

---

# Applied Longitudinal Data Analysis

## Page Singer Willett

---

A Structural Equation Perspective  
Modeling Within-Person Fluctuation and Change  
Autoregressive Linear Mixed Effects Models  
Modeling Change and Event Occurrence  
Longitudinal Data Analysis  
Advances in Longitudinal Data Methods in Applied Economic Research  
Encyclopedia of Survey Research Methods  
Joint Modeling of Longitudinal and Time-to-Event Data  
Best Practices in Quantitative Methods  
Longitudinal Analysis  
Strategies for Bayesian Modeling and Sensitivity Analysis  
An Introduction to Diary and Experience Sampling Research  
Longitudinal Data Analysis  
Longitudinal and Panel Data  
Bayesian Data Analysis, Third Edition  
Mixed Effects Models for Complex Data  
Analysis of Longitudinal Data  
Applied Survey Data Analysis  
Longitudinal Structural Equation Modeling  
Longitudinal Data Analysis  
Applied Longitudinal Data Analysis  
Nonparametric Regression Methods for Longitudinal Data Analysis  
2020 International Conference on Applied Economics (ICOAE)  
Applied Longitudinal Data Analysis  
Analysis of Longitudinal Data with Example  
Applied Longitudinal Data Analysis for Epidemiology  
Longitudinal Data Analysis  
Latent Curve Models  
Practical Issues, Applied Approaches, and Specific Examples  
Mixed-Effects Modeling Approaches  
Applied Longitudinal Data Analysis for Epidemiology  
Analysis and Applications in the Social Sciences  
Intensive Longitudinal Methods  
Applied Missing Data Analysis  
Longitudinal Data Analysis  
Quantitative Longitudinal Data Analysis  
Research Methods  
Data Analysis Using Regression and Multilevel/Hierarchical Models  
Modeling Longitudinal Data

*Applied  
Longitudinal  
Data Analysis*  
Page Singer  
Willett

Downloaded  
from  
[ftp.wtvq.com](http://ftp.wtvq.com) by  
guest

## **RANDALL DEMARION**

### **A Structural Equation Perspective**

Routledge  
First published Open  
Access under a Creative  
Commons license as What  
is Quantitative  
Longitudinal Data  
Analysis?, this title is now  
also available as part of  
the Bloomsbury Research  
Methods series. Across  
the social sciences, there  
is widespread agreement  
that quantitative  
longitudinal research  
designs offer analysts  
powerful scientific data  
resources. But, to date,  
many texts on analysing  
longitudinal social  
analysis surveys have  
been written from a  
statistical, rather than a  
social science data  
analysis perspective and  
they lack adequate  
coverage of common  
practical challenges  
associated with social  
science data analyses.  
This book provides a  
practical and up-to-date  
introduction to influential  
approaches to  
quantitative longitudinal  
data analysis in the social  
sciences. The book  
introduces definitions and  
terms, explains the  
relative attractions of

such a longitudinal  
design, and offers an  
introduction to the main  
techniques of analysis,  
explaining their  
requirements, statistical  
properties and their  
substantive contribution.

### **Modeling Within- Person Fluctuation and Change**

Guilford Press  
An effective technique for  
data analysis in the social  
sciences The recent  
explosion in longitudinal  
data in the social  
sciences highlights the  
need for this timely  
publication. Latent  
Curve Models: A Structural  
Equation Perspective  
provides an  
effective technique to  
analyze latent curve  
models (LCMs). This type  
of data features random  
intercepts and slopes that  
permit each case in  
a sample to have a  
different trajectory over  
time.  
Furthermore, researchers  
can include variables to  
predict the  
parameters governing  
these trajectories. The  
authors synthesize a vast  
amount of research and  
findings and, at the same  
time, provide original  
results. The book  
analyzes LCMs from the  
perspective of structural  
equation models (SEMs)  
with latent variables. While  
the authors discuss

