CONNING®

NAIC
National Association of Insurance Commissioners

Overview of GEMS® Equity and Corporate Models

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Agenda

1. Presentation Approach
2. Reference Materials and Documentation
3. GEMS® Equity and Corporate Models: Potential Goals
4. Exposure for comments

Presentation Approach

1. Potential goals relating to the GEMS® Equity and Corporate Models are outlined.

2. For each goal:

    a. Background information is provided for educational purposes, along with an underlying rationale

    b. Similarities and differences between the Academy ESG and GEMS® will be discussed

    c. Items requiring decisions are highlighted, along with initial recommendations

Reference Materials and Documentation

The following materials are available on the LATF webpage (Related Documents tab):
https://content.naic.org/cmte_a_latf.htm

1. NAIC Technical Documentation - Corporate Bonds.pdf
2. NAIC Technical Documentation - Equity, DRAFT.pdf

ESG Background Information:

Economic Scenario Generators: A Practical Guide
https://www.soa.org/resources/research-reports/2016/2016-economic-scenario-generators/

GEMS® EQUITY AND CORPORATE MODELS: POTENTIAL GOALS

Goal relating to equity and bond fund scenarios:

1. Returns should be provided for funds representative of those offered in U.S. insurance products

Rationale and Background: Funds must be mapped to proxy funds. Applicable VM-21 language is shown below. There is similar language in VM-20.

VM-21 Section 4.A.2 (second paragraph) - An appropriate proxy fund for each variable subaccount shall be designed in order to develop the investment return paths. The development of the scenarios for the proxy funds is a fundamental step in the modeling and **can have a significant impact on results**. As such, the company must map each variable account to an appropriately crafted proxy fund normally expressed as a linear combination of recognized market indices, sub-indices or funds

Equity Scenarios: AAA ESG compared to GEMS®

AAA ESG Returns*	Market Proxy Used to Produce AAA ESG Returns*	Corresponding GEMS Returns
Diversified Large Capitalized U.S. Equity	S&P500 Total Return Index	S&P 500
Diversified International Equity	MSCI-EAFE $USD Total Return Index	MSCI EAFE
Intermediate Risk Equity	U.S. Small Capitalization Index	Russell 2000
Aggressive Equity**	25% Emerging Markets, 12.5% NASDAQ, 62.5% Hang Seng	MSCI Emerging Market, NASDAQ

Additional GEMS® Returns: Russell Midcap (Diversified Midcap U.S. Equity)

The AAA ESG Model produces total returns.

GEMS® returns will be split between income and price, which can be combined to get total returns. Dividends are linked to the 10-Year Treasury yield and are negatively correlated with S&P price movements. Dividends do not affect total returns.

*Source: AAA LCAS C3 Phase II RBC for Variable Annuities: Pre-Packaged Scenarios January 2006
**The Academy Equity Model Aggressive Equity proxy is not meant to suggest a representative asset profile for this class but used merely to build an historic index with high volatility and sufficient history.

Bond Fund Scenarios: AAA ESG compared to GEMS®

AAA ESG Returns*	Market Proxy used to produce AAA ESG Returns*	Corresponding GEMS® Returns
Money Market	3 Month Treasury returns	Money Market
U.S. Intermediate Term Government Bonds	U.S. Intermediate Term Government Bonds	U.S. Intermediate Term Government Bonds
U.S. Long Term Corporate Bonds	U.S. Long Term Corporate Bonds	U.S. Long Term Investment Grade Corporate Bonds
Diversified Fixed Income	65% ITGVT + 35% LTCORP	GEMS® produces corresponding components
Diversified Balanced Allocation	60% Diversified Equity + 40% Fixed Income	GEMS® produces corresponding components

Additional GEMS® Returns: U.S. Short- and Long-Term Government Bonds, Short- and Intermediate-Term U.S. Investment Grade, High Yield Corporates

*Source: AAA LCAS C3 Phase II RBC for Variable Annuities: Pre-Packaged Scenarios January 2006

Decision to be made: Which returns should be included in the Basic Data Set?
Initial Recommendation: See table below. Fund returns in blue are new. For the other fund returns, there may be differences between the market proxies used for the AAA ESG and GEMS.

Fund Returns	Market Proxy Used to Produce Fund Returns
Diversified Large Capitalized U.S. Equity	S&P 500
Diversified International Equity	MSCI EAFE
Intermediate Risk Equity	Russell 2000
Aggressive Equity 1 (Name TBD)	MSCI Emerging Market
Aggressive Equity 2 (Name TBD)	NASDAQ
Diversified Midcap U.S. Equity	Russell Midcap
Money Market	Money Market
U.S. Short-Term Government Bonds	50/50 Blend of 1 and 5-year US Treasuries
U.S. Short-Term Investment Grade	50/50 Blend of 1 and 5-year maturities, 50/50 Blend of A and BBB
U.S. Intermediate Term Government Bonds	50/50 Blend of 5 and 10-year US Treasuries
U.S. Intermediate-Term Investment Grade	50/50 Blend of 5 and 10-year maturities, 50/50 Blend of A and BBB
U.S. Long-Term Government Bonds	50/50 Blend of 10 and 30-year US Treasuries
U.S. Long Term Corporate Bonds	50/50 Blend of 10 and 30-year maturities, 50/50 Blend of A and BBB
Diversified Fixed Income	65% Intermediate Term Government Bonds + 35% Long Term Corporate Bonds
Diversified Balanced Allocation	60% Diversified Large Capitalized U.S. Equity + 40% Diversified Fixed Income
High Yield Corporates	BB Rated Corporates

Note: The proposed set of equity returns allows direct mapping to MSCI Emerging Market, NASDAQ, and the additional Russell Midcap. This would eliminate a blended mix of indices for the Aggressive Equity investment category (VM-20 and VM-21 allow companies to create their own proxy fund blends).

Goal relating to equity and bond fund scenarios:

2. The ESG should be calibrated using an appropriate historical period.

Rationale for this goal: It is important to incorporate a historical period that captures an appropriate range of market dynamics while also being careful not to introduce bias into the generated scenarios.

AAA ESG compared to GEMS®:

- The AAA ESG is calibrated using historical data from 1955 – 2003* for all funds except for Diversified International Equity (1969-2003) and Aggressive Equity (1984-2003).
- Generally, GEMS Equity model uses historical data back to 1994. The Corporate model uses historical data back to 1991
    - Impacted by large spike in 2008 Financial Crisis

Decision to made: What historical period would regulators like to use?

Initial Recommendation: Use Conning's current calibration.

*Source: CONSTRUCTION AND USE OF PRE-PACKAGED SCENARIOS TO SUPPORT THE DETERMINATION OF REGULATORY RISK-BASED CAPITAL REQUIREMENTS FOR VARIABLE ANNUITIES AND SIMILAR PRODUCTS, Revised 2006, AAA C-3 Phase II Working Group

Goal relating to the equity scenarios:

3. The equity model should have stochastic volatility and the initial volatility should be updated frequently

Rationale for this Goal: Most equity models have stochastic volatility because this allows for fatter tails in the scenario distribution. Without it, there would be little ability to produce big drops, such as the 2008 financial crisis or Black Monday.

The initial volatility should be updated frequently to reflect recent market movements.

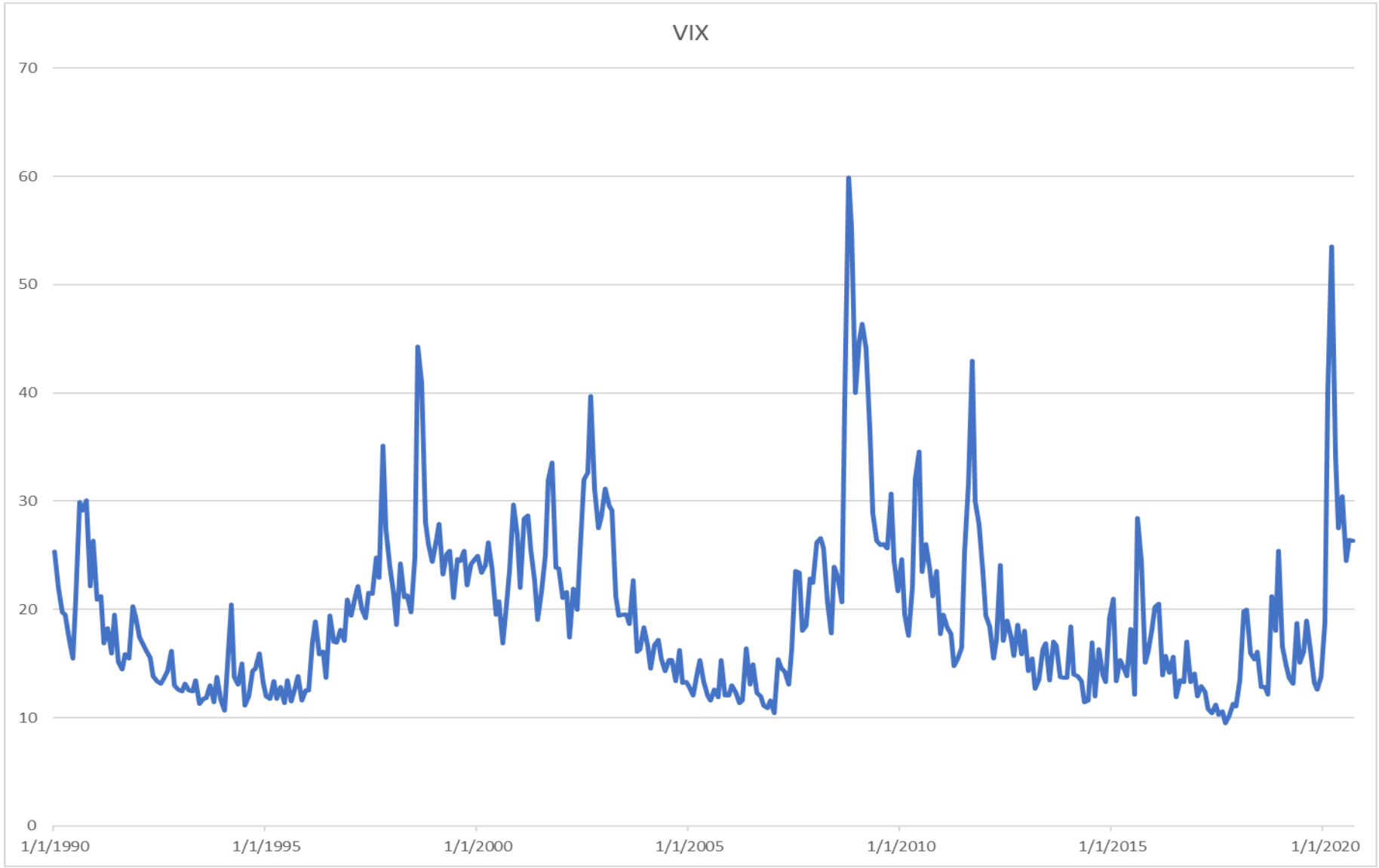
Background: Chicago Board Options Exchange Volatility Index (VIX) reflects the market's estimate of future volatility. When the VIX is high, there tends to be more volatility in the short term.

