Contents

۲

CH/	APTER 1 Introduction and Context	
1.1	What Is Forecasting?	
	1.1.1 The First Forecaster in History: The Delphi Oracle	
	1.1.2 Examples of Modern Forecasts	
	1.1.3 Definition of Forecasting	
	1.1.4 Two Types of Forecasts	
1.2	Who Are the Users of Forecasts?	
	1.2.1 Firms	
	1.2.2 Consumers and Investors	
	1.2.3 Government	
1.3	Becoming Familiar with Economic Time Series:	
	Features of a Time Series	
	1.3.1 Trends	
	1.3.2 Cycles	
	1.3.3 Seasonality	
1.4	Basic Notation and the Objective of the Forecaster	1
	1.4.1 Basic Notation	1
	1.4.2 The Forecaster's Objective	1
1.5	A Road Map for This Forecasting Book	1
1.6	Resources	1
Key	Words	1
Exe	rcises	1
СН	APTER 2 Review of the Linear Regression Model	2
2.1	Conditional Density and Conditional Moments	2
2.2	Linear Regression Model	2

۲

ix

۲

x Contents

2.3 Estimation: Ordinary Least Squares	29
2.3.1 R-squared and Adjusted R-squared	32
2.3.2 Linearity and OLS	33
2.3.3 Assumptions of OLS: The Gauss–Markov Theorem	35
2.3.4 An Example: House Prices and Interest Rates	38
2.4 Hypothesis Testing in a Regression Model	41
2.4.1 The t-ratio	41
2.4.2 The F-test	44
Key Words	46
Appendix	47
Exercises	49
CHAPTER 3 Statistics and Time Series	52
3.1 Stochastic Process and Time Series	54
3.1.1 Stochastic Process	55
3.1.2 Time Series	56
3.2 The Interpretation of a Time Average	57
3.2.1 Stationarity	58
3.2.2 Useful Transformations of Nonstationary Processes	62
3.3 A New Tool of Analysis: The Autocorrelation Functions	65
3.3.1 Partial Autocorrelation	69
3.3.2 Statistical Tests for Autocorrelation Coefficients	71
3.4 Conditional Moments and Time Series: What Lies Ahead	73
Key Words	74
Appendix	74
Exercises	76
MODULE II MODELING LINEAR DEPENDENCE FORECASTING WITH TIME SERIES MODE	LS
CHAPTER 4 Tools of the Forecaster	79

CU/	IAPIER 4 Tools of the Porecaster	/9
4.1	The Information Set	80
	4.1.1 Some Information Sets Are More	
	Valuable Than Others	82
	4.1.2 Some Time Series Are More Forecas	table
	Than Others	84
4.2	The Forecast Horizon	84
	4.2.1 Forecasting Environments	86
4.3	The Loss Function	89
	4.3.1 Some Examples of Loss Functions	91

16/12/11 9:02 PM

۲

Contonto	
Contents	XI

T

۲

	4.3.2 Examples4.3.3 Optimal Forecast: An Introduction	91 93
Арр	7 Words pendix prcises	96 97 98
A P.	AUSE Where Are We and Where Are We Going?	100
Whe	ere Are We Going from Here?	100
Hov	w to Organize Your Reading of the Forthcoming Chapters	102
CH	APTER 5 A Understanding Linear Dependence: A Link to Economic Models	103
5.1		103
	5.1.1 The Effect of Only One Supply Shock	105
	5.1.2 The Effect of Many Supply Shocks5.1.3 A Further Representation of the Dynamics	106
	in the Cob-Web Model	107
	5.1.4 Simulation of the Model, $p_t = p^*(1 - \phi) + \phi p_{t-1} + \varepsilon_t$,	
	and Autocorrelation Function	109
5.2	5	112
5.3	Trading (Intermediate Level) Asset Prices and the Bid–Ask Bounce	113
5.5	(Advanced Level)	116
5.4	Summary	121
Арр	v Words pendix prcises	121 121 123
CH	APTER 6 Forecasting with Moving Average (MA) Processes	125
6.1	A Model with No Dependence: White Noise	125
	6.1.1 What Does This Process Look Like?	126
6.2	I E	120
	(Advanced Section) 6.2.1 Finite Representation of the Wold Decomposition	129 <i>131</i>
6.3	Forecasting with Moving Average Models	131
0.12	6.3.1 MA(1) Process	135
	$6.3.2 MA(q) \ Process$	147
Key	v Words	157
	pendix	157
Exe	ercises	158

