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# Costs Minimization and Profit Maximization

Chapter 11

# Objectives

To understand competitive markets.

- how profits are determined
- why firms enter and exit markets
- what are the different costs industries

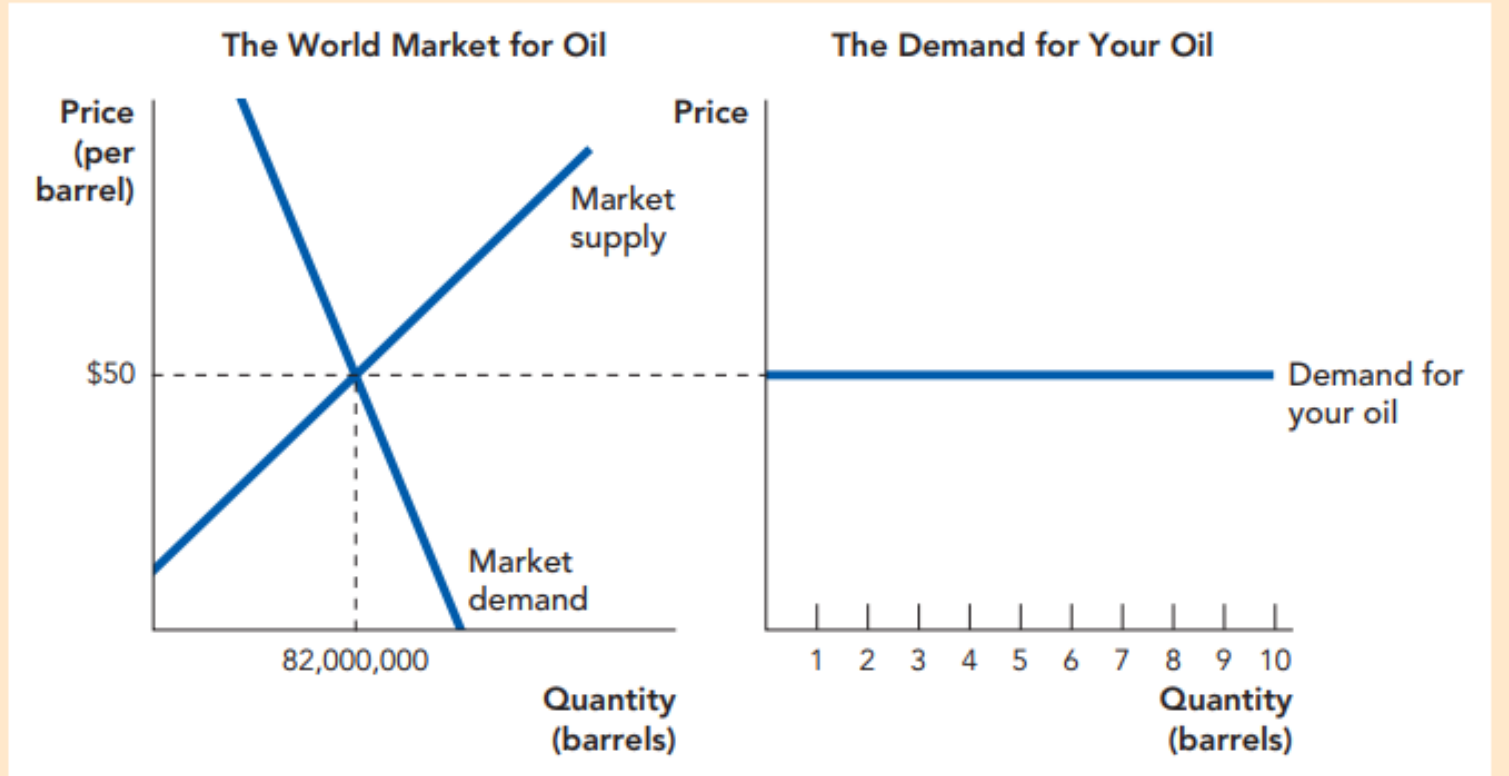
# Definition of competitive markets.

- In competitive markets:
  - Buyers and sellers are “price takers”.
    - The important implication of this as it relates to this chapter is that sellers can not raise price above the current market price. If they do, they will not sell their product.
  - Large number of buyers and sellers
  - There is free entry and exit.

# The Structure of the Oil Market

- There are numerous oil producers in the market. Solar and wind energy are not perfect substitutes for oil.
- Demand for oil is downward sloping
- Since there were many producers and many buyers, one producer cannot “fix” the price of oil.
- The said producer has to sell at the market clearing price.

FIGURE 11.1



**Market Demand and Firm Demand** The price of oil is determined in the world market for oil. You cannot sell oil at a price above the market price. At the market price, you can sell as many barrels as you want.

# Are competitive markets frequent in the real world?

Perfectly competitive markets are rare, but they are useful tools to understand economic phenomenon because:

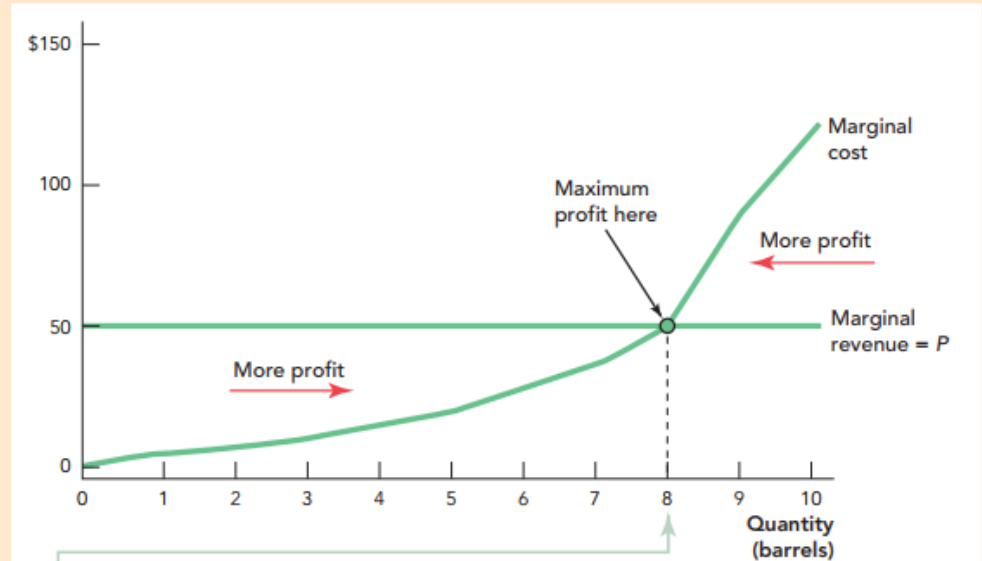
- In general, the perfectly competitive market assumption is consistent with what will happen to prices and quantities if the market is hit with a “shock”.
- It serves as useful benchmark to measure inefficiencies when we depart from perfect competition.

# Profit is maximized when Marginal Revenue = Marginal Cost

Profit is the difference between total revenue and total cost .

- Total Revenue = Price \* Quantity
- Total Costs = Fixed costs ( $FC$ ) + Variable costs ( $VC$ )
- Fixed costs are costs that do not vary with output.
- Variable costs are costs that do vary with output.

