

BRIEF CONTENTS

Examples and Applications

Preface

PART I

The Linear Regression Model

Chapter 1	Econometrics
Chapter 2	The Linear Regression Model
Chapter 3	Least Squares
Chapter 4	The Least Squares Estimator
Chapter 5	Hypothesis Tests and Model Selection
Chapter 6	Functional Form and Structural Change
Chapter 7	Nonlinear, Semiparametric and Nonparametric Regression Models
Chapter 8	Endogeneity and Instrumental Variable Estimation

Part II

Generalized Regression Model and Equation Systems

Chapter 9	The Generalized Regression Model and Heteroscedasticity
Chapter 10	Systems of Equations
Chapter 11	Models for Panel Data

Part III

Estimation Methodology

Chapter 12	Estimation Frameworks in Econometrics
Chapter 13	Minimum Distance Estimation and the Generalized Method of Moments
Chapter 14	Maximum Likelihood Estimation
Chapter 15	Simulation-Based Estimation and Inference
Chapter 16	Bayesian Estimation and Inference

Part IV

Cross Sections, Panel Data and Microeconometrics

Chapter 17	Discrete Choice
Chapter 18	Discrete Choices and Event Counts
Chapter 19	Limited Dependent Variables, Truncation, Censoring and Sample Selection

PART V

Time Series and Macroeconometrics

Chapter 19	Serial Correlation
Chapter 21	Models with Lagged Variables
Chapter 22	Time-Series Models
Chapter 23	Nonstationary Data

PART VI

Appendices

Appendix A	Matrix Algebra
Appendix B	Probability and Distribution Theory
Appendix C	Estimation and Inference
Appendix D	Large-Sample Distribution Theory
Appendix E	Computation and Optimization
Appendix F	Data Sets Used in Applications
Appendix G	Statistical Tables

References

Combined Author and Subject Index

PART I The Linear Regression Model

CHAPTER 1 Econometrics

- 1.1 Introduction
- 1.2 The Paradigm of Econometrics
- 1.3 The Practice of Econometrics
- 1.4 Econometric Modeling
- 1.5 Plan of the Book
- 1.6 Preliminaries
 - 1.6.1 Numerical Examples
 - 1.6.2 Software and Replication
 - 1.6.3 Notational Conventions

CHAPTER 2 The Linear Regression Model

- 2.1 Introduction
- 2.2 The Linear Regression Model
- 2.3 Assumptions of the Linear Regression Model
 - 2.3.1 Linearity of the Regression Model
 - 2.3.2 Full Rank
 - 2.3.3 Regression
 - 2.3.4 Spherical Disturbances
 - 2.3.5 Data Generating Process for the Regressors
 - 2.3.6 Normality
 - 2.3.7 Independence
- 2.4 Summary and Conclusions

CHAPTER 3 Least Squares

- 3.1 Introduction
- 3.2 Least Squares Regression
 - 3.2.1 The Least Squares Coefficient Vector
 - 3.2.2 Application: An Investment Equation
 - 3.2.3 Algebraic Aspects of the Least Squares Solution
 - 3.2.4 Projection
- 3.3 Partitioned Regression and Partial Regression
- 3.4 Partial Regression and Partial Correlation Coefficients
- 3.5 Goodness of Fit and the Analysis of Variance
 - 3.5.1 The Adjusted R -Squared and a Measure of Fit
 - 3.5.2 R -Squared and the Constant Term in the Model
 - 3.5.3 Comparing Models
- 3.6 Linearly Transformed Regression
- 3.7 Summary and Conclusions

CHAPTER 4 The Least Squares Estimator

- 4.1 Introduction
- 4.2 Motivating Least Squares
 - 4.2.1 The Population Orthogonality Conditions
 - 4.2.2 Minimum Mean Squared Error Predictor
 - 4.2.3 Minimum Variance Linear Unbiased Estimation
- 4.3 Finite Sample Properties of Least Squares
 - 4.3.1 Unbiased Estimation
 - 4.3.2 Bias Caused by Omission of Relevant Variables

Av: Include
Sec 3.2.2 in
List of Examples
Applications?

- 4.3.3 Inclusion of Irrelevant Variables
- 4.3.4 The Variance of the Least Squares Estimator
- 4.3.5 The Gauss-Markov Theorem
- 4.3.6 The Implications of Stochastic Regressors
- 4.3.7 Estimating the Variance of the Least Squares Estimator
- 4.3.8 The Normality Assumption
- 4.4 Large Sample Properties of the Least Squares Estimator
 - 4.4.1 Consistency of the Least Squares Estimator of β
 - 4.4.2 Asymptotic Normality of the Least Squares Estimator
 - 4.4.3 Consistency of s^2 and the Estimator of $\text{Asy. Var}[\hat{\beta}]$
 - 4.4.4 Asymptotic Distribution of a Function of $\hat{\beta}$: The Delta Method
 - 4.4.5 Asymptotic Efficiency
 - 4.4.6 Maximum Likelihood Estimation
- 4.5 Interval Estimation
 - 4.5.1 Forming A Confidence Interval for a Coefficient
 - 4.5.2 Confidence Intervals Based on Large Samples
 - 4.5.3 Confidence Interval for a Linear Combination of Coefficients:
The Oaxaca Decomposition
- 4.6 Prediction and Forecasting
 - 4.6.1 Prediction Intervals
 - 4.6.2 Predicting y When the Regression Model Describes $\log y$
 - 4.6.3 Prediction Interval for y When the Regression Model Describes $\log y$
 - 4.6.4 Forecasting
- 4.7 Data Problems
 - 4.7.1 Multicollinearity
 - 4.7.2 Pretest Estimation
 - 4.7.3 Principal Components
 - 4.7.4 Missing Values and Data Imputation
 - 4.7.5 Measurement Error
 - 4.7.6 Outliers and Influential Observations
- 4.8 Summary and Conclusions

CHAPTER 5 Hypothesis Tests and Model Selection

- 5.1 Introduction
- 5.2 Hypothesis Testing Methodology
 - 5.2.1 Restrictions and Hypotheses
 - 5.2.2 Nested Models
 - 5.2.3 Testing Procedures – Neyman-Pearson Methodology
 - 5.2.4 Size, Power, and Consistency of a Test
 - 5.2.5 A Methodological Dilemma: Bayesian vs. Classical Testing
- 5.3 Two Approaches to Testing Hypotheses
- 5.4 Wald Tests Based on the Distance Measure
 - 5.4.1 Testing a Hypothesis about a Coefficient
 - 5.4.2 The F Statistic and the Least Squares Discrepancy
- 5.5 Testing Restrictions Using the Fit of the Regression
 - 5.5.1 The Restricted Least Squares Estimator
 - 5.5.2 The Loss of Fit from Restricted Least Squares
 - 5.5.3 Testing the Significance of the Regression
 - 5.5.4 Solving Out the Restrictions and a Caution about Using R^2
- 5.6 Nonnormal Disturbances and Large Sample Tests
- 5.7 Testing Nonlinear Restrictions
- 5.8 Choosing Between Nonnested Models
 - 5.8.1 Testing Nonnested Hypotheses
 - 5.8.2 An Encompassing Model
 - 5.8.3 Comprehensive Approach – The J Test
- 5.9 A Specification Test

