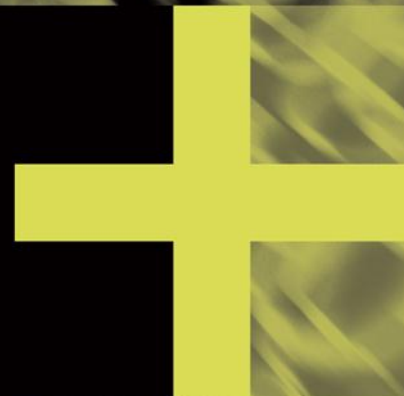


# Annuity Risk Model

barrie+hibbert

Powering objectivity in the global financial services industry



# Annuity Risk Model

The use of stochastic asset / liability models has become routine for larger insurance companies to value, manage and assess capital for with-profits business. However, such models are much less widespread for non-profit business such as annuities.

In many ways this is surprising, since the economic risks being run by insurance companies are often more significant for annuity business than for with-profits business and are just as amenable to analysis with an appropriate stochastic model. In other ways this situation is less surprising, since constructing a useful stochastic model of annuity business is actually harder than it might appear at first sight. The different regulations for non-profit business (and in particular the absence of a "realistic balance sheet") have also removed the short-term catalysts for the use of stochastic modelling.

However, there is now a growing belief that stochastic modelling of annuity business is vital for a genuine understanding of the risk and capital management issues that arise, for example the interaction between market risk and longevity risk. The emerging requirements of the EU's Solvency II initiative are also fuelling the development of such internal models.

## How can we help?

Barrie & Hibbert have developed a flexible and robust Annuity ALM Model, which is already being used by a number of leading annuity providers. This model is fully integrated with our Economic Scenario Generator (ESG) and incorporates stochastic interest rates (nominal and real yield curves and inflation), stochastic credit risk (defaults, rating changes and credit spreads) and stochastic mortality. Its flexibility allows liabilities and assets to be split into any number of separate portfolios and it can handle new business and dynamic investment strategies, for example rematching assets and liabilities during the projections, as well as dynamic valuation and pricing bases. The model is written in the Microsoft .Net software environment, providing a robust software development and testing environment, and includes the functionality for uploading large numbers of assets and liability model points.

Barrie & Hibbert's experience of helping insurers to use stochastic modelling to understand the impact of their own management strategies means that the Annuity ALM incorporates the effect of planned future management actions regarding investment and matching policies. These can have a fundamental impact on the risk and profitability of the business.

Without such an integrated approach to annuity asset / liability modelling, it is very difficult to capture the potential effects of changing interest rate and credit market environments on both the statutory and economic health of the business, as well as the interaction between these factors and possible changes to mortality expectations.

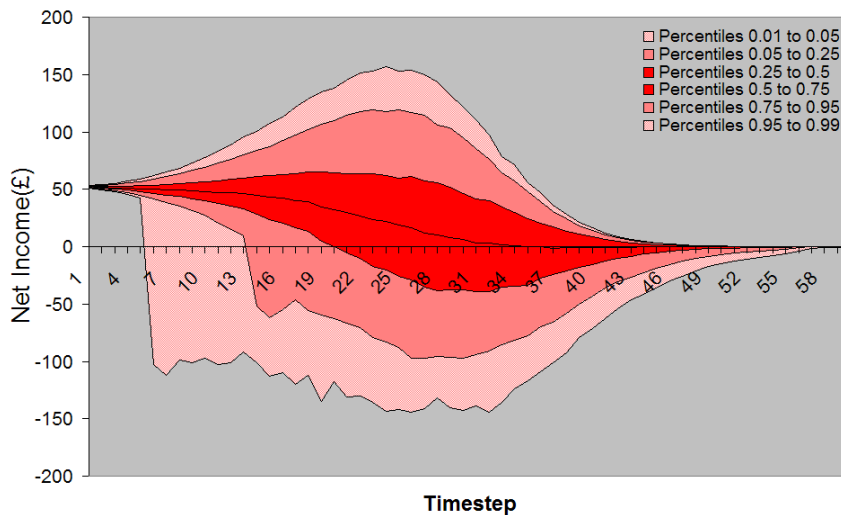
## Key Benefits of the Barrie & Hibbert approach

