



SOCIETY OF  
ACTUARIES®

2019 **ANNUAL  
MEETING**  
& EXHIBIT

October 27-30  
Toronto, Canada

## Session 172: Asset Management Technology for Insurance and Pension Applications

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# **Session 172: Asset Management Technology for Insurance and Pension Applications Planning**

Applying Asset Management Techniques in L&A Actuarial Modeling

October 30<sup>th</sup>, 2019



# The Need for More Reflective ALM Models

Asset-Liability Models have been common at Life, Annuity, and Health companies for some time and are directly impacting the liabilities that are booked to the balance sheet and strategic business decisions (e.g., growth strategy, product lines, and reinsurance).

## Actuarial Purposes

- Asset Adequacy Testing (IF only)
  - CFT, RBC C3P1 & P2
- Forecasting (IF & FNB)
  - Expected earnings using real assets
  - Projecting Capital ratios
- PBR (IF only)
  - VM-20 for the Deterministic & Stochastic Reserves
  - AG-43/VM-21 for the CTE calculation with dynamic hedging
- ALM (IF only)
- IFRS 17 (IF only)
- EC (IF only)
- Nested projections

# Historic Reinvestment/Disinvestment Approaches

Many actuarial ALM models have historically used very understandable and easy to calculate reinvestment/disinvestment logic. The downside is that these are also very unrealistic compared to what an Investment department would do in practice, and often result in a diminishment, or complete cessation, of conversations between Investments & Modeling.

## Reinvestment

- Buy according to fixed weights

## Disinvestment

- Sell Pro Rata
- Buy Negative New Purchase Assets
- Minimize Capital Gains & Losses
- Sell based on highest or lowest maturity first

# More Realistic Approaches → Better ALM Models

In practice, investment departments work to balance several priorities as they manage a portfolio, with a particular responsibility to mitigate the negative impact of tail events. An ongoing communication channel is critical for understanding the investment philosophy, setting assumptions, calibrating the model, and maintaining an ongoing feedback loop.

## Common Investment Priorities

- Maximize Book Yield
- Match Greeks
- Match Cash Flows
- Portfolio mix across asset classes
- Portfolio mix across risk classes
- Capital C1 charges
- Liquidity
- Impact of Realized Capital Gains or Losses

# Assumption Gathering

An ongoing dialogue with your Investment team is required to set and refine your ALM model assumptions including:

<b>Reinvestment Assets</b>	<ul style="list-style-type: none"><li>▪ A more realistic pool of reinvestment assets that should be considered (extending beyond a handful of bonds and mortgages)</li></ul>
<b>Target Greeks</b>	<ul style="list-style-type: none"><li>▪ Target durations for each LOB, and how those are expected to change over time, under different economic environments, and if future new business is reflected</li><li>▪ Asset durations when not calculated by the system</li></ul>
<b>Target Asset Mixtures</b>	<ul style="list-style-type: none"><li>▪ Mapping cusips to asset classifications</li><li>▪ Target asset classification mixtures and tolerance ranges</li></ul>
<b>Liquidity</b>	<ul style="list-style-type: none"><li>▪ Liquidity ratings or classifications at the cusip level</li></ul>
<b>Capital Gain/Loss Tolerance</b>	<ul style="list-style-type: none"><li>▪ Budget of Realized Capital Gains or Losses</li></ul>

# System Requirements

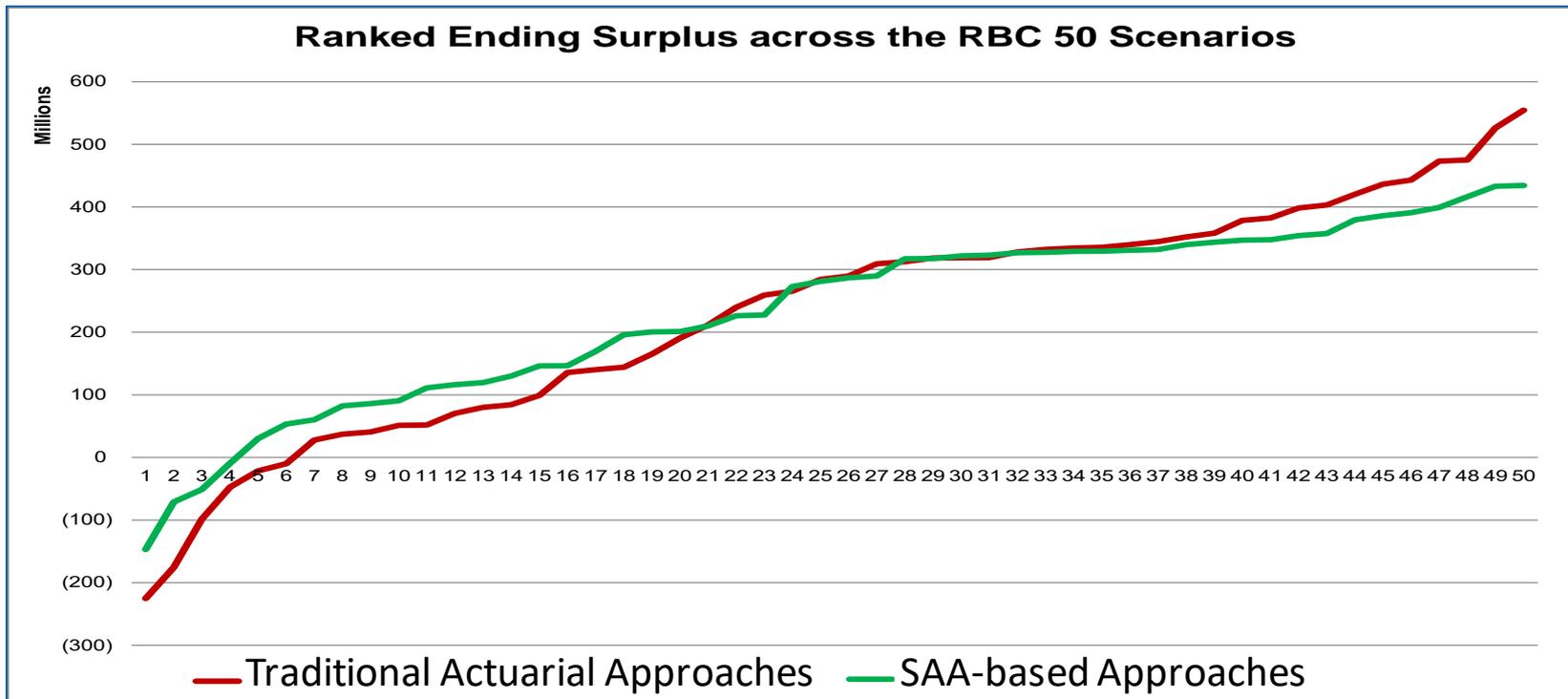
In order to meaningfully reflect a more SAA-based investment philosophy within the model, the actuarial model must incorporate complex financial and mathematical theory. Efficient programming logic must be used to avoid ballooning runtimes.

