



Stochastic Modeling Techniques

Balancing Run Time and Model Robustness

Huan Tseng, FSA, MAAA
Friday, May 7, 2004

ace tempest life re

Overview

Modeling Requirements

Modeling Techniques & Considerations

Case Study

Final Thoughts

Modeling Requirements

Product complexity continues to increase

~ new VA riders with additional options

Need to capture/quantify all options and guarantees inherent in the product

~ if you think it's cheap, prove it!

Even more variables and parameters to consider

~ dynamic p/h behavior, optional resets, correlations, etc.

Modeling Requirements

New reserving and capital requirements

Traditional pricing tools or “black boxes” may not be up to the challenge

~ need programming skills and creativity

After all of the product's functionality is modeled, you will also need to consider the 'run time'

~ availability of better and faster computers have allowed for more robust actuarial models

Minimizing Run Time

Reducing the number of scenarios (more on this later) OR length of projection

Pre-generate scenario independent cash flows

Simplify or carve-out formulas/variables not used or immaterial to the results of the run

Software/vender specific optimizing techniques

Group data into model points (discussed here)

~ for pricing, assumes we use in-force data to model new business

⑦ ***Always test accuracy of the revised model!***

Grouping Considerations

Need to be very careful how data is aggregated

~ mentioned in appendix of C3 Phase II report (Methodology Note C3-02)

~ characteristics to consider shown on next slide

Number of model points will also depend on:

~ complexity of the model

~ product being modeled

~ size and nature of the seriatim data

~ how relevant the underlying data is to the business being modeled (pricing or valuation)

Grouping Considerations

Grouping criteria should consider the following:

- ~ in-the-moneyness
- ~ product variations (including rider variations)
- ~ annuitant and/or owner age
- ~ gender
- ~ duration of contract
- ~ market
- ~ distribution channel
- ~ other factors

Grouping Techniques

Make sure models points are a good representation of the seriatim data

- ~ validate results of the 'condensed' model with the seriatim model before finalizing grouping conditions
- ~ adjust groupings/model points until sufficient
- ~ model points do not need be be equally weighed
- ~ quality of fit will depend on the purpose of the model

If a seriatim run cannot be performed, consider using a 'control' model to determine optimal grouping

Case Study

This exercise would be similar to using a ‘control’ model to determine our grouping criteria

Business to be modeled

- ~ VA with GMDB riders
- ~ 3 different products (B, C, and L-share)
- ~ 10,000 contracts issued over a period of 2 years

Model details

- ~ 1,000 scenarios over 20 years; dynamic assumptions

Case Study

Seriatim Data Fields

- ~ Product type
- ~ Issue month and year
- ~ Attained Age
- ~ Gender
- ~ Asset allocation
- ~ Moneyiness

Validation

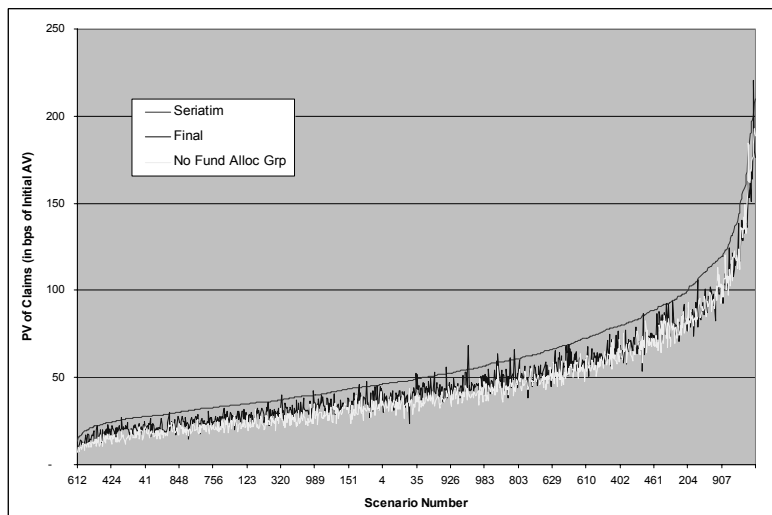
- ~ compare the distribution of the PV of GMDB claims

