

Nebraska Public Employees Retirement System (NPERs)

Asset-Liability Study Results
July 2016

Aon Hewitt
Retirement and Investment

Investment advice and consulting services provided by Aon Hewitt Investment Consulting, Inc., an Aon Company.



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Executive Summary

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Executive Summary

Summary and Conclusions



Financial Projection Trend Analysis

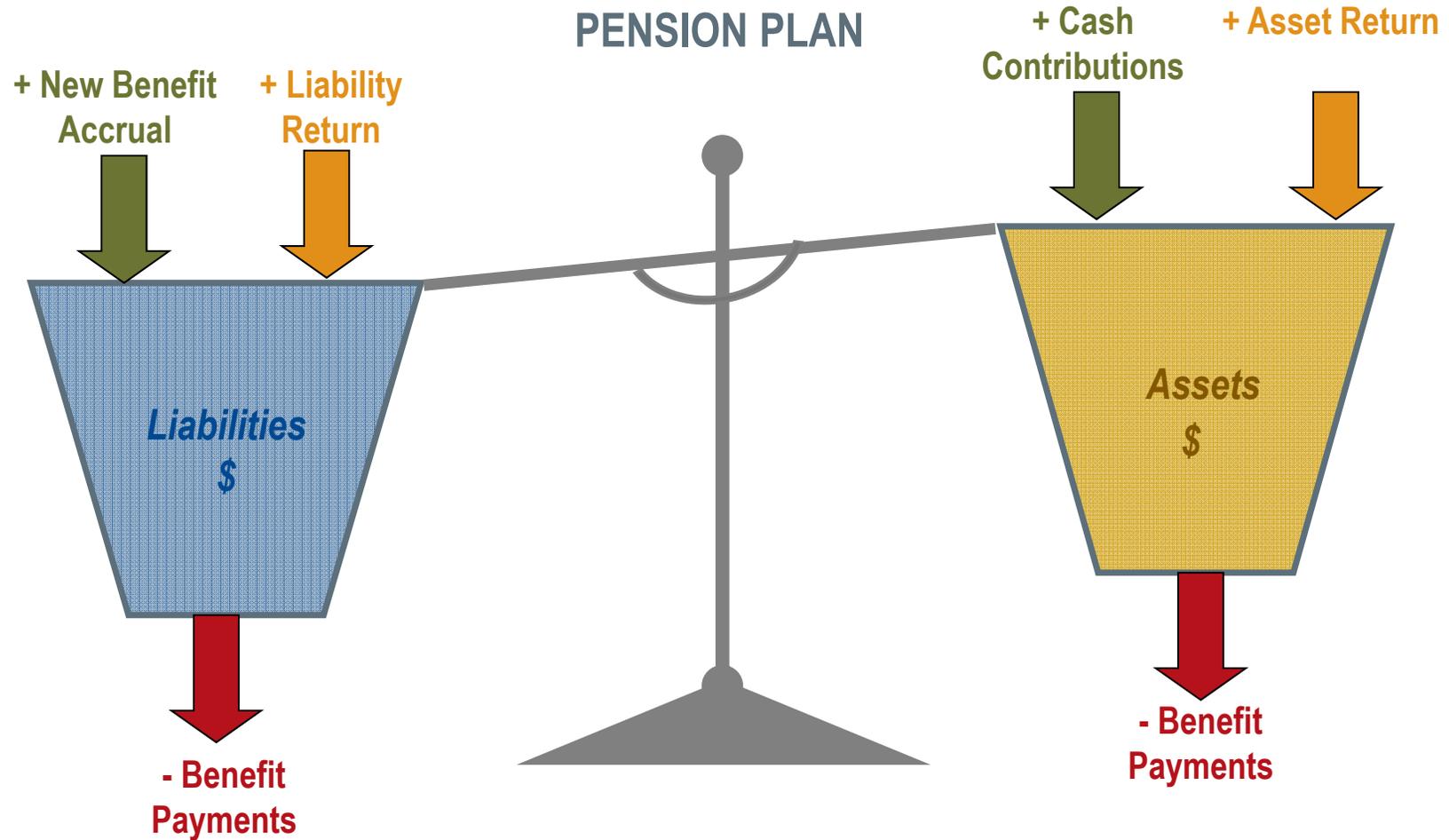
- Asset returns are not expected to keep pace with the actuarial assumed rate of return
- Contributions are therefore projected to trend up while the funded ratios trend sideways for all plans except the State Cash Balance

Portfolio Analysis

- Longer time horizons are expected to reward higher levels of risk; shorter time horizons are not
- The current portfolio is well-diversified; changes to the composition of the portfolio are unlikely to meaningfully impact the results of this Study
- Nebraska should consider its desired balance between funding and investment returns in order to determine the ideal investment portfolio as deviations from the current asset allocation exhibit the standard risk/reward trade-off of expected costs and risks

Executive Summary

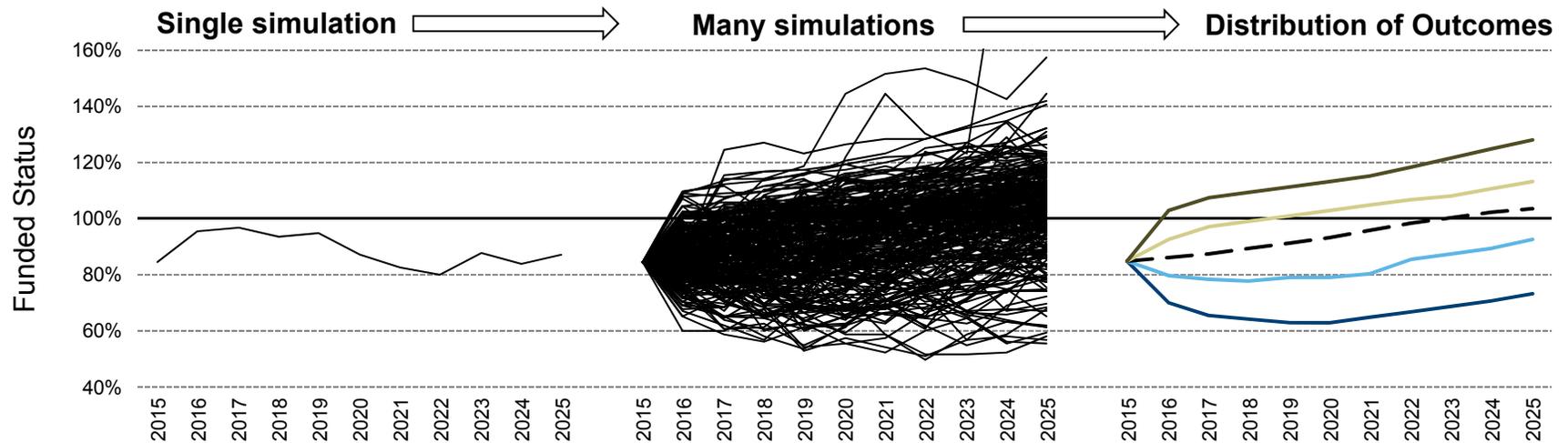
Asset-Liability Management Background: Balance of Liabilities and Assets



Executive Summary

Asset-Liability Management Background: Asset-Liability Modeling Metrics

- Thousands of simulations plotted in one graph would be impossible to interpret
- Instead, we rank the simulations at each point over the future
- This produces a distribution of outcomes illustrating the degree of uncertainty of a plan's financial position over the projection period
- Different investment strategies will produce different distributions of outcomes



* The path of a given scenario will follow a much less smooth pattern than the distribution suggests, as illustrated above

Executive Summary

Current State

	School	State Patrol	Judges	State Cash Balance	County Cash Balance	Total
Snapshot Date	July 1, 2015	July 1, 2015	July 1, 2015	January 1, 2016	January 1, 2016	
Market Value of Assets (MVA)	\$9,685,816,053	\$363,922,631	\$160,800,009	\$1,310,451,038	\$391,428,009	\$11,912,417,740
Actuarial Value of Assets (AVA)	\$9,485,594,650	\$356,446,470	\$157,369,088	\$1,337,161,184	\$400,003,569	\$11,736,574,961
Actuarial Liabilities	\$10,778,303,637	\$410,210,579	\$162,095,235	\$1,304,297,557	\$390,785,123	\$13,045,692,131
Funded Status (based on MVA)	89.9%	88.7%	99.2%	100.5%	100.2%	91.3%
Funded Status (based on AVA)	88.0%	86.9%	97.1%	102.5%	102.4%	90.0%
Actuarial Rate of Return	8.00%	8.00%	8.00%	7.75%	7.75%	
AHIC 2016 Q2 Expected Return ¹	6.56%	6.56%	6.56%	6.56%	6.56%	6.56%
Liability Growth Rate	9.9%	9.8%	10.7%	12.2%	13.6%	10.2%
Asset Growth (Hurdle) Rate ²	11.0%	11.1%	10.8%	12.1%	13.5%	11.2%

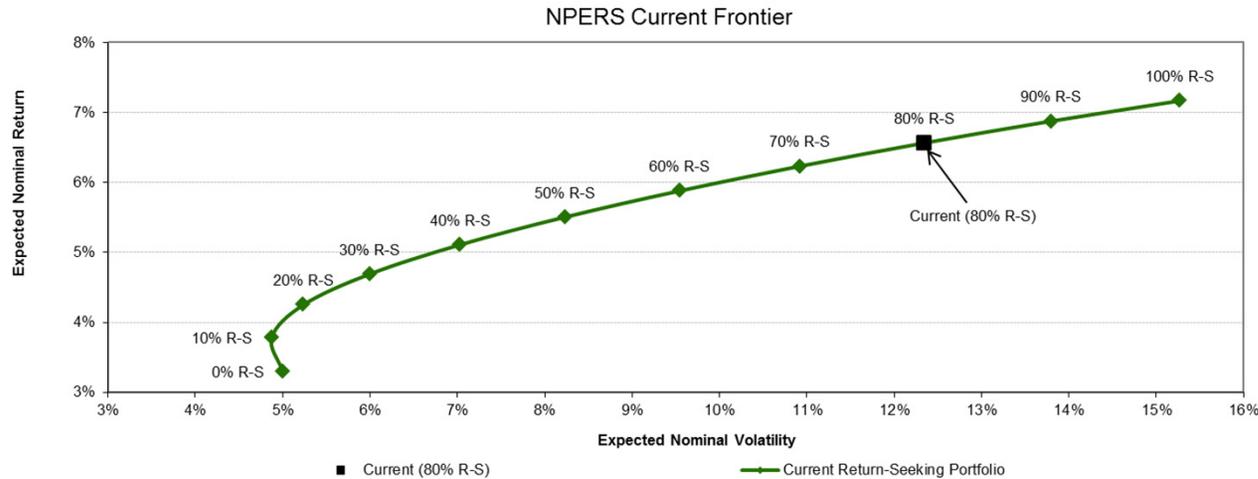
- NPERS consists of five underlying retirement plans that each has the same asset allocation (80% return-seeking / 20% risk-reducing)
 - In arriving at the split above, allocations to high yield bonds, bank loans, and international debt have been classified as return-seeking
- As each plan is separate and distinct, an asset-liability study was conducted individually for the five plans
 - The asset growth rate, or “Hurdle rate” (comprised of contributions and asset returns) across all plans is in excess of 11% if the assets are to keep pace with the liabilities

¹ Using AHIC’s 30-year capital market assumptions for Q2 2016

² The asset growth (hurdle) rate required of the assets to keep pace with the liability growth

Executive Summary

Current Frontier



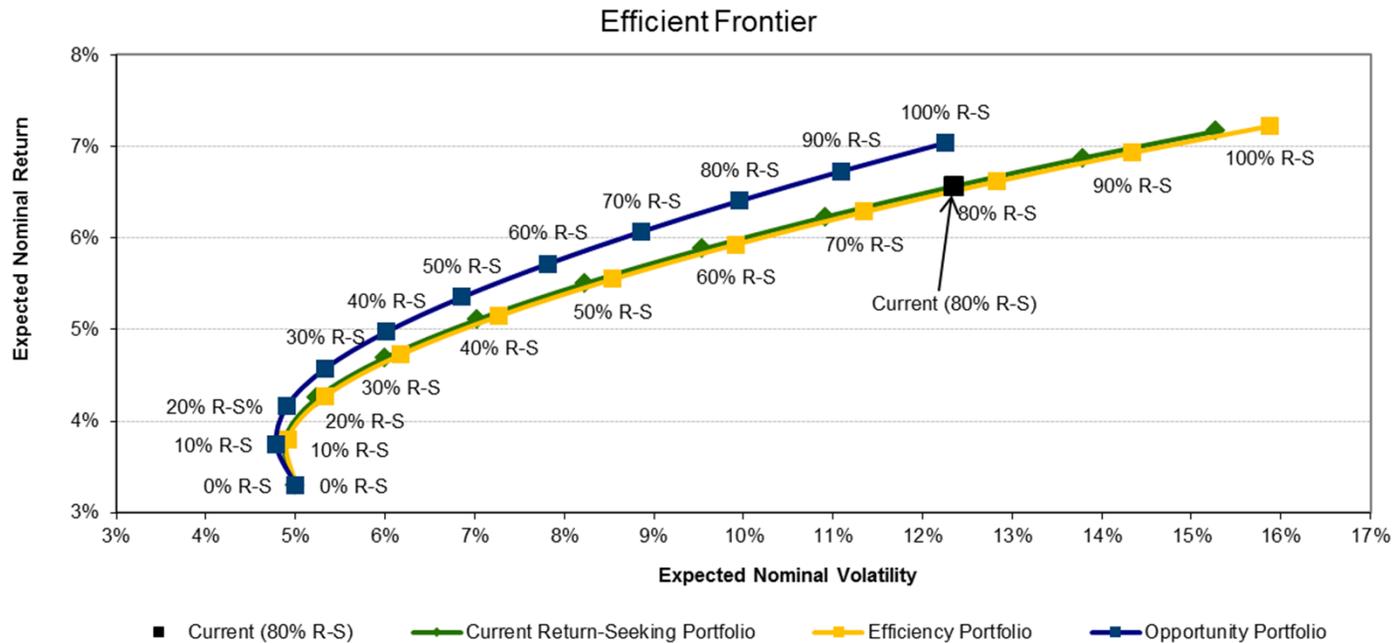
Key Takeaway:

- Portfolio consists of well-diversified return-seeking assets, and a safety asset allocation which should withstand stressed markets

	Expected Nominal Return	Expected Nominal Volatility	Sharpe Ratio	Equity Returns			Diversified Returns				Skill	Safety
				U.S. Equity	Non-U.S. Equity	Global Equity	High Yield Bonds	Dev. Int'l Debt	Bank Loans	Real Estate	Private Equity	Core Bonds
Current (80% R-S)	6.6%	12.3%	0.3455	29%	14%	15%	4%	2%	5%	8%	5%	20%
Current Return-Seeking Portfolio												
0% Return-Seeking	3.3%	5.0%	0.2001	0%	0%	0%	0%	0%	0%	0%	0%	100%
10% Return-Seeking	3.8%	4.9%	0.3052	4%	2%	2%	0%	0%	1%	1%	1%	90%
20% Return-Seeking	4.3%	5.2%	0.3727	7%	3%	4%	1%	0%	1%	2%	1%	80%
30% Return-Seeking	4.7%	6.0%	0.3988	11%	5%	6%	1%	1%	2%	3%	2%	70%
40% Return-Seeking	5.1%	7.0%	0.3996	15%	7%	8%	2%	1%	3%	4%	3%	60%
50% Return-Seeking	5.5%	8.2%	0.3893	18%	8%	9%	2%	1%	3%	5%	3%	50%
60% Return-Seeking	5.9%	9.5%	0.3751	22%	10%	11%	3%	1%	4%	6%	4%	40%
70% Return-Seeking	6.2%	10.9%	0.3601	25%	12%	13%	3%	1%	4%	7%	4%	30%
80% Return-Seeking	6.6%	12.3%	0.3455	29%	14%	15%	4%	2%	5%	8%	5%	20%
90% Return-Seeking	6.9%	13.8%	0.3317	33%	15%	17%	4%	2%	6%	8%	6%	10%
100% Return-Seeking	7.2%	15.3%	0.3188	36%	17%	19%	4%	2%	6%	9%	6%	0%

Executive Summary

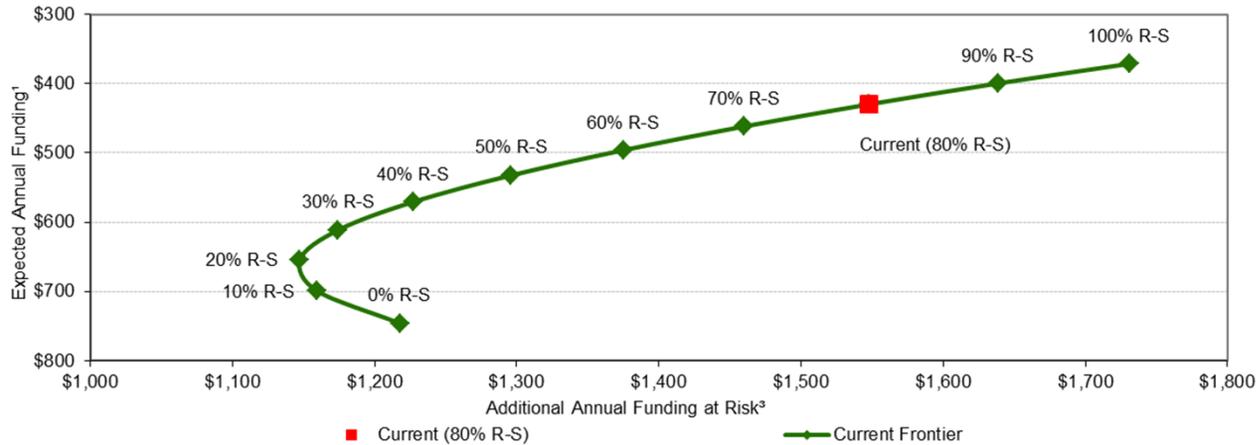
Alternative Frontiers



- Current portfolio is illustrative of AHIC’s best thinking for “Efficiency” investors
 - I.e., those investors that seek to access markets in a cost efficient manner
- Moving toward the “Opportunity” portfolio could enhance risk-adjusted returns, at least at the margin
 - Opportunity investors typically include large allocations to alternative assets (e.g., hedge funds, non-core real estate, private equity)
 - We suggest that Nebraska explore reducing the home-country bias of the equity portfolio and consider increasing the size of the allocation to alternatives as follow-ups to this Study
- Changes to the composition of the return-seeking allocation are unlikely to meaningfully impact the results of this Study

Executive Summary

Funding / Investment Analysis (School Retirement System)



Key Takeaways:

- The growth rate required of the assets to keep pace with the liability growth (the “hurdle rate”) is currently 11.0%:

Interest Cost	8.9%
Normal Cost	<u>2.1%</u>
Total	11.0%

	Modeling Metric					
	Expected Nominal Return	Shortfall Versus Required Return	Expected Annual Funding ¹	Expected Nominal Volatility	1-Year Downside Return ²	Additional Annual Funding at Risk ³
Current (80% R-S)	6.6%	4.4%	\$429.6	12.3%	-5.0%	\$1,548.0
Current Frontier						
0% Return-Seeking	3.3%	7.7%	\$745.8	5.0%	-1.6%	\$1,217.8
10% Return-Seeking	3.8%	7.2%	\$698.6	4.9%	-1.0%	\$1,159.1
20% Return-Seeking	4.3%	6.7%	\$653.7	5.2%	-0.8%	\$1,147.5
30% Return-Seeking	4.7%	6.3%	\$611.0	6.0%	-1.1%	\$1,174.4
40% Return-Seeking	5.1%	5.9%	\$570.5	7.0%	-1.7%	\$1,227.3
50% Return-Seeking	5.5%	5.5%	\$532.2	8.2%	-2.4%	\$1,296.2
60% Return-Seeking	5.9%	5.1%	\$495.9	9.5%	-3.2%	\$1,374.9
70% Return-Seeking	6.2%	4.8%	\$461.8	10.9%	-4.1%	\$1,459.5
80% Return-Seeking	6.6%	4.4%	\$429.6	12.3%	-5.0%	\$1,548.0
90% Return-Seeking	6.9%	4.1%	\$399.5	13.8%	-5.9%	\$1,638.7
100% Return-Seeking	7.2%	3.8%	\$371.2	15.3%	-6.9%	\$1,730.8

- The hurdle rate is covered by a combination of investment returns and cash funding
- Higher allocations to return-seeking assets produce lower expected funding amounts, but with more volatility

¹ Expected annual funding to maintain the current funded ratio is equal to the sum of the net interest cost and normal cost

² Expected annual return under a one standard deviation adverse event

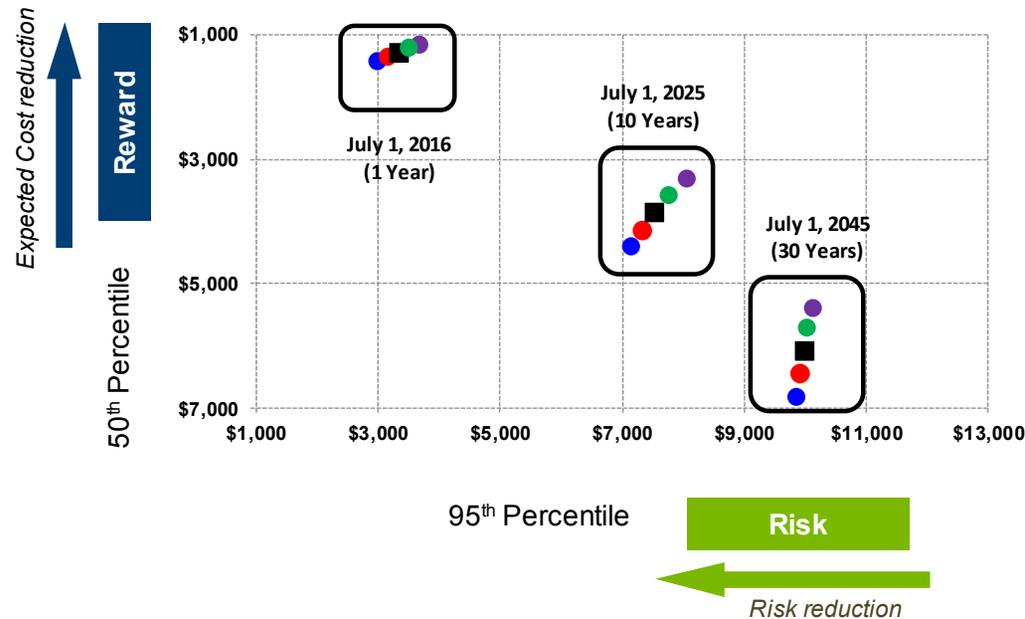
³ Additional annual funding under a one standard deviation adverse event to maintain current funded status

Executive Summary

Economic Cost Analysis (School Retirement System)

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 8.00%, \$billions



Key Takeaways:

- The magnitude of the risk/reward trade-off changes over a longer-term projection
- Under the Current Policy over a 30-year time horizon, the expected Economic Cost is \$6,064.0M and the potential risk is \$9,974.6M
- Adjustments to the return-seeking allocation may have desirable risk/reward characteristics relative to the current policy

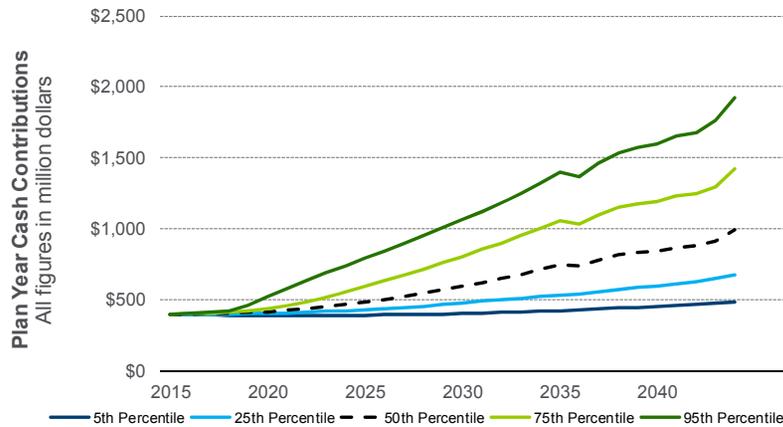
* Liability projections assume discount rates of 8.00% for all investment policies studied; Reflects a *utility function*: Excludes 50% of surplus in excess of 120% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

Economic Cost		
July 1, 2016		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$1,427.3	\$2,992.5
70% Return-Seeking	\$1,361.5	\$3,162.6
Current (80% R-S)	\$1,294.9	\$3,336.2
90% Return-Seeking	\$1,232.6	\$3,513.2
100% Return-Seeking	\$1,166.3	\$3,684.7
July 1, 2025		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$4,408.4	\$7,152.7
70% Return-Seeking	\$4,135.5	\$7,318.2
Current (80% R-S)	\$3,851.5	\$7,524.7
90% Return-Seeking	\$3,600.0	\$7,764.2
100% Return-Seeking	\$3,330.8	\$8,066.5
July 1, 2045		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$6,806.1	\$9,859.8
70% Return-Seeking	\$6,441.4	\$9,903.7
Current (80% R-S)	\$6,064.0	\$9,974.6
90% Return-Seeking	\$5,706.1	\$10,033.5
100% Return-Seeking	\$5,398.9	\$10,132.2

Executive Summary

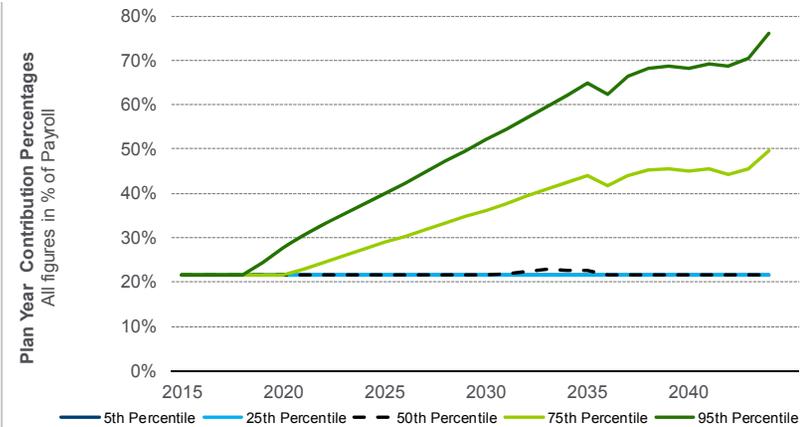
Gross Contributions (School Retirement System)

Gross Dollar Amounts



Strategy	Current (80% R-S)			
Year	2015	2024	2034	2044
5th Percentile	\$399.8	\$391.0	\$419.4	\$486.3
25th Percentile	\$399.8	\$423.9	\$525.0	\$674.6
50th Percentile	\$399.8	\$465.4	\$712.9	\$996.3
75th Percentile	\$399.8	\$554.1	\$1,000.7	\$1,418.4
95th Percentile	\$399.8	\$736.1	\$1,319.2	\$1,923.4
Probability > \$1,000M	<5%	<5%	25%	50%

Gross Contribution Percentage



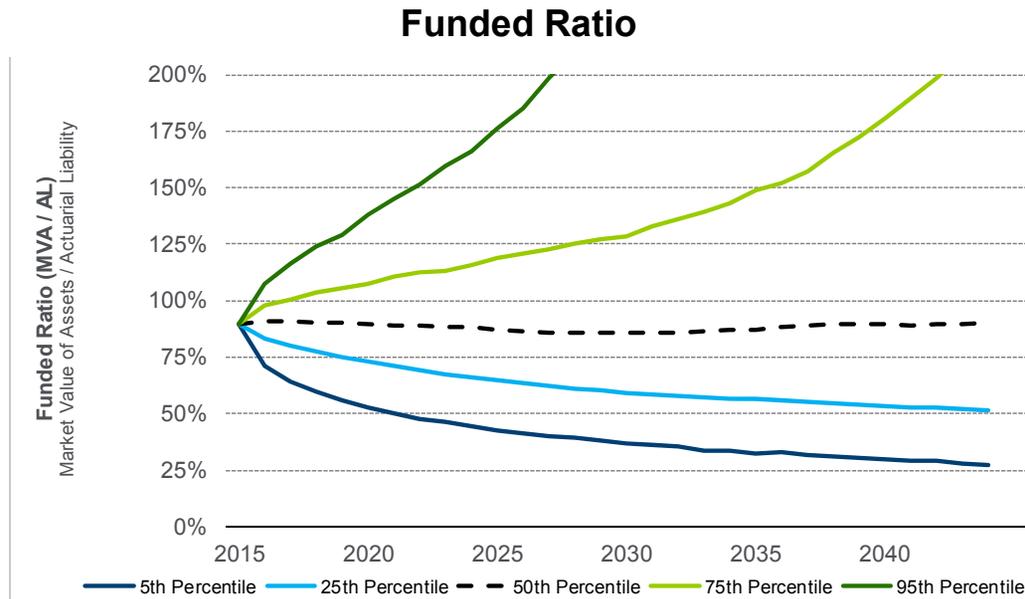
Strategy	Current (80% R-S)			
Year	2015	2024	2034	2044
5th Percentile	22%	22%	22%	22%
25th Percentile	22%	22%	22%	22%
50th Percentile	22%	22%	23%	22%
75th Percentile	22%	27%	42%	50%
95th Percentile	22%	38%	62%	76%
Probability > 22%	<5%	50%	75%	75%

Key Takeaways:

- Median expected contributions (50th percentile) are assumed to increase with payroll/inflation and maintain the current 22% aggregate contribution percentages
 - These contributions levels exceed the actuarially determined contributions but will not be expected to close the funding shortfall
- Adverse market conditions (75th or 95th percentile) could see the actuarially determined contributions exceed 50% of projected payroll

Executive Summary

Market Value of Assets / Actuarial Liability Funded Ratio (School Retirement System)



Key Takeaways:

- The School's funded ratio is projected to begin and end the period at roughly the same position
- Falling short of the actuarial assumed rate of return will stagnate the progression of the funded ratio
- The School's contribution policy spreads (gains)/losses over 30 years meaning that adverse economic environments will not quickly correct through contributions alone
 - i.e., if our capital market assumptions prove optimistic, the funded ratio could decline meaningfully and stay at a depressed level for a prolonged period

Strategy	Current (80% R-S)			
Year	2015	2024	2034	2044
5th Percentile	90%	45%	33%	27%
25th Percentile	90%	66%	57%	51%
50th Percentile	90%	88%	87%	90%
75th Percentile	90%	116%	143%	216%
95th Percentile	90%	166%	319%	857%
Probability > 90%	<5%	49%	49%	50%

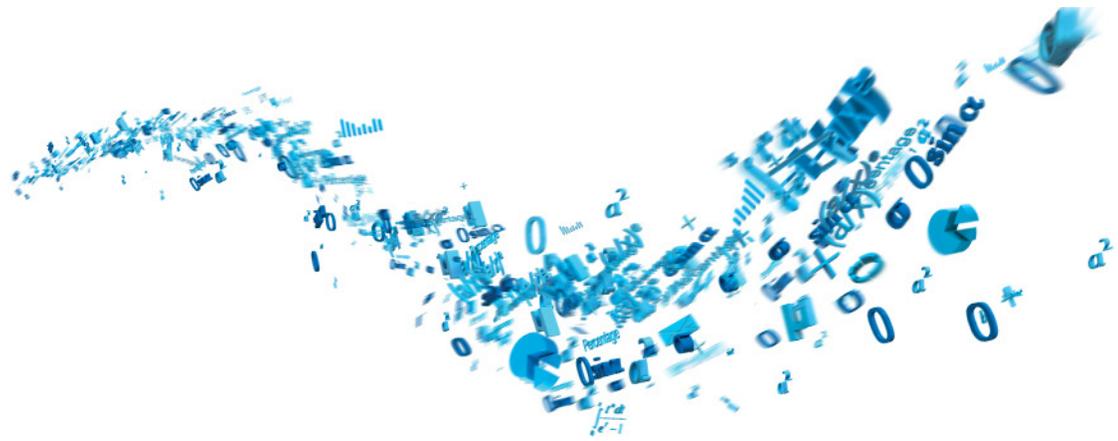
* Liability projections assume discount rates of 8.00% for all investment policies studied

Executive Summary

Glossary of Terms

- **AVA** = Actuarial Value of Assets (i.e., incorporates smoothing of gains and losses)
- **Asset Growth Rate or “Hurdle Rate”** – The required rate of growth of the assets (through both contributions and investment returns) to keep pace with the growth of the liability
- **Current Frontier** – uses Nebraska’s mix of asset classes within the Return Seeking allocation, then dials the Return Seeking allocation up and down from 0% to 100% to illustrate forecasted returns at various Return Seeking / Safety Asset mixes
- **Current Portfolio** – represents Nebraska’s current mix of asset classes
- **Economic Cost** – Present Value of forecasted future contributions + Funding Shortfall / (Surplus)
- **Efficient Frontier (“Frontier”)** – Various combinations of return-seeking and safety assets that produce the highest returns per unit of risk assumed
- **Efficiency Portfolio** – a mix of Return Seeking assets that seeks to access markets in a cost efficient manner
- **Liability Growth Rate** – the projected growth of the liability over the coming year as measurement by the sum of the Normal Cost (new benefit accruals) and Interest Cost (one year of discounting)
- **MVA** = Market Value of Assets (i.e., un-smoothed / economic reality)
- **Opportunity Portfolio** – a mix of Return Seeking assets that includes large allocations to higher-cost, skill-based asset classes
- **Return Seeking Assets (“R-S”)** – All non “Safety” assets
 - Return Seeking assets are further divided into three categories:
 - **Equity returns** – asset classes that provide exposure to the equity risk premium
 - **Diversified returns** – asset classes that provide exposure to other market risk premiums
 - **Skill** – asset classes that rely on manager skill (rather than market risk premiums) to drive returns
- **Safety Assets** – Assets where the primary function is risk control / downside mitigation. (For Nebraska, core bonds.)

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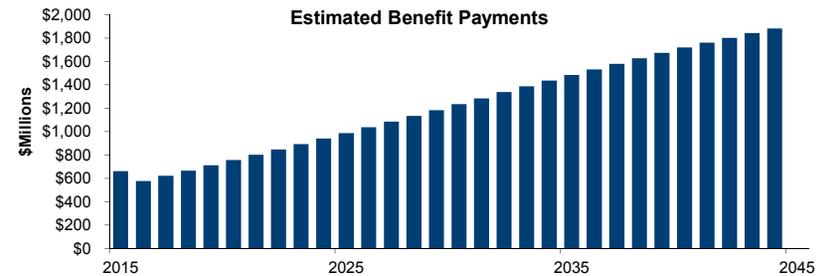
Current State

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Asset-Liability Profile (School Retirement System)

As of July 1, 2015

Asset-Liability Snapshot as of 7/1/2015		
Metric (\$, Millions)	Value	Fund %
Market Value of Assets	\$9,685.8	89.9%
Actuarial Value of Assets	\$9,485.6	88.0%
Liability Metrics		
Actuarial Liability (AL) – Funding	\$10,778.3 ¹	



Asset-Liability Growth Metrics			
Metric (\$, Millions)	Value	% Liability	% Assets
AL Interest Cost	\$862.3	8.0%	8.9%
AL Normal Cost	\$205.6	1.9%	2.1%
Total Liability Hurdle Rate	\$1,067.9	9.9%	11.0%
Expected Return on Assets	\$774.9	7.2%	8.0%
ER + EE Contributions	\$399.8	3.7%	4.1%
Total Exp. Asset Growth	\$1,174.7	10.9%	12.1%
Hurdle Rate Shortfall²	-\$106.8	-1.0%	-1.1%
Est. Benefit Payments	\$662.9	6.2%	6.8%

Target Asset Allocation as of 7/1/2015		
Metric (\$, Millions)	Value	Alloc %
Return-Seeking		
- U.S. Equity	\$2,808.9	29%
- International Equity	\$1,307.6	14%
- Global Equity	\$1,452.9	15%
- Private Equity	\$484.3	5%
- Real Estate	\$726.4	8%
- High Yield Bonds	\$339.0	4%
- Developed International Debt	\$145.3	2%
- Bank Loans	\$484.3	5%
- Total	\$7,748.7	80%
Risk-Reducing		
- Core Fixed Income	\$1,937.2	20%
- Total	\$1,937.2	20%
Total	\$9,685.8	100%

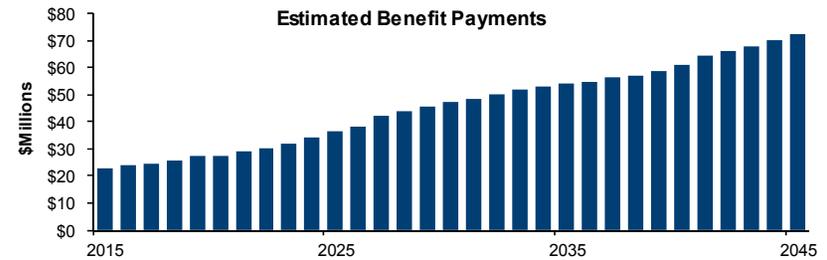
¹Based on a 8.00% discount rate consistent with the July 1, 2015 valuation results.

