N. GREGORY MANKIW

PRINCIPLES OF
ECONOMICS
Eight Edition

CHAPTER
17

Oligopoly

Premium PowerPoint Slides by:
V. Andreea CHIRITESCU
Eastern Illinois University

Modified by Joseph Tao-yi Wang

1

Look for the answers to these questions:

- What outcomes are possible under oligopoly?
- Why is it difficult for oligopoly firms to cooperate?
- How are antitrust laws used to foster competition?

2

Measuring Market Concentration

- Concentration ratio
  - Percentage of total output in the market supplied by the four largest firms
  - The higher the concentration ratio, the less competition
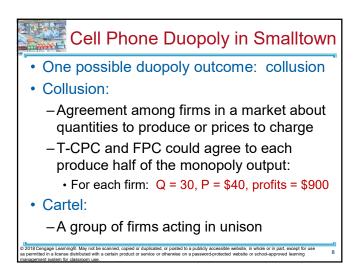- This chapter focuses on oligopoly, a market structure with high concentration ratios.

3

Concentration Ratios in Selected U.S. Industries

Industry	Concentration ratio
Video game consoles	100%
Tennis balls	100%
Credit cards	99%
Batteries	94%
Soft drinks	94%
Web search engines	92%
Breakfast cereal	92%
Cigarettes	89%
Greeting cards	88%
Beer	85%
Cell phone service	82%
Autos	79%

4

Oligopoly

- Oligopoly
  - Market structure in which only a few sellers offer similar or identical products
  - Strategic behavior in oligopoly:
    - A firm's decisions about P or Q can affect other firms and cause them to react
    - The firm will consider these reactions when making decisions
- Game theory: the study of how people behave in strategic situations

5

EXAMPLE: Cell Phone Duopoly in Smalltown

P	Q
$0	140
5	130
10	120
15	110
20	100
25	90
30	80
35	70
40	60
45	50

- Daiwan, not to be confused with Taiwan, has 23 million residents
- The "good": Gasoline, fuel to power vehicles for personal transportation
- Daiwan's demand schedule
- Two firms: T-CPC and FPC (**duopoly**: an oligopoly with two firms)
- Each firm's costs: FC = $0, MC = $10

6

EXAMPLE: Gasoline Duopoly in Daiwan

P	Q	Revenue	Cost	Profit
$0	140	$0	$1,400	−1,400
5	130	650	1,300	−650
10	120	1,200	1,200	0
15	110	1,650	1,100	550
20	100	2,000	1,000	1,000
25	90	2,250	900	1,350
30	80	2,400	800	1,600
35	70	2,450	700	1,750
40	60	2,400	600	1,800
45	50	2,250	500	1,750

Competitive outcome:
$P = MC = \$10$
$Q = 120$
Profit = $0

Monopoly outcome:
$P = \$40$
$Q = 60$
Profit = $1,800

7

Cell Phone Duopoly in Smalltown

- One possible duopoly outcome: collusion
- Collusion:
  - Agreement among firms in a market about quantities to produce or prices to charge
  - T-CPC and FPC could agree to each produce half of the monopoly output:
    - For each firm: Q = 30, P = $40, profits = $900
- Cartel:
  - A group of firms acting in unison

8

Active Learning 1   Collusion vs. self-interest

P	Q
$0	140
5	130
10	120
15	110
20	100
25	90
30	80
35	70
40	60
45	50

Duopoly outcome with collusion:
Each firm agrees to produce Q = 30, earns profit = $900.

1. If T-CPC reneges on the agreement and produces Q = 40, what happens to the market price? T-CPC's profits?
2. Is it in T-CPC's interest to renege on the agreement?
3. If both firms renege and produce Q = 40, determine each firm's profits.

9

Active Learning 1   Answers

P	Q
$0	140
5	130
10	120
15	110
20	100
25	90
30	80
35	70
40	60
45	50

If both firms stick to agreement, each firm's profit = $900

1. If T-CPC reneges on agreement, produces Q = 40:
   - Market quantity = 70, P = $35
   - T-CPC's profit = 40 x ($35 − 10)=$1000
2. T-CPC's profits are higher if it reneges.
3. FPC will conclude the same, both firms renege, each produces Q = 40:
   - Market quantity = 80, P = $30
   - Each firm's profit =40x($30–10) = $800

10

Collusion vs. Self-Interest

- Both firms would be better off if both stick to the cartel agreement.
  - But each firm has incentive to renege on the agreement.
  - Lesson: It is difficult for oligopoly firms to form cartels and honor their agreements.

