Oligopoly and Strategic Behavior

The Rock and Roll Hall of Fame and Museum staged its 2008 induction ceremony in New York City.

PREPARED BY
FERNANDO QUANO, YUHUI QUANO, AND XIAO XUAN RU
CHAPTER 12
Oligopoly and Strategic Behavior

APPLYING THE CONCEPTS

1. How do firms conspire to fix prices?
   Marine Hose Conspirators Go to Prison

2. Does a low-price guarantee lead to higher or lower prices?
   Low-Price Guarantees and Empty Promises

3. What means—legal and illegal—do firms use to prevent other firms from entering a market?
   Legal and Illegal Entry Deterrence

4. How do patent holders respond to the introduction of generic drugs?
   Merck and Pfizer Go Generic?

Oligopoly and Strategic Behavior

- oligopoly
  A market served by a few firms.

- game theory
  The study of decision making in strategic situations.

12.1 WHAT IS AN OLIGOPOLY?

- concentration ratio
  The percentage of the market output produced by the largest firms.

An alternative measure of market concentration is the Herfindahl-Hirschman Index (HHI). It is calculated by squaring the market share of each firm in the market and then summing the resulting numbers.

An oligopoly—a market with just a few firms—occurs for three reasons:

1. Government barriers to entry.
2. Economies of scale in production.
3. Advertising campaigns.
Chapter 12: Oligopoly and Strategic Behavior

12.1 What Is an Oligopoly?

<table>
<thead>
<tr>
<th>Industry</th>
<th>Four-Firm Concentration Ratio (%)</th>
<th>Eight-Firm Concentration Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary copper smelting</td>
<td>99</td>
<td>Not available</td>
</tr>
<tr>
<td>Glass and ceramics</td>
<td>97</td>
<td>99</td>
</tr>
<tr>
<td>Cigarettes</td>
<td>95</td>
<td>99</td>
</tr>
<tr>
<td>Shipyard and shipbuilding</td>
<td>93</td>
<td>Not available</td>
</tr>
<tr>
<td>Household laundry equipment</td>
<td>91</td>
<td>94</td>
</tr>
<tr>
<td>Electric lamp bulbs</td>
<td>89</td>
<td>90</td>
</tr>
<tr>
<td>Military vehicles</td>
<td>88</td>
<td>93</td>
</tr>
<tr>
<td>Primary battery manufacturing</td>
<td>87</td>
<td>99</td>
</tr>
<tr>
<td>Beer and malt</td>
<td>85</td>
<td>98</td>
</tr>
<tr>
<td>Household refrigeration</td>
<td>85</td>
<td>95</td>
</tr>
<tr>
<td>Small arms (rapport)</td>
<td>84</td>
<td>90</td>
</tr>
<tr>
<td>Breakfast cereals</td>
<td>87</td>
<td>95</td>
</tr>
<tr>
<td>Motor vehicles and car bodies</td>
<td>88</td>
<td>94</td>
</tr>
<tr>
<td>Flavoring syrup</td>
<td>Not available</td>
<td>89</td>
</tr>
</tbody>
</table>


Chapter 12: Oligopoly and Strategic Behavior

12.2 Cartel Pricing and the Duopolists’ Dilemma

- **duopoly**: A market with two firms.
- **cartel**: A group of firms that act in unison, coordinating their price and quantity decisions.

**FIGURE 12.1** A Cartel Picks the Monopoly Quantity and Price

The monopoly outcome is shown by point a, where marginal revenue equals marginal cost. The monopoly quantity is 60 passengers and the price is $400. If the firms form a cartel, the price is $400 and each firm has 30 passengers (half the monopoly quantity). The profit per passenger is $300 (equal to the $400 price minus the $100 average cost), so the profit per firm is $9,000.

**profit** = (price − average cost) × quantity per firm

*price-fixing* An arrangement in which firms conspire to fix prices.

### CARTEL PRICING AND THE DUOPOLISTS’ DILEMMA

#### FIGURE 12.2

**Competing Duopolists Pick a Lower Price**

(A) The typical firm maximizes profit at point a, where marginal revenue equals marginal cost. The firm has 40 passengers.

(B) At the market level, the duopoly outcome is shown by point d, with a price of $300 and 80 passengers. The cartel outcome, shown by point c, has a higher price and a smaller total quantity.

#### FIGURE 12.3

**Game Tree for the Price-Fixing Game**

The equilibrium path of the game is square A to square C to rectangle 4: Each firm picks the low price and earns a profit of $8,000. The duopolists’ dilemma is that each firm would make more profit if both picked the high price, but both firms pick the low price.

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### Price-Fixing and the Game Tree

#### TABLE 12.2 DUOPOLISTS’ PROFITS WHEN THEY CHOOSE DIFFERENT PRICES

<table>
<thead>
<tr>
<th></th>
<th>Jack: High Price</th>
<th>Jack: Low Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>$400</td>
<td>$300</td>
</tr>
<tr>
<td>Average cost</td>
<td>$100</td>
<td>$100</td>
</tr>
<tr>
<td>Profit per passenger</td>
<td>$300</td>
<td>$200</td>
</tr>
<tr>
<td>Number of passengers</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Profit</td>
<td>$3,000</td>
<td>$12,000</td>
</tr>
</tbody>
</table>
12.2 CARTEL PRICING AND THE DUOPOLISTS' DILEMMA

Equilibrium of the Price-Fixing Game

- dominant strategy
  An action that is the best choice for a player, no matter what the other player does.

