

# BUEC 311: Business Economics, Organization and Management

## Oligopoly and Monopolistic Competition

Fall 2020

- 1 Overview
- 2 Cartels
- 3 Cournot Oligopoly
- 4 Bertrand Oligopoly
- 5 Monopolistic Competition

## 1 Overview

## 2 Cartels

### 3 Cournot Oligopoly

#### 4 Bertrand Oligopoly

## 5 Monopolistic Competition

## Two Additional Market Structures

- So far, we have discussed markets with many firms (perfect competition) or one a single firm (monopoly).
- There are two additional market structures we need to consider.
  - Oligopoly: A market with few sellers and barriers to entry, so each individual firm has market power.
  - Monopolistic Competition: A market in which each firm has market power, but there is free entry in the long run.

- 1 Overview
- 2 Cartels
- 3 Cournot Oligopoly
- 4 Bertrand Oligopoly
- 5 Monopolistic Competition

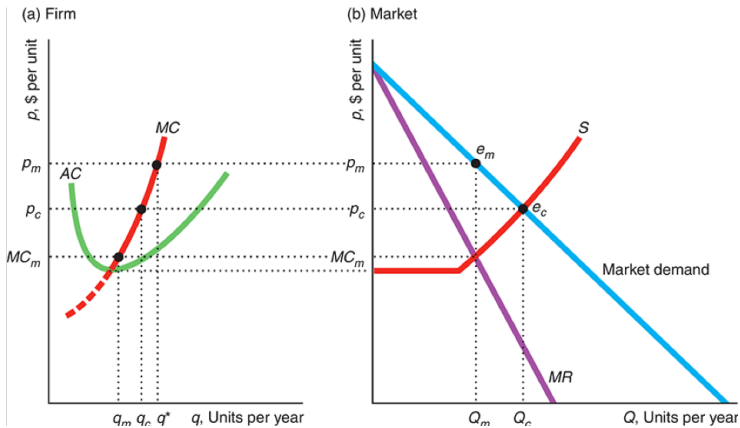
# Cartels

- Oligopolistic firms have an incentive to form a cartel in which they collude and set prices or quantities to increase profits.
  - E.g. OPEC, Montreal's snowplow cartel.
- Typically, each member of a cartel agrees to reduce its output below the level that would be individually profit maximizing.
  - Idea: Increase market price, so firms in cartel earn higher profits.
    - Ideally, the cartel would reduce market output to the monopoly level; this gives highest possible collective profit.
  - Issue: Each member of the cartel has an incentive to cheat.

# Cartels

- A cartel will form if its members believe that they can raise their profits by coordinating their actions.
- By coordinating, the cartel accounts for how output changes from each member firm affect all other members of the cartel.
- This means the aggregate profits of the cartel can exceed the combined profits of the same firms if they acted independently.

# Cartels





# Cartels

- Cartels are hard to sustain in practice:
  - External factors:
    - Cartels are generally illegal in most developed countries. Risk of high fines/jail time may prevent collusion.
    - Some cartels fail because they do not control enough of the market.
  - Internal factors:
    - Cartel members have incentives to cheat other members of the cartel.

# Cartels

- To sustain a cartel, members must be able to detect cheating and punish violators.
  - To detect cheating:
    - Some cartels give members the right to inspect each other's accounts, or divide the market by region/customer.
    - Cartels may also turn to industry organizations to collect data on a firm's market share.
  - To enforce the cartel:
    - Most-favored-customer clause: The seller would not offer a lower price to any other current or future buyer without offering the same price decrease to the firms that signed these contracts.

# Cartels

- Some cartels result from government policy.
  - Sometimes governments help create and enforce cartels, exempting the participants from antitrust and competition laws.
- Some cartels result from barriers to entry into a market.
  - With high barriers to entry, a cartel will have few members. Fewer firms makes it easier to find cheaters and impose penalties.

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- 4 Bertrand Oligopoly
- 5 Monopolistic Competition

# Types of Oligopoly

- If they are not actively trying to collude and form a cartel, oligopolistic firms can compete by independently setting prices or quantities.
- The model we need to use to understand how oligopoly will work depends on whether firms are setting quantities or prices.
  - If firms are **independently setting quantities**, we need to use the Cournot model.
  - If firms are **independently setting prices**, we need to use the Bertrand model.

