Page numbers followed by f and t refer to figures and tables, respectively.

<table>
<thead>
<tr>
<th>Term</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute illiquidity</td>
<td>211</td>
</tr>
<tr>
<td>partial illiquidity, contrast</td>
<td>108</td>
</tr>
<tr>
<td>Absolute performance potential outcomes</td>
<td>81t</td>
</tr>
<tr>
<td>Absorption ratio</td>
<td>211</td>
</tr>
<tr>
<td>After-cost improvement</td>
<td>6</td>
</tr>
<tr>
<td>Aggressive efficient portfolios</td>
<td>21t</td>
</tr>
<tr>
<td>Alpha</td>
<td>213</td>
</tr>
<tr>
<td>Annual skewness</td>
<td>70f</td>
</tr>
<tr>
<td>Appraisal-based valuations</td>
<td>118</td>
</tr>
<tr>
<td>Arithmetic average returns</td>
<td>193–194, 211</td>
</tr>
<tr>
<td>Asset allocation</td>
<td>46–47, 211</td>
</tr>
<tr>
<td>case study</td>
<td>108–118</td>
</tr>
<tr>
<td>conditions</td>
<td>12–13</td>
</tr>
<tr>
<td>considerations</td>
<td>107–108</td>
</tr>
<tr>
<td>correlations</td>
<td>94f</td>
</tr>
<tr>
<td>dimensionality, problem</td>
<td>75–77, 76t</td>
</tr>
<tr>
<td>fallacy/impact</td>
<td>27</td>
</tr>
<tr>
<td>foundation</td>
<td>9–11</td>
</tr>
<tr>
<td>full-scale optimization</td>
<td>73–75</td>
</tr>
<tr>
<td>fundamentals</td>
<td>9, 185–186</td>
</tr>
<tr>
<td>implementation</td>
<td>12–23</td>
</tr>
<tr>
<td>importance</td>
<td>27, 31, 186</td>
</tr>
<tr>
<td>policy return, defining</td>
<td>27–28</td>
</tr>
<tr>
<td>relative importance, analytic determination</td>
<td>31–33</td>
</tr>
<tr>
<td>tactical asset allocation</td>
<td>105, 111</td>
</tr>
<tr>
<td>Asset class</td>
<td>13, 212</td>
</tr>
<tr>
<td>beta, calculation</td>
<td>14</td>
</tr>
<tr>
<td>characteristics</td>
<td>57–58</td>
</tr>
<tr>
<td>components</td>
<td>4–5</td>
</tr>
<tr>
<td>conditional asset class performance</td>
<td>177t</td>
</tr>
<tr>
<td>correlations</td>
<td>46t</td>
</tr>
<tr>
<td>cost-effective access</td>
<td>6–7</td>
</tr>
<tr>
<td>covariances, estimation</td>
<td>153</td>
</tr>
<tr>
<td>defining, 3, 185</td>
<td></td>
</tr>
<tr>
<td>errors, empirical analysis</td>
<td>138–139</td>
</tr>
<tr>
<td>expected returns</td>
<td>5, 46t, 47t</td>
</tr>
<tr>
<td>expected utility</td>
<td>5–6</td>
</tr>
<tr>
<td>factor diversification, equivalence</td>
<td>55–56</td>
</tr>
<tr>
<td>frontiers</td>
<td>56f</td>
</tr>
<tr>
<td>geometric returns, average</td>
<td>13–14</td>
</tr>
<tr>
<td>grouping</td>
<td>128</td>
</tr>
<tr>
<td>multivariate mixture</td>
<td>141</td>
</tr>
<tr>
<td>optimization</td>
<td>44</td>
</tr>
<tr>
<td>potential classes</td>
<td>7–8</td>
</tr>
<tr>
<td>quarterly returns, constructions</td>
<td>96–97</td>
</tr>
<tr>
<td>risk, 9–11, 139t</td>
<td></td>
</tr>
<tr>
<td>risk properties</td>
<td>5</td>
</tr>
<tr>
<td>selection skill</td>
<td>6</td>
</tr>
<tr>
<td>semi-standard deviations</td>
<td>153t</td>
</tr>
<tr>
<td>standard deviation</td>
<td>46t</td>
</tr>
<tr>
<td>transaction costs</td>
<td>165t</td>
</tr>
<tr>
<td>unstable correlation, multivariate mixture</td>
<td>142f</td>
</tr>
<tr>
<td>weights, 47t</td>
<td></td>
</tr>
<tr>
<td>Assets</td>
<td></td>
</tr>
<tr>
<td>combination</td>
<td>54</td>
</tr>
<tr>
<td>expected returns</td>
<td>94f</td>
</tr>
<tr>
<td>mean-variance analysis</td>
<td>207–208</td>
</tr>
<tr>
<td>nonlinear asset dependencies</td>
<td>71</td>
</tr>
<tr>
<td>risk, exposure</td>
<td>37</td>
</tr>
<tr>
<td>risky assets, conditional annualized returns</td>
<td>124t</td>
</tr>
<tr>
<td>standard deviations</td>
<td>94f</td>
</tr>
<tr>
<td>valuation</td>
<td>108</td>
</tr>
<tr>
<td>Asset-specific tail distributions</td>
<td>69–71</td>
</tr>
<tr>
<td>Asymmetric preferences</td>
<td>190–191</td>
</tr>
<tr>
<td>At-the-money option, price</td>
<td>96</td>
</tr>
<tr>
<td>Autoregressive model</td>
<td>212</td>
</tr>
<tr>
<td>Backfill function</td>
