ACLI
Financial Security for Life

Economic Scenario Field Test Run #6: ACLI Equity Calibration for GEMS

June 30, 2022

Objective

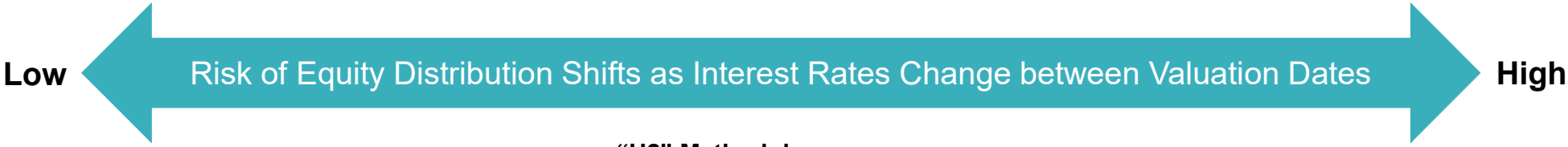
- Test an alternative equity calibration in GEMS that
  - Reflects relevant economic data, theory, and relationships with plausibly severe (worse than history) tails
  - Exhibits different equity scenario behavior as market conditions, particularly interest rates, change
    - Similar to the Conning “H2” calibration approach adopted for the baseline field test runs, with the benefit of maintaining distribution properties across different initial and projected market conditions in a simple and effective way.
  - Can be updated in a transparent, repeatable manner if calibration targets or acceptance criteria change
  - Provides additional information for establishing the parameters of the second field test

Calibration Approach

- Calibrate total returns for each of the 4 native GEMS US equity indices to historical data using generalized maximum likelihood estimation and other standard statistical methods
  - Sets GEMS short rate multiplier input parameter to 0
  - Preserves all other GEMS structural features, including jumps
- Make a limited set of defined adjustments (can be refined to meet acceptance criteria):
  - Adjust the Large Cap (S&P) drift parameter to align with regulators' previously specified 8.75% target annualized average for the average 30-year GWF (corresponds to ~7.4% geometric mean annual return) for the pre-2020 calibration criteria and AIRG
  - Adjust a volatility parameter of the other indices to align with historical volatility relationships with the S&P
  - Adjust the drift parameter for other indices to align Sharpe ratios with the S&P
- Slides 9-10 show the parameters of the calibration
- GEMS dividend process parameters and international fund derivations are unchanged

Behavior in Interest Rate Sensitivity Runs

- ACLI Run #6 helps explore a range of equity distribution behaviors for the field test



ACLI Calibration (Run #6)

Entire GWF distribution remains stable as interest rates fluctuate between reporting dates

"H2" Methodology (Runs #1a, #2a)

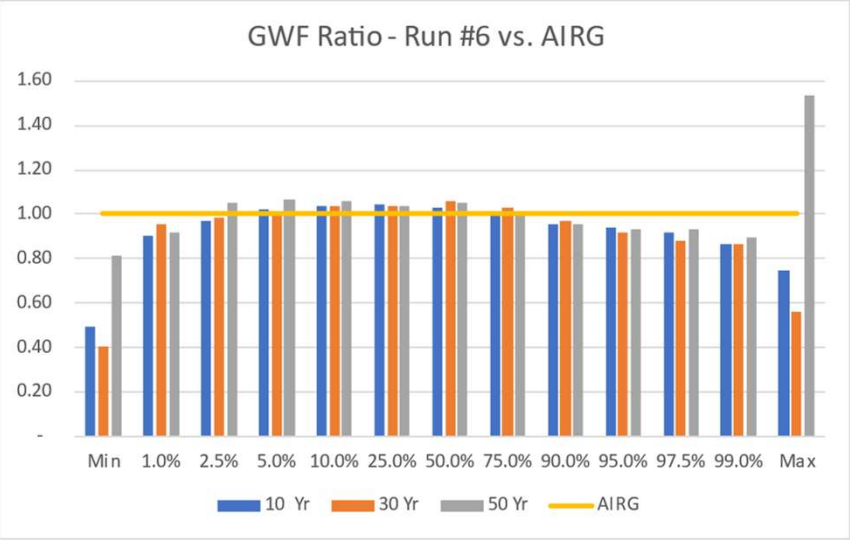
One point in the GWF distribution is stabilized through parameter adjustments while other portions shift up or down (but by smaller magnitudes than Calibration "A")

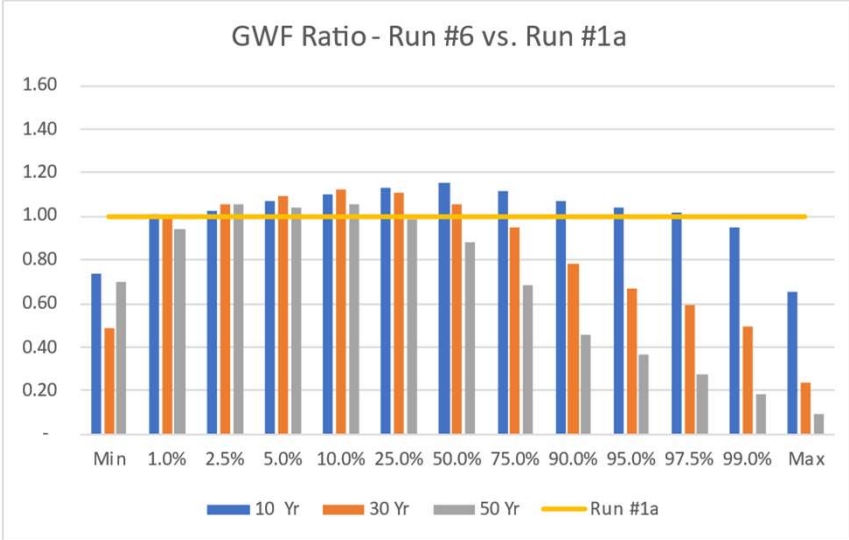
Calibration "A" (Runs #5a, #5b)

Entire GWF distribution may shift dramatically in the same direction as the change in interest rates

See slide 17 for Field Test GWF distributions

Large Cap (S&P) Total Return Gross Wealth Factors





- Distributions are relatively similar to AIRG and GEMS Run #1a, however improves on the right tail in GEMS Run #1a that significantly exceeds AIRG at longer time horizons

Note: All Run #6 statistics were produced by a model that approximates the GEMS equity model based on publicly available information. Actual GEMS output may differ somewhat.

