## Index

Absolute risk aversion (ARA), 10 Acceptance, 21 Active acceptance, 21 Advanced approach, 488 Advanced IRR hedging, 494 duration vectors, 496-499 hedging with fixed income derivatives, 499-502 M-absolute and M-squared models, 494-496 Advanced Measurement Approaches (AMAs), 360, 366 Adverse selection, 37 Aggregation, 18 Alternative risk transfer (ART), 507, 514 insurance derivatives, 519-522 market, 514-516 primary contracts, 516-519 Alternative standardized approach, 366 Altman z score model, 260-262 Analytic approximations, 201-203 Annualized variance, 380 Anti-money laundering (AML), 531 Arbitrage, 23-25, 130 trading, 131 Arbitrage pricing theory (ATP), 62 Arbitrageurs, 130-131 Arithmetic returns, 175 Arrow-Pratt coefficient, 10 Arrow-Pratt relative risk aversion coefficient, 324 Assessments, 351 Asset-backed securities (ABS), 462 Assets, 14, 341 return volatility, 375 swaps, 450-454 Asymptotic normality, 71 Autocorrelation of financial returns, 89-93 Autoregressive conditional heteroscedasticity model (ARCH model), 85-89 Autoregressive model, 86 Available amount of stable funding (ASF), 328 Average rate of trading, 315 Backtesting, 112, 203-206, 406-408 Bands, 238

Bank for International Settlement (BIS), 286 Bank of America, 144 Bank risk, 550–552 Banking sector, 550 areas of future improvements, 556-558 bank risk and business models, 550-552 risk management systems, 552-556 Banks, 173, 251 Basel Accord, 113 Basel Committee, 329-330, 444 Basel II Accord, 195 Basel II Approach, 362-367 Basel III framework, 330 Basic indicator approach (BIA), 364 Basis point value method (BPV method), 239 Basis risk, 237 Bayesian probability models, 114 BEKK model, 425-426 Bernoulli utility functions, 10 Bernoulli variable, 29, 103-104 Bid-ask spreads, 302, 305 Big data, 525, 529-532 Binomial distribution, 102-106, 406-407 Binomial trees, 154-158, 165, 478 Bitcoin, 536 derivatives on, 536-539 hedging techniques, 536-538 impact on markets and investments, 538-539 Bivariate survival function, 396 Black model, 145 Black-76 model, 142 Black/Scholes framework, 25 Black-Scholes pricing formula, 263 Black-Scholes-Merton model (BSM model), 65-66, 127, 153, 158-162 Blockchain, 526 Bonds, 12-13 prices, 212-217 Bootstrapped historical simulation method, 511 Bootstrapping, 229 Bottom-up approach, 360 Breakeven asset swap spread, 454 Brownian motion, 28-33, 236, 513 Business models, 550-552 Business risk, 1, 11, 15 Butterfly shifts, 221

Calendar effects, 95 Calibration, 273 Call option, 131 Callable bonds, 377-380 Capital, 444 relief, 467-468 requirement, 361 Capital asset pricing model (CAPM), 25, 40, 52, 60-63 model assumptions, 52-55 SML, 55-60 Capital market line (CML), 49-50 Caps, 141-143 Captives, 515 Cash CDO, 464 Catastrophe reinsurance swaps, 520 Central bank, 308 Central limit theorem, 29 Certainty equivalent of lottery, 9 Chain rule, 57 Chance nodes, 114 Characteristic function of random variable, 110 Chebyshev's inequality, 180 Chicago Board of Trade (CBOT), 289 Chicago Board Options Exchange (CBOE), 536 Chicago Mercantile Exchange (CME), 289 Chief executive officers (CEOs), 342 Chief information officer (CIO), 353 Cholesky composition, 206 Cholesky decomposition, 189 Citigroup, 144 Classic risk management, 340 Classic theory, 17 Classical MC simulation method, 513 Classical portfolio problem, 4 Classical random walk, 29 Clayton copula, 392 Coefficient of lower tail dependence, 396 Collateral, 331 Collateralization, 463 Collateralized debt obligations (CDOs), 439, 463-467 Commercial banks, 238-239 Committee of Sponsoring Organizations (COSO), 339, 341 ERM, 344-346 Commodity Exchange (COMEX), 289 Commodity futures, 290-294 Commodity markets, 285 commodity types and classification, 286-288 risk for traders and investors, 288-289 Commodity options, 294-298 Commodity prices, 287 Commodity risk, 285 commodity markets, 285-289 hedging, 290-298 Commodity seller, 295 Company, 17 Competitive bidding, 36 Compliance risk, 344

