



서울대학교
SEOUL NATIONAL UNIVERSITY

Introduction to Economics

ECONOMICS
Chapter 6

Game Theory and
Information Economics

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6.1 Basic Structure of a Game

**What is a
game?**

- the consequence of my action depends on the action that my rival takes → essence of a game

**game
theory**

- systematic analyses of actions taken by economic agents in strategic situations
- helpful for the analysis of markets where competition is imperfect

6.1 Basic Structure of a Game

Basic Elements of a Game

player

- economic agents who participate in a game
- most common case is a 2-player game

strategy

- a plan of actions that the player will take
- the results of games vary depending on what strategies players choose

payoff

- the results of a game accruing to each player

6.2 Prisoner's Dilemma Game

- **analysis of a game**

- **payoff matrix** : summary of the results of the game accruing to each player

| | | Mr. Kim | |
|----------|---------|-------------------------|------------------------|
| | | deny | confess |
| Mr. Park | deny | both 1 year | Park-15years, Kim-free |
| | confess | Park-free, Kim-15 years | both 5 years |

6.2 Prisoner's Dilemma Game

dominant strategy

dominant strategy

- a certain strategy which gives the player a better result no matter which strategy the other player chooses
 - Mr. Kim : confession is a dominant strategy
 - Mr. Park : confession is a dominant strategy

6.2 Prisoner's Dilemma Game

Equilibrium of a Game

- **equilibrium of a game**
 - the result of a game which is very likely to happen
 - both players will choose the dominant strategy of confession
 - dominant strategy equilibrium
- **but the dominant strategy equilibrium is not the best result from the viewpoint of the two players**
- **why do they blow the chance to get the best result?**
 - co-operation is impossible
 - the game is played only once (no repetition)

6.2 Prisoner's Dilemma Game

Application of the Prisoner's Dilemma Game

- two mothers(A, B) consider whether they would give private tutoring to their children
(best result → 10 points, worst result → 1 point)
- if only A gives private tutoring : only A's child gets admission to college(10 points) and B's child does not get admission(1 point)
- the opposite case can happen
- if both choose to give private tutoring, both will get 3 points
- if both choose not to give private tutoring, both will get 6 points
- this is a typical example of the prisoner's dilemma game → the result that both choose to give private tutoring is a dominant strategy equilibrium

6.3 Examples of Competitive Strategy

first mover advantage

- the gain that a player who moves one step faster than the rival can enjoy
ex) two cosmetics firms developing new products
- since women's cosmetics are more profitable than men's cosmetics, both of them want to develop new products for women
- if the rival also develops new products for women, however, both firms' profits will be very small
- commitment can play a useful role in this situation

6.3 Examples of Competitive Strategy

Reality of a Price War

price war

- advertisement of Jinyang Benz
 - Jinyang Benz puts a price tag of \$60 thousand
 - the advertisement says that if a customer who buys a car from Jinyang Benz submits the evidence that the other importer charges a lower price, it will pay twice as much as the difference
 - will the rival importer puts a price tag lower than \$60 thousand in this situation? → NO!
- Jinyang Benz in actuality invites the rival importer to collusion

6.3 Examples of Competitive Strategy

Prize Division Game

- two players(A, B) should agree how to divide one thousand dollars between them
 - at the first round, A makes an offer
 - if B says yes, they will divide the money as A proposed
 - if B says no, however, B will make the second round offer
 - when the games reaches the second round, the total prize money is reduced to half (*i.e.* to \$500)
 - B should make an offer how to divide \$500 between the two
 - A could say yes or no to B's offer

6.3 Examples of Competitive Strategy

Prize Division Game

- if A says no to B's second round offer, the game will enter the third round
 - in this round, A will make an offer and this is the ultimatum
 - but the total prize money is further reduced to half (*i.e.* to \$250)
 - it is certain that A says he will have \$250 leaving nothing to B
 - Question: if A wants to finish the game in the first round, what kind of offer he/she should make?
 - Answer : A proposes he will get \$750 leaving \$250 to B
- How do we get this answer? → backward induction

6.4 Theory of Auction

auction

- an open process of trade where a commodity is sold to the highest bidder
- auction theory analyzes the strategic behaviors in the environment of imperfect information
- when auctions are performed?
 - the object of trade does not have any standard value
(ex. art works, curios)
 - government projects

6.4 Theory of Auction

Various Types of Auction

(1) open-outcry bidding

- all participants gather at one place and the auction is performed openly
- i) English auction
 - starts from a low price and then accepts increasingly higher bids from the floor
 - if no higher bid appears, the auction stops there
- ii) Dutch auction
 - starts from a high price and then continues to lower the price until a person who wants it at that price appears

6.4 Theory of Auction

Various Types of Auction

(2) sealed bid

- participants submit their bids in sealed envelopes
- i) first-price sealed-bid auction
 - one who submits the highest bid becomes the winner, and he/she pays his own bid
- ii) second-price sealed-bid auction
 - one who submits the highest bid becomes the winner, but he/she pays the second highest bid