Large Cap (S&P) Total Return Gross Wealth Factors

AIRG	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.40	0.37	0.36	0.40	0.47	0.49
1.0%	0.72	0.61	0.66	0.89	1.23	3.08
2.5%	**0.78**	**0.71**	**0.79**	1.12	1.72	4.47
5.0%	**0.83**	**0.80**	**0.92**	**1.41**	2.30	6.36
10.0%	**0.88**	**0.93**	**1.12**	**1.80**	3.09	9.77
25.0%	0.98	1.16	1.51	2.77	5.24	19.20
50.0%	1.08	1.45	2.11	4.37	8.97	39.11
75.0%	1.19	1.81	2.87	6.82	15.71	80.70
90.0%	**1.30**	**2.19**	**3.82**	**10.30**	25.69	150.99
95.0%	**1.36**	**2.48**	**4.48**	**12.99**	34.80	216.86
97.5%	**1.42**	**2.74**	**5.21**	16.03	44.83	294.06
99.0%	1.52	3.06	6.25	20.16	58.52	426.25
Max	1.85	5.28	12.24	40.39	195.03	1,259.57

GEMS Run #1a	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.50	0.28	0.24	0.39	0.39	0.57
1.0%	0.71	0.59	0.59	0.83	1.17	3.00
2.5%	**0.77**	**0.68**	**0.75**	1.06	1.60	4.46
5.0%	**0.82**	**0.78**	**0.87**	**1.34**	2.11	6.50
10.0%	**0.87**	**0.89**	**1.05**	**1.69**	2.86	9.80
25.0%	0.97	1.09	1.40	2.54	4.88	20.18
50.0%	1.07	1.35	1.88	4.01	8.99	46.87
75.0%	1.16	1.64	2.57	6.49	16.98	119.37
90.0%	**1.25**	**1.96**	**3.41**	**10.25**	31.70	312.82
95.0%	**1.31**	**2.20**	**4.03**	**13.66**	47.46	555.88
97.5%	**1.35**	**2.45**	**4.70**	17.57	66.82	995.72
99.0%	1.41	2.77	5.65	23.40	101.45	2,040.49
Max	1.81	4.53	13.89	55.97	457.07	21,412.21

GEMS Run #6	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.48	0.27	0.18	0.30	0.19	0.40
1.0%	0.71	0.57	0.60	0.77	1.17	2.82
2.5%	**0.78**	**0.70**	**0.77**	1.06	1.69	4.71
5.0%	**0.83**	**0.81**	**0.94**	**1.40**	2.30	6.77
10.0%	**0.89**	**0.94**	**1.15**	**1.89**	3.21	10.35
25.0%	0.99	1.18	1.58	2.91	5.43	19.93
50.0%	1.09	1.49	2.18	4.55	9.51	41.23
75.0%	1.19	1.82	2.87	7.03	16.15	81.31
90.0%	**1.28**	**2.13**	**3.65**	**9.91**	24.87	144.24
95.0%	**1.33**	**2.33**	**4.21**	**11.94**	31.90	201.81
97.5%	**1.38**	**2.52**	**4.77**	14.31	39.47	274.67
99.0%	1.44	2.73	5.39	17.37	50.46	381.13
Max	1.67	3.67	9.11	31.04	108.91	1,933.20

- Distributions are relatively similar to AIRG and GEMS Run #1a, however improves on the right tail in GEMS Run #1a that significantly exceeds AIRG at longer time horizons

Note: All Run #6 statistics were produced by a model that approximates the GEMS equity model based on publicly available information. Actual GEMS output may differ somewhat.

Small Cap Gross Wealth Factors

AIRG	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.26	0.20	0.14	0.10	0.09	0.09
1.0%	0.59	0.44	0.42	0.50	0.63	1.52
2.5%	0.68	0.56	0.56	0.70	1.02	2.51
5.0%	0.75	0.66	0.72	0.98	1.54	4.17
10.0%	0.83	0.80	0.93	1.42	2.35	6.99
25.0%	0.96	1.09	1.41	2.51	4.68	17.21
50.0%	1.09	1.49	2.19	4.73	9.93	45.64
75.0%	1.23	1.99	3.37	8.60	21.20	119.74
90.0%	1.39	2.57	4.85	14.82	41.52	289.80
95.0%	1.49	3.02	6.06	20.19	61.25	470.84
97.5%	1.58	3.50	7.37	26.67	85.41	730.92
99.0%	1.69	4.13	9.23	36.37	117.70	1,181.26
Max	2.41	8.39	18.89	167.40	840.32	7,806.02

GEMS Run #1a	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.46	0.24	0.18	0.17	0.20	0.24
1.0%	0.67	0.49	0.48	0.66	0.90	2.28
2.5%	0.73	0.61	0.63	0.90	1.37	3.83
5.0%	0.78	0.71	0.79	1.17	1.87	5.97
10.0%	0.85	0.83	0.97	1.58	2.69	9.63
25.0%	0.95	1.07	1.38	2.59	5.14	22.53
50.0%	1.07	1.39	1.98	4.46	10.26	57.85
75.0%	1.19	1.76	2.87	7.66	20.84	159.95
90.0%	1.30	2.17	3.90	12.54	40.12	433.95
95.0%	1.37	2.44	4.66	16.77	60.02	802.54
97.5%	1.43	2.73	5.53	21.80	88.64	1,348.54
99.0%	1.50	3.08	6.66	29.61	138.21	2,997.26
Max	1.81	5.62	16.81	123.05	548.09	29,025.90

GEMS Run #6	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.28	0.16	0.09	0.15	0.07	0.13
1.0%	0.63	0.45	0.48	0.64	1.07	2.85
2.5%	0.70	0.61	0.65	1.00	1.58	4.96
5.0%	0.77	0.73	0.85	1.35	2.36	8.09
10.0%	0.85	0.90	1.12	1.96	3.53	13.56
25.0%	0.98	1.21	1.68	3.40	7.02	32.12
50.0%	1.12	1.61	2.49	6.02	13.90	76.68
75.0%	1.24	2.04	3.49	9.89	26.07	175.21
90.0%	1.35	2.46	4.63	14.83	44.77	351.33
95.0%	1.41	2.73	5.45	18.70	58.21	513.41
97.5%	1.47	2.98	6.26	22.96	74.57	712.63
99.0%	1.54	3.32	7.30	29.49	102.89	1,078.11
Max	1.85	5.00	12.43	59.69	283.24	7,533.87

- Run #6 calibrated to historical data (with adjustments to align volatility relationships and Sharpe ratios with the S&P) appears to be more favorable than AIRG and Run #1a but could be adjusted based on updated acceptance criteria or feedback.
- Run #6 preserves more of the differentiation across indices seen in the AIRG and history than the Run #1a adjustments for non-S&P indices (See slide 15-16)

Note: All Run #6 statistics were produced by a model that approximates the GEMS equity model based on publicly available information. Actual GEMS output may differ somewhat.

TECHNICAL APPENDIX

- Equity Parameters for Run #6
- Comparisons of Run #6 to
  - Historical Monthly Returns
  - Other Equity Models
  - Field Test Run #1a Parameters
  - Field Test Run #1a Gross Wealth Factors (All US Indices)
- Large Cap Gross Wealth Factors under Different Initial Market Conditions – Conning “A” and “H2” Methodologies

Calibration and Parameters

Total Return Interest Rate Multipiler (GEMS Input Parameter)	0

	Large	Mid	Small	US Aggressive
mu0	0.0793	0.0579	0.0664	0.1653
mu1	0.2447	1.6990	1.3068	-1.4320
alpha	0.0205	0.0223	0.0213	0.0271
beta	1.0474	0.9698	0.7456	0.7365
sigma	0.1318	0.1237	0.1514	0.1647
mu_jump	-0.1419	-0.1682	-0.1792	-0.1815
sigma_jump	0.0700	0.0747	0.0801	0.0728
lambda_jump	2.9186	9.1715	7.5892	3.7389
ret/var correl	-0.5818	-0.6673	-0.6587	-0.3683
initial vol	0.1400	0.1518	0.1689	0.1917
theta	0.0196	0.0230	0.0285	0.0367
vol of var	0.0128	0.0135	0.0209	0.0260
avg jump freq.	5.7%	21.1%	21.7%	13.7%
MLE Sum LL	1399	838	788	900
MLE Avg. LL	1.83	1.65	1.55	1.51

Total equity returns are independent of the short rate, (i.e. follows constant mean returns and allows equity risk premiums to expand and contract).

