Experimental economics

Lecture 2: Introduction to experimentation in economics

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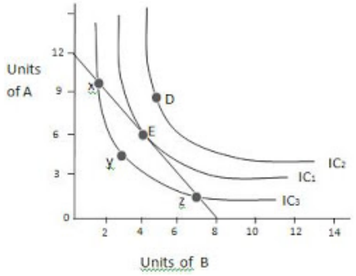
References:

- Weimann, J., & Brosig-Koch, J. (2019). Methods in experimental economics. Springer International Publishing. Chicago
- Jacquemet, N., & l'Haridon, O. (2018). Experimental economics. Cambridge University Press.

Decision-making categories

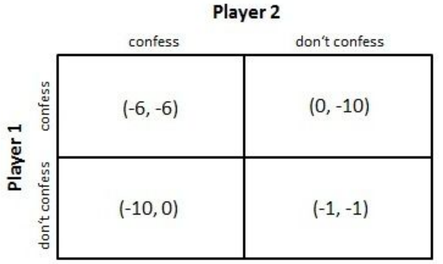
Individual decisions

>> preferences
>> incentives



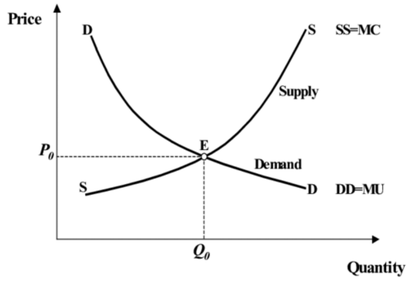
Strategic interactions

+ social norms



Market interactions

+ market rules



What is an experiment?

- Naturally occurring processes often do not allow you to observe a key variable, separate the effects or infer causality. Only controlled variation allows for causal inferences.

- The usual challenge faced in empirical economics is to find out the set of assumptions that best fits the unknown data-generating process inherited from the real world. Experiments reverse this challenge: they allow the data-generating process to be chosen in accordance with the empirical question to be answered.

- An experiment is therefore a controlled data generating process. An economic experiment typically implements a simplified economic model under laboratory conditions.

- Control: factors which influuence behaviour are held constant and at most one factor of interest is varied at a time.

Motivation for experiments

- How can we tell how successful a theory is predicting subsequent outcomes?
  - Traditional Solution: Collect survey data on as many Z variables as thought might be relevant, and use econometric techniques to test for whether historical variation in X can predict variation in Y while controlling for variations in other Z variables.
  - Complementary Solution: Create a decision environment that simulates the real world environment of interest, and randomly assign people between treatments in that environment where X is varied. Structure the design so that Z factors are either held constant across treatments, or else “average out” between treatments due to random assignment. See if Y varies across treatments as theory predicts.
- As researchers we can control the environment and the institutions and then observe behavior. The key idea of the theory is that the proper use of a reward will allow the research to induce specific characteristics in the subject, that he or she impersonates them and that his or her personal characteristics become irrelevant.
- We can implement truly exogenous ceteris paribus changes, discover clean causal links (causality), reproduce the structure of theoretical models - “two countries world” (counterfactuals), observe variables not observable in field data - e.g. subjective values, dishonest behavior, control and manipulate variables - e.g. double the number of competitors, or customers.

What do you need to know in order to collect useful data?

- Elicitation procedures = mechanisms that force agents to reveal something about themselves, such as risk or intertemporal preferences, or beliefs about what others will do.

- Experimental games = games structured with specific theoretical properties that are widely used and studied in experimental economics. These key games include the prisoners' dilemma, the trust game, the stag hunt game, the dictator game, the guessing game, the ultimatum bargaining game, the voluntary-contribution mechanism, the minimum effort game and many others.

- Psychological questionnaires can be used to gather data on how people think through their decisions and how they consider different situations. Psychometric questionnaires include, for instance, measures of cognitive and non-cognitive skills, personality traits or emotions.

