- The Field of Economics is about methods and techniques – a few of which you tried to master for the exams – but it is also about *ideas*.
- Many people who study economics only get as far as the competitive model. This teaches that free markets are efficient, that your income is based on what you contribute, and that government is a bad thing. These are important ideas.
- But maybe this viewpoint is a little incomplete.

1

Markets, Market Failure, and Government

- In the real world, there is always a government.
- Rapid economic development is a relatively new thing historically, and it is tied to the development of capitalism, markets, private ownership, secure property rights, trade, intellectual freedom, and improved communication and transportation.
- In the great span of human history, however, government is also a relatively new thing, and most economists think that effective government is a necessary, but *not sufficient*, condition for growth.
- In the real world, there are many reasons that completely unregulated markets may fail to create the best outcomes. The first one we will cover is *imperfect competition*.

2

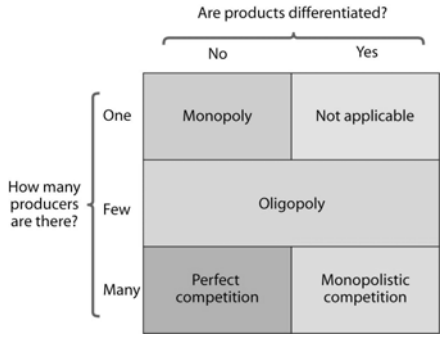
CHAPTER 14
Monopoly

Market Structure

- Different market structures can be modeled by a matrix framework.
- One aspect of the matrix is whether the market has differentiated or undifferentiated products.
- The other aspect is whether there are many producers, few producers or just one.

4

Types of Market Structure



5

Monopoly

- We've discussed perfect competition. It is distinguished by:
  - Many producers with indistinguishable products
  - Entry to from the market is unrestricted.
- A **monopoly** produces a single or related set of products which have no close substitute.
  - A monopolist is the entity that controls the monopoly
- Other producers are barred from entering the market for any of several reasons:
  - Legal restrictions
  - Economies of scale
  - Control of an essential resource
  - Technological superiority

6

Legal Restrictions

- Patents
  - Award an inventor the exclusive right to produce a good or service for 20 years (in the US)
  - Purpose is to provide the stimulus to turn an invention into a marketable product, a process called innovation.
- Governments may confer monopoly status to certain firms by giving them the exclusive right to supply a particular good or service.
  - Example –
    - Pepsi is the sole distributor of soft drink products on campus because they negotiated a contract with the university.

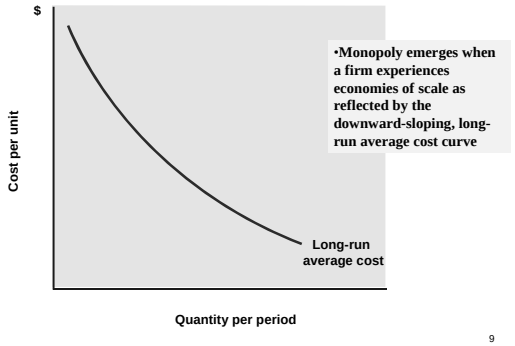
7

Economies of Scale

- Certain monopolies arise because an individual firm is able to achieve economies of scale that block other firms from entering the market.
- There is not enough demand to enable more than one firm to achieve economies of scale.
- Because fixed costs dominate, both the short and the long run average cost curves slope downward.

8

Economies of Scale



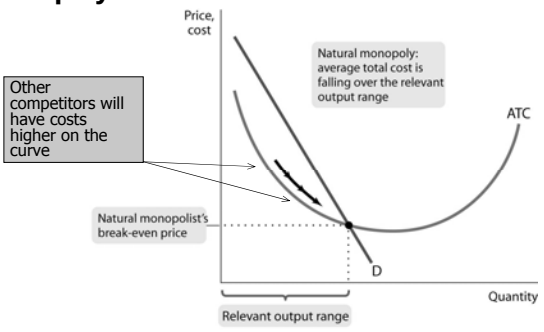
9

Monopolist Revenue

- Since the monopolist controls the entire market, the demand curve for the firm is also the demand curve for the market.
- Demand for a monopolist's product is a downward sloping curve like any other demand curve.

10

Economies of Scale Create Natural Monopoly



11

Economies of Scale

- Often, there will be a competitive process in the beginning.
- A single firm will emerge from this competitive process to become the sole seller in the market.
- Such firms are called natural monopolies because one firm can serve the entire market at a lower per-unit cost than can two or more firms.
  - Examples-
    - Utilities
      - Start-up costs are huge but once established the cost of additional units of output decrease.
      - This creates a decreasing long-run average cost
    - Railroads
    - Canal companies

12

Control of Essential Resources

- A third type of a barrier to market entry is when a firm achieves control over some nonreproducible resource.
- Other firms can not enter the market because they do not own the resource.
- Examples include
  - Professional sports teams
  - Alcoa Aluminum controlled the supply of bauxite for a long period of time.
  - China is the monopoly supplier of pandas
  - DeBeers controls the world's diamond trade

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Technological Superiority

- Technological discoveries may be turned into a monopoly.
- Networking externalities
  - Value of product increase as more people use the product.
  - Examples include phones, fax machines, VHS, Windows & Mac, PDF, Blu-Ray, et cetera.

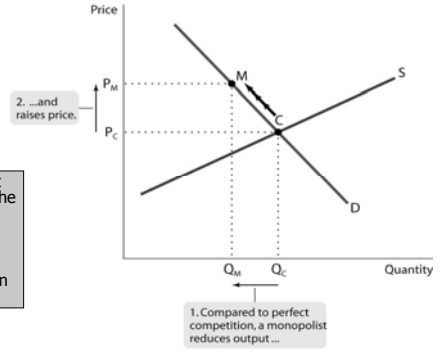
14

Location of Monopolies

- Monopolies are most common at a local level.
- Rural areas, for example, do not have enough demand to support more than one theatre or grocery store.
- Monopolies usually do not last long. The monopoly that a grocery store enjoys in a rural area may end if population increases enough to tempt a competitor to enter the market.

15

What a Monopolist Does



A monopolist can control the supply.

The result is an increase in price.

16

Monopolist Revenue

- Why then do monopolist not simply charge any price they want?
- The answer is that monopolists act rationally so they will seek to earn the highest profit, not the highest price.