# Cournot Oligopoly

- The Cournot model is based on four key assumptions:
  - 1 Few firms and no entry.
  - 2 Identical costs.
  - 3 Identical products.
  - 4 Firms choose output levels independently and simultaneously.
- Level of output is a *strategic choice*.
  - Firms set quantities independently, but prices adjust as needed until market clears.
    - This means that firm profits are interdependent.

# Cournot Oligopoly

- Oligopolistic firms choose output to maximize profits.
- Key departure: Firms make profit maximizing decision based on their residual demand curves.
  - The residual demand curve is the market demand that is not met by other sellers at any given price:

$$D^r(p) = D(p) - Q^0$$

- Profit maximizing decision ( $MR^r = MC$ ) yields the firm's best response.
  - Best response tells firm the profit maximizing level of output *given what other sellers are producing*.

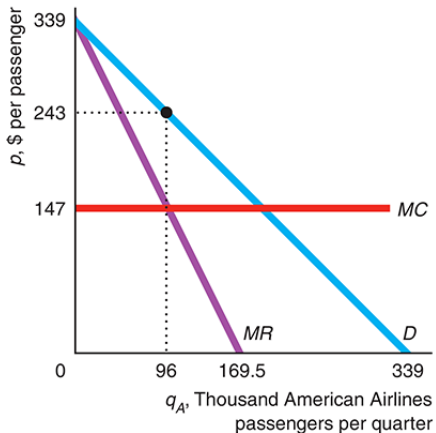
# Cournot Oligopoly

- As an example, consider competition between American Airlines and United Airlines on flights between Chicago and Los Angeles.
  - This is an example of a *duopoly*.
  - Total market output:  $Q = q_A + q_U$
- For simplicity, assume that American and United face the same marginal costs.
- First step: Determine how much American will produce given United's output.

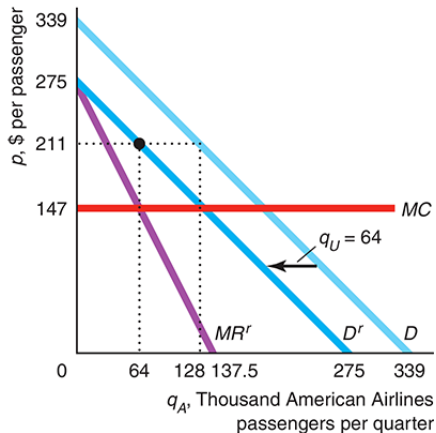


# Cournot Oligopoly

(a) Monopoly



(b) Duopoly



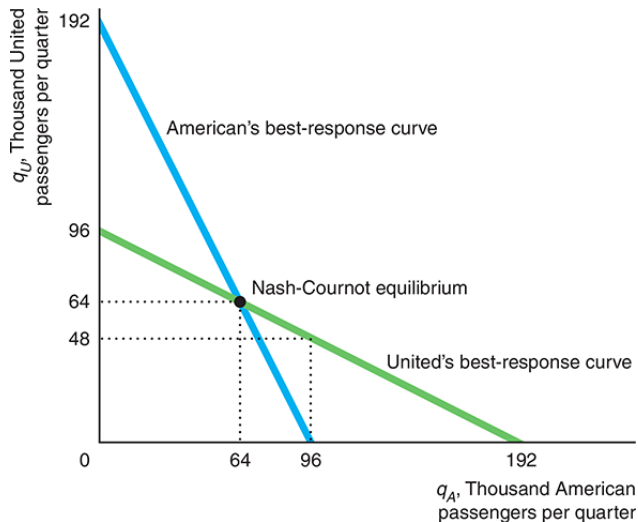
# Cournot Oligopoly

- American repeats this exercise for every level of residual demand:

$$q_A = Q(p) - q_U$$

- This yields American's best response to any level of output from United.
- United's best response is determined in an analogous way.