²Based on plan's valuation interest rate of 8.00%. Using AHIC's 30-year capital market assumptions for Q2 2016, the expected return is 6.56%, which results in a hurdle rate shortfall/(surplus) of \$32.7M.

Asset-Liability Profile (State Patrol Retirement System)

As of July 1, 2015

Asset-Liability Snapshot as of 7/1/2015		
Metric (\$, Millions)	Value	Fund %
Market Value of Assets	\$363.9	88.7%
Actuarial Value of Assets	\$356.4	86.9%
Liability Metrics		
Actuarial Liability (AL) – Funding	\$410.2 ¹	



Asset-Liability Growth Metrics			
Metric (\$, Millions)	Value	% Liability	% Assets
AL Interest Cost	\$32.8	8.0%	9.0%
AL Normal Cost	\$7.5	1.8%	2.1%
Total Liability Hurdle Rate	\$40.4	9.8%	11.1%
Expected Return on Assets	\$29.1	7.1%	8.0%
ER + EE Contributions	\$11.8	2.9%	3.2%
Total Exp. Asset Growth	\$40.9	10.0%	11.2%
Hurdle Rate Shortfall²	-\$0.6	-0.2%	-0.1%
Est. Benefit Payments	\$22.9	5.6%	6.3%

Target Asset Allocation as of 7/1/2015		
Metric (\$, Millions)	Value	Alloc %
Return-Seeking		
- U.S. Equity	\$105.5	29%
- International Equity	\$49.1	14%
- Global Equity	\$54.6	15%
- Private Equity	\$18.2	5%
- Real Estate	\$27.3	8%
- High Yield Bonds	\$12.7	4%
- Developed International Debt	\$5.5	2%
- Bank Loans	\$18.2	5%
- Total	\$291.1	80%
Risk-Reducing		
- Core Fixed Income	\$72.8	20%
- Total	\$72.8	20%
Total	\$363.9	100%

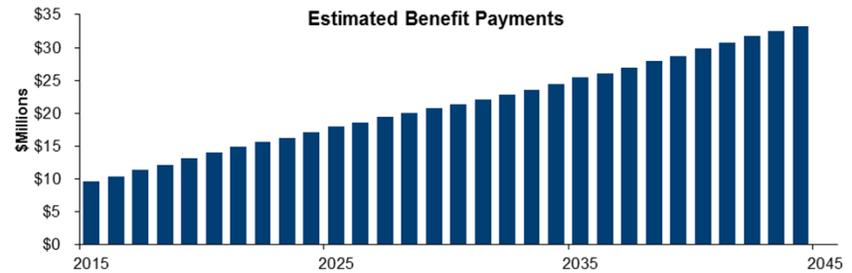
¹Based on a 8.00% discount rate consistent with the July 1, 2015 valuation results.

²Based on plan's valuation interest rate of 8.00%. Using AHIC's 30-year capital market assumptions for Q2 2016, the expected return is 6.56%, which results in a hurdle rate shortfall/(surplus) of \$4.7M.

Asset-Liability Profile (Judges Retirement System)

As of July 1, 2015

Asset-Liability Snapshot as of 7/1/2015		
Metric (\$, Millions)	Value	Fund %
Market Value of Assets	\$160.8	99.2%
Actuarial Value of Assets	\$157.4	97.1%
Liability Metrics		
Actuarial Liability (AL) – Funding	\$162.1 ¹	



Asset-Liability Growth Metrics			
Metric (\$, Millions)	Value	% Liability	% Assets
AL Interest Cost	\$13.0	8.0%	8.1%
AL Normal Cost	\$4.4	2.7%	2.7%
Total Liability Hurdle Rate	\$17.3	10.7%	10.8%
Expected Return on Assets	\$12.9	7.9%	8.0%
ER + EE Contributions	\$5.3	3.2%	3.3%
Total Exp. Asset Growth	\$18.1	11.1%	11.3%
Hurdle Rate Shortfall²	-\$0.8	-0.4%	-0.5%
Est. Benefit Payments	\$9.6	6.0%	6.0%

Target Asset Allocation as of 7/1/2015		
Metric (\$, Millions)	Value	Alloc %
Return-Seeking		
- U.S. Equity	\$46.6	29%
- International Equity	\$21.7	14%
- Global Equity	\$24.1	15%
- Private Equity	\$8.0	5%
- Real Estate	\$12.1	8%
- High Yield Bonds	\$5.6	4%
- Developed International Debt	\$2.4	2%
- Bank Loans	\$8.0	5%
- Total	\$128.6	80%
Risk-Reducing		
- Core Fixed Income	\$32.2	20%
- Total	\$32.2	20%
Total	\$160.8	100%

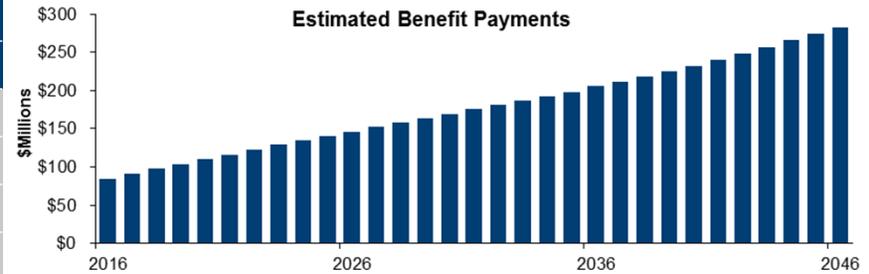
¹Based on a 8.00% discount rate consistent with the July 1, 2015 valuation results.

²Based on plan's valuation interest rate of 8.00%. Using AHIC's 30-year capital market assumptions for Q1 2016, the expected return is 6.56%, which results in a hurdle rate shortfall/(surplus) of \$1.5M.

Asset-Liability Profile (State Cash Balance Plan)

As of January 1, 2016

Asset-Liability Snapshot as of 1/1/2016		
Metric (\$, Millions)	Value	Fund %
Market Value of Assets	\$1,310.5	100.5%
Actuarial Value of Assets	\$1,337.2	102.5%
Liability Metrics		
Actuarial Liability (AL) – Funding	\$1,304.3 ¹	



Asset-Liability Growth Metrics			
Metric (\$, Millions)	Value	% Liability	% Assets
AL Interest Cost	\$101.1	7.8%	7.7%
AL Normal Cost	\$57.3	4.4%	4.4%
Total Liability Hurdle Rate	\$158.4	12.2%	12.1%
Expected Return on Assets	\$101.6	7.8%	7.8%
ER + EE Contributions	\$71.4	5.5%	5.5%
Total Exp. Asset Growth	\$173.0	13.3%	13.3%
Hurdle Rate Shortfall²	-\$14.6	-1.2%	-1.2%
Est. Benefit Payments	\$84.6	6.5%	6.5%

Target Asset Allocation as of 1/1/2016		
Metric (\$, Millions)	Value	Alloc %
Return-Seeking		
- U.S. Equity	\$380.0	29%
- International Equity	\$176.9	14%
- Global Equity	\$196.6	15%
- Private Equity	\$65.5	5%
- Real Estate	\$98.3	8%
- High Yield Bonds	\$45.9	4%
- Developed International Debt	\$19.7	2%
- Bank Loans	\$65.5	5%
- Total	\$1,048.4	80%
Risk-Reducing		
- Core Fixed Income	\$262.1	20%
- Total	\$262.1	20%
Total	\$1,310.5	100%

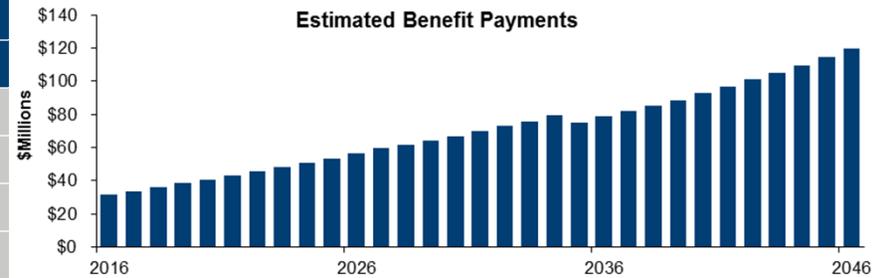
¹Based on a 7.75% discount rate consistent with the January 1, 2016 valuation results.

²Based on plan's valuation interest rate of 7.75%. Using AHIC's 30-year capital market assumptions for Q2 2016, the expected return is 6.56%, which results in a hurdle rate shortfall/(surplus) of \$6.3M.

Asset-Liability Profile (County Cash Balance Plan)

As of January 1, 2016

Asset-Liability Snapshot as of 1/1/2016		
Metric (\$, Millions)	Value	Fund %
Market Value of Assets	\$391.4	100.2%
Actuarial Value of Assets	\$400.0	102.4%
Liability Metrics		
Actuarial Liability (AL) – Funding	\$390.8 ¹	



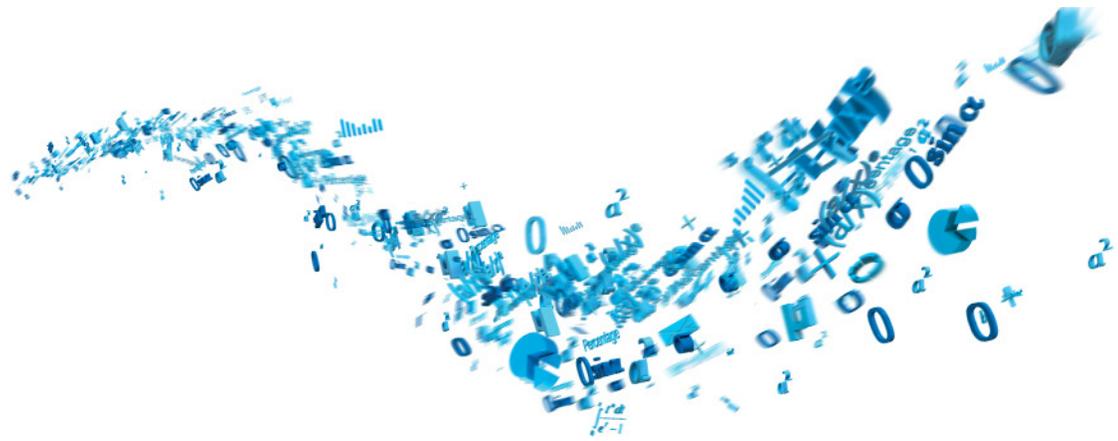
Asset-Liability Growth Metrics			
Metric (\$, Millions)	Value	% Liability	% Assets
AL Interest Cost	\$30.3	7.8%	7.7%
AL Normal Cost	\$22.6	5.8%	5.8%
Total Liability Hurdle Rate	\$52.9	13.6%	13.5%
Expected Return on Assets	\$30.3	7.8%	7.8%
ER + EE Contributions	\$27.8	7.1%	7.1%
Total Exp. Asset Growth	\$58.1	14.9%	14.9%
Hurdle Rate Shortfall²	-\$5.2	-1.4%	-1.4%
Est. Benefit Payments	\$31.8	8.1%	8.1%

Target Asset Allocation as of 1/1/2016		
Metric (\$, Millions)	Value	Alloc %
Return-Seeking		
- U.S. Equity	\$113.5	29%
- International Equity	\$52.8	14%
- Global Equity	\$58.7	15%
- Private Equity	\$19.6	5%
- Real Estate	\$29.4	8%
- High Yield Bonds	\$13.7	4%
- Developed International Debt	\$5.9	2%
- Bank Loans	\$19.6	5%
- Total	\$313.1	80%
Risk-Reducing		
- Core Fixed Income	\$78.3	20%
- Total	\$78.3	20%
Total	\$391.4	100%

¹Based on a 7.75% discount rate consistent with the January 1, 2016 valuation results.

²Based on plan's valuation interest rate of 7.75%. Using AHIC's 30-year capital market assumptions for Q2 2016, the expected return is 6.56%, which results in a hurdle rate shortfall/(surplus) of -\$0.6M.

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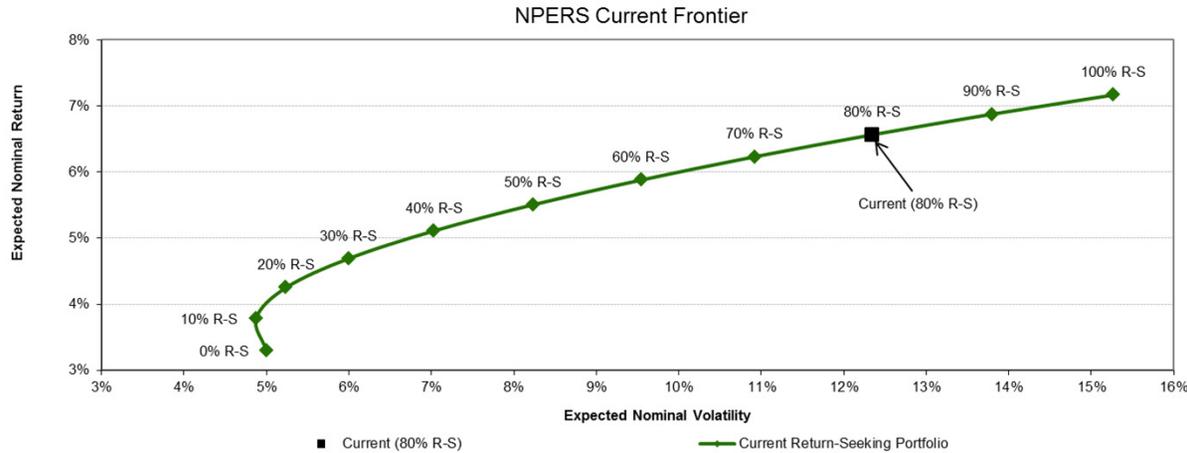
Analysis

- Portfolio Analysis

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Portfolio Analysis

Current Frontier



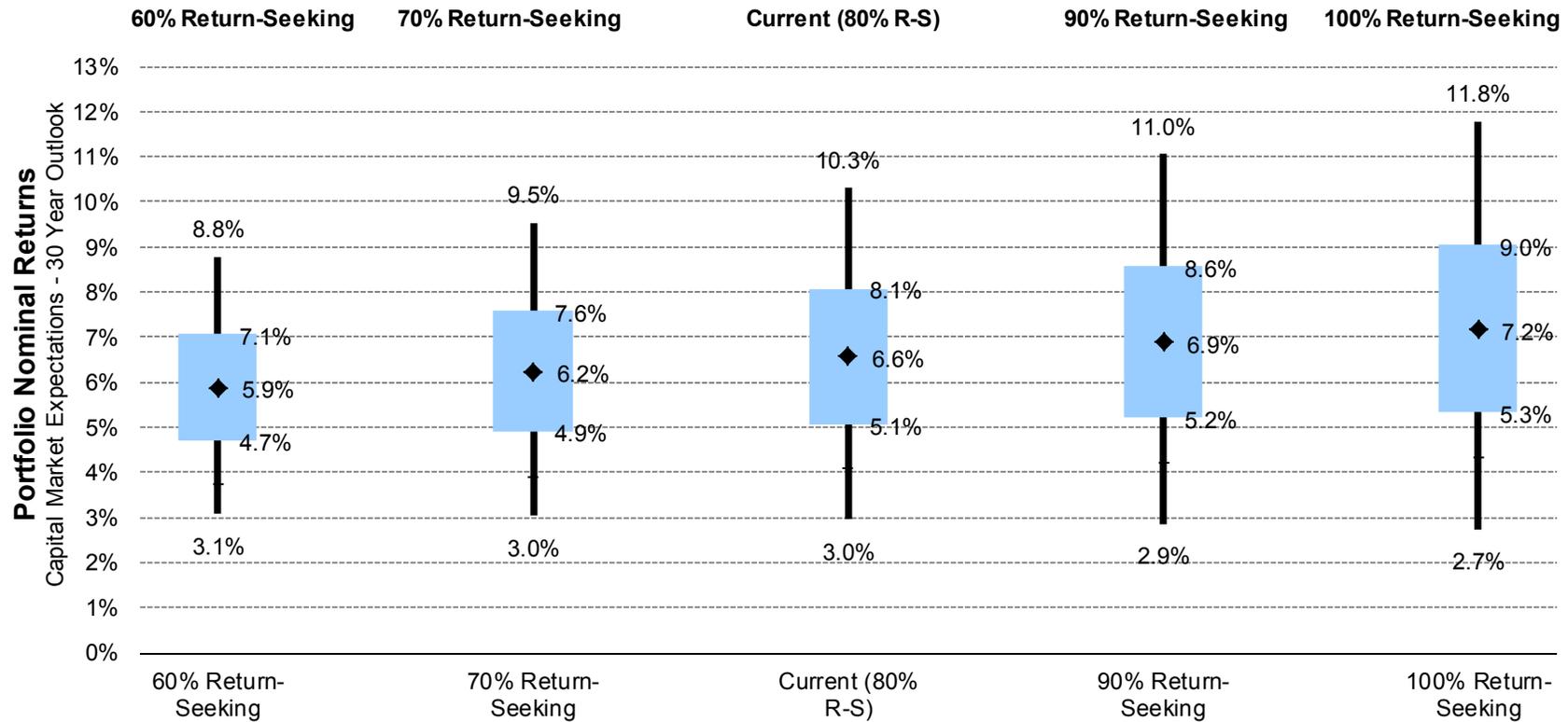
Key Takeaway:

- Portfolio consists of well-diversified return-seeking assets, and a safety asset allocation which should withstand stressed markets

	Expected Nominal Return	Expected Nominal Volatility	Sharpe Ratio	Equity Returns			Diversified Returns				Skill	Safety
				U.S. Equity	Non-U.S. Equity	Global Equity	High Yield Bonds	Dev. Debt	Int'l Loans	Real Estate	Private Equity	Core Bonds
Current (80% R-S)	6.6%	12.3%	0.3455	29%	14%	15%	4%	2%	5%	8%	5%	20%
Current Return-Seeking Portfolio												
0% Return-Seeking	3.3%	5.0%	0.2001	0%	0%	0%	0%	0%	0%	0%	0%	100%
10% Return-Seeking	3.8%	4.9%	0.3052	4%	2%	2%	0%	0%	1%	1%	1%	90%
20% Return-Seeking	4.3%	5.2%	0.3727	7%	3%	4%	1%	0%	1%	2%	1%	80%
30% Return-Seeking	4.7%	6.0%	0.3988	11%	5%	6%	1%	1%	2%	3%	2%	70%
40% Return-Seeking	5.1%	7.0%	0.3996	15%	7%	8%	2%	1%	3%	4%	3%	60%
50% Return-Seeking	5.5%	8.2%	0.3893	18%	8%	9%	2%	1%	3%	5%	3%	50%
60% Return-Seeking	5.9%	9.5%	0.3751	22%	10%	11%	3%	1%	4%	6%	4%	40%
70% Return-Seeking	6.2%	10.9%	0.3601	25%	12%	13%	3%	1%	4%	7%	4%	30%
80% Return-Seeking	6.6%	12.3%	0.3455	29%	14%	15%	4%	2%	5%	8%	5%	20%
90% Return-Seeking	6.9%	13.8%	0.3317	33%	15%	17%	4%	2%	6%	8%	6%	10%
100% Return-Seeking	7.2%	15.3%	0.3188	36%	17%	19%	4%	2%	6%	9%	6%	0%

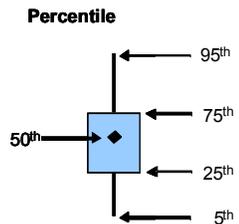
Portfolio Analysis

Range of Nominal Returns



Key Takeaway:

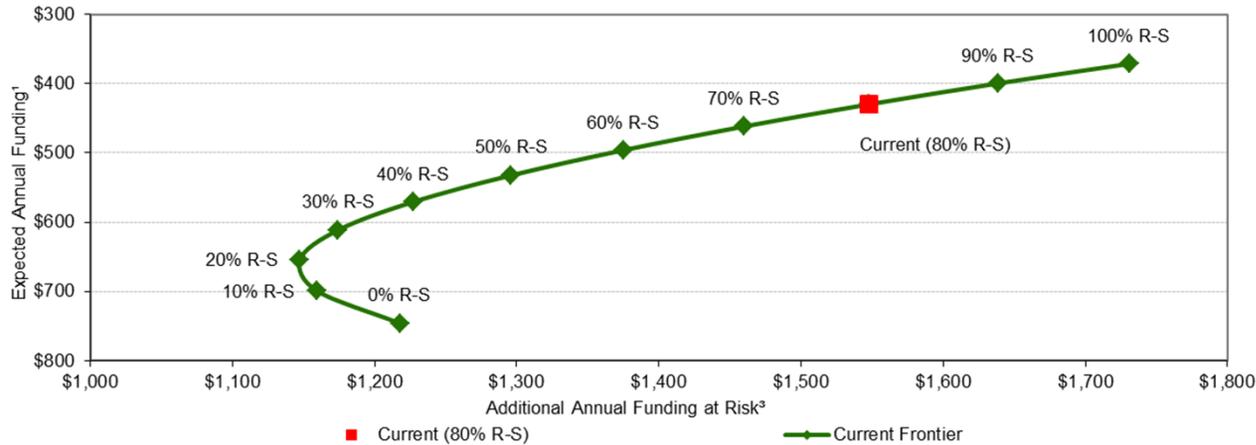
- Median expected returns for asset allocations ranging from 60% return-seeking to 100% return-seeking are projected to trail the actuarial assumed rate of return (8.00% of the traditional benefit plans; 7.75% for the cash balance plans)



Note: Returns based on AHIC's Q2 2016 30 Year Capital Market Assumptions

Portfolio Analysis

Funding / Investment Analysis (School Retirement System)



Key Takeaways:

- The growth rate required of the assets to keep pace with the liability growth (the “hurdle rate”) is currently 11.0%:

Interest Cost	8.9%
Normal Cost	<u>2.1%</u>
Total	11.0%

	Modeling Metric					
	Expected Nominal Return	Shortfall Versus Required Return	Expected Annual Funding ¹	Expected Nominal Volatility	1-Year Downside Return ²	Additional Annual Funding at Risk ³
Current (80% R-S)	6.6%	4.4%	\$429.6	12.3%	-5.0%	\$1,548.0
Current Frontier						
0% Return-Seeking	3.3%	7.7%	\$745.8	5.0%	-1.6%	\$1,217.8
10% Return-Seeking	3.8%	7.2%	\$698.6	4.9%	-1.0%	\$1,159.1
20% Return-Seeking	4.3%	6.7%	\$653.7	5.2%	-0.8%	\$1,147.5
30% Return-Seeking	4.7%	6.3%	\$611.0	6.0%	-1.1%	\$1,174.4
40% Return-Seeking	5.1%	5.9%	\$570.5	7.0%	-1.7%	\$1,227.3
50% Return-Seeking	5.5%	5.5%	\$532.2	8.2%	-2.4%	\$1,296.2
60% Return-Seeking	5.9%	5.1%	\$495.9	9.5%	-3.2%	\$1,374.9
70% Return-Seeking	6.2%	4.8%	\$461.8	10.9%	-4.1%	\$1,459.5
80% Return-Seeking	6.6%	4.4%	\$429.6	12.3%	-5.0%	\$1,548.0
90% Return-Seeking	6.9%	4.1%	\$399.5	13.8%	-5.9%	\$1,638.7
100% Return-Seeking	7.2%	3.8%	\$371.2	15.3%	-6.9%	\$1,730.8

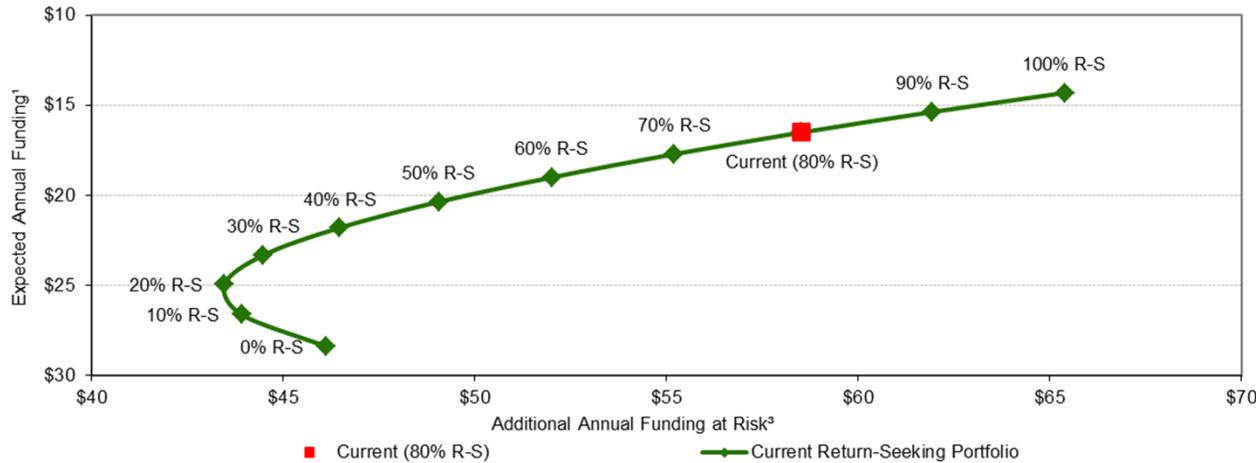
¹ Expected annual funding to maintain the current funded ratio is equal to the sum of the net interest cost and normal cost

² Expected annual return under a one standard deviation adverse event

³ Additional annual funding under a one standard deviation adverse event to maintain current funded status

Portfolio Analysis

Funding / Investment Analysis (State Patrol Retirement System)



Key Takeaways:

- The growth rate required of the assets to keep pace with the liability growth (the “hurdle rate”) is currently 11.1%:

Interest Cost	9.0%
<u>Normal Cost</u>	<u>2.1%</u>
Total	11.1%

- The hurdle rate is covered by a combination of investment returns and cash funding
- Higher allocations to return-seeking assets produce lower expected funding amounts, but with more volatility

	Modeling Metric					
	Expected Nominal Return	Shortfall Versus Required Return	Expected Annual Funding ¹	Expected Nominal Volatility	1-Year Downside Return ²	Additional Annual Funding at Risk ³
Current (80% R-S)	6.6%	4.5%	\$16.5	12.3%	-5.0%	\$58.5
Current Frontier						
0% Return-Seeking	3.3%	7.8%	\$28.4	5.0%	-1.6%	\$46.1
10% Return-Seeking	3.8%	7.3%	\$26.6	4.9%	-1.0%	\$43.9
20% Return-Seeking	4.3%	6.8%	\$24.9	5.2%	-0.8%	\$43.5
30% Return-Seeking	4.7%	6.4%	\$23.3	6.0%	-1.1%	\$44.5
40% Return-Seeking	5.1%	6.0%	\$21.8	7.0%	-1.7%	\$46.5
50% Return-Seeking	5.5%	5.6%	\$20.4	8.2%	-2.4%	\$49.1
60% Return-Seeking	5.9%	5.2%	\$19.0	9.5%	-3.2%	\$52.0
70% Return-Seeking	6.2%	4.9%	\$17.7	10.9%	-4.1%	\$55.2
80% Return-Seeking	6.6%	4.5%	\$16.5	12.3%	-5.0%	\$58.5
90% Return-Seeking	6.9%	4.2%	\$15.4	13.8%	-5.9%	\$61.9
100% Return-Seeking	7.2%	3.9%	\$14.3	15.3%	-6.9%	\$65.4

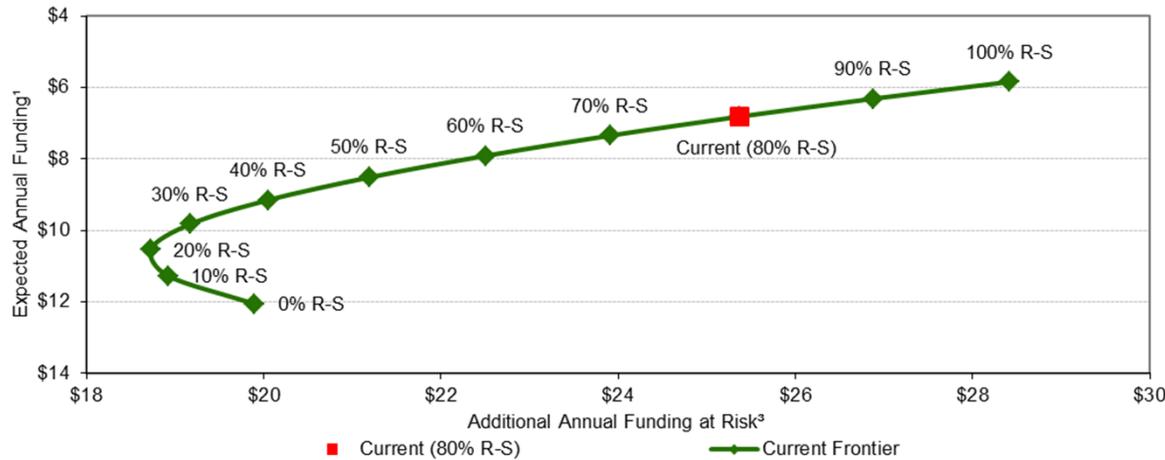
¹ Expected annual funding to maintain the current funded ratio is equal to the sum of the net interest cost and normal cost

² Expected annual return under a one standard deviation adverse event

³ Additional annual funding under a one standard deviation adverse event to maintain current funded status

Portfolio Analysis

Funding / Investment Analysis (Judges Retirement System)



Key Takeaways:

- The growth rate required of the assets to keep pace with the liability growth (the “hurdle rate”) is currently 10.8%:

Interest Cost	8.1%
Normal Cost	<u>2.7%</u>
Total	10.8%

- The hurdle rate is covered by a combination of investment returns and cash funding
- Higher allocations to return-seeking assets produce lower expected funding amounts, but with more volatility

	Modeling Metric					Additional Annual Funding at Risk ³
	Expected Nominal Return	Shortfall Versus Required Return	Expected Annual Funding ¹	Expected Nominal Volatility	1-Year Downside Return ²	
Current (80% R-S)	6.6%	4.2%	\$6.8	12.3%	-5.0%	\$25.4
Current Frontier						
0% Return-Seeking	3.3%	7.5%	\$12.1	5.0%	-1.6%	\$19.9
10% Return-Seeking	3.8%	7.0%	\$11.3	4.9%	-1.0%	\$18.9
20% Return-Seeking	4.3%	6.5%	\$10.5	5.2%	-0.8%	\$18.7
30% Return-Seeking	4.7%	6.1%	\$9.8	6.0%	-1.1%	\$19.2
40% Return-Seeking	5.1%	5.7%	\$9.1	7.0%	-1.7%	\$20.1
50% Return-Seeking	5.5%	5.3%	\$8.5	8.2%	-2.4%	\$21.2
60% Return-Seeking	5.9%	4.9%	\$7.9	9.5%	-3.2%	\$22.5
70% Return-Seeking	6.2%	4.6%	\$7.3	10.9%	-4.1%	\$23.9
80% Return-Seeking	6.6%	4.2%	\$6.8	12.3%	-5.0%	\$25.4
90% Return-Seeking	6.9%	3.9%	\$6.3	13.8%	-5.9%	\$26.9
100% Return-Seeking	7.2%	3.6%	\$5.8	15.3%	-6.9%	\$28.4

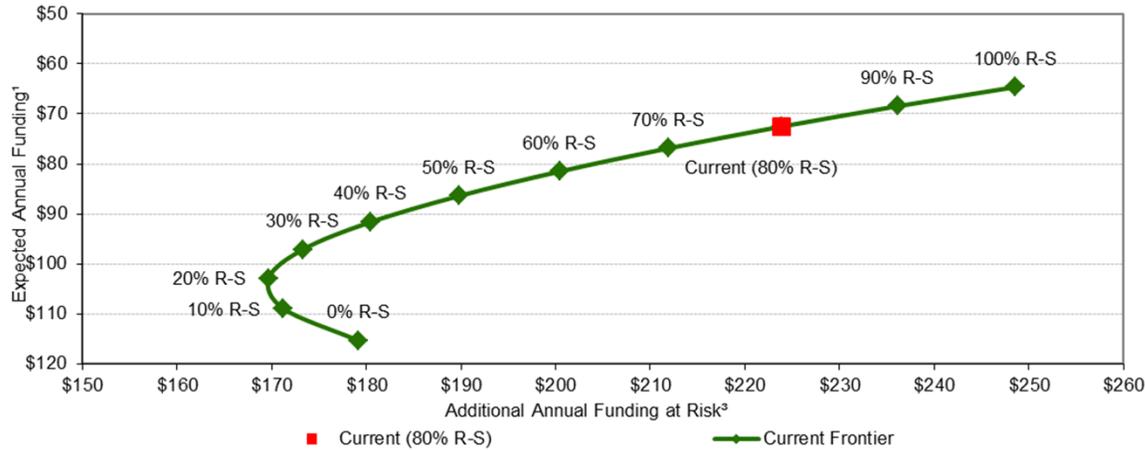
¹ Expected annual funding to maintain the current funded ratio is equal to the sum of the net interest cost and normal cost

² Expected annual return under a one standard deviation adverse event

³ Additional annual funding under a one standard deviation adverse event to maintain current funded status

Portfolio Analysis

Funding / Investment Analysis (State Cash Balance Plan)



Modeling Metric

	Expected Nominal Return	Shortfall Versus Required Return	Expected Annual Funding ¹	Expected Nominal Volatility	1-Year Downside Return ²	Additional Annual Funding at Risk ³
Current (80% R-S)	6.6%	5.5%	\$72.5	12.3%	-5.0%	\$223.9
Current Frontier						
0% Return-Seeking	3.3%	8.8%	\$115.3	5.0%	-1.6%	\$179.2
10% Return-Seeking	3.8%	8.3%	\$108.9	4.9%	-1.0%	\$171.2
20% Return-Seeking	4.3%	7.8%	\$102.9	5.2%	-0.8%	\$169.7
30% Return-Seeking	4.7%	7.4%	\$97.1	6.0%	-1.1%	\$173.3
40% Return-Seeking	5.1%	7.0%	\$91.6	7.0%	-1.7%	\$180.5
50% Return-Seeking	5.5%	6.6%	\$86.4	8.2%	-2.4%	\$189.8
60% Return-Seeking	5.9%	6.2%	\$81.5	9.5%	-3.2%	\$200.4
70% Return-Seeking	6.2%	5.9%	\$76.9	10.9%	-4.1%	\$211.9
80% Return-Seeking	6.6%	5.5%	\$72.5	12.3%	-5.0%	\$223.9
90% Return-Seeking	6.9%	5.2%	\$68.5	13.8%	-5.9%	\$236.1
100% Return-Seeking	7.2%	4.9%	\$64.6	15.3%	-6.9%	\$248.6

¹ Expected annual funding to maintain the current funded ratio is equal to the sum of the net interest cost and normal cost

² Expected annual return under a one standard deviation adverse event

³ Additional annual funding under a one standard deviation adverse event to maintain current funded status

Key Takeaways:

- The growth rate required of the assets to keep pace with the liability growth (the “hurdle rate”) is currently 12.1%:

Interest Cost 7.7%

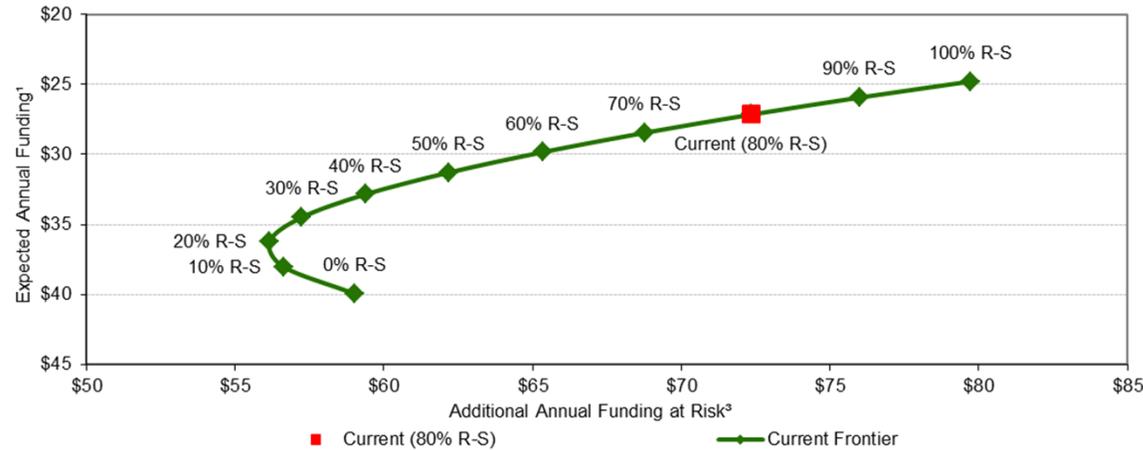
Normal Cost 4.4%

Total 12.1%

- The hurdle rate is covered by a combination of investment returns and cash funding
- Higher allocations to return-seeking assets produce lower expected funding amounts, but with more volatility

Portfolio Analysis

Funding / Investment Analysis (County Cash Balance Plan)