simple regression-  
based procedures that are  
useful in the early stages  
of LCMs, most of  
the presentation uses  
SEMs as a driving tool.  
This cutting-edge  
work includes some of the  
authors' recent work on  
the autoregressive latent  
trajectory model,  
suggests new models for  
method factors in multiple  
indicators, discusses  
repeated latent variable  
models, and establishes  
the identification of a  
variety of LCMs. This text  
has been thoroughly  
class-tested and makes  
extensive use of  
pedagogical tools to aid  
readers in mastering and  
applying LCMs quickly and  
easily to their own data  
sets. Key features include:  
Chapter introductions and  
summaries that provide a  
quick overview of  
highlights Empirical  
examples provided  
throughout that allow  
readers to test their newly  
found knowledge and  
discover  
practical applications  
Conclusions at the end of  
each chapter that stress  
the essential points that  
readers need to  
understand for  
advancement to more  
sophisticated topics  
Extensive footnoting that  
points the way to the  
primary literature for more

information on particular topics. With its emphasis on modeling and the use of numerous examples, this is an excellent book for graduate courses in latent trajectory models as well as a supplemental text for courses in structural modeling. This book is an excellent aid and reference for researchers in quantitative social and behavioral sciences who need to analyze longitudinal data.

### **Autoregressive Linear Mixed Effects Models**

CRC Press

"This book provides accessible treatment to state-of-the-art approaches to analyzing longitudinal studies. Comprehensive coverage of the most popular analysis tools allows readers to pick and choose the techniques that best fit their research. The analyses are illustrated with examples from 12 major longitudinal data sets including practical information about their content and design. Illustrations from popular software packages offer tips on how to interpret the results. Each chapter features suggested readings for further study and a list of articles that

further illustrate how to implement the analysis and report the results. An accompanying website provides syntax examples for several software packages for each of the chapter examples. Although many of the examples address health or social science questions related to aging, readers from other disciplines will find the analyses relevant to their work. In addition to demonstrating statistical analysis of longitudinal data, the book shows how to interpret and analyze the results within the context of the research design. Although most chapters emphasize the use of large studies collected over long term periods, much of the book is also relevant to researchers who analyze data collected in shorter time periods. The book opens with issues related to using publicly available data sets including a description of the goals, designs, and measures of the data. The next 10 chapters provide non-technical, practical introductions to the concepts and issues relevant to longitudinal analysis, including: weighting samples and adjusting designs for longitudinal studies;

missing data and attrition; measurement issues related to longitudinal research; the use of ANOVA and regression for averaging change over time; mediation analysis for analyzing causal processes; growth curve models using multilevel regression; longitudinal hypotheses using structural equation modeling (SEM); latent growth curve models for evaluating individual trajectories of change; dynamic SEM models of change; and survival (event) analysis. Examples from longitudinal data sets such as the Health and Retirement Study, the Longitudinal Study of Aging, and Established Populations for Epidemiologic Studies of the Elderly as well as international data sets such as the Canadian National Population Health Survey and the English Longitudinal Study of Aging, illustrate key concepts. An ideal supplement for graduate level courses on data analysis and/or longitudinal modeling taught in psychology, gerontology, human development, family studies, medicine, sociology, social work, and other behavioral,

social, and health sciences, this multidisciplinary book will also appeal to researchers in these fields."--

*Modeling Change and Event Occurrence Applied Longitudinal Analysis*

Development in methodology on longitudinal data is fast.

Currently, there are a lack of intermediate /advanced level textbooks which

introduce students and practicing statisticians to the updated methods on

correlated data inference. This book will present a

discussion of the modern approaches to inference, including the links

between the theories of estimators and various types of efficient

statistical models including likelihood-based approaches. The theory

will be supported with practical examples of R-codes and R-packages

applied to interesting case-studies from a number of different areas.

Key Features: •Includes the most up-to-date methods •Use simple

examples to demonstrate complex methods •Uses real data from a number

of areas •Examples utilize R code

*Longitudinal Data Analysis* Cambridge University Press  
This book, first published

in 2007, is for the applied researcher performing data analysis using linear and nonlinear regression and multilevel models.

