



North Carolina Department of State Treasurer
Investment Management Division

Investment Strategy Discussion

Investment Advisory Committee Meeting

December 16, 2013

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Project Purpose

- Investment Management Division of the Department of the State Treasurer of North Carolina is undertaking an evaluation of the current and alternative investment strategies for the public retirement systems of the State
- The goals are to develop strategies and tactics that will:
 - Reasonably ensure earning the actuarially assumed rate of investment return with a desired level of likelihood
 - Maintain levels of diversification suitable for a system of its size, given the investment opportunity set available
 - Develop and employ suitable risk management measures to limit exposure to market downturns
 - Provide the necessary liquidity to meet benefit obligations as they come due

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Retirement System Descriptive Information

	TSERS	LGERS	Judicial	Fire & Rescue	National Guard
Valuation	12/31/2012	12/31/2011	12/31/2011	6/30/2012	12/31/2011
Assumed Investment Return	7.25%	7.25%	7.25%	7.25%	7.25%
Membership					
• Active	312,512	121,638	566	40,870	5,567
• Pay Status	179,908	51,700	562	11,912	4,071
• Terminated Vested	117,489	44,350	55	N/A	4,993
• Disabled	7,487	N/A	N/A	154	N/A
Payroll Growth					
• Current	\$12.7B	\$5.1B	\$67.8M	N/A	N/A
• Prior	\$12.8B	\$5.1B	\$66.6M		
Funded Status (GASB)					
• Actuarial Assets	\$59.9B	\$19.33B	\$460.6M	\$338.9M	\$91.1M
• Liabilities	\$63.6B	\$19.37B	\$512.6M	\$403.8M	\$129.5M
• Funded Ratio	94.2%	99.8%	89.9%	83.9%	70.4%
Appropriation Determination					
• Normal Cost (NC)	5.15%	7.07%/7.55% ⁽¹⁾	18.13%	\$151.2 / pm	\$513,667
• Accrued liability (AL)	3.61%	N/A	9.53%	\$206.6 / pm	\$4,835,425
• Death Benefit	N/A	N/A	0.35%	N/A	N/A
Cash flow – prior year					
• Contributions	\$1.9B	\$712.9M	\$18.9M	\$17.2M	\$7,007,443
• Benefits	\$3.7B	\$940.7M	\$32.8M	\$25.5M	\$6,953,632
• Net cash flow	(\$1.8B)	(\$227.8M)	(\$13.9M)	(\$8.3M)	\$53,811

(1) General employees and firemen / law enforcement officers

Retirement System Descriptive Information

	Registers of Deeds	Legislative Retirement ⁽¹⁾	Death Benefits	Disability Income	Retiree Health ⁽¹⁾⁽²⁾
Valuation	12/31/2011	12/31/2011	12/31/2011	6/30/2011	12/31/2010
Assumed Investment Return	5.75%	7.25%	5.75%	5.75%	4.25%
Membership					
• Active	100	170	435,227	324,290	347,000
• Pay Status	84	278	94,195	6,754	169,000
• Terminated Vested	2	83	N/A	N/A	35,000
• Disabled	N/A	N/A	N/A	N/A	N/A
Payroll Growth					
• Current	\$5.9M	\$3.7M	\$18.1B	\$14.1B	\$15.0B
• Prior	\$5.9M	\$3.7M	\$18.4B	\$14.4B	\$15.1B
Funded Status (GASB)					
• Actuarial Assets	\$42.6M	\$29.5M	\$392.4M	\$406.1M	\$0.7B
• Liabilities	\$22.2M	\$23.8M	N/A	\$511.4M	\$33.5B
• Funded Ratio	192.1%	124.0%	N/A	79.4%	2.1%
Appropriation Determination					
• Normal Cost (NC)	\$653,392	23.2%	N/A	0.43%	11.3%
• Accrued liability (AL)	(\$653,392)	(25.4%)	N/A	--	8.0%
• Death Benefit	N/A	N/A	N/A	N/A	N/A
Cash flow – prior year					
• Contributions	\$765,439	\$258,549	\$46.5M	\$77.0M	\$2.9B
• Benefits	\$1,526,318	\$2,148,626	\$43.5M	\$74.2M	\$0.7B
• Net cash flow	(\$760,879)	(\$1,890,077)	\$3.0M	\$2.8M	\$2.2B

(1) Valuation not performed by Buck Consultants

(2) Cash flows estimated

Project Purpose

Retirement System Descriptive Information

Assumption Changes Since September 2013 IAC Mtg.

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Pension Financial Metrics

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Assumption Changes Since September 2013 IAC Mtg.

- Capital Market Assumptions
 - In consultation with the IMD, return distributions for some asset classes were modified from the baseline GEMS* results. Adjustments were made to returns and volatilities.
- Interest Rates
 - In consultation with the IMD, initial Treasury yields were recalibrated to a more current date, and forecasts were modified from the baseline GEMS* results

* GEMS from Conning and Company

Assumption Changes Since September 2013 IAC Mtg.

- Liability Forecasts
 - Salary inflation sensitivities were incorporated into payroll projections
 - No COLA was assumed to be granted for the first five years of the forecast. Thereafter, a COLA is assumed to be granted annually to the extent that it could be fully funded from the gain on the Actuarial Value of Assets. Any increase limited to the increase in CPI-U for the year

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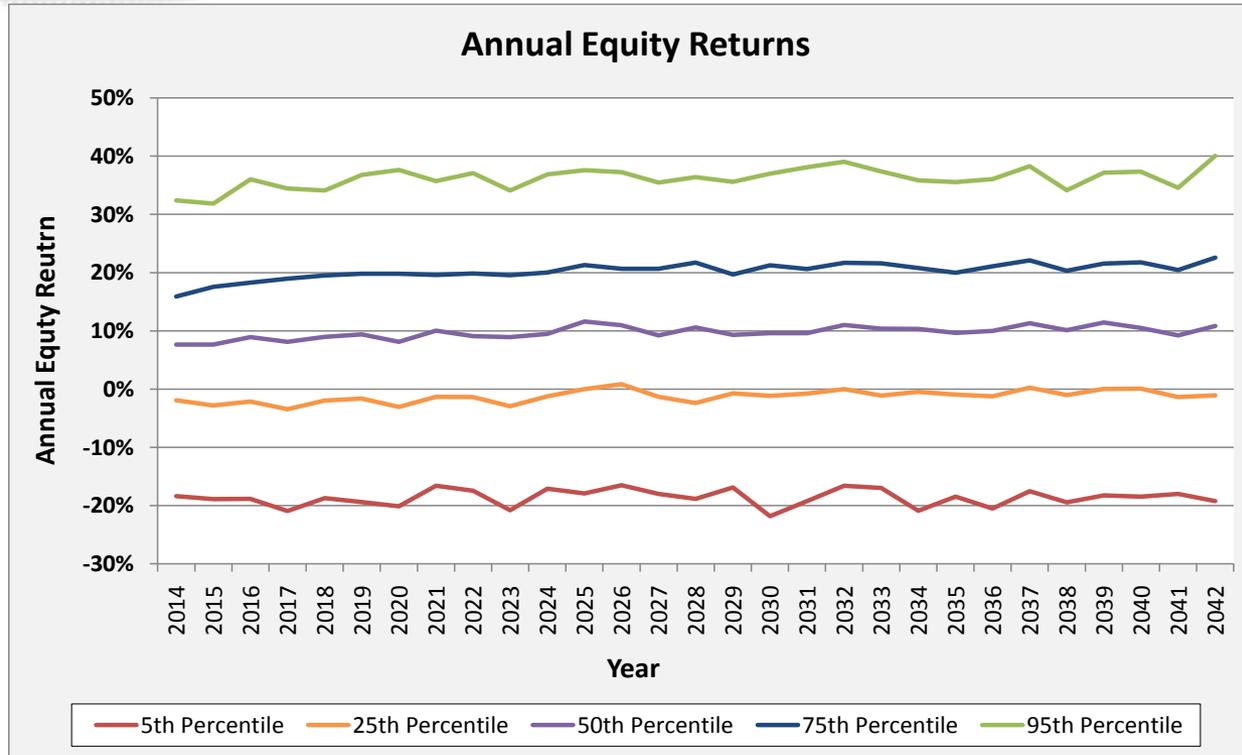
Alternative Strategies

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Pension Financial Metrics

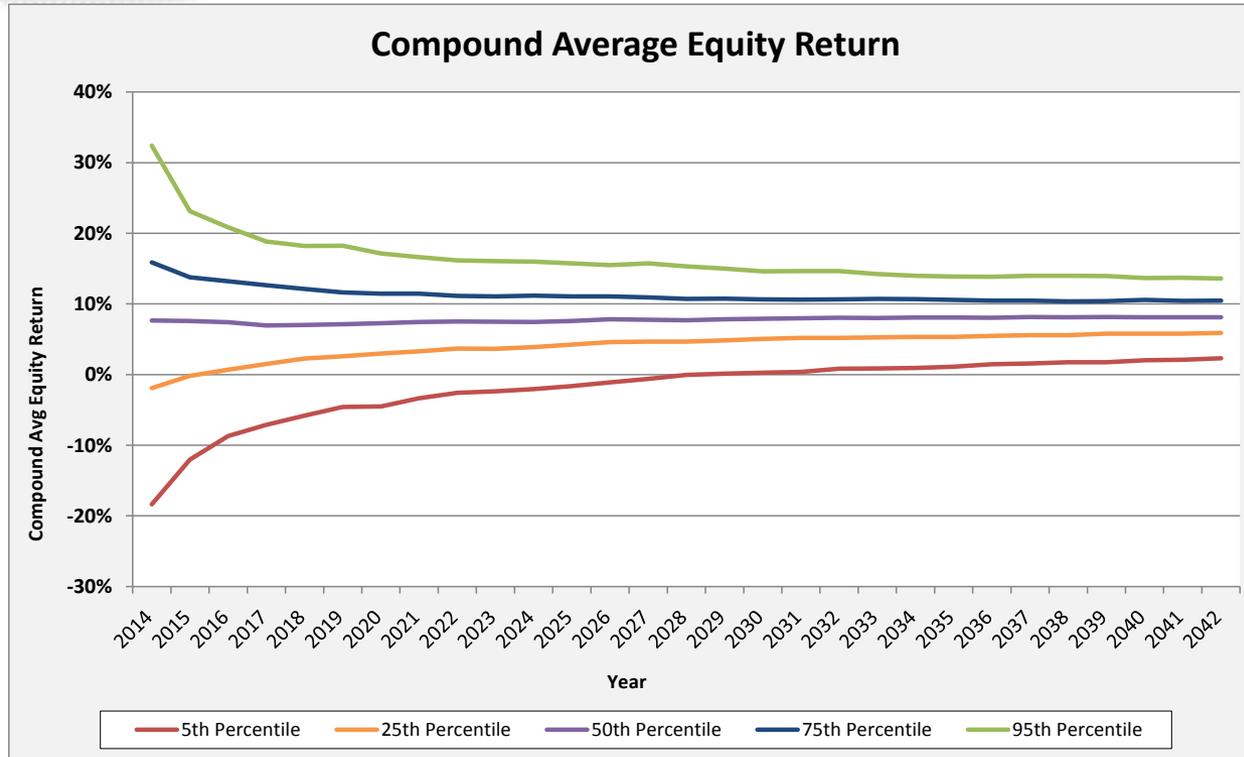
Appendix

Key Assumptions – Annual Equity Returns



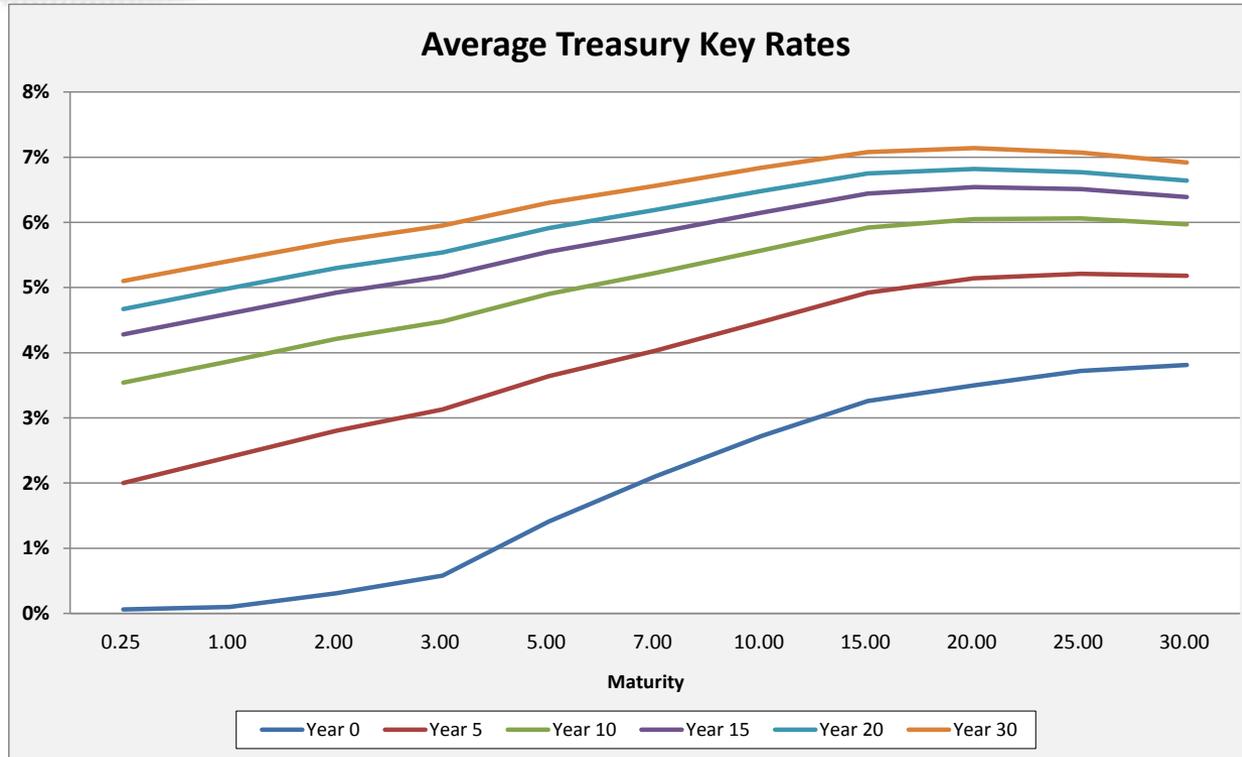
	2014	2016	2018	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040	2042
95th percentile	32.4%	36.0%	34.1%	37.6%	37.1%	36.9%	37.2%	36.4%	37.0%	39.1%	35.9%	36.1%	34.1%	37.3%	40.0%
75th percentile	15.9%	18.3%	19.5%	19.8%	19.9%	20.0%	20.6%	21.7%	21.3%	21.7%	20.8%	21.1%	20.3%	21.8%	22.6%
50th percentile	7.6%	8.9%	9.0%	8.1%	9.1%	9.5%	11.0%	10.6%	9.6%	11.0%	10.3%	10.0%	10.1%	10.5%	10.8%
25th percentile	-1.9%	-2.1%	-2.0%	-3.1%	-1.4%	-1.2%	0.8%	-2.4%	-1.2%	0.0%	-0.5%	-1.2%	-1.0%	0.1%	-1.1%
5th percentile	-18.4%	-18.8%	-18.7%	-20.1%	-17.5%	-17.1%	-16.5%	-18.9%	-21.8%	-16.6%	-20.9%	-20.5%	-19.5%	-18.5%	-19.3%

