

Chapter 14 Lecture - Oligopoly: Firms in Less Competitive Markets

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Oligopoly: a Very Different Market Structure

In the previous chapters, we examined perfect and monopolistic competition.

These two market structures were similar: firms produce until their marginal cost is equal to marginal revenue, and the low barriers to entry would result in profit being competed away in the long run.

Oligopoly, a market structure in which a small number of interdependent firms compete, will require completely different tools to analyze. Why?

1. Oligopolists are large and know that their actions have an effect on one another.
2. Barriers to entry exist, preventing firms from competing away profits.

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Oligopoly and Barriers to Entry

We show how barriers to entry explain the existence of oligopolies.

Before we analyze how oligopolists behave, it is useful to know which firms/markets we are discussing.

A useful tool for identifying the type of market structure is the *four-firm concentration ratio*: the fraction of an industry's sales accounted for by its four largest firms.

- A four-firm concentration ratio larger than 40 percent tends to indicate an oligopoly.

Although there are limits to how useful four-firm concentration ratios can be, they are a useful tool in discussing the concentration of market power within an industry.

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Table 14.1 Examples of Oligopolies in Retail Trade and Manufacturing

Retail Trade		Manufacturing	
Industry	Four-Firm Concentration Ratio	Industry	Four-Firm Concentration Ratio
Discount department stores (Walmart and Target)	97%	Cigarettes (Phillip Morris and R.J. Reynolds)	98%
Warehouse clubs and supercenters (Sam's Club and BJ's Wholesale Club)	94%	Beer (Anheuser-Busch and MillerCoors)	90%
College bookstores (Barnes & Noble and Follett)	75%	Computers (Hewlett-Packard and Dell)	87%
Hobby toy, and game stores (Toys"R"Us and Michael's)	72%	Aircraft (Boeing and Lockheed Martin)	81%
Radio, television, and other electronic stores (Best Buy and Apple)	70%	Breakfast cereal (Kellogg's and General Mills)	80%
Athletic footwear stores (Footlocker and Champs)	68%	Dog and cat food (Mars and Procter & Gamble)	71%
Pharmacies and drugstores (Walgreens and CVS Caremark)	63%	Automobiles (General Motors and Ford)	68%

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Limitations of Four-Firm Concentration Ratios

Four-firm concentration ratios are a good first look at competition in an industry; above 40 percent indicates an oligopoly to many economists.

But they have some weaknesses:

1. They do not include the goods and services that foreign firms export to the United States.
2. They are calculated for national markets, even if the market is really local (like the college bookstore market).
3. The definition of the market is tricky: Walmart and BJ's are in different markets but probably compete against one another to some extent.

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Why Do Oligopolies Exist?

Oligopolies often exist because of **barriers to entry**: anything that keeps new firms from entering an industry in which firms are earning economic profits.

One example of a barrier to entry is **economies of scale**: the situation when a firm's long-run average costs fall as the firm increases output.

- This can make it difficult for new firms to enter a market, because new firms usually have to start small and will hence have substantially higher average costs than established firms.

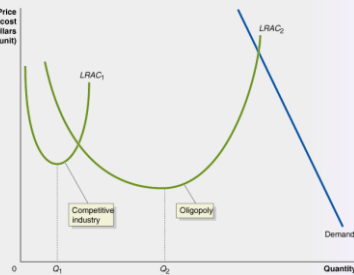
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Figure 14.1 Economies of Scale Help Determine the Extent of Competition in an Industry

If long-run average cost is minimized at a small fraction of industry output, as on $LRAC_1$, there is room in the industry for many firms.

But if it takes a large (relative to industry size) firm to achieve economies of scale, the market is more likely to be an oligopoly.

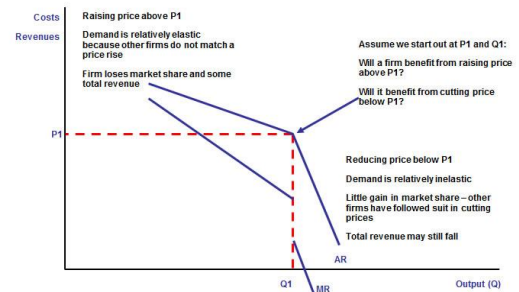


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Kinked-Demand Curve

- Competitor and rivals strategize versus each other
- Consumers effectively have 2 partial demand curves and each part has its own marginal revenue part



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Other Reasons for Oligopolies Existing

Ownership of a key input

- If control of a key input is held by one or a small number of firms, it will be difficult for additional firms to enter.
- *Examples: Alcoa—bauxite for aluminum production
De Beers—diamonds
Ocean Spray—cranberries*

Government-imposed barriers

- Governments might grant exclusive rights to some industry to one or a small number of firms.
- *Examples: Occupational licensing for dentists and doctors
Patents
Tariffs and quotas imposed on foreign companies*

Patent: The exclusive right to a product for a period of 20 years from the date the patent is filed with the government.