AAA ESG compared to GEMS®: Both have stochastic volatility. However, in the AAA ESG, the initial volatility is not updated. So, each time a new set of scenarios is produced, the same starting level of volatility is used.

In GEMS, the initial volatility is updated based on recent market movements (usually during the last month). The process references the VIX and is consistent with how the parameter is simulated.

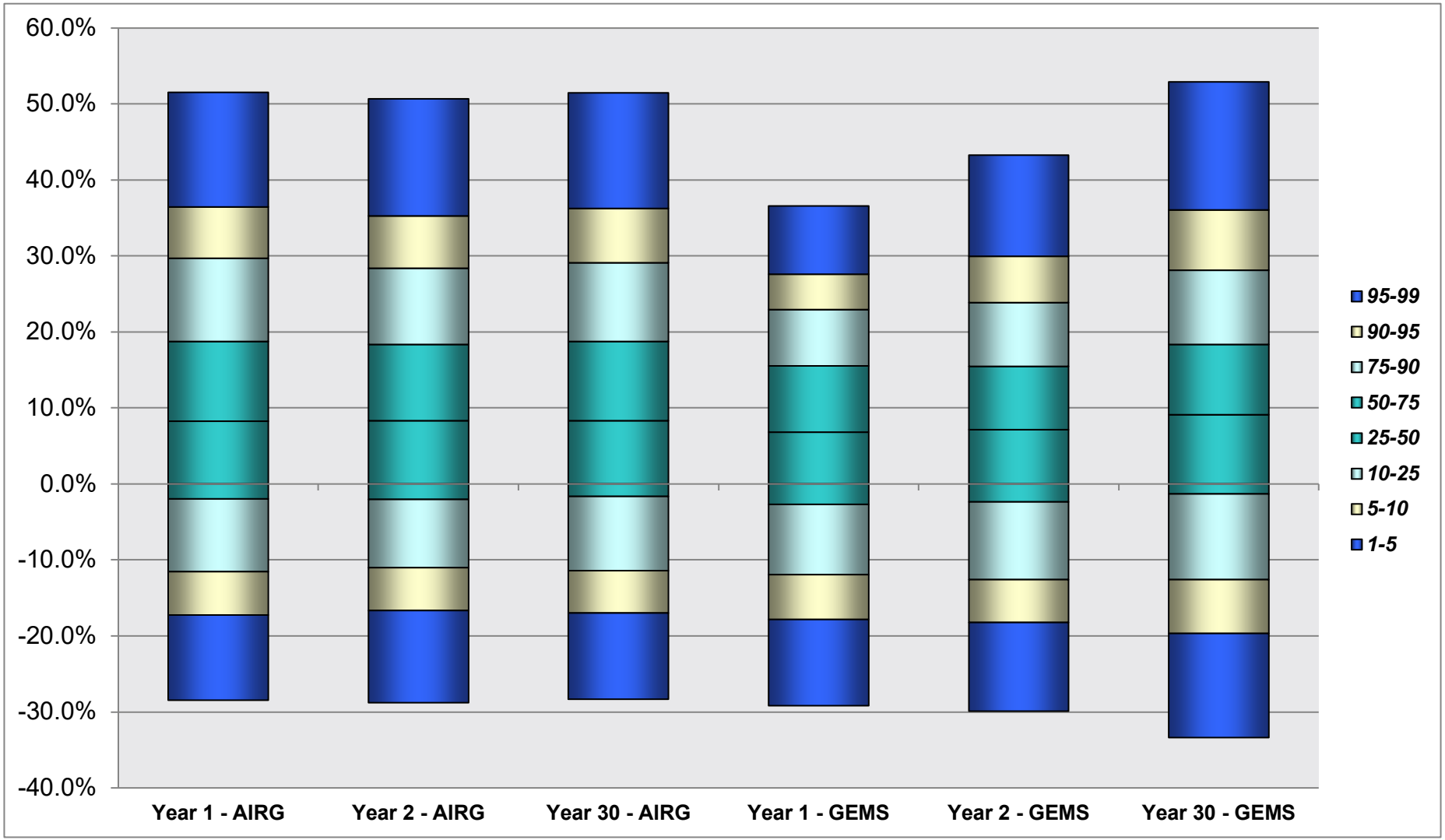
Decision to be made: Do regulators want to begin using a method to update the initial volatility level?
Initial Recommendation: Utilize GEMS stochastic volatility and process for continued parameter calibration.

Historical Chicago Board Options Exchange Volatility Index (VIX) Level



Prepared by Conning. Source: Bloomberg.

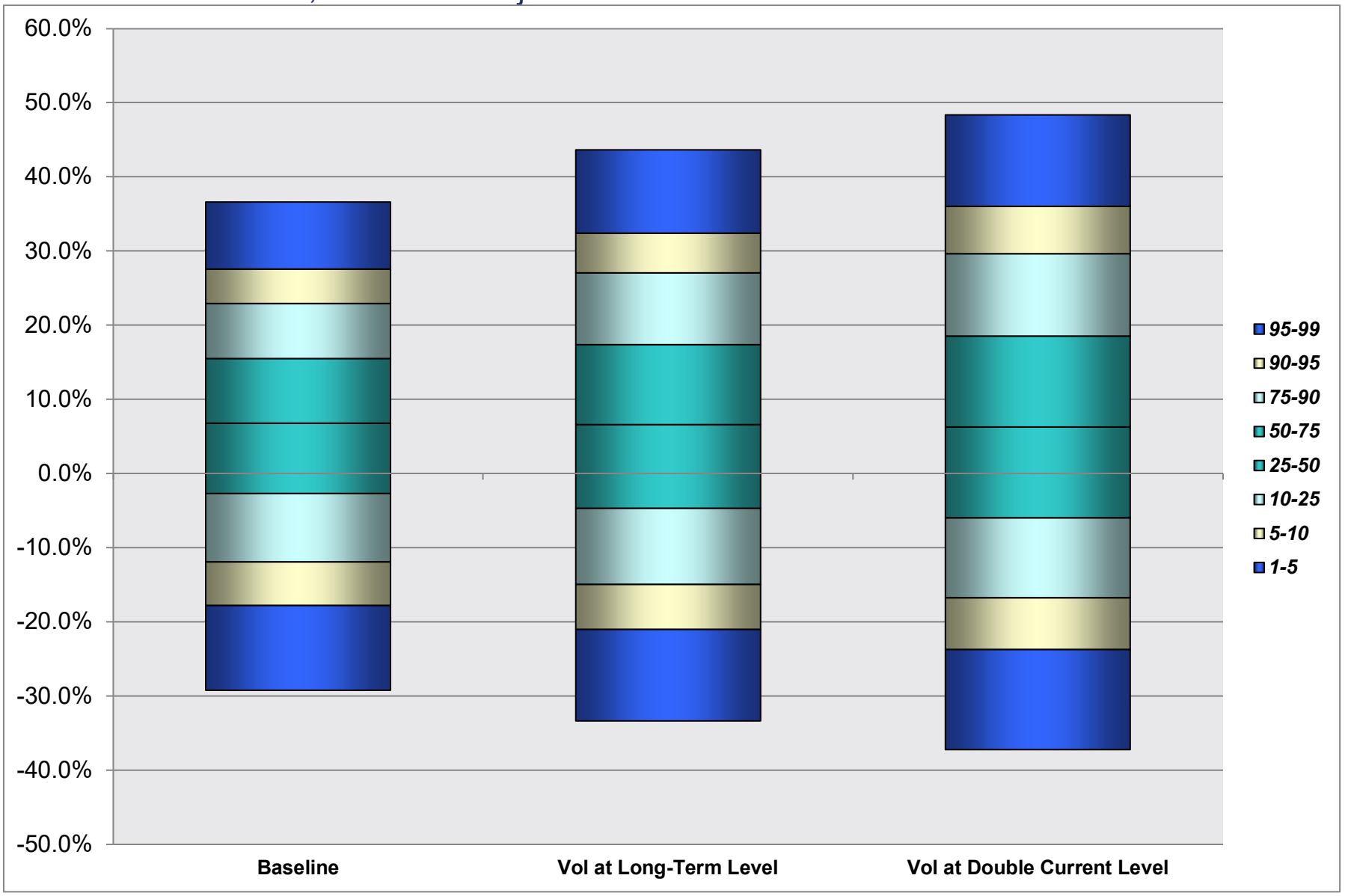
AAA ESG compared to GEMS ® : S&P 500 Total Return by Year with 9/30/20 Start



Prepared by Conning. Source: Bloomberg.

Impact of Changing Initial Volatility: GEMS ®

S&P 500 Total Return, 12 Month Projections with 9/30/20 Start



Goal relating to the equity scenarios:

4. The ESG should have the ability to generate very large losses and gains in short periods of time (i.e. jumps)

Rationale and Background: Historically there have been short periods of large losses (e.g. 1Q 2020, Black Monday) as well as short periods with large gains (e.g. 2Q 2020). This suggests the need for a jump process.