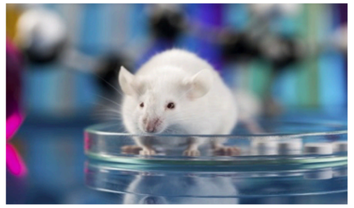
Lab? Field? Natural?

- Experiments can be done in the laboratory or in the field. These may be experimental setups designed by scientists (in the laboratory or the field); they may also be experimental designs that arise naturally..

Experimental Research

→ Medicine

- Lab research

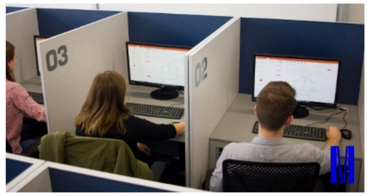


- Clinical Trials

- Confirmatory Studies

→ Economics / Behavioral Science

- Lab Experiments



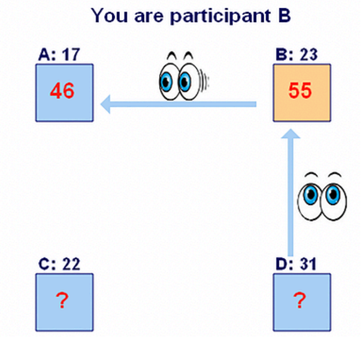
- Field Experiments

- “Natural” Experiment

CONTROL EXTERNAL VALIDITY

case #1: Peer-Effects

- ***Do we exert more effort when our colleagues are highly productive?***



Lab:

Van Veldhuizen, R., Oosterbeek, H., & Sonnemans, J. (2018).
"Peers at work: Evidence from the lab". *PloS one*, *13*(2), e0192038.

Task: solving problems
Treatments: different peer-monitoring settings

→**result:** positive effect of peer-effect on performance
→**positive aspect:** full control over context variables
→**limitation:** very (!) unnatural setting - limited external validity –

Field:

Falk, A., & Ichino, A. (2006). “Clean evidence on peer effects”. *Journal of Labor Economics,*24(1), 39-57.

Task: filling envelops
Treatments: different peer-monitoring settings

Treatments: Individual / Multiple / Peer

→**result:** positive effect of peer-effect
→**positive aspect:** easy and clean / small
→**limitation:** no employment “relationship”

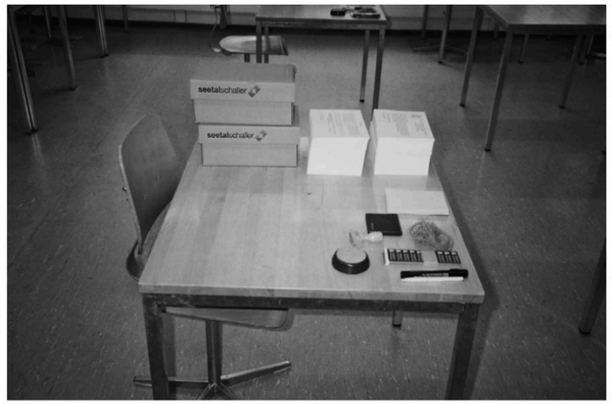


FIG. 1.—One of the desks used for the experiments

“Natural”:

Mas, A., & Moretti, E. (2009). “Peers at work”. *American Economic Review*, 99(1), 112-45.

Treatments: “pseudo” treatments

→**result:** positive effect of peer-effect
→**positive aspect:** long micro-panel dataset
→**limitation:** strong statistical assumptions
mix of advanced methods
demanding data scouting

Laboratory experiment - how does it work?

- Volunteers are recruited, they come to the laboratory and are randomly assigned to roles within the experiment.

- They read the instructions and learn about how the environment works, usually they also need to pass control questions to assure common understanding.

- Interactions are strictly anonymous. Participants are more likely to behave fairly, altruistically, or generously when there might be a way for the experimenter to observe their behavior.

