LIFE ACTUARIAL (A) TASK FORCE

Questions and Unaggregated GOES Field Test Specifications (Attachment Twenty-Nine-A)
GOES (E/A) Subgroup's Feb. 14, 2024, Conference Call Minutes (Attachment Thirty)
Academy Proposed "Quadrant" Criteria (Attachment Thirty-A)
ACLI Proposal for a Correlation Approach (Attachment Thirty-B)
GOES (E/A) Subgroup's Feb. 07, 2024, Conference Call Minutes (Attachment Thirty-One)
Oliver Wyman Presentation on NAIC GOES Model Office Analysis Results (Attachment Thirty-One-A)
GOES (E/A) Subgroup's Jan. 31, 2024, Conference Call Minutes (Attachment Thirty-Two)
SERT Scenarios and DR Scenario Methodology Background Information (Attachment Thirty-Two-A)
GOES (E/A) Subgroup's Jan. 24, 2024, Conference Call Minutes (Attachment Thirty-Three)
GOES (E/A) Subgroup's Jan. 17, 2024, Conference Call Minutes (Attachment Thirty-Four)
Equity-Treasury Linkage Background and Review of Relevant Comments (Attachment Thirty-Four-A)
GOES (E/A) Subgroup's Jan. 10, 2024, Conference Call Minutes (Attachment Thirty-Five)
Scenario Stratification Background Information (Thirty-Five-A)
GOES (E/A) Subgroup's Dec. 18, 2023, Conference Call Minutes (Attachment Thirty-Six)
2024 GOES Subgroup Meetings Plan (Thirty-Six-A)
VA Model Office Testing Plan Presentation (Thirty-Six-B)
Regulator Review of Actuarial Guideline LIII Presentation (Attachment Thirty-Seven)
Asset-Intensive Reinsurance Ceded Offshore Presentation (Attachment Thirty-Eight)
Asset Adequacy Analysis for Certain Reinsurance Presentation (Attachment Thirty-Nine)
SOA Research and Education Initiatives Presentation (Attachment Forty)
ACLI Comment Letter (Attachment Forty-One)
APF 2024-01 (Attachment Forty-Two)
Academy Life Practice Council Update (Attachment Forty-Three)
APF 2023-13 (Attachment Forty-Four)

Draft Pending Adoption

Draft: 4/2/24

Life Actuarial (A) Task Force
Phoenix, Arizona
March 14–15, 2024

The Life Actuarial (A) Task Force met in Phoenix, AZ, March 14–15, 2024. The following Task Force members participated: Cassie Brown, Chair, represented by Rachel Hemphill (TX); Scott A. White, Vice Chair, represented by Craig Chupp (VA); Lori K. Wing-Heier represented by Sharon Comstock (AK); Mark Fowler represented by Sanjeev Chaudhuri (AL); Ricardo Lara represented by Ahmad Kamil and Thomas Reedy (CA); Andrew N. Mais represented by Wanchin Chou (CT); Doug Ommen represented by Mike Yanacheak and Kevin Clark (IA); Dana Popish Severinghaus represented by Vincent Tsang (IL); Amy L. Beard represented by Scott Shover (IN); Vicki Schmidt represented by Nicole Boyd (KS); Grace Arnold represented by Fred Andersen and Ben Slutsker (MN); Chlora Lindley-Myers represented by William Leung (MO); Eric Dunning represented by Michael Muldoon (NE); D.J. Bettencourt represented by Jennifer Li (NH); Justin Zimmerman represented by Seong-min Eom (NJ); Adrienne A. Harris represented by Bill Carmello (NY); Judith L. French represented by Peter Weber (OH); Glen Mulready represented by Andrew Schallhorn (OK); Michael Humphreys represented by Dave Yanick and Steve Boston (PA); and Jon Pike represented by Tomasz Serbinowski (UT).

1. Adopted its Feb. 29, Feb. 15, Feb. 8, Feb. 1, and Jan. 25 Minutes and the Reports of the IUL Illustration (A) Subgroup and the Longevity Risk (E/A) Subgroup

The Task Force met Feb. 29, Feb. 15, Feb. 8, Feb. 1, and Jan. 25. During these meetings, the Task Force took the following action: 1) adopted amendment proposal form (APF) 2023-12, which adds additional requirements on the reflection of equity return volatility in asset adequacy analysis; 2) adopted APF 2024-02, which clarifies governance reporting requirements for Variable Annuity (VA) business in the Principle-Based Reserving (PBR) Actuarial Report; 3) exposed APF 2024-01, which adds a definition for "qualified actuary" to the Valuation Manual; 4) re-exposed APF 2023-13, which updates the Valuation Manual to allow for international mortality tables for relevant assumed business; 5) adopted APF 2023-11, which removes references to risk-based capital (RBC) in the Valuation Manual that are inconsistent with the purpose, scope, and intended use of RBC; and 6) adopted its 2023 Fall National Meeting minutes.

The Task Force also met March 11 and Feb. 26 in regulator-to-regulator session, pursuant to paragraph 8 (consideration of strategic planning issues on international regulatory matters) of the NAIC Policy Statement on Open Meetings.

The Task Force reviewed the reports of the Indexed Universal Life (IUL) Illustration (A) Subgroup and the Longevity Risk (E/A) Subgroup.

Chupp noted some editorial corrections that needed to be made to the Feb. 15 and Feb. 29 minutes.

Yanacheak made a motion, seconded by Weber, to adopt the Task Force's Feb. 29 (Attachment One), Feb. 15 (Attachment Two), Feb. 8 (Attachment Three), Feb. 1 (Attachment Four), and Jan. 25 minutes (Attachment Five) with the corrections noted by Chupp and the reports of the IUL Illustration (A) Subgroup (Attachment Six) and the Longevity Risk (E/A) Subgroup (Attachment Seven). The motion passed unanimously.

2. Adopted the Report of the VM-22 (A) Subgroup and Heard an Update on the VM-22 Field Test

Slutsker delivered the report of the Valuation Manual (VM)-22 (A) Subgroup.

Chris Conrad (American Academy of Actuaries—Academy), Angela McShane (Ernst and Young—EY), and Sean Abate (EY) then presented an update on the Valuation Manual (VM)-22, Requirements for Principle-Based Reserves for Non-Variable Annuities, field test (Attachment Eight). Carmello noted that he was surprised that the crediting rate for fixed deferred annuities used in model office testing would be based on a Treasury rate minus a spread, and instead expected to see a spread on top of the Treasury rate. Abate noted that the crediting rate could be changed ahead of implementation, but this assumption was developed with the feedback of various groups. Slutsker asked whether companies that were only able to include a portion of their in-scope business in field testing would still be able to participate. McShane responded that while companies would be encouraged to include as much of their in-scope business in field testing as possible, it is more desirable for companies to participate with a portion of their business than not participate at all.

Slutsker made a motion, seconded by Reedy, to adopt the report of the VM-22 (A) Subgroup (Attachment Nine), including its Feb. 28, 2024 (Attachment Ten), Jan. 31, 2024 (Attachment Eleven), and Dec. 13. 2023 (Attachment Twelve) minutes, with a modification to the Dec. 13 minutes to correct an editorial issue. The motion passed unanimously.

3. Discussed Comments Received on a Potential Group Annuity Mortality Experience Data Collection and Adopted the Report of the Experience Reporting (A) Subgroup

Andersen noted that the Task Force had received comments on the potential for a mandatory group annuity mortality data collection. Brian Bayerle (American Council of Life Insurers—ACLI) spoke to the ACLI's comment letter (Attachment Thirteen), noting that his group did not have any concerns with the concept of a mandatory group annuity experience collection but felt that there would need to be some questions addressed ahead of implementation. Andersen asked Pat Allison (NAIC) whether there were any lessons learned from mortality experience collection that could be applied to a group annuity experience collection. Allison noted that there were some major lessons learned, including allowing third-party administrators (TPAs) to submit data on a client's behalf along with knowing how to draft the requirements to enhance clarity. Dale Hall (Society of Actuaries—SOA) and Patrick Nolan (SOA) spoke to the SOA's comment letter (Attachment Fourteen) and LIMRA's comment letter (Attachment Fifteen). Hall said that the SOA and LIMRA have already had good success with a voluntary group annuity experience collection, which could inform valuation standards.

Yanacheak highlighted the importance of group annuity experience collection and expressed more comfort with a mandatory experience collection to get participation levels to as high as possible. Eom agreed with Yanacheak and added that a mandatory collection could improve the quality of the data submissions. Weber stated that a process had been built into the *Valuation Manual* for mandatory experience collections and that he felt it was appropriate to continue to move forward with mandatory experience collections. Andersen asked the Task Force if any members objected to moving forward with the mandatory experience collection, to which none objected. Therefore, Andersen said that the Task Force would proceed towards implementation of a mandatory group annuity experience collection.

Bayerle asked what the process would be for setting up a mandatory group annuity experience collection. Allison replied that an amendment proposal form with data elements and criteria for company selection would need to be drafted. Additionally, Allison stated that once the NAIC had an idea of how many companies and data elements, any necessary additional staffing would need to be approved by the NAIC's Executive (EX) Committee.

Andersen made a motion, seconded by Eom, to adopt the report of the Experience Reporting (A) Subgroup. The motion passed unanimously.

4. Heard a Presentation on VM-21 SPA Assumptions and Adopted the Report of the Variable Annuities Capital and Reserve (E/A) Subgroup

Weber walked through the report of the Variable Annuities Capital and Reserve (E/A) Subgroup.

Weber made a motion, seconded by Yanacheak, to adopt the report of the Variable Annuities Capital and Reserve (E/A) Subgroup (Attachment Sixteen). The motion passed unanimously.

Joel Sklar (Academy) then walked through a presentation (Attachment Seventeen) on proposed adjustments to the VM-21, Requirements for Principle-Based Reserves for Variable Annuities, Standard Projection Amount (SPA) mortality factors. Hemphill noted that the recommendation included rates for every fifth age, while the rates in VM-21 were defined at each individual age from 65 to 105, and asked how the recommendation can be translated into the assumption form that is currently provided in VM-21. Sklar noted that he would recommend linear interpolation rounded to one decimal place. Chou asked whether the credibility in the older ages was sufficient. Sklar replied that the Academy did have a lot of experience included in the data and that the grouping of the ages helped with credibility.

5. Discussed VM-20 HMI and FMI Factors

Marianne Purushotham (SOA) provided an update (Attachment Eighteen) on the VM-20, Requirements for Principle-Based Reserves for Life Products, historical mortality improvement (HMI) and future mortality improvement (FMI) rates. Carmello, noting that Purushotham had described challenges in working with the data given changes in underwriting practices over time, asked whether the changes were related to accelerated underwriting or some other underwriting practice. Purushotham said that she was referring just to general changes in the underwriting over time, such as changing preferred class structure or adding body-mass index (BMI) as part of the underwriting. Carmello also mentioned that New York has been collecting data on simplified underwriting that could potentially be used for analysis of mortality improvement. Purushotham said that she would follow up with Carmello on that offer.

Hemphill asked whether the SOA was considering different recommendations between term and permanent products. Purushotham replied that the SOA is not considering that at this time, but it could be a possibility in the future. Weber, noting that there is a large range of simplified underwriting practices, asked whether a broad industry simplified underwriting study would work to capture the range of industry practice. Purushotham said that potentially including simplified underwriting as part of the VM-50, Experience Reporting Requirements, mandatory data collection could help to gather the appropriate data fields such that the nuances present in that business could be captured.

6. Adopted the Report of the GOES (E/A) Subgroup and Heard Comments on Acceptance Criteria

Yanacheak said that the Task Force would be discussing comments received on an updated set of acceptance criteria (Attachment Nineteen) for the generator of economic scenarios (GOES). Jason Kehrberg (Academy) spoke to the Academy Economic Scenario Generator Subcommittee's (ESGS') comment letter (Attachment Twenty), revised equity acceptance criteria (Attachment Twenty-One), and proposed joint interest and equity quadrant criteria (Attachment Twenty-Two), noting that the ESGS recommended a more comprehensive set of criteria. Yanacheak noted that he had concerns with including too many criteria given the difficulty in hitting a wide range of criteria, and instead recommended including a smaller set of prioritized criteria with the potential of adding more later.

Bayerle then spoke to the ACLI's comment letter (Attachment Twenty-Three) and recommended joint interest-equity acceptance criteria (Attachment Twenty-Four). Hemphill noted that changes had been made to the acceptance criteria based on feedback from the ACLI and that the conversation over appropriate acceptance criteria would continue. Patricia Matson (representing herself) then walked through her comment letter

(Attachment Twenty-Five). Eom supported Matson's comment around the transparency of the Corporate model. Mark Tenney (Mathematical Finance Company—MFC) and Steve Strommen (Blufftop) then discussed their respective comment letters (Attachments Twenty-Six and Attachment Twenty-Seven). Scott O'Neal (NAIC), responding to Tenney's comment on documentation, noted that there would be additional efforts to streamline and expand the documentation that had been provided to date on the GOES. Regarding Strommen's comments on a desire to see credit losses greater than credit spreads in some scenarios, Yanacheak supported the development of a criteria for that purpose.

Yanacheak then began walking through a presentation on the activities of the GOES (E/A) Subgroup before turning it over to O'Neal to summarize some of the key decisions. Yanacheak noted that he supported the NAIC Staff recommendation to move forward with the generalized fractional floor approach for the next field test, to which Hemphill agreed. Kehrberg stated that the Academy ESGS would support 1) a full recalibration of the Conning Corporate model rather than adjustments; 2) an independent review of the Conning Corporate documentation to ensure that it is comprehensive; and 3) a holistic review of the Treasury flooring given the prevalence of flooring throughout the projection. Dan Finn (Conning) noted that Conning was open to a full recalibration, but the adjustments made to the Corporate model had been evaluated for reasonableness. Finn further stated that it was the opinion of Conning that the Corporate documentation available under a non-disclosure agreement was sufficient to reproduce the key characteristics of the model, and that more documentation would be released publicly.

O'Neal then walked through the plans for an upcoming unaggregated field test of the GOES. Bayerle then spoke to the ACLI's recommendation for the required scenario sets and optional sensitivities to be provided as part of the field test. Hemphill, noting concern with the availability of Conning and NAIC resources as well as a concern that an optional sensitivity would later be identified as a scenario that should have been required for the field test to be informative, requested that the ACLI provide a strong rationale for why each of the optional scenario sets should be produced by Conning and model office tested by the NAIC rather than included in the field test. Yanacheak then asked if the Task Force had any objection to moving forward with the ACLI's recommended required scenario sets for the unaggregated field test, to which no Task Force members objected.

Yanacheak made a motion, seconded by Chou, to adopt the report of the GOES (E/A) Subgroup (Attachment Twenty-Eight) along with its Feb. 21, 2024 (Attachment Twenty-Nine), Feb. 14, 2024 (Attachment Thirty), Feb. 7, 2024 (Attachment Thirty-One), Jan. 31, 2024 (Attachment Thirty-Two), Jan. 24, 2024 (Attachment Thirty-Three), Jan. 17, 2024 (Attachment Thirty-Four), Jan. 10, 2024 (Attachment Thirty-Five), and Dec. 18, 2023 (Attachment Thirty-Six) minutes. The motion passed unanimously.

7. Discussed AG 53 Reporting

Andersen began a presentation (Attachment Thirty-Seven) on the regulator review of Actuarial Guideline LIII, Application of the Valuation Manual for Testing the Adequacy of Life Insurer Reserves (AG 53) reports. Serbinowski asked whether there was a plan to get more robust attributions of company excess spreads. Andersen said that on a company-by-company basis, some of the results were not intuitive. However, Andersen noted that in aggregating the company excess yield attributions, he felt that state insurance regulators were able to gain valuable information and detect outliers.

8. Heard a Presentation from the Academy on Asset-Intensive Reinsurance Ceded Offshore

Patricia Matson (Academy) and Alan Routhenstein (Academy) discussed a presentation on asset-intensive reinsurance ceded offshore (Attachment Thirty-Eight). Andersen thanked Matson and Routhenstein for the presentation, noting the extensive work that was done. Routhenstein replied that the Academy would be reviewing the recommendations proposed by the Task Force related to reinsurance and providing comment.

9. Discussed a Proposal to Require Asset Adequacy Analysis for Certain Reinsurance.

Andersen delivered a presentation on a proposal to require asset adequacy analysis for certain reinsurance transactions (Attachment Thirty-Nine). Eom highlighted an example of one of the motivations for potential changes, similar to what has been observed in practice, where a company could cede business and the offshore assuming reinsurer could hold an amount of reserves and capital under a foreign regulatory regime that would be less than the reserve liability under a moderately adverse environment according to U.S. standards. Serbinowski discussed another potential example where reserve differences between the U.S. and other jurisdictions could result from differing treatments of the cash surrender value (CSV) floor and asked whether that would be a cause for concern for state insurance regulators or simply a difference in standards. Andersen replied that Serbinowski's example was probably one of the leading causes of the reinsurance activity, and that performing asset adequacy analysis on a prudent best estimate basis for the ceded business could give regulators some comfort even with different treatments of the CSV floor. Eom added that state insurance regulators respect the assumptions and methodologies present in jurisdictions outside the U.S. for reserves and capital. Further, Eom stated that the goal of this proposal is not to make companies additionally hold the entire difference between jurisdictional reserves and/or capital - but rather the potential difference based on asset adequacy analysis.

Serbinowski asked whether the issues driving this proposal are related to the amount of assets required, or rather that the right type of assets are being held. Yanacheak said that he agreed with Serbinowski's comment and felt that getting to that answer would be critical to creating the right solution to state insurance regulators concerns around certain reinsurance transactions.

On the topic of level of aggregation for the asset adequacy analysis, Clark noted that there could be situations where more aggregation should be allowed and others where a more disaggregated level of analysis could be necessary in areas of particular concern to regulators. Clark further stated rather than getting approval to have less aggregation in the asset adequacy analysis, it should go the other way where a more aggregated level of analysis would be required, but a regulator could request more disaggregated analysis. Referencing the presentation given by Matson and Routhenstein, Yanacheak noted that the Bermuda Monetary Authority (BMA) does not allow aggregation unless it can be demonstrated that assets supporting multiple lines of business can be used across the entire block, and that he agreed with that principle.

Routhenstein (representing himself) noted that he was concerned that the Task Force was moving towards asset adequacy analysis as the singular solution to the reinsurance issues and instead recommended that the Task Force evaluate multiple approaches before moving ahead. Bayerle agreed with Routhenstein and noted potential issues that needed to be understood including issues with covered agreements and potentially exacerbating the insurance coverage gap. Bayerle further inquired whether any alternatives had been considered. Andersen noted that other potential solutions to asset adequacy analysis could be 1) a gross premium valuation with a reasonably conservative asset return and 2) calculating Commissioner's Annuity Reserve Valuation Method (CARVM) type reserves with more of a prudent best estimate policyholder behavior assumption. Bayerle questioned whether an asset adequacy analysis approach was necessary. Hemphill noted that the Task Force would like to solicit feedback from interested parties on asset adequacy as an approach or other approaches that could address regulators concerns.

Andersen thanked the Task Force and interested parties for the discussion and proposed that he prepare an exposure document with some questions and considerations for a potential solution based on the discussion.

10. Heard an Update from the SOA on Research and Education

Hall walked through an update from the SOA on its research and education initiatives (Attachment Forty). Ann Weber (SOA) then provided an update on the revisions to the SOA's Fellowship curriculum, noting that the SOA Board was reviewing the new learning objectives for planned implementation in 2026. Weber stated that this timeframe should allow sufficient time to hear feedback from regulators on the regulatory content.

11. Heard an Update from the Academy Council on Professionalism and Education

Lisa Slotznick (Academy), Laura Hanson (Actuarial Standards Board—ASB), and Shawna Ackerman (Actuarial Board for Counseling and Discipline—ABCD) jointly delivered the Academy Council on Professionalism and Education's update. Slotznick noted that the Academy has been preparing to provide input related to the request from the Task Force to develop life actuarial knowledge statements, and that there was a working draft of the knowledge statement that was not yet ready to share publicly. Hanson noted recent work on Actuarial Standards of Practice (ASOPs), including revisions to ASOP 24 on life insurance illustrations and the exposure of a brand new ASOP on pricing reinsurance for life, annuity, and long-duration health products. Ackerman noted that it was a busy 2023 for the ABCD, with over 120 requests for guidance.

12. Re-exposed APF 2024-01

Hemphill walked through the last version of APF 2024-01 that would define standards for Qualified Actuaries in the *Valuation Manual*. Bayerle spoke to the ACLI's comment letter (Attachment Forty-One). Carmello suggested an editorial change for the exposure.

Slutsker made a motion, seconded by Reedy, to expose APF 2024-01 (Attachment Forty-Two) with the editorial change suggested by Carmello for a 21-day public comment period ending April 8. The motion passed unanimously.

13. Heard an Update from the Academy Life Practice Council

Amanda Barry-Moilanen (Academy) delivered a presentation (Attachment Forty-Three) on the activities of the Academy Life Practice Council.

14. Re-exposed APF 2023-13

Leung provided background on APF 2023-13, which would allow non-U.S. mortality tables to be used in the *Valuation Manual* for non-U.S. lives. Bayerle noted some concerns with removing the optionality of being able to use a U.S. table rather than requiring a non-U.S. table be used for non-U.S. lives. Linda Lankowski (Reinsurance Group of America—RGA) noted that it was her company's intent in co-authoring APF 2023-13 to reserve using an appropriate table that reflected the experience of the non-U.S. lives.

Leung made a motion, seconded by Tsang, to expose APF 2023-13 (Attachment Forty-Four) for a 21-day public comment period ending April 8. The motion passed unanimously.

15. Discussed Other Matters

Hemphill noted that certain references in the *Valuation Manual* needed to be corrected and asked whether any Task Force members had concerns relating to the correction of the errors. No Task Force members objected.

Andersen then noted he was working on exposure language related to the proposal for asset adequacy analysis for certain reinsurance transactions and would be seeking comment on terminology, methodology and alternatives, materiality, aggregation, and retroactivity.

Yanacheak brought up a foundational issue with the *Valuation Manual* and whether it should accommodate many variations in practice from different companies or only minor deviations. If the former, Yanacheak noted that a central repository would be needed to allow other state insurance regulators to be notified of variations that are being considered by other state jurisdictions.

Having no further business, the Life Actuarial (A) Task Force adjourned.

SharePoint/NAIC Support Staff Hub/Committees/Member Meetings/A CMTE/LATF/2024-1-Spring/National Meeting/Minutes Packet/LATF Spring National Meeting Minutes.docx

Life Actuarial (A) Task Force
Virtual Meeting
February 29, 2024

The Life Actuarial (A) Task Force met Feb. 29, 2024. The following Task Force members participated: Cassie Brown, Chair, represented by Rachel Hemphill (TX); Lori K. Wing-Heier represented by Sharon Comstock (AK); Mark Fowler represented by Sanjeev Chaudhuri (AL); Ricardo Lara represented by Ahmad Kamil and Thomas Reedy (CA); Andrew N. Mais represented by Wanchin Chou (CT); Dana Popish Severinghaus represented by Vincent Tsang (IL); Amy L. Beard represented by Scott Shover (IN); Vicki Schmidt represented by Nicole Boyd (KS); Grace Arnold represented by Fred Andersen and Ben Slutsker (MN); Chlora Lindley-Myers represented by William Leung (MO); Eric Dunning represented by Michael Muldoon (NE); D.J. Bettencourt represented by Jennifer Li (NH); Adrienne A. Harris represented by Bill Carmello (NY); Judith L. French represented by Peter Weber (OH); Glen Mulready represented by Andrew Schallhorn (OK); Michael Humphreys represented by Steve Boston (PA); and Jon Pike represented by Tomasz Serbinowski (UT).

1. Adopted APF 2023-12

Andersen made a motion, seconded by Leung, to adopt amendment proposal form (APF) 2023-12. The motion passed unanimously.

2. Adopted APF 2024-02

Weber made a motion, seconded by Reedy, to adopt APF 2024-02. The motion passed unanimously.

Having no further business, the Life Actuarial (A) Task Force adjourned.

SharePoint/NAIC Support Staff Hub/Member Meetings/A CMTE/LATF/2024-1-Spring/LATF Calls/02 29/Feb 29 Minutes.docx

Life Actuarial (A) Task Force
Virtual Meeting
February 15, 2024

The Life Actuarial (A) Task Force met Feb. 15, 2024. The following Task Force members participated: Cassie Brown, Chair, represented by Rachel Hemphill (TX); Scott A. White, Vice Chair, represented by Craig Chupp (VA); Lori K. Wing-Heier represented by Sharon Comstock (AK); Mark Fowler represented by Sanjeev Chaudhuri (AL); Peni Itula Sapini Teo represented by Liz Perri (AS); Ricardo Lara represented by Ahmad Kamil (CA); Andrew N. Mais represented by Wanchin Chou (CT); Doug Ommen represented by Mike Yanacheak (IA); Dana Popish Severinghaus represented by Vincent Tsang (IL); Amy L. Beard represented by Scott Shover (IN); Vicki Schmidt represented by Nicole Boyd (KS); Grace Arnold represented by Fred Andersen and Ben Slutsker (MN); Chlora Lindley-Myers represented by William Leung (MO); D.J. Bettencourt represented by Jennifer Li (NH); Justin Zimmerman represented by Seong-min Eom and David Wolf (NJ); Adrienne A. Harris represented by Bill Carmello (NY); Judith L. French represented by Peter Weber (OH); Glen Mulready represented by Andrew Schallhorn (OK); Michael Humphreys represented by Steve Boston (PA) and Jon Pike represented by Tomasz Serbinowski (UT).

1. Discussed APF 2024-03

Andersen provided background on amendment proposal form (APF) 2024-03 (Attachment Two-A), noting that the primary goals of the amendment were to: 1) provide state insurance regulators with what is needed to review the reserves and solvency of life insurers; 2) steer clear of conflict with reciprocal jurisdiction and covered agreement issues; and 3) avoid unnecessary work for U.S. ceding companies where there is an immaterial risk. Tsang noted the potential for companies having to calculate stand-alone asset adequacy testing (AAT) for many treaties where they are ceding business and asked whether a deficiency determined in the testing for one treaty would be able to be offset by sufficiency in another treaty. Andersen noted that could be one of the questions up for additional discussion at the upcoming Spring National Meeting. Yanacheak noted some skepticism that this issue could be appropriately addressed through asset adequacy analysis and said this seems to be more of a credit for reinsurance issue. Leung said that some asset adequacy analysis standards may not be applicable on a gross basis, as the reinsurer is likely to have different assumptions than the ceding company.

Brian Bayerle (American Council of Life Insurers—ACLI) said that it feels like the Task Force is moving toward a solution without first fully identifying the problem and that this may not be a problem for the Task Force to solve. Bayerle further stated that the ACLI felt that exposing APF 2024-03 would limit the discussion to a narrow set of solutions rather than a broader potential set. Hemphill replied that the purpose of exposing APF 2024-03 would be to promote additional discussion and that the exposure would allow progress toward a concrete solution rather than just speaking high-level about the issue. Hemphill suggested including questions in the exposure to facilitate additional discussion.

After further discussion, the Task Force did not elect to expose APF 2024-03 and instead planned to discuss the issue further during the Spring National Meeting.

Having no further business, the Life Actuarial (A) Task Force adjourned.

SharePoint/NAIC Support Staff Hub/Member Meetings/A CMTE/LATF/2024-1-Spring/LATF Calls/02 15/Feb 15 Minutes.docx

Life Actuarial (A) Task Force/ Health Actuarial (B) Task Force
Amendment Proposal Form*

1. Identify yourself, your affiliation, and a very brief description (title) of the issue.

Identification:
Seong-min Eom, FSA, MAAA, Fred Andersen, FSA, MAAA, Ben Slutsker, FSA, MAAA, Rachel Hemphill, FSA, MAAA

Title of the Issue:
Establish asset adequacy analysis requirements for certain reinsurance.

2. Identify the document, including the date if the document is "released for comment," and the location in the document where the amendment is proposed:

VM-30 Subsections 2.C.4., 2.C.5., 3.A.5.a, 3.B.10.f., 3.B.10.g, and 3.B.11.f.

January 1, 2024 NAIC Valuation Manual

3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted, or changed by providing a red-line (turn on "track changes" in Word®) version of the verbiage. (You may do this through an attachment.)

Add the following subsection 2.C.4. as "Liabilities To Be Covered":

4. All business written or assumed by a United States life insurer shall be subject to the standards of asset adequacy analysis, as described in Section 2.B. Therefore, in addition to other applicable requirements in VM-30, asset adequacy analysis shall be completed on a gross of reinsurance basis for any business that is reinsured, whether through an alien reinsurance transaction or a domestic reinsurance transaction. For any business reinsured by an entity outside of the scope of VM-30, that business shall be tested on a standalone basis.

Add the following subsection 2.C.5 as "Liabilities To Be Covered":

5. If the appointed actuary determines, as the result of gross standalone asset adequacy analysis for any business that is reinsured by an entity outside the scope of VM-30, that a reserve should be held in addition to the aggregate reserve held by the company and calculated in accordance with the requirements set forth in the *Valuation Manual*, the company shall establish the additional reserve.

Revise the following within 3.A.5:

a. The additional reserves are the reserves established under Section 2.C.2 and 2.C.5.

Add the following subsections 3.B.10.f and 3.B.10.g under "the memorandum shall specify for assets":

f. If, under the terms of a reinsurance agreement, some of the assets supporting the reserve are held by the counterparty or by another party,

i. A description of the degree of linkage between the portfolio performance and the calculation of the reinsurance cash flows.

ii. The sensitivity of the valuation result to the asset portfolio performance.

g. To the extent that asset adequacy analysis is necessary pursuant to Section 2.C.4,

i. A comparison of the amount of assets held by the counterparty or other party to the assets included in asset adequacy analysis (note that these amounts should be the same).

ii. The investment strategy of the company holding the assets, as codified in the reinsurance agreement or otherwise based on current documentation provided by that company.

iii. Actions that may be taken by either party that would affect the net reinsurance cash flows (e.g., a conscious decision to alter the investment strategy within the guidelines).

Add the following subsection 3.B.11.f under "the memorandum shall specify for the analysis basis":

f. Description of how any business transferred through reinsurance was also tested on a gross of reinsurance basis. Note this should be provided as a sensitivity, in addition to providing asset adequacy analysis on a net of reinsurance basis. For any business reinsured, the memorandum shall also comply with the requirements of ASOP No. 11 and include disclosures as provided in Section 4 of ASOP No. 11.

i. For year-end 2026 and later, when asset or liability cash flows materially vary under different economic scenarios, the form of asset adequacy analysis should be cash-flow testing.

ii. For year-end 2025 asset adequacy analysis, depending on the circumstances including risk exposure, simplified asset adequacy analysis techniques may be appropriate for gross of reinsurance asset adequacy analysis, as noted in ASOP No. 22. If the appointed actuary has any questions on the appropriateness of the use of simplifications, they should inquire with the domiciliary commissioner.

[DRAFTING NOTE: For year-end 2025, the domiciliary commissioner may be recommended to consult with VAWG if addressing questions on simplification techniques. For year-end 2026, there may be consideration of requiring pre-approval for allowing the use of simplifying techniques. This will be determined after observing the effectiveness of company determination of the appropriateness of simplification techniques for year-end 2025.]

4. State the reason for the proposed amendment? (You may do this through an attachment.)

For state regulators to perform their core duty of solvency protection, information on reserve adequacy in light of material risks needs to be available, even if business is reinsured. The goal is to have asset adequacy analysis according to VM-30 standards available for state regulator review for all business written by U.S. life insurers.

Dates: Received	Reviewed by Staff	Distributed	Considered
2/12/24	S.O.		
Notes: 2024-03			

Life Actuarial (A) Task Force
Virtual Meeting
February 8, 2024

The Life Actuarial (A) Task Force met Feb. 8, 2024. The following Task Force members participated: Cassie Brown, Chair, represented by Rachel Hemphill and Francesco Ugo De Gobbi (TX); Scott A. White, Vice Chair, represented by Craig Chupp (VA); Lori K. Wing-Heier represented by Sharon Comstock (AK); Mark Fowler represented by Sanjeev Chaudhuri (AL); Ricardo Lara represented by Ahmad Kamil (CA); Andrew N. Mais represented by Wanchin Chou (CT); Doug Ommen represented by Mike Yanacheak (IA); Dana Popish Severinghaus represented by Vincent Tsang (IL); Amy L. Beard represented by Scott Shover (IN); Vicki Schmidt represented by Nicole Boyd (KS); Grace Arnold represented by Fred Andersen and Ben Slutsker (MN); Chlora Lindley-Myers represented by William Leung (MO); Eric Dunning represented by Michael Muldoon (NE); D.J. Bettencourt represented by Jennifer Li (NH); Justin Zimmerman represented by Seong-min Eom and David Wolf (NJ); Adrienne A. Harris represented by Bill Carmello (NY); Judith L. French represented by Peter Weber (OH); and Michael Humphreys represented by Steve Boston (PA).

1. Exposed APF 2024-02

De Gobbi walked through amendment proposal form (APF) 2024-02, which would correct an apparent omission to require documentation of governance in the VM-31, PBR Actuarial Report Requirements for Business Subject to a Principle-Based Valuation, for business subject to VM-21, Requirements for Principle-Based Reserves for Variable Annuities.

Chupp made a motion, seconded by Muldoon, to deem APF 2024-02 (Attachment Three-A) non-substantive and expose for a seven-day public comment period ending Feb. 15. The motion passed unanimously.

2. Discussed a Proposal to Require Asset Adequacy Analysis for Life and Annuity Reinsurance Transactions

Wolf provided background on a proposal to require asset adequacy analysis for life and annuity reinsurance transactions (Attachment Three-B). Wolf noted that over the past few years, regulators have seen an increase in reinsurance transactions both in the United States and offshore and that the proposal would require asset adequacy analysis on ceded business by treaty to give regulators more comfort in the solvency of their domiciled companies. Andersen added that this proposal was originally included in *Actuarial Guideline LIII—Application of the Valuation Manual for Testing the Adequacy of Life Insurer Reserves* (AG 53), but it was removed in order to expedite the adoption of the remaining requirements.

Tsang agreed that there was an issue with reinsurance, but he questioned how practical requiring asset adequacy analysis on ceded business would be to address the issue. Tsang added that the reinsurer would likely not manage a separate set of assets for a given cedent's business but instead would pool the business of multiple clients together. Bayerle said that he shared many concerns that were raised by Tsang and also questioned whether an assessment should be performed on AG 53 instead to see if the issues with reinsurance are already materially addressed. Andersen replied that there has been a lot of work reviewing the AG 53 reports, and there was a lot of room for improvement.

Having no further business, the Life Actuarial (A) Task Force adjourned.

SharePoint/NAIC Support Staff Hub/Member Meetings/A CMTE/LATF/2024-1-Spring/LATF Calls/02 08/Feb 08 Minutes.docx

Life Actuarial (A) Task Force/ Health Actuarial (B) Task Force
Amendment Proposal Form*

1. Identify yourself, your affiliation, and a very brief description (title) of the issue.

Identification:
Francesco Ugo De Gobbi, ASA, MAAA, Texas Department of Insurance

Title of the Issue:
VM-G applies to all PBR, but documentation on VM-G is only provided in the Life PBR Actuarial Report.

2. Identify the document, including the date if the document is "released for comment," and the location in the document where the amendment is proposed:

VM-31 Section 3.C.7 (to be deleted, and Sections 3.C.8 - 3.C.11 renumbered accordingly), VM-31 Section 3.B.6 (to be added, there are no subsequent sections to renumber)

January 1, 2024, NAIC Valuation Manual

3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted, or changed by providing a red-line (turn on "track changes" in Word®) version of the verbiage. (You may do this through an attachment.)

VM-31 Section 3.C.7 (to be deleted, and Sections 3.C.8 - 3.C.11 renumbered accordingly):

VM-31 Section 3.B.6 (to be added, there are no subsequent sections to renumber):

Governance – A statement indicating that governance documentation, including that required by VM-G Section 2.A.5, VM-G Section 3.A.6 and VM-G Section 4.A.3, is available upon request.

Deleted: Governance – A statement indicating that governance documentation, including that required by VM-G Section 2.A.5, VM-G Section 3.A.6 and VM-G Section 4.A.3, is available upon request.

Deleted: ¶

4. State the reason for the proposed amendment. (You may do this through an attachment.)

The VM-31 report is missing VM-G documentation for VM-21. VM-31 Section 3.C (Life Summary): numeral 7 has a requirement on Governance, but there is no corresponding requirement in VM-31, section 3.E (VA Summary). This APF is to correct that apparent omission. Rather than repeating the requirement in both the Life and Variable Annuity reports, moving the requirement to the Executive Summary is the most efficient way to ensure the documentation is available in all cases.

Note: We have performed a search of the current Valuation Manual, and there are no current references to VM-31 Sections 3.C.7 - 3.C.11 that need to be updated for this change.

Dates: Received	Reviewed by Staff	Distributed	Considered
01/24/24	K.K		
Notes: 2024 - 02			

TO: Life Actuarial (A) Task Force

FROM: David Wolf, Acting Assistant Commissioner, Office of Solvency Regulation, New Jersey Department of Banking and Insurance

Kevin Clark, Chief Accounting & Reinsurance Specialist, Iowa Insurance Division

RE: A Proposal to Require Asset Adequacy Analysis ("AAA") to be Performed using a Cash Flow Testing Methodology for Life and Annuity Reinsurance Transactions

DATE: February 5, 2024

State insurance regulators in various forums have discussed and identified the need to better understand what assets, reserves and capital are supporting long duration insurance business that relies heavily on asset returns ("asset-intensive business"). In particular, there is risk that domestic life insurers may enter into reinsurance transactions that materially lower the total asset requirement (the sum of reserves and required capital) in support of their asset-intensive business, and thereby facilitate releases of capital that prejudice the interests of their policyholders. Based on these discussions, the purpose of this letter is to propose enhancements to reserve adequacy requirements for life insurance companies by requiring that asset adequacy analysis (AAA) use a cash flow testing methodology that evaluates ceded reinsurance as an integral component of asset-intensive business.

The AAA requires reserves to be held at a level that meets moderately adverse conditions, or approximately one standard deviation beyond expected results. When a reinsurance transaction lowers the ceding insurer's reserves, the new reserves established by the reinsurer could be materially less than what would be needed to meet policyholder obligations under moderately adverse conditions in addition to providing an appropriate level of capital. The ceding company's Appointed Actuary might not recognize this insufficiency for the following reasons:

1. Some Appointed Actuaries believe that the requirements of AAA for reinsured business only require evaluation of the counterparty risk. So, if the counterparty is financially strong, no testing is done to assess whether the invested assets supporting the reserves are sufficient under moderately adverse conditions.
2. Some Appointed Actuaries may combine the reinsured business with other direct written business, so that the inadequacy in the reinsured business (and the associated shortfalls in the reinsurer's assets supporting that business) are offset by margins in the cedant's other lines of business.
3. Some Appointed Actuaries may not be able to obtain sufficient information from their reinsurers in order to do AAA, and therefore place reliance on the reinsurer to do so.

The ability of insurers to significantly lower the total asset requirement for long-duration blocks of business that rely heavily on asset returns appears to be one of the drivers of the significant increase in reinsurance transactions.

Regulators are concerned that the level of policyholder protection may be declining for the reasons outlined above. Therefore, this proposal intends to ensure that the AAA safeguard continues to apply within the domestic cedent for all business for which it remains directly liable to pay policyholder claims. This will ensure that the assets supporting reserves continue to be held based on moderately adverse conditions, whether those assets are held by the direct insurer or a reinsurer. Specifically, we recommend

the following requirements for all reinsurance transactions, including but not limited to long-duration business that is subject to material market or credit risks or is subject to material cash flow volatility.

1. AAA must be performed using a cash flow testing methodology.
2. AAA must be performed at the line of business and treaty level (so within each individual treaty, AAA must be performed standalone for life insurance, annuities, long duration health insurance, etc.).

These requirements could be incorporated into VM-30 via an Amendment Proposal Form (APF) or as an Actuarial Guideline.

Consequently, these requirements will allow for reserve levels, and associated supporting assets, that will be sufficient under moderately adverse conditions consistent with the minimum reserve requirements. This approach would also still allow companies to enter into reinsurance arrangements with reinsurers subject to various formulaic, economic or principles-based reserving standards, and would still allow for application of judgement by the Appointed Actuary in determining the methods and assumptions underlying the cash flow testing analysis.

In order to conform with these requirements, consideration should also be given to updating the *Life and Health Reinsurance Agreements Model Regulation* (#791) and *SSAP No. 61R—Life, Deposit-Type and Accident and Health Reinsurance* in the *Accounting Practices and Procedures Manual* to require reinsurance treaties to include the necessary information for the cedent to perform cash flow testing.

In order to move forward with the requirements proposed above, we recommend LATF consider drafting an Amendment Proposal Form for changes to VM-30. The APF could then be referred to the Reinsurance Task Force for consideration and support. Additional referrals may be necessary and/or desired to be made to the Statutory Accounting Principles Work Group, the Macroprudential Working Group and the Financial Stability Task Force.

Please let us know if you have any questions as LATF considers the proposal.

Sincerely,

David Wolf, Acting Assistant Commissioner, Office of Solvency Regulation, New Jersey Department of Banking and Insurance

Kevin Clark, Chief Accounting & Reinsurance Specialist, Iowa Insurance Division

Life Actuarial (A) Task Force
Virtual Meeting
February 1, 2024

The Life Actuarial (A) Task Force met Feb. 1, 2024. The following Task Force members participated: Cassie Brown, Chair, represented by Rachel Hemphill (TX); Scott A. White, Vice Chair, represented by Craig Chupp (VA); Mark Fowler represented by Sanjeev Chaudhuri (AL); Lori K. Wing-Heier represented by Sharon Comstock (AK); Ricardo Lara represented by Ahmad Kamil (CA); Andrew N. Mais represented by Wanchin Chou (CT); Doug Ommen represented by Mike Yanacheak (IA); Dana Popish Severinghaus represented by Vincent Tsang (IL); Amy L. Beard represented by Scott Shover (IN); Vicki Schmidt represented by Nicole Boyd (KS); Timothy N. Schott represented by Marti Hooper (ME); Grace Arnold represented by Fred Andersen and Ben Slutsker (MN); Chlora Lindley-Myers represented by William Leung (MO); Eric Dunning represented by Michael Muldoon (NE); D.J. Bettencourt represented by Jennifer Li (NH); Justin Zimmerman represented by Seong-min Eom (NJ); Adrienne A. Harris represented by Bill Carmello (NY); Judith L. French represented by Peter Weber (OH); Glen Mulready represented by Andrew Schallhorn (OK); Michael Humphreys represented by Steve Boston (PA); and Jon Pike represented by Tomasz Serbinowski (UT).

1. Adopted its 2023 Fall National Meeting Minutes

Chupp discussed three editorial changes that he wanted to be addressed in the Task Force's 2023 Fall National Meeting minutes packet.

Yanacheak made a motion, seconded by Weber, to adopt the Task Force's Fall National Meeting minutes with the editorial changes suggested by Chupp (see NAIC Proceedings – Fall 2023, Life Actuarial (A) Task Force). The motion passed unanimously.

2. Re-Exposed APF 2023-12

Andersen introduced amendment proposal form (APF) 2023-12, which would require that the volatility of equity investments be reflected in asset adequacy analysis. Craig Morrow (American Academy of Actuaries—Academy) (Attachment Four-A), Brian Bayerle (American Council of Life Insurers—ACLI) (Attachment Four-B), and Martin Mair (MetLife) (Attachment Four-C) walked through their groups' comment letters.

Andersen made a motion, seconded by Chupp, to re-expose APF 2023-12 for a 15-day public comment period ending Feb. 16. The motion passed unanimously.

3. Re-Exposed APF 2023-13

After Leung introduced APF 2023-13, which would allow international mortality tables to be used for international business reinsured in the U.S., Bayerle and Connie Tang (Retired) walked through their respective comment letters (Attachment Four-D and Attachment Four-E). Hemphill noted some concerns with the potential for companies to utilize a foreign mortality table without margins in their principle-based valuations. Leung replied that this could be considered during an additional exposure period.

Leung made a motion, seconded by Schallhorn, to re-expose APF 2023-13 for a 21-day public comment period ending Feb. 23. The motion passed unanimously.

Having no further business, the Life Actuarial (A) Task Force adjourned.

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

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

January 29, 2024

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

Re: APF 2023-12 (VM-30 Equity Return Volatility)

Dear Chair Hemphill:

The American Council of Life Insurers (ACLI) appreciates the opportunity to submit comments on APF 2023-12, which aims to clarify expectations on reflection of equity return volatility in VM-30 cash-flow testing.

We agree that the equity return volatility should be reflected in cash flow testing. We believe that Appointed Actuaries are best suited to determine the method to appropriately reflect asset-risk in cash-flow testing and thus want to ensure that the language in VM-30 is not overly prescriptive.

Therefore, we propose the following clarifications to subsection 3.B.7:

7. When the form of asset adequacy analysis is cash-flow testing, the actuary should analyze how the volatility of investment returns ~~assumptions~~ for equity-like instruments may affect the asset adequacy analysis results under ~~which may be expected in~~ moderately adverse conditions and shall not solely project the anticipated long-term average return (e.g., a single level assumption set to the long-term average) ~~but account for the volatility of such returns~~.

    a. ~~To accomplish the accounting for volatility, one or more of the following approaches may be employed, as appropriate~~ The following are examples of approaches that may be used to analyze the volatility of such returns:

i. Stochastic modeling for equity returns, with accompanying analysis of risk metrics.

ii. As relevant to capture the risk, including up, down, and/or volatile equity return scenarios for each given set of interest rate paths.

iii. Projecting one or more market drops, taking into consideration future points at which cash-flow testing results could be vulnerable to market downturns.

iv. Reflecting a level return assumption set equal to a tail risk metric, for example, setting investment returns to the average of the worst 30% of future scenarios, i.e., CTE70.

b. A qualitative description of why the equity return scenario used in asset adequacy analysis is moderately adverse in light of the company's portfolio should be provided.

ACLI previously commented on the definition of "equity-like instrument" and are appreciative of its inclusion in the latest exposure. While there is now alignment between the AG 53 Instructions and the APF, there is a disconnect in that certain Schedule BA assets are fixed income in nature and are assigned NAIC RBC charges consistent with bond-like assets. We suggest the following modification to the second bullet:

- Any assets that are captured on Schedule A or Schedule BA of the annual statement excluding bonds that receive bond-like designations.

Thank you very much for considering our feedback and we look forward to discussion.

Sincerely,

Colin Masterson

cc: Scott O'Neal, NAIC

January 29, 2024

Rachael Hemphill
Chair, NAIC Life Actuarial (A) Task Force
National Association of Insurance Commissioners

Re: APF 2023-12

Dear Chair Hemphill,

On behalf of the of the Life Valuation Committee of the American Academy of Actuaries[1] ("the committee"), thank you for the opportunity to comment on the re-exposure of APF 2023-12.

The committee supports a requirement to reflect the volatility of "equity-like Instruments" in VM-30 cash flow testing. The committee also supports documenting the approach used to reflect such volatility, along with the supporting rationale. However, we note that the APF includes specific examples of possible approaches. The committee suggests that it would be more appropriate to address possible approaches in a guidance note (within VM-30) and/or in a practice note rather than via specific examples in the APF. We encourage clarification that the examples are not prescriptive to allow for other possible approaches.

Practice notes offer examples of current and emerging approaches to actuarial tasks such as cash flow testing. The committee is updating the practice note on asset adequacy analysis and is planning to address this important topic, along with possible approaches.

Thank you for considering our comments. If you have any questions or would like further dialogue on the above topics, please contact Amanda Barry-Moilanen, life policy analyst, at barrymoilanen@actuary.org.

Sincerely,

Craig Morrow
Chairperson, Life Valuation Committee
American Academy of Actuaries

[1] The American Academy of Actuaries is a 20,000-member professional association whose mission is to serve the public and the U.S. actuarial profession. For more than 50 years, the Academy has assisted public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

MetLife

January 29, 2024

Via email

Scott O'Neal, NAIC Life Actuarial (A) Task Force

Re: APF 2023-12 on VM-30 Equity Return Volatility Assumptions

Dear Mr. O'Neal:

MetLife appreciates the opportunity to submit comments on APF 2023-12, which outlines a principles-based approach to setting insurer expections on reflecting equity return volatility in VM-30 cash-flow testing.

We support the principles-based standards set in APF 2023-12 as an appropriate mechanism for ensuring that AAT reserves are adequately conservative, meeting the "moderately adverse" standard. Guardrails on long-term AAT assumptions, including equity returns, ensure that asset allocations within the AAT framework appropriately reflect insurers' expected future balance sheets under a variety of scenarios.

Methodology Recommendation

The APF 2023-12 exposure requests comment on the preferred methodology for incorporating equity return volatility into AAT reserves. The APF offers four potential methodologies for consideration:

1. Stochastic modeling for equity returns, with accompanying analysis of risk metrics.

2. As relevant to capture the risk, including up, down, and/or volatile equity return scenarios for each given set of interest rate paths.

3. Projecting one or more market drops, taking into consideration future points at which cash-flow testing results could be vulnerable to market downturns.

4. Reflecting a level return assumption set equal to a tail risk metric, for example, setting investment returns to the average of the worst 30% of future scenarios, i.e., CTE 70.

MetLife's proposal reflects two salient characteristics of diversified equity returns:

1. Equity returns are relatively well-behaved and more predictable over the long term, i.e., holding periods of 20 years or longer. In general, equities are more suited to backing longer term, less liquid liabilities.

2. Different categories of equities (listed equities, private equity funds, hedge funds, etc.) have varying return and risk profiles and therefore should be modeled by category.

We propose that the CTE 70 methodology, combined with an interest rate dependency, (i.e., a combination of options 4 and 2 above) offers the most robust projection for equity returns in cashflow testing. At a high-level, this proposal could be implemented as follows:

1. Separate equity holdings into different categories

2. For each category, develop a long-term CTE 70 equity risk premium (ERP)

3. Add the ERP to the interest rates defined by the tested interest rate scenarios

4. Implement guardrails for shorter holding periods, (e.g., a demonstration that equity allocation does not exceed the value of long-tailed liabilities in the portfolio)

We believe that this principles-based approach can provide regulators robust and conservative equity return projections without adding significant operational complexity for insurers. Given the impactful nature of this topic, MetLife stands ready to discuss this proposal in greater detail to facilitate ongoing progress at LATF.

MetLife appreciates the opportunity to comment on APF 2023-12, and we look forward to continuing this constructive discussion. Please direct any questions on this letter to Ben Cushman, Head of Global Regulatory Policy, via email at ben.cushman@metlife.com.

Sincerely,

Bryan Boudreau
Executive Vice President and Chief Actuary
MetLife

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

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

January 29, 2024

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

Re: APF 2023-13 (Annuity mortality tables and non-US lives mortality)

Dear Chair Hemphill:

The American Council of Life Insurers (ACLI) appreciates the opportunity to submit comments on APF 2023-13 which proposes changes to VM-M regarding annuity mortality tables and non-U.S. lives mortality. ACLI has several suggestions to improve the APF which are outlined below and reflected as highlighted text in the accompanying draft APF.

The existing Section 1 and Section 2 apply to industry tables. Given the new tables will be constructed from a single company's data, we would suggest moving the optionality to create tables to a new Section 3. We do, however, think it would be beneficial to reflect existing country-specific tables, so we have retained language in Section 1 and Section 2 to allow for these tables.

The language around using own company data should reflect the optional nature of this approach, so we suggest changing "will" to "may."

We also have the following requests and recommendations:

- Regulators should clarify if all the policies in the block valued using a given table are required to have the same country of residence. Are immaterial numbers of policies with residences in other countries allowed? ACLI suggests allowing for accommodation around these issues.
- Given these tables could be used to value group contracts, we suggest adding "certificates" to scope.
- We recommend consistent treatment of international mortality in VM-20 and VM-22. The current draft of the VM-22 Standard Projection Amount points to the 1994 GAM table for international business.

Thank you once again for considering our comments and we look forward to a future discussion of this APF.

Sincerely,

Colin Masterson

cc: Scott O'Neal, NAIC

January 26, 2024

Rachel Hemphill
Chair, NAIC Life Actuarial (A) Task Force
National Association of Insurance Commissioners

Re: APF 2023-13

Dear Chair Hemphill,

Thank you for the opportunity to comment on APF 2023-13.

I believe that the conceptual changes proposed in the APF (i.e., the ability to use more relevant and appropriate mortality assumptions for non-US business) are consistent with valuation principles and would enhance reserving. However, I would like to submit some scope and technical / wording questions for your consideration.

Scope Questions

What is the intended scope of the APF?

- The APF modifies both Sections 1 and 2 of VM-M, so it seems to be attempting to address all prescribed mortality assumptions in VM-20 – i.e., both Net Premium Reserve (NPR) mortality and the industry tables used to derive Deterministic Reserve (DR) and Stochastic Reserve (SR) mortality assumptions.

  However, VM-20 NPR requirements specifically reference VM-M Section 1.G and 1.H, so VM-20 would need to be amended to reference the new VM-M Section 1.N (or VM-M Section 1, more broadly) to implement the new non-US mortality provision.

  It seems that VM-20, Section 9.C.3 may already allow some modifications to DR/SR mortality for non-US business, but this APF extends the modifications beyond industry tables by allowing for company experience. It may be helpful to add clarifying language or a guidance note to VM-20 for this change. (E.g., Editing VM-20, Section 9.C.3.a to reference VM-2 Section 2.C ("The industry basic table shall be based on the most recent VBT listed in VM-M Section 2 *or VM-M Section 2.C (if applicable)*….") or to note in either VM-20, Section 9.C.3.f or a new guidance note that for non-US business, modifications in VM-M Section 2.C may also be applied.)

  - VM-20, Section 9.C.3.f: "If no industry basic table appropriately reflects the risk characteristics of the mortality segment, the company may use any well-established industry table that is based on the experience of policies having the appropriate risk characteristics in lieu of an industry basic table."

  - VM-20, Section 9.C.3.b: "A modified industry basic table is permitted in a limited number of situations where an industry basic table does not appropriately reflect the expected mortality experience, such as joint life mortality, simplified underwriting, or substandard or rated lives. In cases other than modification of the table to reflect joint life mortality, the modification must not result in mortality rates lower than those in the industry basic table without approval by the insurance commissioner."

- While the APF adds selected annuity tables, I believe VM-M is currently used by only VM-20, so the APF, as written, would only affect life products. However, reflecting the most relevant assumptions for non-US business seems conceptually appropriate for *all products*. For example:

  - VM-22 with the 1994 GAR table (one of the tables added by the APF) is used for non-US pension risk transfer and longevity business. Does this APF contemplate non-US mortality provisions for existing VM-22 formulaic reserves and/or future VM-22 principle-based reserves (PBR)?

  - The 2012 IAM Basic Mortality Table is not included in the APF, but its use in the VM-21 Standard Projection and for stochastic reserve mortality assumption development when company experience is limited may or may not be appropriate for non-US business (although non-US business valued under VM-21 may currently be immaterial).

  - Non-US considerations may extend beyond mortality assumptions – e.g., prescribed assumptions for non-US disability benefits.

Technical / Wording Questions

- The APF states that the company "may" use mortality for the country of residence. Does this provide companies with the option to use US or country-specific tables, and is this primarily intended to avoid requiring non-US mortality (and extra work) if non-US mortality is more favorable than prescribed US mortality or for immaterial differences (e.g., immaterial mortality differences or immaterial block)?

  Note:
  - VM-20 Section 3.C.1.g for NPR already requires adjustments if anticipated experience exceeds the US CSO table (although there may be some ambiguity if non-US anticipated experience is less than US CSO but the relevant non-US industry table with appropriate margins exceeds US CSO).
  - In contrast, if this APF applies to formulaic (non-PBR) reserves, there would not be an existing requirement to adjust prescribed mortality when non-US experience is less favorable.

- VM-M Sections 1 and 2 use different language to describe when companies may develop their own mortality table and margin requirements. Is that intentional? (Do the requirements for NPR mortality and DR/SR mortality blending differ, and if so, is that necessary?)

- Section 1 allows the company to develop its own table "in the *absence* of an industry table" while Section 2 allows for the development of a table "if a *relevant* industry table is not available."

- Section 1 requires “margins consistent with the purpose of US statutory reserve methods” while Section 2 requires margins “equivalent to the difference between the company’s anticipated mortality for US business and the VBT table used for its US business.”

Allowing a company to develop non-US assumptions in the absence of a *relevant* industry table (i.e., the Section 2 language) seems conceptually preferable. A non-US industry table may exist but still not be appropriate due to material population differences. In jurisdictions that rely on modeled reserves with company-specific assumptions, there may be industry *reference* tables that are designed to be modified based on the characteristics of the business and anticipated experience – e.g., X% of the industry reference table. Section 1 might be interpreted as requiring the use of 100% of the industry table in both cases because *an industry table exists*.

For margins, Section 1’s emphasis on “consistency” may be clearer. Depending on the interpretation of the word “equivalent,” a literal reading of Section 2 might suggest taking margins directly from the company’s US business (i.e., VBT - Anticipated Experience for a US block). However, developing margins according to the same *underlying principles and considerations* as US margins for each specific purpose (i.e., CSO valuation table for Section 1, best estimate / basic table for Section 2) would be more appropriate than directly using US values since US and non-US blocks may have very different target markets, types / levels of underwriting, and different levels of credibility (e.g., large US block with decades of experience vs. tiny, new non-US block). (As a practical matter, the company may not even have a US block for the particular product, or the exact numerical difference between the VBT and anticipated experience may differ across their various US blocks.)

Thank you for your consideration, and please let me know if you have any questions.

Sincerely,
Connie Tang

Life Actuarial (A) Task Force
Virtual Meeting
January 25, 2024

The Life Actuarial (A) Task Force met Jan. 25, 2024. The following Task Force members participated: Cassie Brown, Chair, represented by Rachel Hemphill (TX); Scott A. White, Vice Chair, represented by Craig Chupp (VA); Lori K. Wing-Heier represented by Sharon Comstock (AK); Mark Fowler represented by Sanjeev Chaudhuri (AL); Peni 'Ben' Itula Sapini Teo represented by Liz Perri (AS); Ricardo Lara represented by Ahmad Kamil (CA); Andrew N. Mais represented by Wanchin Chou (CT); Dana Popish Severinghaus represented by Vincent Tsang (IL); Amy L. Beard represented by Scott Shover (IN); Vicki Schmidt represented by Nicole Boyd (KS); Timothy N. Schott represented by Marti Hooper (ME); Grace Arnold represented by Fred Andersen and Ben Slutsker (MN); Chlora Lindley-Myers represented by William Leung (MO); Eric Dunning represented by Michael Muldoon (NE); D.J. Bettencourt represented by Jennifer Li (NH); Justin Zimmerman represented by Seong-min Eom (NJ); Adrienne A. Harris represented by Bill Carmello (NY); Judith L. French represented by Peter Weber (OH); Glen Mulready represented by Andrew Schallhorn (OK); Michael Humphreys represented by Steve Boston (PA); and Jon Pike represented by Tomasz Serbinowski (UT).

1. Adopted APF 2023-11

Hemphill walked through amendment proposal form (APF) 2023-11, noting that the intention of the changes was to ensure that references in the *Valuation Manual* (VM) were consistent with the purpose of risk-based capital (RBC). Brian Bayerle (American Council of Life Insurers—ACLI) addressed the ACLI's comment letter (Attachment Five-A), noting its support for adoption of APF 2023-11.

Chupp made a motion, seconded by Leung, to adopt APF 2023-11. The motion passed unanimously.

2. Exposed APF 2024-01

Hemphill introduced APF 2024-01, which would define the term "qualified actuary" in the VM. Rhonda Ahrens (Thrivent) stated she was concerned with the potential of the new definition requiring all qualified actuaries performing work on different lines of business to meet the appointed actuary requirements when that may not be necessary. Hemphill noted that was not the intention of the APF and that the Task Force was open to suggested edits.

Andersen made a motion, seconded by Chupp, to expose APF 2024-01 (Attachment Five-B) for a 30-day public comment period ending Feb. 21. The motion passed unanimously.

3. Discussed a Memorandum on Permitted Practices

Hemphill walked through a memorandum (Attachment Five-C) from the Statutory Accounting Principles (E) Working Group that clarified that permitted practices shall not be used to deviate below the VM minimums. Shover asked whether permitted practices that clarified a vague reserve standard would be allowed. Hemphill responded that a Valuation Analysis (E) Working Group meeting would be the appropriate forum to address those questions. Serbinowski noted the difficulty in determining what is included in the VM for purposes of the memorandum, providing the example of references to actuarial guidelines and whether permitted practices would be allowed by those actuarial guidelines. Hemphill replied that NAIC legal staff could look to provide a response on items referenced in the VM and whether permitted practices would be allowed on those items.

Tsang asked whether the restrictions on permitted practices for RBC applied to just the formula and associated factors or if they applied to any permitted practice that changed the required capital amount. Hemphill said that permitted practices were not allowed on any factor or formula that would directly alter the RBC framework.

Having no further business, the Life Actuarial (A) Task Force adjourned.

SharePoint/NAIC Support Staff Hub/Member Meetings/A CMTE/LATF/2024-1-Spring/LATF Calls/01 25/Jan 25 Minutes.docx

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

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

November 17, 2023

Rachel Hemphill
Chair, National Association of Insurance Commissioners (NAIC) Life Actuarial (A) Task Force (LATF)

Re: APF 2023-11 (RBC Consistency)

Dear Chair Hemphill:

The American Council of Life Insurers (ACLI) appreciates the opportunity to submit comments on APF 2023-11, which proposes removing references to RBC in VM-20 and VM-21 that are inconsistent with the purpose, scope, and intended use of RBC in alignment with improvements made in related Sections of the VM-22 draft.

ACLI has no objections to this APF and we support its adoption at a future session of LATF.

Sincerely,

B Bayerle Colin Masterson

cc: Scott O'Neal, NAIC

Life Actuarial (A) Task Force/ Health Actuarial (B) Task Force
Amendment Proposal Form*

1. Identify yourself, your affiliation, and a very brief description (title) of the issue.

Identification:
Rachel Hemphill, PhD, FSA, FCAS, MAAA

Title of the Issue:
Qualified Actuaries should meet the special qualification standards, in addition to Appointed Actuaries.

2. Identify the document, including the date if the document is "released for comment," and the location in the document where the amendment is proposed:

VM-01 definition of "Qualified Actuary"

January 1, 2024 NAIC Valuation Manual

3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted, or changed by providing a red-line (turn on "track changes" in Word®) version of the verbiage. (You may do this through an attachment.)

VM-01 definition of "Qualified Actuary":

- The term "qualified actuary" means an individual who is qualified to sign the applicable statement of actuarial opinion in accordance with the Academy qualification standards for actuaries signing such statements and who meets the requirements specified in the Valuation Manual.

  A qualified actuary must meet the specific qualification standard for providing a NAIC Annual Statement Opinion.

Deleted: (Model #820 definition.)