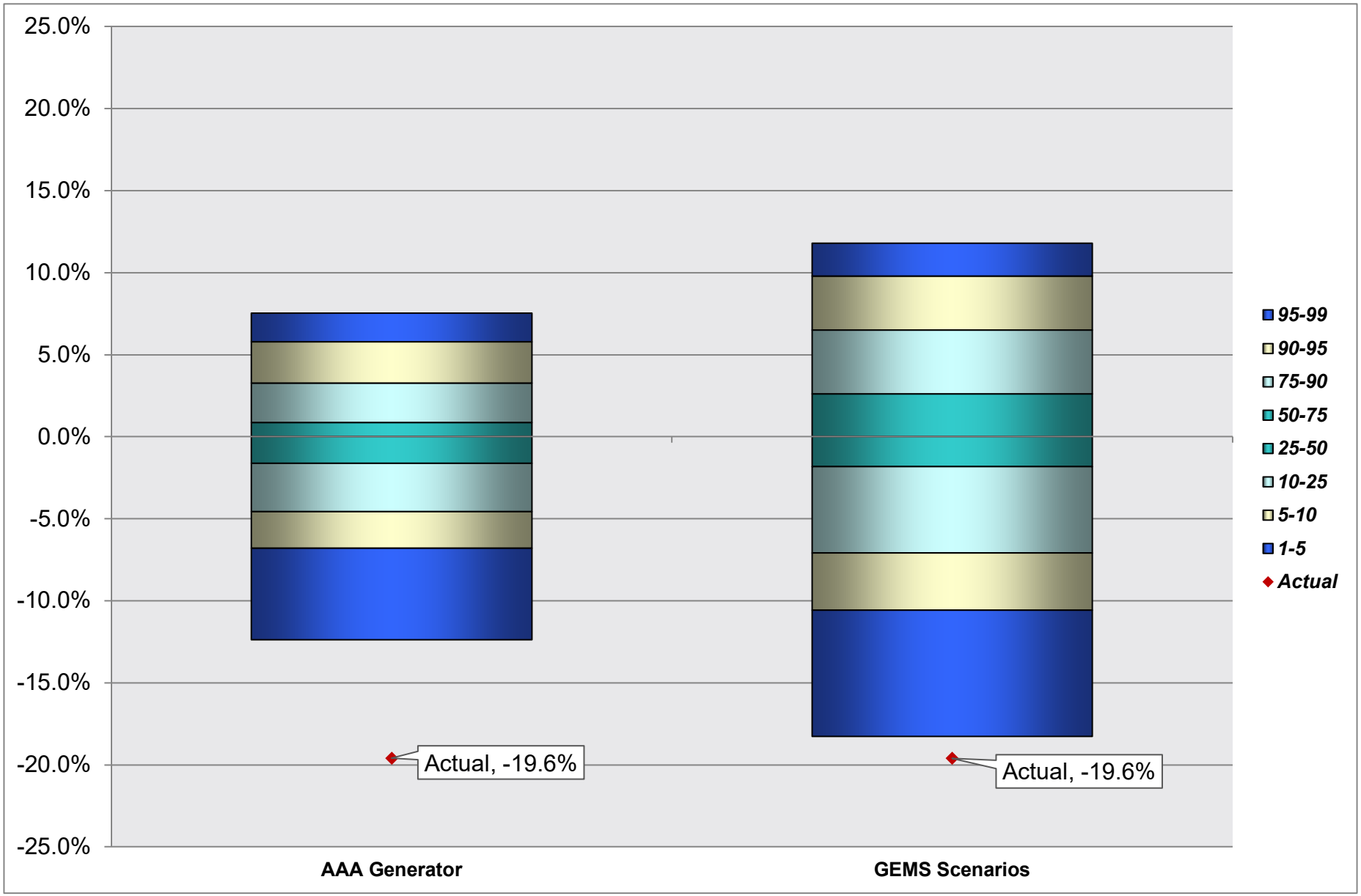
AAA ESG compared to GEMS®:

- AAA ESG does not have a jump process.
- The GEMS jump process is based on historical data and a target for the fatness of the tails (e.g. how likely is a Black Monday). GEMS has more moments and can allow skew and kurtosis, which impact the fatness of the tails.

Decision to be made: How will the targets which impact the calibration of the jump process (e.g. skew and kurtosis) be expressed?

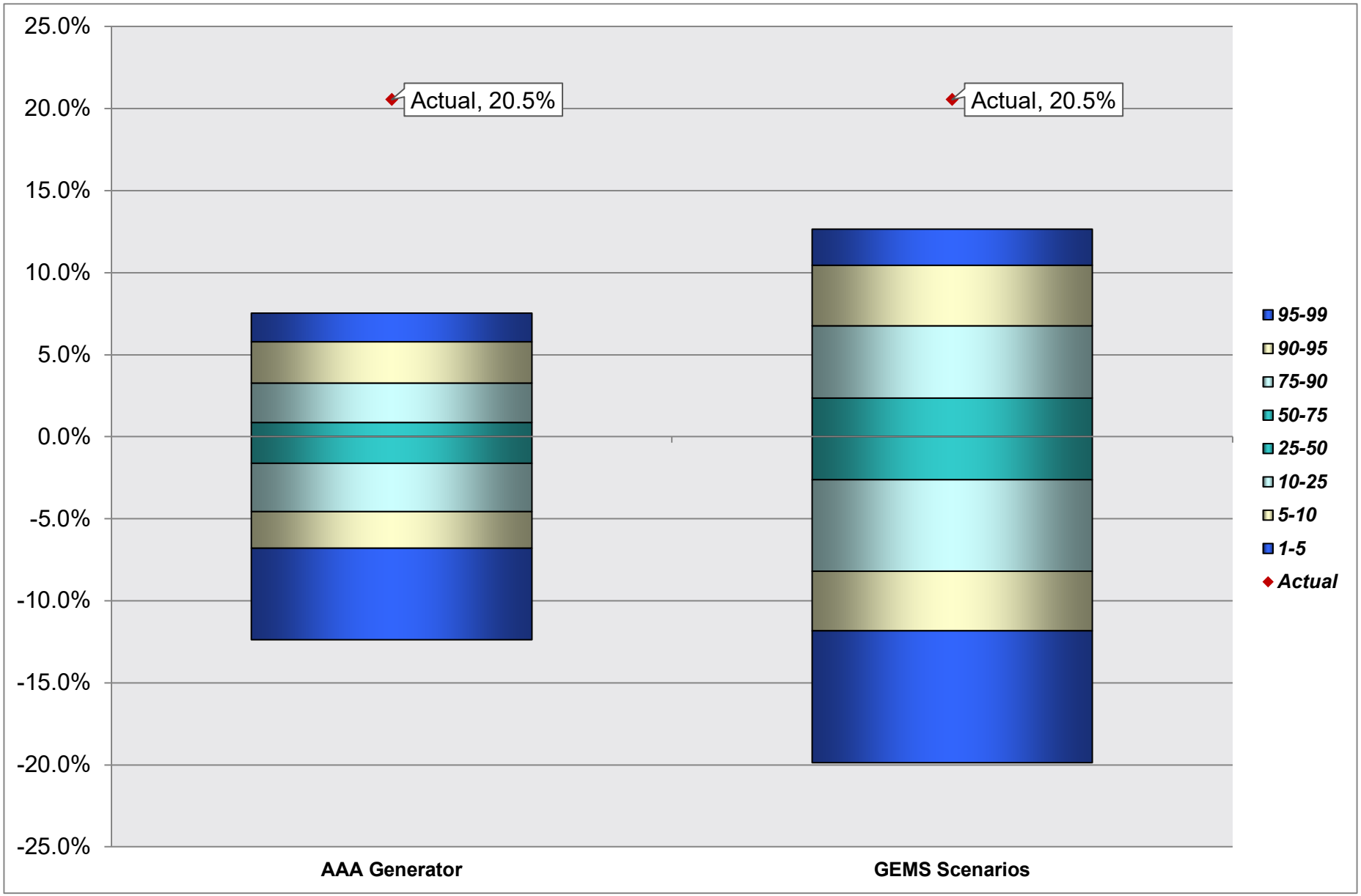
Initial Recommendation: Use Conning's existing calibration.

AAA ESG compared to GEMS®: Actual vs. Projected Q1 2020 S&P 500 Total Returns



Prepared by Conning. Sources: Academy Interest Rate Generator v 7.1.201905 and GEMS® Economic Scenario Generator scenarios

AAA ESG compared to GEMS®: Actual vs. Projected Q2 2020 S&P 500 Total Returns



Prepared by Conning. Sources: Academy Interest Rate Generator v 7.1.201905 and GEMS® Economic Scenario Generator scenarios

Goal relating to the equity scenarios:

5. Equity scenarios need to reflect the possibility of a very long recovery after a period of losses

Rationale and Background: During certain periods of time after periods of recession or depression, there have been extended periods of equity market recovery. This is important to reflect in the scenarios due to the long-term nature of some insurance liabilities.

AAA ESG compared to GEMS®: Both the AAA ESG and GEMS can produce equity scenarios that exhibit low returns over an extended period of time. This is largely driven by volatility and the expected return. If there is enough volatility or if there are low enough expected returns, low for long scenarios will be produced.

