

Game Theory at the Movies 5:

Bargaining and Repeated Games

Felix Munoz-Garcia

EconS 424, Strategy and Game Theory
Washington State University

Outline

- *Bridge of Spies* (2015): bargaining and a simultaneous exchange.
- *Groundhog Day* (1993): an infinitely repeated game.
- *Trainspotting* (1996): the last round of a finitely repeated game.

Bridge of Spies (2015)



Theatrical release poster.

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The Story

- Lawyer James Donovan (Tom Hanks) defends the Soviet spy Rudolf Abel.
- Donovan persuades the judge to spare Abel: a living spy might be useful in an exchange.
- The Soviets capture pilot Francis Gary Powers; East Germany arrests student Frederic Pryor.
- February 10, 1962: Abel for Powers on the Glienicke Bridge, Pryor at Checkpoint Charlie.

Step 1: Keep a Bargaining Chip

- In bargaining, your payoff depends on what you get if talks fail.
- A dead Abel is worth nothing in a negotiation.
- A living Abel is something the Soviets want.
- Intuitively, a bargaining chip that has been spent cannot be traded.

Step 2: Use the Differences Among Rivals

- Donovan negotiates with two governments whose interests differ.
- The Soviets want Abel back; the East Germans want recognition as a government.
- Neither wants to be blamed by the other for the deal's collapse.
- Donovan obtains two Americans for one Soviet spy (Raiffa, 1982).

Step 3: Who Hands Over First?

- Sequential exchange: the US hands over Abel, then the Soviets release or keep Powers.
- Backward induction: once they hold Abel, the Soviets keep Powers too.
- Anticipating this, the US never hands over Abel first: no exchange.
- **Solution:** both prisoners cross the bridge at the same time.

Groundhog Day (1993)



Theatrical release poster.

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The Same Day, Over and Over

- Phil Connors wakes each morning on February 2, in the same small town.
- Everyone else's day resets; only his memory carries over.
- At first he exploits the reset; later he learns how his moves change others' responses.
- In the end he plays the day almost perfectly, and kindly.

A Prisoner's Dilemma Played Every Day

A townspeople			
		Cooperate	Defect
Cooperate	Phil (rows)	3, 3	0, 5
Defect		5, 0	1, 1

- In a single day, Defect is a dominant strategy.
- When the same faces return day after day, the future matters.

When Is Cooperation an Equilibrium?

- Grim trigger: cooperate until someone defects, then defect forever.
- Cooperating forever: $\frac{3}{1-\delta}$. Defecting today: $5 + \frac{\delta}{1-\delta}$.
- Cooperation is a SPE if $3 \geq 5(1-\delta) + \delta$, that is, $\delta \geq \frac{1}{2}$.
- Intuitively, cooperation pays when tomorrow matters enough.

Learning by Repetition

- Phil does not compute the equilibrium: he tries moves, observes payoffs, and adjusts.
- Camerer (2003): real players learn equilibrium play this way, over many rounds.
- Phil's selfish tricks give way to patience and generosity.
- Since only Phil remembers, his decency is rewarded by the better day it builds.

Trainspotting (1996)



Theatrical release poster.

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The Last Deal

- Four friends in Edinburgh have covered for one another for years.
- They buy heroin, take it to London, and sell it for £16,000.
- The next morning Renton slips away with the whole bag while the others sleep.
- He later leaves Spud's share, £4,000, where Spud will find it.

A Known Last Round

- Each friend needed the others again tomorrow: the threat of punishment kept them honest.
- The London deal is the **last round**: there is no tomorrow to protect.
- In the last round, Defect is a dominant strategy.
- Backward induction: then the second-to-last round is also a one-shot game, and so on.

Why Cooperation Lasts Until the End

- Backward induction predicts defection in every round of a finitely repeated PD.
- Kreps, Milgrom, Roberts, and Wilson (1982): a small doubt about a partner's type changes this.
- If a partner might play tit-for-tat, cooperating sustains a valuable reputation.
- Cooperation then lasts through most rounds and breaks down near the end, as in the film.

Summary

- *Bridge of Spies*: keep a chip, use rivals' differences, exchange simultaneously.
- *Groundhog Day*: when the game repeats, cooperation can be an equilibrium.
- *Trainspotting*: a known last round unravels cooperation.
- Repetition sustains cooperation only while there is a future to protect.