4. State the reason for the proposed amendment? (You may do this through an attachment.)

For reference, the Model 820 Definition of qualified actuary is:

- The term "qualified actuary" means an individual who is qualified to sign the applicable statement of actuarial opinion in accordance with the American Academy of Actuaries qualification standards for actuaries signing such statements and who meets the requirements specified in the valuation manual.

Currently, the VM-01 definition of qualified actuary just reiterates that definition. But, as Model 820 specifically calls out "who meets the requirements specified in the valuation manual" adding the specific language is consistent with Model 820.

It is surprising that this is not already the requirement. The complexity of PBR and the reliance on the PBR actuary calls for this requirement, but the United States Qualification Standard (USQS) currently only requires the specific qualification standard for an appointed actuary, not a qualified actuary. The American Academy of Actuaries noted the USQS states that the NAIC or individual states may have additional requirements. So, a change to the Valuation Manual is needed to ensure PBR actuaries have the 15 hours of specific continuing education and the more detailed basic education (which can be based on exams or self-study).

While most qualified actuaries likely already are satisfying this requirement and some may have interpreted this as the current requirement (and some serve as appointed actuaries as well), this clarification is important where regulators have identified some companies whose qualified actuaries are not as knowledgeable as they need to be. This change will be consistent with feedback given by regulators to those qualified actuaries regarding ongoing education.

This requirement would also apply for the qualified actuary who provides the Qualified Actuary on Investments certification, which may not be one of the qualified actuaries providing the PBR sub-reports. Again, given the complexity and reliance on this qualified actuary, the specific qualification standard is appropriate.

Dates: Received	Reviewed by Staff	Distributed	Considered
12/08/2023	K.K		
Notes: 2024-01			

MEMORANDUM

TO: Cassie Brown, Chair of the Life Actuarial (A) Task Force

FROM: Dale Bruggeman, Chair of the Statutory Accounting Principles (E) Working Group

DATE: January 12, 2024

RE: Permitted and Prescribed Practices for Statutory Accounting

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This memorandum was prepared to address questions that have been received regarding permitted and prescribed practices for statutory accounting. The beginning of the year is when most permitted practices are requested and approved, so we wanted to take this opportunity to reiterate key aspects and the permitted practice notification requirement.

A prescribed accounting practice is a practice that differs from the NAIC *Accounting Practices and Procedures Manual* (AP&P Manual) incorporated directly by reference to state laws, regulations and general administrative rules applicable to all insurance enterprises domiciled and/or licensed in a particular state. The "State Prescribed Differences from NAIC Statutory Accounting Principles" is a free publication available on the NAIC website that compiles prescribed practices across the states. Although prescribed practices shall be detailed in Note 1, there is no notification requirement to inform about prescribed practices to other states.

A permitted practice is an individual company request for an accounting practice that departs from the AP&P Manual or a state prescribed accounting practice. States that are considering approval of a permitted practice should provide notice to all states that the company is licensed in. The Preamble of the AP&P Manual details the full notification requirements, but domiciliary states shall provide at least 5 days after providing notice of a permitted practice before approving. The notification requirement intends to allow communication across states before approving a permitted practice request. The NAIC "Permitted Practices for Accounting" database in iSite+ can assist with providing the required notification. All permitted practices shall also be detailed in Note 1.

To clarify recent questions, permitted practices are only intended to address departures from statutory accounting principles detailed in the AP&P Manual or from state prescribed accounting practices, therefore:

- **Permitted practices shall not be used to deviate below the Valuation Manual minimums as adopted by statute.**
- **Permitted practices shall not be used to directly adjust or modify RBC.**

March 14, 2024

From: Fred Andersen, Chair
Indexed Universal Life (IUL) Illustration (A) Subgroup

To: Rachel Hemphill, Chair
The Life Actuarial (A) Task Force

Subject: The Report of the Indexed Universal Life (IUL) Illustration (A) Subgroup (IUL Illustration SG) to the Life Actuarial (A) Task Force

The IUL Illustration SG has not met since the adoption of group's main work product, revisions to Actuarial Guideline 49A, by the Life Actuarial (A) Task Force on December 11, 2022. The revisions to Actuarial Guideline 49A were subsequently adopted by the NAIC's Executive (EX) Committee and Plenary at the Spring National Meeting on March 25. Regulators are reviewing the impact of the Guideline revisions on the market.

March 14th, 2024

From: Seong-min Eom, Chair
The Longevity Risk (E/A) Subgroup

To: Rachel Hemphill, Chair
The Life Actuarial (A) Task Force

Subject: The Report of the Longevity Risk (E/A) Subgroup to the Life Actuarial (A) Task Force

The Longevity Risk (E/A) Subgroup has not met since the 2023 Fall National Meeting. The subgroup will resume the meetings once the currently exposed VM-22 PBR methodology is finalized and adopted to develop and recommend longevity risk factor(s) for the product(s) that were excluded from the application of the current longevity risk factors.

VM-22 Field Test Specifications: A Presentation by the American Academy of Actuaries' Annuity Reserves and Capital Sub-Committee (ARCS)

NAIC Life Actuarial Task Force
March 14, 2024
Phoenix, AZ

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Introduction

ARCS has been actively supporting LATF's efforts to implement PBR in VM-22

1. June 2020: Presentation to the NAIC VM-22 Subgroup on the preliminary framework elements for Fixed Annuity PBR
2. On more than 10 occasions, ARCS has submitted presentations and/or comment letters with discussions of VM-22 elements
3. In 2021-2022, ARCS engaged WTW to assist in developing reasonable assumptions for the Standard Projection Amount:
    a) Final report of their work was presented to VM-22 work group in 2022.
    b) ARCS and WTW representatives participated in meetings of the various workstreams of the VM-22 work group during 2022.

Now working to assist LATF in preparing for the field test of VM-22

A. June 2022: ARCS drafted preliminary specifications for the field test, complete with a template for the collection of data

B. December 2023: [LATF or VM-22 Subgroup) exposed the draft preliminary specifications for public comment

C. December 2023: Academy joined with NAIC and ACLI in engaging EY to:
    a) Assist all parties in the preparation for, conduct of, and analysis of the field test results.
    b) EY will also develop a model office implementation of the VM-22 specifications, usings results from that model office to compare results with those from the field test and to assess products and/or scenarios which might be difficult for participants in the field test.

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Introduction (cont.)

First Task: prepare field test specifications for presentation to LATF and public exposure

January 2024: EY reviews preliminary draft specifications from ARCS, providing comments and suggestions to the three parties.

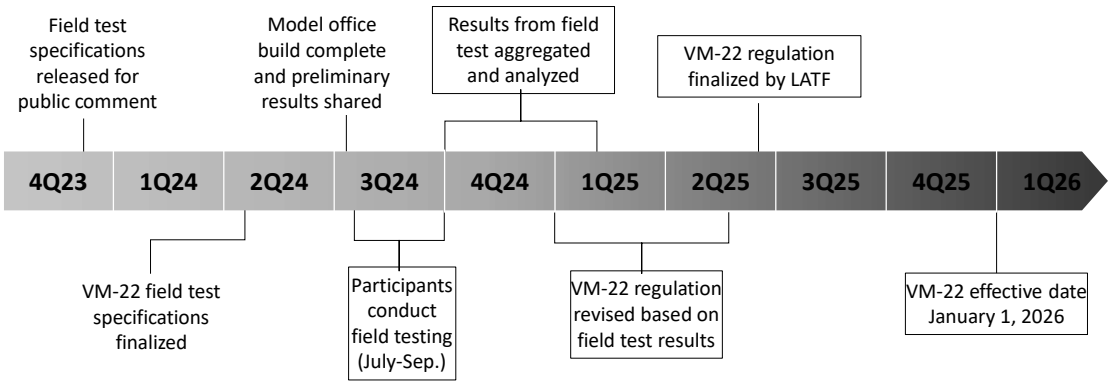
February 2024: NAIC, ACLI, Academy and EY representatives meet weekly to review specifications and seek consensus.

- The draft specifications circulated with the materials for this meeting are the product of those meetings.
- We will now hear from EY which, after introducing the overall timeline expected for this VM-22 work, will talk through the highlights of the specifications which ARCS has submitted for LATF's consideration.

3

Target VM-22 Timeline

VM-22 field test timeline and key milestones are provided below:



4

Overview of Field Test Specifications

Key objectives of the field test include the following items:

Measurement of Business Impacts

Measure the impact on actual business of the proposed reserve and capital frameworks relative to the current standards to ensure frameworks are working as intended.

Uphold Principles

At a high-level, ensure pillars of framework are met:

- Appropriate Reflection of Risk
- Comprehensive
- Consistency Across Products
- Practicality and Appropriateness

Assess Open Design Decisions

Test the impact of key open VM-22 design decisions:

- Aggregation
- Reinvestment guardrail mix
- Stochastic Exclusion Ratio Test threshold
- Standard Projection Amount (SPA) assumptions

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Overview of Field Test Specifications (cont.)

In-scope product classes:

Deferred Annuities with Guaranteed Living Benefits	Deferred Annuities without Guaranteed Living Benefits	Payout Annuities
• Fixed Indexed Annuities (FIAs) with GLBs • Fixed Deferred Annuities (FDAs) with GLBs	• FIAs without GLBs • FDAs without GLBs	• Single Premium Immediate Annuities (SPIAs) • Pension Risk Transfer (PRT) • Deferred Income Annuities (DIAs) • Structured Settlement Contracts (SSCs)

All results should be consolidated and summarized in total and by each of these three product categories

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Overview of Field Test Specifications (cont.)

Other Specifications:

Populations

- At least 10 years of actual in-force business
- 12/31/2023 valuation date

Assumptions

- Asset assumptions as outlined currently in draft VM-22
- Companies must set prudent estimate assumptions for mortality, policyholder behavior, expenses, hedging, etc.
- Companies must set and disclose margins, or use suggested margins provided
- Standard Projection Amount assumptions and GOES scenarios to be determined before field test begins

Required Metrics

- CARVM and C3P1
- Scenario reserves
- Exclusion test
- Standard projection amount
- Sensitivities
- Survey questions
- Projected reserves (if possible)

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Overview of Model Office

EY will be developing a Moody's AXIS-based model office to support the field test

Overview

Model office specifications were recently finalized, after rounds of discussions between EY, NAIC, ACLI and Academy personnel. The specifications were also refined as per feedback provided by ACLI member companies and ARCS.

Objectives

- Produce results to analyze VM22 framework on a **representative set of products**, under various sensitivities and scenarios
- Provide **first cut of analysis** in advance of field test commencement, to get ahead of any unexpected test-related results or issues
- Perform further ad-hoc analysis and sensitivities to **lighten the load** on the number of runs being demanded of industry participants
- **Establish a forum** with industry participants while field test is in progress, to triage emerging issues and provide support
- Assess products, scenarios or projections **which may not be feasible** for participants in the field test

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Overview of Model Office (cont.)

Model office specifications

The table below provides a summary of the model office product chassis that will be built, as per the agreed-upon specifications:

Product Class	Product Features	Notable BE Assumptions	Common Elements

FDA	• 5-year surrender charge period, with MVA
	• Crediting based on Treasury minus spread, subject to GMIR
		• Dynamic lapses based on rate competitiveness	• Valuation date: 12/31/2023
			• 10 years of in-force business modeled (2014-2023)
			• Standard Projection Amount assumptions modeled as currently proposed/specified
			• The following will be built as per field test specs:
			  • Asset assumptions and investment guardrails
			  • Prudent margins
			  • Hedging
			  • Exclusion testing
			  • Pre-PBR measures for comparison
			• No reinsurance will be modeled

	• 10-year surrender charge period, no MVA • Guaranteed Lifetime Withdrawal Benefit (GLWB) with 10-year rollup period and explicit charges • Crediting based on Treasury minus spread, subject to GMIR	• Dynamic lapses based on WB ITM • WB utilization distributed by attained age, duration and Q/NQ	
FIA	• 5-year surrender charge period, no MVA • Crediting based on 1 year S&P PtP, with OB equal to Treasury minus spread	• Dynamic lapses based on rate competitiveness	
	• 10-year surrender charge period, no MVA • GLWB with 10-year rollup period and explicit charges • Crediting based on 1 year S&P PtP, with OB equal to Treasury minus spread	• Dynamic lapses based on WB ITM • WB utilization distributed by attained age, duration and Q/NQ	
SPIA	• 10 year period certain, with life thereafter	• 2012 IAM mortality, with 0.5% improvement from 2012 base	
PRT	• Multiple sub-blocks representing different mixes of deferred and retirees	• Group mortality table from SPA assumptions to be used	

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Next steps and how to prepare

Next steps for the VM-22 field test

- Field test specifications will be released for another public comment period through April 15th
- The NAIC will be requesting company participation in the field test, beginning now through April 28th
- EY will continue working with the NAIC, ACLI, and the Academy to develop a model office

Companies should begin preparing for the field test if they haven't already

- How much of your business will be in scope?
- Do you have a plan and the resources needed to participate in the field test?
- What existing models can you leverage (VM-21, pricing, etc.)?
- What assumptions and margins will you use?
- How will you model hedging?
- Do you have projected reserve capabilities?
- How will you educate your teams about VM-22?
- How will you communicate expected impacts to company leadership?

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Questions or Comments?

Please contact:

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

Steve Jackson (sjackson@actuary.org)
Director of Research (Public Policy)
American Academy of Actuaries

American Academy of Actuaries

11

March 14, 2024

From: Ben Slutsker, Chairperson
Elaine Lam, Vice Chairperson
The VM-22 (A) Subgroup

To: Rachel Hemphill, Chair
The Life Actuarial (A) Task Force

Subject: The Report of the VM-22 (A) Subgroup to the Life Actuarial (A) Task Force

The NAIC VM-22 (A) Subgroup has met three times since the Fall meeting. The focus of these calls have continued to be on liability assumptions for the Standard Projection Amount (SPA) and VM-31 disclosures. In addition, the Subgroup has since welcomed Elaine Lam (CA) as Vice Chairperson of the Subgroup and Chairperson of the VM-22 SPA policyholder behavior assumptions drafting group.

For the SPA liability assumptions, recent discussions have primarily focused on mortality and dynamic lapse assumptions. Over December and January, there was an exposure of the drafting group dynamic lapse assumption proposal, with additional comparisons to an Academy proposal and the New York Special Considerations Letter methodology. The Subgroup anticipates discussing comments on this exposure in the coming month. In addition, the Subgroup also plans to hear a proposal from the drafting group on non-indexed fixed deferred annuity surrender assumptions. Once the remaining liability assumptions are discussed, there will be an exposure of the VM-22 SPA requirements with a full set of tentative assumptions. These assumptions will then be further tested during the VM-22 field test.

VM-31 disclosures, VM-G governance requirements, and a supplement blank for the Annual Statement have also been discussed in the VM-22 Subgroup recently. Comments from an exposure last fall will continue to be a key topic on upcoming calls. Some of the main issues being discussed are non-guaranteed element disclosures, a section on payout annuities that automatically pass the exclusion test, and whether to make a separate VM-31 section for non-variable annuities.

After VM-31 disclosures and SPA assumptions are discussed, the VM-22 Subgroup will turn its attention to the upcoming VM-22 field test. This is a joint field test sponsored by the NAIC, American Academy of Actuaries, and ACLI scheduled to take place this summer. EY has been hired as a consultant to manage the field test and help analyze results. Field test specifications will be further discussed during the Life Actuarial (A) Task Force session at the National Meeting in March.

The goal for the Subgroup continues to be adoption for an initial effective date of 1/1/2026, accompanied by a three year implementation period that ends on 1/1/2029, after which PBR will become mandatory for non-variable annuity contracts on a prospective basis.

Draft: 3/6/24

Valuation Manual (VM)-22 (A) Subgroup
Virtual Meeting
February 28, 2024

The VM-22 (A) Subgroup of the Life Actuarial (A) Task Force met Feb. 28, 2024. The following Subgroup members participated: Ben Slutsker, Chair (MN); Elaine Lam, Vice Chair (CA); Lei Rao-Knight (CT); Mike Yanacheak (IA); Vincent Tsang (IL); Nicole Boyd (KS); William Leung (MO); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill and Iris Huang (TX); and Tomasz Serbinowski (UT).

1. Discussed Comments Received on the VM-G Draft

Slutsker said the Subgroup would be discussing comments received on the VM-G, Appendix G—Corporate Governance Guidance for Principle-Based Reserves draft exposed with edits for VM-22, Requirements for Principle-Based Reserves for Non-Variable Annuities draft. Slutsker clarified that the VM-G draft exposed on Nov. 15, 2023, appeared to mark Section 4.A.3.b as new language. However, it was a recent addition to the 2024 Valuation Manual and was included in the draft along with the proposed edits to ensure VM-G was current. Slutsker discussed the American Council of Life Insurers (ACLI) comment that recommends removing the language regarding the responsibilities of qualified actuaries to notify senior management when the company may not be able to use the alternative methodology for all VM-21 business. Hemphill provided several situations where a qualified actuary may find in the coming years that the company may become unable to use the alternative methodology and should be having conversations with management. Hemphill described how Sections 4.A.3.a and 4.A.3.b would apply, noting the language in the draft is appropriate as written. Hemphill noted that drafting carve-outs on governance should be done in a way that does not apply in situations where senior management should have awareness and oversight in ensuring adequate infrastructure. The Subgroup decided to retain the language in the VM-G draft.

2. Discussed Comments Received on the VM-22 Reserves Supplement Blank

Brian Bayerle (ACLI) spoke to the ACLI's comment questioning whether the VM-22 reserving categories and the more granular categories in the VM-22 Reserve Supplement Blank (Supplement) may cause some confusion for companies. Slutsker recommended adding a footnote to clarify that the reserving categories for aggregation purposes are different than the categories requested in the Supplement. The Subgroup decided to add a footnote as suggested and discuss it at a future meeting.

Bayerle and Bruce Friedland (American Academy of Actuaries—Academy) noted the line descriptions for accumulation type and payout type contract categories both use the term "deferred annuities," which may cause confusion. Carmello suggested using industry terminology, such as deferred income annuities. The Subgroup agreed to update the line descriptions for payout annuities to refer to immediate and deferred income annuities.

Slutsker introduced ACLI's next comment which questions if the Standard Projection Amount (SPA) column should instead be the Additional Standard Projection Amount (ASPA). Slutsker said the SPA column was intentionally included so regulators could see how the calculations work. Tim Ritter (Jackson National Life Insurance) noted that if the SPA for VM-22 worked the same way as in VM-21, then the comparison is not made directly between the stochastic reserve and the SPA. Ritter described the VM-21 SPA process and noted that the ASPA is what impacts the final reported reserve. Slutsker recommended changing the Supplement to report ASPA. Hemphill noted that for regulators reviewing PBR Actuarial Reports, it would be helpful to also have the Prescribed Projections Amount and Buffer Amount columns to make analysis easier. Slutsker noted that the size of the

Supplement could get large and may require splitting across multiple pages. The Subgroup agreed to add additional columns to the draft and discuss them during a future meeting.

3. Discussed Comments Received on the VM-31 Draft

Slutsker said the Subgroup would be discussing comments received on the VM-31, PBR Actuarial Report Requirements for Business Subject to a Principle-Based Valuation, draft exposed with edits to include references to the proposed VM-22 draft.

Slutsker introduced ACLI's comment regarding the structure of the VM-31. Slutsker stated that while VM-21 and VM-22 products cannot be aggregated, there are a lot of the same required disclosures, and that was the intent behind having one annuities section in VM-31. Bayerle noted that while one annuity section may reduce duplication, it may cause confusion for companies with different qualified actuaries working on VM-21 and VM-22. Bayerle suggested it may be more practical to have the disclosure requirements for VM-22 separate from VM-21. Lam noted the substantial overlap in disclosure requirements may create challenges in maintaining consistency across separate sections every time a change is made. The Subgroup decided to continue discussing the benefits during a future meeting.

Slutsker described the Academy's suggestion to modify the VM-22 changes in the reserves table in the summary report to show the account value by separate account, general account, and total. Slutsker noted this information could be helpful to PBR Actuarial Report reviewers, and Carmello agreed. The Subgroup decided to show the account value decomposition as described in the comment.

Bayerle stated that the contract loans disclosure requirement was in the liability section of VM-31 draft and suggested it be included in the assets section of the Annuity Report. Lam said that policy loans under VM-20 are disclosed in the assets section for life reports under VM-31. Carmello suggested VM-31 be consistent between the life and annuities sections regarding where to put the contract loans disclosures. The Subgroup agreed to be consistent with what was done for life under VM-31.

Slutsker said the Subgroup will discuss the remaining comments on the VM-31 draft during a future meeting.

Having no further business, the Valuation Manual (VM)-22 (A) Subgroup adjourned.

Draft: 3/6/24

Valuation Manual (VM)-22 (A) Subgroup
Virtual Meeting
January 31, 2024

The VM-22 (A) Subgroup of the Life Actuarial (A) Task Force met Jan. 31, 2024. The following Subgroup members participated: Ben Slutsker, Chair (MN); Elaine Lam, Vice-Chair (CA); Mike Yanacheak (IA); Vincent Tsang (IL); Nicole Boyd (KS); William Leung (MO); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill and Iris Huang (TX); and Craig Chupp (VA).

1. Heard Updates on Mortality Assumptions for the SPA

Eom said that the VM-22 SPA Mortality Drafting Group, the American Academy of Actuaries (Academy) Annuity Reserves and Capital Work Group, the Society of Actuaries (SOA) Group Annuity Experience Committee (Group Annuity Committee), SOA Individual Annuity Experience Committee, state insurance regulators, and industry subject matter experts developed these VM-22, Requirements for Principle-Based Reserves for Non-Variable Annuities, standard projection amount (SPA) mortality assumptions. Eom emphasized that even if these assumptions are exposed, modified, and adopted for the field test, there will be opportunities to finalize them for the VM-22 implementation.

2. Heard a Presentation on VM-22 SPA Group Annuity Mortality Assumptions

Kristin Gustafson (SOA) presented the group annuity mortality joint recommendation (Attachment Eleven-A) of the SOA's Group Annuity Committee and the Academy's Annuity Reserves and Capital Work Group. Chupp asked if there would be separate tables for blue-collar and white-collar, and a total PRI 2012 Private Retirement Plans Mortality Table (PRI-2012). Gustafson clarified the recommendation for the blue-collar and white-collar guidance provided is referenced from the SOA Retirement Plans Experience Committee (RPEC) PRI-2012 Report. Gustafson said the proposal would allow companies to either assign blue-collar or white-collar on a contract-by-contract basis (or a weighted basis across the block based on company-specific in-force population) or use the total table. Eom noted the drafting group will need to refine the language to provide flexibility but allow for the opportunity to split depending on the population.

Carmello noted that the drafting group appears to be leaning towards blue-collar and white-collar splits even though there was not enough credibility to have such splits in SOA Group Annuity Committee studies. Gustafson said the Group Annuity Committee studies have had union and non-union identifiers, as well as hourly and salary indicators in the data call specifications for years, but the data is generally blank for most participants. Gustafson explained the tables recommended here were developed by the RPEC based on ongoing retirement plans instead of terminated plans that purchased a group annuity. Gustafson stated that the recommendation to use the PRI-2012 tables was because 1) RPEC had a broader set of data and was able to assign the union and salary categories better than the Group Annuity Committee; 2) the group annuity tables and retirement tables are similar in aggregate; and 3) there is credibility to split mortality by blue-collar and white-collar indicators.

Eom suggested the Subgroup use the approach outlined because the current group annuity mortality tables (i.e., GAR) do not have distinctions such as blue-collar and white-collar splits or active employee and retiree splits.

3. Heard a Presentation on VM-22 SPA Proposed Mortality Adjustment Factors for Individual Annuities

Joel Sklar (SOA) presented the SOA Individual Annuity Experience Committee recommendations for mortality adjustment factors for fixed deferred annuities (including fixed indexed annuities), individual payout annuities,

and structured settlement annuities (Attachment Eleven-B). Carmello asked how, if any, margins were included in the recommendations. Sklar clarified that these mortality adjustment factors do not include margins.

4. Discussed its Next Steps

Slutsker said the mortality assumptions presented today for group annuities, fixed deferred annuities, payout annuities, and structured settlements will be the basis for the direction the Subgroup takes in terms of the next VM-22 exposure.

5. Discussed Other Matters

Slutsker announced that Lam agreed to take on the role of vice chair for the Subgroup.

Having no further business, the Valuation Manual (VM)-22 (A) Subgroup adjourned.

SharePoint/NAIC Support Staff Hub/Member Meetings/A CMTE/LATF/2024-1-Spring/VM-22 Calls/01 31/Jan 31 Minutes.docx

VM-22 Standard Projection Amount Group Annuity Mortality Assumptions

American Academy of Actuaries
Annuity Reserves and Capital Work Group
Chris Conrad, FSA, MAAA, Chairperson
Brent Dooley, FSA, MAAA, PRT Subgroup

Society of Actuaries
Group Annuity Experience Committee
Kristin Gustafson, FSA, MAAA, Chairperson
Patrick Nolan, FSA, MAAA, Senior Experience Studies Actuary

General Recommendation for Pension Risk Transfer Annuities

- PRI-2012 and MP Projection Scale recommended by Willis Towers Watson, *Non-Variable Annuity Assumption Development: A report for the American Academy of Actuaries* (May 2022)
- Valuation should reflect most recently released MP scale (currently MP-2021)
  - RPEC released annual updates to the MP scales from 2014–2021, but has not released an update since then due to COVID-19 impacts in the 2020–2021 data
- Should only be applied to annuities owned or purchased by retirement plans
  - "purchased under a retirement plan or plan of deferred compensation, established or maintained by an employer, including a partnership or sole proprietorship, or by an employee organization, or by both, other than a plan providing individual retirement accounts or individual retirement annuities under section 408 of the internal revenue code of 1986, 26 USC 408" (NAIC Model-820 – Standard Valuation Law)
  - Group structured settlements should use Structured Settlement mortality assumptions
  - Other group annuities and IRAs should use Individual Annuity mortality assumptions

Specific Recommendations for Applying the PRI-2012 and MP Scales

- Amount weighted tables based on total dataset
- Upper and lower quartile tables are not appropriate for use in the standard projection
- Allow use of blue-collar and white-collar tables separately or weighted based on company-specific inforce population
  - PRI-2012Total tables assume a mix of blue/white collar annuitants that may not be appropriate for a given group of group annuitants
  - Guidance provided in SOA Retirement Plans Experience Committee PRI-2012 Report subsection 2.3.2*
    - Annuitants classified as either "hourly wage earners" or "belonging to a union" are considered "blue collar"; annuitants classified as either "salaried wage earners" or "no union affiliation" are considered "white collar"
    - Plans may be classified as blue or white collar if at least 70% of the annuitants meet the criteria for either "blue collar" or "white collar" as described above
- Retirement tables should be used for in-pay annuities (retired annuitants), and Employee tables should be used for deferred annuities (active or term-vested annuitants)
- Contingent survivor tables should be used for beneficiaries to the extent that beneficiaries can be identified, or the base tables should be weighted based on company expectation of proportion of benefits associated with beneficiaries

*https://www.soa.org/49c106/globalassets/assets/files/resources/experience-studies/2019/pri-2012-mortality-tables-report.pdf

American Academy of Actuaries
SOA Research Institute

Valuation Manual (VM)-22 (A) Subgroup Meeting

VM-22 SPA Assumptions—Mortality
Proposed Mortality Adjustment Factors for Individual Annuities

Joel Sklar, MAAA, ASA
Chair, SOA Individual Annuity Experience Committee
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VM-22—SPA Assumptions—Mortality Adjustment Factors for Individual Annuity Product Lines

- The mortality adjustment factors have been developed for use as Standard Projection Amount (SPA) assumptions for the anticipated 2024 VM-22 Field Test
- Proposed factors have been developed for all Individual Annuity product lines:
  - Fixed Deferred Annuities (accumulation products), including Fixed Indexed Annuities (FIAs)
  - Individual Payout Annuities
  - Structured Settlement Annuities
- The base mortality adjustment factors were developed based on industry experience studies conducted by the SOA
- A basis for historical mortality improvement has been developed
- The mortality adjustment factors have been brought up to 12/31/2022 based on historical mortality improvement

Development of Basis for Historical Mortality Improvement (HMI)

- Our objective is to set a baseline mortality as of 12/31/2022, to serve as the new "jumping-off" point
- Historical Mortality Improvement is needed to bring mortality up from the mid-point of the respective industry studies, such as 2013 for the fixed deferred annuities, 2016 for individual payout annuities, and 2011 for structured settlements
- We split the historical era into **two periods**, first the pre-pandemic era through 2019, and then 2020–2022
- Historical Mortality Improvement through 2019
  - We used data from the SOA's report on Mortality by Socioeconomic Category, authored by Magali Barbieri, to generate improvement rates by quinquennial age groups
  - U.S. counties were assigned to one of 10 deciles, based on various socioeconomic criteria
  - The 10th decile (highest socioeconomic category) aligned with the experience from all individual annuity product lines, except for Structured Settlements, which aligned with the 1st decile (lowest)
  - Mortality data for this study was sourced from the National Center for Health Statistics (NCHS), which had a fairly good alignment with Social Security data except at older ages (above age 80)

Development of Basis for Historical Mortality Improvement, continued

- Historical Mortality Improvement for 2020 through 2022
  - Actual experience was severely impacted by the pandemic
  - Even if specific COVID-related deaths could be identified with precision and factored out, other aspects of the pandemic environment affected overall mortality drivers
  - **Decision was made to assume 0% improvement for 2020 through 2022**
    - Mortality rates at the end of 2022 had not yet improved to 2019 levels post-pandemic, but were getting close, especially at the older ages relevant for most annuity product lines

Mortality Adjustment Factor Development

- The Base Adjustment Factors, representative of the central point of the respective industry study, are brought up to 12/31/2022 using the historical mortality improvement basis just covered
- The Mortality Adjustment Factors were developed for the quinquennial age groups by averaging the raw factors for the five consecutive ages, and then rounding and smoothing the results
- We propose using linear interpolation for generating the factors for the individual ages
- The Mortality Adjustment Factors are intended to be applied the same way the factors in the current VM-21 are applied, i.e. as a multiplicative factor to a basis using the 2012 IAM Basic table and Mortality Improvement Scale G2 (for Fixed Deferred Annuities and Individual Payout Annuities) and the 1983 IAM Table 'A' and Scale G2 for Structured Settlements
- The following slides show the proposed Mortality Adjustment Factors for quinquennial ages for:
  - Fixed Deferred Annuities, differentiating between those with and without Guaranteed Living Benefits (GLBs)*
  - Individual Payout Annuities
  - Structured Settlements

* Developed based on Variable Annuity relationships between with and without GLBs, due to lack of credible experience on Fixed Deferred Annuities with GLBs from the 2011-2015 experience study

Mortality Adjustment Factors for VM-22 Fixed Deferred Annuities

Fixed Deferred Annuity Mortality Adjustment Factors

	FDA non-GLB		FDA GLB	
Age	Female	Male	Female	Male
52	150%	120%	125%	105%
57	150%	110%	125%	88%
62	120%	95%	95%	78%
67	108%	105%	90%	88%
72	118%	108%	103%	93%
77	125%	108%	110%	98%
82	118%	108%	110%	103%
87	110%	110%	110%	110%
92	108%	110%	108%	110%
97	107%	110%	107%	110%
102	103%	105%	103%	105%
105	100%	100%	100%	100%

Note that Appendix slides 15 & 16 shows the breakout between the Base and HMI Factors

Mortality Adjustment Factors for VM-22 Individual Payout Annuities

	IPA - Female			IPA - Male		
Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022
52	125.0%	101.7%	125%	100.0%	102.5%	100%
57	125.0%	99.8%	125%	100.0%	102.5%	100%
62	100.0%	101.2%	103%	90.0%	104.1%	95%
67	90.0%	100.4%	93%	90.0%	107.2%	97%
72	95.0%	106.4%	100%	100.0%	106.7%	105%
77	102.0%	104.6%	108%	108.0%	105.7%	115%
82	102.0%	106.2%	108%	113.0%	107.1%	120%
87	102.0%	104.1%	108%	113.0%	104.9%	120%
92	112.0%	102.6%	113%	113.0%	103.2%	115%
97	112.0%	101.5%	113%	113.0%	101.6%	115%
102	104.5%	100.5%	105%	104.9%	100.5%	105%
105	100.0%	100.0%	100%	100.0%	100.0%	100%

Structured Settlement Annuities

- Structured Settlement Annuities (SSAs) comprise a niche annuity market, with a very distinct demographic when compared to typical annuities used to fund retirement programs, and much different mortality.
- SSA annuitants often have significant health impairments, and underwriting may be performed. Impaired annuitants are eligible to receive an age "rate up," reflecting a diminished life expectancy; contracts covering annuitants receiving such a rate-up are often referred to as "Substandard" business.
- Statutory reserving for Structured Settlements uses the 1983 IAM Table 'A'; valuation for substandard business uses the "Constant Extra Death (CED)" methodology, as provided for in Actuarial Guideline IX-A. This serves to frontload expected mortality, as adding a constant number of deaths is more impactful on younger ages when mortality is otherwise lower.

Development of Base Mortality Adjustment Factors for SSAs

- Base mortality adjustment factors were developed based on an SOA experience study covering the 2005-2017 period. This longer period was helpful in increasing the credibility of the data, but the sparseness of the data remains an issue.
- Standard and Substandard business were studied separately, and distinct mortality adjustment factors were developed for each. For factor development, experience was compared to the 1983 Individual Annuity Mortality (IAM) Table A, including the CED methodology for substandard business
- A careful analysis of the experience pointed to duration from issue being a very important consideration, and thus it was taken into account with the factor development
- For Substandard business, the degree of rate-up was also identified as significant, so the adjustment factors were differentiated between two groups—1-20 year, and 21+ year rate-ups.

Mortality Adjustment Factors for Structured Settlement Annuities

- The base factors are brought up to 12/31/2022 using the HMI methodology described above.
- The Mortality Adjustment Factors are intended to be applied in a similar way to the way the factors in the current VM-21 are applied, i.e. as a multiplicative factor to a basis using the **1983 IAM Table 'A', with projected mortality improvement using Scale G2 from 2011 (the mid-point of the experience study).** For substandard lives, the multiplicative factor would apply following the application of the Constant Extra Death methodology described in Actuarial Guideline IX-A.
- Based on the duration and rate-up impacts for SSAs, we propose the following 11 distinct cohorts:
  - **Structured Settlement Annuities – Standard Lives** (factors on Slides 12 & 13)
    - Durations 1-5
    - Durations 6-10
    - Durations 11+
  - **Structured Settlement Annuities – Substandard Lives, Rate-Ups < 21 Years** (factors on Slides 17 & 18)
    - Durations 1-10
    - Durations 11-20
    - Durations 21-30
    - Durations 31+
  - **Structured Settlement Annuities – Substandard Lives, Rate-Ups > 20 Years** (factors on Slides 19 & 20)
    - Durations 1-10
    - Durations 11-20
    - Durations 21-30
    - Durations 31+

Mortality Adjustment Factors for VM-22—SSA Standard Lives

	SSA Standard 1-5 - Female			SSA Standard 1-5 - Male				SSA Standard 6-10 - Female			SSA Standard 6-10 - Male		
Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022	Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022
2	290.0%	101.3%	300.0%	290.0%	103.7%	300.0%	2	290.0%	101.3%	300.0%	290.0%	103.7%	300.0%
7	290.0%	116.9%	330.0%	290.0%	115.1%	330.0%	7	290.0%	116.9%	335.0%	290.0%	115.1%	330.0%
12	290.0%	123.6%	355.0%	290.0%	114.0%	330.0%	12	290.0%	123.6%	355.0%	290.0%	114.0%	330.0%
17	290.0%	122.1%	355.0%	290.0%	116.9%	335.0%	17	290.0%	122.1%	355.0%	290.0%	116.9%	335.0%
22	290.0%	120.9%	350.0%	290.0%	115.3%	335.0%	22	290.0%	120.9%	350.0%	290.0%	115.3%	335.0%
27	290.0%	117.9%	350.0%	290.0%	119.3%	350.0%	27	290.0%	117.9%	350.0%	290.0%	119.3%	350.0%
32	290.0%	131.4%	375.0%	290.0%	137.7%	390.0%	32	290.0%	131.4%	375.0%	290.0%	137.7%	390.0%
37	290.0%	131.9%	375.0%	290.0%	137.9%	400.0%	37	290.0%	131.9%	375.0%	290.0%	137.9%	400.0%
42	252.2%	116.9%	295.0%	252.2%	136.0%	335.0%	42	252.2%	116.9%	295.0%	252.2%	136.0%	335.0%
47	195.0%	107.0%	210.0%	195.0%	108.4%	220.0%	47	195.0%	107.0%	215.0%	195.0%	108.4%	220.0%
52	168.8%	112.0%	190.0%	168.8%	109.1%	185.0%	52	168.8%	112.0%	190.0%	168.8%	109.1%	185.0%
57	145.6%	130.3%	185.0%	145.6%	127.8%	185.0%	57	145.6%	130.3%	185.0%	145.6%	127.8%	185.0%
62	120.4%	130.3%	155.0%	120.4%	135.1%	160.0%	62	132.2%	130.3%	170.0%	132.2%	135.1%	175.0%
67	103.6%	118.4%	125.0%	103.6%	125.7%	130.0%	67	126.2%	118.4%	150.0%	126.2%	125.7%	160.0%
72	100.0%	114.8%	115.0%	100.0%	118.6%	120.0%	72	125.0%	114.8%	145.0%	125.0%	118.6%	150.0%
77	100.0%	110.7%	110.0%	100.0%	114.8%	110.0%	77	124.6%	110.7%	135.0%	124.6%	114.8%	140.0%
82	100.4%	105.9%	110.0%	100.4%	106.3%	110.0%	82	117.2%	105.9%	125.0%	117.2%	106.3%	125.0%
87	107.6%	103.9%	110.0%	107.6%	104.3%	110.0%	87	111.2%	103.9%	115.0%	111.2%	104.3%	115.0%
92	109.8%	102.4%	110.0%	109.8%	102.9%	110.0%	92	109.8%	102.4%	110.0%	109.8%	102.9%	110.0%
97	105.9%	101.5%	105.0%	105.9%	101.4%	105.0%	97	105.9%	101.5%	105.0%	105.9%	101.4%	105.0%
102	100.3%	100.5%	100.0%	100.3%	100.5%	100.0%	102	100.3%	100.5%	100.0%	100.3%	100.5%	100.0%
105	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	105	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Mortality Adjustment Factors for VM-22—SSA Standard Lives

	SSA Standard 11+ - Female			SSA Standard 11+ - Male		
Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022
2	355.0%	101.3%	365.0%	355.0%	103.7%	375.0%
7	355.0%	116.9%	410.0%	355.0%	115.1%	405.0%
12	355.0%	123.6%	435.0%	355.0%	114.0%	405.0%
17	355.0%	122.1%	435.0%	355.0%	116.9%	415.0%
22	355.0%	120.9%	430.0%	355.0%	115.3%	410.0%
27	355.0%	117.9%	425.0%	355.0%	119.3%	430.0%
32	355.0%	131.4%	460.0%	355.0%	137.7%	480.0%
37	355.0%	131.9%	460.0%	355.0%	137.9%	490.0%
42	326.0%	116.9%	380.0%	326.0%	136.0%	430.0%
47	270.4%	107.0%	295.0%	270.4%	108.4%	300.0%
52	228.4%	112.0%	260.0%	228.4%	109.1%	255.0%
57	196.4%	130.3%	250.0%	196.4%	127.8%	250.0%
62	174.2%	130.3%	225.0%	174.2%	135.1%	230.0%
67	157.8%	118.4%	190.0%	157.8%	125.7%	200.0%
72	139.4%	114.8%	160.0%	139.4%	118.6%	165.0%
77	127.0%	110.7%	140.0%	127.0%	114.8%	145.0%
82	117.2%	105.9%	125.0%	117.2%	106.3%	125.0%
87	111.2%	103.9%	115.0%	111.2%	104.3%	115.0%
92	109.8%	102.4%	110.0%	109.8%	102.9%	110.0%
97	105.9%	101.5%	105.0%	105.9%	101.4%	105.0%
102	100.3%	100.5%	100.0%	100.3%	100.5%	100.0%
105	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

APPENDIX

Mortality Adjustment Factors for VM-22 Fixed Deferred Annuities

FDA non-GLB - Female

Age	Base Adj Factors	HMI Impact	Factors thru 2022
52	150.0%	97.7%	150%
57	150.0%	105.3%	150%
62	105.0%	108.6%	120%
67	100.0%	104.9%	108%
72	115.0%	103.4%	118%
77	120.0%	105.0%	125%
82	110.0%	106.9%	118%
87	105.0%	104.6%	110%
92	105.0%	102.8%	108%
97	105.0%	101.7%	107%
102	102.0%	100.6%	103%
105	100.0%	100.0%	100%

FDA non-GLB - Male

Base Adj Factors	HMI Impact	Factors thru 2022
115.0%	104.3%	120%
100.0%	107.5%	110%
85.0%	108.3%	95%
95.0%	111.8%	105%
100.0%	109.4%	108%
100.0%	107.5%	108%
100.0%	107.4%	108%
105.0%	105.1%	110%
105.0%	103.4%	110%
110.0%	101.7%	110%
104.0%	100.6%	105%
100.0%	100.0%	100%

Mortality Adjustment Factors for VM-22 Fixed Deferred Annuities

FDA GLB - Female

Age	Base Adj Factors	HMI Impact	Factors thru 2022
52	130.0%	97.7%	125%
57	120.0%	105.3%	125%
62	85.0%	108.6%	95%
67	85.0%	104.9%	90%
72	100.0%	103.4%	103%
77	105.0%	105.0%	110%
82	105.0%	106.9%	110%
87	105.0%	104.6%	110%
92	105.0%	102.8%	108%
97	105.0%	101.7%	107%
102	102.0%	100.6%	103%
105	100.0%	100.0%	100%

FDA GLB - Male

Base Adj Factors	HMI Impact	Factors thru 2022
100.0%	104.3%	105%
80.0%	107.5%	88%
70.0%	108.3%	78%
80.0%	111.8%	88%
85.0%	109.4%	93%
90.0%	107.5%	98%
95.0%	107.4%	103%
105.0%	105.1%	110%
105.0%	103.4%	110%
110.0%	101.7%	110%
104.0%	100.6%	105%
100.0%	100.0%	100%

Mortality Adjustment Factors for VM-22
SSA Substandard Lives

	SSA Substandard 1-10 - Female Rate-Ups of <21 Years			SSA Substandard 1-10 - Male Rate-Ups of <21 Years				SSA Substandard 11-20 - Female Rate-Ups of <21 Years			SSA Substandard 11-20 - Male Rate-Ups of <21 Years		
Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022	Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022
2	55.0%	101.3%	55.0%	55.0%	103.7%	55.0%	2	55.0%	101.3%	55.0%	55.0%	103.7%	55.0%
7	55.0%	116.9%	65.0%	55.0%	115.1%	65.0%	7	55.0%	116.9%	65.0%	55.0%	115.1%	65.0%
12	55.0%	123.6%	65.0%	55.0%	114.0%	65.0%	12	55.0%	123.6%	65.0%	55.0%	114.0%	65.0%
17	55.0%	122.1%	65.0%	55.0%	116.9%	65.0%	17	55.0%	122.1%	65.0%	55.0%	116.9%	65.0%
22	55.0%	120.9%	65.0%	55.0%	115.3%	65.0%	22	55.0%	120.9%	65.0%	55.0%	115.3%	65.0%
27	55.0%	117.9%	65.0%	55.0%	119.3%	65.0%	27	55.0%	117.9%	65.0%	55.0%	119.3%	65.0%
32	55.0%	131.4%	70.0%	55.0%	137.7%	75.0%	32	55.0%	131.4%	70.0%	55.0%	137.7%	75.0%
37	55.6%	131.9%	75.0%	55.6%	137.9%	75.0%	37	57.0%	131.9%	75.0%	57.0%	137.9%	80.0%
42	66.4%	116.9%	75.0%	66.4%	136.0%	85.0%	42	93.0%	116.9%	105.0%	93.0%	136.0%	120.0%
47	70.0%	107.0%	75.0%	70.0%	108.4%	80.0%	47	105.0%	107.0%	115.0%	105.0%	108.4%	115.0%
52	70.0%	112.0%	80.0%	70.0%	109.1%	80.0%	52	105.0%	112.0%	120.0%	105.0%	109.1%	115.0%
57	70.0%	130.3%	90.0%	70.0%	127.8%	90.0%	57	105.0%	130.3%	135.0%	105.0%	127.8%	135.0%
62	70.0%	130.3%	90.0%	70.0%	135.1%	95.0%	62	105.0%	130.3%	135.0%	105.0%	135.1%	140.0%
67	70.0%	118.4%	85.0%	70.0%	125.7%	90.0%	67	105.0%	118.4%	125.0%	105.0%	125.7%	130.0%
72	70.0%	114.8%	80.0%	70.0%	118.6%	85.0%	72	105.0%	114.8%	120.0%	105.0%	118.6%	125.0%
77	71.4%	110.7%	80.0%	71.4%	114.8%	85.0%	77	105.0%	110.7%	115.0%	105.0%	114.8%	120.0%
82	96.6%	105.9%	100.0%	96.6%	106.3%	100.0%	82	105.0%	105.9%	110.0%	105.0%	106.3%	110.0%
87	105.0%	103.9%	110.0%	105.0%	104.3%	110.0%	87	105.0%	103.9%	110.0%	105.0%	104.3%	110.0%
92	105.0%	102.4%	110.0%	105.0%	102.9%	110.0%	92	105.0%	102.4%	110.0%	105.0%	102.9%	110.0%
97	105.0%	101.5%	105.0%	105.0%	101.4%	105.0%	97	105.0%	101.5%	105.0%	105.0%	101.4%	105.0%
102	105.0%	100.5%	105.0%	105.0%	100.5%	105.0%	102	105.0%	100.5%	105.0%	105.0%	100.5%	105.0%
105	105.0%	100.0%	100.0%	105.0%	100.0%	100.0%	105	105.0%	100.0%	100.0%	105.0%	100.0%	100.0%

Mortality Adjustment Factors for VM-22
SSA Substandard Lives

	SSA Substandard 21-30 - Female Rate-Ups of <21 Years			SSA Substandard 21-30 - Male Rate-Ups of <21 Years				SSA Substandard 31+ - Female Rate-Ups of <21 Years			SSA Substandard 31+ - Male Rate-Ups of <21 Years		
Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022	Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022
2	55.0%	101.3%	55.0%	55.0%	103.7%	55.0%	2	55.0%	101.3%	55.0%	55.0%	103.7%	55.0%
7	55.0%	116.9%	65.0%	55.0%	115.1%	65.0%	7	55.0%	116.9%	65.0%	55.0%	115.1%	65.0%
12	55.0%	123.6%	65.0%	55.0%	114.0%	65.0%	12	55.0%	123.6%	65.0%	55.0%	114.0%	65.0%
17	55.0%	122.1%	65.0%	55.0%	116.9%	65.0%	17	55.0%	122.1%	65.0%	55.0%	116.9%	65.0%
22	55.0%	120.9%	65.0%	55.0%	115.3%	65.0%	22	55.0%	120.9%	65.0%	55.0%	115.3%	65.0%
27	55.0%	117.9%	65.0%	55.0%	119.3%	65.0%	27	55.0%	117.9%	65.0%	55.0%	119.3%	65.0%
32	55.0%	131.4%	70.0%	55.0%	137.7%	75.0%	32	55.0%	131.4%	70.0%	55.0%	137.7%	75.0%
37	58.2%	131.9%	80.0%	58.2%	137.9%	85.0%	37	58.8%	131.9%	80.0%	58.8%	137.9%	85.0%
42	115.8%	116.9%	130.0%	115.8%	136.0%	150.0%	42	127.2%	116.9%	145.0%	127.2%	136.0%	165.0%
47	135.0%	107.0%	150.0%	135.0%	108.4%	150.0%	47	150.0%	107.0%	165.0%	150.0%	108.4%	165.0%
52	135.0%	112.0%	150.0%	135.0%	109.1%	150.0%	52	150.0%	112.0%	170.0%	150.0%	109.1%	165.0%
57	135.0%	130.3%	175.0%	135.0%	127.8%	170.0%	57	150.0%	130.3%	190.0%	150.0%	127.8%	190.0%
62	135.0%	130.3%	175.0%	135.0%	135.1%	180.0%	62	150.0%	130.3%	195.0%	150.0%	135.1%	200.0%
67	135.0%	118.4%	160.0%	135.0%	125.7%	170.0%	67	150.0%	118.4%	180.0%	150.0%	125.7%	190.0%
72	135.0%	114.8%	155.0%	135.0%	118.6%	160.0%	72	150.0%	114.8%	170.0%	150.0%	118.6%	180.0%
77	133.8%	110.7%	145.0%	133.8%	114.8%	150.0%	77	148.2%	110.7%	160.0%	148.2%	114.8%	165.0%
82	112.2%	105.9%	120.0%	112.2%	106.3%	120.0%	82	115.8%	105.9%	125.0%	115.8%	106.3%	125.0%
87	105.0%	103.9%	110.0%	105.0%	104.3%	110.0%	87	105.0%	103.9%	110.0%	105.0%	104.3%	110.0%
92	105.0%	102.4%	110.0%	105.0%	102.9%	110.0%	92	105.0%	102.4%	110.0%	105.0%	102.9%	110.0%
97	105.0%	101.5%	105.0%	105.0%	101.4%	105.0%	97	105.0%	101.5%	105.0%	105.0%	101.4%	105.0%
102	105.0%	100.5%	105.0%	105.0%	100.5%	105.0%	102	105.0%	100.5%	105.0%	105.0%	100.5%	105.0%
105	105.0%	100.0%	100.0%	105.0%	100.0%	100.0%	105	105.0%	100.0%	100.0%	105.0%	100.0%	100.0%

Mortality Adjustment Factors for VM-22
SSA Substandard Lives

	SSA Substandard 1-10 - Female Rate-Ups of 21+ Years			SSA Substandard 1-10 - Male Rate-Ups of 21+ Years				SSA Substandard 11-20 - Female Rate-Ups of 21+ Years			SSA Substandard 11-20 - Male Rate-Ups of 21+ Years		
Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022	Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022
2	55.0%	101.3%	55.0%	55.0%	103.7%	55.0%	2	55.0%	101.3%	55.0%	55.0%	103.7%	55.0%
7	55.0%	116.9%	65.0%	55.0%	115.1%	65.0%	7	55.0%	116.9%	65.0%	55.0%	115.1%	65.0%
12	55.0%	123.6%	65.0%	55.0%	114.0%	65.0%	12	55.0%	123.6%	65.0%	55.0%	114.0%	65.0%
17	55.0%	122.1%	65.0%	55.0%	116.9%	65.0%	17	55.0%	122.1%	65.0%	55.0%	116.9%	65.0%
22	55.0%	120.9%	65.0%	55.0%	115.3%	65.0%	22	55.0%	120.9%	65.0%	55.0%	115.3%	65.0%
27	55.0%	117.9%	65.0%	55.0%	119.3%	65.0%	27	55.0%	117.9%	65.0%	55.0%	119.3%	65.0%
32	55.0%	131.4%	70.0%	55.0%	137.7%	75.0%	32	55.0%	131.4%	70.0%	55.0%	137.7%	75.0%
37	56.0%	131.9%	75.0%	56.0%	137.9%	80.0%	37	56.4%	131.9%	75.0%	56.4%	137.9%	80.0%
42	74.0%	116.9%	85.0%	74.0%	136.0%	95.0%	42	81.6%	116.9%	95.0%	81.6%	136.0%	105.0%
47	80.0%	107.0%	85.0%	80.0%	108.4%	90.0%	47	90.0%	107.0%	100.0%	90.0%	108.4%	100.0%
52	80.0%	112.0%	90.0%	80.0%	109.1%	90.0%	52	90.0%	112.0%	100.0%	90.0%	109.1%	100.0%
57	80.0%	130.3%	100.0%	80.0%	127.8%	100.0%	57	90.0%	130.3%	115.0%	90.0%	127.8%	115.0%
62	80.0%	130.3%	105.0%	80.0%	135.1%	105.0%	62	90.0%	130.3%	115.0%	90.0%	135.1%	120.0%
67	80.0%	118.4%	95.0%	80.0%	125.7%	100.0%	67	90.0%	118.4%	110.0%	90.0%	125.7%	110.0%
72	80.0%	114.8%	90.0%	80.0%	118.6%	95.0%	72	90.0%	114.8%	105.0%	90.0%	118.6%	105.0%
77	80.4%	110.7%	90.0%	80.4%	114.8%	90.0%	77	90.0%	110.7%	100.0%	90.0%	114.8%	100.0%
82	87.6%	105.9%	90.0%	87.6%	106.3%	90.0%	82	90.0%	105.9%	95.0%	90.0%	106.3%	95.0%
87	90.0%	103.9%	95.0%	90.0%	104.3%	95.0%	87	90.0%	103.9%	95.0%	90.0%	104.3%	95.0%
92	90.0%	102.4%	90.0%	90.0%	102.9%	90.0%	92	90.0%	102.4%	90.0%	90.0%	102.9%	90.0%
97	90.0%	101.5%	90.0%	90.0%	101.4%	90.0%	97	90.0%	101.5%	90.0%	90.0%	101.4%	90.0%
102	90.0%	100.5%	90.0%	90.0%	100.5%	90.0%	102	90.0%	100.5%	90.0%	90.0%	100.5%	90.0%
105	90.0%	100.0%	100.0%	90.0%	100.0%	100.0%	105	90.0%	100.0%	100.0%	90.0%	100.0%	100.0%

Mortality Adjustment Factors for VM-22
SSA Substandard Lives

	SSA Substandard 21-30 - Female Rate-Ups of 21+ Years			SSA Substandard 21-30 - Male Rate-Ups of 21+ Years				SSA Substandard 31+ - Female Rate-Ups of 21+ Years			SSA Substandard 31+- Male Rate-Ups of 21+ Years		
Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022	Age	Base Adj Factors	HMI Impact	Factors thru 2022	Base Adj Factors	HMI Impact	Factors thru 2022
2	70.0%	101.3%	70.0%	70.0%	103.7%	75.0%	2	70.0%	101.3%	70.0%	70.0%	103.7%	70.0%
7	70.0%	116.9%	80.0%	70.0%	115.1%	80.0%	7	70.0%	116.9%	80.0%	70.0%	115.1%	80.0%
12	70.0%	123.6%	85.0%	70.0%	114.0%	80.0%	12	70.0%	123.6%	85.0%	70.0%	114.0%	80.0%
17	70.0%	122.1%	85.0%	70.0%	116.9%	80.0%	17	70.0%	122.1%	85.0%	70.0%	116.9%	80.0%
22	70.0%	120.9%	85.0%	70.0%	115.3%	80.0%	22	70.0%	120.9%	85.0%	70.0%	115.3%	80.0%
27	70.0%	117.9%	85.0%	70.0%	119.3%	85.0%	27	70.0%	117.9%	85.0%	70.0%	119.3%	85.0%
32	70.0%	131.4%	90.0%	70.0%	137.7%	95.0%	32	70.0%	131.4%	90.0%	70.0%	137.7%	95.0%
37	71.4%	131.9%	95.0%	71.4%	137.9%	100.0%	37	72.6%	131.9%	100.0%	72.6%	137.9%	105.0%
42	96.6%	116.9%	110.0%	96.6%	136.0%	125.0%	42	119.4%	116.9%	135.0%	119.4%	136.0%	155.0%
47	105.0%	107.0%	115.0%	105.0%	108.4%	115.0%	47	135.0%	107.0%	145.0%	135.0%	108.4%	150.0%
52	105.0%	112.0%	120.0%	105.0%	109.1%	115.0%	52	135.0%	112.0%	150.0%	135.0%	109.1%	150.0%
57	105.0%	130.3%	135.0%	105.0%	127.8%	135.0%	57	135.0%	130.3%	175.0%	135.0%	127.8%	170.0%
62	105.0%	130.3%	135.0%	105.0%	135.1%	140.0%	62	135.0%	130.3%	175.0%	135.0%	135.1%	180.0%
67	105.0%	118.4%	125.0%	105.0%	125.7%	130.0%	67	135.0%	118.4%	160.0%	135.0%	125.7%	170.0%
72	105.0%	114.8%	120.0%	105.0%	118.6%	125.0%	72	135.0%	114.8%	155.0%	135.0%	118.6%	160.0%
77	104.4%	110.7%	115.0%	104.4%	114.8%	120.0%	77	133.2%	110.7%	145.0%	133.2%	114.8%	150.0%
82	93.6%	105.9%	100.0%	93.6%	106.3%	100.0%	82	100.8%	105.9%	110.0%	100.8%	106.3%	110.0%
87	90.0%	103.9%	95.0%	90.0%	104.3%	95.0%	87	90.0%	103.9%	95.0%	90.0%	104.3%	95.0%
92	90.0%	102.4%	90.0%	90.0%	102.9%	90.0%	92	90.0%	102.4%	90.0%	90.0%	102.9%	90.0%
97	90.0%	101.5%	90.0%	90.0%	101.4%	90.0%	97	90.0%	101.5%	90.0%	90.0%	101.4%	90.0%
102	90.0%	100.5%	90.0%	90.0%	100.5%	90.0%	102	90.0%	100.5%	90.0%	90.0%	100.5%	90.0%
105	90.0%	100.0%	100.0%	90.0%	100.0%	100.0%	105	90.0%	100.0%	100.0%	90.0%	100.0%	100.0%

Draft: 3/6/24

Valuation Manual (VM)-22 (A) Subgroup
Virtual Meeting
December 13, 2023

The VM-22 (A) Subgroup of the Life Actuarial (A) Task Force met Dec. 13, 2023. The following Subgroup members participated: Ben Slutsker, Chair (MN); Elaine Lam (CA); Lei-Rao Knight (CT); Nicole Boyd (KS); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill and Iris Huang (TX); Tomasz Serbinowski (UT); and Craig Chupp (VA).

1. Discussed the VM-22 SPA Draft

Slutsker said that the Subgroup would discuss comments received on the VM-22, Requirements for Principle-Based Reserves for Non-Variable Annuities Standard Projection Amount (SPA). Regarding the choice of withdrawal timing assumptions for the greatest actuarial present value (GAPV), Andrew Jenkins (American Academy of Actuaries—Academy) stated that actuarial judgment is appropriate. Carmello said that he would lean toward an approach where companies are required to assume that policyholder behavior gets more efficient over time, consistent with VM-21, Requirements for Principle-Based Reserves for Variable Annuities, to which Serbinowski and Huang agreed. After further discussion, the Subgroup decided to move forward with language that required increasing policyholder efficiency over time and withdrawal assumptions for the GAPV that would materially realize the value of the product.

Karl Lund (VM-22 SPA Policyholder Behavior Drafting Group – VM-22 SPA PHB DG) walked through the Academy's recommendation for a dynamic lapse formula and compared it to a proposal from the VM-22 SPA PHB DG. Lam stated that one of the key differences between the proposals was that the Academy's formula behaved in a more linear fashion, while the VM-22 SPA PHB DG's formula had exponential characteristics that they felt made more sense. Lam also discussed the potential for adding a feature in the formula based on the guaranteed minimum interest rate (GMIR) but noted that the additional complexity may not be worth it in the SPA. Lam also stated that the VM-22 SPA PHB DG preferred a higher buffer factor (that controls when the dynamic formula applies) than what the Academy recommended. Carmello said that he felt the GMIR should be factored into the dynamic lapse formula, and that the Academy proposal resulted in lapses that were too low. Hemphill asked whether updating the dynamic lapse formula to account for the GMIR would be completed quickly, or if it would need to be changed in VM-22 down the line. Lam noted that the group would need to work to determine how the GMIR could be incorporated.

Slutsker exposed the proposals for the dynamic lapse formula for a 59-day public comment period ending Jan. 31

2. Discussed Other Matters

Slutsker noted that Vincent Tsang (IL) would be stepping down as the Chair of the VM-22 SPA PHB DG and thanked him for the work that he had done. Slutsker then congratulated Lam on becoming the new chair of the drafting group.

Having no further business, the Valuation Manual (VM)-22 (A) Subgroup adjourned.

SharePoint/NAIC Support Staff Hub/Member Meetings/A CMTE/LATF/2024-1-Spring/VM-22 Calls/12 13/Dec 13 Minutes.docx

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

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

February 12, 2024

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

Re: LATF's Request for Feedback on Mandatory Experience Reporting for Group Annuity Mortality.

Dear Chair Hemphill:

The American Council of Life Insurers (ACLI) appreciates the opportunity to submit comments to LATF regarding their request for feedback on potential group annuity mortality mandatory experience reporting.

ACLI conceptually supports mandatory experience reporting to help ensure appropriate mortality assumptions, to get regulators comfortable with using such assumptions in statutory reserve calculations, and to help create a consistent and level regulatory environment. Such requirements could be developed from existing reporting concepts from VM-50 and VM-51.

As this effort develops, we have several questions and clarifications we would like to see addressed:

- For business subject to third party administration and reinsurance, it would be helpful to clarify which entity is responsible for the data submission.
- Minimum exposure thresholds should also be established to avoid significant effort for immaterial blocks of business and these thresholds may have to be defined by administrator, depending on the response to the first point.
- The availability of certain data elements should be discussed, and companies should be given adequate time to prepare for the data collection should this process occur annually. ACLI suggests that regulators request specific information from companies before determining the data to be collected.

Overarching guidance on scope is critical as well:

- Some states issue business solely under a group contract; are these certificates intended to be in scope?
- Will group VAs be included, or are only fixed annuities in scope?
- Will there be sub-categories to distinguish between other types of business?

While it is premature to determine what data elements should be collected, we would encourage regulators to discuss with companies the availability of data and how they treat certain aspects (such as collars). The following data elements should be considered:

- Identifiers: Contract number, etc.
- Beneficiary information: Age, Gender, Date of Birth, Date of Death, Date of Retirement, Date of Issuance, disability status, ZIP code.
- Recipient type: Annuitant or Beneficiary.
- Benefit Information: Benefit amount, Minimum and Maximum Effective date of payments in calendar year.
- Different definition of collars if used, level of granularity (i.e., life level vs. group cohorts within the liabilities)

Finally, our perspective on the timing of implementation is highly dependent on the substance of the request. The more fields and granularity in the data request, the more time that will be required to prepare the mortality experience. We suggest aligning the timing of implementation with the VM-22 effective date or after to allow companies time to build the infrastructure needed. Industry would suggest annual reporting consistent with existing VM-51 requirements (including the 1-year lag); greater frequency of data collection would create operational challenges for companies. Further, consistent with VM-51, there should be an allowance for smaller companies to be exempt from the data request.

Thank you once again for the opportunity to provide feedback on this topic and we look forward to continuing conversations at future sessions of LATF.

