

Counterfactuals And Causal Inference Methods And

A practical approach to using regression and computation to solve real-world problems of estimation, prediction, and causal inference.

An accessible, contemporary introduction to the methods for determining cause and effect in the social sciences

"Causation versus correlation has been the basis of arguments--economic and otherwise--since the beginning of time. Causal Inference: The Mixtape uses legit real-world examples that I found genuinely thought-provoking. It's rare that a book prompts readers to expand their outlook; this one did for me."--Marvin Young (Young MC)

Causal inference encompasses the tools that allow social scientists to determine what causes what. In a messy world, causal inference is what helps establish the causes and effects of the actions being studied--for example, the impact (or lack thereof) of increases in the minimum wage on employment, the effects of early childhood education on incarceration later in life, or the influence on economic growth of introducing malaria nets in developing regions. Scott Cunningham introduces students and practitioners to the methods necessary to arrive at meaningful answers to the questions of causation, using a range of modeling techniques and coding instructions for both the R and the Stata programming languages.

A Turing Award-winning computer scientist and statistician shows how understanding causality has revolutionized science and will revolutionize artificial intelligence "Correlation is not causation." This mantra, chanted by scientists for more than a century, has led to a virtual prohibition on causal talk. Today, that taboo is dead. The causal revolution, instigated

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by Judea Pearl and his colleagues, has cut through a century of confusion and established causality -- the study of cause and effect -- on a firm scientific basis. His work explains how we can know easy things, like whether it was rain or a sprinkler that made a sidewalk wet; and how to answer hard questions, like whether a drug cured an illness. Pearl's work enables us to know not just whether one thing causes another: it lets us explore the world that is and the worlds that could have been. It shows us the essence of human thought and key to artificial intelligence. Anyone who wants to understand either needs *The Book of Why*.

A discussion of the case study method which develops an integrative framework for causal inference in small-n research. This framework is applied to research design tasks such as case selection and process tracing. The book presents the basics, state-of-the-art and arguments for improving the case study method and empirical small-n research.

This new edition aims to convince social scientists to take a counterfactual approach to the core questions of their fields. This book is devoted to the analysis of causal inference which is one of the most difficult tasks in data analysis: when two phenomena are observed to be related, it is often difficult to decide whether one of them causally influences the other one, or whether these two phenomena have a common cause. This analysis is the main focus of this volume. To get a good understanding of the causal inference, it is important to have models of economic phenomena which are as accurate as possible. Because of this need, this volume also contains papers that use non-traditional economic models, such as fuzzy models and models obtained by using neural networks and data mining techniques. It also contains papers that apply different econometric models to analyze real-life economic dependencies.

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This text presents statistical methods for studying causal effects and discusses how readers can assess such effects in simple randomized experiments.

Publisher Description

What constitutes a causal explanation, and must an explanation be causal? What warrants a causal inference, as opposed to a descriptive regularity? What techniques are available to detect when causal effects are present, and when can these techniques be used to identify the relative importance of these effects? What complications do the interactions of individuals create for these techniques? When can mixed methods of analysis be used to deepen causal accounts? Must causal claims include generative mechanisms, and how effective are empirical methods designed to discover them? The Handbook of Causal Analysis for Social Research tackles these questions with nineteen chapters from leading scholars in sociology, statistics, public health, computer science, and human development.

Many of the concepts and terminology surrounding modern causal inference can be quite intimidating to the novice. Judea Pearl presents a book ideal for beginners in statistics, providing a comprehensive introduction to the field of causality. Examples from classical statistics are presented throughout to demonstrate the need for causality in resolving decision-making dilemmas posed by data. Causal methods are also compared to traditional statistical methods, whilst questions are provided at the end of each section to aid student learning.

