

Index

- Absolute risk aversion, 180n
- Active portfolio management
 - Black-Litterman model (relationship), 154–159
- After-burn-in simulation, 76
- Alpha, 120–121
 - distribution, posterior moments, 157–158
 - forecast, 158–159
 - perspective, 157–158
- Arbitrage Price Theory (APT), 118, 163, 281
 - certainty equivalent returns, 173–174
 - distributional assumptions, 172–173
 - posterior distributions, 172–173
 - predictive distributions, 172–173
 - testing, 171–174
- ARCH. *See* Autoregressive conditionally heteroskedastic
- ARMA. *See* Autoregressive moving average
- Asset pricing models, 118
 - confidence, 123
 - preliminaries, 119–121
 - relationship. *See* Prior beliefs
 - validity, confidence (incorporation), 128–129
- Asset pricing relationship, validity, 145n
- Asset returns
 - covariance matrix, 143
 - nonnormality, 188–189
 - time-series regression, usage, 164–165
- Asymmetric Student's *t*-distributions, 250–251
- Asymmetric volatility, 189, 195
- Asymmetry parameter, 297
- AT&T stock, transaction data (consideration), 16–17
- Autocorrelations, impact. *See* Convergence
- Autoregressive conditionally heteroskedastic (ARCH)
 - ARCH-in-mean model, 190
 - ARCH-type model, 186, 194
 - selection, 200
 - ARCH-type volatility models,
 - Bayesian estimation, 202
 - distributional setup, 204–206
 - terms, usage, 187
- Autoregressive moving average (ARMA). *See* Multivariate ARMA
 - ARMA(1,1)-GARCH(1,1) model, estimation, 193
 - ARMA(1,1) process, 215
 - return model, 190
- Autoregressive process,
 - time-reversibility (usage), 233
- Auxiliary model, 196–197
- Bayesian decisions, Greenspan outline, 3
- Bayesian empirical tests. *See* Mean-variance efficiency

- Bayesian estimation. *See* Stochastic volatility model
- Bayesian hypothesis, comparison, 32–34
- Bayesian inference process, 22
- Bayesian intervals, 32
- Bayesian linear regression model, 43
- Bayesian methodology, 165
- Bayesian methods
 application, 4n
 introduction, 1
 overview, 4–5
 selection, 200–201
- Bayesian model averaging (BMA), 131–134
 methodology, 130–131
 portfolio selection, 133–134
 posterior model probabilities, 132–133
 posterior parameter distributions, 132–133
 predictive distribution, 133–134
 prior distributions, 131–132
- Bayesian numerical computation, 61
- Bayesian paradigm, 6
- Bayesian portfolio problem, 177
- Bayesian portfolio selection, 101–108
 advanced techniques, 247
 illustration, 106–108
 problem, solution, 173
- Bayesian predictive inference, 34–35
- Bayes' Theorem, 6, 10–21
 classification, relationship, 14–15
 continuous version, 19
 discrete version, consideration, 11
 model selection, relationship, 14
- Benchmark efficiency, confidence, 157
- Benchmark inefficiency, 156
- Benchmark parameters, posterior distributions, 125–126
- Benchmark portfolios, 122
 efficiency, 169
- Benchmark timing, 156
- Berger, James, 12n, 23n, 25n
- Bernardo, José, 12n, 25n
- Bernoulli-distributed random variable, 242
- Bernoulli likelihood function, 132n
- Beta
 definition, 127n
 distribution, basis, 237–238
 estimation. *See* Stocks marginal (unconditional) distribution, 47
 posterior densities, 56e
 posterior inference, 55e
- Beta conditional, posterior distribution, 46
- Beta-distributed random variable, 25
- Beta distribution, 17n
 conjugate prior distribution, 20
- Beta function, 18
- Binary data, analysis, 82n
- Binary dependent variable, Bernoulli distribution, 83
- Binomial parameter, prior distributions (density curves), 18e
- Binomial probability
 Bayesian inference, 15–21
 informative prior elicitation, 25
- Black-Litterman (BL) approach, extension, 263–270
 stable distribution, usage, 270–272
- Black-Litterman (BL) framework, extension (consideration), 255

