1. Introduction to Experimental Economics

- Example experiments
- Some points of view
- Control in experiments
- Induced-Value-Theory
- Limits and objections
- Results from classroom experiments

Introductory Readings

- Davis, Douglas and Holt, Charles (1993); Experimental Economics, Princeton University Press, Princeton, New Jersey: Chapter 1.
- Falk, A. and Fehr, E. (2003); "Why labor market experiments?", Labour Economics 10, 399-406 (http://www.iza.org/en/papers/Falk/whylabourmEx.pdf).
- Friedman, Daniel and Sunder, Shyam, Experimental Methods, Cambridge University Press 1994, Chapters 1 and 2.
- Roth, Alvin E. (1988); "Laboratory Experimentation in Economics: A Methodological Overview", Economic Journal, Vol. 98, 974-1031.
- Smith, Vernon L. (1989); "Theory, Experiment and Economics", Journal of Economic Perspectives, Vol. 3, No. 1, 151-169.
- Smith, Vernon L. (1994); "Economics in the Laboratory", Journal of Economic Perspectives, Vol. 8, No. 1, 113-131.
- Smith, Vernon L. (1976); "Experimental Economics: Induced Value Theory", American Economic Review, Vol. 66, 274-279.

Points of view (1)

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, Principles of Economics 1985, p. 8

Points of view (2)

“Economic theory, through a formal deductive system, provides the basis for experimental abstraction and the experimental design, but society in most cases carries out the experiment. ... Therefore, the economic researcher observes the outcome of society’s experiment or performance but has little or no impact on the experimental design and the observations generated. Thus, by the passive nature of the data, economic researchers are, to a large extent, restricted in their knowledge search to the process of nonexperimental model building. ... the experiment is outside the researcher’s control.“

The Nonexperimental Model-Building Restriction, in: Judge et al. (1988)

Points of view (3)

Experimental economics is an “exciting new development”.

Samuelson and Nordhaus: Principles of Economics, 14. ed. New York 1992, p. 5.

The Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel 2002 –

“Traditionally, economic theory has relied on the assumption of a "homo œconomicus", whose behavior is governed by self-interest and who is capable of rational decision-making. Economics has also been regarded as a non-experimental science, where researchers – as in astronomy or meteorology – have had to rely exclusively on field data, that is, direct observations of the real world.

During the last two decades, however, these views have undergone a transformation. Controlled laboratory experiments have emerged as a vital component of economic research and, in certain instances, experimental results have shown that basic postulates in economic theory should be modified. This process has been generated by researchers in two areas: cognitive psychologists who have studied human judgment and decision-making, and experimental economists who have tested economic models in the laboratory. This year’s prize is awarded to the innovators in these two fields: Daniel Kahneman and Vernon Smith.”

Data sources in economics

	Happenstance	*Experimental*
Field	GDP Inflation	Policy experiments Donation experiment
Lab	Discovery of Penicillin Reciprocity	*Bargaining* *Markets*

The key advantage of experiments: Control

- Environment:
  - Preferences, technology, and initial endowments
  - Controlled by using monetary rewards
- Institution (rules of the game):
  - Possible actions
  - Sequence of actions
  - Information conditions
    - Experiments usually define an extensive or normal form game
  - Framing (language, story)

Control…

- Experimenter knows what is exogenous and what is endogenous
  - Few unobservable variables
  - No (?) causality problems: Treatments allow implementation of the ceteris condition
  - Facilitates analysis: no sophisticated econometrics necessary
- Experimenter controls information conditions
  - Important for study of, e.g., asymmetric info games
- Experimenter knows the theoretical equilibrium
  - Equilibrium and disequilibrium can explicitly observed
  - Quick and sticky adjustment can be observed and examined

Control…

- Evidence is replicable
  - o Experimenter controls the conditions under which evidence is generated
  - o Those who question results can replicate the experiment

How lack of control can pollute scientific results (LaLonde AER 1986)

- Do employment and training programs increase mean annual earnings of participants?
- Suppose the econometrician has happenstance field data, i.e., data that are a by-product of some uncontrolled processes.

LaLonde (2)

- Problem: Selection bias
  - o Do participants in the program differ from nonparticipants in an unobservable way?
  - o Are they more ambitious? (upwards bias)
  - o Are they more optimistic about the potential effects of the program? (Optimism and not the program may cause effects)
  - o Are they less optimistic about their labor market prospects? (downwards bias)
- Solution: Apply econometric techniques to control for the sample selection bias, e.g., matching.