The application of causal inference methods is growing

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exponentially in fields that deal with observational data. Written by pioneers in the field, this practical book presents an authoritative yet accessible overview of the methods and applications of causal inference. With a wide range of detailed, worked examples using real epidemiologic data as well as software for replicating the analyses, the text provides a thorough introduction to the basics of the theory for non-time-varying treatments and the generalization to complex longitudinal data. This book summarizes recent advances in causal inference and underscores the paradigmatic shifts that must be undertaken in moving from traditional statistical analysis to causal analysis of multivariate data. Special emphasis is placed on the assumptions that underlie all causal inferences, the languages used in formulating those assumptions, the conditional nature of all causal and counterfactual claims, and the methods that have been developed for the assessment of such claims. These advances are illustrated using a general theory of causation based on the Structural Causal Model (SCM), which subsumes and unifies other approaches to causation, and provides a coherent mathematical foundation for the analysis of causes and counterfactuals. In particular, the paper surveys the development of mathematical tools for inferring (from a combination of data and assumptions) answers to three types of causal queries: those about (1) the effects of potential interventions, (2) probabilities of counterfactuals, and (3) direct and indirect effects (also known as "mediation"). Finally, the paper defines the formal and conceptual relationships between the

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structural and potential-outcome frameworks and presents tools for a symbiotic analysis that uses the strong features of both. The tools are demonstrated in the analyses of mediation, causes of effects, and probabilities of causation.

The United States has long recognized and honored the service and sacrifices of its military and veterans. Veterans who have been injured by their service (whether their injury appears during service or afterwards) are owed appropriate health care and disability compensation. For some medical conditions that develop after military service, the scientific information needed to connect the health conditions to the circumstances of service may be incomplete. When information is incomplete, Congress or the Department of Veterans Affairs (VA) may need to make a "presumption" of service connection so that a group of veterans can be appropriately compensated. The missing information may be about the specific exposures of the veterans, or there may be incomplete scientific evidence as to whether an exposure during service causes the health condition of concern. For example, when the exposures of military personnel in Vietnam to Agent Orange could not be clearly documented, a presumption was established that all those who set foot on Vietnam soil were exposed to Agent Orange. The Institute of Medicine (IOM) Committee was charged with reviewing and describing how presumptions have been made in the past and, if needed, to make recommendations for an improved scientific framework that could be used in the future for determining if a

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presumption should be made. The Committee was asked to consider and describe the processes of all participants in the current presumptive disability decision-making process for veterans. The Committee was not asked to offer an opinion about past presumptive decisions or to suggest specific future presumptions. The Committee heard from a range of groups that figure into this decision-making process, including past and present staffers from Congress, the VA, the IOM, veterans service organizations, and individual veterans. The Department of Defense (DoD) briefed the Committee about its current activities and plans to better track the exposures and health conditions of military personnel. The Committee further documented the current process by developing case studies around exposures and health conditions for which presumptions had been made. *Improving the Presumptive Disability Decision-Making Process for Veterans* explains recommendations made by the committee general methods by which scientists, as well as government and other organizations, evaluate scientific evidence in order to determine if a specific exposure causes a health condition.

"A richly erudite history of measurement and an account of its current state in the social sciences—fascinating, informative, provocative." —James S. Coleman, University of Chicago
"Wise and powerful." — American Journal of Sociology
"Personal and provocative—an excellent set of historical and critical ruminations from one of social measurement's greatest contributors." —Choice

This innovative research design text will help you make informed choices when carrying out your research

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project. Covering both qualitative and quantitative approaches, and with examples drawn from a wide range of social science disciplines, the authors explain what is at stake when choosing a research design, and discuss the trade-offs that researchers have to make when considering issues such as: - causality - categories and classification - heterogeneity - interdependence - time This book will appeal to students and researchers looking for an in-depth understanding of research design issues to help them design their projects in a thoughtful and responsible way.

In the face of conflicting claims about some treatments, behaviors, and policies, the question arises: What is the most scientifically rigorous way to draw conclusions about cause and effect in the study of humans? In this introduction to causal inference, Paul Rosenbaum explains key concepts and methods through real-world examples.

