

Chapter 12 - Imperfect Competition: A Game-Theoretic Approach

Chapter 12 - Imperfect Competition: A Game-Theoretic Approach



Copyright © 2015 The McGraw-Hill Companies, Inc. All rights reserved.

Basic Ideas of Game Theory

- **Game theory** is the general theory of strategic behavior.
 - Generally depicted in mathematical form.
 - Plays an important role in modern economics.

Rules, Strategies, Payoffs, and Equilibrium

- Economic situations are treated as games.
 - The **rules** of the game state who can do what, and when they can do it.
 - A player's **strategy** is a plan for actions in each possible situation in the game.

2

Dominant Strategy and Nash Equilibrium

- **Dominant strategy**: the strategy in a game that produces better results irrespective of the strategy chosen by one's opponent.
- **Nash equilibrium**: the combination of strategies in a game such that neither player has any incentive to change strategies given the strategy of his opponent.
 - A Nash equilibrium does not require both players to have a dominant strategy!

3

Prisoner's Dilemma

- Famous example of game theory.
 - Strategies must be undertaken without the full knowledge of what other players will do.
 - Players adopt dominant strategies, but they don't necessarily lead to the best outcome.
- Two prisoners (A and B) are held in separate cells for a serious crime that they did in fact commit. The prosecutor has only enough hard evidence to convict them of a minor offense, for which the penalty is a year in jail. Each prisoner is told that if one confesses while the other remains silent, the confessor will get parole while the other spends life years in prison. If both confess, they will both get a sentence of 20 years.

4

Chapter 12 - Imperfect Competition: A Game-Theoretic Approach

Prisoner's Dilemma

		Prisoner B's Strategies	
		Do Not Confess	Confess
Prisoner A's Strategies	Do Not Confess	1 Year / 1 Year	Parole / Life
	Confess	Life / Parole	20 Years / 20 Years

5

Nash Equilibrium

Advertising as a Prisoner's Dilemma

		Firm I	
		Don't advertise	Advertise
Firm 2	Don't advertise	$\Pi_1 = 500$ $\Pi_2 = 500$	$\Pi_1 = 750$ $\Pi_2 = 0$
	Advertise	$\Pi_1 = 0$ $\Pi_2 = 750$	$\Pi_1 = 250$ $\Pi_2 = 250$

When advertising's main effect is brand switching, the dominant strategy is to advertise heavily (lower right cell), even though firms as a whole would do better by not advertising (upper left cell).

6

Nash Equilibrium

A Game in Which Firm 2 Has No Dominant Strategy

		Firm I	
		Don't advertise	Advertise
Firm 2	Don't advertise	$\Pi_1 = 500$ $\Pi_2 = 400$	$\Pi_1 = 750$ $\Pi_2 = 100$
	Advertise	$\Pi_1 = 200$ $\Pi_2 = 0$	$\Pi_1 = 300$ $\Pi_2 = 200$

Firm 1's dominant strategy is to advertise. But firm 2 has no dominant strategy. If firm 1 advertises, firm 2 does best also to advertise, but if firm 1 does not advertise, firm 2 does best not to advertise.

7

Maximin and Tit-for-tat Strategies

- **Maximin strategy:** choosing the option that makes the lowest payoff one can receive as large as possible.
- **Tit-for-tat strategy:** The first time you interact with someone, you cooperate. In each subsequent interaction you simply do what that person did in the previous interaction. Thus, if your partner defected on your first interaction, you would then defect on your next interaction with her. If she then cooperates, your move next time will be to cooperate as well.
- Requirement: there not be a known, fixed number of future interactions.

8

Chapter 12 - Imperfect Competition: A Game-Theoretic Approach

Maximin Strategy

TABLE 13.4 Maximin Strategy

		Firm 2	
		Don't invest	Invest
Firm 1	Don't invest	0, 0	-10, 10
	Invest	-100, 0	20, 10

http://www.youtube.com/watch?v=HE_uMiEMSZ4

© 2008 Prentice Hall Business Publishing • Microeconomics • Robert S. Pindyck, 8e.