Sincerely,

cc: Scott O'Neal, NAIC; Fred Andersen, Minnesota Department of Commerce

8770 W. Bryn Mawr Ave, Suite 1000
Chicago, IL 60631
P +1-847-706-3500
F +1-847-706-3599

To: Scott O'Neal

From: Society of Actuaries Research Institute

Date: March 1, 2024

Subject: Experience Reporting for Group Annuity Mortality

The Life Actuarial Task Force has requested comments by March 1, 2024 on the following:

- Initial thoughts on having mandatory experience reporting for group annuity mortality.
- Any high-level guidance on the general content and granularity of data to be collected for group annuity mortality.
- Feasible timing of implementing the experience reporting.

The Society of Actuaries (SOA) Research Institute, along with its Group Annuity Experience Committee (GAEC) respectfully submits these comments to the Life Actuarial Task Force (LATF) of the National Association of Insurance Commissioners (NAIC) with respect to several items related to experience reporting for Group Annuity mortality.

The SOA Research Institute does not believe that mandatory experience reporting to the NAIC for U.S. life insurers on group annuity mortality is necessary.

In recent years, the SOA Research Institute and LIMRA have partnered to produce experience studies and have built an infrastructure to bring experience studies to the U.S. life industry and industry regulators on an efficient and timely basis. The results of these studies are made available to provide valuable insights to the industry and state regulators. Participation in past SOA Research Institute group annuity mortality studies has been growing, and the studies have been meeting the industry's needs. We intend to continue future collection of group annuity data from industry to periodically update mortality trends.

Recent pre-pandemic mortality experience has tracked reasonably closely with the established bases of 1994 GAM projected with Scale AA. Population mortality analysis conducted by the SOA and described in a 2023 Mortality Improvement Update has indicated that retirement-aged mortality in the U.S. population has largely reverted back to close to pre-pandemic levels.

The GAEC has been actively producing several recent studies of Group Annuity mortality (https://www.soa.org/research/topics/group-ann-exp-study-list/), with the most recent study published in March 2022. These studies have historically provided information that is relevant for regulators to assess the adequacy of valuation tables. This study continued to build on industry knowledge of group annuity mortality with updated experience years of 2015-2018 and included over 372,000 deaths from data provided by 13 companies (an increase over the 8-9 companies that have participated in previous studies). The main purposes of the study were to compare recent annuitant mortality experience with valuation tables and to analyze recent annuitant mortality experience by age and sex with respect to various characteristics, such as annuity benefit types, income levels, and retirement classes.

The primary expected basis to which mortality experience has been compared in recent SOA studies is the 1994 Group Annuitant Mortality Table (1994 GAM) projected with mortality improvement Scale AA. Recent studies have yielded the following actual-to-expected (A/E) ratios when comparing group annuity mortality experience to 1994 GAM with Scale AA.

Table 1
INCOME-WEIGHTED ACTUAL-TO-EXPECTED MORTALITY RATIOS, SOA GROUP ANNUITY MORTALITY DATASET COMPARED TO 1994 GAM PROJECTED WITH SCALE AA

Study Years	A/E Ratio
2003-2010	100.5%
2011-2014	95.3%
2015-2018	97.2%

With each study, the GAEC has determined that actual experience had not strayed significantly enough from the 1994 GAM / Scale AA basis to merit the implementation of a new valuation standard. The most recent study also compared the 2015-2018 experience to the Pri-2012 Mortality Tables projected with Mortality Improvement Scale MP-2020. The Pri-2012 study was issued in 2019 and is commonly referenced by pension actuaries as a robust source of mortality information across many demographic categories of pensioners. The A/E ratios of the SOA Group Annuity study data using each of these bases were quite similar.

Table 2
GROUP ANNUITY MORTALITY A/E RATIOS 2015-2018

Expected Basis	Actual-to-Expected Ratios (2015-2018)	
	By Lives	By Income
1994 GAM Basic with Projection Scale AA	103.5%	97.2%
Pri-2012 Projected with MP-2020	102.7%	97.2%

The Pri-2012 study analyzed a broader dataset of pensioners in private pension systems and determined that collar type was a very significant predictor of annuitant mortality. Participants were categorized as “blue collar” if they were either hourly or union employees and categorized as “white collar” if they were both salaried and nonunion. If these distinctions were not known at the individual participant level, plans were characterized as blue collar or white collar if at least 70 percent of the plan’s participants met these criteria.

The GAEC attempted to analyze collar type for its most recent study by collecting information on whether the covered lives were hourly or salaried, as well as whether they were union or nonunion. Only 41 percent of the data collected contained a union indicator, and almost all the populated responses were “nonunion”. The remaining 59 percent had an unknown union indicator. Further challenging was that 95 percent of the data received was provided without an hourly or salaried indicator. It seems that this information has not been reliably collected and retained by insurance companies holding group annuity contracts. This could imply that collar would be difficult to provide in mandatory data calls.

As part of the 2015-2018 study, the GAEC reviewed group annuitant mortality by pension income amount and, per Section 3.4 of that study, did observe lower mortality for groups with higher pension amount. It is worth noting, however, that the Pri-2012 study has observed a decreasing relationship between pension income and mortality over time. In particular, the freezing of benefits in private pension plans in recent decades has reduced the

correlation between pension income and socioeconomic status such that collar type has become a stronger predictor of mortality.

The SOA Research Institute and the GAEC would like to express appreciation for the opportunity to comment on these important matters. Staff of the SOA Research Institute and RPEC would be available to discuss any questions you might have on these comments at your convenience. Please contact Patrick Nolan of the SOA Research Institute at pnolan@soa.org or (847) 273-8860 with any questions regarding this response letter.

Sincerely,

Patrick Nolan
Senior Experience Studies Actuary
Society of Actuaries Research Institute

Kristin Gustafson
Chair, Group Annuity Experience Committee
Society of Actuaries Research Institute

Members of the Group Annuity Experience Committee

Officers
Kristin Gustafson, Chair
Leonid Shteyman, Co-Vice-Chair
Ivy Wu, Co-Vice-Chair

Members
Mei Du
Deborah Faltin
Zachary Granovetter
Stephen Gruber
Dana Lipperman
Michelle Rosel
George Silos
John Stiefel

To: Scott O'Neal

From: LIMRA

Date: March 1, 2024

Subject: Experience Reporting for Group Annuity Mortality

The Life Actuarial Task Force has requested comments by March 1, 2024 on the following:

- Initial thoughts on having mandatory experience reporting for group annuity mortality.
- Any high-level guidance on the general content and granularity of data to be collected for group annuity mortality.
- Feasible timing of implementing the experience reporting.

LIMRA respectfully submits these comments to the Life Actuarial Task Force (LATF) of the National Association of Insurance Commissioners (NAIC) in response to this request.

LIMRA does not believe that mandatory experience reporting to the NAIC for U.S insurers on group annuity mortality is necessary for the following reasons:

1. LIMRA and the SOA Research Institute have partnered to produce future experience studies for group annuity mortality and currently have a means to collect and disseminate group annuity mortality results to industry and regulators.
2. The SOA Group Annuity Experience Committee (GAEC), which provides oversight to LIMRA and SOA Research Institute studies, consists of company representatives with deep group annuity knowledge. With the GAEC's guidance, comprehensive data formats and definitions for these studies have been developed and implemented. The GAEC also provides study peer review and guidance on interpretation of results.
3. Implementation of an additional mandatory data call will result in duplicative effort on the part of companies and lead to additional costs for both industry and the NAIC.
4. The SOA Research Institute and LIMRA have a well-tested process and structure in place for conducting these studies as updates are requested by industry and regulators over time. The output is made available to regulators for their work and includes both a detailed report outlining the study analysis as well as a data tool that allows for greater user analysis of study data and results.
5. Participation in past SOA Research Institute group annuity mortality studies has been growing, and the studies have been meeting the industry's needs.

LIMRA appreciates the opportunity to provide comments on this matter. We are available to respond to any questions you might have on these comments. Feel free to contact Marianne Purushotham at mpurushotham@limra.com or (860) 249-3366 at any time.

Sincerely,

Marianne Purushotham

_____

Marianne Purushotham, FSA, MAAA
Corporate Vice President, Research Data Services
LIMRA

Variable Annuity Capital and Reserve (E/A) Subgroup Report

Pete Weber, Chair

March 14, 2024

VM-21 Standard Projection Amount (SPA) Assumptions

- Require monitor and update
- VA Framework Recommendation 14:
  - Refresh prescribed actuarial assumptions to align with experience
- VM-21 section 6.C.2:
  - *Guidance Note: The framework adopted by the Variable Annuities Issues (E) Working Group includes the review and possible update of these assumptions every three to five years.*

SPA Assumptions to be Considered for Update

- Mortality
  - Based on SOA Report
- Expense
  - To Reflect Historic Inflation
- Policy Holder Behavior
  - Based on LATF Survey

Next Steps

- VACR SG will schedule a meeting in late March or early April
- Develop and Expose an APF
- Goal is Implementation for the 2025 VM

Life Actuarial (A) Task Force

VM-21 SPA Assumptions—Mortality
Proposed Update to Mortality Adjustment Factors

Joel Sklar, MAAA, ASA
Chairperson, SOA Individual Annuity Experience Committee
March 14, 2024

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VM-21: SPA Assumptions—Mortality Adjustment Factor update

- The Mortality Adjustment Factors (MAFs) presented here are being proposed as an update to the current Standard Projection Amount (SPA) assumptions in VM-21.
- The Base Mortality Adjustment Factors have been developed based on an industry study covering variable annuities (VAs) during the 2011-2015 experience period.
- A basis for historical mortality improvement (HMI) has been developed, and was used to bring the factors up to 12/31/2022.
- Compared to the current MAFs in VM-21, the current proposal has the following structural changes:
  - Distinct factors are being proposed for female and male lives, driven by the HMI differences.
  - Factors were developed for a wider range of ages, i.e., starting at age 50 versus 65 in the current VM-21.
  - The non-Guaranteed Living Benefit (non-GLB) factors are split between the Basic and Enhanced Death Benefits; the current VM-21 only has a GLB/non-GLB split.

VM-21: SPA Assumptions—Mortality Adjustment Factor update, continued

- Enhanced Death Benefits are defined as those that include a Roll-up; everything else was categorized with Basic Death Benefits. Therefore, Enhanced DBs include Roll-ups and Roll-up/Ratchet combinations, while Basic DBs consist of contracts with no DBs, minimal DBs such as waiver of surrender charges, Return of Premium DBs, and Ratchets without Roll-ups.
- The updated factors proposed here are intended to be applied using the same formula as the current Standard Projection Amount (SPA) assumptions in VM-21, i.e., tied to an expected basis using the 2012 Individual Annuity Mortality (IAM) Basic Table and the G2 Mortality Improvement Scale.
- The base mortality adjustment factors are comparable to the current VM-21 MAFs, except for the bifurcation of the death benefit categories. This can be seen in slides 6 and 7. Note that in the industry experience study, the Basic Death Benefit has more exposure than the Enhanced Death Benefit, so on a blended basis the non-GLB results were quite similar to the current VM-21 SPA mortality assumptions.
- HMI has generally been below that predicted by the G2 improvement scale, and that is the primary reason the updated factors are higher than the current VM-21 factors.

Base Adjustment Factors for VAs

VA Base Mortality Adjustment Factors*

	VA non-GLB Enhanced DB	VA non-GLB Basic DB	VA GLB
Age	Female and Male	Female and Male	Female and Male
52	150%	105%	95%
57	150%	105%	90%
62	150%	95%	80%
67	145%	95%	83%
72	145%	105%	95%
77	140%	108%	98%
82	125%	108%	105%
87	112%	108%	108%
92	112%	110%	110%
97	110%	110%	110%
102	104%	104%	104%
105	100%	100%	100%

*These Base Mortality Adjustment Factors were developed based on an industry study covering the 2011-2015 experience period.

Base Adjustment Factor Comparison—non-GLB

Age	VA non-GLB Enhanced DB Female and Male*	Current VM-21 non-GLB MAFs Female and Male	Difference Female and Male
52	150%	100%	50%
57	150%	100%	50%
62	150%	100%	50%
67	145%	104%	41%
72	145%	114%	31%
77	140%	118%	22%
82	125%	113%	12%
87	112%	110%	2%
92	112%	110%	2%
97	110%	108%	2%
102	104%	103%	1%
105	100%	100%	0%

Age	VA non-GLB Basic DB Female and Male*	Current VM-21 non-GLB MAFs Female and Male	Difference Female and Male
52	105%	100%	5%
57	105%	100%	5%
62	95%	100%	-5%
67	95%	104%	-9%
72	105%	114%	-9%
77	108%	118%	-10%
82	108%	113%	-5%
87	108%	110%	-2%
92	110%	110%	0%
97	110%	108%	2%
102	104%	103%	1%
105	100%	100%	0%

*These Base Mortality Adjustment Factors were developed based on an industry study covering the 2011-2015 experience period.

Base Adjustment Factor Comparison—GLB

Age	VA GLB Female and Male*	Current VM-21 GLB MAFs Female and Male	Difference Female and Male
52	95.0%	80.0%	15.0%
57	90.0%	80.0%	10.0%
62	80.0%	80.0%	0.0%
67	83.0%	83.0%	0.0%
72	95.0%	90.5%	4.5%
77	98.0%	98.0%	0.0%
82	105.0%	105.5%	-0.5%
87	108.0%	110.0%	-2.0%
92	110.0%	110.0%	0.0%
97	110.0%	108.0%	2.0%
102	104.0%	103.0%	1.0%
105	100.0%	100.0%	0.0%

*These Base Mortality Adjustment Factors were developed based on an industry study covering the 2011-2015 experience period.

Development of Basis for Historical Mortality Improvement

- Our objective is to set a baseline mortality as of 12/31/2022, to serve as the new "jumping-off" point.
- Historical Mortality Improvement is needed to bring mortality up from the 2013 mid-point of the industry study.
- We split the historical era into **two periods**, first the pre-pandemic era through 2019, and then 2020–2022.
- Historical Mortality Improvement through 2019
  - We used data from the SOA's report on Mortality by Socioeconomic Category, authored by Magali Barbieri, to generate improvement rates by quinquennial age groups.
  - U.S. counties were assigned to one of 10 deciles, based on various socioeconomic criteria.
  - The 10th decile (highest socioeconomic category) aligned with the VA mortality experience.
  - Mortality data for this study was sourced from the National Center for Health Statistics (NCHS), which had a good alignment with Social Security data except at older ages (above age 80).

Development of Basis for Historical Mortality Improvement, continued

- Historical Mortality Improvement for 2020 through 2022
  - Actual experience was severely impacted by the pandemic.
  - Even if specific COVID-19 related deaths could be identified with precision and factored out, other aspects of the pandemic environment affected overall mortality drivers.
  - **Decision was made to assume 0% improvement for 2020 through 2022**
    - Mortality rates at the end of 2022 had not yet improved to 2019 levels post-pandemic, but were getting close, especially at the older ages relevant for the VAs.

Annual Rates of Historical Mortality Improvement applied for VAs covering 2013-2019

Female

Age	G2 Scale (1)	Current HMI 2013-2019 (2)	Difference (2) - (1) (3)
52	1.10%	1.97%	0.87%
57	1.20%	0.95%	-0.25%
62	1.30%	0.62%	-0.68%
67	1.30%	1.16%	-0.14%
72	1.30%	1.38%	0.08%
77	1.30%	1.15%	-0.15%
82	1.20%	0.71%	-0.49%
87	0.80%	0.48%	-0.32%
92	0.50%	0.30%	-0.20%
97	0.30%	0.18%	-0.12%
102	0.10%	0.06%	-0.04%
105	0.00%	0.00%	0.00%

Male

Age	G2 Scale (1)	Current HMI 2013-2019 (2)	Difference (2) - (1) (3)
52	1.10%	0.96%	-0.14%
57	1.40%	0.92%	-0.48%
62	1.50%	0.95%	-0.55%
67	1.50%	0.47%	-1.03%
72	1.50%	0.79%	-0.71%
77	1.50%	1.07%	-0.43%
82	1.30%	0.79%	-0.51%
87	0.90%	0.55%	-0.35%
92	0.60%	0.36%	-0.24%
97	0.30%	0.18%	-0.12%
102	0.10%	0.06%	-0.04%
105	0.00%	0.00%	0.00%

Mortality Adjustment Factor Development

- The Base Adjustment Factors, representative of the central point of the industry study (mid-2013), are brought up to 12/31/2022 using the HMI basis just covered.
- The Mortality Adjustment Factors were developed for the quinquennial age groups by averaging the raw factors for the five consecutive ages, and then rounding and smoothing the results.
- We propose using linear interpolation for generating the factors for the individual ages.
- The G2 Improvement Scale would remain the mortality improvement basis for future mortality improvement (FMI).
- Slide 12 below shows a summary of the proposed revision of Mortality Adjustment Factors by the central age in the quinquennial groupings for the Enhanced Death Benefit, Basic Death Benefit, and GLB bases.
- Slides 13-15 show the development combining the base factors with the HMI impacts, along with a comparison to the current VM-21 factors.

Mortality Adjustment Factors for VM-21

Variable Annuity Mortality Adjustment Factors

	VA non-GLB Enhanced DB		VA non-GLB Basic DB		VA GLB	
Age	Female	Male	Female	Male	Female	Male
52	150%	160%	105%	110%	95%	100%
57	160%	160%	110%	110%	95%	95%
62	160%	160%	105%	105%	88%	88%
67	155%	160%	100%	105%	88%	93%
72	150%	160%	108%	115%	98%	103%
77	145%	150%	113%	115%	105%	105%
82	135%	135%	115%	115%	113%	113%
87	120%	120%	113%	113%	113%	113%
92	115%	115%	113%	113%	113%	113%
97	110%	110%	110%	110%	110%	110%
102	105%	105%	105%	105%	105%	105%
105	100%	100%	100%	100%	100%	100%

Mortality Adjustment Factors for VM-21

VA non-GLB
Enhanced DB—Female

Age	Base Adj Factors	HMI Impact	Factors thru 2022	Current VM-21	Diff from VM-21
52	150.0%	97.7%	150%	100.0%	50.0%
57	150.0%	105.3%	160%	100.0%	60.0%
62	150.0%	108.6%	160%	100.0%	60.0%
67	145.0%	104.9%	155%	104.0%	51.0%
72	145.0%	103.4%	150%	114.0%	36.0%
77	140.0%	105.0%	145%	118.0%	27.0%
82	125.0%	106.9%	135%	113.0%	22.0%
87	112.0%	104.6%	120%	110.0%	10.0%
92	112.0%	102.8%	115%	110.0%	5.0%
97	110.0%	101.7%	110%	108.0%	2.0%
102	104.0%	100.6%	105%	103.0%	2.0%
105	100.0%	100.0%	100%	100.0%	0.0%

VA non-GLB
Enhanced DB—Male

Age	Base Adj Factors	HMI Impact	Factors thru 2022	Current VM-21	Diff from VM-21
52	150.0%	104.3%	160%	100.0%	60.0%
57	150.0%	107.5%	160%	100.0%	60.0%
62	150.0%	108.3%	160%	100.0%	60.0%
67	145.0%	111.8%	160%	104.0%	56.0%
72	145.0%	109.4%	160%	114.0%	46.0%
77	140.0%	107.5%	150%	118.0%	32.0%
82	125.0%	107.4%	135%	113.0%	22.0%
87	112.0%	105.1%	120%	110.0%	10.0%
92	112.0%	103.4%	115%	110.0%	5.0%
97	110.0%	101.7%	110%	108.0%	2.0%
102	104.0%	100.6%	105%	103.0%	2.0%
105	100.0%	100.0%	100%	100.0%	0.0%

Mortality Adjustment Factors for VM-21

VA non-GLB
Basic DB—Female

Age	Base Adj Factors	HMI Impact	Factors thru 2022	Current VM-21	Diff from VM-21
52	105.0%	97.7%	105%	100.0%	5.0%
57	105.0%	105.3%	110%	100.0%	10.0%
62	95.0%	108.6%	105%	100.0%	5.0%
67	95.0%	104.9%	100%	104.0%	-4.0%
72	105.0%	103.4%	108%	114.0%	-6.0%
77	108.0%	105.0%	113%	118.0%	-5.0%
82	108.0%	106.9%	115%	113.0%	2.0%
87	108.0%	104.6%	113%	110.0%	3.0%
92	110.0%	102.8%	113%	110.0%	3.0%
97	110.0%	101.7%	110%	108.0%	2.0%
102	104.0%	100.6%	105%	103.0%	2.0%
105	100.0%	100.0%	100%	100.0%	0.0%

VA non-GLB
Basic DB—Male

Age	Base Adj Factors	HMI Impact	Factors thru 2022	Current VM-21	Diff from VM-21
52	105.0%	104.3%	110%	100.0%	10.0%
57	105.0%	107.5%	110%	100.0%	10.0%
62	95.0%	108.3%	105%	100.0%	5.0%
67	95.0%	111.8%	105%	104.0%	1.0%
72	105.0%	109.4%	115%	114.0%	1.0%
77	108.0%	107.5%	115%	118.0%	-3.0%
82	108.0%	107.4%	115%	113.0%	2.0%
87	108.0%	105.1%	113%	110.0%	3.0%
92	110.0%	103.4%	113%	110.0%	3.0%
97	110.0%	101.7%	110%	108.0%	2.0%
102	104.0%	100.6%	105%	103.0%	2.0%
105	100.0%	100.0%	100%	100.0%	0.0%

Mortality Adjustment Factors for VM-21

VA GLB—Female

Age	Base Adj Factors	HMI Impact	Factors thru 2022	Current VM-21	Diff from VM-21
52	95.0%	97.7%	95%	80.0%	15.0%
57	90.0%	105.3%	95%	80.0%	15.0%
62	80.0%	108.6%	88%	80.0%	8.0%
67	83.0%	104.9%	88%	83.0%	5.0%
72	95.0%	103.4%	98%	90.5%	7.5%
77	98.0%	105.0%	105%	98.0%	7.0%
82	105.0%	106.9%	113%	105.5%	7.5%
87	108.0%	104.6%	113%	110.0%	3.0%
92	110.0%	102.8%	113%	110.0%	3.0%
97	110.0%	101.7%	110%	108.0%	2.0%
102	104.0%	100.6%	105%	103.0%	2.0%
105	100.0%	100.0%	100%	100.0%	0.0%

VA GLB—Male

Age	Base Adj Factors	HMI Impact	Factors thru 2022	Current VM-21	Diff from VM-21
52	95.0%	104.3%	100%	80.0%	20.0%
57	90.0%	107.5%	95%	80.0%	15.0%
62	80.0%	108.3%	88%	80.0%	8.0%
67	83.0%	111.8%	93%	83.0%	10.0%
72	95.0%	109.4%	103%	90.5%	12.5%
77	98.0%	107.5%	105%	98.0%	7.0%
82	105.0%	107.4%	113%	105.5%	7.5%
87	108.0%	105.1%	113%	110.0%	3.0%
92	110.0%	103.4%	113%	110.0%	3.0%
97	110.0%	101.7%	110%	108.0%	2.0%
102	104.0%	100.6%	105%	103.0%	2.0%
105	100.0%	100.0%	100%	100.0%	0.0%

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Update on Life Insured Mortality Improvement Recommendation

Mortality Improvement Life Working Group
of the SOA Mortality and Longevity Oversight Advisory Council

MARCH | 2024

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Update on MILWG 2024 Work Plan

- Mortality improvement (MI) recommendation for limited underwriting business
  - 2023 work: review sources of data
  - Determined additional data sources required
  - Options
    - Stand-alone, new voluntary data call for limited underwriting business
    - Consider revision to the valuation manual to include both limited underwriting and fully underwritten business as part of VM-51
      - Need to consider applicability of planned new underwriting data elements for limited underwriting purposes
- MI Recommendation for fully underwritten business

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MI Recommendation – Fully Underwritten Business

- Where we started
  - Assumption that there was too much noise in the industry experience data on insured lives to be used to measure insured MI results
  - Reviewed SOA general population socioeconomic decile work
    - Is there a decile that that can be used as a proxy for the life insurance population?
- Initial Considerations
  - Is there a new baseline level of MI post-pandemic?
  - Should the impact of COVID be included/excluded? If excluded, method of exclusion?
  - How much do drug/opioid and smoking status impact the insurance population?
    - Drug/opioid issue (may be more important for key concentration of insured ages)
    - Smoker/nonsmoker differential

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MI Recommendation – Fully Underwritten Business
Overview of Work (2023-2024)

- Predictive modeling
  - To identify and quantify the primary factors impacting mortality improvement results in the insured population data
- MI analysis tool developed
  - Excel-based tool that allows for normalization of data for factors identified in predictive modeling work
  - Allows for comparison to general population deciles
  - Allows for better understanding of true biometric mortality improvement levels

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MI Recommendation – Fully Underwritten Business
Predictive Modeling

- Goal: Determine the primary factors impacting insured mortality
- Data: 2011-2017 fully insured mortality data provided by SOA
- Separate models developed by product
  - Term business – excluding post level term
  - Post level term business only
  - Permanent products
  - Differences by product in order of factor importance
- Results: confirmed group's hypothesis regarding primary factors impacting MI for insured population
  - Changes in underwriting
  - Changes in risk class structure
  - Changes in face amount

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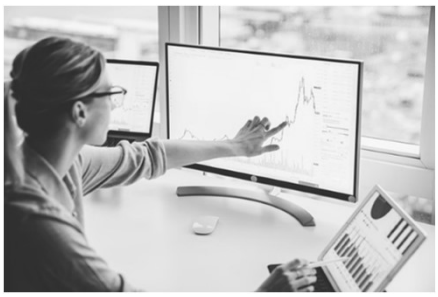
MI Recommendation – Fully Underwritten Business
MI Analysis Tool

- Data
  - General population data from socioeconomic decile study
  - Insured data from NAIC/NYDFS data calls – 2009-2019 period
    - Included all fully underwritten, standard underwriting business (no substandard)
    - Potential additional update for finalized Valuation Basic Table (VBT) Team dataset
- Methodology
  - Insured data distribution was normalized across years for factors having greatest effect
  - Informed by predictive modeling work (underwriting, risk class, face amount changes)
  - Normalized insured data was compared to population data
- Results
  - Have not reached final conclusions but normalized insured data appears reasonably consistent with population trends



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Issues to be Addressed for Initial Recommendation

- Recommend base dataset to measure insured MI
  - Options
    - Use normalized insured data directly, or
    - Select a general population decile as a proxy for insured
- Issues with each option
  - Lag time in data updates
  - General population decile updates would need to be maintained
  - Granularity and credibility of data (e.g., smokers/non-smokers)
- Is the biometric component of MI adequately isolated in the normalized insured data?

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MI Recommendation - Fully Underwritten Business
Next Steps

- Peer review of MI Analysis Tool & Predictive Models
- Continue investigation of patterns in insured versus general population experience generated by MI analysis tool
- Plan to provide updates throughout 2024

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Contact Information

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

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Treasury Model

Targeting criteria T1.T:
a) The scenario set should reasonably reflect history, with some allowance for more extreme high and low interest rate environments
b) Upper Bound:
i. [18%] is >= [99.5%]-tile on the 1Y yield fan chart, and no more than [0.5%] of scenarios have 1Y yields that go above [18%] in the first 30 years
ii. [17%] is >= [99.5%]-tile on the 20Y yield fan chart, and no more than [0.5%] of scenarios have 20Y yields that go above [17%] in the first 30 years

Evaluation statistics T1.E:
Review maximum sojourn length for high interest rates (> 17%)

Targeting criteria T2.T:
Apply the following guidance for negative interest rates:
a) Maturities less than 20 years could experience negative interest rates
b) Interest rates may remain negative for multi-year time periods
c) 1Y rates should not be lower than -1.0%
d) 20Y rates should not be lower than 0.0%

Evaluation statistics T2.E:
e) Frequency of low rates:
i. Review the frequency of negative rates for 1Y rate
ii. Review the frequency of negative rates and rates below 1% for 20Y rate
f) Review Maximum sojourn length for low interest rates (< 0%)

Targeting criteria T3.T:
a) Review initial actual vs. fitted spot curve differences for a sampling of 5 dates representing different shapes and rate levels for the entire curve and review fitted curves qualitatively to confirm they stylistically mimic the different actual yield curve shapes
b) The frequency of different yield curve shapes in early durations should be reasonable considering the shape of the starting yield curve (e.g., a flatter yield curve leads to more inversions).
c) The steady state curve has normal shape (not inverted for short maturities, longer vs shorter maturities, or between long maturities)

Evaluation statistics T3.E:

d) Review upper and lower bound for 20Y-1Y in low, moderate, and high interest rate environments. Compare to historical.
e) Review worse-than-history frequencies for 20Y-1Y in low, moderate, and high interest rate environments. Compare to historical.

Targeting criteria T4.T:
a) At least 7.5% of scenarios need a 10-year geometric average of the 20-year UST below **1.45%**
b) At least 3.75% of scenarios need a 30-year geometric average of the 20-year UST below **1.95%**
Note: As part of the model acceptance process, a given calibration of the GOES will be tested at multiple starting dates. This criteria is relevant for the 12/31/20 starting yield curve.

Targeting criteria T5.T:

a) For each scenario, calculate the geometric average of the [20-year] UST yield over the first [10] and [30] years of the projection.
b) Calculate the [1st] and [99th] percentiles of the distribution of geometric average rates (for both the 10 and 30-year horizons).
c) Look up criteria based on the starting level of the 20-year UST yield (interpolate if necessary).

Evaluation statistics T5.E:

d) Use the Academy approach to determine parameters for 15th and 85th percentiles to expand the criteria table to also include conditions on moderate rate.

Evaluation statistics T6.E:

Mean reversion benchmark:
i. 50th percentile 1.31% < 1Y rate < 3.35%
ii. 50th percentile 3.35% < 20Y rate < 4.89%
Ranges based on 15 year half-life for consistency with AAA recommendation.

Evaluation statistics T7.E:

Note that the buckets refer to starting yield level and the desired range percentages refer to the annualized standard deviation of monthly yield changes.

Rate	Bucket (BOM)	Historical Stat	Desired Range
[Chg1Y]	<= [3%]	0.59%	0.30% to 0.89%
	> [3%] to <= [8%]	1.16%	0.58% to 1.73%
	> [8%]	3.35%	1.67% to 5.02%
[Chg20Y]	<= [3%]	0.61%	0.31% to 0.92%
	> [3%] to <= [8%]	0.75%	0.37% to 1.12%
	> [8%]	1.56%	0.78% to 2.33%

Equity Model

Targeting criteria E1.T:

Use the former C3 Phase II equity model Calibration Criteria as a rough placeholder.

Large Cap (S&P 500) Gross Wealth Factors

Percentile	1 year	5 years	10 years	20 years
2.5%	0.78	0.72	0.79	
5.0%	0.84	0.81	0.94	1.51
10.0%	0.9	0.94	1.16	2.1
90.0%	1.28	2.17	3.63	9.02
95.0%	1.35	2.45	4.36	11.7
97.5%	1.42	2.72	5.12	

Sharpe ratios for equities other than S&P should be within 5% of S&P Sharpe ratio.

Evaluation statistics E1.E:

Review 0.5th percentile, comparing to [0.54/0.58/0.62] for 1/5/10-year WF.

Request for Targeting Criteria E2.T:

Regulators want to ensure that: 1) there is an adequate representation of scenarios with low-for-long Treasury rates and low accumulated equity returns, and 2) that the GOES provides the appropriate incentives for sound risk management programs at insurance organizations. Comments are requested on targeting criteria that could address these concerns.

Corporate Model

Targeting criteria C1.T:

a) Set steady state excess return targets for each bond fund according to the criteria below.

Criteria

Steady state targets *(bps)*	IG 1-5	IG 5-10	IG Long	HY
Target OAS *(avg. VM-20 ult. spread at [12/31/21])*	107	141	163	448
Target Excess Return *(Target OAS * Excess Return % of OAS)*	80	79	66	240
Criteria for avg. annualized Excess Return in years [20-30]	80 -[10]	79 -[10]	66 -[10]	240 -[20]

b) Average annualized excess returns for each bond fund in years 20 through 30 of the projection should be no greater than the steady state excess returns, but no less than the steady state excess returns minus a buffer

Evaluation statistics C2.E:

Bond Fund	Median			Midpoint month Desired Range
	Month [0]	Month [1200]	Midpoint	
IG 1-5	$Median_{[0]}$	$Median_{[1200]}$	$Avg(Median_{[0]}, Median_{[1200]})$	[22] to [26]
IG 5-10	$Median_{[0]}$	$Median_{[1200]}$	$Avg(Median_{[0]}, Median_{[1200]})$	[22] to [26]
IG Long	$Median_{[0]}$	$Median_{[1200]}$	$Avg(Median_{[0]}, Median_{[1200]})$	[22] to [26]
HY	$Median_{[0]}$	$Median_{[1200]}$	$Avg(Median_{[0]}, Median_{[1200]})$	[22] to [26]

Request for criteria or statistics C3:

On the Corporate model, Steve Strommen raised: Stylized fact 1a says "Credit-related losses tend to be "lumpy" or episodic." This increases risk for insurers of significant risk in a short period. Nothing in the criteria or statistics reflect this.

We need a recommended metric if this is to be evaluated.

January 31, 2024

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

Philip Barlow
Chair, Life Risk-Based Capital (E) Working Group (Life RBC)

Mike Yanacheak
Chair, Generator of Economic Scenarios (E/A) Subgroup (GOES Subgroup)
National Association of Insurance Commissioners (NAIC)

Re: Updated Generator of Economic Scenarios (GOES) Targeting Criteria and Evaluation Statistics

Dear Chairs Hemphill, Barlow, and Yanacheak,

On behalf of the Economic Scenario Generator Subcommittee (the subcommittee) of the American Academy of Actuaries,[1] I appreciate the opportunity to offer comments on the Updated GOES Targeting Criteria and Evaluation Statistics exposed on 12/21/23.

The subcommittee strongly supports the targeting criteria and evaluation statistics in the exposure as a foundation for going forward. At the same time, the subcommittee believes the scope of what has been exposed is too limited. The subcommittee strongly recommends that additional targeting criteria and evaluation statistics be adopted to enhance the foundation provided in the exposure. The subcommittee believes that additional criteria and statistics are necessary to achieve a robust set of targeting criteria and evaluation statistics.

The subcommittee's November 2023 comment letter and 2023 presentation at the NAIC's Fall National Meeting include specific details on what we believe represent a robust set of targeting criteria and evaluation statistics.

Thank you for the opportunity to review and provide comments on the exposure. If you have any questions or would like further dialogue, please contact Amanda Barry-Moilanen, life policy analyst, at barrymoilanen@actuary.org..

Sincerely,

Hal Pedersen
Chairperson, Economic Scenario Generator Subcommittee
American Academy of Actuaries

[1] The American Academy of Actuaries is a 20,000-member professional association whose mission is to serve the public and the U.S. actuarial profession. For more than 50 years, the Academy has assisted public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

The Academy's 11/22/23 comment letter to LATF containing updated equity GWFs

This spreadsheet provides backup for the updated equity GWFs contained in the Academy's comment letter linked above

The GWFs in that comment letter were based on the "least binding" GWF from selected reference models

Based on regulator feedback, this spreadsheet also shows GWFs based on the "average" GWF from selected reference models

Cells highlighted in yellow on the "criteria" tab can be changed

GAVG = geometric average return over a horizon of N years

GWF = gross wealth factor over a horizon of N years (i.e., accumulated value of $1 invested over a horizon of N years)

$GWF = (1 + GAVG)^N$

AMERICAN ACADEMY of ACTUARIES

Constrain mean GAVG (over 30 years) to:	6.75%

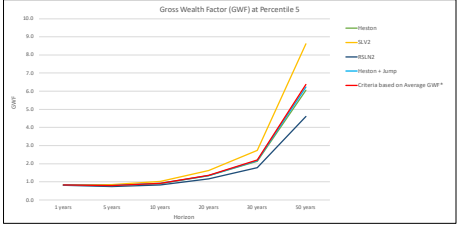
Model	Include in criteria
Heston	1
SLV1	0
SLV2	1
SLV3	0
RSLN2	1
RSDD2	0
LN	0
Heston + Jump	1
ARIG	0

* Criteria is based on the average or least binding percentile across included models (indicated by a "1" in the above table)

Compare models (single percentile)

Percentile: 5

Model	Gross Wealth Factor (GWF)						Geometric Average Return (GAVG)					
	1 years	5 years	10 years	20 years	30 years	50 years	1 years	5 years	10 years	20 years	30 years	50 years
Heston	0.83	0.79	0.90	1.34	2.13	6.06	-17.2%	-4.5%	-1.0%	1.5%	2.6%	3.7%
SLV1	0.79	0.71	0.80	1.12	1.70	4.42	-20.7%	-6.6%	-2.2%	0.6%	1.8%	3.0%
SLV2	0.83	0.84	1.02	1.62	2.73	8.63	-16.8%	-3.4%	0.2%	2.4%	3.4%	4.4%
SLV3	0.84	0.85	1.03	1.63	2.80	8.80	-16.5%	-3.3%	0.2%	2.5%	3.5%	4.4%
RSLN2	0.80	0.75	0.82	1.16	1.79	4.61	-19.9%	-5.6%	-2.0%	0.7%	2.0%	3.1%
RSDD2	0.80	0.87	1.10	1.85	3.33	11.55	-20.1%	-2.7%	0.9%	3.1%	4.1%	5.0%
LN	0.84	0.83	0.95	1.44	2.30	6.53	-15.9%	-3.7%	-0.5%	1.8%	2.8%	3.8%
Heston + Jump	0.83	0.80	0.91	1.34	2.17	6.23	-17.3%	-4.4%	-0.9%	1.5%	2.6%	3.7%
ARIG	0.83	0.80	0.91	1.40	2.26	6.19	-17.2%	-4.4%	-0.9%	1.7%	2.8%	3.7%
Criteria based on Average GWF*	0.82	0.80	0.91	1.36	2.20	6.38	-17.8%	-4.5%	-0.9%	1.6%	2.7%	3.8%
Criteria based on Average GAVG*	0.82	0.80	0.91	1.35	2.18	6.23	-17.8%	-4.5%	-0.9%	1.5%	2.6%	3.7%
Criteria based on Least Binding*	0.83	0.84	1.02	1.62	2.73	8.63	-16.8%	-3.4%	0.2%	2.4%	3.4%	4.4%
Least binding model (of those included)	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2



Criteria based on Average GWF*

Percentile	Gross Wealth Factor (GWF)						Geometric Average Return (GAVG)					
	1 years	5 years	10 years	20 years	30 years	50 years	1 years	5 years	10 years	20 years	30 years	50 years
0	0.46	0.25	0.22	0.25	0.29	0.46	-54.4%	-24.5%	-14.1%	-6.8%	-4.0%	-1.6%
1	0.70	0.58	0.60	0.79	1.15	2.82	-29.8%	-10.4%	-5.0%	-1.1%	0.5%	2.1%
5	0.82	0.80	0.91	1.36	2.20	6.38	-17.8%	-4.5%	-0.9%	1.6%	2.7%	3.8%
10	0.88	0.93	1.12	1.81	3.08	9.78	-11.7%	-1.5%	1.1%	3.0%	3.8%	4.7%
15	0.92	1.02	1.28	2.18	3.84	12.94	-7.6%	0.4%	2.5%	4.0%	4.6%	5.3%
25	0.99	1.18	1.54	2.81	5.26	19.23	-1.5%	3.3%	4.4%	5.3%	5.7%	6.1%
30	1.01	1.24	1.66	3.12	6.01	22.79	1.1%	4.4%	5.2%	5.9%	6.2%	6.5%
50	1.09	1.48	2.15	4.47	9.23	39.98	9.3%	8.1%	7.9%	7.8%	7.7%	7.7%
70	1.17	1.74	2.71	6.30	14.12	68.89	17.2%	11.7%	10.5%	9.6%	9.2%	8.8%
75	1.19	1.82	2.89	6.93	15.88	80.22	19.4%	12.7%	11.2%	10.2%	9.7%	9.2%
85	1.25	2.02	3.36	8.69	21.06	115.31	24.8%	15.0%	12.9%	11.4%	10.7%	10.0%
90	1.28	2.15	3.71	10.09	25.20	147.92	28.4%	16.6%	14.0%	12.3%	11.4%	10.5%
95	1.34	2.37	4.30	12.33	33.19	210.72	34.2%	18.8%	15.7%	13.4%	12.4%	11.3%
99	1.45	2.82	5.64	18.18	53.74	397.23	45.3%	23.1%	18.9%	15.6%	14.2%	12.7%
100	1.76	4.20	8.98	42.03	140.72	1676.94	75.8%	33.3%	24.6%	20.6%	17.9%	16.0%
mean	1.09	1.52	2.31	5.38	12.38	65.77	8.9%	8.7%	8.8%	8.8%	8.7%	8.7%

Criteria based on Average GAVG*

Percentile	Gross Wealth Factor (GWF)						Geometric Average Return (GAVG)					
	1 years	5 years	10 years	20 years	30 years	50 years	1 years	5 years	10 years	20 years	30 years	50 years
0	0.46	0.24	0.21	0.24	0.26	0.41	-54.4%	-26.6%	-14.4%	-6.8%	-4.5%	-1.8%
1	0.70	0.58	0.60	0.79	1.12	2.71	-29.8%	-10.4%	-5.0%	-1.2%	0.4%	2.0%
5	0.82	0.80	0.91	1.35	2.18	6.23	-17.8%	-4.5%	-0.9%	1.5%	2.6%	3.7%
10	0.88	0.93	1.12	1.80	3.05	9.60	-11.7%	-1.5%	1.1%	3.0%	3.8%	4.6%
15	0.92	1.02	1.27	2.17	3.81	12.73	-7.6%	0.4%	2.4%	3.9%	4.6%	5.2%
25	0.99	1.17	1.54	2.81	5.23	19.01	-1.5%	3.3%	4.4%	5.3%	5.7%	6.1%
30	1.01	1.24	1.66	3.12	5.98	22.55	1.1%	4.4%	5.2%	5.8%	6.1%	6.4%
50	1.09	1.48	2.15	4.47	9.21	39.79	9.3%	8.1%	7.9%	7.8%	7.7%	7.6%
70	1.17	1.74	2.71	6.30	14.11	68.78	17.2%	11.7%	10.5%	9.6%	9.2%	8.8%
75	1.19	1.82	2.89	6.93	15.88	80.14	19.4%	12.7%	11.2%	10.2%	9.7%	9.2%
85	1.25	2.02	3.36	8.68	21.05	115.10	24.8%	15.0%	12.9%	11.4%	10.7%	10.0%
90	1.28	2.15	3.71	10.08	25.19	147.88	28.4%	16.6%	14.0%	12.2%	11.4%	10.5%
95	1.34	2.37	4.30	12.30	33.13	210.45	34.2%	18.8%	15.7%	13.4%	12.4%	11.3%
99	1.45	2.82	5.63	18.09	53.28	394.78	45.3%	23.1%	18.9%	15.6%	14.2%	12.7%
100	1.76	4.19	8.94	39.02	135.49	1589.88	75.8%	33.2%	24.5%	20.1%	17.8%	15.9%
mean	1.09	1.52	2.31	5.38	12.38	65.76	8.9%	8.7%	8.8%	8.8%	8.7%	8.7%

Criteria based on Least Binding*

Percentile	Gross Wealth Factor (GWF)						Geometric Average Return (GAVG)						Least binding model (of those included)					
	1 years	5 years	10 years	20 years	30 years	50 years	1 years	5 years	10 years	20 years	30 years	50 years	1 years	5 years	10 years	20 years	30 years	50 years
0	0.48	0.28	0.33	0.52	0.56	0.85	-51.9%	-22.7%	-10.6%	-5.6%	-3.9%	-2.3%	Heston	SLV2	SLV2	SLV2	SLV2	SLV2
1	0.71	0.64	0.71	0.99	1.55	4.15	-28.7%	-8.5%	-3.4%	0.0%	1.5%	2.9%	Heston	SLV2	SLV2	SLV2	SLV2	SLV2
5	0.83	0.84	1.02	1.62	2.73	8.63	-16.8%	-3.4%	0.2%	2.4%	3.4%	4.4%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
10	0.89	0.98	1.22	2.10	3.74	12.78	-10.6%	-0.3%	2.0%	3.8%	4.5%	5.2%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
15	0.93	1.07	1.38	2.46	4.55	16.49	-6.8%	1.4%	3.3%	4.6%	5.2%	5.8%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
25	0.99	1.22	1.64	3.11	6.04	23.61	-0.6%	4.1%	5.1%	5.8%	6.2%	6.5%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
30	1.02	1.28	1.76	3.41	6.84	27.56	1.8%	5.1%	5.8%	6.3%	6.6%	6.9%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
50	1.09	1.48	2.15	4.47	9.23	39.98	9.3%	8.1%	7.9%	7.8%	7.7%	7.6%						
70	1.17	1.73	2.70	6.14	13.50	62.71	16.8%	11.5%	10.4%	9.5%	9.1%	8.6%	Heston	SLV2	RSLN2	RSLN2	RSLN2	RSLN2
75	1.19	1.80	2.86	6.80	15.53	74.13	19.3%	12.5%	11.1%	10.1%	9.6%	9.0%	Heston	SLV2	SLV2	RSLN2	RSLN2	RSLN2
85	1.24	1.97	3.27	8.41	20.39	112.78	24.4%	14.5%	12.6%	11.2%	10.6%	9.9%	SLV2	SLV2	SLV2	SLV2	SLV2	RSLN2
90	1.28	2.09	3.58	9.59	23.93	142.63	27.8%	15.9%	13.6%	12.0%	11.2%	10.4%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
95	1.33	2.28	4.08	11.43	30.68	195.72	32.9%	18.0%	15.1%	13.0%	12.1%	11.1%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
99	1.42	2.67	5.30	15.83	45.17	333.02	42.4%	21.7%	17.7%	14.8%	13.5%	12.3%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
100	1.67	3.75	8.01	29.20	99.48	1019.62	66.9%	30.3%	23.1%	18.4%	16.6%	14.9%	SLV2	Heston + Jump	SLV2	SLV2	SLV2	SLV2
mean	1.09	1.52	2.31	5.38	12.38	65.77	8.9%	8.7%	8.8%	8.8%	8.7%	8.7%						

Mean GAVG (over 30 years)			Adjustment Factor					
Model	Unconstrained	Constrained	1 years	5 years	10 years	20 years	30 years	50 years
Heston	11.468%	8.750%	0.9756	0.8839	0.7812	0.6103	0.4768	0.2910
SLV1	10.341%	8.750%	0.9856	0.9300	0.8648	0.7479	0.6469	0.4838
SLV2	11.365%	8.750%	0.9765	0.8880	0.7885	0.6217	0.4902	0.3048
SLV3	11.611%	8.750%	0.9744	0.8782	0.7713	0.5949	0.4588	0.2730
RSLN2	11.941%	8.750%	0.9715	0.8654	0.7488	0.5608	0.4199	0.2355
RSDD2	11.224%	8.750%	0.9778	0.8936	0.7985	0.6377	0.5092	0.3247
LN	11.676%	8.750%	0.9738	0.8757	0.7668	0.5880	0.4509	0.2652
Heston + Jump	11.800%	8.750%	0.9727	0.8708	0.7584	0.5751	0.4362	0.2508
AIRG	8.809%	8.750%	0.9995	0.9973	0.9946	0.9893	0.9839	0.9734

Data			Unconstrained Mean											
			Gross Wealth Factor (GWF)						Geometric Average Return (GAVG)					
Model	Stat	Key	1 years	5 years	10 years	20 years	30 years	50 years	1 years	5 years	10 years	20 years	30 years	50 years
Heston	0	Heston_0	0.49	0.22	0.23	0.47	0.64	1.25	-50.7%	-26.3%	-13.7%	-3.7%	-1.5%	0.4%
Heston	1	Heston_1	0.73	0.65	0.76	1.28	2.21	9.03	-26.9%	-8.3%	-2.7%	1.2%	2.7%	4.5%
Heston	5	Heston_5	0.85	0.90	1.16	2.20	4.47	20.82	-15.1%	-2.1%	1.5%	4.0%	5.1%	6.3%
Heston	10	Heston_10	0.91	1.05	1.42	2.93	6.35	32.18	-9.2%	0.9%	3.6%	5.5%	6.4%	7.2%
Heston	15	Heston_15	0.95	1.16	1.63	3.52	8.01	43.58	-5.5%	3.0%	5.0%	6.5%	7.2%	7.8%
Heston	25	Heston_25	1.01	1.33	1.97	4.58	11.02	65.40	0.6%	5.9%	7.0%	7.9%	8.3%	8.7%
Heston	30	Heston_30	1.03	1.41	2.14	5.08	12.62	77.72	3.2%	7.1%	7.9%	8.5%	8.8%	9.1%
Heston	50	Heston_50	1.12	1.67	2.76	7.38	19.39	138.42	11.7%	10.8%	10.7%	10.5%	10.4%	10.4%
Heston	70	Heston_70	1.20	1.96	3.48	10.38	29.68	238.65	19.7%	14.4%	13.3%	12.4%	12.0%	11.6%
Heston	75	Heston_75	1.22	2.06	3.70	11.39	33.48	281.06	22.3%	15.5%	14.0%	12.9%	12.4%	11.9%
Heston	85	Heston_85	1.28	2.28	4.31	14.31	44.55	403.11	28.2%	17.9%	15.7%	14.2%	13.5%	12.7%
Heston	90	Heston_90	1.32	2.44	4.79	16.63	53.14	520.18	32.1%	19.5%	16.9%	15.1%	14.2%	13.3%
Heston	95	Heston_95	1.38	2.69	5.55	20.35	70.46	745.92	38.1%	21.8%	18.7%	16.3%	15.2%	14.1%
Heston	99	Heston_99	1.49	3.23	7.15	29.52	109.36	1396.08	49.5%	26.4%	21.7%	18.4%	16.9%	15.6%
Heston	100	Heston_100	1.83	5.17	10.76	54.56	286.57	4520.07	82.9%	38.9%	26.8%	22.1%	20.8%	18.3%
Heston	mean	Heston_mean	1.12	1.72	2.97	8.82	25.98	228.26	11.6%	11.4%	11.5%	11.5%	11.5%	11.5%
SLV1	0	SLV1_0	0.41	0.17	0.20	0.19	0.29	0.49	-59.5%	-29.5%	-15.0%	-7.9%	-4.0%	-1.4%
SLV1	1	SLV1_1	0.66	0.52	0.57	0.80	1.26	3.59	-34.3%	-12.1%	-5.5%	-1.1%	0.8%	2.6%
SLV1	5	SLV1_5	0.80	0.77	0.92	1.50	2.63	9.14	-19.5%	-5.2%	-0.8%	2.1%	3.3%	4.5%
SLV1	10	SLV1_10	0.88	0.93	1.17	2.10	3.96	15.41	-12.3%	-1.3%	1.5%	3.8%	4.7%	5.6%
SLV1	15	SLV1_15	0.92	1.05	1.37	2.58	5.13	21.65	-7.8%	1.0%	3.2%	4.9%	5.6%	6.3%
SLV1	25	SLV1_25	0.99	1.23	1.71	3.44	7.26	34.11	-0.7%	4.2%	5.5%	6.4%	6.8%	7.3%
SLV1	30	SLV1_30	1.02	1.31	1.86	3.88	8.51	41.03	1.9%	5.5%	6.4%	7.0%	7.4%	7.7%
SLV1	50	SLV1_50	1.11	1.59	2.48	5.90	13.77	77.92	10.9%	9.7%	9.5%	9.3%	9.1%	9.1%
SLV1	70	SLV1_70	1.19	1.89	3.18	8.53	22.01	140.28	19.5%	13.6%	12.3%	11.3%	10.9%	10.4%
SLV1	75	SLV1_75	1.22	1.98	3.41	9.45	25.03	168.23	21.9%	14.6%	13.0%	11.9%	11.3%	10.8%
SLV1	85	SLV1_85	1.27	2.19	3.99	11.98	33.70	246.65	27.2%	17.0%	14.8%	13.2%	12.4%	11.6%
SLV1	90	SLV1_90	1.31	2.34	4.42	13.94	40.75	321.56	31.1%	18.6%	16.0%	14.1%	13.2%	12.2%
SLV1	95	SLV1_95	1.37	2.58	5.12	17.25	53.68	480.95	36.9%	20.9%	17.7%	15.3%	14.2%	13.1%
SLV1	99	SLV1_99	1.47	3.06	6.57	24.56	83.97	877.70	47.2%	25.1%	20.7%	17.4%	15.9%	14.5%
SLV1	100	SLV1_100	1.75	4.21	10.15	45.33	212.36	2651.13	74.6%	33.3%	26.1%	21.0%	19.6%	17.1%
SLV1	mean	SLV1_mean	1.10	1.62	2.67	7.18	19.15	137.52	10.0%	10.2%	10.3%	10.4%	10.3%	10.3%
SLV2	0	SLV2_0	0.48	0.31	0.41	0.51	1.15	2.80	-52.3%	-20.8%	-8.5%	-3.3%	0.5%	2.1%
SLV2	1	SLV2_1	0.72	0.72	0.90	1.60	3.15	13.63	-28.0%	-6.3%	-1.1%	2.4%	3.9%	5.4%
SLV2	5	SLV2_5	0.85	0.95	1.30	2.60	5.56	28.30	-14.8%	-1.1%	2.6%	4.9%	5.9%	6.9%
SLV2	10	SLV2_10	0.92	1.11	1.55	3.37	7.63	41.92	-8.4%	2.1%	4.5%	6.3%	7.0%	7.8%
SLV2	15	SLV2_15	0.95	1.21	1.75	3.96	9.28	54.11	-4.5%	3.9%	5.8%	7.1%	7.7%	8.3%
SLV2	25	SLV2_25	1.02	1.38	2.08	5.01	12.33	77.47	1.8%	6.6%	7.6%	8.4%	8.7%	9.1%
SLV2	30	SLV2_30	1.04	1.44	2.23	5.49	13.96	90.42	4.3%	7.6%	8.3%	8.9%	9.2%	9.4%
SLV2	50	SLV2_50	1.12	1.69	2.80	7.53	20.18	148.15	12.3%	11.0%	10.8%	10.6%	10.5%	10.5%
SLV2	70	SLV2_70	1.20	1.95	3.43	10.18	29.42	241.05	20.2%	14.2%	13.1%	12.3%	11.9%	11.6%
SLV2	75	SLV2_75	1.22	2.03	3.63	11.12	32.50	274.23	22.3%	15.2%	13.8%	12.8%	12.3%	11.9%
SLV2	85	SLV2_85	1.27	2.22	4.15	13.53	41.60	377.39	27.3%	17.3%	15.3%	13.9%	13.2%	12.6%
SLV2	90	SLV2_90	1.31	2.35	4.55	15.42	48.82	468.01	30.9%	18.7%	16.3%	14.7%	13.8%	13.1%
SLV2	95	SLV2_95	1.36	2.57	5.17	18.39	62.60	642.20	36.1%	20.8%	17.9%	15.7%	14.8%	13.8%
SLV2	99	SLV2_99	1.46	3.01	6.46	25.47	92.14	1092.72	45.9%	24.6%	20.5%	17.6%	16.3%	15.0%
SLV2	100	SLV2_100	1.71	4.43	10.16	46.96	202.94	3345.63	71.0%	34.7%	26.1%	21.2%	19.4%	17.6%
SLV2	mean	SLV2_mean	1.12	1.72	2.95	8.66	25.26	216.73	11.7%	11.4%	11.4%	11.4%	11.4%	11.4%
SLV3	0	SLV3_0	0.46	0.30	0.41	0.50	1.25	3.04	-54.2%	-21.4%	-8.4%	-3.4%	0.7%	2.2%
SLV3	1	SLV3_1	0.72	0.73	0.92	1.71	3.38	15.86	-28.3%	-6.2%	-0.9%	2.7%	4.1%	5.7%
SLV3	5	SLV3_5	0.86	0.96	1.33	2.74	6.11	32.22	-14.3%	-0.7%	2.9%	5.2%	6.2%	7.2%
SLV3	10	SLV3_10	0.92	1.13	1.60	3.57	8.25	47.25	-7.6%	2.4%	4.8%	6.6%	7.3%	8.0%
SLV3	15	SLV3_15	0.96	1.23	1.81	4.21	10.10	61.89	-3.7%	4.3%	6.1%	7.5%	8.0%	8.6%
SLV3	25	SLV3_25	1.03	1.40	2.15	5.28	13.40	88.37	2.6%	7.0%	8.0%	8.7%	9.0%	9.4%
SLV3	30	SLV3_30	1.05	1.47	2.30	5.80	15.07	103.25	5.0%	8.0%	8.7%	9.2%	9.5%	9.7%
SLV3	50	SLV3_50	1.13	1.71	2.88	7.94	21.74	167.55	13.0%	11.3%	11.2%	10.9%	10.8%	10.8%
SLV3	70	SLV3_70	1.20	1.97	3.51	10.67	31.52	269.07	20.4%	14.5%	13.4%	12.6%	12.2%	11.8%
SLV3	75	SLV3_75	1.23	2.05	3.71	11.58	34.78	307.23	22.5%	15.4%	14.0%	13.0%	12.6%	12.1%
SLV3	85	SLV3_85	1.28	2.23	4.23	14.12	44.21	421.06	27.5%	17.4%	15.5%	14.2%	13.5%	12.8%
SLV3	90	SLV3_90	1.31	2.37	4.61	16.04	51.62	520.16	31.0%	18.8%	16.5%	14.9%	14.0%	13.3%
SLV3	95	SLV3_95	1.36	2.59	5.23	18.97	65.80	707.66	36.0%	20.9%	18.0%	15.9%	15.0%	14.0%
SLV3	99	SLV3_99	1.45	3.01	6.48	26.07	96.92	1175.89	45.4%	24.7%	20.6%	17.7%	16.5%	15.2%
SLV3	100	SLV3_100	1.70	4.38	9.77	48.14	218.59	3793.55	70.0%	34.4%	25.6%	21.4%	19.7%	17.9%
SLV3	mean	SLV3_mean	1.12	1.74	3.02	9.05	26.99	241.65	12.1%	11.7%	11.7%	11.6%	11.6%	11.6%
RSLN2	0	RSLN2_0	0.42	0.31	0.29	0.25	0.36	1.27	-58.3%	-21.0%	-11.7%	-6.7%	-3.3%	0.5%
RSLN2	1	RSLN2_1	0.71	0.62	0.71	1.19	2.13	8.16	-29.2%	-9.0%	-3.3%	0.9%	2.5%	4.3%
RSLN2	5	RSLN2_5	0.82	0.87	1.09	2.06	4.26	19.56	-17.6%	-2.8%	0.9%	3.7%	4.9%	6.1%
RSLN2	10	RSLN2_10	0.89	1.01	1.35	2.75	5.92	30.96	-10.7%	0.2%	3.0%	5.2%	6.1%	7.1%
RSLN2	15	RSLN2_15	0.94	1.12	1.54	3.35	7.49	41.50	-5.7%	2.3%	4.4%	6.2%	6.9%	7.7%
RSLN2	25	RSLN2_25	1.01	1.29	1.90	4.44	10.67	64.99	0.9%	5.3%	6.7%	7.7%	8.2%	8.7%
RSLN2	30	RSLN2_30	1.04	1.38	2.08	5.00	12.34	77.54	3.8%	6.6%	7.6%	8.4%	8.7%	9.1%
RSLN2	50	RSLN2_50	1.12	1.68	2.75	7.45	19.88	144.56	12.4%	10.9%	10.6%	10.6%	10.5%	10.5%
RSLN2	70	RSLN2_70	1.21	2.01	3.61	10.95	32.16	266.28	20.7%	14.9%	13.7%	12.7%	12.3%	11.8%
RSLN2	75	RSLN2_75	1.23	2.12	3.87	12.12	36.97	314.72	23.1%	16.2%	14.5%	13.3%	12.8%	12.2%
RSLN2	85	RSLN2_85	1.29	2.38	4.62	15.87	51.28	478.91	28.8%	19.0%	16.5%	14.8%	14.0%	13.1%
RSLN2	90	RSLN2_90	1.33	2.58	5.13	18.90	63.11	641.94	32.6%	20.8%	17.8%	15.8%	14.8%	13.8%
RSLN2	95	RSLN2_95	1.40	2.87	6.10	23.98	85.85	952.44	39.6%	23.5%	19.8%	17.2%	16.0%	14.7%
RSLN2	99	RSLN2_99	1.53	3.50	8.51	37.63	155.58	1940.00	53.0%	28.5%	23.9%	19.9%	18.3%	16.3%
RSLN2	100	RSLN2_100	1.96	5.27	13.83	131.54	496.28	10105.81	96.1%	39.4%	30.0%	27.6%	23.0%	20.3%
RSLN2	mean	RSLN2_mean	1.12	1.75	3.07	9.54	29.49	276.24	11.9%	11.8%	11.9%	11.9%	11.9%	11.9%
RSDD2	0	RSDD2_0	0.48	0.32	0.46	0.90	2.15	4.57	-51.8%	-20.4%	-7.4%	-0.5%	2.6%	3.1%
RSDD2	1	RSDD2_1	0.69	0.76	1.02	2.07	4.33	19.98	-31.1%	-5.3%	0.2%	3.7%	5.0%	6.2%
RSDD2	5	RSDD2_5	0.82	0.97	1.37	2.89	6.54	35.57	-18.2%	-0.5%	3.2%	5.5%	6.5%	7.4%
RSDD2	10	RSDD2_10	0.89	1.09	1.58	3.55	8.27	47.60	-11.2%	1.8%	4.6%	6.5%	7.3%	8.0%
RSDD2	15	RSDD2_15	0.94	1.18	1.74	4.07	9.69	58.92	-6.4%	3.3%	5.7%	7.3%	7.9%	8.5%
RSDD2	25	RSDD2_25	1.00	1.31	2.00	4.92	12.26	79.40	-0.3%	5.6%	7.2%	8.3%	8.7%	9.1%
RSDD2	30	RSDD2_30	1.02	1.37	2.13	5.34	13.44	90.24	2.1%	6.5%	7.8%	8.7%	9.0%	9.4%
RSDD2	50	RSDD2_50	1.10	1.60	2.62	7.16	19.14	140.95	9.7%	9.9%	10.1%	10.3%	10.3%	10.4%
RSDD2	70	RSDD2_70	1.18	1.87	3.24	9.52	27.61	220.77	17.6%	13.3%	12.5%	11.9%	11.7%	11.4%
RSDD2	75	RSDD2_75	1.20	1.96	3.44	10.36	30.44	249.88	19.8%	14.3%	13.1%	12.4%	12.1%	11.7%
RSDD2	85	RSDD2_85	1.25	2.16	3.96	12.74	38.97	338.13	25.2%	16.6%	14.8%	13.6%	13.0%	12.4%
RSDD2	90	RSDD2_90	1.29	2.32	4.36	14.64	46.11	418.09	29.0%	18.3%	15.9%	14.4%	13.6%	12.8%
RSDD2	95	RSDD2_95	1.35	2.56	5.08	18.19	58.80	581.08	34.8%	20.7%	17.6%	15.6%	14.5%	13.6%
RSDD2	99	RSDD2_99	1.47	3.04	6.74	26.26	94.20	1035.11	47.0%	24.9%	21.0%	17.8%	16.4%	14.9%
RSDD2	100	RSDD2_100	1.79	4.44	11.29	63.71	287.78	4245.65	78.9%	34.7%	27.4%	23.1%	20.8%	18.2%
RSDD2	mean	RSDD2_mean	1.09	1.66	2.85	8.36	24.32	204.17	9.4%	10.7%	11.0%	11.2%	11.2%	11.2%
LN	0	LN_0	0.58	0.47	0.49	0.54	0.95	4.56	-41.9%	-14.1%	-6.9%	-3.0%	-0.2%	3.1%
LN	1	LN_1	0.78	0.75	0.91	1.56	2.92	12.11	-22.1%	-5.5%	-0.9%	2.2%	3.6%	5.1%
LN	5	LN_5	0.86	0.95	1.24	2.45	5.09	24.64	-13.6%	-1.1%	2.2%	4.6%	5.6%	6.6%
LN	10	LN_10	0.91	1.07	1.48	3.08	6.73	36.38	-8.7%	1.4%	4.0%	5.8%	6.6%	7.5%
LN	15	LN_15	0.95	1.17	1.65	3.63	8.21	46.27	-5.4%	3.2%	5.1%	6.7%	7.3%	8.0%
LN	25	LN_25	1.00	1.32	1.96	4.66	11.08	68.06	-0.1%	5.7%	7.0%	8.0%	8.3%	8.8%
LN	30	LN_30	1.02	1.39	2.09	5.12	12.59	80.87	2.3%	6.8%	7.7%	8.5%	8.8%	9.2%
LN	50	LN_50	1.11	1.65	2.70	7.26	19.61	143.95	10.8%	10.5%	10.4%	10.4%	10.4%	10.4%
LN	70	LN_70	1.20	1.95	3.45	10.29	30.19	249.14	19.6%	14.3%	13.2%	12.4%	12.0%	11.7%
LN	75	LN_75	1.22	2.04	3.71	11.43	34.23	288.18	22.2%	15.4%	14.0%	13.0%	12.5%	12.0%
LN	85	LN_85	1.29	2.30	4.37	14.72	45.64	424.58	28.8%	18.2%	15.9%	14.4%	13.6%	12.9%
LN	90	LN_90	1.33	2.49	4.88	17.19	56.28	552.37	33.2%	20.1%	17.2%	15.3%	14.4%	13.5%
LN	95	LN_95	1.41	2.79	5.78	22.10	76.56	807.09	40.8%	22.8%	19.2%	16.7%	15.6%	14.3%
LN	99	LN_99	1.56	3.51	8.00	34.29	130.08	1585.18	56.1%	28.5%	23.1%	19.3%	17.6%	15.9%
LN	100	LN_100	1.89	5.79	15.69	148.48	566.49	10985.70	89.3%	42.1%	31.7%	28.4%	23.5%	20.5%
LN	mean	LN_mean	1.12	1.73	3.00	9.12	27.46	247.80	11.8%	11.6%	11.6%	11.7%	11.7%	11.7%
Heston + Jump	0	Heston + Jump_0	0.48	0.29	0.21	0.48	0.36	1.24	-51.5%	-22.2%	-14.6%	-3.6%	-3.3%	0.4%
Heston + Jump	1	Heston + Jump_1	0.72	0.64	0.75	1.27	2.52	10.24	-27.7%	-8.5%	-2.8%	1.2%	3.1%	4.8%
Heston + Jump	5	Heston + Jump_5	0.85	0.92	1.20	2.32	4.97	24.83	-15.0%	-1.8%	1.9%	4.3%	5.5%	6.6%
Heston + Jump	10	Heston + Jump_10	0.91	1.06	1.50	3.15	7.05	38.70	-8.9%	1.3%	4.1%	5.9%	6.7%	7.6%
Heston + Jump	15	Heston + Jump_15	0.95	1.18	1.70	3.86	8.81	51.12	-4.8%	3.3%	5.5%	7.0%	7.5%	8.2%
Heston + Jump	25	Heston + Jump_25	1.01	1.35	2.06	4.97	12.06	75.62	1.3%	6.2%	7.5%	8.3%	8.7%	9.0%
Heston + Jump	30	Heston + Jump_30	1.04	1.43	2.21	5.52	13.75	90.53	3.9%	7.4%	8.3%	8.9%	9.1%	9.4%
Heston + Jump	50	Heston + Jump_50	1.12	1.71	2.86	7.86	21.61	161.33	12.5%	11.3%	11.1%	10.9%	10.8%	10.7%
Heston + Jump	70	Heston + Jump_70	1.20	2.01	3.57	11.13	33.01	278.88	20.5%	14.9%	13.6%	12.8%	12.4%	11.9%
Heston + Jump	75	Heston + Jump_75	1.23	2.09	3.81	12.26	36.95	324.50	22.7%	15.9%	14.3%	13.3%	12.8%	12.3%
Heston + Jump	85	Heston + Jump_85	1.28	2.32	4.42	15.12	48.28	463.08	28.2%	18.3%	16.0%	14.5%	13.8%	13.1%
Heston + Jump	90	Heston + Jump_90	1.32	2.46	4.84	17.41	57.42	584.08	31.8%	19.7%	17.1%	15.4%	14.5%	13.6%
Heston + Jump	95	Heston + Jump_95	1.37	2.69	5.58	20.87	74.34	820.56	37.3%	21.9%	18.8%	16.4%	15.4%	14.4%
Heston + Jump	99	Heston + Jump_99	1.48	3.15	7.27	30.92	119.94	1565.95	48.5%	25.8%	21.9%	18.7%	17.3%	15.8%
Heston + Jump	100	Heston + Jump_100	1.72	4.31	12.08	55.42	271.39	7945.63	72.1%	33.9%	28.3%	22.2%	20.5%	19.7%
Heston + Jump	mean	Heston + Jump_mean	1.12	1.74	3.05	9.37	28.39	261.27	11.9%	11.8%	11.8%	11.8%	11.8%	11.8%
AIRG	0	AIRG_0	0.40	0.37	0.36	0.40	0.47	0.49	-59.5%	-17.8%	-9.6%	-4.4%	-2.5%	-1.4%
AIRG	1	AIRG_1	0.72	0.61	0.66	0.89	1.23	3.07	-28.5%	-9.4%	-4.0%	-0.6%	0.7%	2.3%
AIRG	5	AIRG_5	0.83	0.80	0.92	1.41	2.30	6.36	-17.3%	-4.3%	-0.9%	1.7%	2.8%	3.8%
AIRG	10	AIRG_10	0.88	0.93	1.12	1.80	3.09	9.77	-11.5%	-1.5%	1.1%	3.0%	3.8%	4.7%
AIRG	15	AIRG_15	0.92	1.01	1.26	2.13	3.83	12.86	-7.7%	0.2%	2.3%	3.9%	4.6%	5.2%
AIRG	25	AIRG_25	0.98	1.16	1.51	2.76	5.24	19.20	-2.0%	3.0%	4.2%	5.2%	5.7%	6.1%
AIRG	30	AIRG_30	1.00	1.22	1.63	3.09	5.93	22.60	0.5%	4.1%	5.0%	5.8%	6.1%	6.4%
AIRG	50	AIRG_50	1.08	1.45	2.11	4.37	8.97	39.11	8.2%	7.7%	7.8%	7.7%	7.6%	7.6%
AIRG	70	AIRG_70	1.16	1.72	2.69	6.17	13.97	68.36	16.4%	11.4%	10.4%	9.5%	9.2%	8.8%
AIRG	75	AIRG_75	1.19	1.81	2.87	6.82	15.71	80.70	18.7%	12.6%	11.1%	10.1%	9.6%	9.2%
AIRG	85	AIRG_85	1.25	2.03	3.41	8.68	21.20	118.51	25.3%	15.2%	13.1%	11.4%	10.7%	10.0%
AIRG	90	AIRG_90	1.30	2.19	3.82	10.31	25.70	151.00	29.7%	17.0%	14.3%	12.4%	11.4%	10.6%
AIRG	95	AIRG_95	1.36	2.48	4.48	12.99	34.81	216.97	36.5%	19.9%	16.2%	13.7%	12.6%	11.4%
AIRG	99	AIRG_99	1.52	3.06	6.25	20.18	58.72	426.31	51.6%	25.1%	20.1%	16.2%	14.5%	12.9%
AIRG	100	AIRG_100	1.85	5.28	12.24	40.39	195.03	1259.57	85.2%	39.5%	28.5%	20.3%	19.2%	15.3%
AIRG	mean	AIRG_mean	1.09	1.52	2.33	5.42	12.59	66.90	8.8%	8.7%	8.8%	8.8%	8.8%	8.8%
Average GWF	0	Average GWF_0												
Average GWF	1	Average GWF_1												
Average GWF	5	Average GWF_5												
Average GWF	10	Average GWF_10												
Average GWF	15	Average GWF_15												
Average GWF	25	Average GWF_25												
Average GWF	30	Average GWF_30												
Average GWF	50	Average GWF_50												
Average GWF	70	Average GWF_70												
Average GWF	75	Average GWF_75												
Average GWF	85	Average GWF_85												
Average GWF	90	Average GWF_90												
Average GWF	95	Average GWF_95												
Average GWF	99	Average GWF_99												
Average GWF	100	Average GWF_100												
Average GWF	mean	Average GWF_mean												
Average GAVG	0	Average GAVG_0												
Average GAVG	1	Average GAVG_1												
Average GAVG	5	Average GAVG_5												
Average GAVG	10	Average GAVG_10												
Average GAVG	15	Average GAVG_15												
Average GAVG	25	Average GAVG_25												
Average GAVG	30	Average GAVG_30												
Average GAVG	50	Average GAVG_50												
Average GAVG	70	Average GAVG_70												
Average GAVG	75	Average GAVG_75												
Average GAVG	85	Average GAVG_85												
Average GAVG	90	Average GAVG_90												
Average GAVG	95	Average GAVG_95												
Average GAVG	99	Average GAVG_99												
Average GAVG	100	Average GAVG_100												
Average GAVG	mean	Average GAVG_mean												
Least Binding	0	Least Binding_0												
Least Binding	1	Least Binding_1												
Least Binding	5	Least Binding_5												
Least Binding	10	Least Binding_10												
Least Binding	15	Least Binding_15												
Least Binding	25	Least Binding_25												
Least Binding	30	Least Binding_30												
Least Binding	50	Least Binding_50												
Least Binding	70	Least Binding_70												
Least Binding	75	Least Binding_75												
Least Binding	85	Least Binding_85												
Least Binding	90	Least Binding_90												
Least Binding	95	Least Binding_95												
Least Binding	99	Least Binding_99												
Least Binding	100	Least Binding_100												
Least Binding	mean	Least Binding_mean												

