2007 SOA Annual Meeting
Washington, D.C.

Session 130PD:
Preparing for the Future: Modelling LTC

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Session 130PD:
Preparing for the Future: Modeling LTC

Al Schmitz, FSA, MAAA
LTC Models

- Pricing Models
- Reserving Models
- Experience Analysis Models
- Projection Models

Transition / Differences
- Stochastic
- Assumptions
- Modeling Differences
Stochastic Models Introduction

LTC Risk Characteristics

- Lapse Rates
- Morbidity
  - Incidence / severity
  - Claim variability
- Mortality
- Interest Rates & Economic Environment

Stochastic Models Introduction

- Reflection of rate increases in future cash flows under stochastic scenarios
- Changing marketplace and government programs’ impact on assumptions and products
- Margin for Rates vs. Margin for Reserves
- Limitations of experience
- Regulatory action
Stochastic Models Introduction

- Conditional Tail Expectation (CTE)
  - $x\% \text{ CTE} = \text{average of lowest (}1 - x\%)\% \text{ scenarios}$
  - Different CTE for reserves vs. surplus
  - Other lines of business

Assumptions

Traditional Projection Model

- Morbidity
  - Own experience
  - Outside sources

- Persistency
  - Published mortality table
  - Own experience

- Investment Income
  - Long term rate

- Expenses
  - Own experience

- Rate Increases
  - Approved increases
  - Future increases
### Assumptions (Stochastic)

**Principle Based Reserve Model**

- **Morbidity**
  - Need for industry table
  - Adjusted for own experience

- **Persistency**
  - Industry vs. own experience

- **Investment Income**
  - Stochastic interest rate scenarios

- **Expenses**
  - Own experience

- **Rate Increases**
  - Future increases

### Modeling Differences

**Incurred Claims**

**Traditional Projection Model**

- Many Variations
  - Incidence rates / termination rates
  - Incurred claims / runoff factors

**Principle Base Reserves Projection Model**

- Incidence rates / recovery rates / death rates
Modeling Differences
Lives / Exposure

Traditional Projection Model

Many Variations

- Total lives – many adjustments needed
- Active / disabled lives
- Benefit exhaustion

Principle Base Reserves Projection Model

- Active / disabled lives

Additional PBR Model Considerations
(From Issues Subgroup)

To Be Included in Stochastic Model

- Allow for premium rate changes
  - Focus on unscheduled premium rate changes
  - Timing of changes at discretion of writing company
    - Trigger point for premium rate action defined in model
    - Reaction time
    - Effectiveness of filed premium rate increases
    - Premium rate actions may vary w/ intensity of management oversight and amount reinsured
    - May depend on whether or not company is writing new business
    - May include appropriate premium rate actions
Additional PBR Model Considerations
To Be Included in Stochastic Model

Allow for premium rate changes (cont.)
- Policyholder behavior at time of rate increase notification
  - Anti-selective lapses
  - Policyholder optional benefit reduction offers
  - Non-forfeiture offers at time of premium rate increase

Additional PBR Model Considerations
To Be Included in Stochastic Model

Allow for Interest Rate Scenarios
- Include traditional impacts on asset earned rates and insurance liabilities
- May include impact on policyholder behavior
  - New market entrants and competition re-prices to lower premium rates
  - Anti-selective shock lapses for existing business
  - Reduced need for premium rate increases on existing business
  - Mandatory decrease in premium rates for existing policyholders
  - Over-insurance and induced utilization of covered benefits
  - Impact of interest rate variability on existing business limited by financial hedging strategies
Additional PBR Model Considerations
To Be Included in Stochastic Model

- Allow for Scenarios that Include Unanticipated Changes in Morbidity or Benefit Utilization Patterns
  - Account for possibility of shift in claim cost curve
  - Examples of factors that could result in changes in morbidity:
    - Greater utilization of lower intensity services
    - Services become more attractive to compete for business of seniors in need of assistance
    - State or federal action resulting in increased availability of long-term care facilities or services

May Consider Regulatory Intervention
- Upon reasonable expectation of new regulation, impact of regulation could be modeled in future results
- Examples:
  - Mandated coverage for new services
  - Changing interpretation of law or regulations
  - Federal or State action to increase / decrease governments share of LTC coverage
- Consider precedent of retroactive application of new regulations
  - Rate stability requires disclosure of past increases
  - Florida HB 947
Additional PBR Model Considerations
To Be Included in Stochastic Model