Versus

5.10 Model Building – A General to Simple Strategy

5.10.1 Model Selection Criteria

5.10.2 Model Selection

5.10.3 Classical Model Selection

5.10.4 Bayesian Model Selection

5.11 Summary and Conclusions

CHAPTER 6 Functional Form and Structural Change

6.1 Introduction

6.2 Using Binary Variables

6.2.1 Binary Variables in Regression

6.2.2 Several Categories

6.2.3 Several Groupings

6.2.4 Threshold Effects and Categorical Variables

6.2.5 Treatment Effects and Difference in Differences Regression

6.3 Nonlinearity in the Variables

6.3.1 Piecewise Linear Regression

6.3.2 Functional Forms

6.3.3 Interaction Effects

6.3.4 Identifying Nonlinearity

6.3.5 Intrinsically Linear and Models

6.4 Modeling and Testing for a Structural Break

6.4.1 Different Parameter Vectors

6.4.2 Insufficient Observations

6.4.3 Change in a Subset of Coefficients

6.4.4 Tests of Structural Break with Unequal Variances

6.4.5 Predictive Test of Model Stability

6.5 Summary and Conclusions 128

CHAPTER 7 Nonlinear, Semiparametric and Nonparametric Regression Models

7.1 Introduction

7.2 Nonlinear Regression Models

7.2.1 Assumptions of the Nonlinear Regression Model

7.2.2 The Nonlinear Least Squares Estimator

7.2.3 Large Sample Properties of the Nonlinear Least Squares Estimator

7.2.4 Hypothesis Testing and Parametric Restrictions

7.2.5 Applications

7.2.6 Computing the Nonlinear Least Squares Estimator

7.3 Median and Quantile Regression

7.3.1 Least Absolute Deviations Estimation

7.3.2 Quantile Regression Models

7.4 Partially Linear Regression

7.5 Nonparametric Regression

7.6 Summary and Conclusions

CHAPTER 8 Endogeneity and Instrumental Variable Estimation

8.1 Introduction

8.2 Assumptions of the Extended Model

8.3 Estimation

8.3.1 Least Squares

8.3.2 The Instrumental Variables Estimator

8.3.3 Motivating the Instrumental Variables Estimator

8.3.4 Two Stage Least Squares

8.4 Two Specification Tests

8.4.1 The Hausman and Wu Specification Tests

- 8.4.2 *A Test for Overidentification*
- 8.5 Measurement Error
 - 8.5.1 *Least Squares Attenuation*
 - 8.5.2 *Instrumental Variables Estimation*
 - 8.5.3 *Proxy Variables*
- 8.6 Nonlinear Instrumental Variables Estimation
- 8.7 Weak Instruments
- 8.8 Natural Experiments and the Search for Causal Effects
- 8.9 Summary and Conclusions

Part II Generalized Regression Model and Equation Systems

CHAPTER 9 The Generalized Regression Model and Heteroscedasticity

- 9.1 Introduction
- 9.2 Inefficient Estimation by Least Squares and Instrumental Variables
 - 9.2.1 *Finite-Sample Properties of Ordinary Least Squares*
 - 9.2.2 *Asymptotic Properties of Least Squares*
 - 9.2.3 *Robust Estimation of Asymptotic Covariance Matrices*
 - 9.2.4 *Instrumental Variable Estimation*
- 9.3 Efficient Estimation by Generalized Least Squares
 - 9.3.1 *Generalized Least Squares (GLS)*
 - 9.3.2 *Feasible Generalized Least Squares (FGLS)*
- 9.4 Heteroscedasticity and Weighted Least Squares
 - 9.4.1 *Ordinary Least Squares Estimation*
 - 9.4.2 *Inefficiency of Ordinary Least squares*
 - 9.4.3 *The Estimated Covariance Matrix of \hat{b}*
 - 9.4.4 *Estimating the Appropriate Covariance Matrix for Ordinary Least Squares*
- 9.5 Testing for Heteroscedasticity
 - 9.5.1 *White's General Test*
 - 9.5.2 *The Breusch-Pagan/Godfrey LM Test 166*
- 9.6 Weighted Least Squares
 - 9.6.1 *Weighted Least Squares with Known Ω*
 - 9.6.2 *Estimation When Ω Contains Unknown Parameters*
- 9.7 Applications
 - 9.7.1 *Multiplicative Heteroscedasticity*
 - 9.7.2 *Groupwise Heteroscedasticity*
- 9.8 Summary and Conclusions

CHAPTER 10 Systems of Equations

- 10.1 Introduction
- 10.2 The Seemingly Unrelated Regressions Model
 - 10.2.1 *Generalized Least Squares*
 - 10.2.2 *Seemingly Unrelated Regressions with Identical Regressors*
 - 10.2.3 *Feasible Generalized Least Squares*
 - 10.2.4 *Testing Hypotheses*
 - 10.2.5 *A Specification Test for the SUR Model*
 - 10.2.6 *The Pooled Model*
- 10.3 Seemingly Unrelated Generalized Regression Models
- 10.4 Nonlinear Systems of Equations
- 10.5 Systems of Demand Equations: Singular Systems
 - 10.5.1 *Cobb-Douglas Cost Function (Example 6.3 Continued)*
 - 10.5.2 *Flexible Functional Forms: The Translog Cost Function*
- 10.6 Simultaneous Equations Models
 - 10.6.1 *Systems of Equations*
 - 10.6.2 *A General Notation for Linear Simultaneous Equations Models*
 - 10.6.3 *The Problem of Identification*

Do: Should these applications be added to List of Examples and Applications?

- 10.6.4 Single Equation Estimation and Inference
- 10.6.5 System Methods of Estimation
- 10.6.6 Testing in the Presence of Weak Instruments 377
- 10.7 Summary and Conclusions 394

CHAPTER 11 Models for Panel Data

- 11.1 Introduction
- 11.2 Panel Data Models
 - 11.2.1 General Modeling Framework for Analyzing Panel Data
 - 11.2.2 Model Structures
 - 11.2.3 Extensions
 - 11.2.4 Balanced and Unbalanced Panels
 - 11.2.5 Well Behaved Panel Data
- 11.3 The Pooled Regression Model
 - 11.3.1 Least Squares Estimation of The Pooled Model
 - 11.3.2 Robust Covariance Matrix Estimation
 - 11.3.3 Clustering and Stratification
 - 11.3.4 Robust Estimation Using Group Means
 - 11.3.5 Estimation With First Differences
 - 11.3.6 The Within- and Between-Groups Estimators
- 11.4 The Fixed Effects Model
 - 11.4.1 Least Squares Estimation
 - 11.4.2 Small T Asymptotics
 - 11.4.3 Testing the Significance of the Group Effects
 - 11.4.4 Fixed Time and Group Effects
 - 11.4.5 Time Invariant Variables and Fixed Effects Vector Decomposition
- 11.5 Random Effects
 - 11.5.1 Least Squares Estimation
 - 11.5.2 Generalized Least Squares
 - 11.5.3 Feasible Generalized Least Squares When Σ Is Unknown
 - 11.5.4 Testing for Random Effects
 - 11.5.5 Hausman's Specification Test for the Random Effects Model
 - 11.5.6 Extending the Unobserved Effects Model: Mundlak's Approach
 - 11.5.7 The Random and Fixed Effects Models: Chamberlain's Approach
- 11.6 Nonspherical Disturbances and Robust Covariance Estimation
 - 11.6.1 Robust Estimation of the Fixed Effects Model
 - 11.6.2 Heteroscedasticity in the Random Effects Model
 - 11.6.3 Autocorrelation in Panel Data Models
 - 11.6.4 Cluster (and Panel) Robust Covariance Matrices for Fixed and Random Effects Estimators
- 11.7 Spatial Autocorrelation
- 11.8 Endogeneity
 - 11.8.1 Hausman and Taylor's Instrumental Variables Estimator
 - 11.8.2 Consistent Estimation of Dynamic Panel Data Models: Anderson and Hsiao's IV Estimator
 - 11.8.3 Efficient Estimation of Dynamic Panel Data Models: The Arellano/Bond Estimators
 - 11.8.4 Nonstationary Data and Panel Data Models
- 11.9 Nonlinear Regression with Panel Data
 - 11.9.1 A Robust Covariance Matrix for Nonlinear Least Squares
 - 11.9.2 Fixed Effects
 - 11.9.3 Random Effects
- 11.10 Systems of Equations
- 11.11 Parameter Heterogeneity
 - 11.11.1 The Random Coefficients Model
 - 11.11.2 A Hierarchical Linear Model