- We never lie. Not deciving subjects is an essential factor that increases the credibility of the research and the experimentalist. The discipline made a choice, and it is strictly forbidden to deceive subjects and lie to them.

- Participants are paid in cash according to their decisions.

Why not just use survey?

- Say you want to study altruism… how about to use a survey?
- But… do respondents tell truth? How can we know that they are not lying?
- Economists are sceptical when it comes to data from surveys.
- They rather look on what people do than what people say.

Basic expressions

- Treatment
  - A particular condition of the experiment. A treatment is a completely specified set of procedures, which includes instructions, incentives and rules of play.
- Session
  - 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 of the experiment.

Experimental design

- Experimental design = Method of research in the social sciences in which a controlled experimental factor is subjected to special treatment for purposes of comparison with a factor kept constant
- Treatment vs Control
- Within vs. Between subject design
  - Within: 1 subject : N treatments (N treatments, 1 group) -> ordering effect
  - Between: 1 subject : 1 treatment (2 treatments , 2 groups)
- Pre – Post treatment (field-natural exp.)
- Decision method vs Strategy method
- Dependent observations: Random payment determination

Treatment effects

- Treatment ⟹ Outcome
  - exogenously controlled set of procedures, instructions, incentives, rules and parameter values ⟹ endogenous variable capturing some aspect of subject behavior
- Change in treatment ⟹ Change in outcome
- Change in outcome is called Treatment Effect
- Between treatments, an experimenter only changes variables which are directly relevant to a hypothesis being tested, holding other variables constant.

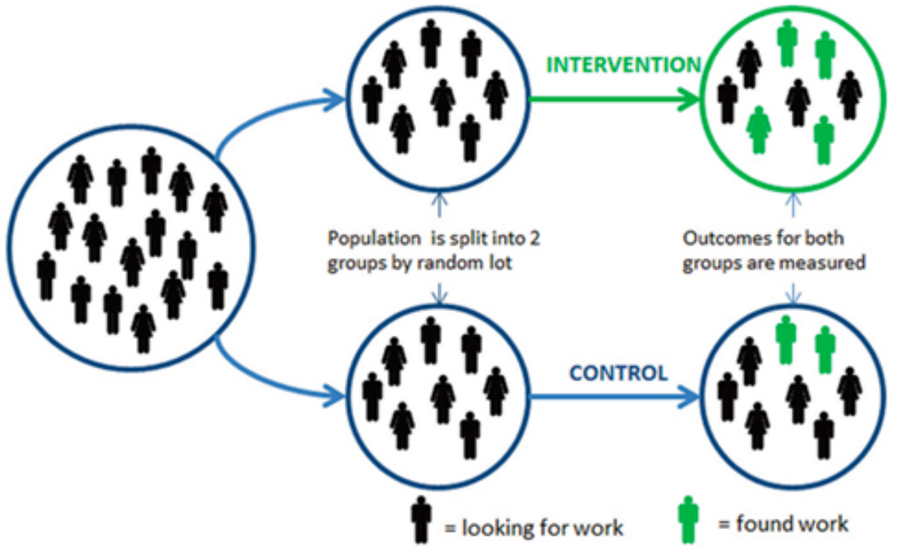


Figure 1. The basic design of a randomised controlled trial (RCT), illustrated with a test of a new 'back to work' programme.

Causality

- In an ideal situation, treatment effects are identied by systematically varying the relevant treatment, each time observing and recording the corresponding outcome, holding all other relevant factors/variables constant (ceteris paribus).

- Control + Change in treatment $\Longrightarrow$ Causality

- That way any observed change in the outcome can be attributed to corresponding changes in the treatment, and hence causality can be established.

- Most important rule of experimental design is: change only the treatment, holding all other potentially relevant factors constant. What needs to be kept constant?