17

Monopolist Revenue

- De Beers is a South African corporation created by Cecil Rhodes in the 1880s.
- By 1889, DeBeers controlled almost all of the world's supply of diamonds. That control was dominant until the last few decades.
- De Beers still controls a large percentage of the supply and limits yearly output. However, DeBeers has less control over the demand for diamonds.

18

Demand Schedule for De Beers Diamonds

- **As the price of De Beers diamonds decreases, the quantity demanded will increase.**
- **If they can sell three diamonds a day, their revenue will be $21,000.**
- **Average revenue will be total revenue/quantity sold = $7,000.**
- **So average revenue = price.**

(1) 1-Carat Diamonds per Day (Q)	(2) Price (average revenue) (p)
0	$7,750
1	7,500
2	7,250
3	7,000
4	6,750
5	6,500
6	6,250
7	6,000
8	5,750
9	5,500
10	5,250
11	5,000
12	4,750
13	4,500
14	4,250
15	4,000
16	3,750
17	3,500

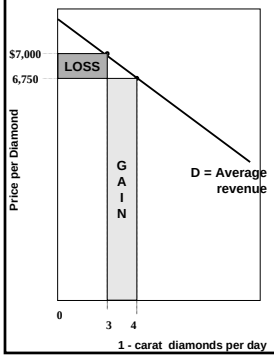
19

Monopolist Revenue

- Suppose De Beers asks a price of $7,750 for a one-carat diamond. At that price no one is willing to buy.
- At $7,500, one diamond per day can be sold, and at $7,250 two diamonds can be sold. At $7000, a third diamond can be sold.
- Suppose De Beers sells a fourth diamond. The price for all four diamonds will be $6,750.
- De Beers will gain revenue from the fourth diamond sold but also lose revenue because the first three could have been sold at a higher price.

20

Loss or Gain from Selling One More Unit



- **By selling another diamond, De Beers gains the revenue from the sale of the 4th diamond**
- **To sell the 4th unit, De Beers must sell all four diamonds for $6,750 each, sacrificing $250 on each of the first three diamonds that could have been sold for $7,000 each**
- **The loss in revenue from the first three units is $750**
- **The net change in total revenue from selling the 4th diamond is $6,750 - $750 = $6,000**

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Monopolist Revenue

- This $6,000 represents the marginal revenue for De Beers.
- The new revenue for 4 diamonds is $27,000.
- The revenue for 3 diamonds was $21,000 so the marginal difference is $6,000.
- Notice that the marginal revenue of $6,000 is less than the average revenue (the price) of $6750.
- Remember, in perfect competition, marginal revenue always equaled price. With monopolies, marginal revenue is always less than price.

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Revenue Schedule

■**As De Beers expands output, total revenue increases until quantity reaches 15 diamonds when total revenue tops out**

■**For all units of output except the first, marginal revenue is less than price**

■**The gap widens as the price declines because the loss from selling all diamonds at the lower price increases**

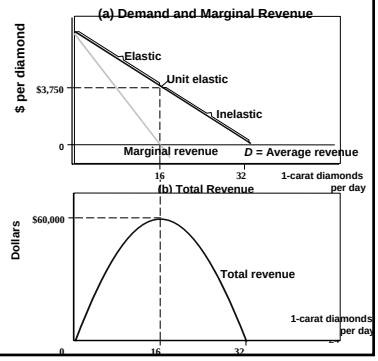
(1) 1-Carat Diamonds per Day (Q)	(2) Price (average revenue) (p)	(3) Total Revenue ($TR = p \times Q$)	(4) Marginal Revenue ($MR = \Delta TR/\Delta Q$)
0	$7,750	0	____
1	7,500	$ 7,500	$7,500
2	7,250	14,500	7,000
3	7,000	21,000	6,500
4	6,750	27,000	6,000
5	6,500	32,500	5,500
6	6,250	37,500	5,000
7	6,000	42,000	4,500
8	5,750	46,000	4,000
9	5,500	49,500	3,500
10	5,250	52,500	3,000
11	5,000	55,000	2,500
12	4,750	57,000	2,000
13	4,500	58,500	1,500
14	4,250	59,500	1,000
15	4,000	60,000	500
16	3,750	60,000	0
17	3,500	59,500	–500

Monopoly Demand and Marginal and Total Revenue

■**Total revenue is maximized when marginal revenue equals zero**

■**When demand is elastic, a decrease in price increases total revenue ➔ marginal revenue is positive**

■**When demand is inelastic, a decrease in price reduces total revenue ➔ marginal revenue is negative**



The slope of the MR Curve

- If demand is linear, then the MR curve is twice as steep. If demand is $P = 100 - 5Q$, then $MR = 100 - 10Q$.
- In general, $MR/P = 1 - 1/|E_D|$, where $|E_D|$ is the absolute value of elasticity demand.
  - If $E_D = -5$ (very elastic), MR is 80% of P.
  - If $E_D = -2$ (elastic), MR is half of P.
  - If $E_D = -1$ (unit elastic), $MR = 0$.
  - If $E_D = -0.5$ (inelastic), $MR < 0$.
- Therefore, since $MC > 0$, monopolists will always choose to sell where demand is elastic.

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Price Making

- Monopolist can choose *either* the price or the quantity, but choosing one determines the other.
- Because the monopolist can select the price that maximizes profit, we say the monopolist is a **price maker**. More generally, any firm that has some control over what price to charge is a price maker.
- Since monopolists are profit maximizers, they will work to maximize the difference between total revenue and total cost.
- Suppose De Beers has the following short-run cost and revenue schedule.

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Short-Run Revenues and Costs for the Monopolist

Short-run Costs and Revenue for a Monopolist

- **Profit-maximizing monopolist produces that quantity where total revenue exceeds total cost by the greatest amount**
- **This is $12,500 per day when output is 10 units per day.**
- **Total revenue is $52,500 and total cost is $40,000**

