Foundations of Experimental Economics

University of Kassel

Winter Term 2025/2026

Lecture 1: Introduction and Basic Concepts

Introduction

John Stuart Mill (1844) on Methodology

"In chemistry and natural philosophy, we can not only observe what happens under all the combinations of circumstances which nature brings together, but we may also try an indefinite number of new combinations."

"This we can seldom do in ethical, and scarcely ever in political science. We cannot try forms of government and systems of national policy on a diminutive scale in our laboratories […]. We therefore study nature under circumstances of great disadvantage in these sciences […]"

John Stuart Mill (1844): Essays on Some Unsettled Questions of Political Economy, chapter V: On the Definition of Political Economy.

Experiments as Scientific Method

- The quote by Mill underscores the central role of experimentation in the natural sciences, while expressing skepticism about its applicability to the social sciences, such as economics.

- This perspective remained dominant well into the 1980s but has since shifted significantly.

- Experimental approaches have become a cornerstone of modern economic research.

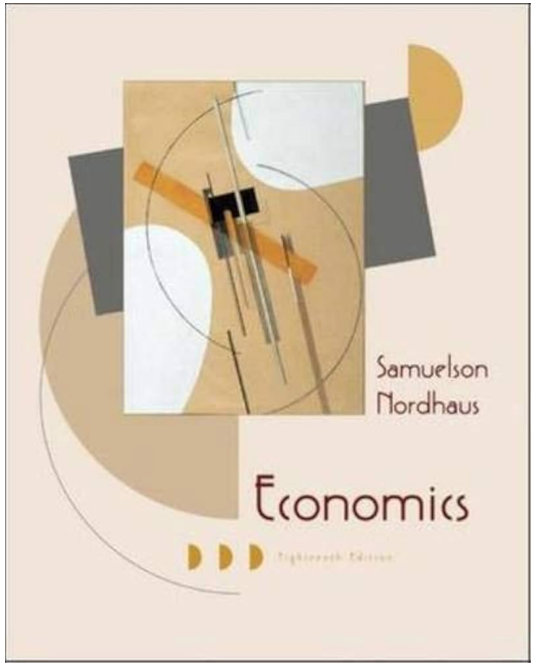
Principles of Economics (1985 vs. 1992)

- *"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.

- Experimental economics is an *"exciting new development."*

  Samuelson and Nordhaus, Principles of Economics 1992, p. 5.



Objectives for Today

- **Understand** what economic experiments are.

- **Explore** why they are such a powerful tool.

- **Examine** how they became a mainstream method in modern economic research.

Recommended Readings

- Kagel, J. H., & Roth, A. E. (1995). *The handbook of experimental economics.* Princeton University Press. (Chapter 1, p. 3-21)

- Weimann, J., & Brosig-Koch, J. (2019). *Methods in experimental economics: An introduction*. (Chapter 1, p. 1-38)

Economic Experiments

- An **Economic Experiment** is a method to collect data in a **controlled manner** used to establish **causal effects** on how people make decisions, interact in markets, or respond to policies.

Experimental Economics

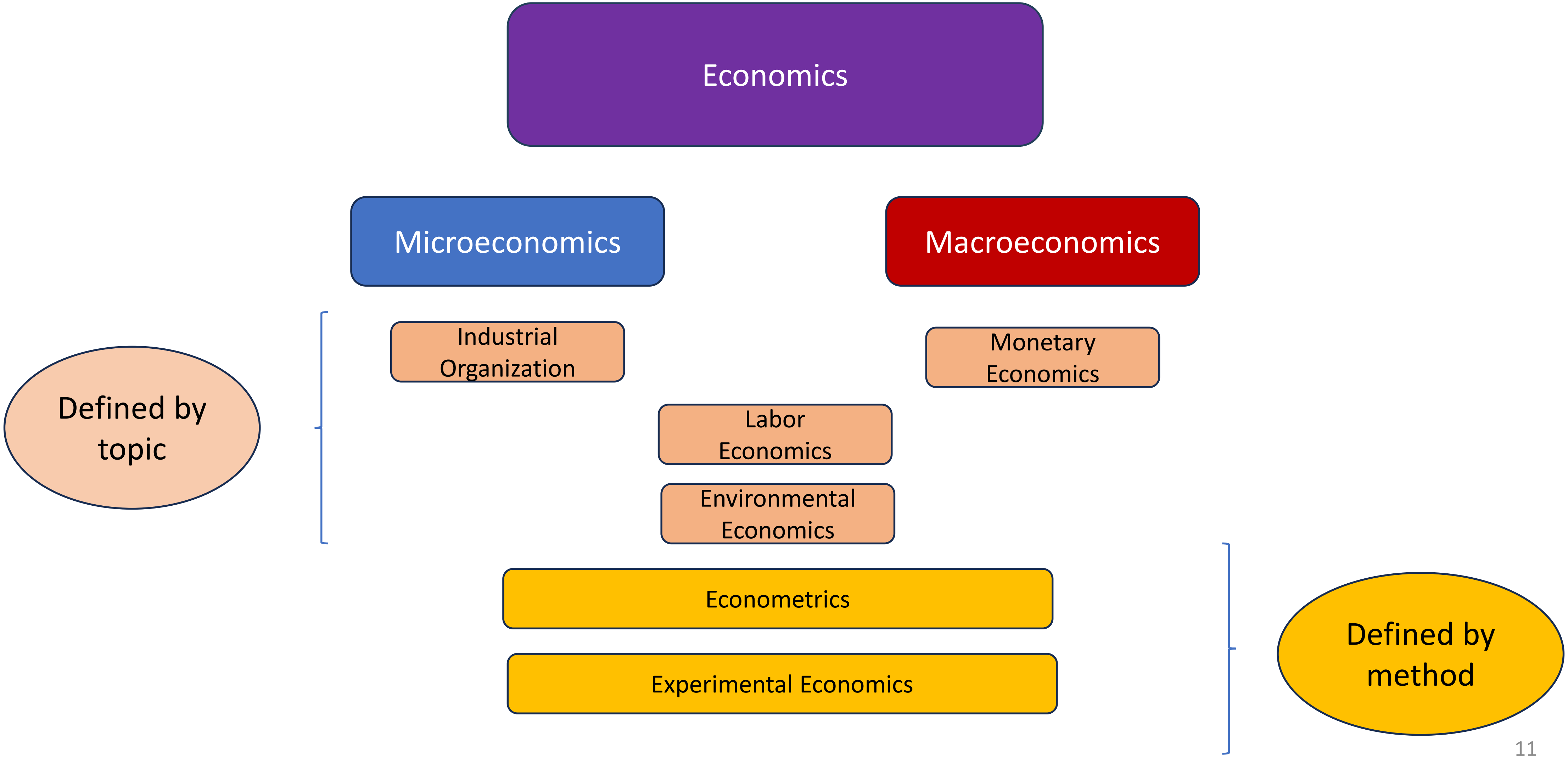
- **Experimental Economics** is the branch of economics that involves conducting **experiments**—either in laboratory settings or in the field—to study economic behavior.

- It is part of **empirical economics**, as it relies on data collection to test theories and gain insights into decision-making.

Theoretical vs. Emprical Economics

	Theoretical Economics	Empirical Economics
Goal	Explain or predict behavior through models.	Test theories and measure relationships with data.
Methods	Mathematics, logical reasoning	Statistics, econometrics
Key Question	"What would happen under certain assumptions?"	"What actually happens?"
Example	When prices increase demand decreases.	Collect data on prices and demand and apply econometric methods to see if relationship holds.

Experimental Economics as a Branch of Economics



Topics Studied with Experiments

THE JOURNAL OF
POLITICAL ECONOMY

Volume LXX | APRIL 1962 | Number 2

AN EXPERIMENTAL STUDY OF COMPETITIVE MARKET BEHAVIOR[1]

VERNON L. SMITH
Purdue University

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Does Market Experience Eliminate Market Anomalies?