Modeling Metric

	Expected Nominal Return	Shortfall Versus Required Return	Expected Annual Funding ¹	Expected Nominal Volatility	1-Year Downside Return ²	Additional Annual Funding at Risk ³
Current (80% R-S)	6.6%	6.9%	\$27.1	12.3%	-5.0%	\$72.3
Current Frontier						
0% Return-Seeking	3.3%	10.2%	\$39.9	5.0%	-1.6%	\$59.0
10% Return-Seeking	3.8%	9.7%	\$38.0	4.9%	-1.0%	\$56.6
20% Return-Seeking	4.3%	9.2%	\$36.2	5.2%	-0.8%	\$56.2
30% Return-Seeking	4.7%	8.8%	\$34.5	6.0%	-1.1%	\$57.2
40% Return-Seeking	5.1%	8.4%	\$32.8	7.0%	-1.7%	\$59.4
50% Return-Seeking	5.5%	8.0%	\$31.3	8.2%	-2.4%	\$62.2
60% Return-Seeking	5.9%	7.6%	\$29.8	9.5%	-3.2%	\$65.3
70% Return-Seeking	6.2%	7.3%	\$28.4	10.9%	-4.1%	\$68.8
80% Return-Seeking	6.6%	6.9%	\$27.1	12.3%	-5.0%	\$72.3
90% Return-Seeking	6.9%	6.6%	\$25.9	13.8%	-5.9%	\$76.0
100% Return-Seeking	7.2%	6.3%	\$24.8	15.3%	-6.9%	\$79.7

¹ Expected annual funding to maintain the current funded ratio is equal to the sum of the net interest cost and normal cost

² Expected annual return under a one standard deviation adverse event

³ Additional annual funding under a one standard deviation adverse event to maintain current funded status

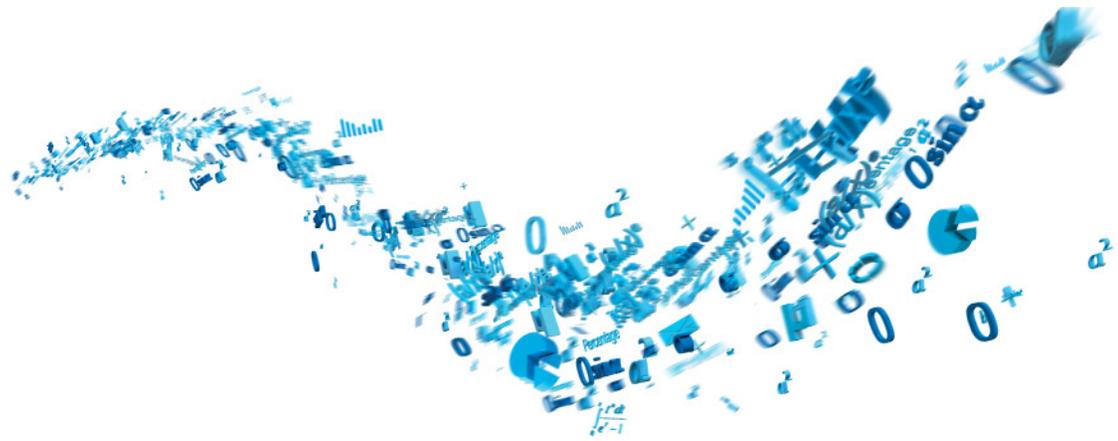
Key Takeaways:

- The growth rate required of the assets to keep pace with the liability growth (the “hurdle rate”) is currently 13.5%:

Interest Cost	7.7%
<u>Normal Cost</u>	<u>5.8%</u>
Total	13.5%

- The hurdle rate is covered by a combination of investment returns and cash funding
- Higher allocations to return-seeking assets produce lower expected funding amounts, but with more volatility

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Analysis

- Asset-Liability Projection Results (School Retirement System)

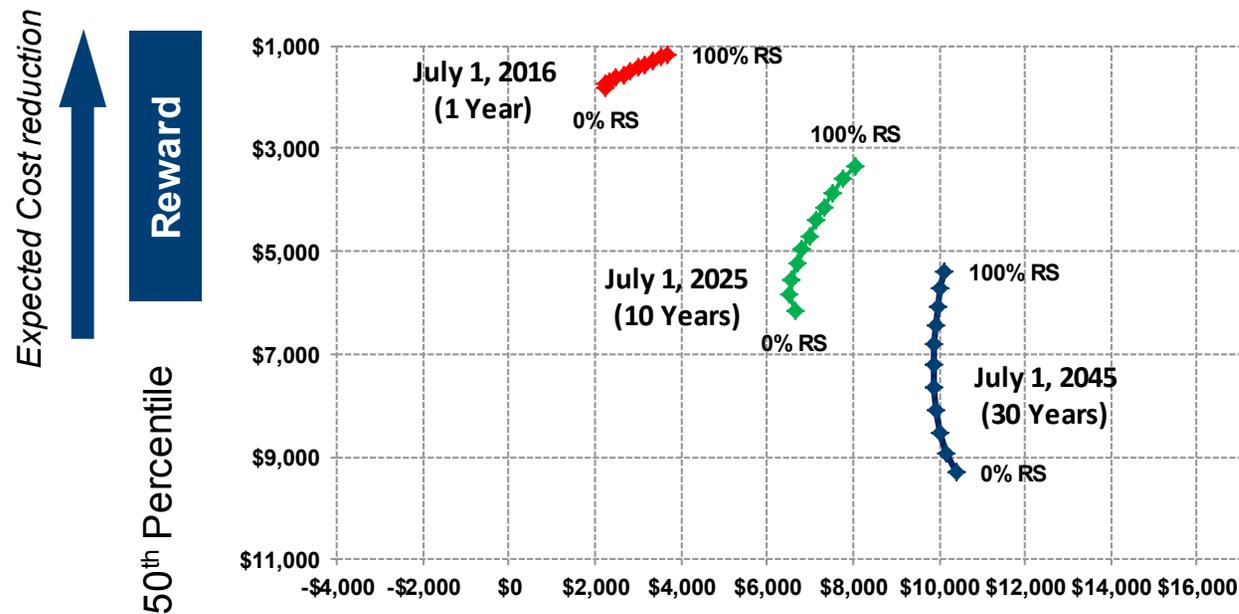
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Asset-Liability Projection Results (School Retirement System)

Economic Cost Analysis—1 Year, 10 Year, and 30 Year Horizons

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 8.00%, \$millions



Key Takeaway:

- Longer time horizons are expected to reward higher levels of risk whereas shorter time horizons are not

95th Percentile



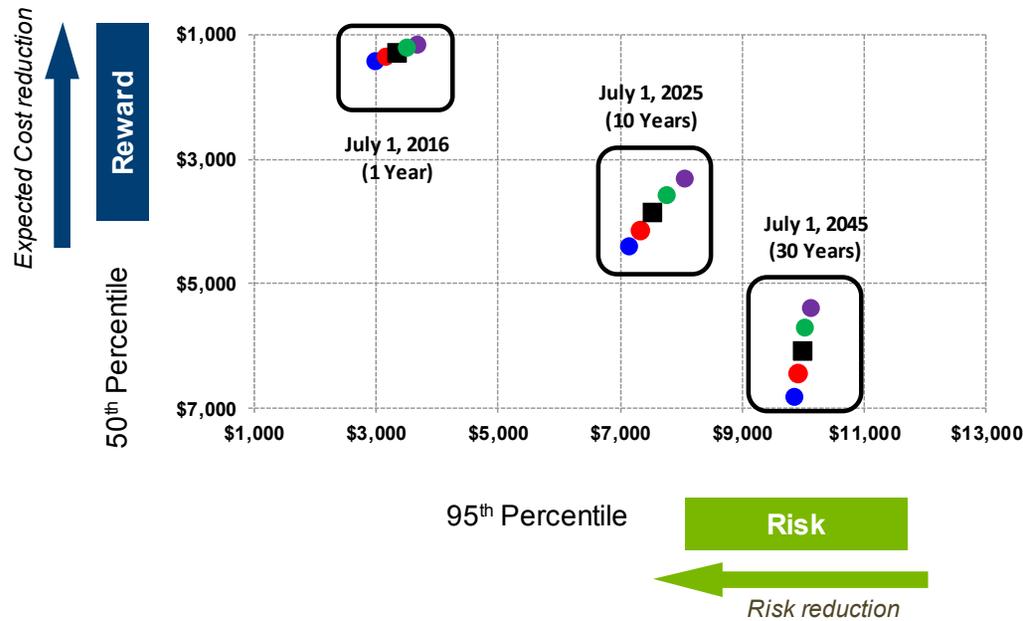
* Liability projections assume discount rates of 8.00% for all investment policies studied; Reflects a *utility function*: Excludes 50% of surplus in excess of 120% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

Asset-Liability Projection Results (School Retirement System)

Economic Cost Analysis

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 8.00%, \$billions



Economic Cost		
July 1, 2016		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$1,427.3	\$2,992.5
70% Return-Seeking	\$1,361.5	\$3,162.6
Current (80% R-S)	\$1,294.9	\$3,336.2
90% Return-Seeking	\$1,232.6	\$3,513.2
100% Return-Seeking	\$1,166.3	\$3,684.7
July 1, 2025		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$4,408.4	\$7,152.7
70% Return-Seeking	\$4,135.5	\$7,318.2
Current (80% R-S)	\$3,851.5	\$7,524.7
90% Return-Seeking	\$3,600.0	\$7,764.2
100% Return-Seeking	\$3,330.8	\$8,066.5
July 1, 2045		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$6,806.1	\$9,859.8
70% Return-Seeking	\$6,441.4	\$9,903.7
Current (80% R-S)	\$6,064.0	\$9,974.6
90% Return-Seeking	\$5,706.1	\$10,033.5
100% Return-Seeking	\$5,398.9	\$10,132.2

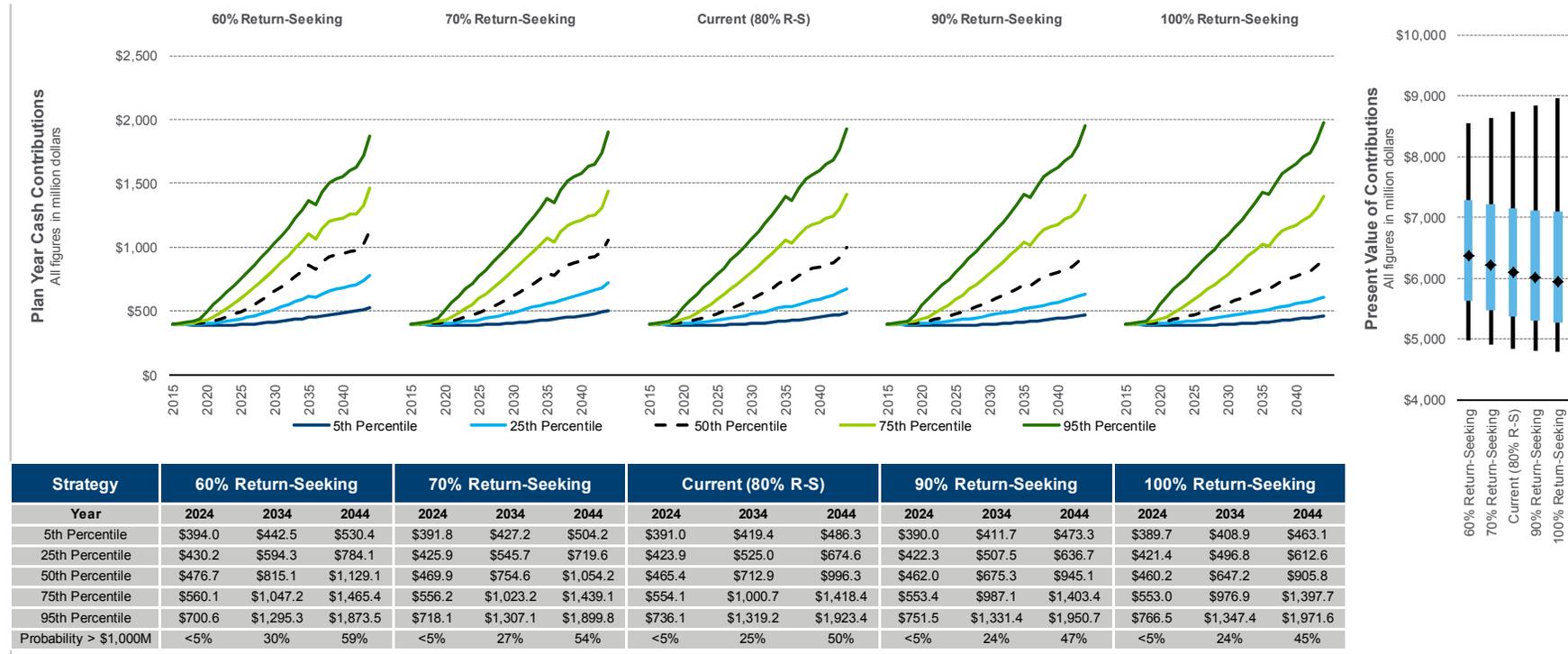
Key Takeaways:

- The magnitude of the risk/reward trade-off changes over a longer-term projection
- Under the Current Policy over a 30-year time horizon, the expected Economic Cost is \$6,064.0M and the potential risk is \$9,974.6M
- Adjustments to the return-seeking allocation may have desirable risk/reward characteristics relative to the current policy

* Liability projections assume discount rates of 8.00% for all investment policies studied; Reflects a *utility function*: Excludes 50% of surplus in excess of 120% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

Asset-Liability Projection Results (School Retirement System)

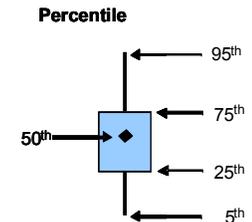
Gross Contribution Amount



Key Takeaways:

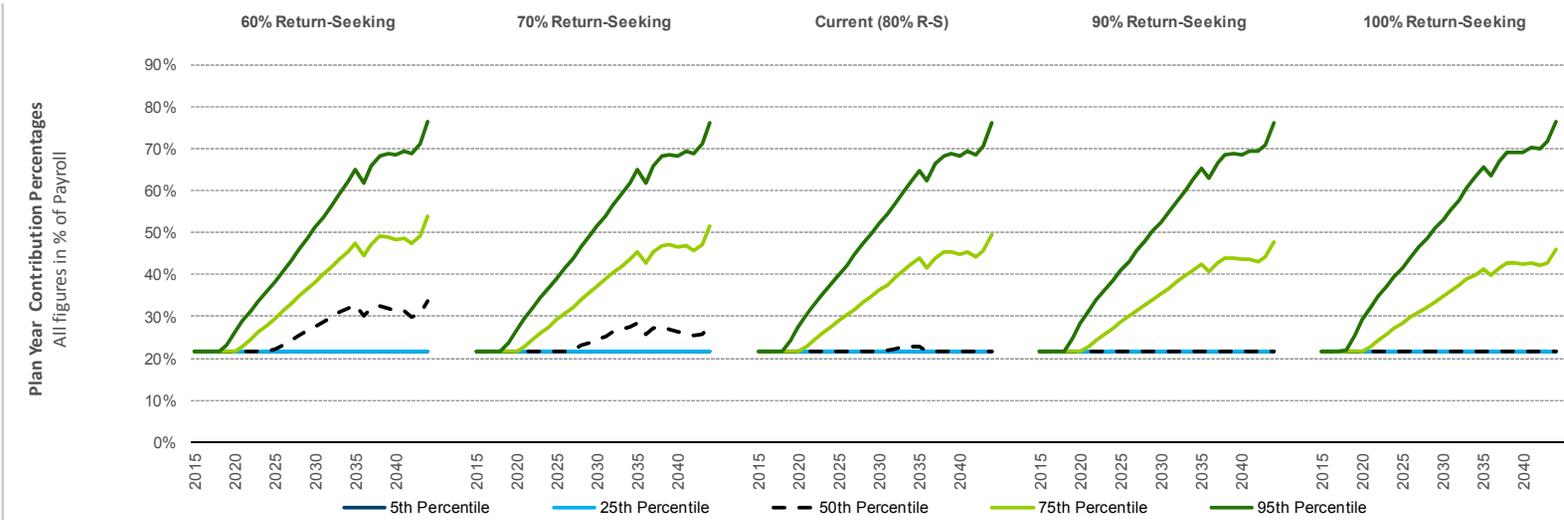
- Contribution amounts are projected to increase over the period with a floor of statutory, payroll-based contributions
- Increases to the return-seeking allocation will lower expected (50th percentile outcomes) while increasing the volatility of those amounts

* Liability projections assume discount rates of 8.00% for all investment policies studied



Asset-Liability Projection Results (School Retirement System)

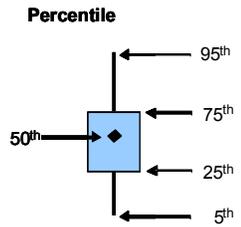
Gross Contribution Percentage of Payroll



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%
25th Percentile	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%
50th Percentile	22%	32%	34%	22%	28%	28%	22%	23%	22%	22%	22%	22%	22%	22%	22%
75th Percentile	28%	45%	54%	28%	44%	51%	27%	42%	50%	27%	41%	48%	27%	40%	46%
95th Percentile	36%	62%	76%	37%	62%	76%	38%	62%	76%	39%	63%	76%	39%	63%	76%
Probability > 22%	49%	74%	74%	49%	74%	74%	49%	67%	50%	48%	50%	50%	48%	50%	50%

Key Takeaway:

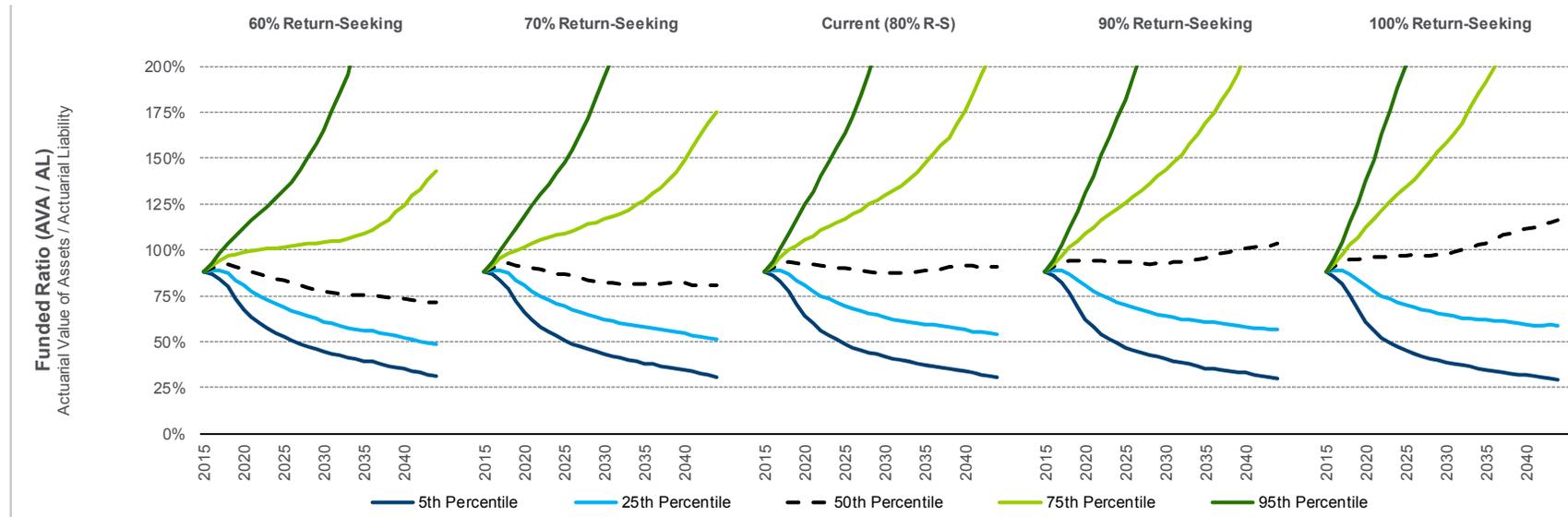
- Contribution percentages are projected to stay at the current statutory, payroll-based level (22%) until such time as the actuarial contribution exceeds that level



* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (School Retirement System)

Actuarial Value of Assets / Actuarial Liability Funded Ratio



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	55%	41%	31%	53%	39%	31%	51%	38%	31%	49%	37%	30%	47%	35%	29%
25th Percentile	70%	57%	49%	71%	59%	51%	71%	60%	54%	71%	61%	57%	71%	62%	59%
50th Percentile	84%	75%	71%	87%	81%	81%	90%	88%	91%	94%	95%	104%	96%	103%	116%
75th Percentile	101%	108%	143%	108%	125%	175%	115%	142%	216%	122%	163%	256%	130%	185%	303%
95th Percentile	128%	213%	558%	142%	248%	669%	156%	293%	793%	171%	348%	956%	188%	406%	1147%
Probability > 100%	26%	31%	40%	34%	39%	45%	40%	45%	48%	44%	48%	52%	47%	52%	57%

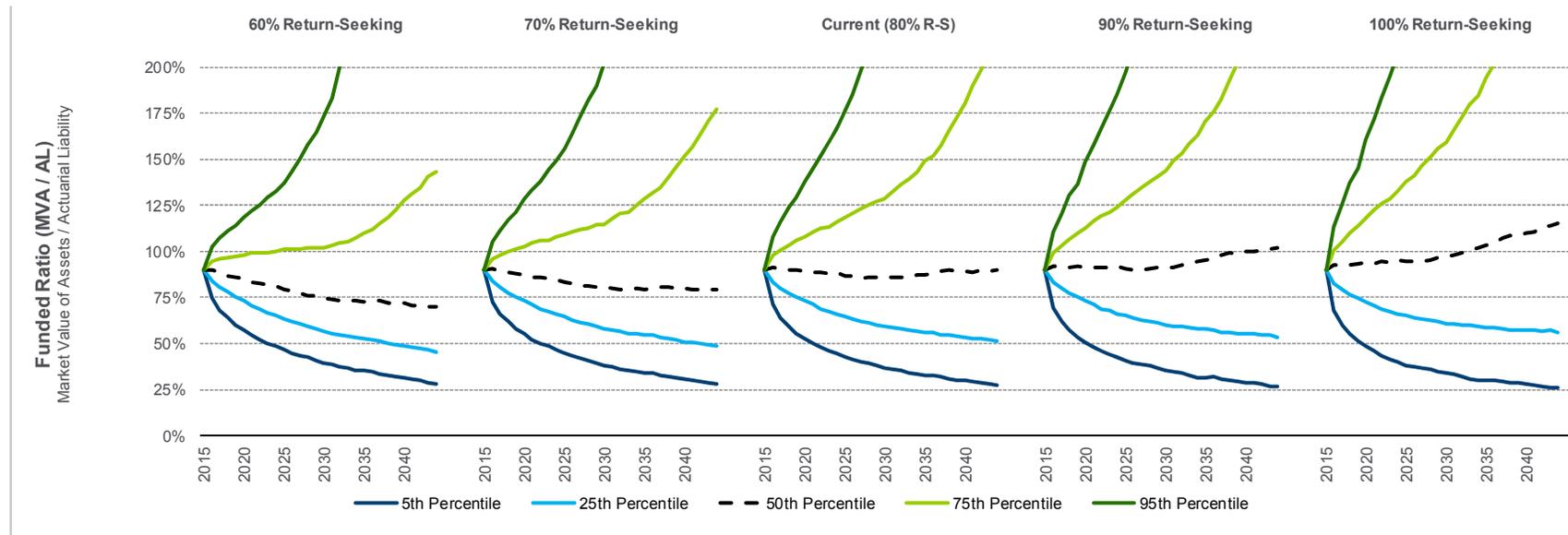
Key Takeaways:

- Policies with 90% return-seeking assets or greater are projected to result in the Plan attaining full funded status in the central expectation (50th percentile)
- Higher allocations to return-seeking assets will increase the volatility of the Plan’s funded status

* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (School Retirement System)

Market Value of Assets / Actuarial Liability Funded Ratio



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	49%	36%	28%	47%	34%	28%	45%	33%	27%	42%	32%	27%	40%	30%	26%
25th Percentile	65%	53%	45%	66%	55%	48%	66%	57%	51%	66%	58%	54%	66%	59%	56%
50th Percentile	81%	74%	70%	85%	80%	79%	88%	87%	90%	92%	95%	102%	95%	102%	115%
75th Percentile	100%	107%	143%	108%	125%	177%	116%	143%	216%	124%	163%	259%	133%	184%	307%
95th Percentile	133%	228%	611%	149%	271%	725%	166%	319%	857%	185%	379%	1042%	207%	442%	1249%
Probability > 100%	25%	30%	40%	33%	39%	45%	39%	44%	48%	44%	48%	51%	47%	51%	56%

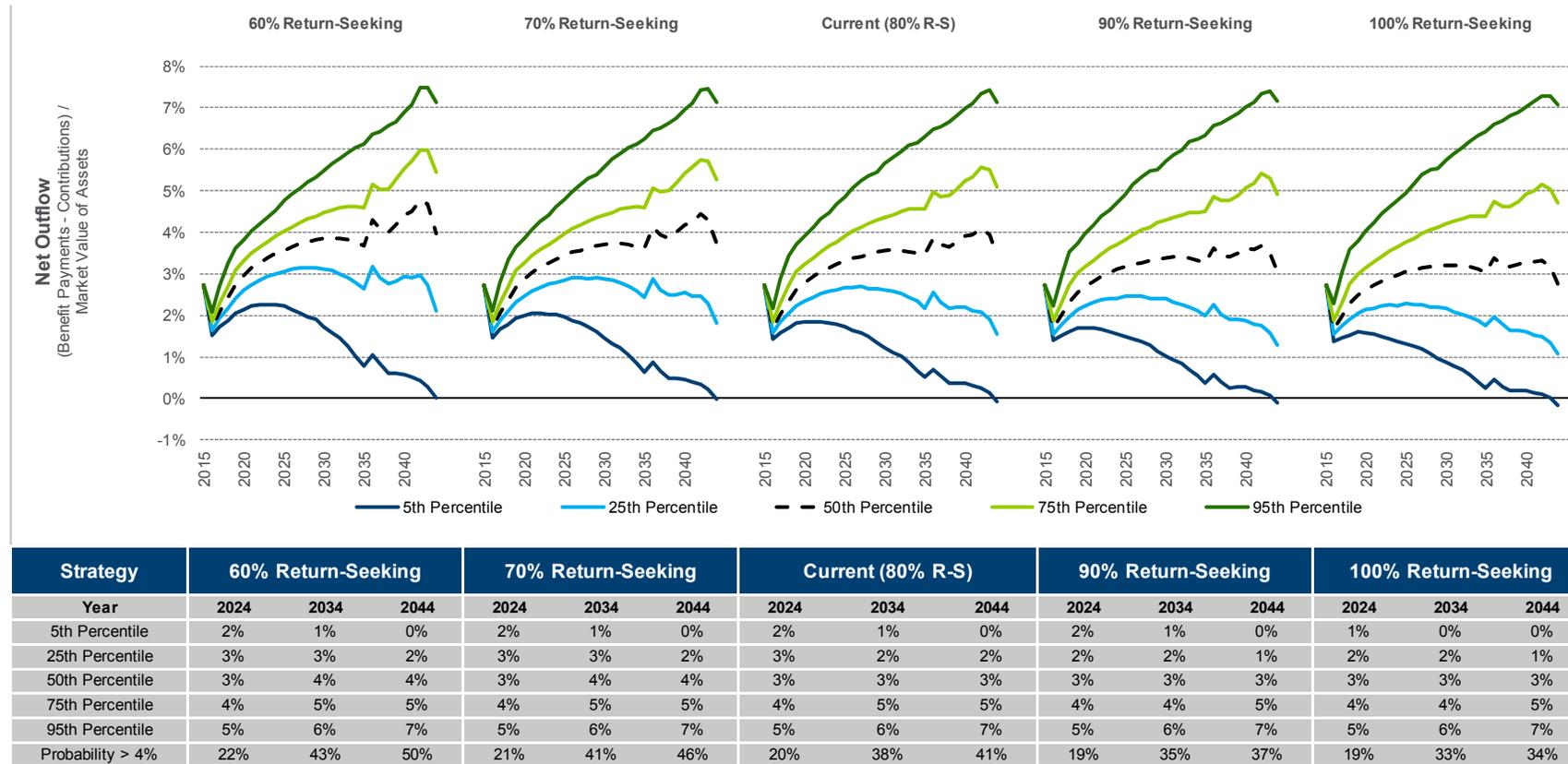
Key Takeaways:

- Policies with 90% return-seeking assets or greater are projected to result in the Plan attaining full funded status in the central expectation (50th percentile)
- Higher allocations to return-seeking assets will increase the volatility of the Plan's funded status

* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (School Retirement System)

Net Outflow Analysis: (Benefit Payments less Contributions) / Market Value of Assets



Key Takeaway:

- Net Outflow is consistent across the policies modeled

* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (School Retirement System)

Summary of Results

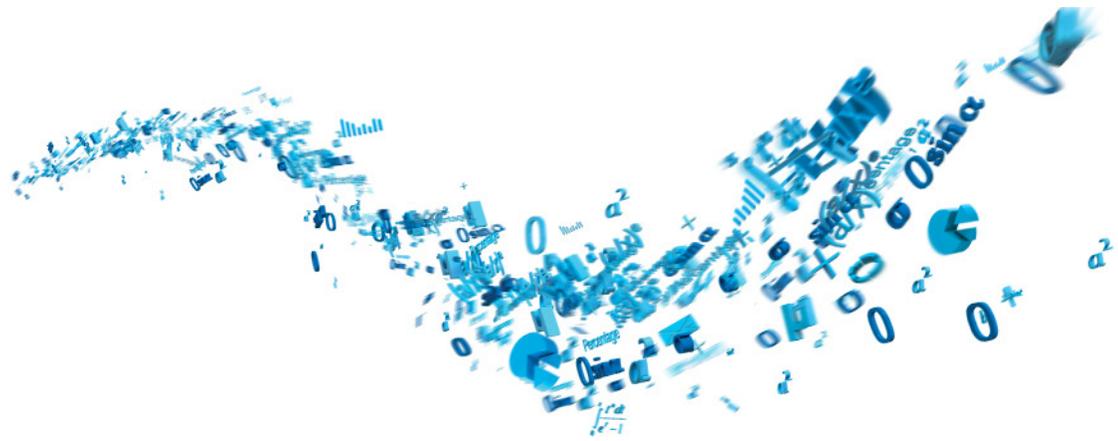
All Scenarios \$ millions	30-year Economic Cost		30-year Present Value of Contributions		30-year Ending Funded Ratio (MVA / AL)	
	Expected ¹	Downside ²	Expected ¹	Downside ²	Expected ¹	Downside ²
0% Return-Seeking	\$9,303.7	\$10,404.0	\$7,866.5	\$8,348.1	39%	24%
10% Return-Seeking	\$8,925.3	\$10,169.7	\$7,593.7	\$8,264.4	42%	25%
20% Return-Seeking	\$8,520.1	\$10,023.1	\$7,307.7	\$8,263.4	45%	26%
30% Return-Seeking	\$8,102.6	\$9,925.9	\$7,042.1	\$8,320.4	49%	27%
40% Return-Seeking	\$7,666.2	\$9,868.9	\$6,789.3	\$8,388.6	55%	27%
50% Return-Seeking	\$7,222.8	\$9,864.6	\$6,572.9	\$8,460.6	61%	28%
60% Return-Seeking	\$6,806.1	\$9,859.8	\$6,375.0	\$8,554.8	69%	28%
70% Return-Seeking	\$6,441.4	\$9,903.7	\$6,210.8	\$8,641.4	79%	28%
Current (80% R-S)	\$6,064.0	\$9,974.6	\$6,090.2	\$8,729.9	91%	28%
90% Return-Seeking	\$5,706.1	\$10,033.5	\$6,007.9	\$8,837.5	104%	27%
100% Return-Seeking	\$5,398.9	\$10,132.2	\$5,946.5	\$8,964.2	117%	26%

¹ Expected = 50th percentile outcome or central expectation across all 5,000 simulations

² Downside = 95th percentile outcome across all 5,000 simulations

Key Findings:

- Plan is projected to fall below fully funded status at the end of 30 years under the current policy due to the expected return on plan assets falling short of the plan assumed discount rate
- Adjusting the return-seeking vs. risk-reducing allocation will exhibit standard risk/reward trade-off of expected costs and risks



Analysis

- Asset-Liability Projection Results (State Patrol Retirement System)

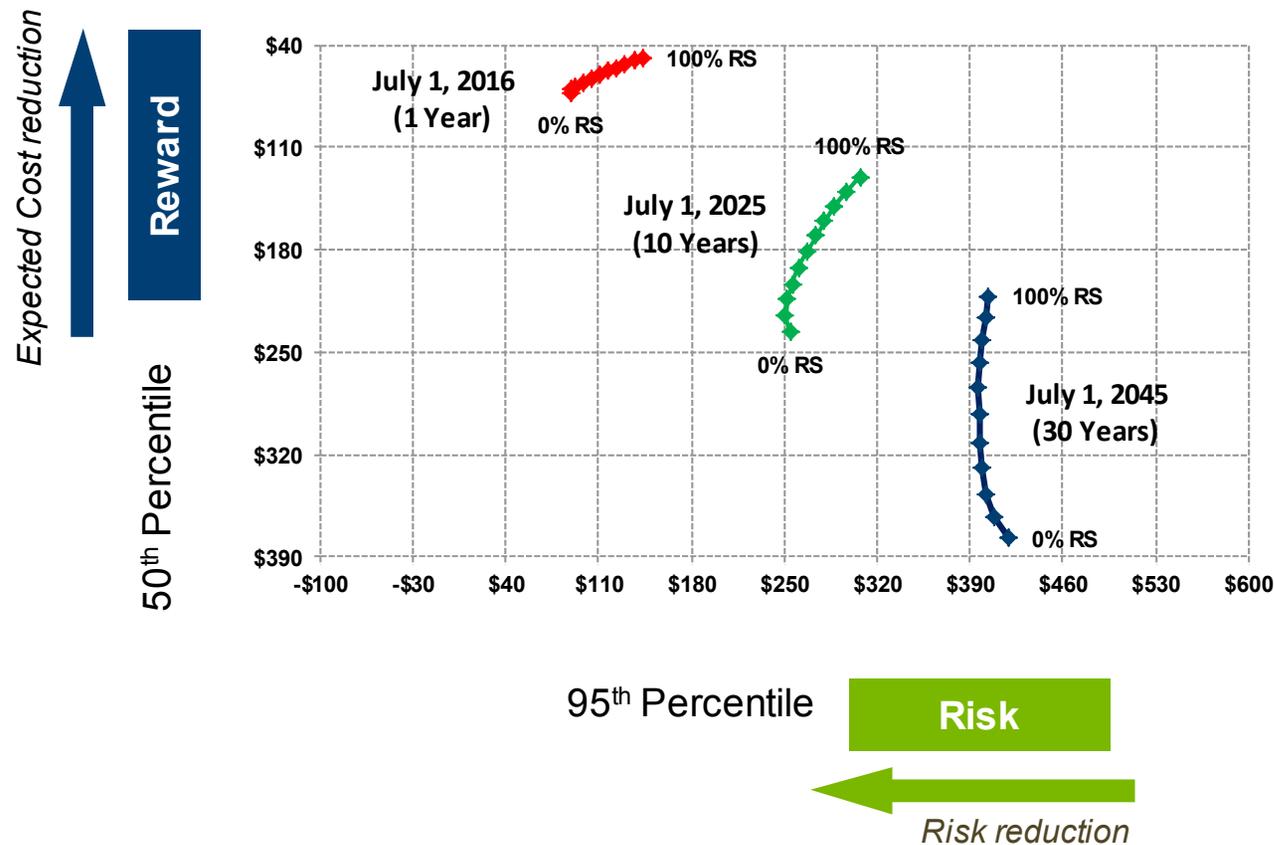
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Asset-Liability Projection Results (State Patrol Retirement System)

Economic Cost Analysis - 1 Year, 10 Year, and 30 Year Horizons

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 8.00%, \$millions



Key Takeaway:

- Longer time horizons are expected to reward higher levels of risk whereas shorter time horizons are not