Model parameters calibrated to monthly historical data using generalized maximum likelihood estimation (MLE):

- Large Cap: S&P total return index from 3/1957 to 12/2020, based on data provided by Link Richardson from a combination of sources
- Mid Cap: Willshire Mid Cap from 8/1978 to 12/2020 , sourced from FRED
- Small Cap: Willshire Small Cap from 8/1978 to 12/2020 , sourced from FRED
- Aggressive: NASDAQ Composite from 3/1971 to 12/2020 , sourced from FRED

Adjustments / Targeting

- Large Cap drift coefficient, mu0, adjusted by -0.02954 to align with the 8.75% annualized average of the average 30-year GWF specified by regulators for the original AIRG and calibration criteria

- Mid, Small, and US Aggressive alpha parameter adjusted to align with the historical volatility relationships to Large Cap returns (see below)

- Mid, Small and US Aggressive mu0 adjusted to align with the Sharpe Ratio of 30.0% implied in the Large Cap scenarios, assuming a risk-free rate of 3%.

cross index volatility alignement				
	large	**mid**	**small**	**aggressive**
historical (78-2020)	15.2%	18.2%	19.9%	21.5%
ratio to Large		1.19716	1.31045	1.41669
model target	14.5%	17.4%	19.0%	20.6%
model unadjusted	14.5%	18.2%	20.4%	20.2%
variance adj ratio		0.916501	0.873311	1.037511

Correlation Matrix

	Large Var	Large Ret	Mid Var	Mid Ret	Small Var	Small Ret	Aggr. Var	Aggr. Ret
Large Var	1.0000							
Large Ret	-0.5818	1.0000						
Mid Var	0.8279	-0.6281	1.0000					
Mid Ret	-0.5476	0.9105	-0.6673	1.0000				
Small Var	0.7604	-0.5840	0.9557	-0.6379	1.0000			
Small Ret	-0.5376	0.8705	-0.6649	0.9816	-0.6587	1.0000		
Aggr. Var	0.7681	-0.3550	0.8146	-0.3645	0.8107	-0.3699	1.0000	
Aggr. Ret	-0.5278	0.8631	-0.6256	0.8896	-0.6078	0.8977	-0.3683	1.0000

Correlation matrix based on historical data from 8/1978 to 12/2020:

- Variance/Return, or skew, correlation for each individual index based on each specific MLE
- Cross index Variance/Variance explicitly calculated using filtered historical Heston variance based on calibrated parameters
- Cross-skew correlation computed based on same filtered variances as above, but scaled to align with MLE-based correlation coefficients
- Cross index Return/Return explicitly calculated based on historical data

Comparison to Historical Return Distributions

Monthly Log-Return Scenaior Statistics (GEMS 50yrs)				
	large	mid	small	US Aggressive
mean (annual.)	7.4%	8.2%	8.6%	9.2%
st.dev (annual.)	14.5%	17.4%	19.2%	20.6%
skew	-0.33	-1.01	-0.93	-0.63
kurtosis	5.89	9.06	9.08	6.61

Monthly Historical Log-Return Statistics (8/1978-12/2020)				
	large (price)	mid (tot)	small (tot)	Nasdaq (price)
mean (annual.)	11.2%	11.9%	11.6%	10.8%
st.dev (annual.)	15.2%	18.2%	19.9%	21.5%
skew	-0.88	-1.18	-1.18	-0.94
kurtosis	6.00	7.84	7.51	6.04

Monthly Log-Return Scenaior Statistics (AIRG 50yrs)				
	large	mid	small	Aggressive
mean (annual.)	7.3%		7.6%	(AIRG definition
st.dev (annual.)	15.1%		20.5%	differs from
skew	-0.67		-0.89	GEMS
kurtosis	7.00		8.36	US Aggressive)

Large Cap volatility of 14.5% reflects longer historical data (from 1957 to 2020) used in calibration, slightly lower than 15.2% observed between 1978 and 2020.

GEMS Monthly Return (10k scenarios / 50yrs)				
	Large	Mid	Small	NASDAQ
0.0%	-0.43	-0.51	-0.54	-0.52
0.5%	-0.12	-0.19	-0.20	-0.19
1.0%	-0.10	-0.14	-0.16	-0.15
5.0%	-0.06	-0.07	-0.07	-0.09
10.0%	-0.04	-0.05	-0.05	-0.06
50.0%	0.01	0.01	0.01	0.01
90.0%	0.06	0.07	0.07	0.08
95.0%	0.08	0.09	0.10	0.10
99.0%	0.12	0.13	0.15	0.16
99.5%	0.13	0.15	0.18	0.19
100.0%	0.37	0.41	0.55	0.56

AIRG Monthly Return (10k scenarios / 50yrs)				
	Large	Mid	Small	Aggressive
0.0%	-0.56		-0.65	
0.5%	-0.14		-0.20	
1.0%	-0.12		-0.16	
5.0%	-0.07		-0.09	
10.0%	-0.04		-0.06	
50.0%	0.01		0.01	
90.0%	0.06		0.07	
95.0%	0.07		0.10	
99.0%	0.12		0.16	
99.5%	0.14		0.18	
100.0%	0.71		1.22	

Historical Monthly Return (78-2020)				
	Large	Mid	Small	Aggr.
0.0%	-0.22	-0.26	-0.29	-0.27
0.5%	-0.13	-0.20	-0.20	-0.21
1.0%	-0.11	-0.15	-0.17	-0.17
5.0%	-0.07	-0.07	-0.08	-0.09
10.0%	-0.04	-0.05	-0.06	-0.06
50.0%	0.01	0.01	0.02	0.02
90.0%	0.06	0.07	0.08	0.08
95.0%	0.08	0.09	0.09	0.11
99.0%	0.11	0.14	0.14	0.14
99.5%	0.12	0.14	0.15	0.16
100.0%	0.13	0.17	0.20	0.22

- Field Test Run #6 GEMS equity scenarios and AIRG are reasonably well aligned with historical distributions and produce tail outcomes beyond the observed range.
- Right tail AIRG returns seem somewhat extreme

Large Cap GWF: Comparisons to Other Models Centered at 8.75%

WFs calibrated to 1957-2020 and centered at 8.75%

Heston

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.44	0.16	0.16	0.19	0.27
1.0%	0.69	0.55	0.58	0.75	1.08
2.5%	0.76	0.67	0.74	1.04	1.59
5.0%	0.82	0.79	0.90	1.36	2.16
10.0%	0.89	0.94	1.13	1.85	3.11
25.0%	0.99	1.20	1.59	2.90	5.48
50.0%	1.10	1.50	2.20	4.65	9.60
75.0%	1.19	1.81	2.89	7.05	16.18
90.0%	1.27	2.10	3.64	9.89	24.99
95.0%	1.32	2.31	4.16	11.87	31.85
97.5%	1.36	2.48	4.68	14.08	39.00
99.0%	1.42	2.69	5.18	16.35	47.73
Max	1.68	3.73	7.91	30.25	111.12

