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November 20, 2023

Rachel Hemphill,

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

Craig Chupp

Vice Chair, NAIC LATF

Philip Barlow,

Chair, NAIC Life Risk-Based (E) Capital Working Group (LRBC)

Re: Generator of Economic Scenarios (Generator) Acceptance Criteria and Stylized Facts

Dear Chair Hemphill, Vice-Chair Chupp, and Chair Barlow:

The American Council of Life Insurers (ACLI) appreciates the opportunity to comment on the exposed stylized facts and acceptance criteria to support the Generator. We appreciate the dedication and hard work of LATF and LRBC on the development of a Generator to replace the existing American Academy of Actuaries (Academy) Interest Rate Generator. We recognize the countless hours that regulators have spent on this effort. We are committed to this project and look forward to continuing to work with the regulators to achieve implementation of the replacement Generator by January 1, 2026.

The Generator will affect the reserves and/or capital levels for virtually all life products, including variable and fixed annuity products. The finalized Generator will have a significant impact on both the level and volatility of reserves and capital, as well as internal company practices. Movements in reserves and capital should be intuitive based on current economic conditions and suitable for agreed upon long-term targets. Material changes in reserves and capital need to be well understood by practitioners and company senior management. Setting reasonable and appropriate parameters for the Generator is critical as it reduces the risk of unnecessary costs and complexities in company capital planning, risk management frameworks, hedging programs, and new business processes.

Paramount to the development of the Generator is the selection of reasonable and appropriate acceptance criteria and stylized facts. Stylized facts, the qualitative view of the desired behaviors of the Generator, are a critical foundation as they describe key characteristics of the scenarios produced by the Generator.

Acceptance criteria, which are measurable, quantifiable, and transparent, are necessary to ensure the Generator produces reasonable scenarios over a wide range of plausible economic conditions. A minimal yet comprehensive set of acceptance criteria provides a clear gauge of outcomes relative to the desired properties of the Generator. There will need to be a balance in the acceptance criteria: too constrictive and the Generator be more difficult to maintain and likely to fail to meet enough of the criteria on a consistent basis; too broad and the Generator could always pass, regardless of the validity of the scenario sets.

ACLI proposes modifying the acceptance criteria set exposed by regulators. We attempted to balance a minimal but comprehensive set of criteria over a wide range of economic conditions. Our recommendations were developed using the expertise of our member companies with the support of data analysis and perspective on the criteria provided by our actuarial consultant, Milliman, Inc. ACLI recommends inclusion of all our proposed changes to acceptance criteria in order to produce scenarios that are sound and practical. Absence of some of these criteria could lead to undesirable behaviors of the generator under certain economic conditions.

We have aggregated our suggested changes in the following categories below. The specific recommended changes (if any) for each of the exposed criteria can be found in Appendix A. The technical rationale behind our recommendations can be found in Appendix B.

Categories:

1. Severity and frequency of worse-than-history interest rate events (applicable to the exposed acceptance criteria T1, T2, T3, T4, T5)
2. Equity returns and relationship to interest rates (applicable to the exposed acceptance criterion E1)
3. Mean reversion and volatility (applicable to ACLI proposed acceptance criteria T6, T7, C2)

**1. Severity and frequency of worse-than-history interest rate events.**

**ACLI proposes bounding the absolute limits and likelihood of extremely low and high interest rates and the duration of time rates could remain there (T1, T2).**

ACLI agrees with regulators it is appropriate for worse-than-history events to be reflected by the Generator; however, scenarios produced need to be reasonably related to historical dynamics and economic expectations and any worse-than-history events should not be excessive. Extremely low

or high rates occurring for an extended period of time would not only have a significant impact on life insurers, but it would also have potentially catastrophic consequences for the economy.

### **ACLI proposes retaining the Academy yield curve inversion criterion (T3).**

The generator should produce yield curves that are plausible even in worse-than-history conditions. The absence of reasonable curve shapes has several potential consequences: introduction of arbitrage opportunities, inappropriate incentives for hedge behavior, among other issues.

### **ACLI proposes removing the low-for-long and high-for-long varying starting conditions criterion (T4) and expanding the general low-for-long criterion (T5).**

ACLI supports regulators have prioritized “low-for-long” and “high-for-long” criteria in the Generator, but caution on the criteria being overly extreme. ACLI is concerned that forcing excessive low-for-long could challenge the model meeting the other important acceptance criteria, impair the Generator’s ability to produce reasonable scenarios, and lead to significant changes to the model (such as higher than reasonable volatility or excessive reliance on a floor creating unreasonable curve shapes).

Regulators have exposed two criteria to address these situations. “Low- and High-For-Long at Varying Starting Conditions” (T5) is an extremely robust criterion, and we directionally support it. In addition to addressing the extreme rates, the Generator should also produce an appropriate number of “moderate” scenarios; we proposed modifying T5 criteria to account for this consideration. We would suggest removal of “Low For Long: 12/31/20 Starting Conditions” (T4) as an acceptance criterion as it does not provide significant incremental value beyond that provided by the T5 criterion.

## **2. Equity returns and relationship to interest rates:**

### **We believe the interest-equity linkage assumption should be set to zero.**

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.

### 3. Mean reversion and volatility

ACLI proposes expanding the list of acceptance criteria by retaining the Academy criteria for rate mean reversion (new T6) and volatility (new T7), and credit spread mean reversion (new C2).

ACLI proposes reinstating several additional Academy criteria. Acceptance criteria which serve to evaluate mean reversion are necessary to define and support realistic interest rates and a realistic credit spread process. Not effectively modeling the mean reversion dynamics of credit spreads can generate multiple large negative returns within a short duration which would result in unrealistic outcomes. Similarly, having effective criteria to address an appropriate level of rate volatility is of critical importance as realized volatility is a key driver of the cost of hedging, which impacts liability valuation and risk capital for certain products.

ACLI would recommend establishing mean reversion targets for the interest rate model (new T6) and the corporate model (new C2). We would also propose reinstating an interest rate volatility target (T7).

#### Future considerations:

As part of the governance process after adoption of the Generator, the stylized facts and acceptance criteria will need to be reviewed for appropriateness in evolving economic environments. Some of the criteria, such as the interest rate mean reversion point and corporate model excess return, would be appropriate to review and update on a frequent basis. Other parameters should be reviewed and updated as appropriate as part of a broader review of the model calibration. Part of the governance should be developing a process to determine what criteria to assess and evaluate.