- 11.11.3 *Parameter Heterogeneity and Dynamic Panel Data Models*
- 11.12 Summary and Conclusions

III Estimation Methodology

CHAPTER 12 Estimation Frameworks in Econometrics

- 12.1 Introduction
- 12.2 Parametric Estimation and Inference
 - 12.2.1 *Classical Likelihood-Based Estimation*
 - 12.2.2 *Modeling Joint Distributions with Copula Functions*
- 12.3 Semiparametric Estimation
 - 12.3.1 *GMM Estimation in Econometrics*
 - 12.3.2 *Maximum Empirical Likelihood Estimation*
 - 12.3.3 *Least Absolute Deviations Estimation and Quantile Regression*
 - 12.3.4 *Kernel Density Methods*
 - 12.3.5 *Comparing Parametric and Semiparametric Analyses*
- 12.4 Nonparametric Estimation
 - 12.4.1 *Kernel Density Estimation*
- 12.5 Properties of Estimators
 - 12.5.1 *Statistical Properties of Estimators*
 - 12.5.2 *Extremum Estimators*
 - 12.5.3 *Assumptions for Asymptotic Properties of Extremum Estimators*
 - 12.5.4 *Asymptotic Properties of Estimators*
 - 12.5.5 *Testing Hypotheses*
- 12.6 Summary and Conclusions

CHAPTER 13 Minimum Distance Estimation and the Generalized Method of Moments

- 13.1 Introduction
- 13.2 Consistent Estimation: The Method of Moments
 - 13.2.1 *Random Sampling and Estimating the Parameters of Distributions*
 - 13.2.2 *Asymptotic Properties of the Method of Moments Estimator*
 - 13.2.3 *Summary: The Method of Moments*
- 13.3 Minimum-Distance Estimation
- 13.4 The Generalized Method of Moments (GMM) Estimator
 - 13.4.1 *Estimation Based on Orthogonality Conditions*
 - 13.4.2 *Generalizing the Method of Moments*
 - 13.4.3 *Properties of the GMM Estimator*
- 13.5 Testing Hypotheses in the GMM Framework
 - 13.5.1 *Testing the Validity of the Moment Restrictions*
 - 13.5.2 *GMM Counterparts to the WALD, LM, and LR Tests*
- 13.6 GMM Estimation of Econometric Models
 - 13.6.1 *Single-Equation Linear Models*
 - 13.6.2 *Single-Equation Nonlinear Models*
 - 13.6.3 *Seemingly Unrelated Regression Models*
 - 13.6.4 *Simultaneous Equations Models with Heteroscedasticity*
 - 13.6.5 *GMM Estimation of Dynamic Panel Data Models*
- 13.7 Summary and Conclusions



CHAPTER 14 Maximum Likelihood Estimation

- 14.1 Introduction
- 14.2 The Likelihood Function and Identification of the Parameters
- 14.3 Efficient Estimation: The Principle of Maximum Likelihood
- 14.4 Properties of Maximum Likelihood Estimators
 - 14.4.1 *Regularity Conditions*
 - 14.4.2 *Properties of Regular Densities*
 - 14.4.3 *The Likelihood Equation*

- 14.4.4 *The Information Matrix Equality*
- 14.4.5 *Asymptotic Properties of the Maximum Likelihood Estimator*
 - 14.4.5.a *Consistency*
 - 14.4.5.b *Asymptotic Normality*
 - 14.4.5.c *Asymptotic Efficiency*
 - 14.4.5.d *Invariance*
 - 14.4.5.e *Conclusion*
- 14.4.6 *Estimating the Asymptotic Variance of the Maximum Likelihood Estimator*
- 14.5 *Conditional Likelihoods, Econometric Models, and the GMM Estimator*
- 14.6 *Hypothesis and Specification Tests and Fit Measures*
 - 14.6.1 *The Likelihood Ratio Test*
 - 14.6.2 *The Wald Test*
 - 14.6.3 *The Lagrange Multiplier Test*
 - 14.6.4 *An Application of the Likelihood-Based Test Procedures*
 - 14.6.5 *Comparing Models and Computing Model Fit*
 - 14.6.6 *Vuong's Test and the Kullback Leibler Information Criterion*
- 14.7 *Two-Step Maximum Likelihood Estimation*
- 14.8 *Pseudo-Maximum Likelihood Estimation and Robust Asymptotic Covariance Matrices*
 - 14.8.1 *Maximum Likelihood and GMM Estimation*
 - 14.8.2 *Maximum Likelihood and M Estimation*
 - 14.8.3 *Sandwich Estimators*
 - 14.8.4 *Cluster Estimators*
- 14.9 *Applications of Maximum Likelihood Estimation*
 - 14.9.1 *The Normal Linear Regression Model*
 - 14.9.2 *The Generalized Regression Model*
 - 14.9.2.a *Multiplicative Heteroscedasticity*
 - 14.9.2.b *Autocorrelation*
 - 14.9.3 *Seemingly Unrelated Regression Models*
 - 14.9.3.a *The Pooled Model*
 - 14.9.3.b *The Sur Model*
 - 14.9.3.c *Exclusion Restrictions*
 - 14.9.4 *Simultaneous Equations Models*
 - 14.9.5 *Maximum Likelihood Estimation of Nonlinear Regression Models*
 - 14.9.6 *Panel Data Applications*
 - 14.9.6.a *ML Estimation of the Linear Random Effects Model*
 - 14.9.6.b *Nested Random Effects*
 - 14.9.6.c *Random Effects in Nonlinear Models: MLE Using Quadrature*
 - 14.9.6.d *Fixed Effects in Nonlinear Models: Full MLE*
- 14.10 *Latent Class and Finite Mixture Models*
 - 14.10.1 *A Finite Mixture Model*
 - 14.10.2 *Measured and Unmeasured Heterogeneity*
 - 14.10.3 *Predicting Class Membership*
 - 14.10.4 *A Conditional Latent Class Model*
 - 14.10.5 *Determining the Number of Classes*
 - 14.10.6 *A Panel Data Application*
- 14.11 *Summary and Conclusions*

CHAPTER 15 Simulation-Based Estimation and Inference

- 15.1 *Introduction*
- 15.2 *Random Number Generation*
 - 15.2.1 *Generating Pseudo-Random Numbers*
 - 15.2.2 *Sampling from a Standard Uniform Population*
 - 15.2.3 *Sampling from Continuous Distributions*
 - 15.2.4 *Sampling from a Multivariate Normal Population*
 - 15.2.5 *Sampling from Discrete Populations*
- 15.3 *Simulation Based Inference: The Method of Krinsky and Robb*



 Add: Include
 Sec. 14.10.6 in
 List of Examples
 & Applications?