## Core Platform Challenges

- For each individual objective, measure the modeled position relative to the target and make adjustments accordingly
  - For example, how to project durations for various asset types, for both 1<sup>st</sup> principle & imported assets
- Enact a mathematical decision-making framework that allows the model to move towards multiple, sometimes competing, objectives simultaneously in accordance with Investment's priorities
- Build out functionality and/or parameterize the model
- Transparency of interim and final model outputs to show which specific decisions were made in order to facilitate meaningful dialogue with Investments
- Adhere to the model governance, control and documentation requirements of actuarial systems that calculate reported reserves

# Calibration & Feedback Loop

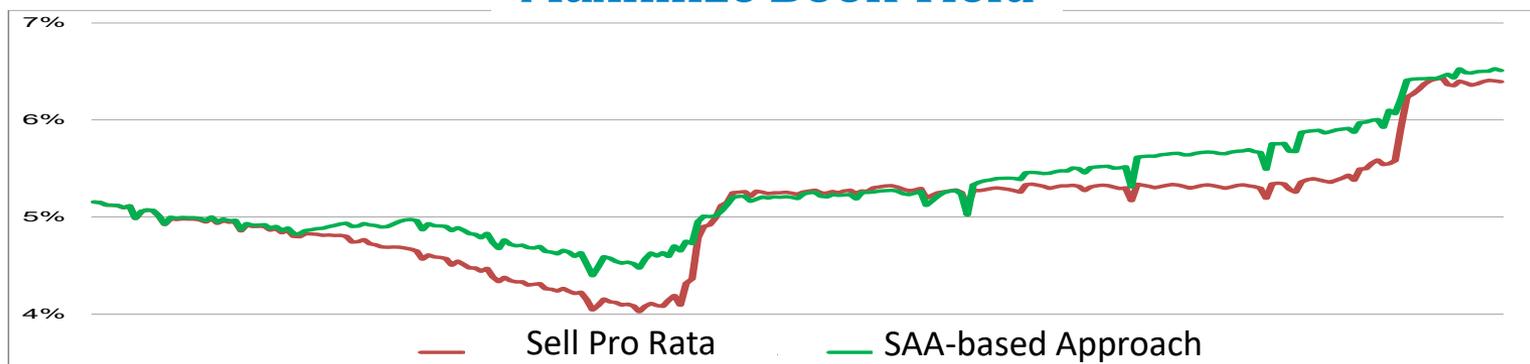
Since one of the primary objectives is to mitigate the negative impact of tail events, it is easier to calibrate your actuarial ALM model with a set of stochastic scenarios (e.g., RBC C3P1, VM 20 SR, VM21 CTE), before carrying it over to deterministic scenario applications (e.g., CFT, VM-20 DR).



# Calibration & Feedback Loop

One of the interesting things of this calibration work is to see how unintentional the previous methodology was compared to a deliberate approach. For example, when no target duration or asset mixture is specified (i.e., a non-SAA approach), the results show it.

## Maximize Book Yield



## Match Effective Duration



# Calibration & Feedback Loop

During the calibration work, auditability of the interim calculations is a critical component in soliciting feedback from Investments. It allows you to ask the question, “Does this model decision in this particular instance seem reasonable?” and make adjustments as necessary.

Asset ID	Asset Description	Maturity Date (*)	Selling Priority	Portfolio Category (ASSET CLASS)	Portfolio Category (NAIC)	Eff Dur	Book Yield	Market Value		
								End of Month (before reinvestment)	Change due to <b>pro rata</b> disinvestment	Change due to <b>SAA</b> disinvestment
29356JAA5	ENSCO OFFSHORE	2020-10	1	BOND	1	1.8	4.70%	188,254	(2,276)	-
294429AJ4	EQUIFAX INC	2022-12	1	BOND	2	4.8	3.34%	8,376,023	(101,271)	-
29736RAE0	ESTEE LAUDER COS INC	2022-08	1	BOND	1	4.7	2.37%	4,101,030	(49,584)	-
313381VS1	FEDERAL HOME LOAN B	2033-02	1	BOND	1	9.4	3.28%	15,199,692	(183,773)	-
<b>3136A2PM9</b>	<b>FNMA</b>	<b>2041-12</b>	<b>1</b>	<b>MBS</b>	<b>1</b>	<b>12.7</b>	<b>4.58%</b>	<b>2,634,065</b>	<b>(31,847)</b>	<b>(2,634,065)</b>
3136A4FU8	FNMA	2042-03	1	MBS	1	7.4	3.54%	17,178,492	(207,698)	-
3136A4UF4	FNMA	2042-03	1	MBS	1	5.1	3.53%	5,595,885	(67,657)	-
3136G1AL3	FANNIE MAE	2033-01	1	BOND	1	9.3	3.30%	11,264,662	(136,196)	-
<b>3136G1AX7</b>	<b>FANNIE MAE</b>	<b>2033-01</b>	<b>1</b>	<b>BOND</b>	<b>1</b>	<b>9.9</b>	<b>3.28%</b>	<b>10,675,140</b>	<b>(129,068)</b>	<b>(545,424)</b>
3137A4CM7	Freddie Mac	2039-12	1	MBS	1	7.2	4.18%	20,638,246	(249,528)	-
<b>3137AYCT6</b>	<b>Freddie Mac</b>	<b>2043-02</b>	<b>1</b>	<b>MBS</b>	<b>1</b>	<b>11.6</b>	<b>3.30%</b>	<b>6,010,341</b>	<b>(72,668)</b>	<b>(6,010,341)</b>
3137GAWY9	Freddie Mac	2038-12	1	MBS	1	5.7	4.17%	6,834,174	(82,629)	-
31395HBS8	FHLMC	2033-07	1	MBS	1	0.1	5.12%	8,475	(102)	-
31395HBS8	FHLMC	2033-07	1	MBS	1	0.1	5.12%	804,351	(9,725)	-
32052WAK5	FIRST HORIZON ALTERN	2037-08	1	MBS	3	7.5	6.99%	9,520,313	(115,106)	-
976826BH9	WISCONSIN POWER & L	2020-06	1	BOND	1	2.7	4.09%	4,646,602	(56,180.0)	-
<b>97806*AD4</b>	<b>WOLVERINE POWER</b>	<b>2040-05</b>	<b>1</b>	<b>BOND</b>	<b>1</b>	<b>12.5</b>	<b>5.10%</b>	<b>6,121,932</b>	<b>(74,017.6)</b>	<b>(6,121,932)</b>
Q3393*AE1	ELECTRANET	2018-06	1	BOND	1	1.0	4.41%	2,834,682	(34,272.9)	-
<b>R2284#AG5</b>	<b>STATNETT SF</b>	<b>2032-06</b>	<b>1</b>	<b>BOND</b>	<b>1</b>	<b>10.7</b>	<b>3.36%</b>	<b>8,320,591</b>	<b>(100,601)</b>	<b>(8,320,591)</b>
COMM MORTGAGE 10		2024-07	1	CMML	1	2.8	5.48%	17,483,056	(211,380)	-
Total Assets								2,035,219,570	(23,632,354)	(23,632,354)
Cash								(215,344,848)	23,632,354	23,632,354

