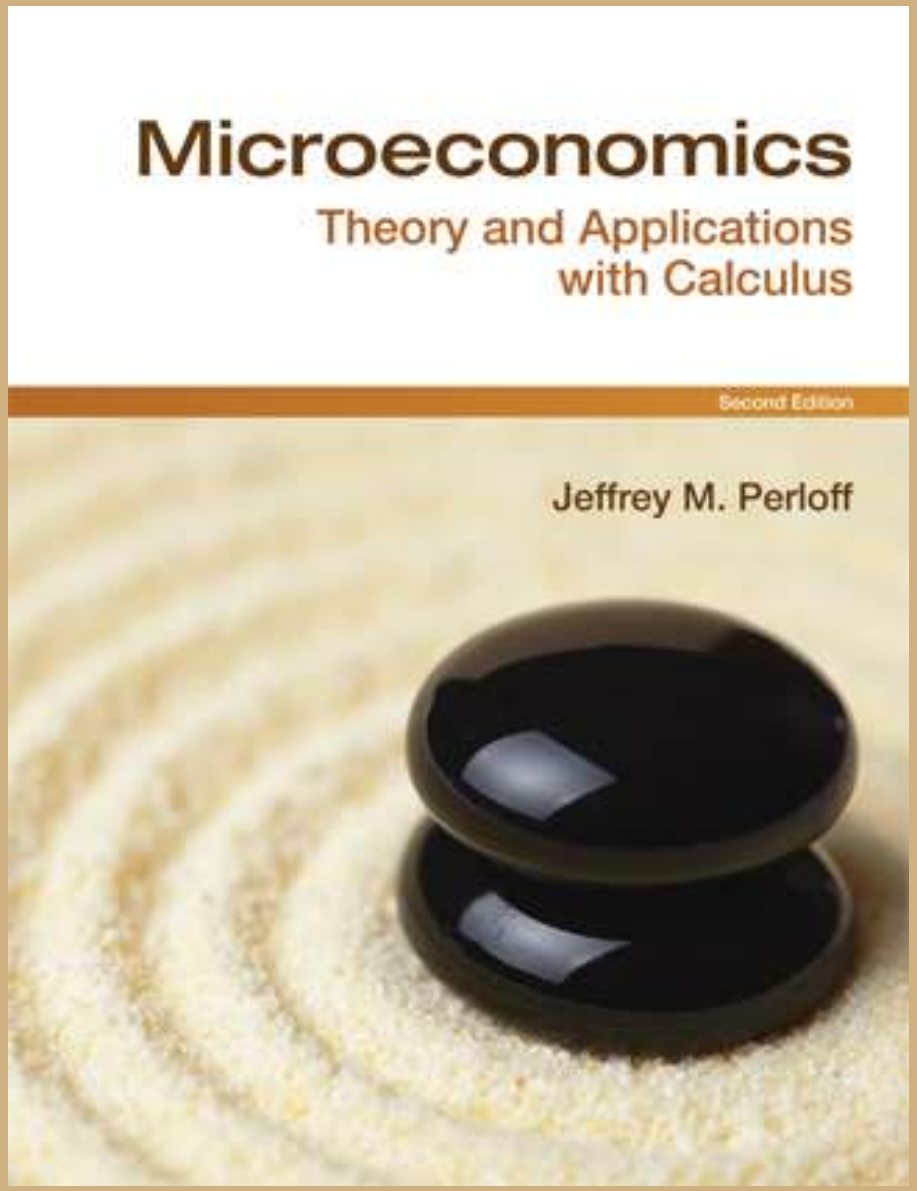
Chapter 14

Oligopoly and Monopolistic Competition

Anyone can win unless there happens to be a second entry.

George Ade



Addison-Wesley is an imprint of PEARSON

Chapter 14 Outline

14.1 Market Structures

- Markets differ according to
  - the number of firms in the market,
  - the ease with which firms may enter and leave the market
  - the ability of firms to differentiate their products from rivals'
- ***Monopolistic competition*** is a market structure in which firms have market power but no additional firm can enter and earn a positive profit.
  - Example: laundry detergent
- ***Oligopoly*** is a market structure in which a small group of firms each influence price and enjoy substantial barriers to entry.
  - Example: video game producers (Nintendo, Microsoft, Sony)

14.1 Comparison of Market Structures

	Monopoly	Oligopoly	Monopolistic Competition	Competition
1. Ability to set price	Price setter	Price setter	Price setter	Price taker
2. Price level	very high	high	high	low
3. Market power	$p > MC$	$p > MC$	$p > MC$	$p = MC$
4. Entry conditions	No entry	Limited entry	Free entry	Free entry
5. Number of firms	1	Few	Few or many	Many
6. Long-run profit	≥ 0	≥ 0	0	0
7. Strategy dependent on individual rival firms' behavior	No (has no rivals)	Yes	Yes	No (cares about market price only)
8. Products	Single product	May be differentiated	May be differentiated	Undifferentiated
9. Example	Local natural gas utility	Automobile manufacturers	Plumbers in a small town	Apple farmers