John A. List

The Quarterly Journal of Economics, Vol. 118, No. 1 (Feb., 2003), pp. 41-71 (31 pages)

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Abhijit Banerjee
Esther Duflo
Rachel Glennerster
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Journal of Economic Behavior & Organization
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AMERICAN ECONOMIC REVIEW
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(pp. 860–85)

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The Demand for Bad Policy when Voters Underappreciate Equilibrium Effects

Ernesto Dal Bó, Pedro Dal Bó, Erik Eyster

The Review of Economic Studies, Volume 85, Issue 2, April 2018, Pages 964–998,
https://doi.org/10.1093/restud/rdx031

Published: 09 May 2017 **Article history**

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Ernst Fehr, Simon Gächter

The American Economic Review, Vol. 90, No. 4 (Sep., 2000), pp. 980-994 (15 page

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Loukas Balafoutas, Adrian Beck, Rudolf Kerschbamer, Matthias Sutter

The Review of Economic Studies, Volume 80, Issue 3, July 2013, Pages 876–891,
https://doi.org/10.1093/restud/rds049

Published: 12 January 2013 **Article history**

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Volume 95, Issues 9–10, October 2011, Pages 1082-1095

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Experimental and Behavioral Economics (1/2)

- Behavioral economics is the branch of economics that focuses on replacing assumptions made in the **rational choice model** with **behavioral assumptions** often rooted in psychology.

- Behavioral economists very frequently use experiments to gain information on human decision-making and many violations of the rational choice model have been observed in experiments.

Experimental and Behavioral Economics (2/2)

- While closely connected, experimental economics and behavioral economics cannot be equated.
- The experimental method is an instrument with which human behavior can be observed under controlled conditions.
- Experiments may well have the result that the rational choice model of neoclassical economics delivers the best explanation for the data.

How do Experiments work?

Scientific Experiments

- A scientific experiment is a **controlled procedure** carried out to collect data in order to test a hypothesis or discover new information.

- It involves manipulating an **independent variable** while keeping other conditions constant to observe the causal effect on a **dependent variable**.

Controlled Procedure and Experimental Data

- A **controlled procedure** means the researcher can manage the environment where the data collection takes place and determine what happens during it.
    - Certain elements are **deliberately changed**, while others are **kept constant.**
    - **External influences** are **minimized** as much as possible.

- When data is collected in this way, it is called **experimental data**, in contrast to **observational data**.

Observational Data

- In **observational data**, the researcher does not intervene or control the environment.

- Natural occurrences are observed and recorded as they happen.

- External influences cannot be controlled, so the researcher normally can only identify **patterns** or **correlational relationships** but not determine causality.

Types of Variables

Dependent variable

- The variable that is **measured** in an experiment. It is the outcome that changes in response to the independent variable according to the underlying hypothesis.

Independent variable

- The variable that is **manipulated (changed)** by the experimenter. It is the factor that will cause a change or effect on the dependent variable according to the underlying hypothesis.

Example from Natural Sciences (1/3)

Hypothesis

- Plants that receive more light will grow taller than plants receiving less light.

Dependent variable

- The (increase in the) height of the plant after a certain period of time.

Independent variable

- The amount of light the plant receives (e.g., full sunlight vs. no sunlight).

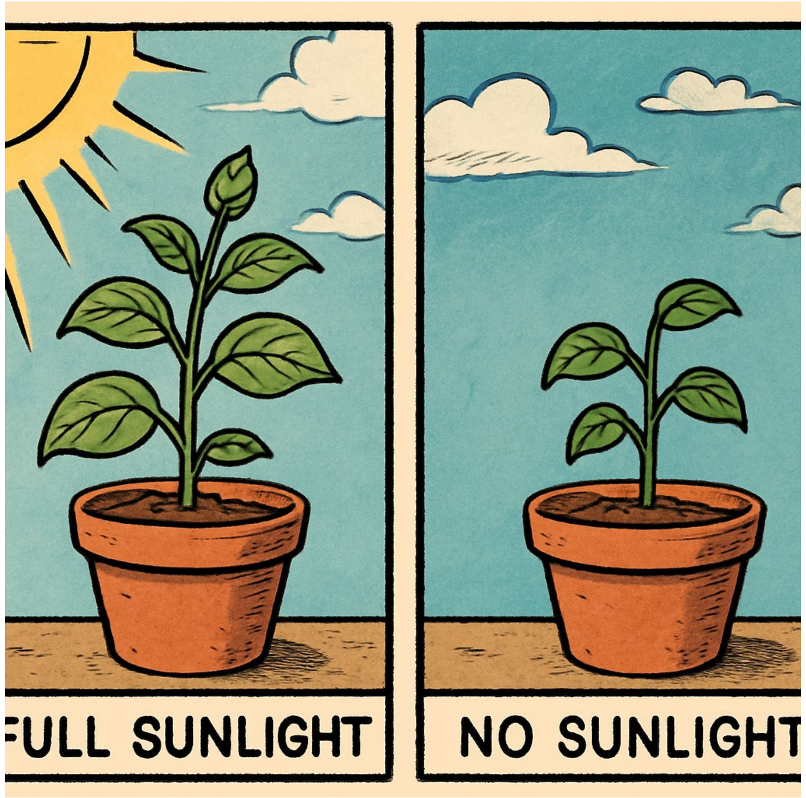
Example from Natural Sciences (2/3)

Controlled procedure

- Everything else that could affect the height of a plant (type of plant, soil, amount of water etc.) must be kept constant between conditions.

Results

- Differences in the dependent variable can be attributed to differences in the independent variable as everything else is constant (i.e., the same).



Example from Natural Sciences (3/3)

Observation without experimentation

- Observing plants in various environments: Some in full sunlight and others in shaded areas.

- Many factors could be influencing plant growth, such as soil quality, water availability, temperature, or the type of plant.

- Unlike in a controlled experiment, these factors are not kept constant, so it's hard to tell if differences in plant height are due to the amount of sunlight or other factors.

Key Design Elements of an Economic Experiment (1/2)

Decision-making task

- The specific decision-making scenario or game structure.

➢ Observed choices are the dependent variables.

Incentives

- Monetary payments or other real material outcomes directly tied to participants' decisions.

➢ Ensures incentive compatibility and motivates real effort.

Key Design Elements of an Economic Experiment (2/2)

Institutions

- Further rules and context under which decisions are made.

➢Includes information structure, timing, matching protocol, etc.

Treatment variation

- Systematic variation of key variables (either incentives or institutions) across participants or sessions.

➢Enables causal inference by comparing outcomes across conditions.

Cherry, Frykblom & Shogren (2002) (1/7)

Hardnose the Dictator

Author(s): Todd L. Cherry, Peter Frykblom and Jason F. Shogren

Source: *The American Economic Review*, Sep., 2002, Vol. 92, No. 4 (Sep., 2002), pp. 1218-1221

Published by: American Economic Association

Stable URL: https://www.jstor.org/stable/3083309

Cherry, Frykblom & Shogren (2002) (2/7)

<u>Decision-making task</u>

- Dictator Game: Game used to study **altruism** and **fairness**.
  - Two players: **“Dictator"** and a **recipient** (or passive player).
  - The dictator is given an **endowment** (e.g., $10) and decides **how much to give** (if any) to the recipient.
  - The recipient has no power to reject or influence the decision — they must accept whatever amount is given to them.

- **Dependent Variable:** Giving by the dictator.

Cherry, Frykblom & Shogren (2002) (3/7)

Incentives

- Dictator receives an **endowment** of either $10 or $40.
- Dictator earns the endowment minus the amount given to the recipient.
- Recipient earns the amount awarded by the dictator.

Cherry, Frykblom & Shogren (2002) (4/7)

Institutions

- Depending on the experimental condition the endowment is just provided to the dictator (windfall) or awarded based on performance in a quiz (earned).

Cherry, Frykblom & Shogren (2002) (5/7)

Treatment variation

- Baseline: Dictators receive the endowment directly; either \$10 or \$40.

- Earnings: Dictators earn the endowment in a quiz before the decision-making task; \$10 or \$40 depending on performance.

- **Independent variable:** Mechanism to provide endowment.