Once again, ACLI very much appreciates the opportunity to submit comments on this exposure and looks forward to future discussions with regulators as we work towards creating and implementing a new, robust, and impactful Generator.

Sincerely,



cc: Scott O'Neal, NAIC

Appendix A: ACLI recommended changes to acceptance criteria compared to NAIC exposed acceptance criteria

I. Treasury Rates

Item	Category	Criteria
T1.	Prevalence of High Rates, Upper Bound on Treasury Rates	<p><b>NAIC Exposed Criteria –</b></p> <ul style="list-style-type: none"> <li>a) The scenario set should reasonably reflect history, with some allowance for more extreme high and low interest rate environments</li> <li>b) Upper Bound:               <ul style="list-style-type: none"> <li>i. [20%] is <math>\geq</math> [99%]-tile on the 3M yield fan chart, and no more than [5%] of scenarios have 3M yields that go above [20%] in the first 30 years</li> <li>ii. [20%] is <math>\geq</math> [99%]-tile on the 10Y yield fan chart, and no more than [5%] of scenarios have 10Y yields that go above [20%] in the first 30 years</li> </ul> </li> </ul> <p><b>ACLI Proposed Criteria -</b></p> <ul style="list-style-type: none"> <li>a) The scenario set should reasonably reflect history, with some allowance for more extreme high and low interest rate environments</li> <li>b) Upper Bound:               <ul style="list-style-type: none"> <li>i. 1Y rates should not exceed 20.3%</li> <li>ii. 20Y rates should not exceed 17.3%</li> </ul> </li> <li>c) Frequency of high rates:               <ul style="list-style-type: none"> <li>i. The 99<sup>th</sup> percentile in the steady state<sup>1</sup> is <math>\leq</math> 17.0% for 1Y rate</li> <li>ii. The 99<sup>th</sup> percentile in the steady state is <math>\leq</math> 15.8% for 20Y rate</li> </ul> </li> <li>d) Maximum sojourn length for high interest rates (<math>&gt; 17\%</math>) <math>\leq</math> 4 years</li> </ul>

<sup>1</sup> Steady state as defined by the Academy is months 961 through 1200 (years 80 through 100) of the projected scenarios.

T2.	Lower bound on negative interest rates, arbitrage free considerations	<p><b><i>NAIC Exposed Criteria</i></b></p> <p>Apply the following guidance for negative rates:</p> <ul style="list-style-type: none"> <li>a) All maturities could experience negative interest rates</li> <li>b) Interest rates may remain negative for multi-year time periods</li> <li>c) Rates should generally not be lower than -1.5%</li> </ul> <p><b><i>ACLI Recommendation</i></b></p> <p>Apply the following guidance for negative interest rates:</p> <ul style="list-style-type: none"> <li>a) Maturities less than 20 years could experience negative interest rates</li> <li>b) Interest rates may remain negative for multi-year time periods</li> <li>c) 1Y rates should not be lower than -1.0%</li> <li>d) 20Y rates should not be lower than 0.0%</li> <li>e) Frequency of low rates: <ul style="list-style-type: none"> <li>i. The 99<sup>th</sup> percentile on the steady state is <math>\geq 0.0\%</math> for 1Y rate</li> <li>ii. The 99<sup>th</sup> percentile in the steady state is <math>\geq 1.0\%</math> for 20Y rate</li> </ul> </li> <li>f) Maximum sojourn length for low interest rates (<math>&lt; 0\%</math>) <math>\leq [4]</math> years</li> </ul>
T3.	Initial Yield Curve Fit, Yield Curve Shapes in Projection, and Steady State Yield Curve Shape	<p><b><i>NAIC Exposed Criteria</i></b></p> <ul style="list-style-type: none"> <li>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</li> <li>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).</li> <li>c) The steady state curve has normal shape (not inverted for short maturities, longer vs shorter maturities, or between long maturities)</li> </ul>

		<p><b>ACLI Recommendation: the above criteria, plus</b></p> <p>d) Retain yield curve inversion criteria from Academy proposal: (Lower Bound and Frequency columns under Slopes):</p> <table border="1" data-bbox="791 355 1864 527"> <thead> <tr> <th></th> <th>Bucket</th> <th>Lower Bound</th> <th>Upper Bound</th> <th>Historical Min and Max (for reference)<sup>1</sup></th> <th>Worse-Than-History Frequencies<sup>2</sup></th> </tr> </thead> <tbody> <tr> <td><b>Slopes:</b></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>20Y-1Y</td> <td>20Y &lt;= 3%</td> <td>-0.5% to -1.5%</td> <td>3% to 4%</td> <td>0.02% &amp; 2.85%</td> <td>0.5% to 2%</td> </tr> <tr> <td>20Y-1Y</td> <td>3% &lt; 20Y &lt;= 8%</td> <td>-2% to -3.5%</td> <td>4.5% to 6%</td> <td>-1.38% &amp; 4.15%</td> <td>0.5% to 2%</td> </tr> <tr> <td>20Y-1Y</td> <td>8% &lt; 20Y</td> <td>-4% to -5%</td> <td>3.5% to 5.5%</td> <td>-3.36% &amp; 2.90%</td> <td>0.5% to 2%</td> </tr> </tbody> </table>		Bucket	Lower Bound	Upper Bound	Historical Min and Max (for reference) <sup>1</sup>	Worse-Than-History Frequencies <sup>2</sup>	<b>Slopes:</b>						20Y-1Y	20Y <= 3%	-0.5% to -1.5%	3% to 4%	0.02% & 2.85%	0.5% to 2%	20Y-1Y	3% < 20Y <= 8%	-2% to -3.5%	4.5% to 6%	-1.38% & 4.15%	0.5% to 2%	20Y-1Y	8% < 20Y	-4% to -5%	3.5% to 5.5%	-3.36% & 2.90%	0.5% to 2%
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T4.	Low For Long: 12/31/20 Starting Conditions	<p><b>NAIC Exposed Criteria (relevant for 12/31/2020 yield)</b></p> <p>a) At least 10% of scenarios need a 10-year geometric average of the 20-year UST below 1.45%</p> <p>b) At least 5% of scenarios need a 30-year geometric average of the 20-year UST below 1.95%</p> <p><b>ACLI Recommendation: Remove criteria (covered by more comprehensive T5)</b></p>																														
T5.	Low- and High-For-Long at Varying Starting Conditions	<p><b>NAIC Exposed Criteria</b></p> <p>a) For each scenario, calculate the geometric average of the [20-year] UST yield over the first [10] and [30] years of the projection.</p> <p>b) Calculate the [1st] and [99th] percentiles of the distribution of geometric average rates (for both the 10 and 30-year horizons).</p> <p>c) Look up criteria based on the starting level of the 20-year UST yield (interpolate if necessary).</p> <p><b>ACLI Recommendation: the above criteria, plus</b></p> <p>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 scenarios (placeholders shown in blue).</p>																														