۲

I

xii Contents

۲

CH	APTER 7 Forecasting with Autoregressive (AR) Processes	160
7.1	Cycles	162
7.2	Autoregressive Models	165
	7.2.1 The $AR(1)$ Process	165
	7.2.2 $AR(2)$ Process	173
	7.2.3 $AR(p)$ Process	185
	7.2.4 Chain Rule of Forecasting	187
7.3	Seasonal Cycles	188
	7.3.1 Deterministic and Stochastic Seasonal Cycles	189
	7.3.2 Seasonal ARMA Models	192
	7.3.3 Combining ARMA and Seasonal ARMA Models	197
-	Words	200
Exe	rcises	200
CH	APTER 8 Forecasting Practice I	202
8.1	The Data: San Diego House Price Index	202
8.2	Model Selection	205
	8.2.1 Estimation: AR, MA, and ARMA Models	205
	8.2.2 Is the Process Covariance-Stationary,	
	and Is the Process Invertible?	206
	8.2.3 Are the Residuals White Noise?	209
	8.2.4 Are the Parameters of the Model Statistically Significant?	211
	8.2.5 Is the Model Explaining a Substantial Variation	
	of the Variable of Interest?	211
	8.2.6 Is It Possible to Select One Model Among Many?	212
8.3	The Forecast	213
	8.3.1 Who Are the Consumers of Forecasts?	213
	8.3.2 Is It Possible To Have Different Forecasts	
	from the Same Model?	215
	8.3.3 What Is the Most Common Loss Function in Economics and Business?	215
	8.3.4 Final Comments	213 221
-	Words rcises	221 222
Exe	rcises	
CH/	APTER 9 Forecasting Practice II: Assessment of Forecasts	
	and Combination of Forecasts	224
9.1	Optimal Forecast	225
	9.1.1 Symmetric and Asymmetric Loss Functions	225
	9.1.2 Testing the Optimality of the Forecast	229
9.2	Assessment of Forecasts	238
	9.2.1 Descriptive Evaluation of the Average Loss	239
	9.2.2 Statistical Evaluation of the Average Loss	240

۲

۲

۲

Contents	xiii
Comenis	- Alli

9.3	Comb	ination of Forecasts	244
	9.3.1	Simple Linear Combinations	244
	9.3.2	Optimal Linear Combinations	245
Key	Words	i i i i i i i i i i i i i i i i i i i	247
Арр	Appendix		248
Exe	rcises		250
A P	AUSE	Where Are We and Where Are We Goina?	252

AFAUSE	where are we and where are we Going?	252
Where Are	We Going from Here?	253

CHAPTER 10		Forecasting the Long Term: Deterministic and Stochastic Trends	255
10.1	Determ	inistic Trends	257
	10.1.1	Trend Shapes	258
	10.1.2	Trend Stationarity	261
	10.1.3	Optimal Forecast	262
10.2	Stochastic Trends		270
	10.2.1	Trend Shapes	270
	10.2.2	Stationarity Properties	272
	10.2.3	Optimal Forecast	279
Key Words			291
Exercises			291

CHAPTER 11		Forecasting with a System of Equations: Vector Autoregression	
11.1	What Is	s Vector Autoregression (VAR)?	
11.2	Estimati	tion of VAR	
11.3	Granger	er Causality	

Exercises		309
Key Words		309
11.5	Forecasting with VAR	305
11.4	Impulse-Response Functions	302
11.3	Granger Causality	299

CHAF	TER 12 Forecasting the Long Term and the Short Term Jointly	311
12.1	Finding a Long-Term Equilibrium Relationship	315
12.2	Quantifying Short-Term Dynamics: Vector Error Correction Model	322
12.3	Constructing the Forecast	327
Key Words Exercises		

293 294 294 ۲

xiv Contents

A PAUSE Where Are We and Where Are We Going?	334
Where We Are Going from Here	335
How to Organize Your Reading of the Forthcoming Chapters	336

MODULE III MODELING MORE COMPLEX DEPENDENCE

۲

CHAPTER 13 Forecasting Volatility I		337	
13.1	Motiva		337
		The World is Concerned About Uncertainty	337
	13.1.2	Volatility Within the Context of Our	220
	13.1.3	Forecasting Problem Setting the Objective	339 340
13.2		Varying Dispersion: Empirical Evidence	341
13.2		345	
13.3		e Time Dependence in Volatility? Iave We Learned So Far?	343
13.4		Specifications for the Conditional Variance	353
15.5	-	Rolling Window Volatility	353 354
	13.5.2	Exponentially Weighted Moving Average	554
	10.0.2	(EWMA) Volatility	355
Key Words			357
Exercises			357
СНА	PTER 14	Forecasting Volatility II	359
14.1		RCH Family	360
		ARCH(1) ARCH(p)	362 368
		GARCH(1,1)	370
	14.1.4	Estimation Issues for the ARCH Family	378
14.2		ed Volatility	380
Kev V	Words		390
Appe			390
Exer			393
CHA	PTER 15	Financial Applications of Time-Varying	
UIA		Volatility	395
15.1	Risk M	anagement	395
		Value-at-Risk (VaR)	396
	15.1.2	Expected Shortfall (ES)	400

۲

۲

۲

	Contents	XV
15.2	Portfolio Allocation	401
15.3	Asset Pricing	404
15.4	Option Pricing	406
Key V	Words	411
Appe	ndix	411
Exer	cises	412
СНА	PTER 16 Forecasting with Nonlinear Models:	
	An Introduction	413
16.1	Nonlinear Dependence	414
	16.1.1 What Is It?	414
	16.1.2 Is There Any Evidence of Nonlinear Dynamics in the Data?	417
	16.1.3 Nonlinearity, Correlation, and Dependence	419
	16.1.4 What Have We Learned So Far?	420
16.2	Nonlinear Models: An Introduction	421
	16.2.1 Threshold Autoregressive Models (TAR)	422
	16.2.2 Smooth Transition Models16.2.3 Markov Regime-Switching Models: A Descriptive Introduction	427 436
16.3	6 6 I	440
10.5	Forecasting with Nonlinear Models 16.3.1 One-Step-Ahead Forecast	440
	16.3.2 Multistep-Ahead Forecast	441
Key V	Words	444
Appe		444
Exer	cises	445
Appe	ndix A: Review of Probability and Statistics	447
Appendix B: Statistical Tables		463
Glossary		472
References		481
Index		483

۲

16/12/11 9:02 PM

۲