<td>198</td>
</tr>
<tr>
<td>Backtest performance</td>
<td>179t</td>
</tr>
<tr>
<td>Bands, statistical significance</td>
<td>70f</td>
</tr>
<tr>
<td>Basket option</td>
<td>100, 189, 212</td>
</tr>
<tr>
<td>Baum-Welch algorithm</td>
<td>175, 180–181, 212</td>
</tr>
<tr>
<td>Bayesian shrinkage</td>
<td>52, 129–130, 212</td>
</tr>
</tbody>
</table>
Bayes theorem, 129, 212
Bayes, Thomas, 129
Beebower, Gilbert, 27, 29
Bernoulli, Daniel, 37–38
Beta, 14, 44, 160, 212
regression beta, 63, 88
Black Monday stock market crash (1987), 171
Blended covariance, 212–213
solution, 173
Bonds, optimal allocation, 18t
Bootstrap simulation, 33
Bootstrap simulation, 186, 209, 213
Borrowing costs, 155t
Brexit vote, 86–87
Brinson, Gary, 27, 29
Calendar-based rebalancing, 164
policies, 160
Calendar-based rules, incurring, 164–165
Call option, 41, 213
Capital Asset Pricing Model (CAPM), 63–64, 149, 213
Capital call, 213
Capitalization-weighted market portfolio, 62
Capital market line, 148–149, 213
Cash demands, 106–107, 113–118
Central Limit Theorem, 201, 213
Certainty equivalents, 206–207, 213
Chi-squared distribution, 213
Comovement, aspects, 195
Composite instability, 138–139
Compounding, effects, 193
Concave utility function, 143, 214
Concentrated portfolios, realized
return/standard deviation (recording), 154
Concentration, 214
Concentration, leverage (contrast), 148, 151t
borrowing costs, usage, 155t
estimation error, usage, 154t, 155t
kinked utility/nonellipticality, usage, 155t
nonelliptical returns/kinked utility, usage, 152t
summary results, 156f
Conditional asset class performance, 177t
Conservative efficient portfolios, 21t
Consolidation, impact, 187
Constant absolute risk aversion, 37, 40, 72, 204, 214
Constant relative risk aversion, 37, 40, 72, 214
Constraints, 80, 188–189, 214
Consumption habits, impact, 37
Contingent option, 100, 214
Continuous probability distribution, 201, 214
Continuous returns, 122, 192–193, 214
Corner solutions, 130
Correlations, 33t, 195, 214
country ranking, 44t
cross-correlation, 215
estimation, 15
elements, 109t, 112t, 116t
ranking, 15t
Country allocation, 44–46
Country expected returns
mismatch, 45t
ranking, 44t
Country weights
optimum, distortion, 45t
problems, loss exposure, 45t
Covariance, 131–132, 196, 214–215
blended covariance, 212–213
equation, 133
invertibility, 196–197
matrix, 55, 173, 196, 215
structure, 140
Cross-correlation, 215
Cross-hedging, 91, 189, 215
solutions, Australian dollar (usage), 93
Cumulative cash demands, 113
Cumulative probability distribution, 215
Cumulative returns, 179f, 215
Currencies
correlations, 94f
currency forward contract, 88, 215
currency-specific hedging, 90–91, 189
expected returns, 94f
exposure, 89–90
portfolio value percentage, 92f
impact, 86
portfolio currency returns (distribution), 98f
hedging strategies (impact), 98f
standard deviations, 94f
volatility, 88–89
Currency risk, 86, 189
hedging, reason, 86–87
Currency-specific hedge positions, 93
Data-driven estimates, 130–131
Data mining, 215
Density, 68, 200–201, 215
De-smoothing adjustment, 115, 119
Dimensionality, 75–77, 76t, 215
Discrete distributions, 200
Discrete probability distribution, 215
Discrete returns, 192–193, 216
Distributions
   central moments, 201–202
   elliptical distributions, 68–71, 202–203, 216–217
   fat-tailed distribution, 219
   leptokurtic distribution, 222
   lognormal distribution, 202, 222
   mixture, 142t
   multivariate distribution, 225
   normal distribution, 201, 225
   platykurtic distribution, 225–226
   probability distributions, 200–201, 227
   stability-adjusted return distribution, construction, 140–142, 143t
   symmetric distribution, 230
Diversification. See Time argument, 87
   factors, impact, 54
Domestic equities, behavior, 4
Dynamic programming, 159–163, 216