The second edition of the Impact Evaluation in Practice handbook is a comprehensive and accessible introduction to impact evaluation for policy makers and development practitioners. First published in 2011, it has been used widely across the development and academic communities. The book incorporates real-world examples to present practical guidelines for designing and implementing impact evaluations. Readers will gain an understanding of impact evaluations and the best ways to use them to design evidence-based policies and programs. The updated version covers the newest techniques for evaluating programs and includes state-of-the-art implementation advice, as well as an expanded

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set of examples and case studies that draw on recent development challenges. It also includes new material on research ethics and partnerships to conduct impact evaluation. The handbook is divided into four sections: Part One discusses what to evaluate and why; Part Two presents the main impact evaluation methods; Part Three addresses how to manage impact evaluations; Part Four reviews impact evaluation sampling and data collection. Case studies illustrate different applications of impact evaluations. The book links to complementary instructional material available online, including an applied case as well as questions and answers. The updated second edition will be a valuable resource for the international development community, universities, and policy makers looking to build better evidence around what works in development.

Sections include: experiments and generalised causal inference; statistical conclusion validity and internal validity; construct validity and external validity; quasi-experimental designs that either lack a control group or lack pretest observations on the outcome; quasi-experimental designs that use both control groups and pretests; quasi-experiments: interrupted time-series designs; regression discontinuity designs; randomised experiments: rationale, designs, and conditions conducive to doing them; practical problems 1: ethics, participation recruitment and random assignment; practical problems 2: treatment implementation and attrition; generalised causal inference: a grounded theory; generalised causal inference: methods for single studies; generalised causal inference: methods for

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multiple studies; a critical assessment of our assumptions.

Written by one of the preeminent researchers in the field, this book provides a comprehensive exposition of modern analysis of causation. It shows how causality has grown from a nebulous concept into a mathematical theory with significant applications in the fields of statistics, artificial intelligence, economics, philosophy, cognitive science, and the health and social sciences. Judea Pearl presents and unifies the probabilistic, manipulative, counterfactual, and structural approaches to causation and devises simple mathematical tools for studying the relationships between causal connections and statistical associations. Cited in more than 2,100 scientific publications, it continues to liberate scientists from the traditional molds of statistical thinking. In this revised edition, Judea Pearl elucidates thorny issues, answers readers' questions, and offers a panoramic view of recent advances in this field of research. Causality will be of interest to students and professionals in a wide variety of fields. Dr Judea Pearl has received the 2011 Rumelhart Prize for his leading research in Artificial Intelligence (AI) and systems from The Cognitive Science Society.

An observational study is an empiric investigation of effects caused by treatments when randomized experimentation is unethical or infeasible. Observational studies are common in most fields that study the effects of treatments on people, including medicine, economics, epidemiology, education, psychology, political science and sociology. The quality and strength of evidence

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provided by an observational study is determined largely by its design. Design of Observational Studies is both an introduction to statistical inference in observational studies and a detailed discussion of the principles that guide the design of observational studies. Design of Observational Studies is divided into four parts. Chapters 2, 3, and 5 of Part I cover concisely, in about one hundred pages, many of the ideas discussed in Rosenbaum's Observational Studies (also published by Springer) but in a less technical fashion. Part II discusses the practical aspects of using propensity scores and other tools to create a matched comparison that balances many covariates. Part II includes a chapter on matching in R. In Part III, the concept of design sensitivity is used to appraise the relative ability of competing designs to distinguish treatment effects from biases due to unmeasured covariates. Part IV discusses planning the analysis of an observational study, with particular reference to Sir Ronald Fisher's striking advice for observational studies, "make your theories elaborate." The second edition of his book, Observational Studies, was published by Springer in 2002.

