2019 LIFE & ANNUITY SYMPOSIUM

PBR Model Design

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SOCIETY OF ACTUARIES®

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Discussion Items

1. Background
2. Modeling of PBR Assumptions and Margins
3. Model Scalability
4. Key Product Features and Modeling Methodologies

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Background

- 3 primary components of PBR calculation
  - NPR
  - DR
  - SR
- PBR reserve = max(NPR, DR, SR)

Component	Key Features	Pre-PBR Equivalent
Net Premium Reserve (NPR)	Seriatim, formulaic, guaranteed product features	CRVM
Deterministic Reserve (DR)	Aggregate, single scenario, ALM, current product features	Cashflow Testing
Stochastic Reserve (SR)	Aggregate, many scenarios, ALM, current product features	VA CARVM

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Background

So why don't we just use our AAT model?

- Already projecting out cashflows
- ALM calculation
- Just run the thing on 10,000 scenarios…

Unique Implications of PBR

- NPR (in some circumstances) may be less conservative than CRVM → may not be sufficient to just project out formulaic reserve for use-cases such as forecasting or pricing
- PBR reporting done on quarter-end cycle. How streamlined is your AAT process?

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Modeling of PBR Assumptions and Margins

- *The company shall use prudent estimate assumptions in compliance with this section for each risk factor that is not prescribed or is not stochastically modeled by applying a margin to the anticipated experience assumption for the risk factor.*
- Isn't this just the same as asset adequacy testing? (No!)
- Standalone section in VM-20 devoted to assumptions (section 9): Over 30 pages of fun reading material.

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Modeling of PBR Assumptions and Margins

Assumption	VM-20 Section	Unique Requirements	Modeling Considerations
Mortality	9.C	Grade from company to industry mortality rates depending on credibility	-Grade inside or outside model? -Model increasing credibility over time for reserve projections?
Mortality improvement	9.C	Mortality improvement beyond the valuation date can't be considered	-Model mortality improvement up until future pivot points for reserve projections?
Mortality margins	9.C	Separate mortality margins for industry and company mortality; mortality margins vary by attained age and level of credibility	-Modeling increasing credibility over time for reserve projections?
Policyholder behavior margins	9.D	-Unlike mortality, not obvious which direction margins should be set	-Sensitivity test different assumptions to determine direction and form of margin

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Modeling of PBR Assumptions and Margins

Assumption	VM-20 Section	Unique Requirements	Modeling Considerations
Lapses	9.D	-Products with minimal or zero cash value should blend to Canadian Term-to-100 table	-Coding up dynamic logic
Post-level term mortality	9.D	-Can't assume profitability on term policies past level period	-Floor post-level mortality rates at premiums -Assume shock lapse of 100% at end of level period
Asset assumptions	9.F	-Unique procedures for setting default costs and asset expenses	-Feed into model final assumptions or do procedure within model?
Revenue Sharing	9.G	-If not contractually guaranteed, grade down over time and cap at 25bps	-Need to have separate revenue sharing assumption for inner loop compared to outer loop

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Model Scalability

1. **Adding More Business** – By the end of this year, all new business will be on PBR. Given PBR is prospective, size of PBR inforce block will grow over time.
2. **Projections** – How will you handle projections? E.g. even if reasonable runtime for valuation, projections require many "recalculations" of reserve at each projection point.

Model Scalability

How does your model perform as you add more business or functionality to it?

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Model Scalability

1. **Scenario Reduction:** Can likely reduce the number of scenarios for projections. Given not statutory requirement, up to company discretion
2. **Pivot Points:** Consider reducing the number of points you are recalculating the DR and SR, especially later in the projection.
3. **Factors:** Do you need to project out an SR? Consider projecting out a DR only or approximating the SR as DR* factor.

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Model Scalability

Number of Scenarios	Stochastic Reserve ($M)	Variance from Base
10,000	$500	0.0%
1,000	$497	-0.6%
750	$502	0.4%
500	$509	1.8%

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Model Scalability

1. **Quarter-over-quarter variance:** Can one guarantee that the bad scenarios are the same bad scenarios every quarter?
2. **Product variance:** Is analysis relevant if the product portfolio is changing? E.g. if company is taking a phased approach to PBR.
3. **Definition of Materiality:** How is the threshold to "understate the reserve by a material amount"

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Key Product Features and Modeling Methodologies

Product feature / modeling methodology	VM-20 Section	Description	Modeling Considerations
Asset collar	7.D	Starting assets need to be within 2% of the final PBR reserve	-Should iteration be done within your actuarial software or using an external process? -Optimize runtime through avoiding repeated calculations
Reinsurance credit	8.C	Reinsurance credit for DR and SR = gross reserve – net reserve	-Optimize runtime through doing calculations in parallel -Optimize runtime through avoiding repeated calculations
Model segments	7.A	Level of granularity that DR and SR calculations should be performed should correspond to company's asset segments	-Aggregation benefits with larger model segments -Optimize runtime through doing calculations in parallel