Cherry, Frykblom & Shogren (2002) (6/7)

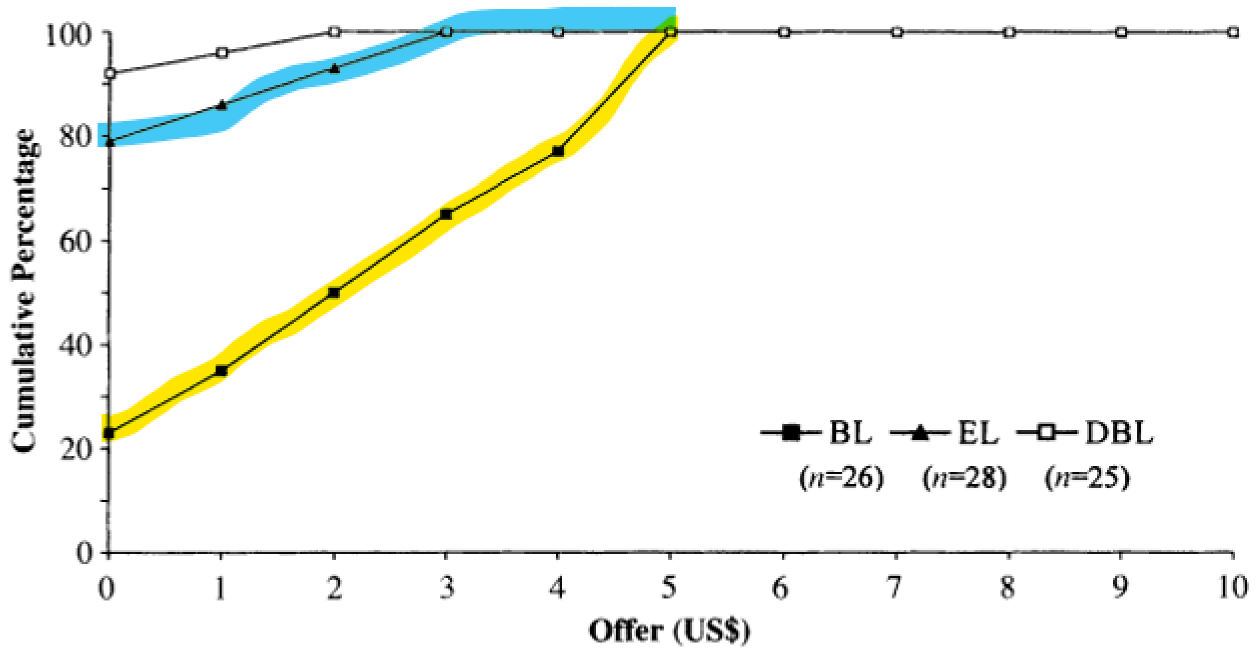


FIGURE 1. CUMULATIVE DISTRIBUTIONS OF OFFERS IN THE $10 DICTATOR GAMES

Source: Cherry, Frykblom & Shogren (2002, p. 1220)

Cherry, Frykblom & Shogren (2002) (7/7)

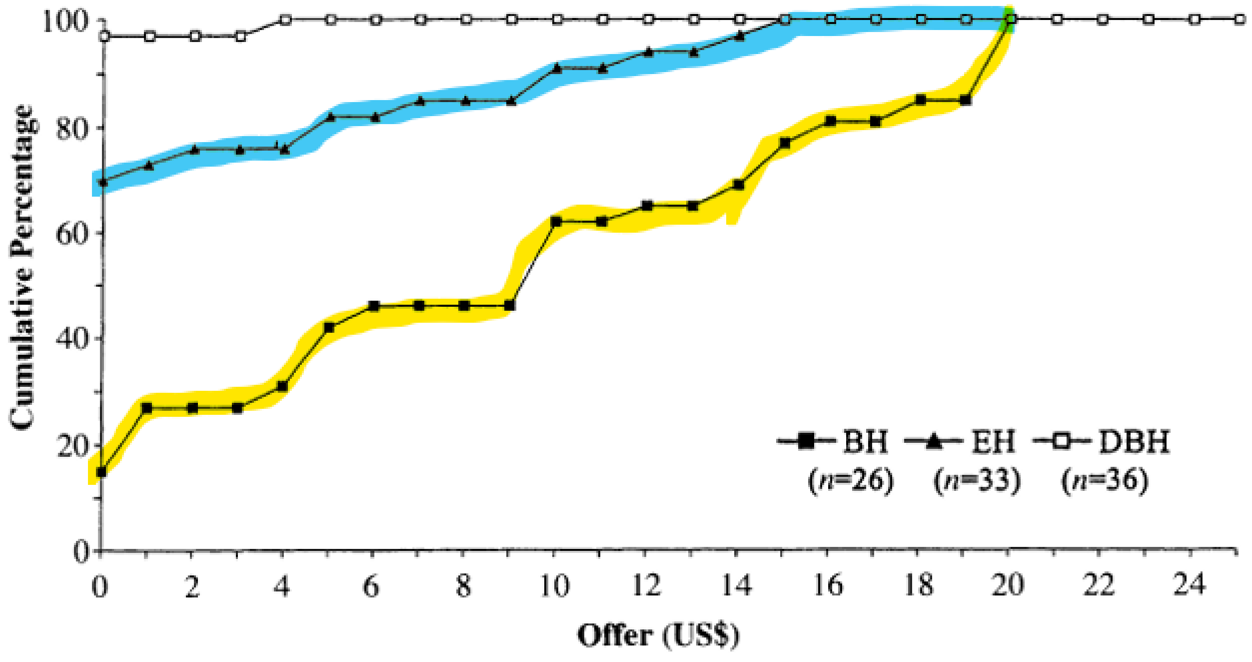


FIGURE 2. CUMULATIVE DISTRIBUTIONS OF OFFERS IN THE $40 DICTATOR GAMES

Source: Cherry, Frykblom & Shogren (2002, p. 1220)

Why conduct Experiments?

Three Main Goals (Roth 1995)

1) **Speaking to theorists:**
    - Testing theories whose predictions are sensitive to difficult-to-observe attributes of the agents, e.g., risk aversion or information.

2) **Searching for facts:**
    - Discover unanticipated regularities that can arise from using experimental methods and holding all factors constant, but one.

3) **Whispering in the ears of princes:**
    - Run experiments motivated by policy questions.

Using Experiments to Establish Causality

- The goals and reasons listed by Roth (1995) can (in principle) also be achieved using empirical methods other than experiments.
  - For example, applying econometric methods to (non-experimental) data collected with surveys.

- So, what do experiments offer in comparison?

➢ Experiments provide a unique advantage: They allow for the identification of **causal effects**, which is often difficult—if not impossible—to establish using observational data alone.

Causality (1/2)

- Causality refers to a relationship between two variables in which a change in one variable (the **cause**) directly brings about a change in another variable (the **effect**).

- Establishing causality requires ruling out **confounding factors** and other alternative explanations.

- Finding **causal effects** is challenging, many conventional empirical methods only establish correlations, which do not imply causation.

Causality (2/2)

- Understanding **causal relationships** is fundamental to both **scientific progress** and **effective policymaking**.

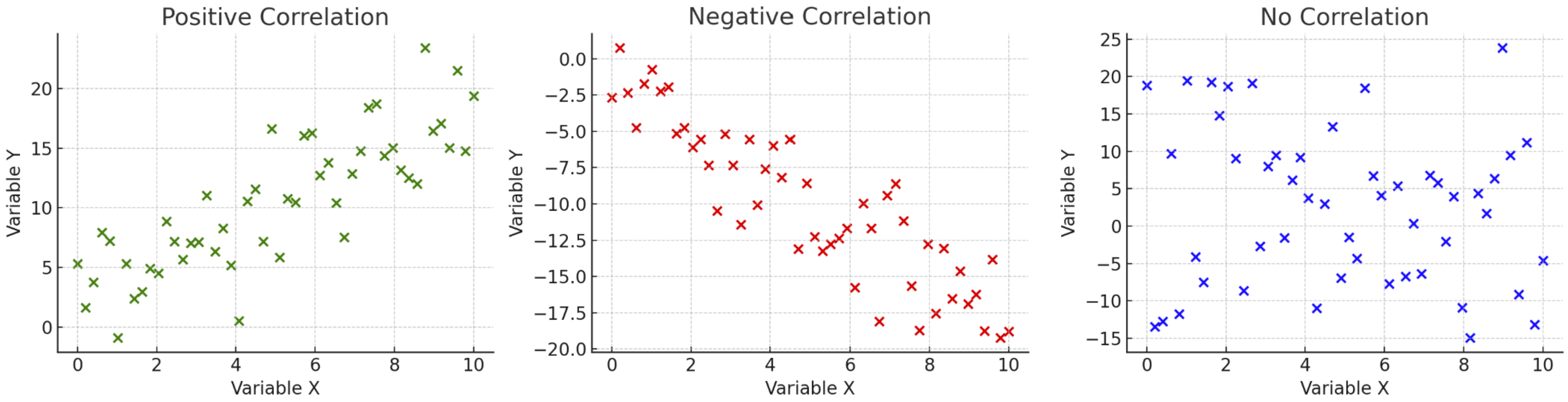
- Without causal evidence, policies risk being based on misleading correlations, resulting in ineffective or potentially harmful outcomes.

