

Contents

List of Contributors	xi
Section One Practitioners and Products	1
1 Robust portfolio optimization using second-order cone programming	3
<i>Fiona Kolbert and Laurence Wormald</i>	
Executive Summary	3
1.1 Introduction	3
1.2 Alpha uncertainty	4
1.3 Constraints on systematic and specific risk	6
1.4 Constraints on risk using more than one model	12
1.5 Combining different risk measures	16
1.6 Fund of funds	18
1.7 Conclusion	22
References	22
2 Novel approaches to portfolio construction: multiple risk models and multisolution generation	23
<i>Sebastian Ceria, Francois Margot, Anthony Renshaw and Anureet Saxena</i>	
Executive Summary	23
2.1 Introduction	23
2.2 Portfolio construction using multiple risk models	25
2.2.1 Out-of-sample results	33
2.2.2 Discussion and conclusions	34
2.3 Multisolution generation	35
2.3.1 Constraint elasticity	39
2.3.2 Intractable metrics	41
2.4 Conclusions	51
References	52
3 Optimal solutions for optimization in practice	53
<i>Daryl Roxburgh, Katja Scherer and Tim Matthews</i>	
Executive Summary	53
3.1 Introduction	53
3.1.1 BITA Star ^(TM)	54
3.1.2 BITA Monitor ^(TM)	54

3.1.3	BITA Curve ^(TM)	54
3.1.4	BITA Optimizer ^(TM)	54
3.2	Portfolio optimization	55
3.2.1	The need for optimization	55
3.2.2	Applications of portfolio optimization	55
3.2.3	Program trading	55
3.2.4	Long–short portfolio construction	55
3.2.5	Active quant management	56
3.2.6	Asset allocation	56
3.2.7	Index tracking	56
3.3	Mean–variance optimization	56
3.3.1	A technical overview	56
3.3.2	The BITA optimizer—functional summary	57
3.4	Robust optimization	58
3.4.1	Background	58
3.4.2	Introduction	58
3.4.3	Reformulation of mean–variance optimization	59
3.4.4	BITA Robust applications to controlling FE	61
3.4.5	FE constraints	61
3.4.6	Preliminary results	62
3.4.7	Mean forecast intervals	65
3.4.8	Explicit risk budgeting	65
3.5	BITA GLO ^(TM) Gain/loss optimization	66
3.5.1	Introduction	66
3.5.2	Omega and GLO	67
3.5.3	Choice of inputs	68
3.5.4	Analysis and comparison	69
3.5.5	Maximum holding = 100%	70
3.5.6	Adding 25% investment constraint	70
3.5.7	Down-trimming of emerging market returns	70
3.5.8	Squared losses	71
3.5.9	Conclusions	72
3.6	Combined optimizations	73
3.6.1	Introduction	73
3.6.2	Discussion	74
3.6.3	The model	75
3.6.4	Incorporation of alpha and risk model information	76
3.7	Practical applications: charities and endowments	78
3.7.1	Introduction	78
3.7.2	Why endowments matter	78
3.7.3	Managing endowments	79
3.7.4	The specification	80
3.7.5	Trustees' attitude to risk	82
3.7.6	Decision making under uncertainty	83
3.7.7	Practical implications of risk aversion	84

3.8	Bespoke optimization—putting theory into practice	86
3.8.1	Request: produce optimal portfolio with exactly 50 long and 50 short holdings	86
3.8.2	Request: how to optimize in the absence of forecast returns	86
3.9	Conclusions	87
	Appendix A: BITA Robust optimization	88
	Appendix B: BITA GLO	89
	References	90
4	The Windham Portfolio Advisor	93
	<i>Mark Kritzman</i>	
	Executive Summary	93
4.1	Introduction	93
4.2	Multigoal optimization	94
4.2.1	The problem	94
4.2.2	The WPA solution	94
4.2.3	Summary	97
4.3	Within-horizon risk measurement	97
4.3.1	The problem	97
4.3.2	The WPA solution	97
4.4	Risk regimes	101
4.4.1	The problem	101
4.4.2	The WPA solution	101
4.4.3	Summary	104
4.5	Full-scale optimization	104
4.5.1	The problem	104
4.5.2	The WPA solution	104
4.5.3	Summary	107
	Appendix—WPA features	111
	References	113
	Section Two Theory	115
5	Modeling, estimation, and optimization of equity portfolios with heavy-tailed distributions	117
	<i>Almira Biglova, Sergio Ortobelli, Svetlozar Rachev and Frank J. Fabozzi</i>	
	Executive Summary	117
5.1	Introduction	117
5.2	Empirical evidence from the Dow Jones Industrial Average components	119
5.3	Generation of scenarios consistent with empirical evidence	121
5.3.1	The portfolio dimensionality problem	121
5.3.2	Generation of return scenarios	126

