VA model office summary

Details of the representative models and the comprehensive set of modeling tools for both VA and RILA are below

Representative population generation (model office)

Calculation engine (model)

Analysis and validation tools

Functionality

Excel-based tool that generates a model office (in-force file) distribution across representative key parameters and outputs a ready-to-load file for the model on the fly

Asset-liability cash flow model configured to project results across best estimate, prudent estimate and prescribed assumptions needed for VM-21 and C3P2 calculations

Scenario level analysis tools to evaluate results in aggregate, detailed policy level implied rate analysis to validate and understand cash flow projections

Key features

- Define policyholder characteristics and product specifications distributions across multiple cohorts
- Define key rider information such as moneyness, rollup rates, and withdrawal utilization
- Aggregate statistics and validation checks

- Best estimate assumptions developed consistent with benchmark data and available industry data
- AAA ESG and Conning scenarios available for testing
- Field test reporting requirements including scenario level output and on-the-fly compilation of scenario candidates
- Model development follows best practice procedures for efficiency and transparency

Scenario level analysis tool

- Scenario reserve development and validation
- Aggregation of scenarios to produce CTE values

Single policy testing tool:

- Illustrates policy level calculations including decrements, fees, and rider features
- Validation of three assumption sets

Impact

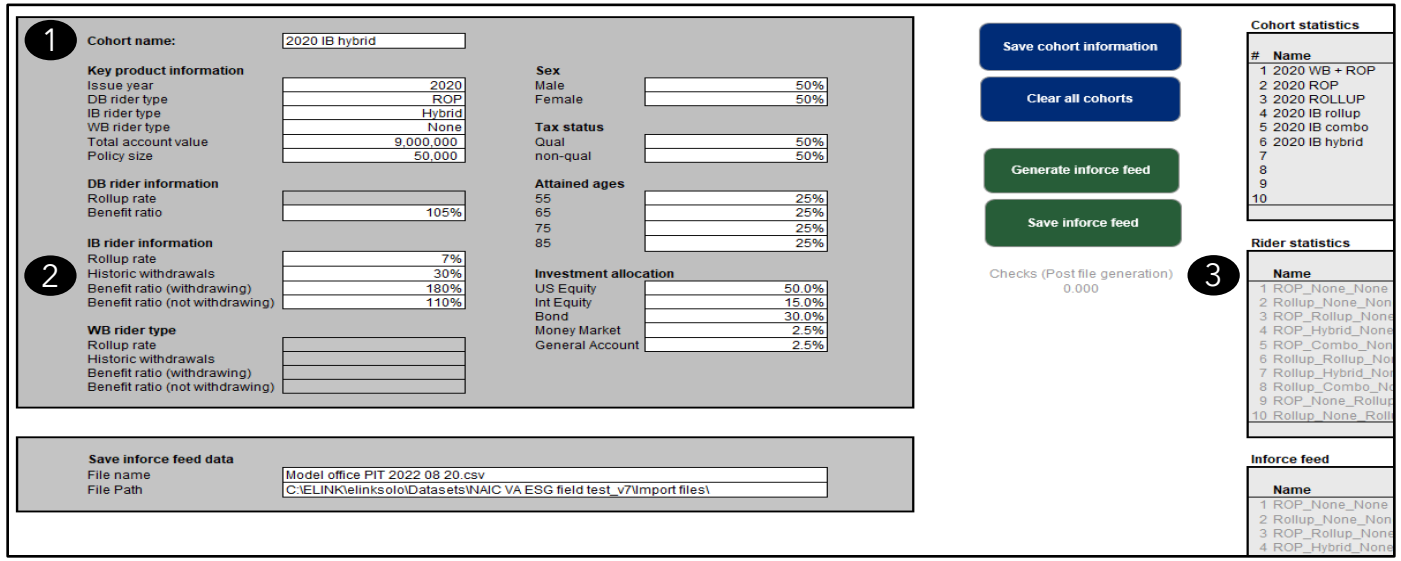
- Customizable and flexible tools allow representative subpopulation analysis that may be used to draw insights and parallels to industry results