Causality vs. Correlation (1/2)

- **Correlation** refers to a statistical relationship between two variables that describes whether and how strongly they move together:
  - If both variables increase together, the correlation is **positive**.
  - If one increases while the other decreases, the correlation is **negative**.
  - If there's no pattern, the correlation is **zero.**

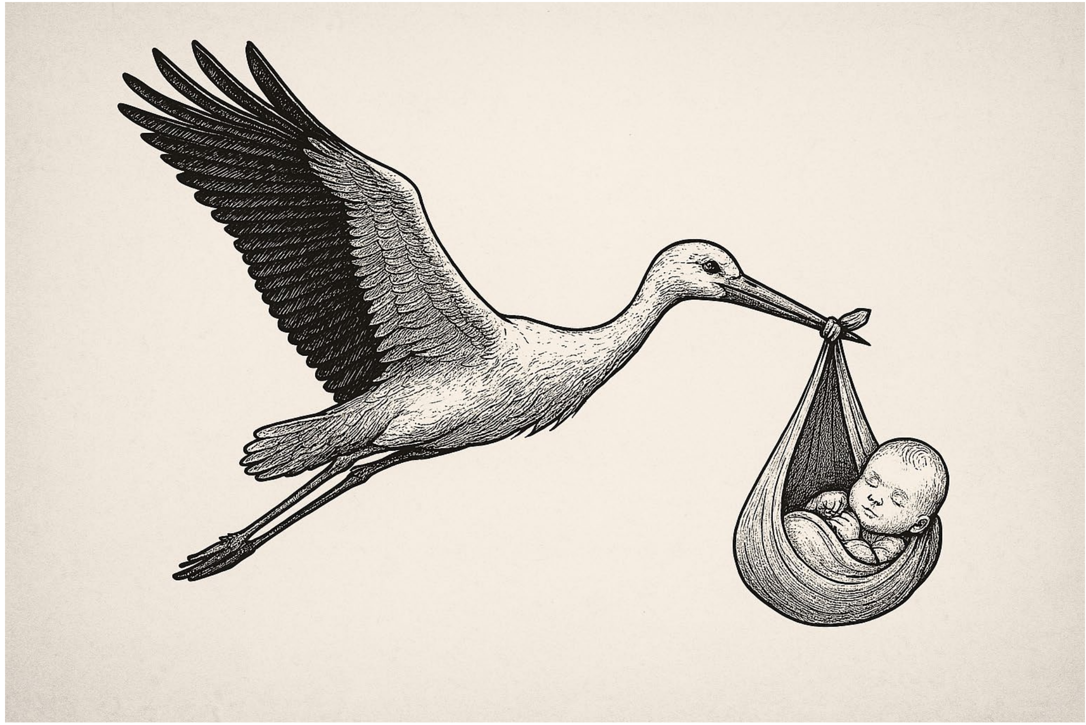
- **Important**: Correlation does **not** imply causation. Just because two variables are correlated doesn't mean one causes the other.

Causality vs. Correlation (2/2)



Causality vs. Correlation: Example I (1/2)

- Studies have found higher birth rates in areas with large stork populations.
- Does this mean storks deliver babies? **No!** (Obviously)



Causality vs. Correlation: Example I (2/2)

- Much more likely explanation: People who are about to start a family move away from cities to rural areas where stork populations are more common.

- There is a third factor (rural living) that effects both:
  - The dependent variable (birth rate) and
  - the (suggested) independent variable (stork population).

- Rural living is a referred to as **confounding factor** in this case.

- Obviously, no one would honestly assume a causal effect despite the correlation. But what about less straightforward examples?

Causality vs. Correlation: Example II (1/3)

- Quinn et al. (1999) report results from a questionnaire-based study among parents of children who were patients at a clinic for eye diseases.
  - The questionnaire collected information on the children's light exposure, both at the time of the study and before the age of two.

- The researchers found a strong correlation between myopia (short-sightedness) and exposure to ambient light at night during sleep in children under the age of two.

- Does this mean exposure to ambient light at night causes myopia? Could be! **But…**

Causality vs. Correlation: Example II (2/3)

- Gwiazda et al. (2000) use data from another study on visual development in children, which additionally considered whether the parents are myopic.

- They find no association between myopia and ambient light exposure at night during the first two years of life.

Causality vs. Correlation: Example II (3/3)

- Families with two myopic parents, however, reported significantly higher use of ambient lighting at night compared to those with one or no myopic parent.
  - This may be due to their own poor vision, requiring light to see their child more easily at night.
  - Another explanation might be a higher socioeconomic status, which is associated with greater use of child-monitoring devices.

- Parental myopia serves as a confounding factor, as it influences both the use of ambient light at night and the likelihood of myopia in their children.

Causality vs. Correlation: Example III (1/4)

- The German government introduces a new and innovative job training program aimed at supporting unemployed individuals.
  - Participation in the program is completely voluntary.

- To assess the program's success, the government collects employment data from both participants and non-participants six months after the program ended.

- The data reveals that individuals who participated in the program have a significantly higher likelihood of being employed compared to those who did not participate.

5-Minute Exercise

- Discuss whether the higher likelihood of employment for program participants is a causal effect of the training program.

Causality vs. Correlation: Example III (2/4)

- A causal interpretation of the data seems very reasonable as economic theory supports this interpretation.
  - Acquiring skills through job training should enhance productivity, which in turn increases the chances of securing employment at market wages.

- But what about confounding factors?

Causality vs. Correlation: Example III (3/4)

- For example, individuals who chose to participate in the program may have had higher motivation to secure a new job in the first place, meaning that they were more likely to be employed regardless of the training program.

- Again, there is a confounding factor as motivation may affect both the dependent variable (employment status) and the independent variable (participation in the program).

- In this context, this leads to a **selection effect**, i.e., highly motivated individuals select into the program, causing the groups (participants and non-participants) to differ in more than one relevant aspect.

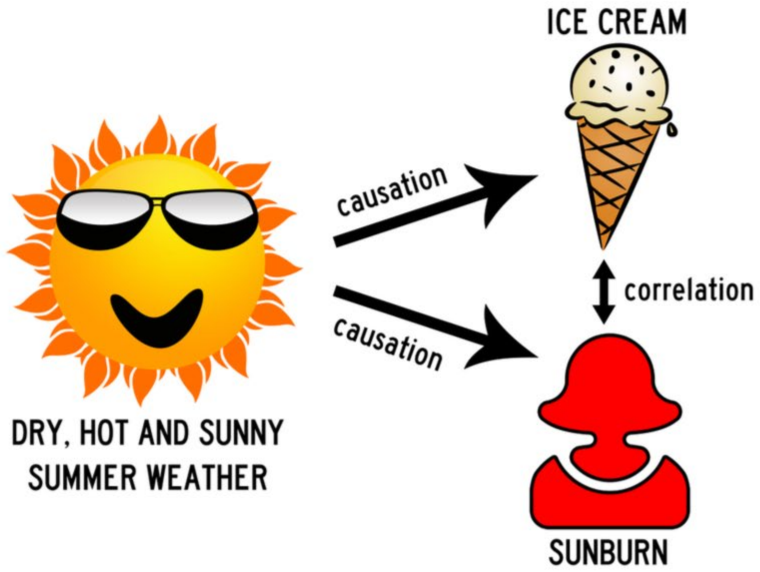
Causality vs. Correlation: Example III (4/4)

- This example highlights the importance of distinguishing between correlation and causality when the results are used to inform policy decisions.
- If the job training program truly has a causal effect on employment, a reasonable recommendation would be to continue or even expand the program.
- However, if the observed effect is simply a correlation, it may not be cost-effective to maintain the program.