14.2 Cartels

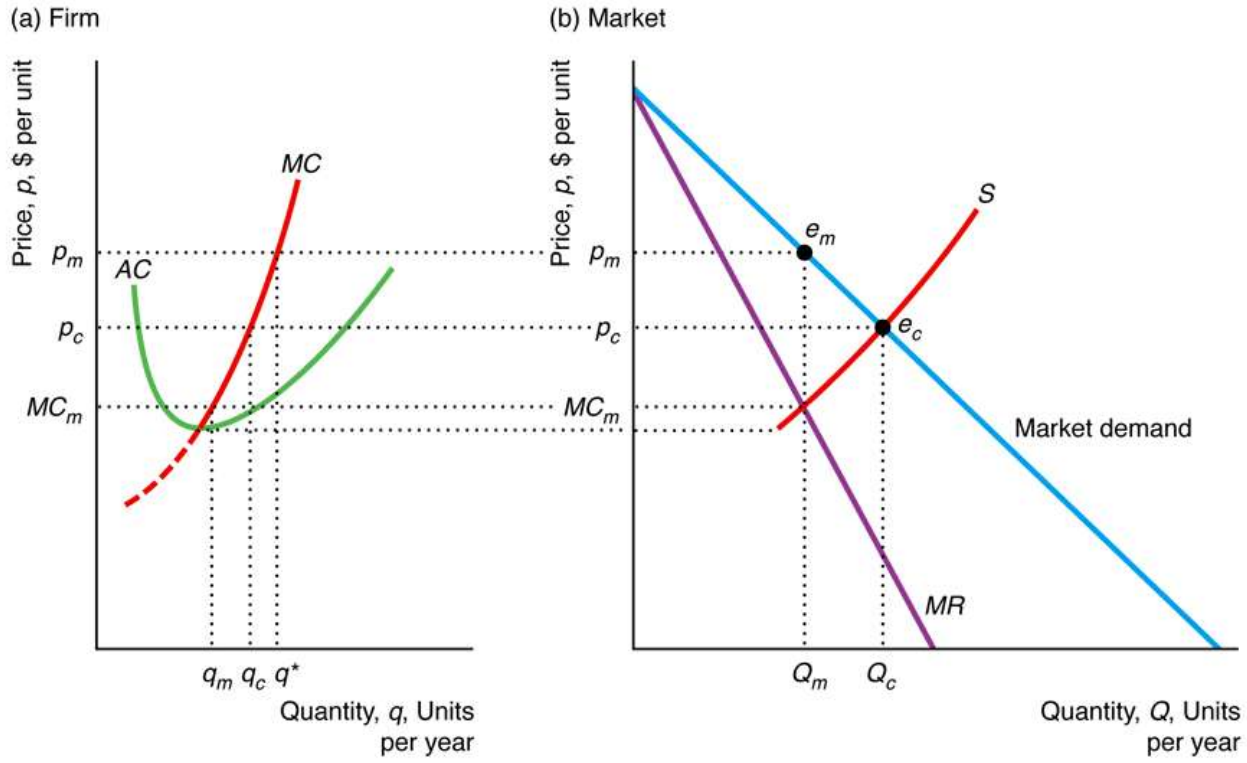
- Oligopolistic firms have an incentive to ***collude***, coordinate setting their prices or quantities, so as to increase their profits.
  - Collusion is illegal in most developed countries.

- A ***cartel,*** a group of firms that collude, is a special case of oligopoly in which the firms behave like a monopoly.

- Because firms can make even more money by cheating on the cartel agreement, collusion is not always successful.

14.2 Why Cartels Form

- Cartel members believe they can raise their profits, relative to competition, by coordinating their actions.



14.2 Laws Against Cartels

- Previously called *trusts* in the U.S. and common in oil, railroad, sugar, and tobacco industries
- Sherman Antitrust Act (1890) and Federal Trade Commission Act (1914)
  - Prohibit firms from ***explicitly*** agreeing to take actions that reduce competition
  - Jointly setting price strictly prohibited
  - Antitrust laws reduce probability that cartels form

- OPEC, most famous cartel, formed in 1960 and is not illegal among participating countries.

14.2 Cartels

- Why Cartels Fail
  - Cartels fail if noncartel members can supply consumers with large quantities of goods.
  - Each member of a cartel has an incentive to cheat on the cartel agreement.

- Maintaining Cartels
  - Detection of cheating and enforcement
  - Government support
  - Barriers to entry (fewer firms makes cheating easier to detect)
  - Mergers

14.3 Noncooperative Oligopoly

- Broad set of models that describe the way in which oligopolistic firms behave if they don't collude.
  - Cournot Oligopoly
  - Stackelberg Oligopoly
  - Bertrand Oligopoly
- Three assumptions:
  1. All firms are identical (same cost functions and produce identical, undifferentiated products)
  2. There are just two firms (duopoly)
  3. Market lasts for only one period
- Each assumption is eventually relaxed

14.4 Cournot Oligopoly

- The Cournot model explains how oligopoly firms behave if they simultaneously choose how much they produce.

- Four main assumptions:
  1. There are two firms and no others can enter the market
  2. The firms have identical costs
  3. The firms sell identical products
  4. The firms set their quantities simultaneously

- Example: Airline market

14.4 Cournot Model of an Airline Market

- Recall the interaction between American Airlines and United Airlines from Chapter 13.
  - In normal-form game, we assumed airlines chose between two output levels.
  - We generalize that example; firms choose any output level.

