



**Actuaries Club of the Southwest
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Modeling Assets for Principle Based Reserves

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Agenda

1. The net asset earned rate
2. Modeling fixed income assets
3. A sample calculation of prescribed default rates
4. Modeling other assets
5. Modeling reinvestments
6. Economic scenarios
7. Financial reporting timelines

The net asset earned rate

- Required for the deterministic reserve
- Net investment earnings / invested assets
 - Net investment earnings includes:
 - Investment income less defaults and expenses
 - Capital gains and losses
 - Income from derivative asset programs
 - Earnings from both starting and reinvestment assets
 - Does not include SA or policy loan income
 - Invested assets consistent with timing of cash flows in the model & including value of derivatives
 - Dependent on starting assets

Starting assets – Level

- Must be determined for each model segment
- Estimate the level of starting assets such that it is close to the aggregate modeled reserve (max DR, SR) based on reserve history, recent sales, new reinsurance treaties, etc.
 - Use asset valuation methods consistent with annual statement values
 - Iterate if not within 2% of the aggregate modeled reserve or demonstrate that the modeled reserve produced is not materially understated

Starting assets – What's included

- The following are included in starting assets:
 - Due and accrued or unearned investment income
 - Separate account assets supporting the policies
 - Policy loans if explicitly modeled
 - Allocatable derivatives (must be part of derivative program) and negative PIMR liability
 - Enough general account assets to hit the determined level of starting assets
- Selection must be consistent from one reserve valuation to the next

Starting assets – General account

- May be negative in certain situations
- The subset of selected assets are typically related to the policies being modeled
 - Pro-rata, or selection based on asset segmentation plan, asset assignment for credited rates, or approach used to allocate statutory investment income
 - VM20 applies to new issues only
- Gross up or use unused assets from other portfolios (i.e. surplus) if not enough real assets

Modeling fixed income assets

- Project gross investment income, subtracting prescribed default costs and prudent estimate investment expenses
 - For reinvestment assets, gross investment income is determined at a prescribed spread to Treasuries
- Model associated asset sales, calls, puts, prepayments, extensions, derivatives, etc.
- Vary by economic scenario
- Grouping is allowed if you can show it won't materially understate the reserve

Defaults if NAIC designation exists

- Defaults are for each asset are sum of:
 - Baseline default cost
 - Table lookup using PBR rating (1-20) and WAL (1-10)
 - Prescribed table is based on historical averages + margin
 - Spread-related factor
 - Based on the prescribed current and historical spreads that vary by PBR rating (1-20) and WAL (1-30)
 - Factor has a max, min and grades to zero over 3 years
 - Maximum net spread adjustment factor
 - Only if portfolio net spread is greater than amthreshold
 - Grades to zero over three years

Defaults if no NAIC designation

- Prescribed defaults are determined differently if the asset has no NAIC designation
 - E.g. CMBS, RMBS, commercial mortgages, residential whole loans, etc.
 - Defaults are determined such that the net yield is capped at 104% of the Treasury rate most closely coinciding with the asset's purchase date and maturity structure, plus 25 basis points

PBR bond ratings (Table K)

Moody's	S&P	Fitch	DBRS	RealPoint	AM Best	NAIC	PBR
Aaa	AAA	AAA	AAA	AAA	aaa	1	1
Aa1	AA+	AA+	AA high	AA+	aa+	1	2
Aa2	AA	AA	AA	AA	aa	1	3
Aa3	AA-	AA-	AA low	AA-	aa-	1	4
A1	A+	A+	A high	A+	a+	1	5
A2	A	A	A	A	a	1	6
A3	A-	A-	A low	A-	a-	1	7
Baa1	BBB+	BBB+	BBB high	BBB+	bbb+	2	8
Baa2	BBB	BBB	BBB	BBB	bbb	2	9
Baa3	BBB-	BBB-	BBB low	BBB-	bbb-	2	10
Ba1	BB+	BB+	BB high	BB+	bb+	3	11
Ba2	BB	BB	BB	BB	bb	3	12
Ba3	BB-	BB-	BB low	BB-	bb-	3	13
B1	B+	B+	B high	B+	b+	4	14
B2	B	B	B	B	b	4	15
B3	B-	B-	B low	B-	b-	4	16
Caa1	CCC+	CCC+	CCC high	CCC+	ccc+	5	17
Caa2	CCC	CCC	CCC	CCC	ccc	5	18
Caa3	CCC-	CCC-	CCC low	CCC-	ccc-	5	19
Ca	CC	CC	CC	CC	cc	6	20



PBR baseline default costs (Table A)