5-Minute Exercise

- Discuss a few more examples for correlations that do not imply causality.

- For each example, briefly describe the reason why it would be wrong to imply causality.



Confounding Factors as Challenge for Empirical Analysis

- The examples show that confounding factors may lead to incorrect conclusions about causal effects.

- Empirical studies must control for all relevant factors to establish causality, i.e., isolate the effect of the variable of interest.

- This is very challenging! Many factors can influence an outcome. Some might not even be known or measurable.
  - For example, motivation to secure employment is hardly measurable.

Ideal Scenario to Study Causal Effects (1/4)

- **Problem in the job training example:** Participants and non-participants differ in more than their participation status, e.g., motivation to secure employment.

- The effect of participation cannot be isolated, and no causal interpretation is possible.

- What would be the ideal study scenario? **A parallel universe!**

Ideal Scenario to Study Causal Effects (2/4)

- **Actual world:** The job training program exists, and we observe the employment status of participants who take part in the program.

- **Parallel universe:** There is an otherwise completely identical world in which the job training program does not exist, and we observe the employment status of participants (without actual participation).

- **Causal inference:** By comparing the employment outcomes between the actual world and the parallel universe, we can isolate the effect of the program and deduce causal effects of participation.

Ideal Scenario to Study Causal Effects (3/4)

- This sounds like science-fiction! How is this helpful?

- Although this scenario is very hypothetical, it helps to specify the conditions needed to detect causal effects.

- Ideal condition: Observe the **same people with and without** taking part in the training program.

- **Goal for research design:** Approximate the "parallel universe“!

Ideal Scenario to Study Causal Effects (4/4)

- What if program participation was assigned **randomly**?

- For each individual there is a coin-toss:
  - Heads: Participation in the program is mandatory (and cannot be avoided)
  - Tails: Participation in the program is not allowed (and cannot be forced).

- For a large enough sample, this ensures that both groups (participants and non-participants) are statistically identical on average.

- When participation is assigned completely at random, confounding factors that influence both participation and outcomes are not a concern.

Randomization & Treatments

- Randomization refers to the process of **randomly** assigning participants to different **treatment groups**.

- Randomization helps to equally distribute known and unknown factors (such as individual preferences, risk attitudes, or demographic characteristics) across treatments groups.

- The goal of randomization is to ensure that any differences observed between the groups are due to the intervention or treatment being tested, rather than pre-existing differences between the participants.

- Randomization allows researchers to infer causal relationships between the experimental intervention and observed outcomes.

Questions

Types of Experiments

Individual Decision-Making Experiments

- Focus: How **one person** makes choices, often under risk or uncertainty, without strategic interaction.
  - No interaction with other participants.
  - Used to study, e.g., preferences, biases, use of heuristics (e.g., risk preferences, time preferences, loss aversion etc.).

➢ Goal: Understand **individual behavior** in isolation.

Strategic Decision-Making Experiments

- Focus: How **multiple participants** make choices that **depend on each others' actions**.
  - Usually based on game theory and equilibrium predictions (e.g., Cooperation in the Prisoner's Dilemma).

➢ Goal: Understand **strategic behavior** in interactive settings.

Taxonomy of Economic Experiments

- Harrison and List (2004) propose the following taxonomy* of experiments:
  - *Conventional lab experiment:* Employs a **standard subject pool of students**, an **abstract framing**, and an **imposed** set of rules.
  - *Artefactual field experiment:* Same as conventional lab experiment, but with a **nonstandard subject pool**.
  - *Framed field experiment:* Same as artefactual field experiment, but with **field context** in either the commodity, task, or information set.
  - *Natural field experiment:* Same as framed field experiment but where the **subjects naturally undertake tasks** and where the subjects do **not know that they are in an experiment**.

* Some researchers may use other classifications and not every study neatly fits into one category.

Conventional Lab Experiment

- The dictator game study by Cherry, Frykblom & Shogren (2002) is a conventional lab experiment. (Abstract framing! Students as subjects!)

Artefactual Field Experiment (1/2)

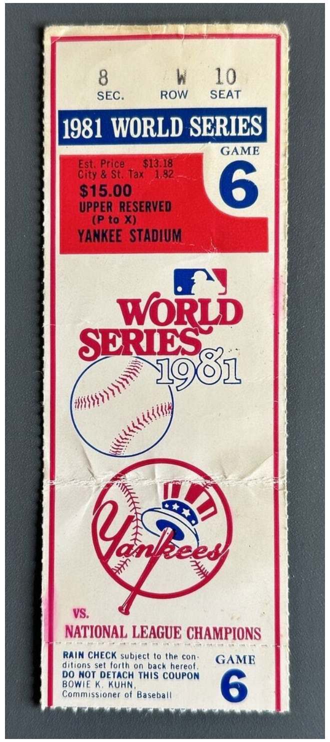
- Dannenberg, Diekert & Händel (2022) investigate how personal experience of good or bad luck and information about the behavior of others influence the risk-taking behavior of **small-scale fishers in Tanzania.** (Nonstandard subject pool!)
- Also known as: Lab-in-the-field experiments
- Results:
  - The results show a slight tendency for fishers to take more risk in a lottery if they have been unlucky in another game shortly before.
  - Risk taking is enhanced by social information when fishers learn that others have taken more risk.

Artefactual Field Experiment (2/2)

Source for all: Philipp Händel

Framed Field Experiment

- List (2003) investigates the endowment effect with dealers at a sports card show.
- The dealers were faced with the choice between different baseball memorabilia. (Field context!)
- Results:
  - Behavior converges to the neoclassical prediction as trading experience intensifies (e.g., no endowment effect found for experienced dealers).



Natural Field Experiment

- Gneezy & List (2006) use different hourly wages (market wage and above market wage) for solicitors in a door-to-door fundraising campaign. (Subjects don't know that they are in an experiment!)
- Results:
  - Evidence suggests that solicitor effort in the first few hours on the job is considerably higher when an above market wage is paid.
  - After the initial few hours, however, no difference in outcomes is observed
  - In total, the additional effort in the beginning did not compensate for the higher wage.

Natural Experiments (1/4)

Not to be confused with Natural Field Experiments!

- A **naturally occurring event or policy change** creates variation in treatment across groups.
- The assignment to treatment is **not controlled by the researcher but** can be considered **“as-if random”**.
- Researchers **exploit** this **exogenous variation** to identify causal effects.
- Usually considered part of general empirical economics, not experimental economics.

Natural Experiments (2/4)

THE
QUARTERLY JOURNAL
OF ECONOMICS

Vol. CVI | November 1991 | Issue 4

DOES COMPULSORY SCHOOL ATTENDANCE AFFECT SCHOOLING AND EARNINGS?*

JOSHUA D. ANGRIST AND ALAN B. KRUEGER

Natural Experiments (3/4)

Research question

- What is the causal effect of compulsory schooling on attendance and earnings?

Natural experiment setup

- In the U.S., **compulsory schooling laws** require students to stay in school until a certain age (not certain years of schooling.)
- Because of cutoff dates, kids born earlier in the year **start school older** and **leave school with less education** (on average) than those born later.

Natural Experiments (4/4)

As-if random variation

- Date of birth (within a year) is **essentially random** but affects **schooling due to policy**.

Results

- More education (due to compulsory schooling) leads to **higher earnings**, supporting the causal link between schooling and income.

Internal vs. External Validity

Internal Validity

- The extent to which an experiment **reflects the research question or theoretical model**, that is, how accurately it identifies a causal relationship between variables.

- Internal validity is a matter of proper experimental controls, experimental design, and data analysis.

External Validity

- The extent to which experimental results can be **generalized to the "real" world.**

- Two criteria to assess external validity:
  - Are the relevant conditions in the experiment and in the "real" world similar?
  - Will behavioral regularities persist in new situations as long as the relevant underlying conditions remain substantially unchanged?

Trade-Offs in Internal and External Validity (1/2)

- There is often a trade-off between internal and external validity when selecting a research design.

- **Lab experiments** tend to have high internal validity because they allow researchers to tightly control the experimental environment but may be deemed low in externality validity due to the artificial setting.

- **Observational studies** have high external validity because they reflect actual behavior and settings but may offer little control.

- **Field experiments** may strike a balance between internal and external validity.