11

Active Learning 2   The oligopoly equilibrium

P	Q
$0	140
5	130
10	120
15	110
20	100
25	90
30	80
35	70
40	60
45	50

If each firm produces Q = 40, market quantity = 80, P = $30, each firm's profit = $800

- Is it in T-CPC's interest to increase its output further, to Q = 50?
- Is it in FPC's interest to increase its output to Q = 50?

12

2

Active Learning 2   Answers

P	Q
$0	140
5	130
10	120
15	110
20	100
25	90
30	80
35	70
40	60
45	50

- If each firm produces Q = 40, then each firm's profit = $800.
- If T-CPC increases output to Q = 50:
  - Market quantity = 90, P = $25
  - T-CPC's profit = 50 x ($25 – 10) = $750
- T-CPC's profits are higher at Q = 40 than at Q = 50.
- The same is true for FPC.

Equilibrium for an Oligopoly

- Nash equilibrium
  - Economic actors interacting with one another, each choose their best strategy
  - Given the strategies that all the other actors have chosen
- Duopoly example has a Nash equilibrium
  - Given that FPC produces Q = 40, T-CPC's best move is to produce Q = 40
  - Given that T-CPC produces Q = 40, FPC's best move is to produce Q = 40

Equilibrium for an Oligopoly

- When firms in an oligopoly individually choose production to maximize profit
  - Produce Q
    - Greater than monopoly Q
    - Less than competitive Q
  - The price is
    - Less than the monopoly P
    - Greater than the competitive P = MC

The Output & Price Effects

- Increasing output has two effects on a firm's profits:
  - Output effect:
    If P > MC, increasing output raises profits
  - Price effect:
    Raising output increases market quantity, which reduces price and reduces profit on all units sold

The Size of the Oligopoly

- As the number of sellers in an oligopoly increases:
  - The price effect becomes smaller
  - The oligopoly looks more and more like a competitive market
  - P approaches MC
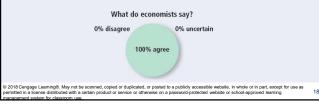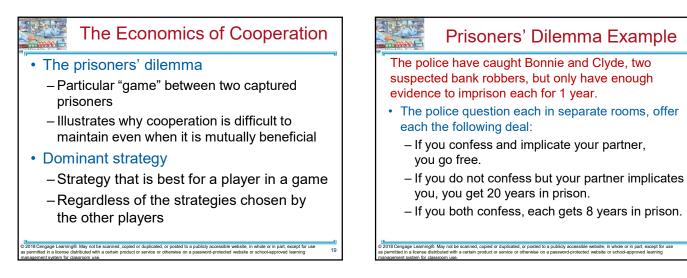 - The market quantity approaches the socially efficient quantity
- Another benefit of international trade

ASK THE EXPERTS
Nash Equilibrium

"Behavior in many complex and seemingly intractable strategic settings can be understood more clearly by working out what each party in the game will choose to do if they realize that the other parties will be solving the same problem. This insight has helped us understand behavior as diverse as military conflicts, price setting by competing firms and penalty kicking in soccer."

What do economists say?

0% disagree   0% uncertain

100% agree

The Economics of Cooperation

- The prisoners' dilemma
  - Particular "game" between two captured prisoners
  - Illustrates why cooperation is difficult to maintain even when it is mutually beneficial
- Dominant strategy
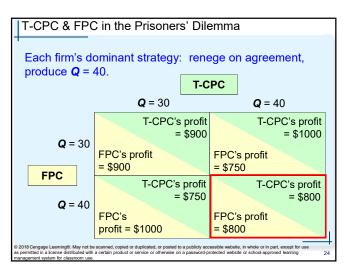 - Strategy that is best for a player in a game
  - Regardless of the strategies chosen by the other players

19

Prisoners' Dilemma Example

The police have caught Bonnie and Clyde, two suspected bank robbers, but only have enough evidence to imprison each for 1 year.

- The police question each in separate rooms, offer each the following deal:
  - If you confess and implicate your partner, you go free.
  - If you do not confess but your partner implicates you, you get 20 years in prison.
  - If you both confess, each gets 8 years in prison.

20

Prisoners' Dilemma Example

Confessing is the dominant strategy for both players.

