

# **Lab Experiments — Introduction & Terminology**

## **Applied Microeconomics**

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# Introduction to Lab Experiments

- What is an experiment? "A scientific procedure undertaken to make a discovery, test a hypothesis, or demonstrate a fact". Different to naturally existing data, we as the scientists are involved in the data-generating process.
- In lab experiments, participants (typically university students) come to the lab (here the BonnEconLab, <https://www.bonneconlab.uni-bonn.de>) to make real decisions with real monetary and non-monetary incentives. The controlled environment of the lab allows a thorough analysis of subjects' behavior.

# Introduction to Lab Experiments

- Lab experiments are an empirical method.
- We should view them as such and have a pragmatic approach.
- In that spirit, questions you should ask yourself when thinking about and evaluating an experiment.
  - What is the research question the experiment tries to answer?
  - Is an experiment the best method to answer that research question?
  - What kind of experiment? (Lab, online survey, field....)
  - How does the ideal design look like?

# Introduction to Lab Experiments

- To answer these questions we need a precise understanding of what lab experiments can (and cannot) achieve....

# Advantages of Lab Experiments

## Control

- In experiments (especially in the lab) the researcher has tight control of the decision environments. The researcher can decide on....
  - material payoffs
  - the information participants possess when they make choices
  - the order in which the different parties can act
  - repeated or one-shot interaction
  - contextual features such as time pressure, cognitive load, alcohol level
- Control allows the researcher to manipulate and study specific aspects of the choice environment.

# Advantages of Lab Experiments

## Randomization

- Suppose you want to establish causality of  $x$  on  $y$
- This is often difficult with naturally occurring data due to issues of selection and endogeneity (we will discuss econometric methods to deal with such issues later in this course)
- In experiments, individuals (or groups) can be randomly assigned to experimental conditions
- By systematically varying  $x$  (and only  $x$ !) between experimental conditions and subsequently measuring  $y$ , we can establish causality of  $x$  on  $y$

# Advantages of Experiments

## Measurement

- In experiments we can observe things that are unobservable in naturally occurring data
  - beliefs
  - psychological traits
  - implicit and explicit preferences
  - physiological responses
  - attention

# Problems

## External validity

- External validity: how valid is it to draw conclusions of a scientific study outside the context of that study? How generalizable are results to other contexts, situations, times? In contrast, internal validity is the validity of conclusions drawn within the context of a specific study (is the identification sound etc).
- For every empirical study, external validity is an issue. This is nothing specific about lab experiments.



# Problems

- However, there are some specific threats to external validity for lab experiments
  - student sample: are students systematically different from rest of population? Probably yes, but this does not necessarily lead to a lack of generalizability, in particular when you look at comparative statics
  - artificial environment: do we get different results than in "real-life situations"
  - extent to which all this is a problem depends on research question. Lab is in particular great for providing "proof of concept" type of evidence.

# Problems

Hawthorne effect and experimenter demand

- Hawthorne effect: does the mere fact that people know that they are part of study and are being observed lead to a change in behavior?
- Experimenter demand: Do people attempt to guess the purpose/hypotheses of an experiment and then act according to that purpose (in order to please the experimenter)?
- Important to think carefully about experimenter demand when designing or evaluating an experiment. Most studies conclude that experimenter demand is not a first order concern

# Use of experiments

Lab experiment are typically used to:

- Test theory
- Establish a causal effect (not theory-based)
- Illuminate underlying psychological mechanisms
- Measure traits, beliefs, preferences and study origins and consequences

# Overview of Methods

- There are essentially two main classes of lab-style experimental papers
- Cleanly identify causal effect of  $x$  on  $y$ 
  - Ex: Increase in observability increases prosocial giving
- Cleanly measure some parameter (and then work with it)
  - Ex: People are present-biased
  - Ex: Measure time preferences and correlate with savings behavior
  - Ex: Measure social preferences at geographic discontinuity of weak / strong institutions

# Overview of Methods

- The distinction between causal identification and measurement in experiments is extremely important
- This needs to become part of your thinking
- First question for any experiment: do I want to identify a causal effect or measure some parameter (if so, which one)?

## Overview of Methods

- For now we will focus in causal identification
- Measurement of some parameters will come later



# **Lab Experiments: Some Terminology**



# Lab Experiments: Some Terminology

- *Treatment*: a particular condition of the experiment
  - Often a (main) treatment and a control treatment (or several)
  - 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* = participants in the experiment

# Lab Experiments: Some Terminology

Level of randomization:

- *Within-session*: subjects within a session are randomized into different treatment conditions
  - ideal, fully exploits advantages of lab
  - ceteris paribus
- *Between-sessions*: randomization is on the session level
  - sometimes difficult to avoid....
  - implications for statistical analysis

# Lab Experiments: Some Terminology

Across- and Within-Subject-Design:

- *Within-Subject-Design*: Subjects participate in more than one treatment
  - Allows individual comparison
  - Control for individual fixed effects
  - More powerful tests
  - More prone to experimenter demand effects
  - Order effect
- *Between-Subject-Design*: Subjects participate only in one treatment
- Implications for statistical analysis.

# Lab Experiments: Some Terminology

## *Statistical Analysis*

- It is very important to design the experiment with the statistical analysis in mind - you should essentially have a pre-analysis plan in mind □
- 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 (session means)



# Lab Experiments: Some Terminology

## Strategy Method

- To make an inference about behavior in a certain situation we need enough observations of this situation
- This can lead to problems in interactive situations.
- Example: Ultimatum Game - Proposer can propose a split of 10 Euros. Responder can accept split or reject. In the latter case both players earn 0.
  - Will a responder reject a split of (9/1)?
  - Difficult to say if only very few people propose (9/1)



# Lab Experiments: Some Terminology

## Strategy Method

- Advantages
  - More information about motivation/behavior of players
  - Information about how people would play "off equilibrium" or "off action path"
- Problems
  - Incentives are weaker
  - No incentive compatibility for information sets that players think will never be reached (off equilibrium)
  - Hot vs. cold emotions
  - Structure of game changes



# Lab Experiments: Some Terminology

## Belief Elicitation

- Great advantage of experiments is that we can ask for people's beliefs
- Artificial:
  - beliefs about abstract state of the world ("red or blue")
- Real:
  - beliefs about real state of the world - crime rate among refugees, degree of inequality in society
  - beliefs about behavior of others in lab
  - beliefs about own performance in, e.g., IQ test

# Lab Experiments: Some Terminology

## Belief Elicitation

- Incentivization:
  - If you can, do incentivize
  - Wide range of scoring rules available
  - Depending on research question, incentive-compatibility more or less important
- Can elicit point beliefs, but also whole distribution