

2017 Valuation Actuary Seminar
October 18-19, 2017
Boston Marriott Copley Place
Boston, MA

Session 12PD: Getting Assets Ready for PBR

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2017 Valuation Actuary Seminar

SESSION 12: GETTING ASSETS READY FOR PBR
SCOTT HOUGHTON, FSA, MAAA

October 19, 2017

Principal at the Actuarial Practice of Oliver Wyman



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Topics

- Valuation Manual guidance – an overview
- Validation of asset values, cash flows, assumptions, and representations of risk
- Capturing asset and liability interaction
- Themes
 - Prevention of common asset modeling issues
 - Differences in asset modeling from cash flow testing models and VM20

Valuation Manual guidance - overview

1	VM-20	<ul style="list-style-type: none">• Cash flow model requirements• Segments• Reinvestment and cash flows• Asset classes• Assumptions
2	VM-30	<ul style="list-style-type: none">• Mirrors current AOMR
3	VM-31	<ul style="list-style-type: none">• Implicit guidance in reporting and documentation requirements

VM-31 Implicit guidance

Bases and
justification of
assumptions and
allocations



Methods used to
derive anticipated
experience
assumptions and
margins

Comparisons of
models to
company practice

Validation of asset cash flows and values- corporate bond example

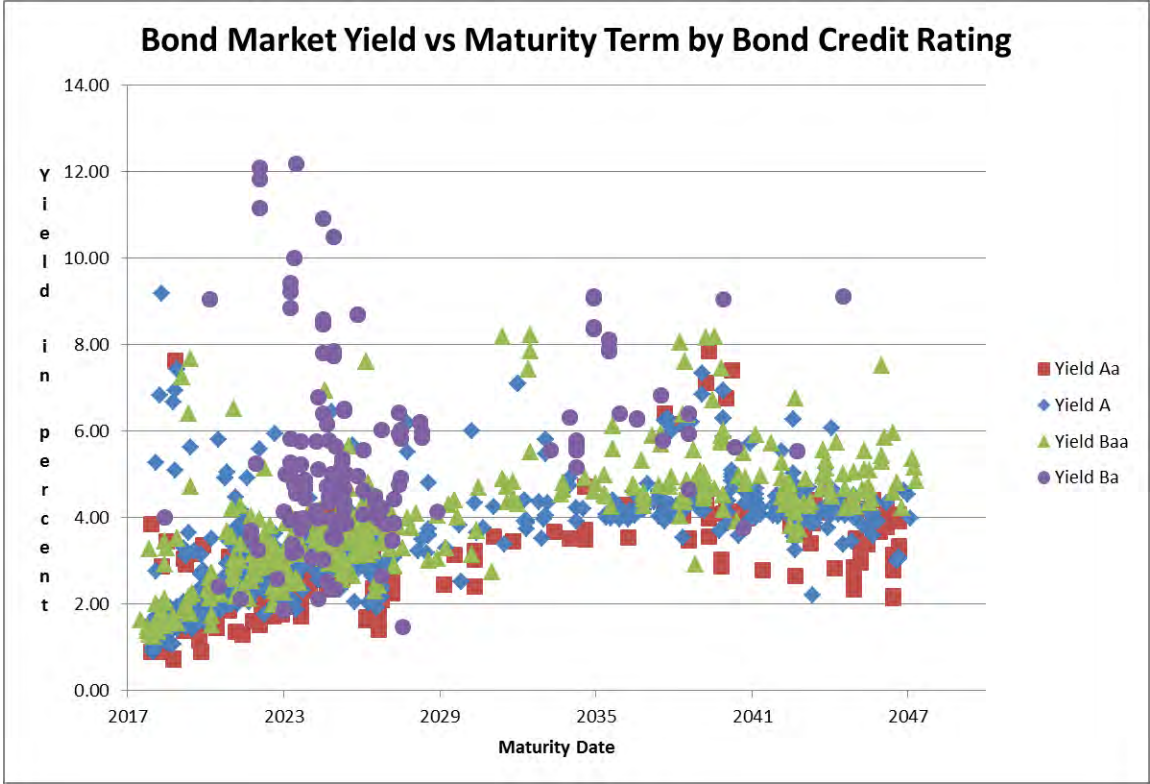
Book value	\$700,000
Market value	\$700,000
Par value	\$1,000,000
Coupon (semiannual)	2.00%
Defaults (annual)	0.25%
Statement date	June 30, 2017
Maturity date	December 30, 2022

