



Stochastic modelling for life assurance reserving and individual capital assessment

The UK Actuarial Profession's Life Board issued a [discussion draft](#) in September 2005 covering changes to GN47, the profession's guidance note on stochastic modelling. The discussion draft is for informal consultation, with the ability to make verbal comments at meetings to be held in Edinburgh and London on 11 and 12 October 2005, respectively. Written comments may be sent to the profession by 2 November 2005. Following the informal consultation, the aim is to produce an exposure draft early in 2006, with formal consultation following thereafter.

The main changes from the existing version of GN47 (version 1.1 issued in December 2004) are as follows:

- **A revised table of (maximum acceptable) excess total equity returns by term and percentile.**

The aim of the table is to provide upper bounds against which the returns from stochastic models at given probability levels (0.5th, 2.5th, 5th and 10th percentiles) may be measured. The table is based on gross returns with income reinvested. The revised table shows excess returns for additional durations compared to the existing table (15 and 20 years, as well as those for 1, 5, 10 and 25 years).

The revised table, despite the impression of the text in the discussion draft, is no longer based on both UK and overseas equity returns. It is now based solely on UK equity returns from the FTSE All-Share index over the period 1901-2004, with the cash return (to determine the excess) being based on returns from UK Treasury Bills over the same period. The existing table, in GN47 version 1.1, was based on returns from a survey of sixteen markets carried out by Dimson, Marsh and Staunton of the London Business School over the period 1900-2003.

The excess return figures in the revised table are somewhat different to the existing table, particularly for longer durations where the 10th percentile excess return for 25 years has moved into significantly positive ground from a factor of 0.78 to 2.10. The primary reason for the significant change in returns at a 25 year duration appears to be due to a change in methodology, rather than the move from composite UK and overseas equity returns to solely UK returns. Under the new methodology, the excess equity percentile returns (for all durations) are based on time-scaled one year mean returns and volatility (assuming a normal distribution with an idealised mean excess one year return of 5% and 20% volatility), rather than being based on the mean returns and volatilities observed over longer durations. The reason for the switch is that the mean returns and volatilities observed for longer durations were determined using rolling data. As the discussion paper points out, this would tend to overstate the true level of volatility over long durations.

- **A new table giving (maximum acceptable) excess total returns for property assets.**

The excess property returns are based on the IPD UK Annual Index total returns for All Properties (Retail, Office and Industrial combined) over the period 1971-2004, with cash returns, as for the equity table, being based on returns from UK Treasury Bills.

An attempt has been made to remove the smoothing effect of surveyors' valuations on the IPD Index (the Index is based on surveyors' valuations rather than actual market prices) by assuming that IPD Index reflects smoothed property prices which are a linear function of this year's and last year's unsmoothed property prices. The discussion draft then puts forward both smoothed and unsmoothed excess property returns (over UK Treasury Bills) for the same durations (1, 5, 10, 15, 20 and 25 years) and percentiles (0.5th, 2.5th, 5th and 10th percentiles) as provided for UK equities.

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As for UK equities, the excess return figures are based on time-scaled one year mean returns and volatility, and the assumption of a normal distribution. For durations of 5 years and over, the resultant smoothed excess property returns were assumed to be the same as the unsmoothed returns. For the percentiles shown, the resultant excess total property returns are higher than those for equities at shorter durations (reflecting lower volatility) but lower at long durations (reflecting lower mean returns). It is suggested that use of the unsmoothed returns is appropriate when properties are being sold (e.g. in a closed fund) and that the smoothed returns could be used otherwise (e.g. where smoothed returns are reflected in asset shares or used by management to determine changes in the equity-backing ratio).

- **Three new tables giving (minimum acceptable) changes in risk free interest rates by term and percentile**

The three new tables are based on changes in 1, 10 and 20 year spot (zero coupon bond) rates. The tables show minimum acceptable changes in risk free interest rates for both low percentiles (0.5th, 2.5th, 5th and 10th percentiles, as for the equity and property tables) and high percentiles (90th, 95th, 97.5th and 99.5th percentiles). The tables are based on idealised volatilities derived from Bank of England data for 1, 10 and 20 year zero coupon bonds over the period 31/12/1979 to 31/12/2004 and assume that changes in interest rates follow a log-normal distribution. The Life Board's GN47 working party did also look at data from the US and Japan but did not place any significant weight on this data in determining the idealised volatilities.

- **Deletion of the sections on insurance risk and a change in the title of the guidance note**

The sections on insurance risk have been deleted and the paper's title has accordingly been changed to Stochastic Modelling of Economic Risks in Life Insurance to reflect the new focus. The working party has suggested that a new guidance note may be required in time to cover insurance risks. This would certainly be in keeping with developments in stochastic modelling of mortality which have been put forward in the Continuous Mortality Investigation Bureau's recent [Working Paper 15](#) on this subject.

- **Deleting the sections on Guaranteed Annuity Rates**

These sections have now been moved to GN45, the profession's guidance note on determining the with-profits insurance capital component.

- **Changes to the order of paragraphs and minor changes to the text**

The text of GN47 now follows a more logical format which is clearly desirable, although it does make it less easy to compare the discussion draft version of GN47 with the existing version.

The Life Board is particularly looking for comments on the methodologies underlying the revised and new tables. There are many issues including:

- The lack of historical data which makes it difficult to derive statistically reliable measures, especially where you are trying to cater for 1 in 200 year events.
- The appropriateness of the methodology and probability distributions assumed.

Are the normal or log-normal distributions used appropriate? Do they give sufficient weight to more extreme market events? Should more sophisticated approaches be used?

- Whether it is reasonable to assume that the mean returns and volatilities observed from historical data will continue in the future?

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