

Book Reviews

Books for review are to be sent to the Book Review Editor Jan Wretman, Statistical Research Unit, Statistics Sweden. S-115 81 Stockholm, Sweden.

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Anderson, C.W. and Loynes, R.M., The Teaching of Practical Statistics. John Wiley & Sons, New York, 1987, ISBN 0-471-91572-6, x + 199 pp., \$ 48.55.

This book is an important contribution to the teaching of statistics and it should be studied by everyone who teaches this subject. In addition to providing the teacher with inspiration, the book also presents a number of concrete statistical projects to be used in teaching. The ideas presented in the book are based on the principle that “statistics as a subject is inseparable from its applications and practice, that any statistical education

should take account of this connection, and that benefits from trying directly to teach statistical practice can be substantial.”

The book starts with a discussion about the nature of statistics and why it should be studied. Following M. Healy, the authors identify four different kinds of statistical activities: the work of the “intelligence statistician,” statistical activities related to scientific research, the work of the scientific statistician, and finally the work of the statistical mathematician. The authors then discuss the current teaching of statistics at universities and conclude that the theoretical parts of the subject are usually satisfactorily taught, while practical applications are not equally well taught.

The general purpose of teaching practical statistics is to enhance the abilities of the trainee statistician. The book provides an extensive, carefully outlined list of such abilities, divided into the following four categories: (1) general, non-technical abilities (2) general, partly technical abilities (3) abilities depending on technical skills, and (4) abilities depending on technical judgement. The following are examples of abilities from the authors' list, one from each category: (1) to communicate clearly and efficiently, both in writing and speech (2) to recognize the need for checks or controls of the quality of the data, and construct suitable procedures for carrying out such checks (3) to learn to understand and use a previously unfamiliar technique (4) and to choose, or develop, an appropriate plan or design for an investigation.

The third chapter of the book gives a survey and discussion of various approaches to teaching practical statistics. These include drill exercises, statistical experiments, critical reading, large projects, applications of statistics in another subject, contact with outside statisticians, consulting courses, external placements, case histories, role-playing and case studies, seminar presentations, and discussion groups. The authors then recommend an approach which combines and extends several of these approaches and can be described as the use of short projects. The organization of this approach is discussed at length and, most useful, the book provides detailed descriptions of 36 such projects, categorized by level, duration, and type (group, individual, or both). Here are titles of some of the projects: future populations, the plight of whales, petrol and car mileage, olympic medals, short term memory, reading habits of students, naive forecasting, maps and distances, and French presidential elections. The book ends with an instructive appendix on report writing and an extensive bibliography. This book is highly recommended.

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Boruch, R.F. and Pearson, R.W., The Comparative Evaluation of Longitudinal Surveys. Social Science Research Council, New York, 1985, viii + 80 pp.

This monograph presents the report and conclusions of a working group of the United States Social Science Research Council tasked to address fundamental issues concerning the evaluation of the comparative value of longitudinal surveys. The issues of concern to the working group revolved around several questions. For example, (1) As funding diminishes for data collection programs, how do program managers and granting agencies determine whether a long established longitudinal survey should be continued? (2) What guidelines are appropriate for comparing and evaluating longitudinal data programs? (3) Under what conditions can large-scale data collection programs produce the largest benefit to science or to public policy?

The monograph has three parts. Part I, "The Comparative Evaluation of Longitudinal Surveys," discusses the intractability of the problem addressed by the working group. Despite coming to the conclusion that it is not possible to determine whether one longitudinal survey is "better" than another, the authors propose standards for judging the quality of longitudinal surveys and provide a brief agenda for improving the use of longitudinal surveys.

Part II, "Guidelines for the Evaluation of Longitudinal Surveys," suggests ten areas for consideration in evaluating longitudinal surveys: (1) access to data, (2) simultaneous analysis, (3) anonymity and confidentiality, (4) evaluating data use, (5) measurement error, (6) data linkage, (7) joining special studies to ongoing surveys, (8) replication, (9) nonresponse and attrition, and (10) theory. Each of these topics is briefly discussed.

Part III, "Enhancing the Usefulness of Longitudinal Surveys by Coupling Longitudinal Surveys and Randomized Experiments," proposes a strategy to improve the usefulness of longitudinal surveys by carrying out randomized field experiments periodically together with an ongoing longitudinal survey. The justification and origins of this idea are presented as well as a proposal for a pilot program.

