Experimental Economics in the Classroom

2008 Teaching Economics Conference
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Pittsburgh

February 15, 2008

Experimental Economics

- Economics is transitioning into an experimental science.
  - According to the *Journal of Economic Literature* in 2006, 101 out of 8,185 published journal articles (1.2%) were in the field of "Experimental Economics". All the top journals are represented. For comparison purposes, there were 81 published articles in "International Finance" (1%) and 108 published articles in "Industrial Organization" (1.3%).
  - In many fields, e.g., game theory, auction theory, public economics, the transformation is essentially complete.
  - Some frontier areas where experiments remain on the periphery: finance, macroeconomics, international, development.

Classroom Experiments

- As experimental methods have become a standard research methodology, experiments have also come to be used in the classroom -many of you are doing this already.
- Recent research confirms that classroom experiments improve student learning:
  - Dickie (*JEE* 2006) and Emerson and Taylor (*SEJ* 2004) show that student learning of economics is significantly improved by the use of experiments (e.g. Bergstrom & Miller (2000)) in principles courses using pre- and post- TUCE (Test of Understanding in College Economics) scores relative to control, "chalk and talk" only principles courses (though no difference in final grades!)
  - Durham et al. (*Ec Inq.* 2007) report that classroom experiments significantly improve student performance on questions specific to the topics the experiments are designed to explore. But they find heterogeneity in outcomes with multimodal or kinesthetic learners benefitting the most, and "read–write" learners not benefiting much at all.

Resources for Conducting Classroom Experiments

1. **Textbooks:** Bergstrom and Miller (2000) *Experiments with Economic Principles* 2nd Ed. (McGraw-Hill), Holt (2006), *Markets, Games, & Strategic Behavior* (Addison-Wesley).
2. **Journal articles with tried-and-true classroom experiments**: *Classroom Expernomics* (1992-2003), *Journal of Economic Education*, (various issues), *Journal of Economic Perspectives* ("Classroom Games" feature), *Southern Economic Journal* ("Teaching Tips" section).
3. **Software**: Veconlab (Holt, U. Virginia), EconPort (Cox, Georgia State), Comlabgames.com (Prasnikar et al.), Aplia.com (Romer). All very useful but *not* necessary!

Practical Issues in Conducting Classroom Experiments

- Choose experiments relevant to the classroom material.
- Choose experiments where everyone can participate in some role.
- Read instructions aloud. Ask for any questions before beginning, but avoid leading students toward any particular outcome - allow students to learn via their participation in the experiment.
- Award points (not money) for individual performance in accordance with the induced payoff objectives. For stronger incentives, points might count in some way toward the final course grade. (Some instructors prefer candy/cookies).
- No deception!
- Leave time to provide an extensive debriefing, and relate the experimental findings to the course material.
- KISS! Double auctions are interesting, but they take some time to set up. Save time by giving out written instructions in advance. Alternatively, focus on simpler experiments and save more time for discussion.

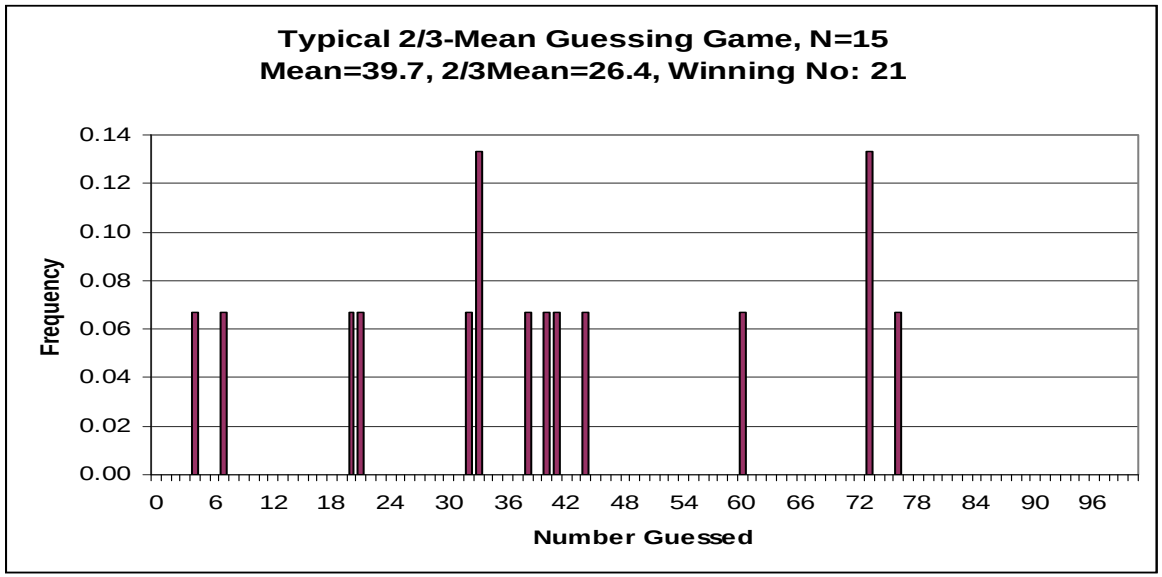
Three Simple 30-Minute Classroom Experiments

