



SOCIETY OF ACTUARIES

Article from:

# The Financial Reporter

March 2001 – Issue 45

## A Summary of the UVS Project

by Dave Sandberg

*Editor's Note: This is a report on the use of Section funds. In addition to those funds, this project was also supported by funds from the Society of Actuaries and the American Academy of Actuaries. But most importantly, the project was supported by extensive time donated by Roger Smith, Victor Kwong, Brian Richards, Doug Eckley, Tom Grondin, Tim Hill, Mark Tenney, Luke Girard, Doug Doll, Donna Novak, and Eric Fasano, as well as the author of this article.*

### Introduction

Last fall, the Financial Reporting Council agreed to provide some funding for a joint Academy/SOA applied research modeling project. The project was based on principles developed by the Valuation Task Force of the American Academy of Actuaries for the assessment of capital adequacy. The project also allowed for the demonstration of a possible "fair value" accounting methodology and the results were presented at a seminar in Philadelphia on November 8<sup>th</sup>. The Section funding contributed to the project's participants being able to build a database of cashflows usable for further theoretical and applied development of these topics by the SOA or other interested parties.

The modeling project utilized actuarial techniques and theory to apply a ruin theory approach to determining capital adequacy. It used current technology and models to investigate how actuarial science can provide a forward-looking analysis of a company's ability to support the risk that it has assumed.

The project developed line-of-business and total company financial information (including statutory and GAAP) for a fictitious insurance company and projected cashflows from three points in time through three balance sheets and two income statements. This allowed a comparison of current accounting practices to the proposed alternatives. While the project used U.S. accounting comparisons, its focus on the projection and evaluation of future cash flows will also allow the inclusion of non-U.S. insurance products as well (if so desired at a later time.) Due

to the emerging national and international developments concerning these concepts, the project looked at both required capital and fair value due to their common prospective orientation to risks on the balance sheet.

### Modeling Framework

There were three main segments — a "worldview" model of economic assumptions, independent insurance product line-of-business models, and a "total company" model that pulled together the financial information for the insurer.

The line of business models utilized information from the world view model, as well as specific assumptions needed for the particular line of business. For example, the mortality for the universal life product model was a multiple of the mortality selected by the world view mortality model.

The output from the line of business models served as input to the total company model.

### World View

The "world view" represented a set of assumptions and parameters common to multiple lines-of-business. They included the following:

- **Corporate Bond Yields** – modeled as constant spreads to Treasury rates
- **Default** – modeled the variations in the default provision by duration from the start of the projection to reflect that default patterns vary since the bond or security was last rated. The chance of a security rated AAA yesterday defaulting in the next several years is effectively zero. As time passes, chance for default increases.
- **Inflation** – modeled as the 90-day Treasury rate less 300 basis points.
- **Prepayment Speeds** – used a typical function driven by interest rates.
- **Expected Mortality** – based improvement assumptions on the 20<sup>th</sup> century U.S. census tables with an average annual improvement rate of 0.3%.

- **Mortality Risk Due to Uncertainty About the True Improvement Rate** – Three mortality sets were used, with the best and worst being one-half standard deviation from the average. These improvement rates were not varied by projection year. This assumption estimates the risk of setting a mortality assumption, but then missing the mark in the sense that the world moves in a different direction. It does not address the problem of variability of a smaller company's experienced mortality rate around the true mean. The term life product line-of-business model conducted sensitivity tests on the effect of the variability.
- **Mortality Catastrophe Risk** – Based on data from the 1918 influenza pandemic, a one time 38% increase in mortality for one year was applied to 26% of the 30-year projection sets.
- A set of 1000 "realistic" interest rate scenarios for capital adequacy requirements
- A set of 1000 risk-neutral interest rate scenarios for fair value calculations
- The interest rate scenarios were generated as of 12/31/89, 12/31/92 and 12/31/95 and were all constrained to be arbitrage free.

### Lines of Business Modeled

Five life product lines were modeled — 10-year term, Universal Life, Single Premium Deferred Annuity, Income Pay and a Variable Annuity with Guaranteed Living Benefits.

### Fair Value Modeling Platform

One of the goals of the project was to provide a platform to experiment with various methodologies for calculation of fair value of liabilities. The modeling platform was used to determine the effect of these methodologies on a company's financial statements and the sensitivity to various techniques and assumptions.

