GOES (E/A) Subgroup: Review Scenario Statistics

April 10th, 2024

NAIC NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

Agenda

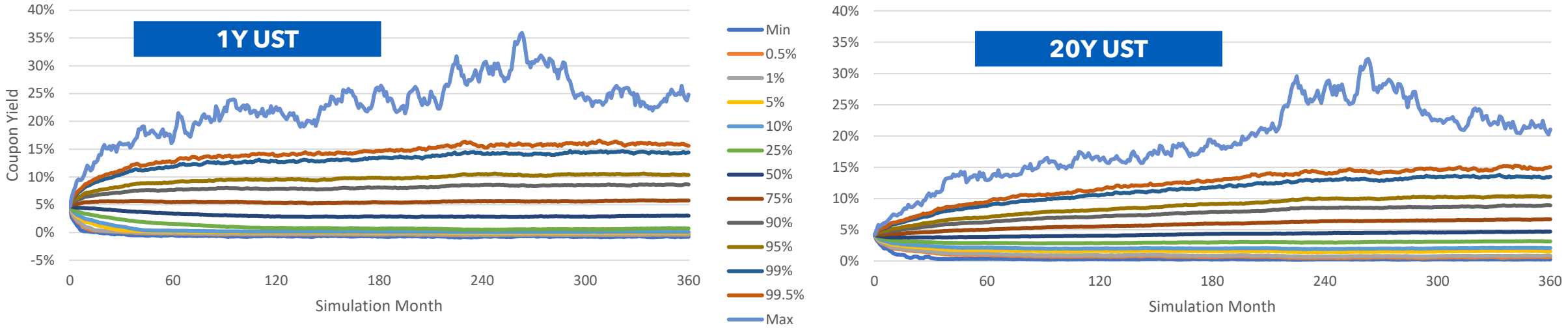
1. Review of Treasury Scenarios vs. Acceptance Criteria
2. Review of Equity Fund Scenarios vs. Acceptance Criteria

Review of Treasury Scenarios vs. Acceptance Criteria

NAIC NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

Item	Category	Criteria
T1.T	Prevalence of High Rates, Upper Bound on Treasury Rates	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