  - 1. Other features of experimental design and implementation (including the physical location of the experiment for dierent treatments)

  - 2. Experimenter and his/her attitude

  - 3. Subjects and their mindset

Order effects of treatments

- If the same set of subjects is sequentially presented with alternative treatments, their behavior is going to be affected by so-called order effects Order effects may be present due to:

- Experience from previous treatments or subject fatigue. Two ways to solve the issue:

  - use different subjects for different treatments, where subjects are randomly assigned to different treatments (between-subject design). With sufficiently many subjects (based on law of large numbers) one can obtain a relatively precise measure of treatment effect.

  - use the same subjects for different treatments, but randomize the ordering of treatments across different experimental sessions (within-subject design)

- Income effect from earnings accumulated in previous treatments. How to solve?

  - If possible, payffos from tasks should not be revealed until the end of the experiment, so that behavior is not affected by previously realized earnings.

  - Strategy method: subjects specify their behavior in various possible scenarios, subset of these scenarios are implemented and subjects are paid based on payoffs realized

Precepts of experimental economics

- As researchers we can control the environment and the institutions and then observe behavior. The key idea of the theory is that the proper use of a reward will allow the research to induce specific characteristics in the subject, that he or she impersonates them and that his or her personal characteristics become irrelevant.

- Subjects perceive incentives according to experimenter not own preferences. Participants understand the connection between their decision making and payoffs. Incentives are significant enough to be taken in mind.

- Principles for rewards

  - Non-Satiation = agents strictly prefer any increase in reward medium

  - Saliency = rewards are increasing in the good and decreasing in the bad outcomes of the experiment

  - Dominance = rewards dominate any subjective costs associated with participation in the experiment

  - Privacy = each subject in an experiment receives information only about own payoffs

  - Parallelism = behavior is the same in and out of the lab as long as the ceteris paribus assumptions hold

Replicability of experiments

- It is important to bear in mind that the nature of the knowledge gained in economic experiments is fundamentally different to that generated by theoretical papers. An experiment can only ever represent one individual observation made under particular conditions at a particular place at a particular time. Further experiments under at least similar conditions in other locations at some other time are necessary before the observations become a finding that can claim to possess a certain degree of generality.

- This means that progress in experimental economics is rather slow. It simply takes time to carry out all the experiments needed to produce such things as stylized facts. It also means there needs to be some degree of coordination between those who conduct experimental research. It is necessary to reach agreement on which phenomena will be investigated in order to find out which observations are reproducible patterns of behavior and which are merely artifacts of a particular experimental design. Many experiments are conducted on one and the same “basic issue”, each with variations that can be exploited to separate the wheat from the chaff amongst the findings.

External validity

- Internal validity deals with whether an experiment does in fact test the model or theory it is supposed to test. External validity concerns the question of whether what is observed in the laboratory can be translated to the real world outside the laboratory.

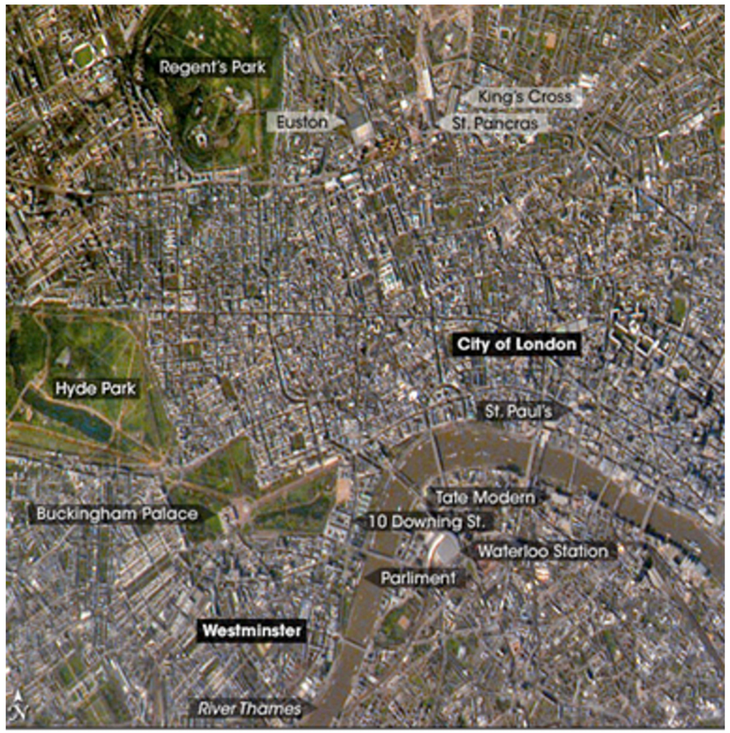
- The empirical testing of theories really only makes sense if the aim of the research is ultimately to explain real-world phenomena. This means, however, that issues of internal and external validity always occur together. Successful research requires that the experiment does in fact test the theory it wants to test, and that this results in observations that contribute to a better understanding of real phenomena.

