20 | 14 | | | | |
| 2 | 40 | 24 | | | | |
| 3 | 60 | 36 | | | | |
| 4 | 80 | 50 | | | | |
| 5 | 100 | 66 | | | | |
| 6 | 120 | 85 | | | | |
| 7 | 140 | 105 | | | | |
| 8 | 160 | 126 | | | | |
| 9 | 180 | 150 | | | | |
| 10 | 200 | 176 | | | | |

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Where is profit maximized?

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Is MR > MC or MR<MC at profit-maximizing Q?

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## Example: Amari's Apple Orchard: Profit

If MR > MC,
increasing Q raises profit.

Max profit at Q where
MR = MC

If MR < MC,
reducing Q raises profit.

| Q | TR | TC | Profit | MR | MC | Δ Profit = MR - MC |
|---|----|----|--------|----|----|-----|
| 0 | $0 | $6 | -6 | | | |
| | | | | $20 | 8 | 12 |
| 1 | 20 | 14 | 6 | | | |
| | | | | 20 | 10 | 10 |
| 2 | 40 | 24 | 16 | | | |
| | | | | 20 | 12 | 8 |
| 3 | 60 | 36 | 24 | | | |
| | | | | 20 | 14 | 6 |
| 4 | 80 | 50 | 30 | | | |
| | | | | 20 | 16 | 4 |
| 5 | 100 | 66 | 34 | | | |
| | | | | 20 | 19 | 2 |
| 6 | 120 | 85 | 35 | | | |
| | | | | 20 | 20 | 0 |
| 7 | 140 | 105 | 35 | | | |
| | | | | 20 | 22 | -2 |
| 8 | 160 | 126 | 34 | | | |
| | | | | 20 | 24 | -4 |
| 9 | 180 | 150 | 30 | | | |
| | | | | 20 | 26 | -6 |
| 10 | 200 | 176 | 26 | | | |

## MC and the Firm's Supply Decision

If the market price is $P_1 = MR_1$

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.

Rule: MR = MC at the profit-maximizing Q.
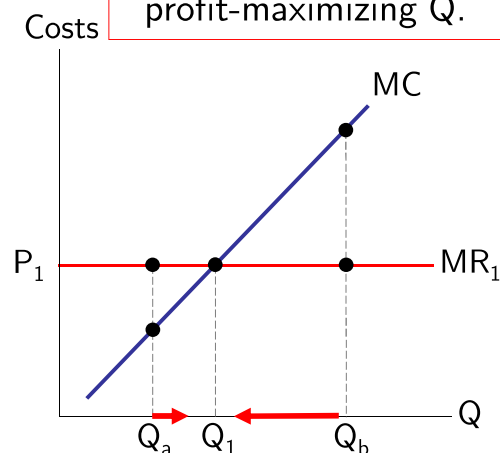
## MC and the Firm's Supply Decision

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

the MC curve <u>is</u> the firm's supply curve.
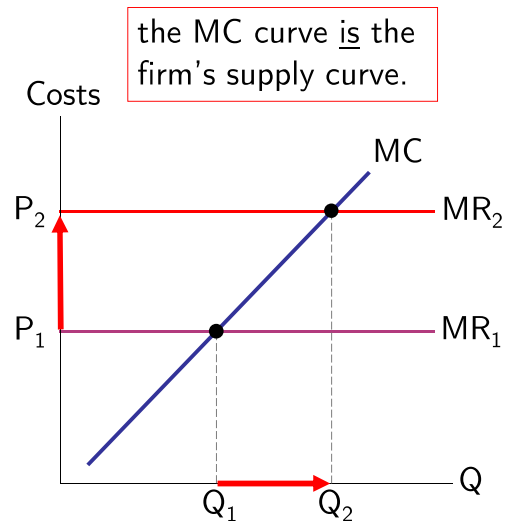
## Shutdown or Exit?

‣ Shutdown:
  ‣ A short-run decision not to produce anything because of market conditions.
  ‣ Q = 0 in the short run
‣ 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.

