Introduction to game theory for social scientists

Workshop
10-14 May 2010
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Course description: Game theory, the study of strategic interaction between multiple agents, is being increasingly applied in the social sciences. The aim of this short introductory course is to make you familiar with the basic concepts and methodology of game theory. After an introduction to rational choice theory and a discussion of the assumptions and notation of game theory we will move on to investigate concepts of domination, Nash equilibrium, the folk theorem, credible threats, evolutionary stable strategies and so on. This provides a basis to engage in modeling, and understand applications. The course is an introduction to the technical aspects, and actual applications will be limited. The level of mathematics is kept to a minimum, but inevitably it helps if you have basic knowledge of calculus and probability theory.

Web page: I will make a webpage where you can find the syllabus, exercises and solution sketches: **http://sites.google.com/site/joelvdweele/home/teaching**.

Exercises: Understanding game theory is impossible without practicing with the concepts. I will provide exercises after each class, which you are strongly encouraged to do. You will learn more from doing these exercises than from reading any book (or, for that matter, from listening to me). Especially since the course takes place in such a short time span, it is essential that you take some time to review the material before the next class.

Credits: 10

Textbook: Many textbooks provide competent treatments of the material in this course, and the most suitable one will depend on your interests and background. It will not be difficult to identify the relevant sections in any textbook. I recommend:

- Hargreaves Heap, Shaun P. and Yanis Varoufakis (2004): "*Game Theory, a Critical Text*", Routledge, New York. Provides thorough philosophical background to the assumptions and concepts of game theory.
- Morrow, James D. (1994): "*Game Theory for Political Scientists*", Princeton University Press. Good coverage with many examples from political science.

For more rigorous and more rewarding treatments:

- Binmore, Kenneth (2007): "*Playing for real*", Oxford University Press;
- McCarty and Meirowitz (2007): "*Political Game Theory*", Cambridge University Press.

Outline:

Lecture 1: Rational choice and the utility function
Monday May 10, 10:00-12:00, Room 2, Badia Fiesolana.
 Questions: What is a utility function? What are the assumptions needed to construct one? Why do we think it is useful? What is the link between rationality and utility? Are rational people bastards? What is expected utility (and what is it not)?
 Content:
 Introduction to the course
 A brief history of rational choice and the utility concept
 Construction of a utility function
 vNM expected utility theorem: rough outline plus discussion

Lecture 2: The basic elements of game theory
Tuesday May 11, 10:00-12:00, Room 2, Badia Fiesolana.
 Questions: What are the basic assumptions of game theory? How do we define a game? What kind of games are there? How do we choose a strategy? How can we discard strategies?
 Content:
 Main assumptions of game theory
 Components of a game
 Notation: Normal and extensive form.
 Common games: Prisoners dilemma, coordination, hawk-dove etc.
 Dominance reasoning: Strictly/weakly dominated strategies, iterated deletion argument

Lecture 3: Pure and mixed strategy Nash equilibrium
Wednesday May 12, 10:00-12:00, Room 2, Badia Fiesolana
 Questions: What is a Nash equilibrium? Is the Nash equilibrium weird? (Spoiler: It is). What is a mixed strategy Nash equilibrium?
 Content:
 Nash equilibrium: definition and examples.
 Interpretation and discussion of the Nash equilibrium
 Mixed strategy Nash equilibrium: definition and examples

Lecture 4: Dynamic and repeated games
Thursday May 13, 10:00-12:00, Room 2, Badia Fiesolana
 Questions: What if people don't make their decisions at the same time? Can I threaten people to get what I want? What if two people meet very often? Is cooperation rational in the repeated prisoners dilemma?
 Content:

Sequential games, the chainstore paradox
Subgame perfection and (non-)credible threats
Repeated games, backward induction and the folk theorem
Tit for tat and beyond

Lecture 5: Evolutionary game theory (social science meets biology)
Friday May 14, 10:00-12:00, Room 2, Badia Fiesolana
    <u>Questions</u>: What if people are not so smart, but biologically programmed? Does evolution lead to Nash equilibria? Can we understand conventions with the help of evolutionary game theory?
    <u>Content</u>:
Introduction to evolutionary game theory
Bounded rationality
Evolutionary stable strategies
The evolution of conventions: case study 'the ultimatum game'.