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A Review of *Multilevel and Longitudinal Modeling Using Stata*

S. F. Heil
The City University of New York

Sophia Rabe-Hesketh and Anders Skrondal. *Multilevel and Longitudinal Modeling Using Stata* (2nd ed.). College Station, TX: Stata Press, 2008, 562 pp., $89.95, paperback.

In their new edition, Rabe-Hesketh and Skrondal add to the maturing applied literature on multilevel modeling techniques with an in-depth demonstration in Stata. Suitable for self-study or an applied first graduate course, the book goes well beyond simply covering the relevant command syntax. Starting with a review of simple regression, it presents a largely nonspecialist account of the most common multilevel extensions. Repeated illustrations are also included of many software features—descriptive statistics, hypothesis tests, data recoding and restructuring, basic data simulations, and custom graphing—of practical interest beyond the modeling techniques at hand. Every chapter includes study exercises, and sample data used in the examples can be retrieved directly into Stata from the Internet. Most formulas and notation will be understood by any reader with a reasonable grasp of linear regression.

Each topic is developed through case studies of one or more data sets and includes discussion of inference and interpretation of results. A few tips on model identification are included throughout, although it is not a major focus. A chapter is dedicated to panel data and estimating growth curves, while another outlines crossed random-effects models in contrast to their more familiar nested-effects cousins. Treatment of longitudinal data has been expanded considerably since the first edition. The authors also provide alternate equation notation in several places to ease the transition between the competing multilevel notation schemes, and they helpfully point out a few inconsistencies in notation between various Stata procedures. The book is geared toward Stata version 10, but most commands will work in other recent versions.

The book's strengths include diverse data examples drawn from disciplines ranging from medicine and public health to education and economics. It displays a generous amount of command syntax and procedure output, which makes it easy to follow and replicate its sample analyses. Another high point is a section

Correspondence should be directed to sheil@gc.cuny.edu.

devoted to problems and tests of endogeneity, a topic that receives far too little attention in most introductory texts. It also has a broader scope than comparable texts. Even while it assumes no previous knowledge about mixed models, it addresses several intermediate issues, which many researchers will encounter if they use these techniques in depth. For instance, the authors cover in some detail the problems associated with analyzing crossed-effects designs. Other issues of even broader interest include how to perform a basic power analysis for a mixed model and how to choose between estimation methods such as maximum likelihood (ML) and restricted maximum likelihood (REML). The authors, having written "gllamm," one of the nonlinear multilevel estimation procedures for Stata (with documentation and samples at http://gllamm.org), likewise pay considerable attention to the most popular generalized linear models, specifically for binary, ordinal, and count outcomes, each of which has its own chapter. Another useful feature in this edition is a concise yet extensive survey of discrete survival/event history analysis, including a short conceptual presentation, illustration of data structuring, simple models using both proportional odds and proportional hazards techniques, and ending with a multilevel illustration. Committed Stata users who work with mixed models will no doubt want to seriously consider this volume, as they are likely to gain new insights and learn new tricks even if they have some previous exposure to the concepts or the procedures used. For experienced analysts interested in learning to navigate Stata, this book provides a virtuoso demonstration. Others may find a comparable applied text like Littell, Milliken, Stroup, Wolfinger, and Schabenberger (2006) for SAS or especially Gelman and Hill (2006) for R/WinBUGS more amenable to studying and teaching the mixed-effects concepts, while Fitzmaurice, Lang, and Ware (2004, also for SAS) would serve as an excellent counterpart on concepts related to models for repeated measures.

References

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Littell, R. C., Milliken, G. A., Stroup, W. W., Wolfinger, R. D., & Schabenberger, O. (2006). *SAS for mixed models* (2nd ed.). Cary, NC: SAS Institute.