LATF Spring National Meeting
Supplemental Packet

LIFE ACTUARIAL (A) TASK FORCE

March 20-21, 2023

NAIC SPRING NATIONAL MEETING

March 20-21, 2023

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Agenda Item 3

Hear Presentations on the Impact of
a Rising Interest Rate Environment
(Additional Material)

SOA Research INSTITUTE

CHANGING INTEREST RATES: RESEARCH UPDATE

March 2023

R. DALE HALL, FSA, MAAA, CERA, CFA
Managing Director of Research

Presentation Disclaimer

The material and information contained in this presentation is for general information only. It does not replace independent professional judgment and should not be used as the basis for making any business, legal or other decisions. The Society of Actuaries assumes no responsibility for the content, accuracy or completeness of the information presented.

SOA Research INSTITUTE

Fixed Rate Deferred Annuity Surrenders

- Last large SOA/LIMRA study released in 2006 with large focus on fixed deferred annuities; approximately 70% were book value products with no market value adjustment or equity index component
- Looking to initiate update to study this year

- Key factors impacting surrender activity
  - Time remaining in surrender charge period
  - Age of policyholder
  - Distribution method
  - Difference between Credited Rate and New Market Rate
- Factors reaffirmed by other industry studies in recent years

- Surrender functions commonly modeled using level and time remaining of surrender charges, current credited rates and proxy for potential new money rate from competing products

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https://www.soa.org/resources/experience-studies/2005-2009/deferred-annuity-persist
https://ruark.co/wp-content/uploads/2021/08/COVID-and-annuity-PH-behavior-2021-update.pdf

Product Lines and Considerations

- AAA Asset Adequacy Analysis Practice Note
  - https://www.actuary.org/sites/default/files/files/Asset_Adequacy_Practice_Note_Exposure_August2014.pdf
  - Increased focus for sensitivity testing include dynamic lapse parameters
  - Base Lapses and Dynamic Lapses both among the most commonly sensitivity-tested assumptions

- Interactions Between Dynamic Lapses and Interest Rates in Stochastic Modeling
  - SOA Product Matters
  - https://www.soa.org/globalassets/assets/library/newsletters/product-development-news/2010/june/pro-2010-iss77-xue.pdf

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Product Lines and Considerations

- The Impact of a Rising Interest Rate Environment on Life Insurance
  - https://www.soa.org/sections/reinsurance/reinsurance-newsletter/2021/october/rsn-2021-10-tall/

- The Impact of a Rising Interest Rate Environment on GAAP and Statutory Financial Reporting
  - https://www.soa.org/sections/financial-reporting/financial-reporting-newsletter/2021/july/fr-2021-07-su/

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Product Lines and Considerations

- Market Trends and Product Designs in a Rising Interest Rate Environment
  - https://www.soa.org/sections/product-dev/product-dev-newsletter/2021/november/pm-2021-11-sun-moench-strother-ruscito-lee-mu/

- Mechanics of Dividends
  - https://www.soa.org/resources/research-reports/2022/mechanics-dividends/

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Agenda Item 7

Hear a Presentation on the VM-21, Requirements for Principle-Based Reserves for Variable Annuities/C-3 Phase II Economic Scenario Generator Field Test Results

NAIC Economic Scenario Generator Field Test: VM-21 and C3 Phase II Quantitative Results

Scott O'Neal, FSA, MAAA
soneal@naic.org

March 20, 2023

NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

NAIC NATIONAL MEETING **SPRING 2023**

Agenda

1. Background and Purpose
2. Limitations
3. Field Test Run Descriptions
4. Field Test Participation
5. High-Level Results, Observations, and Drivers of Results
6. Next Steps
7. Detailed Field Test Results

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Background and Purpose

- The purpose of this presentation is to summarize quantitative information from the VM-21/C3 Phase II field test participants to:
  - Understand the impact on reserves and capital,
  - Evaluate the impact of hedging programs across field test scenario sets,
  - Review the range of results across field test participants,
  - Compare the stability of results over time, and
  - Inform regulator decision-making on model and calibration choices.

Limitations

- The NAIC took steps to review the quantitative results for reasonableness, including comparing field test data to annual statement values, reviewing qualitative survey responses, sending questions to participants, and asking participants to confirm that the NAIC compilations matched their intended result submission. However, the accuracy and reliability of the results are ultimately dependent on the quality of participant submissions.
- The field test reserve and/or capital participant analytics (average reserve/ capital impact, range of impacts, etc.) can be strongly dependent on a subset of the participants. Results shown today for the different field test runs will include varying numbers of participants corresponding to the levels of participation for that run. The lack of participation in some of the runs will limit their applicability to the overall variable annuity industry.
- Four legal entities were excluded from the analysis due to results that did not seem reasonable to the NAIC.
- A number of comparisons between company-provided field test or baseline runs are made in the presentation. These comparisons are limited to the participation of whichever run had the least participation. For example, as Baseline 2 (as of 12/31/19 + 200 BP) had significantly lower participation than run 2A, many of the 2A results will not be shown for this comparison.
- For the most part, companies did not make changes to their models to account for changes in the field test scenario sets. Therefore, field test results may not be fully representative of company results post implementation of the new scenarios.

Field Test Run Descriptions

Note: Bold = Required Run

Run #	Description	Purpose of Run
Baseline #1	Scenario set(s) the company used for 12/31/21 statutory reporting	Baseline used as comparative basis for 12/31/21 runs
Baseline #2	ESG the company used for 12/31/21 statutory reporting of reserves and RBC, but modified to produce scenario sets with a 12/31/19 yield curve modified using a 200 BP increase across all maturities	Baseline used as comparative basis for 12/31/19 + 200 BP runs
Test #1a	GEMS Baseline Equity and Corporate model scenarios as of 12/31/21, and Conning Treasury model calibration with generalized fractional floor as of 12/31/21	Tests Conning Treasury model w/ GFF and Baseline Equity at YE 2021
Test #1b	Same as Test #1a, but with Alternative Treasury model calibration with shadow floor as of 12/31/21	Tests Alternative Treasury model with shadow floor and Baseline Equity at YE 2021
Test #2a	Same as Test #1a, but with Equity, Corporate, and Treasury models with a 12/31/19 starting yield curve modified using a 200 BP increase across all maturities. All other initial market conditions are unchanged. The Equity model parameters would be adjusted from #1a so that the year 30 median Large Cap Equity gross wealth factors remain consistent with #1a.	Stresses the starting Treasury rates using the same calibration as 1a to evaluate whether the model produces appropriate results in different economic environments
Test #2b	Same as Test #2a, but with the Alternative Treasury model calibration with shadow floor instead of the Conning Treasury model calibration with generalized fractional floor	Same as 2a, but designed to stress the 1b calibration

Field Test Run Descriptions

Note: Bold = Required Run

Run #	Description	Purpose of Run
Test #3	Conning Treasury model calibration with generalized fractional floor as of 12/31/21, GEMS Corporate model as of 12/31/21, and GEMS Baseline Equity model corresponding to a 12/31/19 yield curve with a 200 BP increase across all maturities	Attribution analysis that will illustrate how much of the difference between runs #1a and #2a is driven by the equity model vs the Treasury and Corporate models
Test #4	Same as Test #3, but using Alternative Treasury model calibration with shadow floor as of 12/31/21	Same as #3, but with respect to runs #1b and #2b.
Test #5a	Same as #1a, but with Conning's original Equity model calibration that had significantly lower Gross Wealth Factor's (GWFs) than the AIRG Equity Model.	Tests Conning Treasury model w/ GFF and original equity model as of year-end 2021.
Test #5b	Same as #5a but using a 12/31/19 starting yield curve modified using a 200 BP increase across all maturities. The parameters of Conning's original Equity model are used without any adjustment.	Stresses the starting Treasury rates to understand the full impact of equity-Treasury linkage in Conning's original equity model
Test #6	Same as #1a, but with the ACLI's GEMS® Equity Calibration	Tests the ACLI's GEMS® Equity Calibration that assumes a constant mean equity return independent of rates and increases alignment with AIRG equity model GWFs

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Field Test Participation: VM-21 and C3 Phase II

- 26 participant legal entity results are summarized in this presentation. The individual level of participation for each field test run is shown below.
- Hedging practices varied throughout the field test participants, but a majority used 1,000 scenario subset sizes and the AIRG in their reporting.
- Several participants commented that the value of results for field test runs 3 and 4 may be limited, and therefore those results have not been prioritized to be included in this presentation.

Hedge Modeling	Implicit	Explicit	No Model	Runoff
	7	8	9	2

Was Proprietary Economic Scenario Generator Used?	Yes	No
	4	22

Number of Scenarios	1000	<1000	>=1000
	22	2	2

Valuation Dates: 12/31/21 | 12/31/19 + 200 BP | Hybrid

Field Test Run	Baseline 1*	Baseline 2	1A*	1B*	2A*	2B*	3	4	5A*	5B*	6
Number of Participants	26	11	26	26	26	26	13	13	25	25	12

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*Required Run

Participant Separate Account Fund Distribution

Equity and Bond Funds (AIRG Names)	Type	Average Variable Annuity Separate Account Allocation
Diversified Large Capitalized U.S. Equity	Equity	41.3%
Diversified International Equity	Equity	10.9%
Intermediate Risk Equity	Equity	11.3%
Aggressive Equity	Equity	6.7%
Money Market	Bond	4.0%
U.S. Intermediate Term Government Bonds	Bond	4.3%
U.S. Long Term Corporate Bonds	Bond	12.6%
Diversified Fixed Income	Bond	5.3%
Diversified Balanced Allocation (60/40)	Equity and Bond	3.6%
Total		100%

Average Equity Fund Separate Account Allocation: **72.4%**

Average Bond Fund Separate Account Allocation: **27.6%**

- Participants were asked to provide the approximate separate account fund mapping that was used for the 12/31/21 field test runs. Data from 26 participating legal entities was included in this analysis.
- The average separate account allocation is shown in the table. Note that the average is simply an average allocation by fund across the participating legal entities, and is not weighted by the legal entity separate account balance
- All of the participating legal entities had a majority of their separate account funds mapped to equity funds, with the smallest allocation to equities being approximately 60%. The maximum equity fund allocation was 93%.