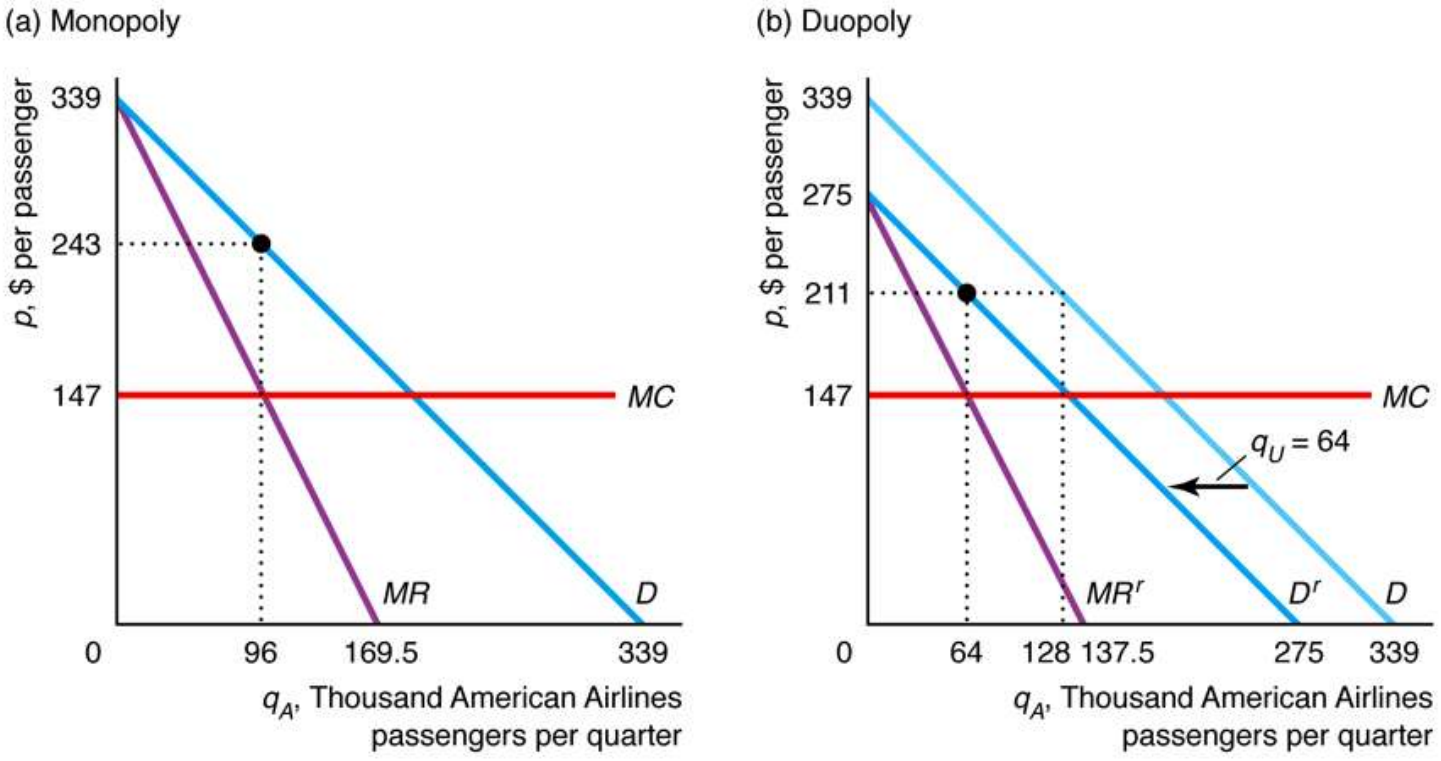
- The ***Cournot equilibrium*** (or Nash-Cournot equilibrium) in this model is a set of quantities chosen by firms such that, holding quantities of other firms constant, no firm can obtain higher profit by choosing a different quantity.

14.4 Cournot Model of an Airline Market

- The quantity each airline chooses depends on the residual demand curve it faces and its marginal cost.
- Estimated airline market demand: $Q = 339 - p$
  - p = dollar cost of one-way flight
  - Q = total passengers flying one-way on both airlines (in thousands per quarter)
- Assume each airline has cost MC = \$147 per passenger
- How does the monopoly outcome compare to duopoly (Cournot with two firms)?

14.4 Cournot Model of an Airline Market

- American Airlines' choice under monopoly and duopoly.



14.4 Cournot Model of an Airline Market

- In duopoly, if United flies q_U passengers, American transports residual demand.
  - American's residual demand: $q_A = Q(p) - q_U = (339 - p) - q_U$
- What is American's best-response, profit-maximizing output if it believes United will fly q_U passengers?
  - American behaves as if it has a monopoly over people who don't fly on United (summarized by residual demand).
  - American's residual inverse demand: $p = 339 - q_A - q_U$
- Residual inverse demand function is useful for expressing revenue (and MR) in terms of rival's quantity.