- 15.4 Bootstrapping Standard Errors and Confidence Intervals
- 15.5 Monte Carlo Studies
 - 15.5.1 *A Monte Carlo Study: Behavior of a Test Statistic*
 - 15.5.2 *A Monte Carlo Study: The Incidental Parameters Problem*
- 15.6 Simulation-Based Estimation
 - 15.6.1 *Random Effects in a Nonlinear Mode*
 - 15.6.2 *Monte Carlo Integration*
 - 15.6.2.a *Halton Sequences and Random Draws for Simulation-Based Integration*
 - 15.6.2.b *Computing Multivariate Normal Probabilities Using the GHK Simulator*
 - 15.6.3 *Simulation Based Estimation of Random Effects Models*
- 15.7 A Random Parameters Linear Regression Model
 - 15.7.1 *Maximum Simulated Likelihood Estimation of Random Parameters Models 590*
 - 15.7.2 *The Method of Simulated Moments 595*
- 15.8 Hierarchical Linear Models
- 15.9 Nonlinear Random Parameter Models
- 15.10 Individual Parameter Estimates
- 15.11 Mixed Models and Latent Class Models
- 15.12 Summary and Conclusions

CHAPTER 16 Bayesian Estimation and Inference

- 16.1 Introduction
- 16.2 Bayes Theorem and the Posterior Density
- 16.3 Bayesian Analysis of the Classical Regression Model
 - 16.3.1 *Analysis with A Noninformative Prior*
 - 16.3.2 *Estimation with an Informative Prior Density*
- 16.4 Bayesian Inference
 - 16.4.1 *Point Estimation*
 - 16.4.2 *Interval Estimation*
 - 16.4.3 *Hypothesis Testing*
 - 16.4.4 *Large Sample Results*
- 16.5 Posterior Distributions and the Gibbs Sampler
- 16.6 Application: Binomial Probit Model
- 16.7 Panel Data Application: Individual Effects Models
- 16.8 Hierarchical Bayes Estimation of A Random Parameters Model
- 16.9 Summary and Conclusions



Av: Include
Secs. 16.6 and
16.7 in list of
Examples & Applications

IV Cross Sections, Panel Data and Microeconometrics

CHAPTER 17 Discrete Choice

- 17.1 Introduction
- 17.2 Models for Binary Outcomes
 - 17.2.1 *Random Utility Models for Individual Choice*
 - 17.2.2 *A Latent Regression Model*
 - 17.2.3 *Functional Form and Regression*
- 17.3 Estimation and Inference in Binary Choice Models
 - 17.3.1 *Robust Covariance Matrix Estimation*
 - 17.3.2 *Marginal Effects and Average Partial Effects*
 - 17.3.2.a *Average Partial Effects*
 - 17.3.2.b *Interaction Effects*
 - 17.3.3 *Goodness of Fit*
 - 17.3.4 *Hypothesis Tests*
 - 17.3.5 *Endogenous Right-Hand-Side Variables in Binary Choice Models*
 - 17.3.6 *Endogenous Choice-Based Sampling*
 - 17.3.7 *Specification Analysis*

- 17.3.7.a Omitted Variables
- 17.3.7.b Heteroscedasticity
- 17.4 Binary Choice Models for Panel Data
 - 17.4.1 The Pooled Estimator
 - 17.4.2 Random Effects Models
 - 17.4.3 Fixed Effects Models
 - 17.4.4 A Conditional Fixed Effects Estimator
 - 17.4.5 Mundlak's Approach, Variable Addition and Bias Reduction
 - 17.4.6 Dynamic Binary Choice Models
 - 17.4.7 A Semiparametric Model for Individual Heterogeneity
 - 17.4.8 Modeling Parameter Heterogeneity
 - 17.4.9 Nonresponse, Attrition and Inverse Probability Weighting
- 17.5 Bivariate and Multivariate Probit Models
 - 17.5.1 Maximum Likelihood Estimation
 - 17.5.2 Testing for Zero Correlation 820
 - 17.5.3 Partial Effects
 - 17.5.4 A Panel Data Model for Bivariate Binary Response
 - 17.5.5 Endogenous Binary Variable in a Recursive Bivariate Probit Model
 - 17.5.6 Endogenous Sampling in a Binary Choice Model
 - 17.5.7 A Multivariate Probit Model
- 17.6 Summary and Conclusions



Ans Confirm
"Attention" is
correct

CHAPTER 18 Discrete Choices and Event Counts

- 18.1 Introduction
- 18.2 Models for Unordered Multiple Choices
 - 18.2.1 Random Utility Basis of the Multinomial Logit Model
 - 18.2.2 The Multinomial Logit Model
 - 18.2.3 The Conditional Logit Model
 - 18.2.4 The Independence from Irrelevant Alternatives Assumption
 - 18.2.5 Nested Logit Models
 - 18.2.6 The Multinomial Probit Model
 - 18.2.7 The Mixed Logit Model
 - 18.2.8 A Generalized Mixed Logit Model
 - 18.2.9 Application: Conditional Logit Model for Travel Mode Choice
 - 18.2.10 Estimating Willingness to Pay
 - 18.2.11 Panel Data and Stated Choice Experiments
 - 18.2.12 Aggregate Market Share Data - The BLP Random Parameters Model
- 18.3 Random Utility Models for Ordered Choices
 - 18.3.1 The Ordered Probit Model
 - 18.3.2 A Specification Test for the Ordered Choice Model
 - 18.3.3 Bivariate Ordered Probit Models
 - 18.3.4 Panel Data Applications
 - 18.3.4.a Ordered Probit Models with Fixed Effects
 - 18.3.4.b Ordered Probit Models with Random Effects
 - 18.3.5 Extensions of the Ordered Probit Model
 - 18.3.5.a Threshold Models - Generalized Ordered Choice Models
 - 18.3.5.b Thresholds and Heterogeneity - Anchoring Vignettes
- 18.4 Models for Counts of Events
 - 18.4.1 The Poisson Regression Model
 - 18.4.2 Measuring Goodness of FIT
 - 18.4.3 Testing for Overdispersion
 - 18.4.4 Heterogeneity and the Negative Binomial Regression Model
 - 18.4.5 Functional Forms for Count Data Models
 - 18.4.6 Truncation and Censoring in Models for Counts
 - 18.4.7 Panel Data Models 915
 - 18.4.7.a Robust Covariance Matrices for Pooled Estimators

Me/



Ans Include
Sections
18.3.4a and
18.3.4b in
List of Examples
and Applications
?



- 18.4.7.b *Fixed Effects*
- 18.4.7.c *Random Effects*
- 18.4.8 *Two Part Models: Zero Inflation and Hurdle Models*
- 18.4.9 *Endogenous Variables and Endogenous Participation*
- 18.5 **Summary and Conclusions**

CHAPTER 19 Limited Dependent Variables – Truncation, Censoring and Sample Selection

