

ACTUARIAL SUPPORT FOR MODEL OFFICE ANALYSIS

GOES Subgroup update

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01

BACKGROUND

Model Office Testing

Field Testing

- **Advantages:**

- Obtains impacts that account for company-specific factors such as product variation, existing asset portfolio and reinvestment assumptions, cost structure, etc.

- **Disadvantages:**

- Resource intensive for companies to participate and for NAIC to compile results
- Lack of transparency into understanding individual company results
- Limited participation for certain products/frameworks resulted in unknown applicability to overall industry

Model Office Testing

- **Advantages:**

- No effort required from industry other than reviewing results
- Potential for quicker feedback on candidate scenario sets

- **Disadvantages:**

- Model office only a proxy for impact to industry
- Will not cover entire range of product- and company-specific impacts

NAIC Model Office

Variable Annuity and Registered Index-Linked Annuity Model Office

- Tool to generate model population:
 - GMDBs, GMIBs, GLWBs
 - In-the-moneyness
 - Withdrawal utilization
 - Separate Account Investments
 - Age of business (inforce vs new business)
- VM-21 and C3 Phase II Calculations
- Implicit Hedging Strategy

ULSG and Term Model Office

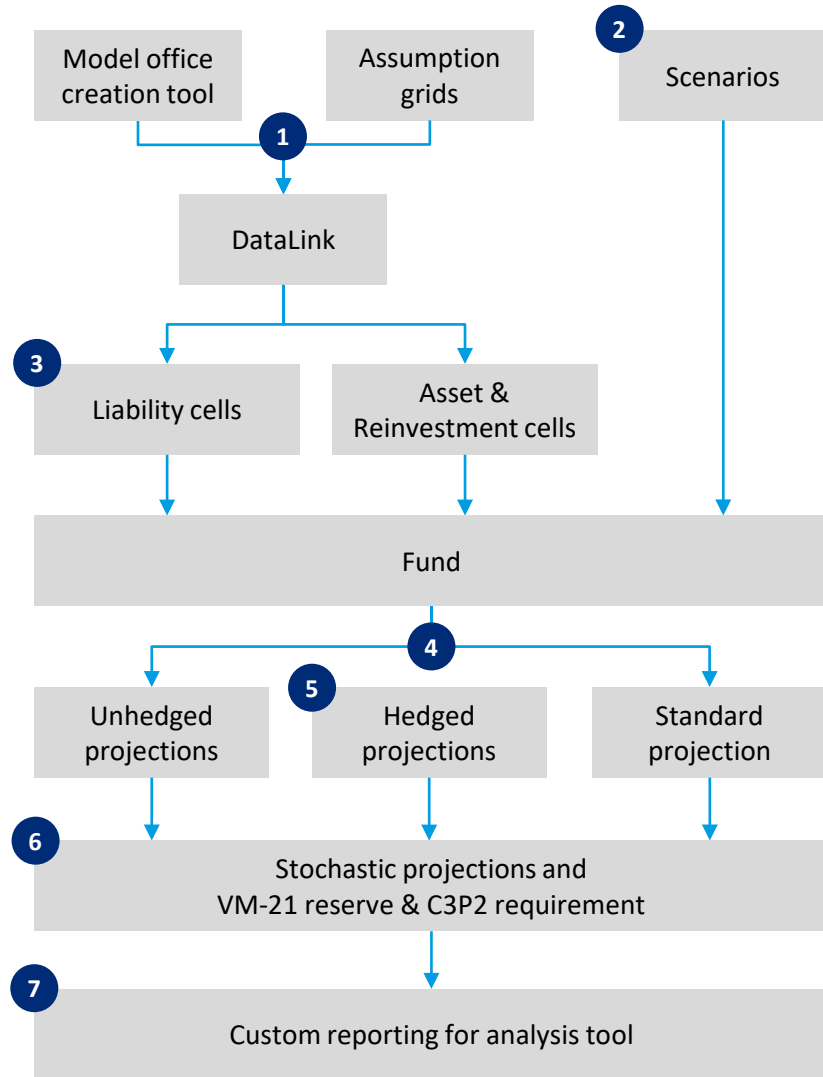
- UL with shadow account secondary guarantee
- Term product with 10- and 20-year terms
- Deterministic Reserves
- Considering enhancements including:
 - SR
 - More representative products

02

MODELING CAPABILITIES

VA AXIS MODEL DESIGN OVERVIEW

The following illustrates the high-level AXIS 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 DataLink, and export from DataLink into AXIS objects
- 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 AXIS 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

