

LECTURE 5

12 August 2024

Tragedy of the commons & Invisible Hand

- Invisible hand of the market argues that given free market conditions, even self-interested actions can lead to socially optimal conditions.
- Tragedy of the commons is a social dilemma that leads to social outcomes that are not optimal.
- Tragedy of the commons – common pool resources like environment, case of vaccination.
- *Free riding* – outcome of the common pool resource situation.

RESOLVING SOCIAL DILEMMAS

1. Preferences :

- Self-interested preferences
- Social preferences : individual's utility depends not just on their own outcomes but also depends on others' outcomes.
- Social preferences could be altruistic or the situation where you wish harm on others.
- A person can have both self-interested preferences and social preferences depending on the situation.

2. Social institutions :

- Government regulations such as taxation and laws
- Local institutions setup by tradition

Modelling social interactions as games – strategic interactions

		Bala	
		Rice	Cassava
Anil	Rice	<p>Both produce rice: there is a glut of rice (low price)</p> <p>There is a shortage of cassava</p> <p>Anil not producing cassava, which he is better able to produce</p>	<p>No market glut</p> <p>High prices for both crops</p> <p>Both farmers producing the crop for which they are less suited</p>
	Cassava	<p>No market glut</p> <p>High prices for both crops</p> <p>Both farmers producing the crop for which they are better suited</p>	<p>Both produce cassava: there is a glut of cassava (low price)</p> <p>There is a shortage of rice</p> <p>Bala not producing rice, which he is better able to produce</p>

		BALA	
		Rice	Cassava
ANIL	Rice	1,3	2,2
	Cassava	4,4	3,1

When self-interest works

- Best response: The action that will give the player the highest payoff given the actions of other players.
- Best response function:
$$B_i(a_{-i}) = \{a_i \text{ in } A_i : u_i(a_i, a_{-i}) \geq u_i(a_i', a_{-i}) \text{ for all } a_i' \text{ in } A_i\}$$
- We can redefine NE using Best Response Functions

The action profile a^ is a NE of a strategic game with ordinal preferences if and only if every player's action is a best response to the other players' actions:*

$$a_i^* \text{ is in } B_i(a_{-i}^*) \text{ for every player } i$$

	L	C	R
T	1,2	2,1	1,0
M	2,1	0,1	0,0
B	0,1	0,0	1,2

STRICT NE AND NON-STRICT NE

- *An action profile a^* is a strict Nash equilibrium if for every player i we have $u_i(a^*) > u_i(a_i, a^*_{-i})$ for every action $a_i \neq a_i^*$ of player i .*

	L	M	R
T	1, 1	1, 0	0, 1
B	1, 0	0, 1	1, 0

DOMINATED ACTIONS

- *In a strategic game with ordinal preferences, player i 's action a''_i strictly dominates her action a'_i if $u_i(a''_i, a_{-i}) > u_i(a'_i, a_{-i})$ for every list a_{-i} of the other players' actions, where u_i is a payoff function that represents player i 's preferences.*
- A strictly dominated action is not used in NE

	L	R
T	1	0
M	2	1
B	1	3

	L	R
T	1	0
M	2	1
B	3	2

WEAK DOMINATION

- In a strategic game with ordinal preferences, player i 's action a''_i weakly dominates her action a'_i if

$u_i(a''_i, a_{-i}) \geq u_i(a'_i, a_{-i})$ for every list a_{-i} of the other players' actions and

$u_i(a''_i, a_{-i}) > u_i(a'_i, a_{-i})$ for some list a_{-i} of the other players' actions, where u_i is a payoff function that represents player i 's preferences.

- In a strict NE no players' equilibrium action is weakly dominated

	L	R
T	1	0
M	2	0
B	2	1

- A two-player game with ordinal preferences is **symmetric** if the players' sets of actions are the same and the players' preferences are represented by the payoff functions u_1 and u_2 for which $u_1(a_1, a_2) = u_2(a_2, a_1)$ for every action pair (a_1, a_2)

	A	B
A	w, w	x, y
B	y, x	z, z

- Dominant Strategy: Strategy that yields the highest payoff for a player, no matter what the other players do.
- Dominant Strategy Equilibrium: A NE in which every player plays their dominant strategy.
- Go back to the rice and cassava growing example

Game Theory for Social Interactions

- Pest Control game
- Is there a dominant strategy equilibrium here?

		Bala	
		IPC	Terminator
Anil	IPC	3, 3	1, 4
	Terminator	4, 1	2, 2

Repeated Games

- A game in which the same interaction may occur more than once.
- Consider the Prisoner's Dilemma being repeated multiple times