

Econ 200 D SU08

Repeated Games / Incomplete Info

Most real-world games get played repeatedly.

Repeated games have a larger number of strategies because a player can be punished for not cooperating. This can result in:

- Cournot firms can collude to set the monopoly quantity
- Bertrand firms can collude to set price higher than MC.

For collusion to work in repeated games

- players must have a high enough value for future payoffs.
- either games must be repeated forever, or it is uncertain when the game will end

i) Value of future payoffs are usually worth less than payoffs right now.

- Would you rather have \$100 now or \$100 a year from today?
- If a player has a low value for future payments, there is little incentive to cooperate, the player doesn't care about the punishment.

ii) If the game is repeated a finite number of times with certainty, a player has an incentive to cheat at the end of the game.

- At the last game, a rational player will cheat on the collusive agreement, since they cannot be punished.
- Since future payoffs are discounted, a cheating player will cheat in the first game.

Recall the definition of a Nash equilibrium

NE: a set of strategies where no player can gain by deviating alone.

For collusion to be a NE in repeated games the stream of payoffs colluding is valued higher than the stream of payoffs not colluding.

EX 1: “Studying Game” Finite game where colluding does not work.

Avg course grade (2.8 – 3.1).

If nobody studies: everybody scores low on exams, avg low so, everybody gets a 2.9 – 3.1

If one studies: others don't, average increases, the one who studies gets 4.0, others get 2.0

If everybody studies: avg high, everybody gets 3.1

Payoffs are in units of happiness. Happiness is based on grade and # hrs studying, don't care how much econ knowledge they have:

	Not Study	Study
N Study	8, 8	0, 20
Study	20, 0	1, 1

NE if game played once: everybody studies for the single exam

Story: All students are rational and identical in ability. When each student is trying to figure out their strategy to either study or not study they rationalize as follows. They know that if they do not study for the exam, their possible payoffs of happiness are either 8 units if everybody doesn't study, or 0 if they don't study but everyone else does. If they do study, they'll be really happy with 20 units given nobody else studies, or slightly happy with 1 unit.

Regardless of what the other students do, the individual student knows that their payoffs will be higher if they study.

Thus everybody studies for the exam.

Played twice: everybody studies for both exams

This can be solved if the rational student uses what we call backwards induction. Assuming that the students worked together and colluded for the midterm. What should s/he do for the final? The final exam is like playing the one shot game above. The best strategy regardless of what the other person does is to study. Thus we get everyone studying.

Given that everyone knows that everyone else is going to study for the final, what should they do for the midterm? Study! If they don't they may get 8 units or 0. If they do study they'll either get 20 or 1 unit.

With this finitely repeated game the students study all the time. Students lose out on happiness, but society benefits by having more informed students.

Ex 2: Cournot Duopoly with discrete output choices: Low, Medium, High

Payoffs = economic profit

The dupopolists “play forever” or they don’t know when the game ends. Given this uncertainty, they do not know when it benefits them to cheat on the collusive agreement.

Firm 1’s Output	Firm 2’s Output		
	L = 3/wk	M= 4/wk	H=6/wk
L	36 , 36	40 , 30	18, 36
M	40 , 30	32 , 32	16, 24
H	36, 18	24, 16	0, 0

Think of (H,H) as the perfectly competitive outcome

Think of (L,L) as the monopoly outcome

One repeated NE enforcing collusion: *tit-for-tat*

both play L to start.

if other player played L in prev period, play L this period. otherwise, play what they played last period.

Ex 3: Example of an infinitely repeated game where players punish using the one shot NE.

C/P	L	C	R
U	5, 5	0, 0	2, <u>6</u>
M	<u>6</u> , 2	<u>4</u> , <u>3</u>	1 , 2
D	0,0	2 , 1	<u>3</u> , <u>4</u>

One shot NE: (m, c), (d, r)

player 1 prefers NE (m, c)

player 2 prefers NE (d, r)

One repeated NE enforcing collusion: play NE of one shot

cooperate by playing (U, L)

if one player deviates, the other commits on playing either (M, C) or (D, R)

Lets look at the payoffs of a player who is considering to cheat on the agreement. Again, assume if they’re going to cheat, they’ll cheat in the first period. If the other player plays by the rules above, the person considering cheating could get:

payoffs if colluding = 5 + 5 + 5 + 5

payoffs if cheated = 6 + 3 + 3 + 3..... we can see the cheater benefit in SR, but not LR

Main takeaway message: under certain conditions, we can get cooperation (collusion) among individually rational players who seek to maximize their own payoffs.

■ Is Oligopoly Efficient?

We have seen how oligopoly firms maintain collusive agreements, thus price usually exceeds marginal cost. So the quantity produced is less than the efficient quantity.

Oligopoly suffers from the same source and type of inefficiency as monopoly.

Because oligopoly is inefficient, antitrust laws and regulations are used to try to reduce market power and move the outcome closer to that of competition and efficiency.

Comment on games of asymmetric (incomplete) information.

- Signaling

With asymmetric information, it is hard to differentiate between high quality vs low quality, high ability vs low ability.

Signals provide information, a good signal is hard to imitate and must be relatively more costly for the low quality player to imitate.

Ex 4. Job interview:

signals: answers to interview questions, resume, clothes.

poor signal: clothes

better signal: education

A company expects to recover those costs by selling a lot of the good or by repeat business.

- Screening

hard to differentiate between people with high MV, vs low MV, between risky or safe people

Ex 5: Car Insurance

screen via mixture of payments and deductibles.

- Principal/agent models

hard for boss (principal) monitor whether worker (agent) is working or not working.

pay a higher wage than intersection btw supply and demand for labor. If the worker is found slacking they will get fired. A higher wage induces the agents to work harder, they'll have more to lose if they get fired. The opportunity cost of slacking has increased.