- Require little prep time. Any class size. Micro & Macro Interpretations
  1. Guessing games
  2. Entry games
  3. Team participation games

Guessing Games

- What you need: N 3×5 cards, one for each of the N participants.
- Rules of the game: All N participants privately, and without communication, write down a number on their card between 0 and 100, inclusive. The cards are collected and the mean of all numbers submitted is calculated, $\overline{X}$. The person(s) whose guess is closest (in absolute value) to $2/3 \times \overline{X}$ is the winner of a prize (all others earn nothing).
- Variant (1): Repeat play of the game for several rounds, pointing out the winning number and showing the distribution of guesses at the end of each round.
- Variant (2): The person(s) whose guess is closest (in absolute value) to $100 - 2/3 \times \overline{X}$ is the winner.

Guessing Games: Typical Results and Discussion



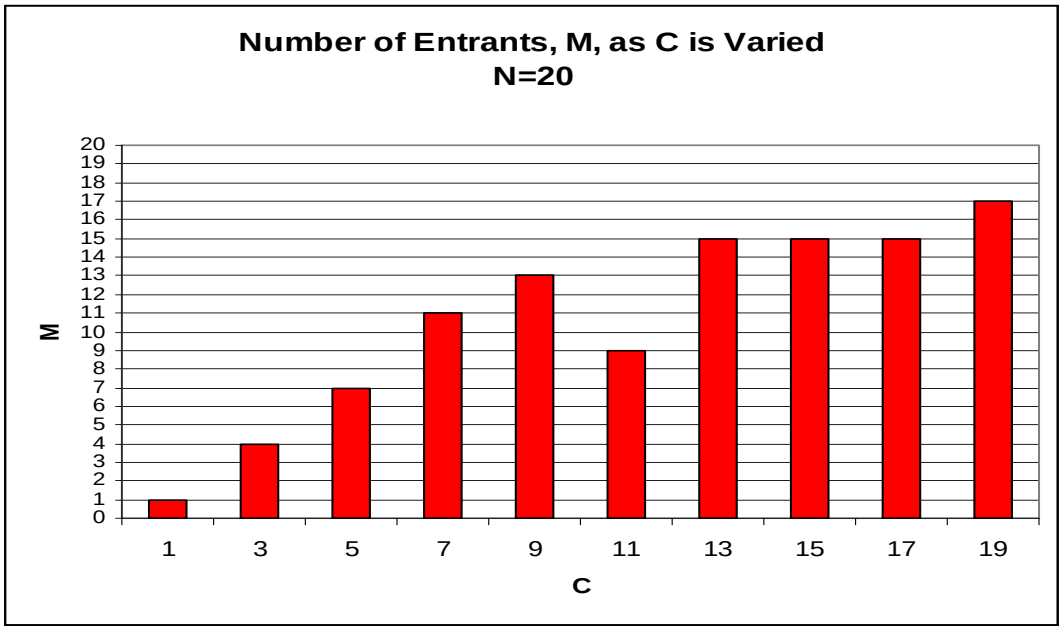
- Macro: Keynes' (1936) beauty contest characterization of investment decisions.
  Rational expectations steady state calculation: $\overline{X} = 2/3\overline{X} \Rightarrow \overline{X} = 0$; $\overline{X} = 100 - 2/3\overline{X} \Rightarrow \overline{X} = 60$.
- Micro: Concept of dominance, iterated elimination of dominated strategies.
  Bounded rationality/cognitive hierarchies.

