

Index

- ALCS, *see* assembly line crew scheduling problem
- antimonotonicity, 7
- APT, *see* arbitrage pricing theory
- arbitrage pricing theory (APT), 162
- Archimedean copulas, 207
 - positive dependence properties, 207
 - supermodular ordering, 207
- assembly line crew scheduling problem (ALCS), 23
- assumption, (DF), (EF), (EF^{\leq}), 151
- asymptotic
 - equivalence
 - inhomogeneous case, 67
 - result, 62
 - sharpness of TVaR bounds, 68
 - VaR in the infinite mean case, 64
- asymptotically mixing, 68
- asymptotics
 - conservative capital charges, 61
 - superadditivity ratio, 63
 - worst case diversification limit, 63
- best case dependence, 93
- Beta model, 118, 278
- block rearrangement algorithm (BRA), 23, 29, 37
- Bonferroni type bounds, 147
- bounded variance assumption, 200
- bounds
 - central domain, 128
 - constrained, 95
 - copulas between subgroups, 215
 - distribution functions, 226
 - distributional, 228
 - Fréchet, 6
 - improved, known correlations, 110
 - moment, connection with, 97
 - price, model independent, 160
 - sharp, unbounded domain, 247
 - tail risks, 94
 - weighting scheme, 150
- BRA, *see* block rearrangement algorithm (BRA)
- CAPM, 162
- center, 56
- central domain, bounds, 128
- CIS, *see* conditional increasing in sequence
- Clayton copula, 208
- coherent, 6, 237, 243
- comonotonic risk vector, 7, 52
- comonotonicity, 7
- concave densities, 18, 58
- concentration, max-/minimal, 52
- concordance order, 187
- conditional
 - in sequence, weakly, 192
 - increasing, 203
 - in sequence, 203
 - moments, method of, 15
- connection, moment bounds, 97
- constrained bounds, 95, 166
- convex, 6
 - order, 6, 192, 224
 - risk measure, 6, 131, 161, 170–173, 175, 176, 192
- convolution
 - infimal, 75
 - Ψ -inf-, Ψ -sup-, 76
 - supremal, 75
- copula
 - Archimedean, 207
 - between subgroups, 215
 - Clayton, 208
 - Gaussian, 84
 - Gumbel, 83, 208
- countermonotonic risk vector, 7, 8
- countermonotonicity, 7
- coupling
 - bounded random variables, 69
- covariance representation, 48
- credit risk
 - portfolio, 119
- CreditRisk⁺, 116, 278
- crossing conditions, 225
- crossing points, number of, 225
- densities
 - concave, 18, 58
 - decreasing, 19
 - monotone, 18, 57
- dependence, 187
 - best case, 93

- in the tails, 125
 - maximal, 52
 - orderings
 - relations between, 204
 - structure, 208
 - worst case, 93
 - dependency spreads, 192
 - df, dfs, *see* distribution function(s)
 - (DF)-assumption, 151
 - distance, Wasserstein, 283
 - distortion
 - dual power, 287, 292
 - TVaR, 287, 292
 - Wang, 287, 292
 - distribution, 189, 190
 - elliptical, 204
 - informative domains, 129
 - distribution function(s)
 - bounds, 226
 - distributional bounds, 228
 - even number, 228
 - diversification benefit, 60
 - worst case, 60
 - dual bounds
 - sharpness, 57
 - tail risk, 53
 - homogeneous case, 54
 - dual power distortion, 287, 292
 - duality
 - holds, 49
 - theorem for sets, 51
 - EAD, 92, *see* exposure at default
 - (EF)-, (EF[≤])-assumption, 151
 - elliptical distribution, 204
 - enterprise risk management (ERM), xiv
 - ERM, *see* enterprise risk management
 - even number
 - distributional bounds, 228
 - moments fixed, 228
 - exponential marginal distribution, 190
 - exposure at default, 106, 278
 - factor model, single, 117
 - Fréchet
 - bounds, 6, 48
 - reduced, 149
 - sharpness, 50
 - class, 6, 47
 - generalized, 146
 - function on a subset, 128
 - Gamma model, 196
 - Gauss factor submodels, 212
 - Gaussian copula, 84
 - general solution, 190
 - generalized
 - Fréchet class, 146
 - Pareto distributions (GPD), 36
 - GPD, *see* generalized Pareto distributions
 - Gumbel copula, 83, 208
 - higher-dimensional marginals, 146
 - Hoeffding bounds, 48
 - Hoeffding–Fréchet
 - bounds, improved, 123
 - functionals, 48
 - homogeneous case; dual bounds, tail risk, 54
 - II, *see* inverse Gamma model
 - IG, *see* inverse Gaussian model
 - IMA, *see* internal model approach
 - improved bounds
 - known correlations, 110
 - increasing in sequence, conditional, 203
 - inequality
 - length, 19
 - mean, 19
 - norm, 19
 - variance, 19
 - infimal convolution, 75
 - informative domains, 129
 - insurance portfolio
 - application, 201
 - internal dependence, 187
 - internal model approach (IMA), xvi
 - inverse Gamma model (II), 296
 - inverse Gaussian model (IG), 296
 - inverse Weibull model (IW), 296
 - isotone projection, 306
 - IW, *see* inverse Weibull model
 - KMV model, 115, 184, 278
 - known mean, 228
 - and variance, 229
 - LGD, 92, *see* loss given default
 - linearisation, 255
 - LL, *see* log-logistic model
 - LN, *see* lognormal model
 - log-logistic model (LL), 296
 - lognormal model (LN), 296
 - loss given default, 106, 278
 - lower bound(s), 83, 84
 - convex risk measures, 192
 - partial sum information, 154
 - simplified, 191
 - under (DF), 152
 - relaxed, 153
 - under (EF) resp. (EF[≤]), 155
 - relaxed, 155
 - lower semicontinuous, 76
 - lsc, *see* lower semicontinuous
 - majorization order, 25
 - marginal
 - distribution, 190
 - normal, 197
 - distribution, Pareto, 189

