

Intro to Game Theory

AUECO 220



Agenda

- Why game theory
- Games of Strategy
- Examples
- Terminology



Why Game Theory

- Provides a method of solving problems where each agent takes into account how others will react to his or her own actions
 - Standard models in economics (perfect competition, monopolistic competition, etc) do not allow for strategic interaction between players



Games of Strategy vs other kinds

- We will focus our attention on games where strategy is a central element
- We will not focus on games of chance (lotteries) or games of skill (most sports)
- Chance and skill will be important in many cases we look at but the focus is on strategy



Examples

- The Contractor
- Entry Deterrence
- Making Coffee & Other Household Chores
- Excessive studying
- Cheating on a Cartel



The Contractor

- Suppose that you want to hire a contractor to build a house for you
- Before you sign a contract you are dealing with a competitive market
- Once you sign a contract you are dealing with a single contractor and the transaction is now subject to strategic behaviour



Entry Deterrence

- The standard model of monopolistic competition suggests that when positive profits are made, new firms enter the industry
- Existing firms can deter entry through various means such as having excess capacity or reputations for being ruthless fighters



Making Coffee & Other Household Chores

- You and your office mate both enjoy coffee. You both arrive at the office and wait for someone to make coffee.
 - If your office mate makes it, you benefit by drinking coffee without the hassle of making it
 - If you have to make the coffee, you suffer the disutility of making it
 - When should you act?



Excessive Studying

- Suppose that this class were graded on a curve
- If everyone in the class were to conspire to keep the performance level low, you would all get reasonably good marks with no effort
- One person would realize that if he or she puts in that extra little bit of effort, he or she can get a higher grade



Examples - recap

- In each of the examples given, two or more players were involved
- Each faced incentives to act in a particular way that may or may not have been in the group's best interest



Game Types

- Sequential vs Simultaneous
- Zero sum, constant sum, and win-win games
- Single Play or repeated play.
- Fully informed, equally informed
- Rules of the game - fixed or flexible
- Cooperation & Punishment



Sequential vs Simultaneous

- In simultaneous games, players move within the same information set
 - They might move at precisely the same time, but when each moves, he or she is unaware of the actions chosen by the other player
- In a sequential move game, one player moves and then the other player makes a move, usually contingent on what the other has done



Zero sum, constant sum, and win-win games

- Some games are zero sum – what one player wins, the other player loses (poker)
- In some games, the total amount available to all players is the same in all outcomes (a zero sum game is a special case of a constant sum game)
- In win-win games, the total payoff to players varies but in general both players come out ahead (many joint ventures)



Single Play or repeated play.

- In single play games, the game plays once and it is over
 - No opportunity for retribution
- Repeated games can be played an infinite number of times or a finite number of times greater than once
 - Depending upon the game, retribution may be possible



Fully informed, equally informed

- Players can both have full information about their environment or they can have incomplete information (about things like the state of nature)
- Players may also have different information sets (one player knows something that the other player doesn't)



Rules of the game - fixed or flexible

- The rules of the game may be fixed and unchanging or they may be flexible – one player may be able to manipulate things to his or her own advantage (setting an agenda for a council meeting)



Cooperation & Punishment

- In repeated play games, it may be possible to elicit cooperation
 - If punishment is not possible, one or more players may have an incentive to “cheat” on a previous agreement to cooperate
- Cooperation and punishment are not relevant in single play games



Definitions & Terminology

- Strategies vs Actions
- Rationality
- Common Knowledge
- Equilibrium Concepts
- Dynamic Games



Strategies vs Actions

- Actions are moves that a player can make
- A strategy is a full enumeration of actions to take conditional on what other players do
- In a single play, simultaneous game actions and strategies are synonymous
- In multiple-play games, strategies can be quite complex



Rationality

- We assume that players are *rational*
 - by rational we mean that players correctly choose strategies **based on the information available**
 - In more complex games we will encounter situations where the player faces a range of probabilistic outcomes



Payoffs

- We assume that players are trying to achieve the highest possible payoff for themselves
 - We assume away spite as a motivator, however spite may enter into a player's utility function
 - We also allow for altruism but it too enters in the player's utility function



Equilibrium Concepts

- There are several equilibrium concepts to consider
 - Most common is a Nash equilibrium
 - No player has a desire to choose a different strategy given the strategy of the other player (important in simultaneous move games)



Dynamic Games

- In terms of rationality, we assumed that players were perfect calculators – may not be a good assumption
- Dynamic and evolutionary games allow for the players to learn with each iteration of the game and improve their skills as the game progresses



Recap

- Game theory is a tool that allows us to examine the interactions between economic agents in richer and fuller settings than the simple price-taker model of perfect competition
- Sequential games, one player plays then the other and so on
- Simultaneous games, players both move within one information set



Recap

- Games are characterised by rules, players, and payoffs
- Players are generally assumed to be rational
- Payoffs can include value placed on the well being of another (we do not need to assume that people are greedy and selfish)