

University of Oxford

Research Methods in Politics: Lecture Four

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Today's Lecture: Overview

- ▶ Game Theory

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- ▶ Rationality

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- ▶ Prisoner's Dilemma: Economic Application
- ▶ Prisoner's Dilemma: Political Application
- ▶ Game Theory in the Lab

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Where do theories come from?

- ▶ Identify interesting variation in a dependent variable
- ▶ From the specific to the general
- ▶ Learning from previous research
- ▶ The role of deductive reasoning (or “formal theory”)

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- ▶ Models are precise expression of ideas – hence mathematical symbols
- ▶ They start with an idea related to some aspects of the interaction of decision-makers (firms, parties, members of social networks)
- ▶ Analysing the model – discovering its implications

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 - ▶ faced with three choices, x , y , and z , and if the individual prefers x to y and y to z it can't be the case that he prefers z to x – transitive preferences
- ▶ That is it, rationality doesn't have any substantive content.

Strategic/Normal form games

- ▶ A strategic game is defined as:
 - ▶ a set of players
 - ▶ a set of actions
 - ▶ and for each player, preferences over action profiles
- ▶ Alternatively, $\langle N, \{A_i, u_i(\cdot \dots \cdot)\}_i \rangle$
 - ▶ N is the set of actors $\{1, \dots, n\}$
 - ▶ A_i is the set of actions available to actor i
 - ▶ $u_i(\cdot \dots \cdot)$ is actor i 's utility function (preferences), which (normally) depends on the actions of all the actors.

Nash Equilibrium

Consider a familiar game: Prisoner's Dilemma

		Suspect 2	
		<i>Quiet</i>	<i>Fink</i>
Suspect 1	<i>Quiet</i>	-4, -4	-25, -1
	<i>Fink</i>	-1, -25	-8, -8

Here $N = \{1, 2\}$, $A_1 = A_2 = \{\text{Quiet}, \text{Fink}\}$ and, e.g., $u_1(\text{Fink}, \text{Quiet}) = -1$

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Definition (Nash Equilibrium)

$$\forall i \in N, u_i(a^*) \geq u_i(a_i, a_{-i}^*), \forall a_i \in A_i \quad (1)$$

Dominated actions

Are there any actions such that we would always prefer taking some other action instead? Formally: action a_i'' dominates action a_i' if

$$u_i(a_i'', a_{-i}) > u_i(a_i', a_{-i}), \forall a_{-i} \in A_{-i} \quad (2)$$

Consider this game:

		Actor 2		
		<i>Left</i>	<i>Center</i>	<i>Right</i>
Actor 1	<i>Up</i>	2, 1	0, 0	2, 1
	<i>Middle</i>	2, 4	0, 0	6, 3
	<i>Down</i>	1, 0	0, 0	5, 1

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Best Response

		Actor 2		
		<i>Left</i>	<i>Center</i>	<i>Right</i>
Actor 1	<i>Top</i>	1, 2	2, 1	1, 0
	<i>Centre</i>	2, 1	0, 1	0, 0
	<i>Bottom</i>	0, 1	0, 0	1, 2

- ▶ What does actor 1 do if actor 2 is playing “Left”?

Best Response

		Actor 2		
		<i>Left</i>	<i>Center</i>	<i>Right</i>
Actor 1	<i>Top</i>	1, 2	2, 1	1, 0
	<i>Centre</i>	2*, 1	0, 1	0, 0
	<i>Bottom</i>	0, 1	0, 0	1, 2

- ▶ What does actor 1 do if actor 2 is playing “Left”?
- ▶ What does actor 1 do if actor 2 is playing “Center”?

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		Actor 2		
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Actor 1	<i>Top</i>	1, 2	2*, 1	1, 0
	<i>Centre</i>	2*, 1	0, 1	0, 0
	<i>Bottom</i>	0, 1	0, 0	1, 2

- ▶ What does actor 1 do if actor 2 is playing “Left”?
- ▶ What does actor 1 do if actor 2 is playing “Center”?
- ▶ etc. . .

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		<i>Left</i>	<i>Center</i>	<i>Right</i>
Actor 1	<i>Top</i>	1, 2	2*, 1	1*, 0
	<i>Centre</i>	2*, 1	0, 1	0, 0
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	<i>Centre</i>	2*, 1*	0, 1*	0, 0
	<i>Bottom</i>	0, 1	0, 0	1*, 2*

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- ▶ $p = f(x_1 + x_2)$
- ▶ how many DVDs should each firm produce?

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- ▶ competitive solution is 16 units of output
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- ▶ restrict firms to produce either 4 units or 5 units of output
- ▶ profits $\pi_i = [a - b(x_1 + x_2)]x_i - cx_i = [16 - (x_1 + x_2)]x_i$

Duopoly as Prisoner's Dilemma

Consider Price Competition between BMG and CBA for DVD

		CBA Output	
		4	5
BMG Output	4	32, 32	28, 35
	5	35, 28	30, 30

Here $N = \{bmg, cba\}$, $A_{bmg} = A_{cba} = \{4, 5\}$ and, e.g., $u_{bmg}(5, 4) = 35$

Tragedy of the commons: two fishermen and a single lake

		Fisherman 2	
		light fishing	heavy fishing
Fisherman 1	light fishing	32, 32	28, 35
	heavy fishing	35, 28	30, 30

(32,32) pareto dominates (30,30) – all players are at least as well off, and one is strictly better off

First Experiment with the PD Game: Flood(1958)

AA	JW		
	1	2	Total
1	8	60	68
2	14	18	32
Total.....	22	78	100

Two

subjects ($N = 2$) 100 repeated interactions “It seems unlikely that the Nash equilibrium point is in any realistic sense the solution that human bargainers would be likely to use.” (Flood 1958: 14)