e (natural logarithm base), 216
Economic indicators, 174
Economics
   behavioral bias. See Positive economics, intuition, 100–101
   Economic variable, out-of-sample behavior (uncertainty), 4
Efficient frontier, 11, 20f, 216
   borrowing/lending, inclusion, 149f
   derivation, 55
   mean-tracking error efficient frontier, 224
   mean-variance efficient frontier, 82–84
Efficient portfolios, 15, 21t, 216
Efficient surface, 83f, 218. See also
   Mean-variance efficient surface
Eigenvalue, 197, 216
Eigenvector, 197, 216
Elliptical assets, 208
Emerging market equities, returns, 135f, 136f
Empirical analysis, 143–146
End-of-horizon exposure, 121–123
End-of-horizon loss probability, 123, 217
End-of-horizon value at risk, 217
Equally weighted portfolios, comparison, 60
Equilibrium return, 14–15, 217
Error maximization, 43, 186–187, 217
   analytical argument, 48–52
   argument, intuition, 43–44
   empirical argument, 44–47
Error optimization, mean-variance-tracking error optimization, 81–85, 224
Errors, ignoring, 146f
Estimation error, 128, 150, 190, 217
   approaches, 129–131
   Bayesian shrinkage, 129–130
   components, 132f
   empirical analysis, 143–146
   resampling, 130
   robust optimization, 130–131
   types, 131–132
   usage, 153, 154t, 155t
Euclidean distance, 125, 217
Eventual acceptance property, 218
E-V maxim, 9, 217
Expected log-wealth utility, usage, 160t
Expected return, 9, 218
   assumptions, 19
   changes, 51t, 52t
   estimation, 13–15
   examples, 109t, 112t, 116t
   measurement, efficient frontier (usage), 55
   ranking, 14t
   shadow allocations, risk, 105–107
   shadow asset/liability, 114t
   spread, 46–47
Expected utility, 5–6, 39t, 75f, 75t, 206, 218
   maximization, 37, 208, 218
   time, relationship, 37–40
Expected wealth, example, 39t
Exponential function, 193, 207, 218
Externally heterogeneous (measure), 5
   128, 218
Externally homogeneous asset, 5
Factors, 54, 187, 218
   defining, 54–55
   diversification, asset class (equivalence), 55–56
   exposure, 218
   factor-mimicking portfolio, 55, 137, 219
   fundamental factor, 55
   statistical factor, 55
   term, usage, 54–55
Fair-value pricing, 218  
  downward bias, adjustment, 111  
Fat-tailed distribution, 219  
50/50 portfolio, 160  
Financial turbulence, 170–171, 171f, 219  
First passage time probability, 190, 219  
Fixed-income portfolio, example, 88–89  
Foreign asset contingent option, 100  
Foreign equity returns, 71f  
45/55 percent stock/bond portfolio,  
  expected utility, 75t  
Forwards, usage, 99t  
Full-sample exposure, regime-dependent  
  exposure (contrast), 126–127  
Full-sample optimal portfolios, 173t  
Full-sample values, 153  
Full-scale allocations/characteristics, 78t  
Full-scale optimal hedging results,  
  forwards/options (usage), 99t  
Full-scale optimization, 73–78, 97–98,  
  144t, 188, 219  
Fully hedged portfolio, standard deviation  
  (low level), 93  
Fundamental factor, 55, 219  
Future wealth, dependence, 37  