Component VaR, 197-198 Compound interest, 212 Compounding frequencies for interest rates, 226 Concavity of utility function, 5 Concentration of funding, 331 Concentration reports, 553 Conditional correlation, 83-85 Conditional covariance, 82-83 Conditional default probability, 273 Conditional dependence, 81 financial comovements, 82-85 time series analysis, 85-95 Conditional expected value, 178 Conditional heteroscedasticity, 86 Conditional risk analysis multivariate return distributions, 424-426 VaR, 420-424 Conditional VaR (CVaR), 411, 419, 422-424 Consistency, 71 Constant absolute risk aversion (CARA), 15 Constant conditional correlation (CCC), 426 Constant relative risk aversion (CRRA), 15 Consumption-based capital asset pricing model (CCAPM), 60 Continuous auction market, 302 Continuous compounding, 212 Contractual maturity mismatch, 330 Control activities, 346 Conversion factors (CF), 256 Convexity adjustment for interest rate derivatives, 501-502 Convexity hedging, 240-244 Cooling degree day (CDD), 519 Copula functions, 389-390 application to risk management, 396-399 basic properties, 390-393 measures of dependence, 393-396 Cornish-Fisher approximation, 320, 412, 423, 510 Corporate (managerial) appetite for risk, 349 Corporate governance, 543-544 management fails, 544-547 postcrisis perspectives, 549-550 remuneration and incentive systems, 547-549 Corporate Governance Committee (CGC), 544 Corporate stockholders, 17 Corporate value dilution, 342 Correction factor, 181 Correlation, 40, 63-73, 206, 393 Correlation coefficient, 44 Correlogram, 91 Cost of hedging, 167-170, 480-483 Counterparties, 251 Counterparty credit risk, CDS spreads with, 458-460 Coupon bond value, 272 Covariance, 66-69

Covariance matrix, 187 of financial returns, 72 Cox, Ingersoll and Ross model (CIR model), 232 Cramer-Rao lower bound, 71 Credit analysis, 259 Credit crunch, 440 Credit default swaps (CDS), 441, 454-457 Credit derivatives, 450 asset swaps, 450-454 CDS spreads with counterparty credit risk, 458-460 credit default swaps, 454-457 Credit event, 455 Credit rating agencies (CRAs), 442 Credit ratings, 259-262 Credit risk, 11-13, 18, 251, 552 credit ratings, 259-262 default probabilities, 252-255 loss, 255-259 reduced-form models, 271-277 structural models, 262-271 Credit risk hedging, 475, 483 CVA, 487-491 modeling exposure, 483-487 Monte Carlo methods, 491-494 Credit score, 13 Credit value adjustment (CVA), 487-491 CreditMetrics<sup>™</sup> model, 269–271 CreditRisk+TM, 275-277 Critical rate, 223 Critical value, 186-187, 196 Cross hedge, 499 Cross-currency asset swap, 452 Crypto tokens, 538 Crypto traders, 535 Cryptocurrencies, 527, 535 Cumulative distribution, 98, 101 Cumulative distribution function (c. d. f.), 511 Cumulative positions, 238 Currency forward, 369 Currency risk, 11, 367 foreign exchange derivatives, 369-373 risk hedging in FX markets, 373-375 types, 367-369 Currency swap, 373 Current exposure (CE), 256 Current exposure method (CEM), 256, 489 Customer assets, 341 Data, 350 analysis, 350 errors, 431 filtering, 429-432 protection, 533 visualization, 351 Database Italiano delle Perdite Operative (DIPO),