9

Sequential Games

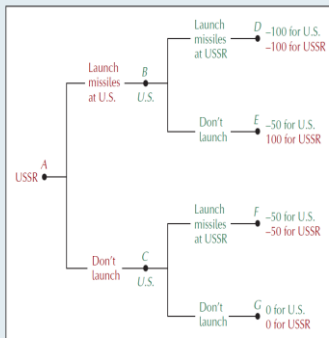
- **Sequential game:** one player moves first, and the other is then able to choose his strategy with full knowledge of the first player's choice.
- Example - United States and the former Soviet Union (USSR) during much of the cold war.
- **Strategic entry deterrence** – they change potential rivals' expectations about how the firm will respond when its market position is threatened.

10

Nuclear Deterrence as a Sequential Game

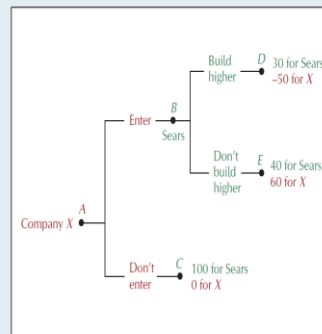
Nuclear Deterrence as a Sequential Game

If the USSR attacks, the best option for the United States is not to retaliate (point E). If the USSR doesn't attack, the best option for the United States is also not to attack (point G). Since the USSR gets a higher payoff at E than at G, it will attack. If the United States is believed to be a payoff maximizer, its threat to retaliate against a first strike will not be credible.



11

The Decision to Build the Tallest Building



The Decision to Build the Tallest Building

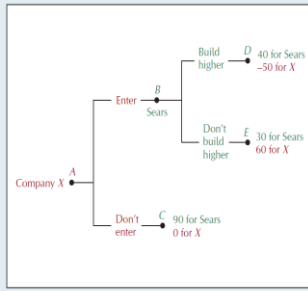
If company X builds a skyscraper taller than the Sears Tower, Sears must decide whether to build higher (point D) or yield its status as the tallest building (point E). Because Sears earns a higher payoff at E than at D, it will not build higher. And since X knows that, it will enter the market despite Sears's threat to build a taller building.

12

Chapter 12 - Imperfect Competition: A Game-Theoretic Approach

Strategic Entry Deterrence

Now suppose that before Sears had originally built its tower, it had the option of building a platform atop the building on which it could build an addition that would make the building taller. Building this platform costs 10 units, but reduces the cost of building a taller building by 20 units



Strategic Entry Deterrence

Deterrence
Had it originally built a platform atop its building at a cost of 10 units, Sears would have reduced the cost of building a taller building by 20 units. Then company X would have calculated that it would not be worthwhile to build a taller building, because it then would have been in Sears's interest to respond with an addition. The Nash equilibrium of the altered game occurs at point C.

13

Economic Applications of Game Theory - Cheating on a Cartel

- Cartel members' possible strategies range from abiding by their agreement to cheating.
 - Cartel members can charge the monopoly price or a lower price.
 - Cheating firms can increase profits.
 - The best strategy is charging the low price.

14

Cheating on a Cartel

		PepsiCo	
		Cheat on Cartel (Charge Low Price)	Don't Cheat (Charge Monopoly Price)
Coca Cola	Cheat on Cartel	\$3 million each	Coke earns \$8 million Pepsi earns \$2 million
	Don't Cheat	Coke earns \$2 million Pepsi earns \$8 million	\$6 million each

15

Payoffs in a Game with Multiple Equilibria

		Mark	
		Party	Movie
Carolyn	Party	Carolyn gets 2 units Mark gets 1 unit	Each loses 2 units
	Movie	Each gets 2 units	Carolyn gets 1 unit Mark gets 2 units

16