Data			Constrained Mean											
			Gross Wealth Factor (GWF)						Geometric Average Return (GAVG)					
Model	Stat	Key	1 years	5 years	10 years	20 years	30 years	50 years	1 years	5 years	10 years	20 years	30 years	50 years
Heston	0	Heston_0	0.48	0.19	0.18	0.29	0.30	0.36	-51.9%	-28.1%	-15.8%	-6.1%	-3.9%	-2.0%
Heston	1	Heston_1	0.71	0.57	0.60	0.78	1.05	2.63	-28.7%	-10.6%	-5.0%	-1.2%	0.2%	2.0%
Heston	5	Heston_5	0.83	0.79	0.90	1.34	2.13	6.06	-17.2%	-4.5%	-1.0%	1.5%	2.6%	3.7%
Heston	10	Heston_10	0.89	0.92	1.11	1.79	3.03	9.36	-11.4%	-1.6%	1.1%	2.9%	3.8%	4.6%
Heston	15	Heston_15	0.92	1.03	1.28	2.15	3.82	12.68	-7.8%	0.5%	2.5%	3.9%	4.6%	5.2%
Heston	25	Heston_25	0.98	1.18	1.54	2.79	5.26	19.03	-1.8%	3.3%	4.4%	5.3%	5.7%	6.1%
Heston	30	Heston_30	1.01	1.24	1.67	3.10	6.02	22.61	0.7%	4.5%	5.2%	5.8%	6.2%	6.4%
Heston	50	Heston_50	1.09	1.48	2.15	4.51	9.25	40.28	9.0%	8.1%	8.0%	7.8%	7.7%	7.7%
Heston	70	Heston_70	1.17	1.73	2.72	6.34	14.15	69.44	16.8%	11.6%	10.5%	9.7%	9.2%	8.9%
Heston	75	Heston_75	1.19	1.82	2.89	6.95	15.96	81.78	19.3%	12.7%	11.2%	10.2%	9.7%	9.2%
Heston	85	Heston_85	1.25	2.01	3.36	8.74	21.24	117.30	25.1%	15.0%	12.9%	11.4%	10.7%	10.0%
Heston	90	Heston_90	1.29	2.15	3.74	10.15	25.34	151.36	28.9%	16.6%	14.1%	12.3%	11.4%	10.6%
Heston	95	Heston_95	1.35	2.37	4.34	12.42	33.59	217.05	34.7%	18.9%	15.8%	13.4%	12.4%	11.4%
Heston	99	Heston_99	1.46	2.85	5.58	18.01	52.14	406.24	45.8%	23.3%	18.8%	15.6%	14.1%	12.8%
Heston	100	Heston_100	1.78	4.57	8.40	33.30	136.63	1315.27	78.5%	35.5%	23.7%	19.2%	17.8%	15.4%
Heston	mean	Heston_mean	1.09	1.52	2.32	5.38	12.38	66.42	8.8%	8.7%	8.8%	8.8%	8.7%	8.8%
SLV1	0	SLV1_0	0.40	0.16	0.17	0.14	0.19	0.24	-60.0%	-30.5%	-16.2%	-9.2%	-5.4%	-2.8%
SLV1	1	SLV1_1	0.65	0.49	0.49	0.60	0.82	1.74	-35.3%	-13.4%	-6.8%	-2.5%	-0.7%	1.1%
SLV1	5	SLV1_5	0.79	0.71	0.80	1.12	1.70	4.42	-20.7%	-6.6%	-2.2%	0.6%	1.8%	3.0%
SLV1	10	SLV1_10	0.86	0.87	1.01	1.57	2.56	7.46	-13.6%	-2.8%	0.1%	2.3%	3.2%	4.1%
SLV1	15	SLV1_15	0.91	0.98	1.19	1.93	3.32	10.47	-9.2%	-0.5%	1.7%	3.3%	4.1%	4.8%
SLV1	25	SLV1_25	0.98	1.14	1.48	2.58	4.70	16.50	-2.2%	2.7%	4.0%	4.8%	5.3%	5.8%
SLV1	30	SLV1_30	1.00	1.22	1.61	2.90	5.50	19.85	0.5%	4.0%	4.9%	5.5%	5.8%	6.2%
SLV1	50	SLV1_50	1.09	1.48	2.15	4.42	8.90	37.70	9.3%	8.2%	7.9%	7.7%	7.6%	7.5%
SLV1	70	SLV1_70	1.18	1.76	2.75	6.38	14.24	67.87	17.7%	12.0%	10.7%	9.7%	9.3%	8.8%
SLV1	75	SLV1_75	1.20	1.84	2.95	7.07	16.19	81.39	20.1%	13.0%	11.4%	10.3%	9.7%	9.2%
SLV1	85	SLV1_85	1.25	2.04	3.45	8.96	21.80	119.33	25.4%	15.3%	13.2%	11.6%	10.8%	10.0%
SLV1	90	SLV1_90	1.29	2.18	3.83	10.43	26.36	155.57	29.2%	16.9%	14.4%	12.4%	11.5%	10.6%
SLV1	95	SLV1_95	1.35	2.40	4.42	12.90	34.72	232.69	34.9%	19.2%	16.0%	13.6%	12.6%	11.5%
SLV1	99	SLV1_99	1.45	2.85	5.68	18.37	54.31	424.64	45.1%	23.3%	19.0%	15.7%	14.2%	12.9%
SLV1	100	SLV1_100	1.72	3.92	8.78	33.90	137.37	1282.65	72.0%	31.4%	24.3%	19.3%	17.8%	15.4%
SLV1	mean	SLV1_mean	1.08	1.51	2.31	5.37	12.38	66.53	8.5%	8.6%	8.7%	8.8%	8.7%	8.8%
SLV2	0	SLV2_0	0.47	0.28	0.33	0.32	0.56	0.85	-53.4%	-22.7%	-10.6%	-5.6%	-1.9%	-0.3%
SLV2	1	SLV2_1	0.70	0.64	0.71	0.99	1.55	4.15	-29.7%	-8.5%	-3.4%	0.0%	1.5%	2.9%
SLV2	5	SLV2_5	0.83	0.84	1.02	1.62	2.73	8.63	-16.8%	-3.4%	0.2%	2.4%	3.4%	4.4%
SLV2	10	SLV2_10	0.89	0.98	1.22	2.10	3.74	12.78	-10.6%	-0.3%	2.0%	3.8%	4.5%	5.2%
SLV2	15	SLV2_15	0.93	1.07	1.38	2.46	4.55	16.49	-6.8%	1.4%	3.3%	4.6%	5.2%	5.8%
SLV2	25	SLV2_25	0.99	1.22	1.64	3.11	6.04	23.61	-0.6%	4.1%	5.1%	5.8%	6.2%	6.5%
SLV2	30	SLV2_30	1.02	1.28	1.76	3.41	6.84	27.56	1.8%	5.1%	5.8%	6.3%	6.6%	6.9%
SLV2	50	SLV2_50	1.10	1.50	2.21	4.68	9.89	45.15	9.7%	8.4%	8.2%	8.0%	7.9%	7.9%
SLV2	70	SLV2_70	1.17	1.73	2.71	6.33	14.42	73.46	17.3%	11.5%	10.5%	9.7%	9.3%	9.0%
SLV2	75	SLV2_75	1.19	1.80	2.86	6.91	15.93	83.58	19.5%	12.5%	11.1%	10.1%	9.7%	9.3%
SLV2	85	SLV2_85	1.24	1.97	3.27	8.41	20.39	115.01	24.4%	14.5%	12.6%	11.2%	10.6%	10.0%
SLV2	90	SLV2_90	1.28	2.09	3.58	9.59	23.93	142.63	27.8%	15.9%	13.6%	12.0%	11.2%	10.4%
SLV2	95	SLV2_95	1.33	2.28	4.08	11.43	30.68	195.72	32.9%	18.0%	15.1%	13.0%	12.1%	11.1%
SLV2	99	SLV2_99	1.42	2.67	5.10	15.83	45.17	333.02	42.4%	21.7%	17.7%	14.8%	13.5%	12.3%
SLV2	100	SLV2_100	1.67	3.94	8.01	29.20	99.48	1019.62	66.9%	31.5%	23.1%	18.4%	16.6%	14.9%
SLV2	mean	SLV2_mean	1.09	1.52	2.33	5.38	12.38	66.05	9.1%	8.8%	8.8%	8.8%	8.7%	8.7%
SLV3	0	SLV3_0	0.45	0.26	0.32	0.30	0.57	0.83	-55.4%	-23.4%	-10.8%	-5.9%	-1.8%	-0.4%
SLV3	1	SLV3_1	0.70	0.64	0.71	1.02	1.55	4.33	-30.2%	-8.6%	-3.4%	0.1%	1.5%	3.0%
SLV3	5	SLV3_5	0.84	0.85	1.03	1.63	2.80	8.80	-16.5%	-3.3%	0.2%	2.5%	3.5%	4.4%
SLV3	10	SLV3_10	0.90	0.99	1.24	2.13	3.79	12.90	-10.0%	-0.2%	2.1%	3.8%	4.5%	5.2%
SLV3	15	SLV3_15	0.94	1.08	1.40	2.50	4.64	16.89	-6.2%	1.6%	3.4%	4.7%	5.2%	5.8%
SLV3	25	SLV3_25	1.00	1.23	1.66	3.14	6.15	24.12	0.0%	4.3%	5.2%	5.9%	6.2%	6.6%
SLV3	30	SLV3_30	1.02	1.29	1.78	3.45	6.92	28.18	2.3%	5.2%	5.9%	6.4%	6.7%	6.9%
SLV3	50	SLV3_50	1.10	1.50	2.22	4.73	9.97	45.73	10.1%	8.5%	8.3%	8.1%	8.0%	7.9%
SLV3	70	SLV3_70	1.17	1.73	2.71	6.35	14.46	73.45	17.3%	11.6%	10.5%	9.7%	9.3%	9.0%
SLV3	75	SLV3_75	1.19	1.80	2.86	6.89	15.96	83.86	19.4%	12.4%	11.1%	10.1%	9.7%	9.3%
SLV3	85	SLV3_85	1.24	1.96	3.26	8.40	20.28	114.93	24.2%	14.4%	12.6%	11.2%	10.6%	10.0%
SLV3	90	SLV3_90	1.28	2.08	3.56	9.54	23.68	141.98	27.6%	15.8%	13.5%	11.9%	11.1%	10.4%
SLV3	95	SLV3_95	1.33	2.27	4.04	11.29	30.19	193.16	32.6%	17.8%	15.0%	12.9%	12.0%	11.1%
SLV3	99	SLV3_99	1.42	2.65	5.00	15.51	44.47	320.97	41.7%	21.5%	17.5%	14.7%	13.5%	12.2%
SLV3	100	SLV3_100	1.66	3.85	7.53	28.64	100.30	1035.49	65.6%	31.0%	22.4%	18.3%	16.6%	14.9%
SLV3	mean	SLV3_mean	1.09	1.53	2.33	5.39	12.38	65.96	9.3%	8.8%	8.8%	8.8%	8.7%	8.7%
RSLN2	0	RSLN2_0	0.40	0.27	0.21	0.14	0.15	0.30	-59.5%	-23.3%	-14.3%	-9.4%	-6.1%	-2.4%
RSLN2	1	RSLN2_1	0.69	0.54	0.53	0.67	0.89	1.92	-31.2%	-11.6%	-6.1%	-2.0%	-0.4%	1.3%
RSLN2	5	RSLN2_5	0.80	0.75	0.82	1.16	1.79	4.61	-19.9%	-5.6%	-2.0%	0.7%	2.0%	3.1%
RSLN2	10	RSLN2_10	0.87	0.87	1.01	1.54	2.49	7.29	-13.2%	-2.6%	0.1%	2.2%	3.1%	4.1%
RSLN2	15	RSLN2_15	0.92	0.97	1.16	1.88	3.14	9.77	-8.4%	-0.7%	1.5%	3.2%	3.9%	4.7%
RSLN2	25	RSLN2_25	0.98	1.12	1.43	2.49	4.48	15.30	-2.0%	2.3%	3.6%	4.7%	5.1%	5.6%
RSLN2	30	RSLN2_30	1.01	1.19	1.56	2.80	5.18	18.26	0.9%	3.6%	4.5%	5.3%	5.6%	6.0%
RSLN2	50	RSLN2_50	1.09	1.45	2.06	4.18	8.35	34.04	9.2%	7.8%	7.5%	7.4%	7.3%	7.3%
RSLN2	70	RSLN2_70	1.17	1.74	2.70	6.14	13.50	62.71	17.3%	11.7%	10.4%	9.5%	9.1%	8.6%
RSLN2	75	RSLN2_75	1.20	1.83	2.90	6.80	15.53	74.11	19.6%	12.9%	11.2%	10.1%	9.6%	9.0%
RSLN2	85	RSLN2_85	1.25	2.06	3.46	8.90	21.54	112.78	25.1%	15.6%	13.2%	11.5%	10.8%	9.9%
RSLN2	90	RSLN2_90	1.29	2.23	3.84	10.60	26.50	151.17	28.8%	17.4%	14.4%	12.5%	11.5%	10.6%
RSLN2	95	RSLN2_95	1.36	2.48	4.57	13.45	36.05	224.28	35.6%	19.9%	16.4%	13.9%	12.7%	11.4%
RSLN2	99	RSLN2_99	1.49	3.03	6.38	21.10	65.33	456.84	48.7%	24.8%	20.4%	16.5%	14.9%	13.0%
RSLN2	100	RSLN2_100	1.90	4.56	10.36	73.76	208.40	2379.76	90.5%	35.5%	26.3%	24.0%	19.5%	16.8%
RSLN2	mean	RSLN2_mean	1.09	1.51	2.30	5.35	12.38	65.05	8.7%	8.6%	8.7%	8.7%	8.7%	8.7%
RSDD2	0	RSDD2_0	0.47	0.29	0.37	0.57	1.09	1.48	-52.8%	-22.1%	-9.5%	-2.7%	0.3%	0.8%
RSDD2	1	RSDD2_1	0.67	0.68	0.81	1.32	2.20	6.49	-32.6%	-7.4%	-2.1%	1.4%	2.7%	3.8%
RSDD2	5	RSDD2_5	0.80	0.87	1.10	1.85	3.33	11.55	-20.1%	-2.7%	0.9%	3.1%	4.1%	5.0%
RSDD2	10	RSDD2_10	0.87	0.97	1.26	2.26	4.21	15.46	-13.1%	-0.5%	2.3%	4.2%	4.9%	5.6%
RSDD2	15	RSDD2_15	0.92	1.05	1.39	2.60	4.93	19.13	-8.5%	1.0%	3.4%	4.9%	5.5%	6.1%
RSDD2	25	RSDD2_25	0.97	1.17	1.60	3.14	6.24	25.78	-2.5%	3.2%	4.8%	5.9%	6.3%	6.7%
RSDD2	30	RSDD2_30	1.00	1.23	1.70	3.40	6.84	29.30	-0.1%	4.2%	5.4%	6.3%	6.6%	7.0%
RSDD2	50	RSDD2_50	1.07	1.43	2.10	4.56	9.75	45.77	7.3%	7.4%	7.7%	7.9%	7.9%	7.9%
RSDD2	70	RSDD2_70	1.15	1.67	2.58	6.07	14.06	71.69	15.0%	10.8%	10.0%	9.4%	9.2%	8.9%
RSDD2	75	RSDD2_75	1.17	1.75	2.75	6.60	15.50	81.14	17.1%	11.8%	10.6%	9.9%	9.6%	9.2%
RSDD2	85	RSDD2_85	1.22	1.93	3.17	8.12	19.84	109.80	22.4%	14.0%	12.2%	11.0%	10.5%	9.9%
RSDD2	90	RSDD2_90	1.26	2.07	3.49	9.33	23.48	135.76	26.2%	15.7%	13.3%	11.8%	11.1%	10.3%
RSDD2	95	RSDD2_95	1.32	2.29	4.06	11.60	29.94	188.69	31.8%	18.0%	15.0%	13.0%	12.0%	11.0%
RSDD2	99	RSDD2_99	1.44	2.72	5.38	16.75	47.97	336.12	43.7%	22.1%	18.3%	15.1%	13.8%	12.3%
RSDD2	100	RSDD2_100	1.75	3.97	9.01	40.63	146.54	1378.64	74.9%	31.7%	24.6%	20.3%	18.1%	15.6%
RSDD2	mean	RSDD2_mean	1.07	1.49	2.27	5.33	12.38	66.30	7.0%	8.3%	8.6%	8.7%	8.7%	8.8%
LN	0	LN_0	0.57	0.41	0.38	0.32	0.43	1.21	-43.5%	-16.4%	-9.3%	-5.5%	-2.8%	0.4%
LN	1	LN_1	0.76	0.66	0.70	0.92	1.32	3.21	-24.1%	-8.0%	-3.5%	-0.4%	0.9%	2.4%
LN	5	LN_5	0.84	0.83	0.95	1.44	2.30	6.53	-15.9%	-3.7%	-0.5%	1.8%	2.8%	3.8%
LN	10	LN_10	0.89	0.94	1.13	1.81	3.04	9.65	-11.1%	-1.3%	1.3%	3.0%	3.8%	4.6%
LN	15	LN_15	0.92	1.02	1.27	2.13	3.70	12.27	-7.9%	0.5%	2.4%	3.9%	4.5%	5.1%
LN	25	LN_25	0.97	1.15	1.50	2.74	5.00	18.05	-2.7%	2.9%	4.2%	5.2%	5.5%	6.0%
LN	30	LN_30	1.00	1.22	1.61	3.01	5.68	21.45	-0.4%	4.0%	4.8%	5.7%	6.0%	6.3%
LN	50	LN_50	1.08	1.44	2.07	4.27	8.84	38.17	7.9%	7.6%	7.6%	7.5%	7.5%	7.6%
LN	70	LN_70	1.16	1.71	2.65	6.05	13.61	66.06	16.5%	11.3%	10.2%	9.4%	9.1%	8.7%
LN	75	LN_75	1.19	1.79	2.84	6.72	15.43	76.41	19.0%	12.3%	11.0%	10.0%	9.6%	9.1%
LN	85	LN_85	1.25	2.02	3.35	8.66	20.58	112.59	25.5%	15.1%	12.9%	11.4%	10.6%	9.9%
LN	90	LN_90	1.30	2.18	3.74	10.11	25.38	146.47	29.7%	16.9%	14.1%	12.3%	11.4%	10.5%
LN	95	LN_95	1.37	2.44	4.43	13.00	34.52	214.01	37.1%	19.6%	16.0%	13.7%	12.5%	11.3%
LN	99	LN_99	1.52	3.07	6.14	20.16	58.66	420.34	52.0%	25.2%	19.9%	16.2%	14.5%	12.8%
LN	100	LN_100	1.84	5.07	12.03	87.31	255.45	2913.04	84.3%	38.4%	28.2%	25.0%	20.3%	17.3%
LN	mean	LN_mean	1.09	1.52	2.30	5.36	12.38	65.71	8.8%	8.7%	8.7%	8.8%	8.7%	8.7%
Heston + Jump	0	Heston + Jump_0	0.47	0.25	0.16	0.28	0.16	0.31	-52.8%	-24.3%	-17.0%	-6.2%	-5.9%	-2.3%
Heston + Jump	1	Heston + Jump_1	0.70	0.56	0.57	0.73	1.10	2.57	-29.7%	-11.0%	-5.5%	-1.5%	0.3%	1.9%
Heston + Jump	5	Heston + Jump_5	0.83	0.80	0.91	1.34	2.17	6.23	-17.3%	-4.4%	-0.9%	1.5%	2.6%	3.7%
Heston + Jump	10	Heston + Jump_10	0.89	0.93	1.13	1.81	3.07	9.71	-11.4%	-1.5%	1.3%	3.0%	3.8%	4.7%
Heston + Jump	15	Heston + Jump_15	0.93	1.02	1.29	2.22	3.84	12.82	-7.4%	0.5%	2.6%	4.1%	4.6%	5.2%
Heston + Jump	25	Heston + Jump_25	0.99	1.18	1.56	2.86	5.26	18.97	-1.5%	3.3%	4.6%	5.4%	5.7%	6.1%
Heston + Jump	30	Heston + Jump_30	1.01	1.25	1.68	3.17	6.00	22.71	1.1%	4.5%	5.3%	5.9%	6.2%	6.4%
Heston + Jump	50	Heston + Jump_50	1.09	1.49	2.17	4.52	9.43	40.47	9.4%	8.3%	8.0%	7.8%	7.8%	7.7%
Heston + Jump	70	Heston + Jump_70	1.17	1.75	2.71	6.40	14.40	69.96	17.2%	11.8%	10.5%	9.7%	9.3%	8.9%
Heston + Jump	75	Heston + Jump_75	1.19	1.82	2.89	7.05	16.12	81.40	19.4%	12.7%	11.2%	10.3%	9.7%	9.2%
Heston + Jump	85	Heston + Jump_85	1.25	2.02	3.35	8.70	21.06	116.16	24.7%	15.1%	12.8%	11.4%	10.7%	10.0%
Heston + Jump	90	Heston + Jump_90	1.28	2.14	3.67	10.01	25.04	146.51	28.2%	16.5%	13.9%	12.2%	11.3%	10.5%
Heston + Jump	95	Heston + Jump_95	1.34	2.35	4.23	12.00	32.42	205.83	33.5%	18.6%	15.5%	13.2%	12.3%	11.2%
Heston + Jump	99	Heston + Jump_99	1.44	2.75	5.51	17.78	52.31	392.81	44.4%	22.4%	18.6%	15.5%	14.1%	12.7%
Heston + Jump	100	Heston + Jump_100	1.67	3.75	9.16	31.87	118.37	1993.12	67.4%	30.3%	24.8%	18.9%	17.2%	16.4%
Heston + Jump	mean	Heston + Jump_mean	1.09	1.52	2.31	5.39	12.38	65.54	8.8%	8.7%	8.7%	8.8%	8.7%	8.7%
AIRG	0	AIRG_0	0.40	0.37	0.36	0.40	0.46	0.48	-59.5%	-17.9%	-9.6%	-4.5%	-2.5%	-1.5%
AIRG	1	AIRG_1	0.71	0.61	0.66	0.88	1.21	2.99	-28.5%	-9.5%	-4.1%	-0.6%	0.6%	2.2%
AIRG	5	AIRG_5	0.83	0.80	0.91	1.40	2.26	6.19	-17.3%	-4.4%	-0.9%	1.7%	2.8%	3.7%
AIRG	10	AIRG_10	0.88	0.92	1.11	1.78	3.04	9.51	-11.6%	-1.6%	1.1%	2.9%	3.8%	4.6%
AIRG	15	AIRG_15	0.92	1.01	1.25	2.11	3.77	12.52	-7.8%	0.2%	2.3%	3.8%	4.5%	5.2%
AIRG	25	AIRG_25	0.98	1.15	1.51	2.74	5.15	18.69	-2.0%	2.9%	4.2%	5.2%	5.6%	6.0%
AIRG	30	AIRG_30	1.00	1.22	1.62	3.06	5.84	22.00	0.4%	4.0%	4.9%	5.7%	6.1%	6.4%
AIRG	50	AIRG_50	1.08	1.45	2.10	4.33	8.83	38.07	8.2%	7.6%	7.7%	7.6%	7.5%	7.6%
AIRG	70	AIRG_70	1.16	1.71	2.67	6.10	13.75	66.54	16.3%	11.4%	10.3%	9.5%	9.1%	8.8%
AIRG	75	AIRG_75	1.19	1.80	2.86	6.75	15.46	78.55	18.7%	12.5%	11.1%	10.0%	9.6%	9.1%
AIRG	85	AIRG_85	1.25	2.02	3.39	8.59	20.85	115.36	25.2%	15.1%	13.0%	11.4%	10.7%	10.0%
AIRG	90	AIRG_90	1.30	2.18	3.80	10.20	25.29	146.98	29.6%	16.9%	14.3%	12.3%	11.4%	10.5%
AIRG	95	AIRG_95	1.36	2.47	4.46	12.85	34.25	211.19	36.4%	19.9%	16.1%	13.6%	12.5%	11.3%
AIRG	99	AIRG_99	1.52	3.05	6.21	19.96	57.78	414.96	51.5%	25.0%	20.0%	16.1%	14.5%	12.8%
AIRG	100	AIRG_100	1.85	5.26	12.17	39.95	191.89	1226.04	85.1%	39.4%	28.4%	20.2%	19.2%	15.3%
AIRG	mean	AIRG_mean	1.09	1.52	2.32	5.36	12.38	65.12	8.7%	8.7%	8.8%	8.8%	8.7%	8.7%

Data			Constrained Mean (included models only)																	
			Gross Wealth Factor (GWF)						Geometric Average Return (GAVG)											
Model	Stat	Key	1 years	5 years	10 years	20 years	30 years	50 years	1 years	5 years	10 years	20 years	30 years	50 years						
Heston	0	Heston_0	0.48	0.19	0.18	0.29	0.30	0.36	-51.9%	-28.1%	-15.8%	-6.1%	-3.9%	-2.0%						
Heston	1	Heston_1	0.71	0.57	0.60	0.78	1.05	2.63	-28.7%	-10.6%	-5.0%	-1.2%	0.2%	2.0%						
Heston	5	Heston_5	0.83	0.79	0.90	1.34	2.13	6.06	-17.2%	-4.5%	-1.0%	1.5%	2.6%	3.7%						
Heston	10	Heston_10	0.89	0.92	1.11	1.79	3.03	9.36	-11.4%	-1.6%	1.1%	2.9%	3.8%	4.6%						
Heston	15	Heston_15	0.92	1.03	1.28	2.15	3.82	12.68	-7.8%	0.5%	2.5%	3.9%	4.6%	5.2%						
Heston	25	Heston_25	0.98	1.18	1.54	2.79	5.26	19.03	-1.8%	3.3%	4.4%	5.3%	5.7%	6.1%						
Heston	30	Heston_30	1.01	1.24	1.67	3.10	6.02	22.61	0.7%	4.5%	5.2%	5.8%	6.2%	6.4%						
Heston	50	Heston_50	1.09	1.48	2.15	4.51	9.25	40.28	9.0%	8.1%	8.0%	7.8%	7.7%	7.7%						
Heston	70	Heston_70	1.17	1.73	2.72	6.34	14.15	69.44	16.8%	11.6%	10.5%	9.7%	9.2%	8.9%						
Heston	75	Heston_75	1.19	1.82	2.89	6.95	15.96	81.78	19.3%	12.7%	11.2%	10.2%	9.7%	9.2%						
Heston	85	Heston_85	1.25	2.01	3.36	8.74	21.24	117.30	25.1%	15.0%	12.9%	11.4%	10.7%	10.0%						
Heston	90	Heston_90	1.29	2.15	3.74	10.15	25.34	151.36	28.9%	16.6%	14.1%	12.3%	11.4%	10.6%						
Heston	95	Heston_95	1.35	2.37	4.34	12.42	33.59	217.05	34.7%	18.9%	15.8%	13.4%	12.4%	11.4%						
Heston	99	Heston_99	1.46	2.85	5.58	18.01	52.14	406.24	45.8%	23.3%	18.8%	15.6%	14.1%	12.8%						
Heston	100	Heston_100	1.78	4.57	8.40	33.30	136.63	1315.27	78.5%	35.5%	23.7%	19.2%	17.8%	15.4%						
Heston	mean	Heston_mean	1.09	1.52	2.32	5.38	12.38	66.42	8.8%	8.7%	8.8%	8.8%	8.7%	8.8%						
SLV2	0	SLV2_0	0.47	0.28	0.33	0.32	0.56	0.85	-53.4%	-22.7%	-10.6%	-5.6%	-1.9%	-0.3%						
SLV2	1	SLV2_1	0.70	0.64	0.71	0.99	1.55	4.15	-29.7%	-8.5%	-3.4%	0.0%	1.5%	2.9%						
SLV2	5	SLV2_5	0.83	0.84	1.02	1.62	2.73	8.63	-16.8%	-3.4%	0.2%	2.4%	3.4%	4.4%						
SLV2	10	SLV2_10	0.89	0.98	1.22	2.10	3.74	12.78	-10.6%	-0.3%	2.0%	3.8%	4.5%	5.2%						
SLV2	15	SLV2_15	0.93	1.07	1.38	2.46	4.55	16.49	-6.8%	1.4%	3.3%	4.6%	5.2%	5.8%						
SLV2	25	SLV2_25	0.99	1.22	1.64	3.11	6.04	23.61	-0.6%	4.1%	5.1%	5.8%	6.2%	6.5%						
SLV2	30	SLV2_30	1.02	1.28	1.76	3.41	6.84	27.56	1.8%	5.1%	5.8%	6.3%	6.6%	6.9%						
SLV2	50	SLV2_50	1.10	1.50	2.21	4.68	9.89	45.15	9.7%	8.4%	8.2%	8.0%	7.9%	7.9%						
SLV2	70	SLV2_70	1.17	1.73	2.71	6.33	14.42	73.46	17.3%	11.5%	10.5%	9.7%	9.3%	9.0%						
SLV2	75	SLV2_75	1.19	1.80	2.86	6.91	15.93	83.58	19.5%	12.5%	11.1%	10.1%	9.7%	9.3%						
SLV2	85	SLV2_85	1.24	1.97	3.27	8.41	20.39	115.01	24.4%	14.5%	12.6%	11.2%	10.6%	10.0%						
SLV2	90	SLV2_90	1.28	2.09	3.58	9.59	23.93	142.63	27.8%	15.9%	13.6%	12.0%	11.2%	10.4%						
SLV2	95	SLV2_95	1.33	2.28	4.08	11.43	30.68	195.72	32.9%	18.0%	15.1%	13.0%	12.1%	11.1%						
SLV2	99	SLV2_99	1.42	2.67	5.10	15.83	45.17	333.02	42.4%	21.7%	17.7%	14.8%	13.5%	12.3%						
SLV2	100	SLV2_100	1.67	3.94	8.01	29.20	99.48	1019.62	66.9%	31.5%	23.1%	18.4%	16.6%	14.9%						
SLV2	mean	SLV2_mean	1.09	1.52	2.33	5.38	12.38	66.05	9.1%	8.8%	8.8%	8.8%	8.7%	8.7%						
RSLN2	0	RSLN2_0	0.40	0.27	0.21	0.14	0.15	0.30	-59.5%	-23.3%	-14.3%	-9.4%	-6.1%	-2.4%						
RSLN2	1	RSLN2_1	0.69	0.54	0.53	0.67	0.89	1.92	-31.2%	-11.6%	-6.1%	-2.0%	-0.4%	1.3%						
RSLN2	5	RSLN2_5	0.80	0.75	0.82	1.16	1.79	4.61	-19.9%	-5.6%	-2.0%	0.7%	2.0%	3.1%						
RSLN2	10	RSLN2_10	0.87	0.87	1.01	1.54	2.49	7.29	-13.2%	-2.6%	0.1%	2.2%	3.1%	4.1%						
RSLN2	15	RSLN2_15	0.92	0.97	1.16	1.88	3.14	9.77	-8.4%	-0.7%	1.5%	3.2%	3.9%	4.7%						
RSLN2	25	RSLN2_25	0.98	1.12	1.43	2.49	4.48	15.30	-2.0%	2.3%	3.6%	4.7%	5.1%	5.6%						
RSLN2	30	RSLN2_30	1.01	1.19	1.56	2.80	5.18	18.26	0.9%	3.6%	4.5%	5.3%	5.6%	6.0%						
RSLN2	50	RSLN2_50	1.09	1.45	2.06	4.18	8.35	34.04	9.2%	7.8%	7.5%	7.4%	7.3%	7.3%						
RSLN2	70	RSLN2_70	1.17	1.74	2.70	6.14	13.50	62.71	17.3%	11.7%	10.4%	9.5%	9.1%	8.6%						
RSLN2	75	RSLN2_75	1.20	1.83	2.90	6.80	15.53	74.11	19.6%	12.9%	11.2%	10.1%	9.6%	9.0%						
RSLN2	85	RSLN2_85	1.25	2.06	3.46	8.90	21.54	112.78	25.1%	15.6%	13.2%	11.5%	10.8%	9.9%						
RSLN2	90	RSLN2_90	1.29	2.23	3.84	10.60	26.50	151.17	28.8%	17.4%	14.4%	12.5%	11.5%	10.6%						
RSLN2	95	RSLN2_95	1.36	2.48	4.57	13.45	36.05	224.28	35.6%	19.9%	16.4%	13.9%	12.7%	11.4%						
RSLN2	99	RSLN2_99	1.49	3.03	6.38	21.10	65.33	456.84	48.7%	24.8%	20.4%	16.5%	14.9%	13.0%						
RSLN2	100	RSLN2_100	1.90	4.56	10.36	73.76	208.40	2379.76	90.5%	35.5%	26.3%	24.0%	19.5%	16.8%						
RSLN2	mean	RSLN2_mean	1.09	1.51	2.30	5.35	12.38	65.05	8.7%	8.6%	8.7%	8.7%	8.7%	8.7%						
Heston + Jump	0	Heston + Jump_0	0.47	0.25	0.16	0.28	0.16	0.31	-52.8%	-24.3%	-17.0%	-6.2%	-5.9%	-2.3%						
Heston + Jump	1	Heston + Jump_1	0.70	0.56	0.57	0.73	1.10	2.57	-29.7%	-11.0%	-5.5%	-1.5%	0.3%	1.9%						
Heston + Jump	5	Heston + Jump_5	0.83	0.80	0.91	1.34	2.17	6.23	-17.3%	-4.4%	-0.9%	1.5%	2.6%	3.7%						
Heston + Jump	10	Heston + Jump_10	0.89	0.93	1.13	1.81	3.07	9.71	-11.4%	-1.5%	1.3%	3.0%	3.8%	4.7%						
Heston + Jump	15	Heston + Jump_15	0.93	1.02	1.29	2.22	3.84	12.82	-7.4%	0.5%	2.6%	4.1%	4.6%	5.2%						
Heston + Jump	25	Heston + Jump_25	0.99	1.18	1.56	2.86	5.26	18.97	-1.5%	3.3%	4.6%	5.4%	5.7%	6.1%						
Heston + Jump	30	Heston + Jump_30	1.01	1.25	1.68	3.17	6.00	22.71	1.1%	4.5%	5.3%	5.9%	6.2%	6.4%						
Heston + Jump	50	Heston + Jump_50	1.09	1.49	2.17	4.52	9.43	40.47	9.4%	8.3%	8.0%	7.8%	7.8%	7.7%						
Heston + Jump	70	Heston + Jump_70	1.17	1.75	2.71	6.40	14.40	69.96	17.2%	11.8%	10.5%	9.7%	9.3%	8.9%						
Heston + Jump	75	Heston + Jump_75	1.19	1.82	2.89	7.05	16.12	81.40	19.4%	12.7%	11.2%	10.3%	9.7%	9.2%						
Heston + Jump	85	Heston + Jump_85	1.25	2.02	3.35	8.70	21.06	116.16	24.7%	15.1%	12.8%	11.4%	10.7%	10.0%						
Heston + Jump	90	Heston + Jump_90	1.28	2.14	3.67	10.01	25.04	146.51	28.2%	16.5%	13.9%	12.2%	11.3%	10.5%						
Heston + Jump	95	Heston + Jump_95	1.34	2.35	4.23	12.00	32.42	205.83	33.5%	18.6%	15.5%	13.2%	12.3%	11.2%						
Heston + Jump	99	Heston + Jump_99	1.44	2.75	5.51	17.78	52.31	392.81	44.4%	22.4%	18.6%	15.5%	14.1%	12.7%						
Heston + Jump	100	Heston + Jump_100	1.67	3.75	9.16	31.87	118.37	1993.12	67.4%	30.3%	24.8%	18.9%	17.2%	16.4%						
Heston + Jump	mean	Heston + Jump_mean	1.09	1.52	2.31	5.39	12.38	65.54	8.8%	8.7%	8.7%	8.8%	8.7%	8.7%						
Average GWF	0	Average GWF_0	0.46	0.25	0.22	0.25	0.29	0.46	-54.4%	-24.5%	-14.1%	-6.6%	-4.0%	-1.6%						
Average GWF	1	Average GWF_1	0.70	0.58	0.60	0.79	1.15	2.82	-29.8%	-10.4%	-5.0%	-1.1%	0.5%	2.1%						
Average GWF	5	Average GWF_5	0.82	0.80	0.91	1.36	2.20	6.38	-17.8%	-4.5%	-0.9%	1.6%	2.7%	3.8%						
Average GWF	10	Average GWF_10	0.88	0.93	1.12	1.81	3.08	9.78	-11.7%	-1.5%	1.1%	3.0%	3.8%	4.7%						
Average GWF	15	Average GWF_15	0.92	1.02	1.28	2.18	3.84	12.94	-7.6%	0.4%	2.5%	4.0%	4.6%	5.3%						
Average GWF	25	Average GWF_25	0.99	1.18	1.54	2.81	5.26	19.23	-1.5%	3.3%	4.4%	5.3%	5.7%	6.1%						
Average GWF	30	Average GWF_30	1.01	1.24	1.66	3.12	6.01	22.79	1.1%	4.4%	5.2%	5.9%	6.2%	6.5%						
Average GWF	50	Average GWF_50	1.09	1.48	2.15	4.47	9.23	39.98	9.3%	8.1%	7.9%	7.8%	7.7%	7.7%						
Average GWF	70	Average GWF_70	1.17	1.74	2.71	6.30	14.12	68.89	17.2%	11.7%	10.5%	9.6%	9.2%	8.8%						
Average GWF	75	Average GWF_75	1.19	1.82	2.89	6.93	15.88	80.22	19.4%	12.7%	11.2%	10.2%	9.7%	9.2%						
Average GWF	85	Average GWF_85	1.25	2.02	3.36	8.69	21.06	115.31	24.8%	15.0%	12.9%	11.4%	10.7%	10.0%						
Average GWF	90	Average GWF_90	1.28	2.15	3.71	10.09	25.20	147.92	28.4%	16.6%	14.0%	12.3%	11.4%	10.5%						
Average GWF	95	Average GWF_95	1.34	2.37	4.30	12.33	33.19	210.72	34.2%	18.8%	15.7%	13.4%	12.4%	11.3%						
Average GWF	99	Average GWF_99	1.45	2.82	5.64	18.18	53.74	397.23	45.3%	23.1%	18.9%	15.6%	14.2%	12.7%						
Average GWF	100	Average GWF_100	1.76	4.20	8.98	42.03	140.72	1676.94	75.8%	33.3%	24.6%	20.6%	17.9%	16.0%						
Average GWF	mean	Average GWF_mean	1.09	1.52	2.31	5.38	12.38	65.77	8.9%	8.7%	8.8%	8.8%	8.7%	8.7%						
Average GAVG	0	Average GAVG_0	0.46	0.24	0.21	0.24	0.26	0.41	-54.4%	-24.6%	-14.4%	-6.8%	-4.5%	-1.8%						
Average GAVG	1	Average GAVG_1	0.70	0.58	0.60	0.79	1.12	2.71	-29.8%	-10.4%	-5.0%	-1.2%	0.4%	2.0%						
Average GAVG	5	Average GAVG_5	0.82	0.80	0.91	1.35	2.18	6.23	-17.8%	-4.5%	-0.9%	1.5%	2.6%	3.7%						
Average GAVG	10	Average GAVG_10	0.88	0.93	1.12	1.80	3.05	9.60	-11.7%	-1.5%	1.1%	3.0%	3.8%	4.6%						
Average GAVG	15	Average GAVG_15	0.92	1.02	1.27	2.17	3.81	12.73	-7.6%	0.4%	2.4%	3.9%	4.6%	5.2%						
Average GAVG	25	Average GAVG_25	0.99	1.17	1.54	2.81	5.23	19.01	-1.5%	3.3%	4.4%	5.3%	5.7%	6.1%						
Average GAVG	30	Average GAVG_30	1.01	1.24	1.66	3.12	5.98	22.55	1.1%	4.4%	5.2%	5.8%	6.1%	6.4%						
Average GAVG	50	Average GAVG_50	1.09	1.48	2.15	4.47	9.21	39.79	9.3%	8.1%	7.9%	7.8%	7.7%	7.6%						
Average GAVG	70	Average GAVG_70	1.17	1.74	2.71	6.30	14.11	68.78	17.2%	11.7%	10.5%	9.6%	9.2%	8.8%						
Average GAVG	75	Average GAVG_75	1.19	1.82	2.89	6.93	15.88	80.14	19.4%	12.7%	11.2%	10.2%	9.7%	9.2%						
Average GAVG	85	Average GAVG_85	1.25	2.02	3.36	8.68	21.05	115.30	24.8%	15.0%	12.9%	11.4%	10.7%	10.0%						
Average GAVG	90	Average GAVG_90	1.28	2.15	3.71	10.08	25.19	147.88	28.4%	16.6%	14.0%	12.2%	11.4%	10.5%						
Average GAVG	95	Average GAVG_95	1.34	2.37	4.30	12.30	33.13	210.45	34.2%	18.8%	15.7%	13.4%	12.4%	11.3%						
Average GAVG	99	Average GAVG_99	1.45	2.82	5.63	18.09	53.28	394.78	45.3%	23.1%	18.9%	15.6%	14.2%	12.7%						
Average GAVG	100	Average GAVG_100	1.76	4.19	8.94	39.02	135.49	1589.88	75.8%	33.2%	24.5%	20.1%	17.8%	15.9%						
Average GAVG	mean	Average GAVG_mean	1.09	1.52	2.31	5.38	12.38	65.76	8.9%	8.7%	8.8%	8.8%	8.7%	8.7%						
Least Binding	0	Least Binding_0	0.48	0.28	0.33	0.32	0.56	0.85	-51.9%	-22.7%	-10.6%	-5.6%	-1.9%	-0.3%	Heston	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	1	Least Binding_1	0.71	0.64	0.71	0.99	1.55	4.15	-28.7%	-8.5%	-3.4%	0.0%	1.5%	2.9%	Heston	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	5	Least Binding_5	0.83	0.84	1.02	1.62	2.73	8.63	-16.8%	-3.4%	0.2%	2.4%	3.4%	4.4%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	10	Least Binding_10	0.89	0.98	1.22	2.10	3.74	12.78	-10.6%	-0.3%	2.0%	3.8%	4.5%	5.2%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	15	Least Binding_15	0.93	1.07	1.38	2.46	4.55	16.49	-6.8%	1.4%	3.3%	4.6%	5.2%	5.8%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	25	Least Binding_25	0.99	1.22	1.64	3.11	6.04	23.61	-0.6%	4.1%	5.1%	5.8%	6.2%	6.5%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	30	Least Binding_30	1.02	1.28	1.76	3.41	6.84	27.56	1.8%	5.1%	5.8%	6.3%	6.6%	6.9%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	50	Least Binding_50	1.09	1.48	2.15	4.47	9.23	39.98	9.3%	8.1%	7.9%	7.8%	7.7%	7.6%						
Least Binding	70	Least Binding_70	1.17	1.73	2.70	6.14	13.50	62.71	16.8%	11.5%	10.4%	9.5%	9.1%	8.6%	Heston	SLV2	RSLN2	RSLN2	RSLN2	RSLN2
Least Binding	75	Least Binding_75	1.19	1.80	2.86	6.80	15.53	74.11	19.3%	12.5%	11.1%	10.1%	9.6%	9.0%	Heston	SLV2	SLV2	RSLN2	RSLN2	RSLN2
Least Binding	85	Least Binding_85	1.24	1.97	3.27	8.41	20.39	112.78	24.4%	14.5%	12.6%	11.2%	10.6%	9.9%	SLV2	SLV2	SLV2	SLV2	SLV2	RSLN2
Least Binding	90	Least Binding_90	1.28	2.09	3.58	9.59	23.93	142.63	27.8%	15.9%	13.6%	12.0%	11.2%	10.4%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	95	Least Binding_95	1.33	2.28	4.08	11.43	30.68	195.72	32.9%	18.0%	15.1%	13.0%	12.1%	11.1%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	99	Least Binding_99	1.42	2.67	5.10	15.83	45.17	333.02	42.4%	21.7%	17.7%	14.8%	13.5%	12.3%	SLV2	SLV2	SLV2	SLV2	SLV2	SLV2
Least Binding	100	Least Binding_100	1.67	3.75	8.01	29.20	99.48	1019.62	66.9%	30.3%	23.1%	18.4%	16.6%	14.9%	SLV2	Heston + Jump	SLV2	SLV2	SLV2	SLV2
Least Binding	mean	Least Binding_mean	1.09	1.52	2.31	5.38	12.38	65.77	8.9%	8.7%	8.8%	8.8%	8.7%	8.7%						

Proposed "quadrant" criteria for the joint distribution of interest rates and equity returns

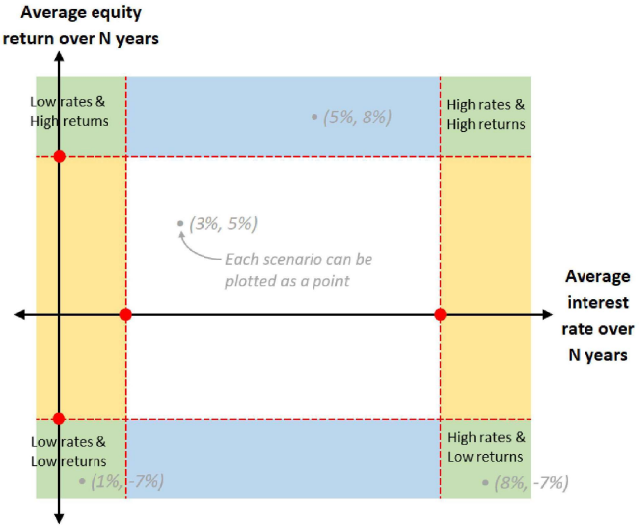
Iouri Karpov, MAAA, FSA
Member, Economic Scenario Generator Subcommittee (ESGS)

Jason Kehrberg, MAAA, FSA
Vice President, Life Practice Council (LPC)

Hal Pedersen, MAAA, ASA
Chairperson, Economic Scenario Generator Subcommittee (ESGS)

National Association of Insurance Commissioners (NAIC)
Generator of Economic Scenarios (GOES) (E/A) Subgroup—February 14, 2024

"Quadrant" criteria can be used to evaluate the frequency and severity of scenarios in the "four corners" of the joint distribution of interest rates and equity returns



- Proposed quadrant criteria are focused on deciles of the joint distribution of geometric average rates and returns over a horizon.
- Two forms of this criteria are proposed
  - **"Frequency" quadrant criteria:**
    - Quadrants are defined by explicit bounds (red lines) based on deciles from reference model(s).
    - Relevant statistic is the number of scenarios in a quadrant.
  - **"Severity" quadrant criteria:**
    - Quadrants are defined using deciles from the scenario set being evaluated, first interest rates then equity returns (number of scenarios in a quadrant is always 10,000 * 10% * 10% = 100).
    - Relevant statistic is the average geometric average across scenarios in a quadrant (for both rates and returns).
    - Implied interest rate / equity return linkage can also be estimated.

Frequency quadrant criteria — Interest rate bounds

- LATF's exposed "T5" criteria for interest rates (i.e., the low-for-long and high-for-long criteria) were proposed by the ESGS in our 9/14/23 presentation to LATF.
- "T5" uses 1st and 99th percentiles as criteria for low-for-long and high-for-long interest rates, but such percentiles are rather severe as quadrant criteria for the *joint* distribution of interest rates and equity returns.
  - 10,000 scenarios * 1% * 1% → about 1 scenario per quadrant.
- The "T5" table was expanded by adding10th and 90th percentiles using the same methodology as before, i.e., the least-binding scenario set percentile from a range of identified reference models (see our 9/14/23 presentation for additional detail).
  - 10,000 scenarios * 10% * 10% → about 100 scenarios per quadrant.
- For any given scenario set, interest rate bounds for frequency quadrant criteria are determined by noting the starting level of the 20-year Treasury rate (UST20) and then interpolating 10th and 90th percentiles from the expanded "T5" table.

Expanded "T5" Table — Percentile criteria for the distribution of geometric average UST20 rates (use 10th and 90th percentiles as the low and high interest rate bounds for the frequency quadrant criteria).

Starting	First 10 years of projection				First 30 years of projection			
UST20	1st	10th	90th	99th	1st	10th	90th	99th
1%	0.9%	1.3%	2.4%	3.4%	1.5%	2.1%	4.2%	6.2%
2%	1.2%	1.7%	3.7%	5.0%	1.7%	2.4%	5.1%	7.7%
3%	1.6%	2.3%	4.8%	6.6%	1.9%	2.6%	6.0%	8.7%
4%	2.1%	2.9%	5.9%	7.7%	2.1%	2.9%	6.8%	9.6%
5%	2.7%	3.5%	6.9%	8.9%	2.3%	3.2%	7.6%	10.5%
6%	3.1%	4.2%	7.9%	10.0%	2.5%	3.6%	8.2%	11.2%
7%	3.6%	4.7%	8.9%	11.0%	2.8%	4.0%	8.7%	11.6%
8%	4.1%	5.4%	9.8%	12.1%	3.1%	4.3%	9.2%	12.0%
9%	4.6%	6.0%	10.7%	13.1%	3.3%	4.7%	9.7%	12.3%
10%	5.2%	6.7%	11.6%	14.0%	3.6%	5.1%	10.0%	12.6%

Interpolated values for starting UST20 at 1.94% (12/31/21) and 4.24% (12/31/19 + 200bps)

Starting	First 10 years of projection				First 30 years of projection			
UST20	1st	10th	90th	99th	1st	10th	90th	99th
1.94%	1.22%	1.70%	3.61%	4.95%	1.67%	2.34%	5.08%	7.62%
4.24%	2.27%	3.07%	6.18%	8.01%	2.11%	2.98%	6.98%	9.82%

Note: The highlighted values are the interest rate bounds used to apply the frequency quadrant criteria to field test scenario sets 1a, 5a, and 6 (starting UST20 of 1.94%) and 2a, 6a, and 5b (starting UST of 4.24%).

Frequency quadrant criteria — Equity return bounds

- The ESGS is currently only proposing quadrant criteria for low equity returns (quadrant criteria for high equity returns could be developed if regulators are interested).
- As with interest rates, the bound for low equity returns is based on the 10th percentile of the distribution of geometric average equity returns over the first 10 and 30 years of the projection.
- Unlike interest rates, equity return bounds do not depend on the starting level (no interpolation required).
- The proposed equity bounds are simply the 10th percentile from the 10,000 S&P 500 scenarios produced by the NAIC's currently prescribed ESG (AIRG):

Low equity return bounds for the frequency quadrant criteria (based on the 10,000 AIRG S&P 500 scenarios)

	10th Percentile	
Horizon	Geometric average return	Gross wealth factor (GWF)
First 10 years of projection	1.14%	1.12
First 30 years of projection	3.83%	3.09

Note: GWFs are simply an alternative way to express geometric average returns, e.g., $(1 + 1.14\%)^{10} = 1.12$.