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Using Game Theory to Analyze Oligopoly

We use game theory to analyze the strategies of oligopolistic firms.

Unlike perfect and monopolistic competitors, oligopolists are large relative to the market, and the actions of one oligopolist make large differences in the profits of another.

- So graphical analysis of one firm's actions will not capture the nuances of an oligopolistic market.

Oligopolies are best analyzed using a specialized field of study called *game theory*.

Game theory: The study of how people make decisions in situations in which attaining their goals depends on their interactions with others; in economics, the study of the decisions of firms in industries where the profits of a firm depend on its interactions with other firms.

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Game Theory

Game theory was developed during the 1940s and advanced by mathematicians and social scientists like economists.

All "games" share certain characteristics:

1. *Rules* that determine what actions are allowable
2. *Strategies* that players employ to attain their objectives in the game
3. *Payoffs* that are the results of the interactions among the players' strategies

For example, we can model firm production as a "game":

- Rules: the production functions and market demand curve
- Strategies: firms' production decisions
- Payoffs: firms' profits

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Figure 14.2 A Duopoly Game (1 of 5)

	Apple	
	\$14.99	\$9.99
Spotify	\$14.99	\$9.99
	\$9.99	\$9.99
	Spotify earns \$10 million profit Apple earns \$10 million profit	Spotify earns \$5 million profit Apple earns \$15 million profit
	Spotify earns \$15 million profit Apple earns \$5 million profit	Spotify earns \$7.5 million profit Apple earns \$7.5 million profit

Suppose Spotify and Apple are the only two firms selling streaming music service.

Each must choose their **business strategy**: actions that a firm takes to achieve a goal, such as maximizing profits.

Assume each firm can charge either \$14.99 or \$9.99.

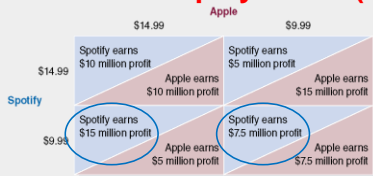
The combination of strategies chosen determines profit, shown in the above **payoff matrix**: a table that shows the payoffs that each firm earns from every combination of strategies by the firms.

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Figure 14.2 A Duopoly Game (2 of 5)



Suppose you are Spotify in this game. How would you play?

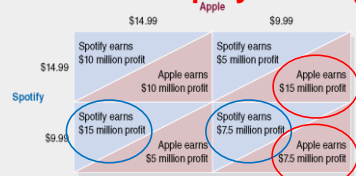
- If Apple charges \$14.99, you earn \$10m profit by charging \$14.99 or \$15m profit by charging \$9.99. You prefer \$9.99.
- If Apple charges \$9.99, you earn \$5m profit by charging \$14.99 or \$7.5m profit by charging \$9.99. You prefer \$9.99.

Charging \$9.99 is a **dominant strategy** for Spotify: a strategy that is the best for a firm, no matter what strategies other firms use.

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Figure 14.2 A Duopoly Game (3 of 5)



Now suppose you are Apple. How would you play?

- If Spotify charges \$14.99, you earn \$10m profit by charging \$14.99 or \$15m profit by charging \$9.99. You prefer \$9.99.
- If Spotify charges \$9.99, you earn \$5m profit by charging \$14.99 or \$7.5m profit by charging \$9.99. You prefer \$9.99.

Charging \$9.99 is a dominant strategy for Apple also.

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Figure 14.2 A Duopoly Game (4 of 5)



Both firms charging \$9.99 is a **Nash equilibrium**: a situation in which each firm chooses the best strategy, given the strategies chosen by the other firm.

The firms don't have to have dominant strategies in order for there to be a Nash equilibrium; their strategies just have to be *best responses* to one another's strategies.

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Figure 14.2 A Duopoly Game (5 of 5)



Notice that both firms could do better via **collusion**: an agreement among firms to charge the same price or otherwise not to compete.

- If both firms charge \$14.99, they achieve more profit than by acting independently.

Collusion is against the law in the United States, but you can see why firms might be tempted to collude: their profits could be substantially higher.

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Cooperative Equilibrium vs. Noncooperative Equilibrium

Nash equilibrium is an example of a **noncooperative equilibrium**: an equilibrium in a game in which players do not cooperate but pursue their own self-interest.