Nash equilibrium: both confess

	Bonnie's decision	
	→ Confess	→ Remain silent
Clyde's decision → Confess	Bonnie gets 8 years / Clyde gets 8 years	Bonnie gets 20 years / Clyde goes free
→ Remain silent	Bonnie goes free / Clyde gets 20 years	Bonnie gets 1 year / Clyde gets 1 year

21

Prisoners' Dilemma Example

- Outcome: Bonnie and Clyde both confess, each gets 8 years in prison.
  - Both would have been better off if both remained silent.
  - But even if Bonnie and Clyde had agreed before being caught to remain silent, the logic of self-interest takes over and leads them to confess.

22

Oligopolies as a Prisoners' Dilemma

- When oligopolies form a cartel
  - In hopes of reaching the monopoly outcome, they become players in a prisoners' dilemma.
- Our earlier duopoly example:
  - T-CPC and FPC are duopolists in Daiwan
  - The cartel outcome maximizes profits:
  - Each firm agrees to serve Q = 30 customers.

23

T-CPC & FPC in the Prisoners' Dilemma

Each firm's dominant strategy: renege on agreement, produce Q = 40.

		T-CPC	
		Q = 30	Q = 40
FPC	Q = 30	T-CPC's profit = $900 / FPC's profit = $900	T-CPC's profit = $1000 / FPC's profit = $750
	Q = 40	T-CPC's profit = $750 / FPC's profit = $1000	T-CPC's profit = $800 / FPC's profit = $800

24

4

Active Learning 3 — The fare wars game

The players: China Airlines and EVA Air

The choice: cut fares by 50% or leave fares alone

- If both airlines cut fares, each airline's profit = $400 million
- If neither airline cuts fares, each airline's profit = $600 million
- If only one airline cuts its fares, its profit = $800 million; the other airline's profits = $200 million

• Draw the payoff matrix, find the Nash equilibrium

Active Learning 3 — Answers

Nash equilibrium: both firms cut fares

	China Airlines	
	Cut fares	Don't cut fares
EVA Air Cut fares	$400 million / $400 million	$200 million / $800 million
Don't cut fares	$800 million / $200 million	$600 million / $600 million

Other Examples of the Prisoners' Dilemma

• Ad Wars
  - Two firms spend millions on TV ads to steal business from each other.
  - Each firm's ad cancels out the effects of the other, and both firms' profits fall by the cost of the ads.
• Organization of Petroleum Exporting Countries
  - Member countries try to act like a cartel, agree to limit oil production to boost prices and profits.
  - But agreements sometimes break down when individual countries renege.

Other Examples of the Prisoners' Dilemma

• Arms race between military superpowers
  - Each country would be better off if both disarm, but each has a dominant strategy of arming.
• Common resources
  - All would be better off if everyone conserved common resources, but each person's dominant strategy is overusing the resources.
• Public goods contribution
  - Everyone would be better off if we all contributed to the pool, but it's a dominant strategy to free ride.
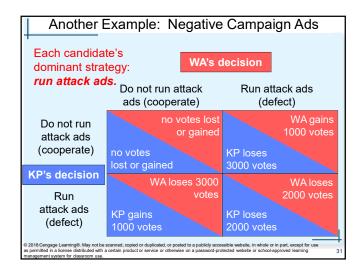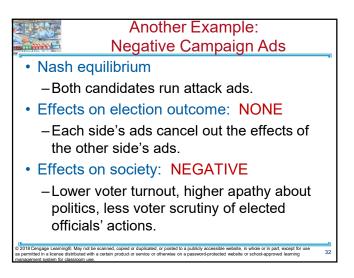
Welfare of Society

• Noncooperative oligopoly equilibrium
  - May be bad for oligopolists
    • Prevents them from achieving monopoly profits
  - May be bad for society
    • Examples: Arms race game, Common resource game, public goods contribution
  - May be good for society
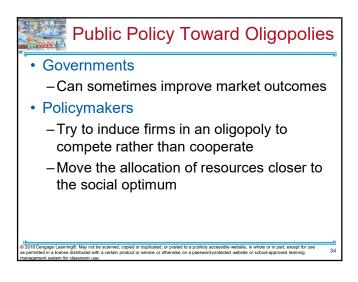   • Quantity and price – closer to optimal level

Another Example: Negative Campaign Ads

• Election with two candidates, "WA" and "KP."
  - If WA runs a negative ad attacking KP, 3000 fewer people will vote for KP (1000 of these people vote for WA, the rest abstain).
  - If KP runs a negative ad attacking WA, WA loses 3000 votes, KP gains 1000, 2000 abstain.
  - WA and KP agree to refrain from running attack ads. Will each of them stick to the agreement?