- Economic theory is very careful to derive as general statements as possible. Specific assumptions concerning utility functions or production functions are therefore only made if statements that are even more general are not possible without them. This goal of modeling is very useful in its own right. It does also mean, however, that almost all economic models function without any context. They are not limited to particular conditions that have to be fulfilled in the “setting” of the phenomenon being studied, since this setting is considered irrelevant. Experimenters take advantage of this. If the context does not play a role, then a theory can also be tested in the artificial environment of a laboratory, since it claims to be valid there too.

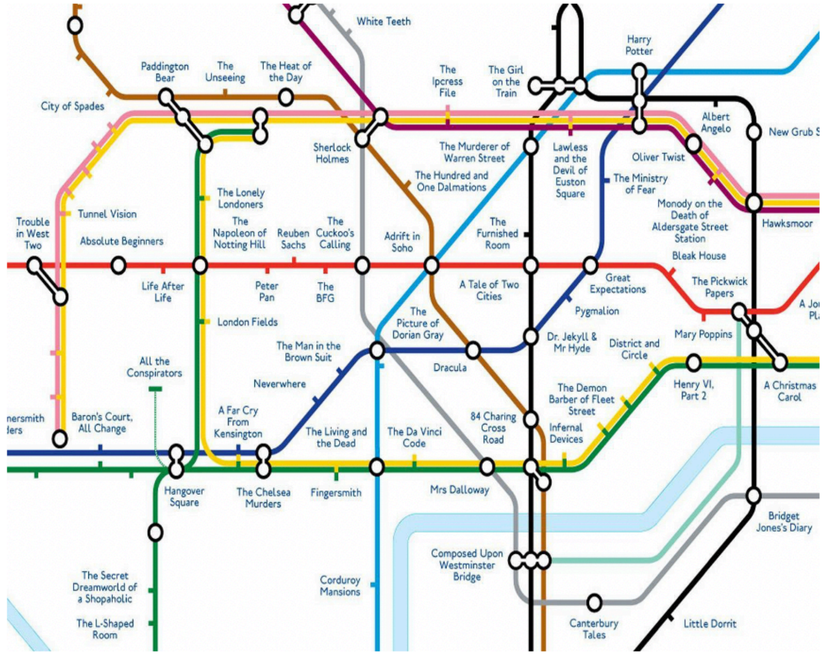
- Should a theory be refuted in the laboratory, however, then the theoreticians are certain to counter by pointing out that they constructed the model for a real economic context and not for the laborarory. This problem can be described using a very nice metaphor. Theories can be understood as maps that do not provide any details so as to highlight the generally valid abstract context. If you want to go from A to B, the context of the streets, the building development along the streets and the number of trees on the sides of the streets are all irrelevant as long as the streets you need are shown.

