Lecture 1

Introduction to Experimental Economics

What is Science?

- The key aspect of science is that hypotheses can be *falsified* through observation
  1. Hypothesis: *If A then B*
     - *"A is sufficient for B" What's a Test?*
  2. Hypothesis: *B is true only if A*
     - "A is necessary for B"
  3. Hypothesis: *B is true if and only if A*
     - *"A is necessary and sufficient for B"*

What is Science?

- *Note:* Hypotheses are supported only when they are not contradicted. They cannot proven to be true…they can only be proven to be false.
  - *Why?*

Economics as a Science

- "Standard Economics" uses data from "natural" observations
  - Surveys (Census, BLS)
  - Scanner Data
  - Advantage:
    - Natural data is the data we care most to explain.
  - Disadvantages:
    - Measurement Error
    - Reporting Error

- Disadvantages Continued:
  - Can't always get data on what you want to know. For Example:
    - **Hypothesis**: If the market is perfectly competitive, then there is an equilibrium p at which Supply = Demand.
      - (competition is sufficient for S=D)
    - What would you need to test this hypothesis?
      - Competitive Market
      - Measure the *complete* demand curve
      - Measure the *complete* supply curve
      - But if the model is true, you only observe the equilibrium…you don't observe enough information to falsify the hypothesis.

- Another Example:
  - **Hypothesis:** In an auction the person with the highest willingness to pay will always win the item.
    - (Having the highest w.t.p. is necessary and sufficient for winning the auction)
    - Can you see the willingness to pay of the winner?
    - How about the losers?
    - You need to see each bidder's willingness to pay to know if the winner's is the highest….but you don't actually see *any* of them, so cannot falsify the hypothesis.

Economics as an *Experimental* Science

- The idea of experimenting in economics is an old one.
  - "Beautiful Mind" studies at the RAND corporation testing the "Nash Equilibrium."
- Began to be taken seriously in the 1980s
- In 2002 the Nobel Prize in Economics went to two pioneers of experimental methods (and enemies of each other), Vernon Smith and Danny Kahneman
  - Smith: Showed economics models can work (the sufficient condition)
  - Kahneman: Showed lots of important situations where economic models don't work (i.e. the necessary condition)

What is an Experiment?

- The social scientist “controls” the environment in which the observations are made.
- “Control” means you manufacture the the “if” part and measure the information you need to falsify your hypothesis.
  - To test “*If A then B”* you make sure A is true as well as you can and see if B appears.
  - To test “*B only if A”* you always make sure you can observe A when it’s true (and observe “not A” when it’s false) whenever you see B.
  - To test “B if and only if A” you do both.

Examples

- Hypothesis: Demand = Supply in a competitive market
- Test:
  - Create Suppliers and Demanders
  - Give each prescribed values of buying or selling.
  - Create rules of exchange to mimic perfect competition.
  - Make sure the predicted equilibrium is clear
  - Record trades and prices