Diamonds per day (Q) (1)	Price (average revenue) (p) (2)	Total revenue (TR = Q x p) (3) =(1) x (2)	Marginal Revenue (MR = ΔTR / ΔQ) (4)	Total Cost (TC) (5)	Marginal Cost (MC = ΔTC / ΔQ) (6)	Average Total Cost (ACT = TC/Q) (7)	Total Profit or Loss = TR - TC (8)
0	$7,750	0	-	$15,000	-	-	-$15,000
1	7,500	$7,500	$7,500	19,750	4,750	$19,750	-12,250
2	7,250	14,500	7,000	23,500	3,750	11,750	9,000
3	7,000	21,000	6,500	26,500	3,000	8,830	-5,500
4	6,750	27,000	6,000	29,000	2,500	7,750	-2,000
5	6,500	32,500	5,500	31,000	2,000	6,200	1,500
6	6,250	37,500	5,000	32,500	1,500	5,420	5,000
7	6,000	42,000	4,500	33,750	1,250	4,820	8,250
8	5,750	46,000	4,000	35,250	1,500	4,410	10,750
9	5,500	49,500	3,500	37,250	2,000	4,140	12,250
10	**5,250**	**52,500**	**3,000**	**40,000**	**2,750**	**4,000**	**12,500**
11	5,000	55,000	2,500	43,250	3,250	3,930	11,750
12	4,750	57,000	2,000	48,000	4,750	4,000	9,000
13	4,500	58,500	1,500	54,500	6,500	4,190	4,000
14	4,250	59,500	1,000	64,000	9,500	4,570	-4,500
15	4,000	60,000	500	77,500	13,500	5,170	-7,500
16	3,750	60,000	0	96,000	18,500	6,000	-36,000
17	3,500	59,500	-500	121,000	25,000	7,120	-61,500

27

Short-Run Revenues and Costs for the Monopolist

■**Notice that MR > MC at this level of output but MR < MC at the next level of output.**

Short-run Costs and Revenue for a Monopolist

Diamonds per day (Q) (1)	Price (average revenue) (p) (2)	Total revenue (TR = Q x p) (3) =(1) x (2)	Marginal Revenue (MR = ΔTR / ΔQ) (4)	Total Cost (TC) (5)	Marginal Cost (MC = ΔTC / ΔQ) (6)	Average Total Cost (ACT = TC/Q) (7)	Total Profit or Loss = TR - TC (8)
0	$7,750	0	-	$15,000	-	-	-$15,000
1	7,500	$7,500	$7,500	19,750	4,750	$19,750	-12,250
2	7,250	14,500	7,000	23,500	3,750	11,750	9,000
3	7,000	21,000	6,500	26,500	3,000	8,830	-5,500
4	6,750	27,000	6,000	29,000	2,500	7,750	-2,000
5	6,500	32,500	5,500	31,000	2,000	6,200	1,500
6	6,250	37,500	5,000	32,500	1,500	5,420	5,000
7	6,000	42,000	4,500	33,750	1,250	4,820	8,250
8	5,750	46,000	4,000	35,250	1,500	4,410	10,750
9	5,500	49,500	3,500	37,250	2,000	4,140	12,250
10	**5,250**	**52,500**	**3,000**	**40,000**	**2,750**	**4,000**	**12,500**
11	5,000	55,000	2,500	43,250	3,250	3,930	11,750
12	4,750	57,000	2,000	48,000	4,750	4,000	9,000
13	4,500	58,500	1,500	54,500	6,500	4,190	4,000
14	4,250	59,500	1,000	64,000	9,500	4,570	-4,500
15	4,000	60,000	500	77,500	13,500	5,170	-7,500
16	3,750	60,000	0	96,000	18,500	6,000	-36,000
17	3,500	59,500	-500	121,000	25,000	7,120	-61,500

28

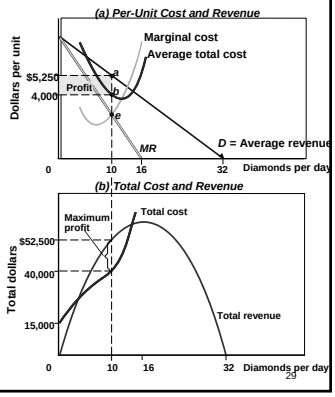
Monopoly Costs and Revenue

■**The intersection of the two marginal curves at point *e* in panel (a) indicates that profit is maximized when 10 diamonds are sold.**

■**ATC of $4,000 is identified by point *b:* the average profit per diamond equals the price of $5,250 minus the ATC of $4,000 = $1,250**

■**Total economic profit is equal to $1,250*10 units sold = $12,500**

■**In panel (b), the firm's profit or loss is measured by the vertical distance between the TR and TC: profit is maximized where 10 diamonds are produced per day**



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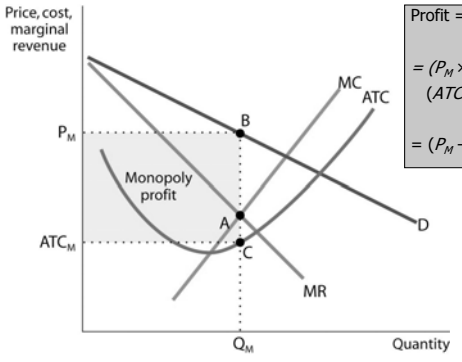
The Monopolist's Profit



Profit = $TR - TC$

$= (P_M \times Q_M) - (ATC_M \times Q_M)$

$= (P_M - ATC_M) \times Q_M$

30

Firm's Costs and Profit Maximization

- Therefore, a monopoly will not charge the highest price possible because it will not maximize profits.
- If De Beers tries to charge the highest price, $7,750 per diamond, it will sell no diamonds and not cover its fixed costs.

31

Minimizing Losses

- A monopoly is not guaranteed a profit. While monopolies have no competitors, it doesn't mean the product which they control has enough demand to ensure a profit.
- For example, some drug companies may hold patents to certain drugs but those drugs may not have that much demand.
- An example of these are 'orphan' drugs. These are drugs designed to remedy esoteric diseases which only a few people have. Such drugs are a lifesaver to the afflicted but there is no incentive for drug companies to make them.

32

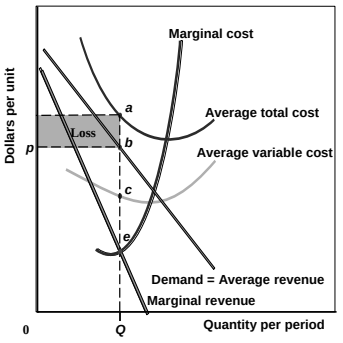
Minimizing Losses

- When losses occur in the short-run, a monopoly will act exactly the same way as a perfectly competitive firm
- It will continue to produce only as long as it covers its variable costs.
- If it can't do that it will shutdown in the short run.