## Short-run Decision to Shut Down

‣ Should a firm shut-down in the short run?
- Cost of shutting down
  = revenue loss = **TR**
- Benefit of shutting down
  = cost savings = **VC**
  (because the firm must still pay **FC**)

‣ Shut down if **TR** < **VC**, or P < AVC
  ‣ Produce Q = 0 in the short run

## A Competitive Firm's Short Run Supply Curve

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

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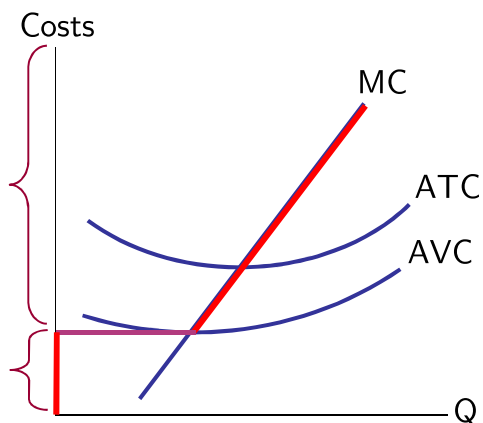


Firm's SR supply curve is the portion of its **MC** curve above **AVC**.

## The Irrelevance of Sunk Costs

▸ Sunk Cost

▸ A cost that has already been committed and cannot be recovered

▸ Should be ignored when making decisions

  ▸ You must pay them regardless of your choice

▸ In the short run, *FC* are sunk costs

  ▸ So, *FC* should not matter in the decision to shut down

## Active Learning: Your Favorite Concert

  ▸ While attending a concert, you paid NT$700 for a hoodie of your favorite artist. But you bought it 2 sizes too small.

▸ You decide to sell your hoodie to your cousin who lives in a different town.

▸ You'll have to pay NT$200 for HCT delivery.

▸ What is the lowest price you should ask for the hoodie?

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While attending a concert, you paid NT$700 for a hoodie of your favorite artist. But you bought it 2 sizes too small.
You decide to sell your hoodie to your cousin who lives in a different town.
You'll have to pay NT$200 for HCT delivery.
What is the lowest price you should ask for the hoodie?

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## Active Learning: Your Favorite Concert

▸ While attending a concert, you paid NT$700 for a hoodie of your favorite artist. But you bought it 2 sizes too small.

▸ You decide to sell your hoodie to your cousin who lives in a different town.

▸ You'll have to pay NT$200 for HCT delivery.

▸ What is the lowest price you should ask for the hoodie?

NT$200 (new cost) since the NT$700 is sunk cost!!

# A Firm's Long-Run Decision

▸ Should a firm exit or enter in the long run?
  ▸ Cost of exiting market = revenue loss = **TR**
  ▸ Benefit of exiting market = cost savings = **TC**
    ▸ (Remember, **FC** = 0 in long run!)
▸ Firm's long-run decision
  ▸ Exit the market if: **TR** < **TC**
              (same as: **P** < **ATC**)
  ▸ Enter the market if: **TR** > **TC**
              (same as: **P** > **ATC**)

# The Competitive Firm's Long Run Supply Curve



If P > ATC, then the firm produces Q on the MC curve.

If P < ATC, then firm exits in the long run.
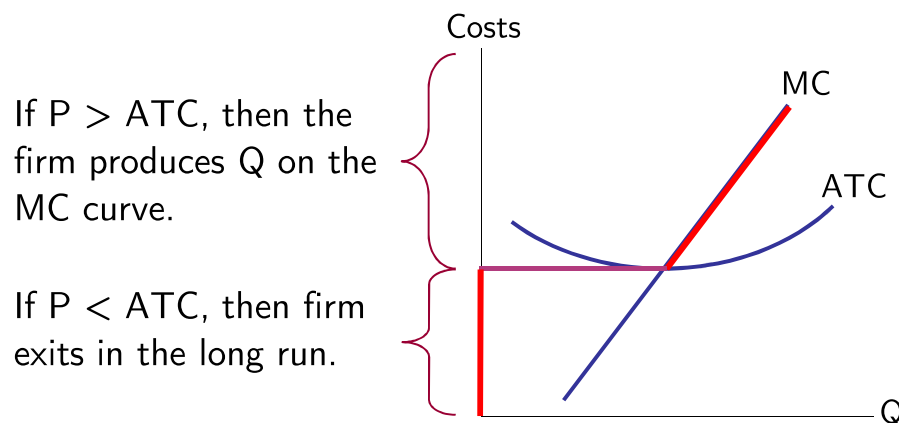
Firm's LR supply curve is the portion of its **MC** curve above **ATC**.