- The level of abstraction, i.e. the degree of generality of the model, depends on the context. Subway map is a nice example. Such maps are well known, showing only straight lines but neither streets nor public squares. They are extremely helpful if you want to know which line to take to get from A to B and where you have to change lines. But they are only useful to the subway rider; they are totally unsuitable for pedestrians. So, if an experimenter comes up with the idea of testing the subway map on a pedestrian, he will come to the conclusion that the map is no good. This test, however, neglects the context in which the map should be seen.

Real world



Experiment



External validity

- Experimenters can quite rightly point out that it is theory that makes a claim to generality and it is theory that should be measured against this claim. If theoreticians are going to claim that their theory is only valid for a particular context, then the context ought to be incorporated into the modeling. As long as this is not the case, experimenters are off the hook. However, if context plays a role in making decisions, then the laboratory context is relevant and observations made in the laboratory cannot be applied to the real world – not so easily at least.

- A biologist observing a rare species of animal in the wild does not need to worry about whether his observations are “externally valid”. The situation is no longer so clear if the same scientist is observing animals kept in the laboratory. This is because the living conditions in the laboratory are simply quite different from those that prevail in the wild, and is not clear whether behavior displayed in the laboratory is also found under natural conditions.

- The situation in experimental economics is very similar. People in the laboratory are in an artificial environment and they have to make decisions in a way and under conditions they would probably never encounter in real life. Can we still assume that experiments are externally valid? Is it permissible to simply extrapolate findings obtained in the laboratory to real-world situations?

External validity

- The biologist carrying out field research by watching animals in their natural habitat gathers individual observations which in themselves do not yet allow any general statements about the typical behavior of a species to be made.

- Only repeated, independent observations of one and the same behavior allow the conclusion to be drawn that the behavior is highly likely to be species-specific. Such inductive conclusions cannot be drawn with a high degree of certainty. No matter how many white swans have been observed, this does not allow the conclusion to be drawn that all swans are white.

- The experimental method is fundamentally dependent on the fact that its observations can be used to deduce general relationships (that hold at least with a high probability). This does not, however, apply to single observations made in a single experiment. The existence of general relationships can only be presumed if the observations are reproducible and prove to be robust to any changes in the experimental design.

- This applies to all types of experimental inquiry. It does not matter whether it is an experiment to test a model or to provide advice on policy or to gather facts about behavior. Generalized conclusions can only be drawn if a large number of independent observations displaying the same, or at least similar, relationships are available. What are sought are stylized facts of behavior that can be confirmed time and again and reproduced under a wide variety of conditions.

- The reproducibility of experiments is then of the utmost importance. However necessary reproducing experiments may be, they are not popular amongst experimentalists. Repeating somebody else's experiment is boring and generally there is no particular promise of success in getting the work published since only few journals are prepared to publish results that can be found elsewhere. As a result of this, straight replications are exceedingly rare. As a general rule, they are "hidden" in published papers investigating a new aspect of an old problem. These papers usually require a "baseline treatment" to which the results of the new experimental design can be compared. Since these baseline treatments are frequently identical in many experiments, the necessary replications are obtained in passing, as it were.

External validity

- It certainly is valid to criticize experimenters that their observations come from an artificial environment and therefore cannot readily be extrapolated to the real world.

- For a time, experimental economists provided quite a clever reply to this criticism. They pointed out that decisions made by people in the laboratory are not artificial at all, but that they are most definitely real! That is indeed true. Subjects in economic experiments are faced with “real” decisions involving “real” money that they receive as a real payoff. They are not just pretending to make decisions in the laboratory; they really are making decisions.

- The fact that experiments in economics always operate with real incentives makes this effort particularly evident. This means that the subjects’ decisions have very real consequences for them – due to the more or less generous payoff they can pocket at the end of the experiment.

  - "*The trick is to notice that economies created in the laboratories might be very simple relative to those found in nature, but they are just as real. Real people motivated by real money make real decisions, real mistakes and suffer real frustrations and delights because of their real talents and real limitations.” — Charlie Plott*