Validation of asset cash flows and values- corporate bond example

Date	Cash Flow
12/30/2017	\$9,987.49
6/30/2018	\$9,975.00
12/30/2018	\$9,962.52
6/30/2019	\$9,950.06
12/30/2019	\$9,937.62
6/30/2020	\$9,925.19
12/30/2020	\$9,912.77
6/30/2021	\$9,900.37
12/30/2021	\$9,887.99
6/30/2022	\$9,875.62
12/30/2022	\$996,190.39

Book and market yields = 8.97%

Validation of asset cash flows and values-corporate bond yields



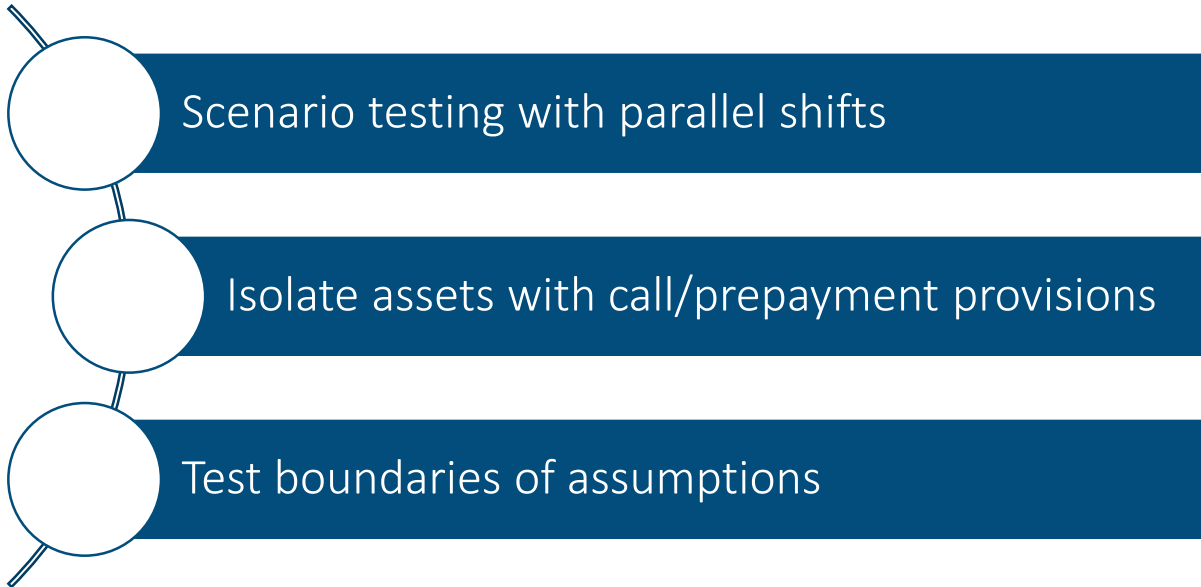
Validation of asset cash flows and values

- Review of book/market yields
- Review of individual assets
- Cash flow review/replication
- Portfolio and asset rollforward
- Accounting treatment

Validation of assumptions – credit risk

- Bonds:
 - Default risk and credit risk
 - Downgrades more common than defaults
- Impact on mortgages and other asset classes

Validation of assumptions – prepayments and prepayment risk



Reflecting liquidity risk in models

- Restriction of sales in software
- Modeling and output review required to avoid leverage of portfolio
- Test boundaries of assumptions

Asset liability interaction

1	Interest rate crediting
2	Dynamic lapses
3	Dividends
4	Disinvestment
5	Reinvestment

Disinvestment / reinvestment

- VM-20 limits / restrictions
- Borrowing
- Liquidity
- Asset and assumption testing

Summary of common asset modeling issues and their prevention

1

Book/market yields

Assumptions, input values

2

Credit risk

Assumptions

3

Other risks

Validation

4

Accounting

Review of results

5

Leverage

Input/parameters, review of results

6

Proper asset/liability interaction

Input, results review



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PATRICK LEDLEE, FSA

Principal at LW Consulting Group

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Setting the Scene

- New Mandate - Deliver Asset/Reinvestment Assumptions for Determining VM-20 Reserves
- Support ALM analysis on VM-20 Scenario Results
- What do you need to prepare?

Key Considerations

- New data needs
- New assumptions/modeling requirements
- Reserve Calculations/ALM Scenario Analysis

Where to start?

