

# Contents

Notation . . . . .	xiii
--------------------	------

## PART I PRELIMINARIES

<b>Chapter 1. An introduction to forecasting . . . . .</b>	<b>3</b>
1.1 Everybody forecasts . . . . .	3
1.2 Methods of forecasting . . . . .	4
1.3 The basis of forecasting . . . . .	5
<b>Chapter 2. Models . . . . .</b>	<b>12</b>
2.1 Scientific forecasting . . . . .	12
2.2 Basic models . . . . .	17
2.3 Models of global and local validity . . . . .	19
2.4 Forecasting models and formulae . . . . .	21
<b>Chapter 3. Forecasting criteria . . . . .</b>	<b>23</b>
3.1 The need for criteria . . . . .	23
3.2 Classification of criteria for testing forecasting formulae on data . . . . .	25
3.3 Statistical features . . . . .	29
3.4 Transient features . . . . .	32
3.5 Steady-state features . . . . .	32
3.6 Criteria for testing forecasting formulae on models . . .	33
3.7 Study by simulation . . . . .	36

## PART II FORECASTING FOR SOME BASIC MODELS

<b>Chapter 4. The constant mean model . . . . .</b>	<b>41</b>
4.1 The global constant mean model . . . . .	41
4.2 The local constant mean model . . . . .	48

<b>Chapter 5. Linear trend models</b> . . . . .	58
5.1 The global linear trend model . . . . .	58
5.2 The local linear trend model . . . . .	63
5.3 Polynomial models . . . . .	75
<b>Chapter 6. Regression models</b> . . . . .	77
6.1 Introduction . . . . .	77
6.2 Fitting regression models . . . . .	79
6.3 Selecting the variables . . . . .	83
6.4 Econometric models . . . . .	88
6.5 Time as a regressor variable . . . . .	90
<b>Chapter 7. Stochastic models</b> . . . . .	93
7.1 Introduction . . . . .	93
7.2 Forecasting and conditional expectation . . . . .	100
7.3 Moving average processes . . . . .	101
7.4 Autoregressive processes . . . . .	105
7.5 Autoregressive — moving average models . . . . .	107
7.6 Models involving stochastic and deterministic elements . . . . .	111
<b>Chapter 8. Seasonal models</b> . . . . .	115
8.1 Introductory concepts . . . . .	115
8.2 Seasonal index methods . . . . .	124
8.3 Fourier methods . . . . .	139
8.4 Stochastic methods . . . . .	147
8.5 Comparison of methods . . . . .	148
<b>Chapter 9. Growth curves</b> . . . . .	150
9.1 Models for growth curves . . . . .	150
9.2 Fitting growth curves . . . . .	156
9.3 Forecasting growth curves . . . . .	160
<b>Chapter 10. Probabilistic models</b> . . . . .	162
10.1 Introduction . . . . .	162
10.2 Forecasting probabilities . . . . .	162
10.3 State models . . . . .	166
10.4 Forecasting criteria . . . . .	170
10.5 Probability forecasting and decision making . . . . .	172
<b>Chapter 11. Multivariate models</b> . . . . .	174
11.1 Introduction . . . . .	174
11.2 Generalizing exponential smoothing . . . . .	175
11.3 Multivariate stochastic models . . . . .	176

<b>Chapter 12. Forecasting methods and models</b> . . . . .	179
12.1 Forecasting methods . . . . .	179
12.2 Model building and identification . . . . .	179
12.3 Model testing . . . . .	183
12.4 The use of judgement . . . . .	188

### PART III THE FORECASTING PROCESS

<b>Chapter 13. Data</b> . . . . .	193
13.1 Introduction . . . . .	193
13.2 Sources of data . . . . .	193
13.3 The quality of data . . . . .	195
13.4 The adjustment of data . . . . .	196
<b>Chapter 14. Adaptive methods and other extensions</b> . . . . .	203
14.1 Introduction . . . . .	203
14.2 Adaptive methods . . . . .	203
14.3 Extensions to recurrence methods . . . . .	206
14.4 Extensions to the error correction method — Kalman filters . . . . .	209
14.5 Linear forecasting formulae . . . . .	213
14.6 Using mixed methods . . . . .	216
<b>Chapter 15. The analysis and comparison of methods</b> . . . . .	220
15.1 Introduction . . . . .	220
15.2 Forecast analysis . . . . .	221
15.3 Choosing forecasting parameters . . . . .	237
15.4 Comparison of methods . . . . .	240
15.5 Prediction intervals . . . . .	241
15.6 Sensitivity analysis . . . . .	243
<b>Chapter 16. Forecast control</b> . . . . .	246
16.1 Quality control in forecasting . . . . .	246
16.2 Tracking signals for bias . . . . .	248
16.3 Cumulative sum methods . . . . .	252
16.4 A tracking signal for autocorrelation . . . . .	254
<b>Chapter 17. Two-stage forecasting</b> . . . . .	256
17.1 Introduction . . . . .	256
17.2 The use of forecast errors . . . . .	258
17.3 The use of external forecasting information . . . . .	264
17.4 Combining forecasts . . . . .	266
17.5 The use of cost and other criteria . . . . .	268

<b>Chapter 18. Problems in practice</b> . . . . .	<b>274</b>
18.1 Introduction . . . . .	274
18.2 Practical forecasting criteria — a stock control example . . . . .	275
18.3 The forecast as part of a system — a stockholding example . . . . .	278
18.4 Forecasts and crystal balls — a scheduling example . . . . .	281
18.5 The forecast as part of a system — self validating and self-defeating forecasts . . . . .	287
18.6 Practical forecasting — a postscript . . . . .	289
 <b>Appendix A Some terminology and definitions for stochastic   processes.</b> . . . . .	 <b>293</b>
 <b>Appendix B Proof that conditional expectation gives minimum   MSE forecasts</b> . . . . .	 <b>298</b>
 <b>Appendix C Two-way exponential smoothing</b> . . . . .	 <b>301</b>
 <b>Appendix D A technical note on discounted least squares</b> . . . . .	 <b>302</b>
 <b>Index</b> . . . . .	 <b>305</b>