10,000 UST Scenarios as of 12/31/23 Fan Charts by Percentile

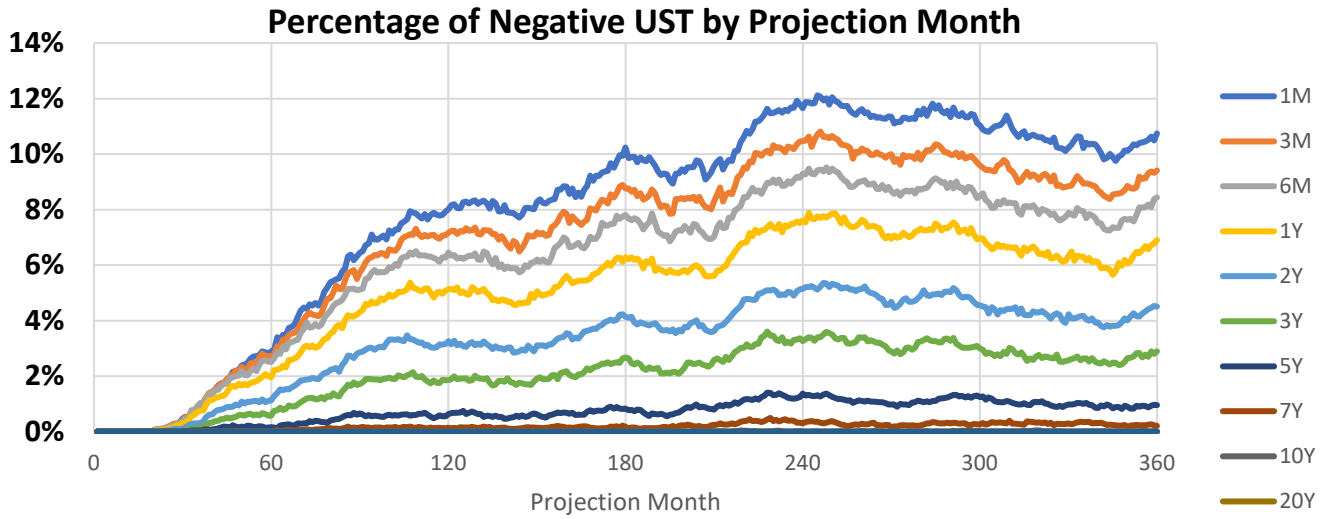


T1.Tb

	>X%, EOY 30	>X%, any of 1st 30 Years	X% >= 99.5th Percentile
1Y	0.19%	**2.35%**	**16.55%**
20Y	0.1%	**1.25%**	**15.24%**

Item	Category	Criteria
T2.T	Lower Bound on Negative Interest Rates	Apply the following guidance for negative 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 generally not be lower than -1.0% d) 20Y rates should generally not be lower than 0.0%

Negative UST Rates, 12/31/23 Scenario Set

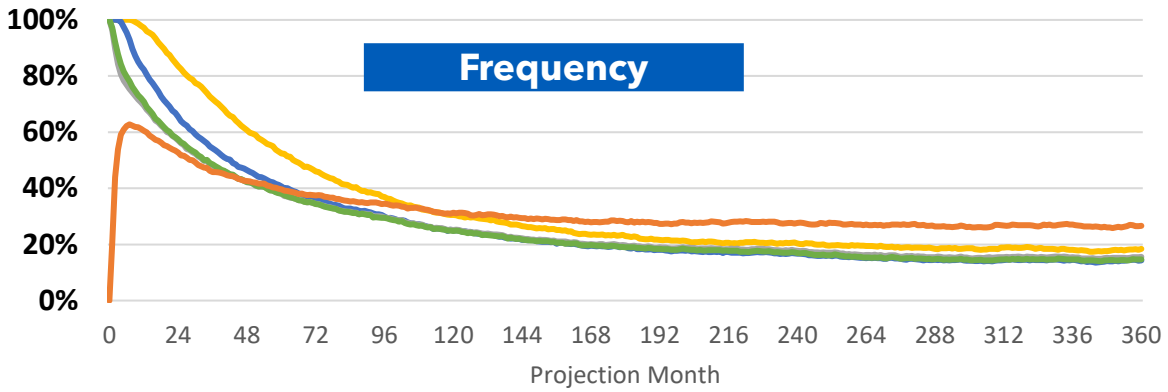


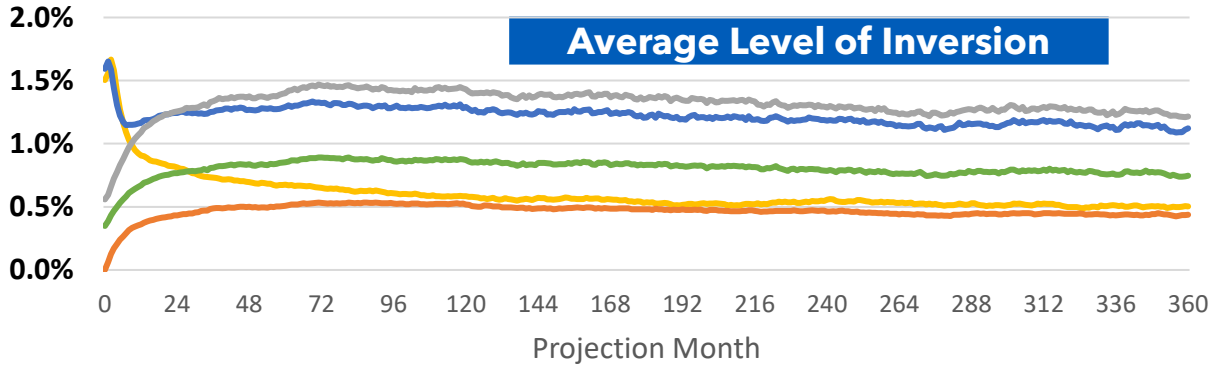
a) Maturities greater than 5Y experience negative rates infrequently
b) This criteria is permissive
c) The minimum 1Y UST in the first 30 years is -0.9%
d) The minimum 20Y UST in the first 30 years is 0.2%