## Example: Amari's Profit: the Graph

▸ Profit = **TR** − **TC**

▸ Profit = (**P** − **ATC**) × **Q**
  ▸ = (20 − 15) * 7
  ▸ = 140 − 105 = $35

▸ **TR** = **P** × **Q** = $140

▸ **TC** = **ATC** × **Q** = $10

Costs, P

$P_1 = \$20$

$ATC_1 = \$15$

Find Q where
MR = MC

MC

$MR_1$

ATC

$Q_1 = 7$    Q

(bushels of apples)
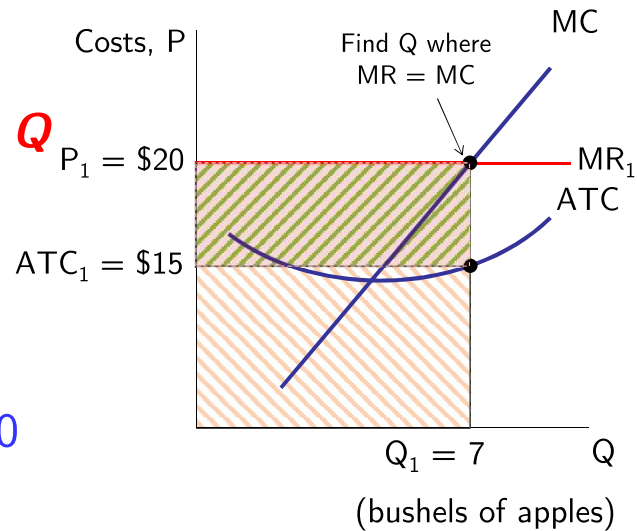
## Active Learning: Identifying Profit or Loss

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

Costs, P

MC

$8

ATC

$5

AVC

P = $3

MR

Q

30  32    40
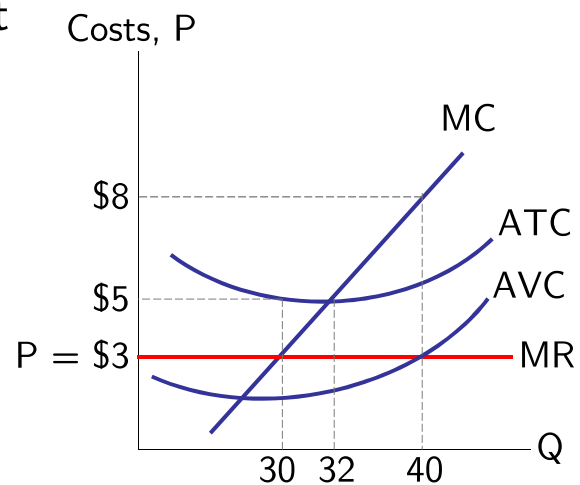
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What is the profit-maximizing quantity at P=$3?

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What is the ATC at this Q?