Gaussian distribution, 201  
Genetic search, 76, 219  
Geometric average returns, 193–194,  
  219–220  
Global financial crisis (2008), 171  

Hardy, G.H., 121  
Hedged portfolio, variance, 88  
Hedge funds, focus, 7–8  
Hedge ratios, 89–90  
Hedging  
  cross-hedging, 93, 215  
  currency-specific hedge positions, 93  
  extension, reason, 87–90  
  full-scale optimal hedging results,  
    forwards/options (usage), 99t  
  linear hedging strategies, 90–96, 91t  
  minimum-regret hedge ratio, 224  
  minimum-variance hedge ratio, 91f, 224  
  nonlinear hedging strategies, 96–100,  
    225  
  overhedging, 225  
  performance, individual quarterly put  
    options (inclusion), 97t  
  reason, 86–87  
  risk-minimizing hedging policy,  
    identification, 93, 96  
  risk-minimizing hedging ratios, 95t  
  strategies, impact, 98f  
Hidden Markov Model, 175–176, 220  
  effectiveness, 191  
  fit, 177t  
  regime probabilities, 177f  
  regime probability forecasts, 178f  
Higher moment, 202, 220  
High-frequency statistics, mapping,  
  198–199  
Hood, Randolph, 27, 29  
Horizons, impact, 36  

Identity matrix, 196, 220  
Illiquid assets, optimal exposure, 118  
Illiquidity, 103–105, 189, 220  
  case study, 108–118  
  cash demands, 113–118  
  considerations, 107–108  
  contrast, 108  
  optimal allocations, real estate  
    (inclusions/exclusions), 110t  
  partial illiquidity, 225  
  rebalancing, 113  
  shadow assets/liabilities, 103–105  
Imaginary world, 28–30  
Independent and identically distributed (IID),  
  198–199, 220  
  continuous returns, 199  
Independent-sample error (ISE), 58,  
  134–135, 150, 190, 220  
Individual quarterly put options, usage, 97t  
Industry, instability, 58t  
Information, reliability, 57  
Initial investment, multiple, 22t  
Input errors, hypersensitivity, 43  
Integral, term (usage), 200–201, 220  
Intermediate-term bonds, redundancy, 5  
Internally homogeneous (measure), 4, 128,  
  220  
Internally homogeneous asset, 4  
Interval error, 58, 135–137, 150, 220–221  
Inverse covariance matrix, scalar multiple,  
  50–51  
Inverse gamma distribution, 221  
Inverse matrix, 18, 221  
Invertible matrix, 221  
Investable asset, 4
Investment constraints, 56
horizon, 86, 126, 139
returns, independence, 37
Investors performance, differences, 28–29
risk aversion, 37
Iso-expected return curve, 84–85, 84f, 221
Jarque-Bera test, 70, 221
Kinked utility function, 72, 73f, 205f, 221
usage, 152t, 155t
Kurtosis, 13, 69t, 70t, 202, 221
calculation, 69–71
Lagrange multiplier, 16–17, 222
Lambda, 16
Law of large numbers, 36, 222
Leptokurtic distribution, 202, 222
Leverage, 222
practice, 150–156
theoretical use, 148–150
Leverage/concentration, contrast, 148, 151t, 190–191
borrowing costs, usage, 155t
estimation error, usage, 154t, 155t
kinked utility/nonellipticality, usage, 155t
nonelliptical returns/kinked utility, usage, 152t
summary results, 156f
Levered portfolios construction, 153
realized return/standard deviation, recording, 154
Linear hedging strategies, 90–96, 91t, 222
Liquid assets, subset, 114
Liquidations, impact, 107
Liquidity, 103
defensive use, 113
impact, 118
optimal allocation, 117t
usage, 118, 189
Logarithm, 222
natural logarithm, 225
Logarithmic returns, 122
Lognormal distribution, 202, 222
Log-wealth utility function, 38f, 222
Longer-interval returns, standard deviation, 136
Long-interval correlations, dependence, 137
Long investment horizon, 86
Long-only portfolios, 76
Lookback window, 177–178
Loss end-of-horizon exposure, 121–123
end-of-horizon loss probability, 217
exposure, 22t, 45t, 47t
full-sample exposure, regime-dependent exposure (contrast), 126–127
probability, 36–37, 37t, 121–122, 126t, 203
within-horizon exposure, 123
within-horizon loss probability, 41t, 231–232
Low-frequency statistics, high-frequency statistics (mapping), 198–199
Macroefficiency, 222
Mahalanobis distance, 124, 190, 223
Mapping error (ME), 137–138, 223
Marginal utility, 223
measurement, 19
Market portfolio, 14, 62, 223
Markowitz, Harry, 9, 148
E-V maxim, 11
portfolio theory, application, 12
Markowitz-Van Dijk (MvD) heuristic, 159, 163–166, 223
Matrix algebra, 223
rules, 49
Matrix inversion, 15–18
Matrix transpose, 200, 223
Maximum Likelihood Estimation (MLE), 175, 198, 223
Mean return, 9, 128, 131, 150, 223
Mean reversion, 77, 223–224
Mean-tracking error (MTE) efficient frontier, 83, 224
Mean-variance (MV) allocations/characteristics, 78t
aversion, 223
Mean-variance (MV) analysis, 12, 63, 207–208, 224
conditions, 67, 188
constraints, 115
equivalence, 208
investor requirement, 43
results, 144
Mean-variance (MV) analysis (Continued)
robustness, 67
tractability, 75–76
usage, 151–152
Mean-variance (MV) approach, 145t
Mean-variance (MV) efficient frontier, 82–84
Mean-variance-tracking error, 189
optimization, 81–85, 224
Metrics, usage, 143
Microefficiency, 224
Minimax optimization, 131
Minimum-regret hedge ratio, 89–90, 224
Minimum-variance hedge ratio, 89f, 90, 224
Moderate efficient portfolios, 21t
Modified covariance, equation, 133
Moments, 201–202, 224
Momentum portfolios, instability, 58t
Monte Carlo simulation, 33, 208–209, 224
application, 106
usage, 140, 164
MSCI U.K. Index, 87
Multi-period optimization, 159
Multivariate distribution, 225
Multivariate normal distribution, 209
MvD rebalancing, 164
Natural logarithm, 192, 225
NCREIF Property Index, usage, 108, 110
Noise, 225
reduction, 54, 57–59
Non-ellipticality, usage, 155t
Nonelliptical returns, usage, 152t, 190–191
Nonlinear asset dependencies, 71
Nonlinear hedging strategies, 96–100, 189, 225
Nonparametric procedure, 225
Nonzero autocorrelations/lagged cross-correlations, 190
Normal distribution, 201, 225
Normalization factor, equation, 133
Normative, term (usage), 30, 225