Participant Guaranteed Benefit Type Distribution

Type of Guaranteed Minimum Death or Living Benefit	Average Variable Annuity GMXB Allocation by:	
	% of Separate Account	% of Net Amount at Risk
Guaranteed Minimum Death Benefit (GMDB) Only	40.2%	46.9%
GMDB/Guaranteed Minimum Income Benefit (GMIB) Combo	9.3%	7.4%
GMDB/Guaranteed Minimum Withdrawal Benefit (GMWB) Combo	41.9%	41.4%
GMDB/Guaranteed Minimum Accumulation Benefit (GMAB) Combo	0.4%	0.1%
Other Benefit Combination	8.3%	4.3%
Total	100%	100%

- The distributions of guaranteed benefit types provided in the table above are shown as a percentage of separate account and as a percentage of net-amount-at-risk (NAAR). Note that the average above is a simple average across the participants and does not reflect any weighting by participant separate account or NAAR.
- The most prevalent guarantee types, by both the separate account and NAAR measures, are GMDB only and GMDB/GMWB combo.
- While the distribution of guaranteed benefits offered by companies could vary significantly within individual participants between the separate account and NAAR measures, overall, the measures showed a similar prevalence of guarantee types across participants.

High-Level Results: Comparisons to Baseline

Average Percent Increase over Baseline	Statistic	1A	1B	2A	2B	5A	5B	6
VM-21 Reserve for Guaranteed Benefits	Max	1,578%	1,279%	2,730%	2,802%	2,862%	5,645%	492%
	Average	29.4%	13.4%	13.5%	5.6%	78.7%	28.3%	10.1%
	Min	-20.7%	-47.8%	-94.9%	-79.5%	4.3%	0%	-14.0%
Risk-Based Capital	Max	6,782%	755%	2,709%	3,136%	17,100%	4,599%	12,161%
	Average	69.1%	43.4%	9.7%	11.6%	114%	26.5%	56%
	Min	-56.4%	-100%	-88.2%	-88.2%	-21.0%	-12.7%	-8.2%
Number of Participants		26	26	11	11	25	11	12

High-Level Observations

- For every field test run, there was a huge range in the reserve and capital impacts across the participating companies. Additional review of individual company results in a regulator-only session may provide a more complete understanding of the underlying factors behind the range of results.
- The field test runs generally produced increases in reserves and capital. However, a minority of participants had substantial reserve and/or capital decreases for some of the runs.
- A number of companies commented that guaranteed benefits were out-of-the-money due to the economic environment (favorable stock market), and that field test impacts would have been larger if a less favorable environment had been tested.

Drivers of Field Test Results

- **Hedging** – Companies that modeled hedging (either implicitly or explicitly) had much smaller impacts to reserves and capital on average vs. those that did not.
- **Relative importance of equity returns vs. interest rates** – This varied among companies. Many commented that equity returns were the main driver of results, while others noted that equity and interest rate impacts were nearly equal, or that interest rates were the primary driver.
- **Distribution of guaranteed benefit types** – There was a range in the distribution of guaranteed benefit types among participants. Some had primarily GMDB or lower guarantees, leading to smaller impacts vs. those with richer benefits.
- **Proprietary economic scenario generators** - Some companies used a proprietary economic scenario generator to produce their baseline results, so reserve and/or capital increases are generally smaller (since these generators are typically more conservative than the AIRG).
- **Hedge costs** - Some companies noted that the field test runs increased hedge costs.
- **Company-specific modeling assumptions** – For some companies, this had a significant impact

High-level Results: Stability of Results Across Valuation Dates

- On average, reserves and capital decreased when comparing the results produced using the 12/31/19 + 200 BP scenarios to their corresponding 12/31/21 results (i.e. Baseline 1 vs Baseline 2, 1A vs 2A, 1B vs 2B, and 5A vs. 5B)
- For reserves, the smallest change in magnitude (and tightest range of results) came from comparing Baseline 1 to Baseline 2. However, the average reduction in reserves was comparable to the other field test results. The comparison of 5B to 5A (which included the full impact of the GEMS® equity-Treasury linkage) showed the largest swing in reserves.
- For risk-based capital results, the average decrease in results from Baseline 1 to Baseline 2 (-0.9%) was much smaller in magnitude than the other field test runs. The change from 1A to 2A was the largest in magnitude, but was comparable to the change seen from 1B to 2B and from 5A to 5B.

Reserve/Capital Amount	% Increase from Baseline 1 to Baseline 2			% Increase from 1A to 2A			% Increase from 1B to 2B			% Increase from 5A to 5B		
	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max
VM-21 Reserve for Guaranteed Benefits	-84.2%	-51.7%	89.1%	-100%	-63.4%	1,486%	-100%	-61.4%	4,668%	-100%	-68.6%	255.3%
Risk-Based Capital	-100%	-0.9%	746.2%	-100%	-67.6%	20.7%	-100%	-66.4%	77.4%	-100%	-59.5%	63.2%
Number of Participants	11			26			26			25		

Next Steps

- The NAIC will look to present economic scenario generator field test results for VM-20 and C3 Phase I in the next 1 – 2 months after the Spring National Meeting. Additional time for follow-up discussions may be necessary
- Regulators will continue to work with interested parties in economic scenario generator drafting groups to continue progress on reserve/capital framework specific implementation tasks
- The Life Actuarial (A) Task Force will engage with the American Academy of Actuaries and other interested parties to decide on stylized facts and acceptance criteria ahead of a recalibration of the economic scenario generator and a second field test.

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Detailed Field Test Results: VM-21/C3 Phase II

Field Test 1A: US Treasury Overview

- Field Test 1A (as of 12/31/21) included a recalibration of the Conning GEMS® US Treasury model that was designed to meet the regulator's acceptance criteria related to low for long, the prevalence of high interest rates, upper and lower bounds, initial yield curve fit, and yield curve shape. The frequency and severity of negative interest rates were controlled using a generalized fractional floor.
- The 1A UST scenario set as of 12/31/21 had a much higher prevalence of low UST rates, including negative interest rates, compared to the scenarios produced by the AIRG as of 12/31/21, which is floored at 1 BP.
- The 1A UST scenario set also included greater and more frequent high UST rates, with maximum UST rates greatly exceeding that of the AIRG. While a floor was employed in all of the field test UST scenario sets, no cap was employed on how high rates could get.

1A: 10,000 1-yr UST Scenario Percentiles by Projection Month as of 12/31/21

Percentile	12	60	120	240	360
Min	-0.49%	-0.97%	-0.94%	-0.91%	-0.93%
1%	-0.17%	-0.51%	-0.58%	-0.56%	-0.56%
10%	0.10%	-0.14%	-0.19%	-0.13%	-0.11%
25%	0.25%	0.14%	0.14%	0.19%	0.25%
50%	0.62%	0.84%	1.18%	1.61%	2.09%
75%	1.63%	2.83%	3.59%	4.39%	4.93%
95%	3.15%	6.14%	7.78%	9.35%	10.38%
99%	4.32%	8.86%	11.38%	13.53%	14.47%
Max	7.93%	14.36%	19.89%	25.18%	26.72%

AIRG: 10,000 1-yr UST Scenario Percentiles by Projection Month as of 12/31/21

Percentile	12	60	120	240	360
Min	0.01%	0.01%	0.01%	0.01%	0.01%
1%	0.01%	0.21%	0.33%	0.32%	0.32%
10%	0.27%	0.66%	0.87%	0.98%	0.99%
25%	0.47%	0.96%	1.22%	1.41%	1.45%
50%	0.69%	1.35%	1.68%	1.99%	2.10%
75%	0.92%	1.78%	2.27%	2.74%	2.90%
95%	1.29%	2.57%	3.40%	4.29%	4.66%
99%	1.59%	3.37%	4.75%	6.17%	6.31%
Max	2.31%	5.82%	10.94%	13.22%	12.76%

1A-AIRG: 10,000 1-yr UST Scenario Percentiles by Projection Month

Difference	12	60	120	240	360
Min	-0.5%	-1.0%	-0.9%	-0.9%	-0.9%
1%	-0.2%	-0.7%	-0.9%	-0.9%	-0.9%
10%	-0.2%	-0.8%	-1.1%	-1.1%	-1.1%
25%	-0.2%	-0.8%	-1.1%	-1.2%	-1.2%
50%	-0.1%	-0.5%	-0.5%	-0.4%	0.0%
75%	0.7%	1.0%	1.3%	1.7%	2.0%
95%	1.9%	3.6%	4.4%	5.1%	5.7%
99%	2.7%	5.5%	6.7%	7.4%	8.2%
Max	5.6%	8.5%	8.9%	12.0%	14.0%

Field Test 1A: Equity Overview

- The 1A equity scenario set used a calibration that targeted the median gross wealth factor (GWF) produced by the AIRG at the end of 30 years. This recentering of the equity return distribution with changes to the starting interest environment partially mitigates the impact of the GEMS® equity-Treasury linkage functionality.
- While the GWF's between the AIRG and field test 1A are consistent at the 50th percentile at the end of the 30th projection year, the 1A scenario set generally has somewhat lower GWFs in the lower percentiles and earlier projection years compared to the AIRG.
- In the later durations and higher percentiles, the 1A GWFs are greater than those produced by the AIRG.

1A: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.50	0.28	0.24	0.39	0.39
1.0%	0.71	0.59	0.59	0.83	1.17
2.5%	0.77	0.68	0.75	1.06	1.60
5.0%	0.82	0.78	0.87	1.34	2.11
10.0%	0.87	0.89	1.05	1.69	2.86
25.0%	0.97	1.09	1.40	2.54	4.88
50.0%	1.07	1.35	1.88	4.01	8.99
75.0%	1.16	1.64	2.57	6.49	16.98
90.0%	1.25	1.96	3.41	10.26	31.70
95.0%	1.31	2.20	4.04	13.67	47.46
97.5%	1.35	2.45	4.70	17.57	66.83
99.0%	1.41	2.77	5.65	23.45	101.58
Max	1.81	4.53	13.89	55.97	457.07

AIRG: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.41	0.32	0.26	0.35	0.38
1.0%	0.70	0.62	0.66	0.83	1.22
2.5%	0.76	0.72	0.77	1.10	1.69
5.0%	0.82	0.81	0.92	1.41	2.25
10.0%	0.89	0.93	1.12	1.83	3.09
25.0%	0.98	1.16	1.51	2.74	5.11
50.0%	1.09	1.45	2.09	4.27	8.84
75.0%	1.19	1.81	2.88	6.80	15.35
90.0%	1.30	2.22	3.81	10.15	24.98
95.0%	1.37	2.48	4.44	12.92	34.25
97.5%	1.44	2.72	5.17	15.65	45.88
99.0%	1.52	3.06	6.18	20.49	60.45
Max	1.92	4.77	11.86	66.94	235.95

1A/AIRG: GWF Ratios by Projection Month

SP500	12	60	120	240	360
Min	123%	90%	94%	113%	101%
1.0%	101%	96%	90%	100%	95%
2.5%	102%	95%	97%	96%	95%
5.0%	100%	96%	95%	95%	94%
10.0%	99%	96%	93%	92%	92%
25.0%	98%	94%	92%	93%	96%
50.0%	98%	93%	90%	94%	102%
75.0%	98%	90%	90%	95%	111%
90.0%	97%	88%	90%	101%	127%
95.0%	95%	89%	91%	106%	139%
97.5%	94%	90%	91%	112%	146%
99.0%	93%	90%	92%	114%	168%
Max	94%	95%	117%	84%	194%

Field Test 1A Quantitative Results

- For field test 1A, the average field test participant VM-21 reserve for guaranteed benefits increased by 29.4% and the average Risk-Based Capital increased by 69.1%.
- However, the results were highly skewed among participants, with many seeing higher impacts to reserves and capital than the average indicates.
- Several participants noted that the lower equity returns and lower (and negative) interest rates that were more prevalent in 1A compared to the AIRG led to increases in reserves and capital. The lower equity returns result in more guaranteed benefits being in-the-money and less account value-based fee income. Lower interest rates lead to less discounting of future guaranteed benefit claims.
- Participants that modeled hedging (implicitly or explicitly) saw smaller impacts to reserves (25.4%) and capital (67.8%) than those that did not model hedging (163.3% and 91.6% for reserves and capital respectively).