- Black-Litterman (BL) model, 94, 118
market equilibrium, usage, 264
perspective, 157–158
relationship. *See* Active portfolio management
trading strategies, incorporation, 153–154
- Black-Litterman (BL) optimal allocation, illustration, 149–152
- Black-Litterman (BL) portfolio selection framework, 141
absolute view, 144
distributional assumptions, 144–146
investor perspective, 144
market information, 144–145
preliminaries, 142–146
relative view, 144
subjective views, 145–146
values, selection, 147–148
- Black-Scholes option-pricing formula, constant volatility (assumption), 194n
- Block structure M-H algorithm, 72–73
extension, 73
- B/M. *See* Book value to market value ratio
- BMA. *See* Bayesian model averaging
- Book-to-market (BM) ratios, 53, 175, 282
- Book-to-market (BM) value, 134
- Book value to market value ratio (B/M), 163
- Broad-based index, 165–166
- Burn-in fraction, 75. *See also* Markov chain
- Burn-in simulation. *See* After-burn-in simulation
- Buy-and-hold investor, 178
- Candidate-generating density, 67
- Candidate model, likelihood function, 138–140
- Capital Asset Pricing Model (CAPM), 118, 163
assumptions, 120
deficiency, 280
distributional assumptions, 168–169
empirical analogue, 120
equilibrium pricing model, 166
extension, 257n
implication, 119, 165
inference, usage, 134
posterior distributions, 168–169
testing, inefficiency measures (usage), 167–171
usage, 128
validity, uncertainty, 129e
- Cash flow/total debt ratio, 86
- CDF. *See* Cumulative distribution function
- Certainty-equivalence scenario, 105, 107–108
- Certainty equivalent returns. *See* Arbitrage Price Theory
- Common-factor risk component, 290–291
- Conditional densities, product, 192
- Conditional distribution. *See* Unobserved volatility
expression, 240
sampling, 261
- Conditional log-posterior distribution, kernel, 222
- Conditional mean, modeling, 189–190
- Conditional posterior distribution. *See* Gamma
elicitation, 227–228
obtaining, 221
usage, 209–210, 219–222

- Conditional value-at-risk (CVaR),
 268, 274–275
 decomposition, 289–292
 definition, 289
 minimization, usage, 269
 optimization, 276–277
 usage, 280
- Conditional variance parameters
 posterior draws, histograms,
 212e
 vector, prior means (elicitation),
 223
- Conditional volatility dynamics,
 regimes (existence), 211
- Confidence
 cases, 150–151
 cross-sectional momentum
 strategy (representation),
 154
 incorporation. *See* Asset pricing
 models
 interval/level, 148
 relative views, effect
 (comparison). *See*
 High-confidence relative
 view
- Conjugate prior distributions,
 27–28. *See also* Beta
 distribution
- Constant relative risk aversion
 (CRRA), 180n
- Contemporaneous stock return, 175
- Contour plot, usage. *See* Normal
 distribution
- Convergence
 autocorrelations, impact, 74–75
 diagnostics, 74–77
 illustration, 81e
 monitoring. *See* Cumsum
 convergence monitoring;
 Parallel chains convergence
 monitoring
- Copulas. *See* Student's *t*-copulas
 estimation, 278–279
 opinion pooling, 263–270
 overview, 277–279
- Corporate defaults, Poisson
 distribution, 8
- Coskewness, 257–258
 definition, 257n
- Country index, volatility, 153–154
- Covariance
 maximum likelihood, 98–99
 return matrix, calculation,
 172–173
 returns, 160
- Covariance matrix. *See* Asset
 returns; Maximum likelihood
 estimate; Proposal distribution
 combined-sample MLE, 115
 computation, 159–160
 determinant, 58
 estimation, 159–161
 knowledge, 31
 truncate MLE, 113–114
- Criterion function, value
 (computation), 198
- Cross-sectional regression, 165
 estimation, 287, 293
- CRRA. *See* Constant relative risk
 aversion
- Cumsum convergence monitoring,
 75
- Cumulative distribution function
 (CDF)
 computation, 227, 278
 inversion method, 228
 usage. *See* Inverse-fitted
 univariate CDFs
- Cumulative excess return,
 prediction, 178
- Cumulative risk-free return, 181
- Current assets/current liabilities
 ratio, 86

- Current assets/net sales ratio, 86
- CVaR. *See* Conditional value-at-risk
- Data-generating process, 130
value, estimation. *See* True data-generating process
- Data precision, 37
- Debt/equity ratios, 189n
- Decaying weights, usage, 160
- Decision theory, loss functions (usage), 30n
- Decomposition, usage, 186
- Default, probability
denotation, 82
predictors, usage, 86
- de Finetti, Bruno, 1n
- Degrees-of-freedom parameter, 26, 107–108. *See also* Student's *t*-distribution
calibration, 205
low value, 71
posterior results, 219
prior mean, setting, 211
- Density function, term (usage/assumption), 7n
- Dependent simulation, 63
- Dependent variables
Bernoulli distribution. *See* Binary dependent variable
observations, 44–45
prediction, 50–51
- Diffuse improper prior, 46–48
usage, 58–60
- Diffuse priors. *See* Noninformative priors
- Dirichlet distribution, 218n
kernel, logarithm, 220
- Dispersion parameter. *See* Scale parameter
- Distributional assumptions. *See* Capital Asset Pricing Model moments, relationship, 259
- Distributional return assumptions, 248–255
- Dividend yield (D/P), 163, 175
correlation, 176
- Earnings-to-price ratio (E/P), 163
- Efficiency, hypothesis, 174
- Efficient frontier, 94, 97. *See also* Mean-variance efficient frontier
certainty-equivalence setting, comparison, 107e
illustration, 98e
optimal portfolio, relationship, 105–106
- Efficient Market Hypothesis (EMH), 162
- Efficient Method of Moments (EMM), 196–198
estimation, selection, 198
- EGARCH. *See* Exponential GARCH
- Elliptical distributions, 254, 273
- EMH. *See* Efficient Market Hypothesis
- EMM. *See* Efficient Method of Moments
- Empirical Bayesian analysis, 28–30
- Endogenous regime-switching models, 214
- End-period portfolio value, utility, 96
- E/P. *See* Earnings-to-price ratio
- Equilibrium returns, 142–144
nonnormality, impact, 270–272
- Ergodic averages, standardization, 79–80
- Error, source, 130
- Errors-in-variables problem, 165
- Estimation error, capture, 93
- Estimation risk, 93
consideration, 99