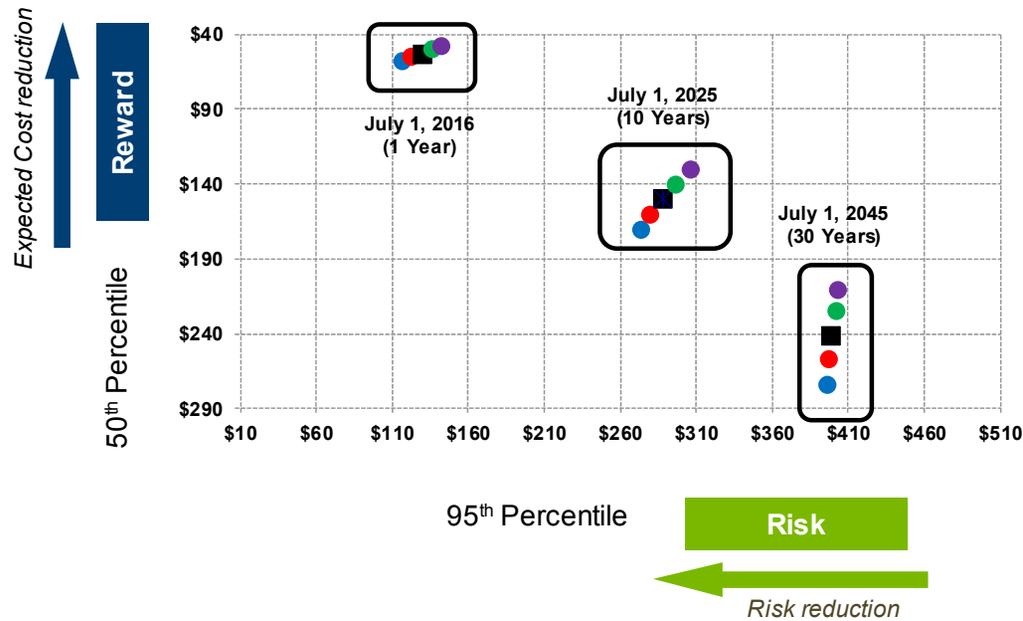
* Liability projections assume discount rates of 8.00% for all investment policies studied; Reflects a *utility function*: Excludes 50% of surplus in excess of 120% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

Asset-Liability Projection Results (State Patrol Retirement System)

Economic Cost Analysis

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 8.00%, \$millions



Economic Cost		
July 1, 2016		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$58.0	\$116.6
70% Return-Seeking	\$55.6	\$123.3
Current (80% R-S)	\$53.1	\$129.5
90% Return-Seeking	\$50.7	\$136.5
100% Return-Seeking	\$48.4	\$143.0
July 1, 2025		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$170.4	\$273.5
70% Return-Seeking	\$160.5	\$280.4
Current (80% R-S)	\$150.2	\$288.0
90% Return-Seeking	\$140.4	\$297.2
100% Return-Seeking	\$130.5	\$306.9
July 1, 2045		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$274.8	\$396.4
70% Return-Seeking	\$257.6	\$397.2
Current (80% R-S)	\$241.2	\$399.0
90% Return-Seeking	\$225.6	\$402.3
100% Return-Seeking	\$211.5	\$403.8

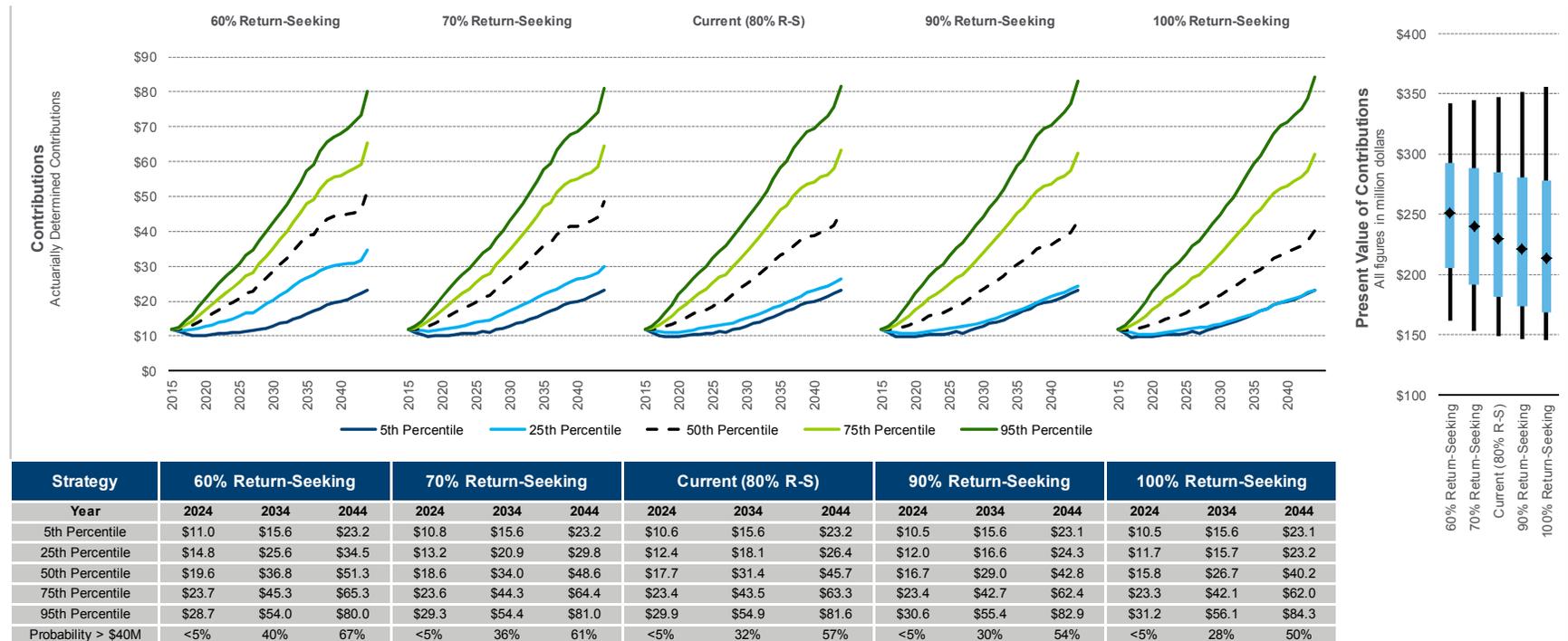
Key Takeaways:

- The magnitude of the risk/reward trade-off changes over a longer-term projection
- Under the Current Policy over a 30-year time horizon, the expected Economic Cost is \$241.2M and the potential risk is \$399.0M
- Adjustments to the return-seeking allocation may have desirable risk/reward characteristics relative to the current policy

* Liability projections assume discount rates of 8.00% for all investment policies studied; Reflects a *utility function*: Excludes 50% of surplus in excess of 120% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

Asset-Liability Projection Results (State Patrol Retirement System)

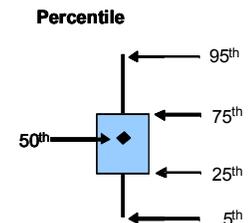
Gross Contribution Amount



Key Takeaways:

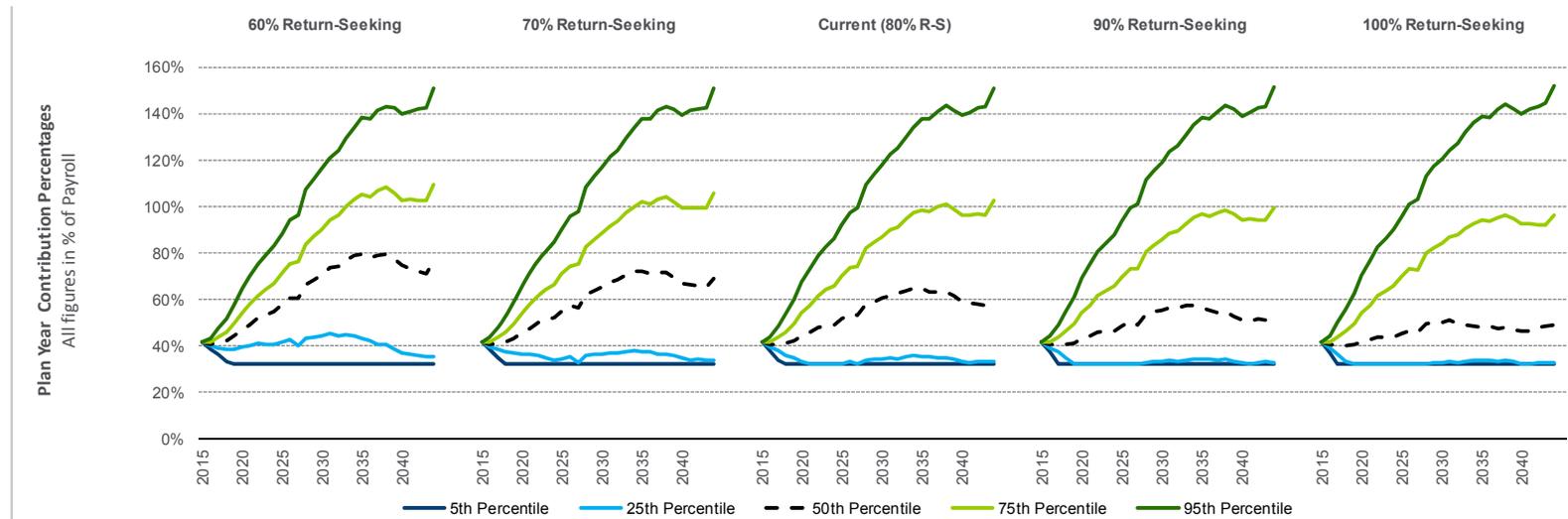
- Contribution amounts are projected to increase over the period with a floor of statutory, payroll-based contributions
- Increases to the return-seeking allocation will lower expected (50th percentile outcomes) while increasing the volatility of those amounts

* Liability projections assume discount rates of 8.00% for all investment policies studied



Asset-Liability Projection Results (State Patrol Retirement System)

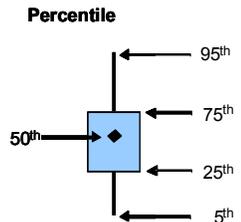
Gross Contribution Percentage of Payroll



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%
25th Percentile	41%	44%	35%	34%	38%	34%	32%	36%	33%	32%	34%	33%	32%	34%	33%
50th Percentile	55%	79%	76%	52%	72%	69%	49%	65%	60%	46%	58%	52%	44%	49%	49%
75th Percentile	67%	103%	110%	66%	100%	106%	66%	97%	103%	66%	95%	99%	66%	93%	96%
95th Percentile	83%	134%	151%	84%	134%	151%	86%	134%	151%	88%	135%	151%	90%	136%	152%
Probability > 32%	95%	95%	95%	95%	95%	95%	75%	95%	95%	75%	95%	95%	75%	95%	95%

Key Takeaway:

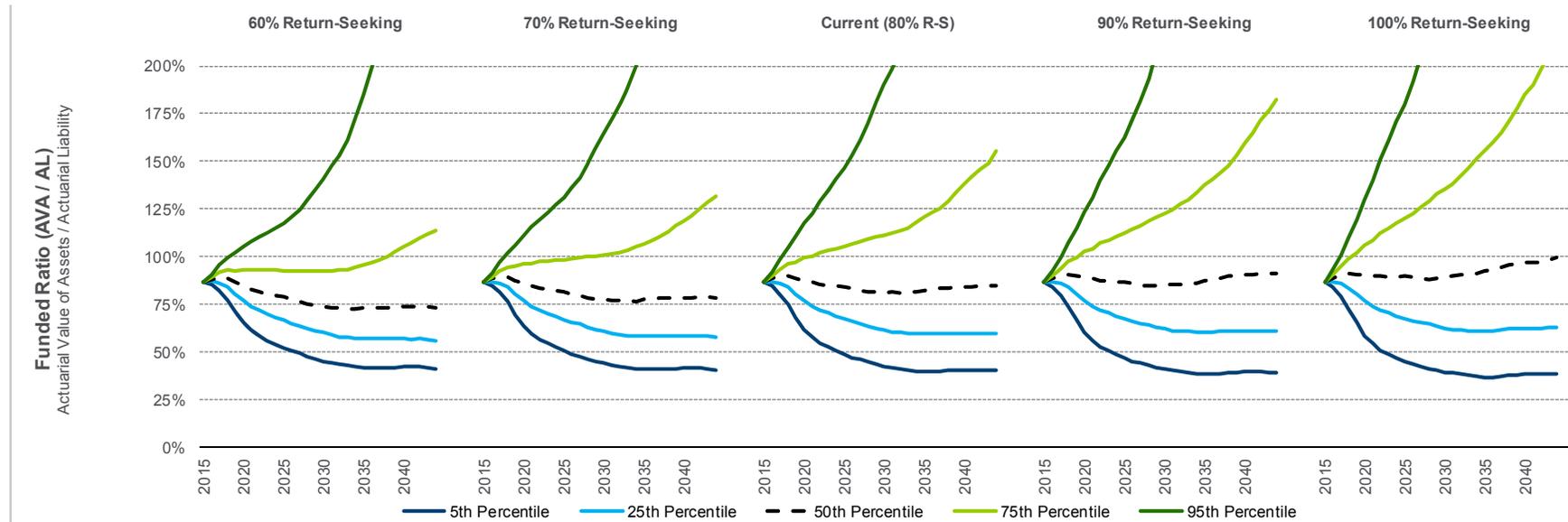
- Contribution percentages, determined by the actuarial contribution, are projected to exceed the current statutory, payroll-based level (32%) in the median expectation



* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (State Patrol Retirement System)

Actuarial Value of Assets / Actuarial Liability Funded Ratio



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	54%	42%	41%	52%	41%	41%	51%	40%	41%	49%	38%	39%	47%	37%	38%
25th Percentile	68%	57%	56%	69%	58%	58%	69%	60%	60%	69%	61%	61%	69%	61%	63%
50th Percentile	80%	73%	74%	82%	77%	78%	85%	82%	85%	87%	86%	91%	89%	91%	99%
75th Percentile	93%	94%	114%	98%	105%	132%	104%	118%	155%	111%	133%	183%	117%	151%	215%
95th Percentile	115%	172%	394%	127%	200%	466%	141%	238%	541%	155%	285%	652%	171%	333%	796%
Probability > 100%	19%	24%	34%	24%	29%	40%	30%	37%	45%	36%	43%	48%	41%	46%	50%

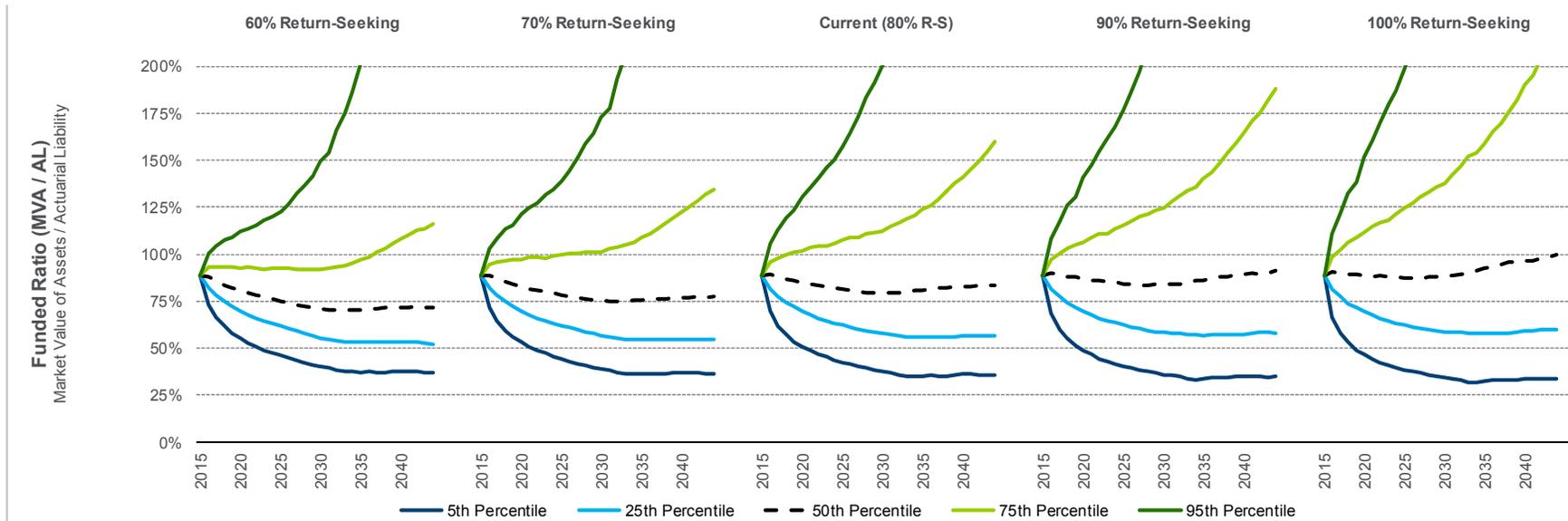
Key Takeaways:

- All policies modeled are projected to result in the Plan falling short of full funded status in the central expectation (50th percentile)
- Higher allocations to return-seeking assets will increase the volatility of the Plan's funded status

* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (State Patrol Retirement System)

Market Value of Assets / Actuarial Liability Funded Ratio



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	48%	37%	37%	46%	36%	36%	44%	35%	36%	42%	33%	35%	40%	32%	34%
25th Percentile	63%	54%	52%	63%	55%	55%	63%	56%	56%	64%	57%	58%	63%	58%	60%
50th Percentile	76%	71%	72%	79%	75%	78%	82%	81%	84%	85%	86%	91%	88%	92%	100%
75th Percentile	92%	95%	116%	99%	106%	134%	106%	121%	160%	114%	136%	188%	121%	154%	219%
95th Percentile	120%	186%	443%	134%	221%	509%	150%	261%	603%	168%	310%	729%	187%	368%	877%
Probability > 100%	19%	24%	34%	24%	30%	40%	31%	38%	45%	37%	43%	48%	41%	47%	50%

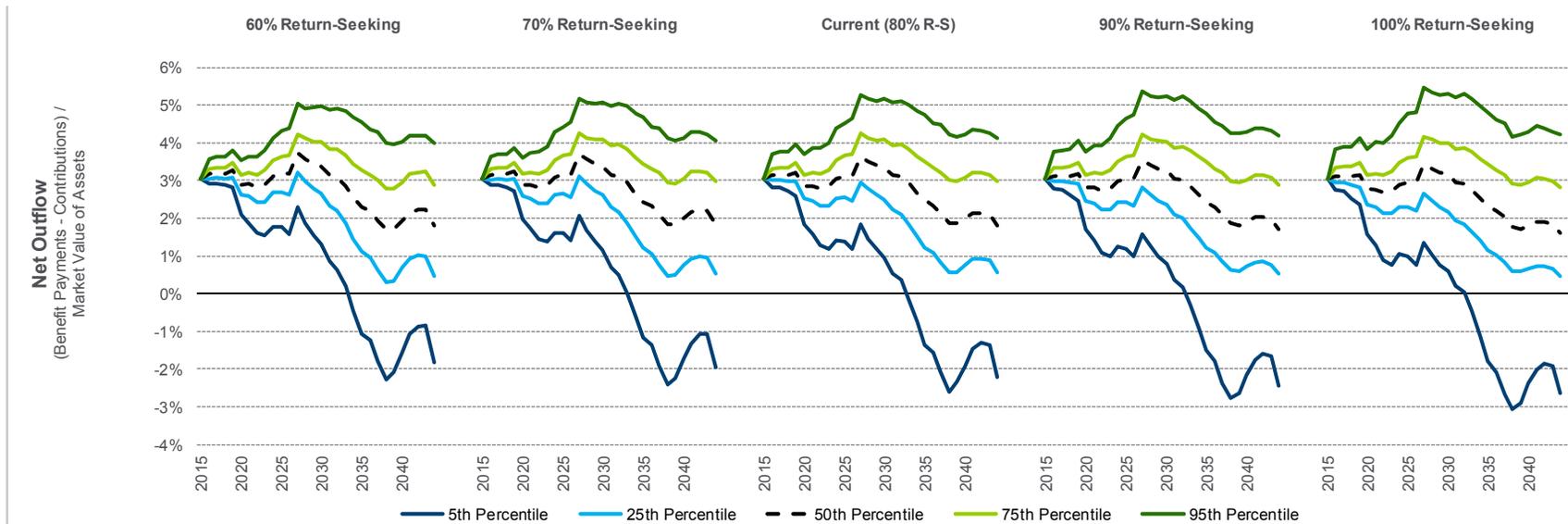
Key Takeaways:

- All policies modeled are projected to result in the Plan falling short of full funded status in the central expectation (50th percentile)
- Higher allocations to return-seeking assets will increase the volatility of the Plan's funded status

* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (State Patrol Retirement System)

Net Outflow Analysis: (Benefit Payments less Contributions) / Market Value of Assets



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	2%	0%	-2%	2%	-1%	-2%	1%	-1%	-2%	1%	-1%	-2%	1%	-1%	-3%
25th Percentile	3%	1%	0%	3%	2%	1%	3%	2%	1%	2%	1%	1%	2%	1%	0%
50th Percentile	3%	3%	2%	3%	3%	2%	3%	3%	2%	3%	3%	2%	3%	3%	2%
75th Percentile	4%	3%	3%	4%	4%	3%	4%	4%	3%	4%	4%	3%	3%	4%	3%
95th Percentile	4%	5%	4%	4%	5%	4%	4%	5%	4%	4%	5%	4%	5%	5%	4%
Probability > 2%	90%	62%	45%	87%	64%	46%	85%	64%	46%	82%	64%	44%	80%	62%	42%

Key Takeaway:

- Net Outflow is consistent across the policies modeled

* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (State Patrol Retirement System)

Summary of Results

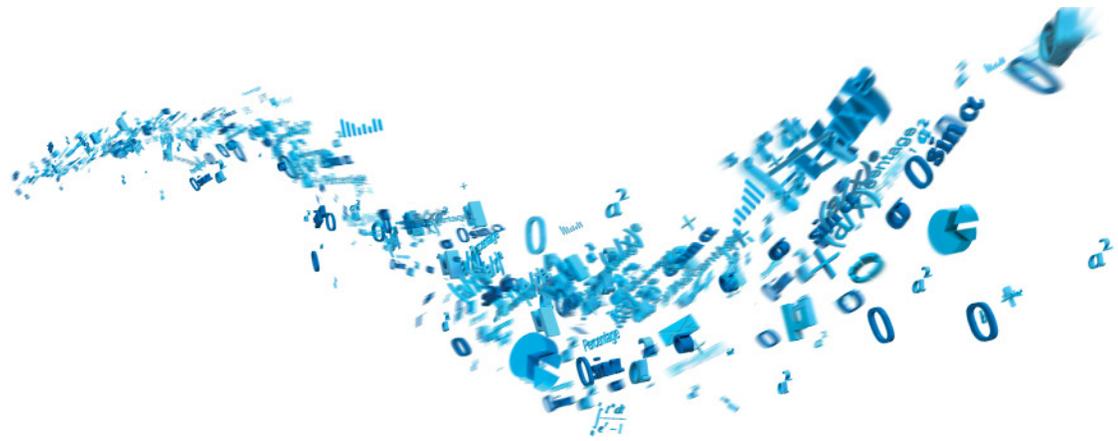
All Scenarios \$ millions	30-year Economic Cost		30-year Present Value of Contributions		30-year Ending Funded Ratio (MVA / AL)	
	Expected ¹	Downside ²	Expected ¹	Downside ²	Expected ¹	Downside ²
0% Return-Seeking	\$377.4	\$418.5	\$320.8	\$338.8	49%	34%
10% Return-Seeking	\$363.0	\$408.1	\$309.8	\$335.1	52%	35%
20% Return-Seeking	\$346.8	\$402.2	\$297.7	\$334.9	55%	37%
30% Return-Seeking	\$329.5	\$398.6	\$286.1	\$335.5	58%	37%
40% Return-Seeking	\$312.0	\$397.1	\$274.1	\$337.3	63%	37%
50% Return-Seeking	\$292.8	\$396.6	\$262.4	\$338.9	67%	37%
60% Return-Seeking	\$274.8	\$396.4	\$251.2	\$341.8	72%	37%
70% Return-Seeking	\$257.6	\$397.2	\$239.9	\$344.5	77%	36%
Current (80% R-S)	\$241.2	\$399.0	\$229.5	\$347.7	84%	36%
90% Return-Seeking	\$225.6	\$402.3	\$221.0	\$351.4	92%	35%
100% Return-Seeking	\$211.5	\$403.8	\$213.9	\$356.1	99%	34%

¹ Expected = 50th percentile outcome or central expectation across all 5,000 simulations

² Downside = 95th percentile outcome across all 5,000 simulations

Key Findings:

- Plan is projected to fall below fully funded status at the end of 30 years under the current policy due to the expected return on plan assets falling short of the plan assumed discount rate
- Adjusting the return-seeking vs. risk-reducing allocation will exhibit standard risk/reward trade-off of expected costs and risks



Analysis

- Asset-Liability Projection Results (Judges Retirement System)

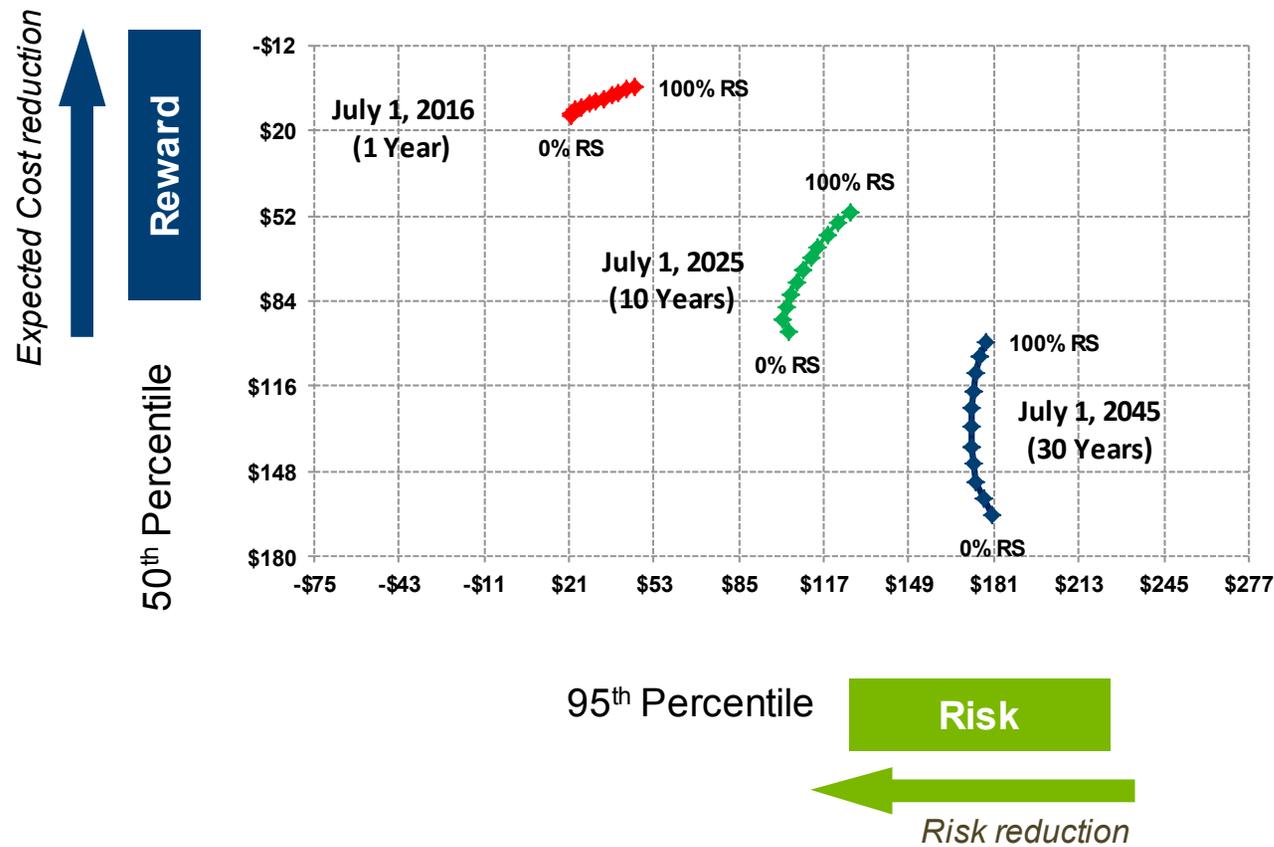
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Asset-Liability Projection Results (Judges Retirement System)

Economic Cost Analysis—1 Year, 10 Year, and 30 Year Horizons

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 8.00%, \$millions



Key Takeaway:

- Longer time horizons are expected to reward higher levels of risk whereas shorter time horizons are not

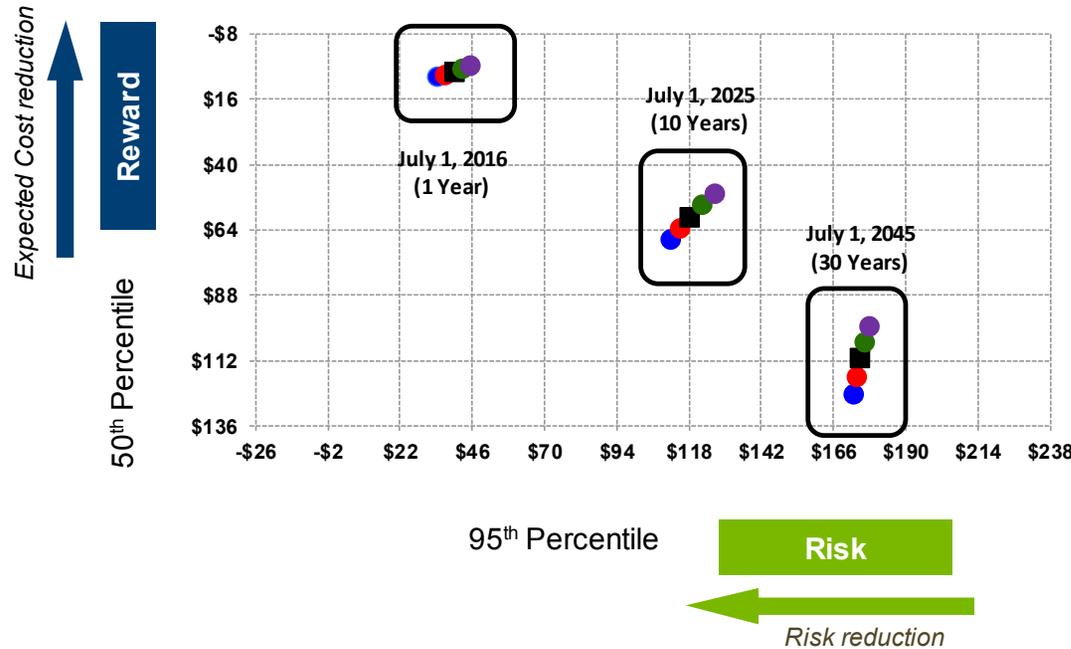
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Asset-Liability Projection Results (Judges Retirement System)

Economic Cost Analysis

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 8.00%, \$Millions



Economic Cost		
July 1, 2016		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$8.1	\$34.1
70% Return-Seeking	\$7.0	\$36.9
Current (80% R-S)	\$5.9	\$39.9
90% Return-Seeking	\$4.9	\$42.7
100% Return-Seeking	\$3.8	\$45.6
July 1, 2025		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$67.7	\$112.0
70% Return-Seeking	\$63.6	\$114.8
Current (80% R-S)	\$59.2	\$118.4
90% Return-Seeking	\$54.9	\$122.1
100% Return-Seeking	\$50.8	\$126.8
July 1, 2045		
Strategy (\$Millions)	Cost	Risk
60% Return-Seeking	\$124.3	\$172.6
70% Return-Seeking	\$117.9	\$173.5
Current (80% R-S)	\$111.0	\$174.5
90% Return-Seeking	\$105.0	\$176.1
100% Return-Seeking	\$99.5	\$177.8

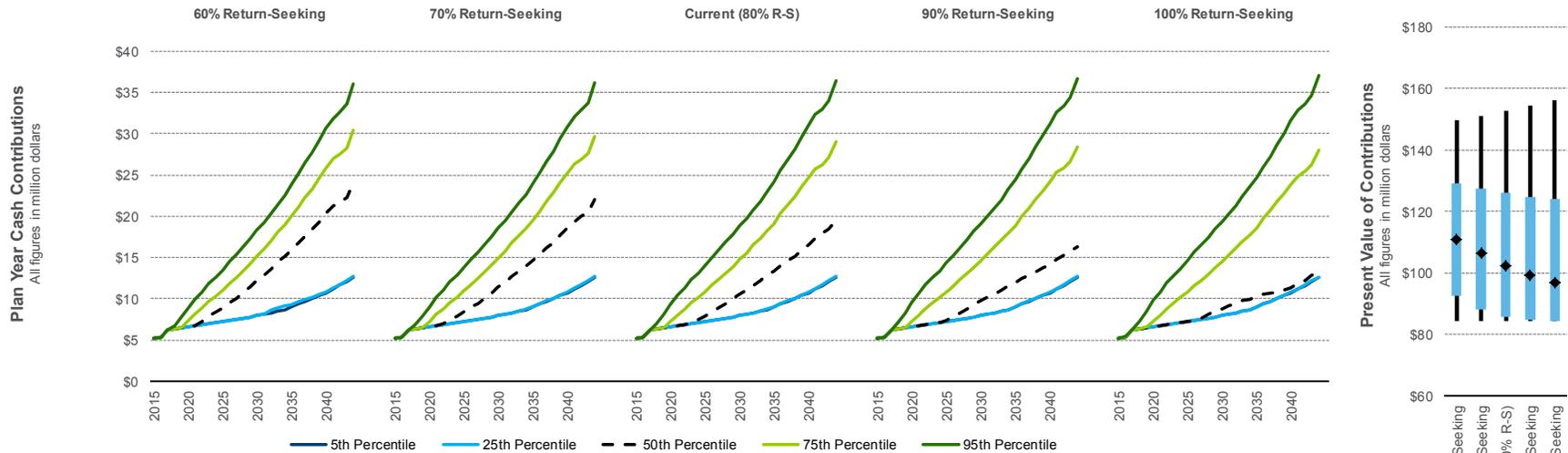
Key Takeaways:

- The magnitude of the risk/reward trade-off changes over a longer-term projection
- Under the Current Policy over a 30-year time horizon, the expected Economic Cost is \$111.0M and the potential risk is \$174.5M
- Adjustments to the return-seeking allocation may have desirable risk/reward characteristics relative to the current policy

* Liability projections assume discount rates of 8.00% for all investment policies studied; Reflects a *utility function*: Excludes 50% of surplus in excess of 130% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

Asset-Liability Projection Results (Judges Retirement System)

Gross Contribution Amount

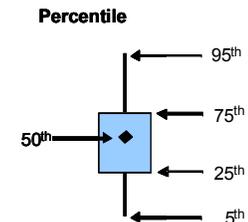
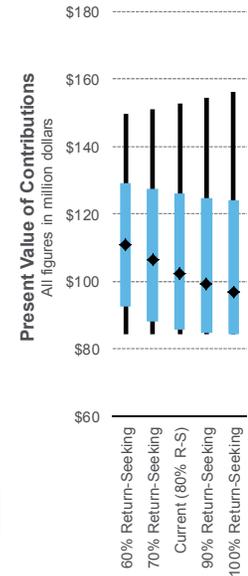


Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	\$7.1	\$8.7	\$12.6	\$7.1	\$8.7	\$12.6	\$7.1	\$8.7	\$12.7	\$7.1	\$8.7	\$12.6	\$7.1	\$8.7	\$12.6
25th Percentile	\$7.1	\$9.1	\$12.8	\$7.1	\$8.7	\$12.7	\$7.1	\$8.7	\$12.7	\$7.1	\$8.7	\$12.7	\$7.1	\$8.7	\$12.7
50th Percentile	\$8.3	\$15.2	\$24.1	\$7.9	\$14.0	\$22.0	\$7.5	\$12.8	\$19.4	\$7.1	\$11.5	\$16.3	\$7.1	\$9.9	\$13.1
75th Percentile	\$10.3	\$18.9	\$30.4	\$10.2	\$18.6	\$29.7	\$10.1	\$18.2	\$29.0	\$10.1	\$18.0	\$28.4	\$10.1	\$17.7	\$28.0
95th Percentile	\$12.5	\$22.5	\$36.0	\$12.8	\$22.7	\$36.1	\$13.1	\$23.0	\$36.4	\$13.4	\$23.2	\$36.7	\$13.7	\$23.5	\$37.1
Probability > \$15M	<5%	51%	70%	<5%	44%	69%	<5%	40%	66%	<5%	36%	59%	<5%	34%	47%

Key Takeaways:

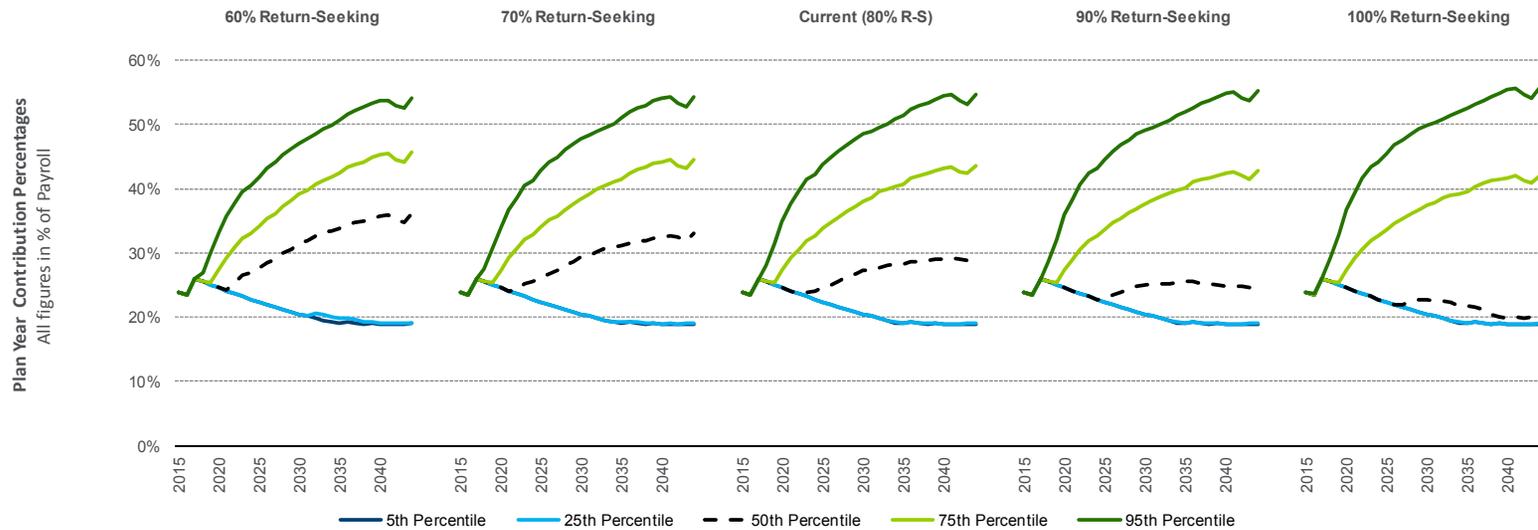
- Contribution amounts are projected to increase over the period with a floor of statutory, payroll-based employee contributions plus expected court fees
- Increases to the return-seeking allocation will lower expected contributions (50th percentile outcomes) while increasing the volatility of those amounts

* Liability projections assume discount rates of 8.00% for all investment policies studied



Asset-Liability Projection Results (Judges Retirement System)

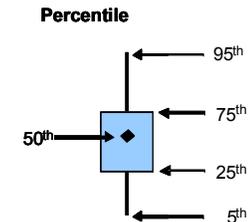
Gross Contribution Percentage of Payroll



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	23%	19%	19%	23%	19%	19%	23%	19%	19%	23%	19%	19%	23%	19%	19%
25th Percentile	23%	20%	19%	23%	19%	19%	23%	19%	19%	23%	19%	19%	23%	19%	19%
50th Percentile	27%	34%	36%	26%	31%	33%	24%	28%	29%	23%	25%	24%	23%	22%	20%
75th Percentile	33%	42%	46%	33%	41%	45%	33%	40%	44%	33%	40%	43%	33%	39%	42%
95th Percentile	40%	50%	54%	41%	50%	54%	42%	51%	55%	43%	51%	55%	44%	52%	56%
Probability > 24%	68%	68%	68%	64%	65%	66%	52%	62%	63%	47%	56%	52%	47%	47%	45%

Key Takeaway:

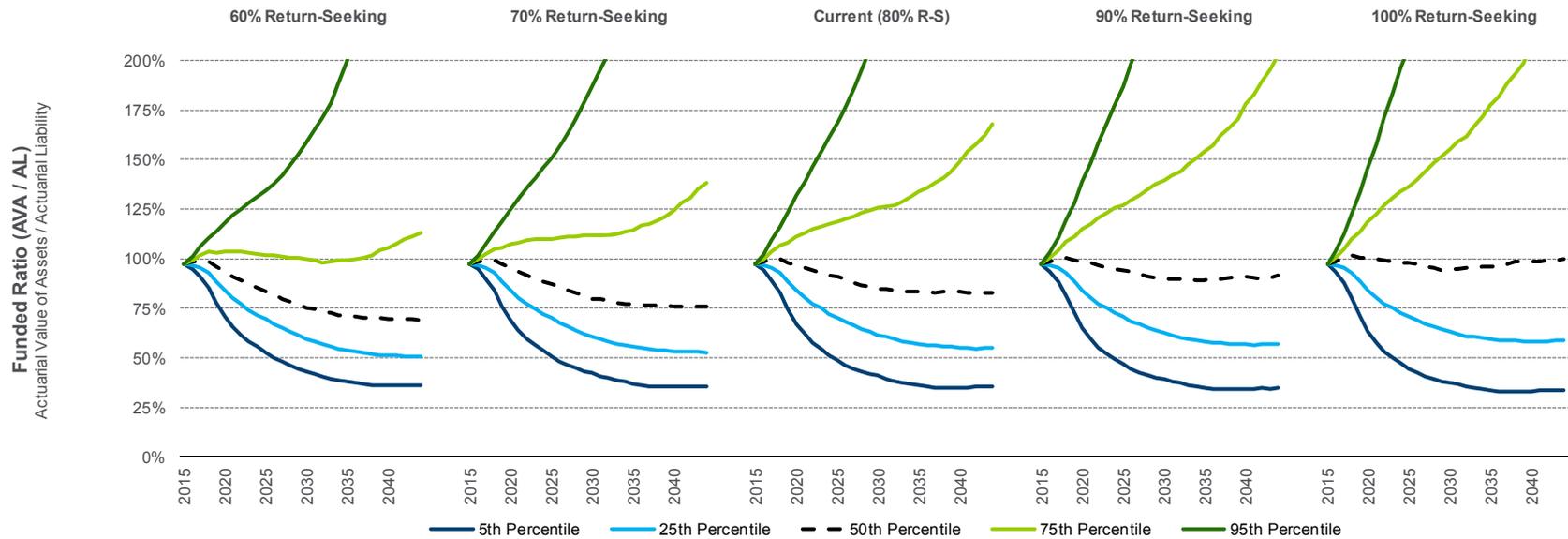
- Contribution percentages, determined by the actuarial contribution, are projected to exceed the anticipated court fees plus the employee, payroll-based contributions in the median expectation



* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (Judges Retirement System)

Actuarial Value of Assets / Actuarial Liability Funded Ratio



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking			
	Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile		55%	39%	36%	54%	38%	36%	51%	37%	35%	49%	36%	35%	47%	34%	34%
25th Percentile		72%	55%	51%	72%	56%	53%	72%	58%	55%	73%	59%	57%	73%	60%	59%
50th Percentile		85%	72%	69%	88%	77%	76%	91%	83%	83%	95%	89%	92%	98%	96%	100%
75th Percentile		103%	99%	113%	110%	114%	139%	118%	131%	168%	126%	151%	203%	134%	172%	242%
95th Percentile		131%	189%	423%	146%	227%	512%	161%	274%	618%	178%	328%	765%	196%	386%	917%
Probability > 100%		29%	25%	33%	37%	34%	40%	42%	41%	45%	46%	46%	48%	48%	49%	50%

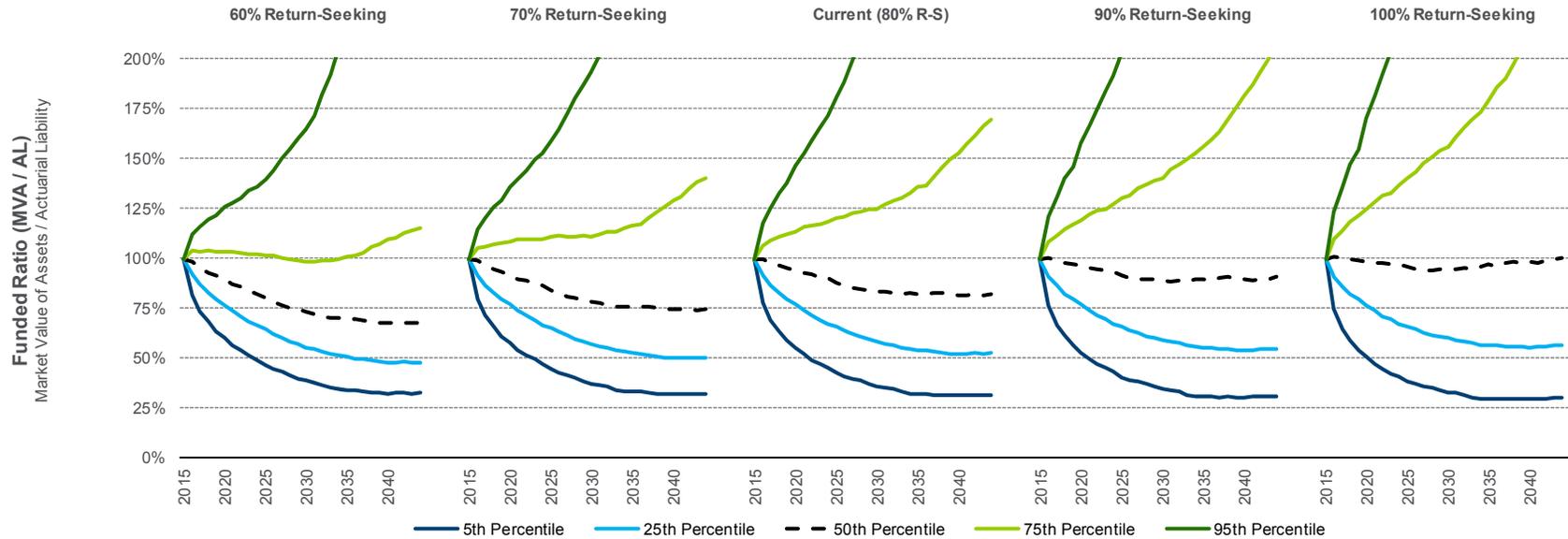
Key Takeaways:

- Policies less than 100% return-seeking assets are projected to result in the Plan falling short of full funded status in the central expectation (50th percentile)
- Higher allocations to return-seeking assets will increase the volatility of the Plan's funded status

* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (Judges Retirement System)

Market Value of Assets / Actuarial Liability Funded Ratio



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	49%	34%	32%	47%	33%	32%	45%	32%	31%	43%	31%	31%	41%	29%	30%
25th Percentile	66%	51%	47%	66%	53%	50%	67%	54%	52%	67%	55%	54%	67%	56%	56%
50th Percentile	82%	70%	67%	86%	76%	74%	90%	82%	82%	93%	89%	90%	97%	96%	100%
75th Percentile	102%	99%	115%	110%	115%	140%	118%	133%	170%	127%	152%	208%	136%	173%	247%
95th Percentile	136%	205%	455%	153%	246%	560%	172%	296%	676%	191%	355%	832%	213%	423%	1032%
Probability > 100%	27%	25%	33%	35%	35%	40%	41%	41%	45%	45%	46%	48%	48%	49%	50%

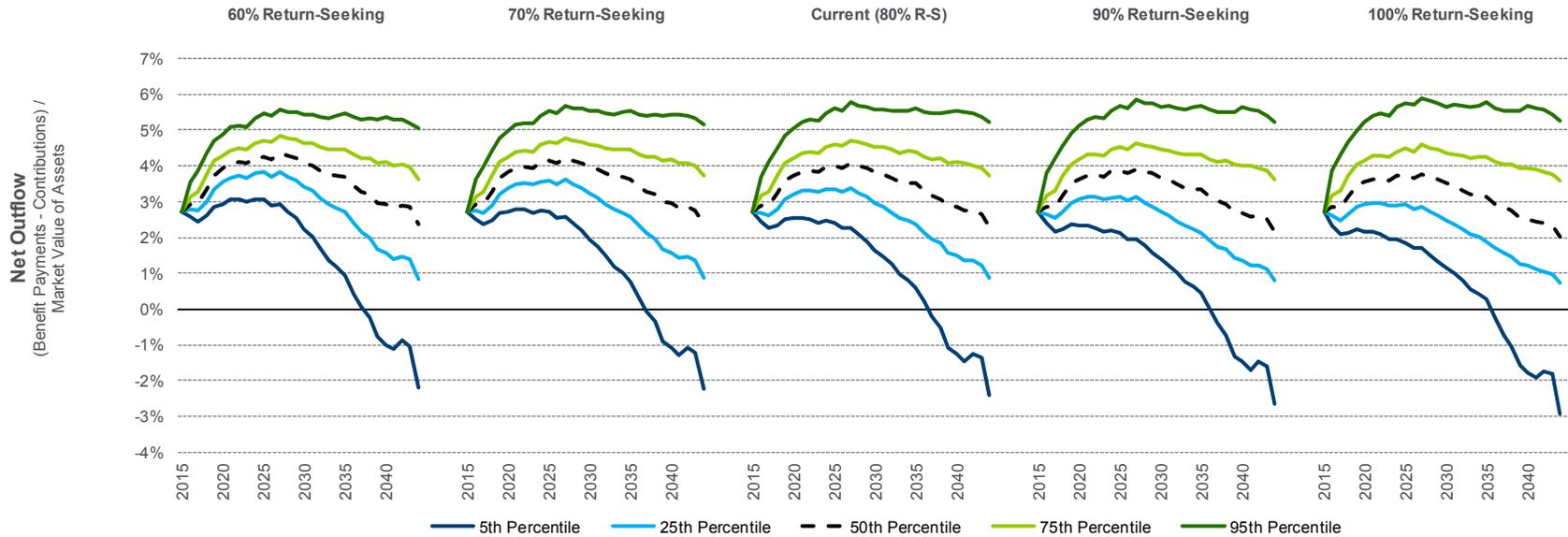
Key Takeaways:

- Policies less than 100% return-seeking assets are projected to result in the Plan falling short of full funded status in the central expectation (50th percentile)
- Higher allocations to return-seeking assets will increase the volatility of the Plan's funded status

* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (Judges Retirement System)

Net Outflow Analysis: (Benefit Payments less Contributions) / Market Value of Assets



Strategy	60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking			100% Return-Seeking		
Year	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044	2024	2034	2044
5th Percentile	3%	1%	-2%	3%	1%	-2%	2%	1%	-2%	2%	1%	-3%	2%	0%	-3%
25th Percentile	4%	3%	1%	4%	3%	1%	3%	2%	1%	3%	2%	1%	3%	2%	1%
50th Percentile	4%	4%	2%	4%	4%	2%	4%	4%	2%	4%	3%	2%	4%	3%	2%
75th Percentile	5%	4%	4%	5%	4%	4%	5%	4%	4%	4%	4%	4%	4%	4%	4%
95th Percentile	5%	5%	5%	5%	5%	5%	5%	6%	5%	6%	6%	5%	6%	6%	5%
Probability > 4%	63%	41%	20%	55%	40%	21%	49%	37%	21%	44%	33%	20%	40%	31%	20%

Key Takeaway:

- Net Outflow is consistent across the policies modeled

* Liability projections assume discount rates of 8.00% for all investment policies studied

Asset-Liability Projection Results (Judges Retirement System)

Summary of Results

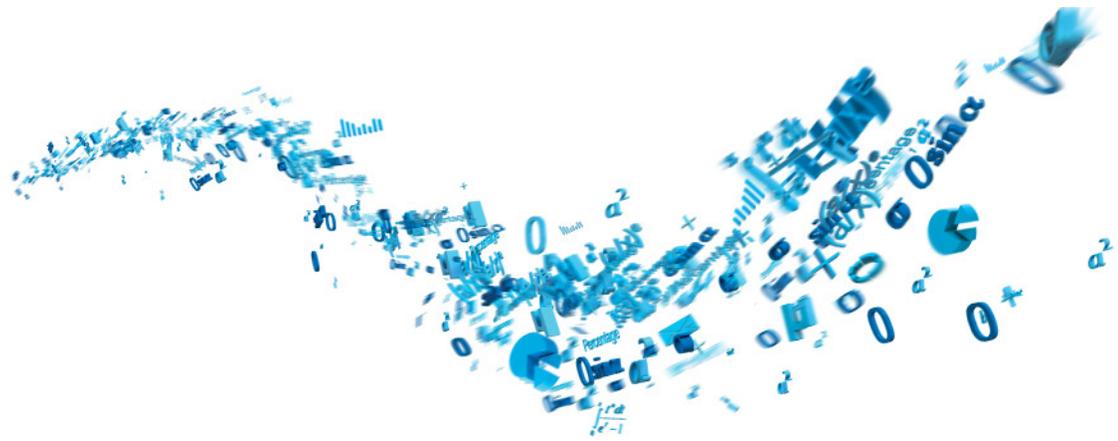
All Scenarios \$ millions	30-year Economic Cost		30-year Present Value of Contributions		30-year Ending Funded Ratio (MVA / AL)	
	Expected ¹	Downside ²	Expected ¹	Downside ²	Expected ¹	Downside ²
0% Return-Seeking	\$164.3	\$180.7	\$140.9	\$147.8	43%	29%
10% Return-Seeking	\$158.4	\$176.9	\$136.2	\$146.3	46%	30%
20% Return-Seeking	\$151.9	\$174.5	\$131.1	\$146.2	49%	32%
30% Return-Seeking	\$145.4	\$173.0	\$125.9	\$146.7	52%	32%
40% Return-Seeking	\$138.5	\$172.4	\$121.0	\$147.5	57%	32%
50% Return-Seeking	\$131.1	\$172.5	\$116.0	\$148.4	62%	33%
60% Return-Seeking	\$124.3	\$172.6	\$111.0	\$149.6	68%	33%
70% Return-Seeking	\$117.9	\$173.5	\$106.5	\$150.9	74%	32%
Current (80% R-S)	\$111.0	\$174.5	\$102.5	\$152.6	81%	32%
90% Return-Seeking	\$105.0	\$176.1	\$99.3	\$154.3	91%	31%
100% Return-Seeking	\$99.5	\$177.8	\$96.7	\$156.3	100%	30%

¹ Expected = 50th percentile outcome or central expectation across all 5,000 simulations

² Downside = 95th percentile outcome across all 5,000 simulations

Key Findings:

- Plan is projected to fall below fully funded status at the end of 30 years under the current policy due to the expected return on plan assets falling short of the plan assumed discount rate
- Adjusting the return-seeking vs. risk-reducing allocation will exhibit standard risk/reward trade-off of expected costs and risks



Analysis

- Asset-Liability Projection Results (State Cash Balance Plan)

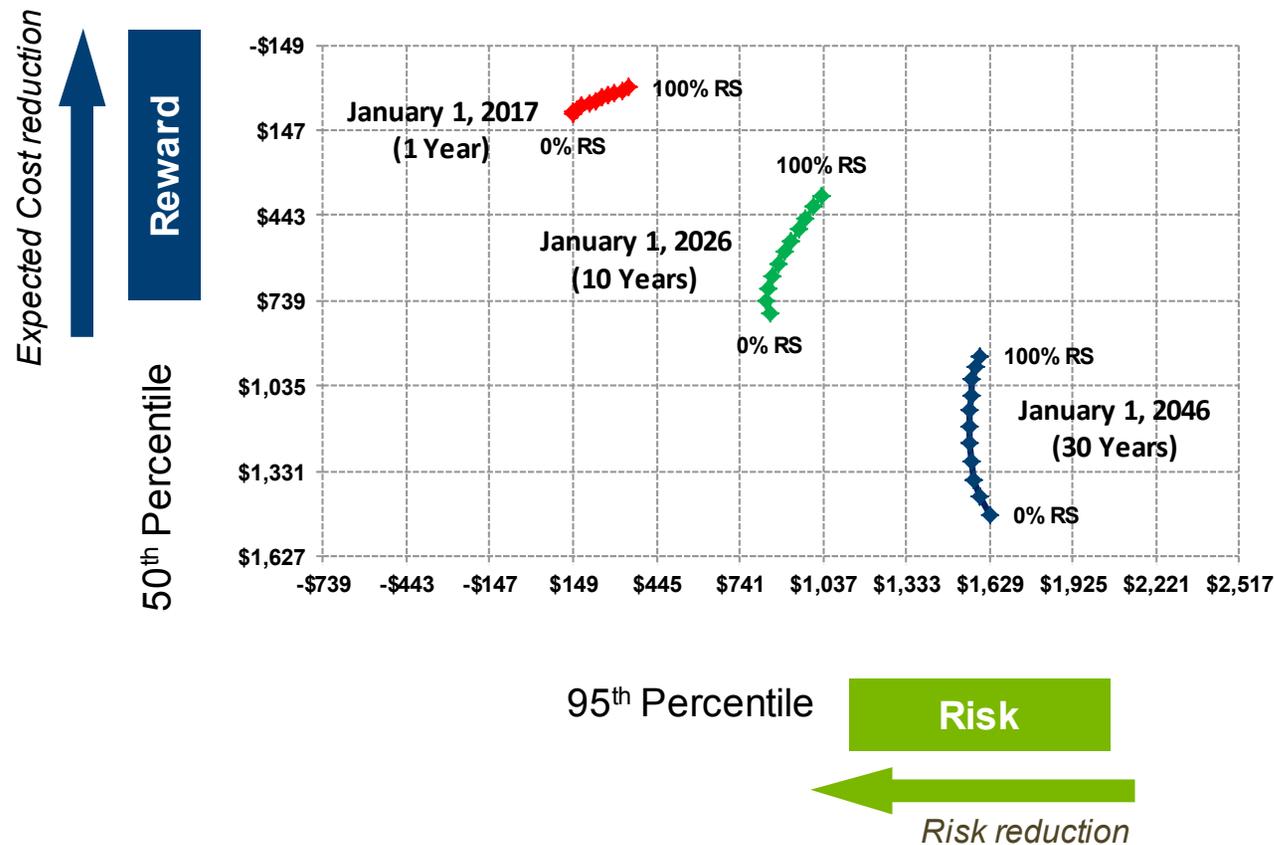
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Asset-Liability Projection Results (State Cash Balance Plan)

Economic Cost Analysis - 1 Year, 10 Year, and 30 Year Horizons

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 7.75%, \$millions



Key Takeaway:

- Longer time horizons are expected to reward higher levels of risk whereas shorter time horizons are not

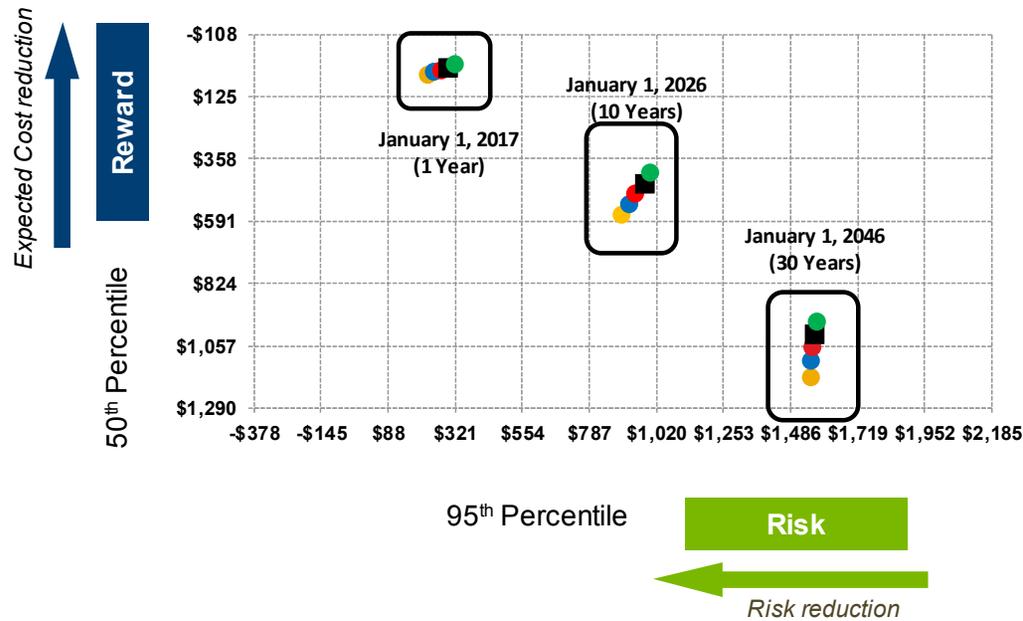
* Liability projections assume discount rates of 7.75% for all investment policies studied; Reflects a utility function: Excludes 50% of surplus in excess of 140% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

Asset-Liability Projection Results (State Cash Balance Plan)

Economic Cost Analysis

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 7.75%, \$millions



Economic Cost		
January 1, 2017		
Strategy (\$Millions)	Cost	Risk
50% Return-Seeking	\$45.3	\$226.7
60% Return-Seeking	\$35.6	\$249.6
70% Return-Seeking	\$26.5	\$273.6
Current (80% R-S)	\$17.0	\$297.9
90% Return-Seeking	\$8.2	\$321.2
January 1, 2026		
Strategy (\$Millions)	Cost	Risk
50% Return-Seeking	\$571.4	\$899.3
60% Return-Seeking	\$532.4	\$924.8
70% Return-Seeking	\$492.5	\$949.7
Current (80% R-S)	\$452.4	\$977.2
90% Return-Seeking	\$412.9	\$1,002.6
January 1, 2046		
Strategy (\$Millions)	Cost	Risk
50% Return-Seeking	\$1,174.9	\$1,556.2
60% Return-Seeking	\$1,114.7	\$1,560.4
70% Return-Seeking	\$1,066.5	\$1,562.7
Current (80% R-S)	\$1,011.9	\$1,567.9
90% Return-Seeking	\$966.5	\$1,580.3

Key Takeaways:

- The magnitude of the risk/reward trade-off changes over a longer-term projection
- Under the Current Policy over a 30-year time horizon, the expected Economic Cost is \$1,011.9M and the potential risk is \$1,567.9M
- Adjustments to the return-seeking allocation may have desirable risk/reward characteristics relative to the current policy

* Liability projections assume discount rates of 7.75% for all investment policies studied; Reflects a *utility function*: Excludes 50% of surplus in excess of 140% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

Asset-Liability Projection Results (State Cash Balance Plan)

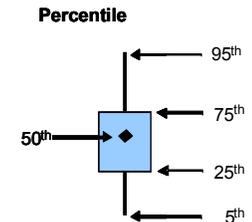
Gross Contribution Amount



Key Takeaways:

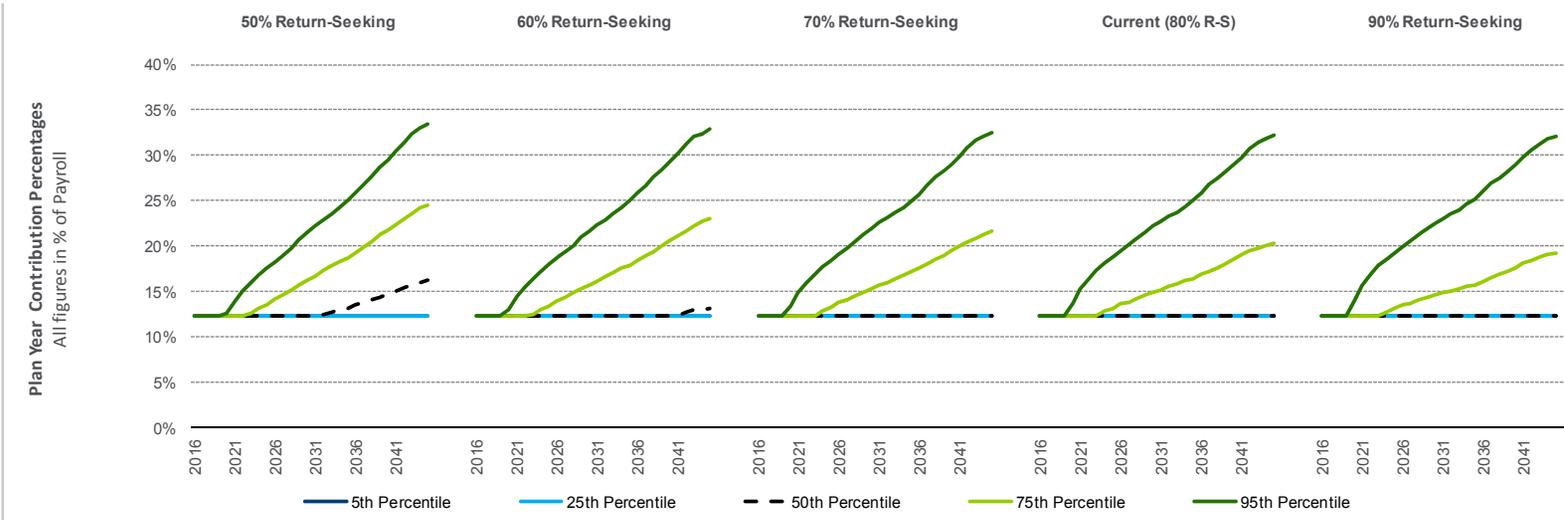
- Contribution amounts are projected to increase over the period with a floor of statutory, payroll-based contributions
- Increases to the return-seeking allocation will lower expected (50th percentile outcomes) while increasing the volatility of those amounts

* Liability projections assume discount rates of 7.75% for all investment policies studied



Asset-Liability Projection Results (State Cash Balance Plan)

Gross Contribution Percentage of Payroll

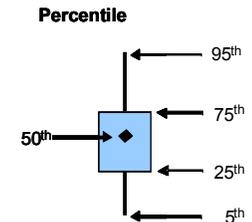


Strategy	50% Return-Seeking			60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking		
Year	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045
5th Percentile	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%
25th Percentile	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%
50th Percentile	12.3%	13.2%	16.2%	12.3%	12.3%	13.2%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%	12.3%
75th Percentile	13.6%	18.7%	24.6%	13.4%	17.9%	23.1%	13.3%	17.2%	21.6%	13.2%	16.4%	20.3%	13.2%	15.7%	19.2%
95th Percentile	17.5%	25.1%	33.5%	18.0%	25.0%	32.9%	18.4%	25.0%	32.5%	18.9%	25.1%	32.3%	19.3%	25.2%	32.0%
Probability > 13%	37%	55%	70%	34%	47%	55%	33%	46%	48%	31%	46%	48%	29%	45%	47%

Key Takeaway:

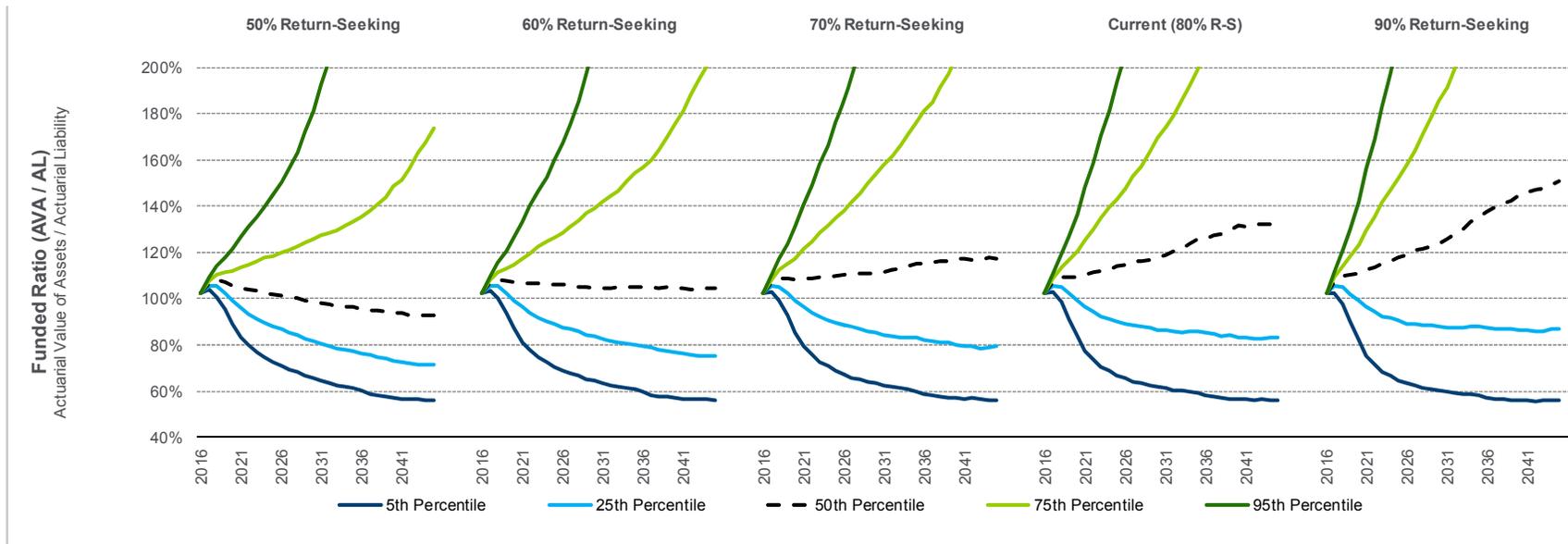
- Contribution percentages are projected to stay at the current statutory, payroll-based level (12.3%) until such time as the actuarial contribution exceeds that level

* Liability projections assume discount rates of 7.75% for all investment policies studied



Asset-Liability Projection Results (State Cash Balance Plan)

Actuarial Value of Assets / Actuarial Liability Funded Ratio



Strategy	50% Return-Seeking			60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking		
Year	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045
5th Percentile	73%	61%	56%	71%	61%	56%	69%	60%	56%	67%	59%	56%	65%	58%	56%
25th Percentile	88%	77%	71%	89%	80%	75%	89%	83%	79%	90%	86%	83%	90%	88%	87%
50th Percentile	102%	96%	93%	106%	105%	104%	110%	115%	117%	114%	126%	133%	118%	136%	151%
75th Percentile	118%	133%	174%	126%	154%	210%	135%	177%	247%	143%	199%	295%	152%	225%	346%
95th Percentile	145%	253%	610%	160%	297%	710%	176%	342%	846%	194%	391%	988%	213%	461%	1148%
Probability > 100%	54%	47%	48%	59%	55%	54%	62%	62%	61%	65%	66%	66%	66%	69%	70%

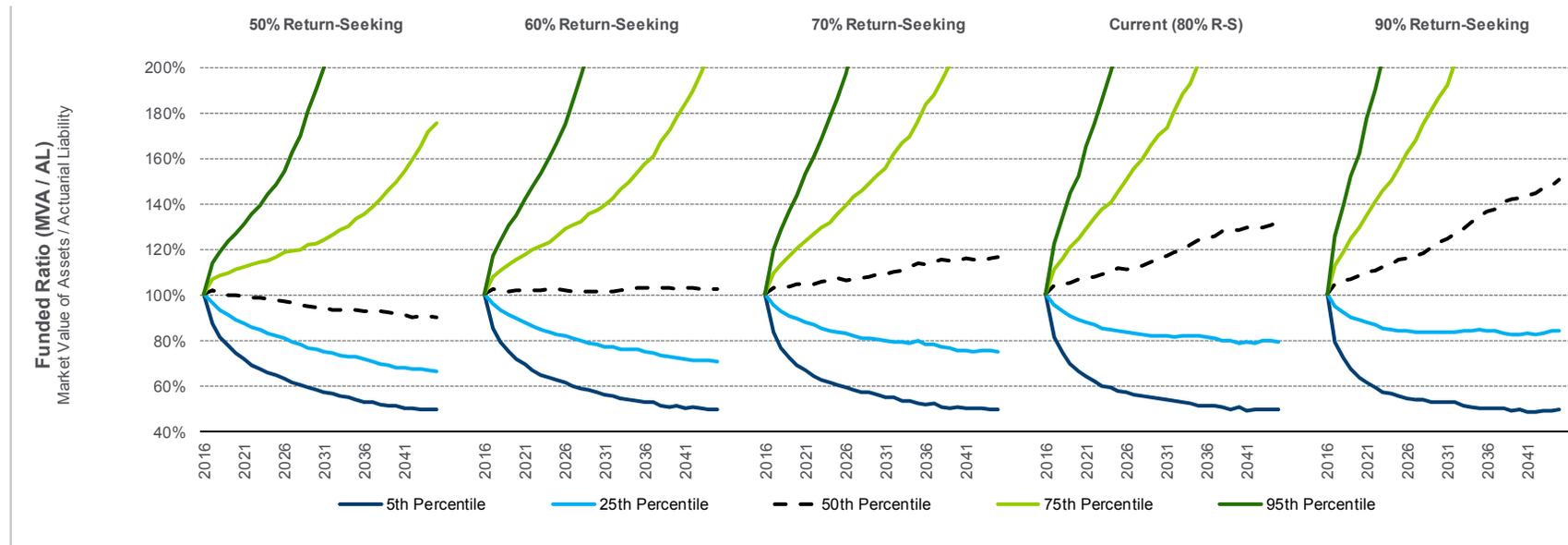
Key Takeaways:

- Policies with 60% return-seeking assets or greater are projected to result in the Plan attaining full funded status in the central expectation (50th percentile)
- Higher allocations to return-seeking assets will increase the volatility of the Plan's funded status

* Liability projections assume discount rates of 7.75% for all investment policies studied

Asset-Liability Projection Results (State Cash Balance Plan)

Market Value of Assets / Actuarial Liability Funded Ratio



Strategy	50% Return-Seeking			60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking		
Year	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045
5th Percentile	65%	54%	50%	63%	53%	50%	60%	53%	50%	58%	52%	50%	56%	50%	50%
25th Percentile	82%	73%	67%	83%	76%	71%	84%	80%	75%	84%	82%	79%	84%	85%	84%
50th Percentile	98%	94%	90%	103%	103%	103%	107%	114%	117%	112%	124%	132%	116%	134%	150%
75th Percentile	117%	133%	175%	126%	154%	210%	135%	177%	252%	145%	202%	300%	156%	227%	346%
95th Percentile	148%	272%	662%	167%	320%	799%	186%	368%	917%	208%	433%	1058%	233%	503%	1263%
Probability > 100%	47%	46%	47%	53%	53%	52%	58%	60%	60%	61%	64%	65%	63%	67%	69%