SLV

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.41	0.17	0.17	0.15	0.20
1.0%	0.66	0.50	0.50	0.62	0.85
2.5%	0.73	0.61	0.66	0.88	1.26
5.0%	0.80	0.73	0.82	1.16	1.77
10.0%	0.87	0.88	1.03	1.61	2.64
25.0%	0.98	1.15	1.50	2.62	4.81
50.0%	1.09	1.48	2.15	4.45	9.01
75.0%	1.20	1.84	2.94	7.05	16.21
90.0%	1.29	2.17	3.80	10.37	26.13
95.0%	1.34	2.39	4.38	12.76	34.44
97.5%	1.39	2.58	4.96	15.27	43.43
99.0%	1.44	2.82	5.60	18.12	52.99
Max	1.71	3.93	8.64	33.07	132.86

RSLN2

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.41	0.28	0.20	0.16	0.21
1.0%	0.70	0.56	0.55	0.71	0.95
2.5%	0.76	0.65	0.70	0.94	1.42
5.0%	0.81	0.76	0.84	1.21	1.88
10.0%	0.87	0.88	1.03	1.59	2.60
25.0%	0.98	1.12	1.44	2.54	4.61
50.0%	1.08	1.45	2.06	4.23	8.55
75.0%	1.18	1.81	2.87	6.77	15.62
90.0%	1.27	2.20	3.80	10.42	26.06
95.0%	1.33	2.43	4.48	13.21	35.45
97.5%	1.38	2.70	5.26	16.32	46.60
99.0%	1.46	2.96	6.17	20.67	63.09
Max	1.81	4.36	10.30	66.09	177.80

WFs Difference vs GEMS #6 (= GEMS #6 - Other Model)

Heston

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	(0.04)	(0.11)	(0.02)	(0.11)	0.08
1.0%	(0.02)	(0.03)	(0.02)	(0.02)	(0.09)
2.5%	(0.01)	(0.03)	(0.02)	(0.02)	(0.10)
5.0%	(0.01)	(0.02)	(0.03)	(0.04)	(0.15)
10.0%	(0.00)	0.00	(0.03)	(0.04)	(0.10)
25.0%	0.00	0.02	0.01	(0.01)	0.05
50.0%	0.00	0.01	0.02	0.10	0.09
75.0%	0.00	(0.01)	0.02	0.01	0.04
90.0%	(0.01)	(0.03)	(0.00)	(0.02)	0.12
95.0%	(0.01)	(0.02)	(0.05)	(0.08)	(0.05)
97.5%	(0.02)	(0.04)	(0.09)	(0.23)	(0.47)
99.0%	(0.02)	(0.03)	(0.21)	(1.02)	(2.73)
Max	0.01	0.06	(1.20)	(0.78)	2.21

SLV

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	(0.07)	(0.10)	(0.00)	(0.15)	0.02
1.0%	(0.05)	(0.07)	(0.09)	(0.14)	(0.32)
2.5%	(0.04)	(0.09)	(0.11)	(0.18)	(0.43)
5.0%	(0.03)	(0.09)	(0.12)	(0.24)	(0.53)
10.0%	(0.02)	(0.06)	(0.13)	(0.28)	(0.57)
25.0%	(0.01)	(0.03)	(0.08)	(0.29)	(0.63)
50.0%	(0.00)	(0.01)	(0.02)	(0.10)	(0.50)
75.0%	0.01	0.02	0.07	0.02	0.06
90.0%	0.01	0.03	0.16	0.46	1.26
95.0%	0.01	0.05	0.17	0.82	2.54
97.5%	0.01	0.06	0.19	0.95	3.96
99.0%	0.01	0.09	0.21	0.75	2.52
Max	0.04	0.26	(0.47)	2.04	23.95

RSLN2

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	(0.07)	0.01	0.02	(0.14)	0.02
1.0%	(0.01)	(0.02)	(0.04)	(0.06)	(0.22)
2.5%	(0.02)	(0.05)	(0.07)	(0.12)	(0.27)
5.0%	(0.02)	(0.06)	(0.10)	(0.19)	(0.43)
10.0%	(0.02)	(0.06)	(0.12)	(0.30)	(0.61)
25.0%	(0.01)	(0.06)	(0.14)	(0.37)	(0.83)
50.0%	(0.01)	(0.04)	(0.11)	(0.33)	(0.96)
75.0%	(0.02)	(0.00)	(0.00)	(0.26)	(0.52)
90.0%	(0.01)	0.06	0.15	0.51	1.19
95.0%	(0.00)	0.10	0.27	1.27	3.55
97.5%	0.00	0.18	0.49	2.01	7.13
99.0%	0.02	0.23	0.78	3.30	12.62
Max	0.14	0.69	1.20	35.05	68.89

- Reference equity models were calibrated to S&P return from 1957 to 2020, and centered at 8.75% NAIC target return for comparison purposes
- 8.75% NAIC target is based on the annualized average of the 30-year wealth factor and is equivalent to a 7.4% geometric average due to volatility/convexity of the GWF distribution. For reference, historical geometric average return for S&P Total Returns from 1957 to 2020 is 10.7%.
- All models assume constant mean return (no explicit short rate component in the equity return)
- The Run #6 GEMS calibration produces reasonable GWFs that are positioned within the neighborhood of outcomes defined by RSLN2/SLV/Heston and Base AIRG models (see slide 5)

GEMS Large Cap

&P 500	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.48	0.27	0.18	0.30	0.19
1.0%	0.71	0.57	0.60	0.77	1.17
2.5%	0.78	0.70	0.77	1.06	1.69
5.0%	0.83	0.81	0.94	1.40	2.30
10.0%	0.89	0.94	1.15	1.89	3.21
25.0%	0.99	1.18	1.58	2.91	5.43
50.0%	1.09	1.49	2.18	4.55	9.51
75.0%	1.19	1.82	2.87	7.03	16.15
90.0%	1.28	2.13	3.65	9.91	24.87
95.0%	1.33	2.33	4.21	11.94	31.90
97.5%	1.38	2.52	4.77	14.31	39.47
99.0%	1.44	2.73	5.39	17.37	50.46
Max	1.67	3.67	9.11	31.04	108.91

Large Cap GWFs: Comparison to Other Models Centered at 10.7%

WFs calibrated to 1957-2020 and centered at 10.7%

Heston

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.45	0.18	0.19	0.27	0.47
1.0%	0.71	0.60	0.69	1.07	1.85
2.5%	0.78	0.73	0.89	1.49	2.72
5.0%	0.84	0.86	1.08	1.95	3.69
10.0%	0.90	1.03	1.35	2.65	5.33
25.0%	1.01	1.31	1.90	4.15	9.39
50.0%	1.12	1.64	2.63	6.66	16.44
75.0%	1.21	1.98	3.46	10.09	27.73
90.0%	1.30	2.30	4.36	14.17	42.82
95.0%	1.35	2.53	4.98	16.99	54.57
97.5%	1.39	2.71	5.61	20.16	66.83
99.0%	1.44	2.95	6.20	23.41	81.79
Max	1.71	4.08	9.46	43.32	190.41

