Contents

Figures Tables Preface		<i>page</i> xii xiii xvii
Part	I Introduction and basic concepts	1
1	Introduction References	3 6
2	Basic concepts	8
2.1	Stochastic processes	8
2.2	Some commonly used stationary models	11
2.3	Box–Jenkins methods	17
2.4	Integrated variables and cointegration	20
2.5	Spurious regression	28
2.6	Deterministic trend and stochastic trend	29
2.7	Detrending methods	32
2.8	VAR, ECM, and ADL	34
2.9	Unit root tests	37
2.10	Cointegration tests and ECM	39
2.11	Summary	41
	References	42
Part	II Unit roots and cointegration	45
3	Unit roots	47
3.1	Introduction	47
3.2	Unit roots and Wiener processes	49
3.3	Unit root tests without a deterministic trend	60
3.4	DF test with a linear deterministic trend	65

viii	Contents	
3.5	Specification of deterministic trends	72
3.6	Unit root tests for a wide class of errors	74
3.7	Sargan–Bhargava and Bhargava tests	82
3.8	Variance ratio tests	86
3.9	Tests for TSP versus DSP	87
3.10	Forecasting from TS versus DS models	89
3.11	Summary and conclusions	92
	References	92
4	Issues in unit root testing	98
4.1	Introduction	98
4.2	Size distortion and low power of unit root tests	100
4.3	Solutions to the problems of size and power	103
4.4	Problem of overdifferencing: MA roots	116
4.5	Tests with stationarity as null	120
4.6	Confirmatory analysis	126
4.7	Frequency of observations and power of unit root tests	129
4.8	Other types of nonstationarity	131
4.9	Panel data unit root tests	133
4.10	Uncertain unit roots and the pre-testing problem	139
4.11	Other unit root tests	140
4.12	Median-unbiased estimation	141
4.13	Summary and conclusions	145
	References	146
5	Estimation of cointegrated systems	155
5.1	Introduction	155
5.2	A general CI system	155
5.3	A two-variable model: Engle–Granger methods	156
5.4	A triangular system	160
5.5	System estimation methods	165
5.6	The identification problem	173
5.7	Finite sample evidence	175
5.8	Forecasting in cointegrated systems	184
5.9	Miscellaneous other problems	187
5.10	Summary and conclusions	191
	References	191
6	Tests for cointegration	198
6.1	Introduction	198
6.2	Single equation methods: residual-based tests	198

	Contents	ix
6.3	Single equation methods: ECM tests	203
6.4	Tests with cointegration as null	205
6.5	Multiple equation methods	211
6.6	Cointegration tests based on LCCA	222
6.7	Other tests for cointegration	226
6.8	Miscellaneous other problems	228
6.9	Of what use are cointegration tests?	233
6.10	Conclusions	241
	References	242
7	Econometric modeling with integrated regressors	249
7.1	I(1) regressors not cointegrated	249
7.2	I(1) regressors cointegrated	250
7.3	Unbalanced equations	251
7.4	Lagged dependent variables: the ARDL model	252
7.5	Uncertain unit roots	254
7.6	Uncertain unit roots and cointegration	256
7.7	Summary and conclusions	258
	References	258
Part	III Extensions of the basic model	261
8	The Bayesian analysis of stochastic trends	263
8.1	Introduction to Bayesian inference	264
8.2	The posterior distribution of an autoregressive parameter	266
8.3	Bayesian inference on the Nelson–Plosser data	268
8.4	The debate on the appropriate prior	271
8.5	Classical tests versus Bayesian tests	277
8.6	Priors and time units of measurement	277
8.7	On testing point null hypotheses	278
8.8	Further comments on prior distributions	284
8.9	Bayesian inference on cointegrated systems	287
8.10	Bayesian long-run prediction	290
8.11	Conclusion	291
	References	292
9	Fractional unit roots and fractional cointegration	296
9.1	Some definitions	296
9.2	Unit root tests against fractional alternatives	298
9.3	Estimation of ARFIMA models	300
9.4	Estimation of fractionally cointegrated models	302

x	Contents	
9.6	Empirical relevance of fractional unit roots Summary and conclusions References	303 305 306
$10.1 \\ 10.2 \\ 10.3$	Small sample inference: bootstrap methods Introduction A review of the bootstrap approach The AR(1) model Bootstrapping unit root tests The moving block bootstrap and extensions Issues in bootstrapping cointegrating regressions Miscellaneous other applications Conclusions References	309 309 322 325 328 332 335 336 336
$11 \\ 11.1 \\ 11.2 \\ 11.3 \\ 11.4$	Cointegrated systems with I(2) variables Determination of the order of differencing Cointegration analysis with I(2) and I(1) variables Empirical applications Summary and conclusions References	342 342 348 355 358 359
	Seasonal unit roots and seasonal cointegration Effect of seasonal adjustment Seasonal integration Tests for seasonal unit roots The unobserved component model Seasonal cointegration Estimation of seasonally cointegrated systems Empirical evidence Periodic autoregression and periodic integration Periodic cointegration and seasonal cointegration Time aggregation and systematic sampling Conclusion References	362 364 365 366 371 375 376 378 378 379 381 381 381 382 383
Part	IV Structural change	387
$13 \\ 13.1 \\ 13.2 \\ 13.3$	Structural change, unit roots, and cointegration Tests for structural change Tests with known break points Tests with unknown break points	389 390 390 391

Contents		
13.4 13.5	A summary assessment Tests for unit roots under structural change	398 200
13.6	8	399
13.0	The Bayesian approach A summary assessment of the empirical work	402
13.8	Effect of structural change on cointegration tests	$\frac{407}{410}$
13.9	Tests for structural change in cointegration tests	411
	Miscellaneous other issues	414
	Practical conclusions	416
10.11	References	418
14	Outliers and unit roots	425
14.1	Introduction	425
14.2	Different types of outliers in time series models	425
14.3	Effects of outliers on unit root tests	428
14.4	Outlier detection	437
14.5	Robust unit root tests	440
14.6	Robust estimation of cointegrating regressions	445
14.7	Outliers and seasonal unit roots	448
14.8	Conclusions	448
	References	449
15	Regime switching models and structural time series models	454
15.1	The switching regression model	454
15.2	The Markov switching regression model	455
15.3	The Hamilton model	457
15.4	On the usefulness of the MSR model	460
15.5	Extensions of the MSR model	463
15.6	Gradual regime switching models	466
15.7	A model with parameters following a random walk	469
15.8	A general state-space model	470
15.9	Derivation of the Kalman filter	472
	Harvey's structural time series model (1989)	475
	Further comments on structural time series models \tilde{a}	477
15.12	Summary and conclusions	479
	References	479
16	Future directions	486
	References	488
Apper	<i>idix 1</i> A brief guide to asymptotic theory	490
Author index		492
Subject index 5		500