Experimental and Behavioral Economics
Ernst Fehr (Univ. of Zürich & MIT)

- Lecture takes place every Wednesday 4 – 7 pm, from September 8th 2003 – October 15th 2003

- Mini-course on z-Tree, one of the leading software packages in experimental economics by Dr. Urs Fischbacher

- Mini-course takes place on Thursday September 18 – Friday September 19 in 4 blocks of 3 hours each (exact details follow).

Experimental and Behavioral Economics - Course Outline

- Lecture 1&2: Advantages and Limitations of Laboratory Experiments
- Lecture 3: Competitive Experimental Markets
- Lecture 4: Bargaining Behavior
- Lecture 5: Fairness and Competition
- Lecture 6: Voluntary Cooperation and Public Goods Provision
- Lecture 7: Theories of Fairness and Reciprocity
- Lecture 8: Enforcement of Social Norms
- Lecture 9: Behavioral Economics of Incentives and Contracts I
- Lecture 10: Behavioral Economics of Incentives and Contracts II
- Lecture 11: Loss Aversion and Labor Supply
- Lecture 12: The Economics of Money Illusion

Expected Performance

- Design an experiment including the writing of instructions and develop behavioral predictions.
- This involves, among other things, answering the following questions:
  - Which economic question do you want to answer with your experiment?
  - What are the potential answers to your question?
  - What are the advantages and disadvantages of an experiment for answering your question?
  - What are the chances that the result of your experiment will surprise others? Will anybody change his/her opionion?
  - How do you conduct the experiment? (Describe the design and write down the instructions)
  - Is you design the simplest possible design to answer your question?

Lecture 1&2: Advantages & Limitation of Lab Experiments

- Experimental and behavioral economics
- An example – buying & selling in a market
- Advantages of lab experiments
- Objections to lab experiments
- Controlling Preferences: Induced-Value-Theory
- Objectives of lab experiments

"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)

"**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))

2002: Vernon Smith and Daniel Kahneman receive the Nobel Prize

- **Vernon Smith**: „for the use of laboratory experiments as a tool in empirical economic analysis, in particular, for the study of different market mechanisms“. **Founder of experimental economics**.
- **Daniel Kahneman**: „for the introduction of insights from psychological research into economics, in particular with regard to judgements and decisions under uncertainty“. Kahneman's research is based on psychological experiments and questionnaires. **Founder of behavioral economics**.
- An Irony: In 1991 (JPE) Smith attacked Kahneman. His claim: Anomalies at the individual level play no role at the aggregate level, in particular, in competitive markets.

Experimental Economics (EE)

	Happenstance Data	*Experimental Data*
Field Data	GDP Inflation	Income Maintenance Experiments Incentive Experiments in Firms
Lab Data	Discovery of Penicillin Reciprocity & Contract Enforcement Money Illusion, ...	Experimental Markets Bargaining Experiments ...

Behavioral Economics (BE)

- PUP Series in behavioral economics

- Behavioral economics uses facts, models, and methods from neighboring sciences to establish descriptively accurate findings about human cognitive ability and social interaction and to explore the implications of these findings for economic behavior. The most fertile neighboring science in recent decades has been psychology, but sociology, anthropology, biology, and other fields can usefully influence economics as well. Behavioral economics is deeply rooted in empirical findings or methods, and advances economics on its own terms – generating theoretical insights, making more accurate predictions of field phenomena, and suggesting better policy.

My Speculation

- Experimental economics is essentially a method of empirical investigation. If successful the method will become a standard instrument in economist‘s toolbox.
- Behavioral economics is concerned with importing relevant insights from other disciplines to economics. Since, by definition, these insights have so far been neglected, it is in opposition to mainstream econ.
- There is only a limited number of insights from other disciplines that are of first-order importance for economics. If these insights are incorporated into mainstream economics BE ceases as a separate sub-field in economics.

My Approach

- Use EE tools to study neurological, psychological and sociological forces in important economic contexts. Combination of EE and BE.

- In general, economists are mainly interested in the aggregate outcomes of interactive games.

- Experiments are an excellent tool for studying how „neglected“ forces play out at the aggregate level.