SLV

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.42	0.18	0.21	0.22	0.35
1.0%	0.67	0.55	0.60	0.89	1.46
2.5%	0.75	0.67	0.79	1.26	2.15
5.0%	0.82	0.79	0.98	1.65	3.04
10.0%	0.89	0.96	1.23	2.31	4.53
25.0%	1.00	1.26	1.79	3.75	8.24
50.0%	1.11	1.62	2.58	6.37	15.44
75.0%	1.22	2.01	3.52	10.10	27.77
90.0%	1.31	2.37	4.55	14.84	44.78
95.0%	1.37	2.61	5.24	18.27	59.02
97.5%	1.41	2.82	5.94	21.86	74.43
99.0%	1.47	3.08	6.70	25.94	90.80
Max	1.74	4.30	10.33	47.36	227.67

RSLN2

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.42	0.31	0.23	0.23	0.35
1.0%	0.72	0.61	0.66	1.02	1.63
2.5%	0.77	0.71	0.84	1.35	2.44
5.0%	0.83	0.83	1.00	1.73	3.22
10.0%	0.89	0.97	1.23	2.28	4.46
25.0%	1.00	1.23	1.72	3.64	7.89
50.0%	1.10	1.58	2.47	6.05	14.65
75.0%	1.20	1.98	3.43	9.70	26.77
90.0%	1.29	2.40	4.54	14.92	44.65
95.0%	1.35	2.66	5.36	18.92	60.74
97.5%	1.41	2.95	6.29	23.37	79.85
99.0%	1.48	3.24	7.38	29.60	108.10
Max	1.84	4.76	12.33	94.63	304.68

Simple LN

S&P 500	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.57	0.41	0.39	0.33	0.45
1.0%	0.76	0.67	0.71	0.94	1.36
2.5%	0.81	0.75	0.83	1.20	1.84
5.0%	0.84	0.84	0.96	1.47	2.36
10.0%	0.89	0.94	1.15	1.85	3.12
25.0%	0.97	1.16	1.52	2.78	5.11
50.0%	1.08	1.45	2.08	4.32	8.99
75.0%	1.19	1.79	2.85	6.77	15.61
90.0%	1.30	2.18	3.74	10.14	25.55
95.0%	1.37	2.44	4.42	13.01	34.65
97.5%	1.44	2.70	5.13	15.83	45.40
99.0%	1.52	3.06	6.11	20.09	58.59
Max	1.84	5.03	11.90	85.83	251.70

WFs Difference vs GEMS #6 (= GEMS #6 - Other Model)

Heston

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	(0.03)	(0.09)	0.01	(0.03)	0.28
1.0%	(0.00)	0.03	0.10	0.30	0.68
2.5%	(0.00)	0.03	0.12	0.43	1.03
5.0%	0.01	0.05	0.15	0.55	1.39
10.0%	0.01	0.09	0.20	0.76	2.12
25.0%	0.02	0.13	0.32	1.24	3.96
50.0%	0.02	0.15	0.45	2.11	6.94
75.0%	0.02	0.16	0.59	3.05	11.59
90.0%	0.02	0.17	0.71	4.26	17.95
95.0%	0.02	0.19	0.77	5.05	22.68
97.5%	0.01	0.19	0.84	5.85	27.36
99.0%	0.00	0.22	0.81	6.04	31.33
Max	0.04	0.41	0.35	12.29	81.50

SLV

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	(0.06)	(0.09)	0.03	(0.08)	0.16
1.0%	(0.04)	(0.02)	0.01	0.12	0.29
2.5%	(0.03)	(0.03)	0.02	0.20	0.46
5.0%	(0.02)	(0.02)	0.04	0.26	0.74
10.0%	(0.00)	0.02	0.07	0.42	1.32
25.0%	0.01	0.08	0.21	0.84	2.81
50.0%	0.02	0.13	0.40	1.82	5.93
75.0%	0.03	0.19	0.64	3.07	11.62
90.0%	0.03	0.24	0.90	4.94	19.91
95.0%	0.04	0.28	1.04	6.33	27.12
97.5%	0.03	0.30	1.17	7.55	34.96
99.0%	0.03	0.35	1.31	8.57	40.34
Max	0.07	0.63	1.23	16.32	118.76

RSLN2

	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	(0.06)	0.04	0.06	(0.07)	0.16
1.0%	0.01	0.03	0.06	0.25	0.46
2.5%	(0.01)	0.01	0.07	0.29	0.75
5.0%	(0.00)	0.02	0.06	0.33	0.91
10.0%	0.00	0.03	0.08	0.39	1.24
25.0%	0.01	0.04	0.14	0.73	2.46
50.0%	0.01	0.09	0.29	1.50	5.14
75.0%	0.01	0.17	0.56	2.67	10.63
90.0%	0.01	0.27	0.90	5.01	19.78
95.0%	0.02	0.33	1.15	6.97	28.84
97.5%	0.03	0.43	1.52	9.06	40.38
99.0%	0.05	0.51	1.99	12.23	57.64
Max	0.17	1.10	3.22	63.60	195.77

Simple LN

S&P 500	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.09	0.15	0.21	0.03	0.26
1.0%	0.05	0.09	0.11	0.17	0.19
2.5%	0.03	0.05	0.07	0.14	0.15
5.0%	0.01	0.02	0.03	0.07	0.06
10.0%	0.00	0.00	(0.01)	(0.04)	(0.10)
25.0%	(0.01)	(0.03)	(0.06)	(0.13)	(0.33)
50.0%	(0.01)	(0.04)	(0.09)	(0.24)	(0.52)
75.0%	(0.00)	(0.03)	(0.02)	(0.27)	(0.54)
90.0%	0.02	0.05	0.10	0.23	0.68
95.0%	0.04	0.11	0.22	1.06	2.76
97.5%	0.06	0.18	0.36	1.52	5.93
99.0%	0.08	0.33	0.72	2.73	8.13
Max	0.17	1.36	2.80	54.80	142.79

- 8.75% NAIC target is based on the annualized average of the 30-year wealth factor and is equivalent to a 7.4% geometric average due to volatility/convexity of the GWF distribution. For reference, historical geometric average return for S&P Total Returns from 1957 to 2020 is 10.7%.
- All models assume constant mean return (no explicit short rate component in the equity return)
- The Run #6 GEMS calibration produces reasonable GWFs that are more conservative than the RSLN2/SLV/Heston and Base AIRG models calibrated directly to S&P data.

GEMS Large Cap

10	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr
Min	0.48	0.27	0.18	0.30	0.19
1.0%	0.71	0.57	0.60	0.77	1.17
2.5%	0.78	0.70	0.77	1.06	1.69
5.0%	0.83	0.81	0.94	1.40	2.30
10.0%	0.89	0.94	1.15	1.89	3.21
25.0%	0.99	1.18	1.58	2.91	5.43
50.0%	1.09	1.49	2.18	4.55	9.51
75.0%	1.19	1.82	2.87	7.03	16.15
90.0%	1.28	2.13	3.65	9.91	24.87
95.0%	1.33	2.33	4.21	11.94	31.90
97.5%	1.38	2.52	4.77	14.31	39.47
99.0%	1.44	2.73	5.39	17.37	50.46
Max	1.67	3.67	9.11	31.04	108.91