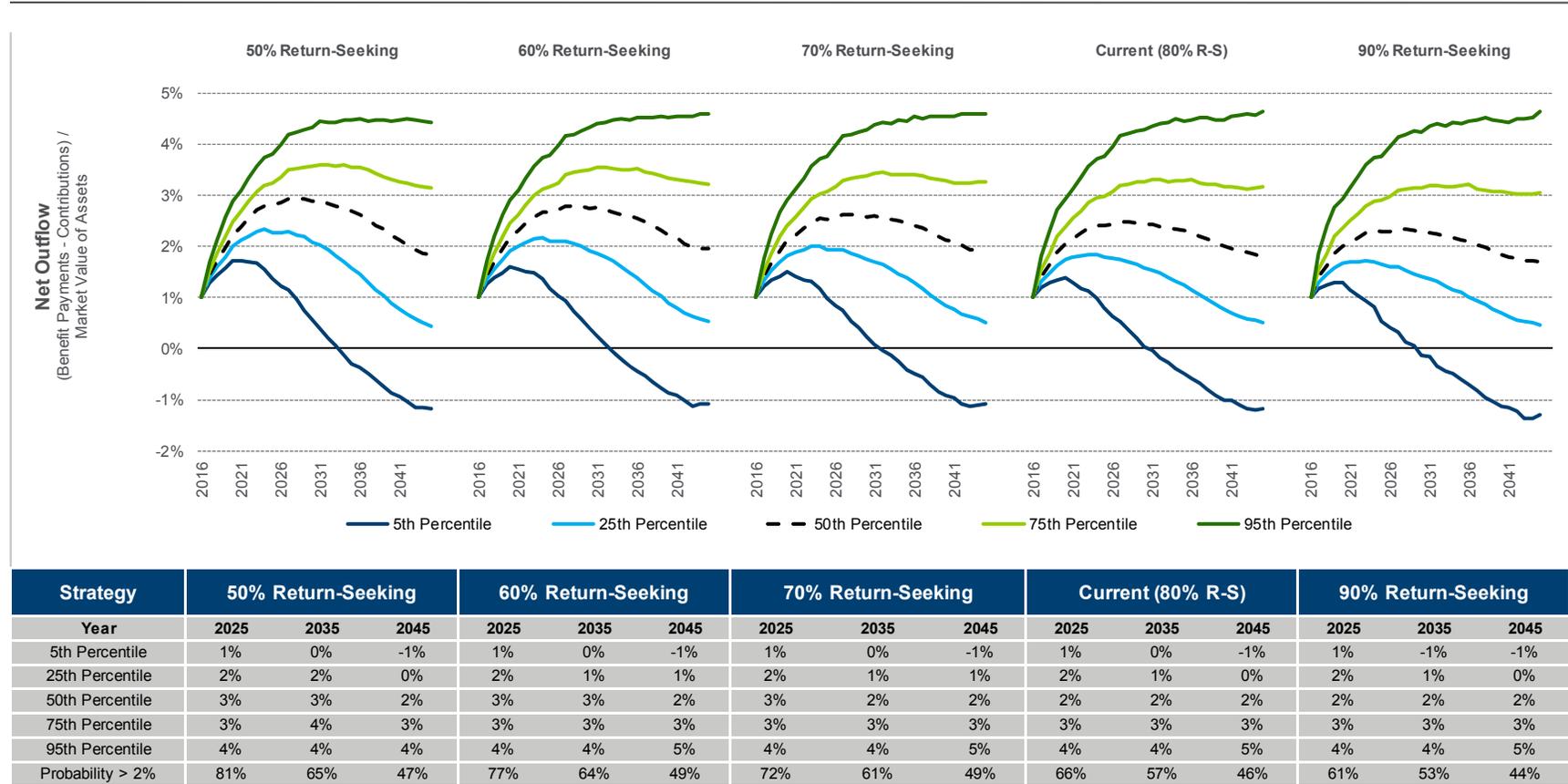
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- Higher allocations to return-seeking assets will increase the volatility of the Plan's funded status

* Liability projections assume discount rates of 7.75% for all investment policies studied

Asset-Liability Projection Results (State Cash Balance Plan)

Net Outflow Analysis: (Benefit Payments less Contributions) / Market Value of Assets



Key Takeaway:

- Net Outflow is consistent across the policies modeled

* Liability projections assume discount rates of 7.75% for all investment policies studied

Asset-Liability Projection Results (State Cash Balance Plan)

Summary of Results

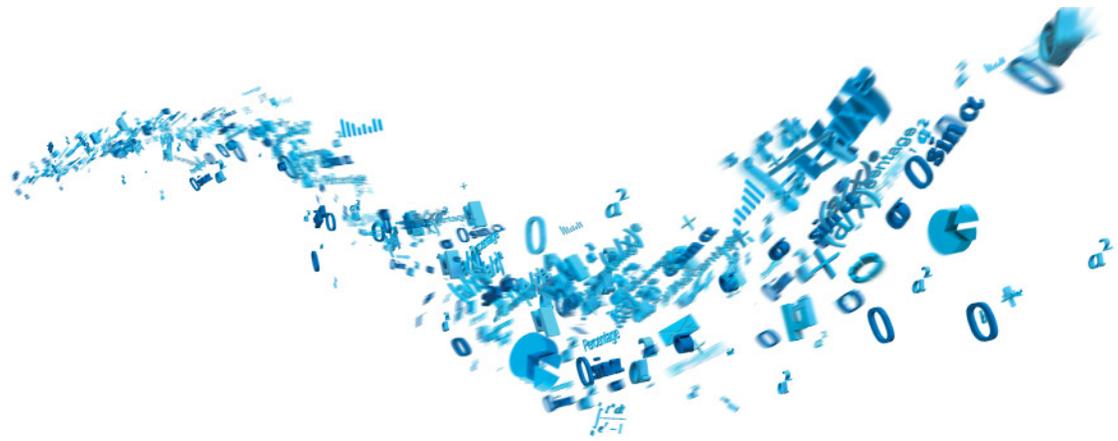
All Scenarios \$ millions	30-year Economic Cost		30-year Present Value of Contributions		30-year Ending Funded Ratio (MVA / AL)	
	Expected ¹	Downside ²	Expected ¹	Downside ²	Expected ¹	Downside ²
0% Return-Seeking	\$1,479.7	\$1,628.1	\$1,381.2	\$1,482.7	64%	45%
10% Return-Seeking	\$1,420.9	\$1,594.0	\$1,335.5	\$1,472.3	66%	47%
20% Return-Seeking	\$1,359.0	\$1,575.6	\$1,294.0	\$1,477.5	70%	48%
30% Return-Seeking	\$1,299.3	\$1,563.8	\$1,257.5	\$1,485.0	74%	49%
40% Return-Seeking	\$1,235.8	\$1,558.5	\$1,228.1	\$1,500.4	82%	50%
50% Return-Seeking	\$1,174.9	\$1,556.2	\$1,205.0	\$1,513.8	90%	50%
60% Return-Seeking	\$1,114.7	\$1,560.4	\$1,186.8	\$1,527.2	102%	50%
70% Return-Seeking	\$1,066.5	\$1,562.7	\$1,172.9	\$1,538.6	116%	50%
Current (80% R-S)	\$1,011.9	\$1,567.9	\$1,163.7	\$1,555.4	133%	50%
90% Return-Seeking	\$966.5	\$1,580.3	\$1,157.9	\$1,576.0	151%	50%
100% Return-Seeking	\$928.9	\$1,594.0	\$1,155.2	\$1,594.9	171%	49%

¹ Expected = 50th percentile outcome or central expectation across all 5,000 simulations

² Downside = 95th percentile outcome across all 5,000 simulations

Key Findings:

- Plan is projected to maintain fully funded status via the current policy
- Contribution amounts are expected to rise over time
- Adjusting the return-seeking vs. risk-reducing allocation will exhibit standard risk/reward trade-off of expected costs and risks



Analysis

- Asset-Liability Projection Results (County Cash Balance Plan)

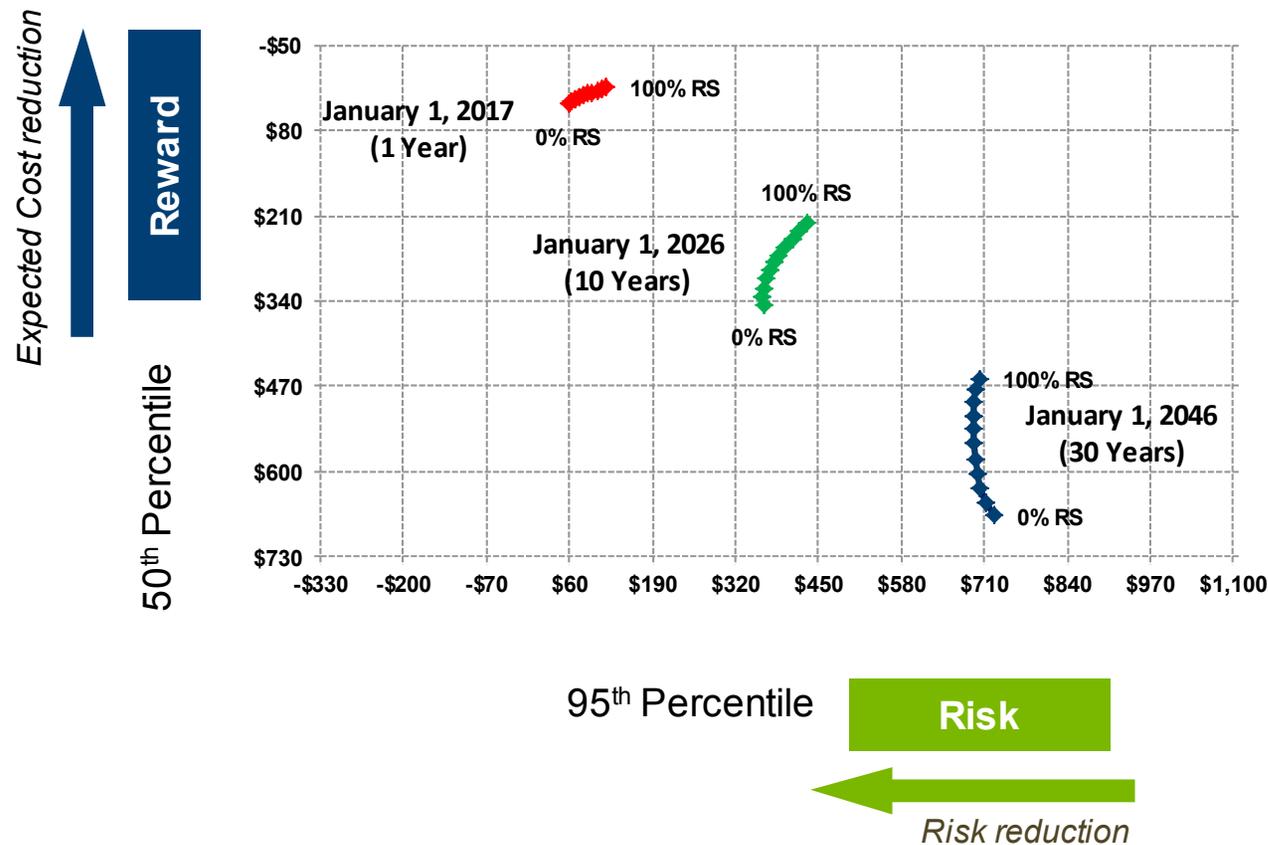
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Asset-Liability Projection Results (County Cash Balance Plan)

Economic Cost Analysis - 1 Year, 10 Year, and 30 Year Horizons

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 7.75%, \$millions



Key Takeaway:

- Longer time horizons are expected to reward higher levels of risk whereas shorter time horizons are not

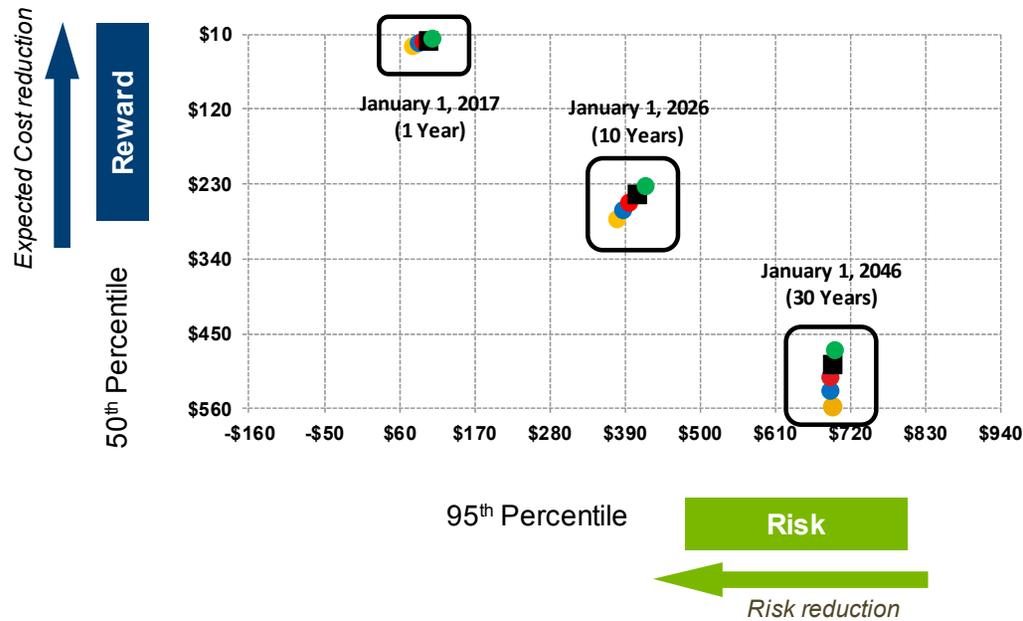
* Liability projections assume discount rates of 7.75% for all investment policies studied; Reflects a *utility function*: Excludes 50% of surplus in excess of 160% of Actuarial liability, and includes twice the shortfall below 50% of Actuarial liability, on a market value basis

Asset-Liability Projection Results (County Cash Balance Plan)

Economic Cost Analysis

Economic Cost

Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 7.75%, \$millions



Economic Cost		
January 1, 2017		
Strategy (\$Millions)	Cost	Risk
50% Return-Seeking	\$27.7	\$81.9
60% Return-Seeking	\$24.8	\$88.7
70% Return-Seeking	\$22.1	\$96.0
Current (80% R-S)	\$19.3	\$103.1
90% Return-Seeking	\$16.6	\$110.1
January 1, 2026		
Strategy (\$Millions)	Cost	Risk
50% Return-Seeking	\$281.9	\$380.9
60% Return-Seeking	\$269.9	\$388.6
70% Return-Seeking	\$258.1	\$398.4
Current (80% R-S)	\$245.8	\$408.9
90% Return-Seeking	\$234.2	\$420.7
January 1, 2046		
Strategy (\$Millions)	Cost	Risk
50% Return-Seeking	\$557.1	\$693.7
60% Return-Seeking	\$535.8	\$692.7
70% Return-Seeking	\$514.9	\$692.6
Current (80% R-S)	\$495.0	\$694.4
90% Return-Seeking	\$475.1	\$698.1

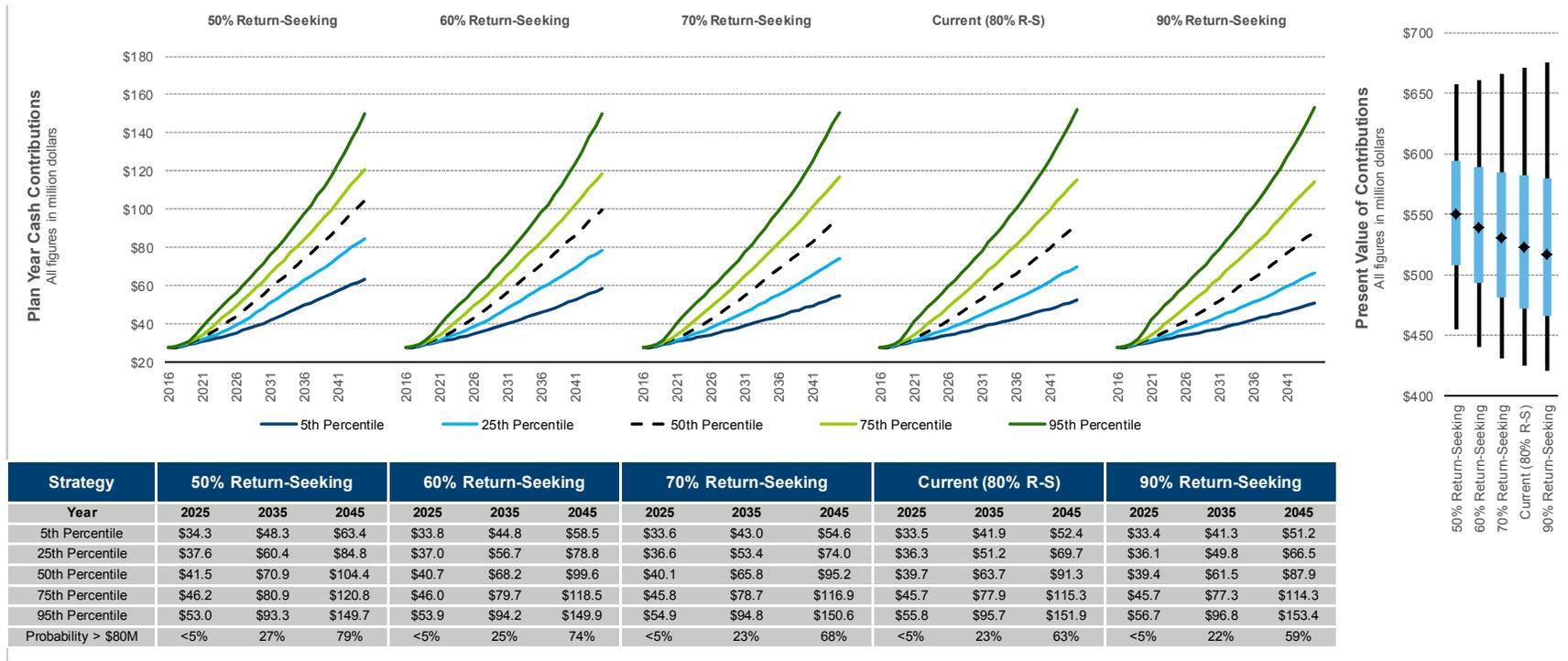
Key Takeaways:

- The magnitude of the risk/reward trade-off changes over a longer-term projection
- Under the Current Policy over a 30-year time horizon, the expected Economic Cost is \$495.0M and the potential risk is \$694.4M
- Adjustments to the return-seeking allocation may have desirable risk/reward characteristics relative to the current policy

* Liability projections assume discount rates of 7.75% for all investment policies studied; Reflects a *utility function*: Excludes 50% of surplus in excess of 160% of Actuarial liability, and includes twice the shortfall below 50% of Actuarial liability, on a market value basis

Asset-Liability Projection Results (County Cash Balance Plan)

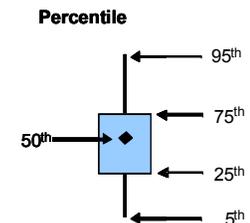
Gross Contribution Amount



Key Takeaways:

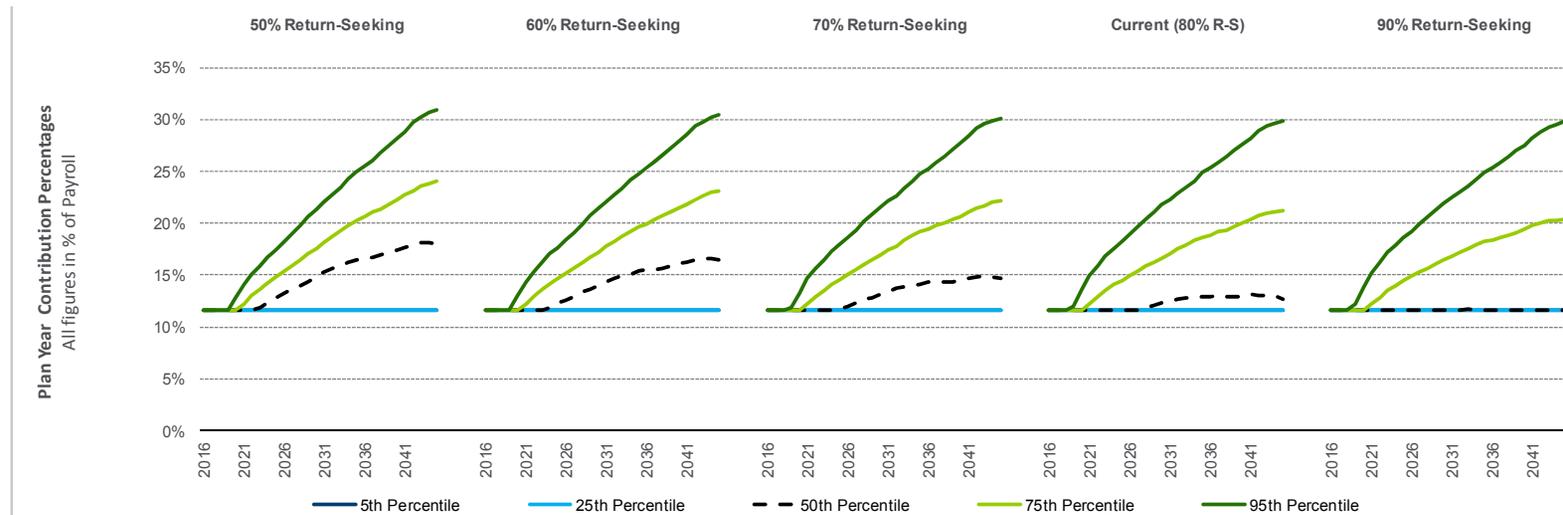
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* Liability projections assume discount rates of 7.75% for all investment policies studied



Asset-Liability Projection Results (County Cash Balance Plan)

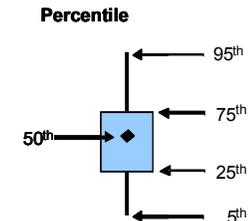
Gross Contribution Percentage of Payroll



Strategy	50% Return-Seeking			60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking		
Year	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045
5th Percentile	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%
25th Percentile	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%	11.6%
50th Percentile	12.8%	16.5%	18.0%	12.3%	15.4%	16.5%	11.7%	14.2%	14.7%	11.6%	12.9%	12.7%	11.6%	11.6%	11.6%
75th Percentile	14.8%	20.3%	24.1%	14.7%	19.6%	23.1%	14.6%	19.2%	22.1%	14.5%	18.7%	21.2%	14.5%	18.2%	20.4%
95th Percentile	17.5%	25.0%	31.0%	17.7%	24.8%	30.5%	18.0%	24.8%	30.1%	18.3%	24.9%	29.9%	18.6%	24.9%	29.8%
Probability > 12%	67%	73%	74%	61%	73%	73%	48%	71%	72%	47%	68%	66%	47%	49%	49%

Key Takeaway:

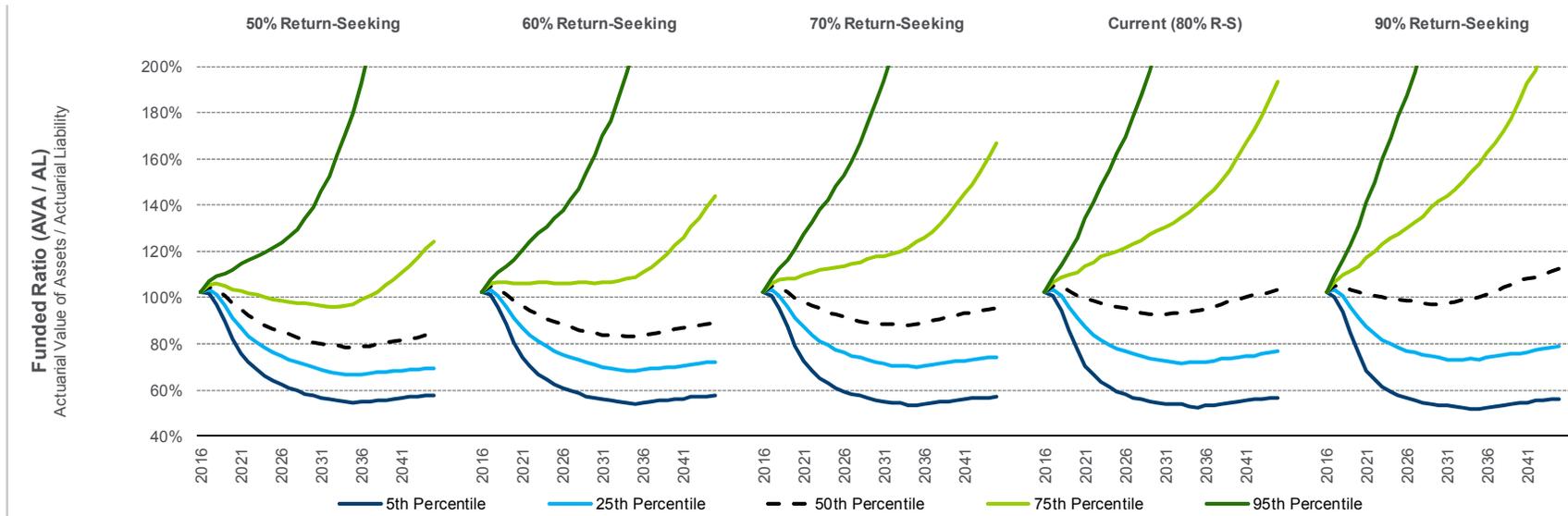
- Contribution percentages are projected to stay at the current statutory, payroll-based level (11.6%) until such time as the actuarial contribution exceeds that level



* Liability projections assume discount rates of 7.75% for all investment policies studied

Asset-Liability Projection Results (County Cash Balance Plan)

Actuarial Value of Assets / Actuarial Liability Funded Ratio



Strategy	50% Return-Seeking			60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking		
Year	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045
5th Percentile	64%	55%	58%	63%	54%	58%	61%	54%	57%	59%	53%	57%	57%	52%	56%
25th Percentile	77%	66%	70%	77%	68%	72%	78%	70%	74%	78%	72%	77%	78%	73%	79%
50th Percentile	87%	78%	84%	90%	83%	89%	93%	89%	96%	96%	94%	103%	99%	100%	112%
75th Percentile	99%	97%	124%	106%	109%	144%	113%	124%	167%	120%	140%	193%	127%	158%	227%
95th Percentile	121%	180%	430%	134%	210%	473%	148%	241%	565%	163%	280%	645%	179%	326%	752%
Probability > 100%	24%	24%	40%	34%	34%	45%	41%	42%	48%	46%	47%	53%	49%	50%	59%

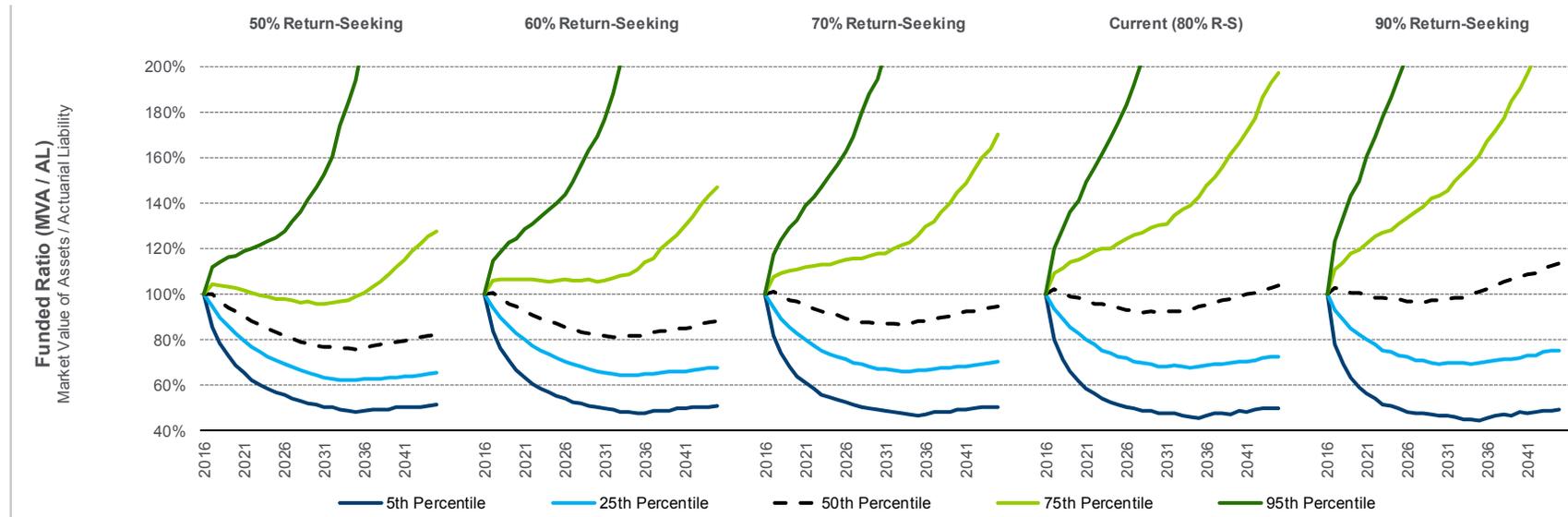
Key Takeaways:

- Policies with 80% return-seeking assets or greater are projected to result in the Plan attaining full funded status in the central expectation (50th percentile)
- Higher allocations to return-seeking assets will increase the volatility of the Plan's funded status

* Liability projections assume discount rates of 7.75% for all investment policies studied

Asset-Liability Projection Results (County Cash Balance Plan)

Market Value of Assets / Actuarial Liability Funded Ratio



Strategy	50% Return-Seeking			60% Return-Seeking			70% Return-Seeking			Current (80% R-S)			90% Return-Seeking		
Year	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045	2025	2035	2045
5th Percentile	57%	48%	51%	55%	48%	51%	53%	47%	51%	51%	46%	50%	50%	44%	49%
25th Percentile	71%	62%	65%	72%	65%	68%	72%	66%	70%	73%	68%	72%	73%	70%	75%
50th Percentile	83%	76%	82%	87%	81%	88%	91%	88%	95%	94%	94%	104%	98%	101%	114%
75th Percentile	98%	99%	127%	106%	111%	147%	114%	126%	170%	122%	143%	197%	131%	161%	229%
95th Percentile	125%	194%	460%	140%	226%	533%	157%	263%	619%	175%	310%	711%	195%	356%	821%
Probability > 100%	23%	25%	40%	32%	34%	45%	40%	42%	48%	45%	47%	53%	48%	51%	59%

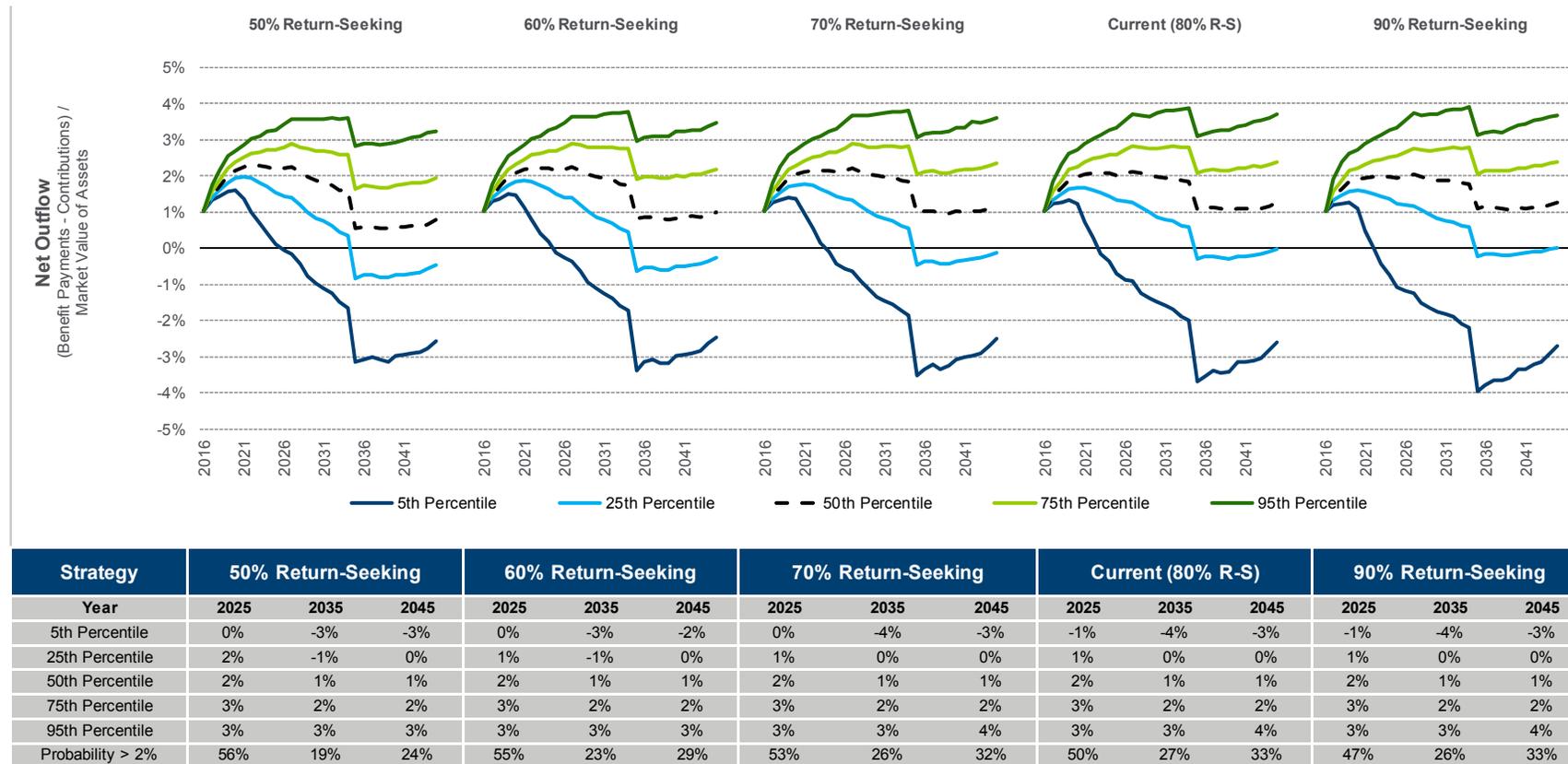
Key Takeaways:

- Policies with 80% return-seeking assets or greater are projected to result in the Plan attaining full funded status in the central expectation (50th percentile)
- Higher allocations to return-seeking assets will increase the volatility of the Plan's funded status

* Liability projections assume discount rates of 7.75% for all investment policies studied

Asset-Liability Projection Results (County Cash Balance Plan)

Net Outflow Analysis: (Benefit Payments less Contributions) / Market Value of Assets



Key Takeaway:

- Net Outflow is consistent across the policies modeled

* Liability projections assume discount rates of 7.75% for all investment policies studied

Asset-Liability Projection Results (County Cash Balance Plan)

Summary of Results

All Scenarios \$ millions	30-year Economic Cost		30-year Present Value of Contributions		30-year Ending Funded Ratio (MVA / AL)	
	Expected ¹	Downside ²	Expected ¹	Downside ²	Expected ¹	Downside ²
0% Return-Seeking	\$667.5	\$724.7	\$621.6	\$654.9	65%	48%
10% Return-Seeking	\$647.9	\$712.1	\$606.2	\$650.6	68%	50%
20% Return-Seeking	\$626.7	\$704.2	\$591.0	\$649.6	71%	51%
30% Return-Seeking	\$603.5	\$698.6	\$576.4	\$650.8	74%	51%
40% Return-Seeking	\$580.8	\$695.5	\$562.8	\$653.7	78%	51%
50% Return-Seeking	\$557.1	\$693.7	\$549.9	\$657.6	83%	51%
60% Return-Seeking	\$535.8	\$692.7	\$539.0	\$661.4	88%	51%
70% Return-Seeking	\$514.9	\$692.6	\$530.4	\$666.0	95%	50%
Current (80% R-S)	\$495.0	\$694.4	\$522.6	\$671.2	103%	50%
90% Return-Seeking	\$475.1	\$698.1	\$517.0	\$675.6	114%	49%
100% Return-Seeking	\$458.9	\$702.4	\$512.9	\$681.0	124%	49%

¹ Expected = 50th percentile outcome or central expectation across all 5,000 simulations

² Downside = 95th percentile outcome across all 5,000 simulations

Key Findings:

- Plan is projected to maintain fully funded status via the current policy
- Contribution amounts are expected to rise over time
- Adjusting the return-seeking vs. risk-reducing allocation will exhibit standard risk/reward trade-off of expected costs and risks



