Experimental Economics

Method and Applications

Over the past two decades, experimental economics has moved from a fringe activity to become a standard tool for empirical research. With experimental economics now regarded as part of the basic tool-kit for applied economics, this book demonstrates how controlled experiments can be useful in providing evidence relevant to economic research. Professors Jacquemet and L'Haridon take the standard model in applied econometrics as a basis for the methodology of controlled experiments. Methodological discussions are illustrated with standard experimental results. This book provides future experimental practitioners with the means to construct experiments that fit their research question, and newcomers with an understanding of the strengths and weaknesses of controlled experiments. Graduate students and academic researchers working in the field of experimental economics will be able to learn how to undertake, understand and criticise empirical research based on lab experiments, and refer to specific experiments, results or designs completed with case study applications.

Nicolas Jacquemet is a full professor at University Paris-1 Panthèon Sorbonne and the Paris School of Economics. His research combines experimental methods and econometrics to study discrimination, the effect of personality traits on economic behaviour, the role of social pre-involvement in strategic behaviour and experimental game theory. His research has been published in *Econometrica, Management Science, Games and Economic Behavior, Journal of Environmental Economics and Management, Journal of Health Economics* and *Journal of Economic Psychology.*

Olivier L'Haridon is a full professor at the University of Rennes 1. His research combines experimental methods and decision theory, applied in the study of individual decision-making as affected by uncertainty. His work has been published in *American Economic Review, Management Science, Journal of Risk and Uncertainty, Theory and Decision, Experimental Economics, Journal of Health Economics* and *Journal of Economic Psychology.*

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NICOLAS JACQUEMET
University Paris 1 Panthèon-Sorbonne and Paris School of Economics, France

OLIVIER L'HARIDON
Université de Rennes I, France

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Abbreviations and Symbols

Abbreviations

AD	Aggregate Demand
ATE	Average Treatment Effect
ATT	Average Treatment on the Treated
BART	Balloon Risk Analogue Task
BDM	Becker-De Groot-Marschak
BMI	Body Max Index
CADI	Constant Absolute Decreasing Impatience
CDF	Cumulative Distribution Function
CE	Certainty Equivalence
CHM	Cognitive-Hierarchy Model
CRDI	Constant Relative Decreasing Impatience
CRRA	Constant Relative Risk Aversion
DARA	Decreasing Absolute Risk Aversion
DA	Deferred Acceptance algorithm
DGP	Data Generating Process
DM	Dissonance Minimization
ECU	Experimental Currency Unit
FPRP	False Positive Report Probability
FR	Fully-revealing game
FTC	Federal Trade Commission
FW	Fixed wage
HSD	Honestly Significant Difference
IEC	Institutional Ethics Committee
IOS	Inclusion of the Other in the Self
IQR	Interquartile Range
IRB	Institutional Review Board
IV	Induced Value
LHS	Left-Hand Side
LSD	Least Significant Difference
MARS	Meta-Analysis Reporting Standards
MD	Mean absolute Deviation
MLE	Maximum Likelihood Estimator
MOOSE	Meta-analysis of Observational Studies in Epidemiology

MPCR	Marginal per Capita Return
MSE	Mean Squared Error
MT	Amazon's Mechanical Turk
MT	Mechanical Turk
MT	Western Educated, Industrialized, Rich, and Democratic
NR	Non-revealing game
OLS	Ordinary Least Squares
PEEM	Portable Extensions of Existing Models
PE	Probability Equivalence
PGG	Public Good Game
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PR	Piece-rate
Q-Q	Quantile-Quantile
QRE	Quantal-Response Equilibrium
RDU	Rank-Dependent Utility
RHS	Righ-Hand Side
RIS	Random Incentive System
UBG	Ultimatum Bargaining Game
VCM	Voluntary Contribution Mechanism
WEIRD	Western Educated, Industrialised, Rich, and Democratic
WTA	Willingness to Accept
WTP	Willingness to Pay
WVS	World Value Survey
WVS	World Values Survey

Symbols

$\bar{y}$	sample average
Δ	variation
δ	exponential discount factor, parameter
ℓ	effort
η	decision error
$\hat{\theta}$	estimator
λ, γ	parameters
$\mathbb{E}$	expectation
$\mathbf{B}$	bias
$\mathbf{T}$	test statistic
$\mathbf{X}$	matrix of individual observations, e.g observable characteristics
$\mathbf{y}$	vector of the observations on the outcome variable
$\mathcal{I}$	beliefs in bayesian estimation
$\mathcal{L}$	sampling distribution
$\mathcal{N}$	normal distribution
$\mathcal{S}$	state space
$\mathcal{T}$	treatment