GEMS Run #6 vs. #1a Parameters

	ACLI alternative parameters			
	Large	**Mid**	**Small**	**US Aggressive**
mu0	0.0793	0.0579	0.0664	0.1653
mu1	0.2447	1.6990	1.3068	-1.4320
alpha	0.0205	0.0223	0.0213	0.0271
beta	1.0474	0.9698	0.7456	0.7365
sigma	0.1318	0.1237	0.1514	0.1647
mu_jump	-0.1419	-0.1682	-0.1792	-0.1815
sigma_jump	0.0700	0.0747	0.0801	0.0728
lambda_jump	2.9186	9.1715	7.5892	3.7389
ret/var correl	-0.5818	-0.6673	-0.6587	-0.3683
initial vol	0.1400	0.1518	0.1689	0.1917
theta	0.0196	0.0230	0.0285	0.0367
vol of var	0.0128	0.0135	0.0209	0.0260

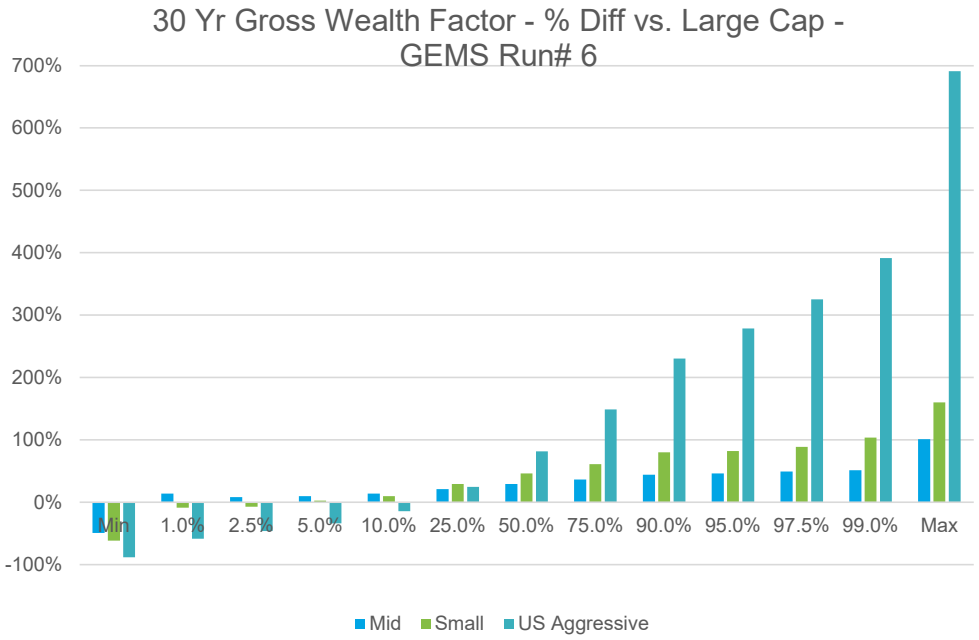
	Conning 1a parameters			
	Large	**Mid**	**Small**	**US Aggressive**
mu0	0.0069	0.0140	0.0161	0.0327
mu1	5.0971	3.4294	3.7711	2.3554
alpha	0.0059	0.0049	0.0052	0.0086
beta	0.4908	0.3059	0.3294	0.3402
sigma	0.0716	0.0181	0.0330	0.0193
mu_jump	-0.0556	-0.0446	-0.0738	-0.0738
sigma_jump	0.0575	0.0575	0.0575	0.0575
lambda_jump	139.5882	113.4168	112.9784	112.9784
ret/var correl	-0.4800	-0.5300	-0.5000	-0.4800
initial vol	0.1093	0.1261	0.1252	0.1593
theta	0.0119	0.0159	0.0157	0.0254
vol of var	0.0079	0.0029	0.0051	0.0037

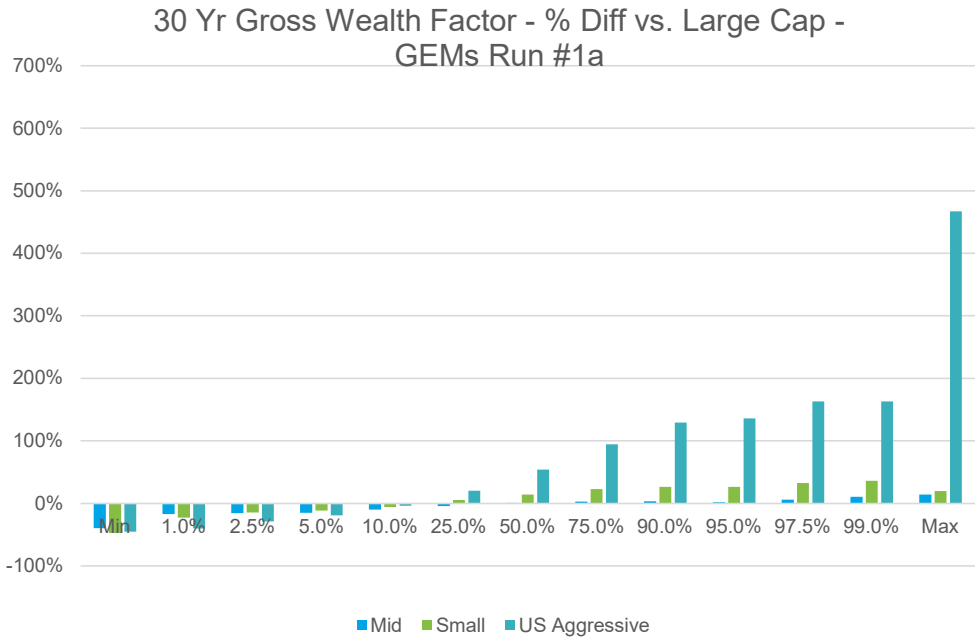
Compared to GEMS 1a parameters, ACLI developed calibration indicates:

- Higher mean reversion of the Heston variance process (beta parameter)
- Lower frequency of jumps and larger / more severe jumps
- More negative skew/correlation between equity return and variance
- Higher volatility of variance (sigma parameter) and more intuitive relationship across indices, especially for non-Large Cap indices

Note: GEMS 1a ("H2") parameterization includes a constant mean ERP with the short rate fully reflected in the equity return (multiplier = 1). The ACLI calibration does not include the short rate dependency (multiplier = 0).

GEMS Run #6 vs. #1a GWF – All Indices





GEMS Run #6 vs. #1a GWF – All Indices

Run #6

e Cap	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.48	0.27	0.18	0.30	0.19	0.40
1.0%	0.71	0.57	0.60	0.77	1.17	2.82
2.5%	0.78	0.70	0.77	1.06	1.69	4.71
5.0%	0.83	0.81	0.94	1.40	2.30	6.77
10.0%	0.89	0.94	1.15	1.89	3.21	10.35
25.0%	0.99	1.18	1.58	2.91	5.43	19.93
50.0%	1.09	1.49	2.18	4.55	9.51	41.23
75.0%	1.19	1.82	2.87	7.03	16.15	81.31
90.0%	1.28	2.13	3.65	9.91	24.87	144.24
95.0%	1.33	2.33	4.21	11.94	31.90	201.81
97.5%	1.38	2.52	4.77	14.31	39.47	274.67
99.0%	1.44	2.73	5.39	17.37	50.46	381.13
Max	1.67	3.67	9.11	31.04	108.91	1,933.20