# Cournot Oligopoly



# Cournot Oligopoly

## Definition (Nash-Cournot Equilibrium)

A set of quantities chosen by firms such that, holding the quantities of all other firms constant, no firm can obtain a higher profit by choosing a different quantity.

- Equilibrium quantity must be on the best response curve for all firms.

# Cournot Oligopoly

- We can also solve for the equilibrium algebraically.
- Suppose the market demand function is  $Q = 339 - p$  and that both companies have  $MC = AC = 147$  per passenger per flight.
- The then residual demand function for American is  $q_A = (339 - p) - q_U$  or  $p = 339 - q_A - q_U$ .
- This means American's marginal revenue is given by:

$$MR^r = 339 - 2q_A - q_U$$

## Cournot Oligopoly

- American's profit maximizing choice:

$$MR^r = MC$$

$$339 - 2q_A - q_U = 147$$

So American's best response is:

$$q_A = 96 - 0.5q_U$$

- Similarly, United's best response is:

$$q_U = 96 - 0.5q_A$$

# Cournot Oligopoly

- We can determine the Nash-Cournot equilibrium by substitution:

$$q_A = 96 - 0.5(96 - 0.5q_A) = 64$$

$$q_U = 96 - 0.5(96 - 0.5q_U) = 64$$

- Hence,  $Q = q_A + q_U = 128$ , and  $p = \$211$ .

# Cournot Oligopoly

- If two Cournot firms set output independently, the Nash-Cournot equilibrium price to consumers is lower than the monopoly price.
  - It is possible to verify, with one firm, in our airline example,  $Q = 96$  and  $p = \$243$ .
- As the number of firms increases, the equilibrium price is even lower.
  - With a large enough number of firms, the Nash-Cournot equilibrium approaches the competitive outcome.



# Cournot Oligopoly

Number of Firms, $n$	Firm Output, $q$	Market Output, $Q$	Price, $p$	Firm Profit, $\pi$ (\$ thousands)
1 (monopoly)	96	96	243	9,216
2 (duopoly)	64	128	211	4,096
3	48	144	195	2,304
4	38	154	185	1,475
5	32	160	179	1,024
10	18	175	164	305
50	4	188	151	14
100 (nearly competitive)	2	190	149	4

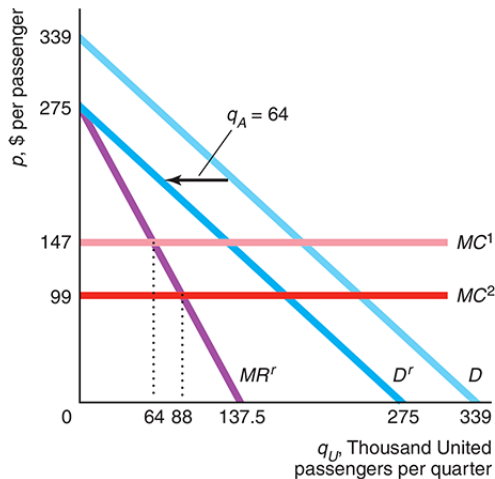
*Note:* The numbers in this table are rounded.

# Cournot Oligopoly

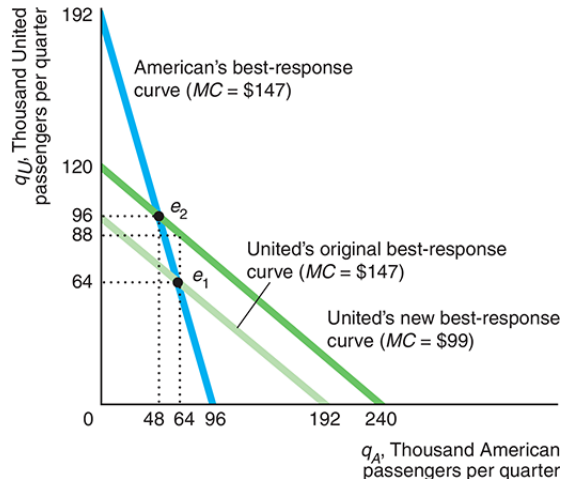
- In our example, firms had the same costs and were selling the same product. In reality, firms can have different costs and/or differentiate their products.
- In the Cournot model, a change in costs shifts a firm's best response function.
  - Recall: For a profit maximizing firm,  $MR = MC$ , so a change in cost changes what level of output is profitable given what other firms are doing.
- As an example, suppose that United's  $MC$  falls from \$147 to \$99.