**Advances in Longitudinal Data Methods in Applied Economic Research**

Oxford University Press  
In conjunction with top survey researchers

around the world and with Nielsen Media Research

serving as the corporate sponsor, the Encyclopedia of Survey Research

Methods presents state-of-the-art information and methodological examples

from the field of survey research. Although there are other "how-to" guides

and references texts on survey research, none is as comprehensive as this

Encyclopedia, and none presents the material in such a focused and

approachable manner. With more than 600 entries, this resource uses

a Total Survey Error perspective that considers all aspects of possible

survey error from a cost-benefit standpoint.

**Encyclopedia of Survey Research Methods**

SAGE  
By looking at the processes of change over time - by carrying out

longitudinal studies - researchers answer questions about learning,

development, educational growth, social change and medical outcomes.

However, longitudinal research has many faces. This book examines all

the main approaches as well as newer developments (such as

structural equation modelling, multilevel modelling and optimal

scaling) to enable the reader to gain a thorough understanding of the

approach and make appropriate decisions about which technique

can be applied to the research problem. Conceptual explanations

are used to keep technical terms to a minimum; examples are provided for

each approach; issues of design, measurement and significance are

considered; and a standard notation is used throughout.

*Joint Modeling of Longitudinal and Time-to-Event Data* Guilford Press

This comprehensive resource reviews structural equation

modeling (SEM) strategies for longitudinal data to help readers see which

modeling options are available for which hypotheses. The author

demonstrates how SEM is related to other longitudinal data

techniques throughout. By

exploring connections between models, readers gain a better understanding of when to choose one analysis over another. The book explores basic models to sophisticated ones including the statistical and conceptual underpinnings that are the building blocks of the analyses. Accessibly written, research examples from the behavioral and social sciences and results interpretations are provided throughout. The emphasis is on concepts and practical guidance for applied research rather than on mathematical proofs. New terms are highlighted and defined in the glossary. Figures are included for every model along with detailed discussions of model specification and implementation issues. Each chapter also includes examples of each model type, comment sections that provide practical guidance, model extensions, and recommended readings. Highlights include: Covers the major SEM approaches to longitudinal analysis in one resource. Explores connections between longitudinal SEM models to enhance integration.

Numerous examples that help readers match research questions to appropriate analyses and interpret results. Reviews practical issues related to model specification and estimation to reinforce connections. Analyzes continuous and discrete (binary and ordinal) variables throughout for breadth not found in other sources. Reviews key SEM concepts for those who need a refresher (Ch. 1). Emphasizes how to apply and interpret each model through realistic data examples. Provides the book's data sets at [www.longitudinalsem.com](http://www.longitudinalsem.com) along with the Mplus and R-lavaan syntax used to generate the results. Introduces the LISREL notation system used throughout (Appendix A). The chapters can be read out of order but it is best to read chapters 1 – 4 first because most of the later chapters refer back to them. The book opens with a review of latent variables and analysis of binary and ordinal variables. Chapter 2 applies this information to assessing longitudinal measurement invariance. SEM tests of dependent means and proportions over time points are explored in Chapter 3, and stability and change,

difference scores, and lagged regression are covered in Chapter 4. The remaining chapters are each devoted to one major type of longitudinal SEM -- repeated measures analysis models, full cross-lagged panel models and simplex models, modeling stability with state-trait models, linear and nonlinear growth curve models, latent difference score models, latent transition analysis, time series analysis, survival analysis, and attrition. Missing data is discussed in the context of many of the preceding models in Chapter 13. Ideal for graduate courses on longitudinal (data) analysis, advanced SEM, longitudinal SEM, and/or advanced data (quantitative) analysis taught in the behavioral, social, and health sciences, this text also appeals to researchers in these fields. Intended for those without an extensive math background, prerequisites include familiarity with basic SEM. Matrix algebra is avoided in all but a few places.

### **Best Practices in Quantitative Methods**

Cambridge University Press

The linear mixed model has become the main

parametric tool for the analysis of continuous longitudinal data, as the authors discussed in their 2000 book. Without putting too much emphasis on software, the book shows how the different approaches can be implemented within the SAS software package. The authors received the American Statistical Association's Excellence in Continuing Education Award based on short courses on longitudinal and incomplete data at the Joint Statistical Meetings of 2002 and 2004.