Key Assumptions – Compound Average Equity Returns



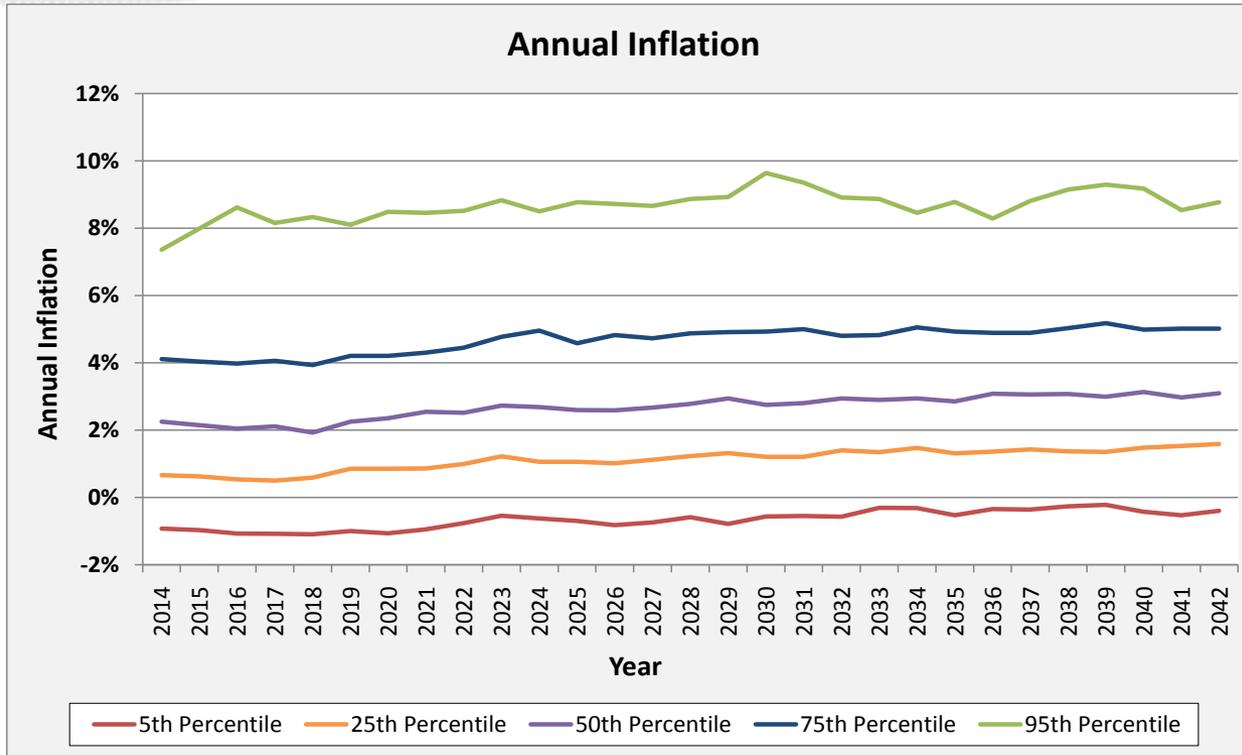
	2014	2016	2018	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040	2042
95th percentile	32.4%	20.8%	18.2%	17.1%	16.2%	16.0%	15.5%	15.3%	14.6%	14.7%	14.0%	13.8%	14.0%	13.7%	13.6%
75th percentile	15.9%	13.2%	12.1%	11.4%	11.1%	11.2%	11.1%	10.7%	10.6%	10.6%	10.7%	10.5%	10.4%	10.6%	10.5%
50th percentile	7.6%	7.4%	7.0%	7.3%	7.5%	7.4%	7.8%	7.7%	7.9%	8.1%	8.1%	8.0%	8.1%	8.1%	8.1%
25th percentile	-1.9%	0.7%	2.3%	3.0%	3.7%	3.9%	4.6%	4.7%	5.1%	5.2%	5.3%	5.5%	5.6%	5.8%	5.9%
5th percentile	-18.4%	-8.7%	-5.8%	-4.5%	-2.6%	-2.1%	-1.1%	0.0%	0.3%	0.8%	0.9%	1.5%	1.7%	2.0%	2.3%

Key Assumptions – Average Treasury Key Rates



	Maturity										
	0.25	1.00	2.00	3.00	5.00	7.00	10.00	15.00	20.00	25.00	30.00
Year 0	0.06%	0.10%	0.31%	0.58%	1.41%	2.10%	2.72%	3.26%	3.50%	3.72%	3.81%
Year 5	2.00%	2.40%	2.80%	3.13%	3.64%	4.03%	4.47%	4.92%	5.14%	5.21%	5.18%
Year 10	3.54%	3.87%	4.21%	4.48%	4.90%	5.22%	5.57%	5.92%	6.05%	6.06%	5.97%
Year 15	4.28%	4.60%	4.92%	5.17%	5.55%	5.84%	6.15%	6.44%	6.54%	6.51%	6.39%
Year 20	4.67%	4.99%	5.30%	5.54%	5.91%	6.19%	6.48%	6.75%	6.82%	6.77%	6.64%
Year 30	5.10%	5.41%	5.71%	5.95%	6.30%	6.56%	6.84%	7.08%	7.14%	7.07%	6.92%

Key Assumptions – Inflation



	2014	2016	2018	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040	2042
95th percentile	7.4%	8.6%	8.3%	8.5%	8.5%	8.5%	8.7%	8.9%	9.6%	8.9%	8.5%	8.3%	9.1%	9.2%	8.8%
75th percentile	4.1%	4.0%	3.9%	4.2%	4.4%	5.0%	4.8%	4.9%	4.9%	4.8%	5.0%	4.9%	5.0%	5.0%	5.0%
50th percentile	2.2%	2.0%	1.9%	2.3%	2.5%	2.7%	2.6%	2.8%	2.8%	2.9%	2.9%	3.1%	3.1%	3.1%	3.1%
25th percentile	0.7%	0.5%	0.6%	0.8%	1.0%	1.1%	1.0%	1.2%	1.2%	1.4%	1.5%	1.4%	1.4%	1.4%	1.6%
5th percentile	-0.9%	-1.1%	-1.1%	-1.1%	-0.8%	-0.6%	-0.8%	-0.6%	-0.6%	-0.6%	-0.3%	-0.3%	-0.3%	-0.4%	-0.4%

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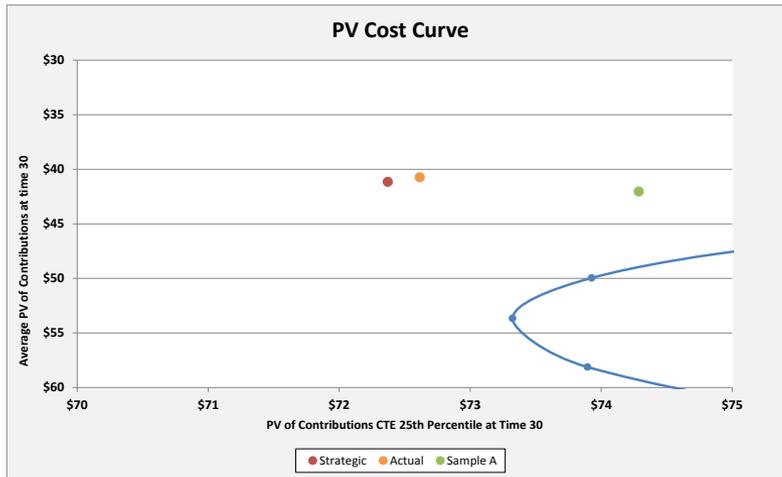
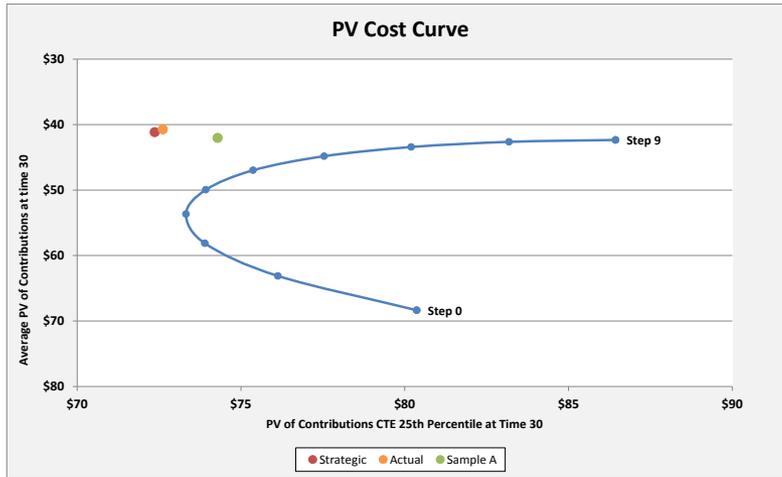
Pension Financial Metrics

Appendix

Current vs. Short Duration Portfolios – TSERS

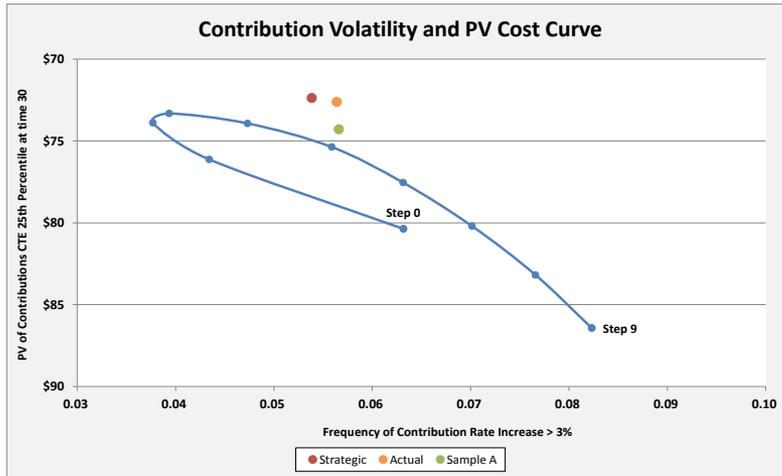
<i>7/31/2013 Data</i>	<i>Strategic</i>	<i>Actual</i>	<i>Sample A Short Duration</i>
Long-Only Public Equity	40.50%	47.20%	47.20%
Hedged Equity	0.00%	0.17%	0.17%
Private Equity	6.50%	4.16%	4.16%
Non IG Credit	4.50%	4.27%	4.27%
Non Core Real Estate	4.32%	4.51%	4.51%
Government	14.40%	11.10%	11.10%
RMBS	9.00%	8.69%	8.69%
IG Credit	12.60%	11.90%	11.90%
Cash (total fund and tactical in LTIF)	0.00%	1.35%	1.35%
Short-Term TIPS	0.00%	0.00%	0.00%
Publicly Traded Commodities	2.70%	1.81%	1.81%
Private Natural Resources (incl Timber)	1.80%	1.95%	1.95%
Core Real Estate	2.88%	1.96%	1.96%
REITS	0.80%	0.62%	0.62%
Multi-Strategy	0.00%	0.33%	0.33%
Growth Oriented	55.82%	60.31%	60.31%
Rates & Liquidity	36.00%	33.03%	33.03%
Inflation Sensitive and Diversifiers	8.18%	6.34%	6.34%
Multi-Strategy	0.00%	0.33%	0.33%
Total	100.00%	100.00%	100.00%

Cost Curve – TSERS

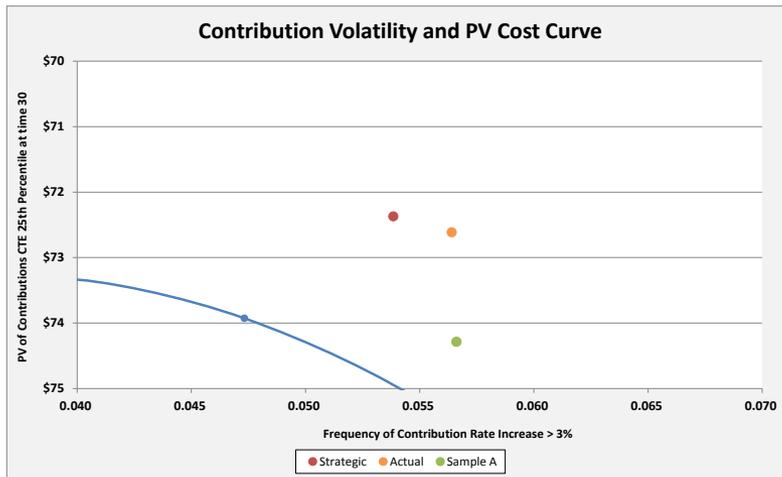


	CTE 25 th Percentile at time 30 (\$Billions)	Average at time 30 (\$Billions)
Strategic	72.4	41.2
Actual	72.6	40.7
Sample A	74.3	42.0

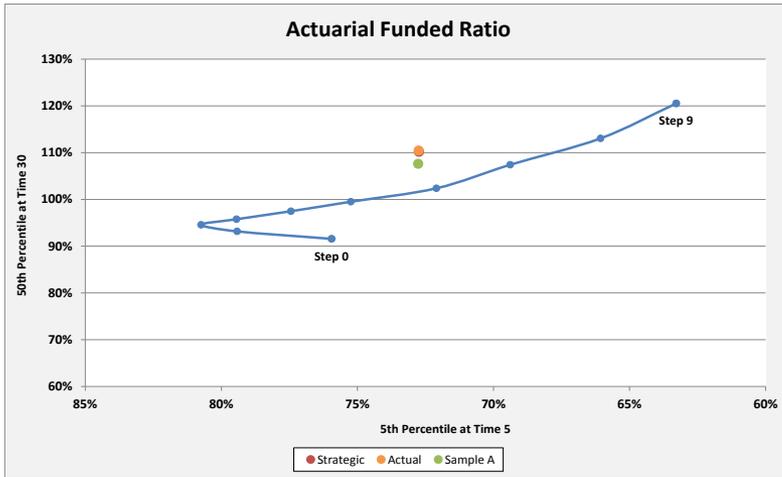
Contribution Volatility Cost Curve – TSERS



