American Academy of Actuaries
Long-Term Care (LTC) Principle Based Reserve (PBR) Work Group
Update to LTC Actuarial Working Group

August 14, 2015

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Co-Chair, LTC PBR Work Group
Objectives of LTC PBR Work Group

- Based on the initial request from the NAIC, the objective of the work group is to develop a prototype stochastic model to be used to help set the direction of PBR for LTC
  - The work group has produced a draft report that is going through final peer review
  - The report includes considerations of stochastic modeling and suggested next steps
  - The model is intended to be illustrative and not inclusive of all policy features that may be offered by an insurer or inclusive of detailed modeling considerations
Draft Report Outline – Table of Contents

- Introduction
  - Overview
  - Background

- Model Objectives
  - Principle-Based Approach
  - Risk Categories and Policy Changes
  - Prototype Model

- Model Description
  - Model Alternatives
  - Functionalities
  - Model Strengths and Weaknesses
  - Future Refinements

- Modeling Results
  - Calibration
  - Discussion of Results

- Future Refinements and other Model Considerations

- Appendices
The work group identified the following objectives for a principle-based model to evaluate LTC liabilities:

- Ability to quantify the degree of variability of results, expose to entire work group,
- Appropriately address the major categories of risk associated with LTC insurance,
- Account for dynamic changes of the actions taken on the policies, and
- Serves as a prototype with adequate functionality from which refined models can be developed.
Model Objectives

- **Risk categories and mitigation**
  - A stochastic model that simulates the future financial performance of a block of LTC insurance policies over a range of scenarios can produce more useful results for principle-based analysis than the traditional point estimates from a deterministic model.

- **Prototype**
  - Excel
  - Stochastic assumptions for active mortality, lapse, incidence, recovery, and disabled mortality
  - Simplifying assumptions
  - Base model does not assume management rate action in adverse scenarios
Model Description

Model alternatives
- Random walk by policy
- Random walk by duration
- Simulation with pre-process look up
- Waiting time

Functionalities, structure, and process
- Role of hazard rates
  - The survival rate of an event $m$ for a short interval $k$ can be converted to a hazard rate as follows:

$$H_{m}^{x+t} = \log kp_{m}^{x+t}.$$

  - The hazard rates are additive to arrive at the total hazard rate. Thus the probability that a specific event occurs given an event is known to have occurred is:

$$H_{m}^{x+t} / \sum_{all s} H_{s}^{x+t}.$$
Model Strengths and Weaknesses

**Strengths**
- Formulas are transparent in Excel
- Handle multiple risks in multiple states on a stochastic basis
- Easily understood by anyone with Excel knowledge
- Can be enhanced to handle many other features such as disabled lives, policyholder behavior, etc.

**Challenges**
- Excel has limited ability to automatically distribute processing over a server farm. This caused very lengthy run times (e.g., a single trial for 6,000 policies took approximately one hour on most workstations)
- Excel workbook size limited the number of trials run at one time
- Only process risk measure
- Stochastic interest rate generators could not be easily integrated
- Validation of the model by comparison to a deterministic model was a lengthy process
Calibration of Cash Flows

Comparison to Deterministic – Inforce Block of LTC Insurance

Sample block of 6,000 policies
Data compiled by the LTC PBR Work Group for final report
Distribution Characteristics of PV of Cash Flow @ 4%

- Mean 87 m
- Maximum 106 m
- Minimum 72 m
- Std Dev 5.261 m
- Skewness 0.138209
- Kurtosis 0.168010

Sample Block of 6,000 Policies
Data compiled by the LTC PBR Work Group for final report
Results

Sample block of 6,000 LTC insurance policies, CTE calculations

- CTE 0 (GPV) 87m 100.0%
- CTE 10 88m 101.2%
- CTE 20 89m 102.1%
- CTE 30 90m 102.9%
- CTE 40 90m 103.8%
- CTE 50 91m 104.8%
- CTE 60 92m 105.8%
- CTE 70 93m 107.1%
- CTE 80 95m 108.6%
- CTE 90 97m 110.8%
- CTE 95 98m 112.8%
- CTE 99 103m 117.8%

Note: CTE 90, for example, is equal to the average of the worst 10% of scenarios, each scenario cash flows discounted at 4%

Data compiled by the by LTC PBR Work Group for final report
### Distribution Characteristics of PV of Cash Flow @ 4%

#### AAA PBR LTC Model Runs

<table>
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<tr>
<th></th>
<th>Base</th>
<th>Incidence Plus 10%</th>
<th>Incidence Minus 10%</th>
<th>Active Mortality Minus 10%</th>
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<td>100.0%</td>
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<td>119.9%</td>
<td>115.1%</td>
</tr>
</tbody>
</table>

Data compiled by the LTC PBR Work Group for final report.
Future Refinements and Model Considerations

- Product features
- Management rate action
- Other
  - Accommodate policy feature or benefit changes initiated by a policyholder
  - Incorporate trends (other than those related to rate increases) in the model. This includes, for example, changes in utilization pattern for claimants of policies with inflation protection features
  - Dynamically combine interest rate scenarios with liability scenarios to reflect policyholders’ behavior and expenses under various interest rate environments
  - Run disabled lives simulation as of the projection date for existing claims in a block of LTC policies
  - Accommodate combination policies
  - Excel platform
- Parameter risk – assumption variability
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