FIGURE 11.2

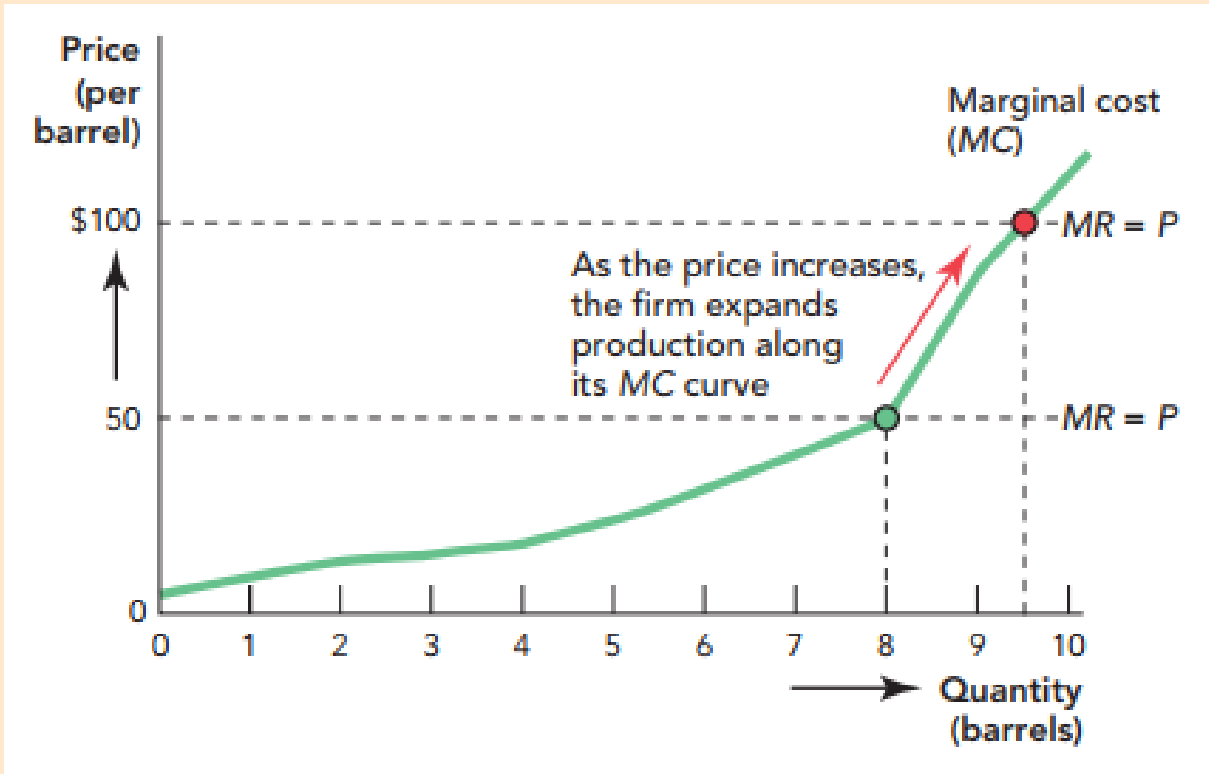


Barrels of Oil Produced	Total Revenue (TR) (P × Q)	Total Cost (TC)	Profit TR - TC	Marginal Revenue $\frac{\Delta TR}{\Delta Q}$ = Price	Marginal Cost $\frac{\Delta TC}{\Delta Q}$	Change in Profit
0	0	30	-30			
1	50	34	16	50	4	46
2	100	40	60	50	6	44
3	150	51	99	50	11	39
4	200	68	132	50	17	33
5	250	91	159	50	23	27
6	300	120	180	50	29	21
7	350	156	194	50	36	14
8	400	206	194	50	50	0
9	450	296	154	50	90	-40
10	500	420	80	50	124	-74

**Profit Is Maximized by Producing until  $MR = MC$**  To maximize profit, a firm compares the revenue from selling an additional unit, marginal revenue (for a firm in a competitive industry, this is equal to the price) to the costs of selling an additional unit, marginal cost. Profit increases from an additional sale whenever  $MR > MC$  so profit is maximized by producing up until the point where  $MR = MC$ .

# Price = Marginal Cost

FIGURE 11.3

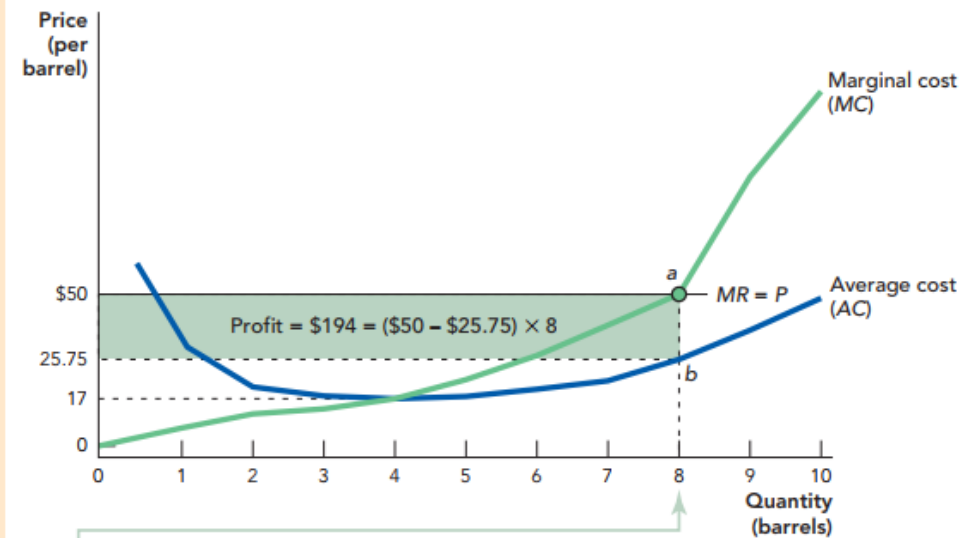


**As the Price Changes, So Does the Profit-Maximizing Quantity** The profit-maximizing quantity is found where  $P = MC$ . At a price of \$50, the profit-maximizing quantity is 8. As the price rises to \$100, the firm expands. At \$100, the profit-maximizing quantity is approximately 9.4 barrels per day.

# Marginal Revenue versus Marginal Costs

- Marginal revenue,  $MR$ , is the change in total revenue from selling an additional unit.  $MR = \Delta TR / \Delta Q$
- Marginal cost,  $MC$ , is the change in total cost from producing an additional unit.  $MC = \Delta TC / \Delta Q$
- For a firm in a competitive industry  $MR = MC = \text{Price}$ .

FIGURE 11.4



Barrels of Oil Produced	Total Revenue (TR) (P × Q)	Total Cost (TC)	Profit TR - TC	Marginal Revenue $\frac{\Delta TR}{\Delta Q} = \text{Price}$	Marginal Cost $\frac{\Delta TC}{\Delta Q}$	Change in Profit	Average Cost = TC/Q
0	0	30	-30				
1	50	34	16	50	4	46	34.0
2	100	40	60	50	6	44	20.0
3	150	51	99	50	11	39	17.0
4	200	68	132	50	17	33	17.0
5	250	91	159	50	23	27	18.2
6	300	120	180	50	29	21	20.0
7	350	156	194	50	36	14	22.29
8	400	206	194	50	50	0	25.75
9	450	296	154	50	90	-40	32.89
10	500	420	80	50	124	-74	42.0

**Profit = (P - AC) × Q** Profit is  $(P - AC) \times Q$ , profit per barrel times the number of barrels produced. When the price is \$50 and 8 barrels of oil are produced, profit is shown on the graph as the shaded area. Notice that the price is the height of point a, AC is the height of point b, so that the area  $(a - b) \times Q$  is equal to profit or  $\$194 = (\$50 - \$25.75) \times 8$ .