REPRESENTATIVE POPULATION GENERATION (“MODEL OFFICE CREATION TOOL”)

Creates a VA model office (in-force file) that interfaces directly with AXIS and allows for a customized population across key product features and policyholder characteristics

VA model office creation tool

1 Cohort name:

Key product information

Issue year	2010
DB rider type	ROP
IB rider type	None
WB rider type	Rollup
Total account value	10,000,000.000
Policy size	10,000,000

DB rider information

Rollup rate	
Benefit ratio	100%

IB rider information

Rollup rate	
Historic withdrawals	
Benefit ratio (withdrawing)	
Benefit ratio (not withdrawing)	

2 **WB rider type**

Rollup rate	6%
Historic withdrawals	50%
Benefit ratio (withdrawing)	185%
Benefit ratio (not withdrawing)	100%

Sex

Male	50%
Female	50%

Tax status

Qual	65%
non-qual	35%

Attained ages

55	0%
65	50%
75	35%
85	15%

Investment allocation

US Equity	50.0%
Int Equity	15.0%
Bond	30.0%
Money Market	2.5%
General Account	2.5%

Save cohort information

Clear all cohorts

Generate inforce feed

Save inforce feed

3 Checks 0.000

Key features

- 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

Save inforce feed data

File name	File name.csv
File Path	C:\FilePath

03

APPROACH

MODEL OFFICE DEVELOPMENT

Field testing was used to inform the model office

Distribution of riders included in initial field testing

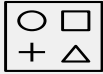
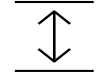

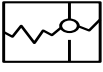

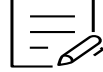
= included in model office

Rider types included in the model office make up over 80% of the separate account in field testing

Riders	% of Separate Account
Guaranteed Minimum Death Benefit Only (GMDB)	40.2%
GMDB/Guaranteed Minimum Income Benefit (GMIB)	9.3%
GMDB/Guaranteed Minimum Withdrawal Benefit (GMWB) Combo	41.9%
GMDB/Guaranteed Minimum Accumulation Benefit (GMAB) Combo	0.4%
Other benefit combinations	8.3%

Model office archetypes – GMWB/GMDB combo

A range of archetypes were developed to capture a range of sensitivity to the change in scenarios

 <p>Total combinations</p> <ul style="list-style-type: none"> 16 archetypes that vary by key characteristics Example archetype: strong guarantee, implicit hedging, mature block, ITM 	 <p>GMWB guarantee strength</p> <ul style="list-style-type: none"> Strong guarantee Weak guarantee 	 <p>Hedging</p> <ul style="list-style-type: none"> Implicit hedge No hedge
 <p>Block maturity</p> <ul style="list-style-type: none"> New Mature 	 <p>Moneyness</p> <ul style="list-style-type: none"> ITM OTM/ATM 	 <p>Static inputs</p> <ul style="list-style-type: none"> M/F sex split Q/NQ split Equity allocation