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## Active Learning: Answers

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

Costs, P

MC

$8

ATC

$5

AVC

loss

P = $3 ————————————— MR

Q

30 32    40
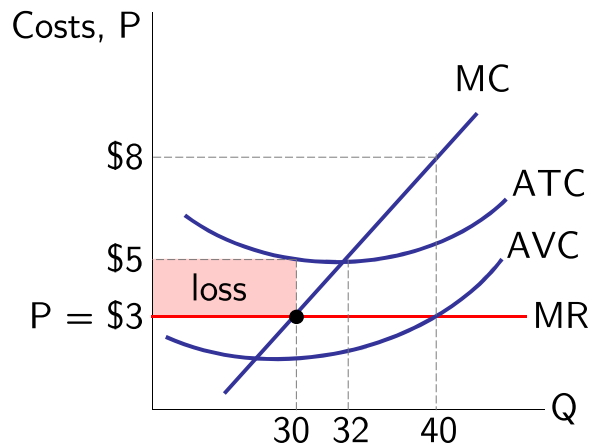
## Market Supply: Assumptions

1. All existing firms and potential entrants have identical cost curves.
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)

## Short Run 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
‣ Market Supply:
  ‣ The sum of all individual supplies

## The Short Run Market Supply Curve

‣ Assume: 1,000 identical firms
‣ At each P, market $Q^s = 1{,}000 \times$ (one firm's $Q^s$)

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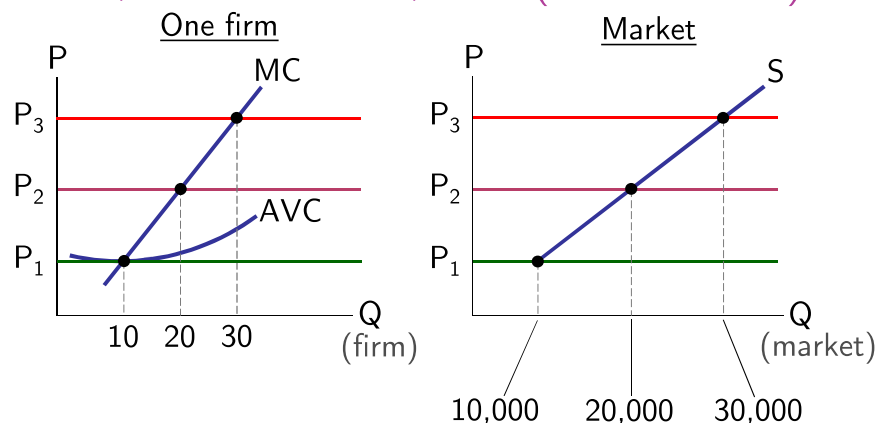
## Entry and Exit in the Long Run

▸ In the long run, the number of firms can change due to entry and 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

▸ Until zero economic profit ($P = $ min $ATC$)

## The Zero-Profit Condition

▸ Long-run Equilibrium: the process of entry or exit is complete

  ▸ Remaining firms earn zero economic profit

▸ Zero Economic Profit: when $P = $ min $ATC$

  ▸ Since firms produce where $P = MR = MC$
  ▸ The zero-profit condition is $P = MC = ATC$
  ▸ Recall that $MC$ intersects $ATC$ at min $ATC$
  ▸ Hence, in the long run, $P = $ min $ATC$
  ▸ Efficient scale

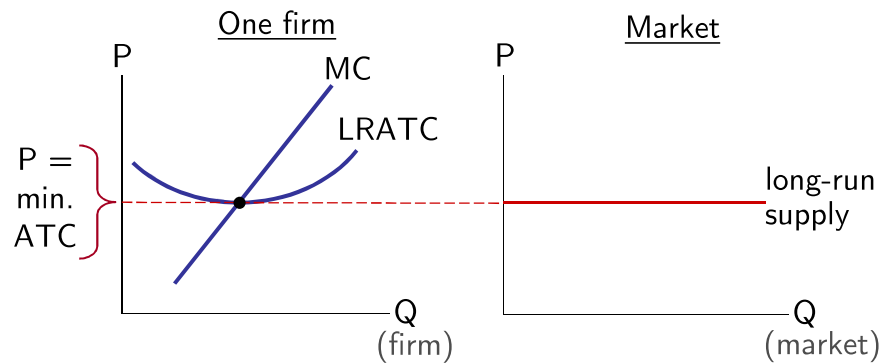# The Long Run Market Supply Curve

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

The LR market supply curve is horizontal at P = minimum ATC.