Reserve/Capital Amount	Percentage Increase over Baseline					
	Average	Min	Percentiles			Max
			25th	50th	75th	
VM-21 Reserve for Guaranteed Benefits	29.4%	-20.7%	19.0%	69.5%	170.5%	1,578%
Risk-Based Capital	69.1%	-56.4%	11.6%	29.6%	256.9%	6,782%

26/30 Participants

Field Test 1B: US Treasury Overview

- Field Test 1B (as of 12/31/21) included a calibration of the Conning GEMS® US Treasury model that was designed to meet regulator acceptance criteria but placed additional emphasis on maintaining realistic term premiums throughout the projection. Towards that end, there was a significantly lower frequency of inversions (e.g.~5% of 1B scenarios had 10 year/2year UST inversions at the end of year 30 compared to ~12% seen in 1A). The average level of inversion was also significantly lower (e.g. in 1B 10 year/2 year UST inversions average ~30 BP at the end of year 30, compared to ~90 BP average inversion level for 1A).
- 1B also included lower and less frequent high interest rates than 1A, but still contained greater and more frequent high interest rates than the AIRG.
- The frequency and severity of negative interest rates were controlled using a shadow floor that preserves the arbitrage free nature of the scenarios. The 1B UST scenario set has a comparable amount of low/negative UST rates to 1A, but significantly more severe and frequent low (and negative) UST rates compared to the AIRG.

1B: 10,000 1-yr UST Scenario Percentiles by Projection Month

Percentile	12	60	120	240	360
Min	-0.59%	-1.08%	-1.24%	-1.18%	-1.19%
1%	-0.10%	-0.51%	-0.61%	-0.59%	-0.58%
10%	0.22%	-0.04%	-0.10%	-0.02%	0.06%
25%	0.42%	0.26%	0.27%	0.37%	0.49%
50%	0.65%	0.65%	0.71%	0.88%	1.28%
75%	0.88%	1.24%	1.67%	2.60%	3.52%
95%	1.76%	3.38%	4.38%	5.99%	7.49%
99%	2.57%	4.89%	6.44%	8.90%	10.64%
Max	4.25%	10.28%	11.63%	17.99%	22.87%

AIRG: 10,000 1-yr UST Scenario Percentiles by Projection Month

Percentile	12	60	120	240	360
Min	0.01%	0.01%	0.01%	0.01%	0.01%
1%	0.01%	0.21%	0.33%	0.32%	0.32%
10%	0.27%	0.66%	0.87%	0.98%	0.99%
25%	0.47%	0.96%	1.22%	1.41%	1.45%
50%	0.69%	1.35%	1.68%	1.99%	2.10%
75%	0.92%	1.78%	2.27%	2.74%	2.90%
95%	1.29%	2.57%	3.40%	4.29%	4.66%
99%	1.59%	3.37%	4.75%	6.17%	6.31%
Max	2.31%	5.82%	10.94%	13.22%	12.76%

1B-AIRG: 10,000 1-yr UST Scenario Percentiles by Projection Month

Difference	12	60	120	240	360
Min	-0.6%	-1.1%	-1.2%	-1.2%	-1.2%
1%	-0.1%	-0.7%	-0.9%	-0.9%	-0.9%
10%	0.0%	-0.7%	-1.0%	-1.0%	-0.9%
25%	-0.1%	-0.7%	-1.0%	-1.0%	-1.0%
50%	0.0%	-0.7%	-1.0%	-1.1%	-0.8%
75%	0.0%	-0.5%	-0.6%	-0.1%	0.6%
95%	0.5%	0.8%	1.0%	1.7%	2.8%
99%	1.0%	1.5%	1.7%	2.7%	4.3%
Max	1.9%	4.5%	0.7%	4.8%	10.1%

Field Test 1B: Equity Overview

- The 1B equity scenario set used the same calibration as 1A. However, due to the equity-Treasury linkage, the resulting GWFs are different. The largest differences between the 1A and 1B equity GWFs are seen at the upper percentiles at the end of the 30th projection year, with the 1B being substantially lower and more in line with the AIRG.
- The median GWF at the end of the 30th projection year for 1B (7.99) is materially lower than both 1A (8.99) and the AIRG (8.84).
- Finally, the 1st percentile GWF at the end of the 30th projection year for 1b (1.19) was consistent with those of 1A (1.17) and the AIRG (1.22).

1B: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.51	0.30	0.26	0.34	0.27
1.0%	0.71	0.61	0.61	0.82	1.19
2.5%	0.78	0.70	0.76	1.05	1.59
5.0%	0.83	0.80	0.90	1.33	2.07
10.0%	0.88	0.92	1.08	1.68	2.72
25.0%	0.98	1.12	1.42	2.47	4.57
50.0%	1.08	1.38	1.90	3.78	7.99
75.0%	1.17	1.68	2.56	5.85	13.71
90.0%	1.26	2.00	3.32	8.61	23.14
95.0%	1.32	2.24	3.94	10.91	32.00
97.5%	1.36	2.50	4.53	13.70	43.02
99.0%	1.42	2.80	5.44	17.25	61.86
Max	1.83	4.67	14.21	76.72	258.35

AIRG: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.41	0.32	0.26	0.35	0.38
1.0%	0.70	0.62	0.66	0.83	1.22
2.5%	0.76	0.72	0.77	1.10	1.69
5.0%	0.82	0.81	0.92	1.41	2.25
10.0%	0.89	0.93	1.12	1.83	3.09
25.0%	0.98	1.16	1.51	2.74	5.11
50.0%	1.09	1.45	2.09	4.27	8.84
75.0%	1.19	1.81	2.88	6.80	15.35
90.0%	1.30	2.22	3.81	10.15	24.98
95.0%	1.37	2.48	4.44	12.92	34.25
97.5%	1.44	2.72	5.17	15.65	45.88
99.0%	1.52	3.06	6.18	20.49	60.45
Max	1.92	4.77	11.86	66.94	235.95

1B/AIRG: GWF Ratios by Projection Month

SP500	12	60	120	240	360
Min	124%	94%	102%	98%	71%
1.0%	102%	98%	93%	99%	98%
2.5%	103%	98%	99%	95%	94%
5.0%	101%	99%	97%	94%	92%
10.0%	100%	99%	96%	92%	88%
25.0%	99%	97%	94%	90%	89%
50.0%	99%	95%	91%	88%	90%
75.0%	99%	93%	89%	86%	89%
90.0%	97%	90%	87%	85%	93%
95.0%	96%	90%	89%	84%	93%
97.5%	95%	92%	88%	88%	94%
99.0%	94%	91%	88%	84%	102%
Max	95%	98%	120%	115%	109%

Field Test 1B Quantitative Results

- For field test 1B, the average field test participant VM-21 reserve for guaranteed benefits increased by 13.4%, and the average Risk-Based Capital increased by 43.3%, compared to 29.4% and 68.0% for 1A reserves and capital, respectively.
- Some participants noted exposure to high UST rates, which were less frequent and severe in 1B compared to 1A.
- Participants that modeled hedging (implicitly or explicitly) saw smaller impacts to reserves (10.1%) and capital (41.9%) than those that did not model hedging (127.4% and 68.9% for reserves and capital respectively).

Reserve/Capital Amount	Percentage Increase over Baseline					
	Average	Min	Percentiles			Max
			25th	50th	75th	
VM-21 Reserve for Guaranteed Benefits	13.4%	-47.8%	3.9%	23.7%	53.2%	1,279%
Risk-Based Capital	43.4%	-100.0%	-12.8%	5.1%	40.7%	755%

26/30 Participants

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Field Test 2A: US Treasury Overview

- Field Test 2A (as of 12/31/19 + 200 BP) used the same calibration as 1A (Conning Calibration with a Generalized Fractional Floor) but with a 12/31/19 starting yield curve modified using a 200 BP increase across all maturities.
- The higher starting interest environment leads to greater and more frequent high interest rates and less severe and less frequent low interest rates in 2A compared to 1A.
- Compared to the AIRG with a 12/31/19 + 200 BP starting interest environment, the 2A scenario set has a greater frequency and severity of high UST rates and more prevalent and severe low (and negative) UST rates.

2A (12/31/19 + 200 BP): 10,000 1-yr UST Scenario Percentiles by Projection Month

Percentile	12	60	120	240	360
Min	-0.13%	-0.78%	-0.82%	-0.89%	-0.92%
1%	0.29%	-0.27%	-0.42%	-0.49%	-0.53%
10%	1.34%	0.19%	0.02%	-0.04%	-0.06%
25%	2.26%	0.87%	0.39%	0.31%	0.32%
50%	3.34%	2.89%	2.69%	2.43%	2.54%
75%	4.49%	5.15%	5.38%	5.47%	5.53%
95%	6.19%	8.80%	10.06%	10.86%	11.30%
99%	7.44%	11.88%	13.61%	15.32%	15.70%
Max	11.48%	17.62%	22.91%	27.07%	28.97%

AIRG (12/31/19 + 200 BP): 10,000 1-yr UST Scenario Percentiles by Projection Month

Percentile	12	60	120	240	360
Min	0.31%	0.01%	0.01%	0.01%	0.01%
1%	1.25%	0.47%	0.34%	0.29%	0.31%
10%	1.82%	1.22%	1.06%	1.04%	1.00%
25%	2.16%	1.72%	1.58%	1.53%	1.50%
50%	2.53%	2.35%	2.24%	2.21%	2.18%
75%	2.92%	3.06%	3.08%	3.10%	3.05%
95%	3.55%	4.39%	4.77%	4.96%	4.94%
99%	4.06%	5.66%	6.73%	7.29%	6.73%
Max	5.24%	9.85%	16.66%	15.13%	13.59%

2A-AIRG: 10,000 1-yr UST Scenario Percentiles by Projection Month

Difference	12	60	120	240	360
Min	-0.4%	-0.8%	-0.8%	-0.9%	-0.9%
1%	-1.0%	-0.7%	-0.8%	-0.8%	-0.8%
10%	-0.5%	-1.0%	-1.0%	-1.1%	-1.1%
25%	0.1%	-0.8%	-1.2%	-1.2%	-1.2%
50%	0.8%	0.5%	0.4%	0.2%	0.4%
75%	1.6%	2.1%	2.3%	2.4%	2.5%
95%	2.6%	4.4%	5.3%	5.9%	6.4%
99%	3.4%	6.2%	6.9%	8.0%	9.0%
Max	6.2%	7.8%	6.3%	11.9%	15.4%

Field Test 2A: Equity Overview

- The targets of the 2A equity scenarios is designed to align the GWF at the end of the 30th projection year (8.97) with those produced by the AIRG (8.84) no matter the starting interest rate environment. However, there is still an impact to the 2A equity scenarios due to the increased starting interest rate environment and the equity-Treasury linkage compared to the 1A equity scenarios.
- The largest differences between the 2A and 1A equity GWFs are seen at the upper percentiles at the end of the 30th projection year, for example the 99th percentile GWF for 1b is 127.28 at the end of the 30th year compared to 101.58 for the 1A scenario set.
- The same considerations apply when comparing 2A to the AIRG with a 12/31/19 + 200 BP starting interest rate environment, with the largest differences between the GWFs of 2A and the AIRG occurring in the higher percentiles and later projection years.

