	List of figures	page xii
	List of tables	xv
	List of boxes	xviii
	List of screenshots	xx
	Preface	xxi
	Acknowledgements	xxv
1	Introduction	1
1.1	What is econometrics?	1
1.2	Is financial econometrics different from 'economic	
	econometrics'? Some stylised characteristics	
	of financial data	2
1.3	Types of data	4
1.4	Returns in financial modelling	6
1.5	Steps involved in formulating an econometric model	8
1.6	Some points to consider when reading articles in	
	the empirical financial literature	10
1.7	Outline of the remainder of this book	11
2	Econometric packages for modelling financial data	15
2.1	What packages are available?	15
2.2	Choosing a package	16
2.3	Accomplishing simple tasks using the two packages	17
2.4	WinRATS	18
2.5	EViews	31
2.6	Further reading	39
	Appendix: economic software package suppliers	40
3	A brief overview of the classical linear regression model	42
3.1	What is a regression model?	42
3.2	Regression versus correlation	43

vi

3.3	Simple regression	43
3.4	Some further terminology	52
3.5	The assumptions underlying the classical linear	
	regression model	55
3.6	Properties of the OLS estimator	56
3.7	Precision and standard errors	58
3.8	An introduction to statistical inference	64
3.9	Generalising the simple model to multiple	
	linear regression	82
3.10	The constant term	83
3.11	How are the parameters (the elements of the β vector)	
	calculated in the generalised case?	85
3.12	A special type of hypothesis test: the <i>t</i> -ratio	88
3.13	Data mining and the true size of the test	89
3.14	An example of the use of a simple <i>t</i> -test to test a theory	
	in finance: can US mutual funds beat the market?	90
3.15	Can UK unit trust managers beat the market?	93
3.16	The overreaction hypothesis and the UK stock market	95
3.17	Testing multiple hypotheses: the F-test	102
3.18	Sample EViews and RATS instructions and output	
	for simple linear regression	108
	Appendix: mathematical derivations of CLRM results	122
3A.1	Deriving the OLS coefficient estimator in the	
	bivariate case	122
3A.2	Derivation of the OLS standard error estimators for	
	the intercept and slope in the bivariate case	123
3A.3	Derivation of the OLS coefficient estimator in the multiple	
	regression context	127
3A.4	Derivation of the OLS standard error estimator in	
	the multiple regression context	128
4	Further issues with the classical linear regression model	100
41	Goodness of fit statistics	133
4.2	Hedonic pricing models	133
4.3	Tests of non-nested hypotheses	147
4.4	Violations of the assumptions of the classical	172
	linear regression model	144
4.5	Assumption 1: $E(u_t) = 0$	146
4.6	Assumption 2: $var(u_t) = \sigma^2 < \infty$	140
4.7	Assumption 3: $cov(u_i, u_j) = 0$ for $i \neq i$	155
4.8	Assumption 4: the x_t are non-stochastic	178

4.9	Assumption 5: the disturbances are normally distributed	178
4.10	Multicollinearity	190
4.11	Adopting the wrong functional form	194
4.12	Omission of an important variable	197
4.13	Inclusion of an irrelevant variable	198
4.14	Parameter stability tests	198
4.15	A strategy for constructing econometric models	
	and a discussion of model-building philosophies	208
4.16	Determinants of sovereign credit ratings	211
	Appendix: a brief introduction to principal	
	components analysis	220
4A.1	An application of principal components to interest rates	222
4A.2	Calculating principal components in practice	225
5	Univariate time series modelling and forecasting	229
5.1	Introduction	229
5.2	Some notation and concepts	230
5.3	Moving average processes	235
5.4	Autoregressive processes	239
5.5	The partial autocorrelation function	247
5.6	ARMA processes	249
5.7	Building ARMA models: the Box–Jenkins approach	255
5.8	Example: constructing ARMA models in EViews	258
5.9	Estimating ARMA models with RATS	268
5.10	Examples of time series modelling in finance	272
5.11	Exponential smoothing	275
5.12	Forecasting in econometrics	277
5.13	Forecasting using ARMA models in EViews	291
5.14	Forecasting using ARMA models in RATS	293
5.15	Estimating exponential smoothing models	
	using EViews and RATS	295
6	Multivariate models	302
6.1	Motivations	302
6.2	Simultaneous equations bias	304
6.3	So how can simultaneous equations models	
	be validly estimated?	306
6.4	Can the original coefficients be retrieved from the π s?	306
6.5	Simultaneous equations in finance	309
6.6	A definition of exogeneity	310
6.7	A special case: a set of equations that looks like	
	a simultaneous equations system, but isn't	313