1/N approach, 60, 187, 211
case, 60–61
problems, 62–63
1/N heuristic, 63
Opportunity set (defining), assets (usage), 55

Optimal allocations

determination, 142–143
real estate inclusions/exclusions, 110t
Optimal asset class weights, distortion, 47t
Optimal country weights, distortion, 45t
Optimal portfolio, 11, 21–23, 225
variance, 49
Optimization
arguments, 128
defense, empirical evidence, 61–62
failure, occurrence, 61
full-scale optimization, 73–75, 77–78, 144t
process, 43
constraints, 81–82
robust optimization, 130–131, 228
stability-adjusted optimization, 131–139
stability adjustment improvement, 146f
Optimized portfolios, comparison, 60
Options, usage, 99t
Out-of-sample tests, 62
Out-of-the-money put option, payout, 68–69
Overhedging, 91, 189, 225
Overlay, 104, 225
Partial illiquidity, 225
absolute illiquidity, contrast, 108
Performance
absolute performance potential outcomes, 81t
hedging performance, individual quarterly put options (inclusion), 97t
relative performance potential outcomes, 81t
Performance fees, 107, 112t, 118
adjustment, 119
dampening effect, 119
optimal allocations, 117t
Period-specific average returns, 155
Platykurtic distribution, 202, 225–226
Playing defense/offense, 104–105, 226
Policy portfolio, 226
Portfolio optimization
input error hypersensitivity, 43
variance, 49
Portfolio performance
determinants, 27–30
hypothesis, 28–30
methodology, flaw, 28
Index