2A: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.51	0.30	0.26	0.40	0.36
1.0%	0.73	0.65	0.64	0.83	1.07
2.5%	0.79	0.75	0.80	1.08	1.46
5.0%	0.84	0.85	0.95	1.34	1.93
10.0%	0.90	0.97	1.15	1.73	2.63
25.0%	1.00	1.20	1.54	2.64	4.71
50.0%	1.10	1.48	2.11	4.38	8.97
75.0%	1.20	1.82	2.96	7.42	18.20
90.0%	1.29	2.19	4.01	12.10	35.66
95.0%	1.35	2.46	4.74	16.60	54.53
97.5%	1.39	2.73	5.63	22.33	83.32
99.0%	1.45	3.10	7.00	30.39	127.28
Max	1.87	5.11	15.80	86.26	817.22

AIRG: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.41	0.32	0.26	0.35	0.38
1.0%	0.70	0.62	0.66	0.83	1.22
2.5%	0.76	0.72	0.77	1.10	1.69
5.0%	0.82	0.81	0.92	1.41	2.25
10.0%	0.89	0.93	1.12	1.83	3.09
25.0%	0.98	1.16	1.51	2.74	5.11
50.0%	1.09	1.45	2.09	4.27	8.84
75.0%	1.19	1.81	2.88	6.80	15.35
90.0%	1.30	2.22	3.81	10.15	24.98
95.0%	1.37	2.48	4.44	12.92	34.25
97.5%	1.44	2.72	5.17	15.65	45.88
99.0%	1.52	3.06	6.18	20.49	60.45
Max	1.92	4.77	11.86	66.94	235.95

2A/AIRG: GWF Ratios by Projection Month

SP500	12	60	120	240	360
Min	124%	95%	99%	116%	94%
1.0%	104%	104%	97%	100%	88%
2.5%	105%	103%	103%	98%	87%
5.0%	103%	105%	103%	95%	86%
10.0%	101%	104%	102%	94%	85%
25.0%	101%	103%	102%	96%	92%
50.0%	101%	102%	101%	103%	101%
75.0%	101%	100%	103%	109%	119%
90.0%	100%	99%	105%	119%	143%
95.0%	98%	99%	107%	129%	159%
97.5%	97%	100%	109%	143%	182%
99.0%	96%	101%	113%	148%	211%
Max	98%	107%	133%	129%	346%

Field Test 2A Quantitative Results

- The average field test participant VM-21 reserve for guaranteed benefits increased by 13.5%, and the average Risk-Based Capital increased by 9.7%.
- Comparisons to the baseline results were limited by participation in the optional Baseline 2 run.
- Less severe and less frequent low (and negative) UST rates combined with higher equity GWFs (relative to 1A) throughout the projection contributed to smaller reserve and capital increases.
- Participants that modeled hedging (implicitly or explicitly) saw smaller impacts to reserves (10.1%) and capital (41.9%) than those that did not model hedging (127.4% and 68.9% for reserves and capital respectively).

Reserve/Capital Amount	Percentage Increase over Baseline					
	Average	Min	Percentiles			Max
			25th	50th	75th	
VM-21 Reserve for Guaranteed Benefits	13.5%	-94.9%	-29.8%	0%	21.5%	2,730%
Risk-Based Capital	9.7%	-88.2%	-15.1%	-0.5%	24.3%	2,709%

11/30 Participants

Field Test 2B: US Treasury Overview

- Field Test 2B (as of 12/31/19 + 200 BP) used the same calibration as 1B (Alternative Calibration with Shadow Floor) but with a 12/31/19 starting yield curve modified using a 200 BP increase across all maturities. Again, generally inversions were significantly less frequent and less severe in the 2B scenario set compared to 2A.
- The higher starting interest environment leads to greater and more frequent high interest rates and less severe and frequent low interest rates in 2B compared to 1B.
- Compared to the AIRG with a 12/31/19 + 200 BP starting interest environment, the 2B scenario set has a greater frequency and severity of high UST rates and more prevalent and severe low (and negative) UST rates.
- Compared to the 2A scenario set, the 2B scenario set has less frequent negative UST rates and less frequent 1-year UST rates over 10%.

2B: 10,000 1-yr UST Scenario Percentiles by Projection Month

Percentile	12	60	120	240	360
Min	0.28%	-0.64%	-0.99%	-1.05%	-1.14%
1%	0.77%	0.11%	-0.17%	-0.33%	-0.44%
10%	1.49%	0.70%	0.48%	0.36%	0.31%
25%	2.27%	1.30%	0.97%	0.86%	0.83%
50%	3.12%	2.83%	2.78%	2.64%	2.69%
75%	3.99%	4.54%	4.79%	5.04%	5.35%
95%	5.31%	7.10%	8.25%	9.24%	10.18%
99%	6.23%	9.11%	10.77%	12.84%	13.81%
Max	8.40%	15.44%	17.83%	23.70%	28.40%

AIRG (12/31/19 + 200 BP): 10,000 1-yr UST Scenario Percentiles by Projection Month

Percentile	12	60	120	240	360
Min	0.31%	0.01%	0.01%	0.01%	0.01%
1%	1.25%	0.47%	0.34%	0.29%	0.31%
10%	1.82%	1.22%	1.06%	1.04%	1.00%
25%	2.16%	1.72%	1.58%	1.53%	1.50%
50%	2.53%	2.35%	2.24%	2.21%	2.18%
75%	2.92%	3.06%	3.08%	3.10%	3.05%
95%	3.55%	4.39%	4.77%	4.96%	4.94%
99%	4.06%	5.66%	6.73%	7.29%	6.73%
Max	5.24%	9.85%	16.66%	15.13%	13.59%

2B-AIRG: 10,000 1-yr UST Scenario Percentiles by Projection Month

Difference	12	60	120	240	360
Min	0.0%	-0.6%	-1.0%	-1.1%	-1.2%
1%	-0.5%	-0.4%	-0.5%	-0.6%	-0.7%
10%	-0.3%	-0.5%	-0.6%	-0.7%	-0.7%
25%	0.1%	-0.4%	-0.6%	-0.7%	-0.7%
50%	0.6%	0.5%	0.5%	0.4%	0.5%
75%	1.1%	1.5%	1.7%	1.9%	2.3%
95%	1.8%	2.7%	3.5%	4.3%	5.2%
99%	2.2%	3.4%	4.0%	5.5%	7.1%
Max	3.2%	5.6%	1.2%	8.6%	14.8%

Field Test 2B: Equity Overview

- The 2B equity scenario set used the same calibration as 2A. However, due to the equity-Treasury linkage, the resulting GWFs are different. The largest differences between the 2A and 2B equity GWFs are seen at the upper percentiles at the end of the 30th projection year, with the 2B being substantially lower and more in line with the AIRG (though still higher).
- The median GWF at the end of the 30th projection year for 2B (9.15) is consistent with both 2A (8.97) and the AIRG (8.84).
- Finally, the 1st percentile GWF at the end of the 30th projection year for 2B (1.13) was consistent with those of 1A (1.17) and the AIRG (1.22).

2B: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.51	0.32	0.30	0.40	0.35
1.0%	0.73	0.63	0.64	0.85	1.13
2.5%	0.79	0.74	0.81	1.09	1.58
5.0%	0.84	0.84	0.96	1.37	2.04
10.0%	0.90	0.96	1.14	1.79	2.80
25.0%	0.99	1.18	1.54	2.71	4.89
50.0%	1.10	1.46	2.08	4.34	9.15
75.0%	1.20	1.78	2.84	7.02	17.15
90.0%	1.29	2.13	3.75	10.90	31.48
95.0%	1.34	2.39	4.50	14.15	47.27
97.5%	1.39	2.66	5.20	18.23	66.95
99.0%	1.45	3.01	6.21	24.31	103.48
Max	1.87	4.81	16.83	142.35	599.47

AIRG: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.41	0.32	0.26	0.35	0.38
1.0%	0.70	0.62	0.66	0.83	1.22
2.5%	0.76	0.72	0.77	1.10	1.69
5.0%	0.82	0.81	0.92	1.41	2.25
10.0%	0.89	0.93	1.12	1.83	3.09
25.0%	0.98	1.16	1.51	2.74	5.11
50.0%	1.09	1.45	2.09	4.27	8.84
75.0%	1.19	1.81	2.88	6.80	15.35
90.0%	1.30	2.22	3.81	10.15	24.98
95.0%	1.37	2.48	4.44	12.92	34.25
97.5%	1.44	2.72	5.17	15.65	45.88
99.0%	1.52	3.06	6.18	20.49	60.45
Max	1.92	4.77	11.86	66.94	235.95

2B/AIRG: GWF Ratios by Projection Month

SP500	12	60	120	240	360
Min	124%	100%	116%	116%	92%
1.0%	104%	102%	98%	103%	92%
2.5%	104%	102%	105%	99%	94%
5.0%	103%	104%	103%	97%	91%
10.0%	101%	103%	102%	98%	90%
25.0%	101%	102%	102%	99%	96%
50.0%	101%	100%	100%	102%	103%
75.0%	101%	98%	99%	103%	112%
90.0%	99%	96%	99%	107%	126%
95.0%	98%	97%	101%	110%	138%
97.5%	97%	98%	101%	117%	146%
99.0%	95%	98%	101%	119%	171%
Max	97%	101%	142%	213%	254%

Field Test 2B Quantitative Results

- The average field test participant VM-21 reserve for guaranteed benefits increased by 5.6%, and the average Risk-Based Capital increased by 11.6%, compared to 13.5% and 9.7% for 2A reserves and capital, respectively.
- Participants that modeled hedging (implicitly or explicitly) saw smaller increases to reserves (4.1%) and capital (4.1%) than those that did not model hedging (276.0% and 414.6% for reserves and capital respectively).