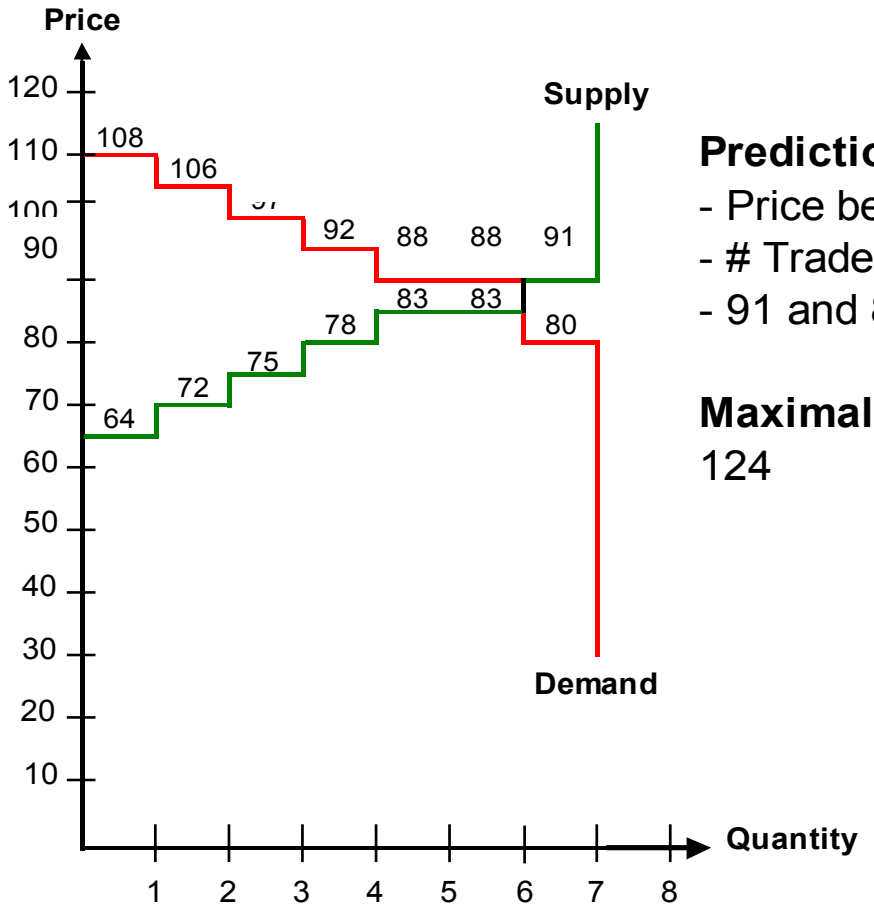
An Example: Buying and Selling on a Market (Instructions)

- In the following experiment you are either a buyer or a seller. The experiment is partitioned into periods. In total, there are 5-8 periods and one period lasts 3 minutes. During the period each buyer can buy at most one unit of the good and each seller can sell at most one unit of the good. By buying and selling you can earn money.
- Each seller receives a sheet of paper with information about the unit costs c of the good. If a seller sells at price p he earns $p - c$. If he sells nothing his profit is zero.
- Each buyer receives a sheet of paper with information about the resale value v of the good. If the buyer buys at price p he earns $v - p$. If he buys nothing his profit is zero.
- $p - c$ and $v - p$ are the profits per period. In each period the same unit costs and resale values prevail. Total profits are given by the sum of profits over all periods.

Trading Rules (Double Auction)

- If a buyer wants to bid he raises his hand and announces: **buyer xx bids yy**. As long as a buyer has not yet traded he can make as many bids as he likes. The bids have to obey the **improvement rule for buyers** – each bid must be higher than the highest prevailing bid.
- A seller who wants to make an ask raises her hand and announces: seller xx demands yy. As long as a seller has not yet traded she can make as many asks as she likes. The asks have to obey the **improvement rule** for sellers - each ask must be lower than the lowest prevailing ask.
- Each buyer can accept a seller‘s aks and each seller can accept a buyer‘s bid. Acceptance leads to a binding contract. The other bids and asks of accepting traders are no longer valid. Each subject who traded once in a period cannot conclude any further contract in that period.