LaLonde (3)

- Suppose the researcher conducts a controlled field experiment. Individuals are randomly assigned to the treatment condition (training) and the control condition (no training).
- This precludes sample selection bias. Due to randomization the distribution of uncontrolled (unobservable) variables is identical in the treatment and the control condition (for high enough number of obs.).
- To test whether training is effective: Conduct a simple statistical test that compares the average incomes in the two conditions.

LaLonde (4)

- LaLonde analyzed the data of such a field experiment under the assumption that no randomization took place and that he has no knowledge of the control group’s result.
- Result: Estimates of the job-training effect on earnings varied considerably and some even had the wrong sign.
- “Even when the econometric estimates pass conventional specification tests (designed to control for sample selection bias, A.F.), they still fail to replicate the experimentally determined results.” (p. 617)

A little sidestep plus advertisement

- Falk, Lalive and Zweimüller (2002) conducted a controlled program evaluation experiment
- We invited unemployed persons who take part in a training program (PC-courses)
- We sent out applications for them (detailed CV, letter etc.)
  - One set of applications without course certificate
  - One set of applications with course certificate
- Everything else kept equal
- Probability of getting an invitation for a job interview as dependent variable
- We found no significant effect
- Method: Correspondence testing, particularly used for analysis of discrimination

Control of preferences: Induced Value Theory

- In many experiments the experimenter wants to control subjects' preferences. How can this be achieved?
- Subjects' homegrown preferences must be "neutralized" and the experimenter "induces" new preferences. Subjects actions should be driven by the induced preferences.
- Reward Medium: Money $m = (m_0 + \Delta m)$ where m_0 represents a subject's "outside"money, Δm denotes money earnings in the experiment.
- Subject's unobservable preference: $V(m_0 + \Delta m, z)$
  - z represents all other motives.

Assumptions (Smith (AER, 1976))

- Monotonicity: Subjects must prefer more of the reward medium to less and not become satiated. Formally: V_m exists and is strictly positive for every feasible combination of (m,z).
- Salience: The reward Δm depends on a subject's actions (note: show up fee is not salient).
- Dominance: Changes in a subject's utility from the experiment come predominantly from Δm and the influence of z is negligible (this assumption is the most critical).
  - Problem: V and z are not observable.
- If these conditions are satisfied, the experimenter has control about the subjects' preferences, i.e., there is an incentive to perform actions that are paid.

Interpretation of z

- Boredom, e.g., creates game playing incentives
  - If you have pressed 22 times the x-button you like to see what happens if you press the y-button
- Public information on all payoffs renders relative comparison motives important (envy, fairness)
- Subjects want to help or hinder the experimenter (experimenter demand effects)

- Potential solutions
  - Make Δm sufficiently large
  - Avoid public information about payoffs
  - Do not give hints about the purpose of the experiment
  - Use a neutral language in the instructions

Illustration

- Experimenter wants to induce the utility function U(x,y)
    - x: number of slips of red paper
    - y: number of slips of blue paper
- The experimenter pays subjects according to the final holdings of x and y.
- She gives and explains subjects the reward matrix R(x,y)= Δm where R(x,y) is identical to the utility function U(x,y) she wants to induce.

- Subjects thus have the following preference:
- $V(m_0+U(x,y), z)$

- Following preferences are induced: $V(m_0+U(x,y), z)$
- To show: If the MRS between x and y under the utility function V is identical to the MRS under the function U or R, resp., V and U represent the same preferences with regard to x and y.

$$MRS^V = \frac{\frac{\partial V}{\partial m}\frac{\partial U}{\partial x} + \frac{\partial V}{\partial z}\frac{\partial z}{\partial x}}{\frac{\partial V}{\partial m}\frac{\partial U}{\partial y} + \frac{\partial V}{\partial z}\frac{\partial z}{\partial y}} = \frac{\frac{\partial V}{\partial m}\frac{\partial U}{\partial x}}{\frac{\partial V}{\partial m}\frac{\partial U}{\partial y}} = \frac{\frac{\partial U}{\partial x}}{\frac{\partial U}{\partial y}} = MRS^U$$

- Dominance ensures that z is not a function of x and y (full dominance); at least the effects of x and y on z are relatively “small”.

- By controlling $R(x,y)$, i.e., the relation between intrinsically worthless objects and the reward medium, the experimenter can induce $U=R$.
- Experimenter has to implement and subjects have to understand $R(x,y)= \Delta m$ (salience), have to be motivated by m (monotonicity) and not by other influences (dominance), i.e., z does not depend on x and y.