360

Debt financing, 18 Decision nodes, 114 Decision trees, 113-116 Decomposition, 196-199 Dedication. 244 Default probability (DP), 12, 252-255, 492 Delta hedge, 163 Delta hedging, 163-165, 476-478 Delta neutral, 163 Delta of derivative, 163 Delta of payer swaption, 146 Delta-neutral, 476 Delta-normal approach, 201 Delta-gamma approach, 202, 509 Delta-gamma minimization method, 510 Delta-gamma-Johnson method, 510 Depth, 309 Derivative securities, 127 Derivatives arbitrage, 24 Diagonal VEC model (DVEC model), 425 Diamond-Dybvig model, 322-325 Digital finance, 525 derivatives on bitcoin, 536-539 Fintech revolution, 526-535 Digital payments, 532 Digitalization, 528 Direct costs, 17 Direct implied volatility estimate (DIVE), 66 Dispersion, 7 Distance to default (DD), 263, 265 Distributions, 97-98 binomial distribution, 102-106 Pareto distribution, 98-102 Poisson distribution, 106-112 of stock price fluctuations, 95 Diversification, 11, 18, 40 Documentation, 469 Dollar duration, 241 Downside risk, 178 measures, 200 Dual trigger contracts, 518 Duffie-Singleton model, 273-274 Dupire's model, 377 Duration, 240-244 of callable bond, 379 vectors, 496-499 Duration Vector Models (DVM), 496 Durbin-Watson test, 92 Econometric models, 66, 97 Economic risk, 367-368 Economic theories of consumption, 6 Economies of scale, 36 Effective convexity, 244 Effective duration, 240, 242

Efficiency, 71

Efficient frontier, 45-46

Efficient market hypothesis (EMH), 6, 25-28 Elasticity, 305 Employee/supplier assets, 341 Energy derivatives, 559-562 Enron, 546 Enterprise risk, 339 building and enhancing capabilities, 347-352 COSO ERM, 344-346 ERM framework, 343-344 fundamentals, 340-346 identification and assessment, 340-343 implementation and models, 354-355 management, 352-354 practical implementation, 352-355 process view, 347-350 technological capabilities, 350-352 Entrepreneurial risk management (ERM), 339 framework, 343-344 Environmental risk, 342 Equal weighting of observations, 184 Equilibrium, 307 gross return, 312 Equity, 18 Estimation methods, 86 Euler's theorem, 197 on homogeneous functions, 189-190 European Financial Stability Facility (EFSF), 446 European Union (EU), 445 Event identification, 345 Event risk category, 358 Excel statistical functions, 111-112 Exception monitoring, 351 Exchange rate risk management, 357 Exchange-traded insurance derivatives (ET insurance derivatives), 519 Expected cash inflows (ECI), 327 Expected cash outflows (ECO), 327 Expected default frequency (EDF), 266 Expected exposure (EE), 12, 488 Expected losses (EL), 363 Expected return on the stock, 25 Expected shortfall (ES), 178, 409-411, 419-422 Expected value of lottery, 7 Explanatory simulation, 117 Exponential smoothing, 85 Exposure-at-default (EaD), 256 Exposure-at-recovery (EaR), 258 External consultants, 20 Extreme value theory (EVT), 389, 399 data application, 403-404 extreme VaR, 404-406 theoretical background, 399-403 Extreme VaR, 404-406

