

N. GREGORY MANKIW NINTH EDITION

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

2020/11/27 Perfect Competition Joseph Tao-yi Wang

IN THIS CHAPTER

- 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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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

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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 1: Amari's Apple Orchard: Revenue

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	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 $MR = MC$

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EXAMPLE 2: 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	$\Delta \text{Profit} = MR - MC$
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			

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MC and the Firm's Supply Decision – 1

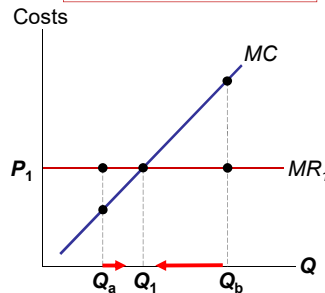
If the market price is $P_1 = MR_1$

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 .



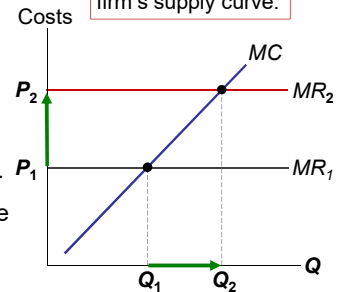
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MC and the Firm's Supply Decision – 2

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 is the firm's supply curve.



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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.

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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

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A Competitive Firm's Short Run Supply Curve

Costs

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

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

The firm's short run supply curve is the portion of its **MC** curve above **AVC**.

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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

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Active Learning 1: 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

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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**)

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The Competitive Firm's Long Run Supply Curve

Costs

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

If $P < ATC$, then firm exits in the long run.

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

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EXAMPLE 3: Amari's Profit: the Graph

Profit = **TR - TC**

Costs, P

Find Q where $MR = MC$

Profit = $(P - ATC) \times Q$
 $= (20 - 15) \times 7$ $P_1 = \$20$
 $= 140 - 105 = \$35$

TR = $P \times Q = \$140$

TC = $ATC \times Q = \$105$

$ATC_1 = \$15$

$Q_1 = 7$ Q

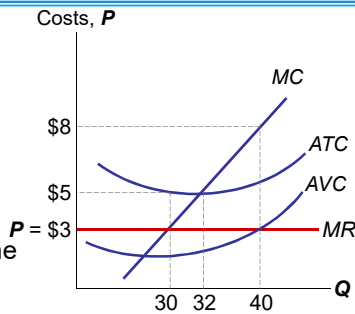
(bushels of apples)

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Active Learning 2: Identifying Profit or Loss

Determine this firm's profit or loss

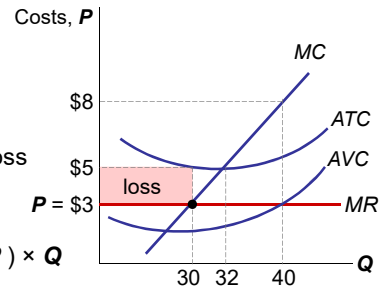
- Calculate TR, TC
- Calculate profit (or loss)
- Identify the profit or loss area on the graph



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Active Learning 2: Answers

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



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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)

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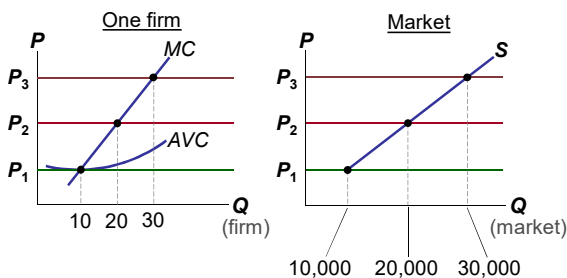
Short Run Market Supply Curve

- 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

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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 ($P = \min ATC$)

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The Zero-Profit Condition

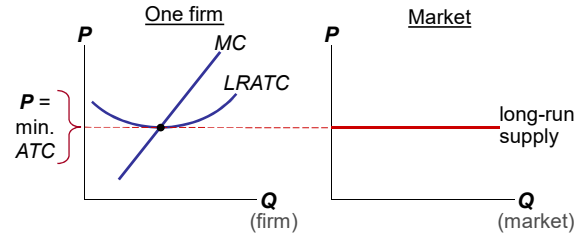
- Long-run equilibrium: the process of entry or exit is complete
 - Remaining firms earn zero economic profit
- Zero economic profit: when $P = \min ATC$
 - Since firms produce where $P = MR = MC$
 - The zero-profit condition is $P = MC = ATC$
 - Recall that MC intersects ATC at $\min ATC$
 - Hence, in the long run, $P = \min ATC$
 - Efficient scale

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The Long Run Market Supply Curve

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

The LR market supply curve is horizontal at $P = \min ATC$.



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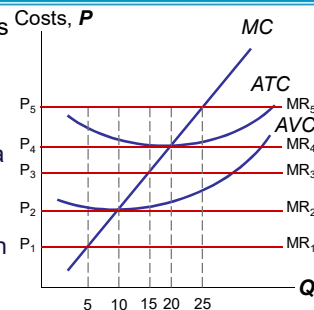
Why Stay in Business with Zero Profit?