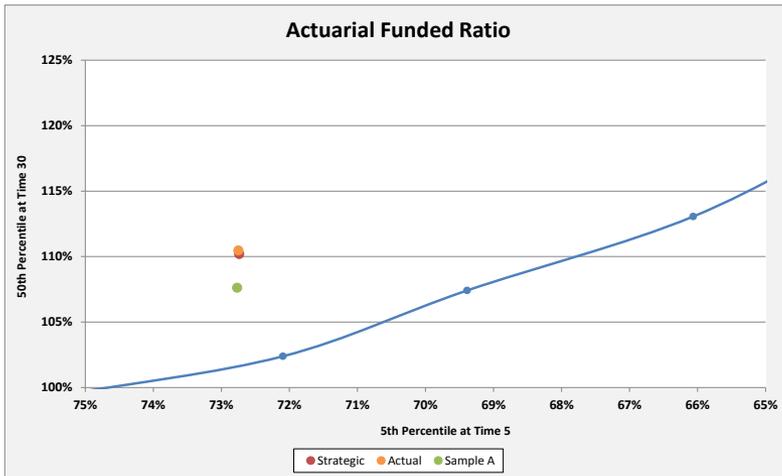
	Frequency of Contribution Rate Increase > 3%	CTE 25 th Percentile at time 30 (\$Billions)
Strategic	0.054	72.4
Actual	0.056	72.6
Sample A	0.057	74.3



AVA Funded Ratio Curve – TSERS

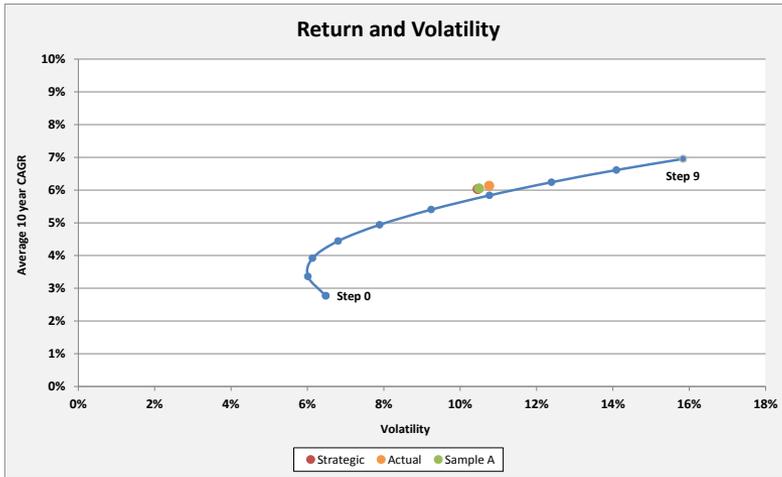


	5 th Percentile at time 5	50 th Percentile at time 30
Strategic	72.7%	110.2%
Actual	72.7%	110.5%
Sample A	72.8%	107.6%

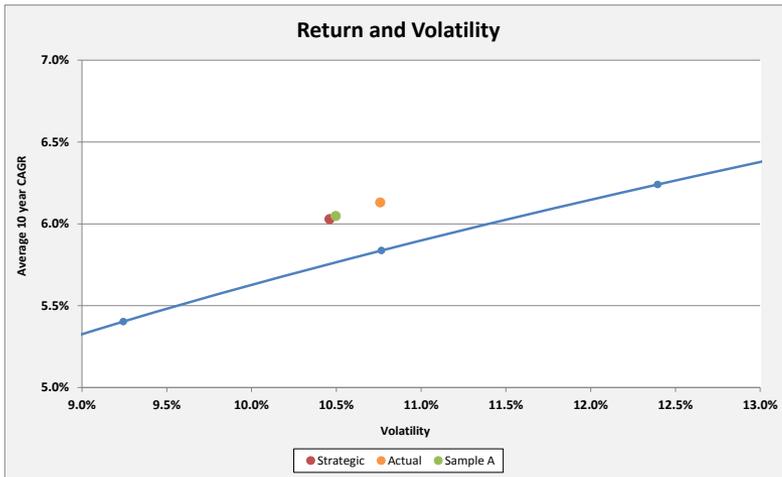


Return and Volatility Curve – TSERS

10 Year Horizon

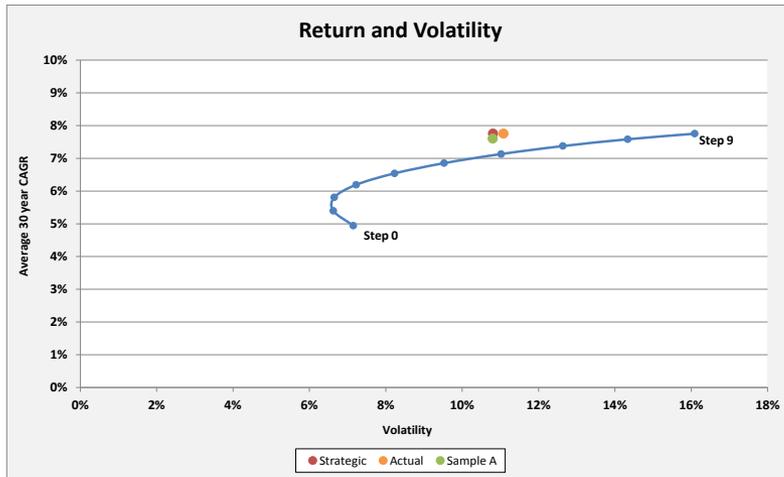


	Average 10 year CAGR	Volatility
Strategic	6.0%	10.5%
Actual	6.1%	10.8%
Sample A	6.0%	10.5%

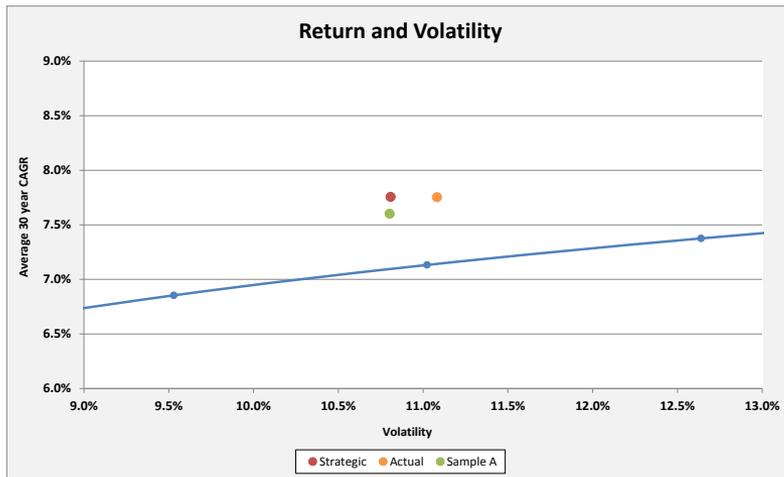


Return and Volatility Curve – TSERS

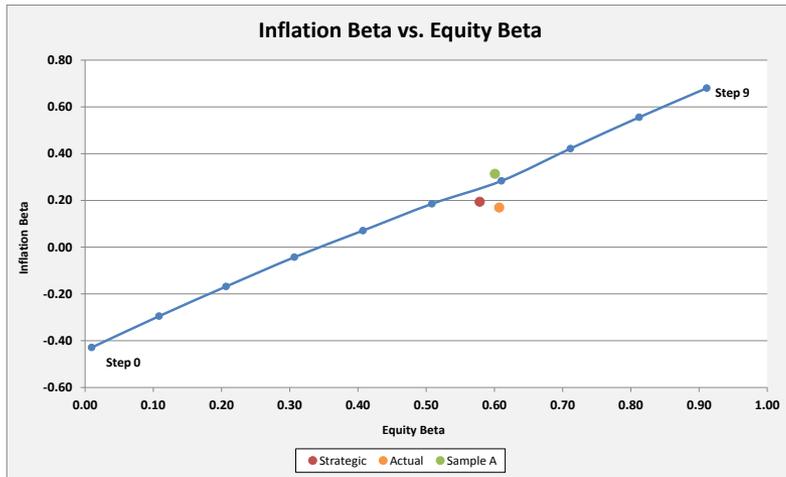
30 Year Horizon



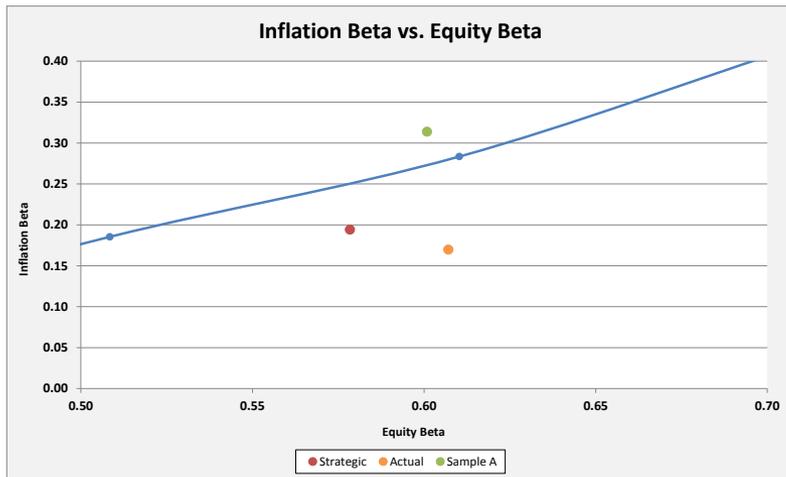
	Average 30 year CAGR	Volatility
Strategic	7.8%	10.8%
Actual	7.8%	11.1%
Sample A	7.6%	10.8%



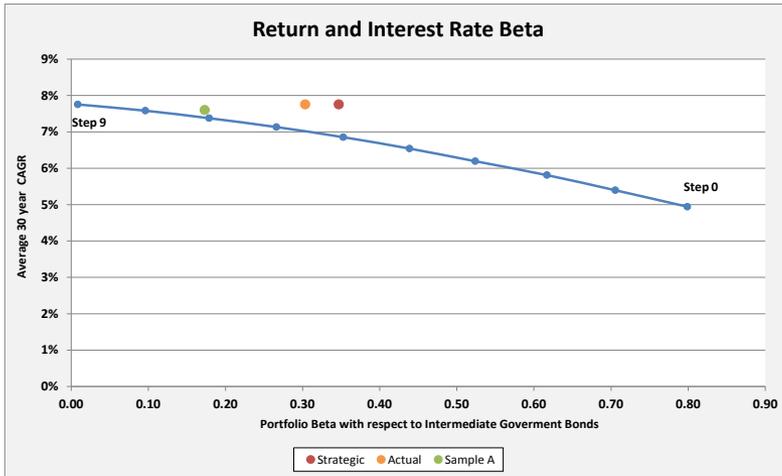
Inflation and Equity Beta Curve – TSERS



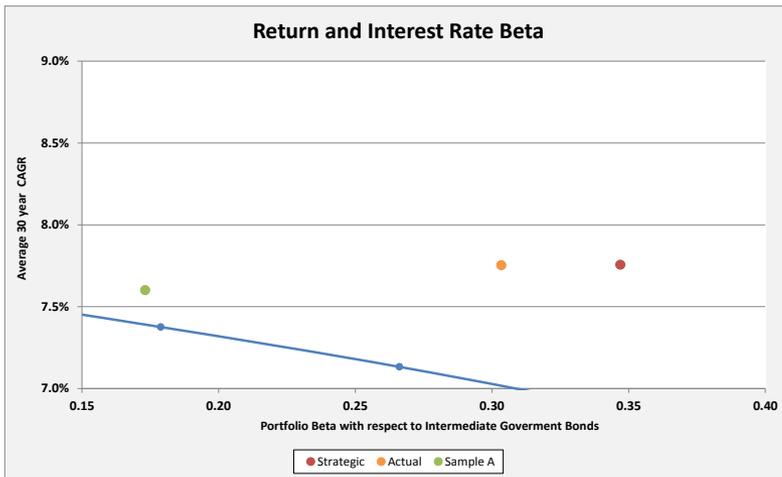
	Equity Beta	Inflation Beta
Strategic	0.578	0.194
Actual	0.607	0.170
Sample A	0.601	0.314



Return and Interest Rate Beta Curve – TSERS



	Portfolio Beta with respect to Inter. Gvt Bonds	Average 30 year CAGR
Strategic	0.347	7.8%
Actual	0.303	7.8%
Sample A	0.173	7.6%



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Alternative Fixed Income Allocations – TSERS

- Staff deconstructed the Investment Grade market for various maturity and sector sleeves using historical data back to 1987
- Modeling considerations included various factors such as:

Expected Returns (based on current yields)

Volatility

Liquidity

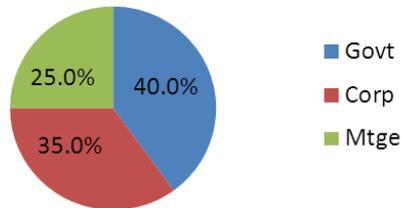
Duration

	E(r)	Std Dev	Sharpe	Duration
Broad Corp	3.38%	5.32%	0.63	6.4
Broad Govt. (Treasury/Agency)	1.41%	4.42%	0.32	5.4
Broad Mortgage	2.94%	3.36%	0.87	5.3
Government 1-5 years	1.12%	2.41%	0.26	2.7
Government 5-10 years	1.95%	5.72%	0.34	6.3
Government 10+ years	3.50%	9.71%	0.36	15.3
Corporate 1-5 years	2.30%	2.98%	0.61	2.8
Corporates 5-10 years	3.88%	5.67%	0.68	6.2
Corporates 10+ years	5.31%	8.26%	0.64	12.7
Cash (STIF)	1.50%	0.69%	1.45	1.0

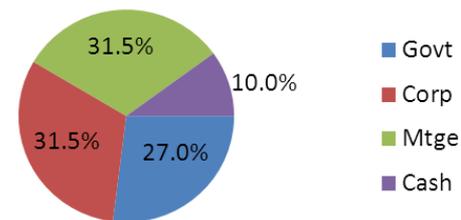
Fixed Income Modeling Results – TSERS

	Current Strategic Mix (5+ yr)	1-10 yr Govt/Mtg Credit	Full Maturity (same mix)	Full Maturity (+ Mtg, -Gvt)	Current Mix w/ 20% cash	Full Maturity w/20% long Gvt	Current w/ +Mtg , - Gvt	Current w/ + Mtg, - Gvt & 10% cash
Government	40%	40%	40%	30%	32%	52%	30%	27%
Corporate	35%	35%	35%	35%	28%	28%	35%	31.5%
Mortgage	25%	25%	25%	35%	20%	20%	35%	31.5%
Cash (STIF)					20%			10%
E(r)	3.30%	2.43%	2.48%	2.63%	2.94%	2.68%	3.34%	3.16%
Std. Dev.	5.46%	3.46%	4.13%	4.03%	4.49%	5.08%	5.11%	4.66%
Duration	8.3	4.6	5.8	5.8	6.8	7.7	7.8	7.2
Sharpe	0.60	0.70	0.60	0.65	0.65	0.53	0.65	0.68

Current Strategic Mix



Alternative Strategic Mix



The lower duration alternative mix is better positioned for a rising rate environment and also has a more attractive risk adjusted expected return. The cash position would provide the ability to take advantage of opportunities that may arise from systemic events or material rate shifts.