**Longitudinal Analysis**  
Springer

Methods and Applications of Longitudinal Data Analysis describes methods for the analysis of longitudinal data in the medical, biological and behavioral sciences. It introduces basic concepts and functions including a variety of regression models, and their practical applications across many areas of research. Statistical procedures featured within the text include: descriptive methods for delineating trends over time linear mixed regression models with both fixed and random effects covariance pattern models on correlated

errors generalized estimating equations nonlinear regression models for categorical repeated measurements techniques for analyzing longitudinal data with non-ignorable missing observations Emphasis is given to applications of these methods, using substantial empirical illustrations, designed to help users of statistics better analyze and understand longitudinal data. Methods and Applications of Longitudinal Data Analysis equips both graduate students and professionals to confidently apply longitudinal data analysis to their particular discipline. It also provides a valuable reference source for applied statisticians, demographers and other quantitative methodologists. From novice to professional: this book starts with the introduction of basic models and ends with the description of some of the most advanced models in longitudinal data analysis Enables students to select the correct statistical methods to apply to their longitudinal data and avoid the pitfalls associated with incorrect selection Identifies the

limitations of classical repeated measures models and describes newly developed techniques, along with real-world examples. *Strategies for Bayesian Modeling and Sensitivity Analysis* John Wiley & Sons

This text describes regression-based approaches to analyzing longitudinal and repeated measures data. It emphasizes statistical models, discusses the relationships between different approaches, and uses real data to illustrate practical applications. It uses commercially available software when it exists and illustrates the program code and output. The data appendix provides many real data sets-beyond those used for the examples-which can serve as the basis for exercises.

**An Introduction to Diary and Experience Sampling Research**

Springer Nature

This book discusses the most important techniques available for longitudinal data analysis, from simple techniques such as the paired t-test and summary statistics, to more sophisticated ones such as generalized estimating of equations and mixed model

analysis. A distinction is made between longitudinal analysis with continuous, dichotomous and categorical outcome variables. The emphasis of the discussion lies in the interpretation and comparison of the results of the different techniques. The second edition includes new chapters on the role of the time variable and presents new features of longitudinal data analysis. Explanations have been clarified where necessary and several chapters have been completely rewritten. The analysis of data from experimental studies and the problem of missing data in longitudinal studies are discussed. Finally, an extensive overview and comparison of different software packages is provided. This practical guide is essential for non-statisticians and researchers working with longitudinal data from epidemiological and clinical studies.

*Longitudinal Data Analysis*  
CRC Press

Longitudinal data analysis for biomedical and behavioral sciences This innovative book sets forth and describes methods for the analysis of longitudinal data, emphasizing applications

to problems in the biomedical and behavioral sciences. Reflecting the growing importance and use of longitudinal data across many areas of research, the text is designed to help users of statistics better analyze and understand this type of data. Much of the material from the book grew out of a course taught by Dr. Hedeker on longitudinal data analysis. The material is, therefore, thoroughly classroom tested and includes a number of features designed to help readers better understand and apply the material. Statistical procedures featured within the text include: \* Repeated measures analysis of variance \* Multivariate analysis of variance for repeated measures \* Random-effects regression models (RRM) \* Covariance-pattern models \* Generalized-estimating equations (GEE) models \* Generalizations of RRM and GEE for categorical outcomes Practical in their approach, the authors emphasize the applications of the methods, using real-world examples for illustration. Some syntax examples are provided, although the authors do not

generally focus on software in this book. Several datasets and computer syntax examples are posted on this title's companion Web site. The authors intend to keep the syntax examples current as new versions of the software programs emerge. This text is designed for both undergraduate and graduate courses in longitudinal data analysis. Instructors can take advantage of overheads and additional course materials available online for adopters. Applied statisticians in biomedicine and the social sciences can also use the book as a convenient reference. *Longitudinal and Panel Data* CRC Press Highly recommended by the Journal of Official Statistics, The American Statistician, and other journals, Applied Survey Data Analysis, Second Edition provides an up-to-date overview of state-of-the-art approaches to the analysis of complex sample survey data. Building on the wealth of material on practical approaches to descriptive analysis and regression modeling from the first edition, this second edition expands the topics covered and presents

more step-by-step examples of modern approaches to the analysis of survey data using the newest statistical software. Designed for readers working in a wide array of disciplines who use survey data in their work, this book continues to provide a useful framework for integrating more in-depth studies of the theory and methods of survey data analysis. An example-driven guide to the applied statistical analysis and interpretation of survey data, the second edition contains many new examples and practical exercises based on recent versions of real-world survey data sets. Although the authors continue to use Stata for most examples in the text, they also continue to offer SAS, SPSS, SUDAAN, R, WesVar, IVEware, and Mplus software code for replicating the examples on the book's updated website.