14.4 Cournot Model of an Airline Market

- Residual inverse demand function is useful for expressing revenue (and MR) in terms of rival's quantity.

$$R^r(q_A) = pq_A = (339 - q_A - q_U)q_A = 339q_A - (q_A)^2 - q_U q_A$$

$$MR^r = \frac{dR^r(q_A)}{dq_A} = 339 - 2q_A - q_U$$

  - Setting MR=MC yields American's best-response function:

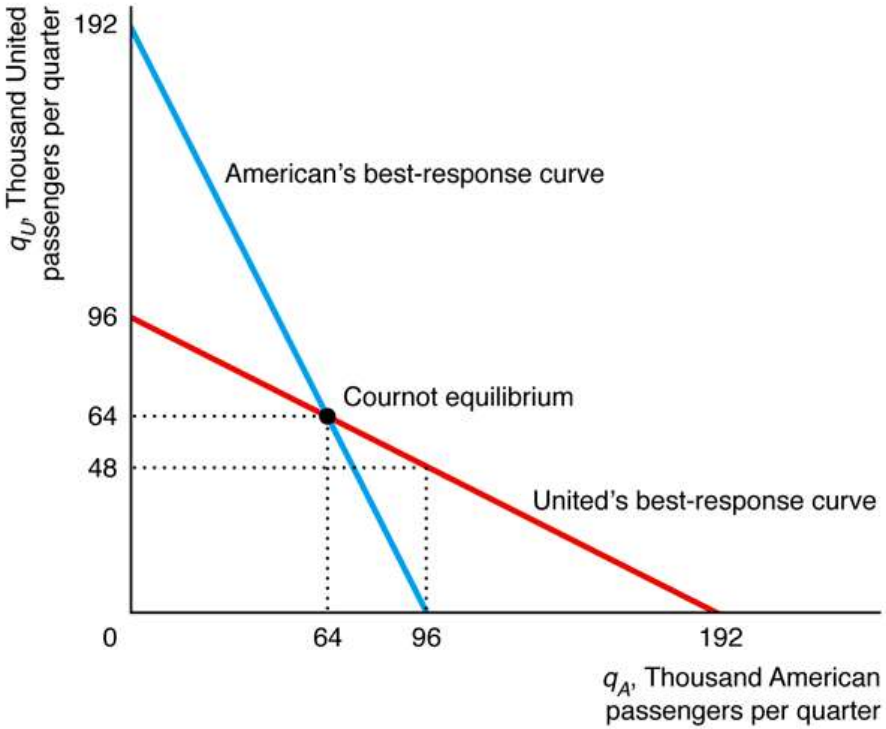
$$q_A = 96 - \frac{1}{2}q_U = B_A(q_U)$$

- Given our assumptions, United's best-response function is analogous:

$$q_U = 96 - \frac{1}{2}q_A = B_U(q_A)$$

14.4 Cournot Model of an Airline Market

- The Nash-Cournot equilibrium is the point where best-response functions intersect: $q_A = q_U = 64$



14.4 Cournot Equilibrium with Two or More Firms

- With n firms, total market output is $Q = q_1 + q_2 + \ldots + q_n$
- Firm 1 wants to maximize profit by choosing q_1:

$$\max_{q_1} \pi_1(q_1, q_2, \ldots, q_n) = q_1 p(q_1 + q_2 + \cdots + q_n) - C(q_1) = q_1 p(Q) - C(q_1)$$

  - FOC when Firm 1 views the outputs of other firms as fixed:

$$\frac{\partial \pi}{\partial q_1} = p(Q) + q_1 \frac{dp(Q)}{dQ} \frac{\partial Q}{\partial q_1} - \frac{dC(q_1)}{dq_1} = 0$$

- Firm 1's best-response function found via MR=MC:

$$MR = p(Q) + q_1 \frac{dp(Q)}{dQ} = \frac{dC(q_1)}{dq_1} = MC$$

- Simultaneously solving for all firms' best-response functions yields Nash-Cournot equilibrium quantities, $q_1 = q_2 = \ldots = q_n = q$

14.5 Stackelberg Oligopoly Model

- Suppose that one of the firms in our previous example was the ***leader*** and set its output before its rival, the ***follower***.
- Does the firm that acts first have an advantage?
- How does this model's outcome differ from the Cournot oligopoly model?

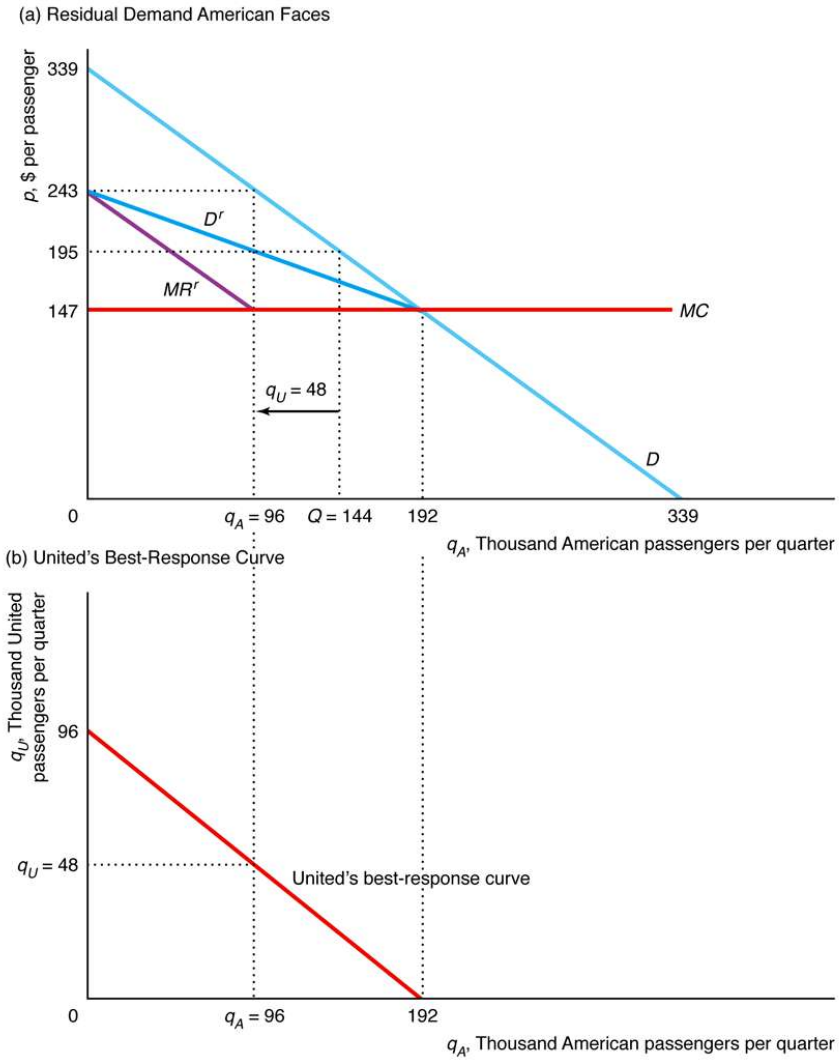
- The Stackelberg model of oligopoly addresses these questions.
  - Note that once the leader sets its output, the rival firm will use its Cournot best-response curve to set its output.

