

Springer Texts in Business and Economics

Springer Texts in Business and Economics (STBE) delivers high-quality instructional content for undergraduates and graduates in all areas of Business/Management Science and Economics. The series is comprised of self-contained books with a broad and comprehensive coverage that are suitable for class as well as for individual self-study. All texts are authored by established experts in their fields and offer a solid methodological background, often accompanied by problems and exercises.

More information about this series at <http://www.springer.com/series/10099>

Joachim Weimann
Jeannette Brosig-Koch

Methods in Experimental Economics

An Introduction

 Springer

Joachim Weimann
Otto-von-Guericke University
Magdeburg
Magdeburg, Germany

Jeannette Brosig-Koch
University of Duisburg-Essen
Essen, Germany

Original German edition published by Springer Fachmedien Wiesbaden GmbH, Wiesbaden, Germany, 2019

ISSN 2192-4333 ISSN 2192-4341 (electronic)
Springer Texts in Business and Economics
ISBN 978-3-319-93362-7 ISBN 978-3-319-93363-4 (eBook)
<https://doi.org/10.1007/978-3-319-93363-4>

© Springer Nature Switzerland AG 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

To our families and in memory of Thomas

About This Book

Experimental economic research has become an integral part of modern economic research. Laboratory experiments, the central subject of this book, are now being used to address a wide range of economic issues in all areas of economics. They can be found in business economics research, industrial economics, finance, capital market research, macroeconomics, health economics, and many other fields. The boom in experimental research has been accompanied by the development of an increasingly sophisticated methodology that has contributed greatly to the fact that the quality of laboratory experiments has continued to rise.

A consequence of this is that it has become increasingly important to know very precisely how a research question can be investigated in the laboratory in a methodologically sound way. This textbook aims to help researchers who want to use the laboratory to do just that. We have set ourselves the goal of writing a book that will help both scientists who have already gained experience in the laboratory and those who are starting to work with this method. No special prior knowledge is required to use this book.

Economic research is, of course, the focus of this book, but we hope that colleagues from other related disciplines in which laboratory experiments are starting to be used can also benefit from it. In any case, we have made an effort to assume as little knowledge of economic theory as possible. This is reflected, for example, in the fact that we have written two appendices in which, on the one hand, important game theoretical terms are explained and, on the other hand, important basic experiments that are used in economics are introduced.

The book is divided into four chapters (plus the appendices). The first chapter seeks to place the experimental method in the context of economic research. This seemed necessary and sensible to us because economics was traditionally not an experimental discipline and, in its beginnings, it clearly distinguished itself from psychology. We therefore need an explanation of how normative theory, with its axiomatic models, together with experiments and the increasingly important field of behavioral economics came to dominate this scientific field today. We endeavor to provide such an explanation in the first chapter.

The second chapter of the book is in a sense its core, for it is devoted to the methodological foundations. We have sought to address what we consider to be the most important methodological questions. Of course, we do not claim it to be exhaustive and it naturally remains a subjective selection. We were assisted in this by regularly reading the newsletter of the Economic Science Association (esa-announce@googlegroups.com), which provided us with many valuable ideas. We would like to take this opportunity to thank the ESA Community.

The third chapter of the book deals with the practical implementation of experiments. This is important in view of the fact that both economists and social scientists are generally not accustomed to getting up from their desks and doing practical work in a laboratory. For this reason, it seemed important to us not only to give some useful advice on how to organize the work there but also to point out the most serious traps that lurk in laboratory work.

The fourth chapter of the book deals with the statistical analysis of the data generated in the laboratory. It was of importance to us to point out that this analysis should not begin only when the experiment is completed. On the contrary, it is advisable to already give some thought to the ensuing statistical analysis when designing the experiment. Errors made during the design of the experiment cannot be rectified by statistics. The fourth chapter posed the greatest challenge for us when it came to selecting material since the literature on the statistical methods that can be used for laboratory data is very extensive and the number of possible methods is exceedingly large. We therefore had to carefully consider what we would include and how far we would go into the details of a procedure. We refer the reader to more specialized textbooks in many places because it would have gone beyond the scope of this book to report on the methods in even greater depth.