$\mathcal{X}$	inputs
$\mathcal{Y}$	outputs
μ	mean
Ω	variance-covariance matrix
$\omega()$	probability weighting function
B	Binomial distribution
dCor	distance correlation
dCov	distance covariance
$\mathrm{F}_l, \mathrm{F}_u$	critical values of the Fisher distribution
Φ	standard normal cumulative distribution
ϕ	standard normal density
π	profit
$\boldsymbol{\varepsilon}$	vector of error terms
ρ	Pearson correlation coefficient
σ, ψ	standard deviations
Θ	parameter space
$\mathbb{V}$	variance
ε_i	individual error terms
a, b, A, B	general purpose parameters (actions, prizes, bids...)
b_L	lower bound of confidence interval
b_U	upper bound of confidence interval
c	threshold in hypothesis testing
$c_e()$	cost of effort
d_0, d_1	decisions in hypothesis testing
DR	decision rule
e	endowment
$F(), f()$	functions
$G()$	cumulative distribution function
$g()$	density
h, i, j, k, s, t	indexes
H_0, H_1, H_a	statistical hypothesis
K	number of samples, treatments, classes...
$L()$	likelihood
$LL()$	log-likelihood
m	number of observable characteristics, median
N	population size
n	number of observations, sample size, number of modeling features
$n_{\mathcal{X}}$	number of inputs
$n_{\mathcal{Y}}$	number of outputs
p, Pr	probability
$p_{(k)}$	rank-ordered p-value
q, Q	price, returns
r	rank
rr	rate of return

S^2	sample variance
SS	sum of squares
T	time, date, period
t_α	critical value of the Student t distribution
$U(), V()$	preference functionals
$u(), v()$	utility functions
w	wage
X, Y	random variables
x, y	realization of random variables
$Y_{(h)}$	ordered value of Y (with order h)
Z	dummy variable
z_α	critical value of the normal distribution
α	Type I error
β	Type II error
θ	parameter(s)
E	event
p_τ	tremble
R	rejection region in hypothesis testing
$W()$	event weighting function
x_{ij}	observation for subject i and variable j
y_i	observation on the outcome variable for subject i

Preface

There is an experimental-economics paradox. Inside the community of researchers carrying out laboratory experiments, these latter are seen as no more and no less than a tool for empirical research. From the outside, however, the method is often perceived as part of a particular sub-field, behavioural economics, which applies insights from both economics and psychology for the better understanding of economic behaviour. Experimental economics is also usually taught this way in most programmes, as part of behavioural-economics classes.

It has, however, long been recognised that experimental and behavioural economics are not the same. Behavioural economics is a research programme with a clear ambition and a well-defined objective: improving economic analysis using realistic psychological assumptions about human behaviour. Experimental economics, on the contrary, is not, per se, a research programme. Rather, it is a research method based on experimental control, applied to the typical topics in economic analysis.

The aim of this textbook is to help close the gap between the perception and reality of experimental methods in economics. We cover experimental economics, i.e. controlled experiments used as a tool to provide empirical evidence that is relevant for economic research. The structure of the textbook thus mimics the way many econometrics textbooks have been written for decades: the coverage focuses on applied statistical methods, the use of which is illustrated with economic results.

There are, however, a number of (good) reasons for this confusion between behavioural and experimental economics, which is at the heart of the experimental–economics paradox. First, behavioural economics emerged partly from the use of experiments – although the contribution of early experiments (such as the Allais paradox and the Chamberlin and Smith market experiments, described in Chapter 1) was to both behavioural economics and mainstream economics (for instance, neoclassical market analysis). Second, the experimental economics method is particularly suited for the study of the phenomena of interest to behavioural economics. In a nutshell, control offers researchers a way of identifying departures from the neoclassical explanation of behaviour. Third, not only behavioural economics but also experimental economics owe a great deal to the accumulated knowledge in experimental psychology: controlled experiments have been used for a long time in this field, and most methodological discussions took place before they even appeared in economics. In addition, the

experimental method is taken as part of the psychology research toolkit across the whole community of researchers.

The scope of this book has been greatly influenced by the place that experimental economics occupies between neoclassical economics, behavioural economics, psychology and statistics. First, our methodological discussion mainly focuses on the use of experiments to understand economic behaviour. We complement this fairly standard view in applied economics by regularly devoting space to insights from, and some discrepancies with, psychology. We also cover a number of standard experimental results that are generally seen as part of behavioural economics.

