<table>
<thead>
<tr>
<th>Index Term</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACD model</td>
<td>301, 302</td>
</tr>
<tr>
<td>exponential</td>
<td>302</td>
</tr>
<tr>
<td>generalized Gamma</td>
<td>303</td>
</tr>
<tr>
<td>Weibull</td>
<td>302</td>
</tr>
<tr>
<td>Airline model</td>
<td>101</td>
</tr>
<tr>
<td>Akaike information criterion (AIC)</td>
<td>61</td>
</tr>
<tr>
<td>APARCH model</td>
<td>224</td>
</tr>
<tr>
<td>ARCH effect</td>
<td>182</td>
</tr>
<tr>
<td>ARCH model</td>
<td>185</td>
</tr>
<tr>
<td>estimation</td>
<td>189</td>
</tr>
<tr>
<td>$t$ distribution</td>
<td>190</td>
</tr>
<tr>
<td>GED innovation</td>
<td>191</td>
</tr>
<tr>
<td>normal</td>
<td>189</td>
</tr>
<tr>
<td>skew $t$ distribution</td>
<td>191</td>
</tr>
<tr>
<td>Augmented Dickey–Fuller test</td>
<td>92</td>
</tr>
<tr>
<td>Autocorrelation</td>
<td>45</td>
</tr>
<tr>
<td>Autocorrelation function (ACF)</td>
<td>45</td>
</tr>
<tr>
<td>Autocovariance</td>
<td>43</td>
</tr>
<tr>
<td>Autoregressive integrated moving-average</td>
<td>(ARIMA) model, 91</td>
</tr>
<tr>
<td>Autoregressive model</td>
<td>51</td>
</tr>
<tr>
<td>estimation</td>
<td>64</td>
</tr>
<tr>
<td>forecasting</td>
<td>67</td>
</tr>
<tr>
<td>order</td>
<td>60</td>
</tr>
<tr>
<td>stationarity</td>
<td>59</td>
</tr>
<tr>
<td>Autoregressive moving-average (ARMA) model</td>
<td>78</td>
</tr>
<tr>
<td>forecasting</td>
<td>84</td>
</tr>
<tr>
<td>Backshift operator</td>
<td>55</td>
</tr>
<tr>
<td>Backtesting</td>
<td>121, 135, 150</td>
</tr>
<tr>
<td>Bar chart</td>
<td>27</td>
</tr>
<tr>
<td>Bartlett’s formula</td>
<td>45</td>
</tr>
<tr>
<td>Bayesian information criterion (BIC)</td>
<td>62</td>
</tr>
<tr>
<td>bid-ask bounce</td>
<td>279</td>
</tr>
<tr>
<td>bid-ask spread</td>
<td>279</td>
</tr>
<tr>
<td>Bonds</td>
<td></td>
</tr>
<tr>
<td>current yield</td>
<td>8</td>
</tr>
<tr>
<td>par value</td>
<td>8</td>
</tr>
<tr>
<td>yield to maturity</td>
<td>8</td>
</tr>
<tr>
<td>Business cycle</td>
<td>56</td>
</tr>
<tr>
<td>Capital asset pricing model</td>
<td>256</td>
</tr>
<tr>
<td>Characteristic equation</td>
<td>59</td>
</tr>
<tr>
<td>Characteristic root</td>
<td>56, 59</td>
</tr>
<tr>
<td>Co-integration</td>
<td>112</td>
</tr>
<tr>
<td>Compounding</td>
<td>4</td>
</tr>
<tr>
<td>Conditional distribution</td>
<td>21</td>
</tr>
<tr>
<td>Conditional forecast</td>
<td>68</td>
</tr>
<tr>
<td>Conditional likelihood method</td>
<td>74</td>
</tr>
<tr>
<td>Conditional value at risk</td>
<td>335</td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>43</td>
</tr>
<tr>
<td>Data</td>
<td></td>
</tr>
<tr>
<td>3M stock return</td>
<td>24, 81, 88</td>
</tr>
<tr>
<td>CAT returns</td>
<td>246</td>
</tr>
<tr>
<td>CSCO returns</td>
<td>246</td>
</tr>
<tr>
<td>GE returns</td>
<td>246</td>
</tr>
<tr>
<td>BA Merrill Lynch AAA total return index</td>
<td>343</td>
</tr>
<tr>
<td>CAT transactions</td>
<td>280, 295, 298, 304</td>
</tr>
<tr>
<td>Coca Cola’s earnings</td>
<td>98</td>
</tr>
<tr>
<td>CRSP monthly value-weighted index</td>
<td>118</td>
</tr>
<tr>
<td>crude oil price</td>
<td>129</td>
</tr>
<tr>
<td>decile 10 monthly returns</td>
<td>45</td>
</tr>
<tr>
<td>Dollar-Euro exchange rate</td>
<td>184</td>
</tr>
<tr>
<td>equal-weighted index</td>
<td>73, 74, 118</td>
</tr>
<tr>
<td>gasoline price</td>
<td>129</td>
</tr>
<tr>
<td>global temperature anomalies</td>
<td>140</td>
</tr>
<tr>
<td>IBM daily log returns</td>
<td>339</td>
</tr>
<tr>
<td>IBM monthly returns</td>
<td>48</td>
</tr>
<tr>
<td>IBM stock return</td>
<td>49, 231, 346, 350, 354, 356, 363, 369</td>
</tr>
<tr>
<td>IBM stock returns</td>
<td>218</td>
</tr>
<tr>
<td>Intel stock return</td>
<td>178, 193</td>
</tr>
</tbody>
</table>

