

Contents

Abstract	ii
Acknowledgments	iv
List of Tables and Figures	vii
1. Foundations	1
1.1 Problem Statement	1
1.2 A Note on Returns	7
1.3 The Simugram	11
1.4 Role of the Geometric Index	15
1.5 Market Performance and Outperformance	24
2. Methodology	29
2.1 Data	29
2.2 The Stochastic Simulation Problem	31
2.3 Objective Function	33
2.4 Baseline Results for S&P 100	36
2.4.1 Exploratory Data Analysis (EDA)	38
2.4.2 Characteristics of Simugram Weights	45
2.5 Constraints	52
2.5.1 Alternate Constraint Set (ACS) - Maximum Allocation by Tail Cutoff.	53
2.5.2 Alternate Constraint Set (ACS) - Risk Percentile (r^*)	60
2.5.3 Alternate Constraint Set (ACS) - Minimum return/risk tolerance r_{tail}	68
2.6 Sampling Studies	71
2.6.1 SP-100 Multiple Trial Sampling	72

2.6.2 Distribution of the Terminal Values and Simugram Returns	80
2.6.3 M-Tests: Effect of Increasing the Number of Simulations	85
2.7 Dimensionality	92
3. Parameter Optimization for the S&P 500	95
3.1 Single Group Results	95
3.2 Portfolio Splitting	101
3.2.1 2-Group Portfolio (DAC-2)	104
3.2.2 3-Group Portfolio (DAC-3)	108
3.2.3 5-Group Portfolio (DAC-5)	110
3.3 Performance Issues	113
4. Conclusions, Recommendations, and Other Matters	117
4.1 Conclusions	117
4.1.1 Hypothesis Review	121
4.1.2 Performance-uniqueness for sub-portfolios	127
4.1.3 Procedure	132
4.2 Suggestions for Further Research	133
4.2.1 Required Research	133
4.2.2 Suggested Research	141
4.3 Recommendations for Improvements	145
4.4 Practical Issues	146
Bibliography	148
Appendix A. Optimal and Operational Tail Risk Parameters (r^*)	153
Appendix B. Market Index Membership Matrix	155

Appendix C. Transformation Reduction on Nelder Mead Convergence Time	159
Appendix D. Volatility Table for Simugram Sample Returns	160
Appendix E. Graphical Return Summary, SP-100 and SP-500	163
Appendix F. Epilogue: DAC-4 and 2003 Results	165