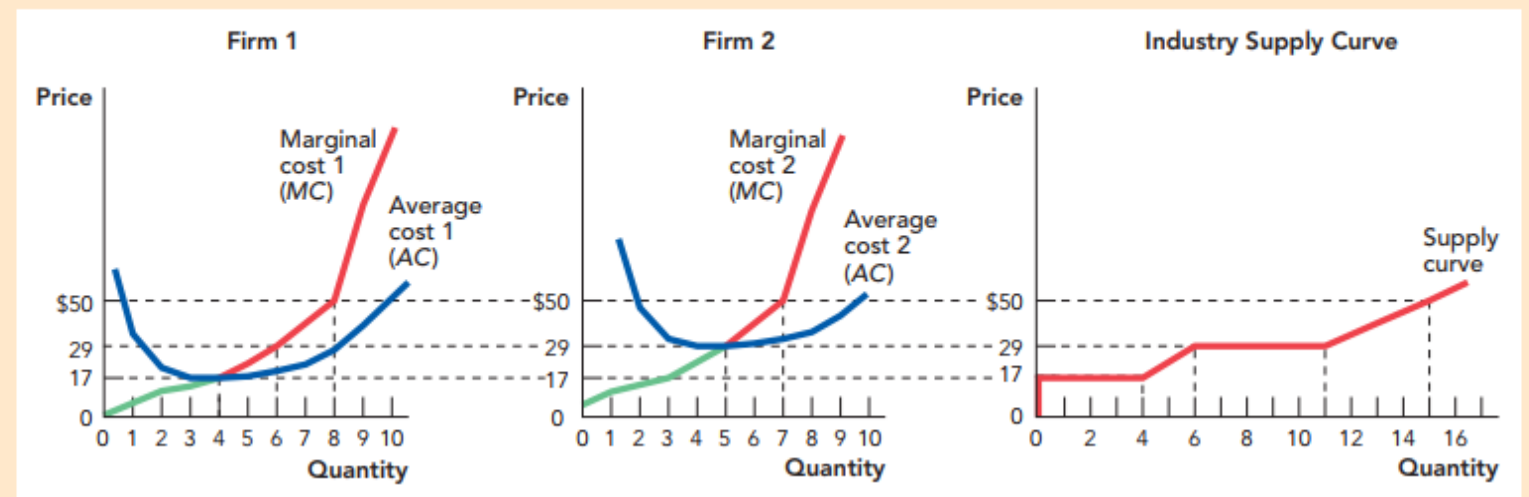
# Industry Supply Curve

At any price below \$17, what is the quantity supplied? Zero.

When the price hits \$17, Firm 1 enters the industry at its profit-maximizing quantity of 4 and thus industry supply at a price of \$17 jumps to 4.

As the price rises, Firm 1 expands along its *MC* curve and so does industry supply. When the price hits \$29, Firm 2 enters the industry with its profit-maximizing quantity of 5.

FIGURE 11.7



	Firm 1	Firm 2	Industry Output
P < \$17	0	0	0
P = \$17	4	0	4
P = \$29	6	5	11
P = \$50	_____	_____	15

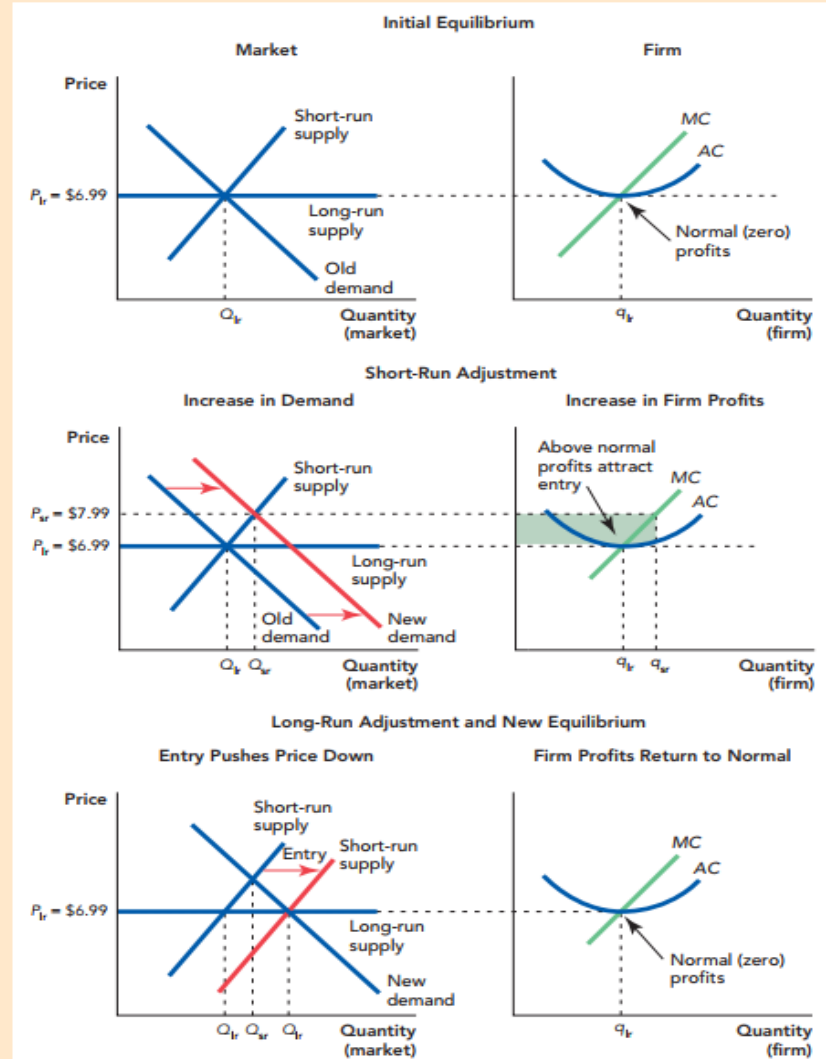
**To Find the Quantity Supplied by the Industry, Add the Quantities Supplied by Each Firm in the Industry**

At any price below \$17, profits for both Firm 1 and Firm 2 are negative so industry output is 0. At a price of \$17, Firm 1 enters the industry with a profit-maximizing quantity of 4 barrels so industry output jumps to 4 barrels. As price rises further, Firm 1 expands along its *MC* curve. At a price of \$29, Firm 2 enters the industry with a profit-maximizing quantity of 5 barrels so total industry output is 11 barrels (6 from Firm 1 and 5 from Firm 2). As price rises further, both firms expand along their marginal cost curve. At any price, industry output is the sum of each firm's output. At a price of \$50, what quantity does Firm 1 produce? What quantity does Firm 2 produce? Fill in the table and check that the production from Firm 1 and Firm 2 add up to industry output.

# How do firms respond to an increase in demand?

- The increase in price generates above-normal profits for each firm in the industry and attract new investment and entry.
- Entry is the *second* response to the increase in demand. In some industries, entry might take a matter of a few months or even as little as a few weeks, while in other industries it could take several years before significant entry occurs.
- After entry, the short-run supply curve shifts to the right and the price falls and profits are reduced.
- Entry doesn't stop until profits return to normal levels, so entry continues until price is pushed down to  $AC$ . In the long run, after all entry and exit have occurred, profits have returned to normal