20yr Rate Initial Condition	10-Year Geometry Average				30-Year Geometry Average			
	1%ile	15%ile	85%ile	99%ile	1%ile	15%ile	85%ile	99%ile
	<	>	<	>	<	>	<	>
1%	0.94%	###%	###%	3.43%	1.50%	###%	###%	6.25%
2%	1.23%	###%	###%	5.05%	1.68%	###%	###%	7.71%
3%	1.62%	###%	###%	6.55%	1.86%	###%	###%	8.72%
4%	2.15%	###%	###%	7.74%	2.06%	###%	###%	9.62%
5%	2.66%	###%	###%	8.87%	2.26%	###%	###%	10.46%
6%	3.15%	###%	###%	9.96%	2.50%	###%	###%	11.16%
7%	3.63%	###%	###%	11.03%	2.78%	###%	###%	11.61%
8%	4.10%	###%	###%	12.07%	3.06%	###%	###%	11.99%
9%	4.64%	###%	###%	13.08%	3.34%	###%	###%	12.33%
10%	5.21%	###%	###%	14.01%	3.65%	###%	###%	12.63%
Rate Control	Low Rate	Moderate Rate		High Rate	Low Rate	Moderate Rate		High Rate

T6. Rate Mean Reversion (retain Academy criteria)

**ACLI Recommendation**

a) Mean reversion target:

- i. 50<sup>th</sup> percentile 2.0% < 1Y rate < 3.5%
- ii. 50<sup>th</sup> percentile 4.0% < 20Y rate < 5.5%

b) Retain Academy Rate median reversion criteria with half-life of 10-20 years

T7. Rate volatility (retain Academy criteria; supplement SF T2.d)

**ACLI Recommendation**

a) Retain Academy criteria (various by rate level):

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%
			<= [3%]	0.61%	0.31% to 0.92%
		<b>[Chg20Y]</b>	> [3%] to <= [8%]	0.75%	0.37% to 1.12%
			> [8%]	1.56%	0.78% to 2.33%

## II. Equity Rates

Item	Category	Criteria																																			
E1.	Low and High Accumulated Equity Returns	<p><b>NAIC Exposed Criteria</b></p> <p>a) Use the former C3 Phase II equity model Calibration Criteria as a rough placeholder benchmark when evaluating equity scenarios.</p> <p><b>Large Cap (S&amp;P 500) Gross Wealth Factors</b></p> <table border="1"> <thead> <tr> <th>Percentile</th> <th>1 year</th> <th>5 years</th> <th>10 years</th> <th>20 years</th> </tr> </thead> <tbody> <tr> <td>2.5%</td> <td>0.78</td> <td>0.72</td> <td>0.79</td> <td></td> </tr> <tr> <td>5.0%</td> <td>0.84</td> <td>0.81</td> <td>0.94</td> <td>1.51</td> </tr> <tr> <td>10.0%</td> <td>0.9</td> <td>0.94</td> <td>1.16</td> <td>2.1</td> </tr> <tr> <td>90.0%</td> <td>1.28</td> <td>2.17</td> <td>3.63</td> <td>9.02</td> </tr> <tr> <td>95.0%</td> <td>1.35</td> <td>2.45</td> <td>4.36</td> <td>11.7</td> </tr> <tr> <td>97.5%</td> <td>1.42</td> <td>2.72</td> <td>5.12</td> <td></td> </tr> </tbody> </table> <p><b>ACLI Recommendation: the above criteria, plus</b></p> <p>b) Add criteria for 0.5<sup>th</sup> percentile &gt; [0.54/0.58/0.62] for 1/5/10-year WF</p>	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	
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		The relationship between the 0.5th (no less than) and 2.5 <sup>th</sup> (no greater than) percentile criteria needs to be rational. (Need to be revisited with the updated Academy proposal that is being developed)
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### III. Corporate Rates

Item	Category	Criteria																				
C1.	Target Steady State Excess Returns and Average Annualized Excess Returns in Years 20-30	<p><b>NAIC Exposed Criteria</b></p> <p>a) Set steady state excess return targets for each bond fund according to the criteria below.</p> <p><b>Criteria</b></p> <table border="1"> <thead> <tr> <th>Steady state targets (bps)</th> <th>IG 1-5</th> <th>IG 5-10</th> <th>IG Long</th> <th>HY</th> </tr> </thead> <tbody> <tr> <td>Target OAS (avg. VM-20 ult. spread at [12/31/21])</td> <td>107</td> <td>141</td> <td>163</td> <td>448</td> </tr> <tr> <td>Target Excess Return (Target OAS * Excess Return % of OAS)</td> <td>80</td> <td>79</td> <td>66</td> <td>240</td> </tr> <tr> <td>Criteria for avg. annualized Excess Return in years [20-30]</td> <td>80 -[10]</td> <td>79 -[10]</td> <td>66 -[10]</td> <td>240 -[20]</td> </tr> </tbody> </table> <p>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</p> <p><b>ACLI Recommendation: No changes</b></p>	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]
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C2. Credit spread mean reversion speed  
(new criteria; supplements SF C1.b)

**ACLI Recommendation**

a) Retain Academy criteria (half-life of 22-26 months)

Bond Fund	Median			Midpoint month Desired Range
	Month [0]	Month [1200]	Midpoint	
<b>IG 1-5</b>	Median <sub>[0]</sub>	Median <sub>[1200]</sub>	Avg(Median <sub>[0]</sub> , Median <sub>[1200]</sub> )	[22] to [26]
<b>IG 5-10</b>	Median <sub>[0]</sub>	Median <sub>[1200]</sub>	Avg(Median <sub>[0]</sub> , Median <sub>[1200]</sub> )	[22] to [26]
<b>IG Long</b>	Median <sub>[0]</sub>	Median <sub>[1200]</sub>	Avg(Median <sub>[0]</sub> , Median <sub>[1200]</sub> )	[22] to [26]
<b>HY</b>	Median <sub>[0]</sub>	Median <sub>[1200]</sub>	Avg(Median <sub>[0]</sub> , Median <sub>[1200]</sub> )	[22] to [26]

## Appendix B: Technical Rational by Model

### 1. Treasury Rates Acceptance Criteria

#### T1. Prevalence of High Rates, Upper Bound on Treasury Rates

##### ACLI Proposed Acceptance Criteria:

- d) The scenario set should reasonably reflect history, with some allowance for more extreme high and low interest rate environments.
- e) Upper Bound:
  - i. 1Y rates should not exceed 20.3% .
  - ii. 20Y rates should not exceed 17.3%.
- f) Frequency of high rates:
  - i. The 99<sup>th</sup> percentile in the steady state<sup>2</sup> is  $\leq 17.0\%$  for 1Y rate.
  - ii. The 99<sup>th</sup> percentile in the steady state is  $\leq 15.8\%$  for 20Y rate.
- g) Maximum sojourn length for high interest rates ( $> 17\%$ )  $\leq 4$  years.