Summary and Conclusions

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Executive Summary

Summary and Conclusions



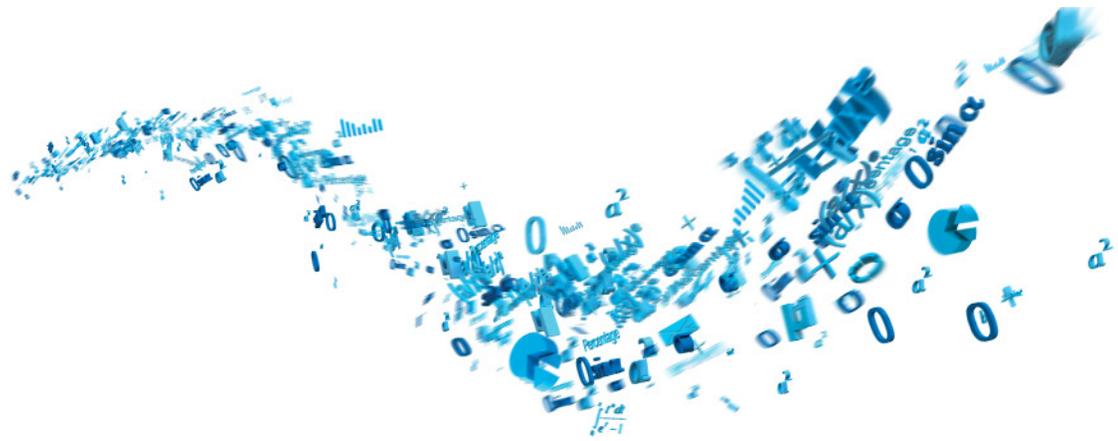
Financial Projection Trend Analysis

- Asset returns are not expected to keep pace with the actuarial assumed rate of return
- Contributions are therefore projected to trend up while funded ratios trend sideways for all plans except the State Cash Balance

Portfolio Analysis

- Longer time horizons are expected to reward higher levels of risk; shorter time horizons are not
- The current portfolio is well-diversified; changes to the composition of the portfolio are unlikely to meaningfully impact the results of this Study
- Nebraska should consider its desired balance between funding and investment returns in order to determine the ideal investment portfolio as deviations from the current asset allocation exhibit the standard risk/reward trade-off of expected costs and risks

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Appendix

- Actuarial Assumptions and Methods

Actuarial Assumptions and Methods

School Retirement System

- Actuarial assumptions:
 - Valuation Rate of Interest = 8.00%
 - Inflation = 3.25%
 - Projected COLA = 2.50%
 - Salary Scale = varies by years of service; ranges from 9.0% to 4.0%
 - Actuarial Value of Assets: smooth gains/losses relative to expected valuation rate of interest over 5 years
 - All other assumptions as documented in the Actuarial Valuation Report as of July 1, 2015
- The Plan's COLA for formula annuity members is equal to the increase in the CPI. The increase percentage in a given year cannot exceed 2.5% for members hired before January 1, 2013 and cannot exceed 1.0% for members hired on or after January 1, 2013.
- There is no COLA for service annuity members.
- Actuarially Determined Contribution Calculation = Normal Cost plus a level percent amortization of the unfunded liability with layered 30 year, closed periods and a 4.00% salary scale
- Contributions:
 - Member = 9.78% of annual compensation
 - Employer = 101% of the members' contributions (or 9.88%)
 - State = 2.00% of annual compensation, plus any additional contributions that are necessary each year to pay the excess of the normal cost plus an amortization payment to fund unfunded actuarial accrued liability bases, over member, employer, and state contributions

Actuarial Assumptions and Methods

State Patrol Retirement System

- Actuarial assumptions:
 - Valuation Rate of Interest = 8.00%
 - Inflation = 3.25%
 - Projected COLA = 2.50%
 - Salary Scale = varies by years of service; ranges from 9.5% to 4.0%
 - Actuarial Value of Assets: smooth gains/losses relative to expected valuation rate of interest over 5 years
 - All other assumptions as documented in the Actuarial Valuation Report as of July 1, 2015
- The Plan's COLA is equal to the increase in the CPI. The increase percentage in a given year cannot exceed 2.5%.
- Actuarially Determined Contribution Calculation = Normal Cost plus a level percent amortization of the unfunded liability with layered 30 year, closed periods and a 4.00% salary scale
- The Employer Contribution Rate to be applied to member salaries for the July 1, 2015 to June 30, 2016 fiscal year is calculated as the greater of the Actuarial Required Contribution Rate (reduced by the 16.0% Member Contribution Rate) and the Employer Statutory Contribution Rate (16.0%). For the July 1, 2015 to June 30, 2016 fiscal year:
 - The Actuarial Required Contribution Rate is 41.6%, and represents the annual cost of accruing active member benefits as well as incorporating actuarial gains and losses
 - This is reduced by the Member Contribution Rate of 16.0%
 - The Employer Statutory Contribution Rate (16.0%) is then applied to the remaining required contribution, leaving a deficit of 9.6%
 - The Additional Required State Contribution rate for the July 1, 2015 to June 30, 2016 fiscal year is 9.6%

Actuarial Assumptions and Methods

Judges Retirement System

- Revised actuarial assumptions effective with the (7/1/15) valuation:
 - Valuation Rate of Interest = 8.00%
 - Inflation = 3.25%
 - Projected COLA = 1.50%
 - Salary Scale = assumed to increase 4.00% per year
 - Actuarial Value of Assets: smooth gains/losses relative to expected valuation rate of interest over 5 years
 - All other assumptions as documented in the “Judges Retirement System Actuarial Valuation Report as of July 1, 2015”
- The Plan’s COLA is equal to the increase in the CPI-W index. The increase percentage in a given year cannot exceed 2.5% for Judges who became members prior to July 1, 2015 and 1.0% for Judges who became members on or after July 1, 2015.
- Actuarially Determined Contribution Calculation = Normal Cost plus a level percent amortization of the unfunded liability with layered 30 year, closed periods and a 4.00% salary scale
- The Employer Contribution Rate to be applied to member salaries for the July 1, 2015 to June 30, 2016 fiscal year consists of two components. These components may be described as follows:
 - Court Fees – beginning July 1, 2015, \$2 from each civil, criminal, traffic, and probate case docket fees will be re-directed from the General Fund to the Judges’ Retirement Fund. This increases to \$4 beginning July 1, 2017.
 - State – The State makes any additional contributions that are necessary each year to pay the excess of the normal cost plus an amortization payment to fund unfunded actuarial accrued liability bases, over member contributions, court fees, and state appropriations.

Actuarial Assumptions and Methods

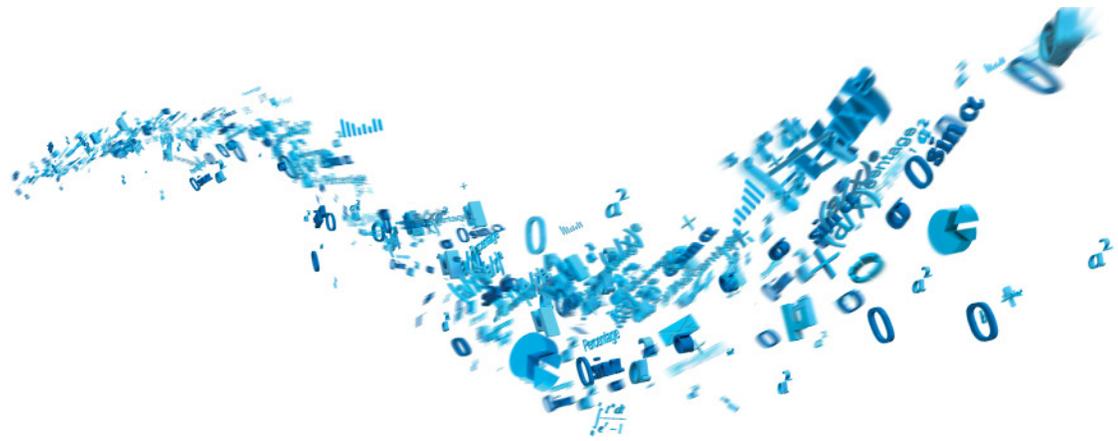
State Cash Balance Plan

- Actuarial assumptions effective with the January 1, 2016 valuation:
 - Valuation Rate of Interest = 7.75%
 - Inflation = 3.25%
 - Interest Crediting Rate = 6.75%
 - Salary Scale = assumed to increase 4.00% per year
 - Actuarial Value of Assets: smooth gains/losses relative to expected valuation rate of interest over 5 years
 - All other assumptions as documented in the “State Employees’ Retirement System Cash Balance Benefit Fund Actuarial Valuation Report as of January 1, 2016”
- Plan Provisions
 - The Plan’s interest crediting rate is the greater of (a) 5.00% or (b) the applicable federal mid-term rate plus 1.50%
 - Granting of dividends, contingent upon the financial health of the plan, is voluntary and has therefore not been factored into this analysis
- Actuarially Determined Contribution Calculation = Normal Cost plus a level dollar amortization of the unfunded liability with layered 25 year, closed periods
- Contributions:
 - Member = 4.80% of annual compensation
 - Employer = 156% of the members’ contributions (or 7.49%)
 - State = the State makes any additional contributions that are necessary each year to pay the excess of the normal cost plus an amortization payment to fund unfunded actuarial accrued liability bases, over member and employer contributions

Actuarial Assumptions and Methods

County Cash Balance Plan

- Actuarial assumptions effective with the January 1, 2016 valuation:
 - Valuation Rate of Interest = 7.75%
 - Inflation = 3.25%
 - Interest Crediting Rate = 6.75%
 - Salary Scale = assumed to increase 4.30% per year
 - Actuarial Value of Assets: smooth gains/losses relative to expected valuation rate of interest over 5 years
 - All other assumptions as documented in the “County Employees’ Retirement System Cash Balance Benefit Fund Actuarial Valuation Report as of January 1, 2016”
- Plan Provisions
 - The Plan’s interest crediting rate is the greater of (a) 5.00% or (b) the applicable federal mid-term rate plus 1.50%
 - Granting of dividends, contingent upon the financial health of the plan, is voluntary and has therefore not been factored into this analysis
- Actuarially Determined Contribution Calculation = Normal Cost plus a level dollar amortization of the unfunded liability with layered 25 year, closed periods
- Contributions:
 - Member = 4.50% of annual compensation; Commissioned law enforcement personnel contribute an additional 1.00-2.00% based on county population
 - Employer = 150% of the members’ contributions; Participating counties will match the additional contributions made by commissioned law enforcement personnel
 - State = the State makes any additional contributions that are necessary each year to pay the excess of the normal cost plus an amortization payment to fund unfunded actuarial accrued liability bases, over member and employer contributions



Appendix

- Capital Market Assumptions

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AHIC Capital Market Assumptions—Q2 2016 (30 Years)

	Expected Real Return ¹	Expected Nominal Return ¹	Expected Nominal Volatility
Equity			
1 Large Cap U.S. Equity	4.3%	6.5%	17.0%
2 Small Cap U.S. Equity	4.8%	7.0%	23.5%
3 Global Equity IMI	5.1%	7.3%	19.0%
4 International Equity (Developed)	5.2%	7.4%	20.5%
5 Emerging Markets Equity	5.4%	7.6%	30.5%
Fixed Income			
6 Cash (Govt)	0.2%	2.3%	2.0%
7 Cash (LIBOR)	0.5%	2.6%	2.0%
8 TIPS	1.0%	3.1%	4.5%
9 Core Fixed Income	1.2%	3.3%	5.0%
10 Short Govt Bonds (2-Year Duration)	0.2%	2.3%	2.0%
11 Short Corporate Bonds (2-Year Duration)	1.0%	3.1%	2.5%
12 Intermediate Govt Bonds (4-Year Duration)	0.4%	2.5%	3.5%
13 Intermediate Corporate Bonds (4-Year Duration)	1.4%	3.5%	4.5%
14 Long Duration Bonds – Govt / Credit	1.7%	3.8%	13.0%
15 Long Duration Bonds – Credit	2.3%	4.4%	14.5%
16 Long Duration Bonds – Govt	1.0%	3.1%	12.5%
17 25-year Government Bond	0.8%	2.9%	20.5%
18 High Yield Bonds	4.3%	6.5%	12.0%
19 Bank Loans	2.3%	4.4%	7.5%
20 Non-US Developed Bond (0% Hedged)	0.3%	2.4%	11.0%
21 Non-US Developed Bond (50% Hedged)	0.5%	2.6%	6.5%
22 Non-US Developed Bond (100% Hedged)	0.6%	2.7%	4.0%
23 Emerging Market Bonds	2.9%	5.1%	13.5%
24 Emerging Market Bonds (Corporate USD)	3.5%	5.7%	11.5%
25 Emerging Market Bonds (Sov. Local)	3.9%	6.1%	14.5%
26 Multi-Asset Credit	4.5%	6.7%	9.5%
Alternatives			
27 Hedge Funds Universe ²	1.7%	3.8%	9.5%
28 Hedge Funds Buy List ²	2.9%	5.1%	9.5%
29 Direct Hedge Funds ³	3.1%	5.3%	9.5%
30 Real Estate (Broad Market)	4.0%	6.2%	12.5%
31 Core Real Estate	3.3%	5.5%	11.5%
32 Global REITs	4.2%	6.4%	19.0%
33 Commodities	2.5%	4.7%	17.0%
34 Private Equity	6.6%	8.8%	24.5%
35 Infrastructure	4.8%	7.0%	14.5%
36 Insurance Linked Securities	2.4%	4.6%	7.0%
37 Equity Insurance Risk Premium - High Beta	4.0%	6.2%	11.0%
38 Equity Insurance Risk Premium - Low Beta	3.6%	5.8%	6.0%
Inflation			
39 Inflation	0.0%	2.1%	1.5%

¹ All expected returns are geometric (long-term compounded; rounded to the nearest decimal) and net of investment fees.

² Represents diversified portfolio of Fund of funds investments (includes additional layer of fees at the FoF level).

³ Represents diversified portfolio of Direct hedge fund investments.

AHIC Capital Market Assumptions—Q2 2016 (30 Years)

Nominal Correlations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
1 Large Cap U.S. Equity	1.00	0.92	0.95	0.79	0.72	0.08	0.08	-0.06	0.06	0.04	0.11	-0.05	0.11	-0.01	0.09	-0.11	-0.12	0.62	0.43	-0.03	-0.02	0.02	0.44	0.41	0.48	0.59	0.72	0.59	0.71	0.40	0.39	0.66	0.31	0.69	0.38	0.02	0.91	0.49	0.05
2 Small Cap U.S. Equity	0.92	1.00	0.90	0.73	0.67	0.07	0.07	-0.06	0.05	0.02	0.09	-0.05	0.10	-0.01	0.08	-0.11	-0.12	0.58	0.40	-0.02	-0.02	0.01	0.40	0.38	0.42	0.54	0.66	0.54	0.65	0.38	0.36	0.61	0.27	0.64	0.36	0.02	0.84	0.44	0.04
3 Global Equity IMI	0.95	0.90	1.00	0.92	0.84	0.07	0.07	-0.05	0.07	0.03	0.10	-0.05	0.11	0.00	0.09	-0.11	-0.12	0.67	0.45	0.17	0.15	0.02	0.49	0.46	0.57	0.65	0.69	0.58	0.69	0.41	0.39	0.64	0.38	0.67	0.37	0.02	0.87	0.46	0.07
4 International Equity (Developed)	0.79	0.73	0.92	1.00	0.75	0.04	0.04	-0.04	0.06	0.01	0.07	-0.05	0.09	0.00	0.08	-0.09	-0.10	0.60	0.40	0.41	0.36	0.00	0.44	0.43	0.61	0.61	0.60	0.50	0.59	0.37	0.36	0.54	0.42	0.56	0.32	0.02	0.73	0.38	0.08
5 Emerging Markets Equity	0.72	0.67	0.84	0.75	1.00	0.06	0.06	-0.04	0.07	0.03	0.09	-0.04	0.11	0.01	0.09	-0.10	-0.11	0.68	0.39	0.19	0.17	0.03	0.50	0.47	0.54	0.63	0.52	0.43	0.51	0.34	0.32	0.49	0.30	0.53	0.30	0.02	0.66	0.35	0.06
6 Cash (Gov't)	0.08	0.07	0.07	0.04	0.06	1.00	0.99	0.45	0.50	0.93	0.80	0.66	0.52	0.22	0.19	0.24	0.16	0.14	0.04	0.14	0.32	0.66	0.16	0.08	0.00	0.09	-0.03	-0.03	-0.03	0.14	0.15	0.08	0.22	0.09	0.11	0.29	0.17	0.37	0.54
7 Cash (LIBOR)	0.08	0.07	0.07	0.04	0.06	0.99	1.00	0.45	0.50	0.92	0.80	0.66	0.53	0.22	0.19	0.24	0.16	0.14	0.05	0.14	0.31	0.65	0.16	0.08	0.01	0.10	-0.03	-0.03	-0.03	0.13	0.15	0.08	0.22	0.09	0.11	0.30	0.17	0.36	0.53
8 TIPS	-0.06	-0.06	-0.05	-0.04	-0.04	0.45	0.45	1.00	0.46	0.57	0.49	0.55	0.44	0.25	0.22	0.27	0.19	0.09	-0.08	0.08	0.14	0.25	0.12	0.03	-0.03	0.02	-0.12	-0.10	-0.12	0.01	0.02	-0.03	0.18	-0.04	0.00	0.13	-0.01	0.12	0.42
9 Core Fixed Income	0.06	0.05	0.07	0.06	0.07	0.50	0.50	0.46	1.00	0.69	0.76	0.87	0.95	0.84	0.85	0.75	0.85	0.33	0.09	0.20	0.38	0.64	0.49	0.22	0.12	0.26	0.05	0.04	0.05	0.08	0.09	0.06	0.08	0.06	0.06	0.15	0.11	0.20	0.17
10 Short Gov't Bonds (2-Year Duration)	0.04	0.02	0.03	0.01	0.03	0.93	0.92	0.57	0.69	1.00	0.86	0.87	0.67	0.38	0.32	0.41	0.29	0.13	-0.08	0.16	0.35	0.68	0.20	0.08	0.00	0.06	-0.12	-0.10	-0.12	0.11	0.12	0.05	0.21	0.05	0.08	0.27	0.12	0.32	0.51
11 Short Corporate Bonds (2-Year Duration)	0.11	0.09	0.10	0.07	0.09	0.80	0.80	0.49	0.76	0.86	1.00	0.74	0.86	0.40	0.42	0.35	0.24	0.29	0.20	0.16	0.34	0.65	0.37	0.19	0.09	0.25	0.07	0.05	0.06	0.13	0.14	0.09	0.18	0.10	0.11	0.24	0.18	0.31	0.42
12 Intermediate Gov't Bonds (4-Year Duration)	-0.05	-0.05	-0.05	-0.05	-0.04	0.66	0.66	0.55	0.87	0.87	0.74	1.00	0.77	0.70	0.61	0.75	0.63	0.05	-0.28	0.19	0.36	0.65	0.23	0.04	-0.02	-0.04	-0.22	-0.19	-0.22	0.04	0.05	-0.02	0.12	-0.03	0.02	0.20	0.02	0.20	0.29
13 Intermediate Corporate Bonds (4-Year Duration)	0.11	0.10	0.11	0.09	0.11	0.52	0.53	0.44	0.95	0.67	0.86	0.77	1.00	0.69	0.74	0.57	0.47	0.39	0.26	0.18	0.35	0.62	0.53	0.27	0.15	0.35	0.15	0.12	0.15	0.10	0.11	0.09	0.10	0.10	0.09	0.16	0.15	0.22	0.22
14 Long Duration Bonds - Gov't / Credit	-0.01	-0.01	0.00	0.00	0.01	0.22	0.22	0.25	0.84	0.38	0.40	0.70	0.69	1.00	0.96	0.95	0.92	0.14	-0.11	0.18	0.31	0.52	0.37	0.11	0.06	0.09	-0.04	-0.03	-0.04	0.02	0.02	0.00	-0.02	0.00	0.01	0.07	0.02	0.07	-0.08
15 Long Duration Bonds - Credit	0.09	0.08	0.09	0.08	0.09	0.19	0.19	0.22	0.85	0.32	0.42	0.61	0.74	0.96	1.00	0.83	0.81	0.35	0.17	0.30	0.50	0.51	0.24	0.15	0.13	0.11	0.13	0.06	0.06	0.06	0.00	0.07	0.05	0.06	0.10	0.11	-0.07		
16 Long Duration Bonds - Gov't	-0.11	-0.11	-0.11	-0.09	-0.10	0.24	0.24	0.27	0.75	0.41	0.35	0.75	0.57	0.85	0.83	1.00	0.97	-0.12	-0.38	0.17	0.30	0.50	0.16	-0.04	-0.06	-0.16	-0.23	-0.19	-0.23	-0.03	-0.03	-0.07	-0.03	-0.09	-0.04	0.08	-0.08	0.03	-0.08
17 25-year Government Bond	-0.12	-0.12	-0.12	-0.10	-0.11	0.16	0.16	0.19	0.65	0.29	0.24	0.63	0.47	0.92	0.81	0.97	1.00	-0.15	-0.36	0.15	0.28	0.44	0.13	-0.06	-0.07	-0.17	-0.22	-0.18	-0.21	-0.05	-0.04	-0.08	-0.06	-0.10	-0.05	0.05	-0.09	0.00	-0.14
18 High Yield Bonds	0.62	0.58	0.67	0.60	0.68	0.14	0.14	0.09	0.33	0.13	0.29	0.05	0.39	0.14	0.35	-0.12	-0.15	1.00	0.73	0.19	0.20	0.19	0.73	0.62	0.57	0.90	0.65	0.54	0.65	0.28	0.27	0.42	0.38	0.47	0.27	0.04	0.58	0.33	0.19
19 Bank Loans	0.43	0.40	0.45	0.40	0.39	0.04	0.05	-0.08	0.09	-0.08	0.20	-0.28	0.26	-0.11	0.13	-0.38	-0.36	0.73	1.00	0.08	0.08	0.03	0.41	0.54	0.43	0.79	0.69	0.57	0.68	0.19	0.18	0.29	0.17	0.31	0.19	0.02	0.40	0.21	0.09
20 Non-US Developed Bond (0% Hedged)	-0.03	-0.02	0.17	0.41	0.19	0.14	0.14	0.08	0.20	0.16	0.16	0.19	0.18	0.18	0.17	0.17	0.15	0.19	0.08	1.00	0.96	0.30	0.22	0.21	0.51	0.28	0.02	0.02	0.02	0.01	0.01	-0.02	0.43	0.00	0.02	0.04	-0.01	0.03	0.15
21 Non-US Developed Bond (50% Hedged)	-0.02	-0.02	0.15	0.36	0.17	0.32	0.31	0.14	0.36	0.35	0.34	0.36	0.35	0.31	0.30	0.30	0.26	0.20	0.08	0.96	1.00	0.56	0.27	0.22	0.46	0.28	0.01	0.01	0.01	0.03	0.03	-0.01	0.40	0.01	0.03	0.10	0.02	0.10	0.21
22 Non-US Developed Bond (100% Hedged)	0.02	0.01	0.02	0.00	0.03	0.66	0.65	0.25	0.64	0.68	0.65	0.65	0.62	0.52	0.50	0.50	0.44	0.13	0.03	0.30	0.56	1.00	0.27	0.12	0.07	0.12	-0.02	-0.02	-0.02	0.07	0.08	0.03	0.11	0.02	0.06	0.19	0.08	0.23	0.26
23 Emerging Market Bonds	0.44	0.40	0.49	0.44	0.50	0.16	0.16	0.12	0.49	0.20	0.37	0.23	0.53	0.37	0.51	0.16	0.13	0.73	0.41	0.22	0.27	0.27	1.00	0.70	0.61	0.75	0.53	0.44	0.52	0.20	0.20	0.30	0.21	0.32	0.19	0.05	0.42	0.26	0.09
24 Emerging Market Bonds (Corporate USD)	0.41	0.38	0.46	0.43	0.47	0.08	0.08	0.03	0.22	0.08	0.19	0.04	0.27	0.11	0.24	-0.04	-0.06	0.62	0.54	0.21	0.22	0.12	0.70	1.00	0.60	0.73	0.57	0.47	0.57	0.17	0.17	0.27	0.25	0.28	0.17	0.03	0.38	0.22	0.08
25 Emerging Market Bonds (Gov. Local)	0.48	0.42	0.57	0.61	0.54	0.00	0.01	-0.03	0.12	0.00	0.09	-0.02	0.15	0.06	0.15	-0.06	-0.07	0.57	0.43	0.51	0.46	0.07	0.61	0.60	1.00	0.74	0.49	0.41	0.49	0.12	0.11	0.29	0.44	0.20	0.13	0.01	0.42	0.22	0.02
26 Multi-Asset Credit	0.59	0.54	0.65	0.61	0.63	0.09	0.10	0.02	0.26	0.06	0.25	-0.04	0.35	0.09	0.29	-0.16	-0.17	0.90	0.79	0.28	0.28	0.12	0.75	0.73	0.74	1.00	0.70	0.58	0.69	0.24	0.23	0.39	0.37	0.39	0.24	0.03	0.54	0.30	0.13
27 Hedge Funds Universe ¹	0.72	0.66	0.69	0.60	0.52	-0.03	-0.03	-0.12	0.05	-0.12	0.07	-0.22	0.15	-0.04	0.13	-0.23	-0.22	0.65	0.69	0.02	0.01	-0.02	0.53	0.57	0.49	0.70	1.00	0.77	0.99	0.28	0.27	0.47	0.28	0.49	0.27	-0.01	0.66	0.32	0.02
28 Hedge Funds Buy List ¹	0.59	0.54	0.58	0.50	0.43	-0.03	-0.03	-0.10	0.04	-0.10	0.05	-0.19	0.12	-0.03	0.11	-0.19	-0.18	0.54	0.57	0.02	0.01	-0.02	0.44	0.47	0.41	0.58	0.77	1.00	0.76	0.23	0.22	0.39	0.22	0.41	0.23	-0.01	0.54	0.26	0.01
29 Direct Hedge Funds ¹	0.71	0.65	0.69	0.59	0.51	-0.03	-0.03	-0.12	0.05	-0.12	0.06	-0.22	0.15	-0.04	0.13	-0.23	-0.21	0.65	0.68	0.02	0.01	-0.02	0.52	0.57	0.49	0.69	0.99	0.76	1.00	0.28	0.27	0.46	0.27	0.48	0.27	-0.01	0.65	0.32	0.02
30 Real Estate (Broad Market) ²	0.40	0.38	0.41	0.37	0.34	0.14	0.13	0.01	0.																														

Explanation of Capital Market Assumptions—Q2 2016 (30 Years)

The following capital market assumptions were developed by Aon Hewitt's Global Asset Allocation Team and represent the long-term capital market outlook (i.e., 30 years) based on data at the end of the first quarter of 2016. The assumptions were developed using a building block approach, reflecting observable inflation and interest rate information available in the fixed income markets as well as Consensus Economics forecasts. Our long-term assumptions for other asset classes are based on historical results, current market characteristics, and our professional judgment.

Inflation – Expected Level (2.1%)

Based on Consensus Economics long-term estimates and our near-term economic outlook, we expect U.S. consumer price inflation to be approximately 2.1% during the next 30 years.

Real Returns for Asset Classes

Fixed Income

- **Cash (0.2%)** – Over the long run, we expect the real yield on cash and money market instruments to produce a real return of 0.2% in a moderate- to low-inflationary environment.
- **TIPS (1.0%)** – We expect intermediate duration Treasury Inflation-Protected Securities to produce a real return of about 1.0%.
- **Core Fixed Income (i.e., Market Duration) (1.2%)** – We expect intermediate duration Treasuries to produce a real return of about 0.4%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 0.8%, resulting in a long-term real return of 1.2%.
- **Long Duration Bonds – Government and Credit (1.7%)** – We expect Treasuries with a duration comparable to the Long Government Credit Index to produce a real return of 1.0%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 0.7%, resulting in an expected real return of 1.7%.

Explanation of Capital Market Assumptions—Q2 2016 (30 Years)

- **Long Duration Bonds – Credit (2.3%)** – We expect Treasuries with a duration comparable to the Long Credit Index to produce a real return of 1.0%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 1.3%, resulting in an expected real return of 2.3%.
- **Long Duration Bonds – Government (1.0%)** – We expect Treasuries with a duration of ~12 years to produce a real return of 1.0% during the next 30 years.
- **High Yield Bonds (4.3%)** – We expect intermediate duration Treasuries to produce a real return of about 0.4%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 3.9%, resulting in an expected real return of 4.3%.
- **Bank Loans (2.3%)** – We expect LIBOR to produce a real return of about 0.5%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults) to be 1.8%, resulting in an expected real return of 2.3%.
- **Non-US Developed Bonds: 50% Hedged (0.5%)** – We forecast real returns for non-US developed market bonds to be 0.5% over a 30-year period after adjusting for a 50% currency hedge. We assume a blend of one-third investment grade corporate bonds and two-thirds government bonds. We also produce assumptions for 0% hedged and 100% hedged non-US developed bonds.
- **Emerging Market Bonds (Sovereign; USD) (2.9%)** – We forecast real returns for emerging market sovereign bonds denominated in USD to be 2.9% over a 30-year period.
- **Emerging Market Bonds (Corporate; USD) (3.5%)** – We forecast real returns for emerging market corporate bonds denominated in USD to be 3.5% over a 30-year period.
- **Emerging Market Bonds (Sovereign; Local) (3.9%)** – We forecast real returns for emerging market sovereign bond denominated in local currency to be 3.9% over a 30-year period.
- **Multi Asset Credit (MAC) (4.5%)** – We assume nominal returns from beta exposure to high yield, bank loans and emerging market debt to add 5.7% plus 1.0% from alpha (net of fees) over a 30-year period.

Explanation of Capital Market Assumptions—Q2 2016 (30 Years)

Equities

- **Large Cap U.S. Equity (4.3%)** – This assumption is based on our 30-year outlook for large cap U.S. company dividends and real earnings growth. Adjustments are made for valuations as needed.
- **Small Cap U.S. Equity (4.8%)** – Adding a 0.5% return premium for small cap U.S. equity over large cap U.S. equity results in an expected real return of 4.8%. This return premium is theoretically justified by the higher risk inherent in small cap U.S. equity versus large cap U.S. equity, and is also justified by historical data. In recent years, higher small cap valuations relative large cap equity has reduced the small cap premium.
- **Global Equity (Developed & Emerging Markets) (5.0%)** – We employ a building block process similar to the U.S. equity model using the developed and emerging markets that comprise the MSCI All-Country World Index. Our roll-up model produces an expected real return of 5.0% for global equity.
- **International (Non-U.S.) Equity, Developed Markets (5.2%)** – We employ a building block process similar to the U.S. equity model using the non-U.S. developed equity markets that comprise the MSCI EAFE Index.
- **Emerging Market Stocks (5.4%)** - We employ a building block process similar to the U.S. equity model using the non-U.S. emerging equity markets that comprise the MSCI Emerging Markets Index.
- **Equity Risk Insurance Premium Strategies- High Beta (4.1%)** – We expect nominal returns from insurance equity risk premium to average 4.5% plus 2.0% from cash & dividends over the next 30 years.

Alternative Asset Classes

- **Hedge Fund-of-Funds Universe (1.7%)** – The generic category “hedge funds” encompasses a wide range of strategies accessed through “fund-of-funds” vehicles. We also assume the *median* manager is selected and also allow for the additional costs associated with Fund-of-Funds management. A top-tier portfolio of funds (hedge fund-of-funds buy-list) could add an additional 1.1% in return at similar volatility based on alpha, lower fees and better risk management.

Explanation of Capital Market Assumptions—Q2 2016 (30 Years)

- **Hedge Fund-of-Funds Buy List (2.9%)** – The generic category of top-tier “hedge funds” encompasses a wide range of strategies accessed through “fund-of-funds” vehicles. We assume additional costs associated with Funds-of-Funds management. To use this category the funds must be buy rated or we advise on manager selection.
- **Broad Hedge Funds (3.1%)** – Represents a diversified portfolio of direct hedge fund investments. This investment will tend to be less diversified than a typical “fund-of-funds” strategy as there will be fewer underlying managers and will not include the extra layer of fees found in a Fund-of-Funds structure.
- **Broad Hedge Funds Buy List (4.4%)** – Represents a diversified portfolio of top-tier direct hedge fund investments. This investment will tend to be less diversified than a typical “fund-of-funds” strategy as there will be fewer underlying managers and will not include the extra layer of fees found in a Fund-of-Funds structure. To use this category the funds must be buy rated or we advise on manager selection.
- **Real Estate (4.0%)** – Our real return assumption for broad real estate market is based on a gross income of about 6.0%, management fees of roughly 2%, and future capital appreciation near the rate of inflation during the next 30 years. We assume a portfolio of equity real estate holdings that is diversified by property type and by geographic region.
- **Core Real Estate (3.3%)** – Our real return assumption for core real estate is based on a gross income of about 5.3%, management fees of roughly 2%, and future capital appreciation near the rate of inflation during the next 30 years. We assume a portfolio of equity real estate holdings that is diversified by property type and geographic region.
- **U.S. REITs (4.2%)** – Our real return assumption for U.S. REITs is based on income of 4.2% and future capital appreciation near the rate of inflation over the next 30 years. REITs are a sub-set of the U.S. small/mid cap equities.
- **Commodities (2.5%)** – Our commodity assumption is for a diversified portfolio of commodity futures contracts. Commodity futures returns are composed of three parts: spot price appreciation, collateral return, and roll return (positive or negative change implied by the shape of the future curve). We believe that spot prices will converge with CPI over the long run (i.e., 2.1%). Collateral is assumed to be LIBOR cash 0.5%. Also, we believe the roll effect will be near zero, resulting in a real return of approximately 2.5% for commodities.

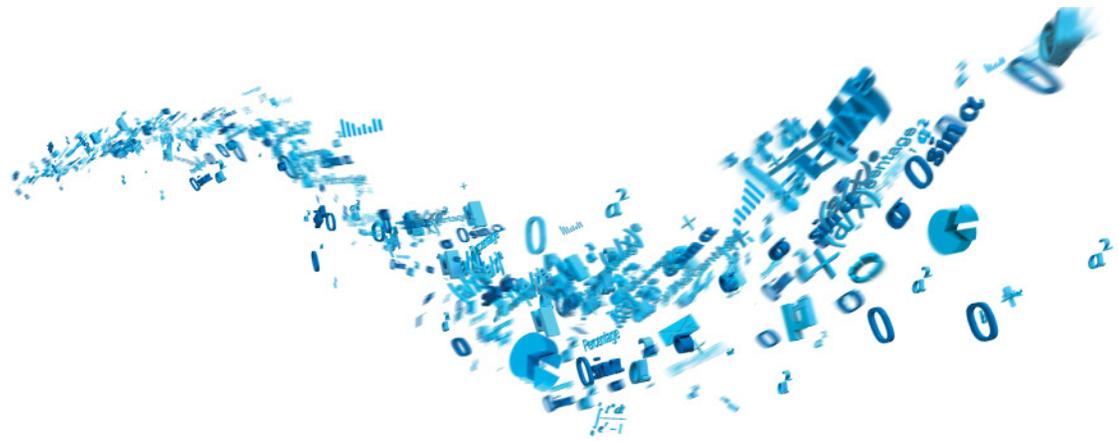
Explanation of Capital Market Assumptions—Q2 2016 (30 Years)

- **Private Equity (6.6%)** – Our private equity assumption reflects a diversified fund of funds with exposure to buyouts, venture capital, distressed debt, and mezzanine debt.
- **Infrastructure (4.8%)** – Our infrastructure assumption is formulated using a cash flow based approach that projects cash flows (on a diversified portfolio of assets) over a 30 year period. Income and capital growth as well as gearing levels, debt costs and terms, relevant tax and management expenses are all taken into consideration. Our approach produces an expected real return of 4.8% for infrastructure.
- **Equity Risk Insurance Premium Strategies- Low Beta (3.6%)** – We assume nominal returns from cash of 2.3% + 3.5% from alpha.

Volatility / Correlation Assumptions

Assumed volatilities are formulated with reference to implied volatilities priced into option contracts of various terms, as well as with regard to historical volatility levels. For asset classes which are not marked to market (for example real estate), we “de-smooth” historical returns before calculating volatilities. Importantly, we consider expected volatility trends in the future – in recent years we assumed the re-emergence of an economic cycle and a loss of confidence in central bankers would lead to an increase in volatility. Correlation assumptions are generally similar to actual historical results; however, we do make adjustments to reflect our forward-looking views as well as current market fundamentals.