360 month minimum	1M	3M	6M	1Y	2Y	3Y	5Y	7Y	10Y	20Y	30Y
12/31/2023	-1.1%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.5%	-0.3%	-0.1%	0.2%	0.4%

Item	Category	Criteria
T3.T	Initial Yield Curve Fit, Yield Curve Shapes in Projection, and Steady State Yield Curve Shape	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)

Inversion Statistics, 12/31/23 Scenario Set





Historical Inversion Data	1m > 2y	3m > 10y	2y > 10y	10y > 30y	1y > 20y
% Inversions, 4/1953 to 3/2021*	10%	10%	19%	22%	16%
% Inversions, 12/31/21 to 11/21/23**	51%	64%	78%	5%	69%
Average Inversion, 4/1953 to 3/2021*	0.33%	0.54%	0.38%	0.22%	0.63%
Average Inversion, 12/31/21 to 3/26/24**	0.72%	1.21%	0.52%	0.05%	0.69%

*Based on month-end data

**Based on daily data

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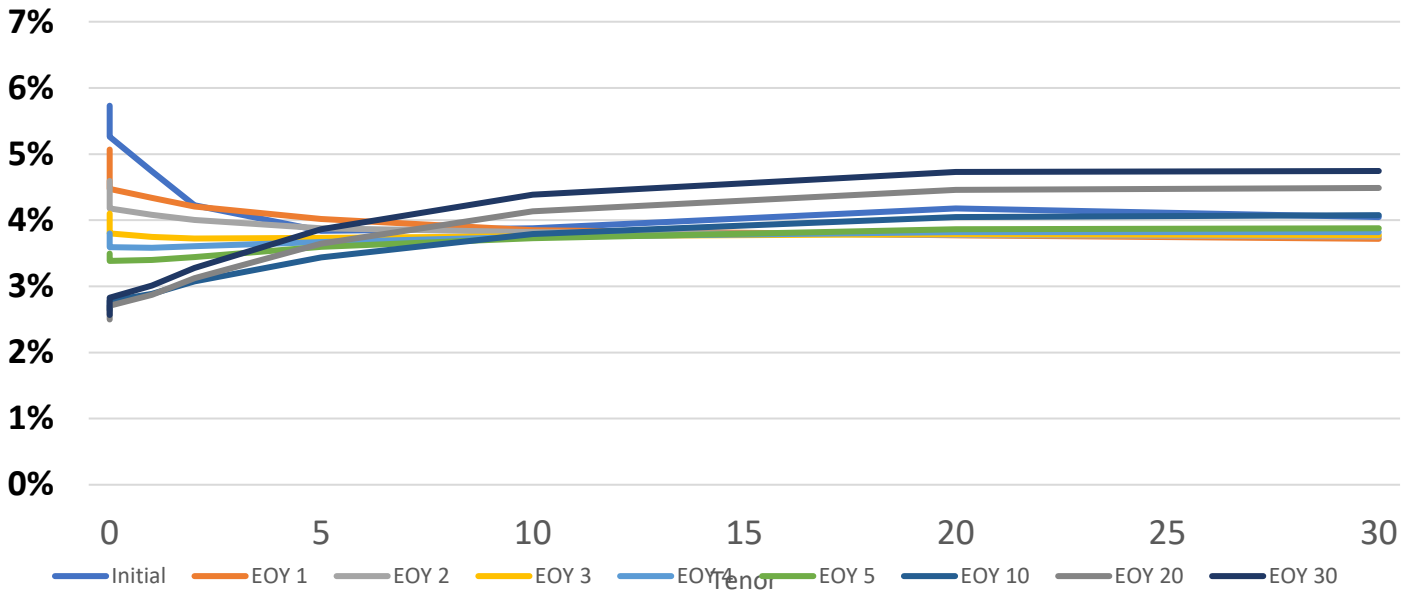
Median Yields at Selected Projection Months, 12/31/23 Scenario Set



From the graph on the left, you can see that the median yield curve evolves from the inverted starting conditions to the normal yield curve that is targeted in the steady state.