Another short sidestep: Experiments vs. questionnaire studies (not paying the subjects)

- Paying subjects essential for economic experiments
- What people say they would do in hypothetical circumstances does not necessarily correspond to what they actually do if actions have monetary consequences (e.g., Glaeser/Laibson/Scheinkman/ Soutter, C. (2000). Measuring Trust, The Quarterly Journal of Economics, Vol. 115, S. 811-841.)
- Are you a fair person?
  - o Do you help others who are in need?
  - o Would you say, that you say what you mean?
- Questionnaires help to understand behavior in the lab (socioeconomic, personality etc.)
- Complementarity of methods!
  - o E.g.: Fairness in labor relations (see below)

Objectives of experiments

- Testing theories
- Establish empirical regularities as a basis for new theories
- Testing institutions and environments
- Policy advice and wind-tunnel experiments
- The elicitation of preferences
  - Goods, risk, fairness, time
- Teaching experiments

Testing theories

- Test a theory or discriminate between theories
  - Economic theory provides the basis for experimental abstraction and experimental design
  - Implement the conditions of the theory (e.g., preference assumptions, technology assumptions, institutional assumptions)
  - Compare the prediction with the experimental outcome
  - Note: an experimental test is always a joint test concerning all assumptions (in particular also induced value theory)

- Explore the causes of a theory's failure
  - Find out when the theory fails and when it succeeds
  - Design proper control treatments that allows causal inferences about why the theory fails (Example: Bargaining Experiments)

Establish empirical regularities as a basis for new theory

- Well established empirical regularities direct the theorists' effort (e.g., theories of fairness, see below) and can help develop empirically relevant theories
- In the presence of multiple equilibria (e.g., in repeated games), experiments may help to select relevant ones
- Allows to go beyond the present state of the art in theory (Example: continuous double auction)
- The failure of the homo economicus concept (rationality and selfishness) has led to a great body of new theories (Bounded rationality, learning, Fairness theories etc.)

Institutions and environments

- Compare environments within the same institution
  - How robust are the results across different environments?
- Compare institutions within the same environment
  - Allows for welfare comparisons even when no theory about the effects of the institution is available (Example: continuous double auction versus continuous one-sided auction)
  - Usual aggregate welfare measure: Aggregate amount of money earned divided by the maximum that could be earned

Policy and wind-tunnel experiments

- Evaluate Policy Proposals
  - Does the reduction of entry barriers increase aggregate welfare?
  - Which auctions generate the higher revenue? (e.g., in arts auctions or UMTS license auctions)
  - Do emission permits allow efficient pollution control?
  - Workfare and welfare incentives
- The laboratory as a wind tunnel for new institutions
  - What are the distributional and welfare consequences of incentive compatible mechanisms?
  - How does a privatized electricity industry with small numbers of suppliers and intermediate traders work?

The elicitation of preferences

- How much should the government spend on avoiding traffic injuries?
- How much should be spend on the conservation of nature?
- In general: How should nonmarketable commodities be produced? How should they be distributed?
- Does relative comparison affect people's preferences, i.e. are there important consumption externalities? Answer is important for tax policy, growth policy, etc.

Elicitation…

- A nonarbitrary and nonpaternalistic answer to these questions depends crucially on one's view how much people value the above goods.

- Yet, measuring people's values requires a theory of individual preferences and knowledge about the strength of particular "motives" (preferences). This requires the testing of individual choice theories and instruments for the elicitation of preferences.

Teaching experiments

- Better understanding of economic phenomena
  - Markets
  - Bargaining
  - Social dilemma

- Own experience important
  - „Failing“ to behave rationally or optimally
  - Anomalous behavior

- Starting to think about economic questions differently

Internal and external validity

- Internal validity: Do the data permit causal inferences? Internal validity is a matter of proper experimental controls, experimental design, and data analysis.
- External validity: Can we generalize our inferences from the laboratory to the field?

External validity raises two questions

- Isomorphism: are the relevant conditions in the experiment and in the “real” world similar? (also called: Parallelism)
  - o The honest skeptic who challenges the external validity of an experiment has to argue that the experiment does not capture important conditions that prevail in reality.
  - o Response: Try to implement the neglected conditions.

- Induction: Will behavioral regularities persist in new situations as long as the relevant underlying conditions remain substantially unchanged?

Induction

- You observe the sun rise every morning for 50 years. Yet, deductive logic does not imply that the sun will rise again tomorrow morning. Despite this most people believe that it will rise again. This act of faith is called induction.
- No experiment, in fact no empirical result whatsoever can prove that under the same circumstances the same will happen again.
- Yet, if an experiment implements certain conditions that generate robust and replicable regularities, we can have faith that the same regularities will occur in reality given that the conditions are met.

