

Book Reviews

Books for review are to be sent to the Book Review Editor Jaki Stanley, USDA/NASS, South Building, Room 4151, Washington, DC 20250, U.S.A.

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Maisel, Richard and Persell, Caroline Hodges, *How Sampling Works*. Pine Forge Press, Thousand Oaks, CA, U.S.A., 1996. ISBN 0-8039-9061-8, xx + 243pp.

As survey and polling play an increasingly important role in research and people’s everyday lives, it has been found that a large portion of the public does not really believe it is possible for a relatively “small” sample to produce accurate estimates of population values (Roper 1986; Hastings and Hastings 1990). In addition, many people do not understand the meaning of the “margin of error” reported with survey results (Roper 1986; Lavrakas, Holley and Miller 1991). As a survey methodologist, I would not complain about the public’s lack of basic knowledge on the power of sampling because the statistical theories and assumptions behind the sample design and sampling process are difficult for even the student of social research to understand. I clearly remember my confusion when learning the concept of “standard error” in graduate school. I thought it was costly and exhausting to randomly select a sample just once, why bother to sample hundreds or more times to generate that standard error? Today, I still have difficulty clearly explaining certain sampling concepts to students in the form of equations or graphs, such as the expected value of means, sample distribution, design effect, and standard error. This book and its accompanying ISEE sampling software is a very useful tool for students to open the door to modern sampling techniques.

This textbook-type booklet contains seven chapters on the basic aspects of sampling and applications with each chapter including some very useful exercises and experiments with the ISEE program. Using a computer to simulate the sampling process and to explore the sample distribution is not something new. However, one of the outstanding features of this book is the use of plain language and simple sampling experiments from everyday life with user-friendly software to help students who have little mathematical background understand the basic concepts and theoretical principles underlying statistical sampling and inference. With the assistance of the ISEE software package, which is designed for students with little or no background in computers, the book consists of a series of sampling experiments that allow students to discover the principles of sampling for

themselves. Dull sampling principles become more interesting with vivid stories in the carefully designed experiments. The results of these experiments are presented visually in the form of interactive graphs that change when different values are entered for the sampling elements. By simply following the instructions in exercises and experiments students should be able to master the major sample concepts.

The sampling distribution is one of the most difficult and important concepts in understanding sampling theory. It is a statistical concept that is so difficult to understand that the Maisel and Persell book used the simplest example of selecting two cases out of a population of four to illustrate this principle. Although I feel some examples in the book oversimplify the problem, the basic concepts in sampling are really complex and extremely difficult to explain in ordinary English. However, with the assistance of the ISEE program, a different picture emerges. After running some design and sampling simulations in the "Sample Design" module of the ISEE program, students will have a better understanding of the sampling distribution, how it is related to the population distribution, and how sample size and method of sampling affect the sampling distribution. After drawing numbers of samples from the populations with different distributions, the students will notice that, no matter what the population distribution is, as long as the sample size is not too small and the number of samples selected are large enough, the shape of the sample distribution is almost always normal, and the mean of these samples is equal or close to the population mean. Based on this kind of visual understanding of a sample distribution, it becomes much easier to distinguish the standard deviation of sample mean (i.e., standard error) from the standard deviation of a sample. In addition, the "Univariate" module of the ISEE offers six real data sets of middle size (population sizes range from 951 to 5,834) with both categorical and continuous variables for students to experiment with, and to explore the relationships among population, sample size, method of sampling and the sample distribution. Students can also enter their own data to further examine the sampling rules in actual situations.

Advancements in computer technology and application of computer programs in statistical analyses and sampling processes have accelerated our accumulation of scientific knowledge and understanding of the nature and human society. Without the computer simulation of sampling processes and the immediate visual display of sample distributions, many students might never fully appreciate the principles behind sampling theory. However, I believe the programs could be improved by increasing the variety of sample designs and the distributions of the variables used. For example, in the "Sample Design" module, there are only 36 cases in the populations as the base for various sample designs. Popular cluster and multistage designs were not included because it is unnecessary to implement complicated sample designs for a population of 36. A researcher may easily conduct a census of all 36 cases to get the true population distribution and parameter. However, in reality, most of the time we select a sample because the population is so large and so complicated that a census is impossible or too expensive. In the section on sample frames, the book discusses a number of problems in finding appropriate lists for the targeted population, but does not mention that the clustering and multistage selection has been one of the most powerful solutions for the lack of complete listing in a large population. In the "Simple Sample" module, the size of the population is as small as 12 cases and all variables are limited to a numeric with values from 36 to 60, which may greatly restrict, or

mislead what the students can do with the program, and how students will imagine the necessity of sampling and true variables characteristics.