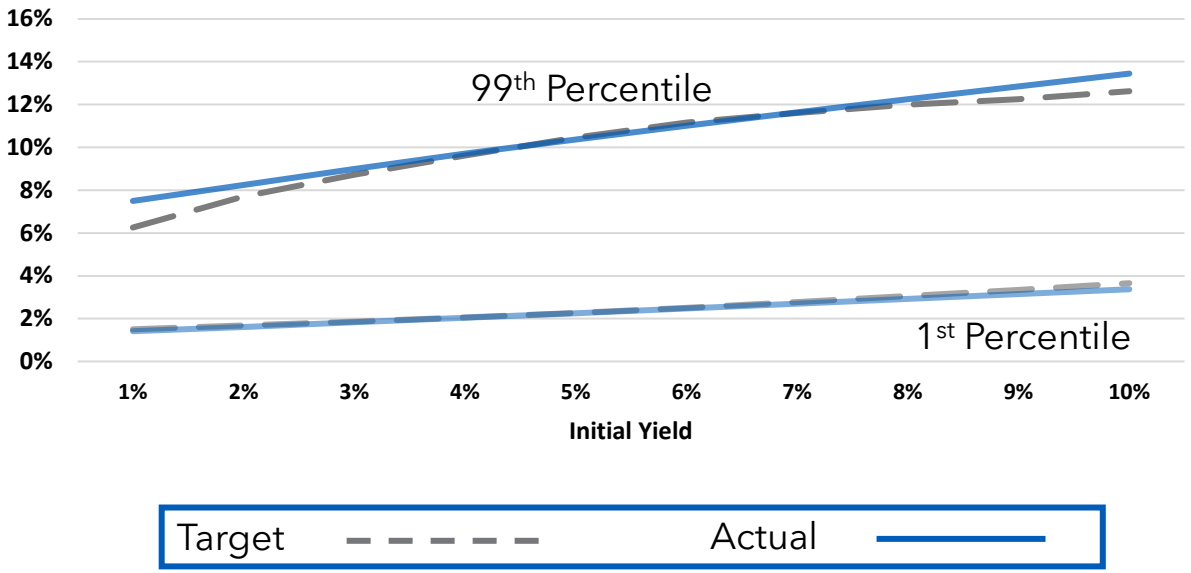
Item	Category	Criteria
T4.T	Low For Long: 12/31/20 Starting Conditions	a) At least 7.5% of scenarios need a 10-year geometric average of the 20-year UST below **1.45%** b) At least 3.75% of scenarios need a 30-year geometric average of the 20-year UST below **1.95%** **Note: As part of the model acceptance 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.**

A			B		
7.5th Percentile of 10Y Geometric Average	**Criteria**	**Pass / Fail**	**3.75th Percentile of 30Y Geometric Average**	**Criteria**	**Pass / Fail**
1.38%	1.45%	✓Pass	1.84%	1.95%	✓Pass

The calibration is comfortably meeting the low-for-long 12/31/20 calibration criteria.

Item	Category	Criteria
T5.T	Low- and High-For-Long at Varying Starting Conditions	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).

Geometric Average of 20Y UST over 30 years



	10-Year				30-Year			
	1st Percentile		99th Percentile		1st Percentile		99th Percentile	
Starting Yield of 20Y UST	*Target*	Actual	*Target*	Actual	*Target*	Actual	*Target*	Actual
1%	*0.94%*	0.75%	*3.43%*	4.86%	*1.50%*	1.42%	*6.25%*	7.50%
2%	*1.23%*	1.09%	*5.05%*	6.05%	*1.68%*	1.61%	*7.71%*	8.25%
3%	*1.62%*	1.47%	*6.55%*	7.21%	*1.86%*	1.83%	*8.72%*	8.99%
4%	*2.15%*	1.87%	*7.74%*	8.28%	*2.06%*	2.04%	*9.62%*	9.71%
5%	*2.66%*	2.28%	*8.87%*	9.31%	*2.26%*	2.25%	*10.46%*	10.36%
6%	*3.15%*	2.70%	*9.96%*	10.32%	*2.50%*	2.47%	*11.16%*	11.01%
7%	*3.63%*	3.13%	*11.03%*	11.33%	*2.78%*	2.70%	*11.61%*	11.64%
8%	*4.10%*	3.58%	*12.07%*	12.31%	*3.06%*	2.93%	*11.99%*	12.25%
9%	*4.64%*	4.03%	*13.08%*	13.28%	*3.34%*	3.15%	*12.25%*	12.85%
10%	*5.21%*	4.47%	*14.01%*	14.23%	*3.65%*	3.37%	*12.63%*	13.45%