5.4	The portfolio selection problem	130
5.4.1	Review of performance ratios	132
5.4.2	An empirical comparison among portfolio strategies	134
5.5	Concluding remarks	136
	References	140
6	Staying ahead on downside risk	143
	<i>Giuliano De Rossi</i>	
	Executive Summary	143
6.1	Introduction	143
6.2	Measuring downside risk: VaR and EVaR	145
6.2.1	Definition and properties	145
6.2.2	Modeling EVaR dynamically	147
6.3	The asset allocation problem	150
6.4	Empirical illustration	153
6.5	Conclusion	158
	References	159
7	Optimization and portfolio selection	161
	<i>Hal Forsey and Frank Sortino</i>	
	Executive Summary	161
7.1	Introduction	161
7.2	Part 1: The Forsey–Sortino Optimizer	162
7.2.1	Basic assumptions	162
7.2.2	Optimize or measure performance	165
7.3	Part 2: The DTR optimizer	167
	Appendix: Formal definitions and procedures	171
	References	177
8	Computing optimal mean/downside risk frontiers: the role of ellipticity	179
	<i>Tony Hall and Stephen E. Satchell</i>	
	Executive Summary	179
8.1	Introduction	179
8.2	Main proposition	180
8.3	The case of two assets	184
8.4	Conic results	190
8.5	Simulation methodology	194
8.6	Conclusion	198
	References	198
9	Portfolio optimization with “Threshold Accepting”: a practical guide	201
	<i>Manfred Gilli and Enrico Schumann</i>	
	Executive Summary	201

9.1	Introduction	201
9.2	Portfolio optimization problems	204
9.2.1	Risk and reward	204
9.2.2	The problem summarized	209
9.3	Threshold accepting	210
9.3.1	The algorithm	210
9.3.2	Implementation	211
9.4	Stochastics	215
9.5	Diagnostics	218
9.5.1	Benchmarking the algorithm	218
9.5.2	Arbitrage opportunities	218
9.5.3	Degenerate objective functions	219
9.5.4	The neighborhood and the thresholds	219
9.6	Conclusion	220
	Acknowledgment	221
	References	221
10	Some properties of averaging simulated optimization methods	225
	<i>John Knight and Stephen E. Satchell</i>	
	Executive Summary	225
10.1	Section 1	225
10.2	Section 2	226
10.3	Remark 1	229
10.4	Section 3: Finite sample properties of estimators of alpha and tracking error	230
10.5	Remark 2	235
10.6	Remark 3	236
10.7	Section 4	236
10.8	Section 5: General linear restrictions	238
10.9	Section 6	241
10.10	Section 7: Conclusion	244
	Acknowledgment	244
	References	245
11	Heuristic portfolio optimization: Bayesian updating with the Johnson family of distributions	247
	<i>Richard Louth</i>	
	Executive Summary	247
11.1	Introduction	247
11.2	A brief history of portfolio optimization	248
11.3	The Johnson family	251
11.3.1	Basic properties	251
11.3.2	Density estimation	254

11.3.3	Simulating Johnson random variates	256
11.4	The portfolio optimization algorithm	257
11.4.1	The maximization problem	257
11.4.2	The threshold acceptance algorithm	260
11.5	Data reweighting	261
11.6	Alpha information	262
11.7	Empirical application	265
11.7.1	The decay factor, ρ	266
11.7.2	The coefficient of disappointment aversion, A	268
11.7.3	The importance of non-Gaussianity	268
11.8	Conclusion	271
11.9	Appendix	272
	References	278
12	More than you ever wanted to know about conditional value at risk optimization	283
	<i>Bernd Scherer</i>	
	Executive Summary	283
12.1	Introduction: Risk measures and their axiomatic foundations	283
12.2	A simple algorithm for <i>CVaR</i> optimization	285
12.3	Downside risk measures	288
12.3.1	Do we need downside risk measures?	288
12.3.2	How much momentum investing is in a downside risk measure?	288
12.3.3	Will downside risk measures lead to “under-diversification”?	290
12.4	Scenario generation I: The impact of estimation and approximation error	292
12.4.1	Estimation error	292
12.4.2	Approximation error	293
12.5	Scenario generation II: Conditional versus unconditional risk measures	295
12.6	Axiomatic difficulties: Who has <i>CVaR</i> preferences anyway?	296
12.7	Conclusion	298
	Acknowledgment	298
	References	298
	Index	301