##### Rationale:

While the current criteria set a minimum threshold for extremely low or high rates, they do not control how frequently this could occur. Therefore, we could have a generator that has a high frequency of extreme low rates, extreme high rates, low-for-long rates, or high-for-long rates that could be unduly severe but still pass the criteria. We think it would be reasonable to set targets around the maximum frequency of these tail scenarios, as well as the minimum and maximum scenario rates to put plausible limits on the severity of low and high rates.

A sojourn length is also important to include as a criterion as the generator could easily have excessively low or high rates for extended periods of time, which is incongruent with observed history and monetary policy by the Federal Reserve.

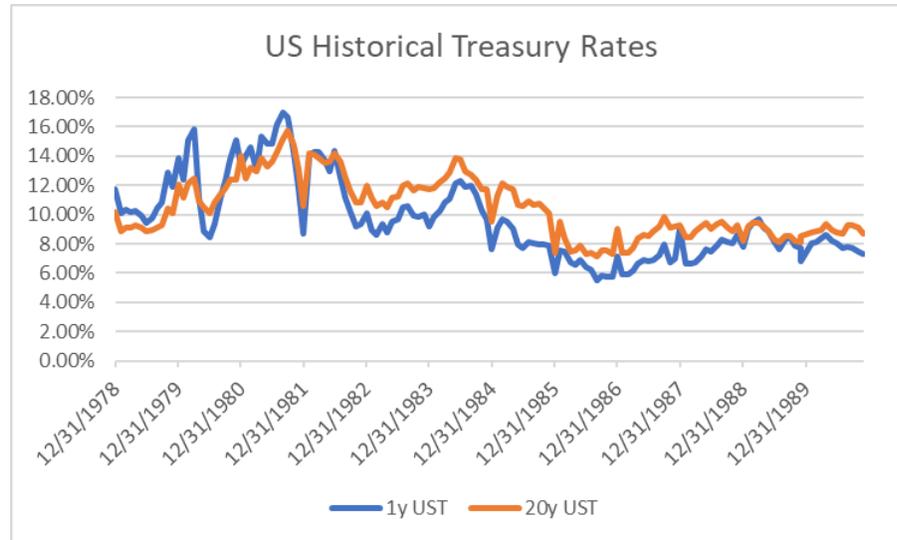
##### Supporting Data:

- T1.a) Guidance Based on relevant US historical rates with allowance for worse than history scenarios.

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<sup>2</sup> Steady state as defined by the Academy is months 961 through 1200 (years 80 through 100) of the projected scenarios.

T1.b)



Guidance Based on relevant US Historical Rates plus one standard deviation for volatilities when rates are high (3.35% and 1.56% for the 1Y and 20Y UST, respectively). A specific boundary limits the severity of the deep tail compared to the 99<sup>th</sup> percentile. The 99<sup>th</sup> percentile would be unbounded above that level in the exposed criteria and could produce implausibly high rates.

T1.c) Guidance Based on maximum relevant US Historical Rates. This criterion is necessary to limit the frequency of severe rates.

T1.d) Reviewed relevant US and Non-US Historical Events. Based on this analysis, a maximum sojourn length of 8 years was determined. However, based on the assumption that high interest rate persistence could cause the US government to take action and Federal Reserve to adjust rates to alleviate negative economic impacts, a reasonable maximum sojourn length of 4 years was determined. Any longer sojourn length, compounded with a worse-than-history rate level criteria, will most likely lead to undue extreme stress scenarios.

## T2. Lower bound on negative interest rates, arbitrage free considerations

### ACLI Proposed Acceptance Criteria

Apply the following guidance for negative interest rates:

- g) Maturities less than 20 years could experience negative interest rates.
- h) Interest rates may remain negative for multi-year time periods.
- i) 1Y rates should not be lower than -1.0%.
- j) 20Y rates should not be lower than 0.0%.
- k) Frequency of low rates:
  - i. The 99<sup>th</sup> percentile on the steady state is  $\geq 0.0\%$  for 1Y rate.
  - ii. The 99<sup>th</sup> percentile in the steady state is  $\geq 1.0\%$  for 20Y rate.

- l) Maximum sojourn length for low interest rates ( $< 0\%$ )  $\leq [4]$  years.

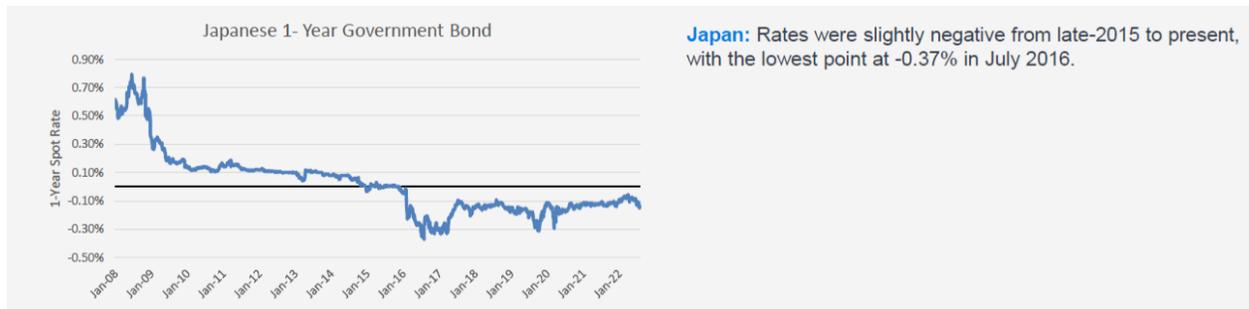
**Rationale:**

Same rationale as T1 above.