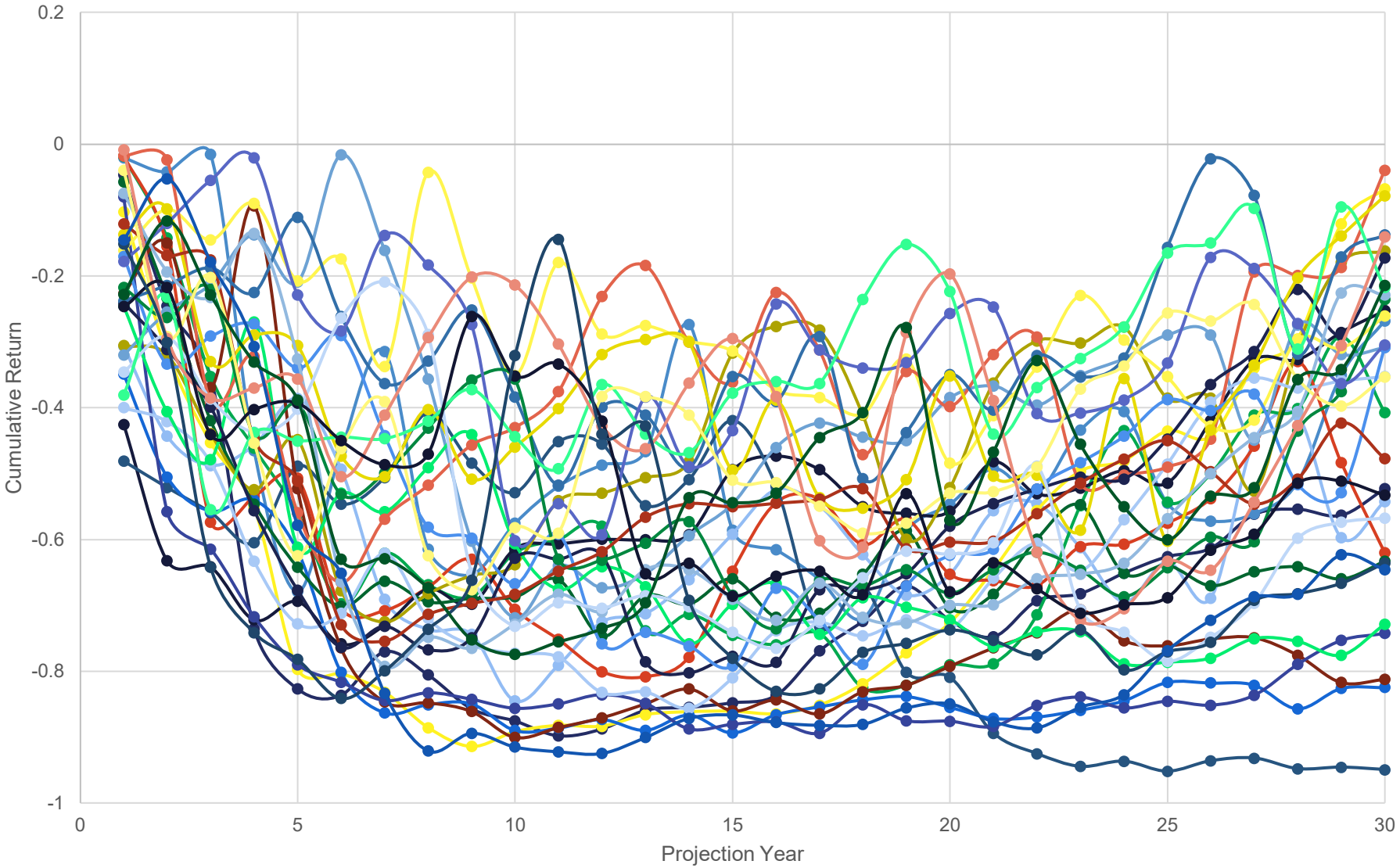
As of 9/30/20, GEMS produced 34 scenarios with cumulative negative returns over a 30-year projection compared to 3 scenarios for the AAA ESG.

Decision to be made: None

Historical S&P 500 Returns

Prepared by Conning. Source: Bloomberg.

Projected S&P 500 Returns with a 9/30/20 Start Date
GEMS Scenarios with All Negative Cumulative Returns



Goal relating to the equity scenarios:

6. There should be higher correlation in the tail scenarios between different equity indices

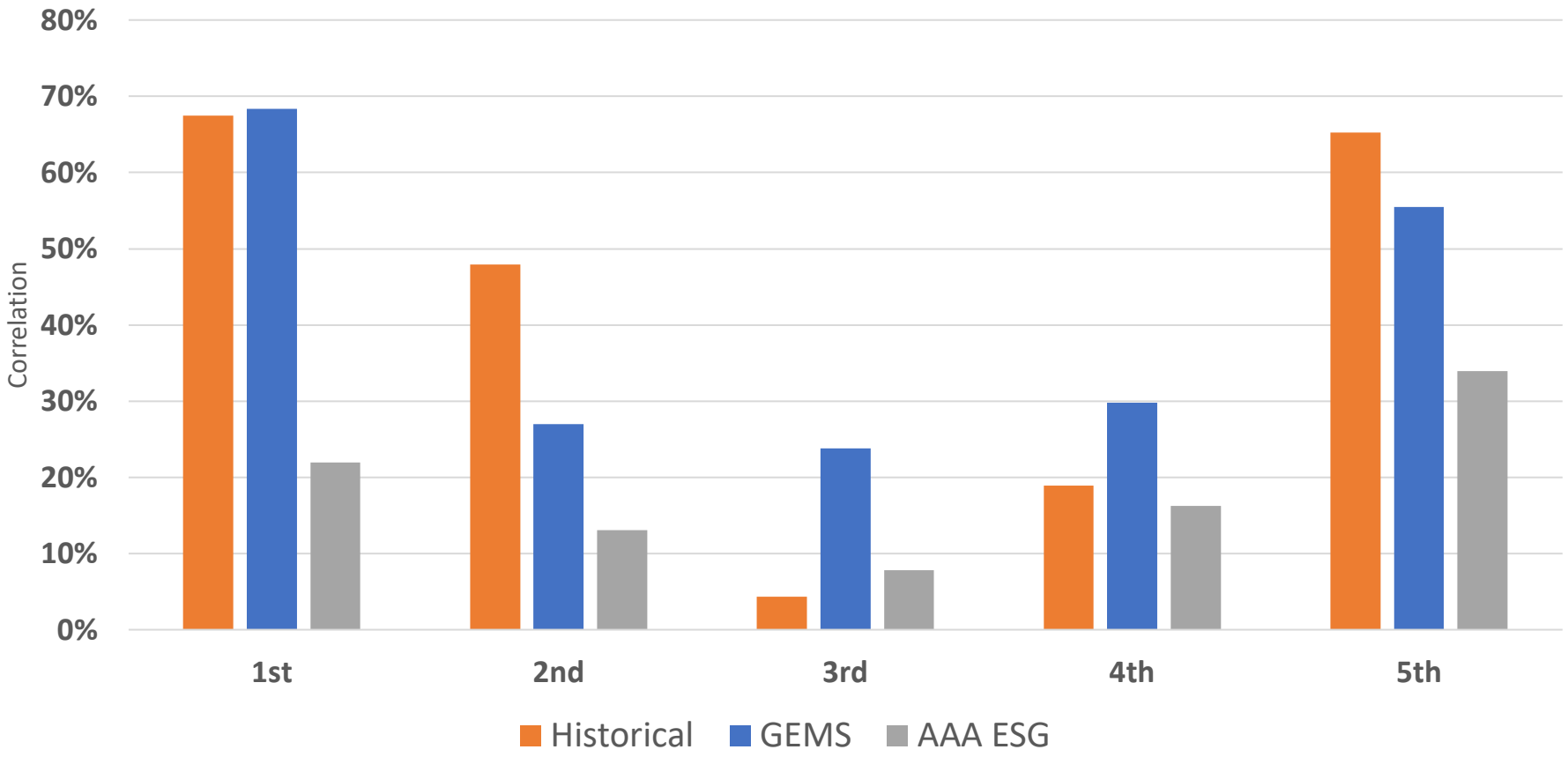
Rationale and Background: Historically, equity markets have been highly correlated in bad times. This is particularly important for reserve and capital CTE calculations

Applicable VM-21 language:
VM-21 8.C.9: It is not necessary to assume that all markets are perfectly positively correlated, but an assumption of independence (zero correlation) between the equity markets would inappropriately exaggerate the benefits of diversification. An examination of the historic data suggests that correlations are not stationary and that they tend to increase during times of high volatility or negative returns. As such, the company should take care not to underestimate the correlations in those scenarios used for the reserve calculations.

AAA ESG compared to GEMS®:

- AAA ESG uses a static correlation matrix based on data going back to 1953
- GEMS is capable of producing returns that exhibit higher degrees of correlation in the tail scenarios. GEMS correlations are based on historical data going back mainly to 1994, and back to 1953 for some components.

AAA ESG compared to GEMS® as of 9/30/20: Correlation between S&P 500 and Russell 2000 by Quintile



Decision to be made: Should the Conning calibration be utilized or would regulators like to calibrate to a specific historical period?

Initial Recommendation: Use Conning's existing calibration.

*Historical Correlation measured from 1979 to current

Goal relating to the equity scenarios:

7. There should be a link between equity returns and Treasury yields

Rationale and Background: 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. Today's low yields imply lower equity returns.

AAA ESG compared to GEMS®:

- AAA ESG has no link between the equity returns and Treasury yields.

- GEMS links expected equity return to current short Treasury Yield
  - Produces different expected returns across start dates
  - Also makes them impacted by Treasury model's mean reversion
  - This is a functional relationship, not a correlation

.

