

# New models for ailing pensions

Pension fund managers are turning to quants for help during their darkest hours. Navroz Patel looks at some of the latest developments and prospects for stochastic models

Pension fund managers are in a tail-spin. Both public and private schemes are struggling to find yield in bear markets. In addition to unfavourable demographics, managers of corporate schemes have the added problem of the pressure exerted on corporate solvency by a growing funding gap (see box). "State schemes will not be able to pay up, so they are trying to unload pensions on to the private sector. Corporates won't be able to pay up, so they are closing defined-benefit schemes to new employees," says Michael Dempster, a professor at the centre for financial research at the University of Cambridge. "Wherever you look, pension funds are struggling to meet their obligations," he adds.

And with the gradual adoption of the

agement. But constructing a risk-efficient portfolio of assets is only half the story for pension funds - investment decisions must be made in an overall asset and liability management (ALM) context to be truly effective.

Cognisant of this, progressive pension managers are now looking to the latest breed of stochastic models as a way of solving the complex ALM problems. Silvio Vecchi, Munich-based administrator of reserve funds at the European Patent Organisation is one such manager. After considering a number of different solutions, Vecchi selected a cutting-edge stochastic ALM model offered by the pensions advisory team at Siemens Financial Services (SFS) in summer 2002. "There are many features of the model

the ALM system, while the future typically refers to a 10-year horizon divided into quarterly or annual periods. Each period in each scenario is characterised by a certain outcome for the fundamental economic variables. It's these variables that simultaneously drive asset returns and liability growth in that particular environment. Since stochastic processes generate these variables, asset returns and liabilities are stochastic over time too. The strategic asset allocation is optimised over the large number of scenarios the Monte Carlo sampling approach generates.

MSP uses - at each point in time and for each scenario - all available information to derive a strategic asset allocation, optimal under the then-prevailing economic environment. So MSP returns one optimal asset allocation for each point of time and each scenario. The investor can then identify in each future period the particular scenario most closely resembling the economic environment of that time, and implement the corresponding optimal strategic asset allocation.

While MSP generates a large number of optimal asset allocations, DR optimisation yields just one optimal strategic asset allocation for a certain investment rule. 'Mix rebalancing' is an example of a popular rule - it consists of rebalancing the portfolio to the optimal strategic asset allocation in either fixed intervals, or whenever market conditions precipitate a significant change in the portfolio's overall mix. "Around two thirds of our clients chose DR optimisation," says SFS' Inkmann. "It's easier for them to understand, communicate and work with," he adds.

In addition to the ALM model's dynamic nature, SFS claims that having the economic model drive both asset returns and liability growth over time makes it more powerful. "Many of our competitors' ALM tools represent liabilities by a single scenario," says Inkmann. This kind of treatment ignores the fact that higher interest rates, for example, imply higher discount rates and smaller liability positions.

SFS is not alone in developing ambitious dynamic stochastic ALM models for pension funds. A team consisting of researchers from the University of Cambridge and Boston-based Pioneer Investments claims to have recently developed a unique model that combines simulation and stochastic optimisation

## "Wherever you look, pension funds are struggling to meet their obligations"

Michael Dempster, University of Cambridge

international mark-to-market accounting standard IAS 39, the changing regulatory environment is preventing managers from continuing to bury their heads in the sand. "Almost by definition, market-driven valuation requires risk to be evaluated on a stochastic basis for a realistic assessment," says Guy Coughlan, London-based global head of asset and liability management at JP Morgan Chase. Though still regarded as the most conservative of investors, pension fund managers are increasingly aware that they must update their attitude to risk man-

agement. "That caught my attention," says Vecchi, who points to mean-reversion, regime switching, calibration and worst-case scenario tests as particular strengths of SFS's model.

The German financial services company offers clients two generic approaches: multi-stage stochastic programming (MSP), and decision rule (DR) optimisation, says Joachim Inkmann, a Munich-based consultant in pension advisory at SFS. A scenario is one possible path of future outcomes of the fundamental economic variables of all countries covered by

### Pensions' effect on credit ratings

Last month, rating agency Standard & Poor's aimed a broadside at all board directors who continue to view their under-funded pension schemes as an irritation, distinct from the commercial side of their business. Following its review of more than 500 European companies' unfunded pension liabilities, the agency placed the credit ratings of 10 European corporates on CreditWatch, with negative implications.