General Remark

- Whether the conditions implemented in the laboratory are also present in reality will probably always be subject to some uncertainty.
- Therefore, laboratory experiments are no substitute
  - o for the analysis of field happenstance data
  - o for the conduct and the analysis of field experiments
  - o and for survey data.
- This calls for a combination of all these empirical methods.

Frequent objections against experiments
(see Falk/Fehr, Labour Economics 2003)

- *Experiments are unrealistic*
- Most economic models are unrealistic in the sense that they leave out many aspects of reality.
- However, the simplicity of a model or an experiment is often a virtue because it enhances our understanding of the interaction of relevant variables. This is particularly true at the beginning of a research process.
- Whether realism is important depends on the purpose of the experiment. Often the purpose is to test a theory or understanding the failure of a theory. Then the evidence is important for theory building but not for a direct understanding of reality.

Comments on realism

- Ch. Plott (JEL 1982, p. 1509): “The art of posing questions rests on an ability to make the study of simple special cases relevant to an understanding of the complex. General theories and models by definition apply to all special cases. Therefore, general theories and models should be expected to work in the special cases of laboratory markets. As models fail to capture what is observed in the special cases, they can be modified or rejected in light of experience. The relevance of experimental methods is thereby established”

- Ch. Plott (JEL 1982, p. 1482): 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.

Objections continued

- *Experiments are artificial*, because
  - o of subject pool bias (students)
  - o low stakes
  - o small number of participants
  - o inexperienced subjects
- This is no fundamental objection
  - o Use other subjects, e.g.,: (Fehr et al., JLE 1998: soldiers; Cooper et al. AER 1999: managers)
  - o Increase the stake level, e.g.,: (Holt/Laury, AER 2002; Cameron, JRU 1999)
  - o Increase the number of participants, e.g.,: (Isaac and Walker, J.Pub.E 1990; Bellemare/Kröger 2003)
  - o Recruit experienced participants, e.g.,: (Kagel/Levin, AER 1986)

Limits of experiments

- Control is never perfect
  - Weather, Laboratory environment
  - No real control about z (no dominance)
  - Self-selection: who takes part in the experiment?
- Experiments compared to theory
  - Experiments are never general, just an example
  - No comparative static or simple change of assumptions etc.
- Experiments compared to field studies
  - Can all preferences be induced? For example:
    - Time preference (an experiment lasts 2 hours)
    - Disutility of labor (just a number, i.e., monetary equivalent? See “real” effort experiments)

An Illustration: Classroom Experiments

For each experiment we discuss:

- Purpose of the experiment
- Key techniques
- Results

Experiment 2

- Many, if not all economic decisions involve risk.
- It is commonly believed that many people have strong preferences regarding risk.
- Some people are **risk averse**, I.e. they would rather have Y euro for sure, rather than play a gamble with expected value of X euro, which is greater than Y.
- Some are **risk neutral**, I.e. they are indifferent between X for sure and a lottery with expected value of X.
- Some may be **risk loving**, I.e. they prefer the lottery to receiving X for sure.
- Little evidence on what determines risk attitudes, and on how much heterogeneity there is.

Risk attitudes and MU

- The standard explanation for risk attitudes is based on the **curvature of the utility function**.

- E.g. risk aversion is due to Diminishing Marginal Utility (DMU) of lifetime wealth.

- **Certainty equivalent**: amount of money Z such that you are indifferent between playing a lottery, and receiving Z for sure.

- Another definition of risk aversion: individual's certainty equivalent is less than EV of lottery.

Experiments and risk attitudes

How prevalent is risk aversion?

What determines risk attitudes?

- Does risk aversion increase with age?
- Are risk attitudes passed on genetically? Socially?

Can we measure the degree of risk aversion of an individual?

- The degree of risk aversion would then be an ideal explanatory variable for a multitude of economic decisions.

What techniques will be important?

- We want to know an individual's **true** certainty equivalent for a particular lottery.
- We will say that people with a lower certainty equivalent are more risk averse.
- Thus, it is crucial that the monetary incentives be real.
- If we just ask hypothetical lottery questions, people may not take the risks seriously, and we do not get an accurate indication of risk attitudes.

Techniques continued…

One way to get the certainty equivalent is to present a lottery, and ask for the certainty equivalent.

What amount of money do I have to pay you, to make you willing to play lottery B?

What is the problem with this technique?

