

Preface

This book can be used by Master and PhD students and researchers in the economic, social, behavioral and many other sciences who need to have a basic understanding of multivariate statistical theory and methods for their analysis of multivariate data. It can also be used as a text book for courses on multivariate statistical analysis.

There are many books available on multivariate statistical analysis and many books have been written about structural equation modeling (SEM) and on LISREL¹. But this book is unique in the sense of being the only one that covers both the statistical theory and methodology and how to do the analysis with LISREL. It does not only cover the typical uses of LISREL such as confirmatory factor analysis (CFA) and structural equation models (SEM) but also several other topics of multivariate analysis such as regression (univariate, multivariate, censored, logistic, and probit), generalized linear models, multilevel analysis, and principal components analysis. There is no other book with such a full and detailed coverage of all the models, methods and procedures one can use with LISREL.

Our experience is that although students and researchers in these disciplines can learn the basic statistical theory, they often do not know how to do the actual data analysis in practice. Therefore, this book focuses on both the basic statistical method and how to apply it using the LISREL program. Although there are many books on multivariate statistical analysis at various levels, most of them do not explain how to do the analysis in practice and they do not cover the interpretation of the results.

The book is topic-oriented. It describes the method and its basic statistical theory first and then it gives examples mostly with real data describing how to do the analysis with LISREL. This is followed by a discussion of the interpretation of the results in the context of the example. The focus is on learning by means of examples. There are many examples given in the book. We believe that much can be learned from each example. We also believe that researchers with their own data and problems can find a similar example in the book and use this as a guide for how to do the analysis.

This book is based on the idea of learning by examples. The examples, although sometimes small, are mostly real examples using real data. Each chapter and section begins with some general statistical theory presented at an intermediate level. Readers should be able to see how the examples that follow are special cases of this theory. The results are illustrated with sections of output from the LISREL program which are commented, discussed and interpreted in the context of the example. Readers are encouraged to do the examples themselves and verify the results given in the text.

The book is not a LISREL manual. More detailed information about LISREL is available in the various pdf documents that come with the LISREL program. Unlike these documents which either give a complete list of all LISREL commands in alphabetical order or illustrate how to do various analysis using the graphical users interface, this book focus on how to do it with syntax. Once the data is at hand, most analysis can be done with a few simple syntax lines. For example, multivariate regression can be done by the single command line

Regress Y1-Y3 on X1-X4

and factor analysis can be done by the single command line

¹LISREL is a registered trademark of Scientific Software International.

Factor Analysis

Most material is new or based on courses that have been taught by the authors at the Norwegian School of Business (BI) in Oslo, Norway and in the Statistics Department at Uppsala University in Uppsala, Sweden. Various parts of the book have also been used in shorter courses and workshops given by the authors at universities and conferences around the world. Some parts of the book present revised material previously published by Scientific Software International (SSI). These publications are no longer available. All the material in the book is up-to-date for the latest available version of LISREL.

Although the aim is to give a thorough understanding of the basic statistical theory required for the application of each method and procedure, proofs of statements or theorems are not always included. These may be found in other books or articles referred to in the book.

For most examples we give an input file in both **SIMPLIS** syntax and **LISREL** syntax. For some examples, where the use of **SIMPLIS** syntax is inconvenient or impossible, we give only the **LISREL** syntax.

Readers who are familiar with mathematical notation and especially matrix notation should be able to read this book completely. Readers who are not familiar with mathematical and matrix notation should still be able to benefit from this book by skipping the mathematical theory and studying the examples and focusing on the **SIMPLIS** syntax.

All examples are listed in the Table of Contents. To do the examples you need **LISREL 9.2** or a later version. Visit **www.ssicentral.com** for information about **LISREL** and information about ordering and prices.

If **LISREL** is installed on your computer, input and data files for the examples can be found in the following folders.

```
LISREL Examples\MVABOOK\Chapter 1
LISREL Examples\MVABOOK\Chapter 2
LISREL Examples\MVABOOK\Chapter 3
LISREL Examples\MVABOOK\Chapter 4
LISREL Examples\MVABOOK\Chapter 5
LISREL Examples\MVABOOK\Chapter 6
LISREL Examples\MVABOOK\Chapter 7
LISREL Examples\MVABOOK\Chapter 8
LISREL Examples\MVABOOK\Chapter 9
LISREL Examples\MVABOOK\Chapter 10
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