33

The Monopolist Minimizes Losses in the Short Run

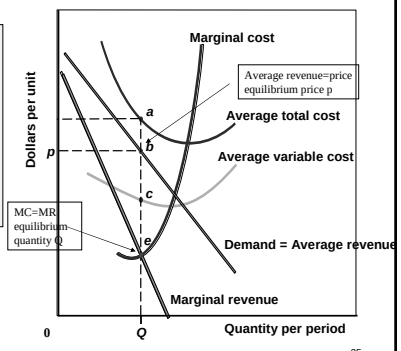
- Marginal revenue equals marginal cost at point *e*.
- At quantity *Q*, price *p* (at point *b*) is less than average total cost (at point *a*)
- The monopolist suffers a loss, and unless things change it will shut down in the long run.
- But the monopolist will continue to produce rather than shut down in the short run because price exceeds average variable cost (at point *c*).



34

The Monopolist Short Run Supply Curve

- Marginal revenue equals marginal cost at point *e*.
- This gives the equilibrium quantity *Q*.
- The price *p* = average revenue (at point *b*).
- This is the equilibrium price.



35

The Supply Curve?

- The equilibrium price is found on the demand curve
- The equilibrium quantity is found on the marginal revenue curve.
- Therefore, a monopolist has no supply curve

36

Long-Run Profit Maximization

- Like firms in perfect competition, a monopoly will shut down if losses continue into the long rum.
- Unlike perfectly competitive firms, monopolies have more tools that allow them to adjust in the long run.
  - Attempt to increase demand
  - Adjust the scale of its operation

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Long-Run Profit Maximization

- Because it controls a product for which there is no close substitute, De Beers sought to increase demand by advertising. Increasing demand will also help a monopoly making a short run profit to continue and perhaps increase that profit into the long-run.
- Monopoly firms can also change their scale (either larger or smaller) to make them more cost efficient and profitable into the long-run.
- Unlike perfect competition, monopolies are insulated by high barriers that block new entry. Economic profit is possible on a continuing basis.

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Loss of Monopoly

- However, changing conditions may that effectively remove a firm's monopoly status. For example, the end of the life of a patent effectively ends a firm's total control over the patented product.
- Monopolies may also crumble to new technology or to changes in government policy.
- Examples:
  - AT&T lost its monopoly on phone service because the government changed its policies towards communication.
  - Railroads once enjoyed a monopoly on both freight and passenger transportation services. That changed with the advent of airplanes and interstate highways.

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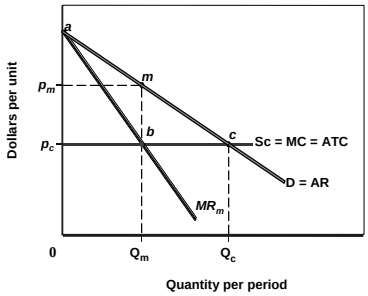
Perfect Competition and Monopoly

- Monopolists maximize profits just as perfect competitors do.
- They also do not charge the highest possible price and they are not guaranteed a profit.
- What then is the problem with monopoly?
- To answer that question, look at a comparison of monopoly and perfect competition.

40

Perfect Competition and Monopoly

- **Suppose, for simplicity, that MC is constant.**
- **Equilibrium in perfect competition is at point *c*, where market demand and supply intersect to yield price p_c and quantity Q_c**
- **Monopolist maximizes profit by equating MR with MC: point *b* and price p_m and output Q_m**



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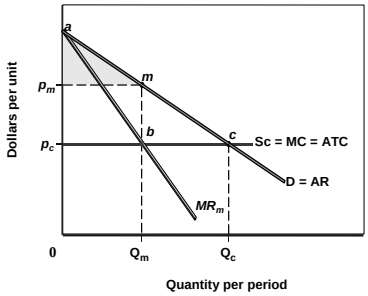
Perfect Competition and Monopoly

- **Under monopoly, price is higher and quantity less than it would be under perfect competition**
- **Thus monopolies are not productively efficient.**
- **Also consumer surplus (by the shaded triangle amp_m) decreases in a monopoly.**



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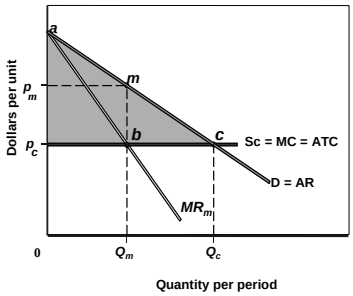
Perfect Competition and Monopoly

■Consumer surplus under perfect competition is the large triangle acp_c



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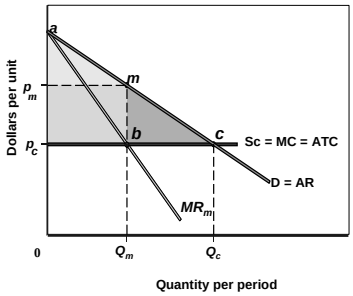
Perfect Competition and Monopoly

■Consumer surplus has been reduced by more than the profit rectangle $P_M mbP_C$

■Consumers have also lost the triangle *mcb*.

■This triangle is the deadweight loss of monopoly because it is a loss to consumers and a gain to nobody.



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Monopoly versus Perfect Competition

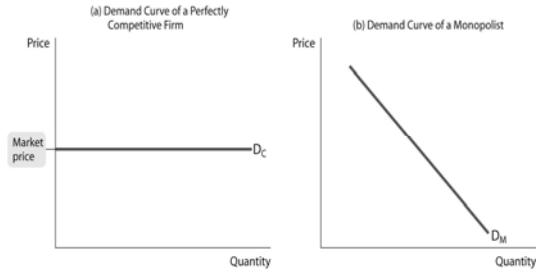
■P = MC at the perfectly competitive firm's profit-maximizing quantity of output

■P > MR = MC at the monopolist's profit-maximizing quantity of output

■Demand curve for perfectly competitive firm is flat; for a monopoly, it slopes down.

45

Comparing the Demand Curves of a Perfectly Competitive Firm and a Monopolist



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Controlling Monopoly

- Perfectly competitive firms are ***price takers***; monopolies are ***price makers***.
- Compared with a competitive industry, a monopolist produces a smaller quantity, charges a higher price, and in the long run can continue to earn an economic profit.
- Since the deadweight loss of monopoly reduces social benefit, monopoly is considered a burden on society.
- Monopolies will disappear if the firm loses the reason for its monopoly. Others may be changed by direct government intervention through anti-trust laws.

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Other Inefficiencies of Monopoly

- Harberger estimated that deadweight loss from monopoly was less that 1% of GDP in 1929.
- Additional inefficiencies include:
  - *Managerial Slack* (i.e., rent-seeking) due to lack of competition.
  - *Rent-seeking*, as monopolies waste society's resources to convince government to grant them a legal monopoly, or to discourage potential entrants through predatory behavior.
- In addition, monopolies can also make the distribution of income less equal – not a tradeoff.