- Euclidean norm, 147n
 Evolutionary algorithms, 262n
 Ex ante, reference, 121n
 Ex ante efficiency, 166n
 Excess returns, predictive
 distribution (derivation), 177
 Excess stock returns, potential
 predictors, 131n–132n
 Expected equilibrium risk
 premiums, 142–143
 Expected returns, 271
 Expected return-standard deviation
 pairs, 108
 Explanatory variables
 calculation, 83
 company-specific characteristics/macro-
 economic variables, 82–83
 Exponential distribution, mean, 205
 Exponential GARCH (EGARCH),
 189
 Extra market information, 119
 Extreme value distributions, 252
- Factors (factor portfolios), 119
 covariance matrix, estimates
 (obtaining), 285
 marginal contribution. *See* Total
 risk
 returns
 covariance matrix, 283
 prediction, 288
 sensitivities, estimation, 120–121
 Fama and French (FF) three-factor
 model, 118
 equivalence, 174
 inference, 134
 Federal Reserve Board, Regulation
 T, 169
 Filtered volatility estimate, 244
 Financial time series, variability,
 185
- Frequentist statistics, frequentist
 interpretation, 1
 Full conditional log-posterior
 distribution, expression,
 239
 Fundamental factor models, 282
 Future excess returns, predictive
 moments, 115–116
- Gamma
 conditional posterior
 distribution, 208–209
 distribution, 206
 multiplicative property. *See*
 Inverted gamma
 distribution
 function, 238
 Gaussian distribution, 9
 Gaussian linear state-space model,
 defining, 231n
 Gaussian stable distributions, 251n.
 See also Non-Gaussian stable
 distributions
- Generalized autoregressive
 heteroscedasticity (GARCH),
 160–161. *See also* Exponential
 GARCH
 component, presence, 216
 effect, 202
 GARCH(1,1) estimation, MH
 algorithm (usage), 208–211
 GARCH(1,1) model
 Bayesian estimation. *See* Simple
 GARCH(1,1) model
 estimation. *See* Markov
 switching (MS)
 GARCH(1,1) model
 illustration. *See* Student's *t*
 GARCH(1,1) model
 GARCH(1,1) process,
 properties/estimation,
 190–193

- models. *See* Markov
 regime-switching GARCH
 models; Volatility
 parameters, 192
 Student's *t*-distributed
 disturbances, 203
 SV models, distinguishing, 229
 process, changes, 215
 process persistence parameter,
 191
- Generalized error distribution
 (GED), 193
- Generalized hyperbolic distribution,
 250n
- Gibbs sampler, 67, 73–74, 203. *See*
also Griddy Gibbs sampler
 posterior summary, 79e
 usage, 261
 possibility. *See* Griddy Gibbs
 sampler
- Global Industry Classification
 Standard (GICS), usage,
 294n
- Global-minimum-variance
 portfolio, return, 109–110
- Greenspan, Alan, 4n
 uncertainty, comment, 2–3
- Griddy Gibbs sampler, 226–228
 usage, possibility, 210
- Half-life, 160
- Heavy-tailed multifactor model,
 estimation (illustration),
 294–297
- Heavy-tailed prior distributions,
 elicitation, 27
- Hessian computation, 70–71
- Hessian matrix. *See* Inverse Hessian
 matrix
- Heuristic (nonquantitative)
 allocation schemes, 141
- Hidden Markov process, 219
- High-confidence relative view,
 low-confidence relative view
 (effects, comparison),
 151–152
- Highest posterior density (HPD),
 32n
 intervals, 54n
- High minus low (HML), 134
- High-volatility state, 215–216
- Holding period, 154
- Hume, David, 1n
- Hyperparameters (prior
 parameters), 22–23
 values
 computation, 29
 selection, 25n
- IC. *See* Information coefficient
- Identity matrix, 122
- Importance sampling, 65–66
- Independent chain M-H algorithm,
 70–72
- Independent simulation, 63
- Independent variables,
 observations, 44–45
 matrices, 52
- Inefficiency, hypothesis, 174
- Inefficiency measures, 167n
 distribution, 170e
 illustration, 170–171
 usage. *See* Capital Asset Pricing
 Model
- Information coefficient (IC), 158
- Information ratio (IR), 158
- Informative prior, 48–50
 beliefs, introduction, 106
 elicitation, 23. *See also* Binomial
 probability; Location
 parameter; Scale parameter
- Interval bounds, determined, 32
- Intervals, credibility, 54
- Intrinsic time, 194n