- duopolists' dilemma
  A situation in which both firms in a market would be better off if both chose the high price, but each chooses the low price.

Nash Equilibrium

- Nash equilibrium
  An outcome of a game in which each player is doing the best he or she can, given the action of the other players.

In 2007, the U.S. government discovered a seven-year conspiracy to fix the price of marine hose, which is used to transfer oil from tankers to onshore storage facilities.

- The case ultimately led to fines and prison sentences for the employees of several marine hose firms and for a person paid by the firms to coordinate the price-fixing scheme.
- The executives were arrested after a meeting in Houston in which they allocated customers to different members of the cartel and fixed prices.
- Each firm in the cartel agreed to submit artificially high bids for customers allocated to other firms, a practice known as bid rigging.

There is some evidence that prison sentences are more effective than fines in deterring business crimes such as price fixing.

In the United States, people convicted of price fixing regularly offer to pay bigger fines to avoid prison.
12.3 OVERCOMING THE DUOPOLISTS’ DILEMMA

Low-Price Guarantees

- **Low-price guarantee**
  A promise to match a lower price of a competitor.

\[ \text{FIGURE 12.4} \]
Low-Price Guarantees Increase Prices

When both firms have a low-price guarantee, it is impossible for one firm to underprice the other. The only possible outcomes are a pair of high prices (rectangle 1) or a pair of low prices (rectangles 2 or 4). The equilibrium path of the game is square A to square B to rectangle 1. Each firm picks the high price and earns a profit of $9,000.

Repeated Pricing Games with Retaliation for Underpricing

- **Grim trigger strategy**
  A strategy where a firm responds to underpricing by choosing a price so low that each firm makes zero economic profit.

- **Tit-for-tat strategy**
  A strategy where one firm chooses whatever price the other firm chose in the preceding period.
OVERCOMING THE DUOPOLISTS’ DILEMMA

12.3 Repeated Pricing Games with Retaliation for Underpricing

\[ \text{FIGURE 12.5} \]

A Tit-for-Tat Pricing Strategy

Under tit-for-tat retaliation, the first firm (Jill, the square) chooses whatever price the second firm (Jack, the circle) chose the preceding month.

Price-Fixing and the Law

Under the Sherman Antitrust Act of 1890 and subsequent legislation, explicit price-fixing is illegal. It is illegal for firms to discuss pricing strategies or methods of punishing a firm that underprices other firms.

LOW-PRICE GUARANTEES AND EMPTY PROMISES

APPLYING THE CONCEPTS #2: Does a low-price guarantee lead to higher or lower prices?

Will a low-price guarantee lead to lower prices?

A low price guarantee eliminates the possibility that one firm will underprice the other and thus leads to high prices.

- If firm A promises to give refunds if its price exceeds firm B’s price, we might expect firm A to keep its price low to avoid handing out a lot of refunds.
- Firm A doesn’t have to worry about giving refunds because firm B will also choose the high price.
- In other words, the promise to issue refunds is an empty promise. Although consumers might think that a low-price guarantee will protect them from high prices, it means they are more likely to pay the high price.
Price Leadership

- **price leadership**
  A system under which one firm in an oligopoly takes the lead in setting prices.

The problem with an implicit pricing agreement is that it relies on indirect signals that are often garbled and misinterpreted. When one firm suddenly drops its price, the other firm could interpret the price cut in one of two ways:

- A change in market conditions.
- Underpricing.

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The **kinked demand curve model** is a model in which firms in an oligopoly match price cuts by other firms, but do not match price hikes.

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**Figure 12.6** Kinked Demand Curve Model

If one firm in an oligopoly cuts its price and the other firms match the price cut, the quantity sold by the firm will increase by a relatively small amount. If one firm increases its price but other firms don’t match the price hike, the quantity sold by the firm will decrease by a relatively large amount.
**12.5 | SIMULTANEOUS DECISION MAKING AND THE PAYOFF MATRIX**

- **payoff matrix**
  A matrix or table that shows, for each possible outcome of a game, the consequences for each player.

**FIGURE 12.7**
Payoff Matrix for the Price-Fixing Game

<table>
<thead>
<tr>
<th></th>
<th>Jill</th>
<th>Jack</th>
</tr>
</thead>
<tbody>
<tr>
<td>High price: $400</td>
<td>Jill earns $9,000</td>
<td>Jack earns $12,000</td>
</tr>
<tr>
<td>Low price: $300</td>
<td>Jill earns $3,000</td>
<td>Jack earns $8,000</td>
</tr>
</tbody>
</table>

Jill's profit is in red, and Jack's profit is in blue. If both firms pick the high price, each firm earns a profit of $9,000. Both firms will pick the low price, and each firm will earn a profit of only $8,000.

