

Time Series
Applications to Finance

Ngai Hang Chan
Chinese University of Hong Kong

 WILEY-INTERSCIENCE

A JOHN WILEY & SONS, INC., PUBLICATION

Contents

<i>Preface</i>	<i>xi</i>
1 <i>Introduction</i>	<i>1</i>
1.1 <i>Basic Description</i>	<i>1</i>
1.2 <i>Simple Descriptive Techniques</i>	<i>5</i>
1.2.1 <i>Trends</i>	<i>5</i>
1.2.2 <i>Seasonal Cycles</i>	<i>8</i>
1.3 <i>Transformations</i>	<i>9</i>
1.4 <i>Example</i>	<i>9</i>
1.5 <i>Conclusions</i>	<i>13</i>
1.6 <i>Exercises</i>	<i>13</i>
2 <i>Probability Models</i>	<i>15</i>
2.1 <i>Introduction</i>	<i>15</i>
2.2 <i>Stochastic Processes</i>	<i>15</i>
2.3 <i>Examples</i>	<i>17</i>
2.4 <i>Sample Correlation Function</i>	<i>18</i>
2.5 <i>Exercises</i>	<i>20</i>
3 <i>Autoregressive Moving Average Models</i>	<i>23</i>
3.1 <i>introduction</i>	<i>23</i>
3.2 <i>Moving Average Models</i>	<i>23</i>
3.3 <i>Autoregressive Models</i>	<i>25</i>

3.3.1	<i>Duality between Causality and Stationarity</i>	26
3.3.2	<i>Asymptotic Stationarity</i>	28
3.3.3	<i>Causality Theorem</i>	28
3.3.4	<i>Covariance Structure of AR Models</i>	29
34	<i>ARMA Models</i>	32
3.5	<i>ARIMA Models</i>	33
3.6	<i>Seasonal ARIMA</i>	35
3.1	<i>Exercises</i>	36
	<i>Estimation in the Time Domain</i>	39
4.1	<i>Introduction</i>	39
4.2	<i>Moment Estimators</i>	39
4.3	<i>Autoregressive Models</i>	40
4.4	<i>Moving Average Models</i>	42
4.5	<i>ARMA Models</i>	43
4.6	<i>Maximum Likelihood Estimates</i>	44
4.1	<i>Partial ACF</i>	41
4.8	<i>Order Selections</i>	49
4.9	<i>Residual Analysis</i>	53
4.10	<i>Model Building</i>	53
4.11	<i>Exercises</i>	54
	<i>Examples in SPLUS</i>	59
5.1	<i>Introduction</i>	59
5.2	<i>Example 1</i>	59
5.3	<i>Example 2</i>	62
54	<i>Exercises</i>	68
	<i>Forecasting</i>	69
6.1	<i>Introduction</i>	69
6.2	<i>Simple Forecasts</i>	10
6.3	<i>Box and, Jenkins Approach</i>	11
6.4	<i>Treasury Bill Example</i>	73
6.5	<i>Recursions</i>	77
6.6	<i>Exercises</i>	11
7	<i>•Spectral Analysis</i>	19
1.1	<i>Introduction</i>	19
1.2	<i>Spectral Representation Theorems</i>	19
1.3	<i>Periodogram,</i>	83
1.4	<i>Smoothing of Periodogram</i>	85
1.5	<i>Conclusions</i>	89
1.6	<i>Exercises</i>	89

8	<i>Nonstationarity</i>	93
8.1	<i>Introduction</i>	93
8.2	<i>Nonstationarity in Variance</i>	93
8.3	<i>Nonstationarity in Mean: Random Walk with Drift</i>	94
8.4	<i>Unit Root Test</i>	96
8.5	<i>Simulations</i>	98
8.6	<i>Exercises</i>	99
9	<i>Heteroskedasticity</i>	101
9.1	<i>Introduction</i>	101
9.2	<i>ARCH</i>	102
9.3	<i>GARCH</i>	105
9.4	<i>Estimation and Testing for ARCH</i>	101
9.5	<i>Example of Foreign Exchange Rates</i>	109
9.6	<i>Exercises</i>	116
10	<i>Multivariate Time Series</i>	111
10.1	<i>Introduction</i>	111
10.2	<i>Estimation of β and T</i>	121
10.3	<i>Multivariate ARMA Processes</i>	121
	10.3.1 <i>Causality and Invertibility</i>	122
	10.3.2 <i>Identifiability</i>	123
10.4	<i>Vector AR Models</i>	124
10.5	<i>Example of Inferences for VAR</i>	121
10.6	<i>Exercises •</i>	135
11	<i>State Space Models</i>	131
11.1	<i>Introduction</i>	131
11.2	<i>State Space Representation</i>	131
11.3	<i>Kalman Recursions</i>	140
11.4	<i>Stochastic Volatility Models</i>	142
11.5	<i>Example of Kalman Filtering of Term Structure</i>	144
11.6	<i>Exercises</i>	150
12	<i>Multivariate GARCH</i>	153
12.1	<i>Introduction</i>	153
12.2	<i>General Model</i>	154
	12.2.1 <i>Diagonal Form,</i>	155
	12.2.2 <i>Alternative Matrix Form,</i>	156
12.3	<i>Quadratic Form</i>	156
	12.3.1 <i>Single-Factor GARCH(1,1)</i>	156
	12.3.2 <i>Constant-Correlation Model</i>	151

124	<i>Example of Foreign Exchange Rates</i>		157
124.1	<i>The Data</i>		158
12.4.2	<i>Multivariate GARCH in SPLUS</i>		158
12.4.3	<i>Prediction</i>		166
12.4.4	<i>Predicting Portfolio Conditional Standard Deviations</i>		167
124.5	<i>BEKK Model</i>		168
12.4.6	<i>Vector-Diagonal Models</i>		169
12.4.7	<i>ARMA in Conditional Mean</i>		110
12.5	<i>Conclusions</i>		111
12.6	<i>Exercises</i>		111
13	<i>Cointegrations and Common Trends</i>		113
13.1	<i>Introduction</i>		113
13.2	<i>Definitions and Examples</i>	11	4
13.3	<i>Error Correction Form</i>		117
13.4	<i>Granger's Representation Theorem</i>		119
13.5	<i>Structure of Cointegrated Systems</i>		183
13.6	<i>Statistical Inference for Cointegrated Systems</i>		184
13.6.1	<i>Canonical Correlations</i>		184
13.6.2	<i>Inference and Testing</i>		186
13.1	<i>Example of Spot Index and, Futures</i>		188
13.8	<i>Conclusions</i>		193
13.9	<i>Exercises</i>		193
	<i>References</i>		195
	<i>Index</i>		201