VARIABLE ANNUITY GMWB/GMDB COMBO IN-FORCE ARCHETYPES

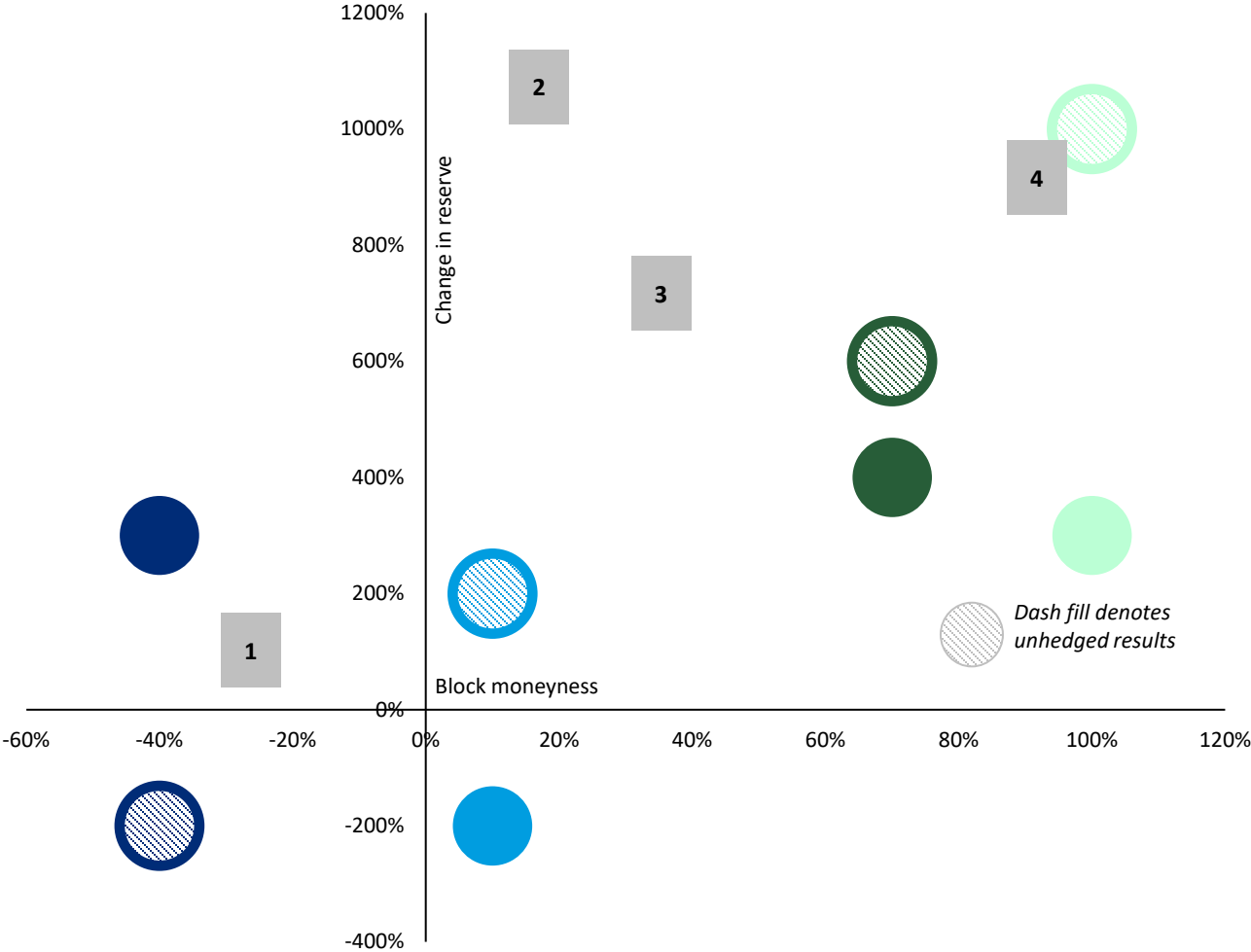
Scenario sensitivity will be tested over 16 archetypes

Archetype	LB rider	DB rider	Hedging	Guarantee strength	Block maturity	Moneyness
1	Rollup GLWB	ROP GMDB	Implicit	Strong	New	ITM
2	Rollup GLWB	ROP GMDB	Implicit	Strong	New	OTM
3	Rollup GLWB	ROP GMDB	Implicit	Strong	Mature	ITM
4	Rollup GLWB	ROP GMDB	Implicit	Strong	Mature	ATM
5	Rollup GLWB	ROP GMDB	Implicit	Weak	New	ITM
6	Rollup GLWB	ROP GMDB	Implicit	Weak	New	OTM
7	Rollup GLWB	ROP GMDB	Implicit	Weak	Mature	ITM
8	Rollup GLWB	ROP GMDB	Implicit	Weak	Mature	ATM
9	Rollup GLWB	ROP GMDB	None	Strong	New	ITM
10	Rollup GLWB	ROP GMDB	None	Strong	New	OTM
11	Rollup GLWB	ROP GMDB	None	Strong	Mature	ITM
12	Rollup GLWB	ROP GMDB	None	Strong	Mature	ATM
13	Rollup GLWB	ROP GMDB	None	Weak	New	ITM
14	Rollup GLWB	ROP GMDB	None	Weak	New	OTM
15	Rollup GLWB	ROP GMDB	None	Weak	Mature	ITM
16	Rollup GLWB	ROP GMDB	None	Weak	Mature	ATM

POTENTIAL EXAMPLE DELIVERABLE

Learnings from Phase 1 will be used to inform strategy for Phase 2

Illustrative results graph for AAA vs Conning 1a scenario set as of 12/31/2021



Legend

- Blue circle: Description of sample model office 1
- Dark blue circle: Description of sample model office 2
- Dark green circle: Description of sample model office 3
- Light green circle: Description of sample model office 4
- ... (dashed fill): Dash fill denotes unhedged results
- Gray square 1: Industry data point 1
- Gray square 2: Industry data point 2
- Gray square 3: Industry data point 3
- Gray square 4: Industry data point 4
- ... (dashed fill): ...

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