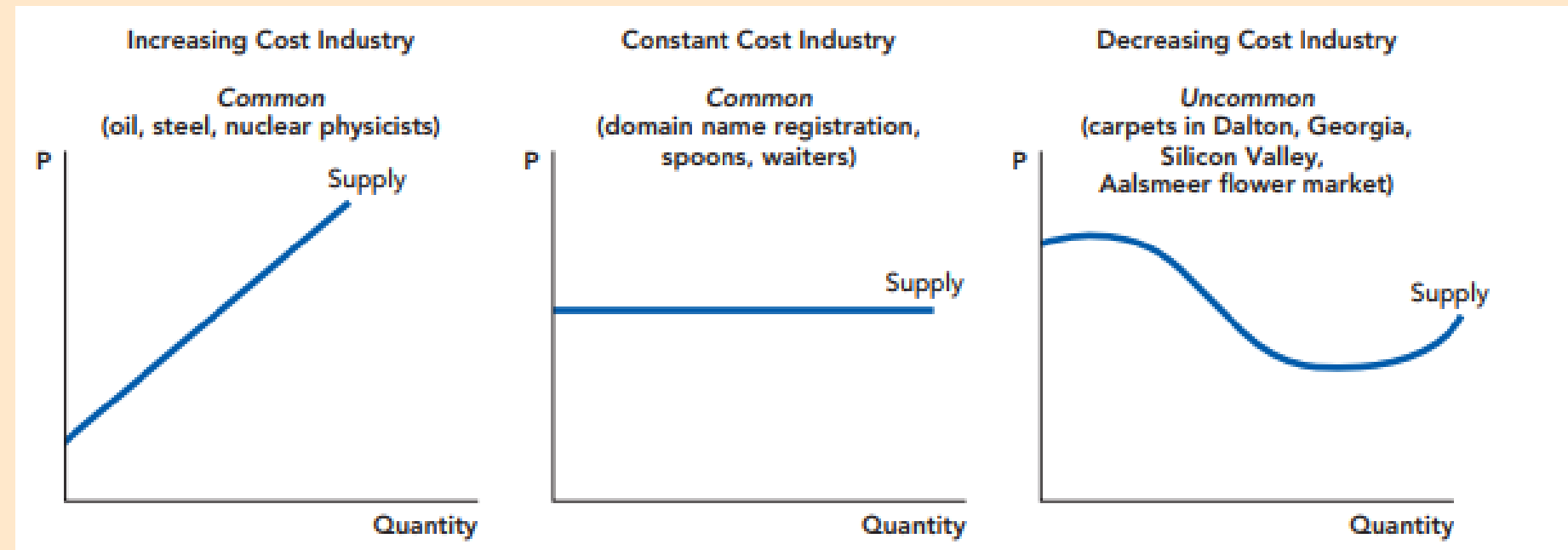
FIGURE 11.8



**How a Constant Cost Industry Adjusts to an Increase in Demand** The top panel shows the initial industry and firm equilibrium. The market price for domain name registration is \$6.99 and each firm is making a normal profit. In the middle panel, the demand for registration increases, which pushes up the market price to \$7.99. In the short run, each firm in the industry expands along its  $MC$  curve and thus market quantity increases to  $Q_2$ . Each firm earns above-normal profits. In the bottom panel, the above-normal profits attract entry. As more firms enter the industry, the short-run supply curve shifts to the right and as it does price falls. Firms continue to enter and the price continues to fall until price returns to \$6.99. At that price, firms are once again earning normal (zero) profits since  $P = AC$ .

# What are the different costs industries?

FIGURE 11.9



**Increasing Cost, Constant Cost, and Decreasing Cost Industries** An upward-sloped curve implies that costs increase with greater industry output, an increasing cost industry. A flat supply curve indicates that costs do not change with industry output, a constant cost industry. A downward-sloping curve implies that costs fall with greater industry output, a decreasing cost industry.

# Practice Questions

Which of the following market types has all firms selling products so identical that buyers do not care from which firm they buy?

- a) perfect competition
- b) oligopoly
- c) monopolistic competition
- d) monopoly

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# Practice Questions

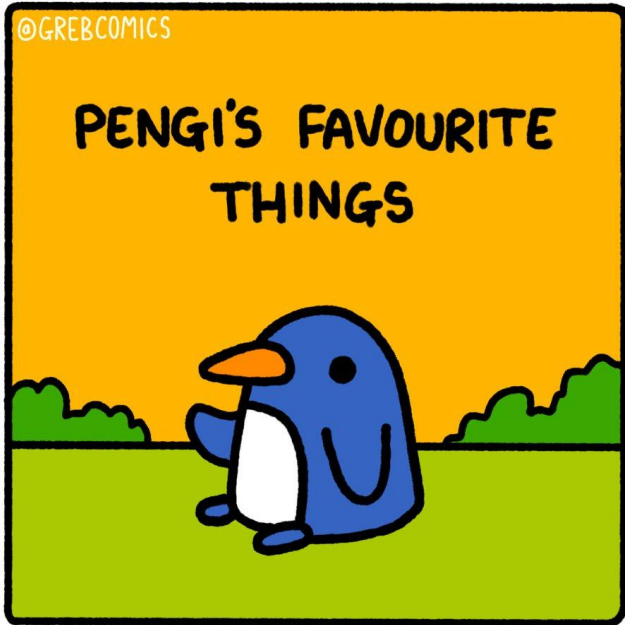
In a perfectly competitive market, the type of decision a firm has to make is different in the short run than in the long run. Which of the following is an example of a perfectly competitive firm's short-run decision?

- a) what price to charge buyers for the product
- b) whether or not to enter or exit an industry
- c) the profit-maximizing level of output
- d) how much to spend on advertising and sales promotion

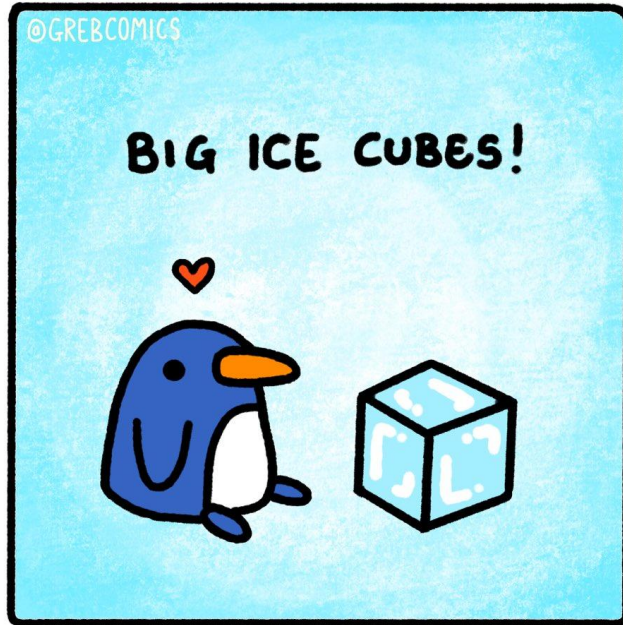
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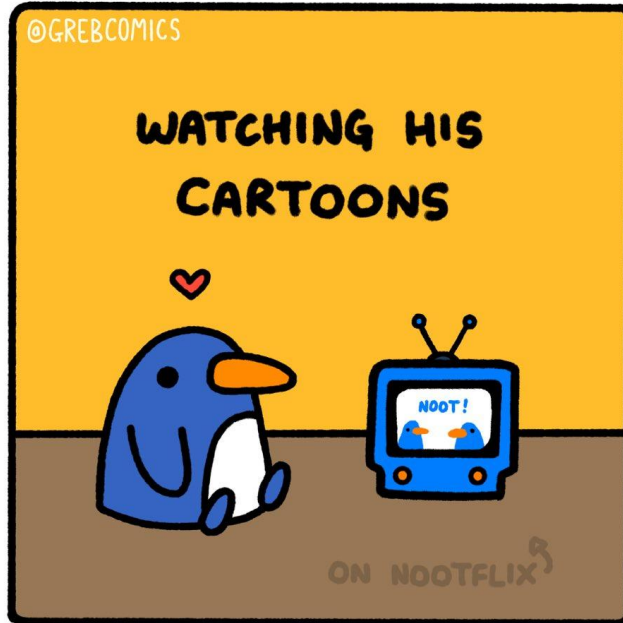
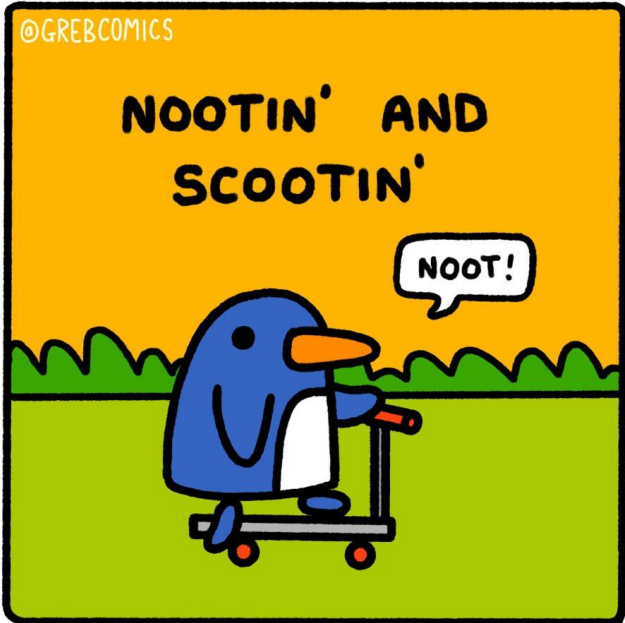
- a) what price to charge buyers for the product
- b) whether or not to enter or exit an industry
- c) the profit-maximizing level of output
- d) how much to spend on advertising and sales promotion