# Cournot Oligopoly

(a) United's Residual Demand



(b) Best-Response Curves



## Cournot Oligopoly

- If an oligopolistic firm can differentiate its products from its rivals, it can shift its demand curve to the right and make it less elastic.
- The less elastic the demand curve, the more the firm can charge because consumers are willing to pay more for a product that “seems” superior.
- Although differentiation leads to higher prices, which harms consumers, differentiation can be desirable in its own right.
  - Consumers value having a choice, and some may prefer new brands to existing ones.
- If consumers think products differ, then Cournot quantities and prices may differ across firms.
  - Each firm faces a different inverse demand function and hence, charges a different price.

# Cournot Oligopoly

- Oligopolistic firms may desire to merge to increase profit.
- In general there are two types of mergers:
  - 1 Vertical mergers that may lower cost with more efficient supply chain organization.
  - 2 Horizontal mergers that may increase market power and reduce competition.
- Mergers designed to reduce competition are rarely profitable unless accompanied by a cost reduction.

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# Bertrand Oligopoly

- In the Bertrand model, **prices are the strategic choice**.
  - Firms set prices and then consumers decide how many units to buy.
- Firms must account for the pricing decisions of all other firms in the market.
  - E.g. Duopoly
    - Firm 1's best response curve comes from answering "What price should we (Firm 1) set if Firm 2 sets a price of  $p_2 = x$ ?" for all possible values of  $x$ .
    - Firm 2's best response curve comes from answering "What price should we (Firm 2) set if Firm 1 sets a price of  $p_1 = y$ ?" for all possible values of  $y$ .

# Bertrand Oligopoly

## Definition (Nash-Bertrand Equilibrium)

The 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.

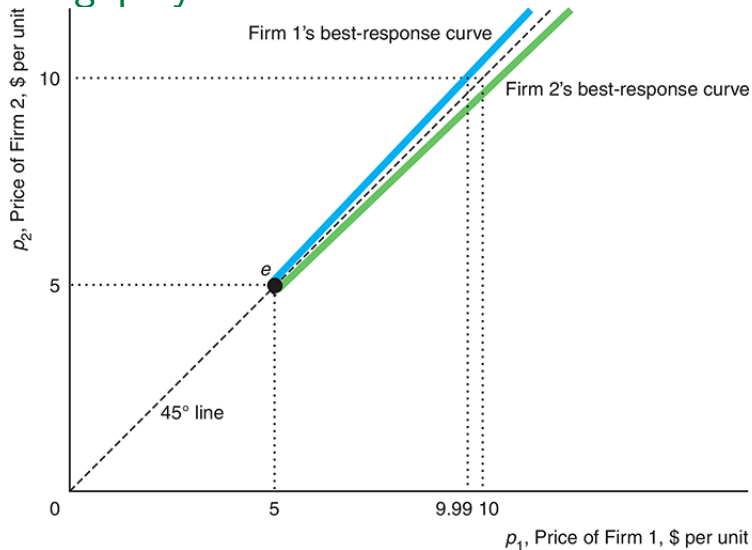
- Nash-Bertrand equilibrium differs from the Nash-Cournot equilibrium; with Bertrand, firms only earn positive profits if they produce differentiated products.



# Bertrand Oligopoly

- As an example, consider a price-setting oligopoly where firms have identical costs and produce identical products.
- Suppose there are two firms (Firm 1 and Firm 2) that produce identical products, and have identical costs so  $MC = AC = \$5$ .
- What price should each firm charge?

# Bertrand Oligopoly



# Bertrand Oligopoly

- When firms produce identical products, the Nash-Bertrand Equilibrium outcome is the same equilibrium as perfect competition.
- This seems implausible for two reasons:
  - ① In a market with few firms, why would firms compete so vigorously that they earn no profit?
  - ② Equilibrium depends only on costs; it is insensitive to demand conditions or the number of firms.
- Implication: Nash-Cournot model is better suited for understanding markets with identical products.