Note: There are other reasonable bases for this criteria besides the AIRG's 10,000 equity scenarios, such as the least-binding (slightly less extreme) reference model basis used to develop C3 Phase II equity GWF criteria. For example, compared to the 10-year 10th percentile of 1.14% (1.12 GWF) above:

- *LATF's exposed "E1" criteria (the former C3 Phase II equity GWF criteria, based on data through 2005) would correspond to a 10-year 10th percentile of 1.50% (1.16 GWF).*
- *The updated C3 Phase II equity GWF criteria in the Academy's 11/22/23 letter to LATF (based on data through 2022) would correspond to a 10-year 10th percentile of 2.01% (1.22 GWF).*

Illustrative application of quadrant criteria

The following slides use these scenario sets to illustrate the proposed quadrant criteria:

Scenario Set	Equity — Model / Calibration / Linkage Approach	Starting Date	Starting UST20
1a	GEMS / NAIC / Constant mean equity risk premium with recentering	12/31/21	1.94%
2a		12/31/19 + 200 bps	4.24%
1a-AIRG	AIRG / AIRG / Constant mean equity return	12/31/21	1.94%
2a-AIRG		12/31/19 + 200 bps	4.24%
5a	GEMS / Conning / Constant mean equity risk premium	12/31/21	1.94%
5b		12/31/19 + 200 bps	4.24%
6	GEMS / ACLI / Constant mean equity return	12/31/21	1.94%
6a		12/31/19 + 200 bps	4.24%

Notes:

1. *All scenario sets listed in this table use the GEMS Interest Model with the Generalized Fractional Floor.*
2. *Scenario sets 1a, 2a, 5a, 5b, and 6 were part of the NAIC's ESG field test (1a-AIRG, 2a-AIRG, and 6a were not).*
3. *All scenario sets are comprised of 10,000 scenarios.*

Frequency quadrant criteria — Illustrative application

	Horizon	Scenario set	1a	2a	1a-AIRG		5a	5b	6	6a
		Starting rate level	*1.94%*	*4.24%*	*1.94%*		*1.94%*	*4.24%*	*1.94%*	*4.24%*
		Linkage approach	*Const mean ERP (with recentering)*		*Const mean return*		*Const mean ERP*		*Const mean return*	
IR & EQ Quadrant Frequency	10 years	Low IR / Low EQ	307	283	194	179	539	354	184	164
		High IR / Low EQ	91	22	164	119	211	52	171	126
	30 years	Low IR / Low EQ	528	562	232	189	972	629	225	170
		High IR / Low EQ	12	4	142	110	87	19	120	104
IR Tail Frequency	10 years	Low IR	1,951	1,834	1,951	1,834	1,951	1,834	1,951	1,834
		High IR	1,723	1,252	1,723	1,252	1,723	1,252	1,723	1,252
	30 years	Low IR	2,389	1,900	2,389	1,900	2,389	1,900	2,389	1,900
		High IR	1,312	1,047	1,312	1,047	1,312	1,047	1,312	1,047
EQ Tail Frequency	10 years	Low EQ	1,227	928	1,000	1,000	2,136	1,226	933	933
	30 years	Low EQ	1,175	1,324	1,000	1,000	2,648	1,754	940	940
IR & EQ Bounds (geometric average rate/return)	*10 years*	*Low IR bound*	*1.70%*	*3.07%*	*1.70%*	*3.07%*	*1.70%*	*3.07%*	*1.70%*	*3.07%*
		High IR bound	*3.61%*	*6.18%*	*3.61%*	*6.18%*	*3.61%*	*6.18%*	*3.61%*	*6.18%*
	30 years	*Low IR bound*	*2.34%*	*2.98%*	*2.34%*	*2.98%*	*2.34%*	*2.98%*	*2.34%*	*2.98%*
		High IR bound	*5.08%*	*6.98%*	*5.08%*	*6.98%*	*5.08%*	*6.98%*	*5.08%*	*6.98%*
	10 years	*Low EQ bound*	*1.14%*	*1.14%*	*1.14%*	*1.14%*	*1.14%*	*1.14%*	*1.14%*	*1.14%*
	30 years	*Low EQ bound*	*3.83%*	*3.83%*	*3.83%*	*3.83%*	*3.83%*	*3.83%*	*3.83%*	*3.83%*

Observations:

1. Constant mean ERP approaches tend to oversample the Low IR / Low EQ quadrant and undersample the High IR / Low EQ quadrant (often an important source of risk, e.g., disintermediation).

Notes:

1. *Quadrants are determined as the scenarios with geometric average rates / returns falling within the specified bounds based on deciles.*
2. *Interest Rate (IR) is the 20-year Treasury (UST20). Equity Return (EQ) is the S&P 500 index.*

Severity quadrant criteria — Illustrative application

	Horizon	Scenario set	1a	2a	1a-AIRG	5a	5b	6	6a
		Starting rate level	*1.94%*	*4.24%*	*1.94%*	*1.94%*	*4.24%*	*1.94%*	*4.24%*
		Linkage approach	*Const mean ERP (with recentering)*		*Const mean return*	*Const mean ERP*		*Const mean return*	
IR & EQ Quadrant Severity (geometric average equity return in quadrant)	10 years	Low IR / Low EQ	-2.2%	-2.3%	-0.8%	-6.2%	-4.7%	-1.1%	-1.3%
		High IR / Low EQ	0.9%	3.1%	-1.0%	-2.0%	1.4%	-1.5%	-1.4%
	30 years	Low IR / Low EQ	1.3%	0.7%	2.9%	-1.7%	-1.1%	3.0%	2.9%
		High IR / Low EQ	6.0%	7.0%	2.6%	3.2%	5.6%	2.5%	2.6%
IR Tail Severity (geometric average interest rate in tail)	10 years	Low IR	1.1%	2.2%	1.1%	1.1%	2.2%	1.1%	2.2%
		High IR	4.8%	7.4%	4.8%	4.8%	7.4%	4.8%	7.4%
	30 years	Low IR	1.5%	2.1%	1.5%	1.5%	2.1%	1.5%	2.1%
		High IR	6.5%	8.4%	6.5%	6.5%	8.4%	6.5%	8.4%
Implied IR & EQ Linkage (in low EQ tail)	10 years	Low EQ	88%	104%	-7%	122%	121%	-9%	-1%
	30 years	Low EQ	90%	97%	-6%	95%	103%	-9%	-5%

Observations:

1. Under the constant mean ERP approaches, average equity returns in the High IR / Low EQ 30-year quadrant are rather high and may not sufficiently capture the risk of lower returns in that quadrant (e.g., 6.0 %, 7.0%).
2. In the 1a and 2a (constant mean ERP with recentering) Low IR / Low EQ quadrant, it is unintuitive that the average equity return decreases (e.g., 1.3% → 0.7%) when the starting rate level increases (i.e., exhibits negative linkage when the goal for 1a and 2a was positive linkage).

Notes:

1. *Quadrants are determined by selecting the 1,000 scenarios (out of 10,000) with the lowest or highest geometric average interest rate, and then selecting the 100 scenarios (out of those 1,000) with the lowest equity return (i.e., quadrants are always comprised of 100 scenarios).*
2. *Interest Rate (IR) is the 20-year Treasury (UST20). Equity Return (EQ) is the S&P 500 index.*
3. *Implied IR & EQ Linkage = Ln((1+High IR & Low EQ geom avg return)/(1+Low IR & Low EQ geom avg return)) / (High IR geom avg rate – Low IR geom avg rate) = (Ln(High IR & Low EQ GWF / Low IR & Low EQ GWF) / horizon in years) / (High IR geom avg rate – Low IR geom avg rate).*

American Academy of Actuaries

New slide not in 2/14/24 presentation

Update to 2/14/24 presentation

Addition of proposed target to accompany severity quadrant criteria

February 29, 2024

American Academy of Actuaries

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Proposed target to accompany severity quadrant criteria

New slide not in 2/14/24 presentation

- The 2/14/24 presentation proposed a quadrant severity statistic and compared that statistic across scenario sets from the field test but did not propose an associated target for those quadrant severity statistics.
- The proposed target to accompany severity quadrant criteria is based on the same four reference models (i.e., Heston, SLV2, RSLN2, and Heston + Jump) used to develop our previously proposed update to equity gross wealth factor (GWF) criteria (i.e., calibrated to returns on the S&P 500 index from 1957-2022, then adjusted to constrain the geometric average return over 30 years to 8.75%).
- The proposed target is based on the average, rather than least binding, statistic across reference models given regulators have indicated that is their preferred method for the updated equity GWF criteria.

Proposed target for quadrant severity statistics

		Average GWF in bottom decile		Average GAVG in bottom decile	
Reference model	Include	10 years	30 years	10 years	30 years
Heston	1	0.87	2.05	-1.4%	2.4%
SLV1	0	0.76	1.65	-2.7%	1.7%
SLV2	1	0.98	2.63	-0.2%	3.3%
SLV3	0	0.99	2.68	-0.1%	3.3%
RSLN2	1	0.78	1.70	-2.4%	1.8%
RSDD2	0	1.06	3.22	0.5%	4.0%
LN	0	0.92	2.19	-0.8%	2.7%
Heston + Jump	1	0.87	2.08	-1.4%	2.5%
AIRG	0	0.89	2.18	-1.1%	2.6%
Average of included models		0.87	2.12	-1.3%	2.5%

Given regulators have expressed a preference for equity-rate linkage in the form of positively correlated changes, it may be reasonable to see lower equity returns when interest rates are low, and higher equity returns when interest rates are high. As such, it may make sense to express these targets as a range, e.g.:

	10 years	30 years
Low rates	(0.87 - *a*) to 0.87	(2.12 - *c*) to 2.12
High rates	0.87 to (0.87 + *b*)	2.12 to (2.12 + *d*)

where a, b, c, and d indicate the size of the desired range (i.e., one-way buffers based on the expected impact of correlation).

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Severity quadrant criteria — Illustrative application (updated to show target)

New slide not in 2/14/24 presentation

	Horizon	Scenario set	1a	2a	1a-AIRG	5a	5b	6	6a	Target
		Starting rate level	*1.94%*	*4.24%*	*1.94%*	*1.94%*	*4.24%*	*1.94%*	*4.24%*	
		Linkage approach	*Const mean ERP (with recentering)*		*Const mean return*	*Const mean ERP*		*Const mean return*		
IR & EQ Quadrant Severity (geometric average equity return in quadrant)	10 years	Low IR / Low EQ	-2.2%	-2.3%	-0.8%	-6.2%	-4.7%	-1.1%	-1.3%	-1.3%
		High IR / Low EQ	0.9%	3.1%	-1.0%	-2.0%	1.4%	-1.5%	-1.4%	-1.3%
	30 years	Low IR / Low EQ	1.3%	0.7%	2.9%	-1.7%	-1.1%	3.0%	2.9%	2.5%
		High IR / Low EQ	6.0%	7.0%	2.6%	3.2%	5.6%	2.5%	2.6%	2.5%
IR Tail Severity (geometric average interest rate in tail)	10 years	Low IR	1.1%	2.2%	1.1%	1.1%	2.2%	1.1%	2.2%	
		High IR	4.8%	7.4%	4.8%	4.8%	7.4%	4.8%	7.4%	
	30 years	Low IR	1.5%	2.1%	1.5%	1.5%	2.1%	1.5%	2.1%	
		High IR	6.5%	8.4%	6.5%	6.5%	8.4%	6.5%	8.4%	
Implied IR & EQ Linkage (in low EQ tail)	10 years	Low EQ	88%	104%	-7%	122%	121%	-9%	-1%	
	30 years	Low EQ	90%	97%	-6%	95%	103%	-9%	-5%	

Observations:

1. Under the constant mean ERP approaches, average equity returns in the High IR / Low EQ 30-year quadrant are rather high and may not sufficiently capture the risk of lower returns in that quadrant (e.g., 6.0 %, 7.0%).
2. In the 1a and 2a (constant mean ERP with recentering) Low IR / Low EQ quadrant, it is unintuitive that the average equity return decreases (e.g., 1.3% → 0.7%) when the starting rate level increases (i.e., exhibits negative linkage when the goal for 1a and 2a was positive linkage).

Notes:

1. *Quadrants are determined by selecting the 1,000 scenarios (out of 10,000) with the lowest or highest geometric average interest rate, and then selecting the 100 scenarios (out of those 1,000) with the lowest equity return (i.e., quadrants are always comprised of 100 scenarios).*
2. *Interest Rate (IR) is the 20-year Treasury (UST20). Equity Return (EQ) is the S&P 500 index.*
3. *Implied IR & EQ Linkage = Ln((1+High IR & Low EQ geom avg return)/(1+Low IR & Low EQ geom avg return)) / (High IR geom avg rate – Low IR geom avg rate) = (Ln(High IR & Low EQ GWF / Low IR & Low EQ GWF) / horizon in years) / (High IR geom avg rate – Low IR geom avg rate).*

American Academy of Actuaries

Questions?

For further information, please contact Amanda Barry-Moilanen, life policy analyst, at barrymoilanen@actuary.org.

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

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

February 2, 2024

Rachel Hemphill
Chair, Life Actuarial (A) Task Force (LATF)
Mike Yanacheak
Chair, Generator of Economic Scenarios (GOES) (E/A) Subgroup

Re: Updated GOES Targeting Criteria and Evaluation Statistics

Dears Chair Hemphill and Yanacheak:

The American Council of Life Insurers (ACLI) appreciates the opportunity to submit feedback on LATF's exposure of updated GOES Targeting Criteria and Evaluation Statistics.

We appreciate the inclusion of some of the ACLI recommendations in the Targeting Criteria and Evaluation Statistics. We would seek clarification as to how exactly the Targeting Criteria and Evaluation Statistics will work together to develop acceptable scenario calibrations. Additional guidance should include details on how Conning will use this information in their calibration process and how regulators intend to use this information to accept or reject the resulting calibrated scenarios. It may also be beneficial to develop guidelines for how many criteria or statistics need to be met for scenario calibration acceptance and whether some criteria will be prioritized over others.

Additionally, it would be beneficial for companies to receive updated scenarios as soon as possible to better understand their statistics, features, and impacts to assess if additional changes are warranted. That way, we can assess whether the current set of criteria are effective in capturing sufficient moderate and tail scenarios across the spectrum of potential risks, without excessively overweighting either. The scenarios can also be used to assess whether an evaluation statistic should be changed to a targeting criterion that would impact the model calibration. To support this robust assessment, we would recommend producing scenarios across varying initial starting conditions to ensure the calibration produces scenarios that are reasonable. Those economic environments would include, but are not limited to, a high interest rate environment, low interest

rate environment and inverted yield curve, and higher and lower starting equity market levels vs. the baseline.

Regarding the Evaluation Statistics, many of the criteria say to review, but do not set a particular target or threshold(s) associated with the review. The review would be more meaningful to see if the criteria were within specified metric(s) (for example, in T1.E and T2.E the review of the sojourn length should have a target of 4 years or less based on ACLI prior comments). Alternatively, guidance may need to be developed for adjusting certain criteria or evaluation statistics, such as mean reversion parameters for interest rates, as initial conditions change, ideally in a formulaic way.

The following comments are on the specific Targeting Criteria and Evaluation Statistics within each of the Treasury, Equity, or Corporate models.

Treasury Model:

- T1.E and T2.E: Add a target of 4 years or less to the sojourn requirements for the review.
- T2.E: We suggest the frequency of negative rates be a Targeting Criterion. ACLI previously proposed that the 99th percentile on the steady state should >=0% for 1Y and 1% for 20Y. Were this to be retained as an Evaluation Statistic, we would suggest these values should still be the targets for the review.
- T3.E: We suggest slope statistic should be a Targeting Criterion; the values should be the Academy proposed boundaries. Were this to be retained as an Evaluation Statistic, we would suggest these values should still be the targets for the review.
- T4.T: There is an indirect conflict between criteria T4 and criteria T5. We interpret both criteria as setting a minimum number of scenarios that should exceed/be lower than a certain threshold; criteria T5 varies based on starting conditions at the 1st and 99th percentile, while T4 is fixed no matter what the initial conditions are or would require each calibration to also generate scenarios for a different valuation date to review this criterion. Therefore, we continue to believe T4 is unnecessary given the more comprehensive T5, which already considers low for long conditions.
- T5.T: We would recommend that the American Academy of Actuaries (the Academy) develop the 15th and 85th percentile parameters on this criterion.
- T6.E: We would recommend that the regulators retain the ACLI proposed criteria on mean reversion. The version included in the exposure had lower rates.
    - A- Mean reversion target:
        i. 50th percentile 2.0% < 1Y rate < 3.5%
        ii. 50th percentile 4.0% < 20Y rate < 5.5%
    - B - Retain Academy Rate median reversion criteria with half-life of 10-20 years. We believe a range of years is more appropriate for this criterion.

Equity Model:

- E1.T and E1.E: We would request clarification from the Academy if the criteria should apply regardless of initial rates. We understood the criteria to apply in all interest rate environments because this is consistent with the original usage and evaluation of the criteria in C-3 Phase II and the targeting criteria document did not indicate an intention for variation in different initial conditions as it did for other targeting criteria. Further, if targets are adjusted as conditions change, it is preferable to have objective thresholds to how criteria should shift as drivers, such as interest rates change, ideally based on more than one model. If criteria would be adjusted due to changes in starting conditions, we would

like to see examples of how the criteria would evolve over a wide range of starting conditions.

- E1.E: This criterion should be a Targeting Criterion to better align with the equity stylized fact such that the wealth factor will not be less than or equal to the specified levels to control the frequency of worse than historical low equity returns, which is consistent with the intent of the criterion. We would also note the intention of this criterion was that the wealth factors in the scenarios under consideration for this criterion would be greater than or equal to instead of less than or equal to the specified levels to control the frequency of worse than history low equity returns. It may also be helpful to extend this criterion out to 20 and 30 years. To develop a proposed factor, we used the ACLI proposed 0.5th percentile over the Academy 1st percentile at 10 years times Academy proposal for 1st percentile at 20 years: 0.64/0.71*0.99 = 0.86. A similar approach could be applied to 30 years, using the Academy proposal for the 1st percentile at 30 years: 0.64/0.71*1.55=1.40.
- E2.T:
  Question:
  Regulators want to ensure that: 1) there is an adequate representation of scenarios with low-for-long Treasury rates and low accumulated equity returns, and 2) that the GOES provides the appropriate incentives for sound risk management programs at insurance organizations.

  ACLI Response:

  ACLI believes that adequate coverage of low/low is achievable without linkage. Linkage may result in challenges with the equity distribution and variances in capital levels.

  ACLI would propose modeling the interest rate and equity relationship through introducing positive correlation as an alternative to the GEMS positive linkage. A positive correlation would emulate partial linkage by adjusting the number of scenarios that would be classified into the low/low and high/low interest rate/equity return quadrants, maintain a stable equity distribution regardless of initial interest rates, remove the need to recentralize the distribution due to interest rate changes, incentivize hedging and sound risk management, and avoid potential undue volatility in capital in changing rates. The proposal would create additional C3P2 criteria to reflect heavier tails for low interest/low equity and high interest/low equity.

  ACLI's proposed criteria is based on analysis of the ACLI reference model (calibrated to the latest AAA criteria) and the AIRG equity model. The AIRG model was run assuming no correlation to rates, as well as a 20% correlation (which roughly is the correlation from 2000-2022).

  To develop ranges, we expressed quadrant criteria in terms of L4L and H4L rates at 10% and 90% percentile respectively:
  - Pick 1k scenarios out of 10k corresponding to L4L and H4L rates criteria.
  - Use 10yr and 30yr time horizon

  Using these scenarios for L4L and H4L, we average equity GWFs in bottom 10%:
  - Using baseline AIRG equity (already in ACLI model) – 0% correlation
  - Adding 20% correlation between log long rate and equity processes
  - Compute average of bottom 10% equity distribution corresponding to scenarios identified above.

The proposed ranges from the analysis would reflect the ranges with and without the correlation. For low/low, we propose a range of gross wealth factors using the low rates with 20% correlation in the lowest decile to 0% correlation for the full 10,000 scenarios (0.82-0.89 for 10 years, 1.88-2.18 for 30 years). For high/low, we propose a range of gross wealth factors using the full 10,000 scenarios with 0% correlation to high rates with 20% correlation in the lowest decile (0.89-1.04 for 10 years, 2.18-2.79 for 30 years).

Average GAVG Rates (bottom and top decile)				
	Low rates	High rates		
10yr	1.3%	4.9%		
30yr	1.7%	6.8%		
Average GWF (bottom decile): 20% correlation				
	Low rates	High rates		
10yr	0.82	1.04		
30yr	1.88	2.79		
Average GWF (bottom decile): no (AIRG)				
	All 10k			

A summary approach for the criteria would be as follows:

For the Low rate/Low equity:

(1) Select bottom 10% of interest rates, out of 10K scenarios, based on the geometric average of UST20Y over the first 10 and 30 years

(2) Within the bottom 10% of interest rate scenarios, calculate the CTE(90) of gross wealth factors of the bottom docile,

(3) The CTE(90) gross wealth factors with and without correlation for years 10, and 30 should be within the proposed ACLI criteria as mentioned above (i.e., 0.82-0.89 for 10 years, 1.88-2.18 for 30 years)

For the High rate/Low equity:

(1) Select top 10% of interest rates, out of 10K scenarios, based on the geometric average of UST20Y over the first 10 and 30 years

(2) Within the top 10% of interest rate scenarios, calculate the CTE(90) of gross wealth factors of the bottom docile,

(3) The CTE(90) gross wealth factors with and without correlation for years 10, and 30 should be within the proposed ACLI criteria as mentioned above (i.e., 0.89-1.04 for 10 years, 2.18-2.79 for 30 years)

Corporate Model:

Question:

On the Corporate model, Steve Strommen raised: Stylized fact 1a says “Credit-related losses tend to be “lumpy” or episodic.” This increases the risk for insurers of significant risk in a short period. Nothing in the criteria or statistics reflect this.

ACLI response:

ACLI proposes developing tail annualized excess returns based on historical highs and lows over a relevant time horizon, e.g., 1st 5Y given faster mean reversion of credit spreads. Additionally, there may be benefits from defining a maximum or minimum sojourn length.

ACLI would like to thank regulators once again for the opportunity to submit our feedback and we look forward to continuing discussions on the GOES project at future sessions of LATF and the GOES (E/A) Subgroup.

Sincerely,

cc: Scott O’Neal (NAIC) and Craig Chupp (Vice-Chair, LATF)

Updated ACLI Proposal on E2.T (joint interest-equity distribution)

The American Academy of Actuaries has updated the Gross Wealth Factors for GOES acceptance criteria. ACLI's proposed joint distribution has been updated to reflect this update, using the average of the 4 Academy reference models. The without correlation GWF between the average of the 4 reference models verses the ACLI model were close, so we applied a ratio to true-up to the ACLI's GWF with correlation.

Current Recommendation:

Tail GWF Target	10 Years	30 Years
Low Rate/Low Equity quadrant	0.81[2] - 0.87[1]	1.82 - 2.12[1]
High Rate/Low Equity quadrant	0.87[1] - 1.02	2.12[1] - 2.71

Prior Recommendation:

Tail GWF Target	10 Years	30 Years
Low Rate/Low Equity quandrant	0.82 - 0.89	1.88 - 2.18
High Rate/Low Equity quadrant	0.89 - 1.04	2.18 - 2.79

[1]: 0.87 and 2.12 are based on Academy's recent update

[2]: 0.81 = ACLI's GWF with correlation (=0.82) * Ratio (=98%), where Ratio = Academy's GWF without correlation using average of the 4 reference models/ACLI's GWF without correlation = 0.87/0.89 = 98%

The average CTE90 for the 4 reference models without correlation is close to the ACLI model, so the ratio was applied to adjust with 20% correlation.

Quadrant	Horizon	AIRG	Avg 4 Ref Models	Ratio
Low Rate -- W/ Corr	10	0.82	0.80	
High Rate -- W/ Corr	10	1.04	1.02	
All Rate -- W/O Corr	10	0.89	0.87	98%
Low Rate -- W/ Corr	30	1.88	1.83	
High Rate -- W/ Corr	30	2.79	2.71	
All Rate -- W/O Corr	30	2.18	2.12	97%

Patricia Matson, FSA, MAAA
1 Mott Avenue
New London, CT 06320

January 31, 2024

Ms. Rachel Hemphill, FSA, MAAA, FCAS
Life Actuarial Task Force

Dear Ms. Hemphill,

The purpose of this letter is to provide my comments to the Life Actuarial Task Force (LATF) regarding the recently exposed Targeting Criteria and Evaluation Statistics for the GOES that is intended for use within principle-based valuations.

I appreciate the opportunity to offer my comments. Please note that these comments are my own, and are not meant to represent views of my employer or any industry committees in which I participate.

I applaud the significant efforts made by the GOES Subgroup, LATF, the Life Risk-Based Capital Working Group, and the NAIC on identifying an appropriate set of economic scenarios for use in principle-based valuations. I have monitored these activities over the past several years, and understand that balancing the needs of a wide range of stakeholders is challenging. I also recognize the significance of appropriate scenarios to ensure that the insurance industry is holding adequate reserves and capital for policyholder protection, while also ensuring the results are not excessively conservative, which can result in the inability to provide well priced products to consumers.

In light of these considerations, I offer the following high-level comments. I realize that these comments extend beyond the scope of the exposure, but I would like to offer them at this time based on the cumulative set of information that has become available regarding the planned use of Conning's GEMS™ generator, including the recent exposure.

General Comments

1. The first piece of guidance in Actuarial Standard of Practice No. 56, Modeling (ASOP 56), states "When the actuary designs, develops, or modifies the model, the actuary should confirm, in the actuary's professional judgment, that the capability of the model is consistent with the intended purpose." In this case the intended purpose for the GOES is to create a scenario set that is suitable for actuaries to use to set reserves and capital. Some of the criteria that should be considered, per ASOP 56, are the level of detail of the model, the dependencies recognized, and the model's ability to identify possible volatility of output, such as volatility around expected values. Considering the challenges faced to date in calibrating the generator for its intended purpose, I suggest that LATF consider whether the ASOP 56 criteria are being met. Although I recognize the significant efforts spent to date, I suggest a reevaluation of fitness for purpose.
2. The Appointed Actuary's (AA) and Qualified Actuary's opinions on reserves play a critical role in the overall reserving process. I believe that the current regulatory approach to Principle Based Reserves (PBR), which combines prescription and judgment, results in a reserve setting process

that both incorporates appropriate conservatism and allows for consideration of company-specific risks. Because of the significance of the opinion provided by the qualified actuary and the level of judgment that underlies it, I believe it is important for the AA to have a complete understanding of results from the PBR projection models, including the economic scenarios. I believe that use of a GOES that does not include full transparency for the user is inappropriate. It may result in unintended consequences, such as understated reserves, since the actuary developing those reserves will not be able to fully understand projection results. I suggest that LATF pursue a GOES for principle based reserving that will allow the actuary preparing reserve analysis full transparency into the generator mechanics. If this does not occur, the result is likely to be PBR reporting with a variety of caveats and limitations in the report, since such disclosures are required under actuarial standards of practice.

3. I am generally supportive of using the American Academy of Actuaries (AAA) Alternative Corporate Model presented to LATF on 10/27/2022 based on its transparency for the user and the fact that it appears to meet the desired criteria. However, I have some concern that use of a "mix and match" approach to the overall scenario generation (in which corporate bonds use one generator and other asset classes use a different one) could create unintended consequences, since it may be challenging in the longer term to ensure that different models used for different asset classes are calibrated in a consistent way, which will be important to properly capture asset risks. The NAIC may wish to consider whether the work of the AAA may be leverageable for other asset classes as well.

Specific Comments

4. Regarding the exposed criteria, it appears that in some cases the criteria are designed to try to correct for issues that are created due to the GOES lack of fitness for purpose described in my comment 1 above. A generator that was originally developed for purposes other than PBR may not be easy to calibrate to meet specific desired outputs. It may be worthwhile to reconsider whether the generator meets fitness for purpose criteria before proceeding further on the targeting criteria and evaluation statistics.

Thank you for the opportunity to provide comments on this important topic. I can be reached at 860-305-0701 or tricia.matson@outlook.com if you or other members have any questions.

Sincerely,

Patricia Matson, FSA, MAAA

Mathematical Finance Company
QTSM CIR Green's Function Multifactor CIR and Affine Options SIRP ESG RS-ESG DMRP RS-DMRP

January 30, 2024

Honorable Rachel Hemphill
Chair, Life Actuarial (A) Task Force (LATF)
Re: Generator of Economic Scenarios (GOES) Targeting Criteria and Evaluation Statistics.

Dear Ms. Rachel Hemphill,

Please accept this comment on the Generator of Economic Scenarios (GOES) Targeting Criteria and Evaluation Statistics.

If there was a single document containing the mathematical specification in standard equation format of the entire model to be calibrated and evaluated, then it would make the development of targeting criteria and evaluation statistics go faster. This would help with the linkages of treasury, corporate and equity models.

One of the stated goals of the exposure is: "2) that the GOES provides the appropriate incentives for sound risk management programs at insurance organizations. " This is not possible if the risk premia do not bear a rational relationship to the risks in the model. If the model contains stochastic volatility and jumps then this is even more necessary.

Only full disclosure and documentation of the model can make it possible to rationally calibrate risk premia among equity portfolios and across asset classes. This will go beyond a constant Sharpe ratio to appropriate risk premia for each stochastic risk factor including stochastic volatility, jumps and correlation to the interest rate state variables.

The stochastic model including the risk premium for each exposure to risk and the exposure to each risk at each time point in each scenario will approximate the result of the full set of calculations. Thus the risk premium for each exposure to risk is key to the results. If the risk premia for the exposures are not rational, then the model will not lead to rational behavior by the companies in choosing their net exposure to risk in the scenarios at each time node. The measures of reserves and capital will likewise be skewed. The correlation of equities and bonds are part of the net exposures to risk. Errors in correlation modeling will then feed into errors in the net exposures to risk and then into the overall model output measures.

The NAIC GOES work has been extremely good and is on its way to setting a milestone in financial risk regulation.

Sincerely yours,

Mark S. Tenney

618 Trailhead Road, Monument, CO 80132
(703) 474 0551 • marktenneymfc@gmail.com • mfcesg.com

1 Treasury Targeting Criteria

The research of James Bullard of the St. Louis Fed is helpful for all of the targeting criteria for treasuries. This is cited at the end.

1.1 Targeting criteria T1.T:

a) The scenario set should reasonably reflect history, with some allowance for more extreme high and low interest rate environments

b) Upper Bound:

i. [18and no more than [0.5

ii. [17and no more than [0.5

Evaluation statistics T1.E:

Review maximum sojourn length for high interest rates (> 17

Note 1.1 (Are these feasible if rates start at the high boundary?) *If the current system and calibration are started at the high boundary points, will it satisfy these criteria? If not, it may be that this should apply to starts at some point below this.*

Note 1.2 (Long run stationary points can be used as well.) *The long run distribution after the start up point no longer has an impact can also be used to help specify this type of requirement.*

Note 1.3 (Regime switching research may support wider spread) *Regime switching in treasury rates may support more of a tail at high rates.*

Note 1.4 (Limiting high rates is reasonable for this application) *A concern that too many high rate scenarios could lead to under-estimating risk of low rates is reasonable. However, if the ability of rates to spike up is under-weighted, it could lead companies to take risks that are not appropriate or regulators to miss seeing them. The linkage of the equity and interest rate models may enter into this as well.*

1.2 Targeting criteria T2.T:

Apply the following guidance for negative interest rates:

a) Maturities less than 20 years could experience negative interest rates

b) Interest rates may remain negative for multi-year time periods

c) 1Y rates should not be lower than -1.0

d) 20Y rates should not be lower than 0.0

These are a reasonable set for negative rates at this time. Over time, there may be lower negative rates as indicated in my prior comments that the Taylor Rule teaches deep negative rates and this is widely taught in universities and will become part of certification exams in financial services.

The Bullard research could support lower values. Bullard also has citations to the work of others on these matters.

1.3 Evaluation statistics T2.E:

e) Frequency of low rates:

i. Review the frequency of negative rates for 1Y rate

ii. Review the frequency of negative rates and rates below 1

f) Review Maximum sojourn length for low interest rates (< 0

The influence of the Taylor Rule may cause these to become more negative for longer. Bullard's research indicates there may be some deeper negative regimes that could appear in the future.

1.4 Targeting criteria T3.T:

a) Review initial actual vs. fitted spot curve differences for a sampling of 5 dates representing different shapes and rate levels for the entire curve and review fitted curves qualitatively to confirm they stylistically mimic the different actual yield curve shapes

b) The frequency of different yield curve shapes in early durations should be reasonable considering the shape of the starting yield curve (e.g., a flatter yield curve leads to more inversions).

c) The steady state curve has normal shape (not inverted for short maturities, longer vs shorter maturities, or between long maturities)

Starting the state variables from their extreme values is another way to calibrate or at least understand the behavior of the model during the period that the initial starting point matters.

The steady state distribution should be part of the calibration process, at least to understand it. The steady state distribution will also help with linkages between the models and the risk, hedging, return relationships among asset classes.

1.5 Evaluation statistics T3.E:

d) Review upper and lower bound for 20Y-1Y in low, moderate, and high interest rate environments. Compare to historical.

e) Review worse-than-history frequencies for 20Y-1Y in low, moderate, and high interest rate environments. Compare to historical.

In addition to these environments, the steady state distribution should be part of the comparison.

1.6 Targeting criteria T4.T:

a) At least 7.5average of the 20-year UST below 1.45

b) At least 3.75average of the 20-year UST below 1.95

Note: As part of the model acceptance process, a given calibration of the GOES will be tested at multiple starting dates. This criteria is relevant for the 12/31/20 starting yield curve.

Understanding the steady state distribution would help understand whether these are difficult criteria to meet. The distribution of rates over some long period of time can be compared to the steady state distribution and these statistics as well.

1.7 Targeting criteria T5.T:

a) For each scenario, calculate the geometric average of the [20-year] UST yield over the first [10] and [30] years of the projection.

b) Calculate the [1st] and [99th] percentiles of the distribution of geometric average rates (for both the 10 and 30-year horizons).

c) Look up criteria based on the starting level of the 20-year UST yield (interpolate if necessary).

The steady state distribution should also be included in this list. So calculate these geometric averages from a point at which the starting value doesn't matter. Another way to do this is to generate starting values using the steady state distribution.

1.8 Evaluation statistics T5.E:

d) Use the Academy approach to determine parameters for 15th and 85th percentiles to expand the criteria table to also include conditions on moderate rate.

The steady state distribution and the empirical distribution over some time period should be compared to see how their shapes compare. This would help understand how the curves are shaped and where there are points of change in convexity of these curves. That would help in finding the key points to include. The 15th and 85th are likely to be important points in such an approach.

1.9 Evaluation statistics T6.E:

Mean reversion benchmark:

i. 50th percentile 1.31

ii. 50th percentile 3.35

Ranges based on 15 year half-life for consistency with AAA recommendation.

Evaluation statistics T7.E:

Note that the buckets refer to starting yield level and the desired range percentages refer to the annualized standard deviation of monthly yield changes.

The Fed and economists linked to it continue to insist on a 2 percent inflation target. But there is skepticism from other observers like Greg Mankiw that 3 percent inflation may be good enough. However, for much of the post-2008 period, inflation was around 1 percent.

Bullard of the St. Louis Fed finds that r-star is regime switching.

See page 29 of the following.

https://www.stlouisfed.org/-/media/project/frbstl/stlouisfed/files/pdfs/bullard/remarks/2018/bullard_nabe_washington_dc_26_february_2018.pdf

His variable, r-dagger can be as low as -1.27 percent and as high as 4.8 percent.

He also discusses Taylor type rules on page 39.

https://www.stlouisfed.org/news-releases/2018/02/26/bullard-natural-real-rate-interest

Bullard has an update in 2019 on r-star.

https://www.stlouisfed.org/from-the-president/-/media/project/frbstl/stlouisfed/files/pdfs/bullard/remarks/2019/bullard_dnb_ecb_workshop_amsterdam_16_may_2019.pdf

Page 17 has an interesting graph on the return of all capital as being around 8 percent.

St. Louis Fed sees the economy as being regime switching.

https://www.stlouisfed.org/-/media/project/frbstl/stlouisfed/files/pdfs/bullard/papers/regime-switching-forecasts-17june2016.pdf

https://www.stlouisfed.org/annual-report/2017/regime-based-view-of-the-economy

Latest views on regime switching and inflation from St. Louis Fed.

https://www.stlouisfed.org/-/media/project/frbstl/stlouisfed/files/pdfs/bullard/remarks/2023/bullard-hoover-12-may-2023.pdf?sc_lang=en&hash=57F46D16C205FF0EE116DFFE0F7239C8

2 Equity model

> Targeting criteria E1.T:
>
> Use the former C3 Phase II equity model Calibration Criteria as a rough placeholder.
>
> Sharpe ratios for equities other than S&P should be within 5% of S&P Sharpe ratio.
>
> Evaluation statistics E1.E:
>
> Review 0.5th percentile, comparing to [0.54/0.58/0.62] for 1/5/10-year WF.
>
> Request for Targeting Criteria E2.T:
>
> Regulators want to ensure that: 1) there is an adequate representation of scenarios with low-for-long Treasury rates and low accumulated equity returns, and 2) that the GOES provides the appropriate incentives for sound risk management programs at insurance organizations. Comments are requested on targeting criteria that could address these concerns.

The Sharpe ratio is one way to try to create a consistent approach to risk. However, the first of the two Cox, Ingersoll, and Ross papers derives more general expressions than the Sharpe ratio. The types of risk premia found in that paper and the related literature contain mathematical relationships for risk that are different than the equality of Sharpe ratios between different asset classes, even ones that are related such as equity portfolios.

Instead, they recognize risk premia due to hedging changes in the investment opportunity set. The

Sharpe ratio does not reflect such hedging. The expressions in the CIR papers reflect the more sophisticated risk, return, and hedging relationships in asset returns.

The goal of sound risk management programs at insurance organizations may be hampered by the use of Sharpe ratios for equity portfolios. Insurance companies are among the long term investors who should be looking at hedging changes in the investment opportunity set.

If there is stochastic equity volatility, then there should be a risk premium for exposure to it. As this exposure varies among equity portfolios their expected return should vary as well as their Sharpe ratio.

The same applies to exposure to interest rates. The interest rate is stochastic in this model. Stochastic interest rates are part of the investment opportunity set. So the varying correlation of different equity portfolios will receive a varying risk premium compensation.

If there are jumps in equity portfolios, and if jump risk is compensated, then this too will cause the Sharpe ratio to vary among portfolios.

Theorem 2 of the first Cox, Ingersoll, and Ross papers gives a multi-factor risk premia equation. See page 374, formula (20) of An Intertemporal General Equilibrium Model of Asset Prices. See also equation (11c) page 370 of that paper.

Stochastic volatility of equity returns and jumps in equity prices or indices requires risk premia for those risks. This means that the Sharpe ratios will differ because of different exposures and correlations to these additional risk factors as well as to interest rates.

The primary determinant of the results of the model are the specification of the stochastic model itself including the risk premium for each risk exposure and the net risk exposure at each time node in each scenario. The risk premia for the risk exposures have to be rational or the model will not provide accurate measures of risk or of risk and return.

The correlation of equity returns to bond returns and the other state variables such as the interest rate state variables, stochastic volatility variables and jump variables is critical to the model. Capturing correlation correctly is a key part of calculating net exposures to each stochastic variable. The risk premium for each stochastic variable then determines the incremental expected return for the net exposure to each stochastic variable.

2.1 Equity Bonds Correlation

2.1.1 Remarks on equity bond correlation

We seem now to be in a period of positive correlation of bond and stock price returns. This reduces asset diversification for insurance companies and so is of importance to regulators.

Calibrating the bond equity price correlation with this model is tricky. The three interest rate state variables are assumed uncorrelated so that the standard CIR bond price formulas can be used. If one thinks in terms of a Cholesky decomposition matrix, the first 3 variables are the interest rate variables. The unexpected stock returns can have non-zero coefficients in that matrix for those 3 interest rate state variables. That does not induce any correlation among the 3 interest rate variables but does create a correlation between stock price returns and bond price returns. This is because both will have a weighting on these 3 interest rate variables.

The stock bond correlation could also be introduced in a second stage by a correlation between stock returns and bond portfolio returns. So the model would be built around the interest rate model but with a consistent structure. Interest rates are generated first, then bond portfolio returns calculated and then a correlation of those to stock returns. Perhaps they do something like that now, I'm not quite sure on the details of their method on this.

The more conservative choice from a regulator perspective is a positive correlation between bond and stock price returns. This is assuming the model does not have a regime to allow this correlation to change. So if regulators have to pick a single correlation, positive correlation between price returns would be more conservative.

2.1.2 References on equity bond price or return correlation

This article by Antti Ilmanen from 2003 is used by several of the links.

Stock-Bond Correlations September 1, 2003 - Antti Ilmanen

https://www.aqr.com/Insights/Research/Journal-Article/Stock-Bond-Correlations

You can download the paper with the download arrow on the right of their page.

https:
//www.aqr.com/-/media/AQR/Documents/Journal-Articles/Stock-Bond-Correlations.pdf?sc_lang=en

https://www.aqr.com/Insights/Research/Journal-Article/A-Changing-Stock-Bond-Correlation

Drivers and Implications Q1 2023 - Alfie BrixtonJordan BrooksPeter HechtAntti IlmanenThomas MaloneyNicholas McQuinn

They introduce the phrase "golden parameter". Several other sources have picked up on this phrase. The search: "golden parameter" stock bond correlation, or equity bond correlation picks up other articles discussing the AQR article.

Their full article can be downloaded from the link on the left saying download.

https://www.aqr.com/-/media/AQR/Documents/Alternative-Thinking/
A-Changing-Stock-Bond-Correlation_JPM.pdf?sc_lang=en

https://russellinvestments.com/us/blog/is-the-stock-bond-correlation-positive-or-negative

I might have put the following graph up during the discussion period at the Fall National Meeting.

https://russellinvestments.com/-/media/images/us/blogs/images/mortensenoct26_1.png

This shows the changing sign and size of the correlation between bond returns and stock returns. The interest rate change correlation will be opposite in sign, of course.

A more economics oriented discussion is here.

The correlation of equity and bond returns BIS Quarterly Review | 04 December 2023 by Marco Jacopo Lombardi and Vladyslav Sushko

https://www.bis.org/publ/qtrpdf/r_qt2312v.htm#:~:text=The%20correlation%20between%20US%

20equity,prolonged%20period%20with%20positive%20correlations.

" Amid a generalised increase in the volatility in fixed income markets and in sync with the inflation surge, the correlation between equity and bond returns has turned from negative to increasingly positive. A departure from the negative correlation between equity and bond returns, the typical configuration for the past two decades, weakens the diversification in the classical long-only asset allocation strategies of pension and investment funds. Specifically, it undermines the role of bonds as a hedge for the portfolio's equity portion. This box documents the recent persistence of positive correlations and explains it with reference to the inflation environment and the attendant uncertainty icon.

The correlation between US equity and government bond returns switched sign in mid-2021. Since then, the monthly realised correlation of the daily returns has become positive (Graph A1.A). One has to go back to the 1980s and the early 1990s to find a prolonged period with positive correlations.icon"

https://www.bis.org/publ/qtrpdf/r_qt2312x.htm

Life insurance companies – the missing relief from rising interest rates

Sean Markowicz article is also valuable to understand the linkages.

https://mybrand.schroders.com/m/6662cf1f5d2d8543/original/202202_what-drives-the-equity-bond-correlation.pdf

Figure 8 on page 6 is a very helpful summary of 3 scenarios for equity bond correlation. This figure may be the easiest visual to explain this that I have found.

Following has useful data, although Google chrome has a problem downloading it for me.

This is monthly data

http://www.econ.yale.edu/~shiller/data/ie_data.xls

http://www.econ.yale.edu/~shiller/data.htm

3 Corporate model

Targeting criteria C1.T:

a) Set steady state excess return targets for each bond fund according to the criteria below.

b) Average annualized excess returns for each bond fund in years 20 through 30 of the projection should be no greater than the steady state excess returns, but no less than the steady state excess returns minus a buffer

Evaluation statistics C2.E:

Request for criteria or statistics C3:

On the Corporate model, Steve Strommen raised: Stylized fact 1a says "Credit-related losses tend to be "lumpy" or episodic." This increases risk for insurers of significant risk in a short period. Nothing in the criteria or statistics reflect this.

We need a recommended metric if this is to be evaluated.

Default rates over NBER recessions could be used as one measure to target. Although this may not be the best based on the research cited below.

https://www.nber.org/system/files/working_papers/w15848/w15848.pdf

CORPORATE BOND DEFAULT RISK: A 150-YEAR PERSPECTIVE Kay Giesecke Francis A. Longstaff Stephen Schaefer Ilya Strebulaev

> We find that over the long term, credit spreads are roughly twice as large as default losses, resulting in an average credit risk premium of about 80 basis points. We also find that credit spreads do not adjust in response to realized default rates.

From the abstract.

> The worst event occurred in the 1870s when the railroad boom of the 1860s was followed by a disastrous decade of defaults. During the three-year period from 1873 to 1875, the annual default rates total to 35.90 percent of the total par value of the corporate bond market. Several other three-year periods in the study period experience comparable default rates. Surprisingly, the worst three year period during the Great Depression with default rates totaling to 12.88 percent barely makes it into the top five credit events for nonfinancials.2 On average, the annual corporate default rate during the sample period is about 1.50 percent. Corporate defaults, however, cluster significantly in time and the default rate is very persistent. Curiously, the correlation between credit events and NBER business downturns is only about 26 percent.

page 4 of pdf.

This covers 1866 to 2008. It also gives value weighted default rates instead of issuer weighted default rates.

https://www.nber.org/system/files/working_papers/w17854/w17854.pdf

MACROECONOMIC EFFECTS OF CORPORATE DEFAULT CRISES: A LONG-TERM PERSPECTIVE Kay Giesecke Francis A. Longstaff Stephen Schaefer Ilya Strebulaev

https://www.nber.org/system/files/working_papers/w25317/w25317.pdf

LOW INFLATION: HIGH DEFAULT RISK AND HIGH EQUITY VALUATIONS Harjoat S. Bhamra Christian Dorion Alexandre Jeanneret Michael Weber

https://fraser.stlouisfed.org/files/docs/publications/frbny_ci/ci2-6.pdf?utm_source=direct_download
Understanding Aggregate Default Rates of High Yield Bonds Jean Helwege and Paul Kleiman

> Corporate defaults spike during times of low expected inflation. But so do firms' equity valuations, despite increased default risk. Figure 1 documents these two stylized facts for the U.S. over the period 1970Q2–2016Q4. Panel A illustrates the strong negative relation between expected inflation and the number of quarterly defaults in the U.S., whereas Panel B shows a similar negative relation between expected inflation and price-dividend ratios.

These types of linkages or correlations are important to a comprehensive model of risk in financial markets such as the NAIC GOES model.

Fred Graph data on corporate bonds. https://fred.stlouisfed.org/tags/series?t=bonds%3Bcorporate

NAIC corporate report. https://content.naic.org/sites/default/files/naic_archive/corporate.pdf

https://content.naic.org/capital-markets-bureau

Also of interest is this page.

https://www.msci.com/research-and-insights/insights-gallery/probabilities-of-default-in-the-corporate-bond-market

January 2, 2024

Dear Mr. O'Neal,

These comments are submitted to the Life Actuarial (A) Task Force in response to the request for comments on the "Updated Generator of Economic Scenarios (GOES) Targeting Criteria and Evaluation Statistics". My comments are limited to T4.T (low for long) and C3 (corporate model credit-related losses).

T4.T (low for long)

The target for low-for-long behavior is expressed with reference to the starting yield curve on 12/31/2020 and in terms of the geometric average of 20-year interest rates over the first 10 to 30 years.

a) At least 7.5% of scenarios need a 10-year geometric average of the 20-year UST below **1.45%**

b) At least 3.75% of scenarios need a 30-year geometric average of the 20-year UST below **1.95%**

These targets are very far from any actual historical experience in the US. The lowest 10-year geometric average in the last 70 years is over 2.4% (not under 1.45%) and the lowest 30-year geometric average is over 4.3% (not under 1.95%). If the proposed targets are adopted and used, the resulting calibration will not produce scenarios that resemble the historical record.

One of the principles underlying the principle-based approach is that any stochastic process used for simulation is to be calibrated based on historical experience. Only then will the statistical measures such as CTE level be meaningful. If the stochastic process (the generator in this case) is calibrated using targets far outside historical experience, the statistical measures such as CTE lose their meaning and the principle-based approach loses its value.

Regulatory concern over the risk of a low-for-long scenario is justified. But such a scenario is often called a "Japan scenario" for a reason – it occurred in Japan, a country with very different economic and demographic characteristics. Such a scenario could occur in the US, but only with a significant change in the economic environment that would justify a significant recalibration of the generator. One cannot calibrate a generator to simulate both the US and Japan at the same time. If that is attempted, the result will resemble neither the US nor Japan. Another approach is needed to address regulatory concern about a low-for-long scenario.

I suggest dropping the targets in T4.T in favor of a different approach to the issue. I suggest that a single deterministic scenario be defined as the "low-for-long" scenario. Recall that there is already a deterministic scenario defined for use in setting minimum reserves. A new "low-for-long" deterministic scenario could be used to set a new minimum total asset requirement (adding to, but not replacing, existing requirements). It would define a path of future interest rates lower than those in the existing deterministic scenario for reserves. When starting from the 12/31/2020 yield curve, the scenario would have a 10-year geometric average of the 20-year UST below 1.45% and a 30-year geometric average of the 20-year UST below 1.95%. One could think of that scenario as being the deterministic scenario for

reserves but recalibrated to reflect a potential significant change in the economic and demographic environment.

Such a "low-for-long" deterministic scenario could be defined in the same manner as the existing deterministic scenario[1], but with one difference. The generator would use a lower mean reversion point when generating the "low-for-long" deterministic scenario. The exact value of the lower mean reversion point would be set so that when starting from the 12/31/2020 yield curve the generated deterministic scenario meets the target 10-year and 30-year geometric averages. It would be a straightforward exercise to determine the required value for the mean reversion point. That value would be fixed and would not change over time. When developing scenarios from any future starting yield curve, the "low-for-long" deterministic scenario would be calculated using that fixed mean reversion point. The scenario would differ for each starting yield curve in a reasonable fashion, always reflecting the regulatory concern about the risk of a potential low-for-long scenario.

I put this idea forward to address regulatory concerns over a low-for-long scenario while allowing the GOES to be calibrated based on historical behavior of interest rates in the US, behavior which does not include low-for-long. Clearly some testing of this approach would be needed, focused on the level of the minimum total asset requirement based on the proposed deterministic low-for-long scenario. Some fine-tuning of the T4.T targets could be debated based on the results of such testing.

C3 (credit-related losses)

A metric was requested regarding the episodic nature or "lumpiness" of credit-related losses. Such a metric could be used to develop a criterion for calibration targeting or acceptance.

The issue is that credit-related losses are not constant; they fluctuate. A simple criterion would be a minimum target for the top of the range in which they fluctuate.

In the model proposed by the Academy of Actuaries, credit-related losses are called "frictional costs". Frictional costs tend to average less than the credit spread (OAS). In Targeting Criteria C1.T their average is implicitly targeted as the excess of the target OAS over the target excess return. That target for the average is much less than 100% of the target OAS. One could stipulate that frictional costs should fluctuate so that on some occasions (some monthly time steps) they exceed 100% of the target OAS. On those occasions, securities with credit risk would provide lower total returns than risk-free government securities. The generator should create scenarios where that happens in some monthly time steps.

I believe the Academy's calibration of its corporate model already meets that criterion.

Stephen J. Strommen FSA, CERA, MAAA

[1] At least two different procedures have been proposed for creating the deterministic scenario using the Conning model. I strongly recommend the procedure suggested by the Academy of Actuaries rather than the procedure implemented by Conning for the first field test. The Academy's procedure is much more consistent with the way the scenarios in the Stochastic Exclusion Ratio Test (SERT) were originally defined and successfully tested.

Generator of Economic Scenarios (GOES) Subgroup Report

Mike Yanacheak
Chair, GOES Subgroup

March 15th, 2024

Agenda

1. Review Decisions made by GOES (E/A) Subgroup
   a) Equity-Treasury Linkage
   b) Corporate Model Decision
   c) Scenario Stratification
   d) DR and SERT Scenario Methodology
   e) Treasury Flooring Methodology
2. Unaggregated Field Test Details
3. Timeline and Next Steps

Appendix: American Council of Life Insurers Suggested Field Test Scenario Sets

GOES Subgroup Discussions

- The GOES Subgroup held eight meetings since the NAIC Fall National Meeting to:
  - Reach key decisions necessary to provide Conning guidance on a new calibration of the GOES,
  - Review a model office approach for testing new scenario sets, and
  - Plan for the upcoming unaggregated GOES field test.

Timing	Meeting Discussion Topic
12/18/2023	Kick-off Call for GOES (E/A) Subgroup
1/10/2024	Scenario Stratification and Statistics
1/17/2024	Equity-Treasury Linkage
1/24/2024	Corporate Model Quantitative Comparison
1/31/2024	1. SERT Scenario Methodology 2. Treasury Flooring Methodology
2/7/2024	Preliminary Model Office Testing Results
2/14/2024	1. Equity-Treasury Linkage 2. Corporate Model Discussion
2/21/2024	Valuation Dates and Other Field Test Parameters

Equity-Treasury Linkage

Background

- In GEMS® there is a functional linkage between the Overnight Treasury Yield and the drift factor for the equity fund price. Therefore, the expected equity fund total returns will rise and fall with changes to the starting short maturity interest rate levels.
- This is a departure from the currently prescribed Academy Interest Rate Generator (AIRG) that does not have this functional equity-Treasury linkage.
- It is difficult to see strong relationships between equities and Treasuries because the equity market is so volatile. However, investors typically demand equity returns in excess of those offered by risk-free assets to compensate for bearing risk.

GOES (E/A) Subgroup Decisions

- The American Council of Life Insurers (ACLI) proposed an approach to include a positive correlation between Treasury and equity movements to achieve regulator's desire for scenarios that were reflective of low rate/low equity returns and high rate/low equity returns.
- Rachel Hemphill also suggested modifying the equity acceptance criteria developed by the Academy to use an average of the results of the reference models that were utilized in development of the criteria, rather than a "least-restrictive" approach.
- The Subgroup elected to move forward with the recommendations from the ACLI and Rachel Hemphill for the unaggregated field test.

Corporate Model Decisions

Background

- The GEMS® Corporate Model captures the key dynamics that influence bond returns, including stochastic spreads, credit rating transitions, and defaults.
- However, due to the proprietary nature of the GEMS® Corporate model, there are limits to the extent of documentation that can be shared publicly.
- The Academy developed an alternative model that is fully documented.
- After regulator acceptance criteria related to the corporate model were released and the GEMS® Corporate Model was recalibrated, results from both the models were compared for a variety of different starting spread conditions were reviewed at a Subgroup meeting.

GOES (E/A) Subgroup Decisions

- Many of the Subgroup members were sympathetic to the need for documentation.
- However, several regulators expressed a preference for the GEMS® Corporate Model given the level of research and development that Conning will continue to provide going forward.
- The Subgroup elected to move forward with the GEMS® Corporate Model for the unaggregated field test.

2024 NATIONAL MEETING SPRING / PHOENIX
NAIC

Scenario Stratification

Background

- Currently the prescribed scenario generator (AIRG) has an embedded scenario picker tool that creates representative scenario subsets solely based off of a significance measure calculated from the 20-year UST.
- Other methodologies to select scenarios may be more appropriate for companies exposed to other risks – for example, the writer of variable annuity products may be more exposed to equity risk.
- The Valuation Manual allows for companies to use alternative scenario selection methodologies provided they meet certain requirements (e.g. documentation that reserves or TAR are not materially understated).

GOES (E/A) Subgroup Decisions

- Conning developed an Excel-based tool to create scenario subsets. The tool is able to select scenarios based off of the same methodology used in the AIRG. It also has the functionality to select scenarios using gross wealth factors (GWFs) determined from the Large Capitalization (S&P 500) equity fund.
- Conning will calculate the UST significance measure and the Large Capitalization GWFs by scenario, and provide that information with each scenario set to use as input for the tool.
- The Subgroup elected to move forward with field test participants utilizing the Conning scenario selection tool.

DR and SERT Scenario Methodology

Background

- The VM-20 stochastic exclusion ratio test (SERT) and deterministic reserve (DR) scenarios are currently created using functionality built into the AIRG that is specific to the AIRG model form.
- To reproduce the stylistic characteristics of the SERT and DR scenarios produced by the AIRG in the Conning model, Conning recommended a percentile-mapping approach.
- Some commenters noted issues with the percentile mapping approach, including 1) deviations from the results of the AIRG, and 2) potential runtime burdens when companies need to perform reserve projections.
- Matt Kauffman proposed an alternative methodology for generating the UST SERT and DR scenarios to overcome the issues noted above.

GOES (E/A) Subgroup Decisions

- The Subgroup decided to move forward with the approach recommended by Matt Kauffman for the UST SERT and DR scenarios.
- For the equity model, the percentile mapping approach will be employed. As the linkage from the Treasury model to the equity model was removed, the equity scenarios will now be static from period to period. Therefore, the reserve projection runtime issues will be eliminated as static equity SERT and DR scenarios can be used at each future valuation period, regardless of the starting conditions.

2024 NATIONAL MEETING SPRING / PHOENIX NAIC

Treasury Flooring Methodology

Background

- The Conning GEMS® Treasury model has the capability of producing negative interest rates, which have been a feature prevalent in other countries currently and in recent history.
- For the first GOES field test, two versions of flooring had been applied to the Treasury scenarios to control the frequency and severity of negative Treasury rates while meeting other regulatory objectives:
  - Generalized Fractional Floor with multiplicative factor and threshold components
  - Shadow-Rate Floor which employed a similar base formula as the generalized fractional floor but employing a shadow-rate model to preserve the arbitrage-free nature of the unfloored Conning GEMS® Treasury model

NAIC Staff Recommendation

- To utilize the shadow-rate floor methodology, an additional step has to be employed during the calibration of the Treasury model.
- The flooring methodology was discussed at the GOES (E/A) Subgroup, but a direction on which methodology to employ was not decided.
- For expediency, NAIC Staff recommends utilizing the Generalized Fractional Floor methodology for the unaggregated GOES field test using the same parameters as the prior field test.
- If additional testing using the Shadow-Rate Floor is desired, this could be done using the NAIC's model office.

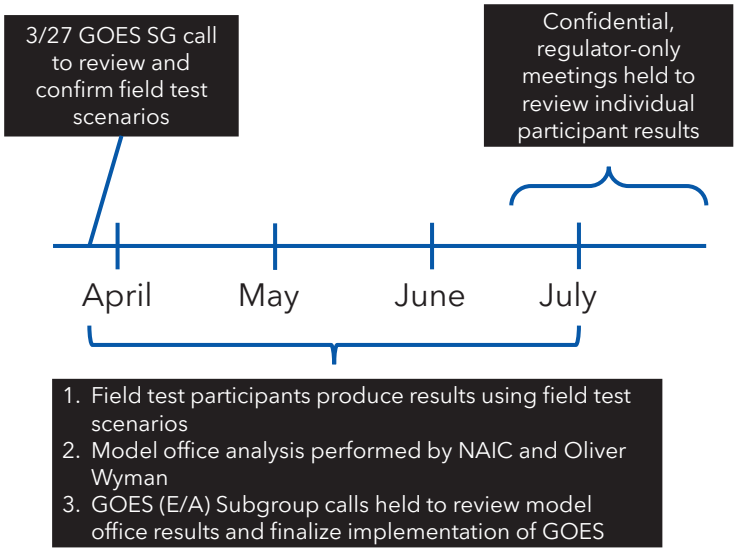
Unaggregated Field Test Details

Valuation Dates	Scenario Subsets	Inforce

• GOES (E/A) Subgroup recommended testing both high and low interest and high and low spread starting conditions
• NAIC Staff recommendation:
  • 12/31/23 - "high" starting interest rates
  • 12/31/21 - low starting interest, low starting spread
  • 12/31/23 high-spread sensitivity – alter starting spread environment to be consistent with close to worst in history high spreads
	• Companies should use a consistent scenario selection approach and number of scenarios between a field test scenario set and the scenario set used in the baseline.
	• Conning excel tool to create subsets will be made available for companies to create desired subsets from full 10k scenario set.
		• The participants' 12/31/23 inforce should be used for each field test run.
		• As necessary, participants should modify their inforce to account for changes in starting conditions.
		• Participants are encouraged to run additional sensitivities to share with regulators to help explain their results. For example, a participant with a block of variable annuities with guaranteed minimum benefits may want to test different starting levels of moneyness.

Timeline and Next Steps

- Conning is working on developing the next calibration of the GOES to be used in the unaggregated field test and model office testing.
- Scenarios with the latest calibration will be released ahead of a 3/27 call of the GOES (E/A) Subgroup, where the results will be reviewed and considered by Subgroup members for inclusion in the unaggregated field test.
- **If confirmed, the field test will be performed from March 27 to June 30.**
- Model office analysis will be performed and shared at public GOES (E/A) Subgroup calls.
- Confidential, regulator-only sessions will be held for individual participants to share their results starting in June as participants finish.



Appendix

American Council of Life Insurers Suggested Field Test Scenario Sets

NAIC NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

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Field Test Run	Sensitivity	Treasury Rates	Equity Markets	Credit Spreads	Run Type
Baseline	N/A	12/31/2023	12/31/2023	12/31/2023	Required - All
Low rate shock	Standalone	3/9/2020	12/31/2023	12/31/2023	Required - All
Up rate shock	Standalone	10/31/1989	12/31/2023	12/31/2023	Required - All
Normal yield curve	Standalone	12/31/2004	12/31/2023	12/31/2023	Required - All
Down equity shock	Standalone	12/31/2023	12/31/2023 - 25%	12/31/2023	VM-21 only, VUL
Low equity / low rate	Combined	3/9/2020	12/31/2023 - 25%	12/31/2023	Model Office & Provide Scenarios
Low equity / high rate	Combined	10/31/1989	12/31/2023 - 25%	12/31/2023	Model Office & Provide Scenarios
Up equity shock	Standalone	12/31/2023	12/31/2023 + 25%	12/31/2023	Model Office & Provide Scenarios
High credit spread	Standalone	12/31/2023	12/31/2023	12/31/2008	Model Office & Provide Scenarios
Low credit spread	Standalone	12/31/2023	12/31/2023	12/31/2021	Model Office & Provide Scenarios
Inverted Curve	Standalone	7/3/2023	12/31/2023	12/31/2023	Model Office & Provide Scenarios
Extreme rate up with inversion	Standalone	3/31/1980	12/31/2023	12/31/2023	Model Office & Provide Scenarios
"Average Scenario"	Standalone	Average	12/31/2023	12/31/2023	Model Office & Provide Scenarios

Generator of Economic Scenarios (GOES) (E/A) Subgroup
Virtual Meeting
February 21, 2024

The GOES (A) Subgroup of the Life Risk-Based Capital (E) Working Group and Life Actuarial (A) Task Force met Feb. 21, 2024. The following Subgroup members participated: Mike Yanacheak, Chair (IA); Peter Weber, Vice Chair (OH); Ted Chang (CA); Wanchin Chou (CT); Philip Barlow (DC); Scott Shover (IN); William Leung (MO); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill (TX); and Craig Chupp (VA).

1. Discussed the Corporate Model

Hal Pedersen (American Academy of Actuaries—Academy) noted that although the Conning corporate model is robust in capturing the key credit dynamics, it also is complex, requiring extensive documentation for users to understand. Pedersen further noted limitations on the public discussion of the model, given the requirement for those with access to the full documentation to sign a non-disclosure agreement (NDA). Jason Kehrberg (Academy) stated that the Academy's position is that the best approach is to move forward with the Academy corporate model.

Carmello asked what the request for proposal (RFP) indicated regarding the completeness of the documentation. Scott O'Neal (NAIC) stated that the RFP required "full documentation," to which Carmello replied he was concerned that Conning was not following the terms of the RFP.

Weber stated that Conning would be able to provide sufficient support if state insurance regulators decided to move forward with the Academy corporate model, including being able to leverage their expertise to make updates as needed. Carmello noted that although he had concerns about the level of documentation, he felt that the Subgroup should stick with Conning's model, as it is the selected vendor. Barlow, Leung, and Hemphill said that part of the reason that the GOES project was initiated in the first place was due to the Academy no longer being able to maintain and develop its scenario generators; therefore, the Subgroup should stick with a fully supported model. Eom and Chou supported the Academy corporate model, given the lack of documentation provided for the Conning model.

Barlow made a motion, seconded by Leung, to move forward with the Conning corporate model for the upcoming field test. The motion passed with New Jersey opposing.