Trade-Offs in Internal and External Validity (2/2)

Controlled Data				Naturally-Occurring Data
Lab	AFE	FFE	NFE	NE, PSM, IV, STR

- Lab: Lab experiment
- AFE: Artefactual field experiment
- FFE: Framed field experiment
- NFE: Natural field experiment
- NE: Natural experiment
- PSM: Propensity score estimation
- IV: Instrumental variables estimation
- STR: Structural modeling

Fig. 1. A field experiment bridge.

Source: Levitt and List (2009, p. 8)

(An Incomplete) History of Experimental Economics

Thurstone (1931)

- Thurstone (1931) considered the problem of experimentally determining an individual's indifference curve.
- Each subject was asked to make a large number of hypothetical choices between commodity bundles consisting of hats and coats, hats and shoes, or shoes and coats.
- Thurstone concluded that choice data could be adequately represented by indifference curves, and that it was practical to estimate them this way.

In order to make the test of Equation 10 fairly complete we have carried out the test with four standards for each of the three possible pairs of three commodities. The procedure was simply to present to the subject a list of alternatives of the following type.

8 hats and 8 shoes
6 hats and 9 shoes

8 hats and 8 shoes
4 hats and 15 shoes

8 hats and 8 shoes
9 hats and 3 shoes

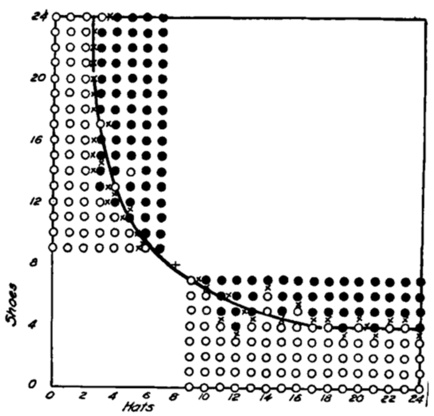


FIGURE 7

Source: Thurstone (1931, p. 153/154)

Wallis & Friedman (1942)

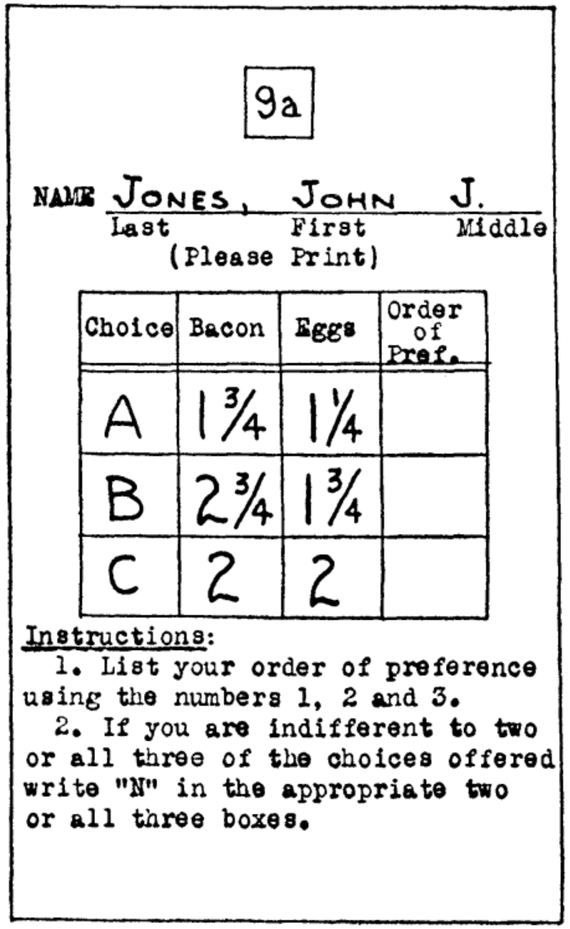
- Wallis & Friedman (1942) critically review the experiment by Thurstone (1931):

  - *"It is questionable whether a subject in so artificial an experimental situation could know what choices he would make in an economic situation; not knowing, it is almost inevitable that he would, in entire good faith, systematize his answers in such a way as to produce plausible but spurious results.“*

  - *"For a satisfactory experiment it is essential that the subject give actual reactions to actual stimuli [...] Questionnaires or other devices based on conjectural responses to hypothetical stimuli do not satisfy this requirement. The responses are valueless because the subject cannot know how he would react."*

Rousseas & Hart (1951)

- Rousseas & Hart (1951) have subjects choose between different breakfast menus.
- In contrast to Thurstone (1931), the experiment involves real incentives: *„each individual was obliged to eat all of what he chose."*
- Only two observations per person; indifference curves constructed from observations of different persons.


9a

NAME JONES, JOHN J.
Last First Middle
(Please Print)

Choice	Bacon	Eggs	Order of Pref.
A	1¾	1¼	
B	2¾	1¾	
C	2	2	

Instructions:
1. List your order of preference using the numbers 1, 2 and 3.
2. If you are indifferent to two or all three of the choices offered write "N" in the appropriate two or all three boxes.

DIAGRAM I

Source: Rousseas & Hart (1951, p. 290)

Three Strands of Development

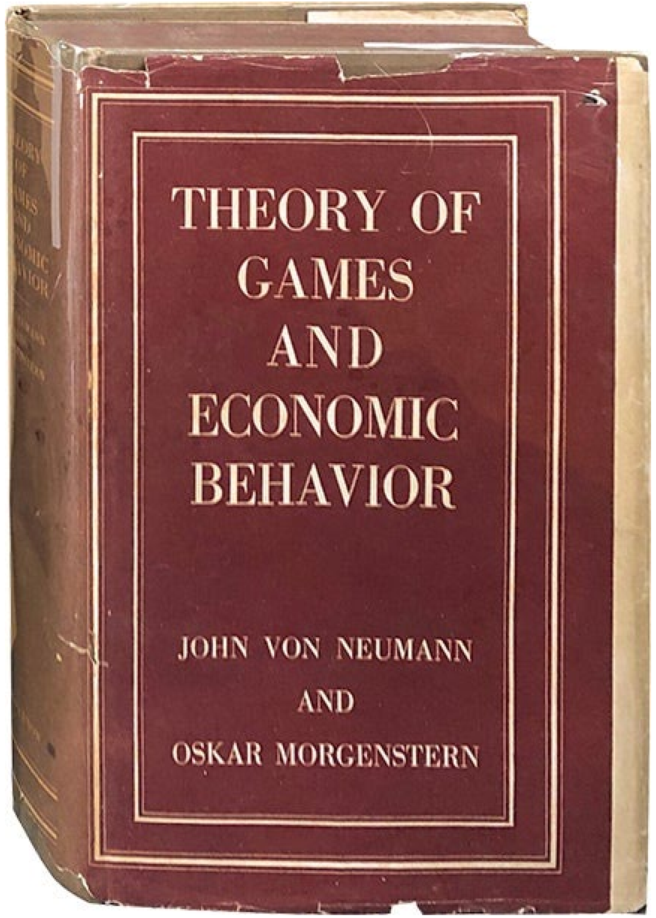
- Following the early work by Thurstone and others, subsequent developments can be divided into three strands:
  - Experiments on **individual decision-making.**
  - Experiments on **strategic decision-making.**
  - Experiments on **market behavior.**

- The first two strands were heavily influenced by the publication of „Theory of Games and Economic Behavior“ by von Neumann & Morgenstern (1944).

Von Neumann und Morgenstern (1944)

- Though not using experimental methods itself, the book established a formal framework for analyzing decision-making under risk and uncertainty known as **expected utility theory** and laid the **mathematical foundation of game theory**, allowing strategic interactions to be studied rigorously.

- Both theoretical developments proofed to be the basis of much experimental work.



