ECO 199 – GAMES OF STRATEGY
Spring Term 2004 – February 5
CONCEPTS AND METHODS OF GAME THEORY

DECISIONS VERSUS GAMES

Decision – may have several stages and need a sequential plan of action (strategy), but environment is neutral

Game – interaction with others, who are similarly strategically aware purposive players, whose interests may conflict with yours

Need at least two "players" to make a game

Old terminology – decisions called games against "nature"

Games not always win-lose; can be
  win-win : international trade
  lose-lose : wars, strikes

USES OF GAME THEORY

1. Explanation of outcomes of past strategic interactions
2. Prediction of outcomes of future interactions
3. Advice to players involved in such interactions

Must combine
  Science – general principles and theories
  Art – less tangible knowledge of specific situation, vague intuitions and skills

Course more about science; occasional forays into art

Success so far enough to be encouraging but not perfect science and art are both evolving
WAYS TO STUDY GAMES

1. CASE METHOD – collection of examples
   indirectly convey some general principles
   THEORY – framework for organizing ideas
   We will have combination – theory through cases
   EMPIRICAL – Observation, Controlled Experiment
   We will gather and use evidence from these
   to sharpen understanding of theory and its limits

2. TYPES OF THEORY

   A. "ECONOMIC" (Rational choice and Equilibrium)

      Choice – Each player optimizes own preferences
      (must be internally logically consistent, but
      need not be purely selfish, or monetary, or short-run)
      Equilibrium – Interaction of choices mutually consistent
      Logical culmination of process of strategic thinking
      Assumption of perfect calculation can be unrealistic
      and equilibrium may not be attained
      But can learn calculation and equilibrium by playing
      most useful central or focal concept for analysis

   B. "BIOLOGICAL" (Adaptation and evolution)

      Limited powers of calculation and purposive choice
      Strategies fixed genetically or as "rules of thumb"
      Transmission of successful strategies
      genetic, and also social (learning, imitation)
      Eventual outcome of process – evolutionary stable outcome,
      also resembles equilibrium of rational choice
DIMENSIONS OF ANALYSIS OF GAMES

1. Moves sequential or simultaneous
   Different kinds of interactive thinking:
   Sequential: If I do this, the other will do that, then I ...
   Simultaneous: I think that he thinks that ...
   Different techniques: "trees" versus "spreadsheets"

2. Pure conflict, or some common alignment of interests
   Pure conflict in some sports; more generally mixed

3. One-time or repeated
   One-time: actions more unscrupulous, less cooperative
       information limited; secrecy valuable
   Repeated: can build up relationships and reputations
       can obtain and convey information
       can harness selfishness to achieve coop outcomes

4. Limited and asymmetric information
   Knowing other players’ skills, motives problematic
   Real game is becomes that obtaining, or conveying
       or concealing information

5. Rules fixed or manipulable
   If latter, then real game is that of manipulating the rules
   These are "strategic moves" – threats, promises

6. "Cooperative" or "non-cooperative" – Technical terms
   Cooperative – actions agreed and jointly implemented
   Non-coop – actions taken separately by each player
   Outcome can show cooperation if in private interest
   For example in repeated interactions
TERMINOLOGY AND FRAMEWORK

1. Moves and strategies
   Each individual instance of action is a move
   Strategies are complete plans of action

2. Payoffs
   Numerical scale – ranking, money, other things
   Probabilistic average (expected values) when uncertainty
   \[ p_1 x_1 + p_2 x_2 + p_3 x_3 + \ldots \]

3. Rational behavior
   Each player has internally consistent scale of values,
   Can calculate and implement best action or strategy
   Scale can embody altruism, can internalize social norms,
   even emotional/angry attitudes toward unfairness etc.
   Can have concerns other than money, long time-horizon ...

4. Common knowledge of structure of game
   Structure of game – strategies, payoffs etc
   (or the nature of uncertainty, manipulability)
   Common knowledge – A knows that B knows that ...

5. Equilibrium
   Each player’s strategy is best for him/her,
   taking the choices of the others as given
   Intended to be "stable" or "predictable" outcome
   but dynamics can be complex, slow, ...
   Theory doesn’t always work, but good enough that
   It should be taken as starting point of analysis
   Equilibrium doesn’t automatically mean "good"
   e.g. prisoners’ dilemma