- Inverse-fitted univariate CDFs,
usage, 279
- Inverse Hessian matrix, 86
evaluation. *See* Negative inverse
Hessian matrix
- Inverted gamma distribution
multiplicative property,
234–235
product, 235–236
- Inverted Wishart distribution,
41–42, 260
- Inverted χ^2 distribution, 39–40
parameters, 48–49
- Investment constraints, 156
efficiency, 169
- Investment (holding) restrictions,
167
- Investment horizon
relationship. *See* Predictability
return variance scales, 162
- Investor, risk-return trade-off, 146
- IR. *See* Information ratio
- Jacquier, Polson, and Rossi (JPR)
estimation results. *See* New York
Stock Exchange
sampling scheme, usage, 237
- James-Stein estimator, form, 108
- Jeffreys, Harold, 12n
- Jeffreys' prior, 26
usage, 58–59
- Joint density function, 7
- Joint hypothesis problem, 163
- Joint posterior density, 101
closed form, absence, 206
- Joint posterior view distribution,
267
- Joint predictive covariance,
137–138
matrix, 137
- Joint predictive distribution,
sampling/simulation, 136
- Joint predictive mean, 137
obtaining, 127
- JPR. *See* Jacquier, Polson, and Rossi
- Jump extension. *See* Simple SV
model
- Jump size, regulation, 69
- Kalman filter
algorithm, 244–246
integration. *See* Markov Chain
Monte Carlo
ease, 239–240
- Kalman filtering, 244–246
prediction stage, 245
updating stage, 245–246
- Kalman smoothing, 244
algorithm, 246
prediction stage, 245
updating stage, 245–246
- Kronecker product, direct
multiplication operator, 59n
- Kurtosis
increase, 186
value, 248–249
- Laplace approximation, 89–90
- Laplace method, 90
- Last-period return observation, 190
- Law of Large Numbers, 62
- Least-squares estimate, 209
denotation, 125
variance, 239
- Leverage effect, 189n
- Likelihood function, 6–10,
122–123. *See also* Normal
distribution likelihood
function; Poisson distribution
likelihood function
example, 9e
formula, 7
representation, 192
usage, 204. *See also* Stochastic
volatility models

- Lindley, Dennis, 1n
- Linear regression, semiconjugate
 prior (usage), 77–81
 illustration, 78–81
- Location parameter, 25n, 251, 254n
 informative prior elicitation,
 23–24
- Logistic regression, 82–90
 data, 87e
- Log-likelihood function, 207
 expression, 238
- Log-normal distribution
 kernel, 234
 multiplicative property, 234–235
 popularity, 234n
- Log-posterior
 approximation, 85
 distribution
 expression. *See* Full conditional
 log-posterior distribution
 proposal distribution,
 210–211
 writing, 207–208
- Log-volatility values, 233
- Long-run variance (unconditional
 variance), 187. *See also*
 Returns
- Long-short portfolio, 153
- Loss functions, usage. *See* Decision
 theory
- Lower partial moment (LPM), 273
- Low-order multivariate
 autoregressive structure, 288
- Low-volatility state, 215–216
- Macroeconomic factor models, 282
- Manager portfolio, squared active
 risk, 285
- Marginal contribution of factor k to
 total risk (MCFTR _{k}), 286
- Marginal contribution of stock i to
 total risk (MCTR _{i}), 286
- Marginal posterior distributions,
 density curves, 90
- Marginal posterior view
 distributions, 266
- Market
 calmness, 186
 capitalization positions, vector,
 143–144
 efficiency, 162
 equilibrium, investor views
 (combination), 146–147
 realizations, posterior
 distribution, 267–268
 views, combination, 266
- Market-implied information,
 264–265
- Market portfolio, 122
 market-capitalization weights,
 143
 risk, 165
- Market risk
 factor, 164–165
 risky asset, sensitivity, 132
- Markov chain
 construction, 74–75
 impact, 75
 simulation, burn-in fraction, 75
- Markov Chain Monte Carlo
 (MCMC)
 algorithm
 Kalman filter, integration,
 231n
 usage. *See* Stochastic volatility
 models
- approach, focus, 230
 computations, 292
 methodology, 216
 methods, 64, 66–81
 sampling algorithm, 240–241
 simulations, 62n
 algorithms, facilitation, 250
 toolbox, 200–201