*Bayesian Data Analysis, Third Edition* Routledge  
This book is unique in its focus on showing students in the behavioral sciences how to analyze longitudinal data using R software. The book focuses on application, making it practical and

accessible to students in psychology, education, and related fields, who have a basic foundation in statistics. It provides explicit instructions in R computer programming throughout the book, showing students exactly how a specific analysis is carried out and how output is interpreted.

### **Mixed Effects Models for Complex Data**

Cambridge University Press

Although many books currently available describe statistical models and methods for analyzing longitudinal data, they do not highlight connections between various research threads in the statistical literature. Responding to this void, *Longitudinal Data Analysis* provides a clear, comprehensive, and unified overview of state-of-the-art theory and applications. It also focuses on the assorted challenges that arise in analyzing longitudinal data. After discussing historical aspects, leading researchers explore four broad themes: parametric modeling, nonparametric and semiparametric methods, joint models, and incomplete data. Each of these sections begins with an introductory chapter that

provides useful background material and a broad outline to set the stage for subsequent chapters. Rather than focus on a narrowly defined topic, chapters integrate important research discussions from the statistical literature. They seamlessly blend theory with applications and include examples and case studies from various disciplines. Destined to become a landmark publication in the field, this carefully edited collection emphasizes statistical models and methods likely to endure in the future. Whether involved in the development of statistical methodology or the analysis of longitudinal data, readers will gain new perspectives on the field.

### **Analysis of Longitudinal Data**

Springer

*Longitudinal Analysis* provides an accessible, application-oriented treatment of introductory and advanced linear models for within-person fluctuation and change. Organized by research design and data type, the text uses in-depth examples to provide a complete description of the model-building process. The core



longitudinal models and their extensions are presented within a multilevel modeling framework, paying careful attention to the modeling concerns that are unique to longitudinal data. Written in a conversational style, the text provides verbal and visual interpretation of model equations to aid in their translation to empirical research results. Overviews and summaries, boldfaced key terms, and review questions will help readers synthesize the key concepts in each chapter. Written for non-mathematically-oriented readers, this text features: A description of the data manipulation steps required prior to model estimation so readers can more easily apply the steps to their own data An emphasis on how the terminology, interpretation, and estimation of familiar general linear models relates to those of more complex models for longitudinal data Integrated model comparisons, effect sizes, and statistical inference in each example to strengthen readers' understanding of the overall model-building process Sample results

sections for each example to provide useful templates for published reports Examples using both real and simulated data in the text, along with syntax and output for SPSS, SAS, STATA, and Mplus at [www.PilesOfVariance.com](http://www.PilesOfVariance.com) to help readers apply the models to their own data The book opens with the building blocks of longitudinal analysis—general ideas, the general linear model for between-person analysis, and between- and within-person models for the variance and the options within repeated measures analysis of variance. Section 2 introduces unconditional longitudinal models including alternative covariance structure models to describe within-person fluctuation over time and random effects models for within-person change. Conditional longitudinal models are presented in section 3, including both time-invariant and time-varying predictors. Section 4 reviews advanced applications, including alternative metrics of time in accelerated longitudinal designs, three-level models for multiple dimensions of within-person time, the analysis

of individuals in groups over time, and repeated measures designs not involving time. The book concludes with additional considerations and future directions, including an overview of sample size planning and other model extensions for non-normal outcomes and intensive longitudinal data. Class-tested at the University of Nebraska-Lincoln and in intensive summer workshops, this is an ideal text for graduate-level courses on longitudinal analysis or general multilevel modeling taught in psychology, human development and family studies, education, business, and other behavioral, social, and health sciences. The book's accessible approach will also help those trying to learn on their own. Only familiarity with general linear models (regression, analysis of variance) is needed for this text.