vii

6.8	Estimation procedures for simultaneous equations	
	systems	313
6.9	An application of a simultaneous equations approach	
	in finance: modelling bid-ask spreads and trading activity	
	in the S&P 100 index options market	317
6.10	Simultaneous equations modelling using EViews	
	and RATS	323
6.11	A Hausman test in RATS	328
6.12	Vector autoregressive models	330
6.13	Does the VAR include contemporaneous terms?	336
6.14	Block significance and causality tests	338
6.15	VARs with exogenous variables	340
6.16	Impulse responses and variance decompositions	340
6.17	An example of the use of VAR models: the interaction	
	between property returns and the macroeconomy	343
6.18	VAR estimation in RATS and EViews	351
7	Modelling long-run relationships in finance	367
7.1	Stationarity and unit root testing	367
7.2	Testing for unit roots in EViews	383
7.3	Testing for unit roots in RATS	386
7.4	Cointegration	387
7.5	Equilibrium correction or error correction models	389
7.6	Testing for cointegration in regression:	
	a residuals-based approach	391
7.7	Methods of parameter estimation in cointegrated systems	393
7.8	Lead-lag and long-term relationships between spot	
	and futures markets	395
7.9	Testing for and estimating cointegrating systems using	
	the Johansen technique based on VARs	403
7.10	Purchasing power parity	409
7.11	Cointegration between international bond markets	411
7.12	Testing the expectations hypothesis of the term structure	
	of interest rates	418
7.13	Testing for cointegration and modelling cointegrated	
	systems using EViews and RATS	420
8	Modelling volatility and correlation	437
8.1	Motivations: an excursion into non-linearity land	437
8.2	Models for volatility	441
8.3	Historical volatility	441
8.4	Implied volatility models	442

.

8.5	Exponentially weighted moving average models	442
8.6	Autoregressive volatility models	444
8.7	Autoregressive conditionally heteroscedastic (ARCH)	
	models	445
8.8	Generalised ARCH (GARCH) models	452
8.9	Estimation of ARCH/GARCH models	455
8.10	Extensions to the basic GARCH model	468
8.11	Asymmetric GARCH models	469
8.12	The GJR model	469
8.13	The EGARCH model	470
8.14	GJR and EGARCH in EViews	471
8.15	Estimating GJR and EGARCH models using RATS	472
8.16	Tests for asymmetries in volatility	474
8.17	GARCH-in-mean	480
8.18	Uses of GARCH-type models including volatility forecasting	482
8.19	Testing non-linear restrictions or testing hypotheses	
	about non-linear models	490
8.20	Volatility forecasting: some examples and results	
	from the literature	493
8.21	Stochastic volatility models revisited	501
8.22	Forecasting covariances and correlations	502
8.23	Covariance modelling and forecasting in finance:	
	examples of model uses	503
8.24	Historical covariance and correlation	505
8.25	Implied covariance models	505
8.26	Exponentially weighted moving average models	
	for covariances	506
8.27	Multivariate GARCH models	506
8.28	A multivariate GARCH model for the CAPM with	
	time-varying covariances	510
8.29	Estimating a time-varying hedge ratio for FTSE stock	
	index returns	512
8.30	Estimating multivariate GARCH models using RATS and	
	EViews	516
	Appendix: parameter estimation using maximum	
	likelihood	526
9	Switching models	533
9.1	Motivations	533
9.2	Seasonalities in financial markets: introduction	
	and literature review	536

ix

9.3	Modelling seasonality in financial data	537
9.4	Estimating simple piecewise linear functions	545
9.5	Markov switching models	546
9.6	An application of Markov switching models to	
	the gilt–equity yield ratio	549
9.7	Estimation of Markov switching models in RATS	558
9.8	Threshold autoregressive models	559
9.9	Estimation of threshold autoregressive models	561
9.10	Specification tests in the context of Markov switching	
	and threshold autoregressive models: a cautionary note	563
9.11	An example of applying a SETAR model to the French	
	franc-German mark exchange rate	564
9.12	Threshold models and the dynamics of the FTSE 100 stock	
	index and stock index futures market	567
9.13	A note on regime switching models and forecasting	
	accuracy	571
9.14	Estimating threshold autoregressive models in RATS	571
10	Simulation methods	577
10.1	Motivations	577
10.2	Monte Carlo simulations	578
10.3	Variance reduction techniques	580
10.4	Bootstrapping	585
10.5	Random number generation	589
10.6	Disadvantages of the simulation approach to econometric	
	or financial problem solving	590
10.7	An example of the use of Monte Carlo simulation	
	in econometrics: deriving a set of critical values	
	for a Dickey–Fuller test.	592
10.8	An example of how to simulate the price of	
	a financial option	601
10.9	An example of the use of bootstrapping to calculate	
	capital risk requirements	612
11	Conducting empirical research or doing a project	
	or dissertation in finance	632
11.1	What is an empirical research project, and what is it for?	632
11.2	Selecting the topic	633
11.3	Working papers and literature on the Internet	636
11.4	Getting the data	636
11.5	Choice of computer software	639

	Contents	Xi
11.6	How might the finished project look?	639
11.7	Presentational issues	643
12	Recent and future developments in the modelling	
	of financial time series	645
12.1	Summary of the book	645
12.2	What was not covered in the book	645
12.3	Financial econometrics: the future?	651
12.4	The final word	654
Appendix 1	A review of some fundamental mathematical	
	and statistical concepts	655
A.1	Introduction	655
A.2	Characteristics of probability distributions	655
A.3	Properties of logarithms	657
A.4	Differential calculus	657
A.5	Matrices	660
A.6	The eigenvalues of a matrix	665
Appendix 2	Tables of statistical distributions	668
	References	680
	Index	693