Robust Portfolio Optimisation

7city Learning Centre, London, EC1Y 4UP
30 June 2008 (Morning)

Workshop timings:

09.00hrs
09.30 –10.45 Daniel Bienstock
10.45 –11.15 Coffee break
11.15 –12.15 Adrian Zymolka
12.15 –13.00 John Beasley
13.00 Close

Part A:

Continuing Work on Robust Portfolio Optimization
Dan Bienstock, Professor of Operations Research, Columbia University

In traditional portfolio optimization problems one constructs a portfolio of assets that simultaneously optimize a blend of high return and small return variance. However, *a posteriori* deviations in the observed returns or variances from the historical estimates may drastically worsen the realized behavior of the "optimal" portfolio.

In recent years a growing body of research has been focused on robust portfolio optimization, that is to say, portfolio optimization problems that seek "robust" solutions; roughly speaking, near-optimal portfolios that are less sensitive to deviations in the data. In the robust optimization framework, one attempts to take an agnostic view of the data errors, as opposed to the approach taken by classical stochastic programming, which requires an explicit probability distribution for the errors.

In this talk we will review a number of recent results in this field, and will also present numerical examples that describe the qualitative impact of robustness.

Part B:

Robust Portfolio Construction
Adrian Zymolka, Axioma

Classical Mean-Variance Optimization (MVO) reveals practical shortcomings, including the well-known "error-maximization" tendency, among other methodological and implementation issues. Robust Mean-Variance Optimization is an approach to overcome these shortcomings by incorporating return estimation process information directly into the optimization.

For constructing portfolios, Robust MVO is a one-pass procedure which is efficiently implemented through Second-Order Cone Programming (SOCP) algorithms, yet flexible and open to complex strategies. Realistic examples from practice exhibit the benefit offered by Robust MVO.

Part C:

Robust Efficient Frontiers
Nigel Meade, Professor of Quantitative Finance, Imperial College; John Beasley, Deputy Director CARISMA: The Centre for the Analysis of Risk and Optimisation Modelling Applications, Brunel University

In quantitative portfolio selection, the efficient frontier identifies a set of portfolios in risk – return space from which a rational investor may choose according to his degree of risk aversion. The assumption of the conventional Markowitz approach that asset returns follow a multivariate normal density function is open to considerable doubt. There is empirical evidence of fat tails and jumps in asset returns; this evidence casts doubt on the effectiveness of using mean and variance as measures of return and risk and suggests that, perhaps, more robust statistics can be used instead. Here we define efficient frontiers using a variety of measures for return and risk. We evaluate the accuracy of the predicted risk and return implied by the choice of a portfolio from an efficient frontier in terms of the realised return during the investment horizon. Over many iterations through time, the realised returns allow the accuracy of density forecasts implied by the efficient frontier to be evaluated. This allows us to judge the value of alternative risk measures such as negative semi-variance and downside deviation. We investigate the sensitivity of our findings to the length of the investment horizon and to the universe of assets.

Robust Portfolio Optimisation

About the presenters:

Daniel Bienstock is a professor of Operations Research at Columbia University, New York, where he has been since 1991. He received the PhD in Operations Research from MIT in 1985.

Professor Bienstock's research focuses on theory and applications of optimization, with special emphasis on high-performance computational implementations. His recent work has concentrated on methodologies and experiments with robust optimization, in particular in the context of financial applications.

Professor Bienstock is the author of over fifty publications, and one book, "Potential function methods for approximately solving linear programs" (Springer, 2000).

John Beasley is Deputy Director of CARISMA (The Centre for the Analysis of Risk and Optimisation Modelling Applications) Brunel University.
Professor Beasley has extensive research experience in quantitative (mathematical) decision making, both for financial and other decisions. He holds degrees from Cambridge University and Imperial College, and a Doctor of Science from the University of London. He has published approximately 65 papers in the academic literature.

Adrian Zymolka is Director of Client Services Europe for Axioma (UK) Ltd., based in London. He holds a diploma in Mathematics from the Philipps University Marburg and a Ph.D. in Mathematics from the Technical University in Berlin. During his Ph.D. time at the Zuse Institute Berlin (ZIB), Dr. Zymolka was research assistant in the Optimization department headed by Prof. Martin Grötschel. He developed optimization methods for highly complex problems in the area of telecommunication network design and was leading and participating in various industrial projects. In 2006, he joined atesio, a ZIB spin-off company, where he worked as optimization developer and consultant. In his current role, Dr. Zymolka helps users of Axioma's optimization technology to model portfolio strategies tailored to their goals and needs.

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