This short monograph is very readable and should be of interest to data collection program managers and staff in granting agencies. Readers interested in technical discussions of topics found in this monograph, particularly the topics related to evaluating longitudinal surveys, should look, however, to other sources.

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Claude, R.P. and Jabine, T.B. (Eds.), *Statistical Issues in the Field of Human Rights*. A special issue of *Human Rights Quarterly*, A Comparative and International Journal of the Social Sciences, Humanities, and Law, Vol. 8, No. 4, The Johns Hopkins University Press, Baltimore, 1986, ISSN 0275-0392.

This issue is a special edition based on the symposium "Statistical Issues in the Field of Human Rights." In the introduction, the editors state that the purpose of this issue is to explore the possible improvements in the analysis of human rights that are offered by the use of statistical and other quantitative tools.

The edition consists of eight articles. The first, "Political Rights and Political Liberties in Nations: An Evaluation of Human Rights Measures, 1950-1984," identifies data sources that can be used to obtain indicators of national political rights and liberties. The properties of these indicators are also discussed, for example, how they are affected by data collection modes and data collection errors. One problem with these indicators is that it is extremely difficult to evaluate their reliability and validity. Directions for future research are also discussed.

The main gist of the second article, "State Violation of Human Rights: Issues and Problems of Measurement," is that for any source of data, some simple indicators of the

different aspects and dimensions of the human rights violations are needed. In the third article, "The Limitations of Using Quantitative Data in Studying Human Rights Abuses," the need for a combination of statistical and nonstatistical information is discussed. The fourth article, "Guidelines for Field Reporting of Basic Human Rights Violations," highlights the need for a system that produces valid and reliable reports objectively assessing systematic violations of basic human rights.

The article "The Analysis of Human Rights Data Over Time" shows that recent advances in exploratory data analysis, robust estimators, and general nonparametric methods offer tools to circumvent some of the problems inherent in statistical methods that rely strongly on assumptions that are difficult to fulfill given the nature of data on human rights. On the other hand, the more complicated the methodology, the less persuasive it is. The author of this article draws the conclusion that the lack of good data and of political, social, and economic models does not preclude the use of analyses that yield approximate results.

The article "Human Rights Country Reports" stresses the importance of published reports and congressional hearings. It is crucial at this stage to develop criteria or definitions of what constitutes violations of human rights. Nevertheless, tangible results will take time.

The article "United Nations Action Procedures Against Disappearances, Summary and Arbitrary Executions, and Torture" describes the work of the Working Group on Enforced and Involuntary Disappearances and their Special Rapporteurs. This group presents factual information on human rights violations and asks governments to answer for these violations.

In the last article, "El Salvador: Methods Used to Document Human Rights Violations," a comparison is made between the methods used by the United States to document human rights violations in El Salvador and the methods used by the Tutela Legal, an independent monitoring agency in San Salvador. The main differences in the reports produced by these two sources is that the categories of victims and perpetrators are different. On the whole, the data from both organiza-

tions show the same trends. This article also contains an appendix "Indices for Comparing Human Rights Abuses."

The use of statistical methods in the analysis of human rights violations will, without doubt, gain general acceptance. This will lead to improvements in the methods themselves and the resulting reports will be more reliable.

It is important to remember that an analysis can never be of better quality than the data itself, and conflicting categorization of victims and perpetrators will undermine the comparability of different analyses. For this reason, I would like to stress that without good and reliable data the analysis will be of little value.

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Schilling, E.G., Acceptance Sampling in Quality Control. Statistics: Textbooks and Monographs Series, Vol. 42, Marcel Dekker, Inc., New York, 1982, ISBN 0-8247-1347-8, xx + 775 pp., \$ 65.00.

This is a book about classical methods of acceptance sampling, that is, tools for deciding the disposal of "incoming" lots based on information gathered from samples drawn from those lots.

This is a text that belongs on everyone's short list of really good books in statistical quality control (SQC), an area where, ironically, quality text material does not abound. Schilling has written an authoritative, balanced, and readable compendium, accessible to upper level undergraduates or first year graduate students. Since the book is true to its title and restricts itself primarily to acceptance sampling, and since today's trend is away from SQC courses that concentrate on acceptance sampling, the book will probably not enjoy wide popularity as a required text

in university courses. But it is one that every statistician seriously interested in the philosophy and methods of SQC ought to own.

