

FOURTH EDITION

*APPLIED
ECONOMETRIC
TIME SERIES*

WALTER ENDERS

University of Alabama

WILEY

CONTENTS

PREFACE vii

ABOUT THE AUTHOR x

CHAPTER 1 DIFFERENCE EQUATIONS 1

Introduction	1
1 Time-Series Models	1
2 Difference Equations and Their Solutions	7
3 Solution by Iteration	10
4 An Alternative Solution Methodology	14
5 The Cobweb Model	18
6 Solving Homogeneous Difference Equations	22
7 Particular Solutions for Deterministic Processes	31
8 The Method of Undetermined Coefficients	34
9 Lag Operators	40
10 Summary	43
Questions and Exercises	44

CHAPTER 2 STATIONARY TIME-SERIES MODELS 47

1 Stochastic Difference Equation Models	47
2 ARMA Models	50
3 Stationarity	51
4 Stationarity Restrictions for an ARMA (p, q) Model	55
5 The Autocorrelation Function	60
6 The Partial Autocorrelation Function	64
7 Sample Autocorrelations of Stationary Series	67
8 Box–Jenkins Model Selection	76
9 Properties of Forecasts	79
10 A Model of the Interest Rate Spread	88
11 Seasonality	96
12 Parameter Instability and Structural Change	102
13 Combining Forecasts	109
14 Summary and Conclusions	112
Questions and Exercises	113

CHAPTER 3 *MODELING VOLATILITY* **118**

-
- 1 Economic Time Series: The Stylized Facts **118**
 - 2 ARCH and GARCH Processes **123**
 - 3 ARCH and GARCH Estimates of Inflation **130**
 - 4 Three Examples of GARCH Models **134**
 - 5 A GARCH Model of Risk **141**
 - 6 The ARCH-M Model **143**
 - 7 Additional Properties of GARCH Processes **146**
 - 8 Maximum Likelihood Estimation of GARCH Models **152**
 - 9 Other Models of Conditional Variance **154**
 - 10 Estimating the NYSE U.S. 100 Index **158**
 - 11 Multivariate GARCH **165**
 - 12 Volatility Impulse Responses **172**
 - 13 Summary and Conclusions **174**
 - Questions and Exercises **176**

CHAPTER 4 *MODELS WITH TREND* **181**

-
- 1 Deterministic and Stochastic Trends **181**
 - 2 Removing the Trend **189**
 - 3 Unit Roots and Regression Residuals **195**
 - 4 The Monte Carlo Method **200**
 - 5 Dickey–Fuller Tests **206**
 - 6 Examples of the Dickey–Fuller Test **210**
 - 7 Extensions of the Dickey–Fuller Test **215**
 - 8 Structural Change **227**
 - 9 Power and the Deterministic Regressors **235**
 - 10 Tests with More Power **238**
 - 11 Panel Unit Root Tests **243**
 - 12 Trends and Univariate Decompositions **247**
 - 13 Summary and Conclusions **254**
 - Questions and Exercises **255**

CHAPTER 5 *MULTIEQUATION TIME-SERIES MODELS* **259**

-
- 1 Intervention Analysis **261**
 - 2 ADLs and Transfer Functions **267**
 - 3 An ADL of Terrorism in Italy **277**
 - 4 Limits to Structural Multivariate Estimation **281**
 - 5 Introduction to VAR Analysis **285**
 - 6 Estimation and Identification **290**
 - 7 The Impulse Response Function **294**
 - 8 Testing Hypotheses **303**
 - 9 Example of a Simple VAR: Domestic and Transnational Terrorism **309**
 - 10 Structural VARs **313**
 - 11 Examples of Structural Decompositions **317**
 - 12 Overidentified Systems **321**

13 The Blanchard–Quah Decomposition **325**
14 Decomposing Real and Nominal Exchange Rates: An Example **331**
15 Summary and Conclusions **335**
 Questions and Exercises **337**

CHAPTER 6 *COINTEGRATION AND ERROR-CORRECTION MODELS* **343**

1 Linear Combinations of Integrated Variables **344**
2 Cointegration and Common Trends **351**
3 Cointegration and Error Correction **353**
4 Testing for Cointegration: The Engle–Granger Methodology **360**
5 Illustrating the Engle–Granger Methodology **364**
6 Cointegration and Purchasing Power Parity **370**
7 Characteristic Roots, Rank, and Cointegration **373**
8 Hypothesis Testing **380**
9 Illustrating the Johansen Methodology **389**
10 Error-Correction and ADL Tests **393**
11 Comparing the Three Methods **397**
12 Summary and Conclusions **400**
 Questions and Exercises **401**

CHAPTER 7 *NONLINEAR MODELS AND BREAKS* **407**

1 Linear Versus Nonlinear Adjustment **408**
2 Simple Extensions of the ARMA Model **410**
3 Testing for Nonlinearity **413**
4 Threshold Autoregressive Models **420**
5 Extensions of the TAR Model **427**
6 Three Threshold Models **433**
7 Smooth Transition Models **439**
8 Other Regime Switching Models **445**
9 Estimates of STAR Models **449**
10 Generalized Impulse Responses and Forecasting **453**
11 Unit Roots and Nonlinearity **461**
12 More on Endogenous Structural Breaks **466**
13 Summary and Conclusions **474**
 Questions and Exercises **475**

INDEX **479**

REFERENCES (ONLINE)

ENDNOTES (ONLINE)

STATISTICAL TABLES (ONLINE)