Sönke Hoffmann supported us in our work on chapter four. We cannot emphasize enough how important his contribution is and would have liked Sönke to be a coauthor of this book. His contribution certainly justifies it. We would also like to thank the Springer Verlag staff, namely, Barbara Fess and Isabella Hanser, for their support and, above all, for their patience with us. Finally, we would like to express our appreciation and thanks to Brian Browne for translating this book.

We very much hope that our book will be put to use in teaching and that it will help those who conduct research in the laboratory to meet the ever-higher methodological standards that research demands. If everything goes well, there will be more editions of this book, and we would be very happy if those who read and use it could let us know if they feel something is missing or see things differently from the way we have presented them. And of course, we look forward to receiving any positive feedback from readers who like the book. We can be reached at:

Joachim.Weimann@ovgu.de and
Jeannette.Brosig-Koch@ibes.uni-due.de

Contents

1	The Study of Behavior	1
1.1	Introduction	2
1.2	Normative Theory and Behavioral Economics	5
1.3	The History of Economic Experiments	7
1.4	The History of the Neoclassical Rational Choice Model and the Return of Psychology	13
1.5	External Validity	22
1.6	Behavioral Research: An Interdisciplinary Issue	33
	References.....	38
2	Methodological Foundations	41
2.1	Introduction	43
2.2	It's About Money	44
2.2.1	The Induced Value Method.....	44
2.2.2	The Size of Payoffs	49
2.2.3	Is It Okay to Take Money from Subjects of Experiments?	52
2.2.4	The House Money Effect.....	55
2.3	The Subjects of the Experiment	57
2.3.1	Is It Permissible to Lie to Subjects of Experiments?	57
2.3.2	Are Students the Right Subjects?	60
2.3.3	What Role Does the Student's Subject of Study Play?	65
2.3.4	Cultural Differences.....	68
2.4	Preferences, Payoffs and Beliefs	70
2.4.1	Risk Behavior in the Laboratory	70
2.4.2	Selecting the Payoff Mechanism.....	75
2.4.3	Eliciting Beliefs.....	78
2.5	The Influence of the Experimenter	83
2.5.1	The Experimenter Demand Effect	83
2.5.2	Double-Blind Design	92
2.5.3	The Frame of the Experiment.....	95
2.5.4	Instructions and Comprehension Tests	101
2.6	Interactions Between the Subjects	104
2.6.1	Reputation Effects and Social Distance	105
2.6.2	Communication Effects.....	107
2.6.3	Possible Causes of Communication Effects.....	115
2.7	Decisions Made by the Subjects	118
2.7.1	Strategy Method Versus Direct Response.....	119
2.7.2	Experiments with Real Effort.....	122
2.7.3	Within- Versus Between-Subject Design	125

2.8	The Repetition of Games	128
2.8.1	Repetition Within a Session	129
2.8.2	The Repetition of Sessions	133
2.9	The Reproducibility of Experiments	136
	References	138
3	Experimental Practice	147
3.1	Setting Up an Experimental Laboratory	148
3.2	Preparing an Experiment	154
3.2.1	Choosing the Design and the Treatments	154
3.2.2	Instructions, Recruiting, Plan of Procedure und Pilot Experiment	159
3.3	Conducting an Experiment	163
3.3.1	Access to the Laboratory, Instructions, Unusual Incidents	163
3.3.2	Organizing the Payments to the Subjects	165
	References	168
4	The Experiment from a Statistical Perspective	169
4.1	Introduction	171
4.2	Operationalizing the Research Question	174
4.2.1	Construct Validity	174
4.2.2	Types of Variables	175
4.2.3	Control, Randomization and Sample Size	176
4.2.4	Scales of Measurement	177
4.2.5	Random Variables and Their Distribution	178
4.3	Creating the Statistical Design	182
4.3.1	Compiling the Observation Units	182
4.3.2	How Do Experimental Treatments Differ?	184
4.4	Statistical Tests	188
4.4.1	Formulating Testable Hypotheses	188
4.4.2	How Inferential Statistics Works	191
4.4.3	Possible Errors and Power of a Test	194
4.5	Power Analysis	196
4.5.1	Basics	196
4.5.2	BEAN and the Optimal Sample Size	202
4.5.3	Power Analysis and the "Hard Truth" of its Results	205
4.5.4	Misapplications and Misunderstandings in Power Analyses	207
4.6	Choosing Statistical Tests	210
4.6.1	What Should be Taken into Consideration?	210
4.6.2	Classifying Test Methods	211
4.6.3	How Do I Choose a Specific Test?	213
4.6.4	The z-Test und t-Test for One Sample	214
4.6.5	t-Test for Two Independent Samples (Between-Subject Comparison)	216
4.6.6	t-Test for Two Dependent Samples (Within-Subject Comparison)	217
4.6.7	Kolmogorov Test	218
4.6.8	The Wilcoxon Rank-Sum Test and the Mann-Whitney <i>U</i> Test	219
4.6.9	Wilcoxon Signed-Rank Test (Two Dependent Samples)	223