# Conclusion

Liability Driven Investment techniques have used Strategic Asset Allocation approaches for some time. Extending Strategic Asset Allocation approaches into your actuarial ALM models will result in more accurate balance sheet and informed strategic business decisions.

## Key Benefits

- From an AOM *“The Company believes the new model provides significantly more realistic decision making, and more accurately reflects the actual process employed by our ALM department.”*
- Should reduce CTE and VaR-based metrics (e.g., VM20 SR & VM21 CTE, RBC C3P1 & P2, EC)
- Likely to decrease additional CFT reserves
- Project more accurate Capital C1 charges, and therefore more accurate capital ratios for more informed strategic decision making
- *“The greatest advantage is in what you disinvest in a block that is selling assets.”*
- Establish or strengthen the relationship between Investments and Actuarial
- Provide a formal feedback loop to ALM



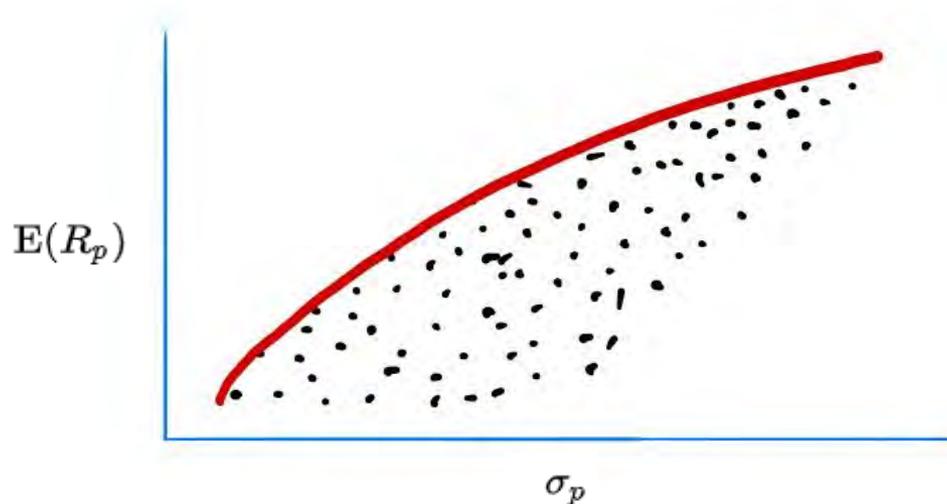
# Asset Management Technology for Insurance and Pension Applications

Society of Actuaries Annual Meeting  
October 30, 2019

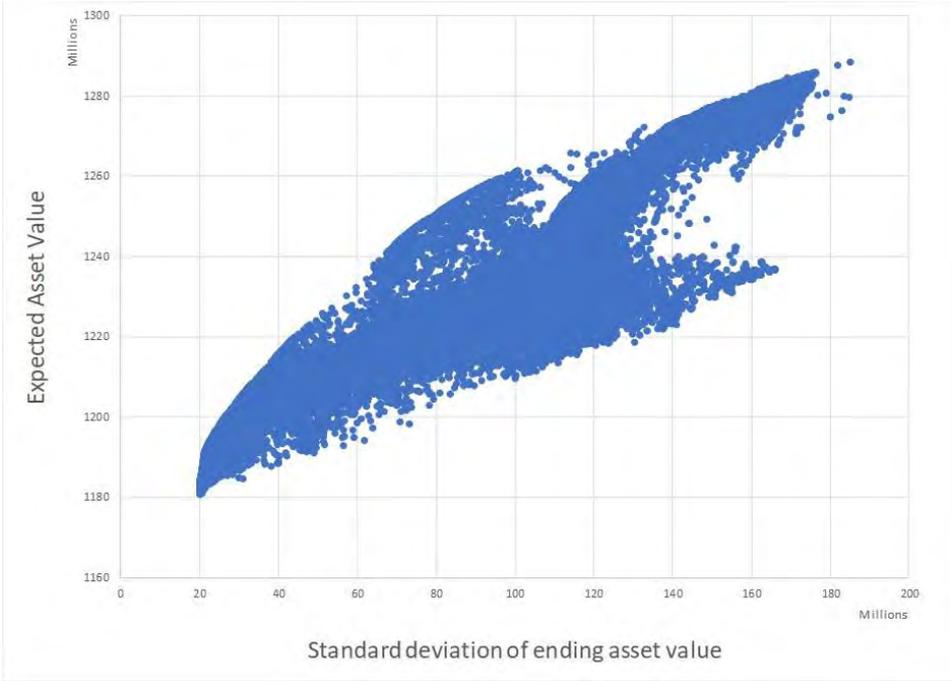
# Modern Portfolio Theory — Mean-Variance Efficient Frontier

$$E(R_p) = \sum_i w_i E(R_i)$$

$$\sigma_p^2 = \sum_i w_i^2 \sigma_i^2 + \sum_i \sum_{j \neq i} w_i w_j \sigma_i \sigma_j \rho_{ij},$$

