

# Contents

<i>Preface</i>	ix
<i>Acknowledgments</i>	xiii

## **Chapter 1 Empirical Analyses in the Social Sciences**

1.1 Introduction	1
1.2 Social Science Theory and Statistical Models	2
1.3 Fitting Models to Data	6
1.4 The Development of Stochastic Models	11
1.5 The Analysis of Nonexperimental Data and the Selection of a Statistical Procedure	13
1.6 Simple Methods	16
Review Questions	23

## **Chapter 2 Estimation with Simple Linear Models**

2.1 Introduction	24
2.2 The Basic Model	25
2.3 Least Squares Estimators	28
2.4 Two Examples	35
2.5 Conclusion	39
Appendix 2.1 Properties of Summations	40
Appendix 2.2 Calculus and the Minimization of Functions	42
Review Questions	44

## **Chapter 3 Least Squares Estimators: Statistical Properties and Hypothesis Testing**

3.1 Introduction	45
3.2 Properties of Least Squares Estimators	46

3.3	Distribution of $b$ —A Monte Carlo Experiment	60
3.4	Statistical Inference	65
3.5	Hypothesis Tests for Schooling/Earnings Model	69
3.6	Conclusion	69
Appendix 3.1	Estimation of Schooling/Earnings Model Using SPSS Computer Program	72
	Review Questions	72

## **Chapter 4 Ordinary Least Squares in Practice**

4.1	Introduction	75
4.2	Interpretation of Regression Coefficients	76
4.3	Model Specification	79
4.4	Multicollinearity	86
4.5	Model Specification and Multicollinearity in Practice	93
4.6	Functional Forms	96
4.7	Dummy Explanatory Variables	101
	Review Questions	108

## **Chapter 5 Multivariate Estimation in Matrix Form**

5.1	Introduction	109
5.2	The Least Squares Estimators	110
5.3	Least Squares in Matrix Notation	113
5.4	Properties of Least Squares	116
5.5	Distributional Aspects of the Error Term	120
5.6	Statistical Inference	122
5.7	Multivariate Education Example	129
5.8	Multicollinearity	131
5.9	Conclusion	133
Appendix 5.1	Proof of Best	137
Appendix 5.2	Proof of Unbiasedness of the Estimator for $\sigma^2$	138
	Review Questions	139

## **Chapter 6 Generalized Least Squares**

6.1	Introduction	141
6.2	Heteroskedasticity and Autocorrelation	142
6.3	Formal Statement of the Problem	145
6.4	Generalized Least Squares	146
6.5	Generalized Least Squares and Examples of Heteroskedasticity and Autocorrelation	149
6.6	Generalized Least Squares and Weighted Regression	150
6.7	Monte Carlo Simulation of Generalized Least Squares	153
6.8	Generalized Least Squares in Practice	157
6.9	Visual Diagnostics	168
6.10	Dynamic Models	169
6.11	Conclusion	174
Appendix 6.1	Derivation of Generalized Least Squares Estimator	176
Appendix 6.2	Unbiased Estimator of $\sigma^2$	177
	Review Questions	178

**Chapter 7 Models with Discrete Dependent Variables**

7.1	Introduction	179
7.2	The Problem of Estimating Models with Discrete Dependent Variables	180
7.3	Alternative Models—Dichotomous Dependent Variables	187
7.4	Logit Analysis—Grouped Data	190
7.5	Logit Analysis—Microdata	200
7.6	Probit Analysis	204
7.7	An Example	206
7.8	Monte Carlo Simulation of Dichotomous Dependent Variables	207
7.9	Polytomous Variables/Joint Distributions	210
7.10	Conclusions	215

**Chapter 8 Introduction to Multiequation Models**

8.1	Introduction	217
8.2	Two Examples of Structural Systems	218
8.3	Path Analysis	220
8.4	The General Multiequation Model	224
8.5	Estimating Hierarchical Models	229
8.6	Hierarchical, Nonrecursive Systems	231
8.7	Underidentification in Hierarchical Models	239
8.8	Nonrecursive Hierarchical Models: Two Examples	241
8.9	Conclusion	243
	Appendix 8.1 Instrumental Variables Estimator	244
	Review Questions	244

**Chapter 9 Structural Equations: Simultaneous Models**

9.1	Introduction	246
9.2	Identification in Simultaneous Systems: An Example	250
9.3	Identification in Simultaneous Models	254
9.4	Estimating Identified Models	266
9.5	Simultaneous Equations: The Voting and Aspiration Examples	269
9.6	Identification through Assumptions about Error Terms	271
9.7	Alternative Estimators	276
9.8	Summary and Conclusions	278
	Appendix 9.1 Variances and Covariances for Peer Influence Data	280
	Review Questions	280

**Chapter 10 Estimating Models with Erroneous  
and Unobserved Variables**

10.1	Introduction	282
10.2	Erroneous Explanatory Variables	286
10.3	Unobserved Variables	289
10.4	Factor Analysis	302

10.5	Linear Structural Models and the General Analysis of Covariances	312
10.6	Conclusion	323
<b>Appendix I Statistical Review</b>		325
I.1	Probability	326
I.2	Theoretical Distributions	332
I.3	Properties of Estimators	337
I.4	Hypothesis Testing	341
I.5	Maximum Likelihood (ML) Estimation	344
<b>Appendix II Matrix Algebra</b>		349
II.1	Basic Properties	349
II.2	Basic Operations	351
II.3	Matrix Multiplication	351
II.4	Other Operations	353
II.5	Systems of Linear Equations	354
II.6	Inverses	355
II.7	Existence of an Inverse-Rank	358
	Review Questions for Appendix II	359
<b>Appendix III Statistical Tables</b>		360
<b>References</b>		367
<b>Index</b>		369