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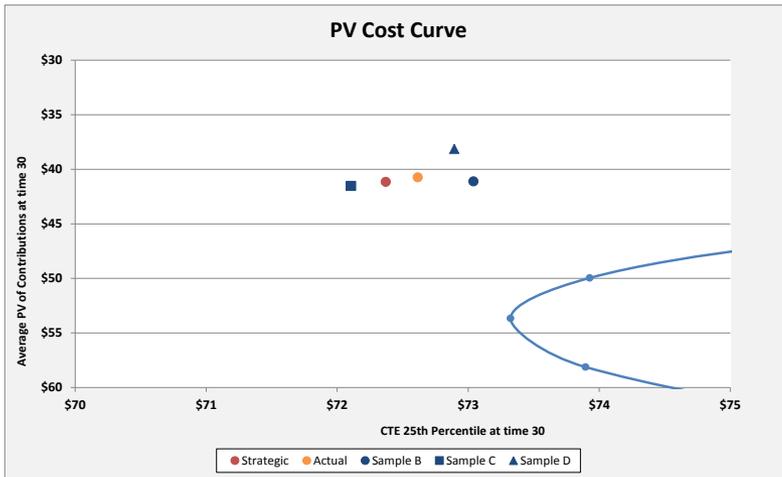
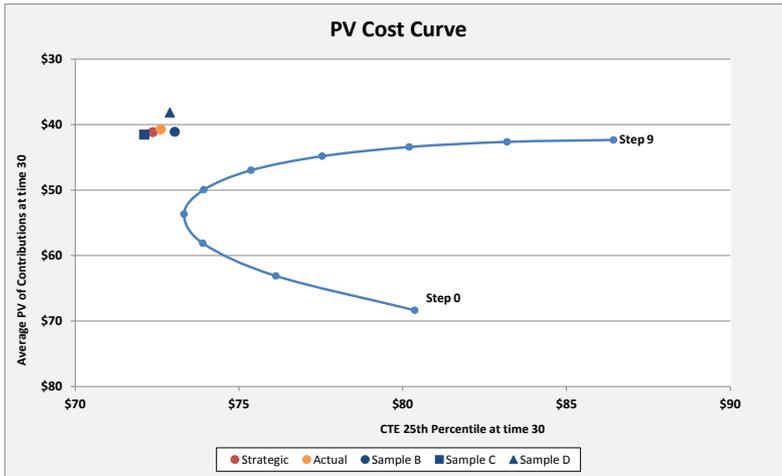
Pension Financial Metrics

Appendix

Alternative Strategies – TSERS

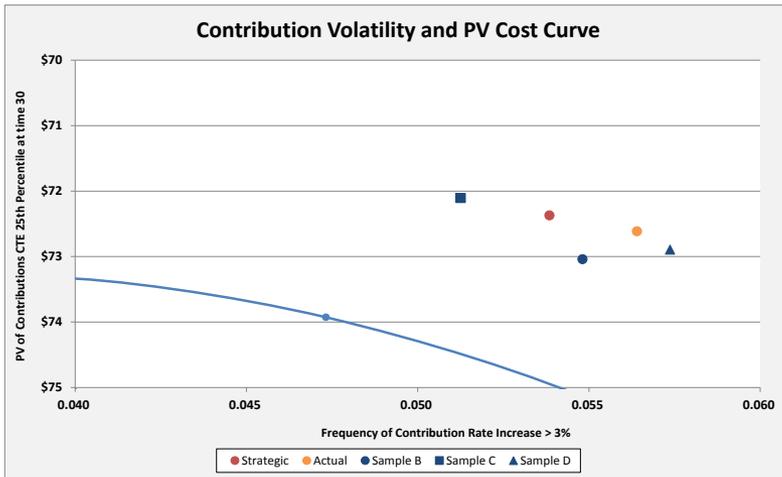
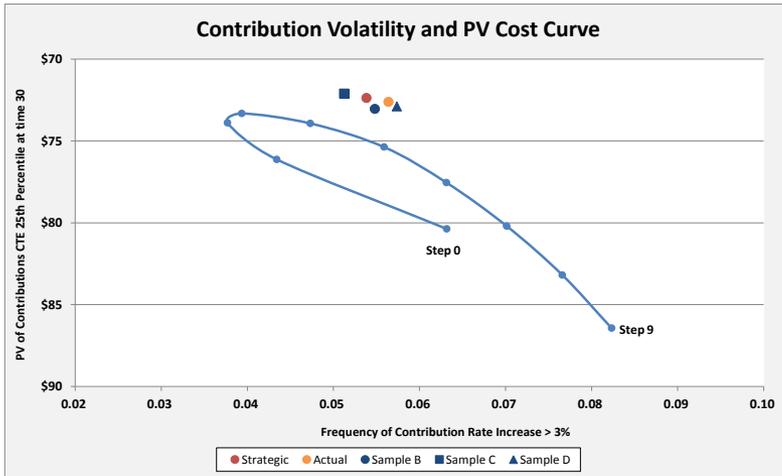
<i>7/31/2013 Data</i>	<i>Strategic</i>	<i>Actual</i>	<i>Sample B</i>	<i>Sample C</i>	<i>Sample D</i>
Long-Only Public Equity	40.50%	47.20%	40.00%	35.00%	50.00%
Hedged Equity	0.00%	0.17%	4.00%	4.00%	2.00%
Private Equity	6.50%	4.16%	6.00%	6.00%	6.50%
Non IG Credit	4.50%	4.27%	7.00%	7.00%	7.00%
Non Core Real Estate	4.32%	4.51%	3.00%	4.86%	3.50%
Government	14.40%	11.10%	6.48%	7.83%	8.00%
RMBS	9.00%	8.69%	7.56%	9.14%	5.00%
IG Credit	12.60%	11.90%	7.56%	9.14%	7.00%
Cash (total fund and tactical in LTIF)	0.00%	1.35%	3.40%	3.90%	0.50%
Short-Term TIPS	0.00%	0.00%	4.00%	3.00%	0.00%
Publicly Traded Commodities	2.70%	1.81%	1.00%	1.00%	0.50%
Private Natural Resources (incl Timber)	1.80%	1.95%	2.50%	2.50%	5.00%
Core Real Estate	2.88%	1.96%	3.50%	3.24%	3.50%
REITS	0.80%	0.62%	1.50%	0.90%	0.00%
Multi-Strategy	0.00%	0.33%	2.50%	2.50%	1.50%
Growth Oriented	55.82%	60.31%	60.00%	56.86%	69.00%
Rates & Liquidity	36.00%	33.03%	25.00%	30.00%	20.50%
Inflation Sensitive and Diversifiers	8.18%	6.34%	12.50%	10.64%	9.00%
Multi-Strategy	0.00%	0.33%	2.50%	2.50%	1.50%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Cost Curve – TSERS



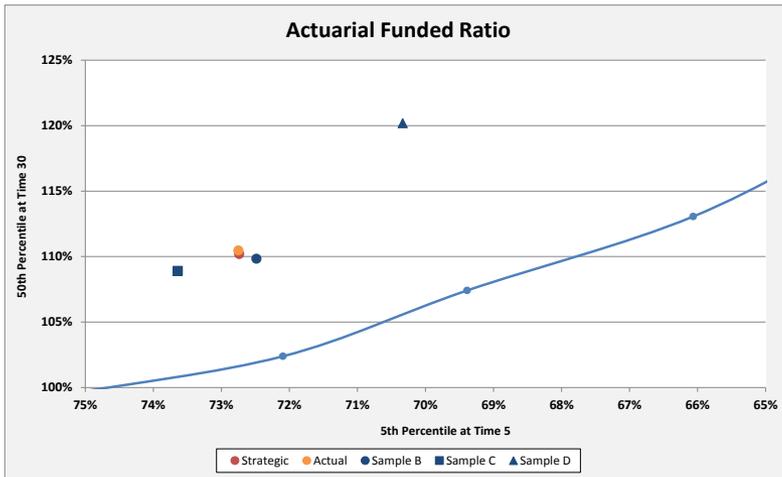
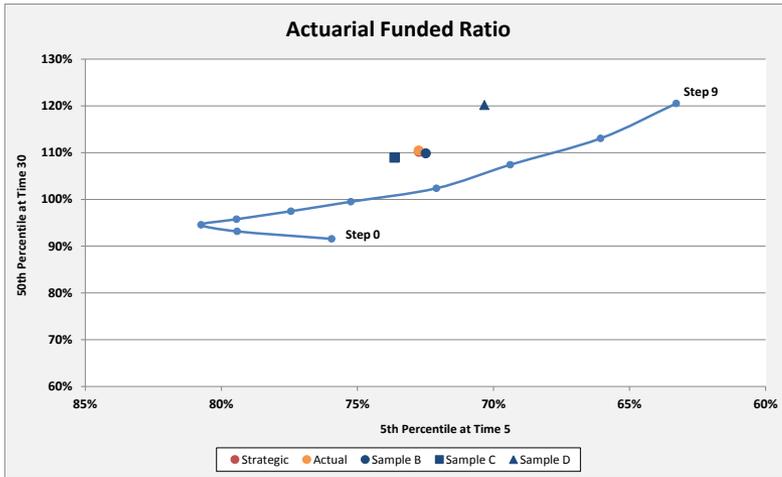
	CTE 25 th Percentile at time 30 (\$Billions)	Average at time 30 (\$Billions)
Strategic	72.4	41.2
Actual	72.6	40.7
Sample B	73.0	41.1
Sample C	72.1	41.5
Sample D	72.9	38.1

Cost Curve – TSERS



	Frequency of Contribution Rate Increase > 3%	CTE 25 th Percentile at time 30 (\$Billions)
Strategic	0.054	72.4
Actual	0.056	72.6
Sample B	0.055	73.0
Sample C	0.051	72.1
Sample D	0.057	72.9

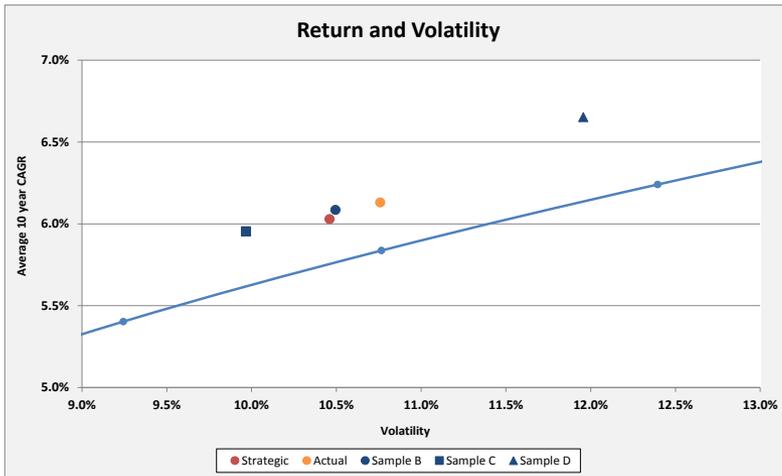
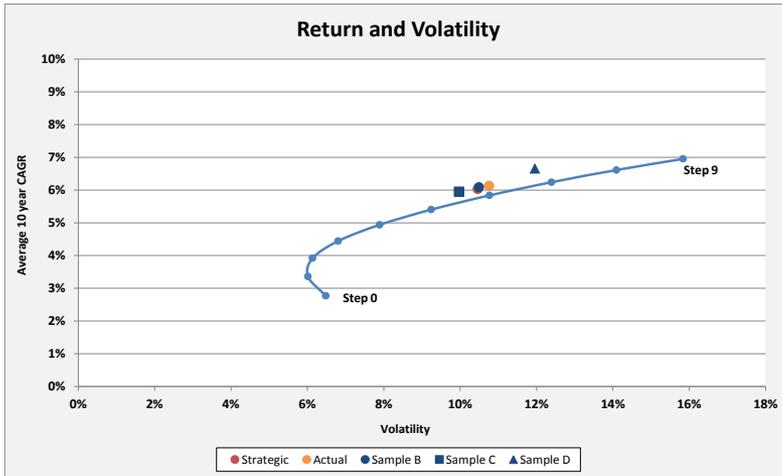
AVA Funded Ratio Curve – TSERS



	5 th Percentile at time 5	50 th Percentile at time 30
Strategic	72.7%	110.2%
Actual	72.7%	110.5%
Sample B	72.5%	109.8%
Sample C	73.6%	108.9%
Sample D	70.3%	120.2%

Return and Volatility Curve – TSERS

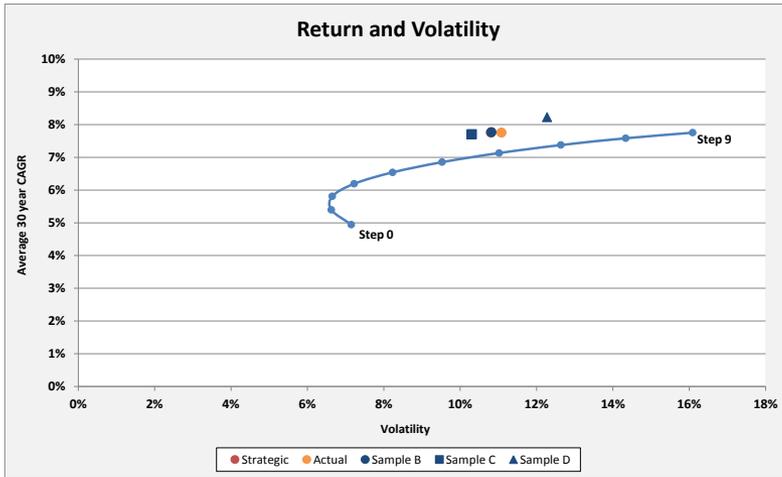
10 Year Horizon



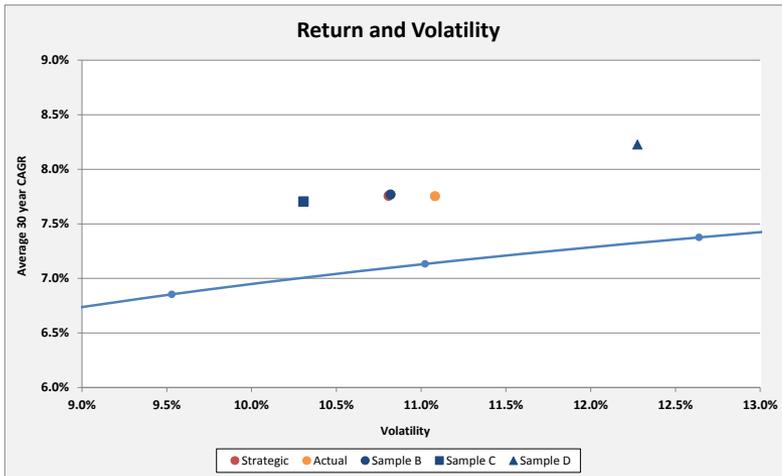
	Average 10 year CAGR	Volatility
Strategic	6.0%	10.5%
Actual	6.1%	10.8%
Sample B	6.1%	10.5%
Sample C	6.0%	10.0%
Sample D	6.7%	12.0%