- Existing ALM models:
 - Asset Adequacy Testing (CFT)
 - C3 Phase I
 - Internal Capital Planning
 - CALM model

Considerations for Existing ALM Models

- Consistency in assumptions?
- Model capabilities to reflect assumptions?
- Granularity to meet reporting requirements?

Potential Modeling Differences for VM-20

- Spreads/defaults
- Corporate taxes
- IMR/AVR Treatment
- Dynamic Starting Asset

Data Requirements Checklist

➤ Inforce assets

- ☐ Weighted Average Life (remaining term)
- ☐ Option-adjusted spreads over treasuries
- ☐ Credit Ratings from multiple sources

➤ NAIC Assumption Tables

- ☐ Baseline annual default cost factors
- ☐ Current market benchmark spreads
- ☐ Historical mean benchmark spreads

➤ Internal assumptions

- ☐ Spreads/defaults for assets without NAIC designation
- ☐ Investment Expenses

Determining PBR Numeric Rating

- Average numeric rating
- If no rating present, use 2nd-highest number for NAIC Designation

Table K. Conversion from NAIC ARO Ratings and NAIC Designations to PBR Numeric Rating

Moody's Rating	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3
S&P Rating	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
Fitch Rating	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
DBRS Rating	AAA	AA high	AA	AA low	A high	A	A low	BBB high	BBB	BBB low
RealPoint Rating	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-
AM Best Rating	aaa	aa+	aa	aa-	a+	a	a-	bbb+	bbb	bbb-
NAIC Designation	1	1	1	1	1	1	1	2	2	2
NAIC Commercial Mortgage Designation							1			2
Numeric Rating	1	2	3	4	5	6	7	8	9	10

Spread Assumptions

- Looked up based on WAL/PBR Numeric Rating
- Spreads assumed to grade **annually** from Current to Long-Term in year 4
 - Not linear in between years
 - WAL's are based on time 0 only

Table F. Illustrative Current Market Benchmark Spreads as of Sept. 30, 2015, for Investment Grade Bonds

WAL	Investment Grade PBR Credit Rating and Moody's/S&P Ratings									
	1	2	3	4	5	6	7	8	9	10
	Aaa/AAA	Aa1/AA+	Aa2/A-	Aa3/AA-	A1/A+	A2/A	A3/A-	Baa1/BBB+	Baa2/BBB	Baa3/BBB-
1	27.11	38.26	49.41	58.12	66.84	75.55	91.10	106.65	122.20	225.83
2	34.97	47.02	59.06	67.20	75.34	83.48	101.59	119.69	137.80	233.63
3	42.84	55.77	68.71	76.28	83.84	91.41	112.07	132.74	153.40	241.43
4	50.70	64.53	78.36	85.35	92.35	99.34	122.56	145.78	169.00	249.23
5	57.92	72.35	86.79	93.96	101.13	108.30	133.99	159.68	185.38	257.42
6	65.13	80.18	95.22	102.57	109.91	117.26	145.42	173.59	201.75	265.61
7	72.36	89.78	107.19	112.83	118.46	124.10	151.88	179.67	207.45	268.46

Table H. Long-Term Benchmark Spreads as of Sept. 30, 2015, for Investment Grade Bonds

WAL	Investment Grade PBR Credit Rating and Moody's/S&P Ratings									
	1	2	3	4	5	6	7	8	9	10
	Aaa/AAA	Aa1/AA+	Aa2/AA	Aa3/AA-	A1/A+	A2/A	A3/A-	Baa1/BBB+	Baa2/BBB	Baa3/BBB-
1	44.26	50.93	57.61	68.24	78.86	89.49	114.53	139.58	164.63	244.90
2	51.12	59.66	68.20	78.56	88.92	99.28	123.43	147.58	171.73	248.45
3	57.99	68.39	78.79	88.89	98.98	109.08	132.33	155.58	178.84	252.00
4	64.85	77.12	89.38	99.21	109.04	118.87	141.23	163.58	185.94	255.56
5	71.07	83.73	96.40	106.71	117.02	127.34	150.04	172.75	195.45	260.31
6	77.28	90.35	103.41	114.21	125.00	135.80	158.85	181.91	204.96	265.07
7	78.99	93.05	107.11	117.13	127.15	137.17	160.06	182.94	205.83	265.50

Default Assumptions

➤ 3 Components

- I. **Baseline default cost factor** looked up by PBR Numeric Rating/WAL
- II. **Spread-related default factor** is calculated and grades to 0 in the 4th year of the projection
- III. **Maximum Net Spread adjustment** is calculated and grades to 0 in the 4th year of projection