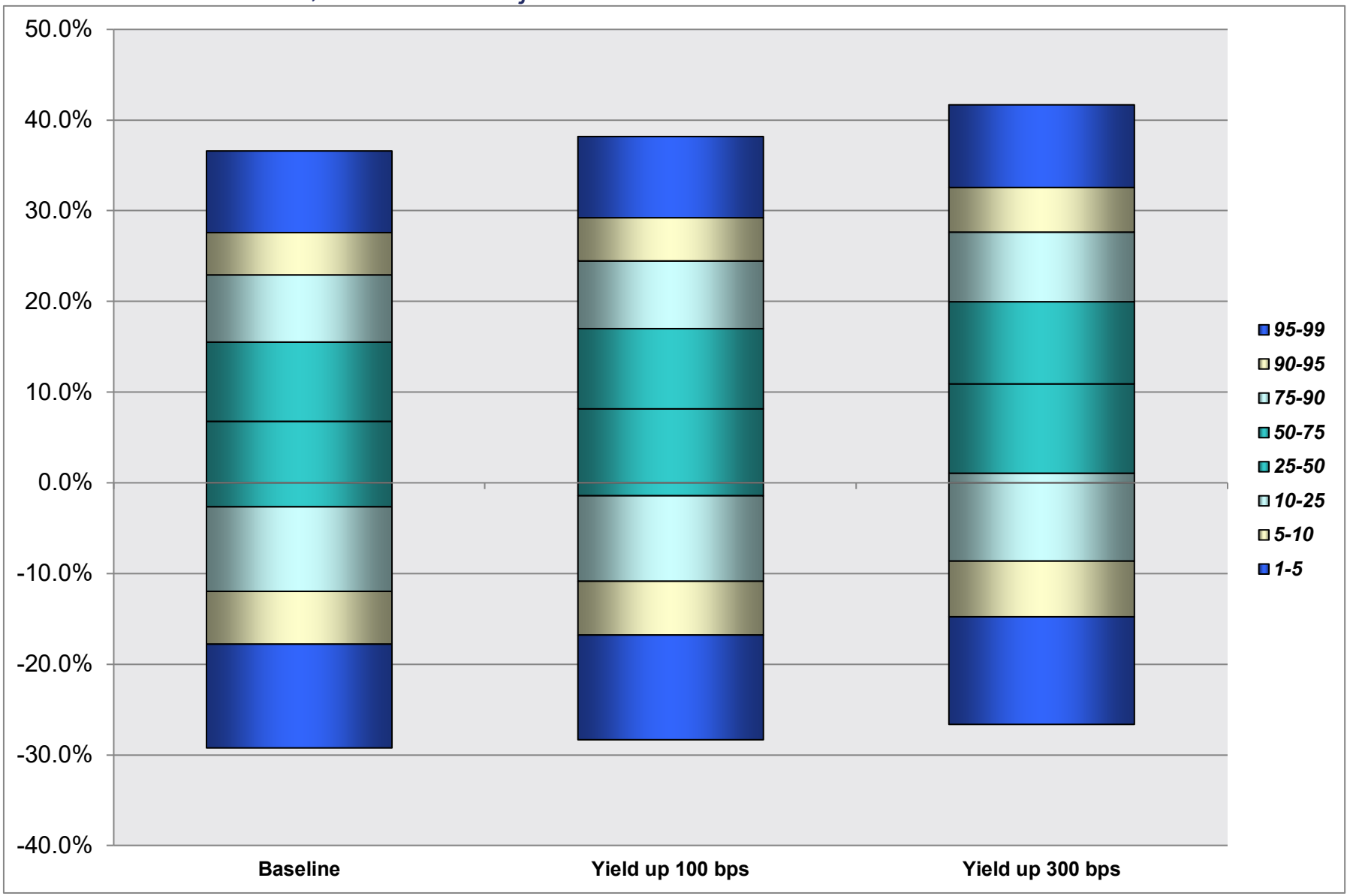
Decisions to be made:

1. Do regulators want a link between equity and treasury scenarios?
2. If so, are any changes to the functional relationship between equities and Treasuries desired?

Initial Recommendation: Use Conning's existing calibration.

Impact of Changing Initial Treasury Yield

S&P 500 Total Return, 12 Month Projections with 9/30/20 Start



Goal relating to the bond fund scenarios:

8. The same model should be used to produce bond fund returns for the Basic and Robust Data Sets*, and the returns should reflect credit rating transitions, defaults, and dynamic spreads.

Rationale and Background:

- Use of the same model will ensure consistency between the total returns in the Basic and Robust Data Sets.
- The Basic and Robust Data Sets provide different levels of detail in the output.
  - The Basic Data Set includes only the total returns for the bond indices.
  - The Robust Data Set will provide details on the components (i.e., spreads, transitions, and defaults).

*The Basic Data Set will be prescribed. The Robust Data Set is optional and is available at a cost.

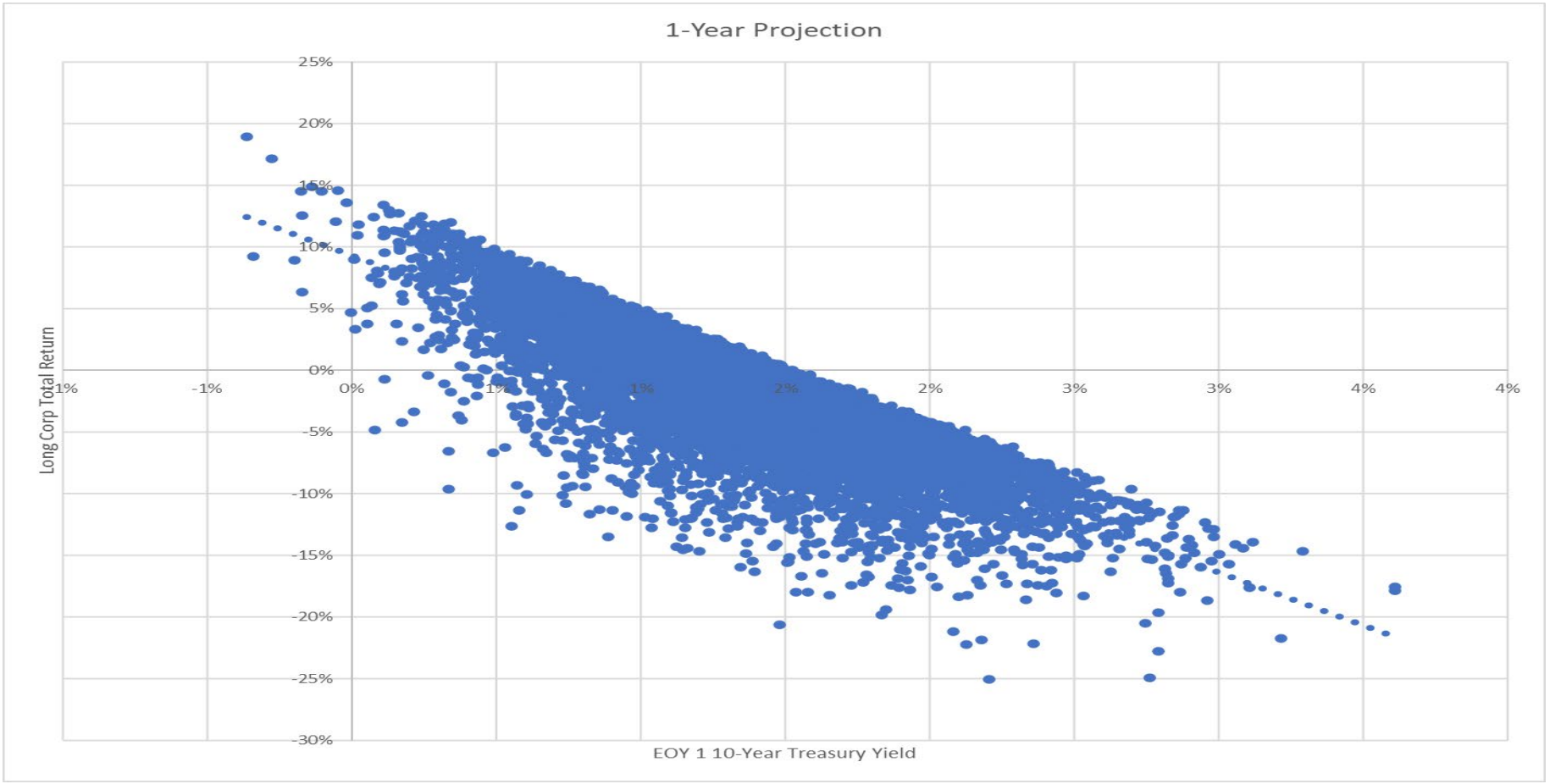
AAA ESG compared to GEMS®: The AAA ESG and GEMS Basic Data Set both provide total returns for bond indices.

- The AAA ESG total returns are linked to Treasuries, with a remainder modeled as a residual based on historical data
- GEMS Basic Data Set total returns will reflect modeled spreads, transitions, and defaults. Returns are expected to be between Treasuries and Corporate Yields minus a haircut.
    - "Haircut" typically reflects impact of defaults over a holding period
    - GEMS' returns will also reflect up- and downgrades
    - Since downgrades tend to be more frequent and have a larger impact, the impact of including them will tend to exceed "haircut"

Decision to be made: Do regulators want any changes to the methodology used to generate credit rating transitions, defaults, and dynamic spreads?