- 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

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Active Learning 3: Let's Recap!

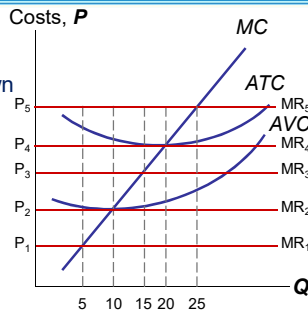
- For each of the prices in the graph, identify:
 - the profit-maximizing quantities
 - If the firm is making a profit (or loss)
 - If the firm should produce or shut down in the SR.
- Identify which P, Q combination is a long-run equilibrium



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Active Learning 3: Answers P_1, P_2, P_3

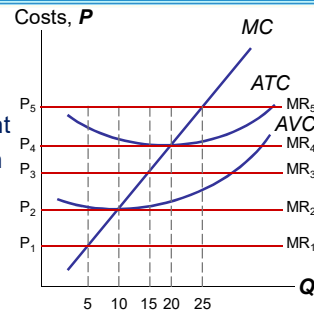
- For P_1
- $MR = MC$ at $Q = 5$,
 - BUT $P_1 < AVC$: shut down in the SR, $Q = 0$
- For P_2
- $MR = MC$ at $Q = 10$
 - where $P_2 = AVC$,
 - shut-down point, $Q = 10$
- For P_3
- $MR = MC$ at $Q = 15$,
 - $P_3 < ATC$ (loss) and
 - $P_3 > AVC$: keep producing



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Active Learning 3: Answers P_4, P_5

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



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Figure 8: An Increase in Demand in SR and LR (a)

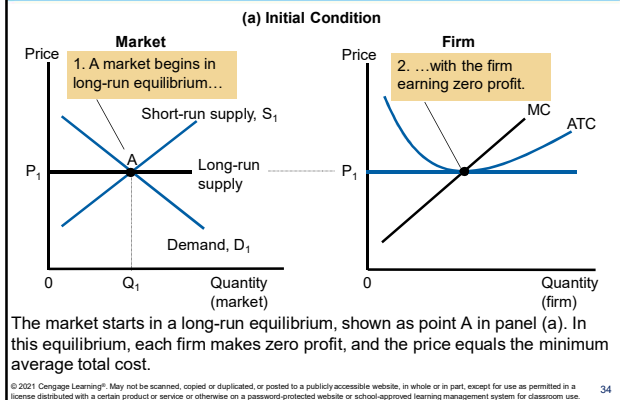


Figure 8: An increase in demand in SR and LR (b)

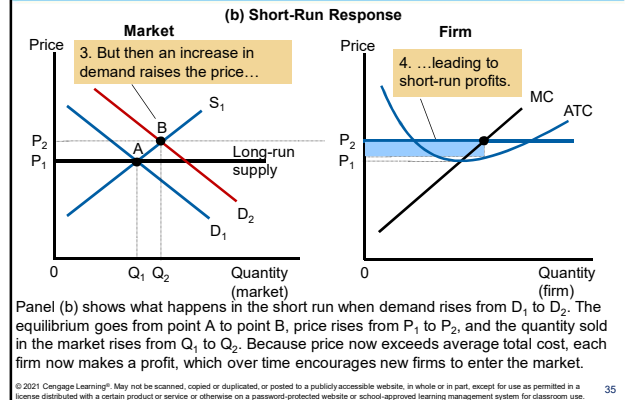
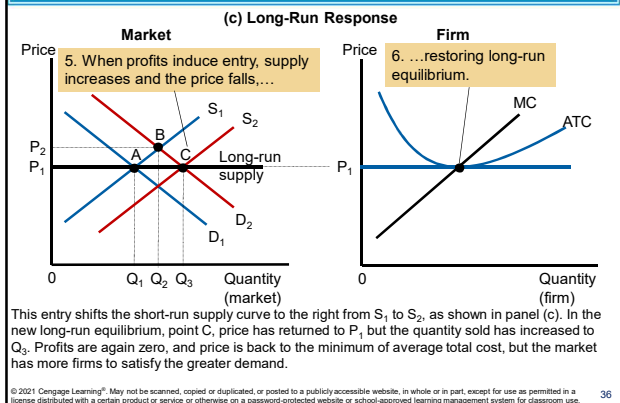


Figure 8: An increase in demand in SR and LR (c)



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 S Curve may Slope 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.

LR S Curve may Slope Upward – 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.

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

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THINK-PAIR-SHARE

Walking into a Walmart store at 2:00 a.m. 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."

- Why do you think this Walmart is open all night?
- 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?
- 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 $P < ATC$

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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, $P = \min ATC$
 - The **number of firms** adjusts to satisfy the quantity demanded at this price.
- **Changes in demand** have different effects over different time horizons.
 - **Short run**, an increase in demand raises prices and leads to profits (a decrease in demand lowers prices and leads to losses).
 - **Long run**: **zero-profit equilibrium**

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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

2020/11/27

Perfect Competition

Joseph Tao-yi Wang

Chapter 14: Perfect Competition

- ▶ 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

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