



CARISMA

A multi-disciplinary research centre focussed on understanding, modelling, quantification, management and control of RISK

- **School of Information Systems, Computing and Mathematics**
- **Brunel Business School**
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TECHNICAL REPORT

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A Special Report I: Quantitative Methods for LDI Solutions

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Quantitative Methods for LDI Solutions

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Traditional Asset and Liability Management (ALM) models have been recently recast as Liability Driven Investment (LDI) models for making integrated financial decisions in pension schemes investment: matching and outperforming liabilities. LDI has become extremely popular as a decision tool of choice for pension funds. Investors (pension schemes and their sponsoring companies) are increasingly concerned with the difference between their pension funds assets and liabilities and not solely on their assets returns. Global accounting and regulatory frameworks have moved towards requiring companies to fully disclose the difference between scheme assets and liabilities directly impacting the companies' balance sheets and valuations.

In practice there are three core strategies: a) **classical immunisation** (duration and convexity matching) employs the construction of a bond portfolio which meets the liabilities even when there is a small change in the interest rate. b) **Cash-Flow matching** where the patterns of the liabilities outflow streams are matched by the bonds inflows. c) Construction of two portfolios, a **matching portfolio plus a return-seeking (alpha seeking) portfolio**. The matching portfolio contains structured products that aim to hedge inflation risk, interest-rate risk, longevity risk and contribution risk of the sponsor.

Fabozzi (2004) found quantitative models were being used by fund managers mainly for risk management. They have also been used in the past to select appropriate portfolios for passive management. However in Fabozzi (2007) he finds there is an increasing use of quantitative models for the full active asset management process of generating returns in excess of the market or a benchmark (alpha generation). Traditional portfolio managers seek to exploit market inefficiencies to generate excess returns by exercising judgement based on extensive equity research. The active management process is in defiance of the classical academic view that markets are efficient and returns are unpredictable. Empirical evidence is inconclusive and there is increasing academic acceptance that returns are predictable to some extent and inefficiencies can be exploited.

Quantitative methods are gaining acceptance due to positive results, increasing computational power, more extensive and better quality data and the availability of third-party analytical software and visualisation tools. Further, consultants on behalf of their institutional clients use quantitative models to assess the value-added by and performance of fund managers. The survey is based on the responses of some of the largest fund managers in North America and Europe.

Optimisation increasingly plays a key role in this process; the majority of survey participants are using optimisation methods. Classical mean-variance is still the most widely used technique however use of utility optimisation and robust optimisation methods are reported. Only one of the survey member reports using stochastic programming. These methods allow the fund managers to automate the construction of a portfolio from a wide range of assets with the optimiser choosing assets to meet the companies' specific risk-return requirements. They are also important tools in the construction of products with specially engineered returns such as guaranteed returns.

Fabozzi, Frank J., Focardi, Sergio and Jonas, Caroline (2007), *Trends in quantitative equity management: survey results*. Quantitative Finance, 7:2, 115-122.