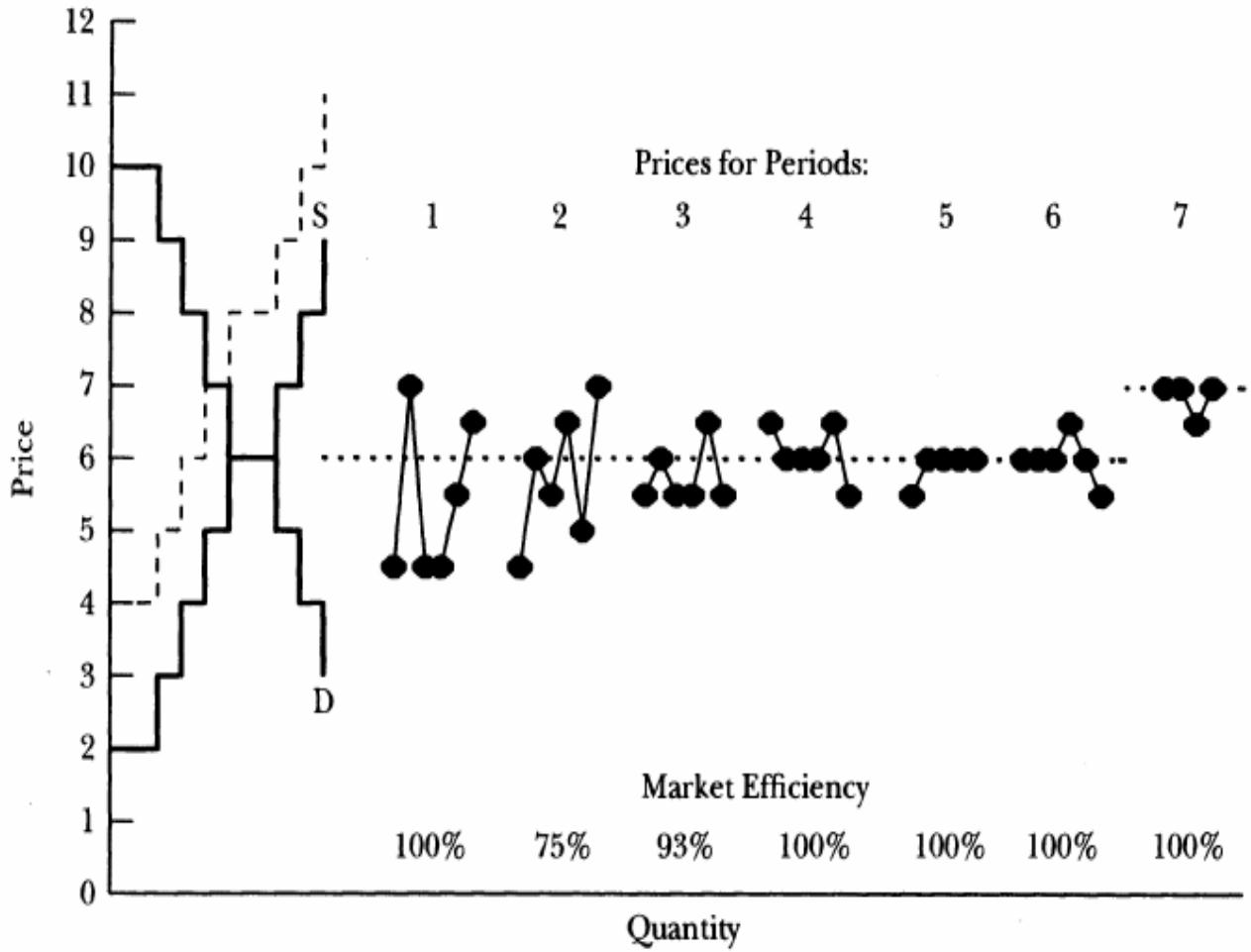
- Implementation:
- Hand out playing cards to students
  - Black is Supply, Red is Demand
  - Number for supplier is the cost (S pays to the experimenter after a trade)
  - Number for demander is value (D gets from the experimenter after a trade)
  - Design a mechanism for communication and trade, e.g. an “open pit” as in a mercantile exchange.

- For example:
  - (Black is supply, Red is demand)
  - What's the Prediction?

Black (spades or clubs):	2, 2, 3, 4, 5, 6, 6, 7, 8
Red (hearts or diamonds):	10, 10, 9, 8, 7, 6, 6, 5, 4

Figure 1

Data from a Classroom Pit Market (University of Virginia, fall 1994)



Types of Experiments

- Lab Experiments
  - Decisions are made in an artificial and/or novel setting ☹
  - You have (nearly) complete control of everything important ☺
- Field Experiments
  - Decisions are made in a natural environment ☺
  - Many things cannot be measured/controlled. ☹

Designing An Experiment

- Alternative Hypotheses
  - The problem of null effects
  - If you don't falsify any hypothesis, you aren't sure whether it is because the hypothesis or the experimenter sucks.
- Power vs. Goodness of fit:
  - Goodness of fit: How well you data conforms to the prediction
  - Power: How easy it *could have been* for your hypothesis to be falsified if it wasn't true.
- Design by Subtraction
  - A powerful way to construct an experiment
  - If the hypothesis is that A is necessary for B you can get two types of evidence:
    - Amplify A and see if you get more B (not conclusive)
    - Subtract A and see if B goes away (conclusive)

Issues with Lab Experiments

- How do you make incentives “real”?
  - Pay subjects cash money that depends on decisions.
  - Payments must be big enough to be taken seriously, both the average and marginal payoffs
    - Avoid the “flat maximum” problem
    - Make searching for the best strategy worth the effort
  - But you still have to give people a fair chance to *falsify* the theory
    - Cannot make the predicted choice *too much* better than the rest
  - Generally look to pay on average about two or three times the prevailing wage in the market.