Expected Utility Theory

- A theory of decision-making under **risk and uncertainty.**
- People are assumed to **maximize expected utility**, not expected monetary value.
- Based on assumptions regarding preferences, clear predictions can be derived:
  - If someone is risk-averse, they will prefer $100 for sure over a 50/50 gamble between $200 and $0, even though both options have the same expected value.
- Experimental economics tests whether **real choices follow these predictions**

Game Theory

- The study of **interdependent decision-making** where outcomes depend on one's own actions and the **actions of others.**
- Game theory includes clear rules for games and generates **precise predictions** (e.g., Nash equilibria) for these strategic settings.
- Experimental economics tests whether actual human behavior **matches theoretical equilibrium predictions.**

Individual Decision-Making

Mosteller & Nogee (1951)

- Mosteller & Nogee (1951) test predictions of expected utility theory:
  - (a) subjects participate in a game with opportunities to take or refuse certain gambles or risks entailing use of *real money*;
  - (b) from behavior in the game to construct a utility curve for each subject;
  - (c) to make predictions from the utility curves about future individual behavior toward other and more complicated risks; and
  - (d) to test the predictions by examining subsequent behavior toward more complex risks.
- Results: Predictions derived from these utility functions *"are not so good as might be hoped, but their general direction is correct."*

Allais (1953)

- Allais (1953) demonstrates that actual decision-making often violates the predictions of expected utility theory.
- Allais found stable pattern of people **choosing A over B** (preferring certainty) but **choose D over C**.
- This cannot be explained by expected utility theory and is known as "Allais Paradox."

Lottery 1:

- **A**: 100% chance of $1,000
- **B**: 89% chance of $1,000, 10% chance of $5,000, 1% chance of $0

Lottery 2:

- **C**: 11% chance of $1,000, 89% chance of $0
- **D**: 10% chance of $5,000, 90% chance of $0

Kahnemann & Tversky (1979) (1/2)

- Influenced by the work of Allais (1953), Kahnemann & Tversky published *„Prospect Theory: An Analysis of Decision under Risk“* in *Econometrica* in 1979.

- The paper further challenges expected utility theory and introduces “Prospect Theory” as an alternative.

- Based on controlled experiments they show systematic deviations from expected utility theory.

- Sparked a wave of lab experiments investigating how people make decisions under risk.

Kahnemann & Tversky (1979) (2/2)

TABLE I

PREFERENCES BETWEEN POSITIVE AND NEGATIVE PROSPECTS

Positive prospects				Negative prospects			
Problem 3:	(4,000, .80)	<	(3,000).	Problem 3′:	(−4,000, .80)	>	(−3,000).
$N = 95$	[20]		[80]*	$N = 95$	[92]*		[8]
Problem 4:	(4,000, .20)	>	(3,000, .25).	Problem 4′:	(−4,000, .20)	<	(−3,000, .25).
$N = 95$	[65]*		[35]	$N = 95$	[42]		[58]
Problem 7:	(3,000, .90)	>	(6,000, .45).	Problem 7′:	(−3,000, .90)	<	(−6,000, .45).
$N = 66$	[86]*		[14]	$N = 66$	[8]		[92]*
Problem 8:	(3,000, .002)	<	(6,000, .001).	Problem 8′:	(−3,000, .002)	>	(−6,000, .001).
$N = 66$	[27]		[73]*	$N = 66$	[70]*		[30]

Source: Kahnemann & Tversky (1979, p. 268)

Strategic Decision-Making

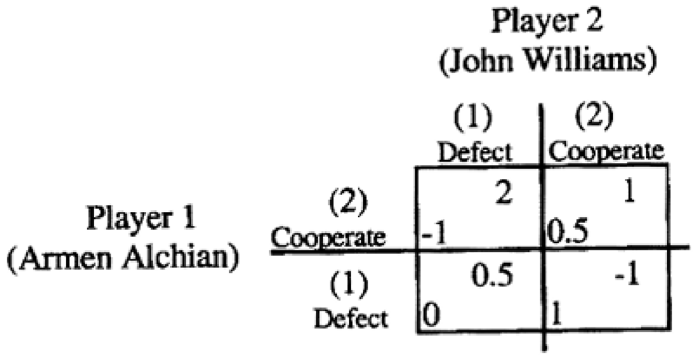
RAND Corporation

- Founded in 1948, the RAND Corporation is a nonprofit think tank focused on policy research and strategic decision-making.
- RAND played a pivotal role in developing and applying game theory to military and economic problems during the Cold War.
- Merrill M. Flood & Melvin Dresher devised an early version of the Prisoner’s Dilemma in 1950 while working at RAND.
- Many RAND researchers visited the influential two-month seminar on "The Design of Experiments in Decision Processes" which was held in Santa Monica in 1952.

Prisoner‘s Dilemma (1/2)

- Flood and Dresher invited two friends, economist Armen Alchian (UCLA) and mathematician John Williams (RAND), to play a game they devised a 100 in a row.

- The story about the prisoners was only later added by mathematician Albert Tucker and nowadays a version with symmetric payoffs is most often used.



Source: De Herdt (2003, p. 184)

Prisoner‘s Dilemma (2/2)

- Based on the experiment with their friends, Flood (1958) reports: *“It seems unlikely that the Nash equilibrium point is in any realistic sense the solution that human bargainers would be likely to use.”*

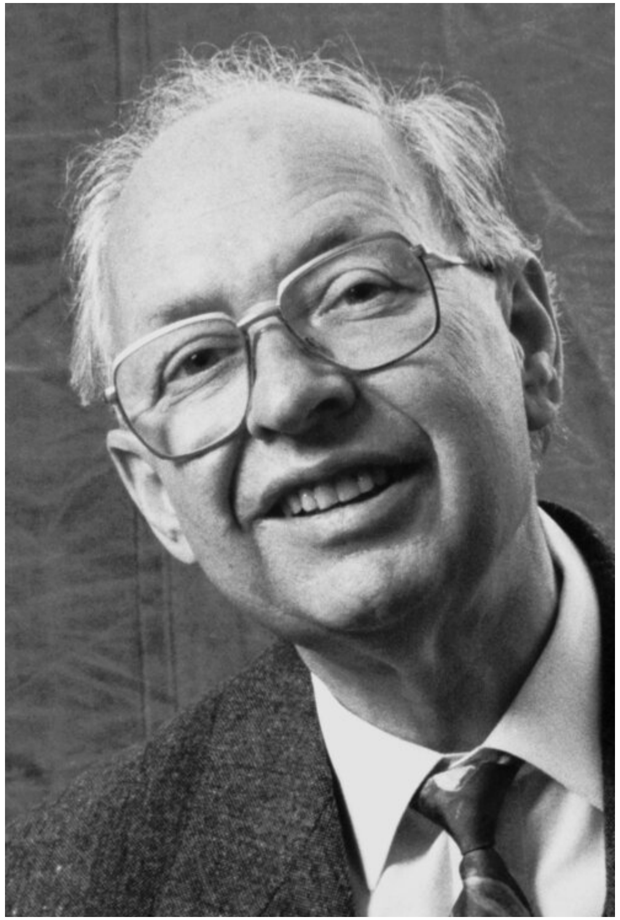
- Reply by John Nash in Flood (1958): *“The flaw in the experiment as a test of equilibrium point theory is that the experiment really amounts to having the players play one large multi-move game. One cannot just as well think of the thing as a sequence of independent games as one can in zero-sum cases.”*

Experimental Economics in Germany

- Reinhard Selten, Nobel laureate in 1994, began experimental work in the 1950s. His awarded game theory research was motivated by experimental results, such as those reported in Sauermann & Selten (1959).

- Sauermann and Selten co-founded the GfeW in 1977 and in 1984, Selten founded one of the first European experimental economics labs in Bonn.

- Güth et al. (1982) published the first experimental study of the Ultimatum Game.



Market Behavior

Chamberlain (1948) (1/2)

- Edward Chamberlin conducted market experiments with students in his economics classes at Harvard.

- Students received pieces of paper informing them whether they were sellers or buyers including their reservation prices for a single unit of an indivisible commodity.

- From that the competitive equilibrium (price and quantity) could be established unambiguously (and was under the control of the experimenter).

Chamberlain (1948) (2/2)

- The experiment he reported involved forty-six markets created in this way, with slightly varying equilibrium prices.
  - The number of units transacted was greater than the competitive volume in forty-two of these markets and equal to the competitive volume only in the remaining four markets.
  - The average price was below the competitive price in thirty-nine of these markets and higher in the rest.

- Chamberlain concluded that market outcomes would often differ from the competitive equilibrium.