Factor analysis, 193 Factor mapping for VaR, 193–194, 209–210 Fair strike, 381 Fama-French model, 62 Fannie Mae (FMA), 449 Fat tails, 95 Financial Accounting Standards Board, 553 Financial and reporting risks, 344 Financial assets, 341 Financial comovements, 82 conditional correlation, 83-85 conditional covariance, 82-83 Financial crisis, 439 credit derivatives, 450-460 in Europe, 444–448 impact on financial industry, 448-450 lack of regulatory framework, 440-444 and regulation, 440-450 securitization, 461-469 Financial deregulation, 441 Financial derivatives, 127, 130 interest rate derivatives, 139-147 options and futures, 128-138 Financial fraud, 531 Financial instability, 37 Financial institutions, 18, 211 Financial instruments, 1 Financial investors, 45 Financial markets, 1, 39 CAPM, 52-63 MPT, 40-51 Financial returns, 95 Financial risk, 1, 15-16 banking sector, 550-558 challenges for research, 558-565 corporate governance, 544-550 management, 543 Financial Stability Board, 442 Financial volatility, 63 Fintech, 525 big data, 529-532 revolution, 526-535 and risk management, 532-535 First difference, 90 First passage models, 266-268 First-order conditions, 73 Fixed income futures, 217-222 Fixed trigger, 518 Flat volatility approach, 143 Floorlet, 141 Floors, 141-143 Foreign currencies, 13 Foreign exchange derivatives, 369-373 Foreign exchange risk, 13, 552 Forward, 134-137 contracts, 127, 136, 290-294 points, 371 price of asset, 135 Foucault model, 306 Frank copula, 392

Fraud risk, 14 Frèchet distribution form, 400 Freddie Mac (FMC), 449 Free-market rule, 441 Funding liquidity, 308-314 Funding risk, 13 Futures, 127-138 market. 539 price, 320 price of commodity, 308 value, 212 FX forward, 370 G20, 442 Gamma distribution, 101 Gamma hedging, 165-167, 478-480 Gamma swaps, 383 Gap analysis, 238 Gap method, 554 Gaussian (normal) distribution, 41 Gaussian copula model, 269, 391-392 Gaussian estimator, 89 Gaussian likelihood, 89 Gaussian multi-factor model, 234-235 Generalized autoregressive conditional heteroscedasticity model (GARCH model), 85-89 GARCH (p, q) modeling, 424–426 for variance estimation, 185 Generalized Brownian motion, 31 Generalized extreme value (GEV), 390, 401 Generalized Pareto distribution (GPD), 403 Generalized Wiener process, 31 Geometric Brownian motion, 32 Geometric returns, 176, 186-187 Global Association of Risk Professionals (GARP), 18 Global Operational Loss Database (GOLD), 360 Globalization of financial markets, 357 Grace period, 486 Gramm-Leach-Bliley Act, 442 Greeks of swaptions, 146 Gross income, 364 Gross return, 312 Group captives, 517 Gumbel copula, 392 Gumbel distribution, 400 Hazard rate, 271 Heating degree day (HDD), 519 Hedge ratio, 225 Hedged assets, 326 Hedgers, 128-129, 217 Hedging, 18 advanced IRR hedging, 494-502

credit risk hedging, 483-494

with fixed income derivatives, 499-502

market risk hedging, 476-483 techniques, 158, 475, 536-538 Heterogeneous ARCH process (HARCH process), 433 Heterogeneous volatility, 433-435 Heteroscedasticity, 86 High minus low (HML), 62 High-frequency data, 429 high-frequency trading, 429-433 intraday risk analysis, 433-435 High-frequency trading, 429 basic stylized facts, 432-433 data filtering, 429-432 High-quality assets (HQAs), 325 Hill estimator of tail index, 404 Historical assessment, 359 Historical data, 113 Historical simulation approach, 184-185, 240, 511-513 Historical volatility, 63 Holding periods, 310 Ho-Lee model, 233 Hot wallets, 535 Hotline management, 351 Hull-White model, 233 Illicit financial flows, 531 Illiquidity, 306 Immunization, 220-226, 244 Implied forward rate, 140 Implied volatility, 65, 375-377 Incentive systems, 547-549 Incremental VaR, 198 Indirect costs, 17 Information and communication, 346 Inside value at risk, 195 VaR features, 195-203 VaR testing, 203-207 Insurance, 22, 37 contracts, 519 derivatives, 519-522 Interbank risk, 543, 558-559 Interest rate cap (IRC), 141 Interest rate floor (IRF), 141 Interest rate risk (IRR), 11, 211, 552 duration and convexity hedging, 240-244 dynamics of, 212-226 management, 236 measurement techniques, 238-240 short rate models, 226-236 sources and identification, 236-238 Interest rate swaps (IRSs), 127, 139-141 Interest rates, 12 caps and floors, 141-143 derivatives, 139 interest rate swaps, 139-141 swaptions, 144-147

