The Methodology of Experimental Economics

The experimental approach is a driving force behind some of the most exciting developments in economics. The "experimental revolution" was based on a series of bold philosophical premises that have remained until now mostly unexplored. This book provides the first comprehensive analysis and critical discussion of the methodology of experimental economics, written by a philosopher of science with expertise in the field. It outlines the fundamental principles of experimental inference in order to investigate their power, scope, and limitations. The author demonstrates that experimental economists have a lot to gain by discussing openly the philosophical principles that guide their work, and that philosophers of science have a lot to learn from the ingenious techniques devised by experimenters in order to tackle difficult scientific problems.

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CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo

Cambridge University Press
40 West 20th Street, New York, NY 10011-4211, USA

www.cambridge.org
Information on this title: www.cambridge.org/9780521853408

First published 2005

Printed in the United States of America

A catalog record for this publication is available from the British Library.

Library of Congress Cataloging in Publication Data
Guala, Francesco, 1970–
The methodology of experimental economics / Francesco Guala.
p. cm.
Includes bibliographical references and index.
ISBN 0-521-85340-0 (hardcover) – ISBN 0-521-61861-4 (pbk.)
1. Economics – Methodology. 2. Economics – Experiments – Methodology. I. Title.
HB131.G83 2005
330′.072′4 – dc22 2004031079

ISBN-13 978-0-521-85340-8 hardback
ISBN-10 0-521-85340-0 hardback

ISBN-13 978-0-521-61861-8 paperback
ISBN-10 0-521-61861-4 paperback

To Francesca

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are routinely tested by scientists, and introduce an important distinction between "data" and "phenomena".

4 Causation and Experimental Control

The key to experimental control is the controlled variation of one variable keeping the other (background) conditions fixed. The rationale of variation can be explained using a second important model of scientific method, the perfectly controlled experimental design. This model is particularly important in experiments aimed at testing causal hypotheses. Causes can be used to control or manipulate their effects. Causal relations can be deterministic or probabilistic, and the perfectly controlled experiment exemplifies a situation in which the statistical association between variables reflects the underlying causal relations.

5 Prediction

Laboratory experimentation helps to tackle the Duhem-Quine problem constructively, or to draw tight inductive inferences from the evidence to a given hypothesis. Much philosophical literature, however, has focused on the wrong aspects of this inductive step, by stressing the importance of predictive success. In fact, the crucial advantage of the experimental method is that it allows the control of the background assumptions upon which strong inductive inferences rest. This thesis is illustrated using the example of preference reversal experiments.

6 Elimination

Bayesian confirmation theory stresses the importance of the background, but for the wrong reasons. Scientists' prior beliefs should not be given too much weight in confirmation theory. What matters is whether the background factors have been controlled by means of an effective experimental design. The experimental method is best characterized as a procedure of eliminative induction, in which factors that may potentially disturb the inference from the evidence to a hypothesis are checked one by one, until all sources of error have been controlled for. Experiments on preference reversals provide several examples of this strategy at work.

Part two: inferences from the experiment

7 External Validity
There is a trade-off between the internal validity of an experimental result (whether a given laboratory phenomenon or mechanism has been correctly identified) and its external validity (whether the results can be generalized from the laboratory to the outside world). External validity is a genuine problem and cannot be solved by metaphysical speculation or methodological stipulation. It is an issue that must be tackled and solved empirically.

8 Economic Engineering
The best example of successful external validity inference is provided by cases of economic engineering, in which a piece of the real world is shaped so as to mirror the conditions of a laboratory experiment. I illustrate this procedure using the early auctions of the Federal Communication Commission as an example. The key external validity step is taken by comparing field evidence with experimental evidence and using a so-called no-miracle argument.

9 From the Laboratory to the Outside World
"Radical localists" argue that experimental results only apply to laboratory circumstances, or to real-world circumstances that have been engineered so as to resemble the lab. In reality, when experimenters cannot shape the real world so as to fit the laboratory, they can try to shape the laboratory so as to mimic the target system in the real world. Winner's curse experiments illustrate this principle at work. The inference from experiment to the real world is a special kind of analogical argument, in which the inference is strengthened by making sure that the two systems are similar in all relevant (causal) respects.

10 Experiments as Mediators
Models and experiments share several important characteristics. Both are systems that are created to aid scientists in their investigations of a target system. They are "mediating tools," an intermediary step in the process connecting our theoretical speculations with the real world. Like models, experiments can be closer to abstract theory or to application. The purpose of an experiment is often to test the robustness of a phenomenon rather than its applicability to a particular real-world situation.

