Experimental Economics

Lecture 2: Some design issues
(based on slides by Armin Falk)

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Steps

• Questions
• Design
• Hypotheses
  - Standard
  - Alternative
• Preparing the experiment
  - Instructions
  - Computer program
  - Procedural details
• Running the experiment
• Data analysis
• Writing the paper and presenting the results
Technicalities of experiments

- **Treatment**: a particular condition of the experiment
  - Often there is a (main) treatment and a control treatment (or more).
  - Everything else kept equal, only one change

- An **experiment** usually consists of several **sessions**.
  - In a session a group of people takes part in the experiment at a particular date and place.

- **Subjects** are participants in the experiment.
Across- and Within-Subject-Design

• **Within-Subject-Design**: Subjects participate in more than one treatment
  - Allows for individual comparison
  - Control for individual fixed effects
  - More powerful tests
  But: Problem with order effects as in the second treatment subjects have learned something already. Solution: reverse order to control for order effects (AB / BA Design).

• **Across-Subject-Design**: Subjects participate only in one treatment
What are observations?

- Distinction between observation and statistically independent observation
- Example: 5 Sessions of a market experiment with ten periods and ten trades each
  - 500 price observations
  - Only 5 independent observations (means per session, which in this case is a matching group)
  - Independent because no interaction across matching groups
- If there are only few (independent) observations, experimentalists often use non-parametric tests instead of regressions.
One shot vs. repeated interactions

• Pro One-Shot
  - Strong incentives for decision
  - No strategic spillovers across periods
  - Easy to perform and short

• Pro repetitions (“repeated one-shot”)
  - Learning
  - Possible to observe dynamics, e.g., convergence to equilibrium
  - More observations
Implementing repeated games

• E.g., partner design: Groups of subjects stay together for more than one period

• Finitely repeated game
  - If only selfish types and unique Nash equilibrium in stage game: backward induction gives solution to game (start in last period…).
  - If stage game has multiple Nash equilibria, no unique prediction (“anything goes”).
  - If multiple types (e.g., reciprocal and selfish players), many Bayesian Nash equilibria.
Implementing repeated games

• “Infinitely” repeated game
  - Implementation with the help of a termination probability
  - Problem: length of the experiment is endogenous
    ~ Do you want to throw dice for five hours?
    ~ What if after the first period the game ends?
    ~ Different sessions have different lengths
Partner vs. stranger design

- Partner (groups of subjects stay together for several periods)
  - Every pair/group of partners yields one independent observation
  - Allows analysis of strategic considerations
- Stranger (pairs or groups are recomposed randomly)
  - Similar behavior/prediction as “one-shot” but more observations
- Perfect stranger: probability of being re-matched with the same person is exactly zero (and subjects know that)
Strategy method

- Strategy method was first used by Reinhard Selten.
  - Idea: Instead of just playing the game, subjects are asked to indicate an action at each information set
  - i.e., the experimenter elicits a strategy

- Example: Sequential prisoner’s dilemma
  - Second mover is asked: What do you do (defect or cooperate)
    ~ if first mover cooperates?
    ~ if first mover defects?
• Advantages of strategy method
  - More information about motivation/behavior of players
    (Figure out, e.g., that someone is a reciprocal player, even though first movers always defect)
  - Information about how people would play “off equilibrium” or “off action path” (since this is not usually reached, you have no information how they play unless use strategy method)

• Problems of strategy method
  - Incentives are weaker, since each information set is reached only with probability < 1.
  - Hot vs. cold emotions: People might feel and act differently knowing they have reached a particular information set, compared to potentially reaching it.
  - Explaining the strategy method to subjects is tricky (loss of understanding, control)
  - Lose move structure of game
• Does strategy method induce a different behavior relative to a situation where a subject responds to the actual move of an opponent?


• Moreover: You may use strategy method in all your treatments, and focus on treatment differences.
Role switching

- Role switching: Subjects act in different roles, e.g., in the ultimatum game as a proposer and a responder.
- Helps to put oneself in the shoes of the other person. This can be useful for learning in complex games (e.g. signaling games).
- May not be a good procedure because you lose information about how people act in a given role (e.g. when focus is on fairness).
Learning rounds

• In complicated experiments (e.g., with difficult trading rules in markets) it is a good idea to have subjects try out the rules of the game first, without monetary consequences.

• Advantages
  - Guarantees subjects’ understanding from the first paid period on
  - Allows answering “new” questions of subjects that arise after learning trials

• Disadvantages
  - You lose information about the “true” first period
  - People infer uncontrolled things from the learning trials
  - Subjects may send (costless) signals

• Makes most sense if the institutions are really difficult. Maybe it is not necessary to play a full game (e.g., just the complicated part) and maybe it is not necessary to display all information about others’ actions.

• In any case: if learning trials, then in all treatments
Implementing risky decisions

• Most important: use credible chance moves
  - If many chance moves are necessary: Random device at the computer
  - If only few chance moves and if credibility is easily doubted (e.g., imposing infinitely repeated games): Throwing dice may be better, and may have people do that on their own.