Second, we mainly focus on laboratory experiments rather than field experiments or randomised controlled trials (see Chapter 3, Section 3.5 for the definition of these). This restriction reflects at least three factors. First, one textbook cannot suffice to embrace the large literature on methods for both laboratory experiments and randomised controlled trials. Second, this restriction also comes from our own limitations in expertise. Last, but not least, laboratory experiments are a convenient step in the study of controlled experiments in economics. Laboratory experiments can be seen as an extreme case of controlled experiments; they allow the accurate identification of behavioural phenomena, but at the cost of a highly artificial environment. Due to this artificiality, laboratory experiments provide answers that are sometimes hard to interpret – and are often challenged by non-experimentalists. Other kinds of experiment offer a way of loosening these limitations by implementing the same empirical method in less artificial contexts. We thus believe that laboratory experiments are a good starting point for anyone who wants to learn about controlled experiments in economics. Many of the discussions in this textbook aim to clarify the most appropriate cases for each type of empirical method; for example, whether observational or experimental data are required and, if it is experimental data, how close to the field the experiment should be.

Structure of the book

This textbook is not the first experimental-economics book by a long way, with respect to both methods and applications. Our predecessors can be split into two groups. First, textbooks/handbooks written for students and academics provide extensive surveys of experimental results. This applies to the textbook of Friedman and Sunder (1994) and the two seminal handbooks edited by Plott and Smith (2008) and Kagel and Roth (1995). In the same spirit, a number of books propose reviews of existing results from laboratory experiments with more specialised perspectives: Camerer (2003) contrasts behaviour in the lab with predictions from game theory, Cartwright (2011) and Chaudhuri (2009) mainly focus on social preferences and behavioural economics, and Angner (2012) provides a detailed overview of laboratory experiments regarding decision problems. These are all required reading for anyone wanting to learn more about experimental results. On the other hand, a few advanced books on the methodology of experiments have recently appeared. These are state-of-the-art collections of papers, written mainly for

academics working in the field. This is the case for Guala (2005), Bardsley et al. (2009) and Fréchette and Schotter (2015).

This textbook is an attempt to build a bridge between these two kinds of reference: it provides a detailed presentation of the methodological aspects of economic experiments for readers (students, academics and professionals) who want to enter the field. To this end the book inverses the usual way of presenting the material, as the experimental results are used to illustrate methodological issues – rather than spreading out the methodological discussions over the presentation of various experimental designs. The content of the book is set out at the end of Chapter 1. We are aware that 'Methodology, like sex, is better demonstrated than discussed, though often better anticipated than experienced' (Leamer, 1983, p. 40). Mimicking the approach in applied economics and econometrics textbooks, the concrete applications of the method that constitute the core material in existing textbooks are here introduced as illustrations of the main material. To this end, the book contains three types of side material describing particular experiments, results or designs: case studies, illustrations and focuses.

- **Case studies** are sections devoted to the detailed presentation of a particular strand of experiments. They seek to illustrate the methodological discussions provided in the corresponding chapter – identified as such in the table of contents.
- **Illustrations** are boxes providing a presentation of one particular experiment or result, to illustrate the point discussed in the text. Illustrations are often provided in sequences, showing how the literature has evolved according to the different dimensions discussed in the text.
- **Focuses** are boxes providing a more detailed and/or formal presentation of a point discussed in the text.

These together provide examples of most of the applications or results that are generally seen as essential in the field – as described in Section 1.4. To help readers bring together all of the information on one particular topic, they appear as specific index headers (see p. 431).

Audience

There are three natural audiences for this book. Its first purpose is as part of a graduate course, describing methods in experimental economics. The organisation of the book closely follows the typical outline of an 8 × 3-hour course. Chapters 1–4 cover the material that would serve as an introductory lecture to laboratory experiments. These chapters describe the main objectives of laboratory experiments and provide examples. Chapters 5 and 8 provide core methodological insights that would best be split in two lectures each. Longer classes could include a discussion of the statistical analysis of experimental data based on Chapter 7 and a discussion of the insights drawn from behavioural economics in Chapter 9, and/or use case studies to devote some lectures to applications that illustrate the main material. In particular, a thorough methodological

course would probably feature some lectures devoted to risk preferences (Section 7.4), time preferences (Section 6.6) and belief-elicitation methods (Section 5.6).

Second, the book more generally seeks to provide future experimental practitioners with a broad picture of the toolkit that they will need. By providing the rationale for the general method and setting out in detail each particular choice of design feature, we hope that readers will be able to construct experiments that fit their research question well. A good understanding of the methodological challenges is also an important requirement for becoming an informed reader: this book may help to interpret the results from laboratory experiments or the writing of referee reports on papers using the experimental method. Third, we hope the community of academics who are new to this literature will find it a useful summary of the current state of the art about what experimental economics can tell us, and under which conditions it provides valuable answers to research questions in economics.

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