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Controlling Monopoly

- Some monopolies can be split up to create competing firms. If this antitrust policy works, quantity will rise and price (and profit) will fall in the long run.
- Some monopolies are rewards for innovation. They may be less efficient than perfect competition, but better than having no market at all.
- Natural monopolies cannot be easily split be because they have the lowest average total cost. However, they would still use their monopoly to raise prices, and cause inefficient social outcomes.

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How to Control Natural Monopolies

- Public Ownership: government establishes a public agency to administer the monopoly. Examples include:
  - Amtrak
  - Some municipal utilities
  - The Post Office
- Regulation: Government allows the monopoly to remain in private hands but subjects it to legal rules.
  - Prices could be set where price = marginal cost, but with a natural monopoly MC < ATC, so this means P < ATC.
  - Commonly, price is set where price = ATC.
  - Other methods of regulation include rate-of-return regulation, cross-subsidization, and price caps.

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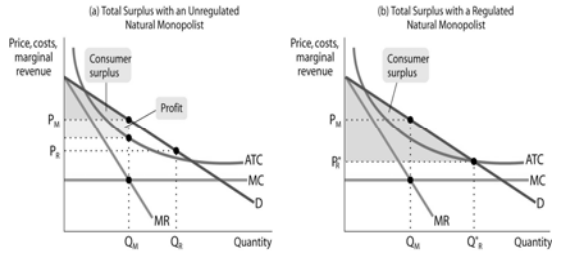
Regulated and Unregulated Natural Monopoly



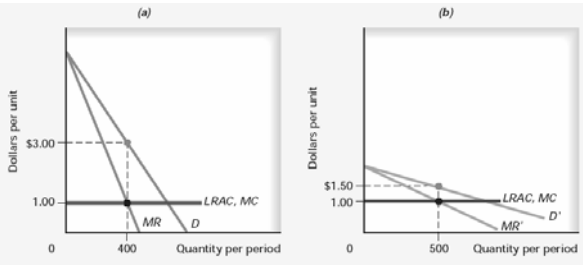
51

Price Discrimination

- Firms with market power (like monopolists) are sometimes able to increase profit by using price discrimination.
- Price discrimination means charging different prices to different customers when the price differences are not justified by differences in cost.
- Conditions for price discrimination:
  - Demand curve must slope downward – the firm has some market power and control over price, and MR < P.
  - The firm must be able to distinguish and separate at least two groups of consumers for the product, each with a different price elasticity of demand.
  - The firm must be able to charge each group a different price for essentially the same product, and prevent those who pay the lower price from reselling the product to those who pay the higher price.

52

Price Discrimination



•At a given price, price elasticity of demand (panel b, elastic) is greater than in panel a (inelastic).

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Price Discrimination

- Examples of price discrimination
  - Airlines have different prices for different types of customers – e.g., tourists and business travelers -- and different prices depending on when you buy and when you travel.
  - Movie theaters have children, adult, and senior prices.
  - Amusement parks often discriminate between tourists and locals.
- If a monopolist could charge a different price for *each* unit sold, the firm's marginal revenue curve from selling one more unit would equal the price of that unit. This is *perfect price discrimination*.
  - The marginal revenue curve would be on the demand curve.
  - The monopolist would produce where MV = MC, which is efficient.
  - Producer surplus would include the entire net surplus.

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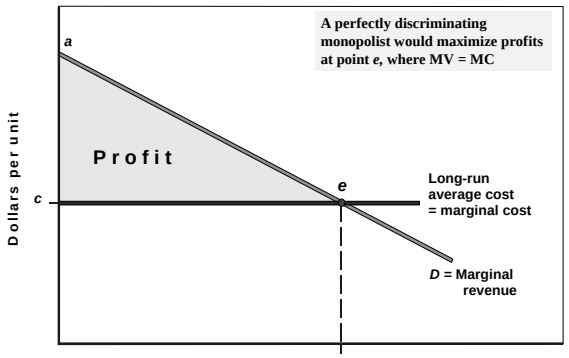
Perfect Price Discrimination



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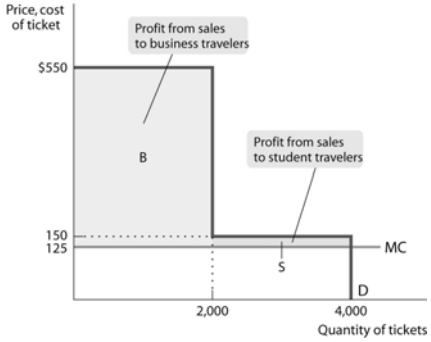
Price Discrimination: Two Types of Airline Customers



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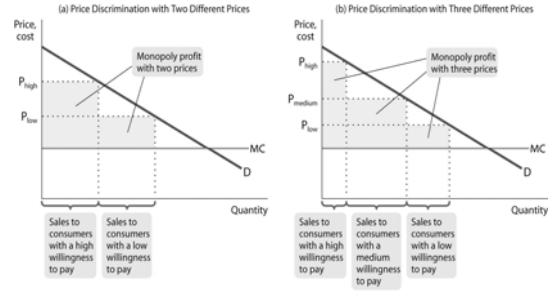
Price Discrimination: Two versus Three Different Prices



By increasing the number of different prices charged, the monopolist captures more of the consumer surplus and makes a large profit.

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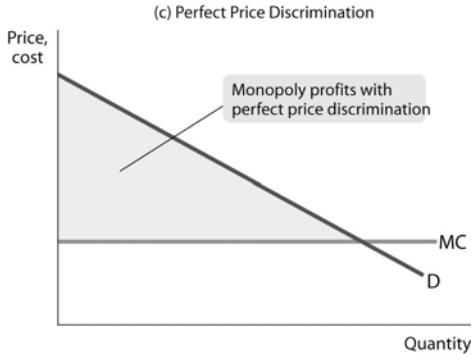
Perfect Price Discrimination



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CHAPTER 15
Oligopoly

Oligopoly

- A market structure characterized by several large firms is called an **oligopoly**.
- The term comes from the Greek meaning "few sellers."
- The industry has only a small number of producers. A producer in such an industry is known as an **oligopolist.**
- Oligopolies arise from the same forces that lead to monopoly, except in weaker form.

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Oligopoly

- No single firm has a monopoly. However, producers are each able to affect market prices. Two (duopoly) to seven firms is typical.
- Oligopolies can be classified into two groups by the type of products that they sell. Some sell homogeneous products, some sell differentiated products.
- Like monopolies, oligopolies are characterized by imperfect competition.