Mid Cap	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.32	0.19	0.16	0.20	0.10	0.28
1.0%	0.67	0.52	0.56	0.79	1.33	3.57
2.5%	0.73	0.67	0.74	1.14	1.83	5.83
5.0%	0.80	0.78	0.93	1.50	2.54	8.60
10.0%	0.87	0.92	1.17	2.01	3.67	13.43
25.0%	0.99	1.20	1.66	3.29	6.59	28.69
50.0%	1.11	1.56	2.38	5.50	12.28	63.61
75.0%	1.22	1.95	3.24	8.71	22.09	136.08
90.0%	1.32	2.33	4.24	12.74	35.93	257.41
95.0%	1.38	2.56	4.95	15.78	46.70	367.30
97.5%	1.43	2.80	5.62	19.12	59.02	481.25
99.0%	1.49	3.06	6.45	23.67	76.34	722.75
Max	1.74	4.21	10.39	51.05	219.41	3,675.11

Small Cap	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.28	0.16	0.09	0.15	0.07	0.13
1.0%	0.63	0.45	0.48	0.64	1.07	2.85
2.5%	0.70	0.61	0.65	1.00	1.58	4.96
5.0%	0.77	0.73	0.85	1.35	2.36	8.09
10.0%	0.85	0.90	1.12	1.96	3.53	13.56
25.0%	0.98	1.21	1.68	3.40	7.02	32.12
50.0%	1.12	1.61	2.49	6.02	13.90	76.68
75.0%	1.24	2.04	3.49	9.89	26.07	175.21
90.0%	1.35	2.46	4.63	14.83	44.77	351.33
95.0%	1.41	2.73	5.45	18.70	58.21	513.41
97.5%	1.47	2.98	6.26	22.96	74.57	712.63
99.0%	1.54	3.32	7.30	29.49	102.89	1,078.11
Max	1.85	5.00	12.43	59.69	283.24	7,533.87

US Aggressive	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.30	0.10	0.03	0.04	0.02	0.02
1.0%	0.60	0.35	0.29	0.33	0.49	1.18
2.5%	0.69	0.49	0.46	0.59	0.91	2.65
5.0%	0.75	0.62	0.66	0.94	1.52	4.89
10.0%	0.83	0.79	0.95	1.54	2.75	10.26
25.0%	0.97	1.16	1.60	3.28	6.79	32.37
50.0%	1.12	1.68	2.70	6.91	17.25	106.51
75.0%	1.27	2.27	4.25	13.84	40.19	329.37
90.0%	1.41	2.92	6.13	23.84	82.22	836.94
95.0%	1.51	3.35	7.52	32.40	120.80	1,409.45
97.5%	1.59	3.75	9.05	41.28	167.95	2,202.18
99.0%	1.70	4.28	11.10	56.85	248.03	3,589.49
Max	2.11	7.09	20.70	137.30	861.23	40,317.06

Run #1a

e Cap	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.50	0.28	0.24	0.39	0.39	0.57
1.0%	0.71	0.59	0.59	0.83	1.17	3.00
2.5%	0.77	0.68	0.75	1.06	1.60	4.46
5.0%	0.82	0.78	0.87	1.34	2.11	6.50
10.0%	0.87	0.89	1.05	1.69	2.86	9.80
25.0%	0.97	1.09	1.40	2.54	4.88	20.18
50.0%	1.07	1.35	1.88	4.01	8.99	46.87
75.0%	1.16	1.64	2.57	6.49	16.98	119.37
90.0%	1.25	1.96	3.41	10.25	31.70	312.82
95.0%	1.31	2.20	4.03	13.66	47.46	555.88
97.5%	1.35	2.45	4.70	17.57	66.82	995.72
99.0%	1.41	2.77	5.65	23.40	101.45	2,040.49
Max	1.81	4.53	13.89	55.97	457.07	21,412.21

Mid Cap	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.51	0.33	0.19	0.17	0.23	0.21
1.0%	0.71	0.54	0.53	0.71	0.97	2.15
2.5%	0.76	0.64	0.68	0.95	1.35	3.63
5.0%	0.80	0.74	0.81	1.17	1.79	5.43
10.0%	0.86	0.85	0.98	1.55	2.57	8.71
25.0%	0.95	1.06	1.34	2.41	4.68	18.78
50.0%	1.06	1.34	1.89	4.06	9.02	46.60
75.0%	1.17	1.69	2.64	6.71	17.47	123.83
90.0%	1.28	2.06	3.58	10.80	32.67	316.14
95.0%	1.34	2.31	4.27	14.34	48.38	593.29
97.5%	1.40	2.56	4.90	18.63	70.83	1,027.74
99.0%	1.47	2.95	5.96	25.49	111.90	2,047.63
Max	1.80	4.51	11.82	94.25	521.48	23,948.39

Small Cap	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.46	0.24	0.18	0.17	0.20	0.24
1.0%	0.67	0.49	0.48	0.66	0.90	2.28
2.5%	0.73	0.61	0.63	0.90	1.37	3.83
5.0%	0.78	0.71	0.79	1.17	1.87	5.97
10.0%	0.85	0.83	0.97	1.58	2.69	9.63
25.0%	0.95	1.07	1.38	2.59	5.14	22.53
50.0%	1.07	1.39	1.98	4.46	10.26	57.85
75.0%	1.19	1.76	2.87	7.66	20.84	159.95
90.0%	1.30	2.17	3.90	12.54	40.12	433.95
95.0%	1.37	2.44	4.66	16.77	60.02	802.54
97.5%	1.43	2.73	5.53	21.80	88.64	1,348.54
99.0%	1.50	3.08	6.66	29.61	138.21	2,997.26
Max	1.81	5.62	16.81	123.05	548.09	29,025.90

US Aggressive	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	50 Yr
Min	0.42	0.13	0.12	0.11	0.21	0.19
1.0%	0.62	0.45	0.41	0.53	0.70	2.12
2.5%	0.70	0.55	0.55	0.77	1.14	3.51
5.0%	0.75	0.65	0.69	1.06	1.70	6.03
10.0%	0.82	0.77	0.90	1.47	2.74	10.77
25.0%	0.94	1.04	1.37	2.75	5.88	30.58
50.0%	1.08	1.43	2.19	5.35	13.83	97.40
75.0%	1.23	1.97	3.46	10.54	33.00	312.90
90.0%	1.39	2.61	5.15	19.00	72.69	971.80
95.0%	1.49	3.06	6.49	27.51	111.87	1,891.37
97.5%	1.57	3.51	7.94	38.48	175.75	3,553.02
99.0%	1.68	4.11	10.08	54.39	266.84	7,520.68
Max	2.05	8.23	18.05	174.53	2,590.84	78,128.11

- Run #6 allows for greater differentiation across indices, e.g., more severe tails for US Aggressive Equity
- Also avoids unintuitively explosive right tails over long horizons

Large Cap GWF – Conning Methodologies for Different Initial Rat

Under H2, parameter adjustments are derived to maintain the median 30Y GWF

Conning "H2" Methodology for Different Initial Interest Rates (Runs #1a and #2a)