Also, other shortcomings include that the book contains little material on the most popular sample design in polling or social surveys, the PPS (probability proportional to size) design or the stratified multistage probability sample. Although the design of a probability sample, especially in the national or statewide scale, is extremely difficult, and most of us may never have a chance to practice it, many people have actually heard or used results from this kind of sample design from either media or survey research. A basic book on sampling should serve at least two purposes: First, to help readers understand how sampling works and why sample design is important in achieving accurate data from a complex population; second, to teach students how to apply the sampling methods in the actual survey. For most readers or students, the greatest need is the ability to understand the sample design of an opinion poll or survey, and what the reported marginal error may mean to the result. Therefore, it is my opinion that introducing students to the more popular methods of sampling in our everyday lives may be more important than teaching them how to conduct a simple random sample. In addition, probably because the goal of this book was mainly to help students conduct a simple sample, rather than to help them understand the complicated but popular probability sample, the book does not touch on other important issues in sampling statistics like design effects, weighting, and selection bias. In this respect the book may not help the public much in overcoming their cognitive obstacles in understanding how sampling works in public opinion poll and survey research.

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Lehtonen, Risto and Pahkinen, Erkki, J., *Practical Methods for Design and Analysis of Complex Surveys*. John Wiley and Sons, Chichester, England, 1995. ISBN 0-471-93934-X, 337pp.

This very ambitious book attempts to cover two distinct but closely related topics. The first half of the book treats the statistical aspects of survey sample design and estimation. The second half concerns the analysis of data from a survey sample. While a host of good books exist covering the first topic, far less has been written on the second.

Practical Methods for Design and Analysis of Complex Surveys is not really designed to be a textbook. There are no homework assignments. It works best as a guidebook for the working professional without a background in survey statistics, per se. There are many worked out examples that provide insights into important issues. Although readers who have taken a course in survey statistics will not get much out of the first half of the book, even they might profit from the attention paid to design effects and to the estimation of population medians. The authors' examples bring out the important distinction between an estimated design effect and a true design effect. Even more valuable, they repeatedly show that the design effects can be very different for different estimates derived from the same data—say, for totals as opposed to medians.

The special attention afforded design effects and medians is praiseworthy, but the authors' efforts are undercut by a surprising lack of rigor in defining these terms and describing their estimation. Ultimately, readers are often directed to commercial software packages like SUDAAN and PC CARP for the nuts and bolts of calculation.

There is usually a good list of references to help the curious discover what is missing in the text. Sometimes, the authors themselves would benefit from a stronger understanding of their references. A section of model-assisted estimation fails to incorporate the weighted residual variance estimator (named in Särndal, Swensson, and Wretman 1989 [not cited in the text], and used extensively in their 1992 textbook on model-assisted estimation). The treatment of post-stratification cites Holt and Smith (1994) and Rao (1995), but misses the point of those two path-breaking articles (that, where possible, design-based inferences should be conditional).

A transitional chapter on the linearization and sample re-use methods of variance estimation is for the most part helpful and user friendly. The same can be said about the treatment of one-way tables. After that, the text suffers from excessive use of technical jargon and sterile mathematics (why is it heavier here than in the discussions of, say, model-assisted estimators and imputation?). The key point, that the working professional should use software designed for the analysis of survey data, has already been made.

Practical Methods for Design and Analysis of Complex Surveys is a good idea for a book that is flawed in execution. Some sections are repetitive, others are obscure. There are many mistakes due to simple carelessness. Two early cases stand out. The initial example of a median is calculated incorrectly (p. 20). The introductory description of systematic sampling (p. 40) is likewise faulty.