Internal control process, 362 Internal data processing, 366 Internal environment, 345 Internal rate of return (IRR), 214 International Monetary Fund (IMF), 287, 442 Intraday effects, 95 Intraday risk analysis, 433 heterogeneous volatility, 433–435 Intuition assessment, 359 Inverse functions, 391 Investment banks, 442 Investors, 4, 6, 39, 306 Itô process, 31 Ito's lemma, 123–125

January effect, 27–28, 95 Jarrow–Turnbull model, 271–273 Jensen's inequality, 9 Joint probability density function, 69 JP Morgan Chase, 144

Kendall's tau, 394–395 KMV-Merton approach, 262–266 Kupiec's test, 204–205

Lagged value, 89 Lagrangian function, 46 Lagrangian multipliers, 46-47 Latent variable models, 397 Learning, 22 Legal risk, 358 Lehman Brothers (LB), 441 Leverage, 50, 238 Likelihood function, 69-71, 108 Likelihood ratio, 407 test, 204 Limit law, 400 Limit order, 303 Linear correlation, 389, 393 Linear utility, 14 Liquidity, 305, 468 black holes, 313-314 CAPM, 337-338 Liquidity coverage ratio (LCR), 325-328 Liquidity models, 314 Diamond-Dybvig model, 322-325 theoretical models, 314-318 traceable models, 318-322 Liquidity risk, 11, 13, 301, 552 liquidity models, 314-325 market prices, 302-314 and regulation, 325-332 Liquidity-adjusted VaR (LVaR), 314, 319 Log-likelihood, 89, 105, 108 function, 70-71 London Inter Bank Offered Rate (LIBOR), 139

Loss, 255-259 frequency, 363 function, 492 severity, 363 Loss given default (LGD), 488 Losses and profits (L/P), 175 Lower tail dependence coefficient, 396 M-absolute models, 494-496 m-dimensional copula, 390 M-squared models, 494-496 Macaulay duration, 240, 242 Macro hedge, 500 Maintenance margin, 304 Managed CDOs, 467 Managers, 17 Mapping, 193, 209 to regulation, 350 Margin Agreements (MAs), 486 Marginal scrubbing error, 431 Marginal VaR, 196-197 Market clearing condition, 311 Market efficiency, 36 Market failures, 36 types of, 36-37 Market inefficiencies, 36 Market liquidity, 308-314 risk, 14 Market microstructure, 302-306 Market portfolio, 52-53 Market prices, 302 funding vs. market liquidity, 308-314 market microstructure, 302-306 price formation, 306-308 of risk, 150-152 Market risk, 11, 18, 173 metrics, 174-178 overview, 174-176 quantile metrics and VaR, 176-179 VaR calculation methods, 184-189 VaR rationale and definition, 180-182 Market risk hedging, 476 cost of hedging, 480-483 delta hedging, 476-478 gamma and Vega hedging, 478-480 Marking to market, 137, 293 Markov chain, 282 Markov process, 28 for transition matrices, 282-283 Mass function of binomial distribution, 104 Matching, 244 Maturity model, 355 Maximum likelihood estimation (MLE), 69 Maximum likelihood estimator for binomial distribution, 105 for time-independent probability, 282 Maximum likelihood methods, 69-73