Entry Games

- What you need: N 3×5 cards, one for each of the N participants.
- Rules of the game: All N participants privately, and without communication, write down whether they want to "enter" or "not enter". The cards are collected and the total number choosing to enter (not enter) is determined. Let M be the number choosing to enter, and let $1 \leq C \leq N$ be a pre-announced integer representing market *capacity*. The payoff to each person choosing "not enter" is a known fixed value, F. The payoff to each person choosing "enter" is variable, and depends on M: $F + (C - M)$.
- Variant (1): Repeat play of the game for several rounds. Prior to each round draw a random value for the integer C and announce it out loud before entry decisions are made.
- Variant (2): Change the intercept and/or slope of the payoff function for those choosing enter, e.g.: $3F + 2(C - M)$ and $1 \leq C \leq N - F$.

Entry Games: Typical Results and Discussion

- $N = 20$, C varied randomly (odd numbers between $1 - 19$). Number entering $M = C \pm \varepsilon$



- Micro: Tacit collusion: How firms agree to play certain strategies without explicitly saying so. Adding another lane to a freeway.
- Macro: Self-organization/the invisible hand. Absence of arbitrage opportunities/efficient markets hypothesis.

Team Participation Games

- What you need: N 3×5 cards, one for each of the N participants.
- Rules of the game: All N participants are awarded C points and are then divided into two equal-sized teams. Each participant must then decide privately and without communication whether or not to buy one token. A token costs C points. The total number of tokens purchased by each team is then counted. Each member of the team with the most tokens earns $B > C$ points, regardless of whether they bought a token or not (tie-breaking rule). Each member of the losing team earns 0 points, regardless of whether they bought a token or not.
- Possible payoffs: 1) $B + C$ points (doesn't buy a token, is a member of the winning team) 2) B points, (buys token, is a member of the winning team), 3) C points (doesn't buy token, is a member of the losing team), 4) 0 points (buys token, is a member of the losing team).
- Variant (1): Repeatedly play the game for several rounds.
- Variant (2): Elicit each individual's pre-play belief that their decision will be "decisive."

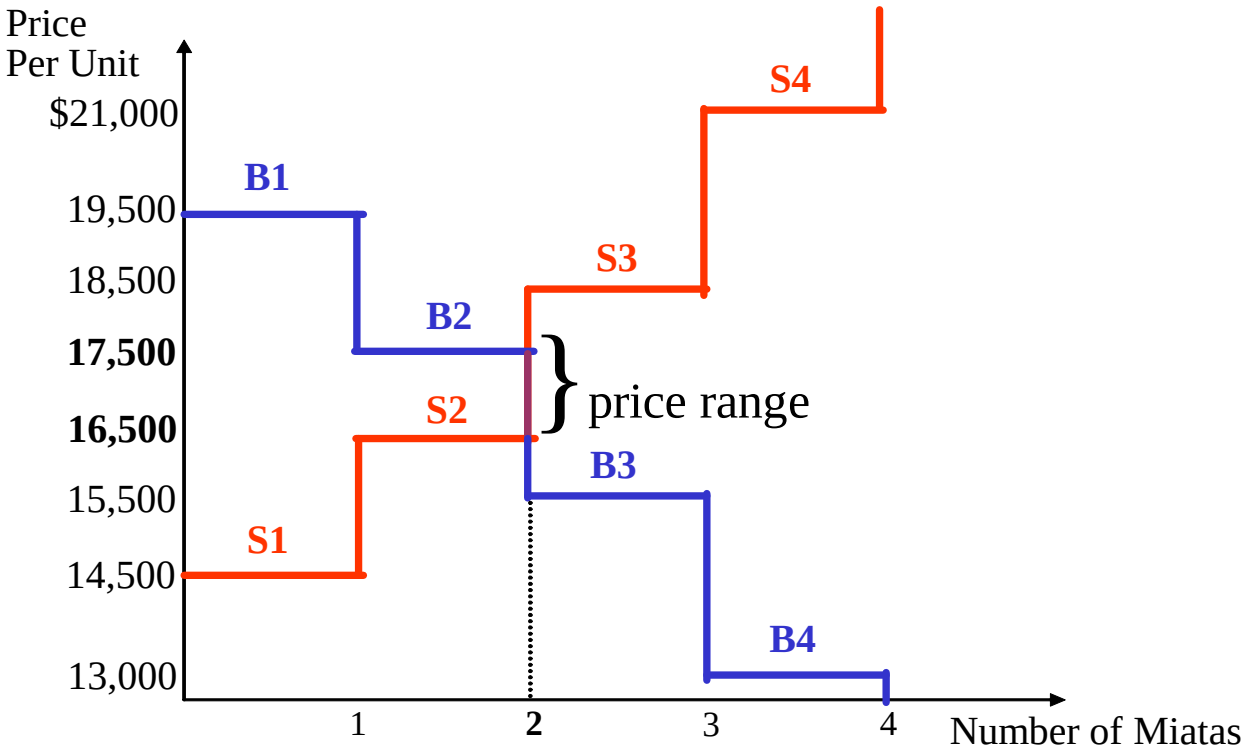
Team Participation Games: Typical Results and Discussion