Often Lehtonen and Pahkinen get the theory wrong as well. The chapter on handling nonresponse is so filled with technical errors that I would recommend readers avoid it entirely. Consider, for example, this surprising statement: “[i]tem nonresponse means that missing values are distributed more or less randomly among the observations in the data matrix” (p. 126).

The authors make the common mistake of confusing regression results under an unweighted, simple random sample with those derived from assuming an IID population (p. 252). To be fair, Lee, Forthofer, and Lorimor (1989) make the same mistake. By contrast, Skinner (1989) not only gets it right but brings the distinction to the readers' attention. I would send anyone interested in learning about the analysis of survey data to that essay and to the splendid collection containing it (Skinner, Holt, and Smith 1989).

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Barrett, Richard E., *Using the 1990 U.S. Census for Research, Guides to Major Social Science Databases*, vol. 3. Sage Publications, Thousand Oaks, CA, U.S.A., 1994. ISBN 0-8039-5389-5. Hardcover 24.00 USD, Paperback 10.95 USD.

With the increasing ease by which census data are available in electronic media, the increasing power of microcomputing and the increasing use of geographic information/mapping software, applications of census data will also grow. Given the wide array of data and geographic files available, the complexity of the file structures, the subtle and not-too-subtle differences across files, the time appears ripe for a book that can provide insight into the possibilities offered by the data collected and distributed by the U.S. Census Bureau and that can help guide researchers in such use. This monograph by Richard E. Barrett is such a book.

The book consists of five chapters. The first is a discussion of the history of the census and a discussion of the current contents of the 1990 census data. While brief, the discussion of the history is informative and alerts the reader to a number of different data sets offered by the Bureau of the Census. The chapter also does an admirable job in detailing the content differences between the 1990 and 1980 censuses. For researchers dealing with longitudinal analysis, this discussion will prove extremely helpful. Barrett also informs readers of the sources for a number of question choices, response scales, and response categories.

The second chapter presents much of the “nuts-and-bolts” of the geographic categories used by the Census Bureau and the data available. The discussion of the Public Use Micro-data Sample (PUMS) Computer Tapes is extremely informative. Barrett provides charts of sample data that reveal the potential of the PUMS data sets. Likewise, the chart depicting

the geographic hierarchy and the chart detailing the coverage areas for various printed reports are helpful. The discussion on the computer tapes was too brief. I concur with the author that "Most users will need some guidance because the way in which hierarchical geographic census files are organized makes the job fairly complex, and computer programmers are not usually familiar with Bureau of the Census data conventions (p. 39)." Having said that, some coverage of the issue beyond a referral to the availability of someone else's program is warranted.

Chapter 3 discusses the procedures and problems of the 1990 census. The depth of coverage in this chapter exceeds that in all other chapters. The author very clearly presents the mechanics of collecting census information, the things that could and did go wrong, and the issues that potential users must address. The analysis of undercounting, missing data, and confidentiality are particularly informative. The information contained in this chapter is must reading for anyone who may use census data in his or her research.

Chapter 4 presents two case studies in which census data had been used in research. One case study emphasizes aggregate level analysis while the second focuses on individual level data. The examples step the reader through the research process from question development and operational definition to computer tape mounting and data extraction.

The final chapter directs the reader to other publications that might prove helpful in mastering the census data. It also informs the reader as to various locations (e.g., on-line services) of such information and data.

Generally, the book is well written, but the results are uneven across chapters. The two major flaws are an unusual organizational structure and a lack of illustrative examples in spots. The sequencing of topics in the first two chapters might obfuscate issues for neophytes. The discussion of the census geography did not begin until the second chapter. Concurrently, the discussion in the first chapter refers to census tracts, blocks, and block groups. Anyone new to census data might find this confusing. Likewise, jumping into the specific changes from the 1980 to the 1990 census in the first chapter before giving a broad picture of what one means by "census" data might cause some confusion. It would appear that this discussion could easily have been put off until the discussion of the pitfalls in using census data.