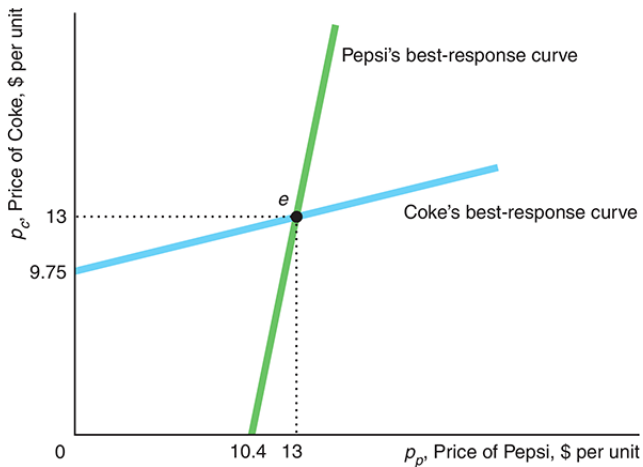
# Bertrand Oligopoly

- The Bertrand model is better suited for understanding markets featuring differentiated products.
- E.g. Coke and Pepsi
  - Two firms with nearly identical costs:

$$MC = AC = \$5$$

- Products are differentiated, so some consumers prefer one to the other regardless of price.
  - This means neither firm has to exactly match a price cut by its rival.

# Bertrand Oligopoly

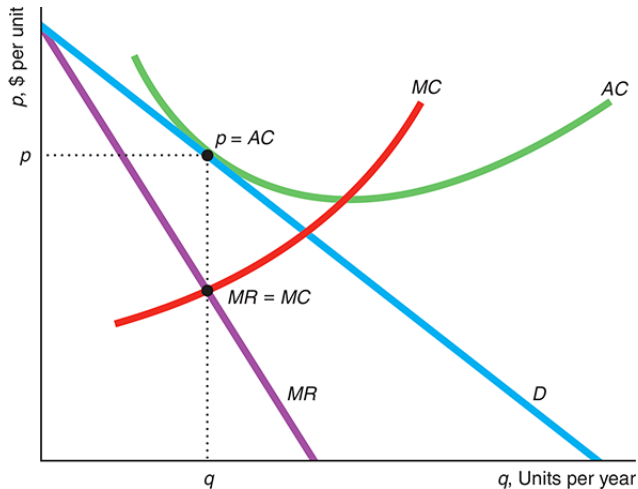


- 1 Overview
- 2 Cartels
- 3 Cournot Oligopoly
- 4 Bertrand Oligopoly
- 5 Monopolistic Competition

# Monopolistic Competition

- Final market structure: Monopolistic Competition
  - Features the price setting characteristics of monopoly and oligopoly and the free entry of perfect competition.
    - Firms face downward sloping demand curves, and have market power.
    - Firms may earn zero profit in the long run due to free entry.
- Demand may be downward sloping for two reasons:
  - ① Market demand may be limited so there is only room in the market for a few firms; each firm faces a residual demand curve that is downward sloping.
    - E.g. A market may only be large enough to support a few service providers (barbers/plumbers/etc).
  - ② Firms produce differentiated products. Each firm can retain those customers who like product more even if its prices is above that of rivals.
    - E.g. Food trucks.

# Monopolistic Competition





# Monopolistic Competition

- If all firms in a monopolistically competitive market produce identical products and have identical costs, each firm earns *zero economic profit in the long run*.
- If firms have different cost functions or produce differentiated products, then firms will likely differ in their long run profitability.
  - Low-cost firms, or firms with superior products may earn positive economic profit in the long run.

# Takeaways

- ① Oligopolistic firms have an incentive to collude and form a cartel.
- ② In oligopolies, firm profits are interdependent. Profitability depends on differences in cost and product differentiation.
- ③ In monopolistically competitive markets, profitability also depends on differences in cost and product differentiation. If firms produce identical goods with identical costs, they all earn zero economic profit in the long run.