All of the fair value calculations were centralized in the module that brought line-of-business data into a company wide perspective. This allowed alternative approaches to determining fair value without needing to rerun the line-of-business models.

## Access Database for Total Company

To facilitate a total company analysis, and to provide a platform for calculation of fair values under different criteria, an Access database was defined and populated. The database has quarterly projection results (quarterly instead of monthly to reduce file size — the monthly cash flows are summed within the quarter). The data fields were as follows:

- Scenario Number
- Calendar Year
- Month
- Premiums
- Death Claims
- Annuity Payouts
- Health Claims
- Surrenders and Withdrawals
- Claim Expenses
- Premium Tax
- All Other Expenses
- Transfers to Separate Account
- Earned Interest (net of investment expense)
- Payments of Principal
- Decrease in Cash Account Balance
- Default Charges
- Investment Income
- FIT
- Asset Book Value
- Asset Market Value
- Statutory Reserves
- Tax Reserves
- Asset Tax Basis
- Commissions

The cash flows for premiums, death claims, annuity payouts, health claims, surrenders and withdrawals, claim expenses, premium taxes, other expenses and transfers to separate account are intended to cover all liability cash flows. In these models, there are no maturities, no policy loans, no policyholder dividends, no reinsurance or other liability cash flows.

## Total Company View

Since the Access database had a consistent format for all the lines of business, it was used for the total company calculations. For required capital calculations, the results by line were combined scenario by scenario and a new ranking of scenarios performed. This allowed for

covariance of risks among the lines to be measured. For fair value, the present value calculations for each line were assumed to be additive when addressing the total company values.

The following issues were simplified in the total company results and were deemed to have not materially affected the results:

**Federal Income Tax** – The line of business models assumed immediate credit for any negative taxes. On a total company basis, it would be possible to utilize tax carry-forwards and carry-backs (although these may not have been entirely appropriate for an inforce-only projection).

**Overhead Expenses** – Overhead expenses were allocated to maintenance expenses included in the line of business unit expense factors. Acquisition expense overhead was included in the new business assumptions. A total company model could have included overhead on a more “fixed amount” basis but was not done here.

**Free Surplus** – A total company model could include additional surplus not allocated to the lines. Although this would affect cash flows and tax carry-forwards/carry-backs, it would not be expected to have a direct impact on calculated required capital or fair value of liabilities.

## Seminar Results/Concepts

The seminar demonstrated the application of a ruin theory approach and a fair value methodology using current technology and techniques. Items of interest included:

- The effect of the “discount for diversification,” (i.e., the reduction in surplus required for the combination of lines of business).
- Differences in capital requirements using a ruin theory approach as compared to current capital requirements.
- How convergence of results was affected by the number of scenarios used.
- Sensitivity of financial results to changes in core assumptions, such as mortality and lapses.
- Comparisons of fair value results to current GAAP reporting.
- Effect of using realistic vs. risk-free rates on fair values as well as a demonstration of the use of Market Value of Margins in the liability cashflows.

- 50-60 people in attendance, including one P&C actuary, two individuals from the Federal Reserve Board and one individual from the Pension Benefit Guaranty Corporation (PBGC).
- A good review of the uses and differences of arbitrage-free, risk-neutral and realistic interest rates.
- Illustration of the lack of current formulaic RBC responsiveness to changing risks.
- The use of the Conditional Tail Expectation (CTE) concept developed by Harry Panjer and the CIA for assessing segregated fund capital adequacy.

## Work Still Remaining

- Finalize documentation of data and key conclusions of seminar.
- One way to reduce the number of projections needed is to model each risk independently and build a correlation matrix to determine the impact of diversification. This requires more research in how to estimate the magnitude of those correlations.
- Cementing the relationship of capital levels to fair value discount rates.
- Business risk classifications and segmenting of risks into quantifiable, subjective and high impact/low frequency categories.
- Since the seminar focused on one aspect of UVS — capital for inforce business — it did not illustrate a Viability Report, nor a High Impact Low Frequency Report.
- Continue discussions with NAIC. Concepts are relevant to:
  - Life Health Actuarial Task Force (LHATF)
  - Life RBC Working Group
  - Liquidity Working Group
  - E Committee
- Trade-off of relevant vs. accurate. Is it better to be precisely wrong or approximately right?
- Establishing a basis for comparing required capital for Life, Health, P&C and Banking?
- Use of Feedback Loop to compare actual to expected results and its impact on required capital.