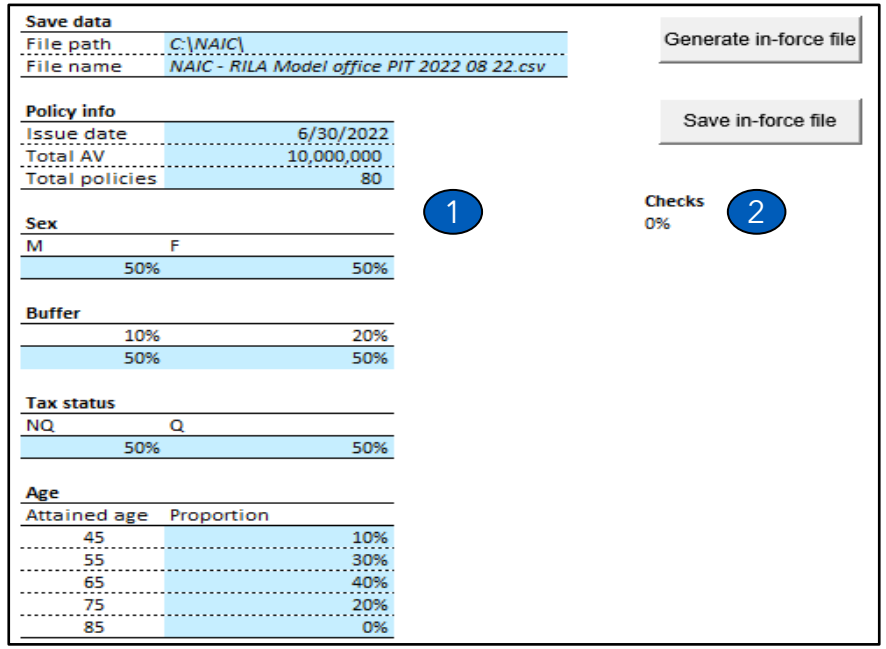
- Dynamic VA and RILA cash flow model chasis ready to support field testing, future regulatory requests or additional model enhancements

- Scenario analysis tools provide a quick view into high-level results; detailed implied rate analysis provides insight into model calculation and integrity against expectations

Representative population generation

"Model office creation tool" creates a model office (in-force file) that interfaces directly with modeling software and allows for a customized population across key product features and policyholder characteristics