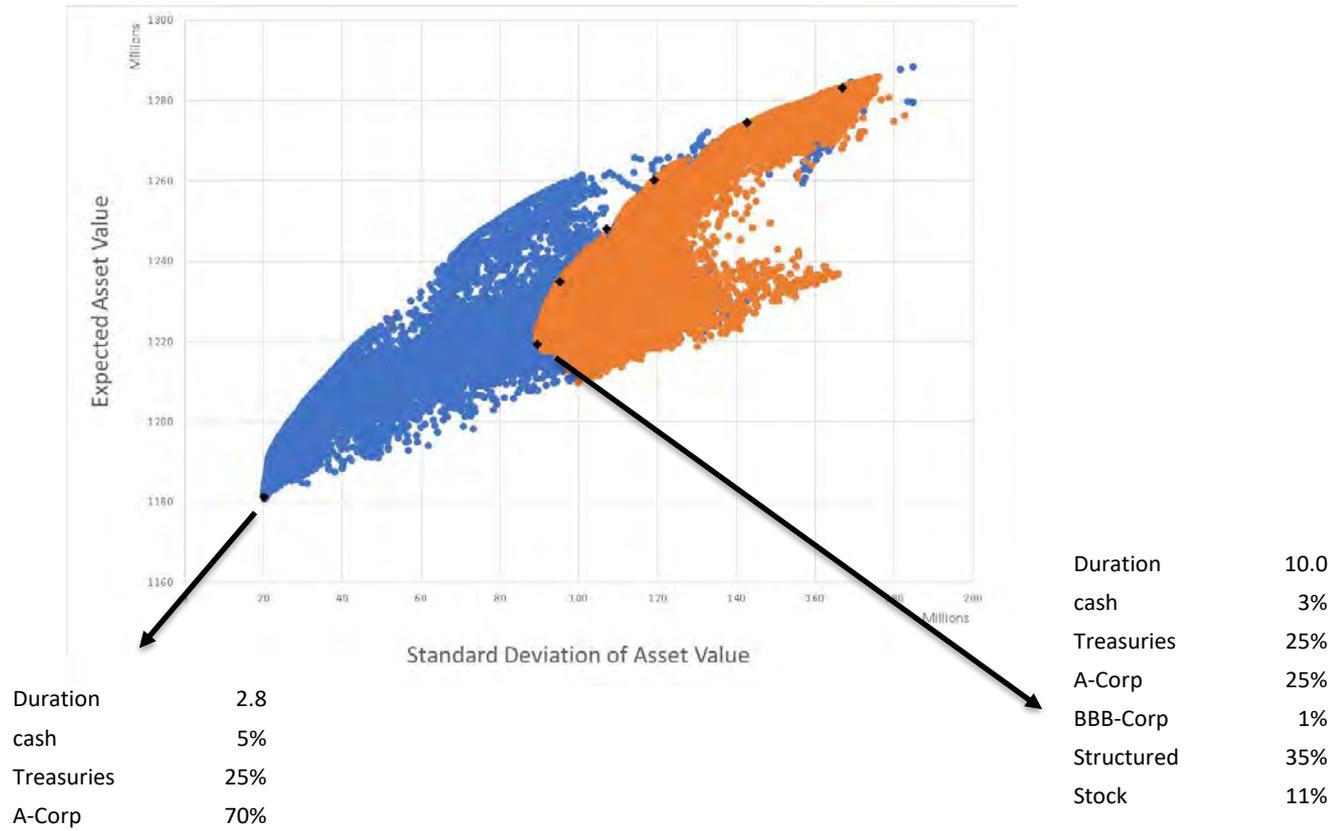


# Asset-Only Efficient Frontier



Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

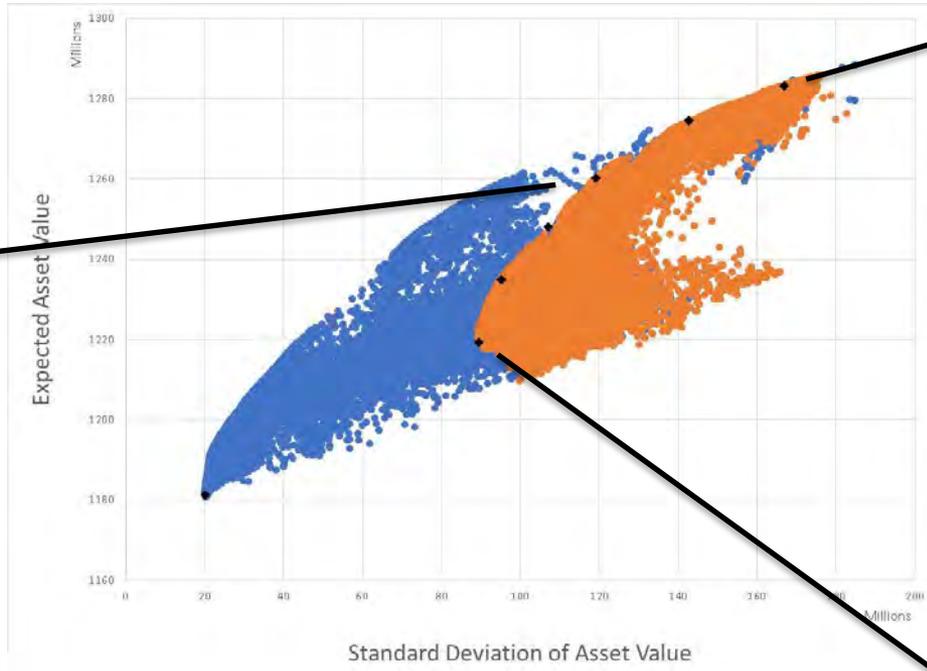
# Constrained Asset-Only Efficient Frontier



Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# Constrained Asset-Only Efficient Frontier