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Type of Products

- Homogeneous products: each firm sells similar commodities.
  - Examples include petroleum products, coal, steel, aluminum.
- Differentiated products: each firm is able to distinguish the products it sells from the products of other firms in the market, but there are still barriers to entry and few producers.
  - Examples include automobiles, airlines, airplane manufacturers, breakfast cereals, and personal care products (e.g., deodorants, soaps).

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Quantity vs Price Competition

- Oligopolistic firms can compete by quantity, by price, or by product differentiation.
- *Cournot* competition is when oligopolists match prices but each firm chooses the profit-maximizing quantity assuming his competitors are already committed to a certain quantity.
- *Bertrand* competitition is when each firm chooses the profit-maximizing price assuming his competitors are already committed to a certain price.
- *Stackelberg* competition is where one firm is first mover, and chooses the profit-maximizing price and quantity given his prediction of how other firms will react.

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Quantity Competition

- Some industries have production capacities that are difficult to change in the short term. Producers of things like airplanes and ships are unable to change quantities quickly. When firms are near maximum capacity, this is more likely.
- There will be few just a few firms in the industry and they know their competition will not be able to increase output quickly.
- Each firm acts as if their competitors' output is a given and they will produce a similar amount at a price above marginal cost.
- The result will be fewer units of output than under perfect competition and all firms will earn a profit.

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Price Competition

- When firms have excess capacity, they are more likely to engage in price wars to meet their capacity.
- In *Bertrand* competition, firms compete on price by taking their competitors' prices as given.
- Each firm's demand curve is more elastic, because they can gain or lose market share more easily, and so each firm will set a lower price to increase quantity. With many firms, this becomes perfect competition.
- *Bertrand* competition is likely to be more efficient than *Cournot* competition. Either way, oligopoly is more efficient than monopoly, but less efficient than perfect competition.

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Interdependence

- Because there are so few firms in the market, each firm must consider the effect of its own actions on competitors' behavior. Firms in an oligopoly are interdependent.
- Firms with very homogeneous products, like coal, will be very sensitive to changes in prices. Small price increases can cause customers to switch to competitors.
- Firms with more differentiated products are less sensitive to changes in competitors prices. Increasing the price on a Ford is not likely to cause buyers immediately to switch to buying Chevrolets.

66

Game Theory

- Because there are only a few firms in the market and each firm's actions are interdependent, their interactions can be treated as a game.
- Game theory is used to explain oligopolistic behavior.
- Game theory examines oligopolistic behavior as a series of strategic moves and countermoves among rival firms.
- It analyzes the behavior of decision-makers, or players, whose choices affect one another.

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Payoff Matrix

- Game theory also provides a general approach that allows us to focus on each player's incentives to cooperate or not.
- Game theory analysis usually begins with a **payoff table** or **matrix**.
- A payoff matrix is a table listing the rewards or penalties that each can expect based on the strategy that each pursues.

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Prisoners' Dilemma

- The most widely examined game is the Prisoners' Dilemma.
- Suppose two crooks (Ben and Jerry) are caught at the scene of a crime and brought to police headquarters to be interrogated separately.
- Each prisoner has the option of pursuing one of two strategies.
- They can confess or they can clam up.
- If both clam up, they'll go to jail for a year on a technicality.
- If Ben confesses and Jerry doesn't, Ben will be the prosecution's witness and receive immunity from prison while Jerry gets ten years.
- If both confess, they will each get five years.

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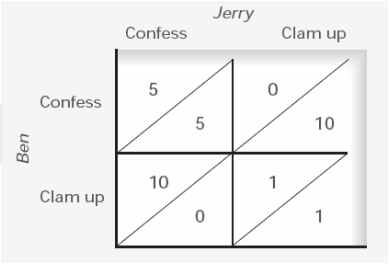
Payoff Matrix

■Ben's payoff is in red and Jerry's in blue.



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Price Setting Game

- In this model, each player has a *dominant strategy.* Each is better off confessing no matter what the other player does.
- If each player is maximizing his welfare given what the other player is doing, this is a *Nash equilibrium*. The Nash equilibrium is often not the joint optimum.
- The result is that both Ben and Jerry go to prison for 5 years when they would have only served one year had both kept quiet.

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Price Setting Game

- The prisoner's dilemma applies to a broad range of economic phenomena such as pricing policy and advertising strategy.
- Consider the market for gasoline in a rural community with only an Exxon and a Texaco station: a duopoly.
- Suppose customers are indifferent between the two brands and consider only the price.
- Each station sets its daily price early in the morning before knowing the price set by the other.
- Suppose only two prices are possible: a low price and a high price.

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Price Setting Game

- If both charge the low price, they split the market and each earns a profit of $500 per day.
- If both charge the high price, they also split the market and each earn $700 profit.
- If one charges the high price but the other the low one, the low-price station earns a profit of $1,000 and the high-price station earns $200.
- What price for each would maximize profits?

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Price Setting Game

- Texaco's incentives:
  - If Exxon charges the low price, Texaco earns $500 by charging the low price.
  - But Texaco only earns $200 by charging the high price.
  - If Exxon charges the high price, Texaco earns $1000 by charging the low price.
  - But Texaco only earns $500 by charging the high price.
  - Texaco is better off charging the low price in either case.
- Exxon faces the same incentives.
- Each seller will charge the low price, regardless of what the other does. Each earns $500 a day.

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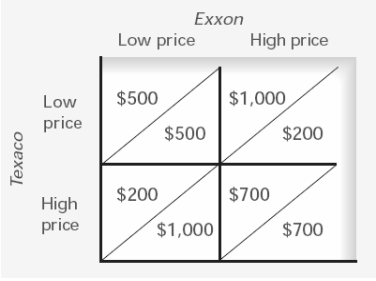
Price-Setting Payoff Matrix



75

Cola Wars

- Another example is the choice of the size of the advertising budget for Pepsi and Coke.
- This can be illustrated by another prisoner's dilemma game.
- If Coke sets a big budget and Pepsi goes with moderate budget, Coke boosts profits by 4 billion a year while Pepsi only gains a billion.
- The opposite is true if Coke sets a moderate budget and Pepsi a large one.
- If they both set a moderate budget, they get a $3 billion boost each and if they both go with a large budget, they increase profits by $2 billion.
- The result is the following matrix.