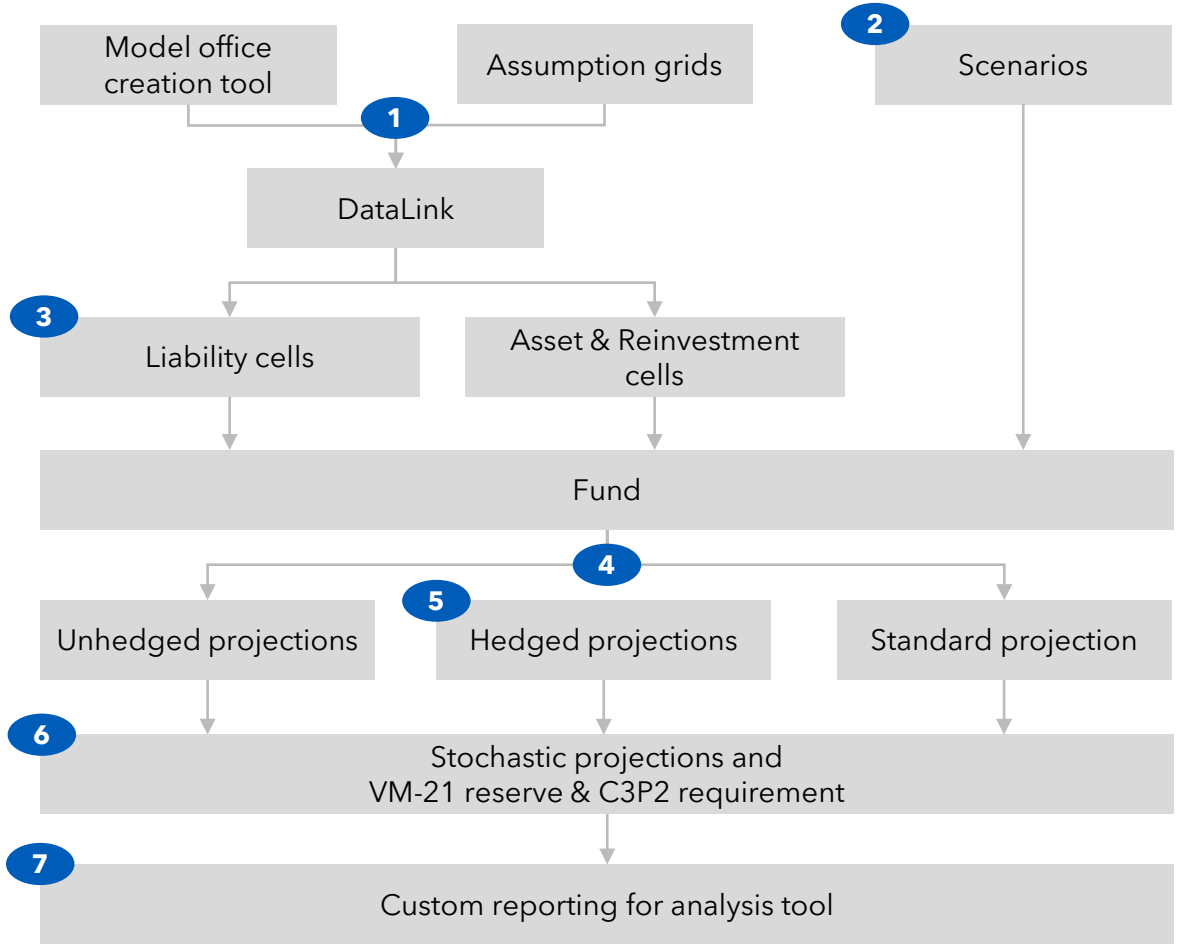


1. Cohort level inputs provide flexibility to create a representative population made up of different vintages of variable annuities
2. Inputs provide the ability to capture rider details and policyholder characteristics of a given cohort
3. Aggregate statistics and checks allow for validation and analysis of the generated inforce file

1. Customizable inputs allow for a mix of buffer levels and policyholder characteristics
2. Checks validate the generated inforce file has the desired characteristics

VA & RILA model design overview

The following illustrates the high-level model design for point-in-time VM-21 and C3P2 use cases