We think it is critical to set a different minimum for the shorter end and longer end of the yield curve as short rates are more likely to experience negative interest rates. Similar to high rates, it is critical to set a maximum frequency of extreme low rates and low-for-long rates which were not specified in the exposed criteria. Lastly, interest rates remaining negative for multi-year time periods criterion was expanded to have a quantitative measure of the duration for such circumstances under the maximum sojourn length criteria.

**Supporting Data:**

We considered international experience in our recommendations. Given significant differences in economies, we would caution looking at the world’s worst case as being on par with US expectations; rather, it should be used to guide absolute limits for the criteria.



- T2.a) Use information on rates from developed economies including Switzerland which has experienced prolonged periods of negative rates.
- T2.b) Use information on rates from developed economies including Switzerland which has experienced prolonged periods of negative rates.
- T2.c): Use information on rates from developed economies including Switzerland which has experienced prolonged periods of negative rates.
- T2.d): Same as T2.c) above. Historical minimum differences between 1Y and 20Y rates are approximately 1.0%, so propose setting 20Y minimum 1.0% higher than the 1Y minimum.
- T2.e): Use information on rates from developed economies including Switzerland which has experienced prolonged periods of negative rates.
- T2.f): Reviewed relevant US and Non-US Historical Events. Based on this analysis, a maximum sojourn length of 8 years was determined. However, based on the

assumption that low interest rate persistence could cause the US government to take action and Federal Reserve to adjust rates to alleviate negative economic impacts, a reasonable maximum sojourn length of 4 years was determined. Any longer sojourn length, compounded with a worse-than-history rate level criteria, will most likely lead to undue extreme stress scenarios.

### T3. Initial Yield Curve Fit, Yield Curve Shapes in Projection, and Steady State Yield Curve Shape

#### ACLI Proposed Acceptance Criteria:

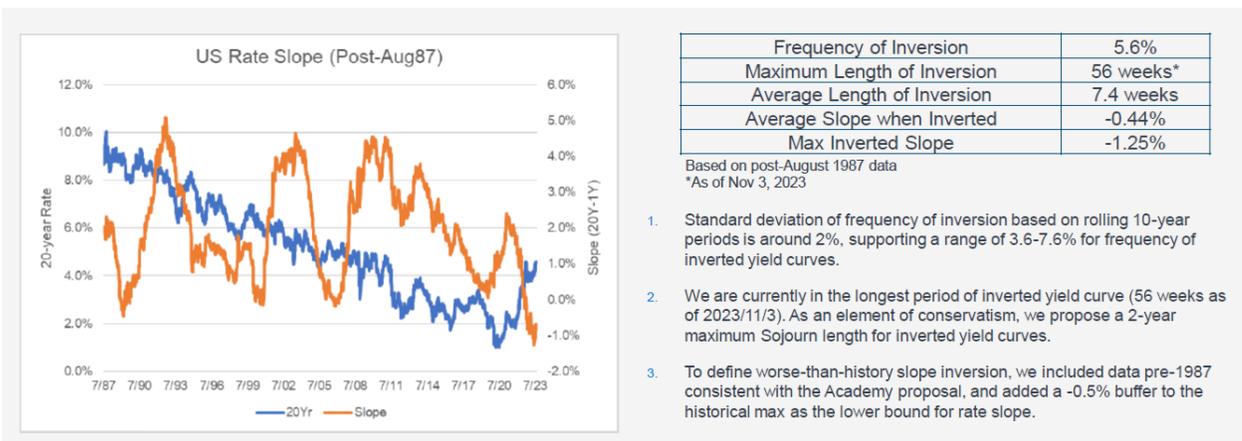
- a) Frequency of inversions overall years between 3.6% and 7.6%.
- b) Max inversion sojourn length  $\leq$  24 months.
- c) Retain maximum of yield curve inversion criteria from Academy proposal:  
Max Inversion -0.5%/-2.0%/-4.0% where 20Y Rate  $\leq$ 3%/3-8%/>8%.

#### Rationale:

We believe the criteria exposed should include quantitative measures such as those suggested above.

#### Supporting Data:

- T3.a) Guidance based on relevant US historical rates.
- T3.b) Guidance based on relevant US historical rates.
- T3.c) Guidance based on relevant US historical rates.



### T4. Low For Long: 12/31/20 Starting Conditions

#### ACLI Proposed Acceptance Criteria:

- a) ACLI Recommendation: Remove criteria

#### Rationale:

- T4.a) This Criterion is covered under T5 which is more comprehensive guidance based a review of criteria T4 and T5. Additionally, the T4 criterion is not defined for other starting conditions.

## T5. Low- and High-For-Long at Varying Starting Conditions

### ACLI Proposed Acceptance Criteria (a through c same as NAIC):

- 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).
- d) Use the Academy approach to determine parameters for 15<sup>th</sup> and 85<sup>th</sup> percentiles.

### Rationale:

T5.a-c) Support NAIC and Academy justification for inclusion.

T5.d) Same approach should be used to evaluate additional percentiles that allows for Incorporation of Criteria on Boundary Conditions on Moderate Scenarios.

The 99<sup>th</sup> and 1<sup>st</sup> percentile criteria well define minimum and maximum thresholds for high-rate scenarios (i.e., extreme high or high-for-long) and low-rate scenarios (i.e., extreme low or low-for-long), respectively. The criteria do not constrain how much such tail scenarios can be included (i.e., criteria uses less than threshold for low rates and greater than for high rates).). To avoid excessive amounts of high or low-rate scenarios (at the cost of inadequate number of moderate scenarios), it is critical and necessary to include 15<sup>th</sup> and 85<sup>th</sup> percentiles to ensure an appropriate level of moderate scenarios to enable adequate reserve calculations (with proper mid-range rate scenarios) and capital valuations (without excessive tail scenarios).

## T6. Rate Mean Reversion (additional criteria)

### ACLI Proposed Acceptance Criteria

- a) Mean reversion target:
  - i. 50<sup>th</sup> percentile  $2.0\% < 1Y \text{ rate} < 3.5\%$ .
  - ii. 50<sup>th</sup> percentile  $4.0\% < 20Y \text{ rate} < 5.5\%$ .
- b) Retain Academy Rate median reversion criteria with half-life of 10-20 years.

### Rationale:

Acceptance criteria which serve to evaluate mean reversion are necessary to define and support realistic interest rates.