Another Example: Negative Campaign Ads

Each candidate's dominant strategy: **run attack ads.**

		WA's decision	
		Do not run attack ads (cooperate)	Run attack ads (defect)
KP's decision	Do not run attack ads (cooperate)	no votes lost or gained / no votes lost or gained	WA gains 1000 votes / KP loses 3000 votes
	Run attack ads (defect)	WA loses 3000 votes / KP gains 1000 votes	WA loses 2000 votes / KP loses 2000 votes

Another Example: Negative Campaign Ads

- Nash equilibrium
  - Both candidates run attack ads.
- Effects on election outcome: NONE
  - Each side's ads cancel out the effects of the other side's ads.
- Effects on society: NEGATIVE
  - Lower voter turnout, higher apathy about politics, less voter scrutiny of elected officials' actions.

Why People Sometimes Cooperate

  - When the game is repeated many times, cooperation may be possible
- Two strategies may lead to cooperation:
  - If your rival reneges in one round, you renege in all subsequent rounds.
  - "Tit-for-tat"
    Whatever your rival does in one round (whether renege or cooperate), you do in the following round.

Public Policy Toward Oligopolies

- Governments
  - Can sometimes improve market outcomes
- Policymakers
  - Try to induce firms in an oligopoly to compete rather than cooperate
  - Move the allocation of resources closer to the social optimum

Public Policy Toward Oligopolies

- Antitrust laws
  - The Sherman Antitrust Act, 1890
    - Elevated agreements among oligopolists from an unenforceable contract to a criminal conspiracy
  - The Clayton Act, 1914
    - Further strengthened the antitrust laws
  - Used to prevent mergers
  - Used to prevent oligopolists from colluding

Controversies Over Antitrust Policy

  - Most people agree that price-fixing agreements among competitors should be illegal.
  - Some economists are concerned that policymakers go too far when using antitrust laws to stifle business practices that are not necessarily harmful, and may have legitimate objectives.
- We consider three such practices…

1. Resale Price Maintenance ("Fair Trade")

- A manufacturer imposes lower limits on the prices retailers can charge
  - Often opposed because it appears to reduce competition at the retail level
  - Yet, any market power the manufacturer has is at the wholesale level
    - No gains from restricting competition at the retail level
  - Legitimate objective: preventing discount retailers from free-riding on the services provided by full-service retailers

2. Predatory Pricing

- A firm cuts prices to prevent entry or drive a competitor out of the market
  - So that it can charge monopoly prices later
- Illegal under antitrust laws
  - Difficult: when a price cut is predatory and when it is competitive & beneficial to consumers?
- Many economists doubt that predatory pricing is a rational strategy:
  - It involves selling at a loss (costly for the firm)
  - It can backfire

3. Tying

- A manufacturer bundles two products together and sells them for one price
- Critics
  - Tying gives firms more market power by connecting weak products to strong ones
- Others: tying cannot change market power
  - Buyers are not willing to pay more for two goods together than for the goods separately
- Firms may use tying for price discrimination
  - Sometimes increases economic efficiency

Summary

- Oligopolists can maximize profits if they form a cartel and act like a monopolist.
- Yet, self-interest leads each oligopolist to a higher quantity and lower price than under the monopoly outcome.
- The larger the number of firms, the closer will be the quantity and price to the levels that would prevail under competition.

Summary

- The prisoners' dilemma shows that self-interest can prevent people from cooperating, even when cooperation is in their mutual interest. The logic of the prisoners' dilemma applies in many situations.
- Policymakers use the antitrust laws to prevent oligopolies from engaging in anticompetitive behavior such as price-fixing. But the application of these laws is sometimes controversial.

Chapter 17: Oligopoly

- When there are only a few firms
- Firms care about each other's actions
  - Game Theory; Nash Equilibrium
  - Dominant Strategy; P.D.
- Collusion (Monopoly) vs. Self-Interest
- Policy: Increase competition; Antitrust Laws

- Homework: Mankiw, Ch.17: 1-3, 6, 8-9

2018/12/3　　Oligopoly　　Joseph Tao-yi Wang

Chapter 17: Oligopoly

▸ Challenge Questions (Past Finals)

2018/12/3   Oligopoly   Joseph Tao-yi Wang