Return and Volatility Curve – TSERS

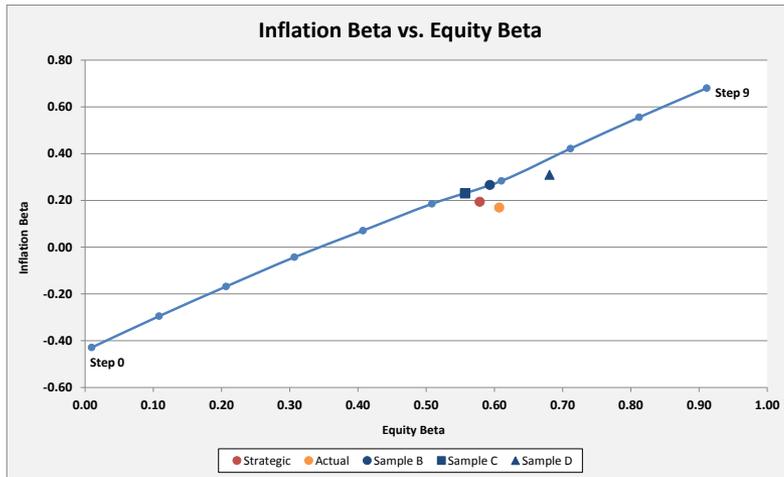
30 Year Horizon



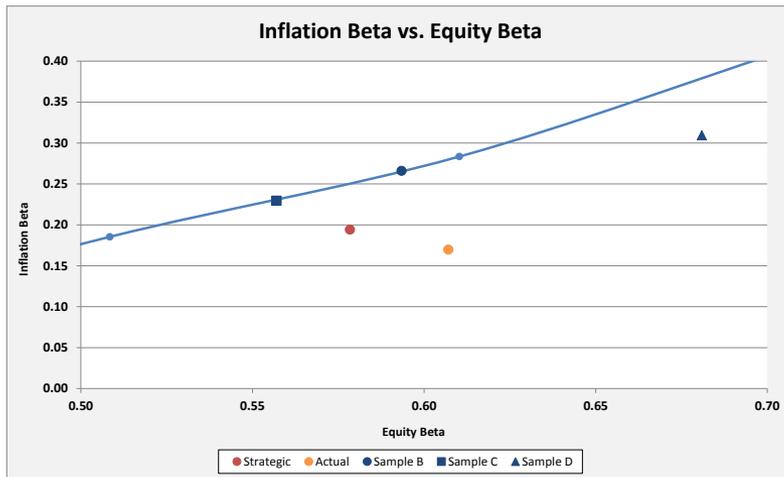
	Average 30 year CAGR	Volatility
Strategic	7.8%	10.8%
Actual	7.8%	11.1%
Sample B	7.8%	10.8%
Sample C	7.7%	10.3%
Sample D	8.2%	12.3%



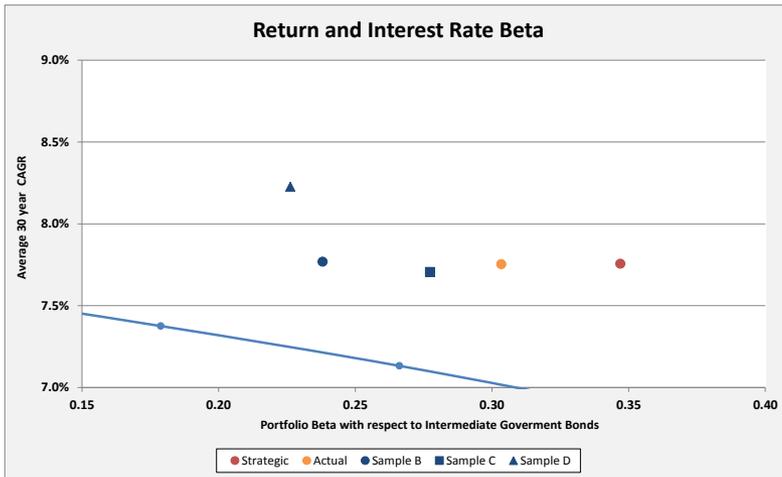
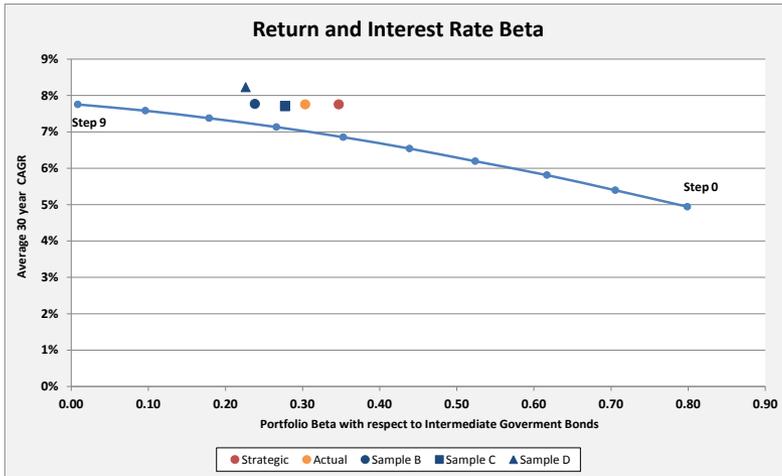
Inflation and Equity Beta Curve – TSERS



	Equity Beta	Inflation Beta
Strategic	0.578	0.194
Actual	0.607	0.170
Sample B	0.593	0.266
Sample C	0.557	0.230
Sample D	0.681	0.309



Return and Interest Rate Beta Curve – TSERS



	Portfolio Beta with respect to Inter. Gvt Bonds	Average 30 year CAGR
Strategic	0.347	7.8%
Actual	0.303	7.8%
Sample B	0.238	7.8%
Sample C	0.277	7.7%
Sample D	0.226	8.2%

Project Purpose

Retirement System Descriptive Information

Assumption Changes Since September 2013 IAC Mtg.

Key Assumptions

Duration Discussion

New Fixed Income Structure

Alternative Strategies

Sensitivity / Scenario Analysis

Pension Financial Metrics

Appendix

Scenario Matrix – 10yr Average CAGR

	10 Year CAGR Equity below 10th Percentile			10 Year CAGR Equity between 10th and 90th Percentile			10 Year CAGR Equity above 90th Percentile		
10 Year CAGR Inflation below 10th Percentile	-1.0%	-1.0%	-1.3%	4.8%	5.0%	4.7%	9.6%	10.1%	9.9%
	-1.2%	-0.8%	-1.6%	4.8%	4.7%	5.3%	9.9%	9.4%	11.2%
10 Year CAGR Inflation between 10th and 90th Percentile	-0.2%	-0.4%	-0.4%	6.1%	6.2%	6.1%	11.6%	12.0%	11.9%
	-0.3%	-0.1%	-0.7%	6.1%	6.0%	6.7%	11.9%	11.4%	13.2%
10 Year CAGR Inflation above 90th Percentile	1.3%	1.0%	1.1%	7.8%	7.6%	7.6%	13.2%	13.3%	13.3%
	1.2%	1.3%	1.1%	7.7%	7.6%	8.6%	13.4%	12.9%	15.0%

Key:

Strategic	Actual	Sample A
Sample B	Sample C	Sample D

Scenario Counts	10 Year CAGR Equity below 10th Percentile	10 Year CAGR Equity 10th - 90th Percentile	10 Year CAGR Equity above 90th Percentile
10 Year CAGR Inflation below 10th Percentile	14	79	17
10 Year CAGR Inflation 10th - 90th Percentile	80	645	74
10 Year CAGR Inflation above 90th Percentile	6	75	19

Scenario Matrix – 10yr Average AVA Funded Ratio

	10 Year CAGR Equity below 10th Percentile			10 Year CAGR Equity between 10th and 90th Percentile			10 Year CAGR Equity above 90th Percentile		
10 Year CAGR Inflation below 10th Percentile	66.8%	66.6%	65.4%	94.2%	95.4%	93.3%	114.2%	116.7%	114.7%
	65.9%	67.2%	64.2%	93.9%	93.3%	96.7%	115.5%	112.9%	124.3%
10 Year CAGR Inflation between 10th and 90th Percentile	67.7%	67.3%	67.2%	93.4%	94.0%	93.6%	116.5%	118.9%	118.3%
	67.4%	68.3%	66.1%	93.7%	93.1%	96.4%	118.3%	114.9%	130.2%
10 Year CAGR Inflation above 90th Percentile	65.7%	64.6%	64.8%	89.9%	89.4%	89.6%	108.8%	109.5%	109.9%
	65.1%	65.9%	64.2%	89.6%	89.1%	92.7%	110.0%	106.5%	121.7%

Key:

Strategic	Actual	Sample A
Sample B	Sample C	Sample D

Scenario Matrix – 10yr Avg. PV Contributions (\$Billions)

	10 Year CAGR Equity below 10th Percentile			10 Year CAGR Equity between 10th and 90th Percentile			10 Year CAGR Equity above 90th Percentile		
10 Year CAGR Inflation below 10th Percentile	24.6	24.8	25.7	15.9	15.6	16.4	11.2	10.9	11.4
	25.2	24.6	25.9	16.1	16.1	15.6	11.2	11.6	10.1
10 Year CAGR Inflation between 10th and 90th Percentile	24.7	24.9	25.0	15.0	14.8	14.9	10.1	9.8	9.8
	25.0	24.5	25.7	14.9	15.1	14.3	9.9	10.3	8.9
10 Year CAGR Inflation above 90th Percentile	22.7	23.0	22.7	14.9	15.0	14.8	11.1	10.8	10.4
	22.8	22.6	23.2	14.9	15.1	14.2	10.6	11.2	9.2

Key:

Strategic	Actual	Sample A
Sample B	Sample C	Sample D

Project Purpose

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Assumption Changes Since September 2013 IAC Mtg.

Key Assumptions

Duration Discussion

New Fixed Income Structure

Alternative Strategies

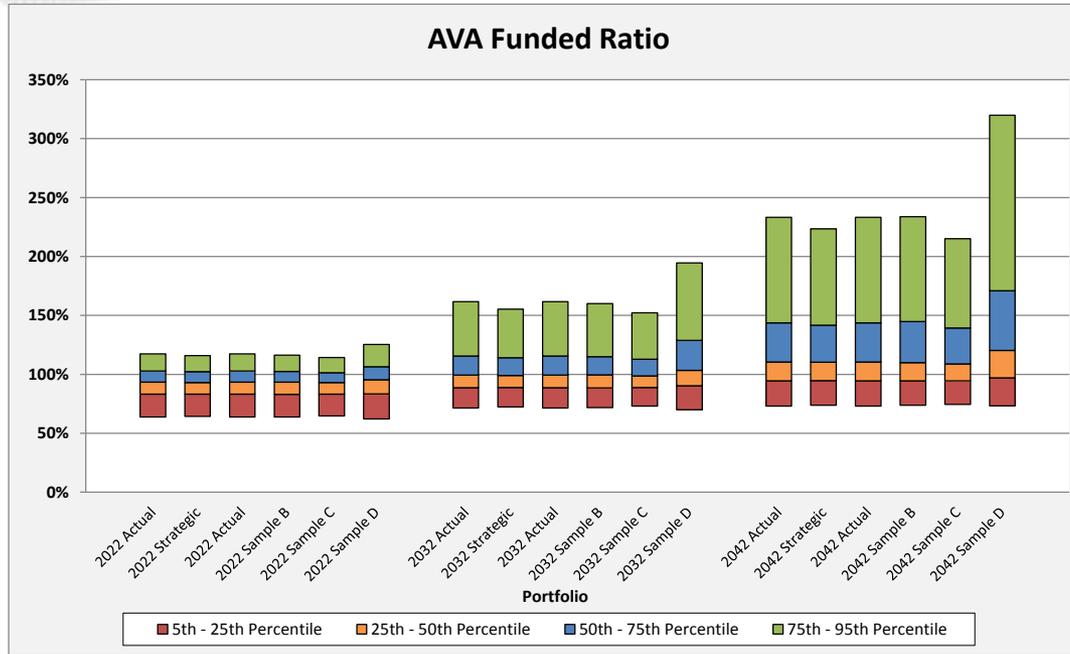
Sensitivity / Scenario Analysis

Pension Financial Metrics

Appendix

AVA Funded Ratio – TSERS

AVA Funded Ratio as of 12/31/2012 was 94.2%



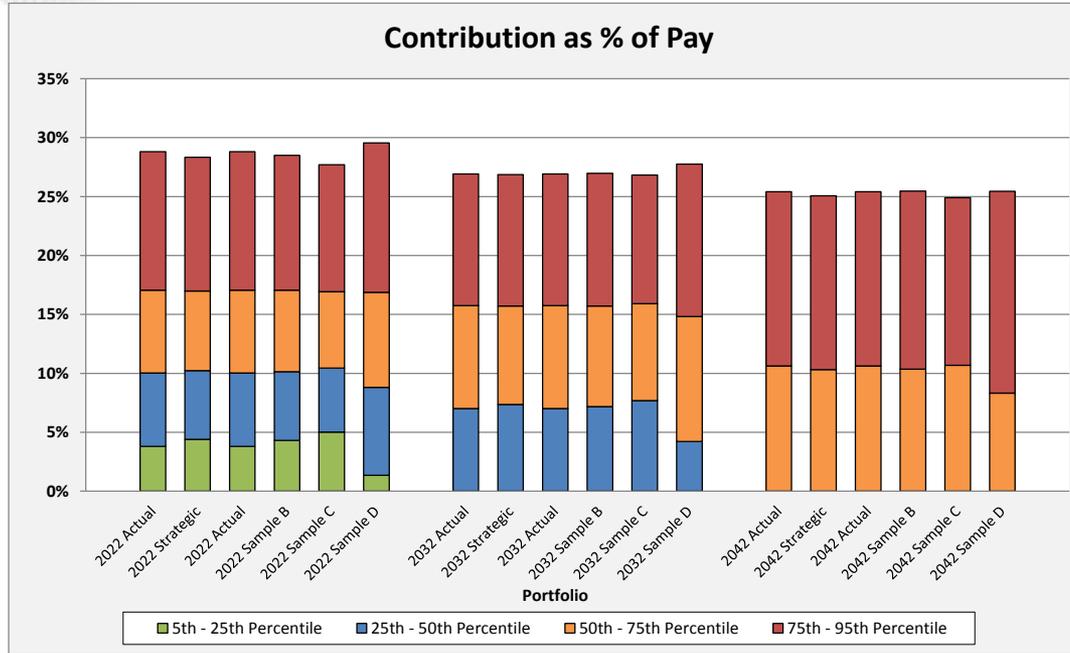
AVA Funded Ratio

	2022						2032					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	117.4%	115.8%	117.4%	116.3%	114.2%	125.3%	161.7%	155.3%	161.7%	160.1%	152.3%	194.6%
75th percentile	102.9%	102.3%	102.9%	102.5%	101.4%	106.5%	115.5%	114.0%	115.5%	114.9%	112.8%	128.9%
50th percentile	93.4%	93.1%	93.4%	93.3%	93.0%	95.3%	99.4%	99.1%	99.4%	99.5%	98.6%	103.3%
25th percentile	83.2%	83.2%	83.2%	83.0%	83.1%	83.3%	88.7%	88.8%	88.7%	88.6%	88.8%	90.3%
5th percentile	63.8%	64.4%	63.8%	63.7%	64.8%	62.2%	71.5%	72.3%	71.5%	71.8%	73.1%	70.0%