Table A. Baseline Annual Default Costs (in bps) using Moody's Data as of December 2014

PBR Credit Rating	Moody's/ WAL	1	2	3	4	5	6	7	8	9	10
1	Aaa	0.02	0.02	0.05	0.08	0.11	0.12	0.13	0.15	0.16	0.17
2	Aa1	0.13	0.36	0.66	0.99	1.14	1.29	1.40	1.51	1.62	1.74
3	Aa2	0.31	0.96	1.72	2.22	2.49	2.72	2.88	3.04	3.24	3.48
4	Aa3	0.67	2.28	3.91	4.77	5.21	5.61	5.89	6.13	6.48	6.97
5	A1	1.30	4.44	7.76	8.94	9.59	10.14	10.56	10.86	11.40	12.25
6	A2	2.44	8.41	14.74	16.34	17.20	17.97	18.55	18.84	19.65	21.14
7	A3	4.89	11.03	17.12	19.44	21.11	21.83	22.94	23.62	24.65	26.31

Default Assumption - Example

➤ Assume PBR Rating = 4 and WAL = 6

- Baseline Default = 5.61

Table A. Baseline Annual Default Costs (in bps) using Moody's Data as of December 2014

PBR Credit Rating	Moody's\ WAL	1	2	3	4	5	6	7	8	9	10
1	Aaa	0.02	0.02	0.05	0.08	0.11	0.12	0.13	0.15	0.16	0.17
2	Aa1	0.13	0.36	0.66	0.99	1.14	1.29	1.40	1.51	1.62	1.74
3	Aa2	0.31	0.96	1.72	2.22	2.49	2.72	2.88	3.04	3.24	3.48
4	Aa3	0.67	2.28	3.91	4.77	5.21	5.61	5.89	6.13	6.48	6.97
5	A1	1.30	4.44	7.76	8.94	9.59	10.14	10.56	10.86	11.40	12.25
6	A2	2.44	8.41	14.74	16.34	17.20	17.97	18.55	18.84	19.65	21.14
7	A3	4.89	11.03	17.12	19.44	21.11	21.83	22.94	23.62	24.65	26.31

Spread-Related Default Factor

- Assumes that current market spread views reflect some embedded default risk
- Assume PBR Rating = 4 and WAL = 6
- Current Spread = 102.57 bps, Long-Term Spread = 112.8
- **Preliminary** Spread related factor is $25\% * (\text{Current} - \text{Long-Term}) = 25\% * (102.57 - 112.8) = -2.56$
- Boundaries
 - If positive, cannot be greater than 2x Baseline Default
 - If negative, can offset Baseline default at most
- Resulting corridor: $[-5.61, 2 \times 5.61] = [-5.61, 11.12]$
- Because -2.56 is inside corridor, no capping/flooring is necessary
- Preliminary = Final spread related factor = -2.56

Maximum Net Credit Spread Adjustment

- Intention is to account for extra default risk reflected in inforce asset spreads in excess of current benchmark spreads
- Calculate a **Preliminary** net credit spread for each cusip:

$$\text{Net Credit Spread} = \text{OAS} - \text{Inv Exp} - \text{VM20 Defaults (i/ii)}$$

- Max spread defined by a hypothetical asset portfolio with a PBR rating of 9
- Any excess spread in actual portfolio is offset by increasing defaults
- Detailed example available on SOA website ([link](#))

Preliminary Net Credit Spread

➤ Continuing Example

- OAS = 300bps
- Investment Expense = 12bps
- Baseline default = 5.61bps
- Spread-related default = -2.56bps

➤ **Preliminary** net credit spread = OAS – Inv Exp – Default (I) – Default(II)
= 300bps – 12bps – 5.61bps – (-2.56bps) = 285bps

Portfolio Net Credit Spread Adjustment

➤ Assume portfolio with 3 inforce assets

CUSIP	WAL	Prelim Net Credit Spread	Statement Value	WAL*SV	PNCS*SV
1	6	285	6,000,000	36,000,000	1,710,000,000
2	4	150	1,000,000	4,000,000	150,000,000
3	4	100	3,000,000	12,000,000	300,000,000
Total	5	216	10,000,000	52,000,000	2,160,000,000
	=52M/10M =2.16B/10M				