While the monograph contains a number of examples, I looked for clarifying examples several times when none were present. For example, in the discussion of the differences between the 1980 and 1990 censuses, one might expect to see one or two figures with the questions as they appeared on the forms. No such illustration is present. While the author identifies a number of data sets available through the census, he does not present a summary table comparing their contents. The author also points out that the reader will likely contact the state data center for assistance. Beyond the fact that there is no discussion as to what a state data center is, a table listing addresses and phone numbers would have been very easy to provide. It would have been more helpful than identifying a Census Bureau publication that lists the information. The one table that provides some of the information regarding the data within a report refers only to printed reports, but these are likely to be less important as electronic access increases.

Overall, the book does an excellent job of discussing the problems that researchers address and resolve when using census data, the development of the census over time, and the potential uses of the data. The book is less successful at providing a clear, concise overview of all the information available, the differences across data sets, and the best sources for information. As such, while the book will prove useful to anyone contemplating using census data, it will be more beneficial to researchers who already know where to find the data for the unit of analysis that they need.

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Bryant, Barbara. E. and Dunn, William, *Moving Power and Money: The Politics of Census Taking.* New Strategist Publications, Ithaca, N.Y., U.S.A. 1995. ISBN 0-9628092-7-6 \$24.95.

This book differs from most books reviewed in this journal both in its subject matter and its style. The emphasis is on the institutional rather than the technical context of statistics. However, despite its subtitle, the book is not simply a discussion of the political aspects of census taking. As the dust-jacket claims, "This is not a dry, academic book. Rather it's an intriguing, at times funny, and always informative drama of a fiercely independent yet besieged government agency."

Barbara Bryant, the principal author, is a professional survey researcher who was appointed head of the U.S. Bureau of the Census a few months before the 1990 census of population went into the field. Though she did not plan the census operation herself, she was involved in its management, and in decisions about the form and publication of the census findings. She also had to defend the bureau and her own decisions in the media, to her political superiors, before Congress and in the law courts. In the latter part of her period of office she was involved in initial planning for the next census in 2000. Since the post of head of the Census Bureau is a patronage appointment, the advent of the Clinton administration meant the end of her term of office. In this book she reflects on her experience at the bureau. Her co-author William Dunn is a journalist with an interest in demographic matters but, as the book is written in the first person singular, his contribution must have been mainly to do with style and presentation.

The book combines a discussion of the political environment of census taking, and the pressures facing those in charge of the operation; a defence of the work of the Bureau of the Census in general; a defence of her own role; a discussion of what she believes went wrong; and recommendations about how things might be done better in the future.

All this is interwoven with a chronological account of Bryant's period in office, so that each chapter is simultaneously a discussion of a substantive issue and the next episode of the plot. The first four chapters set the scene. Chapter 1 introduces several of the main themes: the clash between concern for privacy and the government's need for information; problems of cost and undercount; and some points about postal questionnaires and following them up in the field.

Chapter 2 discusses the historical development of the, now very strict, rules about the confidentiality of census data, and contrasts them with the less strict rules governing other statistical agencies and the virtually uncontrolled use of commercially held personal data. Chapter 3 describes the increasingly high public profile of the Census Bureau and the resulting pressures on its Director, and tells the story of how Bryant was appointed to the job. Chapter 4 explains the use of census data in planning and funding decisions, and in the apportionment of congressional seats.

The next five chapters tell the story of the 1990 census. Chapter 5 is about the logistics of census taking, and the way the demands of the census have helped to shape the development of computing technology. Chapter 6 describes the public relations effort to encourage census response, and some problems with the way it was received, and looks at the practical and public relations aspects of counting the homeless.

Chapter 7 describes Bryant's dealings with Congress during and after the census operation. Chapter 8 discusses why response to the 1990 census was lower than in 1980. Chapter 9 gives estimates of the size and composition of the final undercount, and describes the controversy over whether to adjust census outputs and population estimates.

Chapter 10 is a general account of the range and importance of the Census Bureau's work. Chapter 11 discusses relations between the different statistical agencies of the federal government and to what extent it would be feasible to rationalise them. Chapter 12 argues that many of the tribulations of the 1990 census could be avoided by undertaking a 'one-number census' next time.