- 19.1 **Introduction**
- 19.2 **Truncation**
 - 19.2.1 *Truncated Distributions*
 - 19.2.2 *Moments of Truncated Distributions*
 - 19.2.3 *The Truncated Regression Model*
 - 19.2.4 *The Stochastic Frontier Model*
- 19.3 **Censored Data**
 - 19.3.1 *The Censored Normal Distribution*
 - 19.3.2 *The Censored Regression (Tobit) Model*
 - 19.3.3 *Estimation*
 - 19.3.4 *Two Part Models and Corner Solutions*
 - 19.3.5 *Some Issues in Specification*
 - 19.3.5.a *Heteroscedasticity*
 - 19.3.5.b *Nonnormality*
 - 19.3.6 *Panel Data Applications*
- 19.4 **Models for Duration**
 - 19.4.1 *Models for Duration Data*
 - 19.4.2 *Duration Data*
 - 19.4.3 *A Regression-Like Approach: Parametric Models of Duration*
 - 19.4.3.a *Theoretical Background*
 - 19.4.3.b *Models of the Hazard Function*
 - 19.4.3.c *Maximum Likelihood Estimation*
 - 19.4.3.d *Exogenous Variables*
 - 19.4.3.e *Heterogeneity*
 - 19.4.4 *Nonparametric and Semiparametric Approaches*
- 19.5 **Incidental Truncation and Sample Selection**
 - 19.5.1 *Incidental Truncation in a Bivariate Distribution*
 - 19.5.2 *Regression in A Model of Selection*
 - 19.5.3 *Two Step and Maximum Likelihood Estimation*
 - 19.5.4 *Sample Selection in Nonlinear Models*
 - 19.5.5 *Panel Data Applications of Sample Selection Models*
 - 19.5.5.a *Common Effects in Sample Selection Models*
 - 19.5.5.b *Attrition*
- 19.6 **Evaluating Treatment Effects**
 - 19.6.1 *Regression Analysis of Treatment Effects*
 - 19.6.1.a *The Normality Assumption*
 - 19.6.1.b *Estimating the Effect of Treatment on the Treated*
 - 19.6.2 *Propensity Score Matching*
 - 19.6.3 *Regression Discontinuity*
- 19.7 **Summary and Conclusions**

AU: Include
Secs. 19.3.6,
19.5.5a, and
19.5.5b in list
of Examples and
Applications?

PART V Time Series and Macroeconometrics

CHAPTER 19 Serial Correlation

- 20.1 Introduction
- 20.2 The Analysis of Time-Series Data
- 20.3 Disturbance Processes
 - 20.3.1 Characteristics of Disturbance Processes
 - 20.3.2 AR(1) Disturbances
- 20.4 Some Asymptotic Results for Analyzing Time-Series Data
 - 20.4.1 Convergence of Moments—The Ergodic Theorem
 - 20.4.2 Convergence to Normality—A Central Limit Theorem
- 20.5 Least Squares Estimation
 - 20.5.1 Asymptotic Properties of Least Squares
 - 20.5.2 Estimating the Variance of the Least Squares Estimator
- 20.6 GMM Estimation
- 20.7 Testing for Autocorrelation
 - 20.7.1 Lagrange Multiplier Test
 - 20.7.2 Box and Pierce's Test and Ljung's Refinement
 - 20.7.3 The Durbin-Watson Test
 - 20.7.4 Testing in the Presence of a Lagged Dependent Variable
 - 20.7.5 Summary of Testing Procedures
- 20.8 Efficient Estimation When Ω Is Known
- 20.9 Estimation When Ω Is Unknown
 - 20.9.1 AR(1) Disturbances
 - 20.9.2 Application: Estimation of a Model with Autocorrelation
 - 20.9.3 Estimation with a Lagged Dependent Variable
- 20.10 Autocorrelation in Panel Data
- 20.11 Common Factors
- 20.12 Forecasting in the Presence of Autocorrelation
- 20.13 Autoregressive Conditional Heteroscedasticity
 - 20.13.1 The ARCH(1) Model
 - 20.13.2 ARCH (q), ARCH-in-Mean, and Generalized ARCH Models
 - 20.13.3 Maximum Likelihood Estimation of the Garch Model
 - 20.13.4 Testing for Garch Effects
 - 20.13.5 Pseudo-Maximum Likelihood Estimation
- 20.14 Summary and Conclusions

CHAPTER 21 Models with Lagged Variables

- 21.1 Introduction
- 21.2 Dynamic Regression Models
 - 21.2.1 Lagged Effects in A Dynamic Model
 - 21.2.2 The Lag and Difference Operators
 - 21.2.3 Specification Search for the Lag Length
- 21.3 Simple Distributed Lag Models
- 21.4 Autoregressive Distributed Lag Models
 - 21.4.1 Estimation of the Ardl Model
 - 21.4.2 Computation of the Lag Weights in the ARDL Model
 - 21.4.3 Stability of A Dynamic Equation
 - 21.4.4 Forecasting
- 21.5 Methodological Issues in the Analysis of Dynamic Models
 - 21.5.1 An Error Correction Model
 - 21.5.2 Autocorrelation
 - 21.5.3 Specification Analysis
- 21.6 Vector Autoregressions
 - 21.6.1 Model Forms
 - 21.6.2 Estimation



Adv: Include
Sec. 20.9.2 in
list of Examples &
Applications?

- 21.6.3 *Testing Procedures*
- 21.6.4 *Exogeneity*
- 21.6.5 *Testing for Granger Causality*
- 21.6.6 *Impulse Response Functions*
- 21.6.7 *Structural VARs*
- 21.6.8 *Application: Policy Analysis with a VAR*
 - 21.6.8a *A VAR Model for the Macroeconomic Variables*
 - 21.6.8b *The Sacrifice Ratio*
 - 21.6.8c *Identification and Estimation of a Structural VAR Model*
 - 21.6.8d *Inference*
 - 21.6.8e *Empirical Results*
- 21.6.9 *VARs In Microeconomics*
- 21.7 *Summary and Conclusions*

CHAPTER 22 Time-Series Models

- 22.1 *Introduction*
- 22.2 *Stationary Stochastic Processes*
 - 22.2.1 *Autoregressive Moving-Average Processes*
 - 22.2.2 *Stationarity and Invertibility*
 - 22.2.3 *Autocorrelations of a Stationary Stochastic Process*
 - 22.2.4 *Partial Autocorrelations of a Stationary Stochastic Process*
 - 22.2.5 *Modeling Univariate Time Series*
 - 22.2.6 *Estimation of the Parameters of a Univariate Time Series*
- 22.3 *Summary and Conclusions*

CHAPTER 23 Nonstationary Data

- 23.1 *Introduction*
- 23.2 *Nonstationary Processes and Unit Roots*
 - 23.2.1 *Integrated Processes and Differencing*
 - 23.2.2 *Random Walks, Trends, and Spurious Regressions*
 - 23.2.3 *Tests for Unit Roots in Economic Data*
 - 23.2.4 *The Dickey-Fuller Tests*
 - 23.2.5 *The KPSS Test of Stationarity*
- 23.3 *Cointegration*
 - 23.3.1 *Common Trends*
 - 23.3.2 *Error Correction and VAR Representations*
 - 23.3.3 *Testing for Cointegration*
 - 23.3.4 *Estimating Cointegration Relationships*
 - 23.3.5 *Application: German Money Demand*
 - 23.3.5.a *Cointegration Analysis and a Long-Run Theoretical Model*
 - 23.3.5.b *Testing for Model Instability*
- 23.4 *Nonstationary Panel Data*
- 23.5 *Summary and Conclusions*