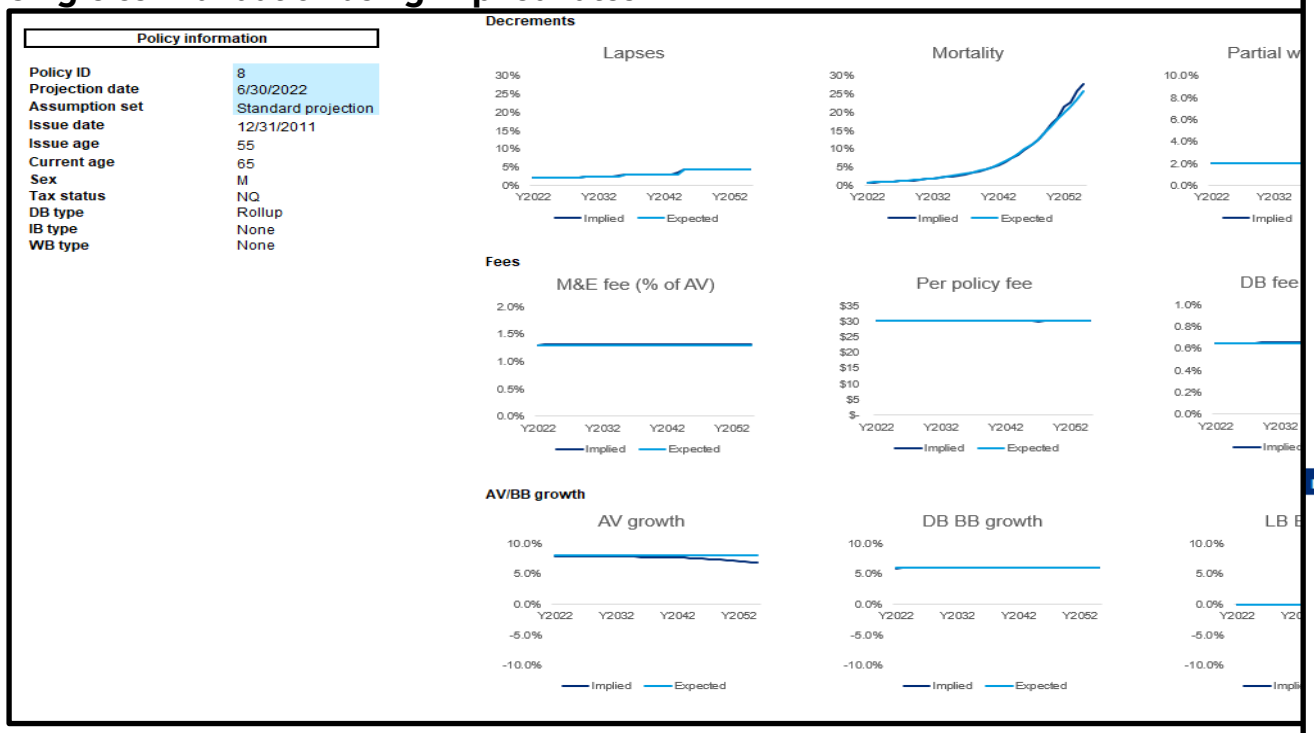
Design notes

1. Automated batch processes import model office and assumption grids to modelling software
2. Conning (1a through 2b) and AAA ESG interest rate and equity scenarios are loaded into the model
3. Liability cells contain product features, rider features and 3 assumption sets (best estimate, prudent estimate, and VM-21 prescribed standard projection)
4. Nested modeling via "embedded blocks" are included in the fund to perform stochastic projections on an adjusted, best effort hedge and standard projection basis
5. Hedged projections use the implicit method; option values are calculated as a pre-run using native model functionality and risk neutral scenario generator
6. VM-21 reserve and C3P2 requirement are calculated using summary reports and formula tables
7. Custom reports are output to populate the model output analysis tools and compare to field test submissions

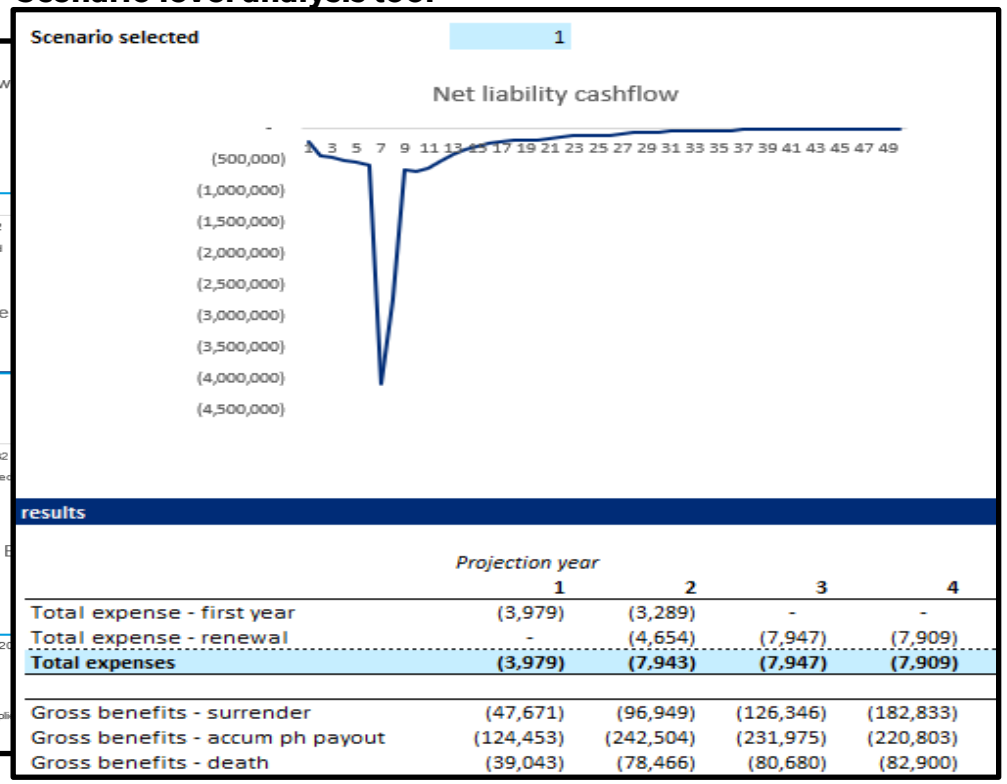
Analysis and validation tools

Two model output analysis tools provide transparency into the representative model calculations as well as support validation of future model updates or testing results

Single cell validation using implied rates



Scenario level analysis tool



	Projection year 1	2	3	4
Total expense - first year	(3,979)	(3,289)	-	-
Total expense - renewal	-	(4,654)	(7,947)	(7,909)
Total expenses	**(3,979)**	**(7,943)**	**(7,947)**	**(7,909)**
Gross benefits - surrender	(47,671)	(96,949)	(126,346)	(182,833)
Gross benefits - accum ph payout	(124,453)	(242,504)	(231,975)	(220,803)
Gross benefits - death	(39,043)	(78,466)	(80,680)	(82,900)

Appendix A

Product modeling (supplemental information)