	2042					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	233.2%	223.5%	233.2%	233.8%	215.1%	319.9%
75th percentile	143.7%	141.7%	143.7%	144.7%	139.4%	171.0%
50th percentile	110.5%	110.2%	110.5%	109.8%	108.9%	120.2%
25th percentile	94.4%	94.7%	94.4%	94.5%	94.4%	97.0%
5th percentile	73.1%	73.8%	73.1%	73.8%	74.6%	73.3%

Contributions as % of Pay – TSERS

Contribution as % of Pay determined as of 12/31/2012 was 8.76%

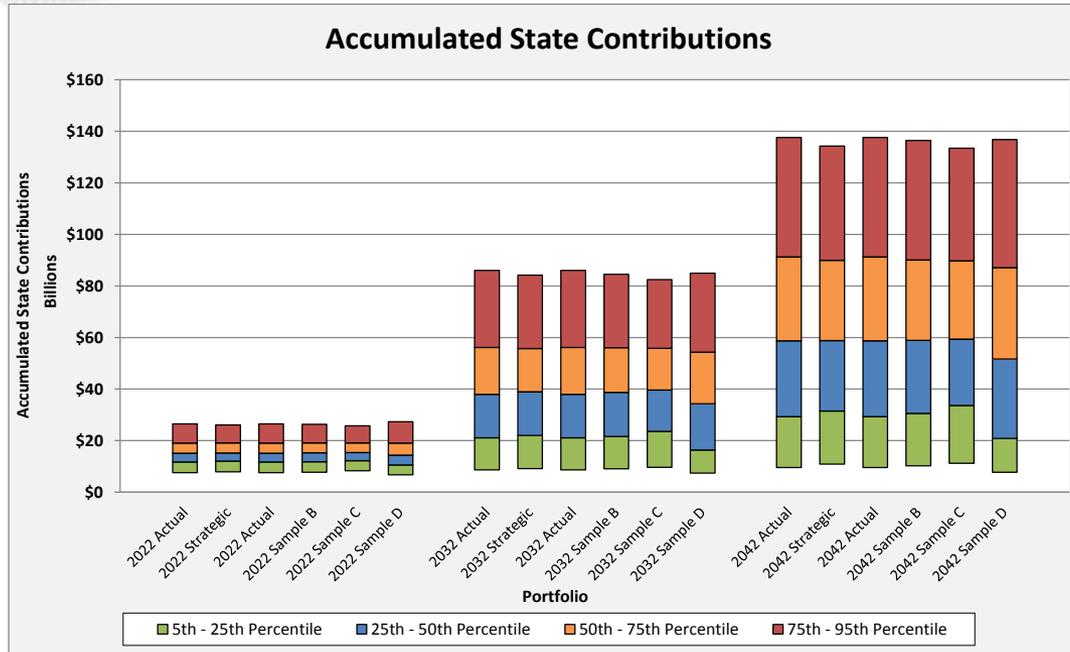


Contributions as a % of Pay

	2022						2032					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	28.8%	28.3%	28.8%	28.5%	27.7%	29.6%	26.9%	26.9%	26.9%	27.0%	26.8%	27.8%
75th percentile	17.1%	17.0%	17.1%	17.1%	16.9%	16.9%	15.8%	15.7%	15.8%	15.7%	15.9%	14.8%
50th percentile	10.0%	10.2%	10.0%	10.1%	10.5%	8.8%	7.0%	7.4%	7.0%	7.2%	7.7%	4.2%
25th percentile	3.8%	4.4%	3.8%	4.3%	5.0%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5th percentile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

	2042					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	25.4%	25.1%	25.4%	25.5%	24.9%	25.5%
75th percentile	10.6%	10.3%	10.6%	10.4%	10.7%	8.3%
50th percentile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25th percentile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5th percentile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Accumulated State Contributions – TSERS

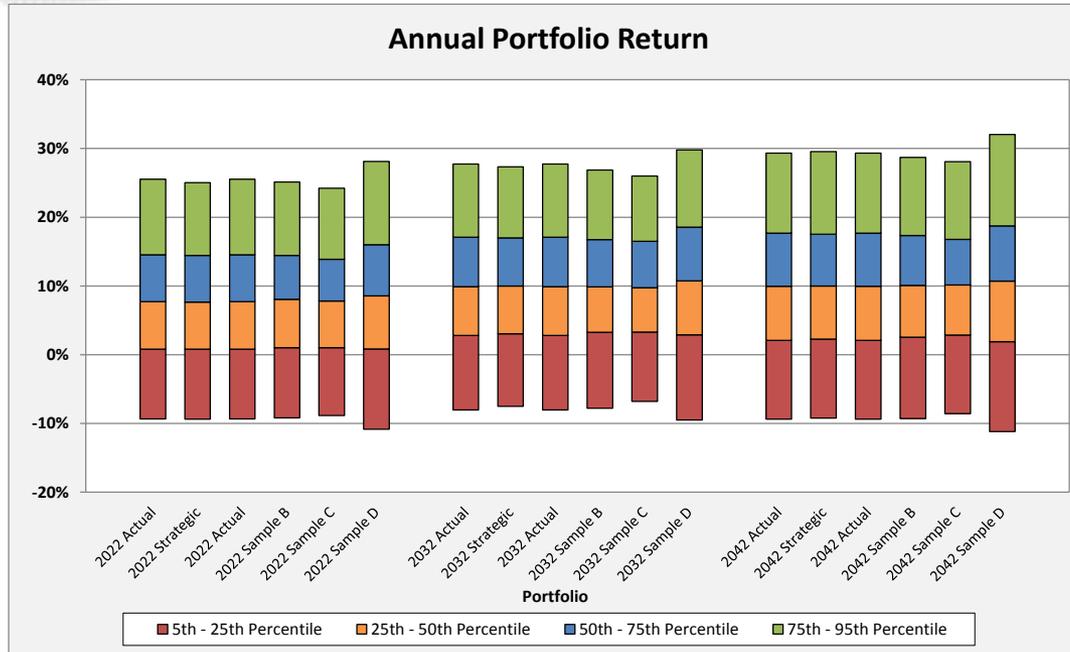


Accumulated State Contributions

	2022						2032					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	26.5	26.1	26.5	26.4	25.8	27.3	86.0	84.2	86.0	84.5	82.5	84.9
75th percentile	19.0	19.1	19.0	19.1	19.1	19.0	56.1	55.8	56.1	56.1	55.8	54.3
50th percentile	15.1	15.2	15.1	15.3	15.4	14.4	37.9	39.0	37.9	38.7	39.6	34.3
25th percentile	11.8	12.1	11.8	11.8	12.2	10.6	21.1	22.0	21.1	21.6	23.6	16.3
5th percentile	7.5	7.9	7.5	7.7	8.3	6.7	8.6	9.1	8.6	9.0	9.7	7.4

	2042					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	137.6	134.3	137.6	136.5	133.4	136.8
75th percentile	91.3	90.0	91.3	90.1	89.8	87.1
50th percentile	58.7	58.8	58.7	58.9	59.4	51.7
25th percentile	29.3	31.5	29.3	30.6	33.6	20.9
5th percentile	9.6	10.9	9.6	10.2	11.2	7.7

Annual Portfolio Return – TSERS

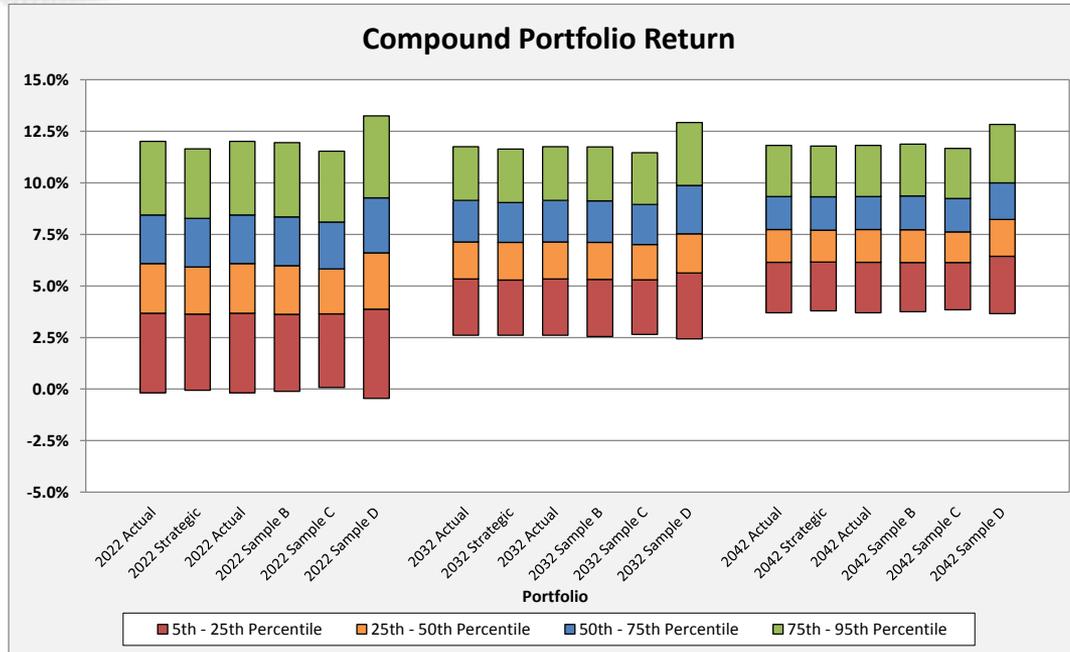


Annual Portfolio Return

	2022						2032					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	25.5%	25.0%	25.5%	25.1%	24.2%	28.1%	27.7%	27.3%	27.7%	26.9%	26.0%	29.8%
75th percentile	14.5%	14.4%	14.5%	14.4%	13.9%	16.0%	17.1%	17.0%	17.1%	16.7%	16.5%	18.5%
50th percentile	7.7%	7.7%	7.7%	8.1%	7.8%	8.6%	9.9%	10.0%	9.9%	9.9%	9.8%	10.7%
25th percentile	0.8%	0.8%	0.8%	1.0%	1.0%	0.8%	2.8%	3.1%	2.8%	3.3%	3.3%	2.9%
5th percentile	-9.3%	-9.4%	-9.3%	-9.2%	-8.8%	-10.8%	-8.0%	-7.5%	-8.0%	-7.8%	-6.8%	-9.5%

	2042					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	29.3%	29.5%	29.3%	28.7%	28.1%	32.0%
75th percentile	17.7%	17.5%	17.7%	17.3%	16.8%	18.7%
50th percentile	10.0%	10.0%	10.0%	10.1%	10.1%	10.7%
25th percentile	2.1%	2.3%	2.1%	2.5%	2.9%	1.9%
5th percentile	-9.4%	-9.2%	-9.4%	-9.3%	-8.6%	-11.2%

Compound Portfolio Return – TSERS

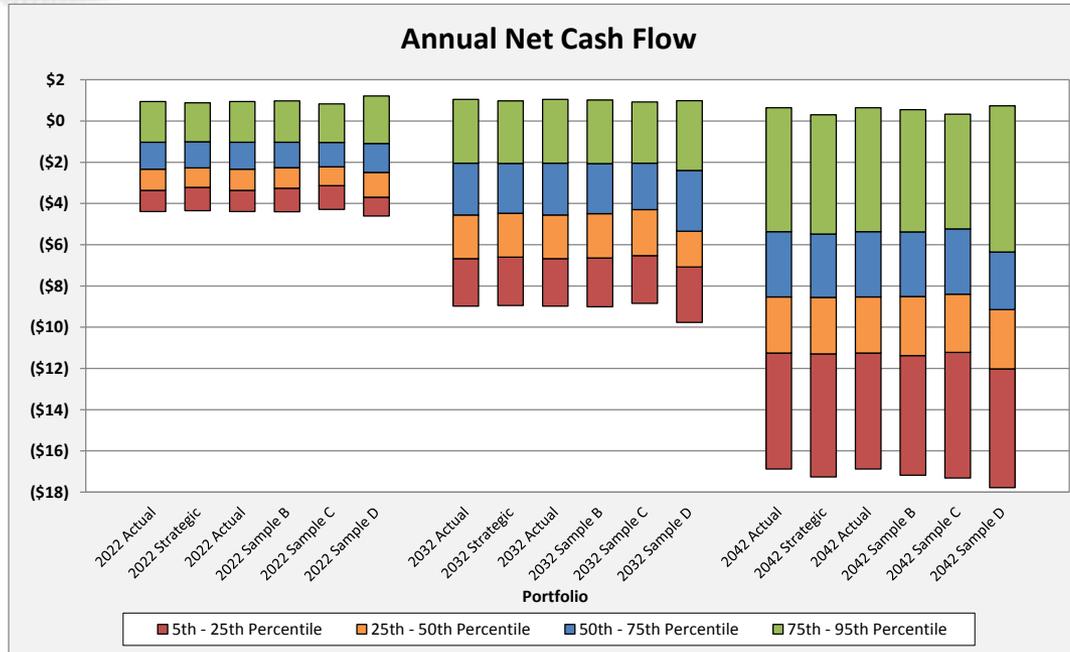


Compound Portfolio Return

	2022						2032					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	12.0%	11.7%	12.0%	11.9%	11.5%	13.2%	11.8%	11.6%	11.8%	11.7%	11.5%	12.9%
75th percentile	8.4%	8.3%	8.4%	8.3%	8.1%	9.3%	9.1%	9.0%	9.1%	9.1%	9.0%	9.9%
50th percentile	6.1%	5.9%	6.1%	6.0%	5.8%	6.6%	7.1%	7.1%	7.1%	7.1%	7.0%	7.5%
25th percentile	3.7%	3.6%	3.7%	3.6%	3.6%	3.9%	5.3%	5.3%	5.3%	5.3%	5.3%	5.6%
5th percentile	-0.2%	-0.1%	-0.2%	-0.1%	0.1%	-0.4%	2.6%	2.6%	2.6%	2.5%	2.7%	2.4%

	2042					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	11.8%	11.8%	11.8%	11.9%	11.7%	12.8%
75th percentile	9.3%	9.3%	9.3%	9.4%	9.2%	10.0%
50th percentile	7.7%	7.7%	7.7%	7.7%	7.6%	8.2%
25th percentile	6.1%	6.2%	6.1%	6.1%	6.1%	6.4%
5th percentile	3.7%	3.8%	3.7%	3.7%	3.8%	3.7%