Portfolios, 199–200
  comparison, 60
  concentrated portfolio, construction, 153
  constraints, 80–81
  construction, conditional risk estimates (inclusion), 171–173
  currency returns (distribution), hedging strategies (impact), 98f
  diversification, 21, 170
  currency introduction, 86
  expected utility, improvement, 111
  factor-mimicking portfolio, 219
  45/55 percent stock/bond portfolio, expected utility, 75t
  full-sample optimal portfolios, 173t
  market portfolio, 223
  misallocation, 45–46
  optimal portfolio, 11, 21–23, 225
  policy portfolio, 226
  rebalancing, 105–106
  rebalancing approaches, performance evaluation, 164
  regime-conditioned optimal portfolios, 173t
  risk, 16–17
  standard deviation, sensitivity, 51, 52t
  tangency portfolio, 230
  theory, 9–11, 149–150, 226
  value, currency exposure percentage, 92f
  variance, 10, 49
  weighted average, 48–49

Positive economics, behavioral bias, 30–34
  Positive-semi-definite, 197, 226
  Positive, term (usage), 226
  Posterior probability, 129
  Power utility function, 67, 71, 204, 226
  Predictive signal, identification, 174
  Preference free, 41, 226
  Price-to-book value ratio, 58
  Principal Component Analysis (PCA), 56, 197, 226
  Principal components, 56t, 57t
  Prior-period values, 108
  Private equity funds, active management, 6
  Probability density function (PDF), 200, 226–227
  Probability distributions, 200–201, 227
    continuous probability distribution, 214
    cumulative probability distribution, 215
    discrete probability distribution, 215
  Put option, 41, 68, 227

Quadratic function, 67, 227
  Quadratic utility, departures, 71–73
  Random variable, 140, 227
  Random walk, 37, 227
  Real estate investment trusts (REITs), 62
  Real estate, optimal allocation (allocations inclusion/exclusion), 117f
  Realized return, recording, 154
  Rebalancing, 106, 113, 160–159, 191
    absence, 164
    strategies, performance, 165t, 166t
  Regime
    detection, 175–176
    hidden Markov Model regime probabilities, 177f
    hidden Markov Model regime probability forecasts, 178f
    nonturbulent regimes, risk characteristics, 172t
    persistence, 176
    regime-conditioned optimal portfolios, 173t
    regime-dependent exposure, full-sample exposure (contrast), 126–127
    regime-sensitive allocation, 169–173
    risk regimes, 124–127, 227–228
    shifts, 168, 191
    turbulent/nonturbulent regimes, risk characteristics, 172t
    turbulent regimes, risk characteristics, 172t
  Regression analysis, 55, 58, 227
  Regression beta, 63, 88
  Relative importance, determination, 31–33
  Relative performance potential outcomes, 81t
  Relative volatility, 33t
  Resampling, 130
  Return intervals, increase
    kurtosis, excess, impact, 69t
    skewness, usage, 69t
  Returns
    arithmetic average returns, 192–193
    continuous returns, 192–193
    cumulative returns, 179f, 215
    curve, iso-expected return curve, 84–85, 84f
    data, partition, 153
    discrete returns, 192–193, 216
    distribution, 160t, 227
### INDEX

**Returns (Continued)**
- equilibrium return, 217
- estimates, 60
- excess return, 218
- expected return, 9, 218
- geometric average returns, 192–193, 219–220
- predictability, 169
- scatter plot, 125f
- stability-adjusted return distribution, 140–142, 141t, 230
- U.S./foreign equity returns, 71f

**Risk**, 9–11, 121, 189–190
- constant absolute/relative risk aversion, 214
- currency risk, 86
- diversification, time (usage), 36
- instability, 139t
- predictability, 169
- prediction, 169
- regimes, 124–127, 227–228
- risk-equivalent bias, 154
- risk-free investment, 148–149
- risk-free return, 228
- risk-minimizing currency positions, 93–94
- risk-minimizing hedging policy, identification, 93, 96
- risk-minimizing hedging ratios, 95t
- within-horizon risk, 40–41

**Risk aversion**, 37, 63, 227
- coefficient, 227

**Riskless arbitrage**, 41, 228

**Risky assets**, conditional annualized returns, 124t

**Robust optimization**, 130–131, 228

**Root-mean-squared error**, 58, 132, 228

**Russian debt default (1998)**, 171

**Sample error**
- independent-sample error, 134–135
- small-sample error, 132–134

**Sample statistic**, 195, 228

**Samuelson, Paul A.**, 169
- bet, 36
- dictum, 34, 228
- rationale, 39

**Securities**
- asset class grouping, 128
- returns, comovement (quantification), 10

**Security**
- attribute, 55, 228
- selection, 228

**Semi-standard deviations**, 152–153, 153t, 229

**Separation theorem**, 148, 150, 229

**70/30 portfolio**, 160, 162

**70/30 stock/bond portfolio**, 161–162

**75/35 portfolio**, 162

**75 percent stock portfolio, expected utility**, 74t

**Shadow allocations**, 105–107, 189

**Shadow assets**, 103–105, 116t, 229
- allocation constraint, 115
- expected return/standard deviation, 114t
- Shadow liabilities, 103–106, 116t
- allocation constraint, 115
- expected return/standard deviation, 114t