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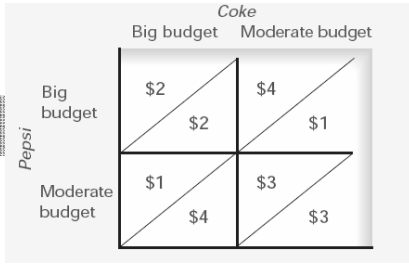
Cola War Payoff Matrix

Pepsi's profit appears in red and Coke's in blue



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Cola Wars

Pepsi's decision:

If Coke adopts a big promotional budget, Pepsi earns $2 billion by also adopting the large budget, and only earns $1 billion by adopting a moderate budget.

- Therefore Pepsi should adopt the big budget

Coke faces the same incentives.

The result is that both will adopt the big budget. They each gain $2 billion in profits even though they could have gained $3 billion if they had both adopted the moderate budget.

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One-Shot versus Repeated Games

- The outcome of a game often depends on whether it is a one-shot game or the repeated game.
- The classic prisoner's dilemma is a one-shot game: the game is to be played only once.
- However, if the same players repeat the prisoner's dilemma, as would likely occur in the price setting game, other possibilities unfold
- In a repeated-game setting, each player has a chance to establish a reputation for cooperation and thereby can encourage the other player to do the same
- The cooperative solution makes both players better off than if they fail to cooperate.

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Tit-for-Tat Strategy

- Experiments show that the strategy with the highest payoff in repeated games turns out to be the **tit-for-tat strategy**.
- You begin by cooperating in the first round of play
  - *Every round thereafter, you cooperate if your opponent cooperated in the previous round, and*
  - *You cheat if your opponent cheated in the previous round*

80

Game Theory

- Game theory explains why it so difficult for players to cooperate although cooperation leads to the best outcome for both parties.
- There are other, more complicated approaches in game theory than the simple examples considered here.
- Game theory is more of an approach to understanding oligopolistic behavior rather than a model to precisely predict that behavior.

81

Tacit Collusion

- Over time, oligopolistic firms tend to act in a manner that is helpful to other firms in the industry.
- They do this because they believe that it is in their own best interest.
- All firms in the industry act as if they have a collusive agreement even though they have not communicated with one another.
- This is called **tacit collusion**.
- Price leadership is a form of tacit collusion.

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Tacit Collusion

- Tacit collusion also leads to a phenomenon peculiar to oligopolies.
- This is the **kinked demand curve**. It is actually a composite of two different demand curves.
- One curve is predicated on the assumption that rival oligopolies don't respond to price increases (D_1 in the following slide).
- The other is predicated on the assumption that rivals do respond to price increases (D_2 in the following slide).

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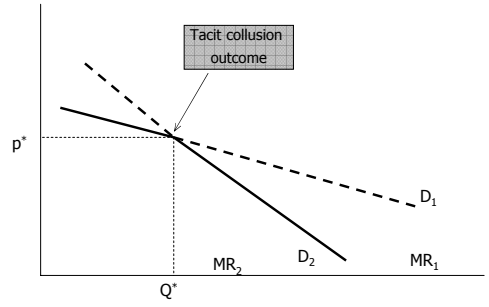
Kinked Demand Curve



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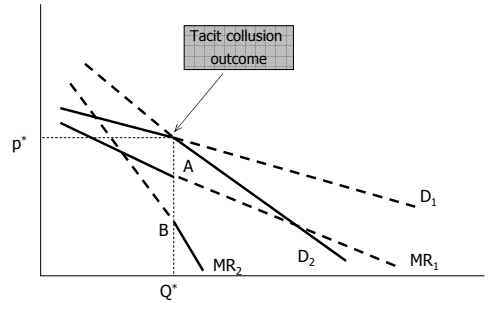
Kinked Demand Curve

- The oligopolist faces the possibility of going down demand curve 1 and then switching to demand curve 2 at the tacit collusion point.
  - This causes the "kink" in the curve.
- There are marginal revenue curves associated with each demand curve.
  - MR_1 is the relevant curve until the curve crosses the quantity line at point A.
  - The MR curve then drops to point B on the MR_2 curve

85

Kinked Demand Curve



86

Kinked Demand Curve

- Between point A and B, the MR curve is vertical.
- Oligopolists will produce the quantity found at the point where MR = MC.
- But on the kinked curve, they will produce the same quantity even though their MC curve goes up.

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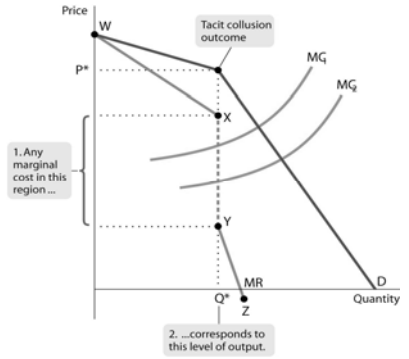
The Kinked Demand Curve



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Evolution of Oligopolies

- What causes some industries to adopt an oligopolistic market structure?
- Usually, they occur because of some barrier to entry into the industry. These barriers are similar to those of a monopoly.
- In the airline industry, some airports are dominated by a single carrier.
  - Examples are Northwest in Minneapolis, Delta in Atlanta, United in Dallas.
  - In some cases, these carriers hold a virtual monopoly over the doors available at the airport. If a competitor has trouble obtaining a door, it is effectively blocked from entering the market.

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Barriers to Entry

- A second barrier is the brand name recognition that an established carrier has.
  - Many customers prefer to fly one of the larger airlines even if their prices are somewhat higher.
- A third barrier are the 'frequent flyer' miles offered by airlines.
  - Established airlines tend to go to more places which gives their customers more choices
  - Thus larger airlines have more attractive programs.
  - This makes it more difficult for start-ups to gain customers.

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Barriers to Entry

- Finally, the start-up fixed costs for a new airline are exceptionally high.
  - The firm must purchase aircraft and establish space in airports before it begins to see any revenue.
  - These high costs reduce the number of firms willing to enter the market.
- This last barrier to entry is based on economies of scale.
  - Established firms are able to produce at a lower cost than new entrants.
  - For example a firm desiring to enter the automotive industry will need to produce at a certain level to achieve the minimum efficiency level.

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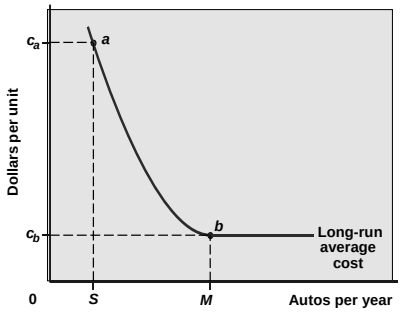
Economies of Scale as a Barrier to Entry

- If a new entrant sells only S cars, the average cost per unit, c_a, exceeds the average cost, c_b, of a manufacturer that sells enough cars to reach the minimum efficiency scale, M.
- If autos sell for a price less than c_a, a potential entrant can expect to lose money.