One firm

P

MC

LRATC

P =
min.
ATC

Q
(firm)

Market

P

long-run
supply

Q
(market)

# Why Stay in Business with Zero Profit?

▸ Why do competitive firms stay in business if they make zero profit?

  ▸ Profit = Total Revenue − Total Cost
  ▸ Total cost includes all implicit costs like the opportunity cost of the owner's time and money
  ▸ Zero-profit equilibrium
    ▸ Economic profit is zero
    ▸ Accounting profit is positive

## Active Learning: Let's Recap!

A. For each of the prices in the graph, identify:

1. the profit-maximizing quantities
2. If the firm is making a profit (or loss)
3. If the firm should produce or shut down in the SR.

B. Identify which ($P$, $Q$) is a long-run equilibrium



Costs, P

MC
ATC
$P_5$ — $MR_5$
$P_4$ — $MR_4$
$P_3$ — $MR_3$
AVC
$P_2$ — $MR_2$
$P_1$ — $MR_1$
Q

5  10 15 20 25

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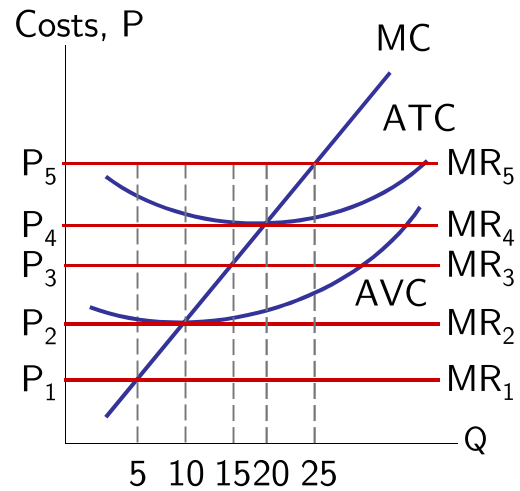
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For price P1 in the graph, the profit-maximizing quantity is

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For the profit-maximizing quantity at price P1, the firm should

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For price P2 in the graph, the profit-maximizing quantity is

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For the profit-maximizing quantity at price P2, the firm should

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For price P3 in the graph, the profit-maximizing quantity is

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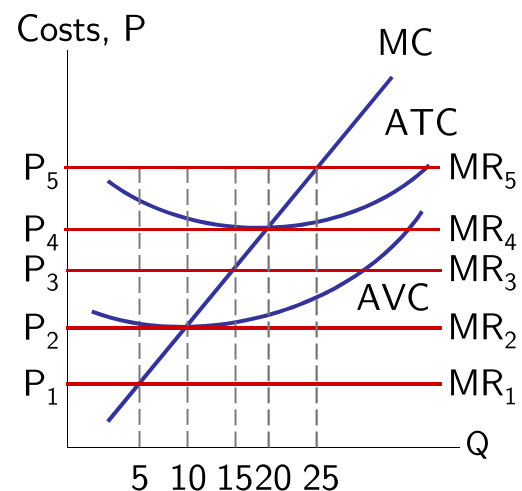
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For price P4 in the graph, the profit-maximizing quantity is

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For the profit-maximizing quantity at price P4, the firm should

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For price P5 in the graph, the profit-maximizing quantity is

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For the profit-maximizing quantity at price P5, the firm should

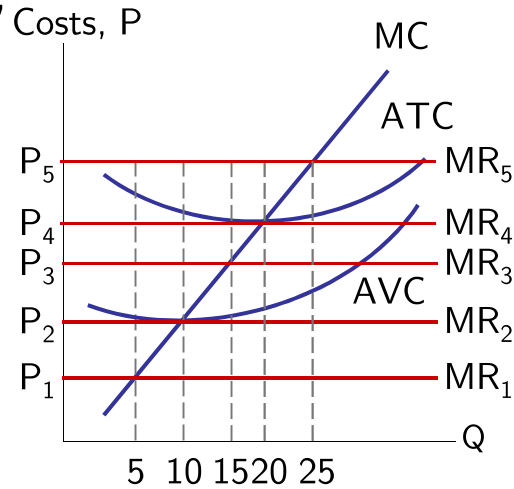ⓘ Start presenting to display the poll results on this slide.