- Markov process. *See* Hidden Markov process
- Markov property
analytic expression, 216
possession, 67n
- Markov regime-switching GARCH models, 214–225
preliminaries, 215–217
prior distributional assumptions, 217–218
- Markov switching (MS) GARCH(1,1) model
estimation, 218–222
parameters, sampling algorithm, 222
posterior regime probabilities, 225e
- Markov switching (MS) model, 214
three-regime switching setup, 220
- Markowitz, Harry, 1n
- Maximum likelihood. *See* Quasi-maximum likelihood method, 7
procedure, 240
- Maximum likelihood estimate (MLE), 7, 105
computation, 111–112
covariance matrix, 71
determination, 71
feed-through effect, 113
usage, 46n
- MCFTR_k. *See* Marginal contribution of factor *k* to total risk
- MCMC. *See* Markov Chain Monte Carlo
- MCSE. *See* Monte Carlo Standard Error
- MCTR_i. *See* Marginal contribution of stock *i* to total risk
- Mean, combined-sample MLE, 114–115
- Mean/covariance
diffuse/improper priors, usage, 102–103
proper priors, usage, 103–105
- Mean-reversion, 162
exhibition, 163
- Mean-variance analysis, 92
grounding, 94
- Mean-variance efficiency
Bayesian empirical tests, 166
tests, 164–166
- Mean-variance efficient frontier, 97–99
- Mean-variance frontier, 97
- Mean-variance optimal portfolio, portfolio constraints, 99–100
- Mean-variance optimization, concave utility function (assumption), 103n
- Mean-variance portfolio optimization, 280
- Mean vector, likelihood function, 102
- Median, measurement, 23n
- Methods of moments (MM), 196.
See also Efficient Method of Moments
- Metropolis-Hastings (M-H) algorithm, 67–68, 203. *See also* Block structure M-H algorithm; Independence chain M-H algorithm; Random walk M-H algorithm
posterior summary, 79e
usage. *See* Generalized autoregressive heteroscedasticity
- Meucci model, 264
illustration, 269–270
- MiniMax, 274
- Mixing variables, 206
posterior results, 219

- Mixture components, empirical determination, 240n
- MLE. *See* Maximum likelihood estimate
- MM. *See* Methods of moments
- Model risk
- sources, 130
 - treatment, 129n
- Model uncertainty, 129–134
- Modern Portfolio Theory (MPT), 92
- Moment-matching procedure, 240
- Moments, methods. *See* Methods of moments
- Momentum, 153
- Monte Carlo integration, 61–63
- approximation procedure, 62
 - usefulness, 63
- Monte Carlo simulation, 93
- Monte Carlo Standard Error (MCSE), 62–63
- MS. *See* Markov switching
- MSCI Canadian returns/squared return innovations, 211
- MSCI Canadian returns/VaR, 199e
- MSCI country indexes
- daily excess returns, 106
 - monthly returns, 100e
- MSCI European country indexes, excess returns, 99
- MSCI Germany, daily returns (sample mean impact), 108
- MSCI sample/equilibrium-implied information, 150e
- MSCI World Index, 153
- realized returns, 155e
 - realized volatilities, 155e
- Multifactor equity risk models, 280
- preliminaries, 281–282
- Multifactor models
- analysis, 114
 - Bayesian methods, 292–294
- Multimove algorithm setting, filtered/smooth volatility estimates, 242e
- Multi-move MCMC algorithm, usage. *See* Stochastic volatility models
- Multinomial distribution, parameters (conjugate prior distribution), 218n
- Multiplicative property. *See* Inverted gamma distribution; Log-normal distribution
- Multivariate ARMA, 288
- Multivariate asymmetric Student's *t*-distribution, 264
- Multivariate distributions, marginal distributions (form similarity), 265
- Multivariate linear regression model, 56–60
- estimation, 60
- Multivariate normal distribution, 40
- assumption, 57n, 101, 112
- Multivariate normal likelihood, 260
- Multivariate regression analysis, 125n
- Multivariate regression estimation, 57
- Multivariate skew-normal distribution, usage, 253
- Multivariate statistical distributions, definitions, 38–42
- Multivariate Student's *t*-distribution, 40–41, 181
- degrees of freedom, 103
 - parameter, 47
 - obtaining, 49–50
- Multivariate theory, application, 254

- Multivariate uniform distribution, 278
- Natural conjugate priors, 28n
scenario, posterior parameters, 30
- Negative exponential utility function, usage, 180
- Negative inverse Hessian matrix, evaluation, 86–87
- Net income/total assets ratio, 86
- New York Stock Exchange (NYSE) increasing-with-horizon allocation, 182–183
stocks, value-weighted index (JPR estimation), 236–237
- Next-period benchmark returns, 126
- Next-period excess return data, 101
- Next-period returns covariance, 112
predictive density, mean/covariance, 113
- Non-Gaussian distributions, assumptions. *See* Stocks
- Non-Gaussian stable distributions, 251n
- Noninformative diffuse prior, assertion, 52
- Noninformative prior distributions, 25–27
- Noninformative priors (vague priors // diffuse priors), 25
- Nonnormality. *See* Asset returns; Returns
presence, 193
- Normal approximation. *See* Posterior density
quality, visual evaluation, 87–88
- Normal distribution, mixture, 249–250
- Normal distribution, parameters likelihood function, 11e
contour plot, usage, 11e
writing, 179–180
- Normal distribution likelihood function, 9–10
- Normal likelihood, noninformative improper prior (combination), 36
- Normally distributed random variable, consideration, 234n
- Normal mean parameter. *See* Posterior trade-off
- Normals continuous mixtures, 249
location-scale mixture, 249
scale mixture, 249
- Normal variance, unbiased sample estimator, 31
- Notation, explanation, 3–4
- Null hypothesis, comparison, 33
- Objective information, 146
- Observation equation, 231n
- Off-diagonal elements, nonzero characteristic, 56
- OLS. *See* Ordinary least squares
- One-month T-Bill, return, 170–171
- One-period investment decisions, 120
- One-step-ahead realization, 35
- Optimal portfolio allocation, 148–152
positions, vector, 148–149
shrinkage, 110
weights, 100e
computation, 127
views, 152e
- Optimal weights, sensitivity, 109e
- Optimized momentum strategy realized returns, 155e
realized volatilities, 155e
- Ordinary least squares (OLS)