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Appendix A.1

Variable annuity

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Model components and functionality

Variable annuity

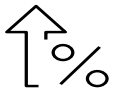
Component	Description of functionality
Liability modeling	• Liability cash flows for model office comprised of the following product features: – Base variable annuity contract and a variety of GMxB (GLWB, GMDB, GMIB) with typical features and charges • Modeled on a direct basis only (i.e., without reinsurance)
Asset modeling	• Guardrail VM-21 prescribed strategy**:** 10-year bonds with ratings A and AA consistent with the guardrail prescribed under VM-21
Calculations	• Outer loop cash flows under best estimate assumptions and input deterministic scenarios • Pre-tax asset and liability projections under input stochastic scenarios reflecting all cashflows under prudent best estimate and VM-21 prescribed assumptions • Inforce asset iteration at valuation date under input stochastic scenarios to achieve no GPVAD • Fair value of living benefit riders on annual timesteps to support implicit hedging approach
Assumption sets	• Best estimate • Prudent best estimate • VM-21 standard projection prescribed
Hedging	• Implicit cost of reinsurance method used in the best efforts run, option cost is charged at time 0 and rider fees and claims are removed
Reporting	• Stochastic reserve (CTE70 pre-tax under adjusted and best efforts hedge) • Standard projection add-on under CTEPA method (CTE70 under prescribed in excess of SR, subject to CTE70 – CTE65 unfloored buffer) • C3 at 100% RBC (CTE98 pre-tax and subsequent calculations). Note: C3 will be unsmoothed

Summary of product features

Variable annuity product features and rider parameters are customizable to other product configurations, along with populations make-up

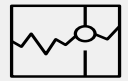
Product

- 10 different rider combinations
  - GMDB only
  - GMIB & GMDB
  - GLWB & GMDB



Riders

- GMDB: ROP and rollup
- GMIB: rollup, hybrid, combo
- GLWB: rollup



Investment accounts

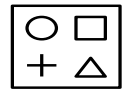
- US & international equity
- Bond & money market
- General account

Contract fees

- 130bp M&E fee
- $30 per policy fee

Surrender charges

- 7 years: 7%, 6%, 5%, 4%, 3%, 2%,1%



Rider parameters

- Rider fees vary by rider type
- Min GLWB withdrawal age: 60
- Max DB/IB/WB rollup age: 85

Liability best estimate assumptions

Variable annuity (1/2)

Assumption	Active rider	Best estimate assumption	Prudent margin
Mortality	GMDB only	Baseline * VM-21 attained age factor (higher mortality than baseline)	+5% base, -5% MI
	GMDB + living benefit	Baseline * VM-21 attained age factor (lower mortality than baseline)	-5% base, +5% MI
Surrender	GMDB only	**Base lapse:** SC Period = 1%-4%, SC+1 = 20%; SC+n = 10% **Dynamic lapse:** multiplicative factor based on moneyness level **Lapse floor post-SC:** 2.0%	-5% (multiplicative)
	GMDB + GLWB or Hybrid GMIB	**Base lapse:** SC period same as DB; SC+1=15%; SC+n=8% **Dynamic lapse:** multiplicative factor based on moneyness level, varies by withdrawal status **Lapse floor post-SC:** 1.5% if withdrawing, 2.0% if deferring	-5% multiplicative on lapse rate (post dynamic adjustment) and floor
	GMDB + traditional GMIB	**Base lapse:** same as GLWB **Dynamic lapse:** multiplicative factor based on moneyness level **Lapse floor post-SC:** 2%	
Withdrawals (non-rider)	GMDB only	**Partial withdrawal:** 2% *(+consideration for tax status)*	No PAD
	GMDB + living benefit	GLWB: 0%; GMIB: 2%	

Liability best estimate assumption

Variable annuity (2/2)

Assumption	Active rider	Best estimate assumption	Prudent margin
GMIB utilization	GMDB + hybrid GMIB (standard projection assumption)	**Base utilization:** Varies by year, GAPV value of non-annuitization benefits, and withdrawal status **Dynamic utilization:** Adjustment based on moneyness level	10% (multiplicative)
	GMDB + traditional GMIB	**Base utilization:** FY exercisable = 15%, subsequent years = 3% **Dynamic utilization:** Adjustment based on moneyness level	10% (multiplicative)
GLWB / withdrawal utilization	GMDB + living benefit	Use VM-21 WDCM with lower never withdrawal cohort ("NWC")%: 5.0%/15% Q/NQ	NWC %: -2.5%/-5% additive for Q/NQ (i.e. 2.5%/10% as PE)
Withdrawal efficiency	GMDB + living benefit	90% with no excess withdrawal	5.0% additive