Mean of binomial distribution, 105 Mean reversion effect, 28 Mean-excess function (MEF), 403 Measurement techniques, 238-240 Merton latent variable model, 397 Metrics, 330-332 Miners, 527 Minimization problem, 316 Minimum transfer amount, 486 Minimum variance portfolio (MVP), 45 Mispricing, 27 Modern portfolio theory (MPT), 40 optimal portfolios of risky assets, 45-48 optimal portfolios with risk-free asset, 48 - 51risk/return trade off. 40-44 Modified Delta-VaR, 508-510 Modified duration, 240, 242 Modified MC and scenario analysis, 513-514 Monitoring tools, 330-332 Monte Carlo kernel, 397 Monte Carlo methods, 491-494 Monte Carlo simulation (MC simulation), 117, 187-189, 507 of copulas, 399 Moral hazard, 37 Mortgages, 440 Multi-factor models, 234-236 Multidimensional approach, 14 Multiperiod model, 60 Multiple peril products, 517 Multivariate GARCH (MGARCH), 419 Multivariate return distributions, 424 GARCH (p, q) modeling, 424–426 Mutual funds, 441 n-copula, 391 n-dimensional copula, 390 *n*-dimensional covariance matrix, 82 Nationally Recognized Statistical Rating Organization (NRSRO), 443 Natural monopoly, 36 Negative externalities, 36 Net cash outflows (NCO), 325 Net liquidity demand (NLD) indicator, 309 Net present values (NPVs), 115 Net return, 312 Net Stable Funding Ratio (NSFR), 328-330 Net working capital, 19 Netting agreement, 484 New York Mercantile Exchange (NYMEX), 289 Newton-Rapson method, 460 No-arbitrage models, 233 Nonlinearity, 94, 202 Nonnormal percentile, 320 Nonparallel shifts, 220 Normal distribution, 98

Normality, 173 Null hypothesis, 92, 204-205, 408 Objective-setting, 345 Obligations, 251 One-factor copula model, 398 One-period return on security, 60 Operational risk, 11, 14, 18, 344, 358 Basel II Approach, 362-367 identification and assessment, 358-361 treatment and control, 361-362 Operational Riskdata eXchange (ORX), 360 Optimal asset value, 312 Optimal bid price, 307 Optimal contract, 324 Optimal portfolios with risk-free asset, 48-51 of risky assets, 45-48 Optimal trading model, 314 Optimization approach, 374 Option contracts, 294 Option pricing, 153 binomial trees, 154-158 BSM model, 158-162 models, 154-162 theory, 202 Option spreads, 295 Option structure, 131-133 Option value, 376 Optionality, 238 Options, 127-138 Order statistic, 409 Order-driven markets, 306 Ordinary least squares (OLS), 86 Organization for Economic Cooperation and Development (OECD), 544 Organizational assets, 341 Over-the-counter markets (OTC markets), 127, 288 Par yield, 216 Parallel shifts, 220 Parametric method, 185-187 Pareto distribution, 98-102 Passive acceptance, 21 Past stock price, 25 Path-dependent simulation, 485 Payoffs to bondholders at time, 263 equation, 456 of forward contract, 134, 290 at maturity, 380 Payout, 131-133 Peak over threshold method (POT method), 402 Permanent impact, 316 Physical assets, 341 Piecewise constant random function, 29 Poisson distribution, 106-112

Poisson process, 494 Portfolio hedging, 163 cost of hedging, 167-170 delta hedging, 163-165 gamma and Vega hedging, 165-167 Portfolio optimization in Excel, 51 Portfolio return, 49 Portfolio value, 43 Portfolio weights, 49 Positive and negative outcomes, 3-4 Positive externality, 36 Postcrisis perspectives, 549-550 Potential future exposure (PFE), 256 Power law (PL), 437 for intraday data, 437-438 Premium 52 Present value, 457 of bond in discrete compounding, 216 Preventive controls, 362 Prices, 63 cycle, 287 drop, 316 dynamics, 315 formation, 302, 306-308 tree, 157 Primary contracts, 516-519 Principal component analysis of term structure, 248-249 Probabilistic approaches, 112 decision trees, 113-116 scenario analysis, 112-113 simulations, 116-118 Probability and consequences, 3 mass function, 106 Probability density function (p. d. f.), 40, 102, 511 Probability of default (PD), 456, 488 Process risk, 342, 358 Product copula, 391 Profit/loss data (P/L data), 174 Proportion of failures test (POF test), 204-205, 407 Public economic policies, 6 Public goods, 36 Put option, 131 Put-call parity formula, 373