2. Discussed Unaggregated GOES Field Test Specifications

O'Neal walked through a series of questions (Attachment Twenty-Nine-A) regarding the unaggregated GOES field test specifications. On the question of having only mandatory runs versus including more optional runs, Hemphill noted that she would be okay with including optional runs focused on certain products, to which Carmello and Yanacheak agreed. After O'Neal asked the Subgroup what starting conditions should be included in the field test, Yanacheak noted that a high and low starting spread environment would be good to include in addition to a high and low starting level of interest rates.

Randall McCumber (Lincoln Financial Group) suggested that companies include different starting inforces with varying in-the-moneyness levels. On the question of other field test variations to include, Carmello suggested including an equity model with a full equity-treasury linkage. Yanacheak suggested testing that using the NAIC's model office.

Having no further business, the GOES (A) Subgroup adjourned.

SharePoint/NAIC Support Staff Hub/Member Meetings/A CMTE/LATF/2024-1-Spring/GOES SG Calls/02 21/Feb 21 Minutes.docx

Generator of Economic Scenarios (GOES) Unaggregated Field Test Questions

1. Should the focus of the field test be on a limited set of field test runs that are all mandatory for participants, or should additional scenario sets on top of the mandatory scenario sets be provided to allow some companies to do more analysis as desired?
2. What valuation date/starting condition(s) should be included?
    a. What types of economic environments need to be tested?
        i. High/low starting interest rate levels
        ii. High/low spread environments
        iii. Other?
    b. Initial Recommendation: 12/31/23 and 12/31/21 with inforce from 12/31/23 adjusted as necessary for other valuation dates. SERT scenarios will also be included with these starting conditions.
3. Should any variations other than valuation date be included in the field test runs?
    a. Note: Original field test included runs with multiple calibrations, UST Floor designs, and attribution analysis.
    b. Initial Recommendation: No
4. What scenario subsets should be utilized?
    a. Initial Recommendation: Companies should use a consistent scenario selection approach and number of scenarios between a field test scenario set and the scenario set used in the baseline.
    b. Note: Conning excel tool to create subsets will be made available for companies to create desired subsets from full 10k scenario set.
5. What other features of the unaggregated field test need to be defined?
    a. Initial Recommendation: As the first GOES field test was designed to be aggregated across companies, the characteristics were well defined in order to support comparisons. The emphasis this time will be on each company sharing the results of the field testing that they feel are most crucial to communicate to regulators. Therefore, less specifications are needed for the unaggregated field test.

Generator of Economic Scenarios (GOES) (E/A) Subgroup
Virtual Meeting
Feb 14, 2024

The GOES (E/A) Subgroup of the Life Actuarial (A) Task Force met Feb. 14, 2024. The following Subgroup members participated: Mike Yanacheak, Chair (IA); Judith French and Pete Weber, Vice Chair (OH); Ted Chang (CA); Wanchin Chou (CT); Philip Barlow (DC); Scott Shover (IN); William Leung (MO); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill (TX); and Craig Chupp (VA).

1. Discussed the GOES Equity-Treasury Linkage

Jason Kehrberg (American Academy of Actuaries—Academy) presented proposed "quadrant" criteria for the joint distribution of interest rates and equity returns (Attachment Thirty-A). Brian Bayerle (American Council of Life Insurers—ACLI) then discussed a proposal for a correlation approach for the relationship between expected equity returns and interest rate levels (Attachment Thirty-B). Weber asked how complicated the implementation of the ACLI proposal would be in the Conning model. Daniel Finn (Conning) replied that the software already has the capability, however this functionality is not currently used. Finn added that to fully implement the ACLI proposal, the correlation will have to be extended to the other equity indices to ensure that the relationship between them is appropriate. French asked Bayerle to describe how the ACLI approach was different from the Academy's approach. Bayerle replied that the key difference is that the Academy approach was not specifically outlining a particular approach to how the linkage would be implemented in the GOES itself, whereas the ACLI defines a correlation approach.

Hemphill reviewed the approach the Academy used to develop equity acceptance criteria, noting that the Academy utilized multiple reference models and took the least binding of these at various gross wealth factor percentiles to determine the criteria. Hemphill said that the least binding approach reduced the dispersion of the equity returns, and instead suggested that a set of criteria be used that are based on an average of the results of the reference models.

Hemphill made a motion, seconded by Weber, to move forward with the ACLI approach for the equity-Treasury correlation in tandem with her suggested equity acceptance criteria for the upcoming unaggregated field test. The motion passed unanimously.

2. Corporate Model Discussion

Yanacheak asked Finn to describe the level of support Conning would provide for the Academy's corporate model if approved by regulators. Finn replied that they would provide maintenance of the Academy model, but would not actively be developing the model with additional improvements as they do with the Conning corporate model. Yanacheak then asked how a company actuary could obtain a level of documentation to be able to understand the model. Finn replied that Conning had allowed previously for clients and companies undergoing a free trial that have signed a non-disclosure agreement (NDA) to access the comprehensive documentation. Additionally, Finn noted that Conning was now willing to companies that are not competitors of Conning to sign an NDA and get access to the comprehensive documentation, even if they are not clients or participating in a free trial. Bayerle commented that if only those that have signed an NDA are able to access the comprehensive documentation, that could severely limit the public discussion of the model, which ACLI views as a concern.

Having no further business, the GOES (E/A) Subgroup adjourned.

Proposed "quadrant" criteria for the joint distribution of interest rates and equity returns

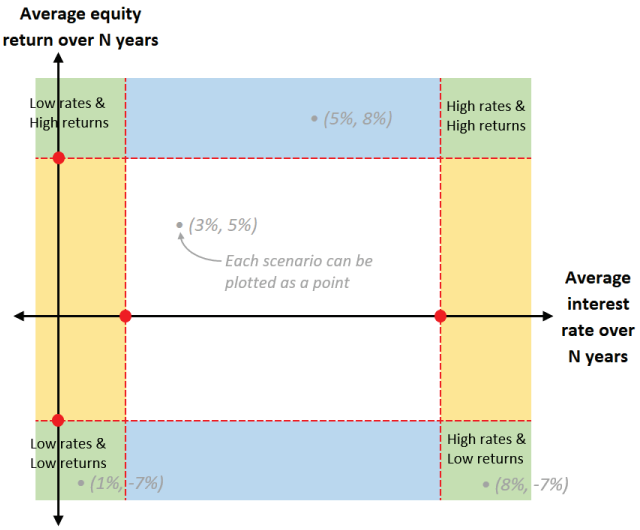
Iouri Karpov, MAAA, FSA
Member, Economic Scenario Generator Subcommittee (ESGS)

Jason Kehrberg, MAAA, FSA
Vice President, Life Practice Council (LPC)

Hal Pedersen, MAAA, ASA
Chairperson, Economic Scenario Generator Subcommittee (ESGS)

National Association of Insurance Commissioners (NAIC)
Generator of Economic Scenarios (GOES) (E/A) Subgroup—February 14, 2024

"Quadrant" criteria can be used to evaluate the frequency and severity of scenarios in the "four corners" of the joint distribution of interest rates and equity returns



- Proposed quadrant criteria are focused on deciles of the joint distribution of geometric average rates and returns over a horizon.
- Two forms of this criteria are proposed
  - **"Frequency" quadrant criteria:**
    - Quadrants are defined by explicit bounds (red lines) based on deciles from reference model(s).
    - Relevant statistic is the number of scenarios in a quadrant.
  - **"Severity" quadrant criteria:**
    - Quadrants are defined using deciles from the scenario set being evaluated, first interest rates then equity returns (number of scenarios in a quadrant is always 10,000 * 10% * 10% = 100).
    - Relevant statistic is the average geometric average across scenarios in a quadrant (for both rates and returns).
    - Implied interest rate / equity return linkage can also be estimated.

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Frequency quadrant criteria — Interest rate bounds

- LATF's exposed "T5" criteria for interest rates (i.e., the low-for-long and high-for-long criteria) were proposed by the ESGS in our 9/14/23 presentation to LATF.
- "T5" uses 1st and 99th percentiles as criteria for low-for-long and high-for-long interest rates, but such percentiles are rather severe as quadrant criteria for the *joint* distribution of interest rates and equity returns.
  - 10,000 scenarios * 1% * 1% → about 1 scenario per quadrant.
- The "T5" table was expanded by adding10th and 90th percentiles using the same methodology as before, i.e., the least-binding scenario set percentile from a range of identified reference models (see our 9/14/23 presentation for additional detail).
  - 10,000 scenarios * 10% * 10% → about 100 scenarios per quadrant.
- For any given scenario set, interest rate bounds for frequency quadrant criteria are determined by noting the starting level of the 20-year Treasury rate (UST20) and then interpolating 10th and 90th percentiles from the expanded "T5" table.

Expanded "T5" Table — Percentile criteria for the distribution of geometric average UST20 rates (use 10th and 90th percentiles as the low and high interest rate bounds for the frequency quadrant criteria).

Starting	First 10 years of projection				First 30 years of projection			
UST20	1st	10th	90th	99th	1st	10th	90th	99th
1%	0.9%	1.3%	2.4%	3.4%	1.5%	2.1%	4.2%	6.2%
2%	1.2%	1.7%	3.7%	5.0%	1.7%	2.4%	5.1%	7.7%
3%	1.6%	2.3%	4.8%	6.6%	1.9%	2.6%	6.0%	8.7%
4%	2.1%	2.9%	5.9%	7.7%	2.1%	2.9%	6.8%	9.6%
5%	2.7%	3.5%	6.9%	8.9%	2.3%	3.2%	7.6%	10.5%
6%	3.1%	4.2%	7.9%	10.0%	2.5%	3.6%	8.2%	11.2%
7%	3.6%	4.7%	8.9%	11.0%	2.8%	4.0%	8.7%	11.6%
8%	4.1%	5.4%	9.8%	12.1%	3.1%	4.3%	9.2%	12.0%
9%	4.6%	6.0%	10.7%	13.1%	3.3%	4.7%	9.7%	12.3%
10%	5.2%	6.7%	11.6%	14.0%	3.6%	5.1%	10.0%	12.6%

Interpolated values for starting UST20 at 1.94% (12/31/21) and 4.24% (12/31/19 + 200bps)

Starting	First 10 years of projection				First 30 years of projection			
UST20	1st	10th	90th	99th	1st	10th	90th	99th
1.94%	1.22%	1.70%	3.61%	4.95%	1.67%	2.34%	5.08%	7.62%
4.24%	2.27%	3.07%	6.18%	8.01%	2.11%	2.98%	6.98%	9.82%

Note: The highlighted values are the interest rate bounds used to apply the frequency quadrant criteria to field test scenario sets 1a, 5a, and 6 (starting UST20 of 1.94%) and 2a, 6a, and 5b (starting UST of 4.24%).

Frequency quadrant criteria — Equity return bounds

- The ESGS is currently only proposing quadrant criteria for low equity returns (quadrant criteria for high equity returns could be developed if regulators are interested).
- As with interest rates, the bound for low equity returns is based on the 10th percentile of the distribution of geometric average equity returns over the first 10 and 30 years of the projection.
- Unlike interest rates, equity return bounds do not depend on the starting level (no interpolation required).
- The proposed equity bounds are simply the 10th percentile from the 10,000 S&P 500 scenarios produced by the NAIC's currently prescribed ESG (AIRG):

Low equity return bounds for the frequency quadrant criteria (based on the 10,000 AIRG S&P 500 scenarios)

	10th Percentile	
Horizon	Geometric average return	Gross wealth factor (GWF)
First 10 years of projection	1.14%	1.12
First 30 years of projection	3.83%	3.09

Note: GWFs are simply an alternative way to express geometric average returns, e.g., $(1 + 1.14\%)^{10} = 1.12$.

Note: There are other reasonable bases for this criteria besides the AIRG's 10,000 equity scenarios, such as the least-binding (slightly less extreme) reference model basis used to develop C3 Phase II equity GWF criteria. For example, compared to the 10-year 10th percentile of 1.14% (1.12 GWF) above:

- *LATF's exposed "E1" criteria (the former C3 Phase II equity GWF criteria, based on data through 2005) would correspond to a 10-year 10th percentile of 1.50% (1.16 GWF).*
- *The updated C3 Phase II equity GWF criteria in the Academy's 11/22/23 letter to LATF (based on data through 2022) would correspond to a 10-year 10th percentile of 2.01% (1.22 GWF).*

Illustrative application of quadrant criteria

The following slides use these scenario sets to illustrate the proposed quadrant criteria:

Scenario Set	Equity — Model / Calibration / Linkage Approach	Starting Date	Starting UST20
1a	GEMS / NAIC / Constant mean equity risk premium with recentering	12/31/21	1.94%
2a		12/31/19 + 200 bps	4.24%
1a-AIRG	AIRG / AIRG / Constant mean equity return	12/31/21	1.94%
2a-AIRG		12/31/19 + 200 bps	4.24%
5a	GEMS / Conning / Constant mean equity risk premium	12/31/21	1.94%
5b		12/31/19 + 200 bps	4.24%
6	GEMS / ACLI / Constant mean equity return	12/31/21	1.94%
6a		12/31/19 + 200 bps	4.24%

Notes:

1. *All scenario sets listed in this table use the GEMS Interest Model with the Generalized Fractional Floor.*
2. *Scenario sets 1a, 2a, 5a, 5b, and 6 were part of the NAIC's ESG field test (1a-AIRG, 2a-AIRG, and 6a were not).*
3. *All scenario sets are comprised of 10,000 scenarios.*

Frequency quadrant criteria — Illustrative application

	Horizon	Scenario set	1a	2a	1a-AIRG		5a	5b	6	6a
		Starting rate level	*1.94%*	*4.24%*	*1.94%*		*1.94%*	*4.24%*	*1.94%*	*4.24%*
		Linkage approach	*Const mean ERP (with recentering)*		*Const mean return*		*Const mean ERP*		*Const mean return*	
IR & EQ Quadrant Frequency	10 years	Low IR / Low EQ	307	283	194	179	539	354	184	164
		High IR / Low EQ	91	22	164	119	211	52	171	126
	30 years	Low IR / Low EQ	528	562	232	189	972	629	225	170
		High IR / Low EQ	12	4	142	110	87	19	120	104
IR Tail Frequency	10 years	Low IR	1,951	1,834	1,951	1,834	1,951	1,834	1,951	1,834
		High IR	1,723	1,252	1,723	1,252	1,723	1,252	1,723	1,252
	30 years	Low IR	2,389	1,900	2,389	1,900	2,389	1,900	2,389	1,900
		High IR	1,312	1,047	1,312	1,047	1,312	1,047	1,312	1,047
EQ Tail Frequency	10 years	Low EQ	1,227	928	1,000	1,000	2,136	1,226	933	933
	30 years	Low EQ	1,175	1,324	1,000	1,000	2,648	1,754	940	940
IR & EQ Bounds (geometric average rate/return)	*10 years*	*Low IR bound*	*1.70%*	*3.07%*	*1.70%*	*3.07%*	*1.70%*	*3.07%*	*1.70%*	*3.07%*
		High IR bound	*3.61%*	*6.18%*	*3.61%*	*6.18%*	*3.61%*	*6.18%*	*3.61%*	*6.18%*
	30 years	*Low IR bound*	*2.34%*	*2.98%*	*2.34%*	*2.98%*	*2.34%*	*2.98%*	*2.34%*	*2.98%*
		High IR bound	*5.08%*	*6.98%*	*5.08%*	*6.98%*	*5.08%*	*6.98%*	*5.08%*	*6.98%*
	10 years	*Low EQ bound*	*1.14%*	*1.14%*	*1.14%*	*1.14%*	*1.14%*	*1.14%*	*1.14%*	*1.14%*
	30 years	*Low EQ bound*	*3.83%*	*3.83%*	*3.83%*	*3.83%*	*3.83%*	*3.83%*	*3.83%*	*3.83%*

Observations:

1. Constant mean ERP approaches tend to oversample the Low IR / Low EQ quadrant and undersample the High IR / Low EQ quadrant (often an important source of risk, e.g., disintermediation).

Notes:

1. *Quadrants are determined as the scenarios with geometric average rates / returns falling within the specified bounds based on deciles.*
2. *Interest Rate (IR) is the 20-year Treasury (UST20). Equity Return (EQ) is the S&P 500 index.*

Severity quadrant criteria — Illustrative application

	Horizon	Scenario set	1a	2a	1a-AIRG	5a	5b	6	6a
		Starting rate level	*1.94%*	*4.24%*	*1.94%*	*1.94%*	*4.24%*	*1.94%*	*4.24%*
		Linkage approach	*Const mean ERP (with recentering)*		*Const mean return*	*Const mean ERP*		*Const mean return*	
IR & EQ Quadrant Severity (geometric average equity return in quadrant)	10 years	Low IR / Low EQ	-2.2%	-2.3%	-0.8%	-6.2%	-4.7%	-1.1%	-1.3%
		High IR / Low EQ	0.9%	3.1%	-1.0%	-2.0%	1.4%	-1.5%	-1.4%
	30 years	Low IR / Low EQ	1.3%	0.7%	2.9%	-1.7%	-1.1%	3.0%	2.9%
		High IR / Low EQ	6.0%	7.0%	2.6%	3.2%	5.6%	2.5%	2.6%
IR Tail Severity (geometric average interest rate in tail)	10 years	Low IR	1.1%	2.2%	1.1%	1.1%	2.2%	1.1%	2.2%
		High IR	4.8%	7.4%	4.8%	4.8%	7.4%	4.8%	7.4%
	30 years	Low IR	1.5%	2.1%	1.5%	1.5%	2.1%	1.5%	2.1%
		High IR	6.5%	8.4%	6.5%	6.5%	8.4%	6.5%	8.4%
Implied IR & EQ Linkage (in low EQ tail)	10 years	Low EQ	88%	104%	-7%	122%	121%	-9%	-1%
	30 years	Low EQ	90%	97%	-6%	95%	103%	-9%	-5%

Observations:

1. Under the constant mean ERP approaches, average equity returns in the High IR / Low EQ 30-year quadrant are rather high and may not sufficiently capture the risk of lower returns in that quadrant (e.g., 6.0 %, 7.0%).
2. In the 1a and 2a (constant mean ERP with recentering) Low IR / Low EQ quadrant, it is unintuitive that the average equity return decreases (e.g., 1.3% → 0.7%) when the starting rate level increases (i.e., exhibits negative linkage when the goal for 1a and 2a was positive linkage).

Notes:

1. *Quadrants are determined by selecting the 1,000 scenarios (out of 10,000) with the lowest or highest geometric average interest rate, and then selecting the 100 scenarios (out of those 1,000) with the lowest equity return (i.e., quadrants are always comprised of 100 scenarios).*
2. *Interest Rate (IR) is the 20-year Treasury (UST20). Equity Return (EQ) is the S&P 500 index.*
3. *Implied IR & EQ Linkage = Ln((1+High IR & Low EQ geom avg return)/(1+Low IR & Low EQ geom avg return)) / (High IR geom avg rate – Low IR geom avg rate) = (Ln(High IR & Low EQ GWF / Low IR & Low EQ GWF) / horizon in years) / (High IR geom avg rate – Low IR geom avg rate).*

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New slide not in 2/14/24 presentation

Update to 2/14/24 presentation

Addition of proposed target to accompany severity quadrant criteria

February 29, 2024

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Proposed target to accompany severity quadrant criteria

New slide not in 2/14/24 presentation

- The 2/14/24 presentation proposed a quadrant severity statistic and compared that statistic across scenario sets from the field test but did not propose an associated target for those quadrant severity statistics.
- The proposed target to accompany severity quadrant criteria is based on the same four reference models (i.e., Heston, SLV2, RSLN2, and Heston + Jump) used to develop our previously proposed update to equity gross wealth factor (GWF) criteria (i.e., calibrated to returns on the S&P 500 index from 1957-2022, then adjusted to constrain the geometric average return over 30 years to 8.75%).
- The proposed target is based on the average, rather than least binding, statistic across reference models given regulators have indicated that is their preferred method for the updated equity GWF criteria.

Proposed target for quadrant severity statistics					
		Average GWF in bottom decile		Average GAVG in bottom decile	
Reference model	Include	10 years	30 years	10 years	30 years
Heston	1	0.87	2.05	-1.4%	2.4%
SLV1	0	0.76	1.65	-2.7%	1.7%
SLV2	1	0.98	2.63	-0.2%	3.3%
SLV3	0	0.99	2.68	-0.1%	3.3%
RSLN2	1	0.78	1.70	-2.4%	1.8%
RSDD2	0	1.06	3.22	0.5%	4.0%
LN	0	0.92	2.19	-0.8%	2.7%
Heston + Jump	1	0.87	2.08	-1.4%	2.5%
AIRG	0	0.89	2.18	-1.1%	2.6%
Average of included models		0.87	2.12	-1.3%	2.5%

Given regulators have expressed a preference for equity-rate linkage in the form of positively correlated changes, it may be reasonable to see lower equity returns when interest rates are low, and higher equity returns when interest rates are high. As such, it may make sense to express these targets as a range, e.g.:

	10 years	30 years
Low rates	(0.87 - *a*) to 0.87	(2.12 - *c*) to 2.12
High rates	0.87 to (0.87 + *b*)	2.12 to (2.12 + *d*)

where a, b, c, and d indicate the size of the desired range (i.e., one-way buffers based on the expected impact of correlation).

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Severity quadrant criteria — Illustrative application (updated to show target)

New slide not in 2/14/24 presentation

	Horizon	Scenario set	1a	2a	1a-AIRG	5a	5b	6	6a	Target
		Starting rate level	*1.94%*	*4.24%*	*1.94%*	*1.94%*	*4.24%*	*1.94%*	*4.24%*	
		Linkage approach	*Const mean ERP (with recentering)*		*Const mean return*	*Const mean ERP*		*Const mean return*		
IR & EQ Quadrant Severity (geometric average equity return in quadrant)	10 years	Low IR / Low EQ	-2.2%	-2.3%	-0.8%	-6.2%	-4.7%	-1.1%	-1.3%	-1.3%
		High IR / Low EQ	0.9%	3.1%	-1.0%	-2.0%	1.4%	-1.5%	-1.4%	-1.3%
	30 years	Low IR / Low EQ	1.3%	0.7%	2.9%	-1.7%	-1.1%	3.0%	2.9%	2.5%
		High IR / Low EQ	6.0%	7.0%	2.6%	3.2%	5.6%	2.5%	2.6%	2.5%
IR Tail Severity (geometric average interest rate in tail)	10 years	Low IR	1.1%	2.2%	1.1%	1.1%	2.2%	1.1%	2.2%	
		High IR	4.8%	7.4%	4.8%	4.8%	7.4%	4.8%	7.4%	
	30 years	Low IR	1.5%	2.1%	1.5%	1.5%	2.1%	1.5%	2.1%	
		High IR	6.5%	8.4%	6.5%	6.5%	8.4%	6.5%	8.4%	
Implied IR & EQ Linkage (in low EQ tail)	10 years	Low EQ	88%	104%	-7%	122%	121%	-9%	-1%	
	30 years	Low EQ	90%	97%	-6%	95%	103%	-9%	-5%	

Observations:

1. Under the constant mean ERP approaches, average equity returns in the High IR / Low EQ 30-year quadrant are rather high and may not sufficiently capture the risk of lower returns in that quadrant (e.g., 6.0 %, 7.0%).
2. In the 1a and 2a (constant mean ERP with recentering) Low IR / Low EQ quadrant, it is unintuitive that the average equity return decreases (e.g., 1.3% → 0.7%) when the starting rate level increases (i.e., exhibits negative linkage when the goal for 1a and 2a was positive linkage).

Notes:

1. *Quadrants are determined by selecting the 1,000 scenarios (out of 10,000) with the lowest or highest geometric average interest rate, and then selecting the 100 scenarios (out of those 1,000) with the lowest equity return (i.e., quadrants are always comprised of 100 scenarios).*
2. *Interest Rate (IR) is the 20-year Treasury (UST20). Equity Return (EQ) is the S&P 500 index.*
3. *Implied IR & EQ Linkage = Ln((1+High IR & Low EQ geom avg return)/(1+Low IR & Low EQ geom avg return)) / (High IR geom avg rate – Low IR geom avg rate) = (Ln(High IR & Low EQ GWF / Low IR & Low EQ GWF) / horizon in years) / (High IR geom avg rate – Low IR geom avg rate).*

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Questions?

For further information, please contact Amanda Barry-Moilanen, life policy analyst, at barrymoilanen@actuary.org.

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ACLI
Financial Security for Life

ACLI Alternative Interest Rate/Equity Soft Linkage Proposal

1

ACLI

Executive Summary

- Regulators want to ensure that the scenarios reflect robust probability and severity of low for long rates combined with low equity returns.
- However, the current equity return linkage approach is overly complex and results in significant non-economic volatility.
- Further, historical data suggested there is no clear durable relationship between interest rates and returns.
- ACLI believes the constant expected equity return relationship implemented in Run 6 and current generator is a more practical and supportable simplification of multifaceted interactions between asset classes that achieves the regulators goals around low for long.

2

2

ACLI

Recommendation

ACLI recommends reflecting positive correlation between rate/equity movements as means of achieving regulators' desired low rate/low equity tails (see appendix I & II) and joint criteria is based on the ranges determined by a reference model with and without the correlation (see appendix III & IV).

Tail Gross Wealth Factor (GWF) Targets	10 Years	30 Years
Low Rates / Low Equity Quadrant[1]	0.82 – 0.89	1.88 – 2.18
High Rates / Low Equity Quadrant[1]	0.89 – 1.04	2.18 – 2.79

[1]: Quadrant is defined in page 10/11 under appendix III

3

3

ACLI

Benefits of Correlation Approach

- This approach has several advantages over current structural equity linkage:
  - Ease of implementation:
    - Equity model can be calibrated separately to ensure reasonable overall distribution
    - Correlation between rate level and equity return ensures robust risks in the tail quadrants
    - No need to centralize or adjust the equity distribution as starting conditions change
    - Straightforward methodology for DR/SERT scenarios
    - We do not believe any structural change to GEMS is needed
  - Robust representation of equity risk in both low and high-rate scenarios
  - Incentivizes hedging of both equity and rate risk drivers
  - Avoids excess capital volatility due to rate fluctuations
  - Positive correlation emulates partial linkage in the tail quadrants of the distribution and address some undesirable effects under structure equity linkage (see detail in next slide)

4

4

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Field Test Scenarios Evaluated Against Quadrant CTE90 GWF

Average Tail GWFs: 10 years

	1a	2a	6	6a	ACLI	ACLI +20% Corr.	Target Range
Low Rates	0.80	0.80	0.89	0.87	0.93	0.82	0.82 - 0.89
High Rates	1.10	1.36	0.86	0.87	0.90	1.04	0.89 - 1.04
All Rates	0.84	0.91	0.88	0.88	0.89	0.89	

Average Tail GWFs: 30 years

	1a	2a	6	6a	ACLI	ACLI +20% Corr.	Target Range
Low Rates	1.47	1.21	2.42	2.34	2.38	1.88	1.88 - 2.18
High Rates	5.78	7.70	2.12	2.13	2.18	2.79	2.18 - 2.79
All Rates	2.01	1.85	2.21	2.21	2.18	2.18	

Geometric Average UST20 over 10 years

	1a	2a	6	6a	ACLI	ACLI +20% Corr.
Low Rates	1.1%	2.2%	1.1%	2.2%	1.3%	1.3%
High Rates	4.8%	7.4%	4.8%	7.4%	4.9%	4.9%

Geometric Average UST20 over 30 years

	1a	2a	6	6a	ACLI	ACLI +20% Corr.
Low Rates	1.5%	2.1%	1.5%	2.1%	1.7%	1.7%
High Rates	6.5%	8.4%	6.5%	8.4%	6.8%	6.8%

Implied Linkage in the Distribution

	1a	2a	6	6a	ACLI	ACLI +20% Corr.
10 years	88%	104%	-9%	-1%	-8%	68%
30 years	90%	97%	-9%	-5%	-6%	26%

□ = GWFs outside of target range but deviation not expected to be material

■ = GWFs outside of target range by amount that is likely to be material

- The table provides the average of bottom decile of the equity GWF under top/bottom decile of the rates over 10/30 years for the field test scenarios (see page 10/11 in appendix III for the joint quadrant definition)
- Linkage in 1a and 2a introduces undesirable effects in quadrants of the distribution (see highlighted in red):
  - Understates risk of low equity return when rates are high (e.g., Extremely favorable tail equity returns in High-Rate scenarios, averaging 6-7% per year over 30 years and positive vs. negative average return over 10 years)
  - More severe equity tail Low Rates in 2a vs. 1a although rates start 2.3% higher
  - Overly severe cumulative effect of linkage over 30 years in Low-Rate scenarios
- ACLI proposal reflects implied positive linkage (=26% over 30 years), which addresses regulators' concern on the severity of low rate combined with low equity return and mitigates the undesirable effect of the distribution through the structural equity linkage.

26% = change in equity return / change in rates
= (ln(2.79/1.88)/30) / (6.8% - 1.7%)

Note that (1) Run 1a, 6, and ACLI start at UST20 = 1.94%, (2) Run 2a and 6a start at UST20 = 4.24%, (3) Run 1a and 2a embed positive linkage and subject to centralization adjustment to reflect current rates, and (4) Run 6 and ACLI embed neutral linkage and don't need to be adjusted for starting rate levels

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Appendix

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Appendix I -- Robust Low Rate/ Low Equity using Correlation

- Positive correlation ties the distribution of rate changes and equity returns to ensure a greater portion of adverse equity outcomes occurs when underlying rates tend to be lower
- Correlation directly impacts incremental (e.g. monthly) joint equity/rate return and affects long term/cumulative outcomes in the tail scenarios, while preserving the severity in the middle of the distribution
- Correlation preserves the underlying distribution of rates and equity when considered in isolation but impact the joint tail of the distribution where the specific concerns have been raised. This approach enables greater variety of interest rate and equity interactions by allowing stochastic drivers in each respective model to have more influence on the joint distribution
- Correlation coefficient of 15-20% can be historically supported, as realized correlation of monthly changes in UST20 rates vs. S&P return is ~+19% from 2000 to 2022.

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Appendix I -- Robust Low Rate/ Low Equity using Correlation

- Correlating Rates and Equity in GEMS:
  - Introduce a positive correlation coefficient between the random driver of the CIR factor responsible for the level of rates and the random driver of equity return diffusion that is multiplied by stochastic volatility of the equity process (see appendix II)
  - No structural model changes are required
  - Rates and Equity parameters can be set independently and rely on existing calibrations.
  - Equity calibration reflective of neutral linkage was already introduced in support of Scenario 6 of the Field Test and can serve as the basis/starting point.
- Scenario quadrants to be evaluated against criteria/joint distribution statistics on slide 5

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Appendix II -- Correlation Effect on Incremental Equity Return

Correlation	20%			
Rate Volatility	0.8%			
Equity Volatility	15%			
Rate Down/ Equity Down				
	Uncorrelated Normal Deviate	Correlated Deviate	Uncorrelated Return	Correlated Return
Rates	-1.00	-1.00	-0.008	-0.008
Equity	-1.00	-1.18	-0.150	-0.177
Rate Up/ Equity Down				
	Uncorrelated Normal Deviate	Correlated Deviate	Uncorrelated Return	Correlated Return
Rates	1.00	1.00	0.008	0.008
Equity	-1.00	-0.78	-0.150	-0.117

= 20% * -1 + $\sqrt{1-20\%^2}$ * -1

Correlation-affected equity deviate is: $\hat{Z}_{eq} = \rho Z_{ir} + \sqrt{1-\rho^2} Z_{eq}$ where:
ρ is the correlation coefficient and Z_{ir} and Z_{eq} are uncorrelated standard normal deviates

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Appendix III -- Evaluating Correlation Effect in ACLI/AIRG Model

- +20% Correlation is introduced between the process that generates the Long Rate (UST20) and equity return process that uses the original AIRG SLV model. Resulting quadrant statistics are compared relative to baseline 0% correlation assumption.
- Quadrant Statistics using generated 10k monthly scenarios:
  - Separately consider 10 year and 30 year time horizon
  - Defining the tail Low-for-Long and High-for-Long rates – consistent with exposed Rate criteria
    - Uses Geometric Average (GAVG) of UST20 rate over 10 and 30 year time horizon
    - **Low for Long Rates**: Sample the bottom decile of the scenarios ranked by the GAVG metric to define 1,000 Low-for-Long scenarios
    - **High for Long Rates**: Sample top decile to define 1,000 High-for-Long scenarios

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Appendix III -- Evaluating Correlation Effect in ACLI/AIRG Model

- Defining the Equity portion of the quadrant – low equity return over 10 and 30 years
  - **Low Rates/ Low Equity quadrant**: for L4L scenario set of 1,000, consider the bottom decile of the GWF (gross wealth factor) , to sample 100 scenarios representative of low equity and low rates.
  - **High Rates/ Low Equity quadrant**: for L4L scenario set of 1,000, consider the bottom decile of the GWF (gross wealth factor) , to sample 100 scenarios representative of low equity and low rates

- Take the average of the 100 GWFs representative of a "CTE 90" severity of the equity distribution in both quadrants.

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Appendix IV -- Evaluating Correlation Effect in ACLI/AIRG Model: Results

Average GAVG Rates (bottom and top decile)

	Low rates	High Rates
10yr	1.3%	4.9%
30yr	1.7%	6.8%

Average GWF (bottom decile): 20% Correlation

	Low rates	High Rates	All 10k
10yr	0.82	1.04	0.89
30yr	1.88	2.79	2.18

Average GWF (bottom decile): No Correlation (AIRG)

	Low rates	High Rates	All 10k
10yr	0.93	0.90	0.89
30yr	2.38	2.18	2.18

Implied Linkage Calc

	return diff	GAVG rate diff	implied linkage
10yr	2.4%	3.5%	68%
30yr	1.3%	5.1%	26%

- Scenarios were generated using 12/31/2021 rates (UST20 = 1.94%) as a starting point.
- Example: Low Rates/Low Equity quadrant over 30 years:
  - **Average UST20** = 1.7%
  - Average GWF = 1.88 if correlated vs. 2.18 assuming 0 correlation in base AIRG
- Example: High Rates/Low Equity quadrant over 30 years:
  - Average UST20 = 6.8%
  - Average GWF = 2.79 if correlated vs. 2.18 assuming 0 correlation in base AIRG
- Positive correlation produces more severe equity tail in low rates and more favorable equity tail in high rates, implying a linkage-like effect in the tail.

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Generator of Economic Scenarios (GOES) (E/A) Subgroup
Virtual Meeting
February 7, 2024

The GOES (E/A) Subgroup of the Life Risk-Based Capital (E) Working Group and Life Actuarial (A) Task Force met Feb. 7, 2024. The following Subgroup members participated: Mike Yanacheak, Chair (IA); Peter Weber, Vice Chair (OH); Ted Chang (CA); Wanchin Chou (CT); Scott Shover (IN); William Leung (MO); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill (TX); and Craig Chupp (VA).

1. Heard a Presentation on the VA Model Office

Scott O'Neal (NAIC) presented some background on variable annuity (VA) model office testing and invited Dylan Strother (Oliver Wyman) and Carson Cook (Oliver Wyman) to present the NAIC GOES model office analysis results (Attachment Thirty-One-A) that they prepared. Jason Kehrberg (American Academy of Actuaries—Academy) asked whether there is any intention to look at the different makeup of existing assets, different reinvestment strategies, and alternative hedging methodologies. Strother noted that the current asset mix and reinvestment strategy are simplified. However, Strother noted that the model is flexible and can be readily updated to the extent that the Subgroup wants to test different scenarios or asset mixes. Strother further stated that since explicit hedging methodologies can vary by company, it was decided that implicit hedging would be appropriate for the model office.

Connie Tang (Retired) echoed the need to use the model office to understand asset modeling variations. Steve Strommen (Blufftop LLC) suggested additional uses of the model office, including: 1) addressing the question of equity risk premium; and 2) understanding how policy owners are investing their cash value, which could be explored using mixed equity and fixed income asset mixture. Yanacheak agreed. Yanacheak noticed that for certain model office archetypes, the reserve increased more on those hedged versus those unhedged. Cook replied that for this particular archetype, the guaranteed benefit reserve changed more on a percentage basis for the hedged archetype; however, the relationship flipped when looking at the total reserve. Strother added that the key here was the size of the reserves relative to the cash surrender value (CSV). Tang suggested looking at other metrics besides the total and excess reserves. Randall McCumber (Lincoln Financial Group) asked whether any sensitivities were done on the error factor for the hedged runs. Cook replied that they could easily perform sensitivities on different E-factor levels.

Having no further business, the GOES (E/A) Subgroup adjourned.

SharePoint/NAIC Support Staff Hub/Member Meetings/A CMTE/LATF/2024-1-Spring/GOES SG Calls/02 07/Feb 07 Minutes.docx

OliverWyman

NAIC NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

NAIC GOES MODEL OFFICE ANALYSIS

Phase 1 results

February 7, 2024

A business of Marsh McLennan

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SECTION 1

BACKGROUND | PHASE 1 EXECUTIVE SUMMARY

SECTION 1.1

BACKGROUND

NAIC GOES ECONOMIC SCENARIO SET EVALUATION

Overview of progress to date

In 2022, a field test examining alternative economic scenario sets under statutory reserve and capital frameworks was conducted across life insurance and annuity products. The results highlighted the expected impact to the industry but **left open questions regarding the company-specific drivers** of changes in the reserves over cash surrender value. **Model office analysis** will be performed alongside **an unaggregated field test** to analyze new GOES candidate scenario sets.

2022 GOES Field Test summary and limitations

Field test summary

- ✓ Between the baseline and field test runs, there was typically a wide range of impacts across participants with some experiencing small changes and others seeing significant increases in excess reserves ("reserves in excess of cash surrender value") and/or capital.
- ✓ Certain drivers of variation in results across participants were identified, such as variable annuity hedging practices and the relationship of VM-20 modeled reserves to net premium reserves.

Limitations

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

Two components for evaluating GOES scenario sets

1. Model office analysis (see next page)

- Phase 1: Proof of concept, variable annuity model officed developed to capture a range of archetypes and assist with explaining field test variation and demonstrate potential industry impacts. AXIS model used to run archetypes under both the AAA and Conning 1a scenarios as of 12/31/2021.
- Phase 2: Expand archetypes to represent typical in-force VA blocks across additional scenario sets; expand model office development and analysis to life insurance.

2. Unaggregated GOES Field Test

- Candidate scenario sets are planned to be developed ahead of the 2024 NAIC Spring National Meeting for use in model office testing and in an unaggregated field test where results will be presented by participants in regulator only sessions.
- In the interim, as promising scenario sets are developed and vetted, they will be released publicly for companies to test.

MODEL AND MODEL OFFICE DEVELOPMENT AND ANALYSIS

Oliver Wyman developed a variable annuity ("VA") AXIS model and "model office toolkit" in a proof-of-concept exercise, with the goal of developing a model with adjustable driving characteristics to explain field test results and analyze potential candidate scenario sets

Current phase

Model build (Phase 0)

- VA model developed in AXIS
- Model office creation tool accepts user input regarding benefits and demographics to quickly generate reserves and capital for different archetypes
- Validation tools are used alongside model to ensure accuracy of results

Proof of concept (Phase 1)

- Defined **driving characteristics** and developed **archetypes** that make up model office
- Generated model office testing results across a range of archetypes, for Test #1a[1], to produce a wide range of results
- Learnings from model office analysis used to draw additional insights into field test results

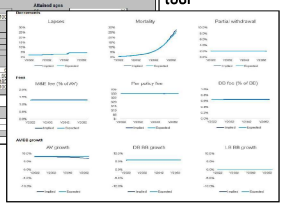
Expanded analysis (Phase 2)

Potential areas identified

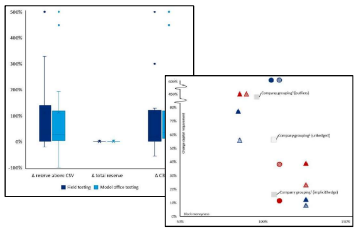
- Analyze combinations of archetypes to better represent a hypothetical industry participant
- Include additional scenario analysis, including candidate scenario testing
- Expand archetype analysis to examine additional potential drivers

Model office creation tool

Model validation tool



Model office results



1: GEMS Baseline Equity and Corporate model scenarios and Conning Treasury model calibration with generalized fractional floor as of 12/31/21

SECTION 1.2

PHASE 1 EXECUTIVE SUMMARY

EXECUTIVE SUMMARY: PROOF OF CONCEPT (PHASE 1)

Phase 1 model office produced a similar range of results to field testing and was used to draw additional insights into field test results

Analysis performed

Identified moneyness, guarantee strength, block maturity, and hedging approach as potential driving characteristics of variance in VM-21 reserves under different economic scenario sets; developed a model office of 16 GMWB/GMDB archetypes and 6 GMDB archetypes to analyze these drivers and compare against field testing

Produced results for change in reserve metrics (VM-21) and capital levels (C3P2) consistent with field testing, Test #1a, using the 1,000 scenarios set comparing AAA vs Conning 1a scenarios as of 12/31/2021

Key takeaways

1 *Consistency of results*

The range of results produced from initial model office testing compare well to field testing: Model office approach is a viable solution to supplement unaggregated GOES field testing and future industry impact testing for variable annuities

2 *Metrics and analysis*

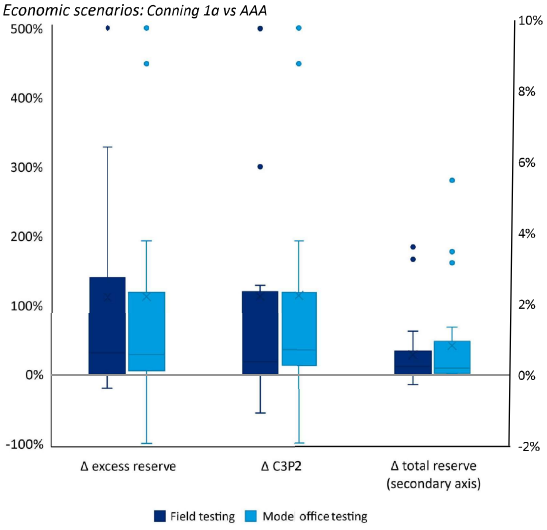
In addition to the change in excess reserve, the primary metric used in field testing, the total change in reserve should be considered when interpreting field test results: Change in excess reserves better highlights the financial impacts while change in total reserves better highlights the impact to the underlying scenario reserves

3 *Drivers of results*

Differing archetypes and hedging strategies will produce a wide range of results: Differing block characteristics will impact scenario sensitivity and interaction with the CSV floor. Hedged blocks will generally be less sensitive to changes in scenarios since they are hedging the market risk

Model office compared to field test: change in reserve levels[1]

Economic scenarios: Conning 1a vs AAA



1: Results capped at 500%. Decrease in reserve is a DB only archetype that had zero scenario reserves in excess of CSV for Conning 1a but had one scenario reserve in excess of CSV for AAA

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OVERVIEW OF CONTENTS

Section	Summary
Section 2 VM-21 & GMXB refresher	*VM-21* • Overview of the scenario reserves and stochastic reserve calculation used in VM-21 • Highlight differences between hedged ("best efforts") and unhedged ("adjusted") scenario reserve runs *GMXB* • Overview of GMWB and GMDB riders used in model office testing • Highlights how equity and interest rate scenarios impact the GMXB benefit
Section 3 Model office development and analysis	*Model office development* • Overview of the key driving characteristics and archetypes developed • Demonstrates the impact the CSV floor has in determining the value of the change in excess reserve • Illustrations of how archetype characteristics can impact scenario sensitivity and the relative position to the CSV *Analysis* • Shows range of results from model office testing compared to field testing in aggregate and across archetypes • Provides explanation behind the variety of results seen in both model office testing and field testing • Demonstrates the importance for considering both the change in excess reserve and the total change in reserve
Appendix	• Contains additional analysis and model specifications • Overview of archetypes used in the model office testing • Contains information on the Oliver Wyman team

SECTION 2

VM-21 REFRESHER | GMXB REFRESHER

SECTION 2.1

VM-21 REFRESHER

VM-21 RESERVE REFRESHER: RESERVE COMPONENTS

The primary component of VM-21 reserves is the stochastic reserves, which is made up of scenario reserves

1 Stochastic reserves

- Combination of two CTE70s based on different **scenario reserves**
  - Hedged
  - Unhedged
- Adjusted for error factor
- Simplified terms: Hedged results + Impact of hedging * error factor

Other VM-21 reserve components

2 Additional standard projection amount ("ASPA")

- Additional reserve held if company assumptions are too aggressive relative to prescribed assumptions

3 Pre-tax IMR ("PIMR")

- Allocated PIMR attributed to assets selected

Initial model office testing resulted in an ASPA value of zero due to the buffer component; PIMR assumed to be zero

Scenario reserves overview

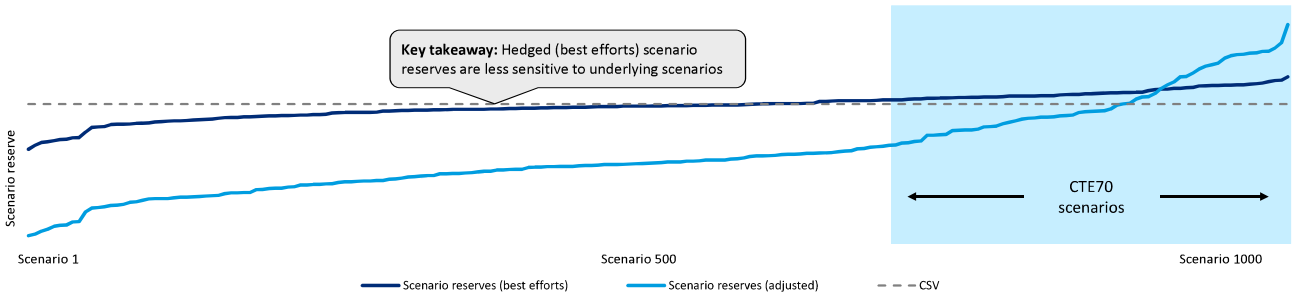
- **Scenario reserve =** Starting assets required to fund all future liability cash flows, with no intermediate deficiencies, for a given economic scenario
- Building block to the stochastic reserve, made up of a set of scenario reserves
- Calculated and recorded for each economic scenario (equity, bond fund, and interest rate)
- Projected separately on both a hedged and unhedged basis, for a contract grouping
- Floored at the cash surrender value

VM-21 RESERVE REFRESHER: STOCHASTIC RESERVE

The stochastic reserve is a combination of CTE70s from scenario reserves on a hedged and unhedged basis

Stochastic reserve = CTE70 (best efforts) + E × max[0, CTE70 (adjusted) – CTE70 (best efforts)]

Illustrative



Component	Details
CTE70 (best efforts)	• CTE70 of **scenario reserves (best efforts)** • Scenario reserve calculation reflects future hedging strategy
CTE70 (adjusted)	• CTE70 of **scenario reserves (adjusted)** • Scenario reserve calculation does not reflect future hedging strategy
Error factor (E)	• Accounts for potential overstatement of the impact of the hedging strategy • Between 5% - 100% based on the model's ability to reflect the parameters of the hedging strategy

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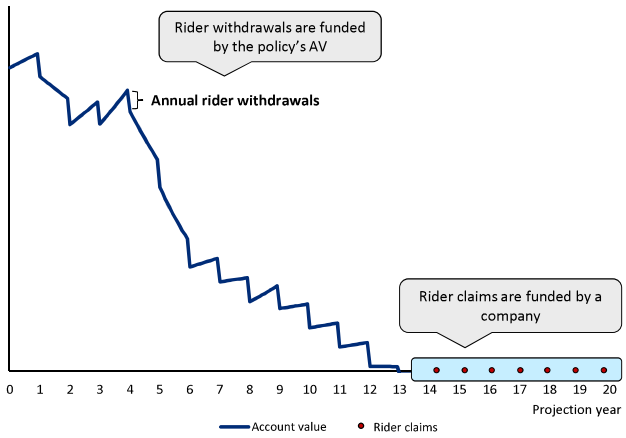
SECTION 2.2

GMXB REFRESHER

GMWB RIDER REFRESHER

Underlying equity and interest rate scenarios impact both the timing and discounted value of GMWB claims

GMWB illustration

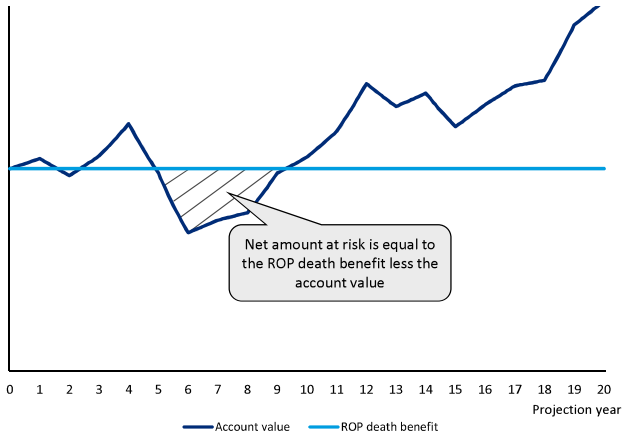


GMWB details	Commentary
Model office	• Rollup GMWB
GMWB benefit	• Guarantees a withdrawal amount for life regardless of the account value
Impact of equity scenarios on GMWB value	• Impacts performance of equity funds in the VA contract • Fund performance influences the timing of account value depletion-when withdrawals become claims
Impact of interest scenarios on GMWB value	• Impacts performance of bond funds in the VA contract • Impacts the present value of future claims

GMDB RIDER REFRESHER

Underlying equity and interest rate scenarios impact both the net amount at risk and discounted value of the death benefit guarantee

ROP GMDB illustration



GMDB details	Commentary
Model office	• Return of Premium ("ROP") GMDB
ROP benefit	• Guarantees the death benefit will be at least equal to the premium deposited, adjusted for withdrawals
Impact of equity scenarios on GMDB value	• Impacts performance of equity funds in the VA contract • Fund performance determines the net amount of risk of the GMDB
Impact of interest scenarios on GMDB value	• Impacts performance of bond funds in the VA contract • Impacts the present value of future claims

KEY TAKEAWAYS: VM-21 AND GMXB REFRESHER

Category		Takeaways
1	**VM-21 stochastic reserve**	• The stochastic reserve is a CTE70 valuation based on underlying scenario reserves calculated with and without hedging *(pg 12)*
2	**Scenario reserves**	• Starting assets required to fund all future liability cash flows, with no intermediate deficiencies, for a given economic scenario *(pg 12)* • Building blocks for the stochastic reserve *(pg 12-13)*
3	**Hedging**	• Hedged scenario reserves are generally less sensitive to the underlying scenarios than unhedged scenario reserves *(pg 13)*
4	**GMXB riders**	• GMWB riders provide a guaranteed withdrawal amount for life regardless of the account value; GMDB riders provide a guaranteed benefit upon death, regardless of the account value *(pg 15-16)* • Exposure to underlying equity and interest rate scenarios is different depending on rider type, e.g., GMWB vs GMDB *(pg 15-16)*

SECTION 3

MODEL OFFICE DEVELOPMENT & ANALYSIS

SECTION 3.1

MODEL OFFICE DEVELOPMENT

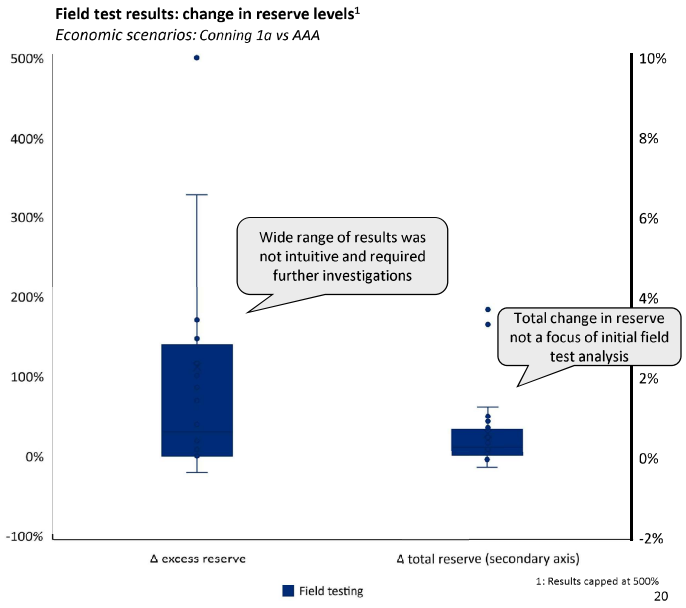
OBSERVATIONS FROM FIELD TESTING AND MODEL OFFICE OBJECTIVES

Observations from field testing

- A wide range of impacts was observed during field testing to the primary metric: increase in excess reserve, between the baseline ("AAA") and field test scenarios
- Macro level observations, particularly how participants reflected future hedging strategies in VM-21, were identified as potential drivers of variance in field test results

Objectives for Phase 1 model office development

- Utilize AXIS modeling software and Oliver Wyman's model office development tool kit to develop a model capable of producing cash flows and VM-21 reserve/capital components
- Develop potential driving characteristics of a liability profile to generate archetypes for model office
- Evaluate macro level observations and use analysis of driving characteristics to develop additional insights into field test results



MODEL OFFICE DEVELOPMENT: DESIGN

Variable annuity model developed in AXIS to calculate VM-21 reserves at time 0; field testing was used to inform the rider types, moneyness and hedging characteristics included in the model office

Model specifications[1]

Component	Details
Model	• AXIS model • 50-year projection period
Model assumptions	• Prudent assumptions developed using a mix of industry benchmarks, industry experience, and prescribed standard projection assumptions
VM-21 assumptions	• Direct iteration approach used to calculate scenario reserves • Implicit method used for hedge modeling; 10% error factor

Model office development

- Defined **driving characteristics** to analyze characteristics that were not available to analyze in field test data
- Withdrawal and death benefit combo (GMWB/GMDB) was the focus based on prevalence in field test (see rider type and combination)
- Developed **16 GMWB combo archetypes** based on combinations of driving characteristics and 6 GMDB only archetypes[3]

Driving characteristics of valuation results

Rider type and combination from field test results	% of separate account value in field testing
Withdrawal / death benefit combo (GMWB/GMDB)	42%
Death benefit only (GMDB)	41%
Income / death benefit combo (GMIB / GMDB)	9%
Other benefit combinations	9%

Included in model office

GMWB guarantee strength
- Strong
- Weak

Moneyness
- In-the-money ("ITM")
- At-the-money ("ATM")
- Out of-the-money ("OTM")

Block maturity
- New
- Mature

Future hedging strategy
- Implicit hedging
- No hedging

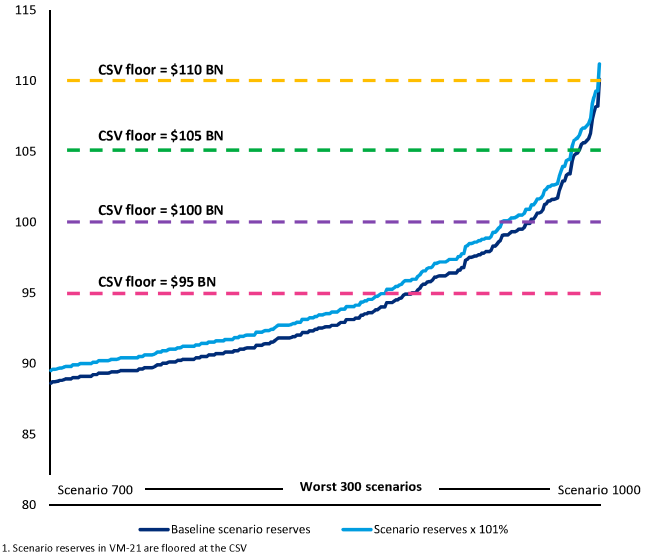
Example archetype:
GMWB combo, newly issued, strong guarantee, ATM, hedged

1: Additional model specification in appendix 2. GMAB/GMDB were 0.4% of the other benefit combinations 3. See Appendix A

CTE70 IN EXCESS OF CASH SURRENDER VALUE ("CSV") FLOOR

A 1% change in underlying scenario reserves results in the largest percentage increase to **CTE in excess of CSV** when the cash surrender value floor is highest, as the excess is made up of only a few tail scenarios

Worst 300 of 1000 scenario reserves ($BN)



CTE70[1] in excess of CSV ($M)

CSV ($BN)	Baseline	Baseline x 101%	Increase (%)	Number of S.R. > CSV
110	0.5	6	1100%	1
105	107	186	74%	12
100	685	916	34%	38
95	2,424	2,975	23%	103
0	96,282	97,245	1%	1000

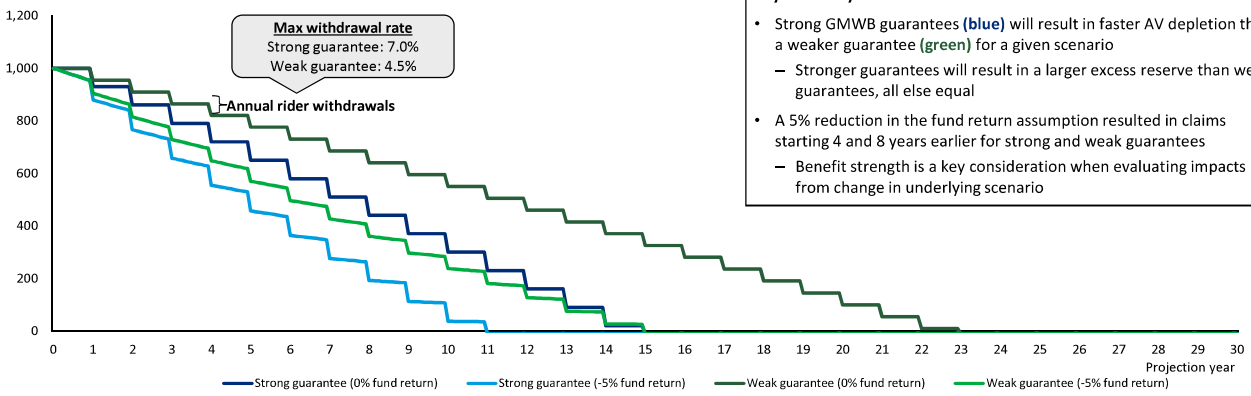
Increase in CTE in excess of CSV decreases as more scenario reserves exceed CSV

1. Scenario reserves in VM-21 are floored at the CSV

DRIVING CHARACTERISTIC: GMWB BENEFIT STRENGTH

GMWB strength is based on the size of the max withdrawal benefit, driven by withdrawal rates and benefit base features

Illustrative[1] AV (in '000s) for weak vs strong guarantees under various fund return assumptions



Key takeaways

- Strong GMWB guarantees **(blue)** will result in faster AV depletion than a weaker guarantee **(green)** for a given scenario
  - Stronger guarantees will result in a larger excess reserve than weak guarantees, all else equal
- A 5% reduction in the fund return assumption resulted in claims starting 4 and 8 years earlier for strong and weak guarantees
  - Benefit strength is a key consideration when evaluating impacts from change in underlying scenario

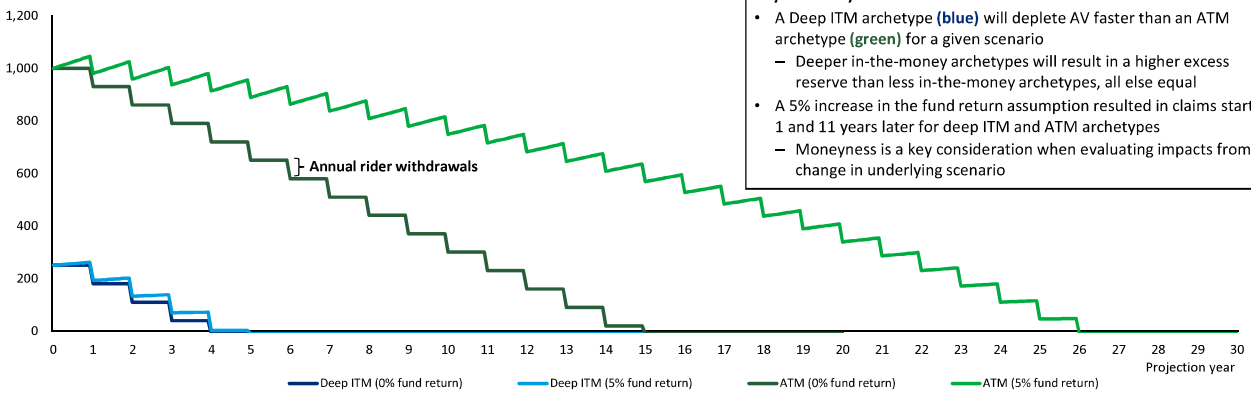
Impact of moneyness	Strong guarantee (0% fund return)	Strong guarantee (-5% fund return)	Weak guarantee (0% fund return)	Weak guarantee (-5% fund return)
Starting AV	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Max withdrawal benefit	$70,000	$70,000	$45,000	$45,000
Claim start year	15	11	23	15

1: Illustration assumes the benefit base is equal to $1,000,000 in all cases.

DRIVING CHARACTERISTIC: MONEYNESS

ITM GMWB contracts will have a higher max withdrawal relative to their account value compared to ATM and OTM GMWB contracts

Illustrative AV (in '000s) for ATM vs deep ITM archetypes under various fund return assumptions



Key takeaways

- A Deep ITM archetype **(blue)** will deplete AV faster than an ATM archetype **(green)** for a given scenario
  - Deeper in-the-money archetypes will result in a higher excess reserve than less in-the-money archetypes, all else equal
- A 5% increase in the fund return assumption resulted in claims starting 1 and 11 years later for deep ITM and ATM archetypes
  - Moneyness is a key consideration when evaluating impacts from change in underlying scenario

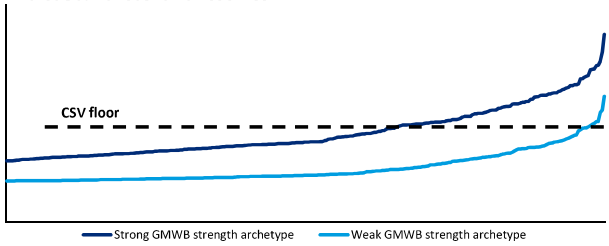
Impact of moneyness	Deep ITM[1] (0% fund return)	Deep ITM[1] (5% fund return)	ATM[1] (0% fund return)	ATM[1] (5% fund return)
Starting AV	$250,000	$250,000	$1,000,000	$1,000,000
Max withdrawal benefit	$70,000	$70,000	$70,000	$70,000
Claim start year	4	5	15	26

1: Deep ITM defined as a benefit base ratio (benefit base / account value) greater than 140% and ATM defined as a benefit base ratio between 100% and 110%. Illustration assumes the benefit base is equal to $1,000,000 in all cases.