Run #1a	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	40 Yr	50 Yr
Min	0.50	0.28	0.24	0.39	0.39	0.55	0.57
1.0%	0.71	0.59	0.59	0.83	1.17	1.70	3.00
2.5%	**0.77**	**0.68**	**0.75**	1.06	1.60	2.56	4.46
5.0%	**0.82**	**0.78**	**0.87**	**1.34**	2.11	3.57	6.50
10.0%	**0.87**	**0.89**	**1.05**	**1.69**	2.86	5.17	9.80
25.0%	0.97	1.09	1.40	2.54	4.88	9.95	20.18
50.0%	1.07	1.35	1.88	4.01	8.99	20.31	46.87
75.0%	1.16	1.64	2.57	6.49	16.98	45.04	119.37
90.0%	**1.25**	**1.96**	**3.41**	**10.25**	31.70	100.27	312.82
95.0%	**1.31**	**2.20**	**4.03**	**13.66**	47.46	162.50	555.88
97.5%	**1.35**	**2.45**	**4.70**	17.57	66.82	260.28	995.72
99.0%	1.41	2.77	5.65	23.40	101.45	465.88	2,040.49
Max	1.81	4.53	13.89	55.97	457.07	4,782.17	21,412.21

Run #2a	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	40 Yr	50 Yr
Min	0.51	0.30	0.26	0.40	0.36	0.47	0.38
1.0%	0.73	0.65	0.64	0.83	1.07	1.37	2.15
2.5%	**0.79**	**0.75**	**0.80**	1.08	1.46	2.11	3.18
5.0%	**0.84**	**0.85**	**0.95**	**1.34**	1.94	2.94	4.79
10.0%	**0.90**	**0.97**	**1.15**	**1.73**	2.63	4.34	7.22
25.0%	1.00	1.20	1.54	2.64	4.71	8.56	15.59
50.0%	1.10	1.48	2.11	4.38	8.97	18.42	38.40
75.0%	1.20	1.82	2.96	7.42	18.19	43.78	103.51
90.0%	**1.29**	**2.19**	**4.01**	**12.10**	35.65	102.41	287.74
95.0%	**1.35**	**2.46**	**4.74**	**16.59**	54.53	180.62	549.68
97.5%	**1.39**	**2.73**	**5.63**	22.31	83.31	300.32	1,013.75
99.0%	1.45	3.10	7.00	30.38	127.25	564.70	2,243.81
Max	1.87	5.11	15.80	86.26	817.22	8,858.21	37,766.52

#2a / #1a	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	40 Yr	50 Yr
Min	1.01	1.06	1.06	1.02	0.93	0.86	0.66
1.0%	1.03	1.09	1.08	1.00	0.92	0.80	0.72
2.5%	**1.03**	**1.09**	**1.07**	1.02	0.91	0.82	0.71
5.0%	**1.03**	**1.09**	**1.08**	**1.00**	0.92	0.82	0.74
10.0%	**1.03**	**1.09**	**1.09**	**1.02**	0.92	0.84	0.74
25.0%	1.03	1.10	1.11	1.04	0.97	0.86	0.77
50.0%	1.03	1.10	1.12	1.09	1.00	0.91	0.82
75.0%	1.03	1.11	1.15	1.14	1.07	0.97	0.87
90.0%	**1.03**	**1.12**	**1.17**	**1.18**	1.12	1.02	0.92
95.0%	**1.03**	**1.12**	**1.18**	**1.21**	1.15	1.11	0.99
97.5%	**1.03**	**1.12**	**1.20**	1.27	1.25	1.15	1.02
99.0%	1.03	1.12	1.24	1.30	1.25	1.21	1.10
Max	1.04	1.13	1.14	1.54	1.79	1.85	1.76

With higher initial rates (e.g., Fed raises rates), H2 produces equity levels that are ~10% higher in the shorter term but ~20% lower in the longer term.

Conning "A" Methodology for Different Initial Interest Rates (Runs #5a and #5b)

Run #5a	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	40 Yr	50 Yr
Min	0.47	0.13	0.06	0.04	0.05	0.03	0.03
1.0%	0.71	0.45	0.36	0.38	0.39	0.53	0.65
2.5%	**0.76**	**0.57**	**0.48**	0.54	0.65	0.85	1.24
5.0%	**0.82**	**0.67**	**0.63**	**0.73**	0.95	1.36	2.04
10.0%	**0.87**	**0.80**	**0.82**	**1.04**	1.48	2.27	3.61
25.0%	0.96	1.02	1.20	1.79	2.93	4.96	8.59
50.0%	1.05	1.28	1.69	3.09	5.88	11.45	22.37
75.0%	1.14	1.56	2.31	5.11	11.43	26.43	59.68
90.0%	**1.21**	**1.85**	**3.02**	**8.11**	21.44	58.36	154.41
95.0%	**1.26**	**2.04**	**3.59**	**10.76**	32.94	101.96	301.48
97.5%	**1.30**	**2.23**	**4.11**	13.82	47.76	159.43	537.93
99.0%	1.35	2.50	4.83	18.93	70.92	276.11	1,032.95
Max	1.68	3.79	10.89	64.69	494.22	2,243.58	9,499.24

Run #5b	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	40 Yr	50 Yr
Min	0.48	0.14	0.07	0.05	0.07	0.04	0.04
1.0%	0.74	0.53	0.44	0.50	0.54	0.71	0.90
2.5%	**0.79**	**0.66**	**0.60**	0.71	0.90	1.21	1.73
5.0%	**0.85**	**0.78**	**0.78**	**0.98**	1.30	1.92	2.98
10.0%	**0.91**	**0.93**	**1.03**	**1.39**	2.05	3.20	5.10
25.0%	1.00	1.19	1.51	2.43	4.14	7.18	12.56
50.0%	1.10	1.50	2.15	4.33	8.59	17.39	34.24
75.0%	1.19	1.85	3.01	7.48	17.73	42.77	96.32
90.0%	**1.27**	**2.20**	**4.04**	**12.44**	35.84	101.71	278.94
95.0%	**1.32**	**2.43**	**4.83**	**17.01**	57.49	179.96	546.31
97.5%	**1.36**	**2.69**	**5.60**	22.64	84.29	299.93	1,079.05
99.0%	1.41	3.01	6.76	31.05	132.88	563.88	2,151.49
Max	1.76	4.87	16.46	115.46	1,058.35	6,515.96	20,885.63

#5b / #5a	1 Yr	5 Yr	10 Yr	20 Yr	30 Yr	40 Yr	50 Yr
Min	1.04	1.10	1.13	1.22	1.34	1.39	1.17
1.0%	1.04	1.17	1.23	1.29	1.40	1.34	1.37
2.5%	**1.05**	**1.16**	**1.24**	1.32	1.39	1.42	1.39
5.0%	**1.04**	**1.16**	**1.24**	**1.35**	1.37	1.41	1.46
10.0%	**1.04**	**1.16**	**1.25**	**1.34**	1.39	1.41	1.41
25.0%	1.04	1.17	1.26	1.36	1.41	1.45	1.46
50.0%	1.04	1.17	1.28	1.40	1.46	1.52	1.53
75.0%	1.04	1.18	1.30	1.46	1.55	1.62	1.61
90.0%	**1.04**	**1.19**	**1.34**	**1.53**	1.67	1.74	1.81
95.0%	**1.04**	**1.19**	**1.35**	**1.58**	1.75	1.77	1.81
97.5%	**1.04**	**1.21**	**1.36**	1.64	1.76	1.88	2.01
99.0%	1.04	1.20	1.40	1.64	1.87	2.04	2.08
Max	1.05	1.28	1.51	1.78	2.14	2.90	2.20

With higher initial rates (e.g., Fed raises rates), A produces equity levels that are significantly higher across the board (e.g., ~40%+ higher over 30+ years).

Under A, equity parameters are not adjusted