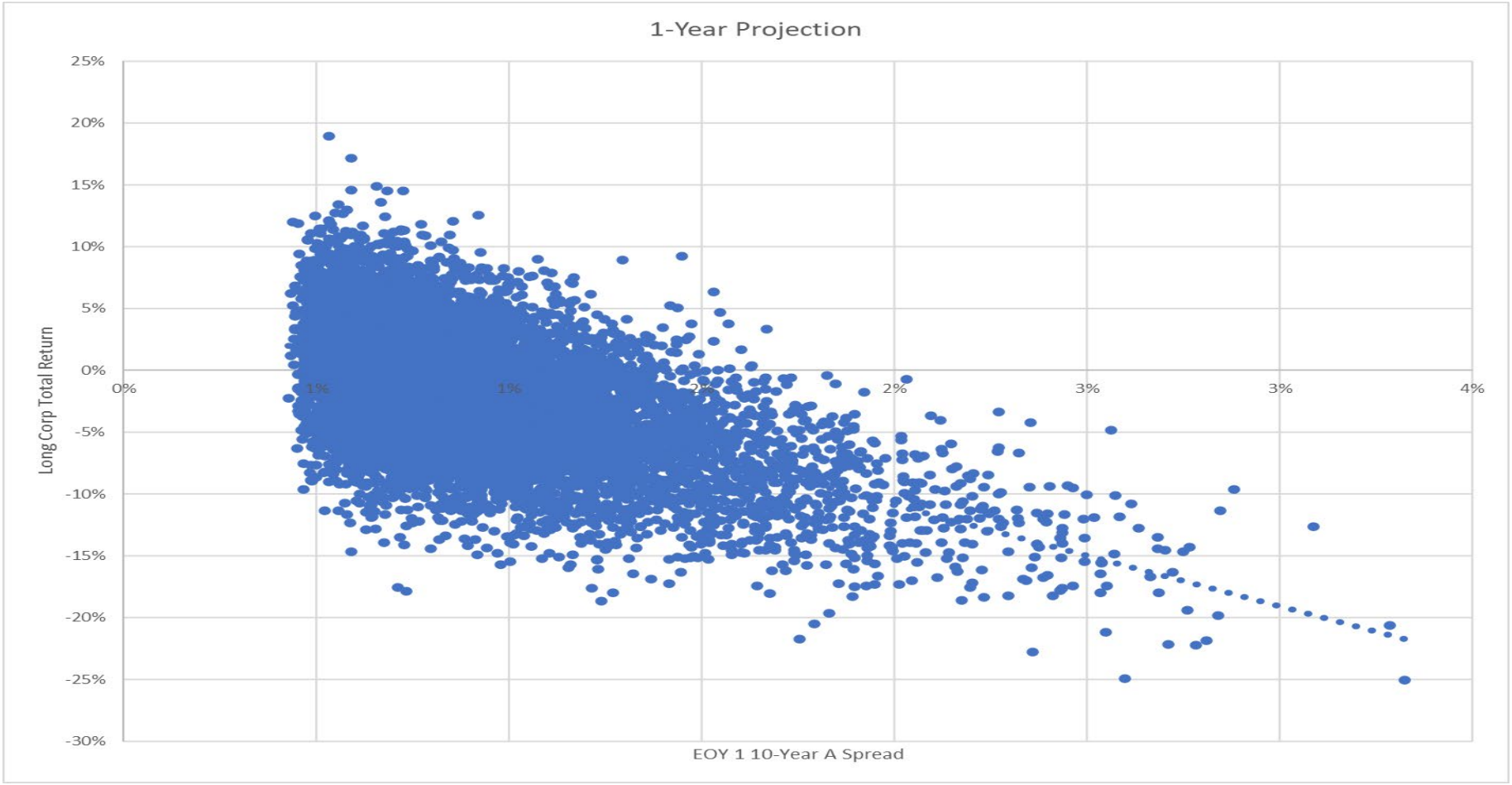
Initial Recommendation: Use Conning's existing calibration.

As Treasury yields increase, bond fund returns tend to decrease



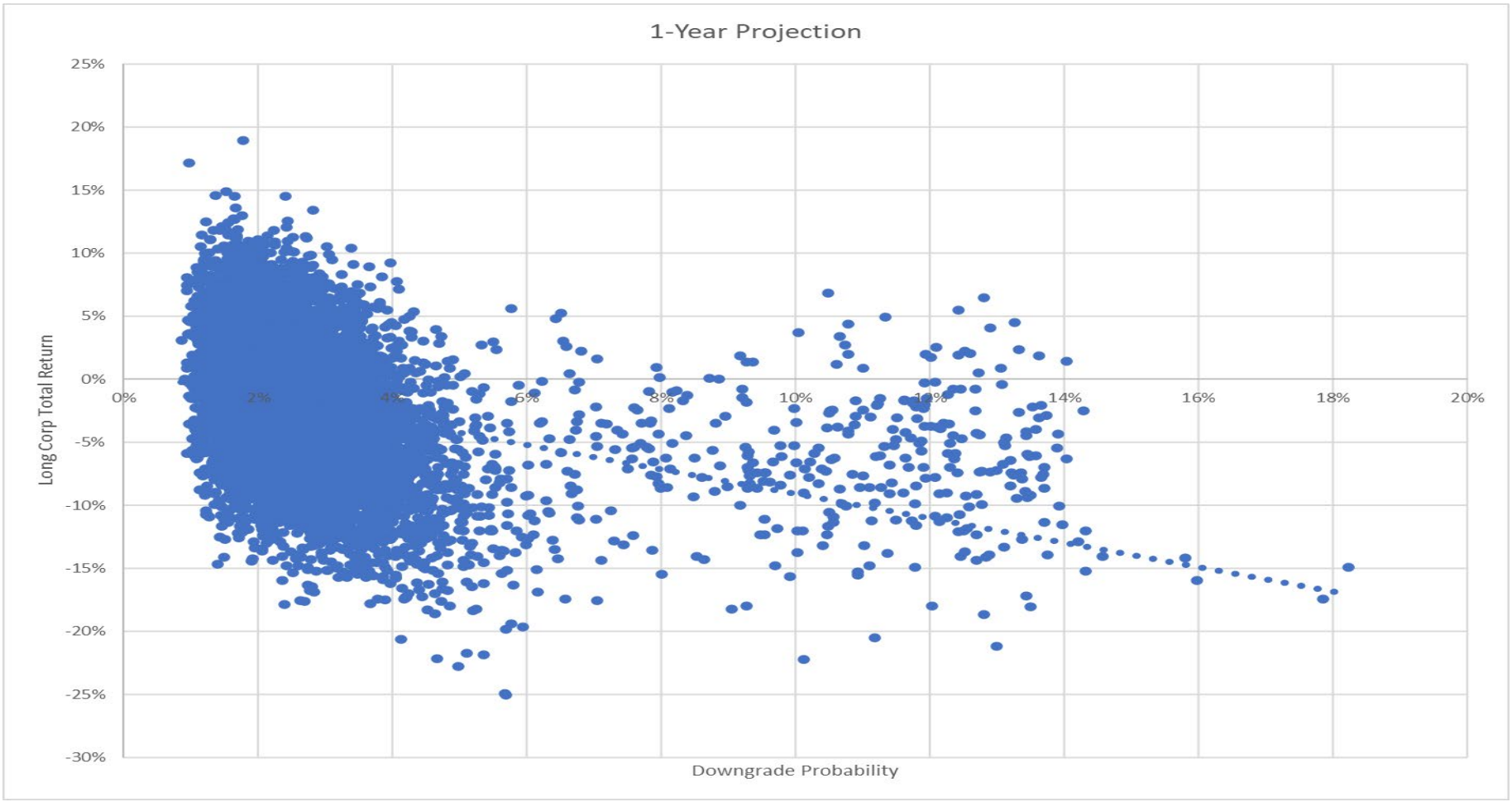
Prepared by Conning. Source: GEMS® Economic Scenario Generator scenarios

As corporate spreads over Treasuries increase, bond fund returns tend to decrease



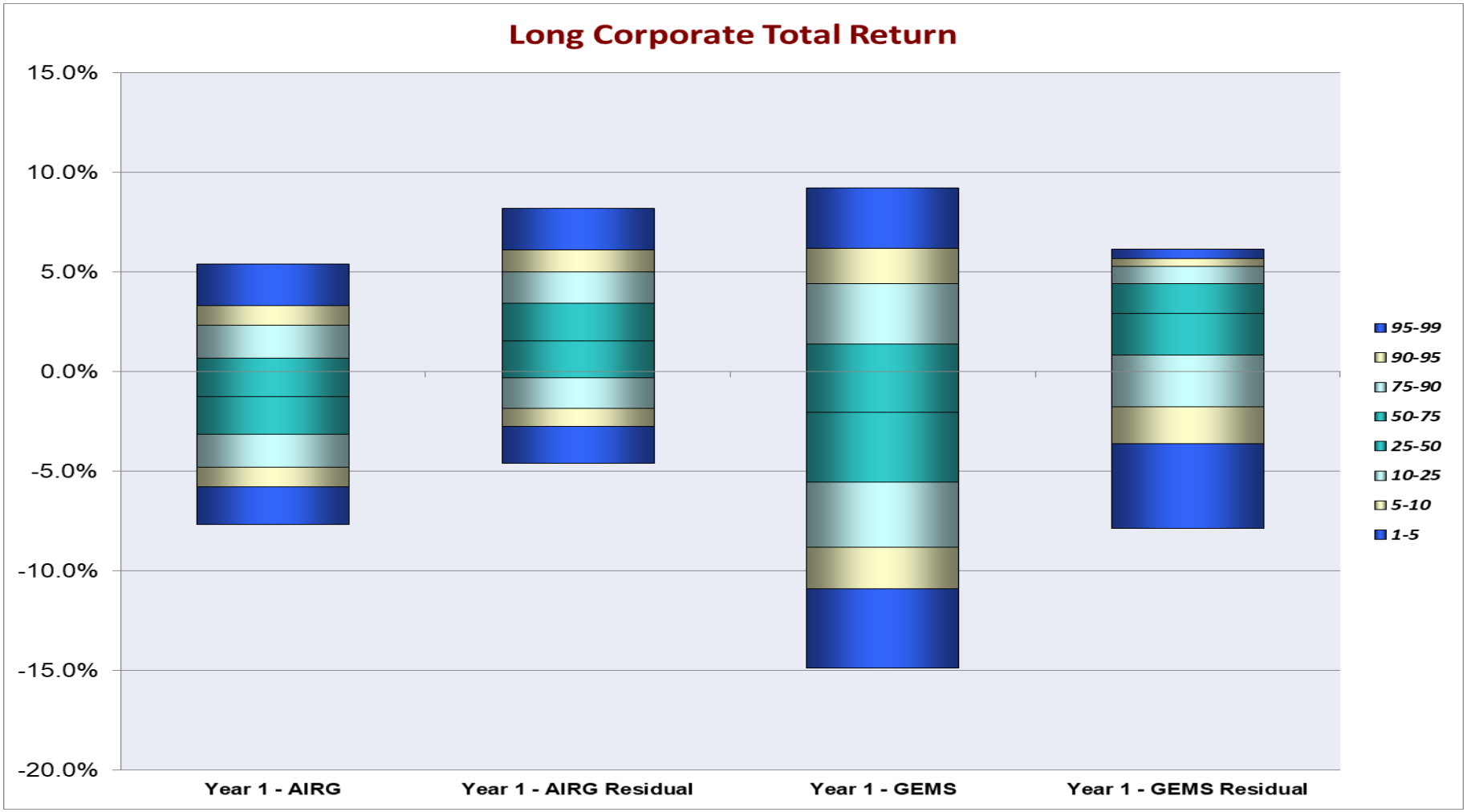
Prepared by Conning. Source: GEMS® Economic Scenario Generator scenarios

As downgrade probability increases, bond fund returns tend to decrease



Prepared by Conning. Source: GEMS® Economic Scenario Generator scenarios

AAA ESG compared to GEMS® : Year 1 Long Corporate Total Return



- Much of the difference between bars 1 and 3 is driven by higher volatility in the GEMS Treasury model.
- Bars 2 and 4 show the difference between the Corporate returns and Treasury returns.