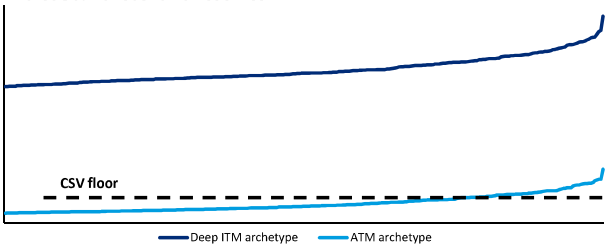
DRIVING CHARACTERSTICS: SCENARIO RESERVES AND CSV FLOOR

Archetype characteristics impact the scenario reserves relative position to the CSV which impacts change in CTE70 in excess of CSV

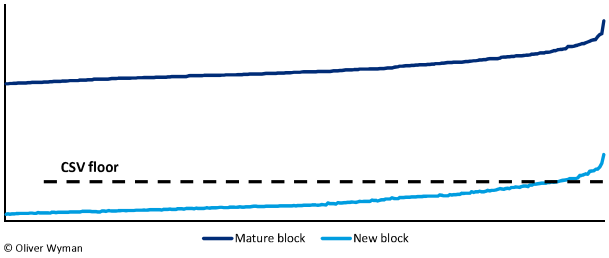
GMWB benefit strength: Strong vs. Weak
Worst 30% of scenario reserves



Moneyness: ITM vs. ATM
Worst 30% of scenario reserves



Block maturity: Mature vs. New
Worst 30% of scenario reserves



KEY TAKEAWAYS: MODEL OFFICE DEVELOPMENT

Category		Takeaways
1	**Objective, design and archetypes**	• Model office archetypes were developed to evaluate macro level observations and develop additional insights into the wide range of results in the primary metric, change in CTE70 in excess of CSV, used to analyze field test results *(pg 20-21)* • Archetypes analyzed are GMWB/GMDB combo riders with a combination of driving characteristics (moneyness, guarantee strength, block maturity) and hedging approach *(pg 21, Appendix B for full listing of archetypes)*
2	**CTE70 in excess of CSV floor**	• The relative position of scenario reserves compared to the CSV floor plays a major factor in determining the value of the change in excess reserve (*pg 22)*
3	**Driving characteristics and archetypes**	• Driving characteristics that make up archetypes have an impact on both relative position of scenario reserves compared to CSV and the sensitivity to changes in underlying scenarios *(pg 23-25)* • Understanding impacts of driving characteristics is a building block for archetype analysis and comparisons to field testing

SECTION 3.2

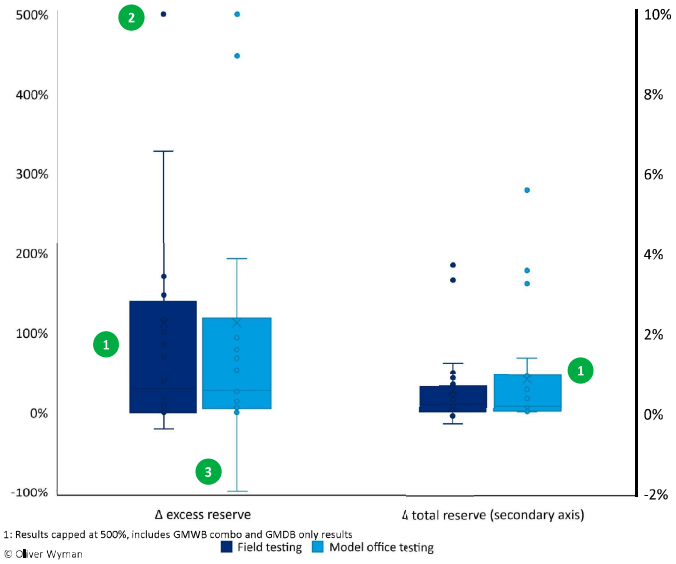
MODEL OFFICE ANALYSIS

MODEL OFFICE RESULTS COMPARED TO INDUSTRY: CHANGE IN RESERVE

Impact of updating economic scenarios from AAA to Conning 1a across archetypes/industry

Model office compared to field test: change in reserve levels[1]

Economic scenarios: Conning 1a vs AAA



1: Results capped at 500%, includes GMWB combo and GMDB only results

1. Model office testing produced a consistent range of results compared to field testing for **both change in excess reserves** and **change in total reserves**
   - Change in excess reserves has a much wider variance as compared to change in total reserves
   - Range in change in excess reserve is heavily influenced by interaction with CSV floor
2. **Extreme impacts to change excess reserve are present in both model office testing and field testing**
   - Business with excess reserves near zero fall into this category (e.g., new cohorts, weak guarantees, OTM cohorts)
   - Impact to total change in reserve are much less pronounced
3. **Excess reserves and total reserves increased in almost all cases under the Conning 1a scenarios**
   - Examples of decreases in reserves occurred in both model office testing and field testing
   - Model office GMDB-only product had one AAA scenario and zero Conning 1a scenarios in excess of CSV

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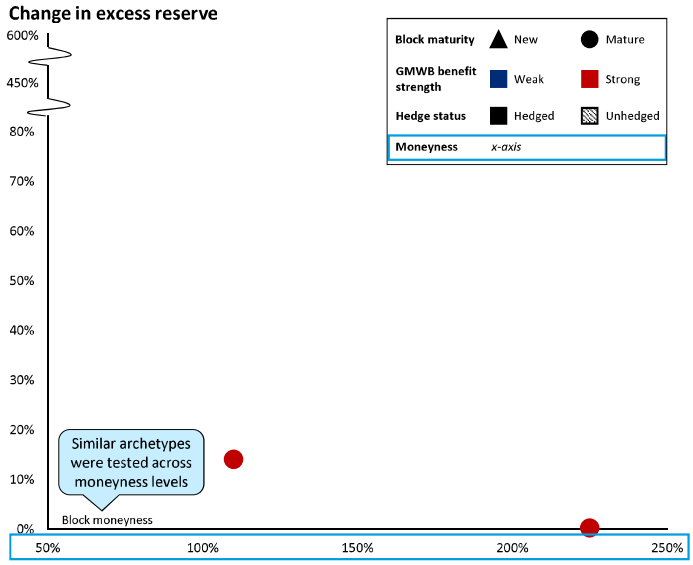
ARCHETYPE DEEP DIVE: MONEYNESS

Similar archetypes with different **moneyness** level are displayed at different positions on the x-axis; level of moneyness combined with other characteristics influence impact



Results guide

Mature/Strong/Hedged = Mature + Strong + Hedged

Moneyness information

- Moneyness is defined as benefit base divided by current account value, which is impacted by "historical" fund performance and withdrawals
- A value greater than 100% represents a rider benefit that is larger than account value

Observations

- Model office archetypes with higher moneyness levels have a larger excess reserve and therefore are less sensitive to changes in underlying scenarios

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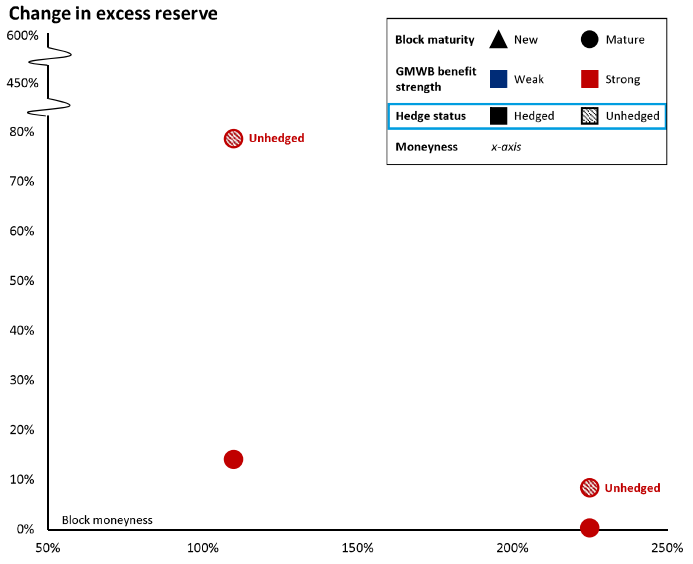
ARCHETYPE DEEP DIVE: HEDGE STATUS

Hedge status is indicated using shading; solid results are hedged and shaded results are unhedged



Results guide

Mature/Strong/Hedged = Mature + Strong + Hedged

Mature/Strong/Unhedged = Mature + Strong + Unhedged

Hedge status information

- Hedged results are calculated using a weighted average of both a hedged ("best efforts") and unhedged ("adjusted") CTE70
- Unhedged archetypes only incorporate the unhedged CTE70 calculation when calculating stochastic reserve

Observations

- Model office archetypes that are unhedged have greater sensitivity to a change in the underlying scenarios than similar hedged archetypes
- Hedging of future capital market risks generally mutes the impact of changes to underlying scenarios

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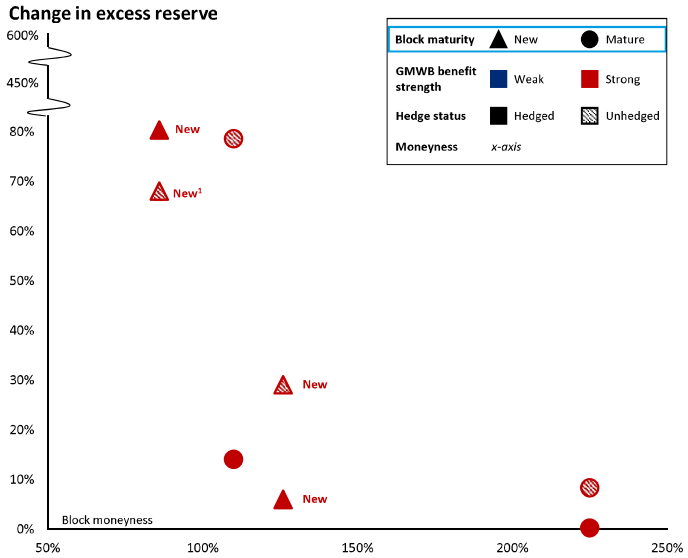
ARCHETYPE DEEP DIVE: BLOCK MATURITY

"New" and "mature" archetypes are indicated by a triangle and circle, respectively

1: Excess reserve ($M): AAA: $0.1 (hedged), $1.3 (unhedged) , Conning 1a: $0.2 (hedged), $2.2 (unhedged)



Results guide

Mature/Strong/Hedged = Mature + Strong + Hedged

New/Strong/ Hedged = New + Strong + Hedged

Block age information

- "New" archetypes used in model office testing were assumed to be issued more recently, had a younger average age, and smaller number of active withdrawers compared to "mature" archetypes
- "Mature" archetypes used in model office testing were assumed to be issued longer ago, had an older average age, and larger number of active withdrawers compared to "new" archetypes

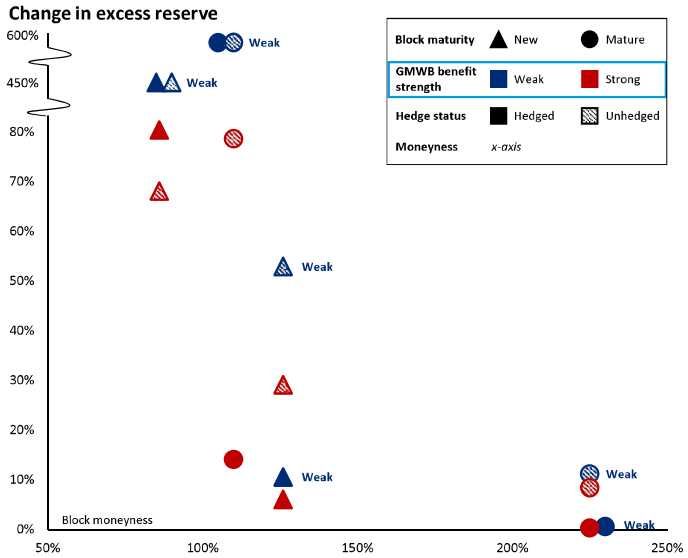
Observations

- "New" archetypes are less in-the-money compared to similar mature blocks since less contracts are taking withdrawals, leading to smaller excess reserve and more sensitivity to changes in underlying scenarios

1: The unhedged archetype has a greater dollar change in excess reserve but a lower percentage change relative to the hedged archetype because a larger majority of best efforts scenario reserves, which only impact hedge results, are below the CSV floor.

ARCHETYPE DEEP DIVE: GMWB BENEFIT STRENGTH

"Weak" and "strong" archetypes are indicated by colors **blue** and red



Results guide

Mature/Strong/Hedged = Mature + Strong + Hedged

Mature/Weak/ Hedged = Mature + Weak + Hedged

GMWB benefit strength information

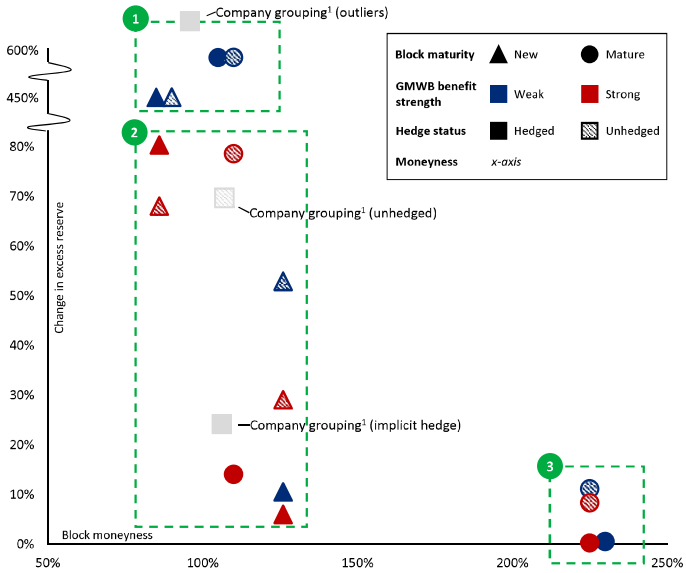
- Weak (strong) archetypes have lower (higher) GMWB rollup and guaranteed withdrawal rates compared to strong (weak) archetypes

Observations

- Model office archetypes with weak GMWB strength are more likely to have a greater change in excess reserve
- Weaker rider benefits lead to a smaller excess reserve and more sensitivity to changes in underlying scenarios

CHANGE IN EXCESS RESERVE: ARCHETYPE & FIELD TEST GROUPING

Range of results across archetypes demonstrate model office versatility and are informative when compared to field test impacts

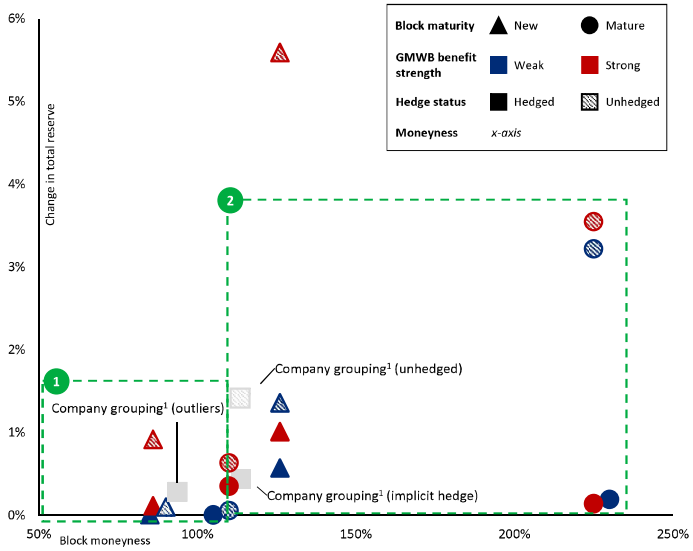


1. Outlier company grouping include companies with **reserves in close proximity to CSV** and had the largest change in excess reserves
   - Model office archetypes that produce similar effects: newer business, weaker benefits
2. Company groupings are made up of a distribution of key characteristics and rider types, leading to wide range of impacts
   - Model office testing confirms that hedging practices (hedged vs unhedged) lead to variations in results
3. Deep-in-the-money (>140%) or mature "runoff business" have a lower change in excess reserves since most scenario reserves are above the CSV floor. Examples of this in field test results were limited but present

1: Grouping of data points from field test results. Each grouping is made up of 3+ normalized data points. Moneyness level for company groupings is based on the reported GMDB/GMWB combo and is calculated using a simple average.

CHANGE IN TOTAL RESERVE: ARCHETYPE & FIELD TEST GROUPING

Excess reserves provide a view of potential financial impact to change in underlying scenarios; however, change in total reserves highlights the impact to the underlying scenario reserves



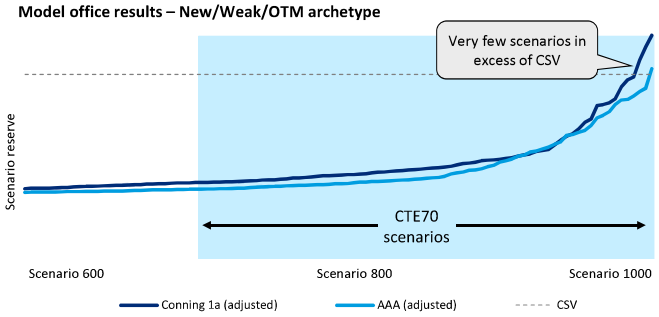
1. "Outliers" company grouping for change in excess reserve are no longer outliers, indicating a similar pattern of scenario reserves between scenario sets
2. The range of change in total reserve in both model office testing and field testing is much tighter compared to change in excess reserve
   - Limited industry data was available to compare to deep ITM business

1: Grouping of data points from field test results. Each grouping is made up of 3+ normalized data points. Moneyness level for company groupings is based on the reported GMDB/GMWB combo and is calculated using a simple average.

EXPLANATION OF RESULTS: OUTLIERS

The extreme changes in reserve levels are a result of CSV flooring and more likely to be observed in new or OTM blocks. Outliers were observed in both model office testing and field testing

Model office results – New/Weak/OTM archetype



Model office results – New/Weak/OTM archetype

Component	AAA	Conning 1a	Change
Floored CTE70 (best efforts)	unhedged	unhedged	NA
Floored CTE70 (adjusted)	94,021	94,116	0.1%
Excess reserve	21	116	449%
Total reserve	94,021	94,116	0.1%

Model office and field-testing results

Change in total reserve is minimal in these cases

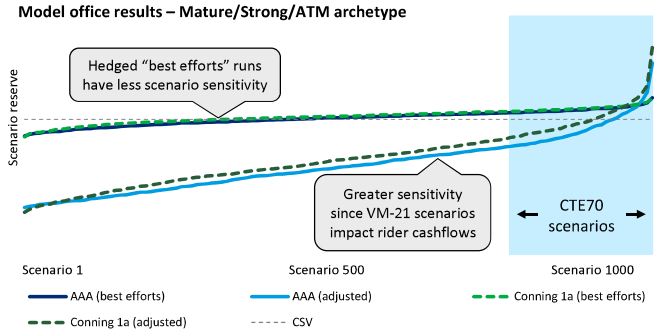
Cohort	Source	Change in excess reserve	Total change in reserve
New/Weak/OTM/Unhedged archetype	Model office	449%	0.1%
Mature/Weak/ATM/Hedged archetype	Model office	631%	0.0%
Field test grouping[1]	Field testing	1025%	0.4%

1: Grouping of data points from field test results. Each grouping is made up of 3+ normalized data points

EXPLANATION OF RESULTS: HEDGED VS UNHEDGED

Hedging programs reduce scenario sensitivity. This trend was observed in both model office testing and field testing

Model office results – Mature/Strong/ATM archetype



Best effort runs are less sensitive to VM-21 scenarios due to hedging

Implicit hedging example	Commentary
Risk-Neutral value of Riders (Used in the best efforts calculation)	• Defined as the average PV(rider claims) – average PV(rider fees) under stochastic risk neutral scenarios • Value is **independent from VM-21 underlying scenarios**
Best efforts scenario reserves	• Risk-neutral value of riders is an upfront cost in the projection, future rider claims and fees are not modeled • Less sensitive to VM-21 scenarios due to the removal of rider cashflows

Model office and field-testing results

Cohort	Source	Change in excess reserve	Total change in reserve
Mature/Strong/ATM/Unhedged archetype	Model office	78.7%	0.6%
Field test grouping[1] – unhedged	Field testing	69.8%	1.3%
Mature/Strong/ATM/Hedged archetype	Model office	14.1%	0.4%
Field test grouping[1] – hedged (implicit)	Field testing	23.8%	0.3%

1: Grouping of data points from field test results. Each grouping is made up of 3+ normalized data points

KEY TAKEAWAYS: MODEL OFFICE ANALYSIS

	Category	Takeaways
1	Model office approach	• Model office approach produced a range of results across archetypes that align well with initial field test results, making it an appropriate tool to supplement unaggregated GOES field testing *(pg 28)*
2	Impact of archetypes	• Archetype analysis demonstrates how liability characteristics and hedging practices can drive the relative impact to change in excess reserves *(pg 29-32, 36)* • Characteristics that drive excess reserves to lower levels: Newer business, weaker benefits, ATM/OTM *(pg 29-33)*
3	Excess vs total reserve	• In addition to change in excess reserves over CSV, additional metrics and results should be considered when evaluating field test results (e.g., total change in reserve, change in scenario reserves) *(pg 28, 34)* • Change in excess reserves highlights the financial impacts to the industry while change in total reserves highlights the impact to the underlying scenario reserves

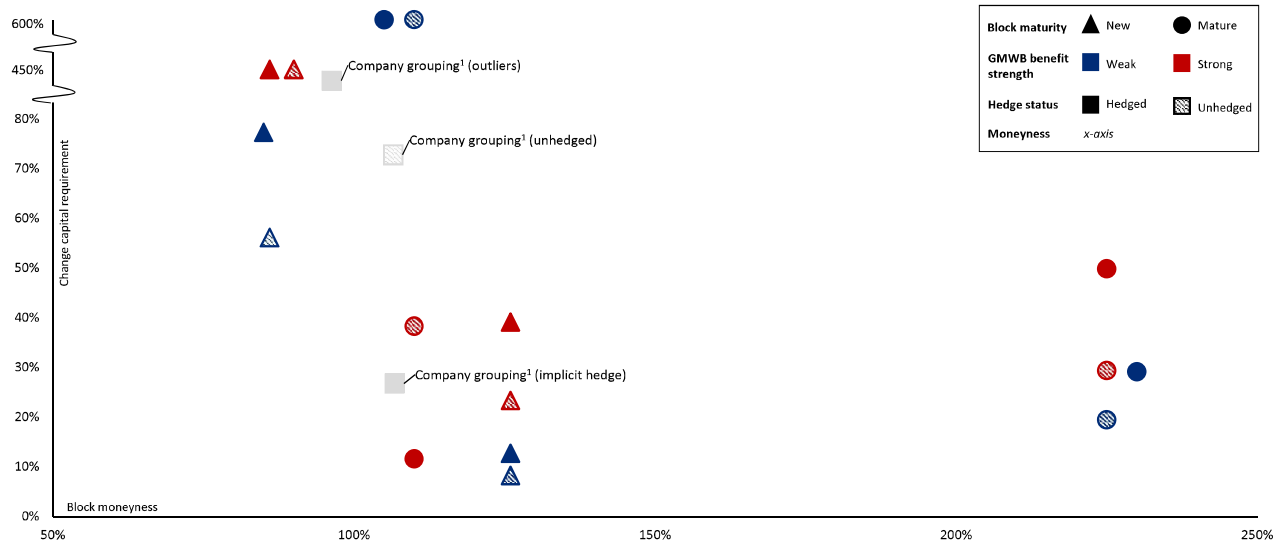
APPENDIX

A

ADDITIONAL ANALYSIS

RESULTS BY ARCHETYPE : CHANGE IN CAPITAL REQUIREMENT

Comparison of model office results for GMWB with ROP GMDB riders to field testing results. Change in capital requirement based on AAA vs Conning 1a scenarios



1: Grouping of data points from field test results. Each grouping is made up of 3+ normalized data points. Moneyness level for company groupings is based on the reported GMDB/GMWB combo and is calculated using a simple average.

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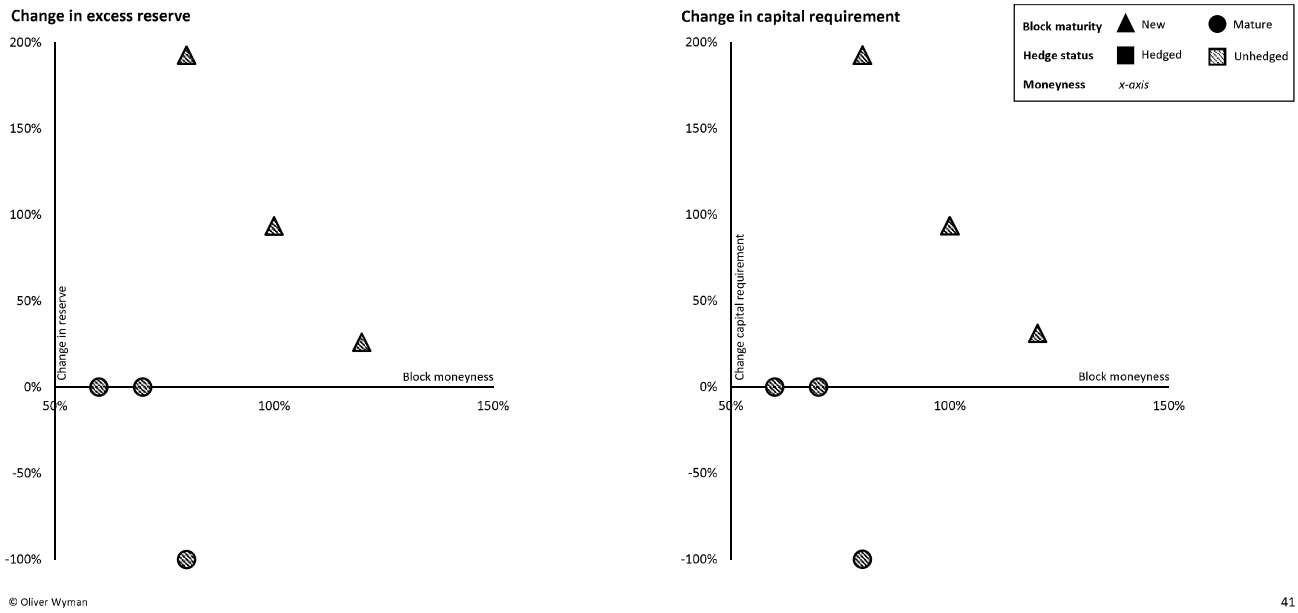
RESULTS BY ARCHETYPE : GMDB ONLY SENSITIVITIES

Model office results for ROP GMDB riders. Changes based on AAA vs Conning 1a scenarios. The relative change in reserves (CTE70) and capital (CTE98) are consistent since a majority of scenario reserves outside of the 98th percentile are lower than CSV



B

DRIVING CHARACTERISTICS AND ARCHETYPES

DRIVING CHARACTERISTICS: SPECIFICATIONS

In-force archetypes were created using a model office creation toolkit and varied by driving characteristics. A wide range was used in determining variation in driving characteristics in order to capture a range of impacts to compare against field testing

Characteristic	Variations	Values
GMWB guarantee strength	Weak guarantee	**Rollup rate:** 3% **Income rates:** 4.0% - 5.5% based on attained age
	Strong guarantee	**Rollup rate:** 7% **Income rates:** 5.5% - 7.0% based on attained age
Hedging	Hedged	**Hedge modeling:** Implicit method
	Unhedged	**Hedge modeling:** None
Block maturity	New	**Issue year:** 2020 **Average age:** 66 **Percentage of GMWB contracts taking income:** 20%
	Mature	**Issue year:** 2005 **Average age:** 75 **Percentage of GMWB contracts taking income:** 75%
Moneyness	Varies	**Moneyness values:** Vary from 60% to 225% depending on riders
Other	Static inputs	**M/F sex split:** 50/50 **Q/NQ split:** 65/35 **Equity allocation:** 70%

IN-FORCE ARCHETYPES: GMWB/GMDB COMBO

16 different GMWB/GMDB combo archetypes were used in model office testing

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

IN-FORCE ARCHETYPES: GMDB ONLY

6 different GMDB only archetypes were used in model office testing

Archetype	DB rider	Hedging	Block maturity	Moneyness
1	ROP GMDB	None	New	OTM
2	ROP GMDB	None	New	ATM
3	ROP GMDB	None	New	ITM
4	ROP GMDB	None	Mature	OTM – 60%
5	ROP GMDB	None	Mature	OTM – 70%
6	ROP GMDB	None	Mature	OTM – 80%

C

MODEL SPECIFICATIONS

MODEL COMPONENTS AND FUNCTIONALITY

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

LIABILITY BEST ESTIMATE ASSUMPTIONS (1/2)

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

LIABILITY BEST ESTIMATE ASSUMPTIONS (2/2)

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

ASSET AND REINVESTMENT MODELING

Component	Notes
Inforce assets	• Inforce assets are made up 50/50 mix of 10-year bond with ratings A/AA • Assets are assumed to be purchased on valuation date and fully scalable to match time zero reserve requirement • Inforce assets will rotate into reinvestment strategy below as they reach maturity
Inforce asset assumptions	• **Investment expenses:** 10bps • **Default rate:** 15bps • **Spreads:** VM-20 prescribed
Reinvestment strategy	• **Reinvestment assets:** 50/50 mix of 10-year bonds with ratings A/AA (consistent with the guardrail defined under VM-21) • **Reinvestment frequency:** Annual, assumes intra-year cash and borrowing at 3 month UST • **Disinvestment:** buy negative reinvestment assets • **Other:** duration matching is not currently considered in the reinvestment strategy
Reinvestment assumptions	• **Investment expenses:** 10bps • **Default rate:** VM-20 prescribed • **Spreads:** VM-20 prescribed

ADDITIONAL MODEL SPECIFICATIONS AND FUNCTIONALITY

Item	Details	Values
Riders	The model can model the following riders	**GMDB:** ROP and rollup **GMIB:** rollup, hybrid, combo **GMWB:** rollup
Investment accounts	The following investment accounts are utilized in the model	**Investment accounts:** US equity, international equity, bond, money market, fixed
Fees	Base contract	**M&E:** 130 bps **Per policy:** $30 **Percentage of GMWB contracts taking income:** 20% **Fund expense ratio:** 1.00%
	Rider	**GMDB:** 0 bps – 35 bps **GMIB:** 85 bps – 145 bps **GMWB:** 130 bps

SCENARIO RESERVE: HEDGE MODELING TECHNIQUES

Implicit hedging is used for model office analysis due to the relative simplicity and transparency compared to explicit hedging

	Explicit Hedging	Implicit Hedging[1]
Existing hedging strategy	Include asset cashflows from existing hedge instruments in the projection	Hedge positions held on the valuation date replaced with cash and/or other general account assets equal to aggregate market value of the hedge positions
Future hedging strategy	Hedging positions and their resulting cash flows are included in the stochastic cash-flow model used to determine the scenario reserve	A risk-neutral upfront cost replaces future claims and/or rider fees in the projection, subject to an effectiveness factor
Field test participants	**8**	**7**
Model office criteria		
Precision	☑	☑
Transparency	☐	☑
Complexity	☐	☑

1. Also referred to as the "cost of reinsurance" method

D

OLIVER WYMAN TEAM

OLIVER WYMAN TEAM

Dylan Strother, FSA
Senior principal
Engagement manager

dylan.strother@oliverwyman.com

Carson Cook, FSA
Manager
Lead Modeler

carson.cook@oliverwyman.com

Alex Potocki, FSA
Senior Manager
Annuity SME

alex.potocki@oliverwyman.com

Nick Farber, ASA
Consultant
Automation SME

nick.farber@oliverwyman.com

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Generator of Economic Scenarios (GOES) (E/A) Subgroup
Virtual Meeting
January 31, 2024

The GOES (A) Subgroup of the Life Actuarial (A) Task Force met Jan. 31, 2024. The following Subgroup members participated: Mike Yanacheak, Chair (IA); Pete Weber, Vice Chair (OH); Ted Chang (CA); Wanchin Chou (CT); Philip Barlow (DC); Scott Shover (IN); Ben Slutsker (MN); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill (TX); and Craig Chupp (VA).

1. Discussed SERT Scenarios and DR Scenario Methodology

Scott O'Neal (NAIC) started by providing some background information on the stochastic exclusion ratio test (SERT) and deterministic reserve (DR) scenarios and decisions that were made by the GOES Technical Drafting Group (Attachment Thirty-Two-A). Matt Kauffman (Moody's Analytics) then discussed an alternative approach to producing the SERT scenarios using the base functionality of the Conning model rather than applying a percentile mapping approach. O'Neal stated that although regulators on the GOES Technical Drafting Group had expressed interest in field testing both the Conning and Kauffman approaches, subsequent discussions had pointed towards using the methodology proposed by Kauffman. Several Subgroup members then voiced support for moving forward with the Kauffman approach to producing SERT scenarios.

2. Discussed Treasury Flooring Methodology

O'Neal provided background for the Treasury model flooring discussion, noting that the Conning Treasury model has the capability of producing negative interest rates, which have been a feature prevalent in other countries currently and in recent history. O'Neal stated that for the first GOES field test, two different versions of a floor had been applied to the Treasury scenarios to control the frequency and severity of negative Treasury rates while meeting other regulatory objectives. For next steps, O'Neal said that the subgroup needed a decision on which flooring methodology to use along with deciding the appropriate flooring parameters to control the frequency and severity of negative interest rates. Jason Kehrberg (American Academy of Actuaries—Academy) noted concerns with the amount of overriding that is occurring in the scenarios in terms of frequency and duration. Hal Pedersen (Academy) said that the 3-Factor Cox-Ingersoll-Ross model used by Conning did have some challenges, similar to other models, in modeling interest rates in a low starting interest rate environment. The meeting concluded without a decision on the direction for flooring.

Having no further business, the GOES (A) Subgroup adjourned.

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SERT Goals

1. Practically sort products that may have a constraining SR from those that would not have a constraining SR.

SERT Decision Points:

1. **Decision Point:** Should the SERT be removed entirely, given that it is duplicative of what could be provided for the certification method? This could include moving the primary SERT outline to the examples for a broadened certification method. With a QA certifying as to the risks, a more judgment-
Drafting Group Recommendation: Maintain SERT scenarios in roughly their current form**.**

2. **Decision Point:** What products are generally expected to pass the SERT, what products are generally expected to fail, and what percentage of the time should this single test be able to accurately sort these
Drafting Group Recommendation: Pass: most Term with 20 year or shorter level period (non-ROP);

3. **Decision Point:** Do the SERT scenarios need to be at a moderately adverse level?
Drafting Group Recommendation: No. The SERT is not a set of scenarios that need to be "passed". They should reasonably assess whether performing an SR and taking a CTE(70) is likely to produce a higher reserve than the DR. Thus, they should assess whether tail scenarios lead to significant increases.

4. **Decision Point:** Should the SERT scenarios be derived directly from the stochastic scenario distribution, as Conning has done or modified, or should they be "stylized" scenarios be created that
Drafting Group Recommendation: Straw poll strongly indicated to test both Matt Kauffman and percentile approach for #4. Connie suggested adding additional scenarios to Matt's method to cover,

5. **Decision Point:** How do we evaluate whether the SERT is appropriately calibrated, independent of the additional risk reflected in the new scenarios? That is, what must be included in a subsequent Field
No Drafting Group Recommendation. Maambo noted for #5 more starting conditions is more

DR Goal
Provide a moderately adverse deterministic scenario that will be adequate to capture risk for products

DR Decision Points:
1. **Decision Point:** Should this scenario be linked to the stochastic exclusion ratio test or can it be
Drafting Group Proposal:

2. **Decision Point:** Do we agree with the format of the current deterministic scenario (adverse for 20
Drafting Group Proposal: NAIC to test different versions in model office.

3. **Decision Point:** Is the deterministic reserve scenario methodology used for the first field test
Drafting Group Recommendation: Current plan is to Field Test both Conning and Matt K. version (one

Generator of Economic Scenarios (GOES) (E/A) Subgroup
Virtual Meeting
January 24, 2024

The GOES (A) Subgroup of the Life Actuarial (A) Task Force met Jan. 24, 2024. The following Subgroup members participated: Mike Yanacheak, Chair (IA); Peter Weber, Vice Chair (OH); Ted Chang (CA); Wanchin Chou (CT); Philip Barlow (DC); Scott Shover (IN); Ben Slutsker (MN); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill (TX); and Craig Chupp (VA).

1. Discussed Quantitative Comparisons Between the Conning and Academy Corporate Models

Scott O'Neal (NAIC) provided some background information on a quantitative comparison of the American Academy of Actuaries (Academy) and Conning Asset Management (Conning) corporate models. Dan Finn (Conning) presented comparisons of four alternative start dates when both the Academy and Conning models were calibrated to some of the same targets and used the same underlying treasury rates. Connie Tang (Retired) asked what targets were revised as part of the latest Conning corporate model calibration. Finn replied that the only targets that have been revised for the Conning model are the initial and long-term spreads, along with the net excess return.

Iouri Karpov (Academy) noted that the two corporate models were now producing broadly more similar results than before the recalibration of the Conning model. However, Karpov stated that there were still differences in the results, particularly in the high-spread starting conditions, which were challenging to understand without complete model documentation. Finn clarified that the Conning GEMS model calibration is fully documented. However, the documentation is available only to clients or companies participating in a free trial that have signed a non-disclosure agreement (NDA). Brian Bayerle (American Council of Life Insurers—ACLI) noted that the best practice for documentation would be to make everything publicly available to any practitioner.

Yanacheak asked the Subgroup what additional information it would need to decide which corporate model to utilize for field and model office testing. Weber noted that the group should not seek the hypothetical perfect solution but instead focus on moving forward with the most reasonable approach. Tang and Karpov raised concerns that there are differences between the excess returns in the Conning and Academy corporate models, and more time would be needed to understand the source of differences. Hal Pedersen (Academy) raised the same concerns that the ACLI did about documentation and wanted more time for the Academy to review the results and provide feedback.

Subgroup members discussed the potential for deciding which corporate model to use for field testing but ultimately decided to take more time reviewing the results from the Academy and Conning models before arriving at a conclusion.

Having no further business, the GOES (A) Subgroup adjourned.

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Generator of Economic Scenarios (GOES) (E/A) Subgroup
Virtual Meeting
January 17, 2024

The GOES (E/A) Subgroup of the Life Actuarial (A) Task Force met Jan. 17, 2024. The following Subgroup members participated: Mike Yanacheak, Chair (IA); Pete Weber, Vice Chair (OH); Ted Chang (CA); Wanchin Chou (CT); Philip Barlow (DC); Scott Shover (IN); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill (TX); and Craig Chupp (VA). Also participating was: D.J. Bettencourt.

1. Discussed the Equity-Treasury Linkage and Relevant Comments Received

Scott O'Neal (NAIC) walked through a presentation (Attachment Thirty-Four-A) that provided background on the equity-Treasury linkage and summarized relevant comments that had been received at the Life Actuarial (A) Task Force session at the 2023 Fall National Meeting. Brian Bayerle (American Council of Life Insurers—ACLI) stated that the ACLI felt that achieving an appropriate reflection of low interest rates paired with low equity returns could be achieved through acceptance criteria without the need for a functional equity-Treasury linkage. Bayerle further stated that a functional equity-Treasury linkage could result in too few high interest rate and low-equity scenarios. D.J. Bettencourt (New Hampshire) noted that he had some concern about the potential for unrealistic scenarios well outside the bounds of history resulting from the inclusion of a functional equity-Treasury linkage. Steve Strommen (Blufftop LLC) stated that including a functional equity-Treasury linkage in the GOES would cause undue volatility in the statutory reserve and capital requirements.

2. Discussed Joint Equity-Treasury Linkage Acceptance Criteria

Jason Kehrberg (American Academy of Actuaries—Academy) noted that the relationship between equities and interest rates should be reflected via a long-term difference in return expectation set during the calibration of the GOES, rather than a structural linkage. Kehrberg then discussed how joint interest and equity "quadrant" criteria could be used to include a sufficient number of low-interest/low-equity and high-interest/low-equity scenarios.

3. Discussed Equity Calibration Approach

O'Neal walked through the results of two different potential approaches for the equity model calibration that built on the Treasury calibration that was released at the 2023 Fall National Meeting. The first approach, O'Neal said, was based off the 2022 Field Test 1A approach, where the equity targets are altered with each valuation date to reduce the impact of the equity-Treasury linkage in the Conning model. O'Neal also discussed the second approach where the equity scenarios would meet the existing static acceptance criteria under a starting interest environment that matched the long-term average, but that would move higher or lower depending on alternative starting interest conditions. Carmello, noting a previous comment letter from Nationwide Financial that stated there were no major problems with the currently prescribed equity model, said that he remembered differently that there was an issue that regulators were seeking to address in the equity model. Hemphill said that the equity-Treasury relationship in the scenario generator had been brought up during the Variable Annuity Reform project and was tabled for later consideration by regulators as part of that process.

Having no further business, the GOES (E/A) Subgroup adjourned.

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Generator of Economic Scenarios (GOES) (E/A) Subgroup

Equity-Treasury Linkage Background and Review of Relevant 2023 Fall National Meeting Comments

January 17, 2024

NAIC NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

Equity-Treasury Linkage Background

- In GEMS® there is a functional linkage between the Overnight Treasury Yield and the drift factor for the equity fund price. Therefore, the expected equity fund total returns will rise and fall with changes to the starting short maturity interest rate levels.
- This is a departure from the currently prescribed Academy Interest Rate Generator (AIRG) that does not have this functional equity-Treasury linkage.
- It is difficult to see strong relationships between equities and Treasuries because the equity market is so volatile. However, investors typically demand equity returns in excess of those offered by risk-free assets to compensate for bearing risk.

American Council of Life Insurers

ACLI is concerned about the equity returns currently being produced by the Generator. First and foremost, interest-equity linkages, namely the equity risk premium and the interest-equity correlation assumptions, should only be implemented when there is statistically significant historical evidence that supports such modeling assumptions. **We believe the historical data suggests such linkages are not statistically significant.** The inclusion of interest-equity linkage serves to increase the complexity of the model without any corresponding benefit. Further, we believe that robust low rate and low equity scenarios may be achieved without modeled linkage. **Adjusting equity parameters to stabilize long-term equity return in a changing rate environment is not an appropriate solution.**

Second, inappropriate relationships in the Generator could lead to counterintuitive results: the interest-equity linkage could potentially lead to an excess requirement for capital in an extreme conditions or down markets; the capital the insurer had built up to that point should be the necessary cushion rather than requiring the company to inject additional capital. Additionally, **inappropriate relationships could lead to significant variance in reserves and capital, which impairs a company's ability to practice sound asset liability management and other risk management activities and for regulators to adequately assess the strength of the companies under their authority.**

 Note: Bolded emphasis from NAIC Staff

Equitable

Equitable supports a structural linkage between interest rates and equity returns via an equity risk premium.

Conceptually, the constant equity risk premium (ERP) approach, as utilized in the GEMS model, reflects the fact that a rational investor would demand expected equity returns in excess of those offered by risk-free assets to compensate for bearing such risk. A phenomenon where variations in risk free interest rates create highly varied, and at times even negative, equity risk premia. This result is a "real world" model that inarguably fails "real world" common-sense investor principles.

Historically, we analyzed the relationship between interest rate and equity returns based on the 20-year UST rate and the S&P 500 index return, and the analysis indicated a positive relationship between the two. Exhibit A below shows the historical 20-year US treasury rates and the annualized 20-year return of the S&P index in the following 20year period. We note that, in performing analysis regarding the relationship of interest rates and equities, it is important to look at the relationship between interest rates and future equity returns, not short-term relationships, as the valuation of insurance liabilities requires long-term projections. The data clearly evidences a high correlation between current interest rates and future equity returns. This is strongly supportive of a positive relationship between interest rates and equities as in the proposed Conning scenarios, as evidenced in Exhibit B, which shows a positive correlation between the average UST 20year rates and 20-year projected cumulative Large Cap returns based on field test Scenario 1A (orange line). This is not existent under current AIRG model (black line). ***[Note: See attached comment letter for exhibit]***

 Note: Bolded emphasis from NAIC Staff

Nationwide

We would like to reiterate that no material deficiencies have been identified with the current Academy equity model. As such, maintaining consistency with the current equity model would be beneficial in understanding impacts to reserve and capital and avoiding unjustified movements. We are in favor of more complete equity acceptance criteria being defined with consistency to the current equity model along with satisfying the stylized facts defined.

Steve Strommen

I applaud continued use of the existing calibration criteria.

I would note that the criteria do not depend on starting conditions such as the starting level of interest rates. This is an important decision, because the model Conning put forward does produce scenario sets that depend very strongly on the stating level of interest rates.

Generator of Economic Scenarios (GOES) (E/A) Subgroup
Virtual Meeting
January 10, 2024

The GOES (E/A) Subgroup of the Life Actuarial (A) Task Force met Jan. 10, 2024. The following Subgroup members participated: Mike Yanacheak, Chair (IA); Pete Weber, Vice Chair (OH); Wanchin Chou (CT); William Leung (MO); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill (TX); and Craig Chupp (VA).

1. Discussed Scenario Stratification

Scott O'Neal (NAIC) provided some background information on scenario stratification and reviewed relevant decisions that the GOES Technical Drafting Group had made (Attachment Thirty-Five-A). Yanacheak noted that despite Conning providing a means to stratify scenarios, it was still the responsibility of the actuary to meet the relevant principle-based reserve requirements to not materially understate the reserve. Dan Finn (Conning) then walked through a proposal for an Excel-based scenario selection tool that could create custom scenario stratifications. Finn noted that the prototype could select scenarios based either on a significance measure calculated on the 20-year Treasury rates or a gross wealth factor determined from the large capitalization equity fund. Finn said that these two measures could be provided with each monthly scenario release and used as input for the Excel-based tool to select the number of scenarios desired by the user.

Link Richardson (Corebridge Financial) noted that the GOES Technical Drafting Group had recommended providing the ability to stratify scenarios on both equity and interest rates simultaneously and asked whether that was still being considered. Finn stated that it would be possible to include an additional metric in the scenario stratification tool. Carmello stated that he preferred that any scenario selection methodology used by companies be provided by Conning due to the potential for companies to artificially lower the reserve or capital amount by choosing alternative scenario selection methodologies. Yanacheak replied that he understood Carmello's concern but that companies with different risk profiles could likely benefit from different scenario selection methodologies. Hemphill said that she supported allowing companies to use alternative scenario selection methodologies, as companies using these alternative methodologies typically demonstrate that they meet the *Valuation Manual* requirements by doing an off-cycle valuation using the full set of scenarios and comparing them to the results using the smaller set.

After a brief discussion, regulators noted support for moving forward with the scenario selection tool with the ability to stratify based on interest rates or equity returns.

Having no further business, the GOES (E/A) Subgroup adjourned.

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Scenario Picker Tool Goal:

- Provide scenario subsets that are reasonably representative of the full 10,000 scenario set for

Scenario Picker Tool Decision Points:

1. **Decision Point:** Should there be a scenario picker that is included as part of the economic scenario
Drafting Group Recommendation: Yes, with understanding that single methodology would not

2. **Decision Point:** Should custom stratifications be allowed, for both VM-20 and VM-21, if the company provides an off-cycle or model office comparison between the subset and full 10,000 to show
Drafting Group Recommendation: Yes. This may reduce the importance of having a perfect response

3. **Decision Point:** What size of subsets are needed?
Original Proposal: 50, 200, 1000, 2000.
Drafting Group Discussion: Requests were made for additional 500 and 5,000 scenario sets, but the potential for a tool to produce custom # scenario sets may mitigate the need to produce numerous

4. **Decision Point:** Should there be stratification based on interest rates and/or equity?
Original Proposal: There should be two or three versions of the scenario picker tool, which stratify
Drafting Group Recommendation: Allow for option to stratify based on interest and equity.

5. **Decision Point:** For interest rates, what tenor(s) should be used for stratification?
Proposal: This may be a limitation in the current scenario picker tool. Consider multiple metrics based
No Drafting Group Recommendation

6. **Decision Point:** What metric should be used for stratification?
Proposal: Evaluate whether the current scenario picker's metric is reasonable, aside from its narrow
No Drafting Group Recommendation

Generator of Economic Scenarios (GOES) (E/A) Subgroup
Virtual Meeting
December 18, 2023

The GOES (E/A) Subgroup of the Life Risk-Based Capital (E) Working Group and Life Actuarial (A) Task Force met Dec. 18, 2023. The following Subgroup members participated: Mike Yanacheak, Chair (IA); Peter Weber, Vice Chair (OH); Wanchin Chou (CT); William Leung (MO); Seong-min Eom (NJ); Bill Carmello (NY); Rachel Hemphill (TX); and Craig Chupp (VA).

1. Discussed 2024 GOES Subgroup Meetings Plan

Scott O'Neal (NAIC) provided a walkthrough of the plan for various milestones to be met during 2024 GOES (E/A) Subgroup meetings (Attachment Thirty-Six-A). Regarding the milestone of reviewing the statistics against the criteria, Brian Bayerle (American Council of Life Insurers—ACLI) asked a question about the process of determining whether a particular scenario set has adequately met the criteria. Yanacheak replied that the process is not yet formalized, and the plan is to have the Subgroup formalize it.

2. Discussed the VA Model Office Testing Plan

Yanacheak provided background that the NAIC has engaged Oliver Wyman, an actuarial consulting firm, to assist with the model building and analysis of the variable annuity (VA) model office testing. O'Neal presented some background on the project and the advantages of performing model office testing before passing it off to Dylan Strother (Oliver Wyman) and Carson Cook (Oliver Wyman) to complete the presentation (Attachment Thirty-Six-B) on the AXIS model design.

Connie Tang (Retired) wanted to learn whether the separate account asset mix (bond fund versus equity fund) could be tested to understand the impact on reserves and capital. Tang also asked if multiple hedging strategies could be tested. O'Neal responded that only implicit hedging strategies would be modeled but noted that field test participants employed both implicit and explicit hedging strategies almost equally. Regarding separate account asset modeling, O'Neal said the most impactful testing would be pursued, but not every variation would be captured due to resource limitations. Yanacheak added that the hope is that companies will be willing to provide feedback when the model office results do not reflect company impacts because of differences in product design, asset strategy, or some other feature of the model. Eom asked about the timing and plan to expose various sensitivity tests. O'Neal replied that additional testing would be performed once Conning releases new scenario sets.

Having no further business, the GOES (E/A) Subgroup adjourned.

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Week Beginning	Meeting Discussion Topic	Milestone
12/18/2023	Kick-off Call for GOES (E/A) Subgroup	
12/25/2023	[redacted]	
1/1/2024		
1/8/2024	Scenario Stratification and Statistics	
1/15/2024	Equity-Treasury Linkage	•NAIC and Oliver Wyman Perform Model Office Testing
1/22/2024	Corporate Model Quantiative Comparison	•Circulate any promising scenario sets. Individual Companies with capacity that wish to do so are encouraged to test using their own models and share results with regulators.
1/29/2024	SERT Scenario Methodology	•GOES Subgroup calls to review scenario statistics against acceptance criteria, review model office results.
2/5/2024	Preliminary Model Office Testing Results	•Adopt Final Stylized Facts and Acceptance Criteria. Conning to recalibrate if regulators have substantial edits
2/12/2024	Valuation Dates and Other Field Test Parameters	
2/19/2024	Discuss Model Calibration	
2/26/2024	Valuation Manual and RBC Instruction Changes	
3/4/2024	[redacted]	
3/11/2024		Present Model Office Results, Expose Scenario Set(s).
March - June		Unaggregated GOES Field Test (VM-20, VM-21/C3P2, and C3P1), If Needed
June-July		Reg-Only Company Presentations of Unaggregated GOES Field Test (VM-20, VM-21/C3P2, and C3P1) Results, If Needed
July-Sept		VM-22 Field Test

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NAIC
National Association of Insurance Commissioners

ACTUARIAL SUPPORT FOR MODEL OFFICE ANALYSIS

GOES Subgroup update

December 18, 2023

A business of Marsh McLennan

CONFIDENTIALITY

Draft

CONTENTS

01

BACKGROUND

Model Office Testing

Field Testing

- **Advantages:**
  - Obtains impacts that account for company-specific factors such as product variation, existing asset portfolio and reinvestment assumptions, cost structure, etc.
- **Disadvantages:**
  - Resource intensive for companies to participate and for NAIC to compile results
  - Lack of transparency into understanding individual company results
  - Limited participation for certain products/frameworks resulted in unknown applicability to overall industry

Model Office Testing

- **Advantages:**
  - No effort required from industry other than reviewing results
  - Potential for quicker feedback on candidate scenario sets
- **Disadvantages:**
  - Model office only a proxy for impact to industry
  - Will not cover entire range of product- and company-specific impacts

NAIC Model Office

Variable Annuity and Registered Index-Linked Annuity Model Office

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

ULSG and Term Model Office

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

NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

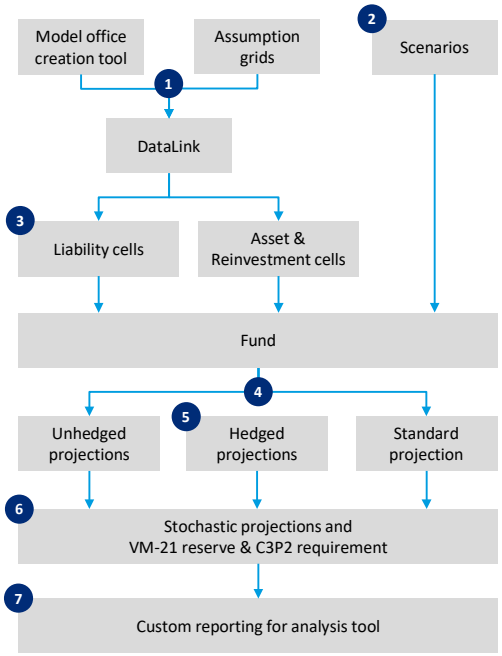
5

02

MODELING CAPABILITIES

VA AXIS MODEL DESIGN OVERVIEW

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



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Design notes

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

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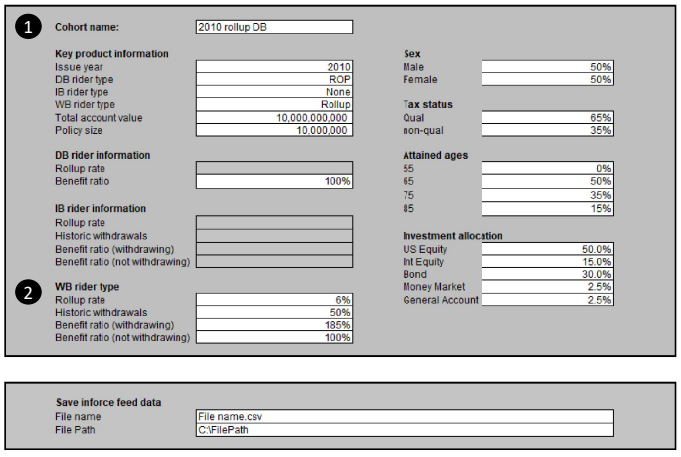
REPRESENTATIVE POPULATION GENERATION ("MODEL OFFICE CREATION TOOL")

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

VA model office creation tool



Key features

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

03
APPROACH

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MODEL OFFICE DEVELOPMENT

Field testing was used to inform the model office

Distribution of riders included in initial field testing

= included in model office

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

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

Model office archetypes – GMWB/GMDB combo

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

Total combinations
- 16 archetypes that vary by key characteristics
- **Example archetype:** strong guarantee, implicit hedging, mature block, ITM

GMWB guarantee strength
- Strong guarantee
- Weak guarantee

Hedging
- Implicit hedge
- No hedge

Block maturity
- New
- Mature

Moneyness
- ITM
- OTM/ATM

Static inputs
- M/F sex split
- Q/NQ split
- Equity allocation

VARIABLE ANNUITY GMWB/GMDB COMBO IN-FORCE ARCHETYPES

Scenario sensitivity will be tested over 16 archetypes

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

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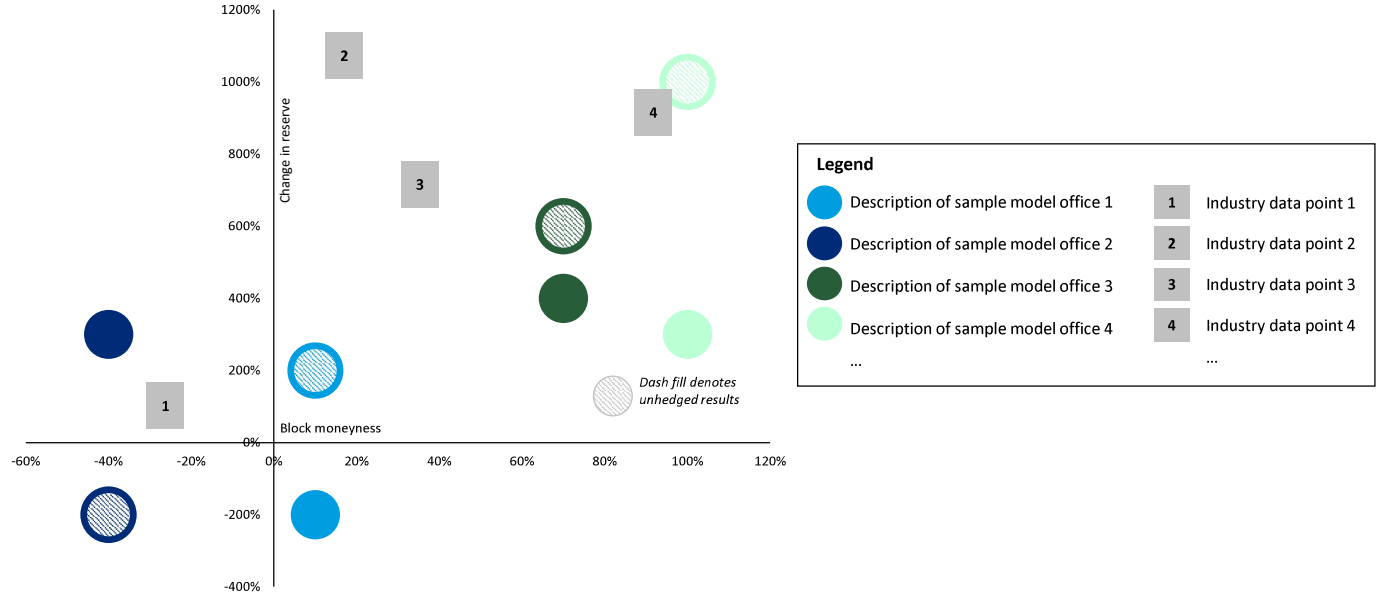
POTENTIAL EXAMPLE DELIVERABLE

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

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



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Updates on Actuarial Guideline 53

Fred Andersen, FSA, MAAA

3/14/2024

AG 53 provides uniform guidance for the asset adequacy testing applied to life insurers and is effective for reserves reported with respect to the Dec. 31, 2022, and subsequent annual statutory financial statements. A statement of actuarial opinion on the adequacy of the reserves and assets supporting reserves after the operative date of the Valuation Manual is required under Section 3B of the NAIC Standard Valuation Law (#820) and VM-30 of the Valuation Manual. Section 14A of Model #820 provides that actuarial opinions and related documents, including an asset adequacy analysis, are confidential information, while Section 14B provides that such confidential information may be shared with other state regulatory agencies and the NAIC. The asset adequacy analyses required under AG 53 reviewed in the preparation of this report were shared with the Valuation Analysis (E) Working Group and the NAIC in accordance with these requirements and continue to remain confidential in nature.

Notice Regarding Confidentiality

AG 53 provides uniform guidance for the asset adequacy testing, and is effective for reserves reported with respect to the Dec. 31, 2022, and subsequent annual statutory financial statements. A statement of actuarial opinion on the adequacy of the reserves and assets supporting reserves after the operative date of the Valuation Manual is required under Section 3B of the NAIC Standard Valuation Law (#820) and VM-30 of the Valuation Manual. Section 14A of Model #820 provides that actuarial opinions and related documents, including an asset adequacy analysis, are confidential information, while Section 14B provides that such confidential information may be shared with other state regulatory agencies and the NAIC. The asset adequacy analyses required under AG 53 reviewed in the preparation of this report were shared with the Valuation Analysis (E) Working Group and the NAIC in accordance with these requirements, and continue to remain confidential in nature.

Data Limitations

- Asset information shown in the slides that follow rely on data submitted by companies in their AG 53 templates. The NAIC took steps to review the data for reasonableness. However, the accuracy and reliability of the results are ultimately dependent on the quality of participant submissions.
- Some of the submitted data was adjusted to make it useable and help ensure greater consistency of reporting across companies. For example: 1) units were changed from dollars to millions where necessary; 2) asset types were mapped to those listed in the standard AG 53 template for companies that substituted different asset descriptions; 3) aggregated initial asset summary templates were created for companies that provided templates by segment but not in total; 4) templates submitted as PDFs were converted to Excel.
- Some companies did not submit AG 53 templates or did not complete all of the AG 53 template tabs.

AG 53 Reviews – Progress

- <u>Net yield assumptions</u>
  - Most cases:
    - Companies will add all the recommended conservatism
    - Will be removed from outlier list.
  - Several other cases:
    - Company will significantly increase the conservatism
    - OK for year-end 2023 but will re-address for year-end 2024
  - A few exceptions
    - e.g., financial exams currently in place
    - Will follow up on these cases

AG 53 Reviews – Progress

- Reinsurance collectability
  - Coordinate with potential reinsurance ceded asset adequacy analysis project
    - e.g., : US stat reserve of $100 -> $70 after reinsurance ceded
    - Asset adequacy analysis would help ensure $70 is adequate under:
      - Moderately adverse conditions and
      - Reasonable and transparent assumptions
        - e.g., on asset returns, guarantee utilization, mortality / longevity
  - Collectability is more focused on, e.g., $70 is adequate reserve under reasonable assumptions but assuming company has very low amount of capital
    - Inquiries note that ceding companies are relying on monitoring, analysis, and asset requirements to determine any collectability issues

AG 53 Reviews – Progress

- Investment Expenses
- Analyzing two aspects:
  - Are investment expenses sufficiently modeled in asset adequacy analysis?
    - If trending towards more complex assets with more attention and expertise needed, future investment expenses will likely be higher and should be modeled that way
  - Is the amount of investment expenses leaving the insurer reasonable?
    - Is there appropriate value being returned?
    - Arms-length
    - Coordinating with other NAIC groups on this aspect of the review

AG 53 Reviews – Progress

- Attribution Analysis
  - Observations of assignment of excess spread to:
    - Credit risk
    - Illiquidity risk
    - Other risks

Attribution Analysis related to Assumptions on Projected High Net Yield Assets (PHNY)

AG 53, Section 5.B:

For projected high net yield assets for non-equity-like instruments, either currently held or in assumed reinvestments, perform and disclose the following attribution analysis steps at the asset type level associated with the templates in Section 6:

i. State the assumed Guideline Excess Spread.

ii. Estimate the proportion of the Guideline Excess Spread attributable to the following factors:

(a) Credit risk

(b) Illiquidity risk

(c) Deviations of current spreads from long-term spreads defined in Appendix 1

(d) Volatility and other risks (identify and describe these risks in detail)

iii. Provide commentary on the results of Section 5.B.ii. Also, where judgment is applied, provide supporting rationale of how the expected return in excess of the Investment Grade Net Spread Benchmark is estimated.

Guidance Note: A best-efforts approach is expected for the year-end 2022 attribution analysis.

