Session 030 PD - PBR Stochastic Reserve - Challenges and Possible Solutions

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PBR Stochastic Reserve

October 16 , 2017

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Slaying the Stochastic Dragon

Runtime = technology + models …
= grids + techniques (efficiency) …

- Not just the model
- Not just run time and technology
- Philosophical, thinking & doing

Resources & References

Slaying the Stochastic Dragon

- Stochastic Reserve (SR) is a modeled reserve
- Valuation/Pricing/Forecast implications
- Pricing & Valuation consistency
- Definitions
- Simplification

Slaying the Stochastic Dragon

- Validation
- Proxy subsets
- Which scenarios
- Unit testing & case coverage – atoms and compounds
- Tools
- Time
- Analyzing results
- Sensitivities and margin quantification
- Simplification demonstrations

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- Fixing projection elements
- Dynamic validation
- Isolation
- Comparisons
- Automation
- Flexibility in model what/how
- Pricing
- Allocation - group of policies/product groups/cells

Slaying the Stochastic Dragon

- Governance
- 20/80 & $1000/0.001
- Discovery
- Reinvent
- Sinking ship and streamlining

Questions?

Comments excerpted from: Voyager m^{2}Lab PBA Training I: Overview and Term & II: Basic UL

Milliman

SOA Annual Meeting
Session 30 PD:

PBR Stochastic Reserve – Challenges and Possible Solutions

Andrew Steenman

October 16, 2017

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Agenda

- Simplifying Model Inputs, Assumptions, and Throughputs
  - What's going into the model?
  - What do you need to capture?
  - What else to consider and how to decide?
  - What solutions exist?

What’s going into the model?

- Key items:
  - Product inputs and inforce
  - Asset inputs and portfolio
  - Assumption sets for liabilities, assets, economic, other areas
- Consider:
  - Maintenance efforts for building, updating, and validating
  - Impacts of the volume of data
  - Impact to results

What do you need to capture?

- Output values needed to calculate or summarize SR, DR, NPR
  - Cash flows, asset balances, earned rates, treasury rate
  - Just the final answer
  - What else might be needed to validate, analyze, and document?
    - Policy mechanics, flags/indicators, other metrics
- Consider:
  - The output data that will be or is likely to be used
  - The processing time to summarize the data
  - The amount and methods to manage the data

What else to consider and how to decide?

- Level of analysis – different needs for production vs. testing vs. development
- Ability of model/system to save all or certain values/results
- What components or calculations are material or not?
  - Example: reinvestment assumption can drive deterministic reserve, should extra effort go into modeling a robust strategy?
  - Example: if a ULSG policy is expected to offer no future cash value, could account value logic be bypassed to save time?
  - Example: likewise, if a policy's premium level can be estimated, can complex shadow account mechanics be bypassed

What else to consider and how to decide? (continued)

- Limit a model to the calculations that are necessary
  - Not uncommon to find models doing a combination of ULMR, AG38, CRVM, XXX, GAAP, fair value, economic reserves at the same time, plus PBR
  - Are separate “models” being used for NPR, DR, SR or all in one?
- Understand the “processing cost” of complex logic before adding formulas, nodes, or calculation packages
- It will probably be necessary to run multiple tests to support decision making – look at reserve impacts/appropriateness, soundness of model
- Create documentation of decision making
- Prioritize efforts based on difficulty, impact, and actuarial judgement

What solutions exist?