- Many game theorists concentrate on noncooperative equilibrium, particularly because of laws against cooperation among firms.

If we allowed players to coordinate their actions in a game, by forming alliances etc., we would be looking for a **cooperative equilibrium**: an equilibrium in a game in which players cooperate to increase their mutual payoff.

- This might make sense for many social interactions: groups of people often try to cooperate rather than work independently.

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The Prisoner's Dilemma

Economists and other social scientists refer to the situation with Spotify and Apple as a **prisoner's dilemma**: a game in which pursuing dominant strategies results in noncooperation that leaves everyone worse off.

The name comes from a problem faced by two suspects the police arrest for a crime.

- The police offer each suspect a suspended prison sentence in exchange for confessing to the crime and testifying against the other suspect.
- Each suspect has a dominant strategy to confess. If both confess, they both go to jail for a long time, while they both could have gone to jail for a short time if they had both remained silent.

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The Prisoners' Dilemma

- In the prisoners' dilemma game, two prisoners (Art and Bob) have been caught committing a petty crime.

Rules

- The rules describe the setting of the game, the actions the players may take, and the consequences of those actions.
- Each is held in a separate cell and cannot communicate with each other. Each is told that both are suspected of committing a more serious crime.
- If one of them confesses, he will get a 1-year sentence for cooperating while his accomplice get a 10-year sentence for both crimes.
- If both confess to the more serious crime, each receives 3 years in jail for both crimes.
- If neither confesses, each receives a 2-year sentence for the minor crime only.

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The Prisoner's Dilemma

Strategies

Strategies are all the possible actions of each player.

- Art and Bob each have two possible actions:
 1. Confess to the larger crime.
 2. Deny having committed the larger crime.
- With two players and two actions for each player, there are four possible outcomes:
 1. Both confess.
 2. Both deny.
 3. Art confesses and Bob denies.
 4. Bob confesses and Art denies.

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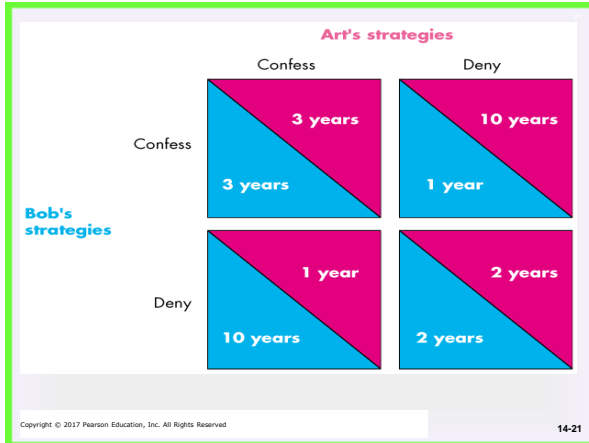


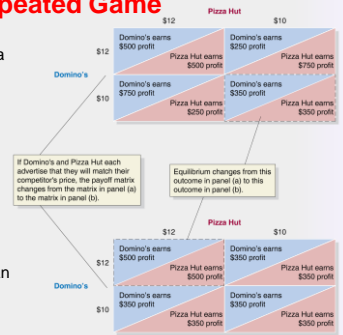
Figure 14.3 Changing the Payoff Matrix in a Repeated Game

Suppose Domino's and Pizza Hut are deciding how to price a pizza: \$12 or \$10.

- This game gets played not once but every day.

A clever way to avoid the low-profit Nash equilibrium is to advertise a price match guarantee. Then if either firm cuts prices, the other has guaranteed to do so as well.

- Now neither firm will have an incentive to cut prices.
- Do price match guarantees really benefit consumers?



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Other Methods for Avoiding Price Competition

A price match guarantee is an *enforcement mechanism*, making automatic the decision about whether to *punish* a competing firm for charging a low price.

Another method is **price leadership**, a form of implicit collusion in which one firm in an oligopoly announces a price change and the other firms in the industry match the change.

- Example: In the 1970s, General Motors would announce a price change at the beginning of a model year, and Ford and Chrysler would match GM's price change.

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Figure 14.4 Oil Prices, 1972 to mid-2015



A **cartel** is a group of firms that collude by agreeing to restrict output to increase prices and profits.

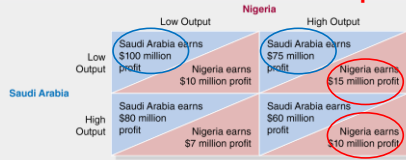
The Organization of Petroleum Exporting Countries is the best known cartel. OPEC colluded to restrict output and raise prices in the 1970s and 1980s.

