

Contents

<i>Preface</i>	xiii
Chapter 1 Introduction	1
1.1 Definition of a Time Series	1
1.2 Examples of Time Series	2
1.3 Graphical Representation	2
1.4 Some Problems in Time Series	7
1.5 Properties of the Methods Used	10
1.6 Time-series Modeling	11
Part I: Traditional Methods	
Chapter 2 Linear Regression for Seasonal Adjustment	19
2.1 Linear Model Setup	19
2.2 Uniqueness of the Decomposition	22
2.3 Transformations for the Raw Series	23
2.4 Ordinary Least Squares Estimator	25
2.5 Applications	26
2.6 Statistical Properties of the Estimators	28
2.7 Applications of the Regression Analysis	31
2.8 Autocorrelated Disturbances	34
2.9 Two Shortcomings of OLS	40

2.10	An Application	41
2.11	Exercises	46
	Chapter 3 Moving Averages for Seasonal Adjustment	49
3.1	Introduction	49
3.2	The Set of Moving Averages	51
3.3	Eigenvectors of a Moving Average	54
3.4	Transformation of a White Noise by a Moving Average	60
3.5	Arithmetic Averages	64
3.6	Averages Derived from the Arithmetic Averages	69
3.7	Moving Regressions	72
3.8	Moving Averages Derived from Minimizing the Reduction Ratio under Constraints	77
3.9	Distribution of the Moving Average Coefficients	78
3.10	Repeated Moving Averages	81
3.11	Treatment of the Extreme Points in the Series	85
3.12	Structural Change	90
3.13	Application to the Passenger Traffic Series	92
3.14	Appendix – Derivation of the Averages Defined in 3.8 and 3.9	93
3.15	Exercises	96
	Chapter 4 Exponential Smoothing Methods	98
4.1	Simple Exponential Smoothing	98
4.2	Double Exponential Smoothing	103
4.3	The Generalized Exponential Smoothing	106
4.4	The Holt–Winters Methods	111
4.5	Exercises	115

Part II: Probabilistic and Statistical Properties of Stationary Processes

	Chapter 5 Some Results on the Univariate Processes	119
5.1	Covariance Stationary Processes	119
5.2	Lead and Lag Operators	137
5.3	ARMA Processes	144
5.4	ARIMA Processes	167
5.5	Appendix	172
5.6	Exercises	174

Chapter 6 The Box and Jenkins Method for Forecasting	179
6.1 Description of the Method	179
6.2 Estimation of an ARIMA Model	181
6.3 Identification	189
6.4 Forecasting with ARIMA Models	197
6.5 Some Issues	203
6.6 Application to the Passenger Traffic Series	208
6.7 Exercises	216
Chapter 7 Multivariate Time Series	223
7.1 Introduction	223
7.2 Stationary Processes	224
7.3 Linear Processes	232
7.4 Appendix – Representation of Matrix Sequences	238
7.5 Exercises	249
Chapter 8 Time-series Representations	250
8.1 ARMA Representations	250
8.2 State-space Representation	271
8.3 Frequency Domain	288
8.4 Appendix – Singular Value Decomposition Theorem	297
8.5 Exercises	300
Chapter 9 Estimation and Testing (Stationary Case)	302
9.1 Limit Distributions of Empirical Moments	303
9.2 Maximum Likelihood Estimator	312
9.3 Testing Procedures	327
9.4 Extensions to the Multivariate Case	341
9.5 Exercises	349
Part III: Time-series Econometrics: Stationary and Nonstationary Models	
Chapter 10 Causality, Exogeneity, and Shocks	355
10.1 Dynamic Macroeconometric Models	355
10.2 Causality	364
10.3 Exogeneity	382
10.4 Shocks and Multipliers	392
10.5 Appendix – Partial Links among Random Vectors	398
10.6 Exercises	408
Chapter 11 Trend Components	410
11.1 Decomposition of a Series with Polynomial Trend	411

11.2	Some Relationships with Macroeconometric Modeling: Error Correction Models and Cointegration	426
11.3	Fractional Processes	436
11.4	Exercises	452
	Chapter 12 Expectations	455
12.1	Review of the Expectation Schemes	456
12.2	Model with Expectation of the Current Variable	460
12.3	Dynamic Properties of a Linear Model with Expectation of the Current Variable	463
12.4	Models with Future Variables Expectations	467
12.5	Models with Several Expectations	478
12.6	Multivariate Models with Rational Expectations	488
12.7	Exercises	492
	Chapter 13 Specification Analysis	494
13.1	General Remarks on Specification Search	494
13.2	Causality Tests	500
13.3	Tests for Predeterminedness and Exogeneity and of Existence of a Structural Form	506
13.4	Tests on the Lag Structure	512
13.5	Tests of Rational Expectations	518
13.6	Exercises	523
	Chapter 14 Statistical Properties of Nonstationary Processes	526
14.1	Introduction	526
14.2	Limit Properties of Some Relevant Statistics	532
14.3	Unit Root Tests	538
14.4	Regression with Nonstationary Explanatory Variables	546
14.5	Cointegration	549
14.6	Determination of the Order of Integration	563
14.7	Appendix – Asymptotic Approximation of Cross Moments	566
14.8	Exercises	569
	Part IV: State-space Models	
	Chapter 15 State-space Models and the Kalman Filter	575
15.1	State-space Models	575
15.2	Kalman Covariance Filter	577
15.3	Forecast	585
15.4	Information Filter	588
15.5	Fixed Interval Smoothing	590

15.6	Estimation	592
15.7	Exercises	598
	Chapter 16 Applications of the State-space Model	601
16.1	Application to Linear Models	601
16.2	Applications to the ARMA and ARIMA Models	605
16.3	Unobserved Components Models	609
16.4	Missing Data	618
16.5	Rational Expectations Models	622
16.6	Exercises	633
	<i>References</i>	637
	<i>Tables</i>	655
	<i>Index</i>	665