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## Active Learning: Answers P4, P5

For: $P_4$ : $MR = MC$ at $Q = 20$,

Costs, P

‣ where $P_4 = $ min $ATC$
‣ this is the efficient point
‣ this is a LR equilibrium

For $P_5$ : $MR = MC$ at $Q = 25$,

‣ where $P_5 > ATC$,
‣ Profit in the SR

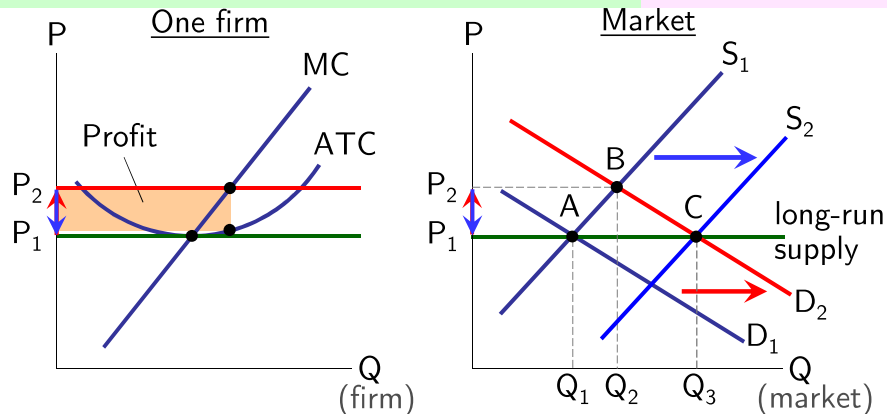## SR and LR Effects of an Increase in Demand

…leading …driving profits to zero fits induce entry,
profits fc and restoring long-run eq'm. e right, reducing P…

## Long-Run Supply Curve

▸ 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

## LR Supply Curve may Slope Upward

▸ 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.

## LR Supply Curve may Slope Upward

▸ 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.

## Efficiency of a Competitive Market

▸ Profit-maximization: $Q$ where $MC = MR$

- ▸ Perfect competition: $P = MR$
- ▸ So, in the competitive equilibrium: $P = MC$

▸ The competitive equilibrium is efficient

- ▸ Maximizes total surplus because $P = MC$
  - ▸ $MC$ is the cost of producing the marginal unit
  - ▸ $P$ is value to buyers of the marginal unit

## Think-Pair-Share

### Walking into a Walmart store at 2am 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?

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Why do you think this Walmart is open all night?

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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?

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If Walmart had 10 customers during its daytime hours, do you think it would continue to operate?

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## Chapter In A Nutshell

‣ A competitive firm w/ substitutes is a price taker
- ‣ Its revenue is proportional to the amount of output it produces.
- ‣ P = MR = AR
- ‣ The firm's marginal-cost curve is its supply curve
‣ Short Run: a firm cannot recover its FC
- ‣ Shut down temporarily if P < AVC
‣ Long Run: the firm can recover both FC and VC
- ‣ Exit if P < ATC

## Chapter In A Nutshell

‣ In a market with free entry and exit, profit is driven to zero in the long run.
- ‣ All firms produce at efficient scale, P = min ATC
- ‣ Number of firms adjusts to satisfy the $Q^d$ at this price
‣ Changes in demand have different effects over different time horizons.
- ‣ Short run: Increase/decrease in demand raises/lowers prices and leads to profits (a losses).
- ‣ Long run: zero-profit equilibrium

## Chapter 14: 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, Problem 3-5, 9, 11

## Chapter 14: Challenge Questions (Past Finals)

▸ 2009 - Essay C

▸ 2010 - Essay B

▸ 2013 - Part III

▸ 2014 - Essay C3-C4

▸ 2017 - Essay D2-D3

▸ 2018 - Essay C2

▸ 2019 - Essay B1-B3

▸ 2020 - Essay A, C5-13

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Audience Q&A Session

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# Principles of Economics

Ch.14:

# The End