14.5 Stackelberg Oligopoly Model

- General linear inverse demand function: $p = a - bQ$
- Two firms have identical marginal costs, m
- Firm 1 (American Airlines) is the Stackelberg leader and chooses output first
- Firm 2 (United Airlines) is the follower and chooses output using best-response function

- The Stackelberg leader knows the follower will use its best-response function and so the leader views the residual demand in the market as its demand.

14.5 Stackelberg Oligopoly Model



14.6 Comparison of Collusive, Cournot, Stackelberg, and Competitive Equilibria

- Cournot and Stackelberg equilibrium outcomes (quantities, prices, profits) lie between competition and collusion.

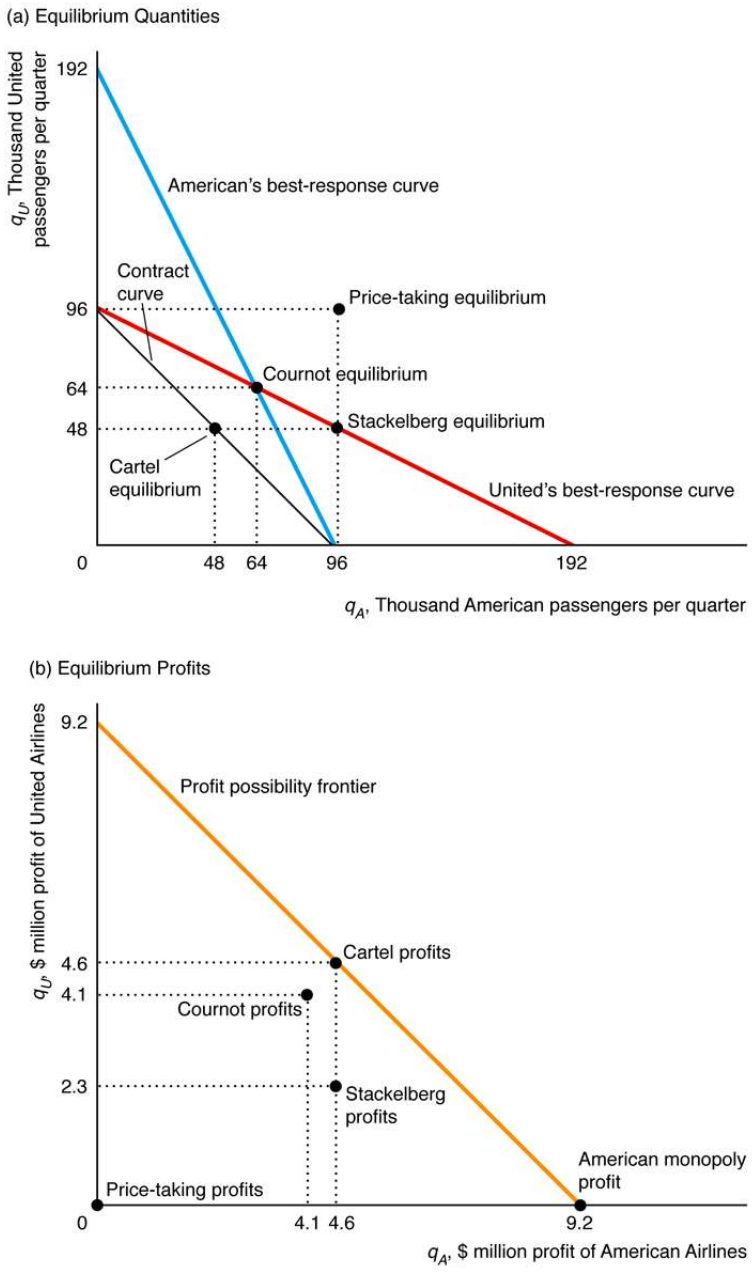
	Monopoly	Cartel	Cournot	Stackelberg	Price Taking
q_A	96	48	64	96	96
q_U	0	48	64	48	96
$Q = q_A + q_U$	96	96	128	144	192
p	\$243	\$243	\$211	\$195	\$147
π_A	\$9.2	\$4.6	\$4.1	\$4.6	\$0
π_U	\$0	\$4.6	\$4.1	\$2.3	\$0
Total profit $= \Pi = \pi_A + \pi_U$	\$9.2	\$9.2	\$8.2	\$6.9	\$0
Consumer surplus, CS	\$4.6	\$4.6	\$8.2	\$10.4	\$18.4
Welfare, $W = CS + \Pi$	\$13.8	\$13.8	\$16.4	\$17.3	\$18.4
Deadweight loss, DWL	\$4.6	\$4.6	\$2.0	\$1.2	\$0

Notes: Passengers are in thousands per quarter. Price is in dollars per passenger. Profits, consumer surplus, welfare, and deadweight loss are in millions of dollars per quarter.