Reserve/Capital Amount	Percentage Increase over Baseline					
	Average	Min	Percentiles			Max
			25th	50th	75th	
VM-21 Reserve for Guaranteed Benefits	5.6%	-79.5%	-1.4%	0.5%	42.8%	2,802%
Risk-Based Capital	11.6%	-88.2%	-4.8%	16.5%	26.7%	3,136%

11/30 Participants

Field Test 5A: Treasury and Equity Overview

- The 5A scenario set uses the exact same UST scenarios as 1A.
- For the 5A equity scenario set, the Conning's original equity model calibration is used that includes the full impact of the equity-Treasury linkage. With 5A's lower overall UST rates, the equity GWFs at the lower percentiles are much more severe than the AIRG and other field test scenario sets. For example, the 1st percentile of equity GWFs for 5A is .39, compared to 1.22 for the AIRG and 1.19 for 1A.
- The median GWF at the end of the 30th projection year for 5A (5.88) is significantly lower than with both 1A (8.99) and the AIRG (8.84).

5A: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.47	0.13	0.06	0.04	0.05
1.0%	0.71	0.45	0.36	0.38	0.39
2.5%	0.76	0.57	0.48	0.54	0.65
5.0%	0.82	0.67	0.63	0.73	0.95
10.0%	0.87	0.80	0.82	1.04	1.48
25.0%	0.96	1.02	1.20	1.79	2.93
50.0%	1.05	1.28	1.69	3.09	5.88
75.0%	1.14	1.56	2.31	5.11	11.43
90.0%	1.21	1.85	3.02	8.11	21.44
95.0%	1.26	2.04	3.59	10.76	32.94
97.5%	1.30	2.23	4.11	13.83	47.77
99.0%	1.35	2.50	4.83	18.95	71.23
Max	1.68	3.79	10.89	64.69	494.22

AIRG: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.41	0.32	0.26	0.35	0.38
1.0%	0.70	0.62	0.66	0.83	1.22
2.5%	0.76	0.72	0.77	1.10	1.69
5.0%	0.82	0.81	0.92	1.41	2.25
10.0%	0.89	0.93	1.12	1.83	3.09
25.0%	0.98	1.16	1.51	2.74	5.11
50.0%	1.09	1.45	2.09	4.27	8.84
75.0%	1.19	1.81	2.88	6.80	15.35
90.0%	1.30	2.22	3.81	10.15	24.98
95.0%	1.37	2.48	4.44	12.92	34.25
97.5%	1.44	2.72	5.17	15.65	45.88
99.0%	1.52	3.06	6.18	20.49	60.45
Max	1.92	4.77	11.86	66.94	235.95

5A/AIRG: GWF Ratios by Projection Month

SP500	12	60	120	240	360
Min	114%	40%	24%	11%	13%
1.0%	101%	73%	54%	46%	32%
2.5%	100%	79%	62%	49%	39%
5.0%	100%	83%	68%	51%	42%
10.0%	99%	86%	73%	57%	48%
25.0%	98%	88%	79%	65%	57%
50.0%	97%	88%	81%	72%	66%
75.0%	96%	86%	80%	75%	74%
90.0%	94%	83%	79%	80%	86%
95.0%	92%	82%	81%	83%	96%
97.5%	91%	82%	80%	88%	104%
99.0%	89%	82%	78%	92%	118%
Max	87%	80%	92%	97%	209%

Field Test 5A Quantitative Results

- The average field test participant VM-21 reserve for guaranteed benefits increased by 78.7%, and the average Risk-Based Capital increased by 114%.
- Several participants noted that the very low equity returns present in 5A were a major driver of the increase in their results.
- Participants that modeled hedging (implicitly or explicitly) saw smaller impacts to reserves (64.5%) and capital (108.7%) than those that did not model hedging (371.7% and 279.6% for reserves and capital respectively).

Reserve/Capital Amount	Percentage Increase over Baseline					
	Average	Min	Percentiles			Max
			25th	50th	75th	
VM-21 Reserve for Guaranteed Benefits	78.7%	4.3%	69.9%	347.8%	643.6%	2,862%
Risk-Based Capital	114%	-21.0%	34.2%	84.6%	388.9%	17,100%

25/30 Participants

Field Test 5B: Treasury and Equity Overview

- The 5B scenario set uses the exact same UST scenarios as 2A (as of 12/31/19 + 200 BP).
- For the 5B equity scenario set, the Conning's original equity model calibration is used that includes the full impact of the equity-Treasury linkage. With 5B's higher starting interest levels, the equity GWFs at the lower percentiles are higher than those in 5A, but still lower than those in the AIRG and 2A. For example, the 1st percentile of equity GWFs for 5A is .54, compared to 1.22 for the AIRG and 1.07 for 2A.
- The median GWF at the end of the 30th projection year for 5B is 8.59, which is in the ballpark of the corresponding GWFs for both 2A (8.97) and the AIRG (8.84).

5B: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.48	0.14	0.07	0.05	0.07
1.0%	0.74	0.53	0.44	0.50	0.54
2.5%	0.79	0.66	0.60	0.71	0.90
5.0%	0.85	0.78	0.78	0.98	1.30
10.0%	0.91	0.93	1.03	1.39	2.05
25.0%	1.00	1.19	1.51	2.43	4.14
50.0%	1.10	1.50	2.15	4.33	8.59
75.0%	1.19	1.85	3.01	7.48	17.74
90.0%	1.27	2.20	4.04	12.44	35.86
95.0%	1.32	2.43	4.84	17.03	57.52
97.5%	1.36	2.69	5.60	22.65	84.51
99.0%	1.41	3.01	6.78	31.13	132.92
Max	1.76	4.87	16.46	115.46	1058.35

AIRG: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.41	0.32	0.26	0.35	0.38
1.0%	0.70	0.62	0.66	0.83	1.22
2.5%	0.76	0.72	0.77	1.10	1.69
5.0%	0.82	0.81	0.92	1.41	2.25
10.0%	0.89	0.93	1.12	1.83	3.09
25.0%	0.98	1.16	1.51	2.74	5.11
50.0%	1.09	1.45	2.09	4.27	8.84
75.0%	1.19	1.81	2.88	6.80	15.35
90.0%	1.30	2.22	3.81	10.15	24.98
95.0%	1.37	2.48	4.44	12.92	34.25
97.5%	1.44	2.72	5.17	15.65	45.88
99.0%	1.52	3.06	6.18	20.49	60.45
Max	1.92	4.77	11.86	66.94	235.95

5B/AIRG: GWF Ratios by Projection Month

SP500	12	60	120	240	360
Min	118%	44%	27%	14%	17%
1.0%	106%	85%	67%	60%	44%
2.5%	105%	91%	77%	64%	54%
5.0%	104%	96%	85%	69%	58%
10.0%	103%	99%	91%	76%	66%
25.0%	102%	103%	99%	89%	81%
50.0%	101%	104%	103%	101%	97%
75.0%	100%	102%	105%	110%	116%
90.0%	98%	99%	106%	123%	144%
95.0%	96%	98%	109%	132%	168%
97.5%	95%	99%	109%	145%	184%
99.0%	93%	98%	110%	152%	220%
Max	92%	102%	139%	172%	449%

Field Test 5B Quantitative Results

- The average field test participant VM-21 reserve for guaranteed benefits increased by 28.3%, and the average Risk-Based Capital increased by 26.8% for field test 5B, compared to much higher average reserve (78.7%) and capital (114%) increases for 5A.
- The equity-Treasury linkage produced higher equity returns in the 5B scenario set as of 12/31/19 + 200 BP, leading to more favorable results for participants.
- Participants that modeled hedging (implicitly or explicitly) saw smaller increases to reserves (25.2%) and capital (15.1%) than those that did not model hedging (586.1% and 638.8% for reserves and capital respectively).

Reserve/Capital Amount	Percentage Increase over Baseline					
	Average	Min	Percentiles			Max
			25th	50th	75th	
VM-21 Reserve for Guaranteed Benefits	28.3%	0%	14.4%	68.7%	219.7%	5,645%
Risk-Based Capital	26.5%	-12.7%	5.9%	45.4%	84.4%	4,599%

11/30 Participants

Field Test 6: Treasury and Equity Overview

- The field test 6 scenario set uses the exact same UST scenarios as 1A.
- The equity calibration for scenario set 6 assumes a constant mean equity return independent of rates and increases alignment with AIRG equity model GWFs.
- The median GWF at the end of the 30th projection year for 6 is 9.49, which is close but somewhat higher than the the corresponding GWFs for both 1A (8.99) and the AIRG (8.84).
- While there are differences (somewhat lower GWFs in low percentiles, lower GWFs at higher percentiles), the equity scenarios from 6 overall are more consistent with those produced by the AIRG than other field test scenario sets.