➤ Compare Portfolio Preliminary Net Credit Spread with Hypothetical Asset

- WAL = 5, PBR = 9, OAS = Current Spreads
- Hypothetical Asset Net Credit Spread = 105bps
- Portfolio Net Credit Spread Adjustment = 216bps – 105bps = 111bps, grading to zero in year 4

Model Limitations/Workarounds

- Assumptions assigned by PBR Rating/WAL
- Defaults In Absence of NAIC Designation
 - Net Yield limited to 104% of Treasury **at date of purchase** + 25bps

Reinvestment/Disinvestment

- Spreads and defaults similar to inforce
 - No Maximum Net Credit Spread Adjustment

- If assets purchased are not public, non-callable corporate bonds, no spreads prescribed
 - Company to provide their own assumptions
 - AA/A quality limitation

- Existing asset sales allowed using prescribed spreads

Pricing Considerations – Projected VM20

- Future published spread/default assumptions will need to be populated by user
 - Consider sensitivities
- “Reset” prescribed calculations

ALM Scenario Analysis

- VM-20 Final Reserve = $\text{Max}(\text{NPR}, \text{DR} + \text{DPA}, \text{SR} + \text{DPA})$
 - NPR = Net Premium Reserve
 - DR = Deterministic Reserve
 - SR = Stochastic Reserve
 - DPA = Deferred Premium Asset

- Deterministic & Stochastic components of the VM-20 Reserve require ALM projections

Deterministic Reserve

➤ Method A

- $DR = PV$ of Liability cashflows at the asset earned rate across a single scenario
- Very similar to CFT

➤ Method B

- Starting asset amount is determined such that ending surplus is 0
- Very similar to CALM

Stochastic Reserve

➤ ALM projections run over stochastic set of scenarios

- Each scenario's reserve is the difference between the starting assets and the worst-case PV of Surplus (discounted at asset earned rate)
- No Working Reserve, so Total Assets = Surplus
- Stochastic Reserve is CTE(70) of all scenario reserves

➤ Sample scenario output:

Projection Year	0	1	2	3	4	5	6	7	8	9	10
Total Assets	30.0	28.0	26.0	24.0	25.0	26.0	25.0	28.0	29.0	30.0	31.0
Working Reserve	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surplus	30.0	28.0	26.0	24.0	25.0	26.0	25.0	28.0	29.0	30.0	31.0
PV of Surplus	30.0	27.0	24.1	21.5	21.5	21.6	20.0	21.6	21.5	21.4	21.3

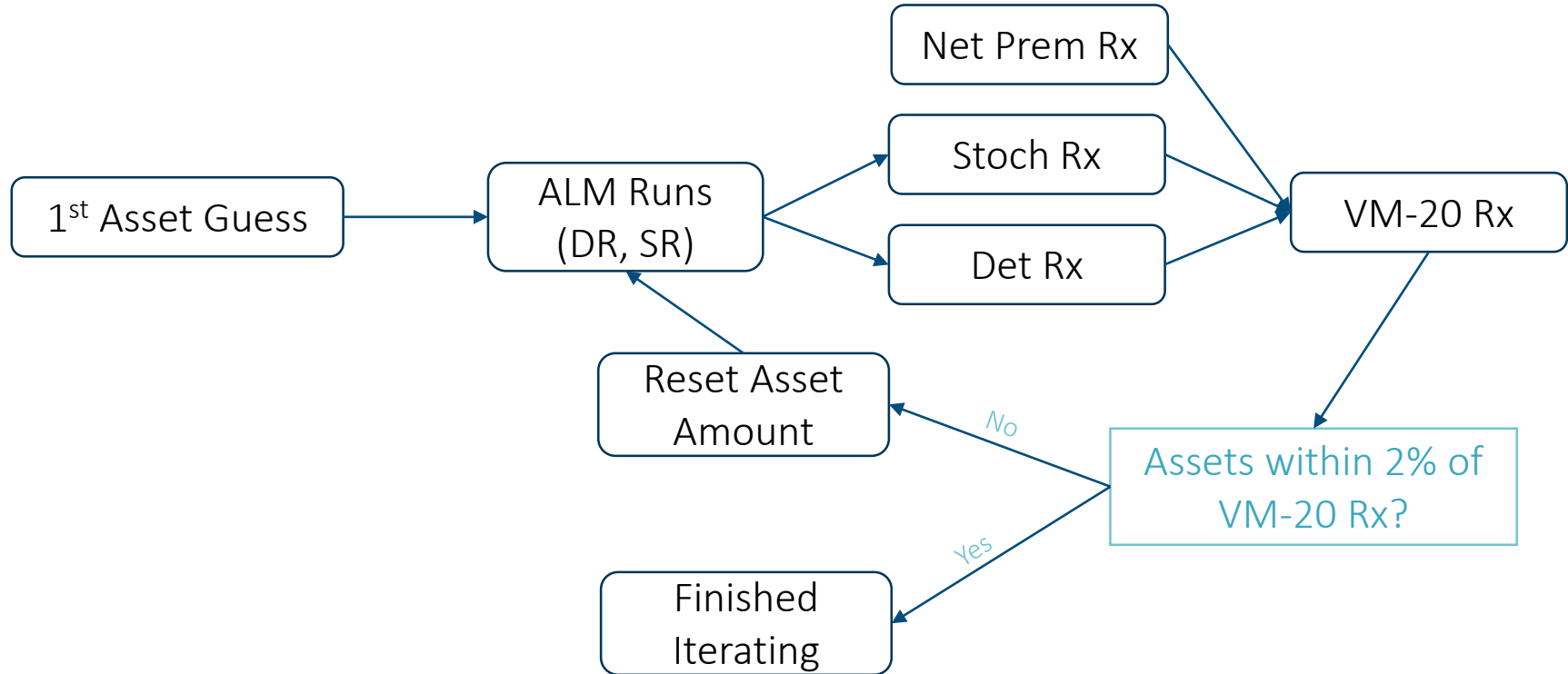
- Starting assets = \$30M
- Lowest PV along projection is \$20M
- Scenario Reserve is \$10M for this particular scenario