- Participation rates (buying a token) are neither 0 nor 100%, but lie in between. In the repeated game, both teams should experience wins.
- Macro: A model of two-party voting: buying a token = vote, which is costly (C points) not buying = abstention (is costless, but your team may lose).
- Micro: Conflicting motivations: Winning versus free-riding. Rational choice theory: Buy if expected benefit outweighs cost. Let p be the probability of being pivotal to the election outcome. Then vote if $pB > C$, abstain if $pB < C$. Critical threshold is C/B.

Classroom Experiments Yield a Nobel Prize

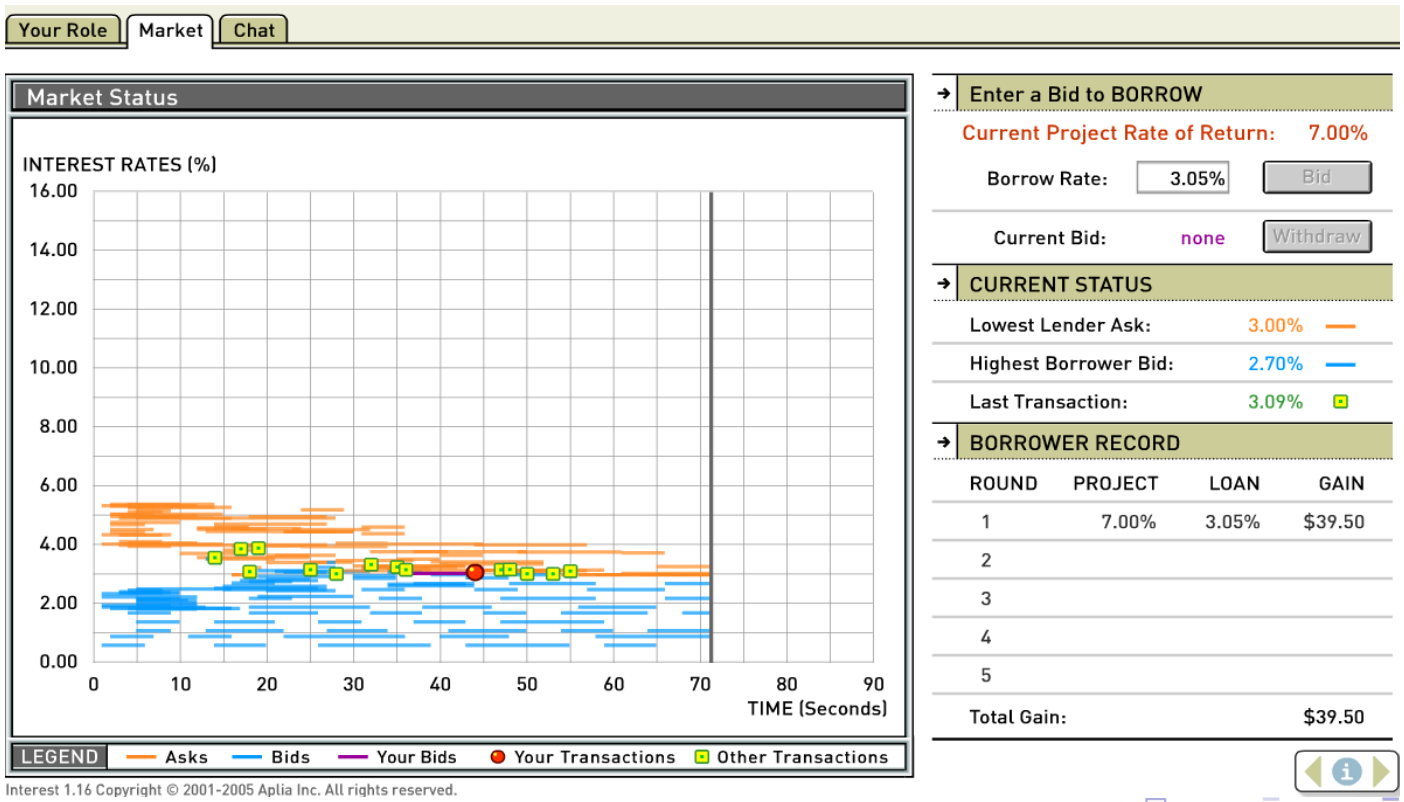
- Vernon Smith's 2002 Nobel prize came about due to a *classroom experiment* conducted by his teacher at Harvard, Edward Chamberlin.
- Chamberlin assigned students seller costs C or buyer values, V and told them to circulate in a room and negotiate prices, P, with one another. Buyers were to maximize $V - P$ (consumer surplus) and sellers to maximize $P - C$ (producer surplus).
- Chamberlin (*JPE* 1948) declared the market experiment "imperfect," as prices did not perfectly equilibrate to the competitive equilibrium price (where demand=supply).
- Smith teaching at Purdue University, modified the design so it more closely approximated a stock market: Buyers/sellers had to submit bids/asks to a centralized market (chalkboard) where they were reported for all to see. In addition, bid/ask improvement rules were implemented. These changes led to rapid convergence of price to the competitive equilibrium level (Smith, *JPE* 1962). This is now the classic "double auction" experimental design.