4.6.10	The Binomial Test.....	227
4.6.11	The Multinomial Test ($1 \times k$).....	230
4.6.12	Fisher's Exact Test (2×2).....	233
4.6.13	χ^2 Test ($2 \times k$).....	237
4.6.14	McNemar Test.....	241
4.7	Statistical Models	244
4.7.1	The Fundamentals.....	244
4.7.2	Using Statistical Models.....	249
4.7.3	The Linear Model (LM).....	251
4.7.4	Models for Discrete and/or Non-Normally Distributed Dependent Variables.....	255
4.7.5	Models for Statistically Dependent Observations.....	259
4.7.6	Models with Limited Dependent Variables.....	281
4.8	Statistics Software	285
	References.....	286
 Supplementary Information		
	Appendix.....	290
	Index.....	303

About the Authors



Joachim Weimann

was born in Düsseldorf. He studied economics at the University of Bielefeld. He received his doctorate and habilitation from the University of Dortmund. After a first call to the Ruhr-University Bochum, he got the call to the Otto-von-Guericke-University Magdeburg in 1994. There he still holds the Chair of Economic Policy. He is the author of numerous publications in international scientific journals and of seven monographs, including three textbooks. He is chairman of the German Society for Experimental Economics and executive director of the MaXLab (Magdeburg Laboratory for Experimental Economic Research), member of the Senate and Approval Committee for Research Training Groups of the German Research Foundation, chairman of the ISSM (Institute for Location Research and Tax Policy Magdeburg), and member of ACATECH (Academy of Engineering Sciences). He was dean of the Faculty of Economics at the University of Magdeburg from 1998 to 2008 and a member of the Scientific Senate of the University of Magdeburg from 1998 to 2011. In addition to experimental economic research, his scientific interests include labor market research, happiness research, and environmental economics. Prof. Weimann also frequently speaks in public about labor market and environmental policy issues. The FAZ listed him several times in the list of the 50 most influential economists in Germany.



Jeannette Brosig-Koch

holds a Chair for Quantitative Economic Policy at the University of Duisburg-Essen, Germany, and is the founding director of the Essen Laboratory for Experimental Economics (elfe). Her main research interests are in the fields of experimental health economics and market design. She obtained her doctoral degree in economics in 2003 and her habilitation in 2008, both from the University of Magdeburg, Germany. During this period, she spent several months as a research fellow at Pennsylvania State University, USA, and served as managing director of the Magdeburg Laboratory for Experimental Economics (MaXLab). From 2006 to 2008, she was interim professor at the University of Cologne, Germany. Since April 2008, Jeannette Brosig-Koch has held a full professorship for quantitative economic policy at the University of Duisburg-Essen. Jeannette Brosig-Koch is a member of the

review board of the German Research Foundation (DFG), chair of the Socio-scientific Committee of the German Economic Association (VfS), and general secretary of the German Health Economics Association (dggö). Moreover, she serves as a member of the management board of the Behavioural Experiments in Health Network which is a European network for experimental and behavioral research in health economics. The network aims to foster the use of experimental methods and behavioral insights in health economics, policy, and management.