### Supporting Data:

- T6.a) Specific acceptance criteria around rate mean reversion rate and speed are critical for appropriate behaviors of the interest rate generator. Recommendation is based on:

- Range of 50th percentile 2.0% < 1Y rate < 3.5% is based on inflation target of 2%, plus real interest rates between 0% and 1.5%;
- Range of 50th percentile 4.0% < 20Y rate < 5.5% is based on 1Y range above, adjusted for relevant historical average rate slope of 2%.

T6.b) Retain Academy criteria for reversion speed, i.e., a half-life of 10-20 years, which is within the range of mean reversion speeds implied in pricing of market swaptions. Market swaptions are generally priced with a mean reversion speed of approximately 5% (i.e., half-life of 13-14 years), largely consistent with the Academy proposal. As such, the Academy proposal seems reasonable and should be retained.

## T7. Rate Volatility (additional criteria)

### ACLI Proposed Acceptance Criteria

a) Retain Academy criteria (various by rate level):

Rate	Bucket (BOM)	Historical	Desired Range
		Stat	
[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%

### Rationale:

T7.a) ACLI supports retaining the Academy rate volatility criteria. Specific targets are important beyond the underlying stylized facts. Lack of specific volatility targets could lead to excess volatility in scenarios; insufficient volatility is unlikely given the other acceptance criteria. Excess volatility could create disconnects from typical and expected real-world economic behavior and can impact performance of hedges and sound risk management practices in the reserve and capital projections.

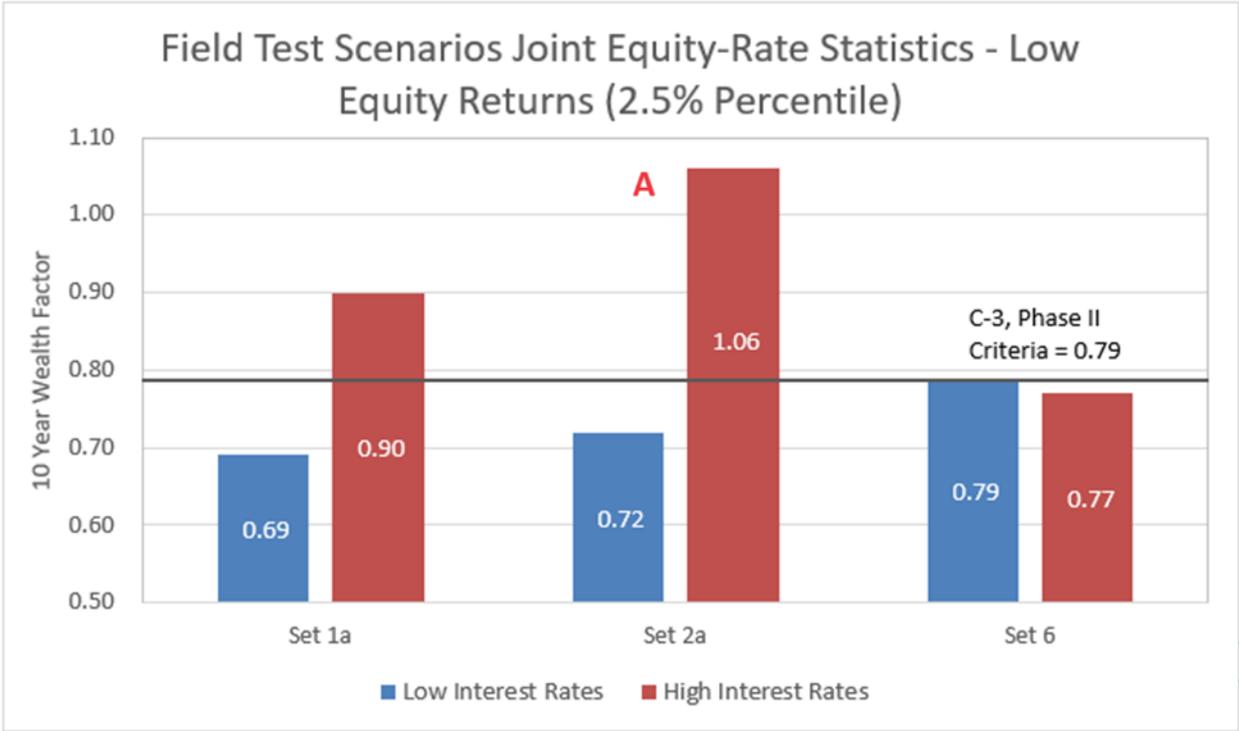
Supporting Data: Academy Proposal.