Quantile metrics, 176–179 Quantile of return distribution, 423 Quasi-Monte Carlo methods (QMC methods), 513

Random error component, 25 Random walk theory of financial assets, 6 Randomness, 2–5 Rating agencies, 259 Rational expectations theory, 5–6 Rationality, 5–10 Real options, 127 Recovery rate (RR), 12, 255 Reduced-form models, 271 (see also Structural models) CreditRisk+TM, 275-277 Duffie-Singleton model, 273-274 Jarrow-Turnbull model, 271-273 Reference entity, 455 Regression formula, 58 Regret operator, 201 Reinsurers, 520 Relative liquidity-adjusted total risk, 321 Relative risk aversion (RRA), 14 Remargin period, 486 Remuneration system, 543, 547-549 Replication argument, 381 Reputational risk, 358 Required amount of stable funding (RSF), 328 Resiliency, 309 Response management, 351 Return of equity (ROE), 468 Return on assets (ROA), 19 Risk, 1, 4, 39, 357 acceptance, 349 arbitrage, 24 assessment, 20, 345 avoidance, 22, 349 in corporations and financial institutions, 15 - 18currency risk, 367-375 dashboards, 351 factor, 320 hedging in FX markets, 373-375 identification, measurement and mitigation, 19-21 impact, 20 likelihood, 20 management, 15-22 measure, 410 mitigation, 22, 362 operational risk, 358-367 or threat, 3 premium, 8, 22, 52, 54 priority, 21 process, 16 randomness and uncertainty, 2-5 rationality and risk aversion, 5-10 reduction, 349 repository, 350 response, 345 response strategies, 21-22 scoring, 351 sharing, 349 theory of markets, 22-33 for traders and investors, 288-289 transfer, 362 types, 10-15 volatility risk, 375-383

Risk aversion, 5-10 relationship, 9 Risk management, 97, 532-535 systems, 552-556 Risk mapping to objectives, 350 to policies, 350 Risk-Adjusted Return on Capital (RAROC), 386-387 Risk-averse investors, 50 Risk-neutral probability, 155-156 Risk-purchasing groups, 515 Risk-retention groups, 515 Risk-return trade-off, 39-44 Rolling yield, 537 Sampling of Brownian Motion paths in Excel, 32-33 Sarbanes-Oxley Act (2002), 546 Scaling laws, 94, 433 Scenario analysis, 112-113, 366 Scorecards, 359, 361 Securitization, 439, 461, 551 advantages and disadvantages, 467-469 CDOs, 463-467 structure and participants, 461-463 Security market line (SML), 52, 55-60 Semistrong-form version of EMH, 26 Semivariance operator, 201 Sensitivity of portfolio, 201 Sensitivity-based risk measures, 200 Shape of utility function, 8 Short rate models, 226 multi-factor models, 234-236 single-factor models, 230-234 term structure of interest rates, 226-229 Significance level, 179 Simple interest, 212 Simulations, 116-118, 240 Single-factor models, 230-234 Sister captives, 517 Skewing, 95 Small firm effect, 28 Small minus big (SMB), 62 Soft storage wallets, 535 Sovereign risk dynamics, 562-565 Spearman's rho, 394-395 Special purpose vehicle (SPV), 446, 472-473 Specialized analytics, 351 Specific risk, 11 Speculation, 129 Speculators, 129-130, 217 Spot rates, 219 Spot volatility approach, 143 Spot-forward parity, 136 Stabilization of rates, 238 Stable funding, 328-329