- system, non-overlapping, 148
 - two-dimensional, 150
- maximal
 - concentration, 52
 - dependent, 52
 - risk, 52
- Merton's model of the firm, 115
- method of conditional moments, 15
- minimal concentration, 52
- mixability, 14
- mixing
 - asymptotically, 68
 - necessary conditions, 19
- model risk, assessing, 118
- models, independent subgroups, 194
- moment(s)
 - bounds, connection, 97
 - odd number, 228
 - spaces, 222
- moments fixed
 - even number, 228
 - odd number, 226
- monotone densities, 18, 57
- Monte Carlo, 193, 196, 198, 199, 202, 215
- multiplicity function, 87
- n -mixable, 56
- negative internal dependence subgroup model, 194
- NISG, *see* negative internal dependence subgroup model
- non-overlapping marginal system, 148
- normal marginal distributions, 197
- number of crossing points, 225
- odd number
 - moments fixed, 226
- optimal coupling, 56
- order
 - concordance, 187
 - convex, 6
 - majorization, 25
 - orthant, 187
 - Schur, 25
- orthant order, upper/lower, 187
- Pareto
 - distributed risks, independent subgroups, 198
 - marginal distribution, 189
- partial
 - independent subgroups, 199
 - sum information, 154
- partially specified factor model (PSFM), xx
- PCOD, *see* positive concordance dependence
- PD, 92
- PISG, *see* positive internal dependence subgroup, 193
- PLOD, *see* positive lower/upper orthant dependent
- POD, *see* positive orthant dependent
- portfolio
 - additional sum information, 159
 - convex minima, 21
 - credit risk, 119
- positive
 - concordance dependence, 187
 - dependence
 - constraints, upper bound, 190
 - properties, 207
 - internal dependence subgroup, 187–191, 193
 - lower/upper orthant dependent, 77, 124
 - condition, 78
 - orthant dependent, 78
 - quadrant dependent (PQD), 206
- PQD, *see* positive quadrant dependent
- price bounds
 - model-independent, 160
- PSFM, xx, 145
- Ψ -inf-convolution, 76
- Ψ -sup-convolution, 76
- PUOD, *see* positive lower/upper orthant dependent
- RA, *see* rearrangement algorithm (RA)
- rearrangement, 67
 - algorithm (RA), 23, 29, 31
 - block (BRA), 37
- representation theorem
 - Strassen, 51
- risk
 - bound(s)
 - covariance information, 159
 - negative dependence assumption, 194
 - normally distributed, 137
 - Pareto-distributed, 140
 - vector
 - comonotonic, 7, 52
 - countermonotonic, 7
 - functionals, 151
- Schur order, 25
- SCR, *see* solvency capital requirement
- semicontinuous, lower resp. upper, 76, 77
- sequence order, 192
- sharp bounds
 - unbounded domain, 247
- sharpness, 124
 - dual bounds, 57
 - Fréchet bounds, 50
 - standard bounds, 11
 - TVaR bounds, 67, 68
- simplified lower/upper bounds, 191
- single factor model, 117
- SMM, *see* standardized measurement method
- solution, general, 190
- solvency capital requirement (SCR), xvi
- spaces, moment, 222
- standard bounds, sharpness, 11
- standardized measurement method (SMM), xvi
- stochastic ordering, results, 203

- stop loss premia, 159
- Strassen representation theorem, 51
- subgroup(s)
 - hypothesis, 194
 - max information, 156, 158
 - models, 187, 202
 - partially independent, 199
- superadditivity ratio, 60
- supermodular ordering, 207
- supremal convolution, 75
- tail risk
 - bounds, 94
 - dual bounds, 53
 - of musk, 156
 - of sum, 158
- TVaR
 - bound(s), 193
 - statistical uncertainty, 238
 - distortion, 287, 292
- two-dimensional marginal, 150
- unbounded domain
 - sharp bounds, 247
- unbounded domain, VaR bounds, 236
- unconstrained bounds, 166
- upper bounds
 - partial sum information, 154
 - positive dependence constraints, 190
 - simplified, 191
 - under (DF), 152
 - relaxed, 153
 - under (EF) resp. (EF[≤]), 155
 - relaxed, 155
- upper semicontinuous, 77
- usc, *see* upper semicontinuous
- Value-at-Risk, 55
 - bounds, 55
- VaR, 55
- VaR bound(s), 135
 - dependence, 200
 - domain \mathbb{R} , known mean and variance, 236
 - independent subgroups, 195
 - partially independent subgroups, 200
 - statistical uncertainty, 233, 235, 236
 - subgroup models, 202
 - unbounded domain, 236
 - under PISG, 189
 - variance bound, 200
- variance assumption, 200
- Wang distortion, 287, 292
- WAS, *see* weakly associated in sequence
- Wasserstein distance, 283
- WCS, *see* weakly conditional in sequence
- weakly
 - associated in sequence, 192
 - conditional in sequence, 192
- weight function, 284
- weighting scheme bounds, 150
- worst case
 - dependence, 93
 - diversification benefit, 60
 - superadditivity ratio, 60