Drawing on a rich trove of focus group data, interviews, and textual sources, Elaine Weiner's Market Dreams powerfully captures the varied responses of female managers and factory workers in the Czech Republic to their country's transition from socialism to capitalism. Her work, rooted in sociology and comparative feminism, is an important advance for the literature on women in Eastern Europe. "Market Dreams is a conceptually-

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sophisticated and empirically-rich account of how the discourses and practices of the free market penetrated the hearts and minds of everyday Czech citizens. Weiner's provocative analysis takes readers inside the worlds of female factory workers to expose the discontinuities between their radiant market dreams and their everyday realities--and juxtaposes them to the continuities experienced by female managers. In the process, it challenges many of our ideas about post/socialism, marketization, and gender and reveals the enduring power of stories in shaping social identities and actions." ---Lynne Haney, Associate Professor of Sociology, New York University "Through interviews and a careful analysis of newspaper articles written in the first decade after the collapse of state socialism, Weiner explores the complicated interconnections between personal stories and the emerging neoliberal metanarrative of the free market in the Czech Republic after 1989. Her book transcends many of the dichotomies with which researchers of post-state socialism have been struggling: 'East' vs. 'West,' losers and winners, emancipation vs. oppression, etc., and thus makes a truly novel contribution to our understanding of women's lives after state socialism." ---Éva Fodor, Assistant Professor of Gender Studies, Central European University "Weiner's rich and innovative study of female Czech managers and workers exemplifies the importance of narrative analysis for understanding why gender and class have not (yet) reconfigured the sense of postcommunism's alternatives. This is critical reading for feminists, class analysts, and students of

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postcommunist social change." ---Michael Kennedy, Director, Center for European Studies, University of Michigan Elaine Weiner is Assistant Professor of Sociology at McGill University. Visit the author's website at: www.mcgill.ca/sociology/faculty/weiner/. Cover Credit: Frank Scherschel/Time & Life Pictures/Getty Images

Did mandatory busing programs in the 1970s increase the school achievement of disadvantaged minority youth? Does obtaining a college degree increase an individual's labor market earnings? Did the use of the butterfly ballot in some Florida counties in the 2000 presidential election cost Al Gore votes? If so, was the number of miscast votes sufficiently large to have altered the election outcome? At their core, these types of questions are simple cause-and-effect questions. Simple cause-and-effect questions are the motivation for much empirical work in the social sciences. This book presents a model and set of methods for causal effect estimation that social scientists can use to address causal questions such as these. The essential features of the counterfactual model of causality for observational data analysis are presented with examples from sociology, political science, and economics.

A new approach for defining causality and such related notions as degree of responsibility, degrees of blame, and causal explanation. Causality plays a central role in the way people structure the world; we constantly seek causal explanations for our observations. But what does it even mean that an event C "actually caused" event E? The problem of defining actual causation goes beyond mere philosophical speculation. For example, in many

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legal arguments, it is precisely what needs to be established in order to determine responsibility. The philosophy literature has been struggling with the problem of defining causality since Hume. In this book, Joseph Halpern explores actual causality, and such related notions as degree of responsibility, degree of blame, and causal explanation. The goal is to arrive at a definition of causality that matches our natural language usage and is helpful, for example, to a jury deciding a legal case, a programmer looking for the line of code that cause some software to fail, or an economist trying to determine whether austerity caused a subsequent depression. Halpern applies and expands an approach to causality that he and Judea Pearl developed, based on structural equations. He carefully formulates a definition of causality, and building on this, defines degree of responsibility, degree of blame, and causal explanation. He concludes by discussing how these ideas can be applied to such practical problems as accountability and program verification. Technical details are generally confined to the final section of each chapter and can be skipped by non-mathematical readers.

Human beings are active agents who can think. To understand how thought serves action requires understanding how people conceive of the relation between cause and effect, between action and outcome. In cognitive terms, how do people construct and reason with the causal models we use to represent our world? A revolution is occurring in how statisticians, philosophers, and computer scientists answer this question. Those

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fields have ushered in new insights about causal models by thinking about how to represent causal structure mathematically, in a framework that uses graphs and probability theory to develop what are called causal Bayesian networks. The framework starts with the idea that the purpose of causal structure is to understand and predict the effects of intervention. How does intervening on one thing affect other things? This is not a question merely about probability (or logic), but about action. The framework offers a new understanding of mind: Thought is about the effects of intervention and cognition is thus intimately tied to actions that take place either in the actual physical world or in imagination, in counterfactual worlds. The book offers a conceptual introduction to the key mathematical ideas, presenting them in a non-technical way, focusing on the intuitions rather than the theorems. It tries to show why the ideas are important to understanding how people explain things and why thinking not only about the world as it is but the world as it could be is so central to human action. The book reviews the role of causality, causal models, and intervention in the basic human cognitive functions: decision making, reasoning, judgment, categorization, inductive inference, language, and learning. In short, the book offers a discussion about how people think, talk, learn, and explain things in causal terms, in terms of action and manipulation.