Duration	11.5
Treasuries	11%
BBB-Corp	33%
Structured	25%
EMD	10%
Stock	21%

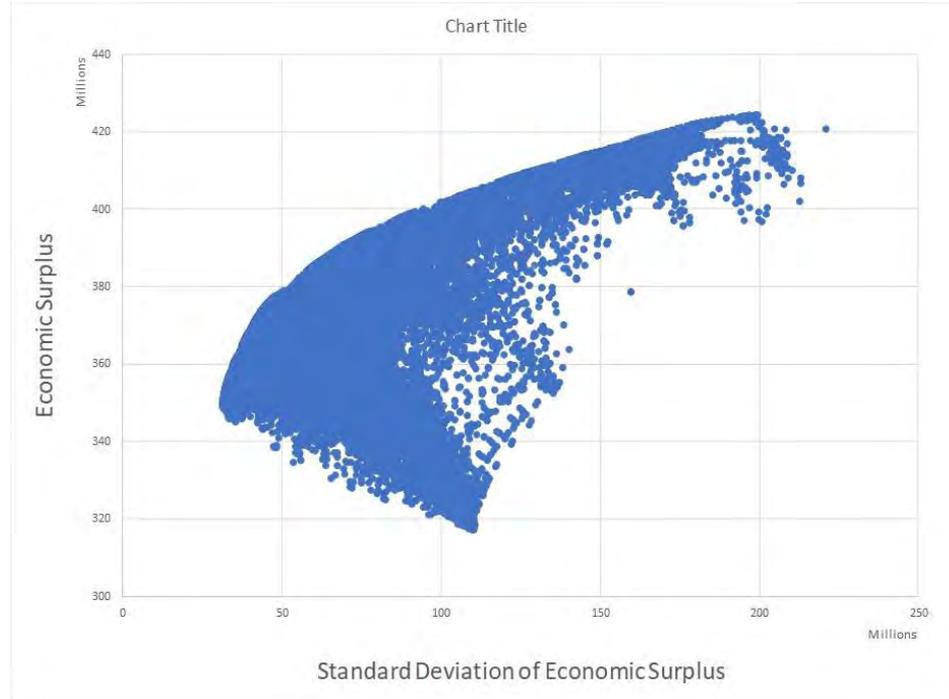


Duration	12.0
A-Corp	3%
BBB-Corp	35%
Structured	1%
EMD	15%
Stock	46%

Duration	10.0
cash	3%
Treasuries	25%
A-Corp	25%
BBB-Corp	1%
Structured	35%
Stock	11%

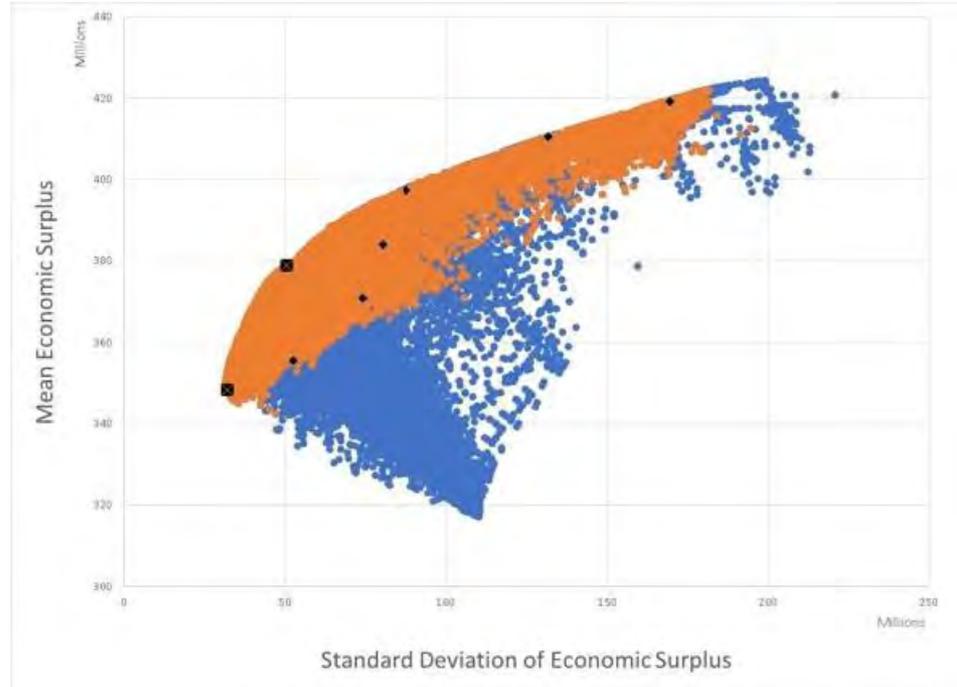
Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# Economic Surplus Efficient Frontier



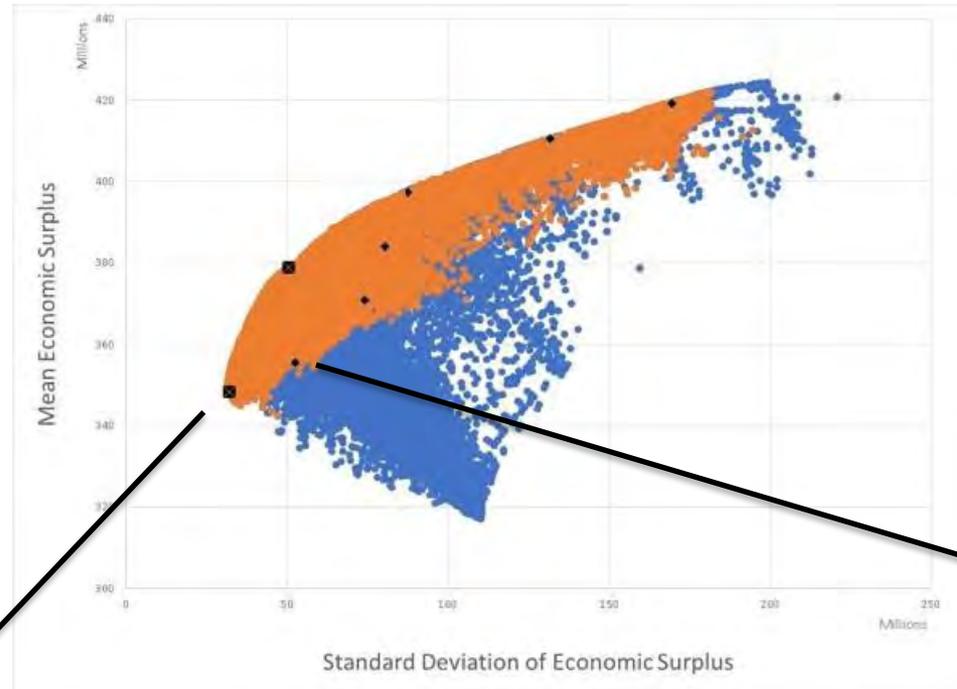
Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# Economic Surplus Efficient Frontier



Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# Economic Surplus Efficient Frontier

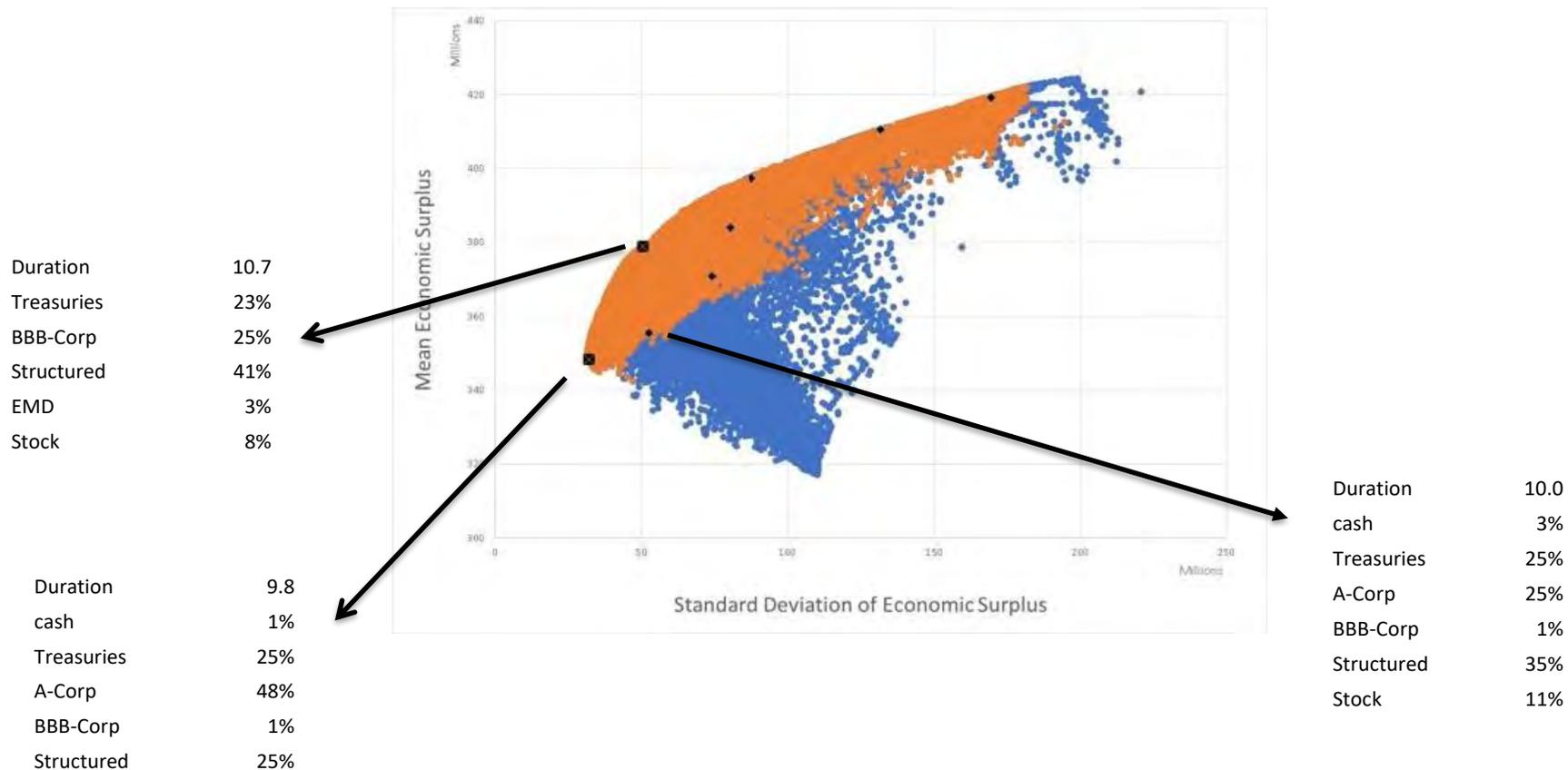


Duration	9.8
cash	1%
Treasuries	25%
A-Corp	48%
BBB-Corp	1%
Structured	25%

Duration	10.0
cash	3%
Treasuries	25%
A-Corp	25%
BBB-Corp	1%
Structured	35%
Stock	11%

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# Economic Surplus Efficient Frontier



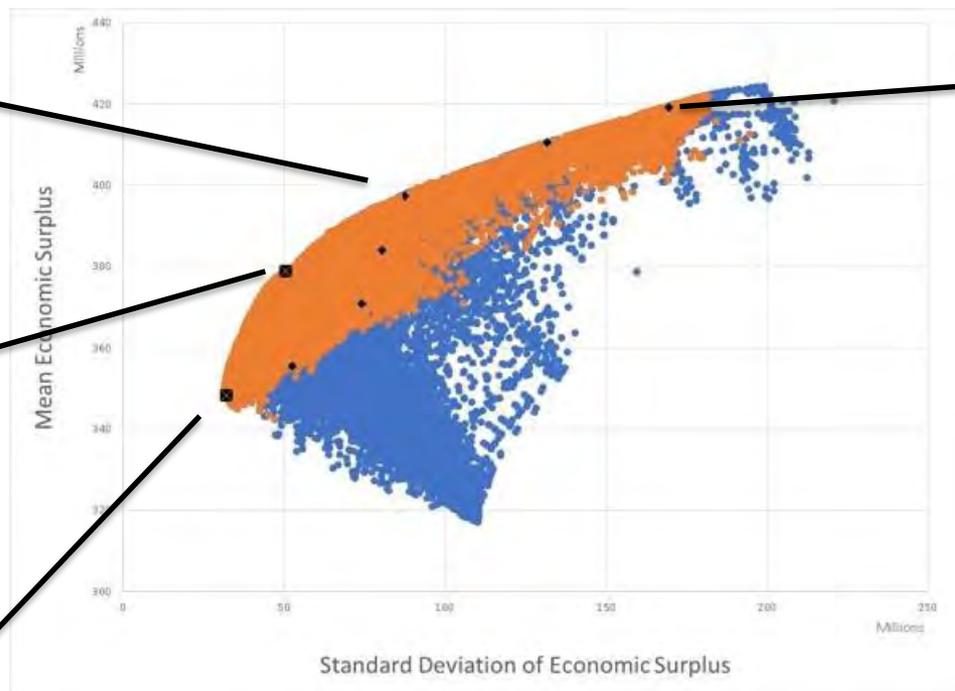
Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# Economic Surplus Efficient Frontier

