CAUSAL INFERENCE

for Statistics, Social, and Biomedical Sciences
An Introduction

Most questions in social and biomedical sciences are causal in nature: what would happen to individuals, or to groups, if part of their environment were changed? In this groundbreaking text, two world-renowned experts present statistical methods for studying such questions.

This book starts with the notion of potential outcomes, each corresponding to the outcome that would be realized if a subject were exposed to a particular treatment or regime. In this approach, causal effects are comparisons of such potential outcomes. The fundamental problem of causal inference is that we can observe only one of the potential outcomes for a particular subject. The authors discuss how randomized experiments allow us to assess causal effects and then turn to observational studies. They lay out the assumptions needed for causal inference and describe the leading analysis methods, including matching, propensity-score methods, and instrumental variables. Many detailed applications are included, with special focus on practical aspects for the empirical researcher.

Guido W. Imbens is Applied Econometrics Professor and Professor of Economics at the Graduate School of Business at Stanford University. He has previously held tenured positions at the University of California at Los Angeles, the University of California at Berkeley, and Harvard University. He is a Fellow of the Econometric Society and the American Academy of Arts and Sciences. He holds an honorary doctorate from the University of St. Gallen, Switzerland. Imbens has done extensive research in econometrics and statistics, specializing in causal inference. He has published widely in leading economics and statistics journals, including the *American Economic Review*, *Econometrica*, the *Review of Economic Studies*, the *Journal of the American Statistical Association*, the *Annals of Statistics*, *Biometrika*, and the *Journal of the Royal Statistical Society, Series A*.

Donald B. Rubin is John L. Loeb Professor of Statistics at Harvard University, where he has been professor since 1983 and Department chair for 13 of those years. He has been elected to be a Fellow/Member/Honorary Member of the Woodrow Wilson Society, the Guggenheim Memorial Foundation, the Alexander von Humboldt Foundation, the American Statistical Association, the Institute of Mathematical Statistics, the International Statistical Institute, the American Association for the Advancement of Science, the American Academy of Arts and Sciences, the European Association of Methodology, the British Academy, and the U.S. National Academy of Sciences. As of 2014, he has authored/coauthored nearly 400 publications (including ten books), has five joint patents, and for many years has been one of the most highly cited authors in the world, with currently over 150,000 citations (Google Scholar). He is also the recipient of honorary doctorates from Otto Friedrich University, Bamberg, Germany; the University of Ljubljana, Slovenia; and Universidad Santa Tómas, Bogotá, Colombia, and has been named an honorary professor at four universities.

Advance Praise for *Causal Inference for Statistics, Social, and Biomedical Sciences*

"This thorough and comprehensive book uses the 'potential outcomes' approach to connect the breadth of theory of causal inference to the real-world analyses that are the foundation of evidence-based decision making in medicine, public policy, and many other fields. Imbens and Rubin provide unprecedented guidance for designing research on causal relationships, and for interpreting the results of that research appropriately."

– Dr. Mark McClellan, Director of the Health Care Innovation and Value Initiative, the Brookings Institution

"Clarity of thinking about causality is of central importance in financial decision making. Imbens and Rubin provide a rigorous foundation allowing practitioners to learn from the pioneers in the field."

– Dr. Stephen Blyth, Managing Director, Head of Public Markets, Harvard Management Company

"A masterful account of the potential outcomes approach to causal inference from observational studies that Rubin has been developing since he pioneered it 40 years ago."

– Adrian Raftery, Blumstein-Jordan Professor of Statistics and Sociology, University of Washington

"Correctly drawing causal inferences is critical in many important applications. Congratulations to Professors Imbens and Rubin, who have drawn on their decades of research in this area, along with the work of several others, to produce this impressive book covering concepts, theory, methods, and applications. I especially appreciate their clear exposition of conceptual issues, which are important to understand in the context of either a designed experiment or an observational study, and their use of real applications to motivate the methods described."

– Nathaniel Schenker, Former President of the American Statistical Association

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