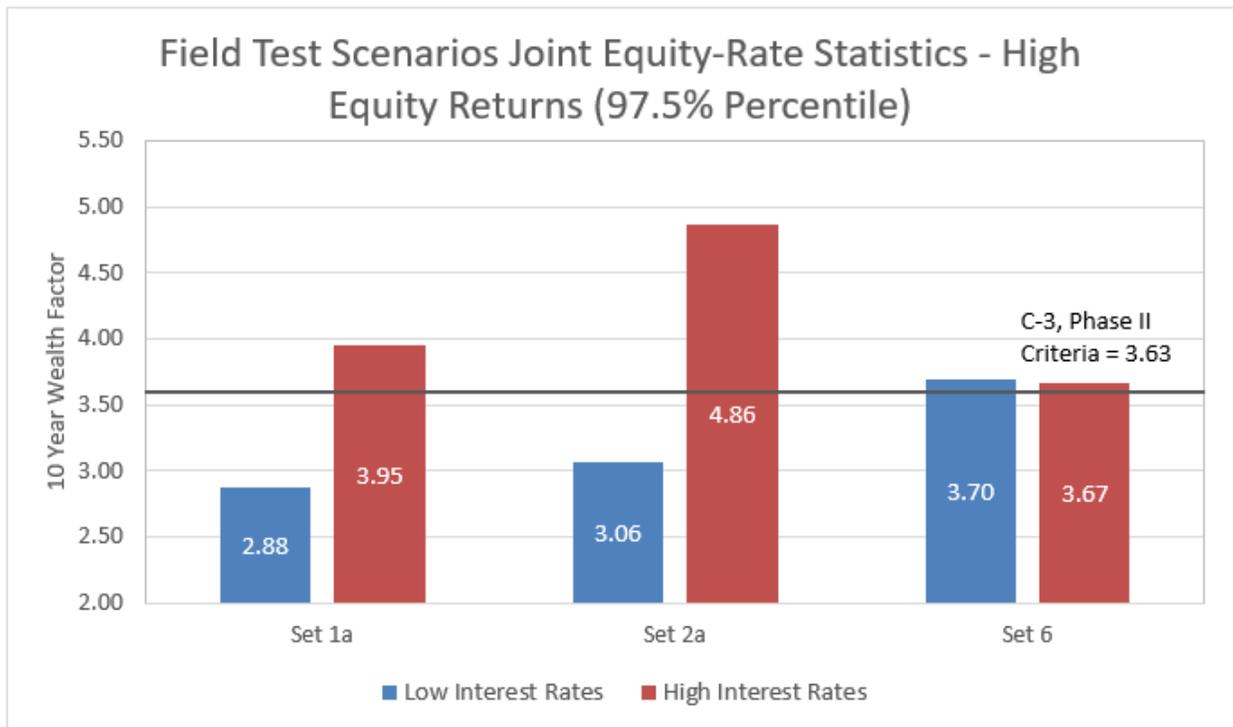
## 2. Equity Model Acceptance Criteria

General. The interest-equity linkage assumption should be set to zero

Rationale:

See charts below for comparisons of scenario sets 1A, 2A, and 6 from the Field Test. Sets 1A and 2A feature a linkage between equity returns and interest rates where the long term expected mean return varies as interest rates change (lower when rates are lower and vice versa as interest rates increase). Set 6 models equity and interest rates movements as independent and uncorrelated processes consistent with the historical approach used in the prescribed generator for US Statutory reserves and capital where relevant. Low/high interest rate scenarios referenced below were defined by dividing the scenario sets into quartiles based on the geometric average of the 20Y rate in the first 10 years (Low = 1<sup>st</sup> quartile and High = 4<sup>th</sup> quartile). Cumulative equity returns (wealth factors) were calculated over the same time horizon.



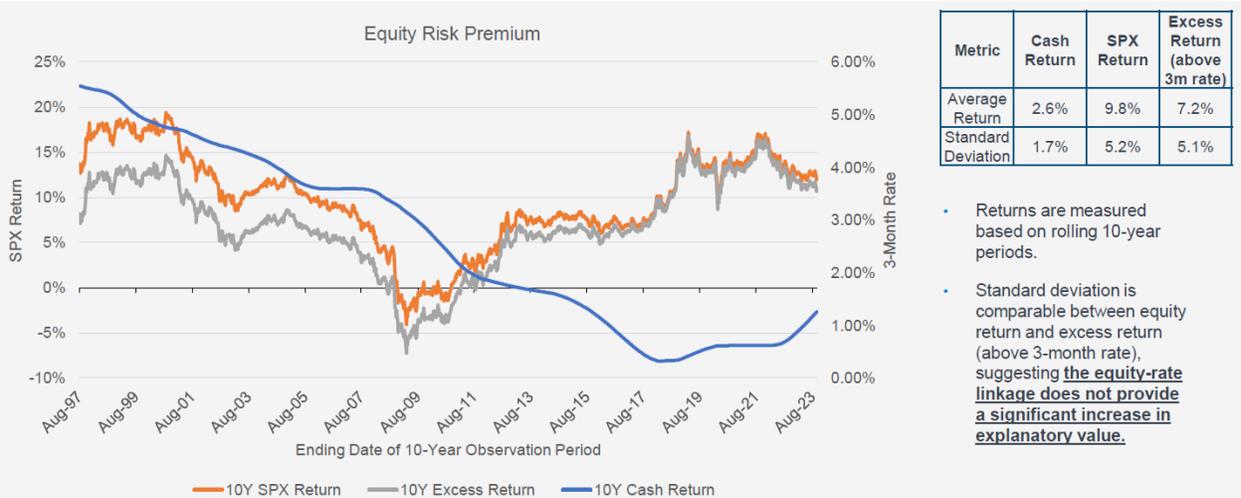


As long as a scenario set meets the wealth factor (WF) criteria in the low and high interest rate scenarios (e.g., the lowest and highest quartiles), we would view the set as having sufficient joint equity-rate severe scenarios. Looking at low equity returns (2.5<sup>th</sup> percentile), Scenario Set 6 (no equity-rate linkage) basically meets the C3P2 Equity WF criteria for all quartiles including those not shown in graph above, while sets 1a and 2a fail to meet the criteria in the highest quartiles and have returns notably below the criteria in lowest quartiles, e.g., there is an approximately 10 percentage point difference compared to the C3P2 criteria in the lowest quartile for scenario set 1a. This exhibit illustrates that the presence of an equity-rate linkage may 1) produce significantly lower equity scenarios relative to the WF criteria, particularly in low-rate scenarios, to compensate for the higher average equity returns in high interest rate scenarios, and 2) fail to generate sufficiently severe equity scenarios in a high interest rate environment. For example, in Set 2a, which was based on 12/31/2021 +200bps initial market conditions, the 2.5<sup>th</sup> percentile equity returns in the highest quartile reflect a 27% difference between the C3P2 criteria over the first 10 years (6% gain versus a 21% loss, respectively; shown as “A” in the 2.5<sup>th</sup> chart above).

When looking at high equity returns (97.5<sup>th</sup> percentile), most scenario sets with an equity-rate linkage in the Field Test struggled to meet the WF criteria. Set 2a is able to meet the C3P2 criteria on an aggregate basis at year 10 but does not meet them for specific quartiles due to the higher starting interest rates coupled with the equity-rate linkage. Set 6 has the least variation in WF across the quartiles and the returns align closely with the C3P2 WF criteria, while the other sets exhibit notable differences between the returns in the 1<sup>st</sup> and 4<sup>th</sup> quartiles.

In summary, sufficiently robust amounts low rate/low equity, or high rate/low equity scenarios can be achieved without modeling an equity/rate linkage. Modeling equity

and interest rate movements as independent and uncorrelated processes enables a more uniform level of prudence across interest rate levels, allows greater certainty of scenario sets satisfying the WF criteria over time and reduces implementation complexity (less risk of recalibration to meet criteria as market conditions change).). Furthermore, historical results indicate that an equity-rate linkage does not provide a statistically significant increase in the realism of the capital markets model (would see notably lower standard deviation in excess return vs. S&P 500 (SPX) return if equity-rate linkage did significantly increase realism of the model (see table below; difference between 5.1% vs 5.2%). Finally, the significant volatility resulting from introducing an equity-rate linkage makes it much more difficult for companies to appropriately manage future capital planning, hedging, and new business pricing.