Acknowledgments

This project started a decade ago at King's College London, was developed during my Ph.D. years at the London School of Economics, and was concluded at the University of Exeter. During this period of time, I have received financial support from various sources; I should mention especially a TMR ("Marie Curie") scholarship of the European Union, the European TMR Network FMRX CT 96005, the center THEMA at the University of Cergy–Pontoise, a research fellowship of the Cognitive Science Laboratory of the University of Trento, and the research leave scheme of the University of Exeter.

I am indebted to a number of people, starting with Mary Morgan and Philippe Mongin, who first encouraged me to study economic experiments as a young graduate student and then in many ways supported this project throughout the years. Philippe became my Ph.D. supervisor jointly with John Worrall; they gave me an example of intellectual rigor that I have always tried to imitate and probably never attained. My first close encounter with experimental economics was via the experimental group of the University of East Anglia. Chris Starmer, Bob Sugden, and Robin Cubitt, in particular, have always been willing to discuss openly and frankly the methodological reasoning that informs their research. I must also thank Roberto Burlando for having guided me into the practical aspects of experimental work, and Luigi Mittone for several discussions on methodological matters. Parts of Chapter 10 derive from a working paper Luigi and I coauthored a few years ago.

Other people who have contributed with several useful comments and critiques over the years include Paul Anand, Roger Backhouse, Barry Barnes, Mark Blaug, John Broome, Nancy Cartwright, Marco Del

Seta, Dan Hausman, Peter Lipton, Gian Maria Martini, Deborah Mayo, Phil Mirowski, Edward Nik-Kah, Nigel Pleasants, Andrea Salanti, Joep Sonnemans, and Sang Wook Yi. I am particularly grateful to John Dupré, Dan Hausman, Mary Morgan, Matteo Motterlini, and the anonymous readers who have read and criticized preliminary versions of the manuscript. Parts of some chapters have been presented at conferences and seminars around the world. I should in particular thank the audiences at the universities of Cambridge, Bergamo, East Anglia, LSE, Paris, Pisa, Rotterdam, Siena, Tilburg, and Trento as well as those at the 1998 HES conference in Montreal, the 1999 Theorizing and Experimentation conference in Rovaniemi, the 1999 SILFS conference in Ferrara, the Model-Based Reasoning conferences held in Pavia (1998 and 2000), the PSA 2002 meeting in Milwaukee, the workshop on the methodology of experimental economics held in Nottingham (2003), the 2004 INEM meeting in Amsterdam, and the performativity of economics workshop in Paris (2004).

The views defended in this book are closest to those of Nancy Cartwright, Dan Hausman, and John Dupré – which is quite natural, I suppose, given that Nancy and Dan have been my teachers at the LSE, and John is now a senior colleague of mine at Exeter. I am sure that in several places I have failed to fully recognize my debt toward their ideas. This initial acknowledgment is offered by way of an apology. Of course, I am entirely responsible for all the mistakes that remain.

Finally, bits and pieces of various published articles are scattered throughout the book: Chapters 5 and 6 build upon "Artefacts in Experimental Economics: Preference Reversals and the Becker-DeGroot-Marschak Mechanism" (*Economics and Philosophy* 16, 2000, pp. 47–75). Traces of "The Problem of External Validity (Or 'Parallelism') in Experimental Economics" (*Social Science Information* 38, 1999, pp. 555–73) can be detected in Chapter 7, and are reprinted by permission of Sage. Chapter 8 is a revised version of "Building Economic Machines: The FCC Auctions" (*Studies in History and Philosophy of Science* 32, 2001, pp. 453–77), reprinted by permission of Elsevier Science. Chapter 9 reproduces material from "Experimental Localism and External Validity" (*Philosophy of Science* 70, 2003, pp. 1195–205), reprinted by permission of the Philosophy of Science Association. "Experiments as Mediators in the Non-laboratory Sciences" (*Philosophica* 62, 1998, pp. 901–18) is the starting point for much of Chapters 9 and 10. Parts of "Models, Simulations, and Experiments" (in *Model–based Reasoning: Science, Technology, Values*, ed. by L. Magnani and N. J. Nersessian, pp. 59–74) are also reproduced in Chapter 10 by permission of Kluwer.