- But collusion has proved difficult to maintain over time.

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Figure 14.5 The OPEC Cartel with Unequal Members



Because Saudi Arabia can produce much more oil than Nigeria, its output decisions have a much larger effect on the price of oil.

- Saudi Arabia has a dominant strategy to cooperate and produce a low output.

Nigeria, however, has a dominant strategy not to cooperate and instead produce a high output.

- In order to punish Nigeria for defecting, Saudi Arabia would have to hurt itself substantially. Would it be worth it to you?

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Sequential Games and Business Strategy

We use sequential games to analyze business strategies.

The game theory models we have analyzed so far have been *simultaneous*: the players have made their decisions at the same time.

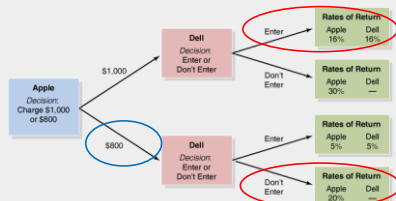
But some games are *sequential* in nature: one firm makes a decision, and the other makes its decision having observed the first firm's decision.

- We analyze such games using a *decision tree*, indicating who gets to make a decision at what point, and what the consequences of their decision will be.

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Figure 14.6 The Decision Tree for an Entry Game



1. Apple decides whether to charge \$1,000 or \$800 for a new laptop.
2. Then Dell decides to enter the market or not, needing a 15 percent return.

If Apple charges \$1,000, Dell will want to enter; its return exceeds 15 percent.

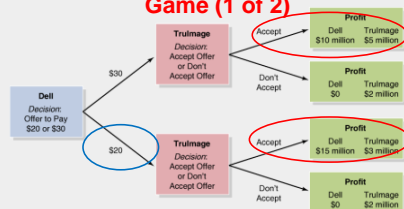
If Apple charges the low price, Dell will not want to enter.

So Apple can deter Dell from entering the market by charging \$800.

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Figure 14.7 The Decision Tree for a Bargaining Game (1 of 2)



1. Dell can offer \$20 or \$30 per copy for Trulmage's software.
2. Then Trulmage can accept or reject the offer.

Dell will look ahead and realize that Trulmage is better off accepting Dell's offer, no matter what price Dell offers.

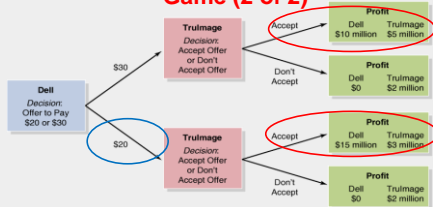
Therefore Dell should offer the low price, anticipating that Trulmage will accept the offer.

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Figure 14.7 The Decision Tree for a Bargaining Game (2 of 2)



Notice that Trulmage would like to threaten to reject an offer of \$20.

- If Dell believed the threat, its best action would be to offer \$30.

But Dell shouldn't believe the threat; it is not *credible*.

- Only the original outcome is a *subgame-perfect equilibrium*: where no player can improve their outcome by changing their decision at any decision node.

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The Five Forces Competitive Model

We use the five competitive forces model to analyze competition in an industry.

Michael Porter of Harvard Business School identifies five separate competitive forces that determine the overall level of competition in an industry:

1. Existing firms

Example: Educational Testing Service administers the (\$52.50) SAT and (\$195) GRE tests. The SAT has competition from the ACT, helping keep its price low. The GRE has no competitor.

2. Threat from new entrants

Example: In the previous section, Apple charged a low price to deter Dell from entering its market.

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The Five Forces Competitive Model (cont.)

3. Competition from substitutes

Example: Printed encyclopedia sets used to cost well over \$1000, but parents would buy them because there were no good substitutes. But the advent of cheap computer-based encyclopedias helped drive printed encyclopedia producers out of business.

4. Bargaining power of buyers

Example: Large companies like Wal-Mart can threaten to buy goods from competitors, forcing suppliers to keep their prices low.

5. Bargaining power of suppliers

Example: As a start-up, Microsoft couldn't force IBM to pay a high price for its operating system. But as Microsoft became the dominant player in operating systems, it could charge much more to computer manufacturers.

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Horizontal Merger

- the combination under one ownership of the assets of two or more firms engaged in the production of similar products
- example: two steel manufacturing companies merging

Vertical Merger

- the creation of a single firm from two firms, one of which was a supplier of the other
- example: a lumber company and a builder merging

Conglomerate Merger

- the combining under one ownership of two or more firms that produce unrelated products
- example: a tire manufacturer and a coffee company merging

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