

Why and How to Experiment in Economics

Daniela Puzzello

Indiana University

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ECONOMICS EXPERIMENTS? WHAAAT?

“One possible way of figuring out economic laws ... is by controlled experiments. ... Economists (unfortunately) ... cannot perform the controlled experiments of chemists or biologists because they cannot easily control other important factors. Like astronomers or meteorologists, they generally must be content largely to observe.” (Samuelson and Nordhaus, 1985, p. 8)

USE IMAGINATION...NOBEL PRIZE WINNERS

- Vernon Smith (2002): “for the use of laboratory experiments as a tool in empirical economic analysis, in particular, for the study of different market mechanisms”
- Daniel Kahneman (2002): “for the introduction of insights from psychological research into economics, in particular with regard to judgements and decisions under uncertainty”
- Elinor Ostrom (2009): “for her analysis of economic governance, especially the commons”
- Al Roth (2012): “for the theory of stable allocations and the practice of market design”
- Richard Thaler (2017): “for his contributions to behavioural economics”

EXPERIMENTAL METHODS

The experimental method is a systematic and scientific approach to research in which the researcher manipulates one or more variables, and controls and measures any change in other variables.

Experimental Economics: application of experimental methods to study economic questions. Human subjects participate in the experiment.

- Survey: Hypothetical settings and responses
- Field: Field settings (e.g., labor supply of New York City cab drivers)
- Laboratory: Lab settings, highly controlled environment

Roth (1986)

- Speaking to Theorists: test and modify economic theories
- Whispering into the Ears of Princes: inform policy making process
- Searching for Facts: collect data to discover and document anomalies

WHY LAB EXPERIMENTS? SMITH

Smith (1994) : Economics in the Laboratory

- Test or select between theories, e.g., Nash equilibrium vs. Competitive equilibrium prediction
- Explore the cause(s) of a theory's apparent failure, e.g., Are instructions clear? Do subjects need more experience? Was implementation accurate? Ultimatum game
- When a theory succeeds, explore extreme portions of the parameter space to stress-test the model and identify the edges of its validity
- Compare institutions, e.g., double auction and call market
- Compare environments, e.g., changes in number of subjects

WHY LAB EXPERIMENTS?

- Establish empirical regularities as a basis for a new theory, e.g., laboratory is not constrained by what can be solved theoretically
- Evaluate policy proposals, e.g., monetary policy... if proposal does not work as intended in the lab, then...
- Use the lab as a test-bed for institutional design, e.g., Arizona Stock Exchange
- Use the lab to help determine which outcome may be more likely to arise, e.g., equilibrium selection
- Estimate parameters, e.g., degree of risk aversion

• Teaching

(Indiana)

COMPONENTS OF ECONOMIC EXPERIMENT

(Smith, 1982): Microeconomic System as an Experimental Science

- Environment: number of subjects, initial endowments, preferences, costs...induced by appropriate (typically monetary) incentives linked to performance (no flat payment)
- Institution: rules of the game, action set, timing of actions, payoff determination
- Behavior: subjects' behavior as a function of environment and institution where they interact. "Agents choose messages, and institutions determine allocations via the rules that carry messages into allocations."

INDUCED VALUE THEORY: MONOTONICITY

Smith (1982): precepts of experimental economics

- Monotonicity or Nonsatiation: Subjects must prefer higher amounts of the reward medium

$V(m, z)$ = subject's preference over reward medium m and other arguments z

$$\frac{\partial V(m, z)}{\partial m} > 0$$

- Saliency: The reward earned by subjects must depend on his/her choices and possibly the ones of the other subjects as specified by the experiment. “In order that subjects rewards in a laboratory experiment have motivational relevance such rewards must be associated indirectly with the message actions of subjects... Individuals are guaranteed the right to claim a reward which is increasing (decreasing) in the goods (bads) outcomes...of an experiment.” (no flat payment).

INDUCED VALUE THEORY: DOMINANCE

- Dominance: “The reward structure dominates any subjective costs (or values) associated with participation in the activities of an experiment.” Subjects’ utility should be mainly affected by the reward medium m , rather than other factors z , such as fatigue, boredom, experimenter’s demand effect, game value, preferences for winning, etc.

INDUCED VALUE THEORY: PRIVACY (WHEN POSSIBLE)

- Privacy: “Each subject in an experiment is given information only on his/her own payoff alternatives.”

INDUCED VALUE THEORY AND DECEPTION

Davis and Holt (1993)

Methodological concerns:

“The researcher should...be careful to avoid deceiving participants. Most economists are very concerned about developing and maintaining a reputation among the student population for honesty in order to ensure that subject actions are motivated by the induced monetary rewards rather than by psychological reactions to suspected manipulation. Subjects may suspect deception if it is present. Moreover, even if subjects fail to detect deception within a session, it may jeopardize future experiments if the subjects ever find out that they were deceived and report this information to their friends” (p.23-24)

WHAT IS DECEPTION?