Design of cognitive systems for assistance to people poses a major challenge to the fields of robotics and artificial intelligence. The Cognitive Systems for Cognitive Assistance (CoSy) project was organized

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to address the issues of i) theoretical progress on design of cognitive systems ii) methods for implementation of systems and iii) empirical studies to further understand the use and interaction with such systems. To study, design and deploy cognitive systems there is a need to consider aspects of systems design, embodiment, perception, planning and error recovery, spatial insertion, knowledge acquisition and machine learning, dialog design and human robot interaction and systems integration. The CoSy project addressed all of these aspects over a period of four years and across two different domains of application – exploration of space and task / knowledge acquisition for manipulation. The present volume documents the results of the CoSy project. The CoSy project was funded by the European Commission as part of the Cognitive Systems Program within the 6th Framework Program.

A collection of important recent work on the counterfactual analysis of causation.

This book offers a new model of educational achievement to explain why some students are committed to preparation for college.

In *Making Things Happen*, James Woodward develops a new and ambitious comprehensive theory of causation and explanation that draws on literature from a variety of disciplines and which applies to a wide variety of claims in science and

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everyday life. His theory is a manipulationist account, proposing that causal and explanatory relationships are relationships that are potentially exploitable for purposes of manipulation and control. This account has its roots in the commonsense idea that causes are means for bringing about effects; but it also draws on a long tradition of work in experimental design, econometrics, and statistics. Woodward shows how these ideas may be generalized to other areas of science from the social scientific and biomedical contexts for which they were originally designed. He also provides philosophical foundations for the manipulationist approach, drawing out its implications, comparing it with alternative approaches, and defending it from common criticisms. In doing so, he shows how the manipulationist account both illuminates important features of successful causal explanation in the natural and social sciences, and avoids the counterexamples and difficulties that infect alternative approaches, from the deductive-nomological model onwards. Making Things Happen will interest philosophers working in the philosophy of science, the philosophy of social science, and metaphysics, and as well as anyone interested in causation, explanation, and scientific methodology. A concise and self-contained introduction to causal inference, increasingly important in data science and machine learning. The mathematization of causality

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is a relatively recent development, and has become increasingly important in data science and machine learning. This book offers a self-contained and concise introduction to causal models and how to learn them from data. After explaining the need for causal models and discussing some of the principles underlying causal inference, the book teaches readers how to use causal models: how to compute intervention distributions, how to infer causal models from observational and interventional data, and how causal ideas could be exploited for classical machine learning problems. All of these topics are discussed first in terms of two variables and then in the more general multivariate case. The bivariate case turns out to be a particularly hard problem for causal learning because there are no conditional independences as used by classical methods for solving multivariate cases. The authors consider analyzing statistical asymmetries between cause and effect to be highly instructive, and they report on their decade of intensive research into this problem. The book is accessible to readers with a background in machine learning or statistics, and can be used in graduate courses or as a reference for researchers. The text includes code snippets that can be copied and pasted, exercises, and an appendix with a summary of the most important technical concepts. "A comprehensive book on methods for mediation and interaction. The only book to approach this topic

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from the perspective of causal inference. Numerous software tools provided. Easy-to-read and accessible. Examples drawn from diverse fields. An essential reference for anyone conducting empirical research in the biomedical or social sciences"-- Counterfactuals and Causal Inference Methods and Principles for Social Research Cambridge University Press

Did mandatory busing programs in the 1970s increase the school achievement of disadvantaged minority youth? Does obtaining a college degree increase an individual's labor market earnings? Did the use of a butterfly ballot in some Florida counties in the 2000 presidential election cost Al Gore votes? Simple cause-and-effect questions such as these are the motivation for much empirical work in the social sciences. In this book, the counterfactual model of causality for observational data analysis is presented, and methods for causal effect estimation are demonstrated using examples from sociology, political science, and economics.

