

Models for Applied Environmental Economics

EDCE course ENV-723

Spring 2023

Game theory

- analyzes strategic behaviour / strategic interactions
- game structure
 - players (symmetric or asymmetric)
 - sequence of possible actions (or one stage and simultaneous)
 - information set
 - payoffs (outcome)
 - equilibrium rule (e.g. Nash equilibrium: each player's strategy is the best response to the other players' best strategies)

Prisoner's Dilemma and Nash Equilibrium

Player 1 \ Player 2	Cooperate	Free-ride
	Cooperate	Free-ride
Cooperate	5,5	1,8
Free-ride	8,1	2,2

Sub-game perfect Nash equilibrium

- Concept for solving games with multiple stages (Selten)
- Nash equilibria on each stage
- Backward induction
 - Nash equilibrium on the last stage, expressed as functions of the decision variables on the previous stages
 - Solving for Nash equilibrium on the previous stage
 - etc., until solution on the first stage is found
- One implication: Repeating the same game does not change the result if the no. of repetitions is finite and known

Games & internat. environmental agreements

- reciprocal externalities
- social optimum: maximization of total net benefits
- non-cooperative Nash equilibrium:
 - each player maximizes the own net benefits
- cooperative game theory: cooperation within coalitions
- stability of coalitions:
 - incentive to join or leave an agreement?
- side payments / transfers

Rationality & game theory: pros & cons

- alternative framing has facilitated new ideas
- opened the way for behavioural games and experiments

- challenging to solve, which tends to limit the number of agents
- are the modeled agents too smart?