Competitive Predictions



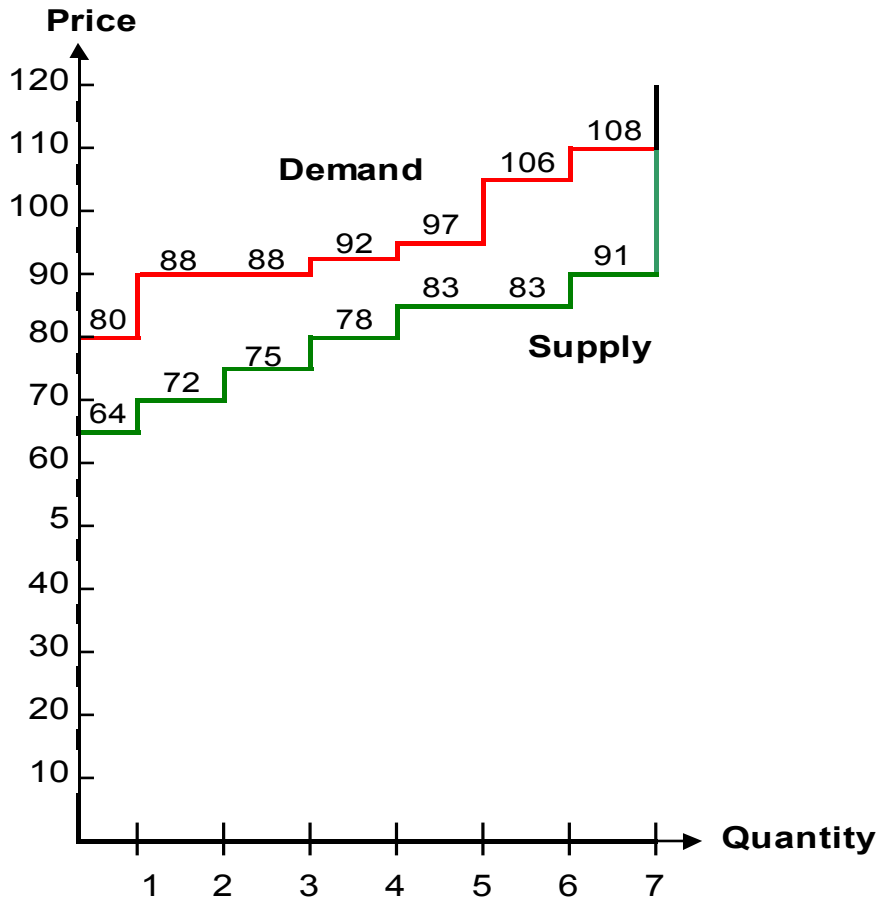
Prediction

- Price between 83 - 88
- # Trades: 6
- 91 and 80 do not trade

Maximal gains from trade:

124

These predictions are not obvious!



In principle, all potential units could be traded so that all subjects actually trade.

Prices could be very different.

There is no full game theoretic solution yet available (though see Sadrieh 2000).

What did we learn?

- Competitive equilibrium prediction organizes the data well although every trader is a price taker as well as a price maker and although there is no auctioneer who limits trading to equilibrium trades.

- In general, prices are in the predicted interval.

- Efficiency is high.

- In general, only those who are predicted to trade do actually trade.

Components of an Experiment

- **Environment**:
  - Preferences, technologies, initial endowment
  - ...implemented by appropriate monetary incentives.
- **Institution** (Rules of the game)
  - Feasible actions
  - Sequence of actions
  - Information conditions

  - Lab experiments often (implicitly or explicitly) define a game. => Game theory and experimental economics are strongly related and affect each other.
- **Framing** of instructions.

Advantages of (Lab) Experiments – Enhanced Control

- Subjects are randomly assigned to the treatment conditions – rules out selection bias.

- It is known which variables are exogenous and which are endogenous – allows to make causal inferences.
  - Does money cause output or does output cause money?

- Experimenter can make ceteris paribus changes in the exogenous variables – allows for the isolation of true causes.

- Many variables that cannot be directly observed in the field can be observed in the lab.
  - Reservation wages, anticipated versus non-anticipated money supply shocks.