Schilling says in his preface:

"This book is intended to present some of the techniques of acceptance quality control that are best known and most practical – in a style that provides sufficient detail for the novice, while including enough theoretical background and reference material to satisfy the more discriminating and knowledgeable reader. ... While the prime goal is the straightforward presentation of methods for practical application in industry, sufficient theoretical material is included to allow the book to be used as a college level text...."

The level of theoretical detail in the book is, in fact, roughly comparable to that in Duncan's (1974) *Quality Control and Industrial Statistics*. The theory is extensive enough to allow a competent statistician to re-derive most of the results if he or she desires, and there are good bibliographies for the few parts that might remain obscure even after some work.

The author takes pains to put the acceptance sampling methods into perspective, by giving them their proper place in the whole spectrum of methods of classical SQC. (Unlike many authors writing SQC books, Schilling understands and says clearly what the various acceptance sampling methods can and cannot do!) There are also a number of interesting historical insights.

The acronyms and idiosyncratic jargon of SQC in general, and acceptance sampling in particular, can be nearly overwhelming. But Schilling has done an excellent job of motivating and explaining these in plain English (as opposed to typically overly formal and opaque SQC idiom).

The book is a hefty 775 pages long, but the majority of these are photo-reproduced double spaced typed pages. So in content, it is really of average to slightly below average textbook length. The publication format is actually the poorest feature of the book. It is too bad that such a fine piece of work is trapped in photo-reproduced form.

There are 19 chapters as outlined below.

1. Introduction
2. Probability and the Operating Characteristic Curve
3. Probability Functions
4. Concepts and Terminology
5. Single Sampling by Attributes
6. Double and Multiple Sampling by Attributes
7. Sequential Sampling by Attributes
8. Variables Sampling for Process Parameters
9. Bulk Sampling
10. Sampling by Variables for Proportion Nonconforming
11. Attributes Sampling Schemes: Mil-Std-105D
12. Variables Sampling Schemes: Mil-Std-414
13. Special Plans and Procedures
14. Series of Lots: Rectification Schemes
15. Continuous Sampling Plans
16. Cumulative Results Plans
17. Compliance Sampling
18. Reliability Sampling
19. Administration of Acceptance Sampling

In addition, there are 150 pages allocated to appendix tables. There is an author index and a well done subject index. Each chapter has a short "routine applications" exercise set, and the answers to essentially all of the exercises are given at the end of the book. The book is full of good quality reproductions of relevant (and sometimes hard to locate) nomographs and charts, gathered from original sources. (This feature alone makes the book worth its price.)

Regarding content, I must remark that I was disappointed to find only the briefest discussion of explicitly economic methods (that in Chapter 19) and no Bayesian material. I am not willing to accept the premise that the large body of work in these areas has no place in a compendium like this. Indeed, it seems that Bayesian and economic arguments in acceptance sampling are quite important these days. See Vardeman (1986) for further comments in this regard.

Ultimately, however, my negative reactions to the text's printing method and the lack of Bayesian material are overwhelmed

by admiration for what Schilling has provided in this volume. I end where I began and recommend the book highly.

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- Vardeman, S.B. (1986): The Legitimate Role of Inspection in Modern SQC. *The American Statistician*, 40, pp. 325–328.

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United Nations, *Non-Sampling Errors in Household Surveys: Sources, Assessment and Control. Preliminary Version. (National Household Survey Capability Programme, DP/UN/INT-81-041/2)* United Nations Department of Technical Cooperation for Development and Statistical Office, New York, 1982, vi + 284 pp.

As a comprehensive, nonmathematical and yet technically accurate review of the major sources and types of nonsampling error, this document has much to recommend it. The audience for the book is "designers and managers of household surveys...working on survey programmes in national statistical organizations in developing countries." However, it can be a valuable resource for anyone interested in the measurement and control of nonsampling errors. Face-to-face household surveys are dealt with exclusively since mail and telephone interviews are generally not used in developing countries. Still, there is much information and practical guidance which is applicable to any survey no matter what the mode of interview.

Topics are divided into six chapters, in addition to a general introductory chapter,

with the following headings: "Basic Concepts," "Coverage Errors," "Errors Due to Non-Response," "Response Errors," "Control of Non-Sampling Errors in Household Surveys," and "Assessment of Errors and Long-Range Strategies for Improvement of Quality."