- Many systems have built in solutions to improve runtimes and to analyze and review results
- Create processes, preferably automated, to execute calibration runs to capture dynamic values for a tabular input or lookup instead of a formulaic calculation
- Scenario reduction techniques
- Policy sampling, grouping, or clustering
- Technology resources such as grid or cloud computing

Conclusions

- There is work on both sides of the calculation – inputs must be managed just as much as outputs
- Understand your model or system to look for efficiency in the model execution
- Runtime savings of even one minute start to add up when multiplied by large scenario sets, sensitivity analysis, the inevitable reruns, and ongoing valuation dates
  - Further dividends if you are paying per hour of computing resources

Implementing Stochastic Reserve – Theory and Practice from an Actuarial Perspective

Haiyang Zhang FSA, CFA

Oct 16th 2017

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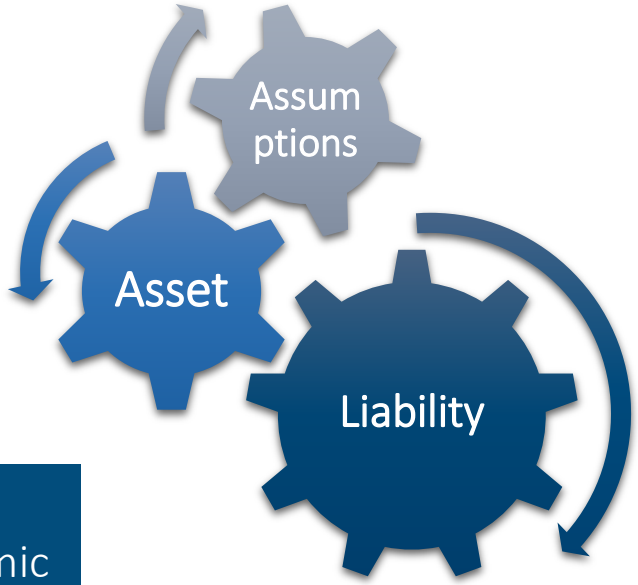
Implementation Step 1: Calculating Stochastic Reserve

An Asset-Liability Integrated System:

Assumptions
Scenario dependent

Asset Module
Asset cash flows that are linked to economic scenarios and liability cash flows

Liability Module
Liability cash flows that vary by economic scenarios or asset performance



SR Model Development

Valuation and Reporting

SR Projection

Pricing Process

Considerations in Practice: Assumptions & Liability

- Assumptions
  - Mostly consistent with Deterministic Reserve
  - Premium Persistency
    - Should premium pattern vary by scenario?
    - Should fund allocation vary by scenario?
  - Lapse
    - Should lapse assumption vary by scenario?
    - What are the drivers for dynamic lapse behavior?
- Liability Module
  - Crediting rate
    - Should crediting rate be linked to asset returns?
  - Non-guarantee elements

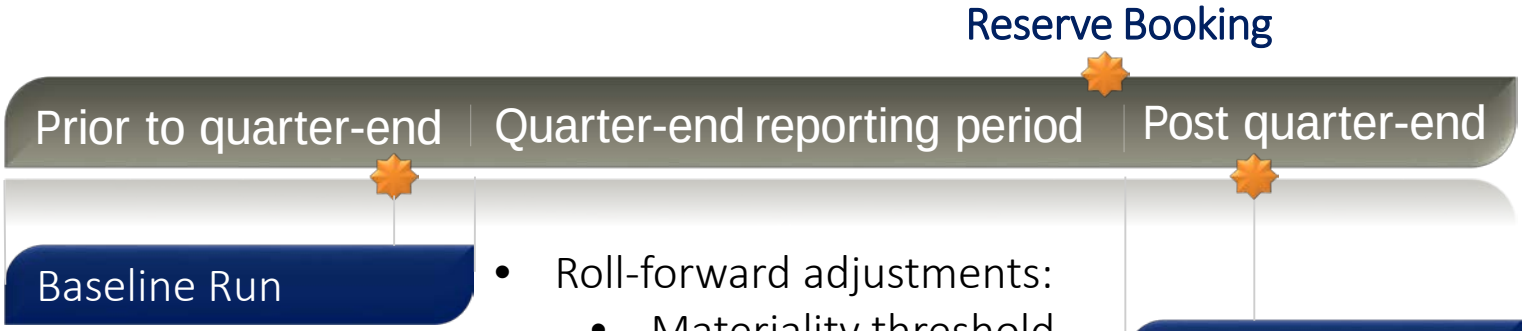
Considerations in Practice: Asset Module

- Asset Module
  - Modeling the asset portfolio
    - Mostly consistent with DR
    - In-force asset or proxy asset?
    - New asset or broader portfolio?
  - How to reflect hedging? Explicit vs. implicit approach
    - What are the risks?
    - What does the past experience tell you?

