

The Actuarial Profession

making financial sense of the future

Stochastic Accreditation Working Party

11 November 2003

Hilton Birmingham Metropole Hotel

**Stochastic Accreditation Working Party -
Background**

- Originally Part of 2005 Accounting Project
 - Successor to 'Fair Values' Working Party
 - Main initial focus on IAS Insurance DSOP
 - Also cover Risk Based Capital
 - Includes Life and GI liability models
- Terms of Reference
 - Consideration of suitability of stochastic engines available for fair value financial results and risk based capital
 - Development of criteria for accreditation of stochastic engines
 - Investigation into range of engines available
 - Cost / benefits of applying these methodologies

Working Party - Major Work Focus

- Criteria for selection of models for use in Fair Value / Risk Based Capital work
 - Theoretical Requirements
 - Practical issues
- Information gathering on models available
 - Single / Multi Asset Class
 - Public Domain / Proprietary
- Role of Faculty / Institute in selection of models
 - Accreditation of individual models?

Fair Values - Background

- Requirement for IAS39 and Phase 2 of IAS Insurance Standard
- IAS 39 Definition of Fair Value
 - Amount for which asset could be exchanged or liability settled, between knowledgeable, willing parties in an arms length transaction
- FSA requirement for market consistent valuation in Realistic Balance Sheets
- Techniques for assessment of market consistent values
 - Closed form solutions
 - Monte Carlo simulation

Fair Values - Use of Stochastic Models

- Assessment of liabilities where payouts depend on asset returns or interest rates
 - With Profits
 - Guaranteed Annuity Options
 - Unit Linked contracts with mismatch between income and expenses
- Insurance risks
 - Assume that risks are diversifiable; or
 - Use stochastic liability models to aid derivation of market value margins

Fair Values - Model Assessment Criteria

- Key criterion is 'Market Consistency'
 - Ability to reproduce market prices of traded assets
 - IAS 39 requirement
 - Assumptions consistent with those used by market participants
 - Implies model must be arbitrage free
- Key issues
 - Calibration of model
 - Choice of traded assets to test market consistency
- Use of Risk Neutral Models / Deflators

Risk Based Capital - Background

- FSA - Individual Capital Assessments
 - CP195 outlines framework for life insurers
 - Use of capital models
 - Assessment of probability of insolvency over appropriate time period
 - Similar approach may be used for GI
 - Stochastic modeling might be used to consider capital requirements arising from Market, Credit and Insurance Risks

Risk Based Capital – Use of Stochastic Models

- Market Risk
 - Use of Asset Models to model asset returns
 - Equity / Property
 - Interest Rate
 - Key areas : Any business line with material asset / liability mismatch
- Credit Risk
 - Model credit standing / defaults for corporate bonds
 - Key areas : Annuity Portfolios / GI / With-profits
- Insurance Risk
 - Model incidence / amount of insurance claims
 - Key areas : GI / Life Protection Business

RBC - Model Assessment Criteria

- No simple tests for model suitability
 - Market consistency not required
 - Distribution of outcomes must be realistic
 - Risk Neutral models not appropriate
 - Distribution of 'tails' vital when assessing RBC requirements
 - Correlations between risks
- Calibration
 - Based on historic experience, market data and judgment
 - Choice of calibration period
 - What period of history to examine?
 - What periodicity of return to calibrate to?

Risk Neutral vs Deflators

- Risk Neutral
 - In 'risk neutral' world all assets earn risk free rate on average
 - Discount rate is risk free
- Deflators
 - 'Stochastic Discount Rates'
 - Cashflows adjusted for risk taken to achieve them and then discounted at the risk free rate
- Either approach can give acceptable answers for Fair Value assessments
 - Both approaches are mathematically equivalent
 - Risk neutral models more commonly used in valuation
 - Deflators may allow use of same scenarios for other exercises

Equity Models

- Number of public domain models developed to price equity options
- Models include
 - Black Scholes lognormal model
 - Lognormal model with stochastic drift
 - Hull & White Stochastic volatility models
 - Regime switching models
 - Jump diffusion models
 - GARCH models

Equity Models - Desirable characteristics

- Ability to reproduce market prices of options
- Ease of calibration
 - Closed-form solutions
- Volatility structure
 - Fat tails
 - Moneyness / volatility smile
 - Term
 - Stochastic volatility?
- Dividends

Interest Rate Models

- Wide range of models available
 - Black's model
 - Short rate models
 - Vasicek
 - Cox Ingersoll Ross (CIR)
 - Term structure models
 - Hull and White
 - Multifactor models
 - Heath Jarrow Morton models

Interest Rate Models - desirable characteristics

- Choice of yield curve – Gilts vs Swaps
 - Options market tends to use swaps
- Quality of fit to yield curve
- Volatility structure
- Possible behaviour of yield curve
 - Driven by number of random factors
 - Correlation between rates of different durations
- Ease of calibration
 - Closed-form solutions for options
 - Swaptions
 - Caps
 - Floors

Other Asset Classes

- Property
 - Some econometric models available
 - Market consistent models used generally adaptations of equity models
 - Some calibration data available
- Corporate bonds / Credit Risk
 - Range of commercially available models
 - Moody's KMV, CreditMetrics
 - Simpler generic models based around theory of firm
- Overseas assets
- Portfolios containing options

Liability Models

- General Insurance – range of commercial models available
 - Igloo, TAS P/C, Moses, Mercury, DFA inc
- Life Insurance
 - Limited number of mortality models
 - Demographic models eg Lee - Carter
 - Issue of consistency with mortality projections
 - CMI scenarios
 - Scope for further development
 - Morbidity models?
 - Dynamic lapse rates?

Multi-Asset Models

- Multi Asset Models needed where liabilities depend on performance of portfolio of investments
 - Assessment of With Profits liabilities
- May build on individual asset class models
- Correlations between asset classes
 - No market 'price' so use historic correlations
- Range of public domain and proprietary models available

Multi-Asset Models - Survey

- Working Party Survey
 - Detailed questionnaire
 - Responses for 12 models
- Questions covered
 - Range of assets modelled
 - Ability to reproduce market prices
 - Suitability for RBC work
- Hope to be able to make survey results available - perhaps through Faculty / Institute Website
 - Update process will be required

Practical Issues

- Run times
 - Number of scenarios will depend on model chosen
 - Variance reduction techniques
 - Deflator based models
- Calibration
 - Availability of assets to support fair value calibration
 - Ease of calibration
- Understanding the model
 - Need to understand uses and limitations

Stochastic Accreditation Board – Working Party Views

- Suitability of models depends on application
 - Choice of model must be made in relation to liability being valued
 - Calibration of model
- Board may operate as disincentive to innovate
- Practical issues
 - Time available for Board to assess and accredit models
 - Speed of change
- Final sign off of accounts rests with Auditors

Working Party Recommendations

- Accreditation of individual models not appropriate
- Professional Guidance for Actuaries working in this area would be helpful
 - Choice of model
 - Calibration
- Successor Working Party to develop this Guidance
- Consider central data source to assist in model calibration