Annual Net Cash Flow (\$) – TSERS

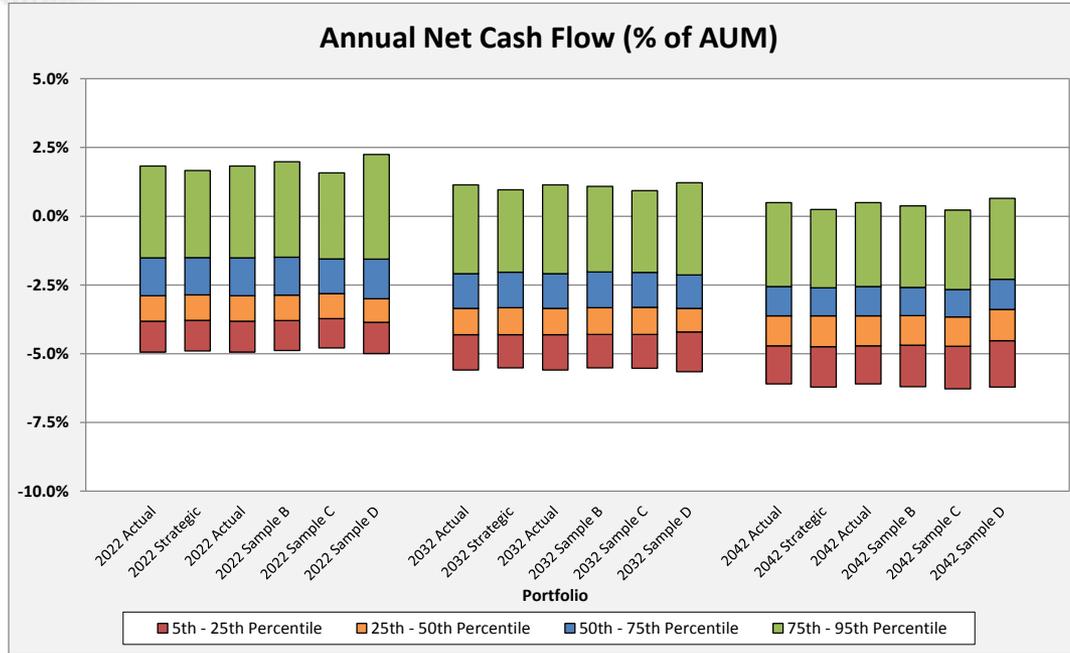


Annual Net Cash Flow

	2022						2032					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	0.9	0.9	0.9	1.0	0.8	1.2	1.0	1.0	1.0	1.0	0.9	1.0
75th percentile	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.1)	(2.0)	(2.1)	(2.0)	(2.1)	(2.0)	(2.4)
50th percentile	(2.3)	(2.3)	(2.3)	(2.3)	(2.2)	(2.5)	(4.6)	(4.5)	(4.6)	(4.5)	(4.3)	(5.3)
25th percentile	(3.4)	(3.2)	(3.4)	(3.3)	(3.1)	(3.7)	(6.7)	(6.6)	(6.7)	(6.6)	(6.5)	(7.1)
5th percentile	(4.4)	(4.3)	(4.4)	(4.4)	(4.3)	(4.6)	(9.0)	(9.0)	(9.0)	(9.0)	(8.8)	(9.8)

	2042					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	0.6	0.3	0.6	0.6	0.3	0.7
75th percentile	(5.4)	(5.5)	(5.4)	(5.4)	(5.2)	(6.4)
50th percentile	(8.5)	(8.6)	(8.5)	(8.5)	(8.4)	(9.1)
25th percentile	(11.3)	(11.3)	(11.3)	(11.4)	(11.2)	(12.0)
5th percentile	(16.9)	(17.3)	(16.9)	(17.2)	(17.3)	(17.8)

Annual Net Cash Flow (% of AUM) – TSERS

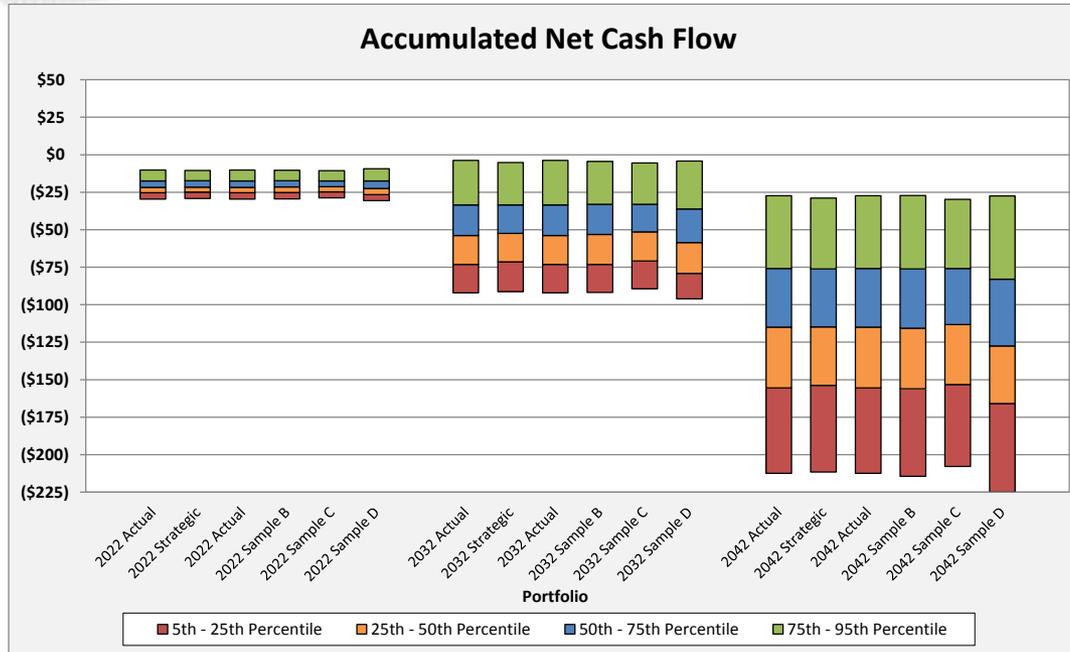


Annual Net Cash Flow (% of AUM)

	2022						2032					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	1.8%	1.7%	1.8%	2.0%	1.6%	2.2%	1.1%	1.0%	1.1%	1.1%	0.9%	1.2%
75th percentile	-1.5%	-1.5%	-1.5%	-1.5%	-1.6%	-1.6%	-2.1%	-2.0%	-2.1%	-2.0%	-2.0%	-2.1%
50th percentile	-2.9%	-2.9%	-2.9%	-2.9%	-2.8%	-3.0%	-3.3%	-3.3%	-3.3%	-3.3%	-3.3%	-3.4%
25th percentile	-3.8%	-3.8%	-3.8%	-3.8%	-3.7%	-3.9%	-4.3%	-4.3%	-4.3%	-4.3%	-4.3%	-4.2%
5th percentile	-4.9%	-4.9%	-4.9%	-4.9%	-4.8%	-5.0%	-5.6%	-5.5%	-5.6%	-5.5%	-5.5%	-5.7%

	2042					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	0.5%	0.2%	0.5%	0.4%	0.2%	0.6%
75th percentile	-2.6%	-2.6%	-2.6%	-2.6%	-2.7%	-2.3%
50th percentile	-3.6%	-3.6%	-3.6%	-3.6%	-3.7%	-3.4%
25th percentile	-4.7%	-4.7%	-4.7%	-4.7%	-4.7%	-4.5%
5th percentile	-6.1%	-6.2%	-6.1%	-6.2%	-6.3%	-6.2%

Accumulated Net Cash Flow – TSERS



Accumulated Net Cash Flow

	2022						2032					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	(10.2)	(10.4)	(10.2)	(10.3)	(10.6)	(9.3)	(3.7)	(5.2)	(3.7)	(4.5)	(5.4)	(4.2)
75th percentile	(17.5)	(17.3)	(17.5)	(17.4)	(17.5)	(17.5)	(33.5)	(33.5)	(33.5)	(33.0)	(33.0)	(36.1)
50th percentile	(21.7)	(21.6)	(21.7)	(21.5)	(21.4)	(22.4)	(53.9)	(52.4)	(53.9)	(53.1)	(51.4)	(58.6)
25th percentile	(25.3)	(24.9)	(25.3)	(25.2)	(24.7)	(26.6)	(73.2)	(71.4)	(73.2)	(73.1)	(70.8)	(79.1)
5th percentile	(29.5)	(29.2)	(29.5)	(29.5)	(28.7)	(30.6)	(92.1)	(91.3)	(92.1)	(91.9)	(89.5)	(96.1)

	2042					
	Actual	Strategic	Sample A	Sample B	Sample C	Sample D
95th percentile	(27.3)	(28.8)	(27.3)	(27.2)	(29.7)	(27.5)
75th percentile	(75.9)	(76.1)	(75.9)	(76.1)	(75.9)	(82.9)
50th percentile	(114.9)	(114.7)	(114.9)	(115.7)	(113.3)	(127.6)
25th percentile	(155.5)	(153.8)	(155.5)	(156.1)	(153.1)	(165.8)
5th percentile	(212.5)	(211.6)	(212.5)	(214.4)	(207.8)	(225.0)

Project Purpose

Retirement System Descriptive Information

Assumption Changes Since September 2013 IAC Mtg.