Considerations in Practice: Model Setup

- Starting Asset
  - What is the level of starting asset
  - Is your SR sensitive to starting asset level?
  - 2% corridor requirement
- Run-time
  - Tips to save run-time
  - How many scenarios are needed to converge?
  - Scenario reduction technique
  - Representative sample policies

Implementation Step 2: Integration with Quarterly Reporting Cycle



- Use prior-quarter input for asset or liability
- Completed before quarter-end

- Roll-forward adjustments:
  - Materiality threshold
  - Sensitivities are helpful
- Booking Reserve =
  Baseline Reserve
  + Roll-forward Adjustments
- Cross-function Collaboration

Analyzing Financial Results

- Reasonability
  - What's reasonable to expect
    - Mainly driven by product features, demographic mix and investment strategy
    - SERT results might be an indicator
  - Comparison to DR
  - By-scenario analysis
- Understanding Financial Results
  - Reserve movement analysis
  - Source of earning

Implementation Step 3: Projecting Future Stochastic Reserves

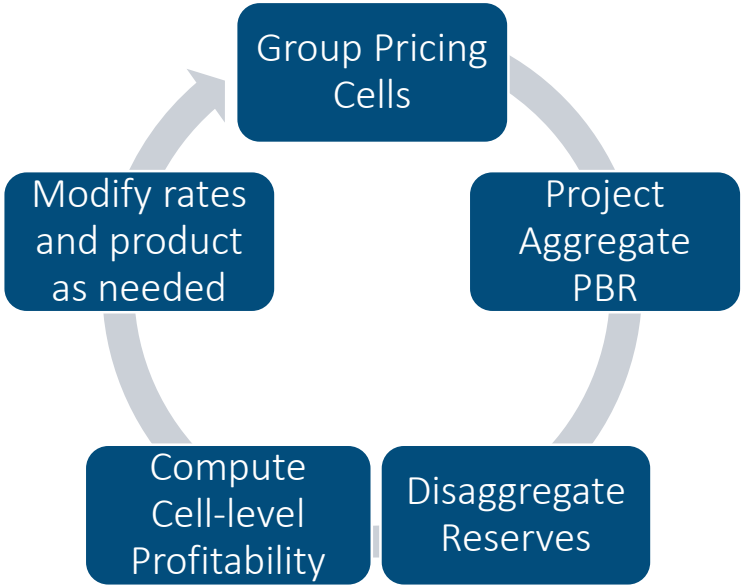
- Nested Reserve Projection System
  - Outer loop: project cash flows and in-force runoff based on best estimate assumptions
  - Inner loop: stochastic model that calculates SR at future valuation dates
- Functions
  - Compute multiple reserves at future valuation dates
  - Use different assumptions in inner and outer loops
  - Solve for starting asset at future valuation dates with 2% corridor rule
  - Run SERT test on future valuation dates

Implementation Step 4: Integration with Pricing Model

Current – Cash Flow Model

- Calculate reserves for individual cell
- Doesn't recognize in-force asset
- Constant net asset earn rate vector along projection
- Doesn't have stochastic projection functionality

Ideal – Iterative Process



Considerations in Practice: Pricing Model

- Simplifications
  - Decisions should be made in accordance to product feature
    - Whether the product is sensitive to investment experience
    - Whether the product has a strong NLG
- Interpreting pricing results
  - Sensitive to cell grouping or reserve allocation
  - Reserves are more meaningful at aggregate level
  - Focus on cash flow based metrics for cell-level analysis
- Run time

Thank You

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