Stablecoins, 538 Standard deviation, 40, 56 Standard duration, 495 Standard error of estimation, 64 Standard normal distribution, 78-79 Standardized approach, 364, 488 Static risk management processes, 340 Static simulations, 240 Statistical analysis, 97 distributions, 98-112 probabilistic approaches, 112-118 Steady state distribution function, 30 Stocks, 4, 12, 55 prices, 158 Stop-loss order, 303 Strategic risks, 344 Stress testing, 206-207 Strike, 131 Strong-form version of theory, 26 Structural models, 262 (see also Reduced-form models) CreditMetrics<sup>™</sup> model, 269–271 first passage models, 266-268 KMV-Merton approach, 262-266 Student-t factor model, 492 Student's t-copula, 391-392 Stylized facts, 93-95 Subadditivity, 409, 420 Subprime mortgages, 461 Sum of square deviation from mean, 64 Super cycles, 287 Survival function, 253 of Pareto variable, 98 Survival probability, 272 Swaps, 294-298 cash flows, 140 payments, 453 Swaptions, 144-147 Synthetic CDO, 464 System integration, 351-352 Systematic risk, 10, 52 Tail. 98 dependence of copulas, 395 index, 433

dependence of copulas, 395 index, 433 Tangency point, 49 Temporary impact, 315 Term structure of interest rates, 226–229 Tether, 538 Theoretical models, 314–318 Theory of markets, 22–33 Three-factor model, 61 Threshold, 486 Tick frequencies, 430 "Tick" loss target function, 413 Tightness, 309 Time horizon, 179, 514

Time series, 81 analysis, 85 ARCH/GARCH models, 85-89 autocorrelation of financial returns, 89-93 stylized facts, 93-95 Time Until First Failure test (TUFF test), 204, 407 Top-down approach, 360 Total cost of trading, 316 Total portfolio VaR, 197 Traceable models, 318-322 Traders in market, 128-131 Trading path, 318 strategy, 315 Trans-European Automated Real-time Gross Settlement Express Transfer System, 445 Transaction cost calculations, 318 Transaction risk, 367 Transfer risk, 22 Transition matrix, 269 Transition periods, 508 Transition thresholds, 271 Translation risk, 367 Transparency, 305, 545 Transparent financial reporting, 21 Trial and error approach, 215 Twice differentiable payoff function, 381 Twist shift, 221 12-point Gauss-Hermite integration, 512 Uncertainty, 2-5, 339 Utility functions common forms of, 14-15 of investor, 4

Value at Risk (VaR), 12, 195, 256, 314, 406, 419, 507, 554 advances, 507–514 analysis, 173, 176–179 analytic approximations, 201–203 backtesting, 406–408 calculation methods, 184–189 choice of parameters for, 183 conditional VaR, 411–413 decomposition, 196–199 expected shortfall, 409–411

features, 195-203 historical simulation approach, 184-185 limitations, 199-201 Monte Carlo simulation, 187-189 parametric method, 185-187 for portfolios of derivatives, 416-417 rationale and definition, 180-182 testing, 203-207 Value tokens, 538 Variable trigger, 518 Variance decomposition of returns, 59 Variance of portfolio, 43 Variance swaps, 380-383 Vasicek model, 230, 232 Vector of optimal weights, 47 Vega hedging, 147, 165-167, 478-480 Vigilance, 21 Volatility, 40, 63-73 strategy with strangles, 138 surface, 376 types, 63-66 Volatility risk, 11, 357, 375 callable bonds, 377-380 implied volatility, 375-377 variance swaps, 380-383 Volume, velocity, variability or veracity, 529-530 Weak-form efficiency, 25

Weekend effects, 95 Weibull distribution, 401 Weighted spread, 322 Weighting factor, 185 Worst-case scenario (WCS), 514

Yield curve, 223, 226 risk, 200, 237 Yield shifts, 220–226 Yield to call, 377–378 Yield to maturity (YTM), 214 Yield to worst, 377 Yields, 212–217

Zero-coupon bond price, 235 Zero-coupon rate, 495 Zero-volatility spread, 454 Zipf's law, 437