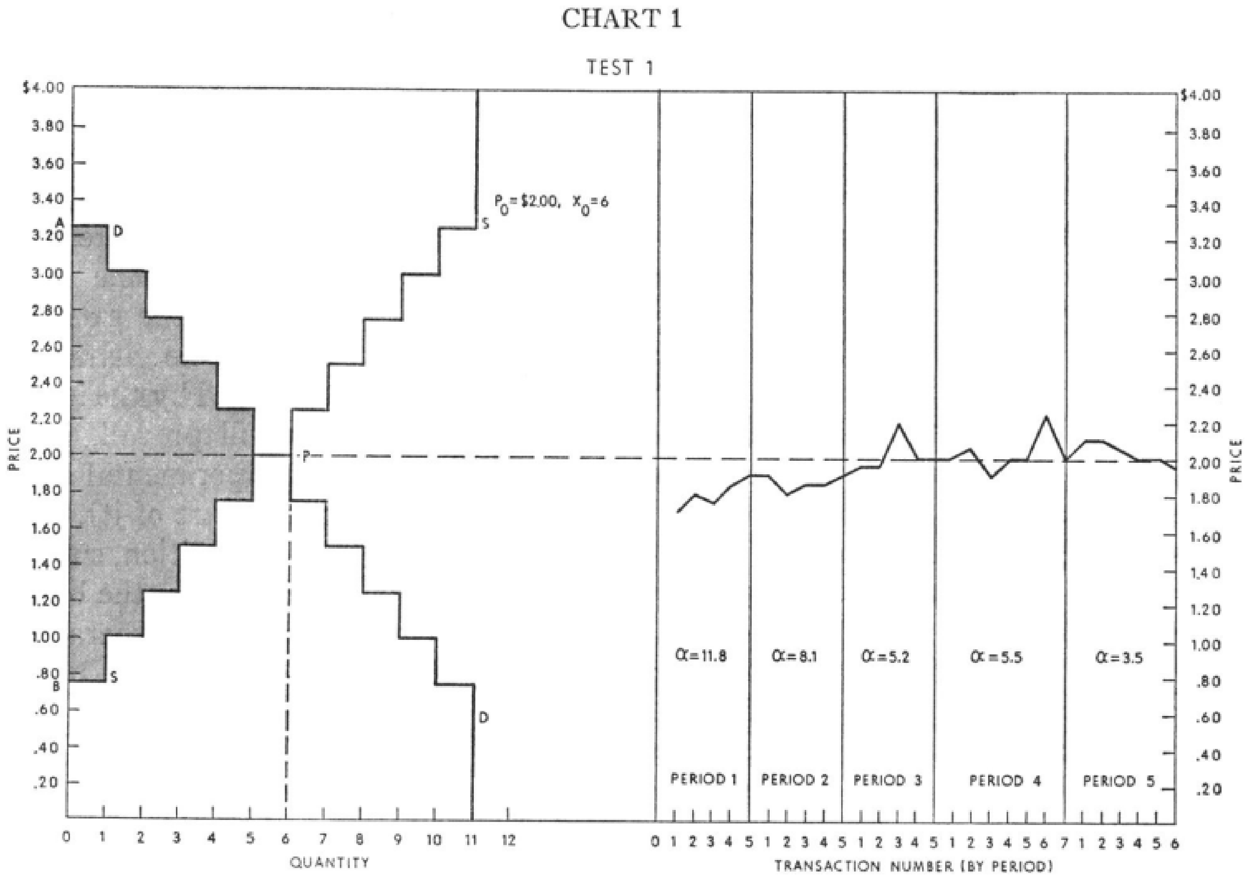
Smith (1962) (1/2)

- Vernon Smith was one of the students who took part in the experiments by Chamberlain.

- Smith replicated the experiments while implementing some changes in the set-up, most importantly:
  - Continuous double oral auction mechanism.
  - Repetition.

- Smith found that the actual trading prices came close to the theoretical equilibrium price.

Smith (1962) (2/2)



Source: Smith (1962, p. 113)

Experiments as an Established Method in Economics

Nobel Prizes (1/2)

- The 2002 Nobel Prize in economics was awarded to **Vernon Smith and Daniel Kahneman**.
  - The prize for Vernon Smith explicitly recognizes his role in establishing experimental economics: *“for having established laboratory experiments as a tool in empirical economic analysis, especially in the study of alternative market mechanisms”*
- A Nobel Prize signals that a method is no longer fringe but is now an established, influential tool in academia and policy-making.

Nobel Prizes (2/2)

- Following the prize in 2002, several others were given to researchers working experimentally:
  - In 2012, **Alvin Roth and Lloyd Shapley** received the Nobel Prize for their work on market design and matching theory, much of which relied on experimental methods.
  - In 2017, **Richard Thaler** received the Nobel Prize for his work in behavioral economics, which often relies on experimental work.
  - In 2019, **Abhijit Banerjee, Esther Duflo, and Michael Kremer** received the Nobel Prize for their work on randomized controlled trials (RCTs), a special form of field experiments.

Trends in Publications

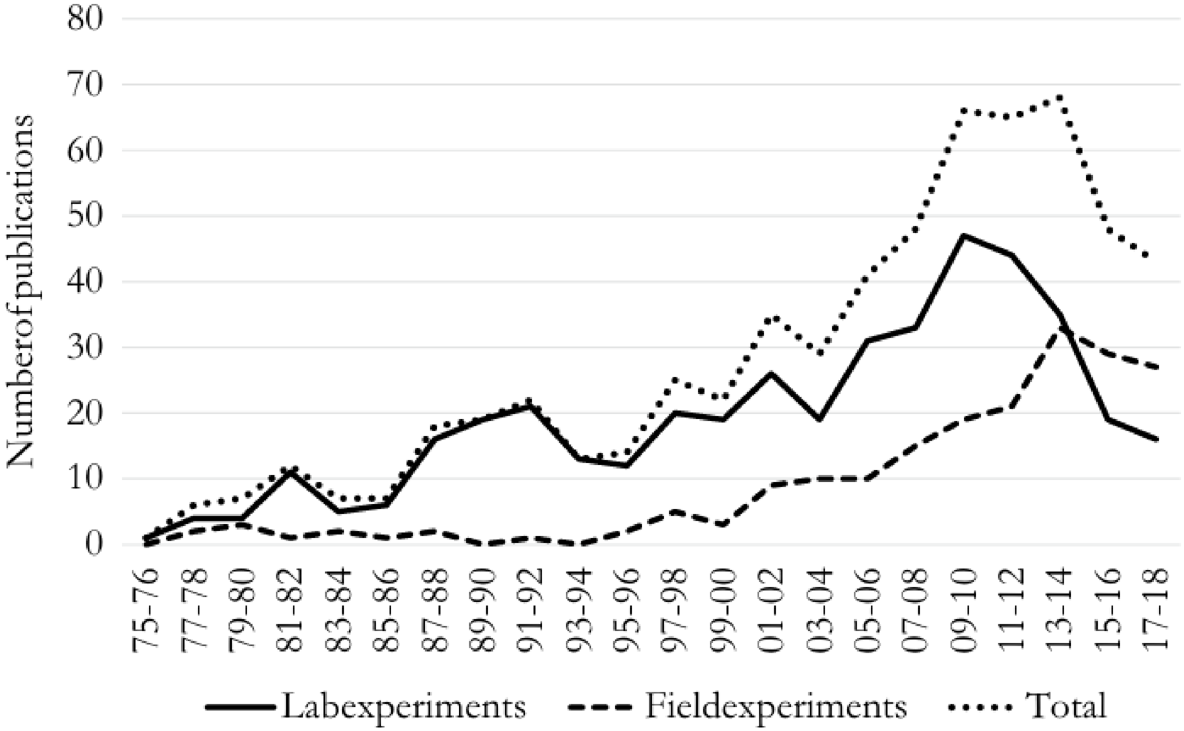


Fig. 1 Experimental papers published in the "top-5" economics journals (1975–2018)

Source: Nikiforakis & Slonim (2019, p. 145)

Questions

Exam Objectives

In the exam, you should be able to:

- **Name and describe** the key design elements of an economic experiment.
- **Explain** the difference between correlation and causation in economic contexts.
- **Explain** the role of experimentation (randomization and treatments) in detecting causal effects.
- **Describe** the different types of economic experiments.
- **Classify** experimental designs according to these types.
- **Explain** the difference between internal and external validity.
- **Explain** the importance of *„Theory of Games and Economic Behavior"* by Von Neumann & Morgenstern (1944) for the development of experimental economics.

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