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# Market Structure

# Objectives

To understand monopolies

- how the monopoly sets prices
- how monopoly profits are determined
- what conditions give rise to monopolies

# Market Structure and Market Power

- When we depart from a world of perfect competition, we need to describe how the market differs from perfect competition and how firms decide to price their good and how much to produce.
  - Market Structure
  - Market Power

# Market Power

- Market Power: is the power to raise the price above *marginal cost* without fear that the firm will lose too much in sales to competing businesses.
- Recall the definition of **Marginal Cost (MC)** and **Marginal Revenue (MR)**
  - Marginal Cost is the change in total costs from producing an additional unit of output.
  - Marginal Revenue is the change in total revenues from producing an additional unit of output.

# Market Structure

Market Structure provides a description of how firms compete against each other (including production and pricing decisions) in order to sell their goods or services to the consumers.

- Perfect Competition
- Monopolies
- Oligopolies/Duopoly
- Monopolistic Competition

# Monopoly

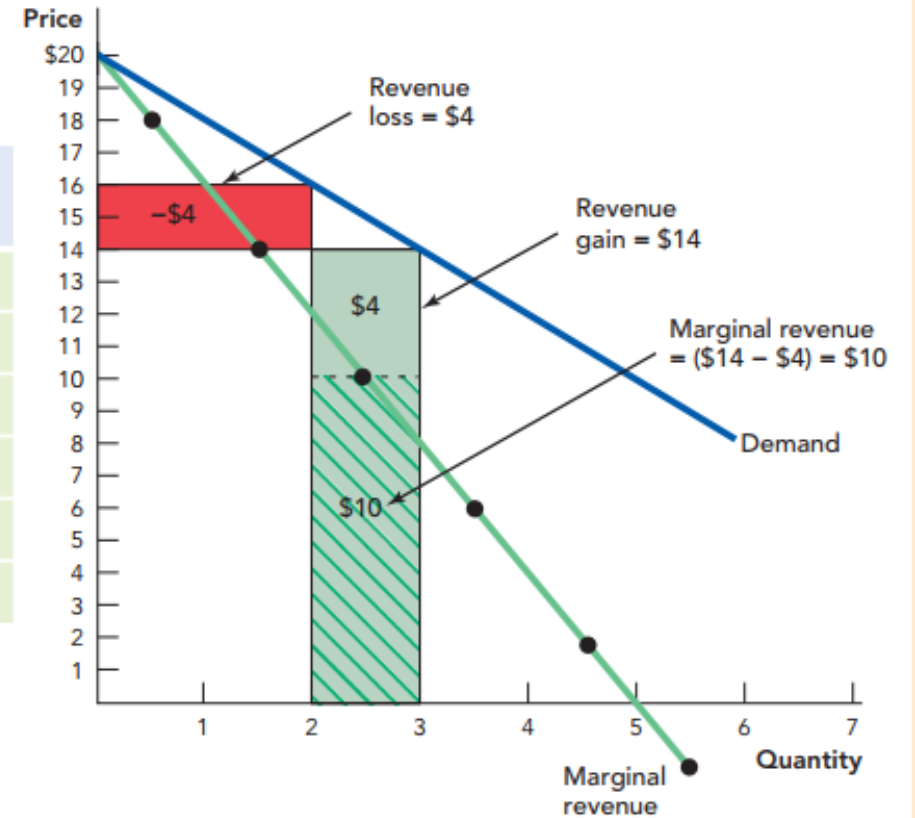
- A monopoly occurs when there is only one seller in the *market*.
- A monopolist has market power and will typically sell its goods or services above marginal cost; that is, a monopolist has market power.
- The following assumptions are typically made when we describe a market that is serviced by a monopolist:
  - The monopolist maximizes profits.
  - The monopolist sets its price.
  - There are barriers to entry or exit
  - There is one firm that dominates the market.

# Marginal Revenues

- In competitive markets, if a firm increases production significantly, the effect on the world price is so small it can be ignored. For a small firm, therefore, the revenue from the sale of an additional unit is the market price ( $MR = Price$ ).
- In case of a monopoly, a firm's output of a product is large relative to the entire market's output of that product (or very close substitutes), a significant increase in the firm's output will cause the market price of that product to fall.

FIGURE 13.1

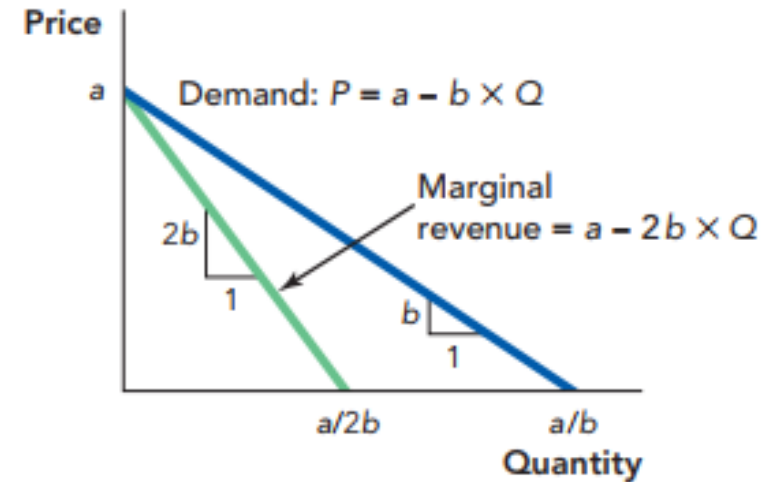
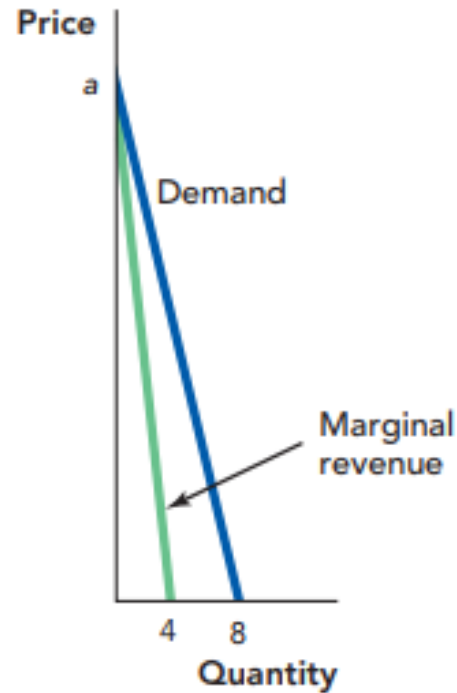
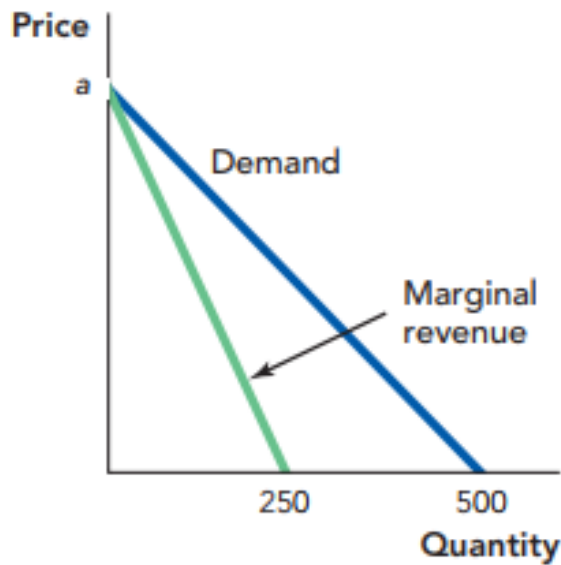
P	Q	TR (P · Q)	MR (Change in TR)
18	1	18	
16	2	32	14
14	3	42	10
12	4	48	6
10	5	50	2
8	6	48	-2