- “You know when you see it”
- Hertwig and Ortmann (2008): “...intentional provision of misinformation is deception and that withholding information about research hypotheses, the range of experimental manipulations, or the like ought not to count as deception.”
- Wilson (2016): “Did the experimenter mislead participants by false appearance or statement?”

Examples: tell subjects that they are paid based on performance and then give them a flat payment, tell subjects that they are randomly matched when they are not, tell subjects that they are matched with 100 other participants when they are matched with 5, tell them they are interacting with a human opponent when they are interacting with a computerized one, etc.

ECONOMIC EXPERIMENT: STEPS

- Research question and objective of the experiment, e.g., test a theory, investigate anomaly, etc.
- Design experiment and materials, including instructions, program etc. Instructions should be as clear as possible but not lead subjects
- Seek and obtain approval from the Institutional Review Board (IRB)
- Conduct experiment (possibly postexperimental questionnaire to better understand what subjects did and why) and pay subjects at the end individually based on their earnings in the experiment
- Analyze data (it is important to think about this step when designing the experiment, no data mining, report results honestly)

- Motivate the hypotheses or conjectures to be tested (e.g., theory or previous experimental findings)
- Occam's razor: Law of parsimony

Choose simplest decision environment to investigate your research question...may take multiple experiments...

- Change one variable at a time to avoid confounding effects
- Within-subjects versus between-subjects design
- Order effects
- Matching protocol (partner, stranger, perfect stranger)
- Number of independent observations

ECONOMIC EXPERIMENT: KISS AND KICK?

- KISS: Keep It Simple Stupid
- KICK: Keep It Clear (even if Complex?) Kid
- Focus on treatment differences rather than point prediction (especially in KICK)

Control and (short distance to) internal validity

- Subjects are randomly assigned to treatment conditions (avoid self-selection issues)
- Possible to change exogenous conditions to make causal inference, e.g., how does trading institution affect bubble formation?
- Variables that are not observed in the field can be observed in the lab and are under the control of the experimenter, e.g., fundamental value of an asset, interactions
- Control information available to subjects
- Replicability

ECONOMIC EXPERIMENTS: CRITICISMS?

- External validity: Do results obtained in the lab generalize to the field?

- what about other empirical methods?

- if there is no support for a conjecture in the lab, it will likely not be supported in the field

- laboratory results can inform field experiments

ECONOMIC EXPERIMENTS: CRITICISMS?

- Lab experiments are unrealistic and artificial
- Are models realistic? Models are simplified frameworks designed to illustrate complex processes
- Simplicity may be a virtue as it helps better understand relationships of interest and main mechanisms that can be further tested in other environments
- “While laboratory processes are simple in comparison to naturally occurring processes, they are real processes in the sense that real people participate for real and substantial profits and follow real rules in doing so. It is precisely because they are real that they are interesting.” (Plott, 1982)
- “...laboratory microeconomies are real live economic systems, which are certainly richer, behaviorally, than the systems parameterized in our theories.” (Smith, 1982)

ECONOMIC EXPERIMENTS: CRITICISMS?

- Subjects are students
- Subjects are inexperienced
- The number of participants is small
- The stakes are small
- Experimenter's demand effect

DATA PROCESSES

	Happenstance	Experiment
Field	GDP, CPI	Discrimination, charitable fundraising
Laboratory	Penicillin, Asset Mkts	Social dilemmas, Mkts

ECONOMIC EXPERIMENTS

- Laboratory experiments complementary tool to field experiments, field happenstance data and survey data
- Most appropriate method depends on data availability as well as constraints (e.g., Friedman rule, subjects cannot pay the experimenter in case of a loss...use survey data)

Breadth of laboratory experiments:

- Individual decision making, game theory, market settings, finance, dynamic games...
- Macroeconomics and Monetary Economics...The sky's the limit?

ECONOMIC EXPERIMENTS: EXAMPLES

- Laboratory asset markets: comparison of trading institutions.

Why? Different institutions are used in different countries and for different assets...difficult to understand the isolated impact of the institution on price formation

- Social dilemma games: test and stress-test theory and experimental evidence.

Why? Understand under when and why theory or cooperation indices used to summarize incentives to cooperate work

- Monetary economics: Is money welfare improving? Does Friedman rule work as intended in a “hypothetical simple society?” Neutrality of money? Welfare costs of inflation?

Why? Some celebrated proposition in monetary economics difficult (and unethical?) to test in the field