14.6 Comparison of Collusive, Cournot, Stackelberg, and Competitive Equilibria

- These four equilibrium outcomes can also be compared graphically.
- Collusive output combinations are summarized on a "Contract curve."
  - Colluding firms could write a contract in which they agree to produce at any point along this curve.
- Best-response curves are also depicted in order to show Cournot and Stackelberg equilibria.
- Differences in quantities and profits are summarized graphically next.

14.6 Comparison of Collusive, Cournot, Stackelberg, and Competitive Equilibria



14.7 Bertrand Oligopoly Model

- What if, instead of setting quantities, firms set prices and allowed consumers to decide how much to buy?

- A ***Bertrand equilibrium*** (or Nash-Bertrand equilibrium) is a set of prices such that no firm can obtain a higher profit by choosing a different price if the other firms continue to charge these prices.

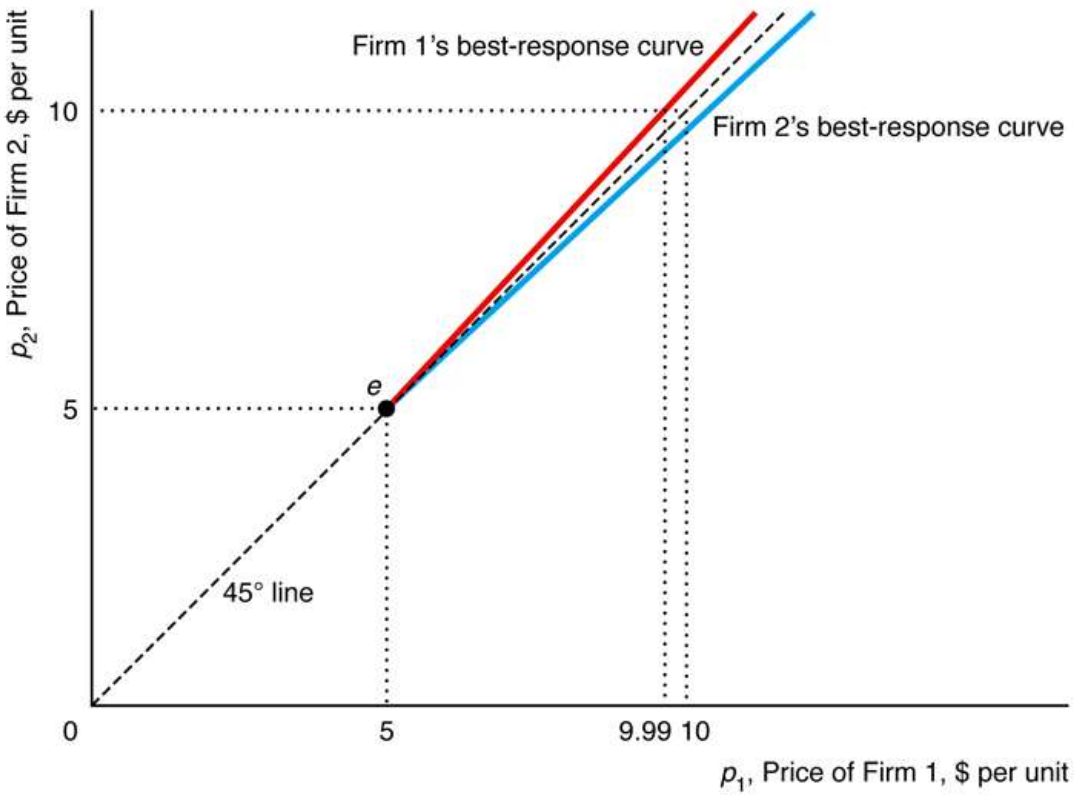
- The Bertrand equilibrium is different than a quantity-setting equilibrium in either the Cournot or Stackelberg models.

14.7 Bertrand Oligopoly Model

- Assumptions of the model:
  - Firms have identical costs (and constant MC=\$5)
  - Firms produce identical goods
- Conditional on the price charged by Firm 2, p_2, Firm 1 wants to charge slightly less in order to attract customers.
- If Firm 1 undercuts its rival's price, Firm 1 captures entire market and earns all profit.
- Thus, Firm 2 also has incentive to undercut Firm 1's price.
- Bertrand equilibrium price equals marginal cost (as in competition) because of incentive to undercut.

14.7 Bertrand Oligopoly Model

- Bertrand equilibrium price equals marginal cost (as in competition) because of incentive to undercut.



14.7 Bertrand Equilibrium with Differentiated Products

- In many markets, firms produce differentiated goods.
  - Examples: automobiles, stereos, computers, toothpaste

- Many economists believe that price-setting models are more plausible than quantity-setting models when goods are differentiated.
  - One firm can charge a higher price for its differentiated product without losing all its sales (e.g. Coke and Pepsi).