**Marginal Revenue** The table on the left shows that marginal revenue is the change in total revenue when quantity sold increases by 1 unit. When the quantity sold increases from 2 units to 3 units, for example, total revenue increases from \$32 to \$42 so marginal revenue, the change in total revenue, is \$10. The figure on the right shows how we can break down the change in total revenue into two parts. When the firm lowers the price from \$16 to \$14, it sells one more unit and so there is a gain in revenue of \$14, the price of that unit, but since to sell that additional unit the firm had to lower the price, it loses \$2 on each of its two previous sales so there is a revenue loss of \$4. Thus, marginal revenue is the revenue gain on new sales plus the revenue loss on previous sales.

# How to find marginal revenues for monopolies?

FIGURE 13.2

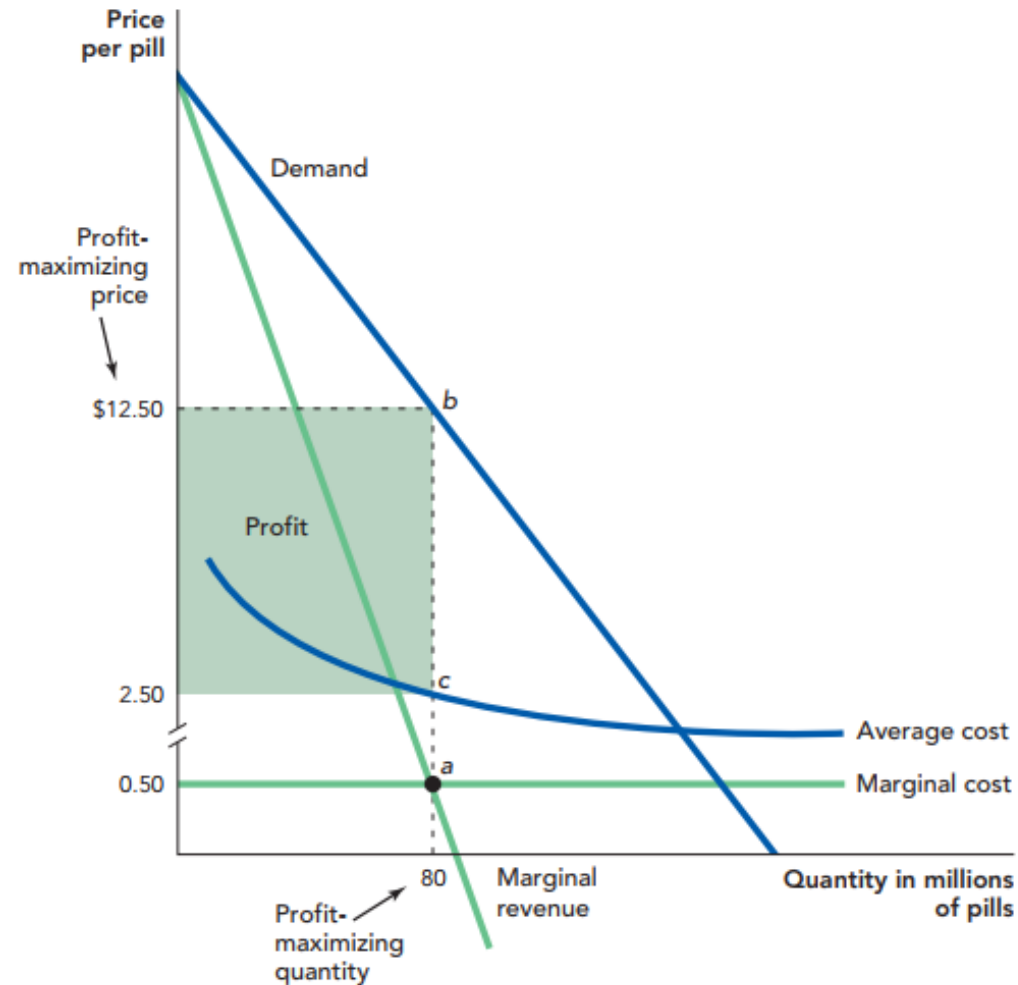


**The MR Shortcut** When the demand curve is a straight line, the marginal revenue curve begins at the same point on the vertical axis as the demand curve and has twice the slope.

# Profit maximization of a monopoly

The monopolist maximizes profit by choosing the quantity at which  $MR = MC$  and the highest price that consumers will pay for that quantity.