In "Basic Concepts," the concepts of "survey data quality," "nonsampling error," and "mean square error" are defined. Furthermore, the various ways of categorizing nonsampling error are described; for example, by survey process (design, collection, processing, etc.), by source (coverage, nonresponse, or response errors), or by component of total error (affecting either the bias or the variance). There is a list (albeit very short) of references for further reading on these topics.

Following this preliminary discussion of nonsampling error is a chapter devoted to coverage error. Using the author's somewhat limited definition, coverage error is "the failure to include some units in the frame used for sample selection." Problems specific to area frames and list frames for both censuses and surveys are treated. (This is the only chapter which discusses the nonsampling error in censuses, perhaps because much of the literature on coverage error pertains to censuses.) The major causes of coverage error in personal interview surveys are discussed. For example, with regard to area frame surveys, there may be problems with inaccurate maps or unclear sampling unit boundaries. In list frame surveys, there are these problems as well as out-of-date and incomplete lists, duplicate listings, and poorly trained listers.

"Errors Due to Non-Response" discusses the various types of both unit and item nonresponse. This chapter contains an impressive number of examples of the extent and effects of nonresponse in household surveys from studies worldwide. The authors observe that "refusals" are primarily a problem in developed countries, not in developing countries. I found Table 4.9, "Sample Outcomes and Response Rates for Fertility Surveys in Selected Developing Countries," particularly interesting. In this table, which compares the components of nonresponse for surveys conducted under the World Fertility Survey Programme for 19 countries, refusals vary from .1% (Panama) to 3.2% (Jamaica).

Other tables examine the *effects* of nonresponse on survey results. The chapter ends with: (a) some general guidelines for improving response rates, and (b) a brief discussion of the most commonly used techniques for reducing the nonresponse bias in survey estimates, citing the advantages and disadvantages of each.

"Response Errors" is the most heavily illustrated chapter, with 61 tables and figures. Unfortunately, a number of the tables are not adequately explained and their interpretations are unclear. Furthermore, the examples illustrate numerous types of response error from studies conducted in many different countries. Although this provides the reader with a vast range of experiences with response error, the disadvantage is that it disturbs the continuity of the chapter. Response bias in age reporting is given extensive coverage, as is recall error. Other topics include: rotation group bias, response inconsistency, and correlated response variance. Following the pattern established by the previous chapters, one would expect the chapter to end with a section providing practical guidance for controlling response errors and methods for their measurement. However, these topics are given considerable coverage in the final two chapters of the document.

"Control of Non-Sampling Errors in Household Surveys" might be retitled "The Proper Way to Conduct a Survey, From Start to Finish." The vast experience of the author(s) in conducting surveys in developing countries is apparent in this chapter. Some of the areas discussed are: planning, questionnaire design, frame development, sample selection, respondent rules, follow-up rules, review of the returns, pretesting, interviewer training, and data processing. Particularly useful for survey designers is the checklist at the end of the chapter which lists more than 80 "rules" regarding good survey design in the form of questions that need to be considered at each phase of the survey process.

The final chapter, "Assessment of Errors and Long-Range Strategies for Improvement of Quality," is a short, practical guide for survey evaluators. Advice on planning, conducting, and reporting the results of survey evaluation studies is provided.

Perhaps the book's major failing as a sole

source guide for the assessment and control of nonsampling errors is that it is *too* nontechnical; there are no formulas which specify how to estimate the nonsampling error components and indicators for most practical situations. Therefore, except for its long list of references, it may not be of use to practicing statisticians. And, as it was written for developing countries, there are major gaps in its coverage of the areas of nonsampling error (for example, no discussion of telephone or mail surveys). Finally, written in 1982, the book is somewhat outdated. Despite these limitations, the book is generally well-written and is highly recommended to its intended audience.

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Wetherill, G.B., Duncombe, P., Kenward, M., Köllerström, J., Paul, S.R., and Vowden, B.J., Regression Analysis with Applications. Chapman and Hall, London, 1986, ISBN 0-412-27490-6, xi + 311 pp., \$33.00.

This book attempts to provide the applied statistician with the tools to do a thorough analysis of regression data. The book, which has several authors, evolved as a result of the preparation of a computer program which incorporated many recent developments in regression methodology. Each author was responsible for one or more chapters and as one might expect, this leads to a rather uneven presentation. I presume that the book was initially the documentation for the computer program and at times it reads like a computer manual while at other times it reads more like a textbook. Some chapters have exercises, both numerical and theoretical, while others do not. This appears to have been the authors' choice as opposed to being justified by the material in the chapter. The book stresses the

analysis of data and several data sets are included, although most are old friends from the literature. At various times, the authors refer to the output of their computer program (as if this were documentation), but the program is not a part of the book. The book can be easily read by persons with a basic knowledge of matrix algebra and a first course in statistical methods.

