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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

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Draft Report Outline – Table of Contents

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Model Objectives

- 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:

      $$H^{m}_{x+t} = \log {}_{k}p^{m}_{x+t}.$$

    - 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:

      $$H^{m}_{x+t} \;/\; \Sigma_{\text{all } s} H^{s}_{x+t}$$

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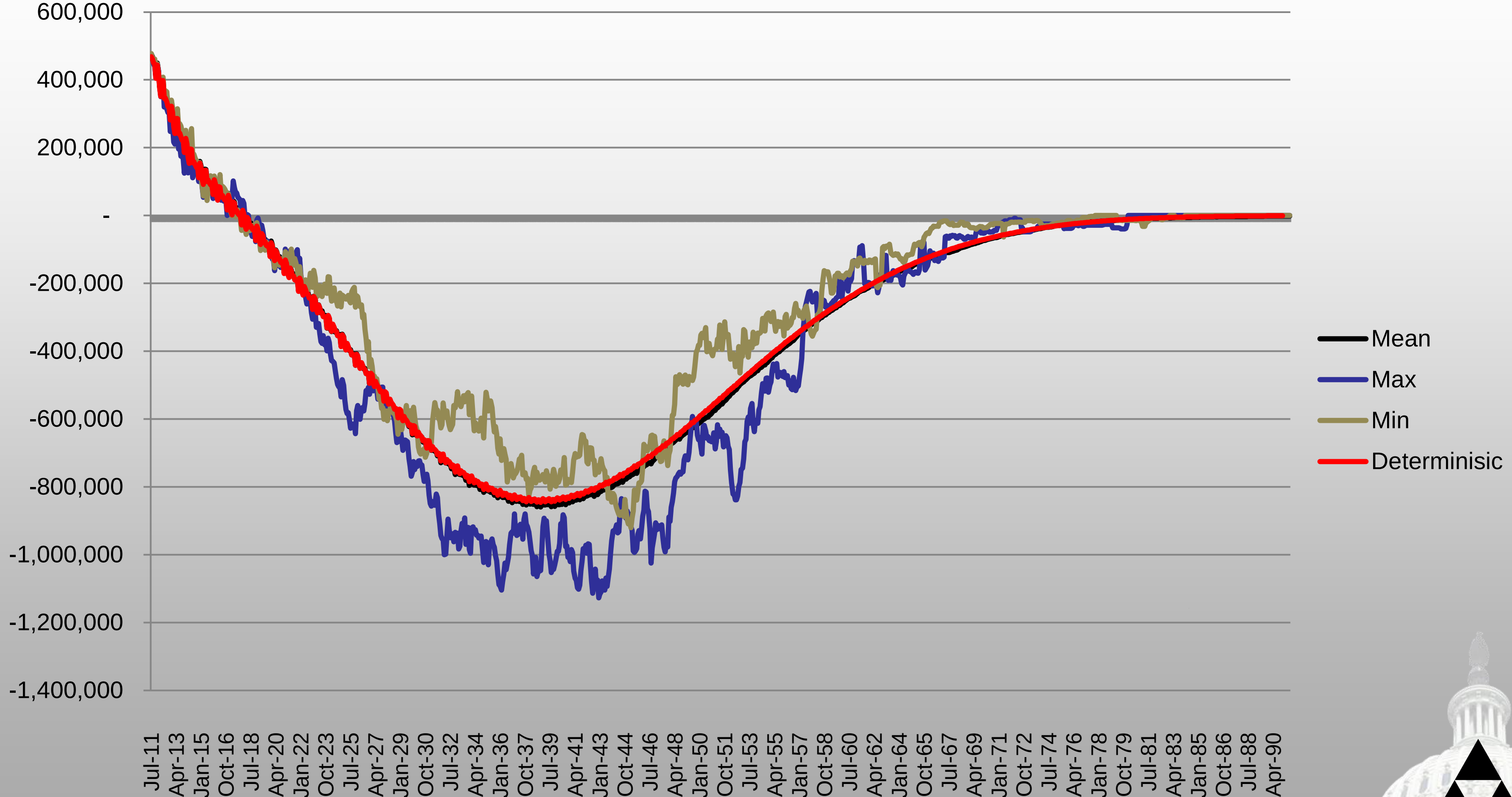
Model Strengths and Weaknesses

- 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 by LTC PBR Work Group for final report

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Results

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

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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%

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Sample Sensitivity Results

Distribution Characteristics of PV of Cash Flow @ 4%

AAA PBR LTC Model Runs	Base	Incidence Plus 10%	Incidence Minus 10%	Active Mortality Minus 10%
Mean	87,130,339	99,228,164	74,036,463	94,746,011
Max	106,262,080	117,344,432	92,581,823	110,851,459
Min	72,487,960	80,432,369	59,192,117	80,400,667
Skewness	0.138	0.058	0.210	0.089
Kurtosis	0.168	-0.146	0.278	-0.050
Std Dev	5,261,055	5,638,591	4,949,694	5,292,701
Std Dev / Mean	6.0%	5.7%	6.7%	5.6%
CTE 0	100.0%	100.0%	100.0%	100.0%
CTE 10	101.2%	101.1%	101.3%	101.1%
CTE 20	102.1%	102.0%	102.3%	101.9%
CTE 30	102.9%	102.8%	103.2%	102.7%
CTE 40	103.8%	103.7%	104.2%	103.6%
CTE 50	104.8%	104.5%	105.3%	104.4%
CTE 60	105.8%	105.5%	106.4%	105.4%
CTE 70	107.1%	106.6%	107.8%	106.5%
CTE 80	108.6%	108.1%	109.5%	108.0%
CTE 90	110.8%	110.2%	112.3%	110.1%
CTE 95	112.8%	111.7%	115.0%	111.8%
CTE 99	117.8%	114.7%	119.9%	115.1%

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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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