- If we relax the "identical goods" assumption, the Bertrand model predicts that firms set prices above MC.

14.7 Bertrand Equilibrium with Differentiated Products

- Example: Cola market
- Demand curve of Coke:

$$q_C = 58 - 4p_C + 2p_P$$

  - q_C = quantity of Coke demanded in tens of millions of cases
  - p_C = price of 10 cases of Coke
  - p_P = price of 10 cases of Pepsi

- If Coke faces constant MC=m, its profit is

$$\pi_C(p_C) = (p_C - m)q_C = (p_C - m)(58 - 4p_C + 2p_P)$$

14.7 Bertrand Equilibrium with Differentiated Products

- Coke maximizes profit by choosing price conditional on the price charged by Pepsi.

$$\frac{\partial \pi_C}{\partial p_C} = q_C + (p_C - m)\frac{\partial q_C}{\partial p_C} = q_C - 4(p_C - m) = 0$$

  - Coke's best-response function:

$$p_C = 7.25 + 0.25p_P + 0.5m$$

- Assuming m = \$5, Coke's best-response function is simplified such that it can be graphed as a function of Pepsi's price:

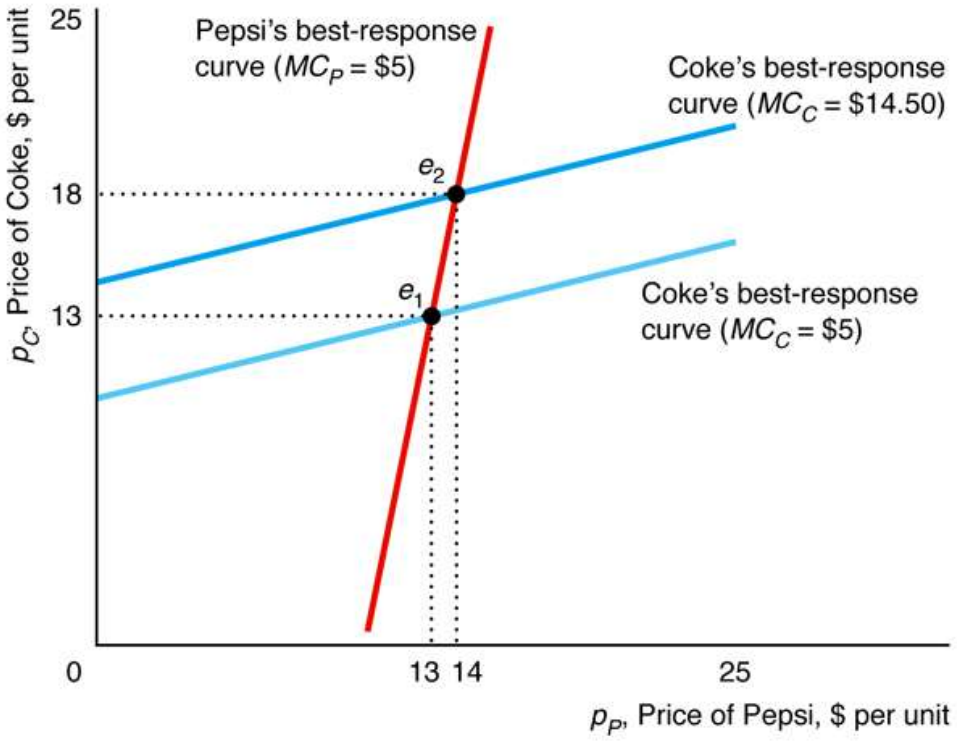
$$p_C = 9.75 + 0.25p_P$$

- Analogous steps for Pepsi yield Pepsi's best-response function:

$$p_P = 10.4 + 0.2p_C$$

14.7 Bertrand Equilibrium with Differentiated Products

- Intersection of best-response curves is equilibrium e_1.
- If Coke's *MC* rises, its best-response curve shifts up and results in new equilibrium e_2.