Chapter 1 provides a review of least squares estimation and some of the basic concepts such as centering and scaling. Hypothesis testing is discussed using the extra sum of squares principle, but not in general. (There is no discussion of interval estimation, a concept presented first in Chapter 10.) The ideas are introduced by two examples.

Chapter 2 contains both numerical and graphical methods for data exploration which vary from elementary to quite difficult. Here, and at various places in the book, the authors tend to allude to results without discussing them in detail. They do provide numerous references for the reader interested in pursuing the topic.

Chapter 3 presents numerical methods of matrix inversion and solutions of linear equations. My feeling is that this material interrupts the flow of the book and it might have been better to put it in an appendix. While there are genuine numerical problems associated with least squares computations, not everyone needs to be concerned with the details required in preparing a computer program. Again, the presentation is somewhat uneven. For example, the intuitive introduction of eigenvalues is probably of interest to readers already familiar with the topic but will be lost on the uninitiated reader. Similarly, presenting the QR decomposition prior to the concept of orthogonality seems strange.

In Chapter 4, the authors address the problem of collinearity among the predictors. This concept is often confusing to practitioners and does not have a simple solution. The best one can do is present the issues and suggest possible remedies and this is the approach taken by the authors. Unfortunately, numerous typographical errors and misleading statements tend to add to the confusion. For example, the authors fail to clearly distinguish removable degeneracies caused by polynomial terms from other sources of near singularity. There is also an implication

that the issue is primarily numerical. For example, the authors suggest that one may improve conditioning by deleting variables. While this is true, the resulting model may be worthless. The effect of collinearity on prediction is generally ignored.

Chapter 5, entitled "Generalized Inverse Regression," is especially disturbing to me. My feeling on the analysis of overparameterized models and how they should be analyzed as cell means models are given in Hocking (1985). The use of the generalized inverse further perpetuates the illusion of difficulty caused by the overparameterization and confuses the interpretation. It is important to distinguish between models which are singular because of the introduction of additional parameters and those which are singular or nearly so because of inadequate data.

Chapter 6 presents a discussion of outliers and influential observations. The authors focus on the hat matrix for identification of high leverage points and on Cook's Distance as a measure of influence. The literature is full of alternatives, but these along with the standardized residuals seem to be sufficient in most cases. Numerical examples are used to illustrate the concepts. The starred sections contain some mathematical detail which is necessary to derive some of the earlier results, but seems otherwise peripheral to the rest of the chapter.

Chapter 7 contains a discussion of the Box-Cox power transformation which is fairly terse and not illustrated by an example. I would prefer the scaled version of the transformation as in Weisberg (1985) so that the choice of power is made in terms of the residual sum of squares. The material on Ramsey's test is not commonly found in textbooks.

In Chapter 8, the authors discuss tests for normality and in Chapter 9, they discuss heteroscedasticity and serial correlation. These are useful chapters, but I wonder why the authors shied away from graphical methods. For example, I find that a good q - q plot is generally more informative than the numerical tests.

Chapter 10 considers prediction and begins with a discussion of the consequences of over and underfitting. In my review paper (Hocking (1976)) I discussed the effect on mean square error which captures the effects on variance and bias and relates directly to the problem of variable selection. I would have preferred a stronger distinction between the concepts of a confidence interval on a mean and a prediction interval on a future response. Sections 10.6 on Mallow's C_p and 10.7 on adding a variable seem to belong in Chapter 11.

Chapter 11 contains a good discussion of the variable selection problem. It should be noted in Section 11.3.1 that there are 2^p possible regressions and not n choose p . The discussion of response surface analysis in Chapter 12 is necessarily brief but adequate.

Chapter 13 contains a brief introduction of the errors in variables problem and other alternative error structures. This chapter should be required reading for regression users.

I have cited several poor aspects of this book which, no doubt, reflect my own biases. There is a lot of good material in this book which is not generally contained in standard texts on applied regression. The book would be a useful reference, especially if one had access to the authors' computer program. However, I do not think that the present version will make a good textbook.

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