Advantages - continued

- Informations conditions and exogenous stochastic processes can be controlled.
  - Important for the testing of models with asymmetric information.
  - Are financial markets informationally efficient?
- Enhanced control opportunities often imply that the experimenter knows the predicted equilibrium exactly.
  - Equilibrium and disequilibrium actions can be explicitely observed.
  - Quick or sticky adjustment can be explicitly observed
  - Example: What are the supply and demand schedules that underlie observable price & quantity data? Is the observed price-quantity combination a competitive equilibrium?

Advantages - continued

- Better direct controls are often a substitute for complicated econometric methods.

- Replicability – provides the basis for statistical tests. Critics can run their own experiments.

Lack of Control – an Illustration

- Question: Do employment and training programs increase mean annual earnings of participants?

- Basic econometric problem: selection bias.
  - More ambitious people participate (upwards bias).
  - More optimistic people participate.
  - Subjects with low earnings prospects participate (downwards bias).

- Solution: apply econometric techniques to control for selection bias.

Lack of Control – Lalonde AER 1986

- Take data from a controlled field experiment in which individuals are randomly assigned to the treatment condition ("training") and the control condition ("no training"). Rules out selection bias.
- Exercise 1: Conduct a simple non-parametric test that compares the average incomes in the two conditions.
- Exercise 2: Assume that you do not know that subjects are randomly assigned. Apply econometric techniques to control for selection bias.
- Striking result:

  "*Even when the econometric estimates pass conventional specification tests (designed to control for sample selection bias, E.F.), they still fail to replicate the experimentally determined results*." (p. 617)

Objections to Lab Experiments: Lack of external validity

- Internal validity: Do the data permit causal inferences?
  - Internal validity is a question of proper experimental controls and correct data analysis.

- External validity: Can we generalize our inferences from the lab to the field?
  - Problem of induction: Behavioral regularities persist in new situations as long as the relevant underlying conditions remain essentially unchanged.
  - Problem of representativity: Are experimental subjects representative for out of sample applications?

Objections - Remarks on Induction

- For millenia the sun rises every morning. Yet, this does not allow you to make the inference that tomorrow morning the sun will rise again. Nevertheless, almost all people believe this. This confidence is the essence of induction.
- No experiment and no other empirical result whatsoever can prove that under the same circumstances the same regularities will prevail.
- Yet, if many experiments have shown that – given a certain set of conditions – robust and replicable regularities emerge, we can have faith that the same regularities will occur in reality given that the conditions are met.
- Therefore, an honest sceptic who doubts the external validity of an experiment, has to argue that the experiment does not capture important conditions that prevail in reality.
- Response: Try to implement the neglected conditions.

Objections – Lack of Realism

- Lab experiments are unrealistic and artificial

- 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.

Objections - continued

- Ch. Plott (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 (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.”

Other Objections

- Participants are just students – lack of representativity
- The stakes are small
- The number of participants is small
- Participants are inexperienced

- Response
  - Take other subject pools (workers, soldiers, CEOs)
  - Conduct representative experiments (Fehr et al. 2003)
  - Increase the stakes (Cameron EI 1999, Slonim & Roth Ectra 1997, Fehr et al. 2002).
  - Increase the number of participants (Isaac and Walker, J.Pub.E 1994)
  - Invite experienced participants (Kagel&Levin, AER 1986)

Objections – General Remarks

- **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 for the analysis of field happenstance data, for the conduct and the analysis of field experiments and survey data. This calls for a **combination of all these empirical methods**.
- **My strategy**: Choose important unresolved debates in theoretical or empirical economics and highlight the contested issues by rigorous experiments (Examples: Gift Exchange Markets, Cooperation and Punishment, Nominal Inertia, Relational Contracts)
- To be a good experimental economist you have to be a good economist.

Controlling Preferences (Induced Value Theory, Smith AER 1976)

- 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.
- Use of money as a reward medium: Δm denotes the subject's money earnings resulting from her actions in the experiment. m_0 represents a subject's "outside" money. Total money holdings are $m = (m_0 + \Delta m)$.
- Subject has *unobservable* preference

$$V(m_0 + \Delta m, z)$$

- z represents all other motives.

Controlling Preferences - Assumptions

1. **Monotonicity**: V_m exists and is strictly positive for any (m,z)-combination.

2. **Dominance**: Changes in a subject's utility from the experiment come predominantly from Δm. The influence of z is negligible.