6: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.43	0.14	0.13	0.31	0.23
1.0%	0.71	0.57	0.59	0.79	1.20
2.5%	0.77	0.68	0.76	1.08	1.73
5.0%	0.83	0.80	0.92	1.41	2.32
10.0%	0.89	0.94	1.14	1.85	3.20
25.0%	0.99	1.19	1.58	2.90	5.41
50.0%	1.09	1.50	2.17	4.55	9.49
75.0%	1.19	1.82	2.90	6.83	15.89
90.0%	1.28	2.15	3.66	9.85	24.35
95.0%	1.33	2.34	4.22	12.01	31.70
97.5%	1.38	2.52	4.76	14.36	39.68
99.0%	1.43	2.75	5.37	17.19	52.06
Max	1.79	3.97	9.38	33.26	135.23

AIRG: 10,000 SP500 GWF %-tiles by Projection Month

	12	60	120	240	360
Min	0.41	0.32	0.26	0.35	0.38
1.0%	0.70	0.62	0.66	0.83	1.22
2.5%	0.76	0.72	0.77	1.10	1.69
5.0%	0.82	0.81	0.92	1.41	2.25
10.0%	0.89	0.93	1.12	1.83	3.09
25.0%	0.98	1.16	1.51	2.74	5.11
50.0%	1.09	1.45	2.09	4.27	8.84
75.0%	1.19	1.81	2.88	6.80	15.35
90.0%	1.30	2.22	3.81	10.15	24.98
95.0%	1.37	2.48	4.44	12.92	34.25
97.5%	1.44	2.72	5.17	15.65	45.88
99.0%	1.52	3.06	6.18	20.49	60.45
Max	1.92	4.77	11.86	66.94	235.95

6/AIRG: GWF Ratios by Projection Month

SP500	12	60	120	240	360
Min	106%	44%	50%	88%	60%
1.0%	101%	92%	89%	95%	98%
2.5%	102%	95%	99%	98%	102%
5.0%	101%	100%	100%	100%	103%
10.0%	100%	101%	102%	101%	103%
25.0%	101%	103%	104%	106%	106%
50.0%	100%	103%	104%	107%	107%
75.0%	100%	100%	101%	101%	104%
90.0%	99%	97%	96%	97%	97%
95.0%	97%	95%	95%	93%	93%
97.5%	96%	92%	92%	92%	86%
99.0%	94%	90%	87%	84%	86%
Max	93%	83%	79%	50%	57%

Field Test 6 Quantitative Results

- The average field test participant VM-21 reserve for guaranteed benefits increased by 10.1%, and the average Risk-Based Capital increased by 56%, compared to 29.4% and 68.0% for 1A reserves and capital, respectively.
- Given the alignment between the AIRG and scenario set 6 equity GWFs, the increases in reserves and capital compared to the baseline are likely driven primarily by the UST model calibration.
- The effect of hedging was less clear in the results of the participants who elected to perform field test 6. There were a limited number of companies that participated in field test 6 and that did not model hedging.

Reserve/Capital Amount	Percentage Increase over Baseline					
	Average	Min	Percentiles			Max
			25th	50th	75th	
VM-21 Reserve for Guaranteed Benefits	10.1%	-14.0%	7.2%	62.2%	218.6%	492.2%
Risk-Based Capital	56%	-8.2%	13.4%	21.7%	216.7%	12,161%

12/30 Participants

Agenda Item 13

Hear an Update on Mortality Improvement

Mortality Improvements Life Work Group (MILWG)— 2023 Update and Work Plan

Academy Mortality Improvements Life Work Group (MILWG);
SOA Mortality and Longevity Oversight Advisory Council (MLOAC)

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Life Actuarial Task Force (LATF) — NAIC 2023 Spring Meeting (3/21/23)

Agenda

- Recap: approved approach for 2022 HMI and FMI scales
- 2023 scale updates (HMI and FMI)
- MILWG 2023 work plan

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Recap: 2022 HMI and FMI scales

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2022 HMI/FMI General Methodology

HMI Scale Year	Historical Component: *Historical Data (10 yrs)* *SSA Data – Gen Population Mean*	Estimated/Future Component: *SSA (Social Security Administration)* *Alt2 Projection (20 yr average)*
2022	Averaging Period: 2010-2020	Averaging Period: 2020-2040
FMI Scale Year	**Process**	**Long-Term Rate (LTR)**
2022	**Basic Scale:** • Grades to LTR at projection yr 10 (2032) • Remains at LTR for projection yrs 10-15 • Grades to no additional MI at projection yr 20 (2042) • Margin for uncertainty included to develop **"Loaded Scale"**	Average of SSA Alt 2 MI for projection years 10-15 (decision point on whether to change LTR basis)

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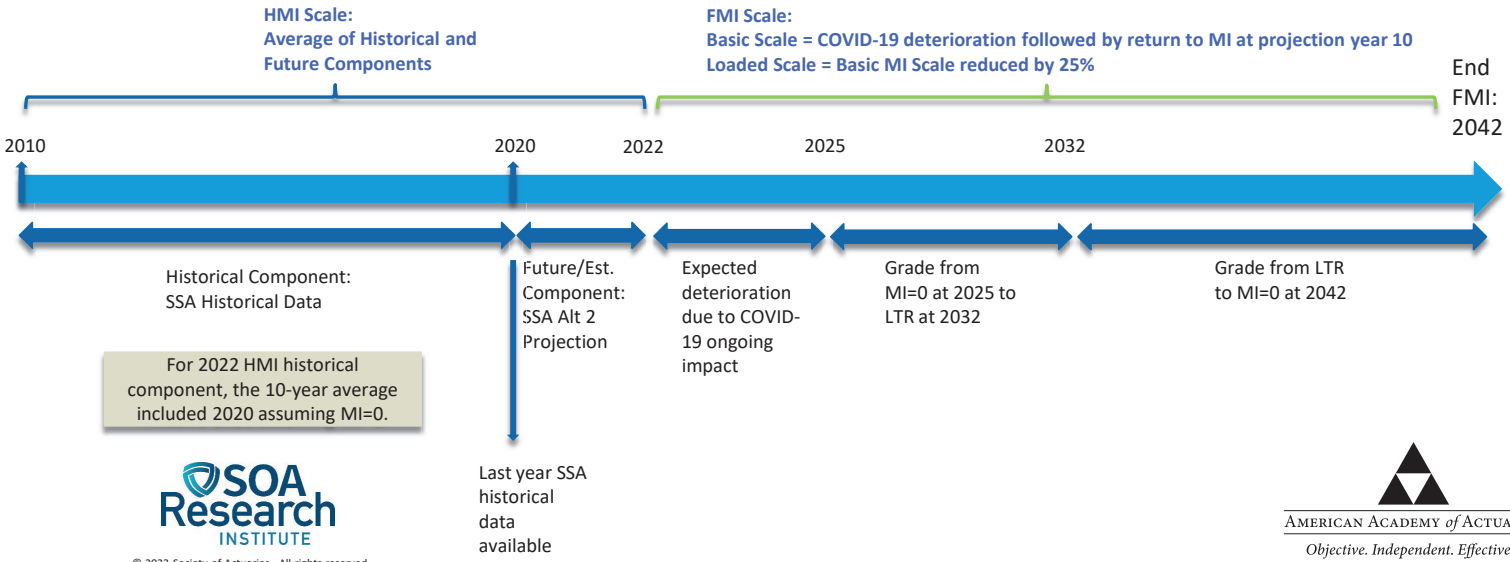
HMI/FMI General Methodology

Example : Scale Year = 2022



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COVID-19 Modifications to General Methodology for 2022 HMI and FMI

HMI Modified Approach:

Use average from 2010–2020 but include 2020 mortality = 2019 mortality

- Assumes zero improvement for 2020
- Results in less mortality improvement in general than HMI Approach 1

FMI Modified Approach:

Basic scale : include COVID-19 impact (deterioration in mortality) in early years of the FMI scale

- Assume deterioration for 2023 and 2024 followed by zero improvement in 2025.
- Then grade to long-term (LT) MI level based on Social Security Administration (SSA) Intermediate projection at year 10 (grade from 2025–2032).

Loaded scale (prudent estimate) = scale above plus 25% general margin for uncertainty in trend

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Issues Addressed

- SSA Alt 2—appears to be a reasonable basis for the LTR development
  - Primary criticism of SSA's intermediate projection has been concern that MI implied rates are too low
- Appropriateness of inclusion of COVID-19 impacts in FMI
  - Consistent with Industry Mortality Group principle that states that the shock impact of COVID-19 or other short-term mortality events should only be included in the future mortality expectations to the extent they are expected to continue
  - Recommended inclusion of FMI deterioration in the first 3 years of the reserve projection estimates the expected future impact of COVID-19

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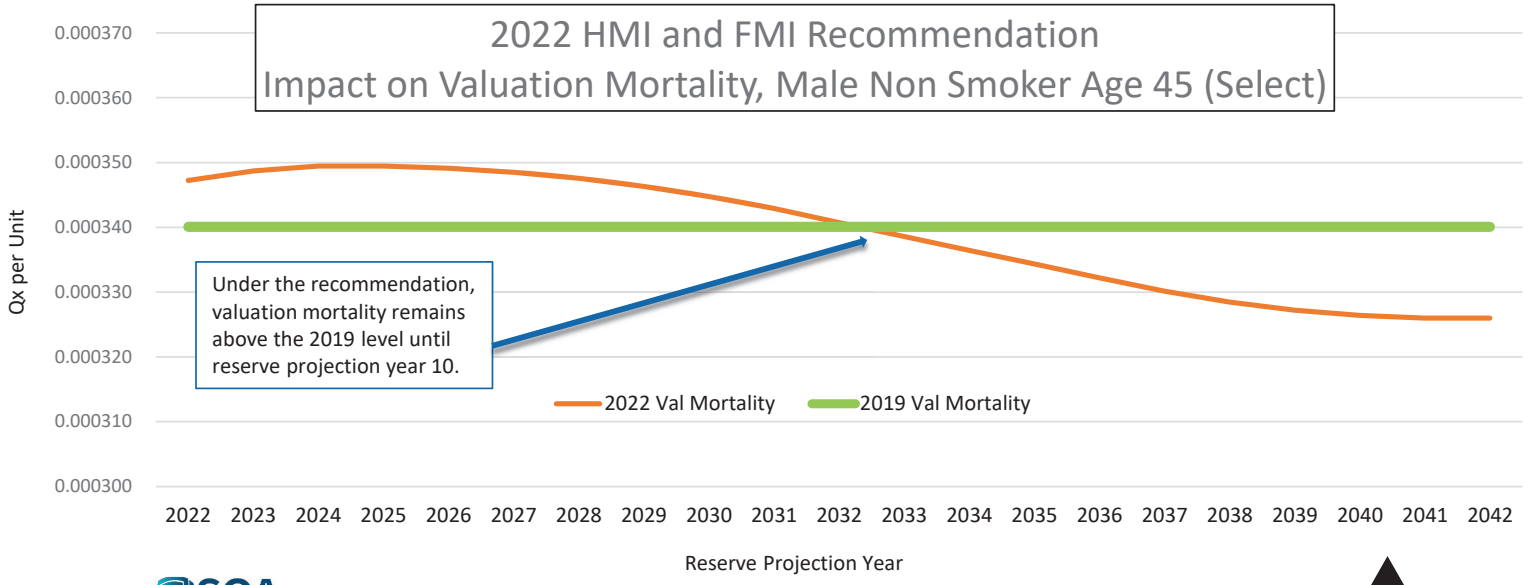
General Impact of 2022 Modifications on Valuation Mortality



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2023 Scale Updates (HMI and FMI)

