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Structural Equation Modeling With LISREL, PRELIS, and SIMPLIS: Basic Concepts, Applications, and Programming. Barbara M. Byrne. Mahwah, NJ: Lawrence Erlbaum Associates, Inc., 1998, 412 pages.

Reviewed by Kit-Tai Hau
Faculty of Education
The Chinese University of Hong Kong, Hong Kong

Structural Equation Modeling With LISREL, PRELIS, and SIMPLIS: Basic Concepts, Applications, and Programming is the latest volume in Barbara Byrne's (1989, 1994) popular series of "step-by-step, do-it-yourself" textbooks on structural equation modeling (SEM). Her intention is to provide a nonmathematical introduction to SEM through applications on real problems and typical models. It can be used as either an introductory or an intermediate-level book and has sufficient detailed discussion on model-fitting procedures and interpretations of results. Thus, it can be used quite independently of the LISREL and PRELIS manuals, though they are recommended as companions by Byrne.

STRUCTURE AND CHARACTERISTICS OF THE BOOK

This new book is a substantially revised and expanded edition of the previous extremely successful book, *A Primer of LISREL* (Byrne, 1989). There are 412 pages (184 in the earlier book) arranged in 4 parts and 12 chapters. The 4 parts are Introduction, Single Group Analyses, Multiple Group Analyses, and LISREL/PRELIS/SIMPLIS through Windows. In Part I, similar to the previous book, Byrne starts with a chapter on basic concepts and the specification of the confirmatory factor analytic (CFA) model. However, in contrast to the earlier book, which deals mainly with CFA models (using the X-side in LISREL terminology), the present edition now also presents the "Full Model" (including X- and Y-sides) in the first chapter. The benefit is that all equations and matrices are presented systematically and coherently in one place, whereas the disadvantage is that beginners may be overwhelmed with too many equations and Greek symbols, which are not totally necessary until the later half of the book. Novices may decide to only skim this part during their first reading.

In the five chapters of Part II, Byrne starts with the basic first-order CFA models and then moves gradually into second-order models, multitrait–multimethod (MTMM) models, and eventually full models involving causal relations among latent factors. In Part III, Byrne shows the analyses of multiple groups; she demonstrates progressively how the invariance of the factor loadings, factor covariances, and mean structures can be tested. Part IV is a short chapter that highlights the major

Requests for reprints should be sent to Kit-Tai Hau, Faculty of Education, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong. E-mail: KTHAU@CUHK.EDU.HK

Windows options in controlling the input, running, and output of a LISREL program under a Windows environment. The book is structured in such a way that readers will "walk through" typical SEM problems and learn various tricks and procedures without being too much hassled by the matrix algebra. The examples and data sets are "real" in the sense that they are not always clean, tidy, and fitting nicely in relation to hypothetical models. Byrne shows techniques for overcoming various model-fitting problems including nonconvergence and improper solutions. She also cautions users on issues ranging from post hoc modifications, negative variances, and extremely large standard errors of parameters. The procedures are generally presented in sufficient detail and represent the most common types of SEM problems. Thus, beginners and novices should be able to match most of their problems with the examples and then adapt the LISREL programs provided in the book.

Although the book is divided into chapters according to the common problem types (simple CFA, second-order CFA, MTMM, etc.), a number of important SEM issues are embedded in various chapters. Readers will be pleasantly surprised at the richness of various practical hints discussed as part of individual examples. For example, although it is extremely hard to catch up with ever increasing number of new fit indexes, there is a 10-page full account of these indexes (pp. 109–119). Here, perhaps beginners may need further advice on which indexes they should generally report. There is also discussion on the analysis of categorical data in the chapter on second-order CFA, the problems of post hoc model fitting (p. 125) in the chapter on first-order CFA, and ways to handle negative variance/Heywood cases (p. 175). These issues are all integrated with various examples scattered throughout the book. It is recommended that first-time readers should make frequent use of the subject index at the end of the book, which is more expanded than the previous volume, to locate topics of their interest.

POSSIBLE CLARIFICATIONS NEEDED

There are nevertheless some suggestions that Byrne may consider in revising the book in the future.