E1. Low and High Accumulated Equity Returns

ACLI Proposed Acceptance Criteria:

- a) Use the former C3 Phase II equity model Calibration Criteria as a rough placeholder when evaluating equity scenarios (and updating when additional data is available).

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	

b) Add criteria for 0.5<sup>th</sup> percentile > [0.54/0.58/0.62] for 1/5/10-year WF.

The relationship between the 0.5<sup>th</sup> (no less than) and 2.5<sup>th</sup> (no greater than) percentile criteria needs to be rational. (Need to be revisited with the updated Academy proposal that is being developed).

**Rationale:**

- E1.a) It is appropriate to have a specific quantitative criterion for all components of the model, which includes equity returns. It would be beneficial to update the prior C3 Phase II equity model Calibration Criteria when additional information is available.
- E1.b) Given the importance of tail behavior for the determination of capital, it would be appropriate to include criteria for the 0.5<sup>th</sup> percentile to control the frequency and severity of the tail. It is important that once such criteria are developed, the relationships in the tails should make sense; the relationship of the 0.5<sup>th</sup> percentile to the 2.5<sup>th</sup> percentile should be logical (there is not any severe or unexplainable jumps between these percentiles).

While criteria could also be developed for the 99.5<sup>th</sup> percentile, such scenarios would likely not be included in either the reserve or capital calculations (e.g., scenarios expected to sit outside of CTE (70)).

**Supporting Data:**

The following table is based on S&P 500 and Dow Jones Industrial Total Return (1950-2023). As a placeholder, we would propose developing criteria for the minimum values in years 1, 5, and 10 based on the historical minimums for years 1 and 10 and average of those years for year 5 for a smoother distribution (resulting in wealth factors of 0.54/0.58/0.62 for years 1/5/10). These targets would allow for a reasonable frequency and severity of “worse than history” scenarios in the extreme tail (aligns with stylized fact E.7). In the absence of such criteria, it can allow the scenario sets to have much lower returns than would be appropriate.

Percentile	Historical Equity Wealth Factors												C3P2 Requirement				
	S&P 500				Dow Jones				AIRG US Index				1-Year	5-Year	10-Year	20-Year	
	1-Year	5-Year	10-Year	20-Year	1-Year	5-Year	10-Year	20-Year	1-Year	5-Year	10-Year	20-Year					
Min	0.54	0.67	0.62	2.51	0.57	0.73	0.83	2.20	0.40	0.37	0.36	0.40	>0.54	>0.67	>0.62		
0.50%	0.64	0.83	0.79	2.98	0.66	0.90	0.97	2.46	0.67	0.56	0.58	0.75					
1.00%	0.68	0.86	0.86	3.10	0.72	0.93	1.04	2.53	0.72	0.61	0.66	0.89					
2.50%	0.78	0.89	0.95	3.29	0.82	0.99	1.17	2.64	0.78	0.71	0.79	1.12	0.78	0.72	0.79		
5.00%	0.84	0.95	1.29	3.57	0.86	1.04	1.31	2.81	0.83	0.80	0.92	1.41	0.84	0.81	0.94	1.51	
10.00%	0.91	1.04	1.46	3.93	0.92	1.12	1.46	3.16	0.88	0.93	1.12	1.80	0.90	0.94	1.16	2.10	
25.00%	1.03	1.35	2.01	4.54	1.01	1.28	1.83	4.19	0.98	1.16	1.51	2.77					
50.00%	1.13	1.74	2.81	6.37	1.11	1.61	2.43	6.07	1.08	1.45	2.11	4.37					
75.00%	1.23	2.08	3.96	9.71	1.21	1.99	3.77	10.26	1.19	1.81	2.87	6.82					
90.00%	1.33	2.51	4.79	16.13	1.32	2.38	4.78	17.35	1.30	2.19	3.82	10.30	1.28	2.17	3.63	9.02	
95.00%	1.39	2.84	5.17	21.85	1.38	2.71	5.30	22.86	1.36	2.48	4.48	12.99	1.35	2.45	4.36	11.70	
97.50%	1.43	3.08	5.45	24.53	1.43	2.96	5.61	24.66	1.42	2.74	5.21	16.03	1.42	2.72	5.12		
99.00%	1.48	3.27	5.66	25.83	1.49	3.32	5.90	27.05	1.52	3.06	6.25	20.16					
99.50%	1.53	3.42	5.78	26.58	1.52	3.55	6.08	27.52	1.57	3.32	6.90	23.33					
Max	1.73	3.83	6.04	29.57	1.74	4.10	6.49	29.74	1.85	5.28	12.24	40.39					

We note that the 5Y in the table above would be inconsistent with the 10Y, so we suggest smoothing the value to be the average of the 1Y and 10Y (so 0.58).

### 3. Corporate Model Acceptance Criteria

#### C1. Target Steady State Excess Returns and Average Annualized Excess Returns in Years 20-30

NAIC Exposed Criteria (no proposed changes):

- 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

**Rationale:** Criteria is sufficiently robust to capture excess returns associated with the corporate model.

#### C2. Low and High Accumulated Equity Returns (additional criteria)

ACLI Proposed Acceptance Criteria:

- a) Retain Academy criteria (half-life of 22-26 months)

Bond Fund	Median			Midpoint month Desired Range
	Month [0]	Month [1200]	Midpoint	
IG 1-5	Median <sub>[0]</sub>	Median <sub>[1200]</sub>	Avg(Median <sub>[0]</sub> , Median <sub>[1200]</sub> )	[22] to [26]
IG 5-10	Median <sub>[0]</sub>	Median <sub>[1200]</sub>	Avg(Median <sub>[0]</sub> , Median <sub>[1200]</sub> )	[22] to [26]
IG Long	Median <sub>[0]</sub>	Median <sub>[1200]</sub>	Avg(Median <sub>[0]</sub> , Median <sub>[1200]</sub> )	[22] to [26]
HY	Median <sub>[0]</sub>	Median <sub>[1200]</sub>	Avg(Median <sub>[0]</sub> , Median <sub>[1200]</sub> )	[22] to [26]

**Rationale:**

C2.a) Consistent with VM-20: VM-20 prescribes a 4-year grading period for general account fixed income spreads. A midpoint around 24 months is reasonable. The Academy suggested a range of 22 to 26 months, which we think is a reasonable band around the midpoint.

**Supporting Data:**

Academy proposal

Historical events may suggest slightly faster mean reversion but decoupling the impact of volatility and mean reversion involves judgement.