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Long-Term Care (LTC) Principle Based Reserve (PBR) Work Group

Presentation to NAIC LTC Actuarial Working Group

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Objectives of LTC PBR Work Group

- Based on the initial request from the NAIC, the objective of the work group was to develop a prototype stochastic model to be used to help set the direction of PBR for LTC
  - **The work group has completed its work and a report was released January 21, 2016**
  - 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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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 considered
  - Random walk by policy
  - Random walk by duration
  - Simulation with pre-process look up
  - Waiting time (this is the approach taken)
- 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:

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

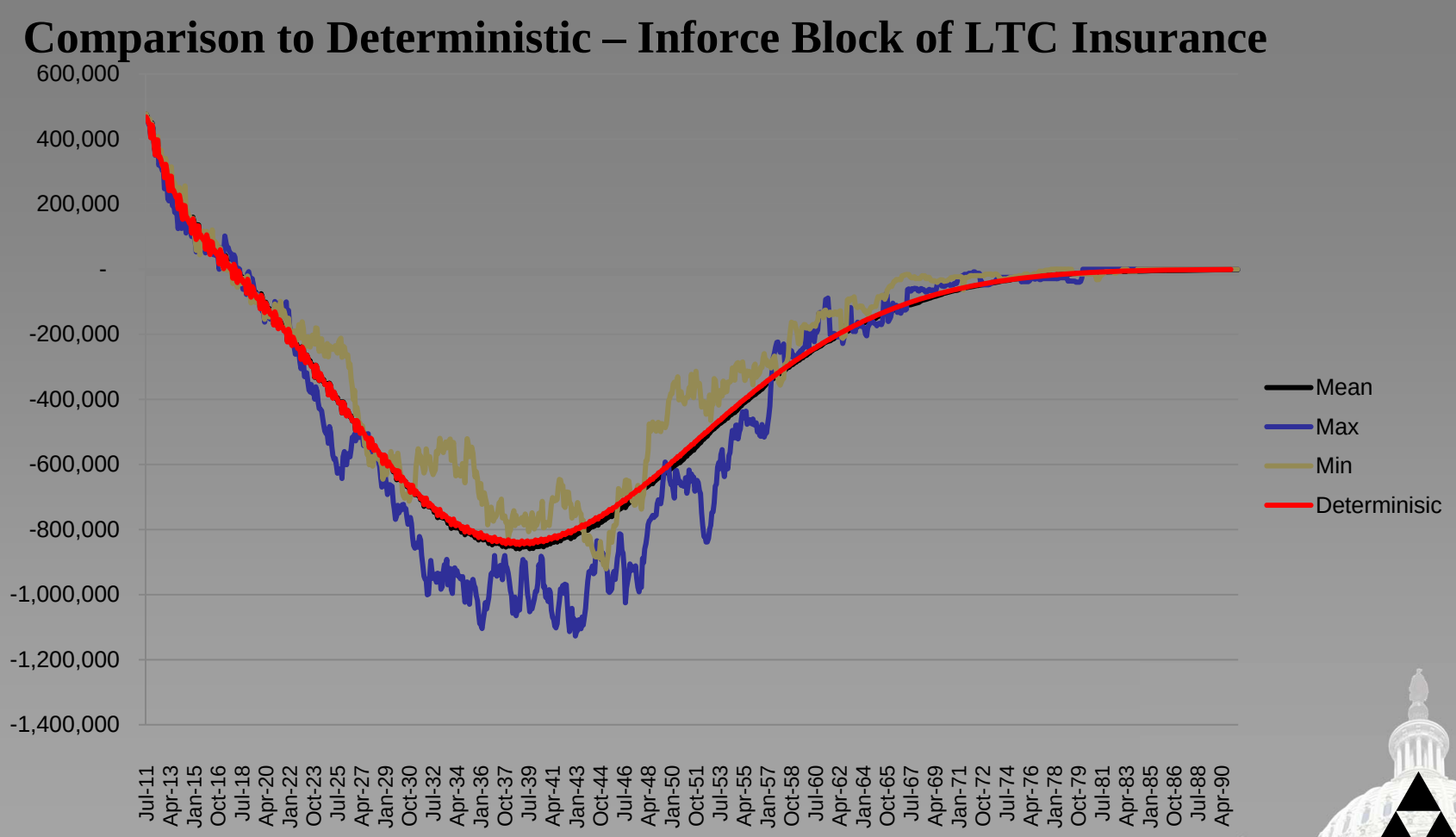
    - The hazard rates are additive to arrive at the total hazard rate. Thus the probability that a specific event occurs given an event is known to have occurred is:

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

Model Strengths and Challenges

- Strengths
  - Formulas are transparent in Excel
  - Handle multiple risks in multiple states on a stochastic basis
  - 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



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

Data compiled by the by LTC PBR Work Group for final report

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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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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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