Guideline Excess Spread = Max (Net Market Spread – Investment Grade Net Spread Benchmark, 0)

Section 5b: Attribution for Asset Adequacy Testing Guideline Excess Spreads - Initial Assets

Asset Type	Net Market Spread	IG Net Spread Benchmark[1]	Guideline Excess Spread	*Excess Spread Components Related to Each Risk* Credit Risk	Illiquidity Risk	[Other Risk Component #1]	[Other Risk Component #2]	[Other Risk Component #3]	[Other Risk Component #4]	[Other Risk Component #5]
Treasuries and Agencies	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Public Non-Callable, Non-Convertible Corporate Bonds[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Callable Bonds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Convertible Securities[3]	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Floating Rate Corporate Notes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Municipal Bonds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other Private Bonds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Convertible Preferred Stock	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Agency Mortgage Backed Securities	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Agency Commercial Mortgage Backed Securities	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Agency Residential Mortgage Backed Securities	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Collateralized Loan Obligations	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other Asset Backed Securities	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Equities or Equity-Like Instruments	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Real Estate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mortgage Loans	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Schedule BA Assets - Equity-Like Instruments	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Schedule BA Assets - Non-Equity-Like Instruments	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Derivative Instruments	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other - Not Covered Above	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

(1) "IG Net Spread Benchmark" = Investment Grade Net Spread Benchmark
(2) Only include public non-convertible, fixed-rate corporate bonds with no or immaterial callability
(3) Convertible securities include convertible preferred stock

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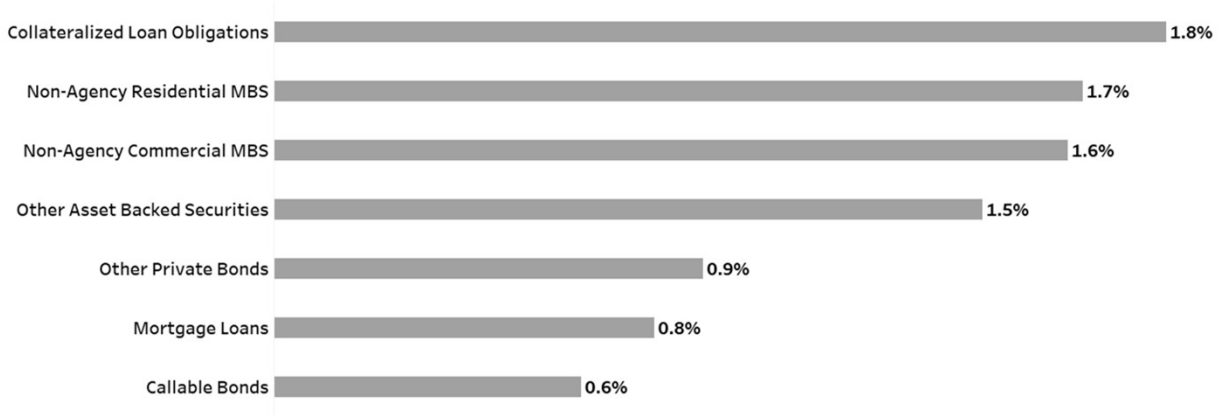
Average Guideline Excess Spreads for Initial Assets at Year-end 2022



Notes:
Includes companies with PHNY > 0 and Guideline Excess Spread > 0
Each asset type shown has a company count of 75 or more
Average Guideline Excess Spread is weighted by PHNY
MBS = Mortgage-Backed Securities

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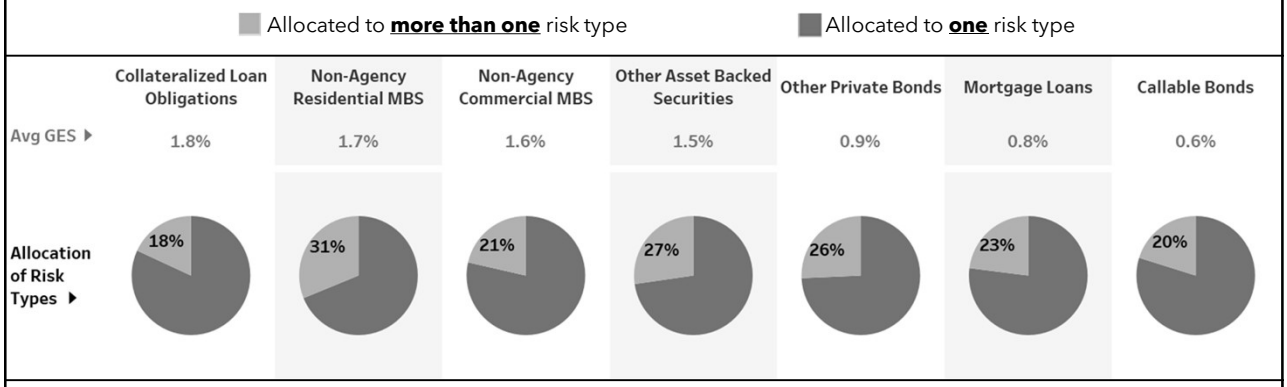
Attribution of Guideline Excess Spreads (GES)

for Initial Assets

Across all asset types, **less than 1/3** of companies attributed the excess spread to **more than one risk type**.



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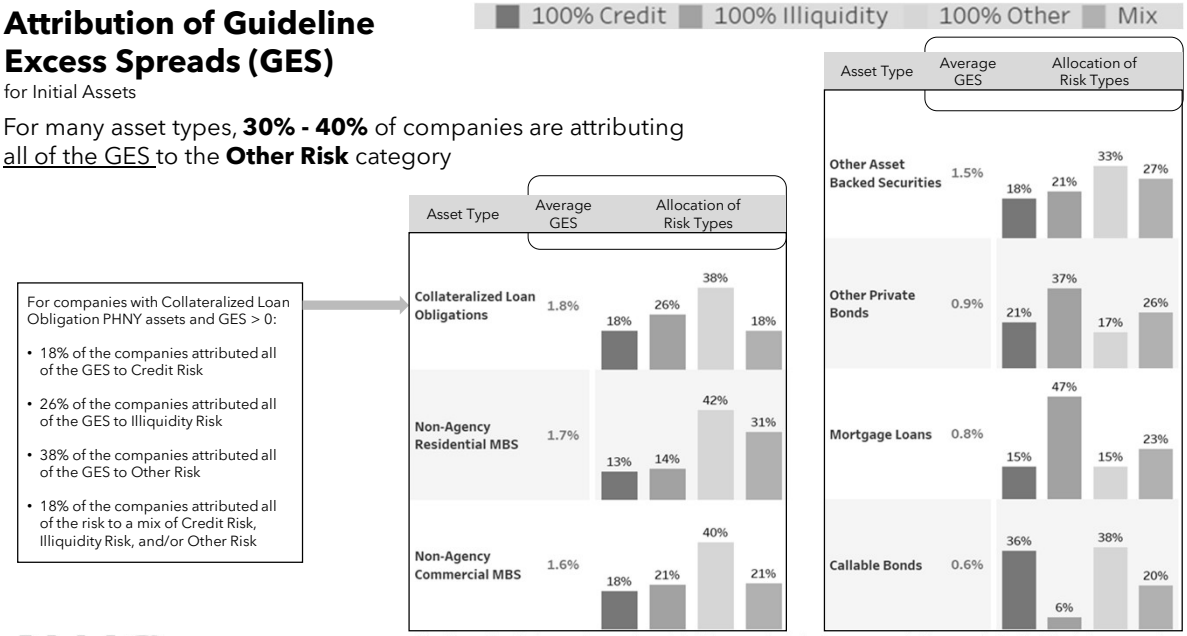
Attribution of Guideline Excess Spreads (GES)

for Initial Assets

For many asset types, **30% - 40%** of companies are attributing all of the GES to the **Other Risk** category

For companies with Collateralized Loan Obligation PHNY assets and GES > 0:

- 18% of the companies attributed all of the GES to Credit Risk
- 26% of the companies attributed all of the GES to Illiquidity Risk
- 38% of the companies attributed all of the GES to Other Risk
- 18% of the companies attributed all of the risk to a mix of Credit Risk, Illiquidity Risk, and/or Other Risk



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Asset Intensive Reinsurance Ceded Offshore from U.S. Life Insurers (with focus on Bermuda)

Patricia Matson, MAAA, FSA

Chairperson, Asset Adequacy and Reinsurance Issues Task Force

American Academy of Actuaries

1

Motivations for Offshore Reinsurance

2

- Reserving, Hedging, Capital, and Accounting Efficiencies
- Investment Flexibility
- Localized Expertise and Innovation
- Tax Efficiency
- Strong regulatory framework (Bermuda)

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2

Existing Actuarial Guidance

3

- Under current statutory rules, the cedant's Appointed Actuary must perform asset adequacy testing (AAT) for all direct business (including reinsured)
- There is no prescribed methodology, but ASOP No. 22 provides the following examples of AAT approaches:
  - Cash flow testing
  - Gross premium reserve test
  - Demonstration of conservatism
  - Demonstration of immaterial variation
  - Risk theory techniques
  - Loss ratio methods
- ASOP No. 11 states that the actuary should take into account counterparty risks that impact the asset adequacy analysis report

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AAT Approaches

4

Approach	Considerations
Perform cash flow testing	• Whether cedant's analysis can reliably extend to reinsured business • Whether data is available • Potential to leverage existing cash flow projections used for other purposes (e.g. enterprise risk management (ERM) • Still important to consider counterparty risk (and required by ASOP No. 11)
Leverage reinsurer SBA	• May include sufficient information to assess asset adequacy under moderately adverse conditions • Some adjustments may be necessary to meet the purpose of the analysis • ASOP No. 22 requires consideration of any cash flow differences • Still important to consider counterparty risk
Assess counterparty risk	• Important regardless of the AAT method • Reinsurance receivable is the asset being tested for adequacy • Consider reinsurer credit rating, default and recovery probabilities, and specifics of the reinsurance program

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Additional Counterparty Risk Considerations

5

- Significant guidance in ASOP No. 11 and ASOP No. 7
- Additional information in the Credit for Reinsurance Practice Note
- Treaty provisions can be used to reduce counterparty risks
  - Collateral requirements
  - Investment guidelines
  - Recapture provisions
- Regulatory notice requirements for concentration risks

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5

Collateral Provisions

6

- Collateral is used to secure the obligations of the reinsurer
- Most common forms of collateral are:
  - Funds withheld
  - Collateral trust
  - Letter of credit
- Historically, unauthorized reinsurers required to hold collateral, but this has changed for certified and reciprocal jurisdiction reinsurers
- Collateral may bring its own risks:
  - Insufficient level of collateral
  - Illiquid collateral unavailable when needed
  - Under funding by the counterparty

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Aggregation

7

- Under AAT, the Appointed Actuary may aggregate blocks together.
- Per ASOP No. 22, "When performing this aggregation, the actuary should not use assets or cash flows from one block of business to discharge the reserves and other liabilities of another block of business if those assets or cash flows cannot be used for that purpose."
- Depending on the reinsurance structure, assets from a reinsurance treaty may not be available for use for another block of business, and therefore aggregation would not be allowed.
- Bermuda also does not allow aggregation unless the insurer demonstrates that the assets can be used across those lines of business (in both normal and adverse scenarios).

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Recapture/Termination

8

Most agreements allow cedant to recapture, and ASOP No. 11 identifies the following risks that should be reflected in the actuary's financial report:

- Impact of potential termination, including post-termination obligations
- How the following factors affect risk of termination
  - Agreement terms and conditions
  - Regulatory and financial reporting regime
  - Known business practices of counterparties
  - Current and potential internal and external environments
- Actuary should consider performing scenario testing to quantify the impact of a potential termination event

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8

Retrocession

9

- Common in the reinsurance industry
- Bermuda Monitory Authority (BMA) monitors this and may correspond with home regulator
- Treaty terms may require disclosure, but unusual
- Management of the risk by the cedant includes:
  - Insolvency considerations
  - Disclosure requirements
  - Relationship management
  - Risk diversification

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9

Questions?

10

For further information, please contact Amanda Barry-Moilanen, life policy analyst, at barrymoilanen@actuary.org.

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10

Reinsurance Ceded Cash Flow Testing Discussion Items

Fred Andersen, FSA, MAAA

3/14/2024

What is the issue? What are state regulators trying to accomplish?

- State regulators oversee the reserves and solvency of US insurers.
- Reinsurance activity is taking place where reserves are held lower than US statutory standards.
  - In some cases, reserves are substantially lower, disappear, or can even be negative
- It is important to know if the lower reserve amounts are adequate.
- One way to evaluate reserve adequacy is with asset adequacy analysis using appropriate assumptions.
  - For example, is reserve adequacy achieved only with aggressive asset return, guarantee utilization, or mortality / longevity assumptions?
- Whether reserves are adequate using appropriate assumptions is important for US regulators to know when the reserves and supporting assets are impacting US insurers.

Goals

- Provide US state regulators what is needed to review the reserves & solvency of US life insurers.
- Steer clear of conflict with reciprocal jurisdiction / covered agreement issues.
  - Regarding treating certain reinsurance arrangements differently than others.
- Prevent work by US ceding companies where there's immaterial risk.

Basic Considerations

- Considerations re: whether cash-flow testing should be performed on ceded business:
  - Does the assuming company not submit a VM-30 actuarial memorandum to a US state regulator?
    - Consider carve out when reinsurer submits VM-30 in US
  - Does the assuming company hold reserves lower than US statutory reserves?
  - Does the assuming company not have substantially high capital (or other safeguards in place) to minimize collectability risk?
    - Should this risk be handled separately, as part of reinsurance collectability inquiries?
    - Should capital level be considered if higher than US even if reserves are less than US?
  - Is the assuming company affiliated with the ceding company?
    - Potentially signaling reserve reduction as a driver of the transaction

Specific Considerations to Drive Discussion

- Terminology "Gross of reinsurance" testing
- Materiality determination
- Aggregation level / prior approval
- Retrospective or prospective application
- Asset assumption guardrails / lessen need to have knowledge of assets
- Other assumption guardrails
- Considerations for holding additional AAT reserves
- Sensitivity testing versus baseline testing

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Example of Cession of U.S. Asset Intensive Reinsurance Offshore/Captive

In the example below, AIR is ceded via 100% coinsurance to either an offshore reinsurer or a U.S. captive that is not subject to the requirements of the valuation manual

Item	US Statutory	Offshore/Captive
Formula Reserves	$100	NA
Total Reserves*	$100	$64
Total Capital	$6	$2
Total Asset Requirement	$106	$66

When cash flow testing (CFT) is run standalone for this business, it shows that $80 of reserves are needed to runoff liabilities under moderately adverse conditions, and $70 under best estimate conditions (this is *before* consideration of required capital)

Significant reduction in total policyholder funds due to regime differences

*US total reserves are formula reserves plus AAT reserves

Reserves are insufficient but even more concerning, even TAR is insufficient even in a best estimate scenario

6

Appendix – Example of VM or AG Wording

Example of Wording re: Gross of Reinsurance AAT

- Language like the following could be added as subsection 2.C.4 "Liabilities To Be Covered" in VM-30 or similar language could be incorporated in an Actuarial Guideline:
  - All business written or assumed by a United States life insurer shall be subject to the standards of asset adequacy analysis, as described in Section 2.B. Therefore, in addition to other applicable requirements in VM-30, asset adequacy analysis shall be completed on a gross of reinsurance basis for any *[material]* blocks of business that are reinsured, whether through an alien reinsurance transaction or a domestic reinsurance transaction.
  - For any *[material]* blocks of business that are reinsured, the business ceded shall be tested on a standalone basis.

(continued)

Example of Wording re: Gross of Reinsurance AAT

- Sample language, continued…
  - *[For the purposes of this standalone testing, reinsurance arrangements with the same legal entity serving as the counterparty (but by line of business / with similar risk profile) may be aggregated.] [Additional aggregation, for example across affiliated legal entities, may be permissible if supported and with prior approval of the domiciliary commissioner, who will consult with the NAIC's Valuation Analysis Working Group when reviewing the request.]*
  - *[The domiciliary commissioner may also accept standalone testing performed by the counterparty, if it is made available to the domiciliary commissioner and is otherwise compliant with these requirements.] [This requirement applies to all reinsurance transaction executed on or after XX/XX/XXXX.]*

Questions and Considerations: Concepts in Wording Example

- All business written or assumed by a United States life insurer shall be subject to the standards of asset adequacy analysis, as described in Section 2.B. Therefore, in addition to other applicable requirements in VM-30, asset adequacy analysis shall be completed on a **gross of reinsurance** basis for any material blocks of business that are reinsured, whether through an alien reinsurance transaction or a domestic reinsurance transaction.
- "Gross of reinsurance" terminology:
  - The most accurately descriptive terminology?
  - Or should the focus be on the starting assets being the amount actually held, including by the assuming company?

Questions and Considerations: Concepts in Wording Example

- For any **material** blocks of business that are reinsured, the business ceded shall be tested on a standalone basis.

- Materiality determination could be based on:
  - Judgment but with general guidance of:
    - 10-20% of reserves ceded to single reinsurer?
    - % of surplus?
    - Cap at the largest 3 or so material asset intensive reinsurance treaties per ceding company?

Questions and Considerations: Concepts in Wording Example

- For the purposes of this standalone testing, reinsurance arrangements with the same legal entity serving as the counterparty may be **aggregated**. Additional aggregation, for example across affiliated legal entities, may be permissible if supported and with **prior approval** of the domiciliary commissioner, who will consult with the NAIC's Valuation Analysis Working Group when reviewing the request.

- What aggregation level makes sense?
  - Will assets from Treaty A cover a shortfall on Treaty B?
  - Amount of regulator discretion?
    - What sort of regulator coordination is needed to ensure a level playing field?
  - Note that an insolvent counterparty won't use surplus from other counterparties.

Questions and Considerations: Concepts in Wording Example

- This requirement applies to all reinsurance transaction executed on or after XX/XX/XXXX.
- Retrospective (including past treaties) or Prospective application?
  - Focus on recent years' transactions?

Example Addition of Asset Documentation for Gross AAT

- Language like the following could be added as subsection 3.B.10.f and 3.B.10.g in VM-30 or similar language could be incorporated in an Actuarial Guideline:
  - f. If, under the terms of a reinsurance agreement, some of the assets supporting the reserve are held by the counterparty or by another party:
    - i. A description of the degree of linkage between the portfolio performance and the calculation of the reinsurance cash flows.
    - ii. The sensitivity of the valuation result to the asset portfolio performance.

(continued on next slide)

Example Addition of Asset Documentation for Gross AAT

- Language like the following could be added as subsection 3.B.10.f and 3.B.10.g in VM-30 or similar language could be incorporated in an Actuarial Guideline:

  - g. To the extent that asset adequacy analysis is necessary pursuant to Section 2.C.4:

    i. A comparison of the amount of assets held by the counterparty or other party to the assets included in asset adequacy analysis (note that these amounts should be the same).

    ii. The investment strategy of the company holding the assets, as codified in the reinsurance agreement or otherwise based on current documentation provided by that company. *[If this information is not available, a discussion of why the investment strategy modeled by the cedant for the gross analysis is prudent and appropriate.] [If this information is not available, asset modeling shall comply with the relevant asset modeling requirements and guardrails in VM-20 and VM-21.]*

    iii. Actions that may be taken by either party that would affect the net reinsurance cash flows (e.g., a conscious decision to alter the investment strategy within the guidelines).

Questions and Considerations

- The investment strategy of the company holding the assets, as codified in the reinsurance agreement or otherwise based on current documentation provided by that company. *[If this information is not available, a discussion of why the investment strategy modeled by the cedant for the gross analysis is prudent and appropriate.] [If this information is not available, asset modeling shall comply with the relevant asset modeling requirements and guardrails in VM-20 and VM-21.]*

- Assumption guardrails
  - Asset assumption guardrails can make it unnecessary to know the actual assets
    - Will reserves be adequate under reasonable asset return assumptions?
    - Actual assets or proxy can be used if known, otherwise apply VM-20 guidance
  - Guarantee utilization and mortality are among other key assumptions
    - Differences between VM-30 or formulaic / PBR assumptions from those underlying the assuming company's reserves should be discussed

Example Addition of Gross of Reinsurance AAT

- Language like the following could be added as subsection 2.C.5 in VM-30 or similar language could be incorporated in an Actuarial Guideline:
  - If the appointed actuary determines, as the result of gross standalone asset adequacy analysis for any business that is reinsured by an entity outside the scope of VM-30, that a reserve should be held in addition to the aggregate reserve held by the company and calculated in accordance with the requirements set forth in the Valuation Manual, the company shall establish the additional reserve. *[Considerations to be evaluated when determining whether an additional reserve is needed shall include but not be limited to:*
    - *Where applicable, do the assuming company's standalone cash-flow testing results (whether produced by the assuming company or the ceding company) show deficiencies?*
    - *Are any assuming company standalone cash-flow testing deficiencies offset by other assuming company's blocks' sufficiencies?]*

Questions and Considerations

- *[Considerations to be evaluated when determining whether an additional reserve is needed shall include but not be limited to:*
  - *Where applicable, do the assuming company's standalone cash-flow testing results (whether produced by the assuming company or the ceding company) show deficiencies?*
  - *Are any assuming company standalone cash-flow testing deficiencies offset by other assuming company's blocks' sufficiencies?]*
- Regarding holding additional asset adequacy analysis reserves in relation to the ceded block of business:
  - Where applicable, do the assuming company's standalone cash-flow testing results show deficiencies?
    - Whether produced by the assuming company or the ceding company.
  - Are any assuming company standalone cash-flow testing deficiencies offset by other assuming company's blocks' sufficiencies?

SOCIETY OF ACTUARIES RESEARCH UPDATE TO LATF

March 14, 2024

Dale Hall, FSA, MAAA, CERA
Managing Director of Research

1

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2

2

2015-2021 Universal Life Lapse and Surrender

- Study was published in November 2023
- First part of a Premium Persistency/Lapse and Surrender analysis
- Public report is available
- For access to full report and detailed study results in Tableau, companies must purchase the Standard Data Package (SDP)

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3

3

Robust/Credible Data

Metric	Current Study	Previous Study
Release date	November 2023	September 2018
Contract years studied	2015-2021	2009-2013
Policy exposures	33.5 million	8.9 million
Face amount exposures	$8.5 trillion	$2.8 trillion
Number of companies	24	11

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4

Available Data Elements

- Product types
  - Traditional Universal Life
  - Universal Life with a Secondary Guarantee
  - Indexed Universal Life
  - Indexed Universal Life with a Secondary Guarantee
  - Variable Universal Life
  - Variable Universal Life with a Secondary Guarantee
- Other data dimensions
  - Sex, policy year, study year, issue age, face amount, risk class

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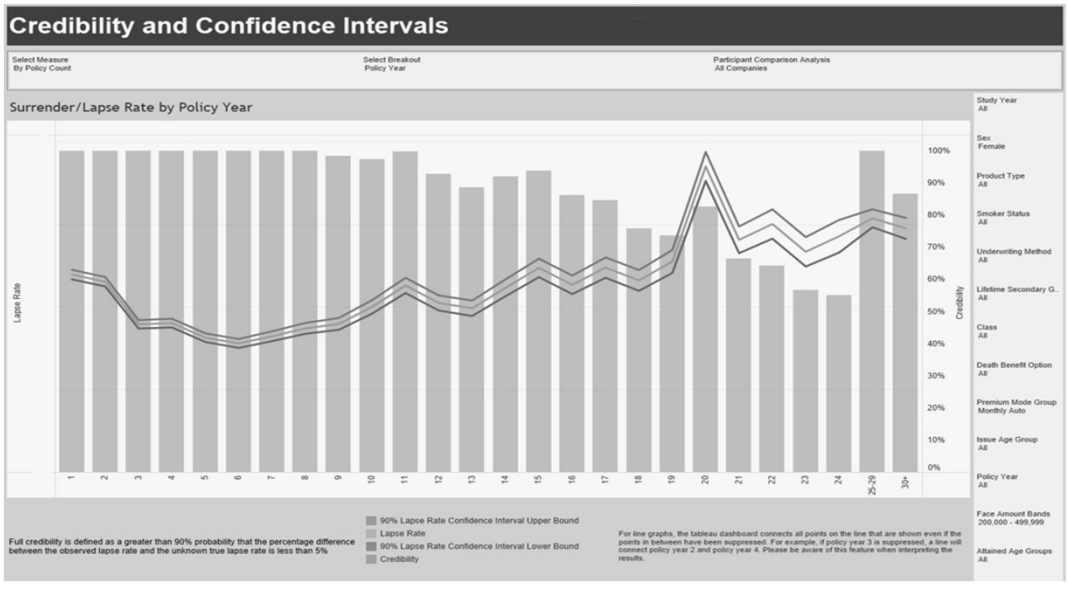
5

New Metrics



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2019-2021 Variable Annuity Contract Owner Behavior Study

- Study was published in November 2023
- This is the third study released under Experience Studies Pro, the partnership between the SOA Research Institute and LIMRA
- For access to full report and detailed study results in Tableau, companies must purchase the Standard Data Package (SDP); state regulators access
- A short report with high-level insights is available to the public
- Link to study: https://www.soa.org/resources/experience-studies/2023/19-21-va/

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2019-2021 Variable Annuity Contract Owner Behavior Study

- High-level summary:
  - Observation years studied: 2019-2021
  - Exposure by contract count: 10.5 million
  - Exposure by contract amount: $1.4 trillion
  - Number of surrenders: 500,000
  - Number of companies: 15
  - Market share: 64%
- Contract owner characteristics and behavior studied:
  - Business mix
  - Withdrawal activity, including under various GLBs (GLWB, GMIB, Hybrid Rider, RILAs, No Rider)
  - Premium deposit activity
  - Surrender activity

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2019-2021 Variable Annuity Contract Owner Behavior Study

Detailed results available in Tableau:

1. Annuitant Profiles	2. Equity Market Experience | GLB
3. APV vs. Contract Value	4. Comparison of ITM | GLWB
5. Withdrawal Activity	6. Withdrawal Amounts
7. First Withdrawals | GLWB	8. Withdrawal Rates by Issue Age and Contract Year | GLWB
9. Benefit Utilization - Total | GLWB	10. Benefit Utilization - Age | GLWB
11. Withdrawal Ratios | GLWB	12. Withdrawal Rates
13. Withdrawal Ratios Beginning and End of Year | GLWB	14. Additional Premium
15. Surrender Rate Analysis	16. Surrender Rates by Surrender Charge
17. Surrender Rates by Utilization	18. Surrender Rates by Withdrawal Method
19. Surrender Rates by Benefit Base to Contract Value Ratio | GLWB	20. Methodology and Definitions

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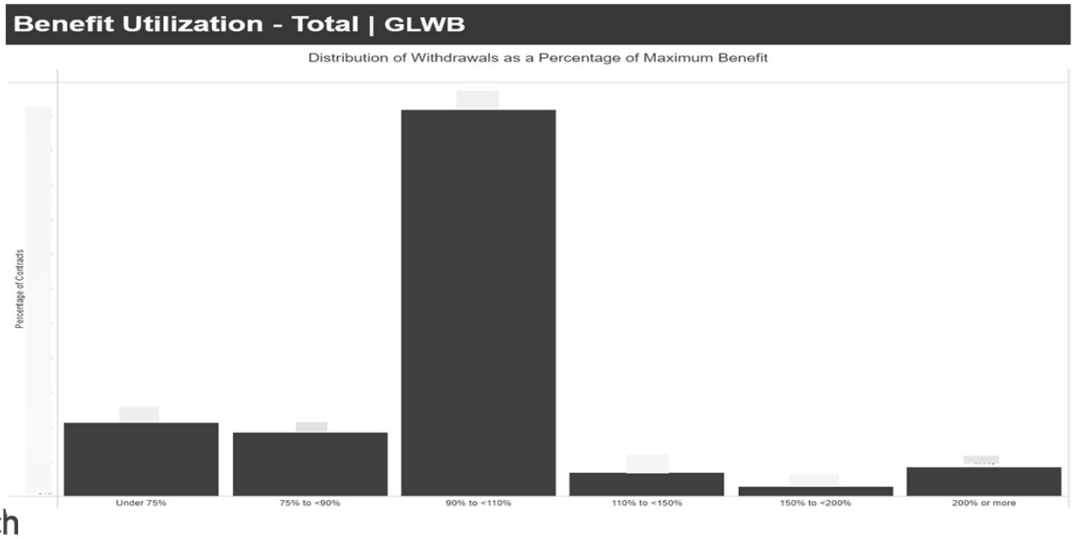
Data Visualization Examples



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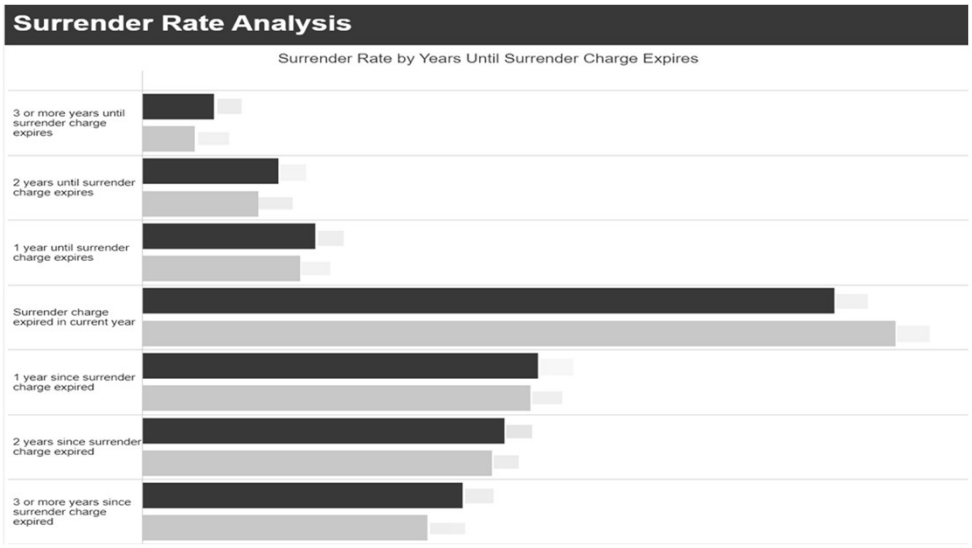
Data Visualization Examples



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Available on SOA website

https://www.soa.org/resources/experience-studies/2023/19-21-va/

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Group Annuity Mortality Response Letter

- SOA Research Institute does not believe mandatory experience reporting is necessary
- SOA and LIMRA have built infrastructure to produce efficient and timely experience studies
- SOA group annuity studies have met industry and valuation needs
- Industry may not have desired collar experience easily accessible for a mandatory data call

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2020-2021 Mortality by Socioeconomic Category Update

1. Update mortality by socioeconomic category series for 2020 and 2021.
2. Investigate how COVID-19 impacted different socioeconomic groups within the U.S. population.
3. Examine non-COVID-19 causes of death by socioeconomic groups
4. Identify future research needed

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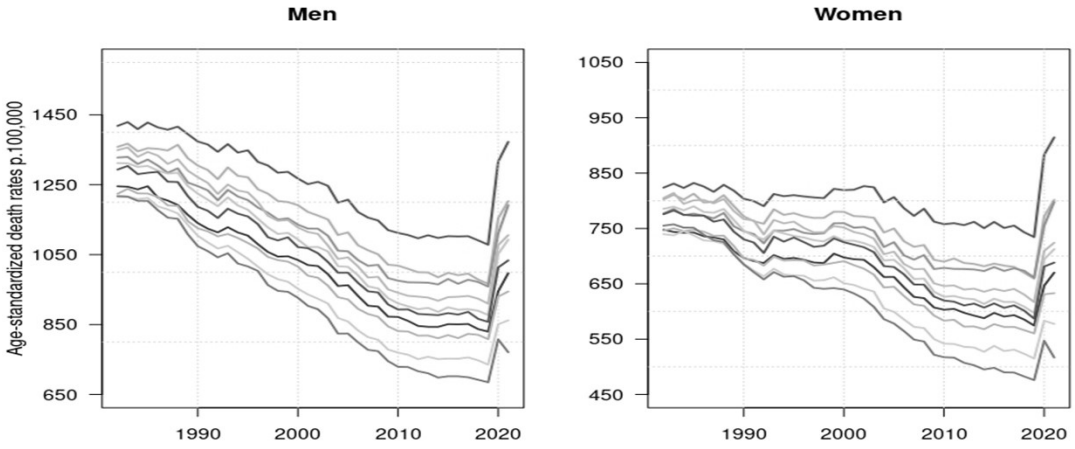
Increasing Gap in Mortality

Age-standardized death rate (all causes of death) by Socioeconomic Status decile (1982-2021)



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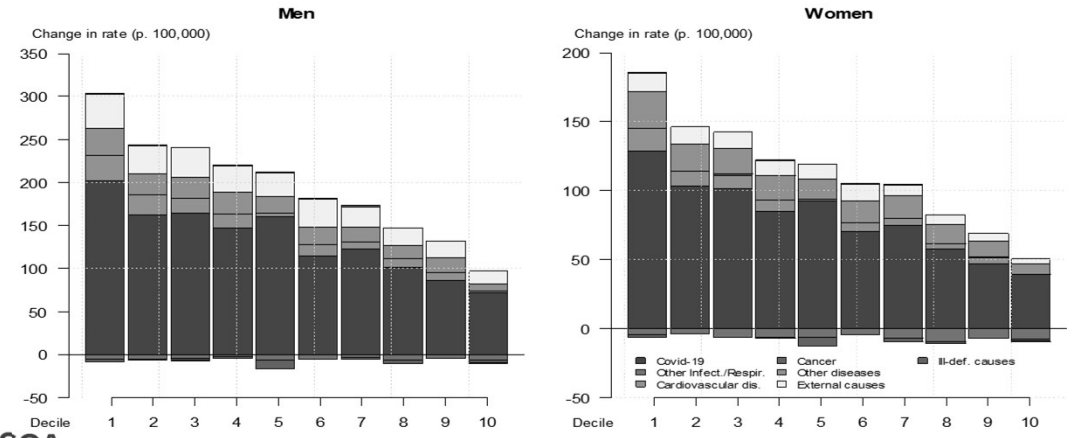
NON-Covid-19 Causes Also Played a Role in Excess

Cause-of-death contributions to the increase in the age-standardized death rates between 2019 and 2021 in each decile



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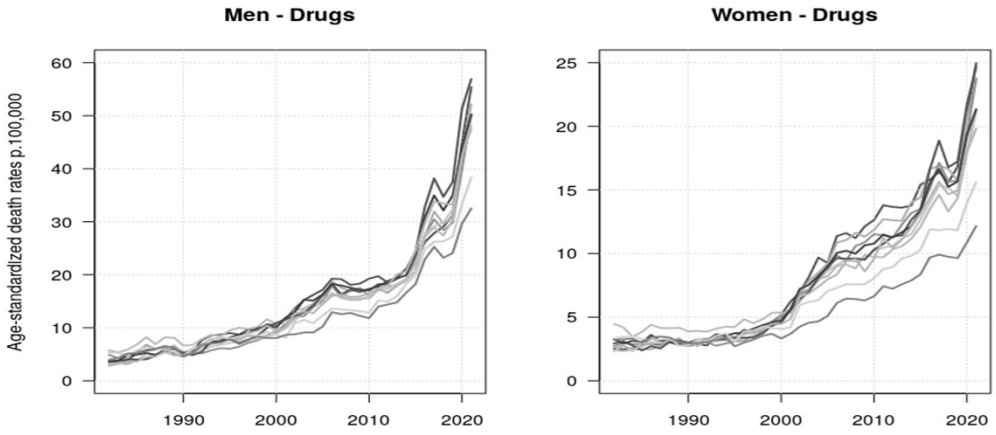
Not much difference by socioeconomic category when looking at drug overdoses

Age-standardized death rates for drug overdoses by decile and sex



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Next Steps

- Report Available by end of the month on SOA website
- Investigate how to address methodology for estimating single age mortality for 85 and over.
- Investigate implications of the research for MIM-2021
- Extend data series for 2022 NCHS

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Additional Life Research

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Experience Studies

Project Name	Objective	Link/Expected Completion Date
2015-21 Universal Life Lapse Surrender - Report	Analyze the premium persistency for universal life products - Data collection and validation phase	https://www.soa.org/resources/experience-studies/2023/15-21-ulls/
2023 Life Mortality Improvement	Develop AG38 mortality improvement assumptions for YE 2023	https://www.soa.org/resources/research-reports/2023/ind-life-mort-imp-scale/
COVID-19 Reported Claims Study - 2Q 2023 Update	Draft a research study reviewing Covid-19 reported deaths by quarter	https://www.soa.org/resources/research-reports/2023/us-ind-life-covid-rca-landing/
Economic Scenario Generator - 2024 Update	Update the AAA Economic Scenario Generator Annually.	3/29/2024
Life Predictive Mortality Model	The theme is around the sharing and warehousing of PA tools and information, similar to a data science environment.	3/31/2024
US Population Mortality Observations: Updated with 2022 Experience	Explore observations from the release of the 2022 U.S. population mortality data.	4/15/2024
ILEC Mortality Experience Report Update for 2018 - 2019	Draft a report updating the ILEC mortality experience reporting for 2019	4/25/2024
2015-21 Fixed Rate Deferred Surrender Study - Report	Complete a study of fixed rate deferred annuity surrender rates.	4/30/2024
2015-21 Universal Life Premium Persistency Study - Report	Analyze the premium persistency for universal life products - Data collection and validation phase	5/15/2024
Group Life COVID-19 Mortality Survey Update - 1Q24 Report	Complete an update on a mortality study assessing the impact of COVID-19 on Group Life Insurance.	5/31/2024

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Practice Research

Project Name	Objective	Link/Expected Completion Date
2023 Living to 100	Produce body of research to help with old age mortality modeling and projection and research to support the needs of an increasing aging population.	https://www.soa.org/resources/essays-monographs/2023-living-to-100-compendium/
Accelerated Underwriting Survey and Impact of COVID in Underwriting	Update prior survey and explore the way insurers have adapted their underwriting practices	https://www.soa.org/resources/research-reports/2023/acc-underwriting-practices-survey/
Behavioral economic in practice - Retirement	Study the economic and behavioral economic factors that influence Deferred Retirement Option Plans ("DROP") choices by plan participants	https://www.soa.org/resources/research-reports/2024/behavioral-econ-individual-discounting/
2022 Mortality by socioeconomic category update	Update mortality by socioeconomic lifetables with 2020 and 2021 data and examine the impact of COVID 19 on socioeconomic mortality trends	https://www.soa.org/resources/research-reports/2024/covid-socioeconomic-mortality/
Modeling and Forecasting Premature Cardiovascular Mortality	Examine cardiovacular disease mortality trends	https://www.soa.org/resources/research-reports/2024/modeling-premature-cardiovascular-mortality/
Challenges and Opportunities with Rethinking Fairness Metrics for Life Insurance Processes: An Actuarial Perspective	Summarize the challenges and complexities with defining and measuring fairness for life insurance products and processes.	https://www.soa.org/resources/research-reports/2023/fairness-metrics-life-insurance/
Mortality and Race	Summarize available literature on mortality and race and discuss actuarial aspects.	3/22/2024
Maternal Mortality	Study maternal mortality in US and compare to other countries	3/22/2024
Ethics and AI 2023 Update		3/27/2024
Using Behavioral Science to Improve Consumers' Comprehension and Appreciation of Life Insurance Products - RGA	Test and improve the life insurance communication using BE	3/31/2024
Redesigning the Life Insurance Underwriting Journey with Behavioral Economics - Scor	Test BE wording for underwriting questions to improve honesty in answers and address under-disclosure of medical conditions	3/31/2024
Statistical Approaches for Imputing Race and Ethnicity	Outline the various approaches for statistically imputing race and ethnicity in the U.S. along with their strengths and weaknesses to help familiarize actuaries with these techniques.	4/1/2024

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

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

February 29, 2024

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

Re: Amendment Proposal Form (APF) 2024-01 (Qualified Actuary Standard)

Dear Chair Hemphill:

The American Council of Life Insurers (ACLI) appreciates the opportunity to submit comments on APF 2024-01 which aims to add additional language to the VM-01 definition of "Qualified Actuary".

ACLI agrees with the need for robust educational and professionalism standards for actuaries. Qualified Actuaries requirements should be tailored to the appropriate needs of their role. The Specific Qualification Standards, while appropriate for Appointed Actuaries, may require Qualified Actuaries to have knowledge beyond the scope of their day-to-day work in terms of product type/focus to meet the requirements.

ACLI believes that a better solution would be the development of Knowledge Statements specific to the Qualified Actuary. Our understanding is that a similar effort for Appointed Actuaries is underway and may provide a better avenue to address appropriate requirements for Qualified Actuaries.

Thank you very much for the opportunity to submit comments on such an important issue for our industry and the actuarial profession and we look forward to conversation at future sessions of LATF.

Sincerely,

BBayerle Colin Masterson

cc: Scott O'Neal, NAIC

Life Actuarial (A) Task Force/ Health Actuarial (B) Task Force
Amendment Proposal Form*

1. Identify yourself, your affiliation, and a very brief description (title) of the issue.

Identification:
Rachel Hemphill, PhD, FSA, FCAS, MAAA

Title of the Issue:
Qualified Actuaries should meet the special qualification standards, in addition to Appointed Actuaries.

2. Identify the document, including the date if the document is "released for comment," and the location in the document where the amendment is proposed:

VM-01 definition of "Qualified Actuary"

January 1, 2024 NAIC Valuation Manual

3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted, or changed by providing a red-line (turn on "track changes" in Word®) version of the verbiage. (You may do this through an attachment.)

VM-01 definition of "Qualified Actuary":

- The term "qualified actuary" means an individual who is qualified to sign the applicable statement of actuarial opinion in accordance with the Academy qualification standards for actuaries signing such statements and who meets the requirements specified in the Valuation Manual.

Deleted: (Model #820 definition.)

A qualified actuary must meet the basic education, experience and continuing education requirements of the Specific Qualification Standard for Statements of Actuarial Opinion, NAIC Life, Accident & Health, and Fraternal Annual Statement, as set forth in the *Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion in the United States* (U.S. Qualifications Standards), promulgated by the Academy. An individual qualified actuary only must be qualified with respect to the area(s) that they are providing a certification and/or opinion. For example, if there are separate life and variable annuity qualified actuaries providing the relevant certifications for VM-20 and VM-21, they each need only be qualified in their own respective area.

4. State the reason for the proposed amendment? (You may do this through an attachment.)

For reference, the Model 820 Definition of qualified actuary is:

- The term "qualified actuary" means an individual who is qualified to sign the applicable statement of actuarial opinion in accordance with the American Academy of Actuaries qualification standards for actuaries signing such statements and who meets the requirements specified in the valuation manual.

Currently, the VM-01 definition of qualified actuary just reiterates that definition. But, as Model 820 specifically calls out "who meets the requirements specified in the valuation manual" adding the specific language is consistent with Model 820.

It is surprising that this is not already the requirement. The complexity of PBR and the reliance on the PBR actuary calls for this requirement, but the United States Qualification Standard (USQS) currently only requires the specific qualification standard for an appointed actuary, not a qualified actuary. The American Academy of Actuaries noted the USQS states that the NAIC or individual states may have additional

requirements. So, a change to the Valuation Manual is needed to ensure PBR actuaries have the 15 hours of specific continuing education and the more detailed basic education (which can be based on exams or self-study). While most qualified actuaries likely already are satisfying this requirement and some may have interpreted this as the current requirement (and some serve as appointed actuaries as well), this clarification is important where regulators have identified some companies whose qualified actuaries are not as knowledgeable as they need to be. This change will be consistent with feedback given by regulators to those qualified actuaries regarding ongoing education.

Similarly, VM-30 allows the appointed actuary to rely on memoranda that are prepared and signed by actuaries that are "qualified actuary within the meaning of the VM-01 definition thereof, with respect to the areas covered in such memoranda".

Specific sections of the USQS are included below; note that all included topics are broadly applicable to PBR qualified actuaries and actuaries that the appointed actuary is relying on for sections of their own memoranda, as well as appointed actuaries. Therefore, while we have revised the edits to reflect that "individual qualified actuary only must be qualified with respect to the area(s) that they are providing a certification and/or opinion" to absolutely ensure that no actuary is being held responsible for areas outside the scope of their work, this may be unnecessary due to the broad applicability of the general topic areas required by the specific qualification standard.

For reference, Section 3.1.1.1 of the USQS regarding Specific Qualification Standard basic education requirement:

> An actuary should successfully complete relevant examinations administered by the American Academy of Actuaries or the Society of Actuaries on the following topics: (a) policy forms and coverages, (b) dividends and reinsurance, (c) investments and valuations of assets and the relationship between cash flows from assets and related liabilities, (d) statutory insurance accounting, (e) valuation of liabilities, and (f) valuation and nonforfeiture laws.

For reference, Section 3.1.2 of the USQS regarding Specific Qualification Standard basic education requirement being satisfied through self-study:

> An actuary may also satisfy this basic education requirement by acquiring comprehensive knowledge of the applicable topics through responsible work and/or self-study. To comply with the basic education requirement through self-study, an actuary must obtain a signed statement from another actuary who is qualified to issue Statements of Actuarial Opinion under the specific qualification standard being met. This statement must indicate that the writer is familiar with an actuary's professional history and that an actuary has obtained sufficient alternative education to satisfy the basic education requirement for the specific qualification standard. A sample statement appears in appendix 2. This statement should be obtained before an actuary issues a Statement of Actuarial Opinion and should be retained by the actuary.

For reference, Section 3.3 of the USQS regarding Specific Qualification Standard continuing education requirement:

> To satisfy the Specific Qualification Standards, an actuary must obtain sufficient continuing education to maintain current knowledge of applicable standards and principles in the area of actuarial practice of the Statement of Actuarial Opinion. At a minimum, an actuary must complete 15 credit hours per calendar year of continuing education that is directly relevant to the topics identified in section 3.1.1. A minimum of 6 of the 15 hours must be obtained through experiences that involve interactions with outside actuaries or other professionals, such as seminars, in-person or online courses, or committee work that is directly relevant to the topics identified in section 3.1.1. Hours that satisfy the continuing education requirement of the Specific Qualification Standards may also be used to satisfy the continuing education requirement of the General Qualification Standard. Hours of continuing education in excess of the annual requirement may be carried forward one year.

Dates: Received	Reviewed by Staff	Distributed	Considered
12/08/2023	K.K		
Notes: 2024-01			

Academy Life Practice Council Update

Life Actuarial Task Force (LATF) Meeting

March 15, 2024

Amanda Barry-Moilanen
Policy Analyst, Life

American Academy of Actuaries

1

Recent Activity

2

The Life Experience Committee released a Resource and Discussion Guide on Dynamic Lapses.

In collaboration with the Academy's Risk Management and Financial Reporting Council, the Asset Adequacy and Reinsurance Issues Task Force released *Asset-Intensive Reinsurance Ceded Offshore From U.S. Life Insurers (With Focus on Bermuda)*.

The Economic Scenario Generator Subcommittee presented to the GOES (E/A) Subgroup on proposed "quadrant" criteria for the joint distribution of interest rates and equity returns.

American Academy of Actuaries

2

Recent Activity

3

Delivered comments to LATF on the re-exposure of APF 2023-12 concerning equity return volatility in VM-30 cash-flow testing.

Delivered comments to LATF, the Life RBC (E) Working Group, and the GOES Subgroup on the Dec. 12 exposure of the updated GOES Targeting Criteria and Evaluation Statistics.

Delivered comments to LATF's Valuation Manual (VM)-22 (A) Subgroup on the Nov. 2023 exposure of VM-31, VM-G, and the VM-22 PBR Supplement Blank.

American Academy of Actuaries

3

Ongoing Activity

4

- Ongoing support for the VM-22 Field Test
- Educational material on economic scenario generators and continued support for the GOES project
- Updating the Model Governance Practice Note
- Updating the Credit for Life Reinsurance Practice Note
- Updating the Asset Adequacy Analysis Practice Note
- Developing a Non-Guaranteed Elements Practice Note

American Academy of Actuaries

4

Academy Webinars and Events

5

Recent

- PBR Bootcamp: VM-31 as Seen by Regulators
- Group Annuity Contracts for Pension-Risk Transfer

Upcoming

- In-person PBR Bootcamp (June 11-13, Philadelphia)

American Academy of Actuaries

5

Thank you

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Questions?

For more information, please contact the Academy's life policy analyst, Amanda Barry-Moilanen (barrymoilanen@actuary.org)

American Academy of Actuaries

6

Life Actuarial (A) Task Force/ Health Actuarial (B) Task Force
Amendment Proposal Form*

1. Identify yourself, your affiliation and a very brief description (title) of the issue.

   Linda Lankowski, RGA, William Leung, MO DCI

   Annuity mortality tables and non-US lives mortality.

2. Identify the document, including the date if the document is "released for comment," and the location in the document where the amendment is proposed:

   - VM-M Sections 1 and 2
   - VM-31 Section 3.D.3 and Section 3.F.3.i
   - VM-20 Sections 3.C.1, 9.C.3.b and , 9.C.3.g
   - VM-21 Sections 6.C.3.h, 7.C.9.b and c, 11.B.3 and 11.C.1

3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted or changed by providing a red-line (turn on "track changes" in Word®) version of the verbiage. (You may do this through an attachment.)

VM-M: Section 1: Valuation and Nonforfeiture Mortality Tables

J. 2012 Individual Annuity Reserve Valuation Table

1. Definitions

a. "2012 IAR Table" means that generational mortality table developed by the Joint Academy/SOA Payout Annuity Table Team and containing rates, q^{2012+n}, derived from a combination of the 2012 IAM Period Table and Projection Scale G2, using the methodology stated in the "Application of the 2012 IAR Mortality Table" paragraph of Appendix A-821 of the AP&P Manual.

b. "2012 Individual Annuity Mortality Period Life (2012 IAM Period) Table" means the Period Table containing loaded mortality rates for calendar year 2012. This table contains rates, q^{2012}, developed by the Joint Academy/SOA Payout Annuity Table Team and is shown in Appendices 1–2 of Appendix A-821 of the AP&P Manual.

c. "Projection Scale G2 (Scale G2)" is a table of annual rates, $G2_x$, of mortality improvement by age for projecting future mortality rates beyond calendar year 2012. This table was developed by the Joint Academy/SOA Payout Annuity Table Team and is shown in Appendices 3–4 of Appendix A-821 of the AP&P Manual.

K. 2017 Commissioners Standard Guaranteed Issue Mortality Tables

1. "2017 Commissioners Standard Guaranteed Issue Mortality Table" (2017 CSGI) means that 2017 Guaranteed Issue basic ultimate mortality table with 75% loading, consisting of separate rates of mortality for male and female lives, as well as combined unisex rates, developed from the experience of 2005–2009 collected by the SOA. This table was adopted by the NAIC on Aug. 7, 2018 and is included in the NAIC Proceedings of the 2018 Summer National Meeting.

L. 1994 Group Annuity Reserving (1994 GAR) Table

1. "1994 GAR Table" means that mortality table developed by the Society of Actuaries Group Annuity Valuation Table Task Force and shown on pages 866-867 of Volume XLVII of the Transactions of the Society of Actuaries (1995).

M. 1983 Table a

1. "1983 Table 'a'" means that mortality table developed by the Society of Actuaries Committee to Recommend a New Mortality Basis for Individual Annuity Valuation and adopted as a recognized mortality table for annuities in June 1982 by the National Association of Insurance Commissioners. [See 1982 Proceedings of the NAIC II, page 454.]

VM-M: Section 2: Industry Experience Valuation Basic Tables

A. 2008 Valuation Basic Table (2008 VBT)

B. 2015 Valuation Basic Table (2015 VBT) The 2015 Valuation Basic Table is a valuation table without loads jointly developed by the Academy and SOA for use in determining a company's prudent estimate mortality assumption for valuations of Dec. 31, 2015, and later. The table consists of the Primary table (Male, Female, Smoker, Nonsmoker and Composite), 10 Relative Risk tables for nonsmokers (Male and Female) and four Relative Risk tables for smokers (Male and Female). Rates for juvenile ages are included in the composite tables. The tables are on a select and ultimate and ultimate-only basis and are available on an age nearest and an age last birthday basis.

C. "2012 Individual Annuity Mortality Basic (2012 IAM Basic) Table" means the unloaded mortality table underlying the 2012 IAM Period Table. This was developed from the 2002 experience table, projected with improvement factors to 2012. The 2000-2004 Payout Annuity Mortality Experience Study includes experience for immediate annuities, annuitizations and life settlement options of individual life insurance and annuity death claims. The experience analyzed excluded substandard annuities, structured settlement annuities and variable payout annuities. The experience represented 16 companies over the exposure period. The result of these efforts was a 2002 experience table.

D. The 1994 Group Annuity Mortality Basic (GAM-94 Basic) Table, developed by the Society of Actuaries Group Annuity Valuation Table Task Force and shown on pages 886-887 of Volume XLVII of the Transactions of the Society of Actuaries (1995).is a static mortality table containing unloaded mortality rates for calendar year 1994. The central calendar year of the modified mortality experience is 1988. Mortality experience is projected from the central experience year of 1988 to central year 1994, to produce a 1994 Basic Table.

VM-31: Section 3.D.3: Life Report Mortality

p. Non-US Mortality – Description and rationale for mortality tables used to value non-US blocks of business, pursuant to VM-20 Section 3.C.1.h and VM-20 Section 9.C.3.b.

VM-31: Section 3.F.3.i: Variable Annuity Report Mortality

xiv. Non-US Mortality – Description and rationale for mortality tables and mortality improvement rates used to value non-US blocks of business, pursuant to VM-21 Section 6.C.3.h.

VM-20:

Section 3.C: Net Premium Reserve Assumptions

Section 3.C.1.h (new):

For a group of policies or certificates covering insureds who are not residents of the United States:

i. The company shall use a valuation mortality table based on a non-US industry mortality table developed as described in Section 9.C.3.b.i.
ii. Appropriate mortality improvement factors should be used to bring the non-US industry table forward or backward to the same as of date of the corresponding CSO table.
iii. Margins consistent with the purpose of US statutory reserve methods shall then be added to the (adjusted) unloaded mortality table. For example, the margins in the non-US valuation rate could be determined by a formula such as CSO rate/unloaded CSO rate x non-US (adjusted) industry rate.
iv. When a company uses such non-US valuation mortality table for one block of non-US business, the company should consistently use the same or similarly developed non-US valuation tables for other non-US business.
v. The provisions in Section 3.C.1.f and 3.C.1.g still apply to the non-US valuation mortality table.

Section 9.C.3 Determination of Applicable Industry Basic Tables

b. A modified industry basic table is permitted in a limited number of situations where an industry basic table does not appropriately reflect the expected mortality experience, such as joint life mortality, simplified underwriting, ~~or~~ substandard or rated lives, or non-US residence. In cases other than modification of the table to reflect joint life mortality, the modification must not result in mortality rates lower than those in the industry basic table without approval by the insurance commissioner.

For blocks of policies or certificates covering insureds who are not residents of the United States:

i. the company shall use a relevant no load mortality table developed by the regulatory authority or the local actuarial society for the life insurance industry in the country of residence. When a relevant non-US industry table developed by the regulatory authority or the local actuarial society is not available, the company shall use any well-established industry table that is based on the experience of policies having the appropriate risk characteristics or create an industry table based on the lives having the appropriate risk characteristics.

Adjustments shall be made to include margins consistent with those included in the relevant VBT. These Margins for industry experience tables are meant to cover lack of credibility, estimation error, and similar data risks, rather than conservatism. Such mortality tables must be approved by the insurance department of the state of domicile before being used for reserve purposes.

ii. When a company uses such non-US Industry mortality table for one block of non-US business, the company should consistently use the same or similarly developed non-US Industry tables for other non-US business.

g. Mortality improvement shall not be incorporated beyond the valuation date in the industry basic table. However, historical mortality improvement from the date of the industry basic table (e.g., Jan. 1, 2008, for the 2008 VBT and July 1, 2015, for the 2015 VBT) to the valuation date shall be incorporated using the improvement factors for the applicable industry basic table as determined by the SOA, adopted by the Life Actuarial (A) Task Force and published on the SOA website, https://www.soa.org/research/topics/indiv-val-exp-study-list/ (Individual Life Insurance Mortality Improvement Scale – for Use with AG38/VM20 – 20XX) for US business. For blocks of policies or certificates covering insureds who are not residents of the United States, appropriate mortality improvement factors should be used to bring the non-US industry table forward to the valuation date; such mortality improvement factors must be approved by the insurance department of the state of domicile before being used for reserve purposes.

VM-21: Section 6: Requirements for the Additional Standard Projection Amount

C. Prescribed Assumptions

3. Guarantee Actuarial Present Value

h. For US business, the mortality assumption used shall follow the 2012 IAM Basic Mortality Table, improved to Dec. 31, 2017, using Projection Scale G2 but not applying any additional mortality improvement in the projection.

For a group of contracts or certificates covering insureds who are not residents of the United States:

i. The company shall use a non-US basic individual annuitant mortality table based on a relevant unloaded mortality table developed by the regulatory authority or the local actuarial society for the life insurance industry in the country of residence. When a relevant non-US table developed by the regulatory authority or the local actuarial society is not available, the company shall use any well-established industry table that is based on the experience of policies having the appropriate risk characteristics or create an industry table based on the lives having the appropriate risk characteristics. Adjustments shall be made as necessary to include margins consistent with those included in the 2012 IAM Basic table used to value contracts or certificates covering US lives. These margins are intended to cover lack of credibility, estimation error, and similar data risks, rather than conservatism. Appropriate mortality improvement factors should be used to bring the non-US industry table forward or backward to the same as of date of the 2012 IAM Basic table.

ii. Mortality improvement shall be applied to improve the table to Dec. 31, 2017, using an appropriate scale developed by the regulatory authority or the local actuarial society for the

life insurance industry in the country of residence with appropriate adjustments where necessary to ensure consistent conservatism. When such mortality improvement scale is not available, the company shall use any well-established projection scale that is based on the experience of policies having the appropriate risk characteristics or create a projection scale based on the lives having the appropriate risk characteristics.

iii. Such mortality table and projection scale must be approved by the insurance department of the state of domicile before being used for determining reserve or capital requirements.

iv. When a company uses such non-US mortality table for one block of non-US business, the company should consistently use the same or similarly developed non-US tables for other non-US business.

9. Mortality

For US business, the mortality rate for a contract holder with age x in year (2012 + n) shall be calculated using the following formula, where q_x denotes mortality from the 2012 IAM Basic Mortality Table, multiplied by the appropriate factor (F_x) from Table 6.9 and $G2_x$ denotes mortality improvement from Projection Scale G2:

$$q_x^{2012+n} = q_x^{2012}(1-G2_x)^n * F_x$$

For non-US business, the mortality rate for a contract holder shall similarly be multiplied by the appropriate factor (F_x) from Table 6.9 after applying appropriate mortality improvement described in Section 6.C.3.h.ii.

Section 7: Alternative Methodology

C. Calculation of the *GC* Component

9. Adjusting *GC* for Mortality Experience

The factors that have been developed for use in determining *GC* assume male mortality at 100% of the 1994 Variable Annuity MGDB ALB Mortality Table. Females use a five-year age setback. Companies electing to use the Alternative Methodology that have not conducted an evaluation of their mortality experience shall use these factors, or they shall adjust the factors using the methodology below to apply the mortality defined in Section 11.C. for products without VAGLB. Other companies should use the procedure described below to adjust for the actuary's prudent estimate of mortality. The development of prudent estimate mortality shall follow the requirements and guidance of Section 11. Once a company uses the modified method for a block of business, the option to use the unadjusted factors is no longer available for that part of its business. In applying the factors to actual in-force business, a five-year age setback should be used for female annuitants.

a. Calculate two sets of NSPs at each attained age:

a. One using 100% of the 1994 Variable Annuity MGDB Age Last Birthday (ALB) Mortality Table (with the aforementioned five-year age setback for females); and

b. A second using either:

i. The prudent estimate mortality if that has been established by the company.

ii. For companies that have not established a prudent estimate mortality assumption, the appropriate percentage of the 2012 IAM Basic Table or the non-US table in in Section 6.C.3.h (if applicable) with Projection Scale G2 ALB (as described in Section 12.B.3).

These calculations shall assume an interest rate off 3.75% and a lapse rate of 7% per year.

b. The *GC* factor is multiplied by the ratio, for the specific attained age being valued, of the NSP calculated using the prudent estimate mortality for blocks with those assumptions or the NSP calculated using the adjusted 2012 IAM Basic Table or the non-US table in in Section 6.C.3.h (if applicable) for blocks without a prudent estimate assumption to the NSP calculated using the 1994 Variable Annuity MGDB ALB Mortality The base factors for females use the values (with the aforementioned five-year age setback).

Section 11: Guidance and Requirements for Setting Prudent Estimate Mortality Assumptions

B. Determination of Expected Mortality Curves

3. No Data Requirements

When little or no experience or information is available on a business segment, the company shall use expected mortality curves that would produce expected deaths no less than the appropriate percentage (F_x) from Table 1 of the 2012 IAM Basic Table with Projection Scale G2 or the non-US table and mortality improvement where applied pursuant to Section 6.C.3.h for contracts with no VAGLBs and expected deaths no greater than the appropriate percentage (F_x) from Table 1 of the 2012 IAM Basic Mortality Table with Projection Scale G2 or the non-US table and mortality improvement where applied pursuant to Section 6.C.3.h for contracts with VAGLBs. If mortality experience on the business segment is expected to be atypical (e.g., demographics of target markets are known to have higher [lower] mortality than typical), these "no data" mortality requirements may not be adequate.

C. Adjustment for Credibility to Determine Prudent Estimate Mortality

c. Adjustment for Credibility

The expected mortality curves determined in Section 11.B shall be adjusted based on the credibility of the experience used to determine the curves in order to arrive at prudent estimate mortality. The adjustment for credibility shall result in blending the expected mortality curves with a mortality table consistent with a statutory valuation mortality table. For contracts with no VAGLBs, the table shall be consistent with the appropriate percentage (F_x) from Table 1 of the 2012 IAM Basic Table with Projection Scale G2 or the non-US table and mortality improvement where applied pursuant to Section 6.C.3.h; and for contracts with VAGLBs, the table shall be consistent with the appropriate percentage (F_x) From Table 1 of the 2012 IAM Basic Mortality Table with Projection Scale G2 or the non-US table and mortality improvement where applied pursuant to Section 6.C.3.h. The approach used to adjust the curves shall suitably account for credibility.

4. State the reason for the proposed amendment? (You may do this through an attachment.)

1994 GAR and 1983 Table a will be needed for valuations using (proposed) VM-22 methodology.

Life insurance that is sold internationally is reinsured into the United States. Mortality for international insureds may vary significantly from that of US insurance markets. The Valuation Manual should be updated to allow for international mortality tables.

* This form is not intended for minor corrections, such as formatting, grammar, cross–references or spelling. Those types of changes do not require action by the entire group and may be submitted via letter or email to the NAIC staff support person for the NAIC group where the document originated.

NAIC Staff Comments:

Dates: Received	Reviewed by Staff	Distributed	Considered
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