In this second edition of Counterfactuals and Causal Inference, completely revised and expanded, the essential features of the counterfactual approach to observational data analysis are presented with examples from the social, demographic, and health sciences. Alternative estimation techniques are first introduced using both the potential outcome model and causal graphs; after which, conditioning techniques, such as matching and regression, are presented from a potential outcomes perspective. For research

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scenarios in which important determinants of causal exposure are unobserved, alternative techniques, such as instrumental variable estimators, longitudinal methods, and estimation via causal mechanisms, are then presented. The importance of causal effect heterogeneity is stressed throughout the book, and the need for deep causal explanation via mechanisms is discussed.

Interest in experimental research in public management is on the rise, yet the field still lacks a broad understanding of its role in producing substantive findings and theoretical advances. Written by a team of leading international researchers, this book sets out the advantages of experiments in public management and showcases their rapidly developing contribution to research and practice. The book offers a comprehensive overview of the relationship between experiments and public management theory, and the benefits for examining causal effects. It will appeal to researchers and graduate-level students in public administration, public management, government, politics and policy studies. The key topics addressed are the distinct logic of experimental methods in the laboratory, in the field, and in survey experiments; how leading researchers are using different kinds of experiment to build knowledge about theory and practice across many areas of public management; and the research agendas for experimental work in public management.

In this book, Reiss argues in favor of a tight fit between evidence, concept and purpose in our causal investigations in the sciences. There is no doubt that the sciences employ a vast array of techniques to address causal questions such as controlled experiments, randomized trials, statistical and econometric tools, causal modeling and thought experiments. But how do these different methods relate to each other and to the causal inquiry at hand? Reiss argues that there is no

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"gold standard" in settling causal issues against which other methods can be measured. Rather, the various methods of inference tend to be good only relative to certain interpretations of the word "cause", and each interpretation, in turn, helps to address some salient purpose (prediction, explanation or policy analysis) but not others. The main objective of this book is to explore the metaphysical and methodological consequences of this view in the context of numerous cases studies from the natural and social sciences.

Abstract: In this report, I first review the evolution of ideas of causation as it relates to causal inference. Then I introduce two currently competing perspectives on this issue: the counterfactual perspective and the noncounterfactual perspective. The ideas of two statisticians, Donald B. Rubin, representing the counterfactual perspective, and A.P. Dawid, representing the noncounterfactual perspective are examined in detail and compared with the evolution of ideas of causality. The main difference between these two perspectives is that the counterfactual perspective is based on counterfactuals which cannot be observed even in principle but the noncounterfactual perspective only relies on observables. I describe the definition of causes and causal inference methods under both perspectives, and I illustrate the application of the two types of methods by specific examples. Finally, I explore various controversies on these two perspectives.

David A. Freedman presents a definitive synthesis of his approach to statistical modeling and causal inference in the social sciences.

Explores the relationship between correlation and causation using a series of novel statistical methods.

Many racial and ethnic groups in the United States, including blacks, Hispanics, Asians, American Indians, and others, have historically faced severe discriminationâ€"pervasive and

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open denial of civil, social, political, educational, and economic opportunities. Today, large differences among racial and ethnic groups continue to exist in employment, income and wealth, housing, education, criminal justice, health, and other areas. While many factors may contribute to such differences, their size and extent suggest that various forms of discriminatory treatment persist in U.S. society and serve to undercut the achievement of equal opportunity. *Measuring Racial Discrimination* considers the definition of race and racial discrimination, reviews the existing techniques used to measure racial discrimination, and identifies new tools and areas for future research. The book conducts a thorough evaluation of current methodologies for a wide range of circumstances in which racial discrimination may occur, and makes recommendations on how to better assess the presence and effects of discrimination.

A fundamental book for social researchers. It provides a first-class, reliable guide to the basic issues in data analysis. Scholars and students can turn to it for teaching and applied needs with confidence.

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