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High Costs of Entry

- The new firm must be committed to an investment needed to reach the minimum cost size.
  - It also amasses heavy costs in advertising a new product enough to compete with established brands
- This makes the fortunes of a new product very uncertain

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Models of Oligopolies

- There is no single model or approach that explains all the outcomes of oligopoly. Different models apply to different types of behavior, but all assume some type of interdependence.
- In some industries, the firms may try to coordinate their behavior to enhance their profits.
  - When this happens, the companies are said to engage in **collusion.** Sellers engage in collusion when they cooperate to raise each others' profits.
  - The strongest form of collusion occurs when the firms act collectively as a single monopolist. This form of collusion is called a **cartel**.

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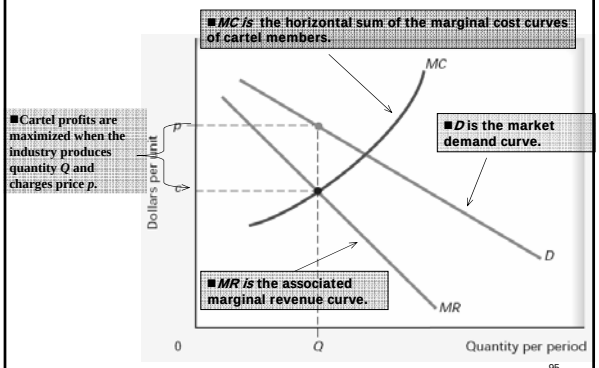
Cartel as a Monopolist



95

Cartel as a Monopolist

- Cartels achieve the ability to act as a monopolist and earn monopoly profits.
- The result is an ability to reduce output, increase price, and block the entry of new firms.
- Q is the profit maximizing level of production
- This means that Q must be split among each firm in the cartel so that each firm operates at a cost level of c.
- This can lead to the downfall of a cartel, because firms often have an incentive to cheat.

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Differences in Cost

- The greater the differences in average costs across firms, the greater will be the differences in economic profits among firms.
- If cartel members try to equalize each firm's total profit, a high-cost firm would need to sell more than a low-cost firm.
- This allocation scheme violates the cartel's profit-maximizing condition of finding the output for each firm that results in identical marginal costs across firms.
- Firms again have an incentive to cheat.

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Cartels

- Cartels usually have a relatively short life span because of a number of issues
  - Cheating
  - Differences in average cost
  - The number of firms in the cartel
  - New entries
- Even when costs are relatively equal, there is an incentive to cheat on the cartel
  - By offering a price slightly below the established price, a firm can usually increase its sales and economic profit.
  - Even if prices don't change, some members may offer special services or secret concessions to increase market share.

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Number of Firms in the Cartel

- The more firms in the industry, the more difficult it is to negotiate an acceptable allocation of output among them.
- Consensus becomes harder to achieve as the number of firms grows.
- The profit of the cartel attracts entry by other firms.
- If a cartel is unsuccessful in blocking the entry of new firms into the industry, new entries will increases market supply and eventually force prices down.
- This will squeeze economic profit and undermine the cartel.

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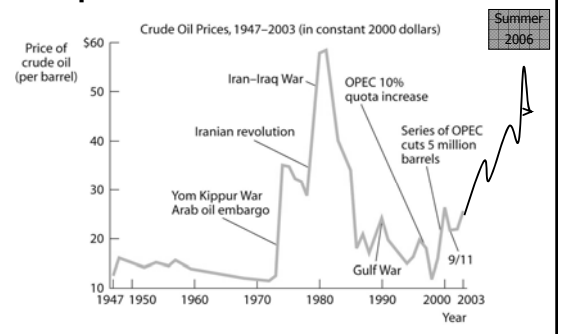
Legal Issues of Cartels

- Cartels are illegal in the United States. However, they are common in other areas of the world.
- Probably the best known cartel in the world is the Organization of Oil Exporting Countries (OPEC).
  - As a cartel, OPEC has attempted to set production levels for its members in order to raise prices and profits.
  - OPEC has experienced many of the problems mentioned above including members cheating on price and output quantity.

100

The Ups and Downs of the Oil Cartel



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Price Leadership

- An informal type of collusion occurs in industries that contain **price leaders** who set the price for the rest of the industry.
- A dominant firm or a few firms establish the market price, and other firms in the industry follow that lead, thereby avoiding price competition.
- Price leaders will also initiates price changes and other members of the industry will follow those changes.

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Obstacles to Price Leadership

- The greater the product differentiation among sellers, the less effective price leadership will be as a means of collusion.
- There is no guarantee that other firms will follow the leader.
- Some firms will try to cheat on the agreement by cutting price to increase sales and profits.
- Unless there are barriers to entry, a profitable price will attract new entrants.

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Legal Framework of Oligopoly

- Cartels were legal in the United States until 1890.
- However, agreements among cartel members were not legally enforceable.
- Therefore, cartels had fluctuating memberships with members who often violated their agreements.
- This impacted profits in the industry and led to the formation of **trusts**.
- A trust was an industry controlled by a small board of 'trustees'.
  - It was a perversion of the trust concept where trustees held property for the interest of an individual or institution.

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Legal Framework of Oligopoly

Trusts:

- Stockholders of companies in competition turned over shares in their companies to these 'trustees'.
  - Shareholders receive 'certificates in trust' in return.
  - Trustees have voting control of all operating companies.
  - Former stockholders get dividends from trust certificates.
- Essentially, the 'trustees' control a monopoly.
- Abuses of the system led to public resentment and efforts to outlaw them.

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Legal Framework of Oligopoly

- The first efforts at controlling trusts led to the Sherman Anti-trust Act (1891)
  - Declared illegal any combination in restraint of trade
  - Fine or imprisonment for anyone monopolizing or attempting to monopolize.
- Sherman wasn't very effective:
  - It was used more often to restrain unionization than to break-up firms in restraint of trade (Clayton made unions immune to Sherman)
  - Many trusts converted to holding companies which were legal under Sherman.
- Sherman's most famous success was the break-up of Standard Oil in 1911.
- Provisions of Sherman were expanded with the Clayton Act of 1914.

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