Appendix A.2

Registered indexed linked annuity

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Model components and functionality

Registered indexed linked annuity

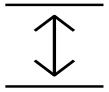
Component	Capabilities
Liability modeling	• Liability cash flows for model office comprised of the following product features: – RILA contracts with either a 10% or 20% buffer and an ROP GMDB • Modeled on a direct basis only (i.e., without reinsurance)
Asset modeling	• Guardrail VM-21 prescribed strategy**:** 10-year bonds with ratings A and AA consistent with the guardrail prescribed under VM-21
Calculations	• Outer loop cash flows under best estimate assumptions and input deterministic scenarios • Pre-tax asset and liability projections under input stochastic scenarios reflecting all cashflows under prudent best estimate and VM-21 prescribed assumptions • Inforce asset iteration at valuation date under input stochastic scenarios to achieve no GPVAD
Assumption sets	• Best estimate • Prudent best estimate • VM-21 standard projection prescribed
Hedging	• The ROP GMDB will not be hedged • Both the CTE70 best efforts and adjusted runs will assume the purchase of future options to cover index credits
Reporting	• Stochastic reserve (CTE70 pre-tax under adjusted and best efforts hedge) • Standard projection add-on under CTEPA method (CTE70 under prescribed in excess of SR, subject to CTE70 – CTE65 unfloored buffer) • C3 at 100% RBC (CTE98 pre-tax and subsequent calculations). Note: C3 will be unsmoothed

Summary of product features

Registered indexed linked annuity product features and rider parameters are customizable to other product configurations, along with populations make-up

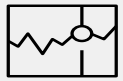
Product

- 6-year crediting term
- Term End Point (TEP) indexing method
- GMDB-only



Buffer

- 10% buffer / uncapped
- 20% buffer / 275% cap



Subaccount types

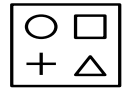
- Indexed: S&P 500
- No variable
- No fixed

Contract fees

- No fee for S&P 500 / indexed accounts (0 bps)

Surrender charges

- 6 years: 7%, 7%, 6%, 5%, 4%, 3%, 0%
- CSV adjusted for unearned index credits



Rider parameters

- GMDB ROP
- No GMDB fee (0 bps)

Liability best estimate assumption

Registered indexed linked annuity

Assumption	Best estimate assumption	Prudent margin
Mortality	Baseline * VM-21 factor (higher mortality than baseline)	+5% base, -5% MI
Surrender	**SC period:** 1% grading to 3% by end of SC period **Shock lapse year:** 50% **Post shock lapse year:** 15%	+10% on shock lapse (additive)
Withdrawals (non-rider)	**Partial withdrawal:** 2.0%	No PAD

Appendix A.3

Additional information

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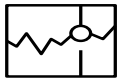
Additional model parameters and assumptions

Model parameters and assumptions can be easily updated to reflect alternatives

Asset

- Investment expense: 10 bps
- Default rates A: 0.15%, Default rates AA: 0.15%
- Spreads: prescribed VM-21

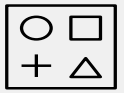


Fund fees (VA only)

- Expense ratio: 100 bps
- Revenue sharing: 50 bps

GMDB fees

- ROP: 0 bps
- Rollup: 35 bps



Living benefit fees

- Rollup IB: 85 bps
- Combo IB: 105 bps
- Hybrid IB: 145 bps
- Rollup WB: 130 bps

Model output summary

Report type	Applicable runs	Description of output
Embedded block calendar year projections	• Stochastic (adjusted) • Stochastic (best efforts) • Standard projection	Scenario level projections including key items: • Net liability cashflow components (e.g., claims, fees) • Coverage movement and decrements (e.g., lapses) • Asset and investment income projections
VM-21 block summary report	• Stochastic (adjusted) • Stochastic (best efforts)	Aggregate scenario calculations containing: • CTE65, 70 & 98 (pre-tax) floored and unfloored – CTE levels are net of hedging and time 0 option value when using best efforts approach • Cash surrender value at valuation
PPA block summary report	• Standard projection	• Aggregate scenario calculation for CTE70 under standard projection assumptions
Hedge liabilities report	• Option value of liabilities	• Present value of claims and fees at valuation for inforce riders