PART VI Appendices

APPENDIX A Matrix Algebra

- A.1 Terminology
- A.2 Algebraic Manipulation of Matrices
 - A.2.1 *Equality of Matrices*
 - A.2.2 *Transposition*
 - A.2.3 *Matrix Addition*
 - A.2.4 *Vector Multiplication*
 - A.2.5 *A Notation for Rows and Columns of a Matrix*
 - A.2.6 *Matrix Multiplication and Scalar Multiplication*
 - A.2.7 *Sums of Values*
 - A.2.8 *A Useful Idempotent Matrix*
- A.3 Geometry of Matrices
 - A.3.1 *Vector Spaces*
 - A.3.2 *Linear Combinations of Vectors and Basis Vectors*
 - A.3.3 *Linear Dependence*
 - A.3.4 *Subspaces*
 - A.3.5 *Rank of a Matrix*
 - A.3.6 *Determinant of a Matrix*
 - A.3.7 *A Least Squares Problem*
- A.4 Solution of a System of Linear Equations
 - A.4.1 *Systems of Linear Equations*
 - A.4.2 *Inverse Matrices*
 - A.4.3 *Nonhomogeneous Systems of Equations*
 - A.4.4 *Solving the Least Squares Problem*
- A.5 Partitioned Matrices
 - A.5.1 *Addition and Multiplication of Partitioned Matrices*
 - A.5.2 *Determinants of Partitioned Matrices*
 - A.5.3 *Inverses of Partitioned Matrices*
 - A.5.4 *Deviations from Means*
 - A.5.5 *Kronecker Products*
- A.6 Characteristic Roots and Vectors
 - A.6.1 *The Characteristic Equation*
 - A.6.2 *Characteristic Vectors*
 - A.6.3 *General Results for Characteristic Roots and Vectors*
 - A.6.4 *Diagonalization and Spectral Decomposition of a Matrix*
 - A.6.5 *Rank of a Matrix*
 - A.6.6 *Condition Number of a Matrix*
 - A.6.7 *Trace of a Matrix*
 - A.6.8 *Determinant of a Matrix*
 - A.6.9 *Powers of a Matrix*
 - A.6.10 *Idempotent Matrices*
 - A.6.11 *Factoring a Matrix*
 - A.6.12 *The Generalized Inverse of a Matrix*
- A.7 Quadratic Forms and Definite Matrices
 - A.7.1 *Nonnegative Definite Matrices*
 - A.7.2 *Idempotent Quadratic Forms*
 - A.7.3 *Comparing Matrices*
- A.8 Calculus and Matrix Algebra
 - A.8.1 *Differentiation and the Taylor Series*
 - A.8.2 *Optimization*
 - A.8.3 *Constrained Optimization*
 - A.8.4 *Transformations*

APPENDIX B Probability and Distribution Theory

- B.1 Introduction
- B.2 Random Variables
 - B.2.1 *Probability Distributions*
 - B.2.2 *Cumulative Distribution Function*
- B.3 Expectations of a Random Variable
- B.4 Some Specific Probability Distributions
 - B.4.1 *The Normal Distribution*
 - B.4.2 *The Chi-Squared, t, and F Distributions*
 - B.4.3 *Distributions With Large Degrees of Freedom*
 - B.4.4 *Size Distributions: The Lognormal Distribution*
 - B.4.5 *The Gamma and Exponential Distributions*
 - B.4.6 *The Beta Distribution*
 - B.4.7 *The Logistic Distribution*
 - B.4.8 *The Wishart Distribution*
 - B.4.9 *Discrete Random Variables*
- B.5 The Distribution of a Function of a Random Variable
- B.6 Representations of a Probability Distribution
- B.7 Joint Distributions
 - B.7.1 *Marginal Distributions*
 - B.7.2 *Expectations in a Joint Distribution*
 - B.7.3 *Covariance and Correlation*
 - B.7.4 *Distribution of a Function of Bivariate Random Variables*
- B.8 Conditioning in a Bivariate Distribution
 - B.8.1 *Regression: The Conditional Mean*
 - B.8.2 *Conditional Variance*
 - B.8.3 *Relationships Among Marginal and Conditional Moments*
 - B.8.4 *The Analysis of Variance*
- B.9 The Bivariate Normal Distribution
- B.10 Multivariate Distributions
 - B.10.1 *Moments*
 - B.10.2 *Sets of Linear Functions*
 - B.10.3 *Nonlinear Functions*
- B.11 The Multivariate Normal Distribution
 - B.11.1 *Marginal and Conditional Normal Distributions*
 - B.11.2 *The Classical Normal Linear Regression Model*
 - B.11.3 *Linear Functions of a Normal Vector*
 - B.11.4 *Quadratic Forms in a Standard Normal Vector*
 - B.11.5 *The F Distribution*
 - B.11.6 *A Full Rank Quadratic Form*
 - B.11.7 *Independence of a Linear and a Quadratic Form*

APPENDIX C Estimation and Inference

- C.1 Introduction
- C.2 Samples and Random Sampling
- C.3 Descriptive Statistics
- C.4 Statistics as Estimators - Sampling Distributions
- C.5 Point Estimation of Parameters
 - C.5.1 *Estimation in a Finite Sample*
 - C.5.2 *Efficient Unbiased Estimation*
- C.6 Interval Estimation
- C.7 Hypothesis Testing
 - C.7.1 *Classical Testing Procedures*
 - C.7.2 *Tests Based on Confidence Intervals*
 - C.7.3 *Specification Tests*

APPENDIX D Large-Sample Distribution Theory

D.1 Introduction

D.2 Large-Sample Distribution Theory

D.2.1 Convergence in Probability

D.2.2 Other Forms of Convergence and Laws of Large Numbers

D.2.3 Convergence of Functions

D.2.4 Convergence to a Random Variable

D.2.5 Convergence in Distribution: Limiting Distributions

D.2.6 Central Limit Theorems

D.2.7 The Delta Method

D.3 Asymptotic Distributions

D.3.1 Asymptotic Distribution of a Nonlinear Function

D.3.2 Asymptotic Expectations

D.4 Sequences and the Order of a Sequence

APPENDIX E Computation and Optimization

E.1 Introduction

E.2 Computation in Econometrics

E.2.1 Computing Integrals

E.2.2 The Standard Normal Cumulative Distribution Function

E.2.3 The Gamma and Related Functions

E.2.4 Approximating Integrals by Quadrature

E.3 Optimization

E.3.1 Algorithms

E.3.2 Computing Derivatives

E.3.3 Gradient Methods

E.3.4 Aspects of Maximum Likelihood Estimation

E.3.5 Optimization with Constraints

E.3.6 Some Practical Considerations

E.3.7 The EM Algorithm

E.4 Examples

E.4.1 Function of One Parameter

E.4.2 Function of Two Parameters: The Gamma Distribution

E.4.3 A Concentrated Log-Likelihood Function

APPENDIX F Data Sets Used in Applications

APPENDIX G Statistical Tables

References

Combined Author and Subject Index

EXAMPLES AND APPLICATIONS

CHAPTER 1 Econometrics

- Example 1.1 Behavioral Models and the Nobel Laureates
- Example 1.2 Keynes's Consumption Function

CHAPTER 2 The Classical Multiple Linear Regression Model

- Example 2.1 Keynes's Consumption Function
- Example 2.2 Earnings and Education
- Example 2.3 The U.S. Gasoline Market
- Example 2.4 The Translog Model
- Example 2.5 Short Run
- Example 2.6 An Inestimable Model
- Example 2.7 Nonzero Conditional Mean of the Disturbances

CHAPTER 3 Least Squares

- Example 3.1 Partial Correlations
- Example 3.2 Fit of a Consumption Function
- Example 3.3 Analysis of Variance for an Investment Equation
- Example 3.4 Art Appreciation

CHAPTER 4 Statistical Properties of the Least Squares Estimator

- Example 4.1 The Sampling Distribution of a Least Squares Estimator
- Example 4.2 Omitted Variable
- Example 4.3 Sampling Variance in the Two-Variable Regression Model
- Example 4.4 Nonlinear Functions of Parameters: The Delta Method
- Example 4.5 Least Squares vs. Least Absolute Deviations – A Monte Carlo Study
- Example 4.6 MLE with Normally Distributed Disturbances
- Example 4.7 The Gamma Regression Model
- Example 4.8 Confidence Interval for the Income Elasticity of Demand for Gasoline
- Example 4.9 Confidence Interval Based on the Asymptotic Distribution
- Example 4.10 Pricing Art
- Example 4.11 Multicollinearity in the Longley Data
- Example 4.12 Predicting Movie Success

