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J. Christopher Westland

Structural Equation Models

From Paths to Networks

Second edition

 Springer

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Foreword to the Second Edition of Structural Equation Models

Since publication of the first edition of *Structural Equation Models*, I have been fortunate to maintain an active dialog on structural equation modeling (SEM) with many of my colleagues around the world. I never cease to be surprised with the broad divergence of opinions and myriad applications of SEM methodologies. Statistical methods such as regression and ANOVA rely on datasets of objectively measured constructs. These fail to satisfy a widespread need among researchers to analyze data concerning relationships between hypothesized and unobservable constructs: aesthetics, perceptions, utilities, and other human and social constructs. Criticisms of SEM have arisen from its lack of fit statistics and indeed the lack of defensible sampling strategies. But my argument is that these problems can be repaired while retaining the desirable features of SEM.

SEM has been applied in both the natural and the social sciences, but it has proven particularly valuable in the social sciences, where researchers apply SEM approaches rather than more structured regression approaches by the inclusion of unobservable (or latent) constructs and by the use of computationally intensive iterative searches for coefficients that fit the data. The expansion of statistical analysis to encompass unmeasurable constructs using SEM, canonical correlation, Likert scale quantification, principal components, and factor analysis has vastly extended the scope and relevance of the social sciences over the past century. Subjects that were previously the realm of abstract argumentation have been transported into the mainstream of scientific research (see Allen and Seaman 2007; Altman and Royston 2000).

This new edition of this widely cited book surveys the full range of available structural equation modeling (SEM) methodologies. The book has been updated throughout to reflect the arrival of new software packages, which have made analysis much easier than in the past. Applications in a broad range of disciplines are discussed, particularly in the social sciences where many key concepts are not directly observable. This is the first book to present SEM's development in its proper historical context—essential to understanding the application, strengths, and weaknesses of each particular method. This book also surveys emerging approaches that complement SEM. They have been applied in diverse areas in

engineering, including neuroscience for accurate examination of the activity among neural regions during different behaviors. The partial least squares SEM method was contemporaneously developed with path analysis software (PLS) regression to address problems in chemistry and spectrography. They improve on predecessor path models that were widely used in genetic research in livestock and agriculture and environmental studies in the elicitation of ecological networks. SEM's ability to accommodate unobservable theory constructs through latent variables is of significant importance to social scientists. Latent variable theory and application are comprehensively explained, and methods are presented for extending their power, including guidelines for data preparation, sample size calculation, and the special treatment of Likert scale data. Tables of software, methodologies, and fit statistics provide a concise reference for any research program, helping assure that its conclusions are defensible and publishable.

Chicago, IL, USA
26 December 2018

J. Christopher Westland

Contents

1	An Introduction to Structural Equation Models	1
1.1	Latent Constructs as Organizing Principles of Science in the Twentieth Century	3
1.2	Path Analysis in Genetics	4
1.3	Sewall Wright's Path Analysis	5
1.4	Networks and Cycles	7
1.5	What Is a Path Coefficient?	9
1.6	Applications and Evolution	9
1.7	The Chicago School	11
1.8	The Scandinavian School	12
1.9	Limited and Full-Information Methods.....	14
2	Partial Least Squares Path Analysis	17
2.1	PLS Path Analysis Software: Functions and Objectives	18
2.2	Path Regression	19
2.3	Hermann Wold' Contributions to Path Analysis	20
2.4	Possible Choices for Path Coefficients: Covariance, Correlation, and Regression Coefficients	22
2.4.1	Covariance and Variance	22
2.4.2	Correlation	22
2.4.3	Regression Coefficients.....	23
2.5	Lohmöller's PCA-OLS Path Analysis Method.....	25
2.6	PLS Path Analysis vs. PLS Regression	27
2.7	Resampling	29
2.8	Measures	29
2.9	Limited Information	31
2.10	Sample Size in PLS-PA	31
2.11	PLS-PA: The Bottom Line	37

3	Full-Information Covariance SEM	39
3.1	LISREL	39
3.2	Short History of LISREL.....	42
3.3	LISREL Performance Statistics	45
4	Systems of Regression Equations	51
4.1	The Birth of Structural Equation Modeling	51
4.2	Simultaneous Regression Equation Models	52
4.3	Estimation	54
4.4	Comparing the Different SEM Methods.....	55
5	Data Collection, Control, and Sample Size	67
5.1	The Role of Data.....	67
5.2	The Ancient Roots of Model-Data Duality	68
5.3	Data: Model Fit	72
5.4	Latent Variables.....	75
5.5	Linear Models.....	77
5.6	Hypothesis Tests and Data	77
5.7	Data Adequacy in SEM	78
5.7.1	Does Our Dataset Contain Sufficient Information for Model Analysis?	78
5.7.2	The “Black-Box” Problem.....	81
5.7.3	Minimum Effect Size and Correlation Metrics	82
5.7.4	Minimum Sample Size for SEM Model Analysis	84
5.8	Can Resampling Recover Information Lost Through Likert Mapping?.....	87
5.9	Data Screening	88
5.10	Exploratory Specification Search	89
6	Survey and Questionnaire Data	91
6.1	Rensis Likert’s Contribution to Social Research	92
6.2	Likert Scales	94
6.3	How Much Information Is Lost in Likert Responses?	97
6.4	The Information Content of Items Measured on a Likert Scale	100
6.5	Affective Technologies to Enhance the Information Content of Likert-Scaled Surveys	101
6.6	Known Unknowns: What Is a Latent Variable?	106
7	Research Structure and Paradigms	107
7.1	The Quest for Truth.....	108
7.2	Research Questions	109
7.3	Models	109
7.4	Theory Building and Hypotheses	110
7.5	Hypothesis Testing	113
7.6	Model Specification and Confirmation	115
7.7	How Many Alternative Models Should You Test?	116
7.8	Distributional Assumptions	116

- 7.9 Statistical Distributions: Are They Part of the Model or Are They Part of the Data? 117
- 7.10 Causality 118
- 7.11 The Risks of Received Wisdom 120
- 7.12 Design of Empirical Studies 122
 - 7.12.1 Concepts 122
 - 7.12.2 Significance Testing 123
 - 7.12.3 Model Identification 124
 - 7.12.4 Negative Error Variance Estimates 124
 - 7.12.5 Heywood Cases 124
 - 7.12.6 Empirical Confirmation of Theory 125
- 8 Frontiers in Latent Variable Analysis 127**
 - 8.1 Genetic Pathways Revisited 128
 - 8.2 Latent Constructs in Neural Networks 130
 - 8.3 The Evolution of SEM Research Questions 132
 - 8.4 Visualization: The New Language of Networks 134
- References 135**
- Index 147**