I personally enjoyed the book's informality, learned a great deal about the context and conduct of the U.S. census, and came to feel considerable sympathy for the author's struggle to pursue a line of statistical rectitude in trying circumstances. At the same time Bryant is also advancing an argument about the value of the census, the social and political pressures that it faces, and how the census should adapt to these pressures in the future. She wants to establish four main points:

1. The census represents good value for money, though the value could probably be improved by adopting various up-to-date statistical and data gathering techniques.
2. Resistance to government intrusion and the increasing diversity of the U.S. population mean that nonresponse is a serious and growing problem.
3. The political pressures, both to cut costs and to produce findings that are pleasing to the politicians concerned, have increased to such a point that they seriously impede the bureau's ability to concentrate on producing accurate results.
4. The solution is to use optimal techniques so as to combine accuracy with financial savings; and to use them to produce a single set of estimates—a "one-number census"—so as to avoid political disputes over whether to use the figures before or after they have been adjusted for differential undercount.

Here, I felt that the journalistic style of the book got in the way of the argument—so that some important issues were not fully explored.

1. The case is convincingly made that, in a country without a population register and with severe restrictions on data sharing between government agencies, a census provides data that are indispensable for planning and resource allocation. But this

does not in itself tell us how much money should be spent on the census. It would have been useful to discuss criteria for evaluating the loss—in efficiency or fairness—resulting from suboptimal resource allocation, so as to be able to weigh this against the marginal cost of improving the accuracy of the census. Given the importance attached to cost control, some estimate of potential savings from improved methods would have been helpful.

2. There is some inconsistency in the discussion of undercount between the general argument that it is a growing problem and the specific results presented in Chapters 8 and 9. On Chapter 9's showing, it is arguable that the problem was well under control.

The net undercount of 1.6% to 1.8% is perfectly respectable in international terms. The fact that the undercount estimates derived from demographic analysis and from the post-enumeration survey were broadly consistent—in both size and composition—gives reasonable confidence that the undercount could be allowed for in adjusted figures (at least for large geographic units). Nor is it clear that the undercount is on a rising trend historically. Though the estimated undercount in 1990 was greater than that in 1980, it was still the second best since undercount measurement began.

In order to substantiate the more alarmist view presented in the book's opening and closing chapter, it is necessary to argue that, even if final coverage is holding up, public attitudes and demographic change mean that the Census Bureau has to work harder to obtain it. The evidence for this is presented in Chapter 8 which discusses why response to the initial postal stage of the 1990 census was very much lower than in 1980. Here again the analysis does not fully support Bryant's main argument. Survey evidence is cited which suggests that confidentiality concerns are only weakly connected to census response. Although we are told that various demographic factors were related to response in 1990, we are not told how strong the relationship was, or how much of the decline in response could be attributed to trends in these demographic factors.

3. Viewed from this side of the Atlantic, the degree of political and legal involvement in detailed decisions about census methods and results is very striking. In some respects it is alarming. Bryant shows how closely political attitudes to undercount adjustment align with perceived party interests, and how ill-informed much political comment is. Though she does not say so explicitly, her account strongly suggests that her recommendation to adjust the census figures for undercount was overruled on political grounds. She herself decided not to adjust the population estimates because of fears about the lawsuits that might result.

On the other hand, court rulings have generally respected statistical expertise. One court decision obliged the government to run a post-enumeration exercise in 1990 that would be large enough for reliable undercount adjustment. Taken as a whole, it is not clear whether the politico-legal process should be viewed as a threat to the census's integrity, or as the means by which that integrity is sustained. This part of the discussion might have benefited from a political science perspective.

4. Similar doubts apply to the political aspects of the case for a one-number census. American censuses were controversial long before undercount estimates provided the possibility of comparing alternative figures. In a culture which so obviously

thrives on argument, will the attempt to restrict technical decisions to an elite really increase public confidence? In any case will there only be one set of figures? In 1990 the bureau supplied its critics with census and PES data to enable them to analyse the undercount for themselves. If the same is done in 2000, alternative estimates seem inevitable. If it is not done, will the bureau not have deprived itself of the benefit of legitimate methodological criticism?

A more “academic” chapter plan might have allowed Bryant to go into these issues more thoroughly—and in the process have dispelled this reviewer’s suspicion that she rather undersells her own and her colleagues’ achievements in running the 1990 census. But the result would have been a different book. The one she has written is well calculated to recruit more “census junkies” and inspire them to investigate the issues for themselves.

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