Case Study - Results

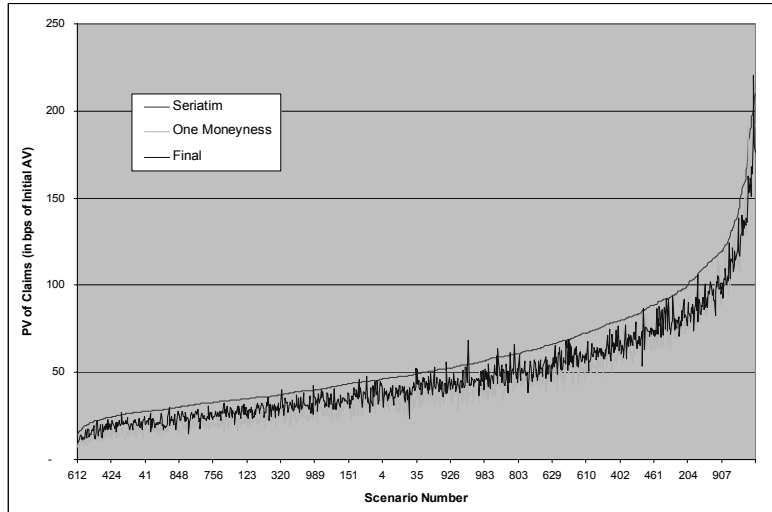
Results using various grouping criteria:

| Run | # Model Pts | Mean | 10th %-tile | 90th %-tile | 90 CTE |
|--|-------------|------|-------------|-------------|--------|
| Seriatim | 10,000 | 100 | 47 | 171 | 225 |
| Final - All Groupings | 800 | 83% | 76% | 85% | 85% |
| No Fund Allocation Groups | 500 | 76% | 63% | 83% | 85% |
| No Moneyess Groups | 400 | 75% | 62% | 82% | 85% |
| Annual Issues Only | 250 | 77% | 58% | 87% | 89% |
| No Product Groups | 350 | 82% | 75% | 84% | 86% |
| * Seriatim results have been adjusted with mean equal to 100 | | | | | |
| * Results for various groupings reflect 'accuracy' of match | | | | | |

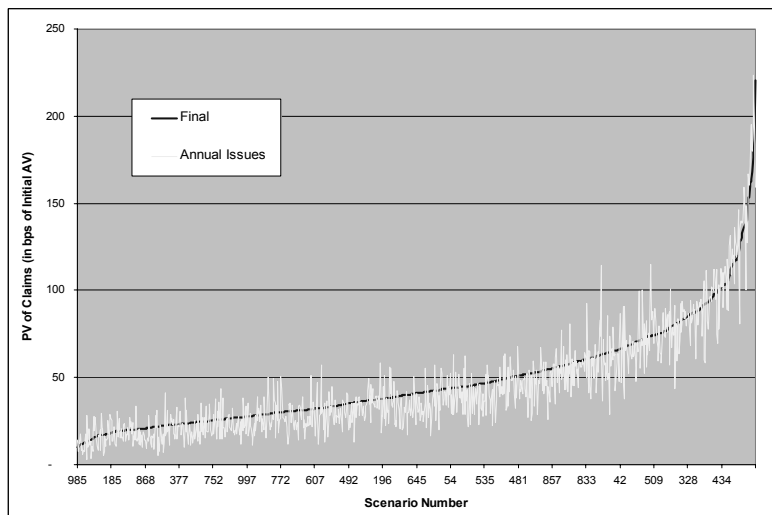
Case Study - Results



Case Study - Results



Case Study - Results



Case Study - Results

From our data sample:

- ~ Model points should reflect differences in asset allocation (aggressive vs conservative investors) -- diversification benefits should not be built in
- ~ Model different issue months to capture diversification over time
- ~ Different product types did not have a significant effect on GMDB claims (may not always be true)
- ~ Number of groups for a given category will depend on variability of underlying data or business
- ~ Make sure nothing is "lost" when grouping data points

Final Thoughts

Compare all relevant outcomes/results

Be sure to look at the entire distribution of results

- ~ comparing the mean is not sufficient

Grouping criteria or methods should be monitored for reasonableness

- ~ significant changes in data, change in purpose of model, etc.

The most optimal set of model points will depend on the data and/or the business being modeled