FIGURE 13.3



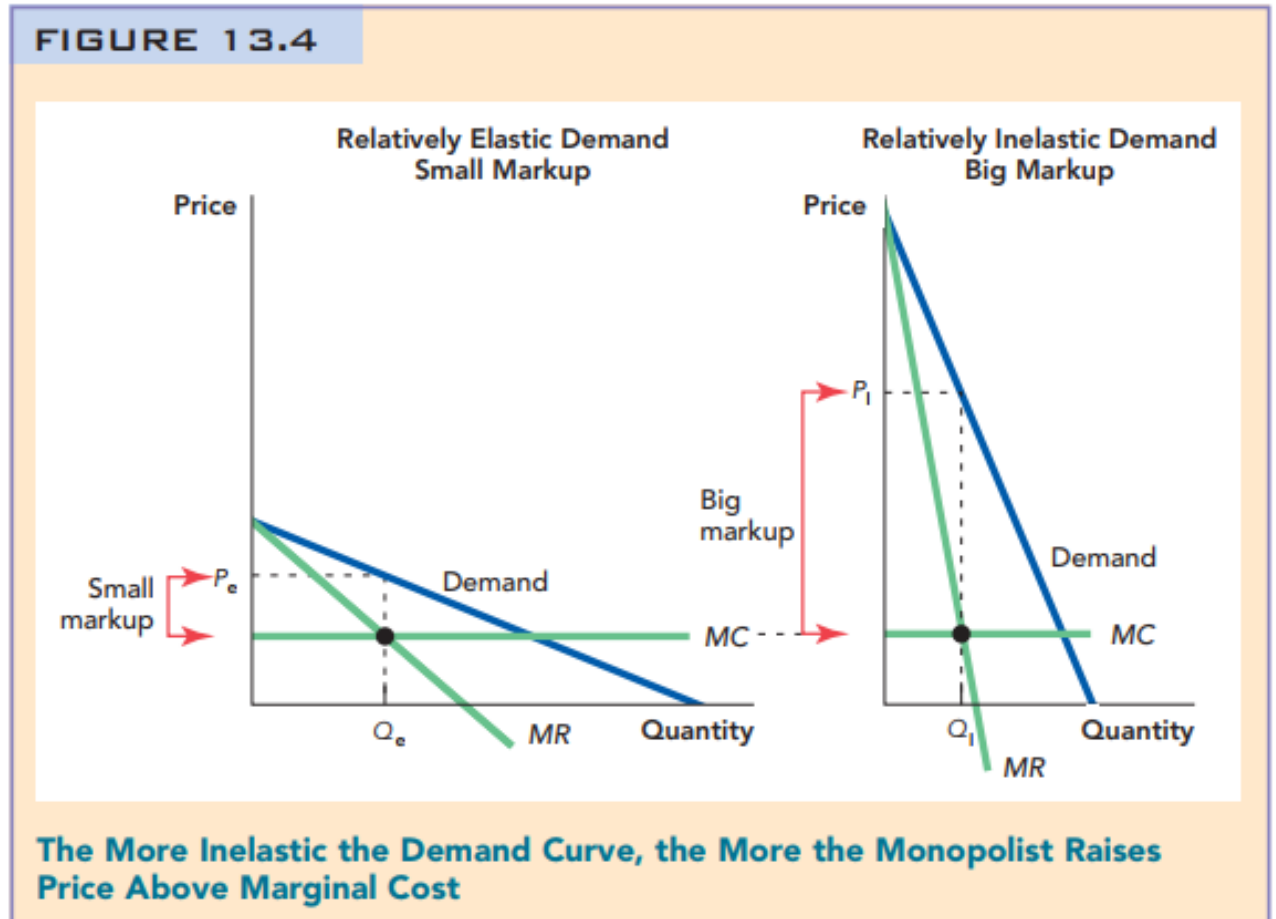
## How a Monopolist Maximizes Profit

To maximize profit, the monopolist produces until  $MR = MC$  (point a). Reading down from point a, we find the profit-maximizing quantity, 80 million pills. Reading upward from point a, we find the profit-maximizing price on the demand curve, \$12.50. Profit is  $(P - AC) \times Q$  and is given by the green rectangle.

# Elastic vs Inelastic Demand

The more inelastic the demand curve, the more a monopolist will raise its price above marginal cost.

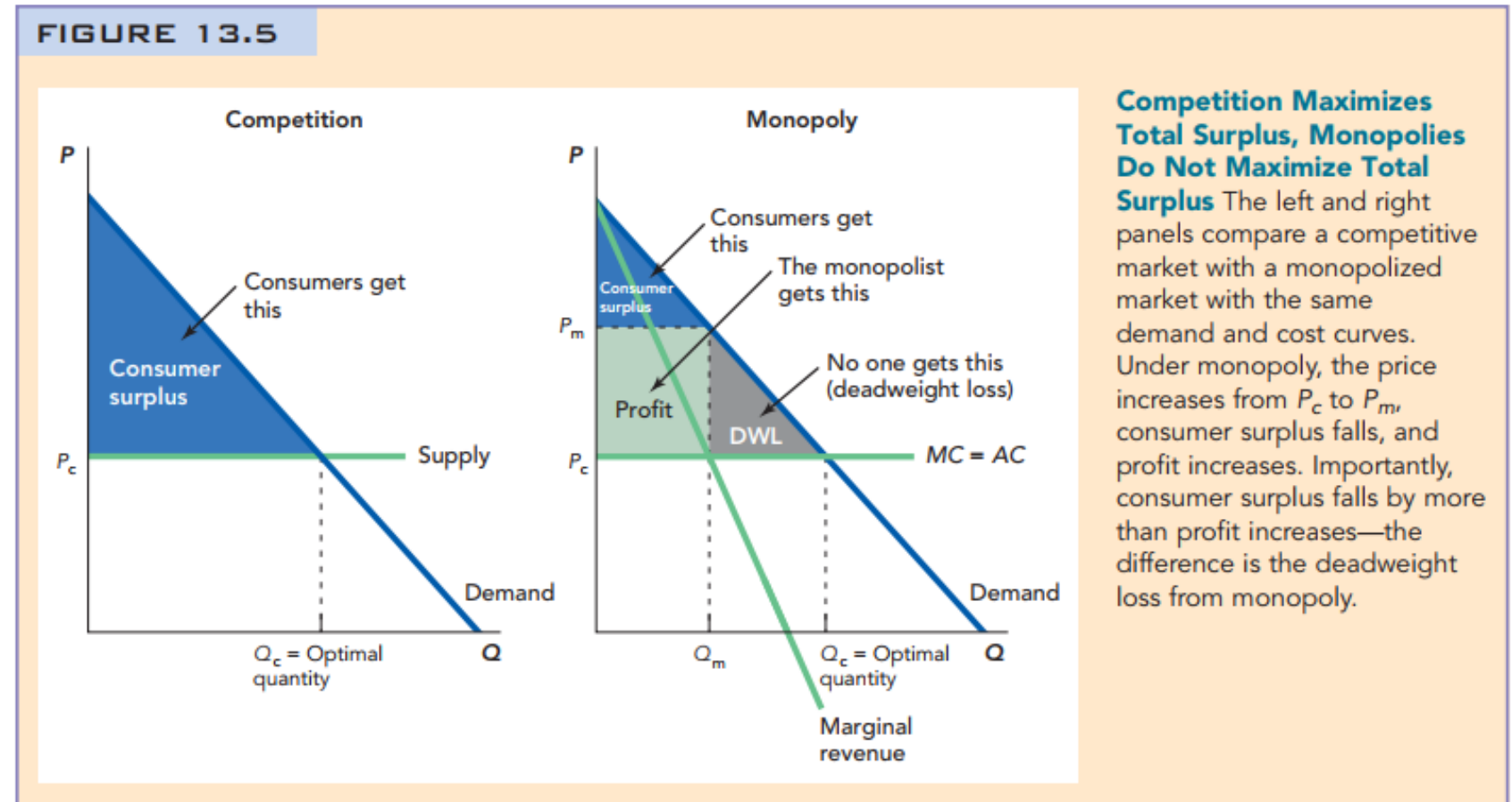
When the monopolist faces a relatively elastic demand curve, the markup will tend to be smaller.



# Difference between perfect competition and monopoly

The competitive equilibrium price and quantity are  $P_c$  and  $Q_c$ .

- $Q_c$  is the optimal quantity because it is the quantity that maximizes total surplus.
- A monopolist with the same costs behaves by setting  $MR = MC$ , the monopolist produces  $Q_m$
- $Q_m$  is much less than  $Q_c$ , and prices at  $P_m$ . Consumer surplus is now the much smaller blue triangle.



# Oligopoly / Duopoly

- Oligopoly: A market with only a few sellers. Typically, the scale of production for the firms is large.
  - A Duopoly means there are only two sellers producing goods for the market.
  - Firms in a market that is characterized by oligopolies have market power.
  - Each firm pricing decision depends on the demand curve and the production and pricing of the other firms in the market.
  - Examples of Oligopolies:
    - Airplane: Airbus and Boeing (and Embraer)
    - Wireless Carriers: Sprint-Nextel, AT&T, Verizon, and T-Mobile (98% of the industry in the US)

# Monopolistic Competition


- Monopolistic Competition: A market with many sellers competing against each other selling a slightly differentiated product.
- Since there are many sellers the degree of market power is diminished and relies partly on the degree of product differentiation.
- If there are more competitors, there will be more substitutes and this makes the demand for the product more elastic and reduces the firm's market power.
- Examples of monopolistically competitive markets:
  - Fast-food restaurants
  - Breakfast cereals
  - Coffee brands

# Perfect Competition

- A market where there are lots of buyers and sellers in the market. Each producer (buyer) produces (buys) a small amount of the industry's output and therefore they view themselves as a price taker.
  - With perfect competition, there many buyers and sellers and the good produced by all the buyers is *identical*.
  - Firms in a market that is characterized by perfect competition *do not have market power*.
  - Each firm pricing decision depends on the market price – if they price above the market price, they will not sell any output and if they price below market, they are not maximizing profits.
  - Industry is characterized by free entry and exit.
- Examples of Perfect Competition:
  - Agriculture markets: wheat, corn, soybean
  - Online Shopping
  - Financial Markets: Stock market and Foreign Exchange market

# Market Structure and Market Power

Market Type	Perfect Competition	Monopolistic Competition	Oligopolies	Monopoly
Competitors	Many	Many	Few	None
Products	Same product	Differentiated Product	Same or Differentiated Product	Unique Product

