

Cold War and Game Theory

Guest Lecture for Principles of Economics - Econ 1101

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Outline

- ① A brief reminder on the Cold War
- ② History of the Cuban Missile Crisis
- ③ Chicken Game
- ④ Repeated Prisoner's Dilemma
- ⑤ Summary

Brief history of the Cold War

- ① Period of conflict, tension and competition between the United States and the Soviet Union.
- ② Many dimensions: nuclear arms race, ideology, technological development (space race), etc.
- ③ Important stages
 - 1948 - Berlin blockade
 - 1950-1953 - Korean War
 - 1959-1975 - Vietnam War
 - 1962 - Cuban Missile Crisis
 - 1980s - Reagan's "star wars" program

Cuban Missile Crisis

Focus on one of the major confrontations - Cuban Missile Crisis

- ① October 14th - U-2 spy plane discovers missile bases being built in Cuba.
- ② October 20-21st - US responds with a blockade coupled with the demand for the Soviets to withdraw the missiles.
- ③ October 28th - Soviets announce they would withdraw the missiles.

Cuban Missile Crisis

- ① The goal is to explain:
 - why did we observe the missile build up and the blockade?
 - why didn't we observe the actual conflict?
- ② We will use two concepts from game theory to explain those two facts.

The first question

Question 1

- Why did we observe the deployment of missiles and the blockade?

The first question

- Invade/protect Cuba?
- Make the enemy believe that you will not hesitate to attack?
- Show off your nuclear potential?
- The Cuban Crisis was a psychological conflict. The winner would have political advantage in other fields of the Cold War (e.g. the problem of Berlin).

Bertrand Russel (1953) compared the Cold War politics to the chicken game, known from game theory.

Chicken game

- Idea: two cars driving towards each other. The first to swerve loses.
- We can write the outcome of the game in a matrix:

		Player 2	
		Swerve	Straight
Player 1	Swerve	Tie, Tie	Lose, Win
	Straight	Win, Lose	Crash, Crash

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- We can assign numbers to different outcomes:

		Player 2	
		Swerve	Straight
Player 1	Swerve	0 , 0	-1 , +1
	Straight	+1 , -1	-10 , -10

Equilibria of the Chicken game

		Player 2	
		Swerve	Straight
Player 1	Swerve	0 , 0	-1 , +1
	Straight	+1 , -1	-10 , -10

There are two pure strategy Nash Equilibria of this game:

- ① (Swerve, Straight)
- ② (Straight, Swerve)

Why do we care what's an equilibrium of the game?

- It's an outcome that is likely to happen!

Chicken game and the Cuban Missile Crisis

We need to know:

- ① Players
- ② Actions
- ③ Payoffs

Chicken game and the Cuban Missile Crisis

Players



Actions

- ① Kennedy
 - Do nothing
 - Respond with a blockade
- ② Khrushchev
 - Keep deploying missiles
 - Retreat

Chicken game and the Cuban Missile Crisis

Payoffs

		USSR	
		Retreat	Deploy more missiles
USA	Do nothing	0 , 0	- 1 , +1
	Blockade	+ 1 , - 1	- 10, - 10

- ① Why did the USA respond with a blockade?
- ② Why did the USSR retreat?

Main idea behind the chicken game: **brinkmanship** - bring the situation to the edge of a disaster in order to achieve highest possible outcome.

Chicken game and the Cuban Missile Crisis

- ① Why did the USA respond with a blockade?
 - In the chicken game it is important to convince your enemy that you will not swerve.
 - If I believe the other guy is crazy and will rather crash than swerve, I'd rather swerve.

Kennedy knew he had to do something:

“(...) the greatest danger of all would be to do nothing”

The second question

Question 2

- Why didn't we observe the actual conflict?

Question 2

- Why didn't we observe the actual conflict?

We will use a repeated version of the Prisoner's Dilemma to answer this question.

Prisoner's Dilemma - review

- Idea: two prisoners locked in separate rooms.
- Dominant strategy for each of them is to betray. The resulting outcome is worse for both of them.

		Prisoner 2	
		stay silent	betray
Prisoner 1	stay silent	0 , 0	- 5 , 5
	betray	5 , - 5	- 3 , - 3

The unique equilibrium of this game is (betray, betray) - quite a “bad” equilibrium for the two prisoners.

Prisoner's Dilemma in the Cuban Crisis context

- Apply that game to potential conflict between two countries:

		USSR	
		Don't attack	Attack
USA	Don't attack	0 , 0	- 5 , 5
	Attack	5 , - 5	- 3 , - 3

The unique equilibrium of this game is (attack, attack) - quite a “bad” equilibrium for both countries (and the rest of the world).

Repeated Prisoner's Dilemma

- ① Tomorrow is important!
- ② If the USSR attacks today, USA will retaliate tomorrow.
- ③ Modify the objective - each player cares about the stream of payoffs over all periods.

Repeated Prisoner's Dilemma

Example 1

Suppose USA and USSR restrain from attacking in each period.
What are their payoffs?

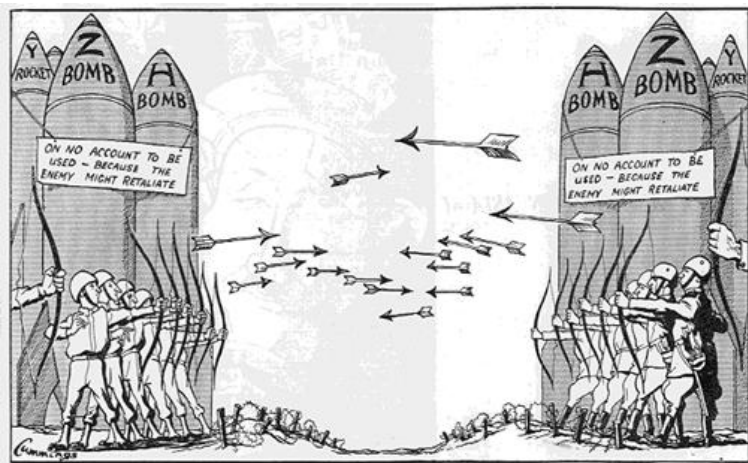
- 1 Today: 0
- 2 Tomorrow: 0
- 3 The day after tomorrow: 0
- 4 etc.

Repeated Prisoner's Dilemma

Example 2

Suppose USSR considers attacking today but knows that it will cause retaliation tomorrow. What is USSR's payoff?

- 1 Today: 5
 - 2 Tomorrow: -3
 - 3 The day after tomorrow: -3
 - 4 etc.
- If you care enough about tomorrow, it is possible to make (don't attack, don't attack) an equilibrium of the game.
 - The “psychological” conflict in 1962 didn't turn into an open war.



Importance of Game Theory

- ① We used economic tools to understand real-life (strategic) political situation.
- ② Can you think of a strategic situation in your life you can apply game theory to?