• Risk preferences
  - May influence theoretical predictions.
  - In theory, possible to control risk preferences with binary lottery method:
    ~ In the experiment earn points
    ~ Payments depend on winning a lottery
    ~ Probability of winning higher the more points a subject has

[Works due to linearity of expected utility in probabilities.]
Losses

• Interesting to study losses
• Asymmetry between gains and losses (prospect theory, e.g., Kahneman/Tversky 1992)
• Relative to a given reference standard, people dislike a loss more than they like a gain of equal size.
• Sometimes losses may occur given the nature of the experiment (e.g., in auction experiments)
Eliciting beliefs

- Example: Prisoner’s dilemma
  - Before subjects make their decisions, both players are asked what they think the other player will do, cooperate or defect?
- Advantages
  - Beliefs can be informative to understand the motivation
  - Beliefs can be used to check the rationality of decisions (Example: guessing game)
- Problems
  - Experimenter-Demand–Effect (you may make people think about stuff they would not have thought about)
  - Desire to be consistent: people state beliefs to “match” their actions
  - People have a desire to “justify” actions: someone defects and states the other person will defect also
Pay beliefs?

- **Pros**
  - Subjects have an incentive to state correct beliefs
- **Cons**
  - Costly and – given a budget – goes at the cost of incentives in the decision part
  - Subjects have no incentive to state wrong beliefs anyway
  - Sometimes complicated to explain (e.g., payment dependent on distance measure between true outcome and expected outcome, „quadratic scoring rule“)
  - Can pollute incentives in the experiment if people “hedge” decisions, e.g., in coordination games
Paper and pencil vs. computerized experiments

- Advantages of paper and pencil experiments
  - Flexibility (quickly develop new treatments)
  - Relatively low start up costs
  - Natural environment
    ~ Not a lab with computers etc. but a classroom
    ~ Procedures more visible and credible (e.g., throw dice)
  - Matching of people is easy to recognize (walking around of experimenter)

- Advantages of computerized experiments
  - Better control
    ~ no communication among subjects
    ~ less interaction with experimenter
  - Running of experiment much simpler (e.g., markets)
  - Fewer mistakes
  - Automatic data collection
Deception

• Never cheat on subjects, even though it is tempting from a scientific point of view.

• Why?
  - You will lose your reputation towards your subjects: If you lie once they will never believe you in the future. This blurs all incentives.
  - There is a moral code among economic experimentalists not to do it. You will never publish a paper and people won‘t like your research.
Hypotheses

• In almost all experiments you want to have a set of predictions / hypotheses

• Traditional assumptions in game theory:
  - Rationality
  - Selfishness = money maximizing
  - Both are „common knowledge“

• Determine equilibria
  - Often simple and unique prediction
  - But often describes behavior not very well

• Use the standard prediction as a benchmark
Deriving alternative predictions

- Observations from everyday life, intuition
- Previous experimental results (economics, psychology)
- Game theoretic analysis under alternative assumptions
  - Prospect Theory (risk behavior, loss aversion)
  - Fairness theories
  - Statistical game theory, QRE (errors depend on cost of error)
  - Level-k model (limited steps of reasoning)
  - Visceral factors, emotions
Writing instructions

• Simple language
  - Simple, short and unambiguous sentences
  - Use redundancies if issues are complicated
  - Consistent/uniform descriptions and framing
  - Avoid suggestive terms
    ~ Punishment: negative points
    ~ Defect: contribute nothing

• Pros and cons of Framing
  - Concrete framing (goods market, labor market)
    ~ Easy to understand
    ~ Problem (?): Associations from real life
  - Abstract framing
    ~ Avoids every day associations (does it really?)
    ~ Harder to understand the rules of the game
    ~ No control about what subjects really think
Instructions

• Complete description of the rules of the game
  - Sequence of decisions
  - Interaction
  - Payoff consequences

• Different ways to explain the payoff function
  - Formula
  - Verbal explanation
  - Table
  - Figure

• Control questions
  - Check understanding
  - Knowing who is done with the instructions
  - One should not be suggestive with examples
Questionnaire

- Test understanding of experiment
- Infer something about motives
- Credibility of experiment
- Control
  - How many subjects did know each other?
  - Socio-economic questions (sex, age, money, city, subject of study etc. etc.)
- Psychological questionnaires (used to construct particular types)
Paying subjects

- Use hypothetical currency and convert it into Euro at the end of experiment
- Show up fee
  - To compensate extra subjects
  - To cover losses in the experiment
- Goal: total payments should cover opportunity costs (typical job)
- Ensure Anonymity when paying
Recruiting subjects

• Tell the subjects that it is an economic experiment
  - Study human behavior
  - Important for understanding economic problems

• Why should you take part?
  - You can earn money (do not mention concrete amounts of money: this creates expectations and may pollute behavior “if I do not earn at least x, I must have been wrong”)
  - Learn about an interesting method in the social sciences
Data analysis

• Collect data in systematic way (one master file, which remains unchanged)

• Descriptive statistics
  - Tables
    ~ Title, clear variable names, round numbers
  - Figures
    ~ As simple as possible, title, label axes, complete legend
    ~ Figures often understood and remembered best

• Test Hypotheses
  - Frequently used:
    ~ Means (t-Test)
    ~ Wilcoxon Signed Rank Test
    ~ Wilcoxon-Mann-Whitney Test
    ~ Kolmogorov-Smirnov Two Sample Test