The calibration meets all of the 10-year geometric average low for long and high for long criteria for varying starting levels. However, there are some misses for the 5% and the 6% starting environments on the high for long criteria.

Review of Equity Scenarios vs. Acceptance Criteria

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E1.T Large Capitalization Equity Gross Wealth Factors

	Targets						Simulated						Ratio					
Percentiles	1	5	10	20	30	50	1	5	10	20	30	50	1	5	10	20	30	50
0	0.46	0.25	0.22	0.25	0.29	0.46	0.49	0.21	0.14	0.08	0.17	0.26	1.08	0.87	0.64	0.29	0.57	0.57
1	0.70	0.58	0.60	0.79	1.15	2.82	0.70	0.55	0.53	0.63	0.94	2.17	1.00	0.95	0.88	0.79	0.82	0.77
5	0.82	0.80	0.91	1.36	2.20	6.38	0.82	0.79	0.88	1.29	2.03	5.47	1.00	1.00	0.96	0.95	0.92	0.86
10	0.88	0.93	1.12	1.81	3.08	9.78	0.88	0.92	1.11	1.74	2.93	8.81	1.00	0.99	0.99	0.96	0.95	0.90
15	0.92	1.02	1.28	2.18	3.84	12.94	0.93	1.02	1.28	2.10	3.73	11.91	1.00	1.00	1.00	0.96	0.97	0.92
25	0.99	1.18	1.54	2.81	5.26	19.23	0.99	1.18	1.55	2.80	5.17	18.42	1.00	1.01	1.01	1.00	0.98	0.96
30	1.01	1.24	1.66	3.12	6.01	22.79	1.01	1.25	1.67	3.13	5.89	22.02	1.00	1.00	1.00	1.00	0.98	0.97
50	1.09	1.48	2.15	4.47	9.23	39.98	1.10	1.49	2.17	4.48	9.28	39.64	1.01	1.01	1.01	1.00	1.01	0.99
70	1.17	1.74	2.71	6.30	14.12	68.89	1.18	1.76	2.75	6.36	14.09	69.20	1.01	1.01	1.02	1.01	1.00	1.00
75	1.19	1.82	2.89	6.93	15.88	80.22	1.20	1.83	2.92	6.96	15.89	80.89	1.01	1.01	1.01	1.00	1.00	1.01
85	1.25	2.02	3.36	8.69	21.06	115.31	1.26	2.03	3.40	8.62	21.02	115.56	1.01	1.01	1.01	0.99	1.00	1.00
90	1.28	2.15	3.71	10.09	25.20	147.92	1.30	2.17	3.76	9.97	25.08	145.91	1.01	1.01	1.01	0.99	1.00	0.99
95	1.34	2.37	4.30	12.33	33.19	210.72	1.36	2.39	4.38	12.30	32.53	211.90	1.01	1.01	1.02	1.00	0.98	1.01
99	1.45	2.82	5.64	18.18	53.74	397.23	1.47	2.83	5.68	17.53	50.56	394.09	1.01	1.00	1.01	0.96	0.94	0.99
100	1.76	4.20	8.98	42.03	140.72	1676.94	1.82	4.29	9.32	38.28	120.07	2292.44	1.03	1.02	1.04	0.91	0.85	1.37

The Large Capitalization (S&P 500) equity fund gross wealth factors (GWFs) are largely aligned with the targets across the bulk of the percentile GWF distribution over the projected durations. The first percentile does show some differences, with lower returns over time in the latest equity calibration compared to the targets.