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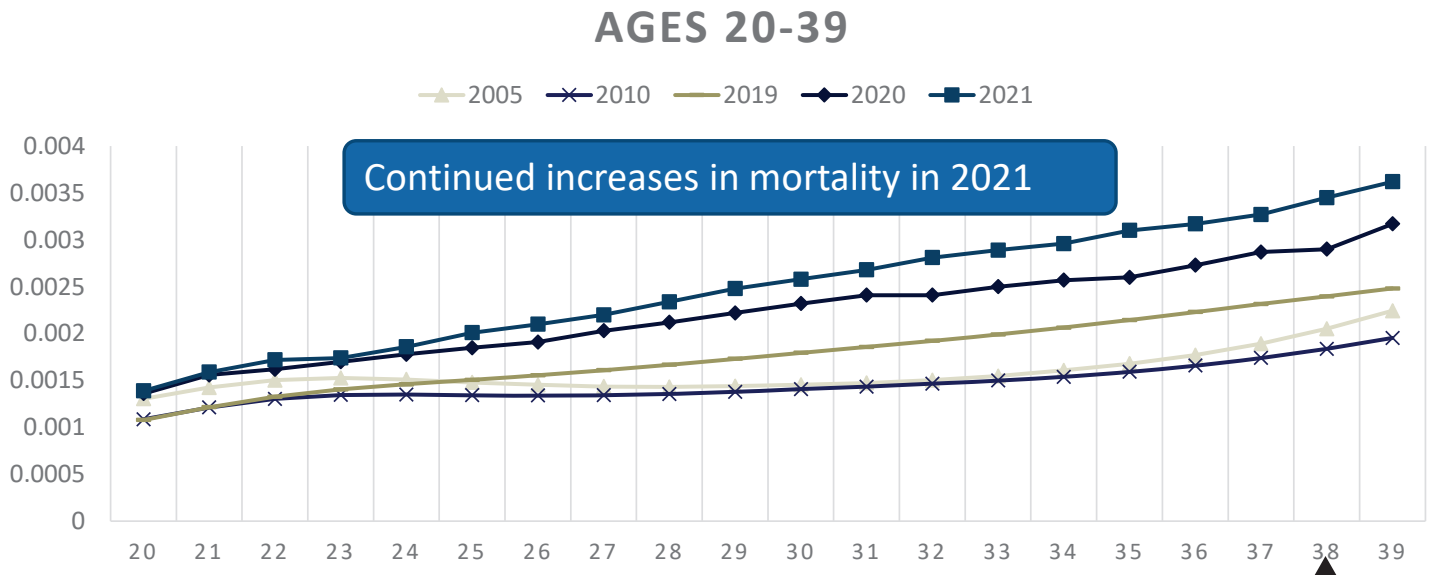
2023 HMI Scale – Males
Preliminary 2021 Mortality Data



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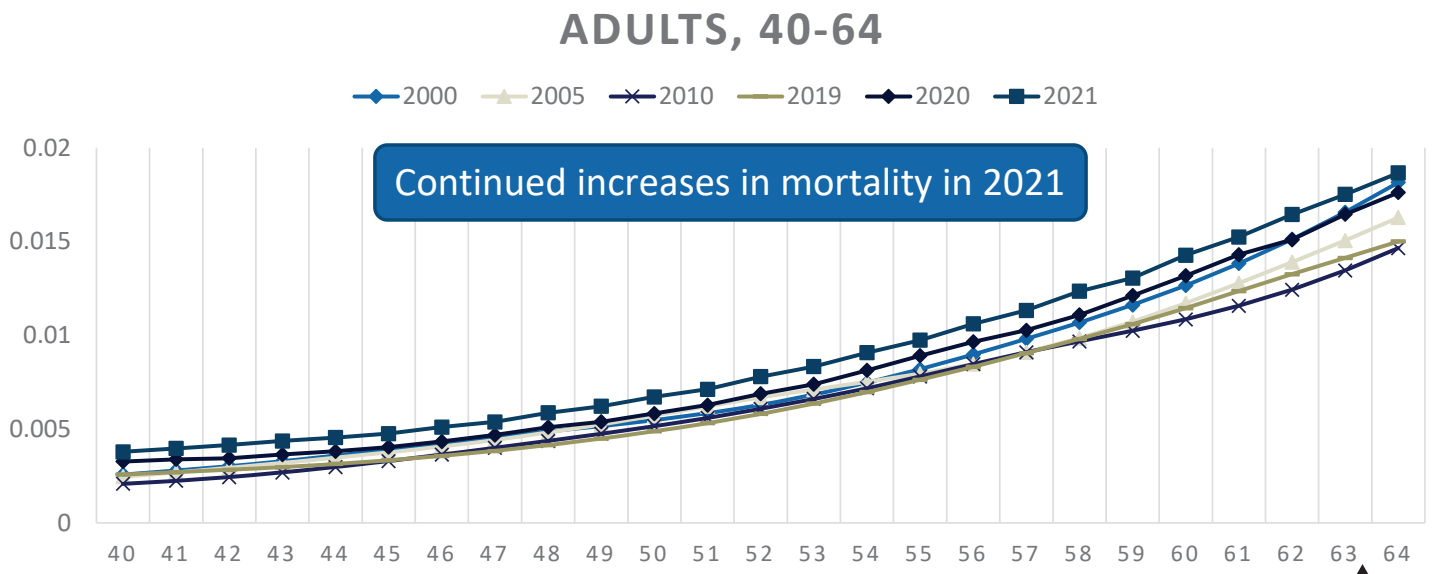

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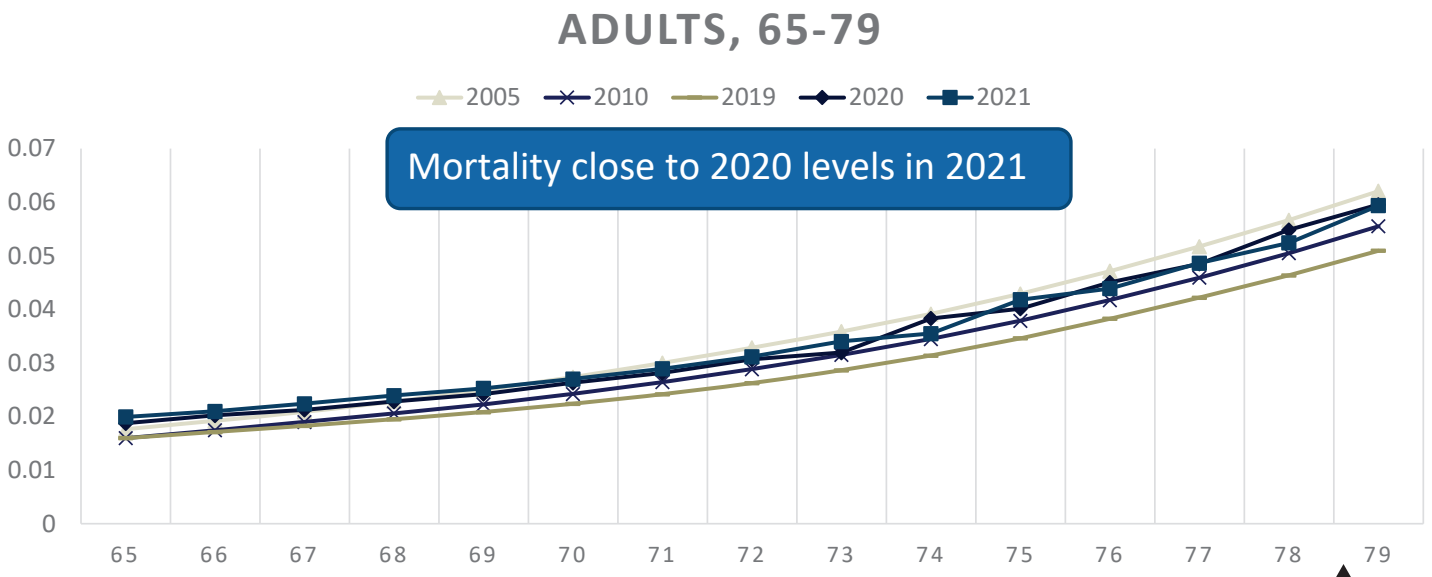

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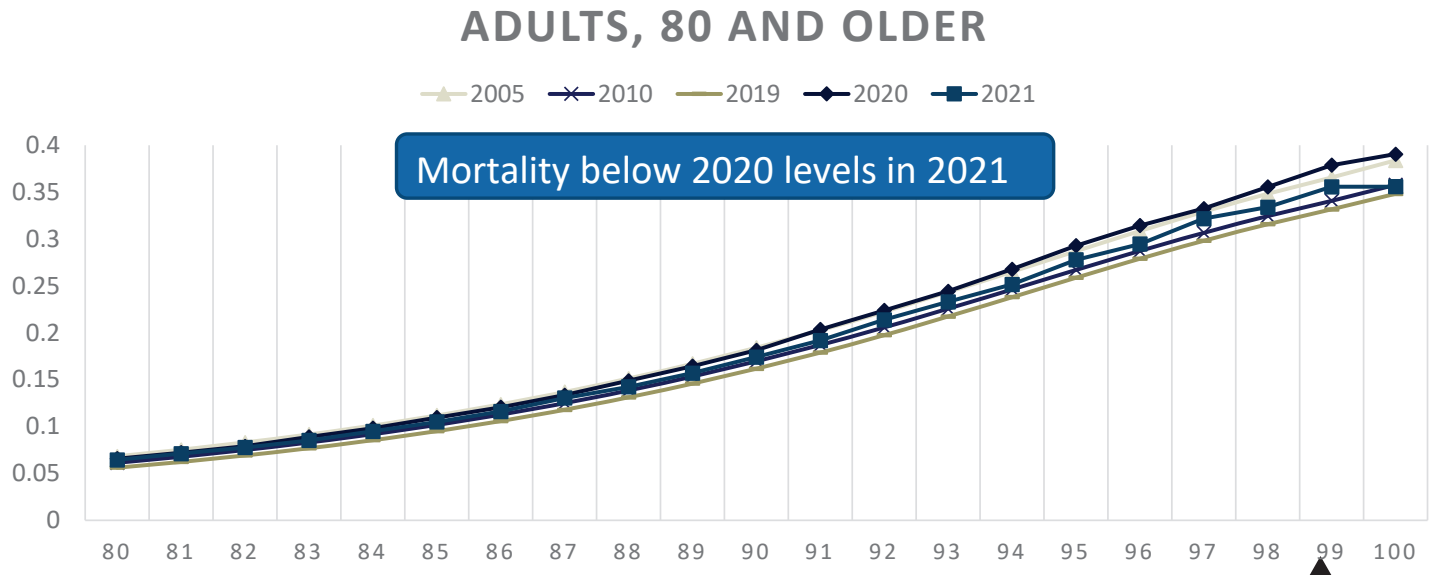
2023 HMI Scale – Males
Preliminary 2021 Mortality Data



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MILWG 2023 Work Plan

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2023 Plan

- Approach to COVID-19 impact for 2023 – FMI and HMI
- Revisit HMI methodology in light of recent and expected experience
- Insured vs. general population MI recommendation
- Revisit FMI margin structure
- Revisit smoothing approach for HMI and FMI
- Review recommendation for MI with 2008 VBT Limited Underwriting (LU) table