PBR Rating	Weighted Average Life (years)									
	1	2	3	4	5	6	7	8	9	10+
1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
2	0.0	0.1	0.3	0.5	0.5	0.6	0.7	0.8	0.8	0.9
3	0.1	0.4	0.8	1.0	1.2	1.3	1.4	1.5	1.7	1.8
4	0.2	0.9	1.7	2.2	2.4	2.7	2.9	3.1	3.3	3.7
5	0.4	1.7	3.4	4.1	4.5	4.9	5.2	5.5	5.9	6.4
6	0.8	3.3	6.5	7.5	8.1	8.6	9.2	9.5	10.1	11.1
7	2.8	7.0	10.6	11.8	12.6	13.5	14.4	14.9	15.6	16.7
8	6.4	13.0	16.5	18.1	19.1	20.4	21.7	22.7	23.5	24.3
9	16.3	26.3	32.5	36.9	39.8	40.3	42.4	44.0	44.7	45.2
10	42.0	61.4	70.0	76.8	81.0	80.0	80.6	81.4	81.9	81.8
11	90.5	123.4	134.7	143.1	148.8	143.9	140.4	138.4	137.2	135.7
12	173.5	226.2	243.5	257.9	267.6	253.8	241.0	232.5	228.0	224.1
13	262.0	295.0	311.3	328.6	349.6	334.4	321.0	313.1	308.2	305.9
14	436.4	453.8	468.5	480.1	495.0	464.0	441.5	425.5	415.2	409.4
15	621.8	573.8	565.2	560.8	567.4	525.7	492.9	467.1	449.6	436.4
16	1009.1	832.5	789.8	779.3	788.6	726.3	689.6	663.7	641.2	626.1
17	1440.9	1095.2	1004.3	983.8	999.3	922.7	879.6	855.0	840.7	839.5
18	2026.5	1427.1	1253.0	1191.4	1191.9	1089.4	1023.7	982.5	960.8	952.3
19	3974.3	2806.9	2385.2	2269.9	2316.1	2090.5	1942.0	1850.2	1809.0	1815.6
20	7090.1	7090.1	7090.1	7090.1	7090.1	7090.1	7090.1	7090.1	7090.1	7090.1



Example of prescribed defaults

- A. WAL = 5 years
- B. Expenses = 10 bps
- C. OAS = 150 bps
- D. Statement value = \$300
- E. Moody's rating of Aa1, S&P rating of AA- → PBR rating = Avg(2,4) = 3
- F. Baseline default cost = 1.2, 1.0, 0.8, 0.4 and 0.1 for years 1-5
- G. Current spread = 134.6
- H. Historical spread = 99.1
- I. Spread related factor = 25%(G-H) but $\geq -F$ and $\leq 2F$ = 2.4, 1.6, 0.8, 0.0 and 0.0 for years 1-5
- J. Prelim 1st year net spread = C-B-F-I = 150.0 - 10.0 - 1.2 - min (max (25% (134.6 - 99.1), -1.2), 2.4) = 136.4
- K. $WAL_{port} = 13$ years
- L. Prelim 1st year net spread for asset with WAL of WAL_{port} , PBR rating of 9 (BBB), and investment expense of 10 bps = 208.9 - 10.0 - 45.2 - min (max (25% (208.9 - 203.1), -45.2), 90.4) = 152.3
- M. Statement value * min(WAL,3) = 900
- N. $\sum_{port} \text{Statement value}_i * \min(WAL_i,3) = 2800$
- O. Weighting = M/N = 32.1%
- P. Prelim 1st year net spread_{port} = $\sum_{port} \text{Prelim 1}^{\text{st}} \text{ year net spread}_i * \text{Weighting}_i = 177.6$
- Q. Max net spread adj. factor = P-L = 25.3, 16.9, 8.4, 0.0 and 0.0 for years 1-5
- R. Total default cost = F+I+R = 28.9, 19.5, 10.0, 0.4 and 0.1 for years 1-5



Modeling other assets – Equity

- Allocate equity assets to chosen proxy funds (e.g. large cap stocks, real estate), often expressed as a linear combination of the recognized market indices available in the prescribed ESG
- Project future gross investment returns for each proxy fund, subtracting prudent estimate investment expenses, and including realized and unrealized capital gains/losses
- Model associated asset sales and derivatives

Modeling other assets – Policy loans

- Two approaches
 - Explicit modeling of all policyholder loan behavior
 - Included as liability cash flows in DR and SR
 - Cash flows not included in DR's net asset earned rate
 - Expenses allocated to policy loans are not modeled as an investment expense
 - Real assets (e.g. bonds) as proxy for policy loans
 - Included as investment cash flow in SR
 - Cash flows included in DR's net asset earned rate
 - Resulting reserve must not be less than explicit approach

