

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

$$p_1 x_1 + p_2 x_2 + p_3 x_3 + \dots$$

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