Economics 8103
Microeconomic Theory
Spring 1999

Lecture 1

I. Significance of Game Theory
   A. Limitations of traditional economic theory.
      1. In perfect competition and monopoly, all agents (except perhaps one)
         face a decision problem characterized by macro variables.
      2. Examples not encompassed by this paradigm include:
         a. Oligopoly.
         b. Bargaining.
         c. Auctions.
         d. Agency, including repeated agency.
         e. Patent races.
   B. A simplistic philosophy of social science.
      1. Pose a mathematically exact description of the physical environment.
      2. Specify a domain of applications.
      3. Based on the character of the applications, argue for a solution concept,
         meaning a set of predicted restrictions on behavior.
      4. Test empirically
   C. Critique.
      1. The model is always much simpler than the reality.
      2. Preferences cannot be observed, but only revealed.
      3. We cling to theories in spite of experimental failures.

II. Interpretations of Normal Form Games
   A. Formalism of finite normal (strategic) form games.
      1. The set of players \( \{1, \ldots, I\} \).
2. For each $i = 1, \ldots, I$, a finite nonempty set $S_i$ of pure strategies. The set of pure strategy vectors is $S := S_1 \times \ldots \times S_I$.

3. For each $i = 1, \ldots, I$, a utility or payoff function $u_i : S \to \mathbb{R}$, which is interpreted as a von Neumann-Morgenstern utility.

B. The One-Shot Interpretation.

1. The game is conceived as the entire world.

2. This avoids psychologically natural confusion between the given game and the game obtained by playing the given game repeatedly.

   a. Consider the two-fold repetition of

   \[
   \begin{pmatrix}
   L & R \\
   U & \begin{pmatrix}
   (6, 6) & (1, 7) \\
   (7, 1) & (0, 0)
   \end{pmatrix}
   \\
   D & \begin{pmatrix}
   \end{pmatrix}
   \end{pmatrix}
   \]

3. This interpretation also avoids reputation effects having to do with the consequences of other observing behavior in the game.

C. Critique.

1. In principle, one cannot do science on a single data point.

2. The agents have no experiential basis for forming beliefs about each other.

D. The Repeated-Anonymous Interpretation.

1. The game happens repeatedly, but no individuals behavior in any play is remembered.

E. Critique.

1. Depends on notion of similarity of games that is to some extent arbitrary.

2. The assumptions are stringent.

F. The Evolutionary Interpretation.

1. Strategies are viewed as genetically determined, rather than rationally calculated.

2. Unquestionably valid in biology, subject to data limitations, but specifies a version of rationality that is very bounded.
In practice the following material was not reached

III. Formalism of Extensive Form Games

A. The agents 1, ..., I.

B. The tree, consisting of a finite set of nodes, an initial node \( x_0 \in X \) and an immediate predecessor function \( p : X \setminus \{ x_0 \} \to X \). Let \( T := X \setminus p(X) \).

C. Actions \( A \), and a function \( \alpha : X \setminus \{ x_0 \} \to A \).

D. The information partition \( H \). Let \( H \) also denote the function mapping each noninitial \( x \) to its cell in \( H \).

E. A function \( \iota : H \to \{ 0, 1, \ldots, I \} \), where 0 is interpreted as chance or nature.

Let \( H_0 := \iota^{-1}(0) \).

E. Perfect Recall.

F. Chance move probabilities.

G. Payoffs \( u = (u_1, \ldots, u_I) : T \to \mathbb{R} \).

H. The derived normal form and reduced normal form.