Duration	11.5
Treasuries	11%
BBB-Corp	33%
Structured	25%
EMD	10%
Stock	21%

Duration	12.0
A-Corp	3%
BBB-Corp	35%
Structured	1%
EMD	15%
Stock	46%

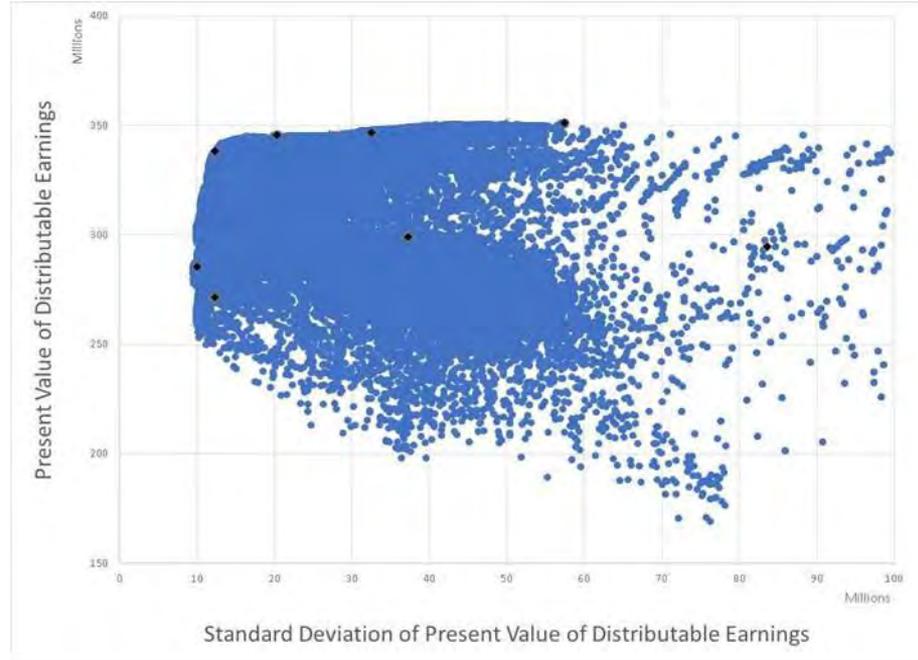
Duration	10.7
Treasuries	23%
BBB-Corp	25%
Structured	41%
EMD	3%
Stock	8%



Duration	9.8
cash	1%
Treasuries	25%
A-Corp	48%
BBB-Corp	1%
Structured	25%

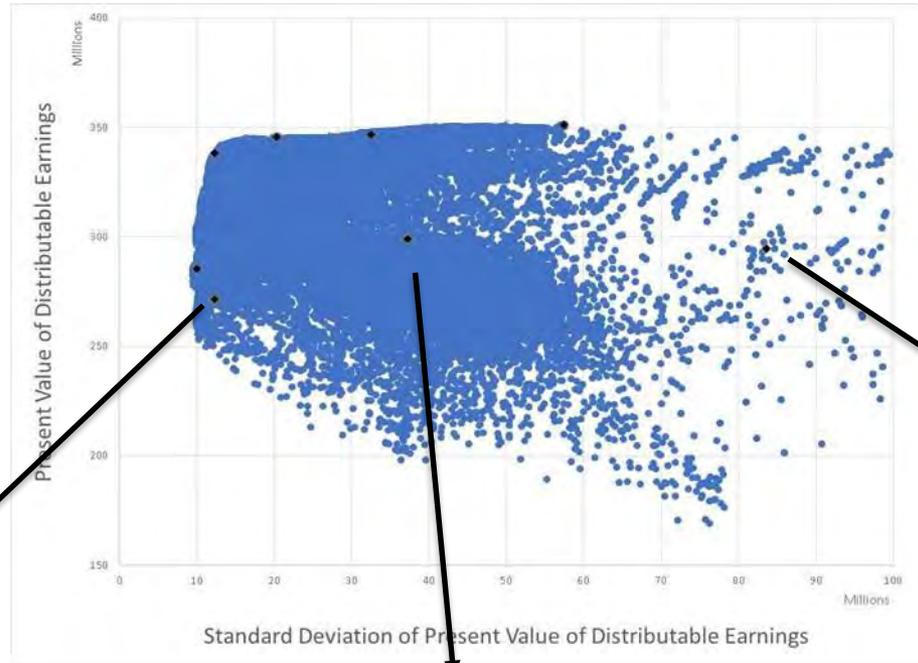
Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# PVDE Efficient Frontier



Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# PVDE Efficient Frontier



Duration	9.8
cash	1%
Treasuries	25%
A-Corp	48%
BBB-Corp	1%
Structured	25%

Duration	10.7
Treasuries	23%
BBB-Corp	25%
Structured	41%
EMD	3%
Stock	8%

Duration	11.5
Treasuries	11%
BBB-Corp	33%
Structured	25%
EMD	10%
Stock	21%

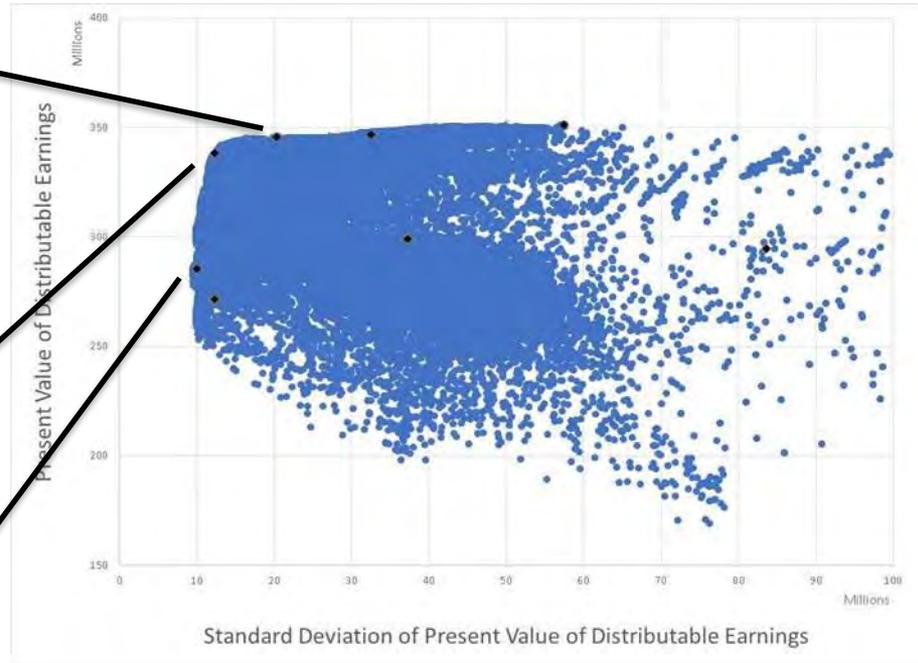
Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# PVDE Efficient Frontier

Duration 9.8  
 cash 2%  
 A-Corp 44%  
 BBB-Corp 25%  
 Structured 15%  
 HY 5%  
 EMD 5%  
 Stock 4%

Duration 9.9  
 cash 2%  
 Treasuries 5%  
 A-Corp 60%  
 BBB-Corp 18%  
 Structured 15%

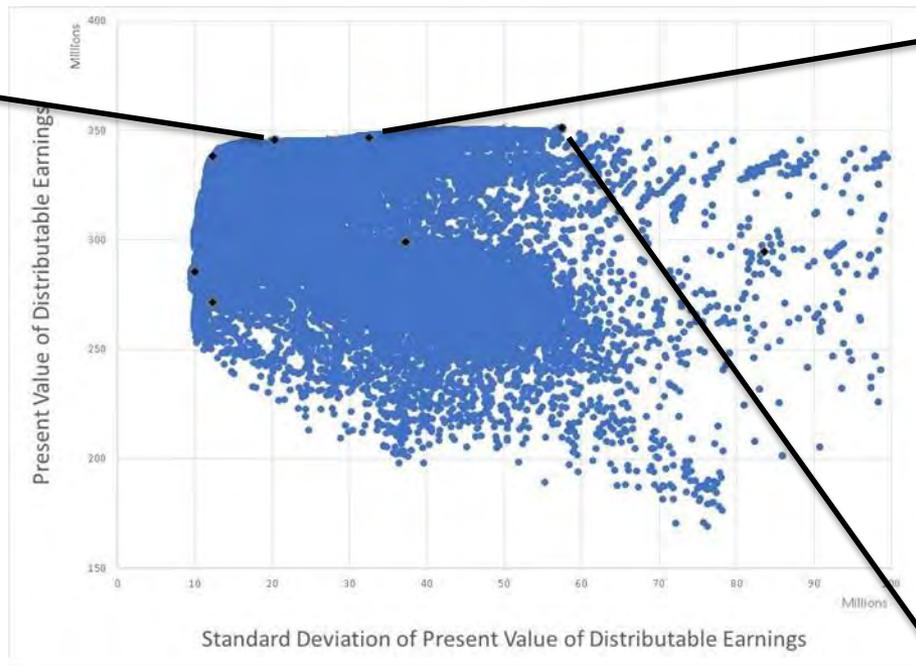
Duration 10.2  
 cash 2%  
 Treasuries 29%  
 A-Corp 46%  
 BBB-Corp 7%  
 Structured 16%



Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# PVDE Efficient Frontier

Duration	9.8
cash	2%
A-Corp	44%
BBB-Corp	25%
Structured	15%
HY	5%
EMD	5%
Stock	4%



Duration	8.9
cash	3%
A-Corp	34%
BBB-Corp	31%
Structured	11%
HY	15%
EMD	1%
Stock	5%

Duration	7.7
cash	3%
A-Corp	17%
BBB-Corp	35%
Structured	9%
HY	25%
Stock	11%

Prepared by Conning, Inc. Source: ADVISE® model based on hypothetical company data.

# Allocation Comparison

	Constrained AO		Economic Surplus		PVDE Efficient Frontier	
High Risk	Duration	12.0	Duration	12.0	Duration	7.7
	A-Corp	3%	A-Corp	3%	cash	3%
	BBB-Corp	35%	BBB-Corp	35%	A-Corp	17%
	Structured	1%	Structured	1%	BBB-Corp	35%
	EMD	15%	EMD	15%	Structured	9%
	Stock	46%	Stock	46%	HY	25%
					Stock	11%
Medium Risk	Duration	11.5	Duration	11.5	Duration	9.8
	Treasuries	11%	Treasuries	11%	cash	2%
	BBB-Corp	33%	BBB-Corp	33%	A-Corp	44%
	Structured	25%	Structured	25%	BBB-Corp	25%
	EMD	10%	EMD	10%	Structured	15%
	Stock	21%	Stock	21%	HY	5%
				EMD	5%	
				Stock	4%	
Low risk	Duration	10.0	Duration	9.8	Duration	10.2
	cash	3%	cash	1%	cash	2%
	Treasuries	25%	Treasuries	25%	Treasuries	29%
	A-Corp	25%	A-Corp	48%	A-Corp	46%
	BBB-Corp	1%	BBB-Corp	1%	BBB-Corp	7%
	Structured	35%	Structured	25%	Structured	16%
	Stock	11%				

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# Metric Choice

Your choice of metric matters, and it should reflect the objectives of your portfolio.

- Highest expected portfolio value, constrained by individual liability, rating agency and regulatory considerations
- Highest expected economic surplus, constrained by accounting and regulatory considerations
- Highest expected embedded value, directly reflecting accounting and regulatory implications

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