CHAPTER 5 Inference and Prediction

- Example 5.1 Art Appreciation
- Example 5.2 Earnings Equation
- Example 5.3 Restricted Investment Equation
- Example 5.4 Production Function
- Example 5.5 F Test for the Earnings Equation
- Example 5.6 A Long Run Marginal Propensity to Consume
- Example 5.7 J Test for a Consumption Function
- Example 5.8 Size of a RESET Test
- Example 5.9 Bayesian Averaging of Classical Estimates

CHAPTER 6 Functional Form and Structural Change

- Example 6.1 Dummy Variable in an Earnings Equation
- Example 6.2 Value of a Signature
- Example 6.3 Genre Effects on Movie Box Office Receipts
- Example 6.4 Analysis of Covariance
- Example 6.5 A Natural Experiment: The Mariel Boatlift
- Example 6.6 Functional Form for a Nonlinear Cost Function
- Example 6.7 Intrinsically Linear Regression
- Example 6.8 CES Production Function

versus

XVLI

Example 6.9 Structural Break in the Gasoline Market

Example 6.10 The World Health Report 124

CHAPTER 7 Nonlinear, Semiparametric and Nonparametric Regression Models

Example 7.1 CES Production Function

Example 7.2 Identification in a Translog Demand System

Example 7.3 First Order Conditions for a Nonlinear Model

Example 7.4 Analysis of a Nonlinear Consumption Function

Example 7.5 The Box-Cox Transformation

Example 7.6 Interaction Effects in a Loglinear Model for Income

Example 7.7 Linearized Regression

Example 7.8 Nonlinear Least Squares

Example 7.9 LAD Estimation of a Cobb-Douglas Production Function

Example 7.10 Income Elasticity of Credit Card Expenditure

Example 7.11 Partially Linear Translog Cost Function

Example 7.12 A Nonparametric Average Cost Function

CHAPTER 8 Endogeneity and Instrumental Variable Estimation

Example 8.1 Models with Endogenous Right Hand Side Variables

Example 8.2 Instrumental Variable Analysis

Example 8.3 Streams as Instruments

Example 8.4 Instrumental Variable in Regression

Example 8.5 Instrumental Variable Estimation of a Labor Supply Equation

Example 8.6 (Continued) Labor Supply Model

Example 8.7 Hausman Test for a Consumption Function

Example 8.8 Overidentification of the Labor Supply Equation

Example 8.9 Income and Education in a Study of Twins

Example 8.10 Instrumental Variables Estimation of the Consumption Function

Example 8.11 Does Television Cause Autism?

Example 8.12 Is Season of Birth a Valid Instrument?

CHAPTER 9 The Generalized Regression Model and Heteroscedasticity

Example 9.1 Heteroscedastic Regression

Example 9.2 The White Estimator

Example 9.3 Testing for Heteroscedasticity

Example 9.4 Multiplicative Heteroscedasticity

Example 9.5 Groupwise Heteroscedasticity

CHAPTER 10 Systems of Regression Equations

Example 10.1 A Regional Production Model for Public Capital

Example 10.2 Stone's Expenditure System

Example 10.3 A Cost Function for U.S. Manufacturing

Example 10.4 Structure and Reduced Form in a Small Macroeconomic Model

Example 10.5 Identification

Example 10.6 Klein's Model I



CHAPTER 11 Models for Panel Data

- Example 11.1 Wage Equation
- Example 11.2 Repeat Sales of Monet Paintings
- Example 11.3 Robust Estimation of the Wage Equation
- Example 11.4 Analysis of Covariante and the World Health Organization Data
- Example 11.5 Fixed Effects Wage Equation
- Example 11.6 Testing for Random Effects
- Example 11.7 Estimates of the Random Effects Model
- Example 11.8 Hausman Test for Fixed versus Random Effects
- Example 11.9 Variable Addition Test for Fixed versus Random Effects
- Example 11.10 Hospital Costs
- Example 11.11 Robust Standard Errors for Fixed and Random Effects Estimators
- Example 11.12 Spatial Autocorrelation in Real Estate Sales
- Example 11.13 Spatial Lags in Health Expenditures
- Example 11.14 The Returns to Schooling
- Example 11.15 Dynamic Labor Supply Equation
- Example 11.16 Health Care Utilization
- Example 11.17 Exponential Model with Fixed Effects
- Example 11.18 Demand for Electricity and Gas
- Example 11.19 Random Coefficients Model
- Example 11.20 Fannie Mae's Pass Through
- Example 11.21 Dynamic Panel Data Models
- Example 11.22 A Mixed Fixed Growth Model for Developing Countries

Av: Confirm
"Covariante"
is correct

CHAPTER 12 Estimation Frameworks in Econometrics

- Example 12.1 The Linear Regression Model
- Example 12.2 The Stochastic Frontier Model
- Example 12.3 Joint Modeling of a Pair of Event Counts
- Example 12.4 Semiparametric Estimator for Binary Choice Models
- Example 12.5 A Model of Vacation Expenditures

CHAPTER 13 Minimum Distance Estimation and the Generalized Method of Moments

- Example 13.1 Euler Equations and Life Cycle Consumption
- Example 13.2 Method of Moments Estimator for $N[\mu, \sigma^2]$
- Example 13.3 Inverse Gaussian (Wald) Distribution
- Example 13.4 Mixtures of Normal Distributions
- Example 13.5 Gamma Distribution
- Example 13.6 Minimum Distance Estimation of a Hospital Cost Function
- Example 13.7 GMM Estimation of a Nonlinear Regression Model
- Example 13.8 Empirical Moment Equation for Instrumental Variables
- Example 13.9 Overidentifying Restrictions
- Example 13.10 GMM Estimation of a Dynamic Panel Data Model of Local Government Expenditures

CHAPTER 14 Maximum Likelihood Estimation

- Example 14.1 Identification of Parameters
- Example 14.2 Log-Likelihood Function and Likelihood Equations for the Normal Distribution
- Example 14.3 Information Matrix for the Normal Distribution
- Example 14.4 Variance Estimators for an MLE
- Example 14.5 Two-Step ML Estimation
- Example 14.6 Multiplicative Heteroscedasticity
- Example 14.7 Autocorrelation in a Money Demand Equation
- Example 14.8 ML Estimates of a Seemingly Unrelated Regressions Model
- Example 14.9 Identification in a Loglinear Regression Model
- Example 14.10 Geometric Model for Doctor Visits
- Example 14.11 Maximum Likelihood and FGLS Estimates of a Wage Equation

- Example 14.12 Statewide Productivity
- Example 14.13 Random Effects Geometric Regression Model
- Example 14.14 Fixed and Random Effects Geometric Regression
- Example 14.15 Latent Class Model for Grade Point Averages
- Example 14.16 Latent Class Regression Model for Grade Point Averages
- Example 14.17 Latent Class Model for Health Care Utilization 566

CHAPTER 15 Simulation-Based Estimation and Inference

- Example 15.1 Inferring the Sampling Distribution of the Least Squares Estimator
- Example 15.2 Bootstrapping the Variance of the LAD Estimator
- Example 15.3 Least Simulated Sum of Squares
- Example 15.4 Long Run Elasticities
- Example 15.5 Bootstrapping the Variance of the Median
- Example 15.6 Bootstrapping Standard Errors and Confidence Intervals in a Panel
- Example 15.7 Monte Carlo Study of the Mean Versus the Median
- Section 15.5.1 A Monte Carlo Study: Behavior of a Test Statistic
- Section 15.5.2 A Monte Carlo Study: The Incidental Parameters Problem
- Example 15.8 Fractional Moments of the Truncated Normal Distribution
- Example 15.9 Estimating the Lognormal Mean
- Example 15.10 Poisson Regression Model with Random Effects
- Example 15.11 Maximum Simulated Likelihood Estimation of the Random Effects Linear Regression Model
- Example 15.12 Random Parameters Wage Equation
- Example 15.13 Least Simulated Sum of Squares Estimates of a Production Function Model
- Example 15.14 Hierarchical Linear Model of Home Prices
- Example 15.15 Individual State Estimates of Private Capital Coefficient
- Example 15.16 Mixed Linear Model for Wages
- Example 15.17 Maximum Simulated Likelihood Estimation of a Binary Choice Model



Av: Inclusion
of Secs. 15.5.1
and 15.5.2
OK?