- estimates, 54
- estimator, 48
- method, usage, 46
- regressions, 111
- Over-underestimation error, 115
- Parallel chains convergence
 - monitoring, 75–77
- Parameter restrictions, 79n
- Parameter uncertainty,
 - incorporation, 106, 292
- Parameter vector
 - decomposition, 208
 - estimation, 197
 - posterior density function, 85
- p -dimension integration/integrals, 84
- Percentage contribution of stock i to total risk (PTCR _{i}), 286
- Percentage marginal contribution of stock i to total risk (PMCTR _{i}), 292
- Persistence measure, posterior draws (histograms), 212e
- Perturbed model, 121–122
- PFCF. *See* Stock price to free cash flow per share
- PMCTR _{i} . *See* Percentage marginal contribution of stock i to total risk
- Point prediction, 34–35
- Poisson distribution
 - function, 9e
 - usage, 8n
- Poisson distribution likelihood
 - function, 7–9
- Poisson process, 8n
- Portfolio
 - acceptable risk, 96
 - allocation, 141
 - Bayesian framework, 92
 - Bayesian setup, 112–113
 - construction, 98, 268
 - risk measures, usage, 273–275
 - expected return, LPM (ratio), 275
 - exposures, vector, 284
 - managers, views, 266
 - mean-variance efficiency, testing, 171
 - optimization, 112, 293. *See also* Mean-variance portfolio optimization
 - problem, 96
 - paradigm (Markowitz), 248
 - performance, 275
 - resampling, 93
 - risk, stock contribution, 291–292
 - skewness, 258
 - variance, measurement, 92
 - weights, 271
- Portfolio selection, 94–100
 - nonnormality, impact, 255–256
 - problem
 - formulations, 95–97
 - solution, 180–182
 - relationship. *See* Predictive distribution; Predictive moments
- Posterior density
 - approximations, 88e
 - curve, points (correspondence), 65
 - envelope, determination, 64
 - examples, 295e
 - logarithm, Taylor expansion, 84–85
 - normal approximation, 84–89
- Posterior distribution, 54. *See also* Benchmark parameters; Capital Asset Pricing Model
 - computation, 169
 - conditions, 124–126
 - usage, 19–21, 206

- Posterior inference, 30–34
 illustration, 53
 Posterior information, 22
 Posterior mean, 20
 Posterior model probabilities,
 posterior parameter
 distributions (relationship),
 132–133
 Posterior moments, 262
 Posterior odds (PO) ratio, 34
 Posterior optimal allocations, 270e
 Posterior probability, 2, 11
 computation, 33
 Posterior simulation, 293–294
 algorithms, 63–81
 categories, 63
 regime path, drawing, 221
 illustration, 78–79
 posterior distribution, impact,
 80e
 Posterior trade-off, normal mean
 parameter (example), 35–37
 Predictability, investment horizon
 (relationship), 182–183
 Predictive covariance, 126–127
 Predictive density, known (closed)
 form, 35n
 Predictive distribution
 numerical simulation, 135–138
 portfolio selection, relationship,
 126–127, 133–134
 sampling, 136–138
 writing, 135
 Predictive inference, 22
 example, 53
 usage, 74
 Predictive mean
 computation, 112
 weighted average, 104–105
 Predictive moments, portfolio
 selection (relationship), 262
 Price dynamics, 194n
 Price-to-earnings-to-growth ratio,
 282
 Pricing model validity,
 quantification, 121
 Prior beliefs, 118
 asset pricing models, relationship,
 119–129
 preliminaries, 119–120
 Prior densities, integration changes,
 26
 Prior distributions, 123–124,
 131–132
 informativeness, 104
 uninformativeness, 104
 usage, 205–206, 217–218
 Prior information, 22–30
 translation process, 23
 Prior optimal allocations, 270e
 Prior parameter elicitation,
 127–128
 Prior precision, 37
 Prior probability, 1, 11
 Probability
 objectification, 12n
 subjectivist interpretation, 1
 Probability density function,
 expression, 10
 Proportionality
 constant, 64
 symbol, usage, 3–4
 Proposal density, 67
 Proposal distribution, covariance
 matrix, 69
 $PTCR_i$. *See* Percentage contribution
 of stock i to total risk
 p -value, interpretation, 165
 Quadratic utility function, 95
 Quantitative Resources Group,
 model development, 119, 141
 Quasi-maximum likelihood (QML),
 196