**FIGURE 12.8**
Payoff Matrix for the Prisoners' Dilemma

<table>
<thead>
<tr>
<th></th>
<th>Clyde</th>
<th>Bonnie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not confess</td>
<td>Clyde gets 2 years</td>
<td>Bonnie gets 2 years</td>
</tr>
<tr>
<td></td>
<td>Clyde gets 1 year</td>
<td>Bonnie gets 10 years</td>
</tr>
<tr>
<td>Confess</td>
<td>Clyde gets 10 years</td>
<td>Bonnie gets 5 years</td>
</tr>
</tbody>
</table>

The prisoners' dilemma is that each prisoner would be better off if neither confessed, but both people confess. The Nash equilibrium is shown in the southeast corner of the matrix. Each person gets five years of prison time.
THE INSECURE MONOPOLIST AND ENTRY DETERRENCE

12.6 THE INSECURE MONOPOLIST AND ENTRY DETERRENCE

The Passive Approach

The quantity required to prevent the entry of the second firm is computed as follows:

deterrent quantity = zero profit quantity − minimum entry quantity

Entry Deterrence and Limit Pricing

The quantity required to prevent the entry of the second firm is computed as follows:

deterrent quantity = zero profit quantity − minimum entry quantity

Game Tree for the Entry-Deterrence Game

The path of the game is square A to square C to rectangle 4. Mona commits to the entry-deterring quantity of 100, so Doug stays out of the market. Mona’s profit of $10,000 is less than the monopoly profit but more than the duopoly profit of $8,000.
Entry Deterrence and Limit Pricing

- **Limit pricing**: The strategy of reducing the price to deter entry.
- **Limit price**: The price that is just low enough to deter entry.

**Examples: Microsoft Windows and Campus Bookstores**

Microsoft picks a lower price to discourage entry and preserve its monopoly. If your campus bookstore suddenly feels insecure about its monopoly position, it could cut its prices to prevent online booksellers from capturing too many of its customers.

**Entry Deterrence and Contestable Markets**

- **Contestable market**: A market with low entry and exit costs.

**When Is the Passive Approach Better?**

Entry deterrence is not the best strategy for all insecure monopolists. Sharing a duopoly can be more profitable than increasing output and cutting the price to keep the other firm out.

**Application 3**

**Legal and Illegal Entry Deterrence**

**Applying the Concepts #3**: What means—legal and illegal—do firms use to prevent other firms from entering a market?

When firms use limit pricing to prevent other firms from entering the market, entry deterrence is legal.

The European Commission has uncovered many examples of entry deterrence that are illegal under the rules of the European Union.

- Van den Bergh Foods, a subsidiary of Unilever, provided "free" freezer cabinets to retailers, under the condition that the cabinets were to be used exclusively for the storage of Unilever’s ice cream products.
- The commission concluded that this practice constituted an abuse of Unilever’s dominant position.
- In 2003, the European Court of First Instance ordered Unilever to share the freezer cabinets with its competitors, including the Mars Company, which had argued that it was unable to sell its ice cream in many retail outlets.
Between 2006 and 2011, many of the top selling branded drugs will lose their patent protection. The producers of generic versions of the branded drugs will enter markets with hundreds of billions of dollars of annual sales.

The producers of branded drugs are responding to the increased competition in two ways.

- First, they are launching their own versions of the generics, in cooperation with other firms.
- The second response to increased competition is to cut the prices of branded drugs to compete with generics.

Anticipating the entry of a generic version of Zokor, Merck cut its price so aggressively that the company was accused of trying to prevent the producers of generics from entering the market.

Sanofi and BMS, the makers of the branded drug Plavix, cut their price to undercut the generic version introduced by Apatex.

### Table 12.3 Advertising and Profit

<table>
<thead>
<tr>
<th>Neither Advertises</th>
<th>Adeline</th>
<th>Vern</th>
<th>Both Advertise</th>
<th>Adeline</th>
<th>Vern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net revenue from sales ($ million)</td>
<td>$7</td>
<td>$6</td>
<td>$13</td>
<td>$13</td>
<td>$17</td>
</tr>
<tr>
<td>Cost of advertising ($ million)</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Profit ($ million)</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

**FIGURE 12.11**

Game Tree for the Advertisers’ Dilemma

Adileine moves first, choosing to advertise or not. Vern’s best response is to advertise no matter what Adeline does. Knowing this, Adeline realizes that the only possible outcomes are shown by rectangles 1 and 3. From Adeline’s perspective, rectangle 1 ($5 million) is better than rectangle 3 ($5 million), so her best response is to advertise. Both Adeline and Vern advertise, and each earns a profit of $5 million.

### Key Terms

- cartel
- concentration ratio
- contestable market
- dominant strategy
- duopolists’ dilemma
- duopoly
- game theory
- game tree
- grim-trigger strategy
- kinked demand curve model
- low-price guarantee
- limit price
- limit pricing
- Nash equilibrium
- oligopoly
- payoff matrix
- price-fixing
- price leadership
- tit-for-tat