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Appendix

- Horizon Survey of Capital Market Assumptions

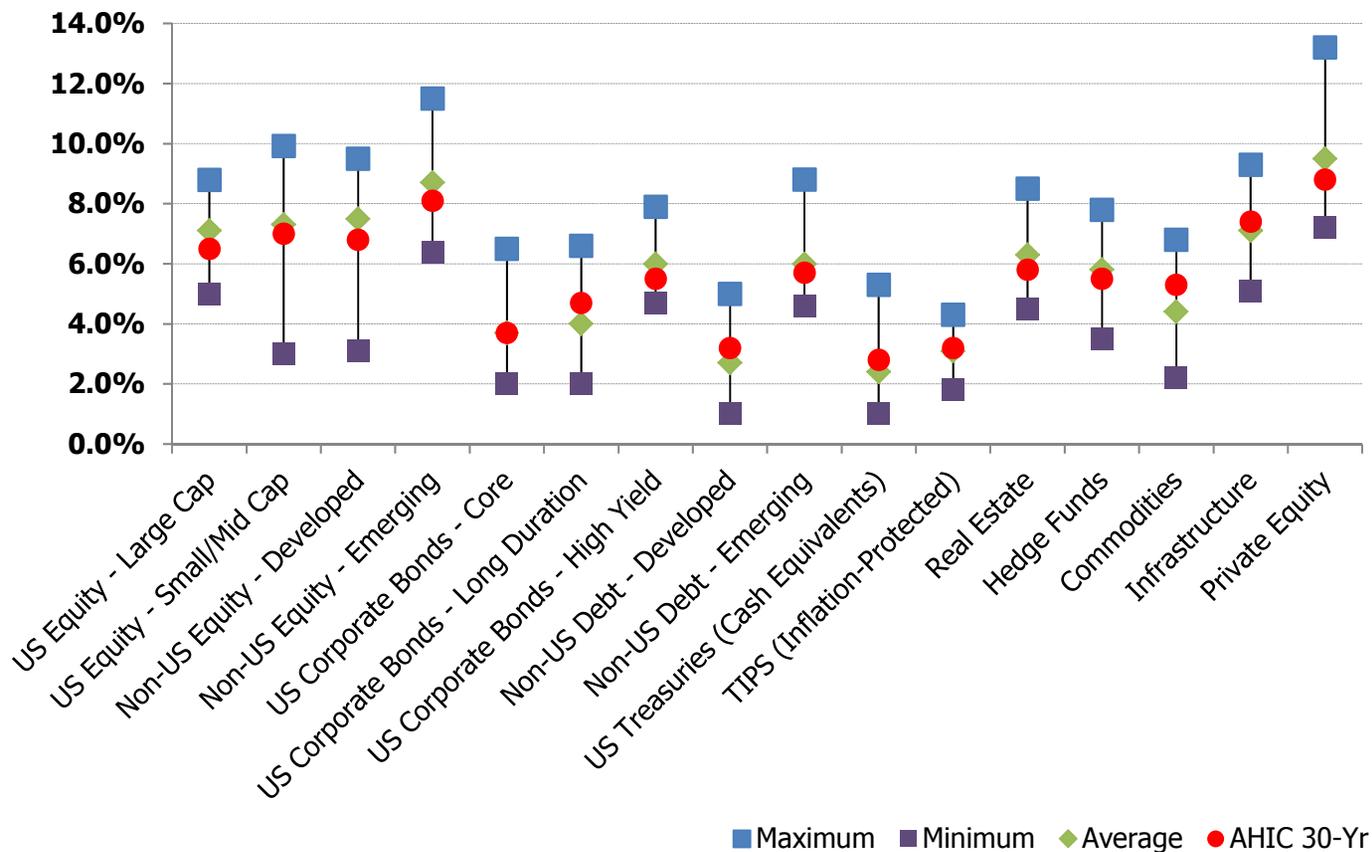
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Capital Market Assumption Overview

- We have what we consider a consistent and conservative approach to modeling asset class returns, risk, and correlations
- AHIC regularly reviews these critical inputs relative to peer consultants as well as the investment management community
- The following slides include a review of 2015 assumptions relative to a study of peer averages
 - AHIC is often more conservative from an expected return standpoint than the peer average
 - While we do not seek to change our approach based on how we stack up to peers, it is a helpful double-check to make sure we are not too far off from others in the industry

Ask 29 Consultants and...

Expected Geometric Returns by Asset Class



SOURCE: Horizon Actuarial survey of 2015 capital market assumptions from 29 independent investment advisors
 Expected returns of the survey are annualized over 10-20 years (geometric). Returns are 'blended,' using 10-year assumptions when 20-year assumptions are not available.
 AHIC expected returns are annualized over 30-years.

Reasons for Differences

- Methodology
- Time Horizon
- Arithmetic vs. Geometric forecasts*
- Alpha (active management)*
- Inflation
- Investment Fees
- Asset class definition

* While some firms in Horizon survey responded with Arithmetic forecasts, the results have been converted to Geometric forecasts for comparison purposes. Additionally, the return expectations included in the Horizon survey are based on indexed returns (no "alpha"). However, AHIC return assumptions for certain asset classes include "alpha" or active management premium (e.g., Private Equity and Hedge Funds)

Leading Methodologies

- Building Block
- Global Capital Asset Pricing Model (Global CAPM)
- Surveys
- Historical data (as a guide to future)
- Black-Litterman (combination of building block and CAPM)

AHIC Capital Market Assumptions

- Long-term (10 and 30 year forecasts) forward-looking assumptions (asset class geometric return, volatility and correlations)
- Building Block approach. Primarily based on consensus expectations and market based inputs
- Best estimates of annualized returns (50/50 better or worse)
- Market returns: no active management value added (other than hedge funds and private equity)
- Net of investment fees

AHIC Versus Peers (2015 Horizon Survey)

Asset Class	Horizon Survey				AHIC			
	Expected Geometric Returns			Expected Risk	10 Year Forecasts		30 Year Forecasts	
	Maximum	Minimum	Average	Average	Expected Return	Expected Risk	Expected Return	Expected Risk
US Equity - Large Cap	8.8%	5.0%	7.1%	17.1%	6.5%	17.0%	6.5%	17.5%
US Equity - Small/Mid Cap	9.9%	3.0%	7.3%	21.0%	6.7%	23.0%	7.0%	23.5%
Non-US Equity - Developed	9.5%	3.1%	7.5%	19.6%	6.9%	20.0%	6.8%	20.5%
Non-US Equity - Emerging	11.5%	6.4%	8.7%	26.6%	8.0%	30.0%	8.1%	30.5%
US Fixed Income - Core	6.5%	2.0%	3.7%	5.6%	2.9%	4.0%	3.7%	5.0%
US Fixed Income - Long Duration Corp	6.6%	2.0%	4.0%	10.8%	4.4%	11.5%	4.7%	13.5%
US Fixed Income - High Yield	7.9%	4.7%	6.0%	11.2%	4.7%	12.0%	5.5%	12.0%
Non-US Fixed Income - Developed	5.0%	1.0%	2.7%	7.4%	2.3%	5.5%	3.2%	6.5%
Non-US Fixed Income - Emerging	8.8%	4.6%	6.0%	11.7%	4.6%	13.0%	5.7%	13.5%
Treasuries (Cash Equivalents)	5.3%	1.0%	2.4%	2.8%	2.1%	1.0%	2.8%	1.5%
TIPS (Inflation-Protected)	4.3%	1.8%	3.1%	6.3%	2.7%	4.5%	3.2%	4.5%
Real Estate	8.5%	4.5%	6.3%	13.6%	5.8%	11.5%	5.8%	11.5%
Hedge Funds	7.8%	3.5%	5.8%	8.3%	5.0%	9.0%	5.5%	10.0%
Commodities	6.8%	2.2%	4.4%	18.0%	4.5%	17.0%	5.3%	17.0%
Infrastructure	9.3%	5.1%	7.1%	13.1%	7.2%	14.5%	7.4%	14.5%
Private Equity	13.2%	7.2%	9.5%	23.6%	8.8%	24.0%	8.8%	24.5%
Inflation	2.8	1.7	2.2%	1.8%	2.1%	1.0%	2.1%	1.5%

Notes (Horizon Survey):

Source: Horizon Actuarial survey of 2015 capital market assumptions from 29 independent investment advisors

Expected returns are annualized over 10-20 years (geometric). Returns are 'blended,' using 10-year assumptions when 20-year assumptions are not available.

Notes (AHIC Forecasts):

AHIC Forecasts are for Q3 2015

US Equity - Small/Mid Cap forecasts represents AHIC forecasts for US Small Cap

US Fixed Income - Long Duration forecasts represents AHIC forecasts for Long Duration Credit

Non-US Fixed Income - Developed forecasts represents AHIC forecasts for Non-US Fixed Income - Developed (50% Hedged)

Non-US Fixed Income- Emerging forecasts represents AHIC forecasts for Non-US Fixed Income- Emerging Sovereign USD

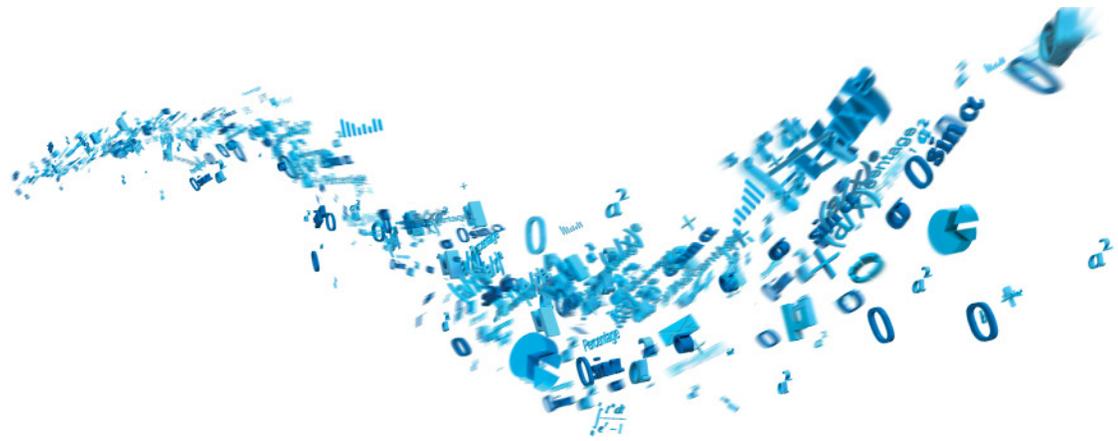
Real Estate forecasts represents AHIC forecasts for Core Private Real Estate

Hedge Funds forecasts represents AHIC forecasts for Hedge Fund-of-Funds

AHIC Versus Peers: Observations

- Compared to 2014, 2015 survey results indicate a decline in return assumptions of both risky assets (equity-like) and fixed income asset classes
 - Equity return assumptions are lower by an average of 0.3%
 - Fixed income return assumptions are lower by an average of 0.3%
 - Alternative asset class return assumptions are lower by an average of 0.4%
- 2015 AHIC assumptions tend to be lower than the survey average
 - AHIC equity assumptions are driven by market valuations, earnings growth expectations and assumed payouts to investors. Recent experience suggests strong equity market performance has been driven more by increasing valuations than increasing profits. As markets have become more expensive, our equity return assumptions have consequently fallen
 - AHIC fixed income assumptions reflect rising yields and steepening of yield curves during the second quarter of 2015
 - AHIC alternative asset class assumptions are generally lower due to methodological and inflation forecast differences compared to survey participant forecasts
- In conclusion, AHIC assumptions appear somewhat more conservative than peers included in the 2015 Horizon Survey of capital market assumptions

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Appendix

- Asset-Liability Management Background

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Asset-Liability Management Background

What is an Asset-Liability Study?

- Provides fiduciaries with an understanding of the dynamic relationship between plan assets and liabilities over time
- Illustrates the impact of various asset allocation targets on required contributions and funded status under a range of different macro-economic scenarios
- Identifies future trends in the financial health of the plan based on economic uncertainties that may not be evident from an actuarial valuation, which provides only a snapshot at a point in time
- Helps determine the level of risk that is appropriate in the context of the Plan's liabilities

An asset-liability study provides the tools to align
a plan's risk taking with its liabilities

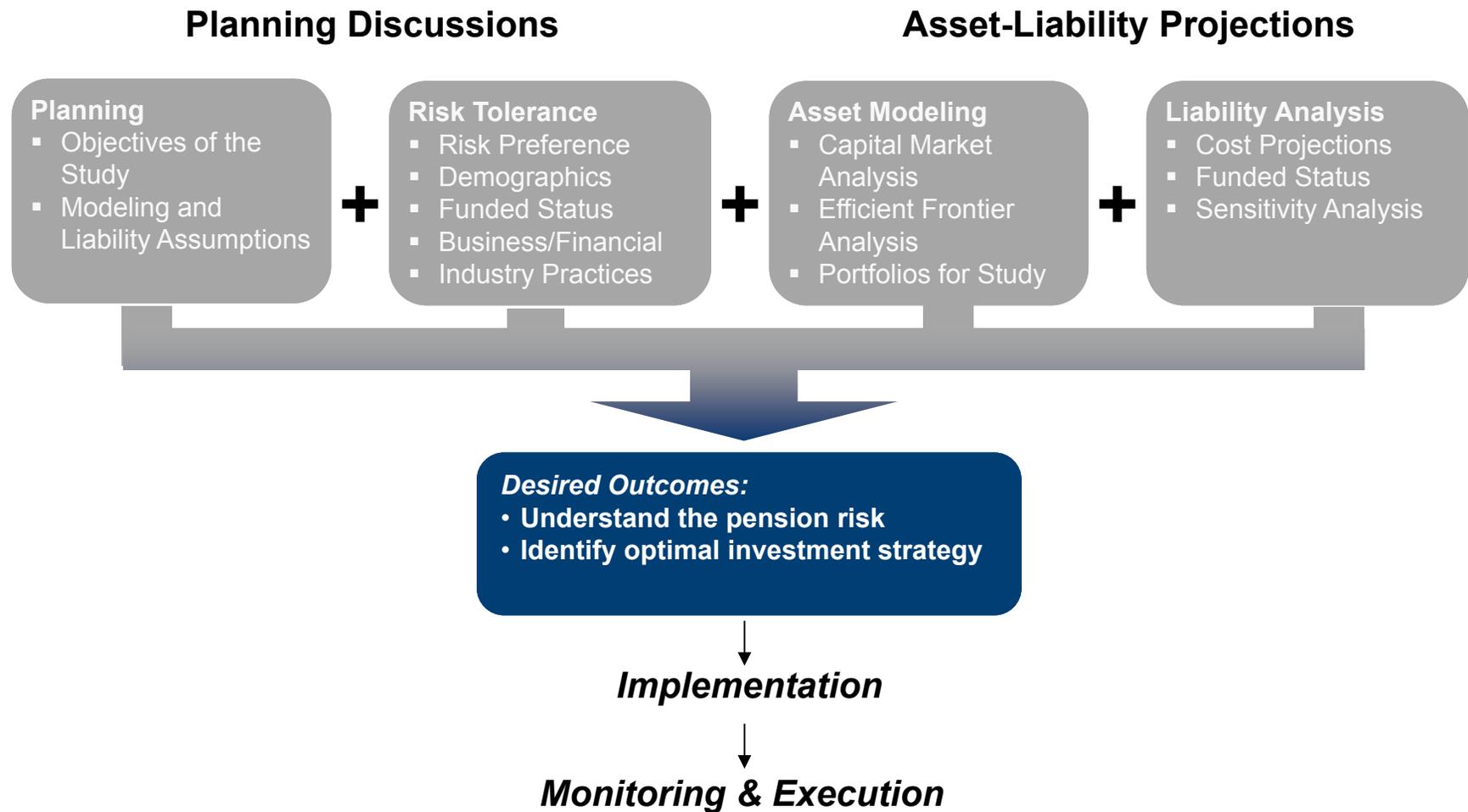
Asset-Liability Management Background

Key Risks for Public Pension Plans

Types of Risk	Time Horizon	Risk Management Tools and Controls
Return Shortfall <ul style="list-style-type: none"> ▪ Assets do not grow with liabilities ▪ Investment return & contribution less than liability growth 	Long-Term (10+ years)	<ul style="list-style-type: none"> ▪ Funding policy ▪ Plan design ▪ Investment policy ▪ Assumptions & methods
Liquidity <ul style="list-style-type: none"> ▪ Cannot liquidate assets efficiently to meet needs ▪ Lose control of asset allocation 	Short- to Medium-Term (<5 years)	<ul style="list-style-type: none"> ▪ Funding policy ▪ Benefit accruals ▪ Use of Illiquid investments ▪ Scenario analysis ▪ Monitoring
Investment <ul style="list-style-type: none"> ▪ Asset allocation (policy) ▪ Investment structure ▪ Manager selection ▪ Rebalancing ▪ Scenario (or path risk) ▪ Factor 	Short-to Medium-Term (<5 years)	<ul style="list-style-type: none"> ▪ Investment policy statement <ul style="list-style-type: none"> – Static/dynamic – Asset allocation – Rebalancing – Manager guidelines – Monitoring/roles & responsibilities ▪ Risk budgeting ▪ Monitoring / dashboards ▪ Medium term views ▪ Regression and scenario analysis

Asset-Liability Management Background

Overview of the Asset-Liability Study Process



Asset-Liability Management Background

Modeling Process

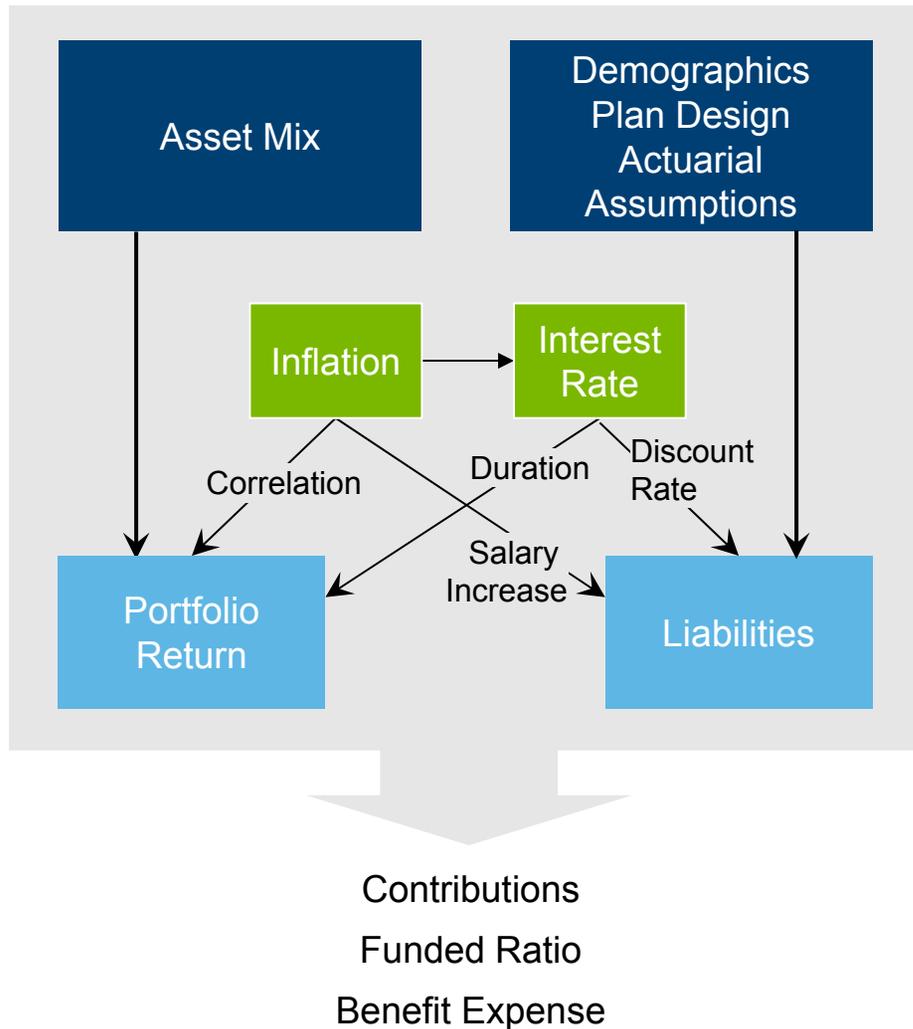
- Goals of an asset-liability study:
 - Understand the pension plan's asset-liability risk, and
 - Identify the optimal investment strategies

- Stochastic, Monte Carlo simulation analysis used
 - 5,000 independent economic trials
 - Building block approach
 - Starts with inflation and interest rates
 - Using a multi-factor regression analysis, other asset classes are then modeled
 - Assets and liabilities are modeled over the projection period
 - Projections include contribution requirements and funded ratios

- Asset-liability studies are best-suited to determine the optimal mix of return-seeking (e.g., equity) and fixed income assets for the pension fund
 - Asset mix is the single most important investment decision for the plan sponsor
 - Is it worthwhile to have a more aggressive allocation in order to reduce long term cost in exchange for risk of higher costs in a bad outcome?
 - Is it worthwhile to have a more conservative allocation in order to have a more predictable cost in exchange for potentially higher average costs?

Asset-Liability Management Background

Mechanics of Asset-Liability Modeling Process



Asset and liability modeling integrated in single platform

- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

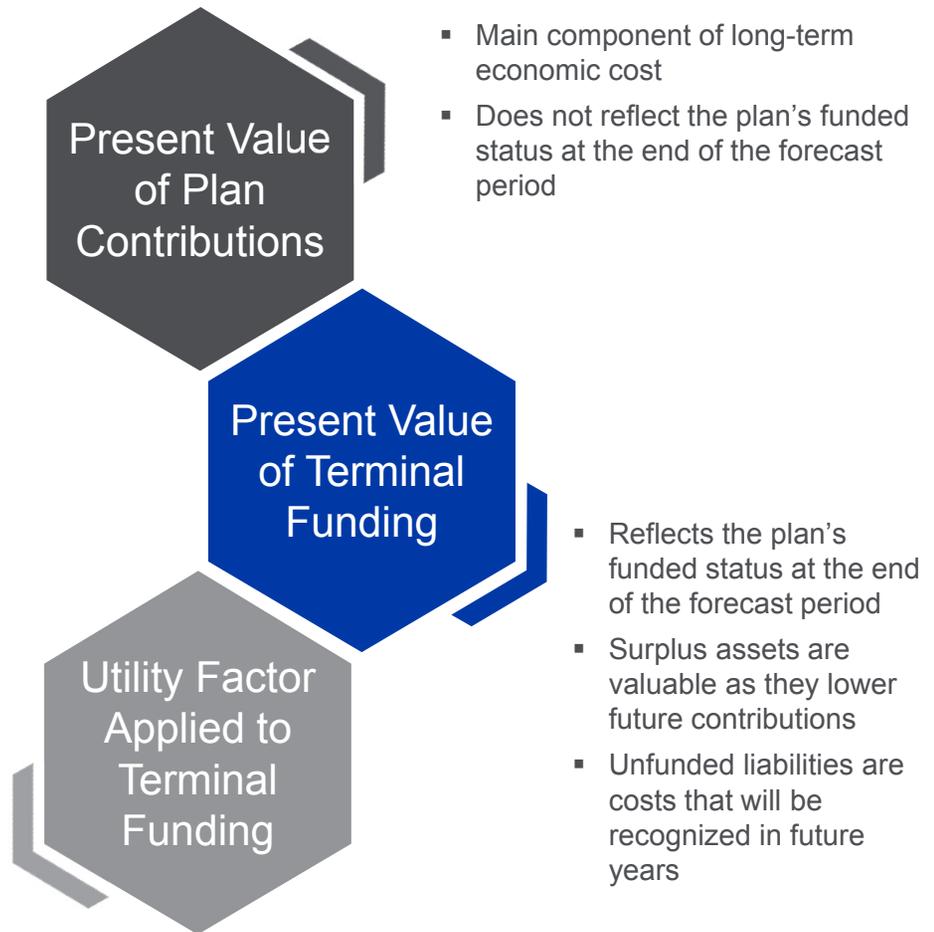
Asset-Liability Management Background

Long-Term Economic Cost of Plan

Long-Term Economic Cost =

- Present Value of Plan Contributions +
- Present Value of Terminal Funding, adjusted by a utility factor

Terminal Funding	Surplus	Shortfall
Utility Rationale	Declining value, or utility, from very high funded ratios	Increasing "pain" as unfunded amounts grow to high levels
Threshold	PVB / AL	(5 Yrs. of Benefit Payments) / AL
Utility Factor above/below threshold	50%	200%



Asset-Liability Management Background

Utility Factor For Terminal Funded Status

- Modest deviations from 100% funding are normal, and no special adjustment is needed for these scenarios – the amount of surplus or unfunded liability can be reflected at its dollar value

- As surplus amounts grow to very high levels, there is a declining value, or utility, to the surplus:
 - Contributions cannot go below zero
 - Long contribution holidays may create a false sense of how much the plan really costs, and lead to confusion when cost levels revert to “normal”
 - Large surplus amounts can become a potential target for non-pension applications

- As unfunded amounts grow to very high levels, there is an increasing amount of “pain” as contributions rise to unacceptable levels:
 - May be viewed as “breaking trust” with future taxpayers
 - Freezing of the pension plan becomes a possibility

Asset-Liability Management Background

Risk and Return in an Asset-Liability Context

- **Traditional:**

- Return = Investment performance
- Risk = Annual volatility of investment gains and losses (e.g. weak/negative capital market returns)

- **Asset-Liability:**

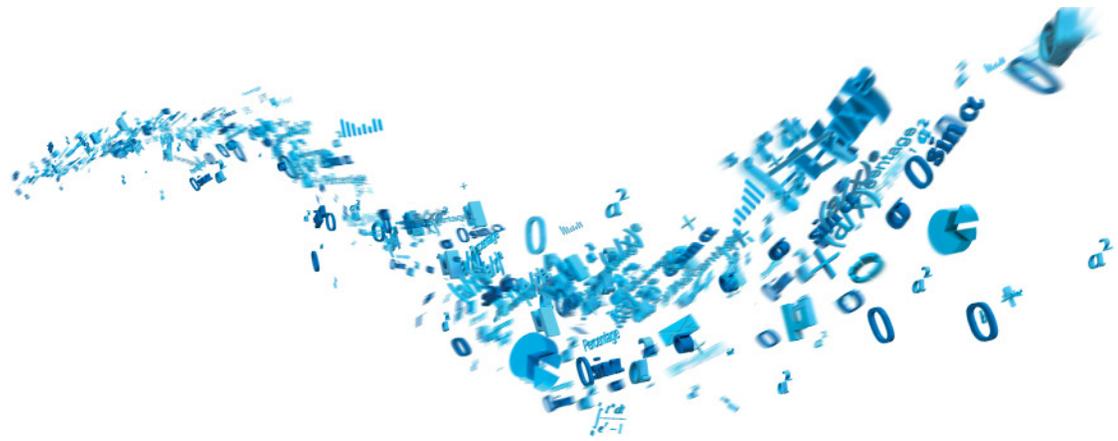
- Return = Potential cost reduction or funded status improvement under average economic conditions
- Risk = During the worst economic conditions, contributions need to increase or funded status declines (e.g., stocks decline, inflation/deflation shocks and/or interest rates decline)

Asset-Liability Management Background

Key Factors Affecting the Risk/Reward Trade-off

- The key take-away from the A/L study is the allocation between equity (“return-seeking”) vs. fixed income (“risk-reducing”)
- Major factors affecting the ultimate mix are:
 - Time horizon (or amortization period of unfunded liability) to fund the liability: a longer time horizon supports more risk taking
 - Characteristics of plan participants: a growing population of active participants supports more risk taking; a mature population with significant retirees might need a more conservative policy
 - Funded status: a less funded plan can utilize additional returns from equity investments
 - Nature of plan benefits: a pension with sensitivity to wage inflation growth can benefit from equities in the long-term; an increased need in liquidity due to significant benefit payments in the near future can have a more conservative policy

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Appendix

- Public Pension Peer Review

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Public Pension Peer Review

Overview

- Public Fund Peer Asset Allocation Comparison
 - Asset allocation should be matched to each defined benefit plan's unique design
 - Peer comparison is meant to inform and not dictate policy

Public Pension Peer Review

NPERS' Asset Allocation versus Public Peers

Asset Allocation	NPERS	Large Public Pension Plans (\$501m-1B)*	Large Public Pension Plans (\$1-5B)*	Large Public Pension Plans (>\$5B)*	Total Public Pension Universe*	Wilshire Report on State Retirement Systems **	AHIC Public Peer Average ***
Equity Exposure							
Global Equity	15.0%	3.2%	3.2%	3.9%	3.8%		45.0%
Total U.S. Equity	29.0%	37.1%	28.5%	24.9%	25.3%	27.9%	
Total Int'l Equity	13.5%	17.1%	16.9%	18.5%	18.4%	21.0%	
Private Markets	5.0%	3.3%	5.4%	8.3%	8.1%	10.1%	12.0%
Total Equity	62.5%	60.7%	54.0%	55.6%	55.6%	59.0%	57.0%
Fixed Income Exposure							
U.S. Fixed Income	20.0%	20.6%	17.7%	20.8%	20.7%	21.4%	
High Yield Bonds / Bank Loans	8.5%						
Non-US Developed Bonds	1.5%	2.5%	4.1%	2.6%	2.7%	2.1%	
Emerging Market Debt	0.0%	0.5%	1.0%	0.7%	0.7%		
Inflation Protected	0.0%						
Total Fixed Income	30.0%	23.6%	22.8%	24.1%	24.1%	23.5%	21.0%
Real Asset Exposure							
US Infrastructure	0.0%						
Commodities	0.0%	1.3%	1.1%	1.2%	1.2%		
Real Estate	7.5%	8.0%	7.0%	8.5%	8.4%	7.2%	
Total Real Assets	7.5%	9.3%	8.1%	9.7%	9.6%	7.2%	12.0%
Hedge Funds / Opportunistic	0.0%	3.0%	7.3%	4.3%	4.4%		8.0%
Multi-Asset / Risk Parity		1.0%	5.0%	1.4%	1.5%		
Money Market / Cash	0.0%	1.0%	0.6%	1.8%	1.8%		2.0%
Other	0.0%	1.5%	2.3%	3.0%	3.0%	10.3%	
Net Other	0.0%	6.5%	15.2%	10.5%	10.7%	10.3%	10.0%
Total	100%	100%	100%	100%	100%	100%	100%

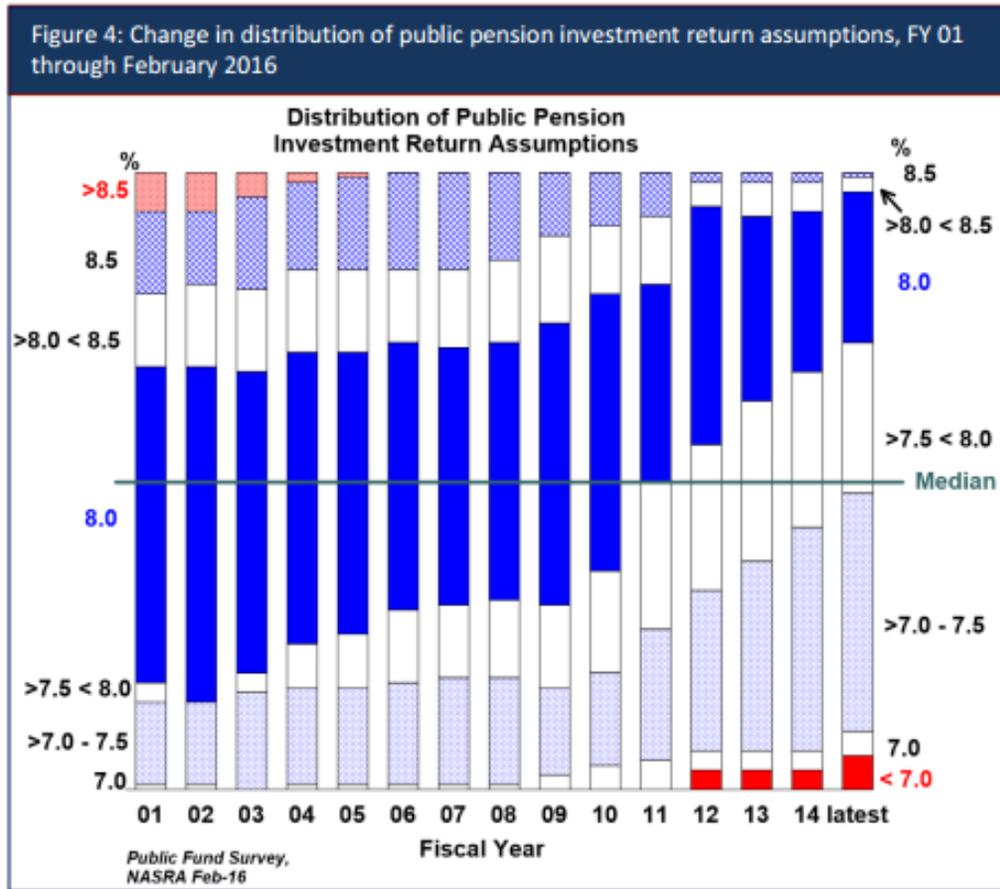
* Source: "Institutional Investors Market Trends 2015", Greenwich Associates

** Source: "2015 Report on State Retirement Systems: Funding Levels and Asset Allocation", Wilshire Consulting

*** Source: AHIC Public Peer Average is based on a universe of AHIC's 11 largest public pension plans with total assets ranging from \$14B-\$146B

Public Pension Peer Review

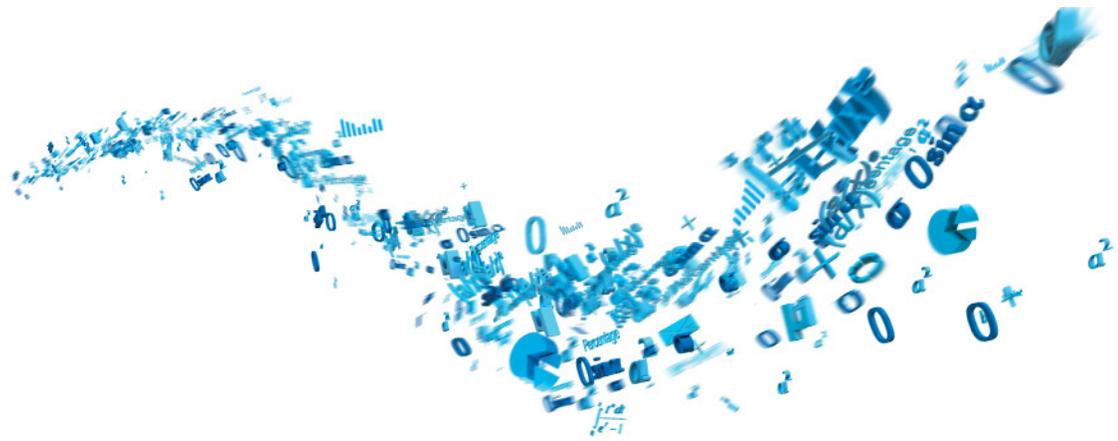
NPERS' Investment Return Assumption versus Public Peers



- The chart to the left illustrates the trend in investment return assumptions over the past 15 years according to the Public Fund Survey complied by NASRA
- The median Investment return assumption has declined from 8.00% in 2001-2010 to between 7.50% - 8.00% based on the latest survey data
 - The average expected return assumption is 7.62% as compared to NPERS' assumptions below:

Plan	Investment Return Assumption
School	8.00%
Judges	8.00%
State Patrol	8.00%
State Cash Balance	7.75%
County Cash Balance	7.75%

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Appendix

- About This Material

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About This Material

This material includes a summary of calculations and consulting related to the finances of Nebraska Public Employees Retirement System (NPERS). The following variables have been addressed:

- Contributions
- Economic Cost
- Funded Ratio
- Hurdle Rate
- Net Outflow

This analysis is intended to assist the Investment Committee with a review of the associated issues and options, and its use may not be appropriate for other purposes. This analysis has been prepared solely for the benefit of the Investment Committee. Any further dissemination of this report is not allowed without the written consent of Aon Hewitt Investment Consulting, Inc.

Our calculations were generally based on the methodologies identified in the actuary's valuation report for NPERS. We believe the methodology used in these calculations conforms to the applicable standards identified in the report.

Experience different than anticipated could have a material impact on the ultimate costs of the benefits. In addition, changes in plan provisions or applicable laws could have a significant impact on cost. Actual experience may differ from our modeling assumptions.

Our calculations were based on data provided by the plan actuary. The actuarial assumptions and methods and plan provisions reflected in these projections are the same as those used for the 2015-16 fiscal year actuarial valuations for NPERS as noted in the actuarial reports, except where noted in this report. Unless specifically noted, our calculations do not reflect any other changes or events after July 1, 2015 (for the School, Judges, and State Patrol Plans) or January 1, 2016 (for the State and County Cash Balance Plans).

In conducting these projections, we have relied on plan design, demographic and financial information provided by other parties, including the plan's actuary and plan sponsor. While we cannot verify the accuracy of all of the information, the supplied information was reviewed for consistency and reasonableness. As a result of this review, we have no reason to doubt the substantial accuracy or completeness of the information and believe that it has produced appropriate results.

These projections have been conducted in accordance with generally accepted actuarial principles and practices, including applicable Actuarial Standards of Practice as issued by the Actuarial Standards Board. The undersigned actuary is familiar with the near-term and long-term aspects of pension valuations and meet the Qualification Standards of the American Academy of Actuaries necessary to render the actuarial opinions contained herein. All sections of this report are considered an integral part of the actuarial opinions.

To our knowledge, no associate of Aon Hewitt Investment Consulting, Inc. providing services to NPERS has any direct financial interest or indirect material interest in NPERS. Thus, we believe there is no relationship existing that might affect our capacity to prepare and certify this report for NPERS.

Aon Hewitt Investment Consulting, Inc.

Phil Kivarkis FSA, EA, CFA

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