[Applied Survey Data Analysis](#) Springer Science & Business Media

This book provides a new analytical approach for dynamic data repeatedly measured from multiple subjects over time. Random effects account for differences across subjects. Auto-regression in response itself is often

used in time series analysis. In longitudinal data analysis, a static mixed effects model is changed into a dynamic one by the introduction of the auto-regression term. Response levels in this model gradually move toward an asymptote or equilibrium which depends on covariates and random effects. The book provides relationships of the autoregressive linear mixed effects models with linear mixed effects models, marginal models, transition models, nonlinear mixed effects models, growth curves, differential equations, and state space representation. State space representation with a modified Kalman filter provides log likelihoods for maximum likelihood estimation, and this representation is suitable for unequally spaced longitudinal data. The extension to multivariate longitudinal data analysis is also provided. Topics in medical fields, such as response-dependent dose modifications, response-dependent dropouts, and randomized controlled trials are discussed. The text is written in plain terms understandable for researchers in other disciplines such as

econometrics, sociology, and ecology for the progress of interdisciplinary research. *Longitudinal Structural Equation Modeling* SAGE Publications Praise for the First Edition ". . . [this book] should be on the shelf of everyone interested in . . . longitudinal data analysis." —Journal of the American Statistical Association Features newly developed topics and applications of the analysis of longitudinal data Applied Longitudinal Analysis, Second Edition presents modern methods for analyzing data from longitudinal studies and now features the latest state-of-the-art techniques. The book emphasizes practical, rather than theoretical, aspects of methods for the analysis of diverse types of longitudinal data that can be applied across various fields of study, from the health and medical sciences to the social and behavioral sciences. The authors incorporate their extensive academic and research experience along with various updates that have been made in response to reader feedback. The Second Edition features six newly added chapters that

explore topics currently evolving in the field, including: Fixed effects and mixed effects models Marginal models and generalized estimating equations Approximate methods for generalized linear mixed effects models Multiple imputation and inverse probability weighted methods Smoothing methods for longitudinal data Sample size and power Each chapter presents methods in the setting of applications to data sets drawn from the health sciences. New problem sets have been added to many chapters, and a related website features sample programs and computer output using SAS, Stata, and R, as well as data sets and supplemental slides to facilitate a complete understanding of the material. With its strong emphasis on multidisciplinary applications and the interpretation of results, *Applied Longitudinal Analysis, Second Edition* is an excellent book for courses on statistics in the health and medical sciences at the upper-undergraduate and graduate levels. The book also serves as a valuable reference for

researchers and professionals in the medical, public health, and pharmaceutical fields as well as those in social and behavioral sciences who would like to learn more about analyzing longitudinal data.

Longitudinal Data Analysis  
SAGE

Change is constant in everyday life. Infants crawl and then walk, children learn to read and write, teenagers mature in myriad ways, the elderly become frail and forgetful. Beyond these natural processes and events, external forces instigate and disrupt change: test scores may rise after a coaching course, drug abusers may

remain abstinent after residential treatment. By charting changes over time and investigating whether and when events occur, researchers reveal the temporal rhythms of our lives. *Applied Longitudinal Data Analysis* is a much-needed professional book for empirical researchers and graduate students in the behavioral, social, and biomedical sciences. It offers the first accessible in-depth presentation of two of today's most popular statistical methods: multilevel models for individual change and hazard/survival models for event occurrence (in both discrete- and continuous-time). Using clear, concise

prose and real data sets from published studies, the authors take you step by step through complete analyses, from simple exploratory displays that reveal underlying patterns through sophisticated specifications of complex statistical models. *Applied Longitudinal Data Analysis* offers readers a private consultation session with internationally recognized experts and represents a unique contribution to the literature on quantitative empirical methods. Visit <http://www.ats.ucla.edu/stat/examples/alda.htm> for:

- Downloadable data sets
- Library of computer programs in SAS, SPSS, Stata, HLM, MLwiN, and more
- Additional material for data analysis