Prepared by Conning. Sources: Academy Interest Rate Generator v 7.1.201905 and GEMS® Economic Scenario Generator scenarios

Goal relating to the bond fund scenarios:

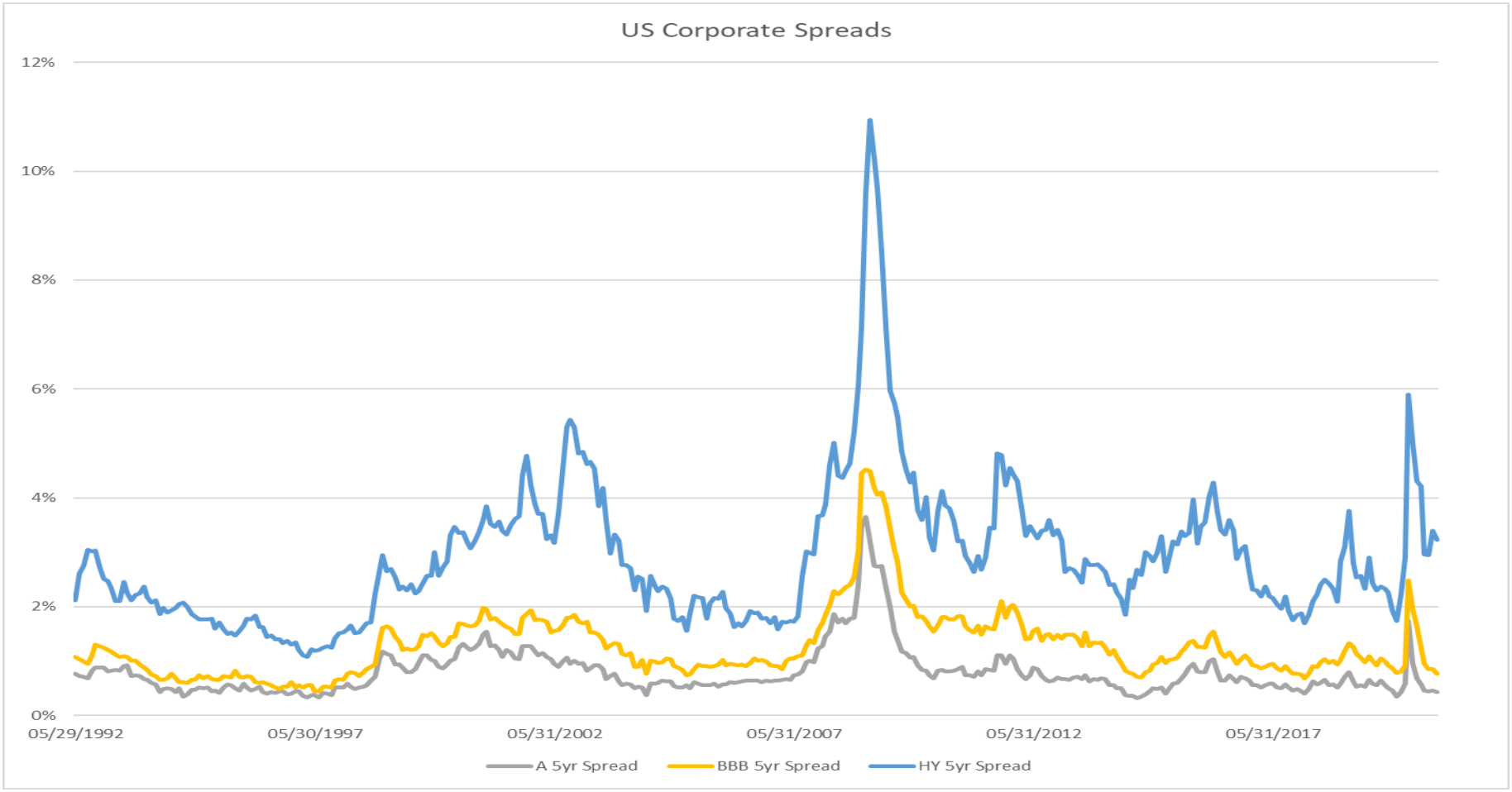
9. Separate yield curves should be generated by rating, and they should be linked to each other

Rationale and Background:

- Life insurers purchase a wide range of Corporate bonds.
- There are large differences in spreads between ratings.
- For blended bond funds (e.g., 50/50 blend of A/BBB), the total returns provided will be driven off blends of distinctly rated bonds. Bond returns by rating will not be provided in the Basic Data Set

Decision to be made: None

Historical Corporate Spreads over US Treasuries



Prepared by Conning. Source: Bloomberg.

Projected GEMS Corporate Spreads over US Treasuries (single scenario)

Prepared by Conning. Source: GEMS® Economic Scenario Generator scenarios

Goal relating to the bond fund scenarios:

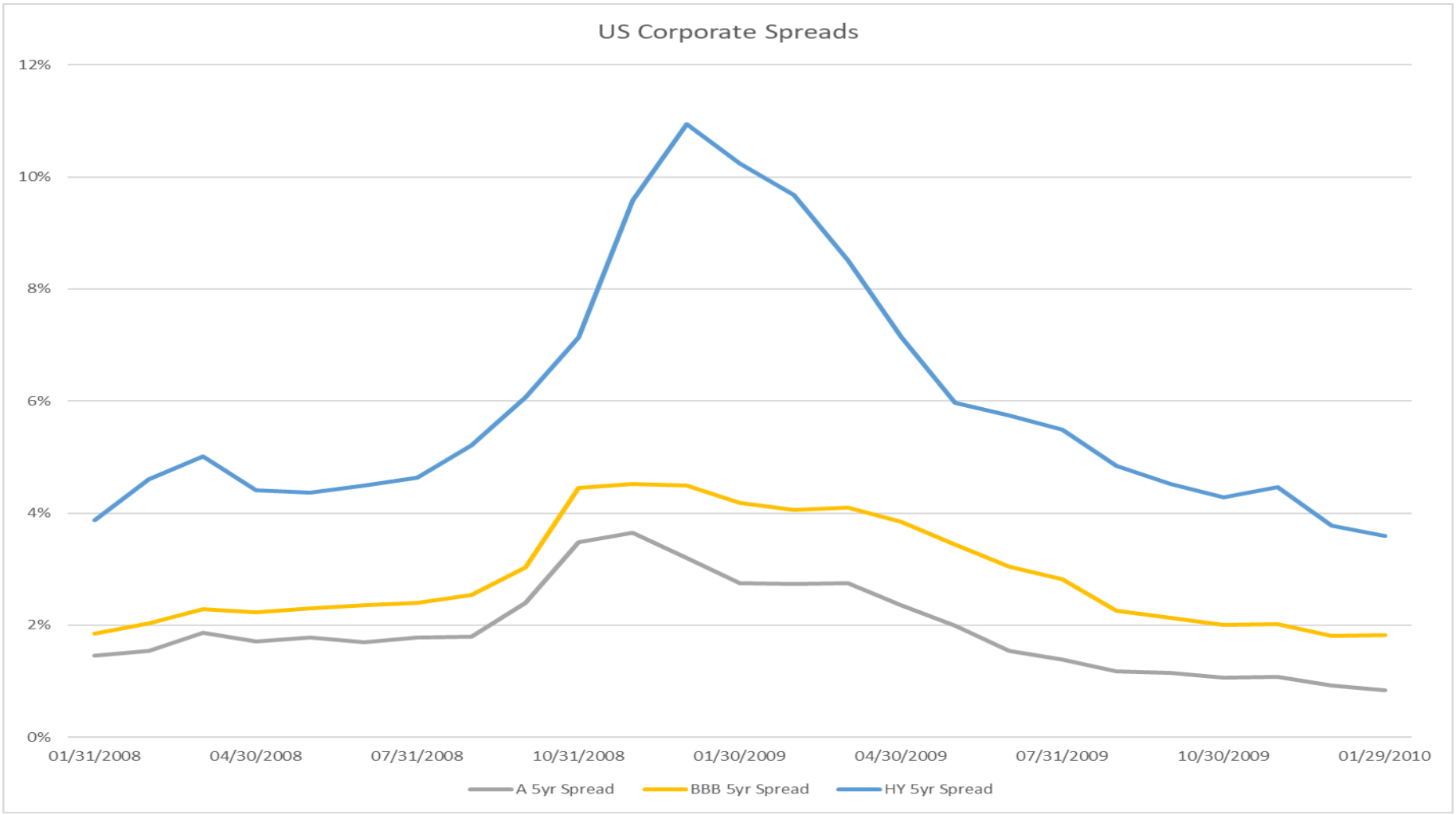
10. The spread between Treasuries and corporate bonds should be stochastic

Rationale and Background: This allows spreads to gap out like they did during the 2008 Financial Crisis and 1Q 2020. The tail of the Corporate Bond returns is driven by these types of jumps. The magnitude of the jump has been significantly different between ratings.

This makes stochastic spreads very important for life insurer's capital considerations, especially given the very large allocation to bond investments.