- May Consider Morbidity and / or Mortality Improvements
  - Measurable “population” impact not directly applicable to insured data
    - Varies by underwriting style
    - Socioeconomic selection
  - Impact of treatment “breakthroughs” or cures for important senior health conditions
  - Is it possible that morbidity or mortality improvement can exist in isolation?
  - Lower level of claim incidence may be accompanied by longer length of claim

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Stochastic Models Introduction
LTC Risk Characteristics

- Lapse Rates
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  - Claim variability
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Stochastic Models Introduction
LTC Other Concerns

- Reflection of Rate Increases in Future Cash Flows under stochastic scenarios
- Changing marketplace and government programs’ impact on assumptions and products
- Margin for Rates versus Margin for Reserves differences
- Limitations of experience
- Anticipated limits on interest rate assumptions and regulatory action
Long Term Care PBS Technical Work Group

- Chair: Al Schmitz, Milliman
- Specify Model Requirements
- Design, Develop and Test Model
- Analyze Results
- Monitor and Support LRWG and LRWG Modeling Subgroup
- Coordinate with SVL2 Economic Scenario Group

LTC Technical Work Group Considerations and Progress

- Consider potential management action
- Ease of ability to program the multi-stochastic-variable LTC product lines
- How much variance is acceptable?
- # of trials to run to establish the proper reserve and capital levels
LTC Technical Work Group Modeling Stage

- Non-Excel models not viable
  - confidentiality issues
  - portability
- Launching pad: Excel-based Cash Flow projection model developed by Jim Robinson, independent consultant
- Must consider business segmentation

LTC Technical Work Group Modeling Stage – Method 1

Random Walk by Policy

Process a single policy through every time interval
A random number at the beginning of each time interval tests the policy’s probability of a change in status within the time interval
Move to next policy
LTC Technical Work Group
Modeling Stage – Method 1

- Easy to understand
- Easy to program
- Difficult to implement management action
- Potentially long execution time

LTC Technical Work Group
Modeling Stage – Method 2

Random Walk by Duration
- Process a single time interval through every policy
- A random number at the beginning of each time interval tests the policy’s probability of a change in status within the time interval
- Move to beginning of next time interval
LTC Technical Work Group
Modeling Stage – Method 2

- Similar to Method 1
- Easy to understand
- Easy to program
- Easier to implement management action
- Still has long execution time

LTC Technical Work Group
Modeling Stage – Method 3

Stochastic Simulation using Database Lookup
Pre-process all possible result paths and store in a database
Generate one random number for each policy and use it to select the result path from the database
LTC Technical Work Group
Modeling Stage – Method 3

- Similar to Method 1
- Reduces run time for the simulation
- Pre-processing will likely increase overall run time but it is only done once
- Database will be quite large
- Management action would be difficult to implement
- Paths do not have equal probability

LTC Technical Work Group
Modeling Stage – Method 4

Waiting Time Model
  Suggested by Eric Stallard, Research Professor, Duke University
  Generate two random numbers for each policy
  - The first determines the time of the next change in status
  - The second determines what the status change is
Waiting Time Model (con’t)

Relies on the hazard rate function:

$$H_{x+t} = -\log_k p_{x+t}$$

Assuming independent probabilities:
Total Hazard Rate = $\sum$ Individual Hazard Rates

Similar to Method 1
- Reduces the number of trials for every policy
- Reduces the run time for the simulation
- Allows for management action
- Less intuitive
- May require software other than Excel
Most assumptions are based on the policy year while some are based on calendar year.

The policy year survival function is normalized to a calendar year valuation date.

Interpolation methods used for normalization can also be used to choose the exact event timing within the calendar year interval.

Secondary and tertiary events

The stochastic liability cash flow is not the end product.
LTC Technical Work Group Modeling
Stage – Preliminary Results

- Prototypes for initial stage of Models 1 & 4
  - Follows policyholder to first event
  - Records the time and type of event
  - Monthly approach to Model 4

LTC Technical Work Group Modeling
Stage – Preliminary Results

- Run Time Benchmarks
  - Pure result is meaningless without full context
  - Model 1 is 2.8 times slower than Annual Model 4
  - Monthly Model 4 is 3.6 times slower than Annual Model 4
  - Scaling factor is < 1
LTC Technical Work Group Modeling
Stage – Preliminary Results

Accuracy of Annual Models

Years

Deterministic