- Ramsey, Frank, 1n
- Randomness, source, 16
- Random variable, 252. *See also*
Bernoulli-distributed random variable
transformation, 24n
unconditional (marginal) distribution, 19
- Random walk M-H algorithm, 68–70
simplicity, 69
- Recursive substitution, usage, 188
- References, 298–309
- Regime switching, 204
GARCH models. *See* Markov regime-switching GARCH models
models, 130, 232. *See also*
Endogenous regime-switching models
inclusion, 178
parameter, deterministic permanent switch (introduction possibility), 214n
- Regression coefficients
posterior results, 219
prior, assumption, 86–87
vector, prior mean, 124
- Regression disturbance, 43–44
- Regression parameter
normal prior, assumption, 205
vector, 73
- Rejection sampling, 64–65
algorithm, example, 65e
- Relative risk aversion, coefficient, 271
- Residual return, computation, 154
- Return dynamics equation, jump, 241–242
- Return-generating process, 111
- Return predictability, 162, 175–182
posterior inference, 177–180
predictive inference, 177–180
- Returns
autocorrelation, 191
covariance matrix, 147–148
distribution
default assumption, 192–193
stationarity, assumption, 178
empirical features, 248n
expressions, 204
facts, 188–189, 195
heavy-tailed characteristics, 247n
heavy-tailedness, 229–230
joint modeling, 254–255
approaches, dichotomy, 265n
long-run variance, 191
nonnormality, 195. *See also* Asset returns
normality
absence, 247
assumption, 271
prediction, relationship. *See* Volatility
predictive (co)skewness, 258
scenario, generation, 287–292, 294
stacking, 283
unequal histories, 110–116
volatility, 185–186
- Reverse optimization, 271
- Risk
analysis, multifactor equity model (usage), 283–286
decomposition, 285–286
error, 130
measures, 185n, 268
- Risk-aversion parameter, interpretation, 143–144
- Risk-free asset, allocation, 119
- RiskMetrics Group, 198n

- Risky asset
 allocation, increase, 128–129
 excess return, 121–122
 sensitivity. *See* Market risk
- Safety risk measures, 273
- Sampling. *See* Importance sampling;
 Rejection sampling
- Savage, Leonard, 1n
- Scaled Student's t -distribution, 27
- Scale matrix, 254n
- Scale parameter (dispersion
 parameter), 9–10, 26, 251
 informative prior elicitation,
 23–24
- Scenario-based setting, risk
 analysis, 288–289
- Scenario generation, 279
- Second-order Taylor expansion,
 application, 89–90
- Semiconjugate prior scenario, 77
- Semistandard deviation,
 measurement, 256n
- Semistrong efficiency, 163
- Sharpe ratio, 97, 255
- Short series, long series dependence,
 112
- Shrinkage estimators, 108–110
- Shrinkage intensity, 108
- Simple GARCH(1,1) model
 Bayesian estimation, 203–214
 forecasting power/inaccuracy,
 213
 parameters, posterior means,
 212e
- Simple SV model
 estimation, 195–198
 jump extension, 241–243
- Simulation-based methods,
 196
- Single-move algorithm, multimove
 algorithm (comparison), 238e
- Single-move MCMC algorithm,
 usage. *See* Stochastic volatility
 models
- Single-move sampler, 230
- Single-move SV model estimation,
 posterior results, 236e
- Size effect, 167
- Skewness. *See* Portfolio
 parameter, 251
- Skew-normal distributions,
 253–254, 259
 usage. *See* Multivariate
 skew-normal distribution
- Slice sampler, 261n
- Small-cap/small-BM portfolio,
 return (variability), 55
- Small minus big (SMB), 134
- Smoothed volatility estimate, 244
- Special purpose vehicle, 196–197
- Split-normal distributions, 70n
- Split-Student's t distribution, 70n
- Stability, index, 251
- Stable distributions, 251–252. *See*
also Gaussian stable
 distributions; Non-Gaussian
 stable distributions
 mixture-of-normals
 representation. *See*
 Symmetric stable distribution
- scenario, factor daily returns
 (posterior means), 296e
 usage. *See* Black-Litterman
 approach
- Standard deviation, 10
- STARR ratio, 275
- State equation, 231n
- State-space models
 Bayesian treatment, 230
 defining. *See* Gaussian linear
 state-space model
- State variable, 231n