Key Assumptions

Duration Discussion

New Fixed Income Structure

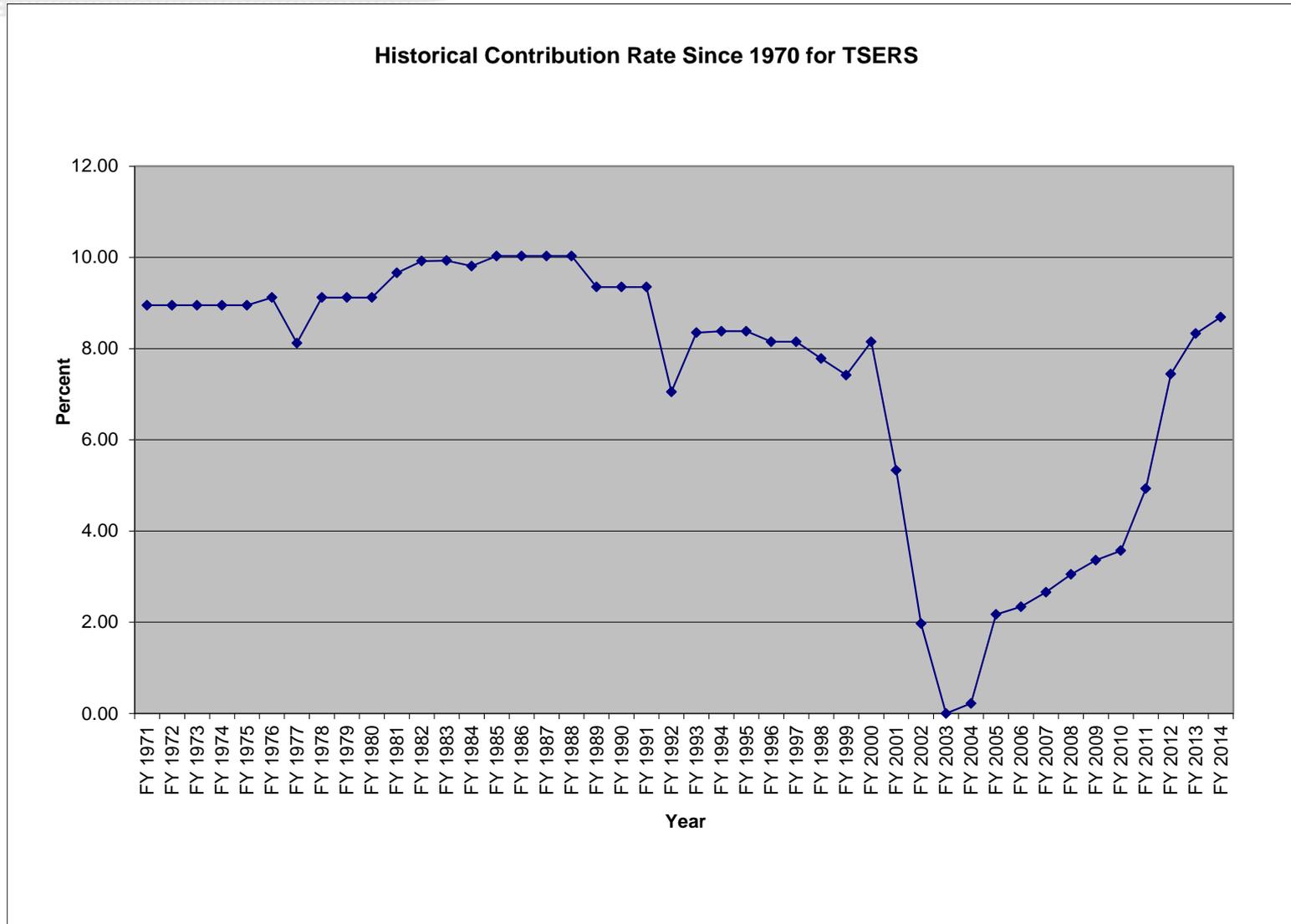
Alternative Strategies

Sensitivity / Scenario Analysis

Pension Financial Metrics

Appendix

TSERS Historical Contribution Rates



Key Assumptions – Treasury Key Rates

Forecast Year	Key Rate	Average Key Treasury Rates										Average Return During the Year			
		0.25	1.00	2.00	3.00	5.00	7.00	10.00	15.00	20.00	25.00	30.00	Treasury 1-5 year	Treasury 5-10 year	Treasury 10+ year
0		0.06%	0.10%	0.31%	0.58%	1.41%	2.10%	2.72%	3.26%	3.50%	3.72%	3.81%			
1		0.09%	0.52%	0.99%	1.37%	2.00%	2.49%	3.05%	3.64%	3.97%	4.14%	4.19%	0.63%	1.18%	2.08%
2		0.68%	1.11%	1.56%	1.93%	2.52%	2.98%	3.50%	4.05%	4.35%	4.48%	4.51%	0.97%	0.91%	1.20%
3		1.19%	1.61%	2.05%	2.40%	2.97%	3.40%	3.89%	4.40%	4.67%	4.78%	4.79%	1.67%	1.76%	2.08%
4		1.68%	2.07%	2.49%	2.82%	3.35%	3.76%	4.22%	4.70%	4.94%	5.03%	5.02%	2.24%	2.48%	2.86%
5		2.00%	2.40%	2.80%	3.13%	3.64%	4.03%	4.47%	4.92%	5.14%	5.21%	5.18%	2.86%	3.31%	3.80%
6		2.43%	2.80%	3.18%	3.49%	3.98%	4.35%	4.76%	5.18%	5.37%	5.43%	5.39%	3.03%	3.29%	3.53%
7		2.72%	3.09%	3.47%	3.77%	4.24%	4.60%	4.99%	5.39%	5.57%	5.61%	5.56%	3.56%	3.96%	4.22%
8		2.96%	3.33%	3.70%	3.99%	4.45%	4.80%	5.18%	5.55%	5.72%	5.75%	5.68%	3.94%	4.48%	4.83%
9		3.27%	3.62%	3.98%	4.27%	4.71%	5.04%	5.41%	5.77%	5.92%	5.93%	5.86%	4.07%	4.38%	4.36%
10		3.54%	3.87%	4.21%	4.48%	4.90%	5.22%	5.57%	5.92%	6.05%	6.06%	5.97%	4.45%	4.98%	5.16%
11		3.71%	4.04%	4.38%	4.65%	5.07%	5.38%	5.73%	6.06%	6.18%	6.18%	6.09%	4.74%	5.27%	5.41%
12		3.85%	4.19%	4.53%	4.80%	5.21%	5.52%	5.85%	6.17%	6.29%	6.28%	6.18%	4.97%	5.61%	5.90%
13		4.01%	4.33%	4.66%	4.91%	5.31%	5.61%	5.94%	6.24%	6.36%	6.34%	6.23%	5.18%	5.95%	6.41%
14		4.16%	4.48%	4.80%	5.06%	5.45%	5.74%	6.06%	6.36%	6.46%	6.44%	6.33%	5.23%	5.79%	5.85%
15		4.28%	4.60%	4.92%	5.17%	5.55%	5.84%	6.15%	6.44%	6.54%	6.51%	6.39%	5.45%	6.12%	6.33%
16		4.37%	4.70%	5.02%	5.28%	5.66%	5.95%	6.26%	6.55%	6.64%	6.60%	6.48%	5.55%	6.12%	6.04%
17		4.52%	4.84%	5.16%	5.41%	5.79%	6.07%	6.37%	6.65%	6.74%	6.69%	6.57%	5.64%	6.20%	6.13%
18		4.53%	4.86%	5.18%	5.43%	5.80%	6.08%	6.38%	6.66%	6.74%	6.70%	6.57%	6.00%	6.90%	7.37%
19		4.64%	4.95%	5.25%	5.49%	5.86%	6.14%	6.43%	6.70%	6.77%	6.73%	6.60%	5.89%	6.65%	6.86%
20		4.67%	4.99%	5.30%	5.54%	5.91%	6.19%	6.48%	6.75%	6.82%	6.77%	6.64%	5.98%	6.70%	6.73%
21		4.79%	5.10%	5.40%	5.64%	6.00%	6.27%	6.56%	6.82%	6.89%	6.84%	6.71%	5.97%	6.62%	6.54%
22		4.82%	5.13%	5.43%	5.67%	6.03%	6.30%	6.59%	6.84%	6.91%	6.86%	6.72%	6.18%	7.00%	7.29%
23		4.90%	5.19%	5.49%	5.72%	6.08%	6.34%	6.63%	6.88%	6.95%	6.89%	6.75%	6.16%	6.94%	7.08%
24		4.91%	5.21%	5.51%	5.74%	6.10%	6.36%	6.64%	6.90%	6.96%	6.90%	6.76%	6.30%	7.14%	7.40%
25		4.96%	5.27%	5.56%	5.80%	6.15%	6.42%	6.70%	6.94%	7.01%	6.95%	6.80%	6.25%	6.95%	7.03%
26		4.99%	5.29%	5.59%	5.82%	6.18%	6.44%	6.72%	6.96%	7.02%	6.96%	6.82%	6.35%	7.16%	7.29%
27		4.98%	5.28%	5.58%	5.82%	6.18%	6.44%	6.72%	6.97%	7.03%	6.97%	6.82%	6.43%	7.32%	7.54%
28		4.98%	5.30%	5.61%	5.85%	6.21%	6.47%	6.75%	7.00%	7.06%	6.99%	6.85%	6.37%	7.12%	7.13%
29		5.04%	5.35%	5.65%	5.88%	6.24%	6.50%	6.78%	7.02%	7.08%	7.01%	6.87%	6.39%	7.19%	7.37%
30		5.10%	5.41%	5.71%	5.95%	6.30%	6.56%	6.84%	7.08%	7.14%	7.07%	6.92%	6.37%	7.02%	6.94%

Performance Metrics Summary

	Strategic	Actual	Sample A	Sample B	Sample C	Sample D
Expected Return - 10 yr	6.0%	6.1%	6.0%	6.1%	6.0%	6.7%
Expected Volatility - 10 yr	10.5%	10.8%	10.5%	10.5%	10.0%	12.0%
Expected Return - 20 yr	7.2%	7.3%	7.1%	7.3%	7.2%	7.8%
Expected Volatility - 20 yr	10.7%	11.0%	10.7%	10.7%	10.2%	12.2%
Expected Return - 30 yr	7.8%	7.8%	7.6%	7.8%	7.7%	8.2%
Expected Volatility - 30 yr	10.8%	11.1%	10.8%	10.8%	10.3%	12.3%
Equity Beta	0.578	0.607	0.601	0.593	0.557	0.681
Inflation Beta	0.194	0.170	0.314	0.266	0.230	0.309
Interest Rate Beta	0.347	0.303	0.173	0.238	0.277	0.226
Average PV of Contributions at time 30	41.2	40.7	42.0	41.1	41.5	38.1
CTE 25th Percentile at time 30	72.4	72.6	74.3	73.0	72.1	72.9
Frequency of Contribution Rate Increase > 3%	0.054	0.056	0.057	0.055	0.051	0.057
Probability Rolling 3 year CAGR < 0.00%	0.110	0.115	0.115	0.112	0.104	0.125
Probability 30 year CAGR ≥ 7.25%	0.594	0.599	0.566	0.601	0.582	0.654
AVA Funded Ratio 50th Percentile at time 30	110.2%	110.5%	107.6%	109.8%	108.9%	120.2%
AVA Funded Ratio 5th Percentile at time 5	72.7%	72.7%	72.8%	72.5 %	73.6%	70.3%

Naïve Investment Strategies

TSRERS Asset Class	Step 0	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9
Global Equity	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
Fixed Income	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
Inflation*	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Total	100%									

* Combination of Commodities and TIPS with Commodities increasing linearly from 0% to 100% of Inflation

Capital Market Assumptions

Return and Risk

Asset Class	10 year		20 year		30 year	
	Expected Return	Standard Deviation	Expected Return	Standard Deviation	Expected Return	Standard Deviation
US Large Cap	7.30%	17.64%	8.65%	18.01%	9.23%	18.23%
US Mid Cap	9.50%	18.50%	10.89%	18.87%	11.49%	19.10%
US Small Cap	9.57%	18.94%	10.96%	19.29%	11.58%	19.52%
MSCI EAFE	9.03%	17.14%	9.22%	17.23%	9.16%	17.26%
MSCI Emerging Markets	9.98%	20.64%	10.57%	20.71%	10.89%	20.81%
Global Equity	8.40%	16.68%	9.16%	16.88%	9.44%	17.00%
Hedged Equity	5.85%	6.87%	6.16%	6.96%	6.28%	7.00%
Private Equity	11.35%	29.05%	13.60%	29.62%	14.58%	29.99%
Non IG Credit	6.56%	14.52%	8.93%	14.93%	10.20%	15.00%
Non-Core Real Estate	7.99%	22.41%	9.40%	22.80%	10.00%	23.00%
Government – Shorter Duration FI	2.74%	3.26%	4.10%	3.73%	4.83%	3.90%
Government – Long Term	3.19%	7.84%	4.69%	8.37%	5.49%	8.57%
Mortgage Backed Securities	2.82%	5.28%	4.39%	5.88%	5.16%	5.90%
IG Credit – Shorter Duration FI	3.58%	3.15%	4.95%	3.63%	5.68%	3.79%
IG Credit – Long Term	4.09%	8.04%	5.73%	8.40%	6.58%	8.52%
Cash	1.97%	1.90%	3.04%	2.41%	3.63%	2.58%
Short-Term TIPS	1.79%	2.34%	3.00%	2.77%	3.65%	2.90%
Publicly Traded Commodities	4.44%	27.80%	4.58%	27.78%	4.64%	27.58%
Private Natural Resources (incl Timber)	9.28%	20.17%	9.39%	20.15%	9.43%	20.00%
Core Real Estate	5.15%	14.41%	6.78%	14.76%	7.76%	15.00%
REITS	5.78%	19.51%	7.01%	19.85%	7.53%	20.03%
Multi-Strategy	6.48%	13.57%	8.59%	13.85%	9.65%	14.00%
Inflation	2.78%	2.94%	3.05%	3.03%	3.19%	2.99%

Capital Market Assumptions

Correlations

	US Large Cap	US Mid Cap	US Small Cap	MSCI EAFE	MSCI Emerging Markets	Global Equity	Hedged Equity	Private Equity	Non IG Credit	Non-Core Real Estate	Government – Shorter Duration FI	Government – Long Term	Mortgage Backed Securities	IG Credit – Shorter Duration FI	IG Credit – Long Term	Cash	Short-Term TIPS	Publicly Traded Commodities	Private Natural Resources (incl Timber)	Core Real Estate	REITS	Multi-Strategy	Inflation
US Large Cap	1.00	0.92	0.87	0.83	0.65	0.96	0.96	0.96	0.43	0.65	0.10	0.04	0.07	0.17	0.17	0.17	0.16	0.22	0.22	0.17	0.65	0.73	0.07
US Mid Cap	0.92	1.00	0.94	0.76	0.63	0.88	0.88	0.98	0.39	0.67	0.10	0.04	0.07	0.16	0.16	0.16	0.15	0.22	0.22	0.16	0.67	0.67	0.06
US Small Cap	0.87	0.94	1.00	0.72	0.59	0.84	0.84	0.97	0.37	0.66	0.10	0.04	0.07	0.16	0.16	0.16	0.15	0.21	0.21	0.15	0.66	0.64	0.06
MSCI EAFE	0.83	0.76	0.72	1.00	0.55	0.93	0.93	0.79	0.32	0.53	0.00	-0.01	-0.01	0.05	0.11	0.01	0.01	0.17	0.17	0.11	0.53	0.70	0.01
MSCI Emerging Markets	0.65	0.63	0.59	0.55	1.00	0.73	0.73	0.64	0.26	0.44	0.05	0.01	0.03	0.09	0.10	0.09	0.08	0.15	0.15	0.11	0.44	0.48	0.04
Global Equity	0.96	0.88	0.84	0.93	0.73	1.00	1.00	0.92	0.39	0.62	0.06	0.02	0.03	0.12	0.15	0.10	0.09	0.21	0.21	0.15	0.62	0.74	0.04
Hedged Equity	0.96	0.88	0.84	0.93	0.73	1.00	1.00	0.92	0.39	0.62	0.06	0.02	0.03	0.12	0.15	0.10	0.09	0.21	0.21	0.15	0.62	0.74	0.04
Private Equity	0.96	0.98	0.97	0.79	0.64	0.92	0.92	1.00	0.41	0.68	0.10	0.04	0.07	0.17	0.17	0.17	0.16	0.22	0.22	0.16	0.68	0.70	0.07
Non IG Credit	0.43	0.39	0.37	0.32	0.26	0.39	0.39	0.41	1.00	0.28	0.41	0.32	0.37	0.45	0.40	0.30	0.32	0.11	0.11	0.14	0.28	0.35	0.07
Non-Core Real Estate	0.65	0.67	0.66	0.53	0.44	0.62	0.62	0.68	0.28	1.00	0.09	0.03	0.06	0.13	0.12	0.14	0.13	0.16	0.16	0.12	1.00	0.48	0.05
Government – Shorter Duration FI	0.10	0.10	0.10	0.00	0.05	0.06	0.06	0.10	0.41	0.09	1.00	0.86	0.94	0.99	0.86	0.63	0.68	0.02	0.02	0.21	0.09	0.18	0.09
Government – Long Term	0.04	0.04	0.04	-0.01	0.01	0.02	0.02	0.04	0.32	0.03	0.86	1.00	0.95	0.83	0.98	0.23	0.28	-0.07	-0.07	0.10	0.03	0.09	-0.11
Mortgage Backed Securities	0.07	0.07	0.07	-0.01	0.03	0.03	0.03	0.07	0.37	0.06	0.94	0.95	1.00	0.92	0.93	0.43	0.48	-0.02	-0.02	0.16	0.06	0.14	-0.01
IG Credit – Shorter Duration FI	0.17	0.16	0.16	0.05	0.09	0.12	0.12	0.17	0.45	0.13	0.99	0.83	0.92	1.00	0.86	0.66	0.70	0.04	0.04	0.22	0.13	0.23	0.11
IG Credit – Long Term	0.17	0.16	0.16	0.11	0.10	0.15	0.15	0.17	0.40	0.12	0.86	0.98	0.93	0.86	1.00	0.27	0.32	-0.03	-0.03	0.12	0.12	0.19	-0.09
Cash	0.17	0.16	0.16	0.01	0.09	0.10	0.10	0.17	0.30	0.14	0.63	0.23	0.43	0.66	0.27	1.00	0.94	0.17	0.17	0.28	0.14	0.23	0.38
Short-Term TIPS	0.16	0.15	0.15	0.01	0.08	0.09	0.09	0.16	0.32	0.13	0.68	0.28	0.48	0.70	0.32	0.94	1.00	0.19	0.19	0.28	0.13	0.22	0.47
Publicly Traded Commodities	0.22	0.22	0.21	0.17	0.15	0.21	0.21	0.22	0.11	0.16	0.02	-0.07	-0.02	0.04	-0.03	0.17	0.19	1.00	1.00	0.25	0.16	0.17	0.54
Private Natural Resources (incl Timber)	0.22	0.22	0.21	0.17	0.15	0.21	0.21	0.22	0.11	0.16	0.02	-0.07	-0.02	0.04	-0.03	0.17	0.19	1.00	1.00	0.25	0.16	0.17	0.54
Core Real Estate	0.17	0.16	0.15	0.11	0.11	0.15	0.15	0.16	0.14	0.12	0.21	0.10	0.16	0.22	0.12	0.28	0.28	0.25	0.25	1.00	0.12	0.17	0.31
REITS	0.65	0.67	0.66	0.53	0.44	0.62	0.62	0.68	0.28	1.00	0.09	0.03	0.06	0.13	0.12	0.14	0.13	0.16	0.16	0.12	1.00	0.48	0.05
Multi-Strategy	0.73	0.67	0.64	0.70	0.48	0.74	0.74	0.70	0.35	0.48	0.18	0.09	0.14	0.23	0.19	0.23	0.22	0.17	0.17	0.17	0.48	1.00	0.08
Inflation	0.07	0.06	0.06	0.01	0.04	0.04	0.04	0.07	0.07	0.05	0.09	-0.11	-0.01	0.11	-0.09	0.38	0.47	0.54	0.54	0.31	0.05	0.08	1.00