**Sharpe algorithm**, 18–21

**Sharpe ratio**, 61–62, 229

**Sharpe, William**, 18

**Simulation**
- techniques, 208–209
- usage, 33–34

**60/40 portfolio**
- return distribution/expected log-wealth utility, usage, 160t
- shift, 162

**65/35 portfolio**, 162

**Skewness**, 68–69, 229
- annual skewness, 70f
- usage, 69

**Small-sample error**, 58, 132–134, 150, 190, 229
- equation, 133

**Smoothed probabilities**, 181

**Smoothing**
- de-smoothing adjustment, 119
- valuation smoothing, 116, 117t

**Sortino ratio**, 151–152, 229

**S-shaped utility curve**, 205

**S-shaped utility function**, 72–73, 73f, 206f, 230

**Stability-adjusted optimization**, 52, 129–139, 143, 180, 190, 230

**Stability-adjusted portfolios**, 145

**Stability-adjusted return distribution**, 140–142, 141t, 230

**Stability-adjusted return sample**, 143, 146

**Stability optimization**, mean-variance approach, 145t

**Stable aggregation**, 3–4

**Standard deviations**, 33t, 194–195, 230
- assumptions, 19
- country ranking, 44t
estimation, 15
examples, 109t, 112t, 116t
function, 80–81
low level, 93
portfolio standard deviation, sensitivity, 52t
ranking, 15t
scales, 153
shadow asset/liability, 114t
Standard normal variable, 230
Statistical factor, 55, 174
Stocks
allocation, expected utility, 75f
optimal allocation, 18t
portfolio (75 percent), expected utility, 74t
Suboptimality costs, 160–161, 161f, 164
Subsample
pairs, 134
testing, 154
Swiss franc, safe-haven currency, 100–101
Symmetric distribution, 12, 68, 230
Systematic risk, 63

Tactical asset allocation, 105, 111,
174–179, 230
investor engagement, 105
out of sample test, 176–179
Tangency portfolio, 148, 230
Taylor series, 67, 230–231
approximations, usage, 188
Time, 36–37, 37t

diversification, 36, 186, 231
preference-free contradiction, 41
expected utility, relationship, 37–40
horizon, adjustment, 199
square root, calculation, 153
Tolerance band rebalancing, 164
Total covariance error, 138
Total portfolio contingent option, 100
Tracking error, 82, 231
aversion, 231
Trading costs, 161f
Transaction costs (TC), 115, 116–164
Transitioning, 181
Turbulence
equation, 124
turbulence-conditioned covariance matrix, 173
Universal hedge ratio, 89–90, 231
Upside deviations, downside deviations
(distinction), 77–78
Upside returns, investor preference, 99–100
U.S. equities
monthly correlation, 170f
returns, 71f
U.S. market equities
five-year returns, 136f
monthly returns, 135f
U.S. Treasury bonds, monthly correlation, 170f
Utility function (U), 204, 231
alternatives, 204–205
concave utility function, 214
kinked utility function, 72, 73f, 205f, 221
log-wealth utility function, 38f, 222
power utility function, 226
S-shaped utility function, 72–73, 73f, 206f, 230
Utility theory, 204, 231
Valuation smoothing, 116t
optimal allocations, 117t
Value at Risk (VaR), 122–123, 126t, 203
day-of-horizon value at risk, 217
measurement, 22
within-horizon value at risk, 123
Variance, 231
square root, usage, 9
Volatility, 36–37, 37t, 169

Wealth
dependence, 37
distribution, 22t
utility, 72
Weights
sensitivity, 51t
vectors, 76–77
Within-horizon losses, 121
probability, 41t, 231–232
Within-horizon probability, 123
Within-horizon risk, 40–41
Within-horizon value at risk, 123
Work effort, impact, 37
Wrong and alone, term (usage), 232