Data (Continued)
JNJ transactions, 283
monthly log returns of Intel stock, 201
SP 500 index return, 231, 233
U.S. GDP, 93
U.S. GNP, 56
U.S. interest rate, 110
U.S. quarterly real GDP, 122
USEU exchange rate, 341
value-weighted index, 61, 118, 217
Decomposition model, 293
Dickey–Fuller test, 92
Differencing, 91
seasonal, 100
Direct market access, 274
Distribution
Frechet family, 359
Gamma, 321
generalized error, 191
generalized extreme value, 359
Generalized Gamma, 322
generalized Pareto, 374
skew-Student-\(t\), 191
Weibull, 321
Diurnal pattern, 282
Duration model, 298
Durbin–Watson statistic, 116
EGARCH model, 215
forecasting, 220
Empirical density function, 27
Estimation
extreme value parameter, 361
Exact likelihood method, 74
Exceedance, 372
Exceeding times, 372
Excess return, 6
Exponential smoothing, 96
Exponentially weighted moving-average, 252
Extended autocorrelation function, 81
Extremal index, 361
Extreme value theory, 358
Financial risk,
Market risk, 327
Credit risk, 328
Operational risk, 328
Forecast
horizon, 67
origin, 67
Fractional differencing, 117
FRED
Federal Reserve Economic Data, 12
GARCH model, 199
GARCH-M model, 213
Generalized Pareto Distribution, 374
Geometric Brownian motion, 249
GJR model, 222
Half life, 69, 245
Hazard function, 323
Hill estimator, 363
Histogram, 27
IGARCH model, 211, 338
Implied volatility, 177
Impulse response function, 85
Innovation, 50
Integrated volatility, 309
Inverted yield curve, 112
Invertibility, 73
Invertible ARMA model, 85
Ito process, 308
January effect, 47
Joint distribution function, 20
Kendall’s tau, 44
Kurtosis, 22
excess, 22
Lag operator, 55
Leptokurtic, 22
Leverage effect, 177, 218
Linear time series, 50
Liquidity, 279
Ljung–Box statistic, 48
Ljung-Box statistic, 182
Log return, 5
Long position, 6
Long-memory
stochastic volatility, 231
time series, 117
Marginal distribution, 21
Market model, 30
Markov property, 51
Martingale difference, 199
Mean equation, 181
Mean excess function, 375
Mean excess plot, 376
Mean residual life plot, 376
Mean reversion, 69, 86
Mean square of forecast errors, 121
Minimum variance portfolio, 259
Model checking, 65
INDEX

Moment
of a random variable, 22
Moving-average chart, 27
Moving-average model, 69

NGARCH model, 226, 250
Nonstationarity
unit-root, 87
Nonsynchronous trading, 275

Option pricing
simulation, 250
Options
in the money, 10
Order statistics, 353
Ordered probit model, 288

Partial autoregressive function (PACF), 60
Peaks Over Thresholds, 372
\( \pi \)-weight, 85
Pickands estimator, 363
Platykurtic, 22
Portmanteau test, 47
Present value, 5
\( \psi \)-weight, 50

Quantile, 21
definition, 330

R command
adfTest, 93
ar, 63
arima, 65
arima, intercept, 75
basicStats, 24
chartSeries, 13
evir, exindex, 382
evir, gev, 363
evir, gpd, 378
evir, meplot, 376
evir, pot, 376
evir, riskmeasures, 377
fGarch, qstd, 332
garchFit, 194
garchFit, cond.dist, 198
getSymbols, 13
polr, 289
qnorm, 332
qt, 332
quantile, 353
read.csv, 16
read.table, 16
rmorm, 35

Rdiag, 65
Rdiag, gof, 104
R package, 12
evir, 362
fBasics, 25
fGarch, 194
fracdiff, 119
MASS, 289
mnormt, 35
quantmod, 12
quantreg, 355
TSA, 82
TTR, xts, zoo, 12
R project, 12
R-square, 67
Adjusted, 67
Random walk, 86
with drift, 88
Realized volatility, 178, 308
Regression
with time series errors, 110
Return level, 371
stress period, 371
RiskMetrics, 337
Rmetrics, 12

Sample autocorrelation, 45
Seasonal adjustment, 99
Seasonal model
multiplicative, 101
Seasonal time series, 98
Shape parameter
of a distribution, 359
Shock, 50, 68, 181
Short position, 6
Simple return, 3
Skewness, 22
Spearman’s rho, 44
Square root of time rule, 339
Standard Brownian motion, 92
Stationarity, 40
Stochastic volatility model, 229
Stock options, 10
Student-\( t \) distribution
standardized, 189

Tail index, 359
Tail value at risk, 335
TGARCH model, 222
Transactions data, 282
Treasury Bill, Note, Bond, 9
Trend shift model, 154
Trend stationary model, 90
Unit-root nonstationarity, 144  
Unit-root test, 92  
Unit-root time series, 86  

VaR  
econometric approach, 345  
RiskMetrics, 338  

traditional extreme value, 368  
VIX volatility index, 176  
Volatility, 177  
implied, 11  
Volatility equation, 181  

White noise, 50