6.4 Theory of Auction

winner's curse

- government is going to sell a small mountain at auction
 - there is no participant who knows the exact economic value of the mountain
 - every participant makes a guess about the value and submits a bid based on it
 - someone who overestimate the value by the greatest margin will be the winner
 - very likely that he/she incurs a loss → winner's curse
- knowing this possibility, participants will submit intentionally reduced bids → second-price sealed-bid auction is a way to prevent this

6.5 Information Economics

- **imperfect information**
 - so far we have assumed that information is perfect
 - in actuality, however, the situation of imperfect information is very common
 - information economics deals with this kind of situation
 - this theory has attracted much attention since the 1970s
- most interesting situation is that of asymmetric information ; one party does not have information while the other party has it

6.5 Information Economics

Types of Asymmetric Information

- two kinds of asymmetric information

(1) the type or the characteristic of the other party is hidden

ex) when I buy a used car, there is no way of telling whether the car I am looking is a lemon or not

(2) the action of the other party is hidden

ex) I don't know whether my agent is working hard for me or not

6.6 Market for Lemon and Adverse Selection

- suppose there are two types of used car
 - (1) **plum** : good both inside and outside
 - (2) **lemon** : looks good outside, but really bad inside
- asymmetric information in the sense that only the person who sells the car knows the truth
- assumption : half of the used cars in the market are plums, while the other half are lemons

6.6 Market for Lemon and Adverse Selection

- the owner of a plum thinks he/she should get at least 8 thousand dollars, while that of a lemon thinks he/she should get at least 3 thousand dollars
- a person who is going to buy a car think he/she is willing to pay as much as 10 thousand dollars for a plum, but only 5 thousand dollars for a lemon
- but it is impossible to tell whether a specific car is a plum or a lemon by just looking
- a person who is going to buy a car is likely to say he is willing to pay 7.5 thousand dollars (= the average of the two)
- The owner of a plum will refuse to sell at this price

6.6 Market for Lemon and Adverse Selection

- plums will disappear from the market and only lemons will remain → **adverse selection**
- adverse selection refers to the phenomenon that the likelihood of meeting undesirable trading partners is very high in the situation of asymmetric information
- adverse selection means that most of the used cars traded in the market are lemons → **market for lemon**

6.6 Market for Lemon and Adverse Selection

Adverse Selection in Insurance Market

- insurance company does not know about the person who wants to buy insurance
- sets the insurance premium on the basis of the average probability of accidents
 - only persons with high probabilities of accidents will buy insurance
- insurance company tries to solve the problem of adverse selection with various measures

6.7 Signaling and Screening

screening

- efforts to get information about the other party in an indirect way

signaling

- efforts to convey information about themselves to the other party

6.7 Signaling and Screening

Signaling and Screening in Commodity Markets

- **signaling by providing warranties**
 - lets the other party know that the commodity has good quality
- **signaling by price**
 - sets a high price intentionally to send a signal that the commodity has good quality
- **signaling by advertisement**
 - sends a message that consumers are expected to buy the commodity again once they buy and use it

6.7 Signaling and Screening

Signaling and Screening in the Labor Market

level of education

- the level of education sends a signal about the individual's level of ability(intelligence, diligence) and the firm uses this as a screening device
- for the level of education to play the role of screening device effectively, the condition that it costs more for a person of less ability to get education should be satisfied
- according to the theory of human capital, education raises the productivity of a person who receives it
 - if education is used just as a screening device, however, it does not have any impact on a person's productivity

6.8 Principal-Agent Relationship and Moral Hazard

- **principal-agent relationship**
 - someone who does not have time or ability to perform a certain task himself/herself employs an agent to perform it instead → principal-agent relationship
 - the phenomenon of moral hazard often appears in this relationship

6.8 Principal-Agent Relationship and Moral Hazard

Moral Hazard

moral hazard

- the agent pursues his own interest first by taking advantage of the situation that the principal cannot monitor his/her actions perfectly
 - ex) shareholders and managers
 - shareholders : want profit maximization
 - managers : could pursue revenue maximization instead of profit maximization
- moral hazard occurs in the situation where the information about the agent's efforts is asymmetrically distributed

6.8 Principal-Agent Relationship and Moral Hazard

Moral Hazard in the Insurance Market

- a person who is covered by insurance perfectly does not have the incentive to make efforts to reduce the occurrence of accidents → moral hazard
- insurance company counters this tendency by the following measures
 - initial deduction
 - coinsurance

6.8 Principal-Agent Relationship and Moral Hazard

Moral Hazard and Incentives

remedies for moral hazard

(1) performance pay

- if one's pay is not related to his/her performance, there is no incentive to work hard
- problems of performance pay
 - not effective for the case of team works
 - uncertainty in laborers' income
 - difficult to measure individuals' performances
 - reluctant to perform tasks which are not included in the measurement of performance

6.8 Principal-Agent Relationship and Moral Hazard

Efficiency Wage

(2) payment of efficiency wage

- according to the traditional theory, productivity of a laborer determines his/her wage
- according to efficiency wage theory, however, the size of wage determines productivity of the person who receives it
- therefore, the firm pays high wages intentionally to induce laborers to work hard voluntarily
- payment of efficiency wage very likely,
 - tasks in which small neglects result in large losses
 - tasks in which the measurement of performance is difficult



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THANK YOU