Issues with Lab Experiments, cont.

- External Validity
  - Does what we learn in the lab generalize outside the lab?
  - We must believe there is some correspondence to the world, but how precise that is cannot be known without more study.
  - Sometimes we a “precise representation” to the real world is important (e.g. measuring risk aversion or forming regulatory policy), and sometimes it isn’t (e.g. testing whether game theory works).

Issues with Lab Experiments, cont.

- Does that mean we need to make experiments more "realistic"?
  - Not necessarily
  - Giving a lab experiment a natural context can bias choices – people may rely too much on real world analogies (habits) and respond too little to the lab incentives.
  - A "neutral context" may free subjects to think about issues in a more careful way.
  - We need to control the bits of reality that we may want to study, but keeping the other parts of reality out allows us to have the most powerful tests.

Issues with Lab Experiments, cont.

- Experimenter Demand Effects
  - This refers to the concern that subjects may try to please (or maybe frustrate) the experimenter if they are able to guess what the hypothesis is.
  - This is also why a “neutral context” is good
- The Effect of Being Observed
  - Sometimes being observed can itself influence behavior and create incorrect inferences.
  - This is why we try to control studies so that subjects are *anonymous*, and choices are *confidential*.
  - The best is when neither the other subjects nor the experimenter can tell which participant made what decisions. So called “double blind”.

Issues with Lab Experiments, cont.

- Why use students as subjects?
  - Students are not a representative sample, but are more homogeneous than the population.
  - This can be an *advantage*
  - Personal differences among people can create unexpected randomness in the data.
    - A homogeneous subject population can reduce randomness, again adding to both power and goodness of fit.
  - If the hypothesis calls for certain experience or expertise, may choose the appropriate subjects
    - Example: Testing stock market theories using brokers

Issues with Lab Experiments, cont.

- Within-Subects vs. Between-Subjects Design
  - *Within-Subject:* Put the same subjects in two different conditions.
    - Advantage: Can use fewer data points
    - Disadvantage: not sure the treatment and control are independent.
    - Must balance the order of treatments, and make sure order doesn't matter.
  - *Between Subjects:* Put different groups into different conditions
    - Advantage: Treatment and control are independent
    - Disadvantage: Other (unmeasured) differences between treatment and control could be causing the results.
    - Need more observations to have power.

Issues with Field Experiments

- They are difficult and expensive
- Many things are difficult to measure or control.
- Typically require many more subjects
- But you are closer to what you really want to study.
- And external validity is not a problem (duh).

Issues with ALL experiments

- Incentives must always be believed
- Economists NEVER lie to subjects
  - This is so we can be as sure as possible that subjects do not doubt what we tell them.
- Subjects' welfare must be protected.
  - History: Milgrom Study and Zimbardo Study
  - Now: Any research must be approved by the UCSD Institutional Review Board *in advance.*

Issues for All Experiments, cont.

- Dealing with “error”
  - Lack of understanding/learning in the study
    - The risks of repetition
    - The risks of one-shot
  - Decision errors
    - Data analysis can maybe measure the error necessary to confirm the model and ask how big it is?
  - Errors from boredom or subjects’ searching
    - This is why we try to makes stakes high
  - Errors from “homemade” decision rules
    - Sometimes these homemade rules are what you want to study (e.g. altrusim)
    - Sometimes these rules may interfere and you want to suppress them (e.g. anti-tax attitudes)

Rejecting Economic Models

- All economic models are lies
- All can be falsified by just the right experiment
- When are we satisfied that a model does "well enough" and when do we discard it?
- The best way to reject a model is to find another that does much better and *is easily replicated.*