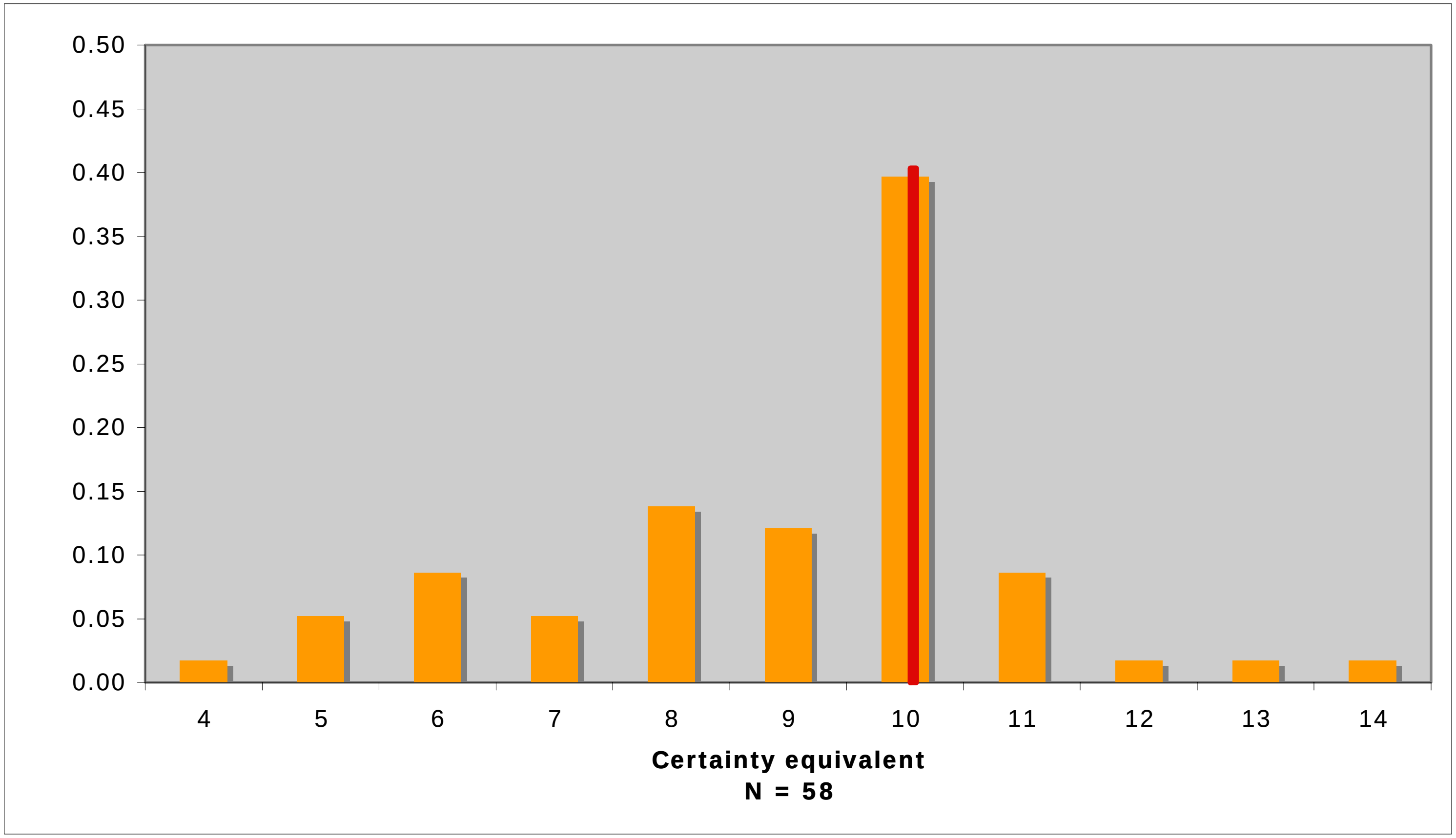
Incentive compatible design

Lottery: .5(20) + .5(0)   EV = 10

Situation	Option A	Option B	I choose Option A	I choose Option B
1	50% chance win 20 50% chance win 0	win 1	✓	o
...	...	...	...	...
8	50% chance win 20 50% chance win 0	win 8	✓	o
4	50% chance win 20 50% chance win 0	win 9	o	✓
5	50% chance win 20 50% chance win 0	win 10	o	✓

Average certainty equivalent: **8.89 Euros**

Distribution of certainty equivalents



Experiment 3

Lottery: .5(25) + .5(-5)   EV = 10

Situation	Option A	Option B	I choose Option A	I choose Option B
1	50% chance win 25 50% chance lose 5	lose -5	o	o
...	...	...	...	...
8	50% chance win 25 50% chance lose 5	win 8	o	o
4	50% chance win 25 50% chance lose 5	win 9	o	o
5	50% chance win 25 50% chance lose 5	win 10	o	o

Average certainty equivalent: **7.97 Euros**

Distribution of certainty equivalents