Three-Factor Second-Order CFA

Sometimes Byrne may not have chosen the most appropriate example to illustrate a particular kind of problem. For example, in the second-order CFA, a model with three first-order factors was chosen. This will perhaps create some confusion. First, it is better to put the problem of equivalent models more coherently in the same place. In the book, Byrne points out that the structural part is just identified in the earlier part of the discussion (p. 172). Then at the very end of the example (p. 189), she also shows that the two models (correlated first-order and second-order) are equivalent. Second, in this presentation, the way she describes the equivalency between the higher and first-order models may leave beginners pondering whether this is a general phenomenon common to all other models as well. So, perhaps it would be more appropriate to show the higher order CFA using a model with more than three first-order factors to avoid the model equivalence issue. Then the equivalence problems with second-order CFA on models with less than four first-order factors could be discussed as an additional issue.

Missing Explanations

Probably due to the need to keep the book as concise as possible, sometimes beginners are left wondering what the purposes, needs, or consequences of certain procedures are. For example, Byrne points out that we should add the no starting (NS) option to the Output command when starting values (ST) statements are used. Perhaps, Byrne should also explain "otherwise, starting values will be generated and override the ST statements." Similarly, in testing the invariance of CFA models across several groups (pp. 266, 291), it is said that "the data ... are in the form of a correlation matrix, ... also, the standard deviations are included thereby enabling the analyses to be based on the covariance matrices" (p. 291). For the benefits of beginner readers, it might be better to explicitly emphasize that "we SHOULD use covariance rather than correlation matrices in such invariance/mean structure analyses." In discussing multiple group-invariant CFA models, she says, "the fitting function represents a weighted combination of model fit across groups" (p. 267). To make the implications more obvious, she may warn that in analyses on groups with very disparate sample sizes, the final model will be very heavily weighted toward the larger groups.

Mysterious Starting Values

Byrne also makes abundant use of starting values to solve various nonconvergence problems, which may have been particularly important in earlier versions of LISREL. This does not mean that in LISREL8 we can do totally without ST in all types of models. My experience shows that starting values may still be useful for complicated models (e.g., MTMM), and may sometimes solve some empirically unidentified problems (i.e., LISREL 8.20 issues an "unidentified parameter" error message, but it is solved when ST values are provided). Even when ST commands are justified, readers may need some guidance on how these ST values are set, particularly when the values look peculiar (e.g., in Table 8.3 on p. 272. PH is set to –.01; some uniquenesses [TD] are set to 40, whereas other TD are set to 18).

Restraining Equivalence Across Groups

There are places in which Byrne has not been very accurate or exact in describing the problems. For example, she says "negative variances ... typically represent boundary parameters" (p. 175). Perhaps, she should also warn users of wild negative variances that differ significantly from the boundary and are commonly found in small sample size analyses. In describing the constraint on a certain LX to be equal across groups, she says, "LX(2,1) will be freely estimated for Group 1 only; for Groups 2 and 3, the value LX(2,1) will be constrained equal to the estimate obtained for Group 1" (p. 273). This seems as if the program first looks for the best LX(2,1) using Group 1 data only and then restrains the LX(2,1) in Groups 2 and 3 to be equal to the solution obtained in Group 1. Actually this is not the case because the LX(2,1) is obtained by taking into consideration Groups 1, 2, and 3 data simultaneously.

Correlated Uniqueness in Longitudinal Panal Data

In the last chapter, Byrne shows the application of Windows LISREL to the analysis of two-wave panel data. In this example, she finds it necessary to free correlated uniquenesses (the covariances of uniqueness for matching variables in the two waves) because of large modification indexes. Marsh and Hau (1996; Marsh, 1999; see also Marsh, Byrne, & Yeung, 1999, on a reanalysis of the example cited in the book) showed that, in such longitudinal multiwave designs, such correlated uniquenesses should generally be imposed in the a priori models to avoid biased (inflated) estimates of stability.

Despite the minor problems that have been raised earlier in this review, the book is definitely well written in simple language, yet with very rich information conveyed. It is destined that this book will become one of the most popular textbooks or self-taught guides for first- to intermediate-level SEM instruction.

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