Modeling other assets – Derivatives

- Must model all benefits, costs, residual risks and frictional costs
 - For all relevant existing derivatives
 - For future derivatives if there is a Clearly Defined Hedging Strategy (CDHS)
 - VM20 encourages future consideration of graded approach for recognizing the impact of non-CDHS derivatives
 - For the DR, asset-associated derivatives are included in the net asset earned rate, whereas liability-associated derivatives are included in the liability cash flows

VM20 definition of CDHS

- Per VM20 a CDHS must identify the:
 - Specific risks being hedged (e.g. CFs, int. credits, Δ , ρ , v , etc.)
 - Hedge objectives
 - Risks not hedged (e.g. different than expected decrements)
 - Financial instruments used to hedge
 - Trading rules including permitted tolerances from hedge objectives
 - Metrics, criteria and frequency for measuring hedge effectiveness
 - Conditions under which hedging will not take place.
 - Person(s) responsible for implementing hedging strategy
 - Circumstances under which hedging strategy will not be effective
 - Areas where basis, gap or assumption risk related to the hedging strategy have been identified

Modeling reinvestments

- Consistent with actual investment policy
- Spreads are prescribed for public non-callable bonds based on market data
 - Grade from current to ultimate over three years
 - Tables vary by WAL (1-30) and PBR rating (1-20)
 - Same approach for defaults as existing assets, but without the maximum net spread adjustment factor
- Other spreads not prescribed
 - But minimum reserve must not be lower than using 50/50 A/AA public non-callable bonds

Other asset modeling considerations

- Spreads for market values of sold assets
 - Must be consistent with spreads for purchases
- Pre-tax IMR (PIMR)
 - Must be allocated to model segments
 - Amortization is included in net investment earnings when calculating the DR's net asset earned rate
- In addition to asset sales, both negative assets and borrowing are allowed
- LOCs aren't prohibited if they're an admitted asset
 - Consideration of modeling the fees



Scenarios – The prescribed ESG

- The prescribed ESG generates 10,000 scenarios:
 - 10 Treasury rates from 90 days to 30 years
 - The following indices:
 - Aggressive or specialized equity (AGGR)
 - Diversified international equity (INT)
 - Diversified large cap US Equity (US)
 - Intermediate risk equity (SMALL)
 - Money market / Short term (MONEY)
 - Intermediate term US government bond (INTGOV)
 - US long term corporate bonds (LTCORP)
 - Diversified fixed income (FIXED)
 - Diversified balanced (BALANCED)

Available at the SOA's website

The screenshot shows a web browser window displaying the SOA website. The address bar shows the URL: <http://www.soa.org/research/software-tools/research-scenario.aspx>. The page header includes the text "SOCIETY OF ACTUARIES" and a navigation menu with items: PROFESSIONAL INTERESTS, NEWS & PUBLICATIONS, PROFESSIONAL DEVELOPMENT, CAREERS, EDUCATION, RESEARCH, ABOUT, LEADERSHIP. The main content area is titled "Research" and features a section for "Economic Scenario Generators".

Economic Scenario Generators

The American Academy of Actuaries and the Society of Actuaries (SOA) have joined resources to manage the economic scenario generators used in regulatory reserve and capital calculations.

The SOA will provide frontline support and maintenance for the economic scenario generators. A joint Society of Actuaries/American Academy of Actuaries oversight group will oversee the generators and assist the SOA in providing technical support and direction for the current and future versions of the generators.

The links found on this page contain the current version of the C3 Phase III generator and supporting documentation. There is also a link to the American Academy of Actuaries' [webpage](#) that contains other versions of the generators and documentation, along with pre-packaged scenario sets.

Related Links

- [September 2013 Updates Interest Rate Generator Version 7.1.201309](#)
- [Frequently Asked Questions – Sep 2013](#)
- [April 2012 Updates Interest Rate Generator Version 7.0.4](#)
- [Frequently Asked Questions – Apr 2012](#)

How many scenarios are enough?

- A subset of the full set of 10,000 scenarios is allowed if results are consistent, and using the full set wouldn't result in a materially greater reserve
- Methods for selecting smaller subsets:
 - The prescribed ESG includes a scenario picking tool that uses the 20 year Treasury for producing subsets of 1,000, 500, 200 or 50 scenarios
 - Random or first n scenarios
 - A representative scenario approach
 - Other scenario reduction techniques

Financial reporting timelines will be more challenging to meet

- VM-20 requires asset projections for the SET, DR & SR, but the current month's assets are not available to the Valuation team in time to perform ALM runs within the reporting close period.
- VM-20 2.E says the calculation of the SR & DR can be done “*no earlier than three months before the valuation date....provided an appropriate method is used to adjust those reserves to the valuation date...*”
- For many companies, this will require greater discipline and structure than their existing AAT process, as well as a mechanism for rolling the DR & SR forward