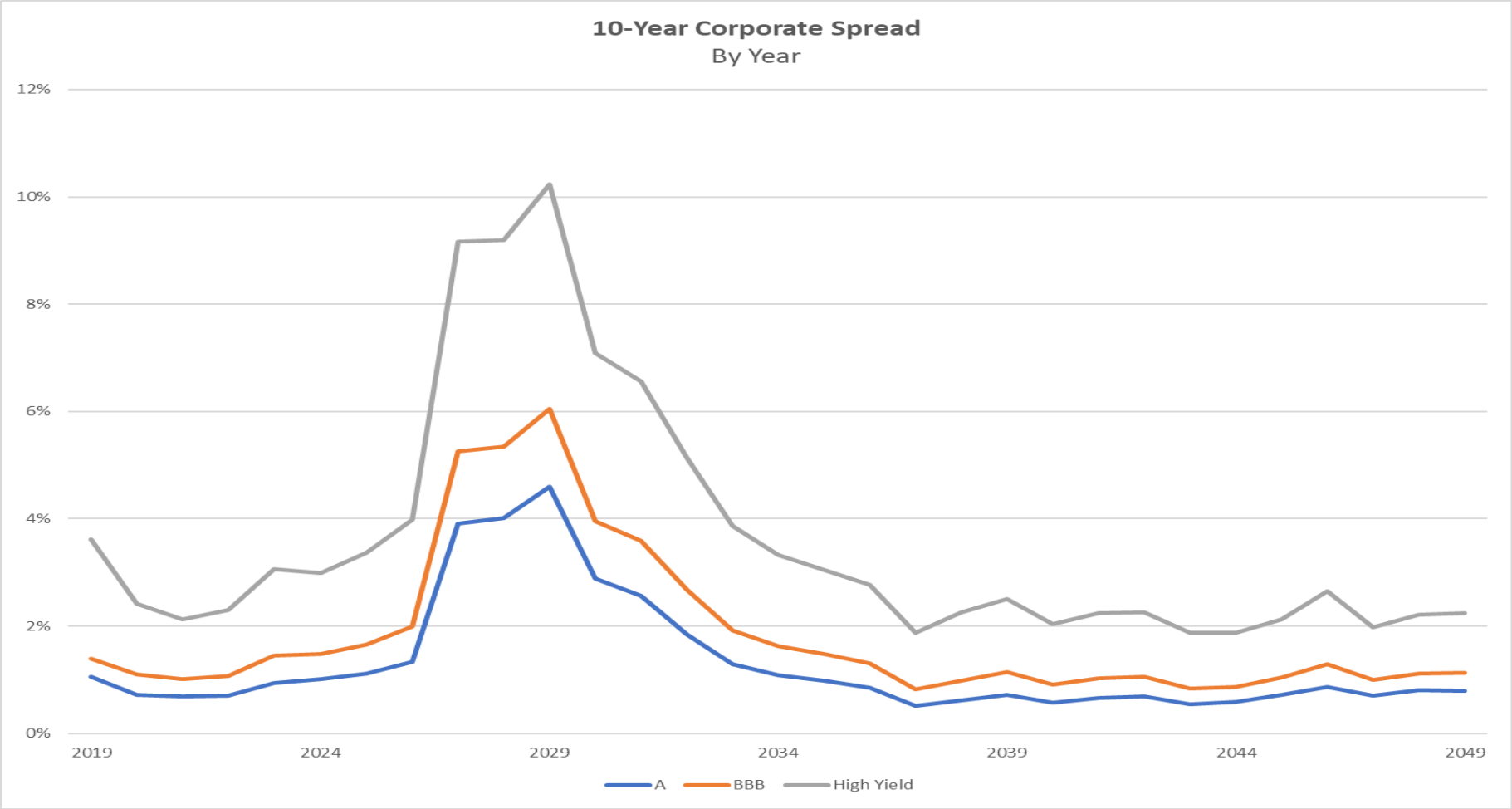
Decision to be made: None

Historical Corporate Spreads over US Treasuries (2008 Financial Crisis)



Prepared by Conning. Source: Bloomberg.

Projected GEMS Corporate Spreads over US Treasuries (single scenario)



Prepared by Conning. Source: GEMS® Economic Scenario Generator scenarios

Goal relating to the bond fund scenarios:

11. The ESG should include bond credit rating transitions and they should be dynamic

Rationale and Background: When Corporate spreads gap out, the market is indicating that these bonds have additional risk. The higher the spread, the more downward rating transitions.

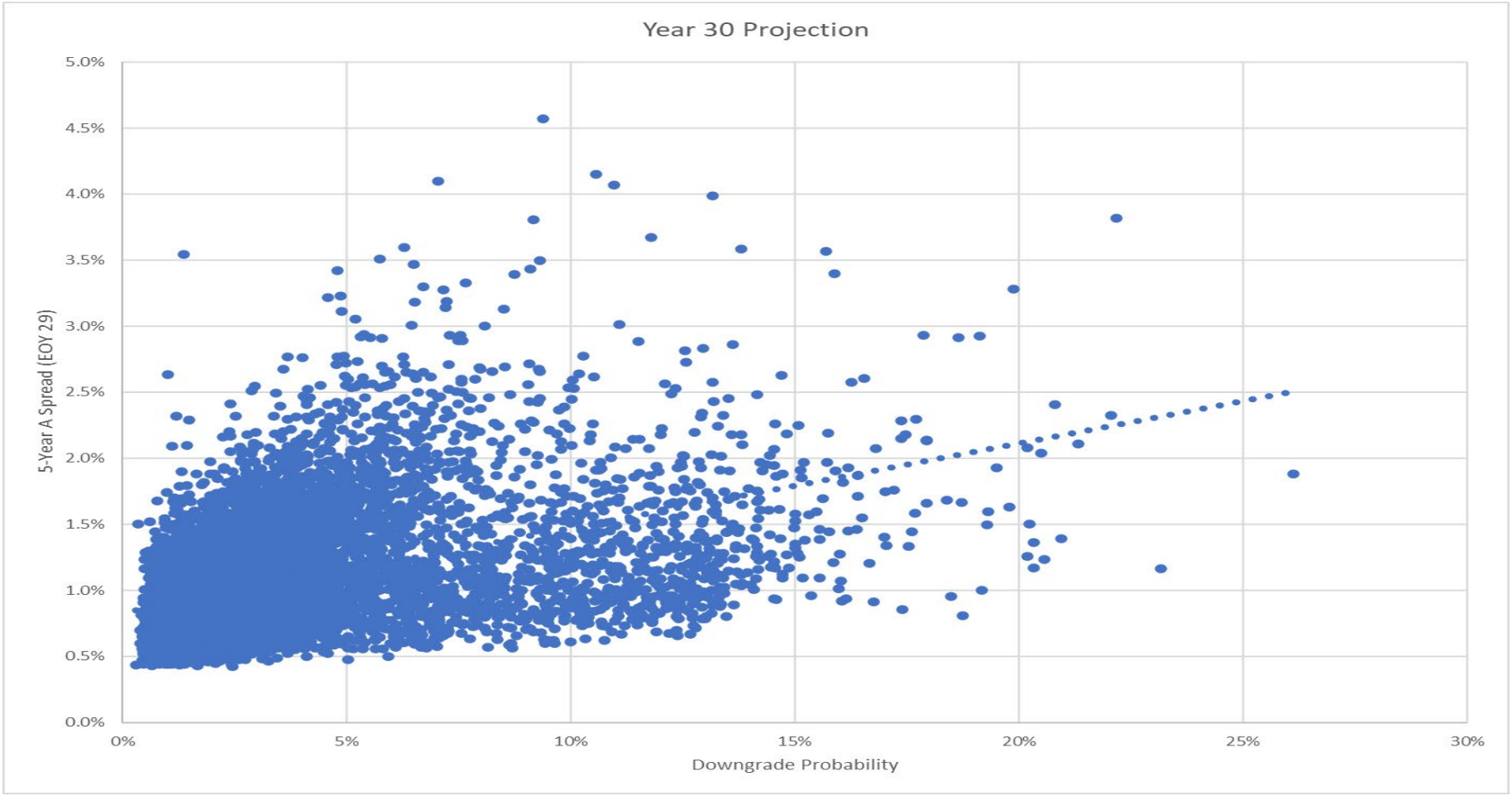
- Increasing the volatility of spreads is helpful, but it won't impact expected returns much in these situations
- Need to have some additional risk of downgrade (e.g., make an A Corporate "act" like a BBB Corporate)

Without this, the extra spread will simply lead to extra returns

Decision to be made: Do regulators want to change any of the assumptions driving spreads, rating transitions, and defaults?

Initial Recommendation: Use Conning's existing calibration.

As spreads increase, downgrade probability increases



Prepared by Conning. Source: GEMS® Economic Scenario Generator scenarios

Summary of Goals

Goals relating to equity and bond fund scenarios:

1. Returns should be provided for funds representative of those offered in U.S. insurance products.
2. The ESG should be calibrated using an appropriate historical period.

Goals relating to the equity scenarios:

3. The equity model should have stochastic volatility and the initial volatility should be updated frequently.
4. The ESG should have the ability to generate very large losses and gains in short periods of time (i.e. jumps).
5. Equity scenarios need to reflect the possibility of a very long recovery after a period of losses.
6. There should be higher correlation in the tail scenarios between different equity indices.
7. There should be a link between equity returns and Treasury yields.

Goals relating to the bond fund scenarios:

8. The same model should be used to produce bond fund returns for the Basic and Robust Data Sets*, and the returns should reflect credit rating transitions, defaults, and dynamic spreads.
9. Separate yield curves should be generated by rating, and they should be linked to each other.
10. The spread between Treasuries and corporate bonds should be stochastic.
11. The ESG should include bond credit rating transitions and they should be dynamic.

ESG Exposure

The items listed below are exposed for a public comment period ending on 1/31/21.

1. A spreadsheet summarizing the decisions needed for the Treasury, equity, and corporate models (these were included in the 12/3/20 and 12/17/20 LATF presentations), along with an initial set of recommendations.
2. The entire Basic Data Set as of 12/31/19, calibrated based on the initial set of recommendations. This includes:
    - The full set of 10,000 interest rate scenarios
    - Equity and bond fund returns for the funds shown on slide 9.
    - Fan charts summarizing the interest rate scenarios
3. A spreadsheet showing the parameters of the Treasury model, and how targets (e.g., short and long-term mean reversion level, mean reversion speed) are converted into these parameters.

Notes regarding the materials:

- The initial set of recommendations and resulting scenarios represent a first cut at the types of changes that may be desired for the ESG. Additional modifications are expected based on comments received.
- These scenarios are a starting point for discussions, and are not intended to be used for an industry field test. A formal field test is currently planned in the March - May timeframe.
- Comments are appreciated on any aspect of the ESG.