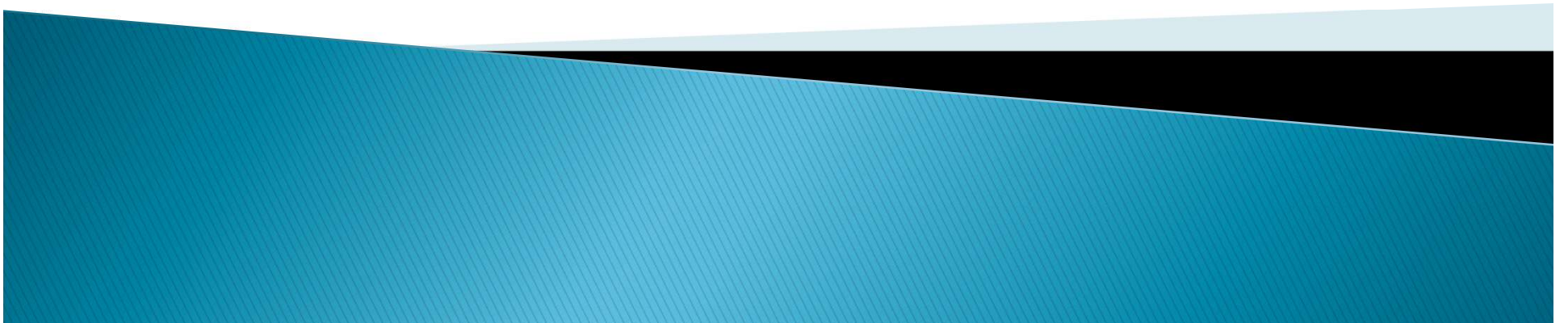# Teaching Game Theory:

A Quick Primer for the OCEE

Defining Game Theory

- Broadly, game theory is everything that isn't physics.
- Study of agents' (anything that can make choices) actions when those actions impact each others *payoffs*.
  - In Football – the plays the Offense and Defense use
  - In Markets – the prices the firms pick
  - While Driving – the speeds drivers use

How to Use Game Theory

▶ Descriptive:
 ◦ Game Theory can describe and model how the population works/interacts.

▶ Prescriptive
 ◦ Game Theory can be used to tell individuals how they should behave given the "rules" (situation) they face.

Using Game Theory in Class

- In class experiments are easiest way to introduce concepts to students.
- For instance, why do economists like markets?
  - Buy some mixed candy bags with various fun size bars.
  - Give each student a bar randomly
  - They write down how happy they are with it (1-10)
  - Give them 3 minutes to trade candy bars
  - Re-record how happy they are with new candy bar
  - Evaluate that no one is worse off and that many are better off.

Start with a Simple Game

- Place people into pairs randomly
  - It's best if they don't know their partner. So just have half the room be Role A and half be Role B.
- Role A gets 10 dollars (or other good currency like bonus points on a test)
- Role A players can divide that 10 up between them and Role B player.
- Role B player gets the split offer from Role A
  - Can accept (both players get the offered split)
 - Can reject (both players get nothing)
- Known as the Ultimatum Game

Ultimatum Game Continued

- This game is nice because it is simple
- Helps teach backward induction
  - Assume in game theory people have utility over consumption (here dollars or bonus points)
  - If that is the case, how could the recipient ever reject and positive amount?
  - Then 9-1 is a great offer – or so says game theory.
- Helps show that traditional Game theory can be flawed.
  - You should see very little splits of 10-0, 9-1 and many of 5-5.
  - 9-1 splits will likely be rejected even though GT says that shouldn't be.

Students Don't Think it Works

- The Ultimatum game shows how Game Theory breaks --- people don't do what is predicted.
- Maybe it is just because we have the wrong assumptions about what people care about.
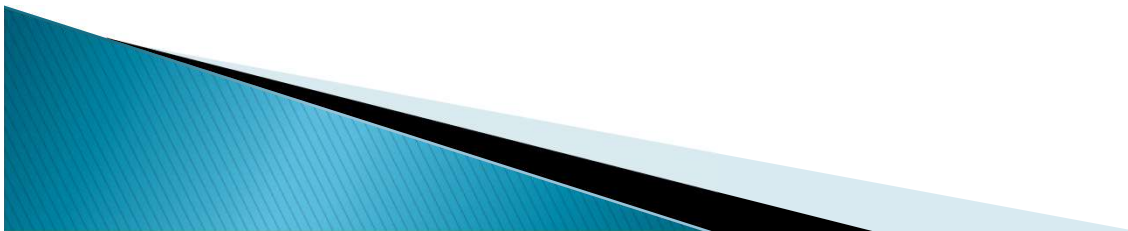
Enter Behavioral Economics

▸ Standard Game Theory says you care about your own consumption or payoff:
- ◦ Normally modeled with a utility function like:
  - • U(x) = x
- ◦ What if people care about more than just their own payoff --- perhaps they care about their relative payoff?
  - • $U_i(x_i, x_j) = x_i$ – G*max{0, $x_i - x_j$} – E*max{0, $x_j - x_i$}
  - • Here G is the guilt for having more than others
  - • And E is the envy for having less than another person.
- ◦ Model explains why people prefer more or less even splits

Oligopoly Experiments

- Very common experiment type
  - Bowes and Johnson (2008) have a great paper introducing various games.
  - Mainly focused on a cartel experiment.
- Classic Experiment presented by Sanyal
- Entry and Exit experiment
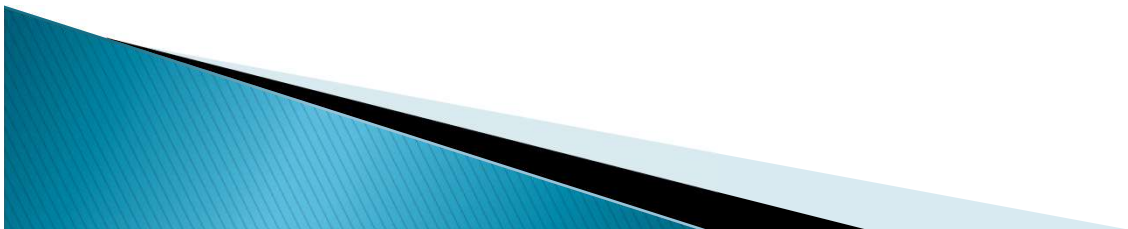
Quick Paragraph about Game Theory

- Game Theory, at least to game theorists, explains everything --- well almost everything. Anything that Physics doesn't cover Game Theory does. It explains how people interact with other people. It tells us why people choose to wear what they where and live where they live. Like models of physics it is often very stylized. We assume perfectly rational, self-interested agents and physicists assume perfect spheres and frictionless environments. They are not perfect, but are informative nonetheless.