The credit analysis was based on estimates of companies' pension liabilities and their assets, as they stood at the end of 2002. Though no corporate was seen as having post-retirement liabilities

of a scale large enough to precipitate a downgrade, the sea change in S&P's approach is clear: "Standard & Poor's views unfunded post-retirement liabilities as debt-like in nature, given the future call on cash these liabilities necessarily represent," says Paris-based credit analyst Emmanuel Dubois-Pelerin at Standard & Poor's.

The companies and ratings affected include large European names such as Rolls-Royce, ThyssenKrupp, GKN Holdings and Michelin. The rating agency will make a decision about whether to affirm ratings or downgrade by the end of April, following discussions with each company. □





to create a truly dynamic model.

Dempster – who led the academic contingent – says their model represents a significant step forward compared with the majority of models currently available. “This is a dynamic model that is robust against alternative futures. Despite its complexity, we’ve turned it into a formal optimisation problem and cracked it,” says Dempster. “The consequences of rebalancing are easy to see and guarantee, and probabilistic constraints can be incorporated,” he adds.

By tackling the pensions problem head-on with dynamic stochastic optimisation, Dempster claims to have stolen a march on those that assume risk neutrality to transform pension fund ALM into a derivatives pricing problem. “Risk neutrality may be a good method for valuation, but it tells you nothing about making

portfolio decisions,” he says. Put simply, to make portfolio decisions in a risk-neutral world requires the addition of risk premiums. But there is often no definitive answer regarding the value, dynamics – or even existence – of these premiums among different market participants.

But even pension fund managers who use traditional non-stochastic models may be falling into a trap. Many use a Markowitz-type optimisation – effectively rolling-over buy and hold portfolios – maybe as frequently as twice a year, given current market volatility. Markowitz rebalancing works fine if returns are independent with no time-dependency and have a Gaussian distribution. But in the real world, these assumptions don’t hold, and real markets are incomplete.

Consistent with eschewing risk neu-

trality, Dempster et al’s model uses utility functions to define risk appetites. However, unlike most other models, the user can choose from a variety of available functions. This allows the model to be tailored for different pension products. While admitting that the model’s initial performance varied with utility function, Dempster claims his team has developed a “bag of tricks” to shape terminal wealth distributions effectively. In addition, the model’s intricate scenario tree – and associated analysis – has been tested and tuned extensively. This is especially important in the context of probabilistic constraints such as value-at-risk, or a requirement to meet a no-capital-loss guarantee with 99% confidence, for example.

One actuary familiar with this project says the generic technology developed by Dempster and his colleagues is attracting interest from investment banks and funds. Others involved in pensions advisory have also seen interest in stochastic models grow. Though he declines to talk specifics, JP Morgan Chase’s Coughlan says that over the past year, the number of staff throughout the bank working on pension-related projects has increased “manifold”.

However, despite theoretical advances and growing awareness of their power, stochastic models’ implementation may not be widespread in the near future. “The biggest obstacle to growing use of stochastic pension ALM models is their complexity,” says Andreas Reichlin, Zurich-based managing director of Ecofin, a Swiss financial consultancy. “When you have a board involved, its members need to sacrifice plenty of their [scarce] time to gain expertise in dynamic ALM and to fully understand the results,” he adds. Coughlan agrees: “Education is an ongoing theme. You can’t always use your most sophisticated models – you have to be able to bring your clients along with you.” □

**Joachim Inkmann, SFS: DR optimisation is easier for clients “to understand, communicate and work with”**



**Evaluate your returns**

**Manage your risk**

**Take control of your portfolio**

#### **Attribution**

Improve the decision making process by accurately assessing what added value and why.

#### **Risk Management**

Highlight and communicate sources of risk, both expected and unexpected.

#### **Performance Measurement**

Report returns with unmatched precision and detail relative to benchmarks and peer groups.

#### **Portfolio Construction**

Develop and manage strategies, from passive index to active quantitative, for both equity and fixed income portfolios.

For more information contact **Wilshire Associates Incorporated** at +44 (0)20 7814 7355 • [quantumsales@wilshire.com](mailto:quantumsales@wilshire.com) • [www.wilshire.com](http://www.wilshire.com)  
**Wilshire Associates Incorporated** • Serving the investment management community since 1972 • Copyright © 2002 Wilshire Associates Incorporated. All rights reserved