CHAPTER 16 Bayesian Estimation and Inference

- Example 16.1 Bayesian Estimation of a Probability
- Example 16.2 Estimation with a Conjugate Prior
- Example 16.3 Bayesian Estimate of the Marginal Propensity to Consume
- Example 16.4 Posterior Odds for the Classical Regression Model
- Example 16.5 Gibbs Sampling from the Normal Distribution
- Example 16.6 Gibbs Sampler for a Probit Model

CHAPTER 17 Discrete Choice

- Example 17.1 Labor Force Participation Model
- Example 17.2 Structural Equations for a Probit Model
- Example 17.3 Probability Models
- Example 17.4 Average Partial Effects
- Example 17.5 Interaction Effect
- Example 17.6 Prediction with a Probit Model
- Example 17.7 Testing for Structural Break in a Logit Model
- Example 17.8 Labor Supply Model
- Example 17.9 Credit Scoring
- Example 17.10 Specification Tests in a Labor Force Participation Model
- Example 17.11 Binary Choice Models for Panel Data
- Example 17.12 Fixed Effects Logit Models: Magazine Prices Revisited
- Example 17.13 Panel Data Random Effects Estimators
- Example 17.14 An Intertemporal Labor Force Participation Equation
- Example 17.15 Semiparametric Models of Heterogeneity
- Example 17.16 Parameter Heterogeneity in a Binary Choice Model 808
- Example 17.17 Nonresponse in the GSOEP Sample

Example 17.18 Tetrachoric Correlation
Example 17.19 Bivariate Probit Model for Health Care Utilization
Example 17.20 Bivariate Random Effects Model for Doctor and Hospital Visits
Example 17.21 Gender Economics Courses at Liberal Arts Colleges
Example 17.22 Cardholder Status and Default Behavior
Example 17.23 A Multivariate Probit Model for Product Innovations

CHAPTER 18 Discrete Choices and Event Counts

Example 18.1 Hollingshead Scale of Occupations
Section 18.2.9 Conditional Logit Model for Travel Mode Choice
Example 18.2 Movie Ratings
Example 18.3 Rating Assignments
Example 18.4 Brant Test for an Ordered Probit Model of Health Satisfaction
Example 18.5 Calculus and Intermediate Economics Courses
Example 18.6 Health Satisfaction 838
Example 18.7 Count Data Models for Doctor Visits
Example 18.8 Major Derogatory Reports
Example 18.9 Extramarital Affairs
Example 18.10 Panel Data Models for Doctor Visits
Example 18.11 Zero Inflation Model for Major Derogatory Reports
Example 18.12 Hurdle Model for Doctor Visits

CHAPTER 19 Limited Dependent Variables – Truncation, Censoring, and Sample Selection

Example 19.1 Truncated Uniform Distribution
Example 19.2 A Truncated Lognormal Income Distribution
Example 19.3 Stochastic Cost Frontier for Swiss Railroads
Example 19.4 Censored Random Variable
Example 19.5 Estimated Tobit Equations for Hours Worked
Example 19.6 Two Part Model for Extramarital Affairs
Example 19.7 Multiplicative Heteroscedasticity in the Tobit Model
Example 19.8 Survival Models for Strike Duration
Example 19.9 Incidental Truncation
Example 19.10 A Model of Labor Supply
Example 19.11 Female Labor Supply
Example 19.12 A Mover-Stayer Model for Migration
Example 19.13 Doctor Visits and Insurance
Example 19.14 German Labor Market Interventions
Example 19.15 Treatment Effects on Earnings

CHAPTER 20 Serial Correlation

Example 20.1 Money Demand Equation
Example 20.2 Autocorrelation Induced by Misspecification of the Model
Example 20.3 Negative Autocorrelation in the Phillips Curve
Example 20.4 Autocorrelation Consistent Covariance Estimation
Example 20.5 Panel Data Models with Autocorrelation
Example 20.6 Test for Common Factors
Example 20.7 Stochastic Volatility
Example 20.8 GARCH Model for Exchange Rate Volatility

CHAPTER 21 Models with Lagged Variables

Example 21.1 A Structural Model of the Demand for Gasoline
Example 21.2 Expectations-Augmented Phillips Curve
Example 21.3 Price and Income Elasticities of Demand for Gasoline
Example 21.4 A Rational Lag Model
Example 21.5 An Error Correction Model for Consumption

(XXI)

Example 21.6 Granger Causality
Section 21.6.8 Policy Analysis with a VAR
Example 21.7 VAR for Municipal Expenditures

CHAPTER 22 Time-Series Models

Example 22.1 ACF and PACF for a Series of Bond Yields

CHAPTER 23 Nonstationary Data

Example 22.1 A Nonstationary Series
Example 22.2 Tests for Unit Roots
Example 22.3 Augmented Dickey-Fuller Test for a Unit Root in GDP
Section 22.3.5 German Money Demand
Example 22.4 Is There a Unit Root in GDP?
Example 22.5 Cointegration in Consumption and Output
Example 22.6 Several Cointegrated Series
Example 22.7 Multiple Cointegrating Vectors
Example 22.8 (Continued) Cointegration in Consumption and Output

APPENDIX C Estimation and Inference

Example C.1 Descriptive Statistics for a Random Sample
Example C.2 Kernel Density Estimator for the Income Data
Example C.3 Sampling Distribution of a Sample Mean
Example C.4 Sampling Distribution of the Sample Minimum
Example C.5 Mean Squared Error of the Sample Variance
Example C.6 Likelihood Functions for Exponential and Normal Distributions
Example C.7 Variance Bound for the Poisson Distribution
Example C.8 Confidence Intervals for the Normal Mean
Example C.9 Estimated Confidence Intervals for a Normal Mean and Variance
Example C.10 Testing a Hypothesis About a Mean
Example C.11 Consistent Test About a Mean
Example C.12 Testing a Hypothesis About a Mean with a Confidence Interval
Example C.13 One-Sided Test About a Mean

APPENDIX D Large-Sample Distribution Theory

Example D.1 Mean Square Convergence of the Sample Minimum in Exponential Sampling
Example D.2 Estimating a Function of the Mean
Example D.3 Probability Limit of a Function of \bar{x} and s^2
Example D.4 Limiting Distribution of t_{n-1}
Example D.5 The F Distribution
Example D.6 The Lindeberg-Levy Central Limit Theorem
Example D.7 Asymptotic Distribution of the Mean of an Exponential Sample
Example D.8 Asymptotic Inefficiency of the Median in Normal Sampling
Example D.9 Asymptotic Distribution of a Function of Two Estimators
Example D.10 Asymptotic Moments of the Sample Variance

APPENDIX E Computation and Optimization

Section E4.1 Function of One Parameter
Section E4.2 Function of Two Parameters: The Gamma Distribution
Section E4.3 A Concentrated Log-Likelihood Function