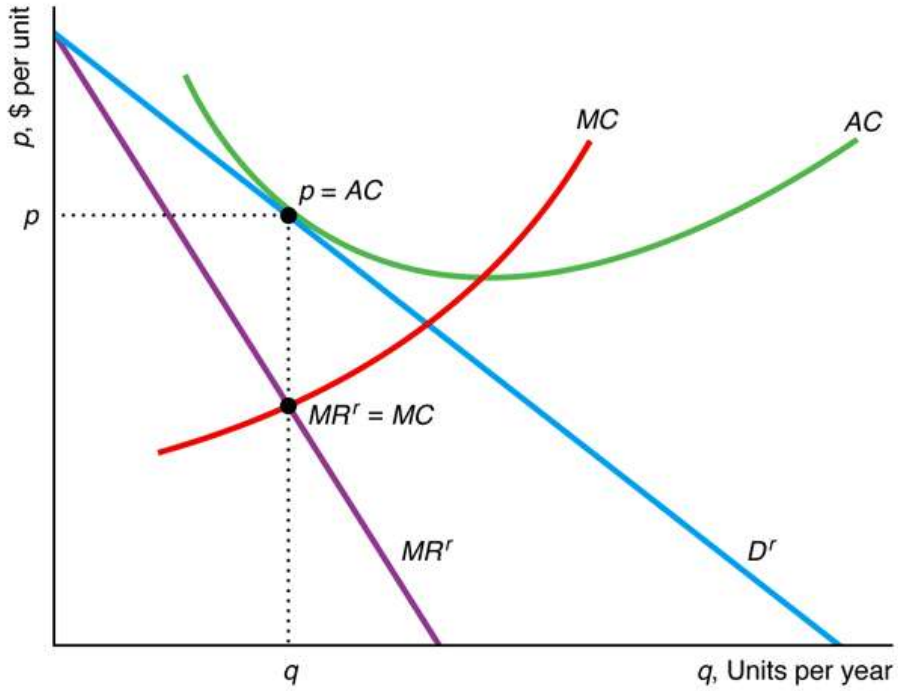
14.8 Monopolistic Competition

- ***Monopolistic competition*** is a market structure in which firms have market power but no additional firm can enter and earn a positive profit.
  - There are no barriers to entry, so firms enter until economic profits are driven to zero.

- What is the difference between competition and monopolistic competition?
  - The latter face a downward-sloping residual demand curve and can charge a price > MC.
  - This occurs because they have relatively few rivals or sell differentiated products.

14.8 Monopolistic Competition

- Despite having market power, MR=MC condition leads to zero profits because there are no barriers to entry.



14.8 Monopolistic Competition

- When these firms benefit from economies of scale, each firm is relatively large compared to market demand and there is only room for a few firms.
- The fewer monopolistically competitive firms, the less elastic is the residual demand curve each firm faces.

- The smallest quantity at which AC reaches its minimum is called full capacity or ***minimum efficient scale***.
  - Monopolistically competitive firm operates at less than full capacity in the long run.

14.8 Monopolistic Competition Among Airlines

- Profits earned with only two firms in the market attracts a new entrant and drives profits to zero.

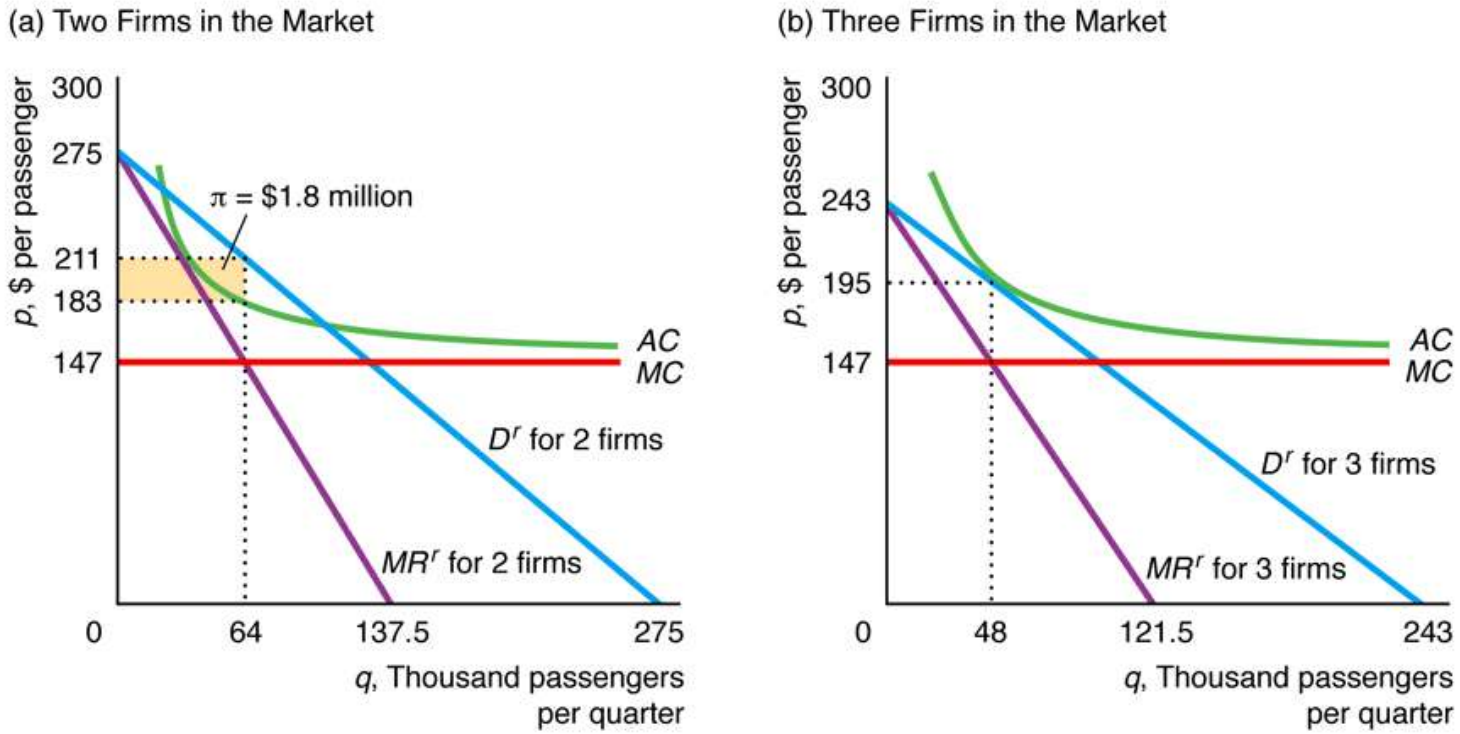


Figure 14.5
Effect of a Government Subsidy on a Cournot Equilibrium