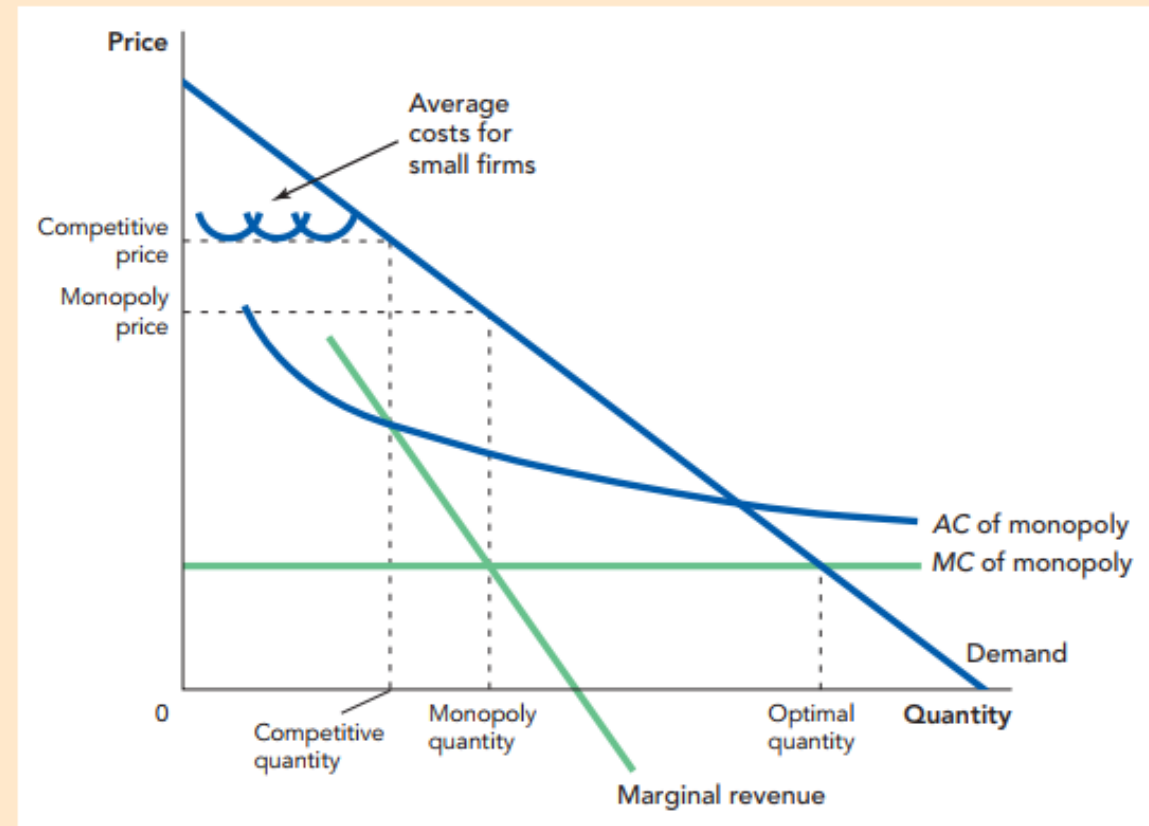
  


Least Market Power      Some Market Power      Most Market Power

# Why monopolies exist naturally?

If the economies of scale are large enough, it's even possible for price to be lower under natural monopoly than it would be under competition.

FIGURE 13.6



**A Monopoly with Large Economies of Scale Can Have a Lower Price than Competitive Firms** Economies of scale mean that a monopoly producer can have lower costs of production than competitive firms. It's cheaper to produce electricity for 100,000 homes with one large dam, for example, than with a solar panel for each home. If economies of scale are large enough, the monopoly price can be lower than the competitive price and the monopoly output can be higher than the competitive output.

# Why monopolies naturally exist?

- The average cost curve for the monopoly is so far below the average cost curves of the competitive firms, that the monopoly price is below the competitive price.

It's possible, for example, for every home to produce its own electric power with a small generator or solar panel, but the costs of producing electricity in this way would be higher than buying electricity produced from a dam even if the dam was a natural monopoly.

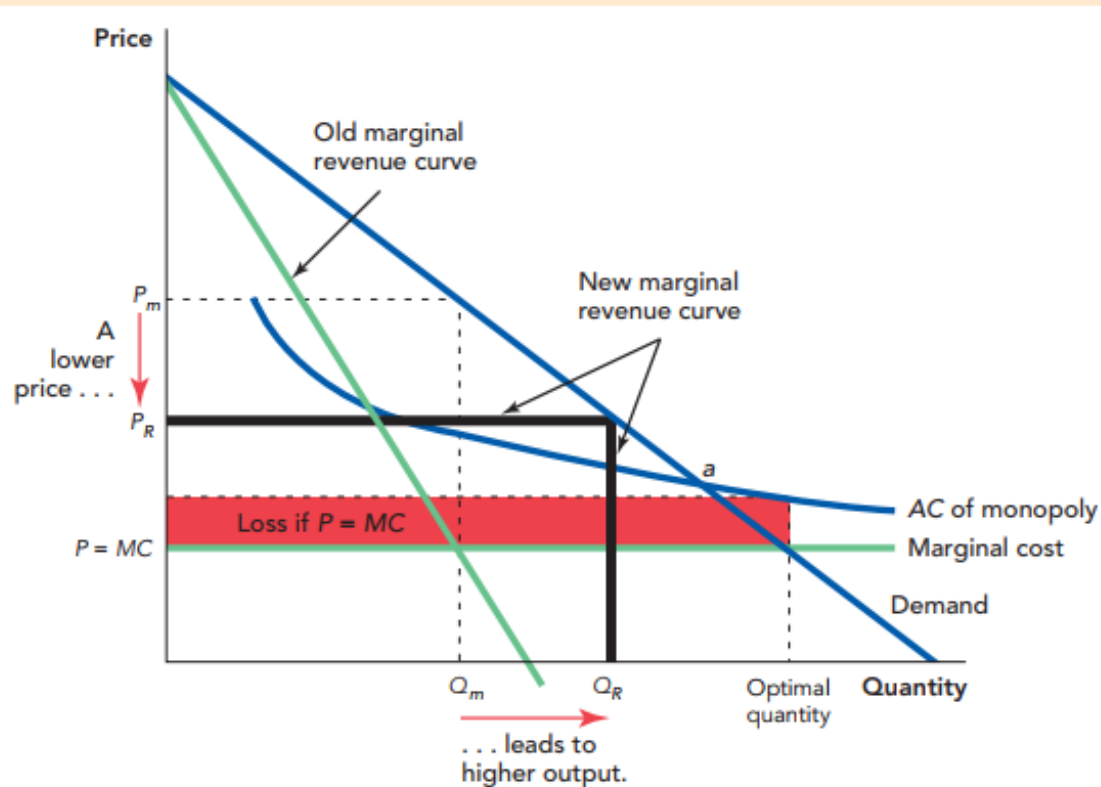
# How to control monopoly prices?

Since the optimal quantity is found where  $P = MC$ , the natural answer is that the government should set  $P_R = MC$ .

Unfortunately, that won't work when economies of scale are large because if the price is set equal to marginal cost, the monopolist will be taking a loss.

Notice that Profit =  $(P - AC) \cdot Q$ , so setting  $P_R$  equal to marginal cost creates a loss.

FIGURE 13.7



**A Price Control on a Monopoly Can Increase Output** Without regulation, the monopoly maximizes profit by choosing  $P_m, Q_m$ . If the government imposes a price control at  $P_R$ , the monopolist chooses  $Q_R$ , a larger quantity. The optimal price is at  $P = MC$ , but at this price the monopolist is making a loss and will exit the industry. The lowest price that will keep the monopolist in the industry is  $P = AC$  at point a. At that price, the monopolist makes a zero (normal) profit.

# Practice Questions

One of the requirements for a monopoly is that

- a) the product cannot be produced by small firms.
- b) there are several close substitutes for the product.
- c) there is a unique product with no close substitutes.
- d) products are high priced

# Practice Questions

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Which of the following market types has a large number of firms that sell similar but slightly different products?

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