- Stationarity, 190–191. *See also*
 Strict stationarity
 assumption. *See* Returns
 measure, 202
- Stationary volatility distribution,
 233n
- Statistical analysis, usage, 1
- Statistical factor models, 281–282
- Stochastic volatility (SV) filtered
 residuals, 200
- Stochastic volatility (SV) models,
 186, 202
 Bayesian estimation, 229
 estimation. *See* Simple SV model
 multi-move MCMC algorithm,
 usage, 237–241
 preliminaries, 230–232
 prior/posterior distributions,
 237–239
 likelihood function, usage,
 231–232
 prior/posterior distributions, 232
 selection, 200
 single-move MCMC algorithm,
 usage, 232–237
 usage, 194–198
- Stock excess return, 175
- Stock prices, irrational bubbles, 176
- Stock price to free cash flow per
 share (PFCF) ratio, example,
 13
- Stocks
 beta, estimation, 164–165
 daily returns, HLLM approach,
 263
 marginal contribution. *See* Total
 risk
 returns, non-Gaussian
 distributions (assumptions),
 292
- Stock-specific component, 290
- Stock-specific return, 281
 independence, 288
 prediction, 288
- Stock-specific risk component, 291
- Strict stationarity, 191n
- Structural parameters, vector,
 196–197
- Student's *t*-copulas, 279
- Student's *t*-distribution, 27n
 degrees-of-freedom parameter,
 227n
 heavy-tailed characteristic, 71n
 normals representation, mixture,
 206–208
 preference, 70
 quantile, degrees of freedom, 199
 representation, 207
 VaR _{α} , obtaining, 272n
- Student's *t* GARCH(1,1) model,
 illustration, 211–214
- Student's *t* MS GARCH(1,1) model
 illustration, 222–225
 parameters, posterior means,
 224e
 posterior parameter, 223–224
- Subjective expected returns vector,
 149–150
- Subjective information, 264–265
- Sufficient statistics, 29n
- SV. *See* Stochastic volatility
- Symmetric distribution, 24
- Symmetric stable distribution,
 mixture-of-normals
 representation, 252n
- Tail parameter, index, 251
- Taylor expansion. *See* Posterior
 density
 application. *See* Second-order
 Taylor expansion
 usage, 85n
- Taylor series, 84n
- Test statistic, realization, 33n

- Three-factor model. *See* Fama and French three-factor model
- Three-regime switching setup. *See* Markov switching model
- Time-invariant behavior, assumption, 288
- Time-varying behavior, assumption, 288
- Time-varying conditional volatility, 186
- Total risk
 factor, marginal contribution. *See* Marginal contribution of factor k to total risk
 stocks, marginal contribution. *See* Marginal contribution of stock i to total risk
- Tracking error, 156, 285
- Trade-by-trade consecutive price increases, 16–19
 probability, scenarios (consideration), 17–18
- True data-generating process, value (estimation), 197–198
- Truncated MLE, usage, 114
- Two-pass regression, 163
- Two-step forward prediction, usage, 233
- Unconditional distribution, 198
- Unconditional predictive distribution, 181n
- Unconditional variance. *See* Long-run variance
- Unequal variance, 51–53
- Univariate linear regression model, 43–56
 example, 53–56
- Univariate normal distribution, 39
- Univariate regression model, Bayesian estimation, 45–53
- Univariate statistical distributions, definitions, 38–42
- Univariate Student's t -distribution, 39
- Unobserved volatility
 block simulation, 239–240
 component-by-component simulation, 235
 conditional distribution, 233–234
 joint distribution, 238
 simulation, 234–236
- Utility, higher moments (usage), 258
- Utility functions, usage, 95n
- Utility maximization
 higher moments, usage, 256–263
 likelihood/prior assumption/posterior distributions, 259–262
- Vague priors. *See* Noninformative priors
- Value-at-risk (VaR), 274. *See also* Conditional value-at-risk definition, 289
 forecasting, 198–199
- Value-weighted NYSE index, 176–177
- VAR. *See* Vector autoregressive
- Variance. *See* Unequal variance computation, 159–160
 overestimation, 51
 weighted estimators, 160
- Vector autoregressive (VAR), 176
 setup, 183–184
- Vectorized OLS estimator, 59
- View matrix, 149–150
- Views-implied expected returns, 151e

- Views (view distributions),
265–266
combination. *See* Market
dependence structure, 267
- Volatility. *See* Asymmetric volatility
- clustering, 185–186, 195
usage, 188
- distribution. *See* Stationary
volatility distribution
- dynamics, expressions, 204
- estimation, 213e
methods, usage, 292
- forecasting, return prediction
(relationship), 243
- forecasts, 214e
- GARCH models, 187–193
- logarithm, dynamics
(assumption), 230–231
- models, 178
overview, 185
predictions, usage, 198–199
persistence, control, 194–195
preference, 256
process, variation (squared
coefficient), 236–237
updating expression, 187
variability, source, 229–230
- Weak efficiency, 163
- Weighting matrix, 198
- Wishart distribution, 41. *See*
also Inverted Wishart
distribution
- Within-model parameter
uncertainty, 14
- Within-model uncertainty,
130–131
- Within-sequence variation,
estimation, 76
- Zero-investment view portfolios,
means, 144
- Zero-mean random variable,
distribution, 69





