Repeated Games

ECON 420: Game Theory

Spring 2018

Announcements

- Homework 4 due next Wednesday (will be posted later today)
- Final exam: Friday, June 15 at 7:30am (!)

Prisoners' Dilemma

		WIFE	
		Confess (Defect)	Deny (Cooperate)
HUSBAND	Confess (Defect)	10 yr, 10 yr	1 yr, 25 yr
	Deny (Cooperate)	25 yr, 1 yr	3 yr, 3 yr

Game 1

- You will play the prisoners' dilemma against a random opponent
- Write your name at the top of a sheet of paper
- Choose a strategy to play (Confess or Deny)
- Your opponent will be randomly selected from among your classmates
- The person(s) with the highest payoffs will receive 5 extra-credit points on the homework

Restaurant Pricing Game

		YVONNE'S BISTRO	
		20 (Defect)	26 (Cooperate)
XAVIER'S TAPAS	20 (Defect)	288, 288	360, 216
	26 (Cooperate)	216, 360	324, 324

Game 2

- Pair up with one of your classmates
- Play the restaurant pricing game for 5 rounds
    - Keep track of your payoffs for each round

Game 3

- Play the restaurant pricing game again
  - Keep track of your payoffs each round
- Continue playing until I say stop

Repetition and cooperation

- Which version of the game are we most likely to observe cooperation? Why?
- Which version of the game are we *least* likely to observe cooperation?

The game tree

Strategies in repeated games

- Strategies can be extremely complicated in repeated games
  - Strategies can contain infinitely many moves if the game is repeated forever!
- Often useful to simplify the strategy to a "rule"
- *Contingent strategies*: Choose action based on action of opponent in previous round

Rollback equilibrium

- Suppose the game is played a finite number of times
  - What is the rollback equilibrium?
- Suppose the game is played an infinite number of times
  - What is the rollback equilibrium?

Tit-for-tat

- Strategy: Cooperate in first round, then do whatever opponent does in previous round
- Allows for cooperative outcomes, but "punishes" opponent for defecting

Grim-trigger

- Strategy: Cooperate in every round if opponent also cooperates, defect forever if opponent defects once
- Most severe punishment for opponent

Time value

- Suppose the restaurant pricing game is repeated monthly
  - Your opponent is playing a tit-for-tat strategy
- Should you defect in the first round?
  - Cooperate every round after
- Gain in the first month
- Lose *more* in the second month
- But money is more valuable today than next month!

Present value

- To compare money now with money later, we need to calculate the *present value* of money later
- The PV of future money is the amount we'd be willing to accept today instead
- For a discount rate *r*, the present value of future income *I* is

$$PV = \frac{I}{1+r}$$

Example

Defecting against a grim trigger

- Receive the higher payoff at first, non-cooperative outcome forever after
- Is immediate payoff the long-run loss?
  - What is the immediate gain?
  - What is the PV of future losses?

Penalties and rewards

- Perhaps there is a social cost to defecting (snitches get stitches?)
- In this case, the payoff table is poorly specified
- Properly specifying the payoffs may mean that the game is not a prisoners' dilemma at all
- Perhaps threats or promises in a new first round can change the payoffs of a game (chapter 9)

Experiments with repeated games

- Robert Axelrod created a computer "tournament" where teams could submit computer programs to play a repeated prisoners' dilemma
- Teams chose a strategy for the programs, then they play other randomly selected programs
  - Which strategy was best?
- After first round, teams could submit *new* strategies knowing what the optimum was
  - Which strategy was the best this time?

Axelrod:

- "Don't be envious. Don't be the first to defect. Reciprocate both cooperation and defection. Don't be too clever."