Double Auction Induced Values: Example



Classroom Experiments with Double Auctions

- Used to study a wide variety of market-based phenomena, e.g. interest rate determination between borrowers and lenders.
- Can be hand-run, but set-up takes time and instructions can be lengthy. Recruit some students to help out.
- Software makes running DAs easy. Aplia DA screenshot:

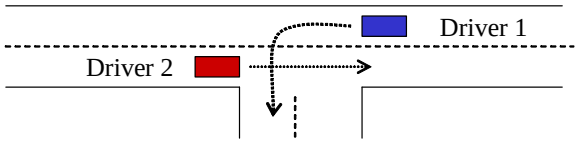


The Next Frontier: Teaching Experimental Methods

- Just as we teach econometrics, it's time we also taught the newer empirical methodology of laboratory experimentation.
- I have taught experimental methods as part of an undergraduate game theory courses. Students had to think of an economic issue, program it up as a game and test it out on their fellow students.
- I had students use the free comlabgames software to do this.
- Many experimental design issues have to be covered, e.g., choice of subjects, proper incentives, neutrality of frames, avoidance of deception, writing of instructions etc. Perhaps it would be best to teach this as a stand-alone course.
- But, students enjoy designing games and having their classmates play them!

Example:

The Pittsburgh Left-Turn Game



Payoffs are in terms of seconds gained or lost (with minus sign)

		Driver 2 (Plan: proceed through intersection)	
		Proceed with Plan	**Yield** to Other Driver
Driver 1 (Plan: make left turn)	**Proceed** with Plan	-1490, -1490	5, -5
	Yield to Other Driver	-5, 5	-10, -10

"I'll tell you, mock jury duty beats cancer testing."