- If monotonicity and dominance are met the experimenter has control over the subjects' preferences, i.e., subjects face economic incentives for those actions that are paid and other motivators are negligible.

- A flat payment for participation in the experiment does not establish control over preferences. This also holds for questionnaires.

Interpretation of z

- Boredom – experiments with hundreds of periods are problematic.
- public information about individual payoffs may render relative comparison motives important (envy, fairness).
- Experimenter demand effects – Subjects want to help or hinder the experimenter; they receive subtle hints what they should or are expected to do.
- Solutions
  - Make Δm sufficiently large.
  - Avoid public information about payoffs.
  - Avoid any hints regarding the purpose of the experiments.
  - Use 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 red and blue paper slips. The monetary payoff function R(x,y) is identical to the utility function U(x,y).
- Subjects have the following preference:

$$V(m_0+U(x,y), z)$$

- Since the MRS between x and y under the utility function V is identical to the MRS under the function U or R, respectively, V and U represent the same preferences with regard to x and y.

$$MRS^V = V_1U_x/V_1U_y = U_x/U_y = MRS^U = R_x/R_y = MRS^R$$

- Remark: Dominance ensures that z does not depend on x and y, i.e., homegrown preferences do not disturb induced preferences.

Purposes of Lab Experiments

1. Testing theories
2. Elicitation of preferences

   Goods, risk, fairness, time
3. Exploring boundedly rational behavior
4. Establish empirical regularities as a basis for new theories
5. Theory free comparison of institutions
6. Wind tunnel experiments
7. Teaching experiments

1. Testing Theories

- Economic theory provides the basis for experimental abstraction and experimental design .
- Implement those conditions of the theory (e.g. preference assumptions, technology assumptions, institutional assumptions) that you do **not** want to check. Comparison of the predictions with the experimental outcome provides a test of those components of the theory that are established through the subjects' behavior.
- Attention: often this comparison is a joint test of several assumptions.
- When does the theory fail, when does it succeed?
- Design proper control treatments that allow causal inferences about why the theory fails (example: bargaining experiments)

2. Elicitation of preferences

- How much money should be spent to avoid traffic accidents? (involves risk preferences)
- How much money should be spent on protecting the natural environment? (involves preferences for public goods)
- Should the government subsidize savings? (involves time preferences)
- A nonarbitrary and nonpaternalistic answer to these questions depends crucially on one's view about how much people value the above goods.
- 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.

3. Exploring Bounded Rationality

- Do people make systematic mistakes in risky decisions or intertemporal choice?
- To what extent do people apply backwards inductions?
- How do people form beliefs about the behavior of others‘?
- Are people prone to money illusion?
- Above all: How does bounded rationality play out in strategic games, i. e. to what extent does it affect aggregate outcomes?
- How and what do people learn?

4. Establish Empirical Regularities as a Basis for New Theories

- Well established empirical regularities direct the theorists' effort and can help develop empirically **relevant** theories.

- Experimenter can implement important games for which no game theoretic predictions exist because the analysis is too complicated (example: double auction)

5. Theory Free Comparison of Institutions

- To learn something about the efficiency properties of institutions it is not necessary to have a full theory that explains and predicts behavior
  - Welfare measure: total money earnings of all subjects in the experiment divided by the total earnings.

- Example: double auction versus one-sided continuous auction

- Check the robustness of institutions in different environments.

6. Wind Tunnel Experiments

- **The great thing about economic theory is that one can examine what would happen if one changed policies or implemented new institutions.**
- Does the reduction of entry barriers increase aggregate welfare?
- Which auctions generate the higher revenue for government securities?
- Do tradable emission permits allow efficient pollution control?
- How should airport slots be allocated?
- How can the market for hospital doctors be organized efficiently?
- Which institutions ensure an efficient provision of public goods?
- **The great thing about economic experiments is that they allow us to examine these questions empirically.**

Clarification of Terms

- Experiment
- Session = Experiment date with a group of subjects.
- Treatment = Experimental condition (HC or LC)
- (Cell)
- Subject = Participant

9. May 2001 13:00	High cost	Low cost
9. May 2001 16:00	High cost	Low cost
9. June 2001 14:00	Low cost	High cost
11. July 2001 13:00	Low cost	High cost
12. July 2001 13:00	High cost	
12. July 2001 16:00	Low cost	