Starting Asset Assumptions

- Iterative Process with respect to the Stochastic Reserve and Deterministic Reserve - Method A
 - Starting assets should be +/- 2% of Final VM-20 Reserve

- Final VM-20 Reserve is not known until Stochastic and Deterministic projections have been run
 - $\text{VM-20 Final Reserve} = \text{Max}(\text{NPR}, \text{DR} + \text{DPA}, \text{SR} + \text{DPA})$
 - NPR = Net Premium Reserve
 - DR = Deterministic Reserve
 - SR = Stochastic Reserve
 - DPA = Deferred Premium Asset

Asset Iteration Process



Starting Asset Assumptions

➤ Potential initial guess

- The NPR is known before the ALM runs are performed

➤ Example:

- $\text{NPR} = \$100\text{M}$
- $\text{DPA} = \$0$
- $\text{Starting Assets} = \100M
- $\text{DR} = \$110\text{M}$
- $\text{SR} = \$120\text{M}$
- $\text{VM-20 Rx} = \text{Max}(\$100\text{M}, \$110\text{M}, \$120\text{M}) = \$120\text{M}$

Starting Asset Iteration - Example

➤ Example:

- $\text{NPR} = \$100\text{M}$
- $\text{DPA} = \$0$
- $\text{Starting Assets} = \100M

➤ Post-Run Results:

- $\text{DR} = \$110\text{M}$
- $\text{SR} = \$120\text{M}$
- $\text{VM-20 Rx} = \text{Max}(\$100\text{M}, \$110\text{M}, \$120\text{M}) = \$120\text{M}$
- Assets too low

Chasing VM-20 Reserve

➤ Trial #2, Starting Assets = \$120M

- DR = \$115M
- SR = \$122M
- VM-20 Rx = $\text{Max}(\$100\text{M}, \$115\text{M}, \$122\text{M}) = \122M
- Assets within 2% of VM-20 Rx, Convergence!

Chasing VM-20 Reserve – Potential Downside

➤ Trial #2, Starting Assets = \$120M

- DR = \$90M
- SR = \$100M
- VM-20 Rx = $\text{Max}(\$100\text{M}, \$90\text{M}, \$100\text{M}) = \100M
- Assets outside 2% of VM-20 Rx, need to retry

➤ If chasing VM-20 Reserve, could oscillate between \$10M and \$12M of starting assets without convergence

➤ Faster convergence possible with more advanced algorithms

Alternatives to Iteration

- If the actuary can demonstrate that movement in the starting asset position doesn't materially impact reserves, then the assets may not need to be within $\pm 2\%$ of final reserve
 - Adjust assets for particularly adverse Stochastic Scenarios
 - Iterate over a few starting asset positions

Preparation Checklist

- ☐ Be aware of data needs
- ☐ Prescribed Calculations
- ☐ “Process” oriented calculations
- ☐ Potential simplifications and workarounds



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