- Access to sophisticated yield curve and credit modelling, together with many alternative assets that might be considered for annuity investment such as equity, property, options, hedge funds, commodities, structured credit, commercial mortgages, etc.
- Fully integrated asset and liability modelling, allowing flexibility to model cashflow matching and management actions such as dynamic investment strategies
- The model incorporates a full range of annuity types, fully capturing LPI liability variations for example, together with stochastic mortality modelling functionality and supported calibrations
- Ability to better understand expected return on capital and distribution of actual ROC
- Allows alternative risk capital measures to be evaluated and projected
- Supports pricing and matching processes – what allowance should be made for credit and longevity risk?
- Aids understanding of impact of alternative investment strategies for assets and capital backing annuity business, for example how much credit risk and over what term?

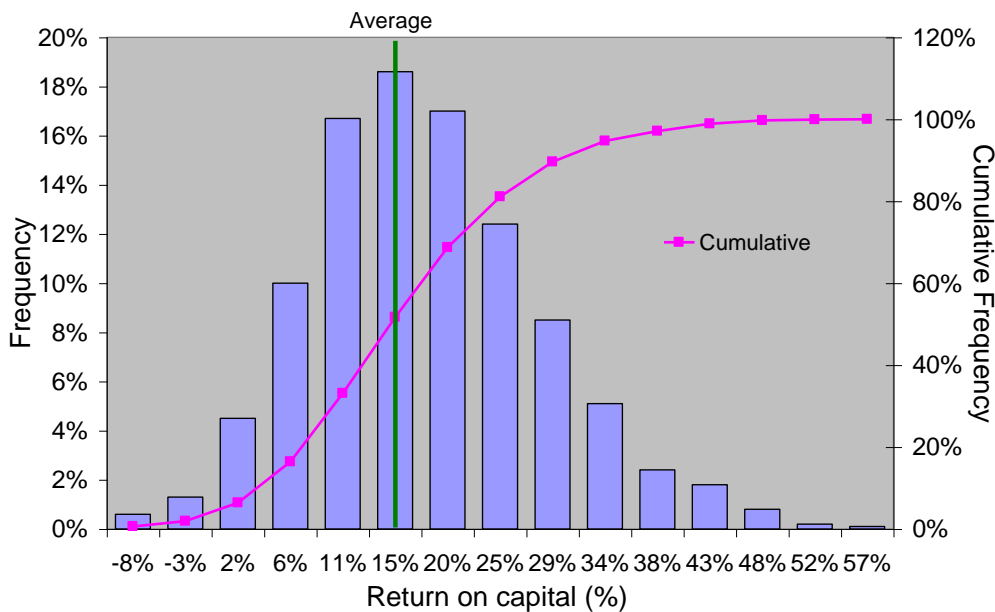
### Example Outputs

Below we show two examples of outputs which can be generated by the model. In each case results are generated for a typical book of fixed annuities backed by investment in corporate bonds.

**Figure 1:** Distribution of net income (income from assets less liability payments) through time for example book of annuity business. The effect of possible asset defaults on the downside risk can be clearly seen.



**Figure 2:** Distribution of return on shareholder capital for a particular pricing assumption. This shows clearly the potential range of outcomes, reflecting the essentially geared nature of the business.



## Why Barrie & Hibbert?

Barrie & Hibbert was established in 1995 by John Hibbert and Andrew Barrie. We provide a range of software modelling tools, research and consulting services to a wide range of financial institutions and strategic partners.

Barrie & Hibbert's primary focus is the identification, quantification and management of financial risk in savings and investment products, institutional portfolios and life and pensions balance sheets. Barrie & Hibbert has developed a powerful library of financial models that can be used to understand the complicated joint financial relationships that drive uncertainty in long-term financial plans.

Collectively our staff of leading academics, quantitative analysts, actuaries and software engineers offer a depth and breadth of expertise combined with an unrivalled track record of experience in implementing risk solution for financial institutions around the world.

Our asset and product modelling capability has been developed over the last 13 years resulting in Barrie & Hibbert becoming a global market leader in stochastic asset modelling services.

Barrie & Hibbert is privately owned and employs around 100 staff across locations in the UK, US and Asia.

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