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Approach to COVID-19 impact

- Quantification of COVID-19 impact
  - Data sources
  - Consideration of short- vs. medium- vs. longer-term impacts
  - Return to previously projected mortality level over time or residual excess mortality
  - Insured vs. general population considerations
  - Direct adjustment to MI rates or reflected in additional margins
- Implicit margins in MI scale development
  - Data source—general population data unadjusted for insured population differences (largest source of margin)
    - Starting MI level (HMI)
    - Long-term rate (FMI)
  - Limit on FMI assumption (20 years)

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COVID-19 Impact Discussions

- Revisit the question of inclusion/exclusion of COVID-19 deaths
  - Could remove deaths directly attributed to COVID-19 as primary cause
  - This will not remove COVID-19 deaths where it was not reported as the primary cause
- Review data for other causes of death and how much those trends will likely continue
  - Utilize data from SOA research on excess mortality for individual life insureds
  - Utilize cause of death information from SOA general population mortality research
- Keep in mind goal of this scale development work

  HMI: Establish a reasonable starting point for valuation mortality

  FMI: Establish a reasonable expectation of ongoing life insured mortality

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HMI Methodology Review

To be completed for 2023 HMI Scale Recommendation

- Data sources – historical and future/estimated components
- Gender and age scales
- Historical averaging period – 10 years
- Averaging methodology
- Forecast/estimate averaging period – 20 years
- Continue with 50/50 weighting for average

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Insured vs General Population Mortality Recommendation (HMI and FMI)

Data review and analysis, initial thinking to be completed in 2023

- Data sources – historical and future/estimated components
- SOA Mortality Improvement Model (MIM) support work:
  - Updated 2020-2021 data with COVID-19 impacts
  - Developing/documenting potential methodology to remove COVID-19 impact for data analysis work
  - Compare population data by socioeconomic decile to 2015 VBT and to actual industry experience for the same periods

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Other MILWG Projects

- Revisit FMI margin structure
- Revisit smoothing approach for HMI and FMI
- Review recommendation for MI with 2008 VBT Limited Underwriting (LU) table

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Questions?

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Contact Information

Marianne Purushotham, MAAA, FSA
Corporate Vice President, Research Data Services
LLGlobal
mpurushotham@limra.com

Amanda Barry-Moilanen
Life Policy Analyst
American Academy of Actuaries
barrymoilanen@actuary.org

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Appendix

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Reserve Impact—NAIC Model Office

- Universal Life with Secondary Guarantees (ULSG) model—long-duration product, larger potential for reserve reduction
  - Model office and assumptions same as used in the yearly renewable term (YRT) representative model analysis
  - Lifetime shadow account secondary guarantee
  - No reinsurance in the model

Component	Values
Issue ages	Decennial issue ages 30 – 70
Gender	Male Female
Risk classes	Preferred non-tobacco Standard non-tobacco Standard tobacco
Face bands	Low ($250,000) High ($1,000,000)

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Reserve Impact—NAIC Model Office

- Term Life Insurance Product with 10- and 20-year level premium periods
  - Model office and assumptions same as used in the YRT representative model analysis
  - Mature at age 95
  - 100% shock lapse at end of level term period

Component	Values
Issue ages	Decennial issue ages 20 – 60
Gender	Male Female
Risk classes	Preferred non-tobacco Standard non-tobacco Standard tobacco
Face bands	Low ($250,000) High ($1,000,000)
Term lengths	10 year 20 year

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Reserve Impact Results—ULSG

Mortality Improvement Basis	ULSG Normalized VM-20 Deterministic Reserve (DR)	ULSG Percentage Change from Baseline
Baseline: **HMI: no change to HMI** **FMI: zero FMI**	**$ 1,000,000.00**	**----**
HMI: Approach 2 **FMI: Zero FMI**	**$ 1,014,962.02**	**1.50%**
RECOMMENDATION: **HMI: Approach 2** **FMI: Approach 2**	**$ 940,464.62**	**-5.95%**
Sensitivity: **HMI: Approach 2** **FMI: Approach 3**	**$ 938,346.28***	**-6.17%***

Approaches to HMI and FMI

HMI
Approach 1 = historical average 2009-2019
Approach 2 = historical average 2010-2020 (zero MI in 2020)

FMI - grades to SSA intermediate projection long-term rate over 10 years
Approach 1 = no FMI deterioration for COVID-19
Approach 2 = apply deterioration due to COVID-19 for first 3 years
Approach 3 = apply greater 50 percent greater deterioration due to COVID-19 for first 3 years (sensitivity)

*The slight decrease in reserves for the sensitivity run compared to the recommendation seems counterintuitive given the higher initial mortality deterioration present in the sensitivity. However, specific impacts related to the net-amount-at-risk pattern (decreasing in the initial years due to fund value growth before growing in later years as fund value runs out and the secondary guarantee comes into effect) meant that the shift of death claims to earlier years from later years for the sensitivity run resulted in a slightly reduced deterministic reserve compared to the recommendation. Overall, the conclusion is that the additional margin did not have a material impact on the deterministic reserve calculation for this model office product.

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Reserve Impact Results—Term

	Term	
Mortality Improvement Basis	**VM-20 DR**	**Reserve Change**
Baseline: **HMI: no change to HMI** **FMI: zero FMI**	**$ (79,846)**	**----**
HMI: Approach 2 **FMI: Zero FMI**	**$ (50,285)**	**$ 29,561**
RECOMMENDATION: **HMI: Approach 2** **FMI: Approach 2**	**$ (68,968)**	**$ 10,878**
Sensitivity: **HMI: Approach 2** **FMI: Approach 3**	**$ (66,303)**	**$ 13,543**

Approaches to HMI and FMI

HMI
Approach 1 = historical average 2009-2019
Approach 2 = historical average 2010-2020 (zero MI in 2020)

FMI - grades to SSA intermediate projection long-term rate over 10 years
Approach 1 = no FMI deterioration for COVID-19
Approach 2 = apply deterioration due to COVID-19 for first 3 years
Approach 3 = apply greater 50 percent greater deterioration due to COVID-19 for first 3 years (sensitivity)

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Note: All of the valuation date deterministic reserves shown on this slide are negative

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Additional Considerations
HMI and FMI

- MI improvement scale annual updates should not create reserve volatility
- Individual companies should also consider their own business and make appropriate additional adjustments

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Agenda Item 14

Consider Partial Adoption of
APF 2023-03 VM-20 Updates
(Additional Materials)

Brian Bayerle
Senior Actuary
202-624-2169
BrianBayerle@acli.com

Colin Masterson
Policy Analyst
202-624-2463
ColinMasterson@acli.com

March 6, 2023

Rachel Hemphill
Chair, NAIC Life Actuarial (A) Task Force (LATF)

Re: APF 2023-03 Parts 3-5

Dear Ms. Hemphill:

The American Council of Life Insurers (ACLI) appreciates the opportunity to submit comments on Parts 3-5 of APF 2023-03 (APF), which was exposed by LATF during their meeting on February 2nd. While we are generally supportive of the provisions contained within these sections of the APF, we do have some concerns related to the scope of the proposal as well as some technical details that we believe should be addressed before adoption.

Overall, APF 2023-03 includes several potentially material changes that are not related to or dependent on one another, so we would recommend splitting this proposal into multiple APFs so each item can be considered separately. This would likely lead to easier and quicker adoption of the more minor items that are included. In addition, several of the proposed items cite consistency with other sections in the Valuation Manual as rationale for the change. While consistency may be desirable, further explanation of the rationale for the changes would be appreciated for these items.

However, as stated above, our feedback for this round of comments addresses changes proposed in Part 3 of the APF. Particularly, we have concerns surrounding the differences between VM-20 and VM-21 as we feel that the changes do not take into consideration that VM-20 and VM-21 also differ in the discount rates used to calculate scenario reserves. Under the APF, a company that models its actual strategy (rather than the alternative investment strategy) would have to document it as a simplification if borrowing cost being greater than or equal to reinvestment rate isn't true in every period.

The American Council of Life Insurers (ACLI) is the leading trade association driving public policy and advocacy on behalf of the life insurance industry. 90 million American families rely on the life insurance industry for financial protection and retirement security. ACLI's member companies are dedicated to protecting consumers' financial wellbeing through life insurance, annuities, retirement plans, long-term care insurance, disability income insurance, reinsurance, and dental, vision and other supplemental benefits. ACLI's 280 member companies represent 94 percent of industry assets in the United States.

This is especially troublesome when you add the consideration of VM-20 Section 7.E.2 consistent with the VM-21 Section 4.D.4.c requirement on the company's assumed cost of borrowing along with the associated Guidance Note. This consideration adds language requiring that the assumed cost of borrowing is not lower than the rate at which positive cash flows are reinvested in the same time period, taking into account duration, ratings, and other attributes of the borrowing mechanism. While this change does align the assumed cost of borrowing between VM-20 and VM-21, it results in a disconnect between the rate at which deficiencies are accumulated and the scenario discount rate. As stated in each respective VM section:

> *VM-20 Section 7.H.4: "The company shall use the path of one-year Treasury interest rates in effect at the beginning of each projection year multiplied by 1.05 for each model segment within each scenario as the discount rates in the SR calculations in Section 5."*
>
> *VM-21 Section 4.B.2: "In determining the scenario reserve, accumulated deficiencies shall be discounted at the NAER on additional assets, as defined in Section 4.B.3". Section 4.B.3 describes an NAER that would be akin to a new money earned rate.*

Furthermore, the disconnect created between the Stochastic Reserve discount rate and borrowing rate could result in infinite SR calculations. For example, suppose that at the end of 50 years in the projection, there is a 1M deficiency and no/few policies remaining. Assuming the net earned rate on positive cash flows = borrowing rate = 5% and the discount rate is = 1.05 * Treasury = 2%, letting the projection run another N years would result in the PV of deficiency continuing to grow by (1.05/1.02)^N. It may be difficult for companies to defend cutting off the projection at 50 years, if running it 100 years causes the scenario reserve to increase by 300%, primarily driven by the disconnect in discounting accumulation rates.

It is our current understanding that these changes are regulators way of saying that companies should not be assuming significant benefits from borrowing, which is a point we agree with at an overarching level. But as we have stated above, if regulators would like to reach this goal as expeditiously as possible, there are several changes that could be made to address both the technical and bureaucratic challenges presented by the APF as it currently stands including dividing the APF into smaller proposals and acknowledging the differences between VM-20 and VM-21 requirements.

Thank you once again for your consideration of our comments and we are looking forward to further conversation and cooperation with regulators on this matter as we work towards compiling feedback on Parts 1 and 2.

Colin Masterson

cc: Scott O'Neal, NAIC