

STATE OF RHODE ISLAND

ASSET ALLOCATION ANALYSIS

July, 2019

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BOSTON | ATLANTA | CHARLOTTE | CHICAGO | DETROIT | LAS VEGAS | PORTLAND | SAN FRANCISCO

SIC RISK CONSTRAINTS

NEPC, LLC

SIC Risk Preferences : September 2016

Asset Liability Review: Key Priorities

Funding:

- Continue progress towards plan full funding (100%)
- Avoid funding level falling below 50% (current funding level 60%)

Contributions:

- Avoid employer contribution rising to > 30% of payroll



Modeling Optimization:

- Success (**Goal**) = probability of a 100% funding ratio in 22 years
 - i.e., improving fund sustainability
- Risk (**Constraint**) = probability of breaching 50% funding level in the next 5 years
 - i.e., achieving a more stable return path

POTENTIAL SIC GOALS & RISK PREFERENCES: JULY 2019

SIC Goals:

Improving Fund sustainability and progressing towards a fully funded plan

- Maintain or improve probability of 100% funding ratio in 20 years

Risk Constraints:

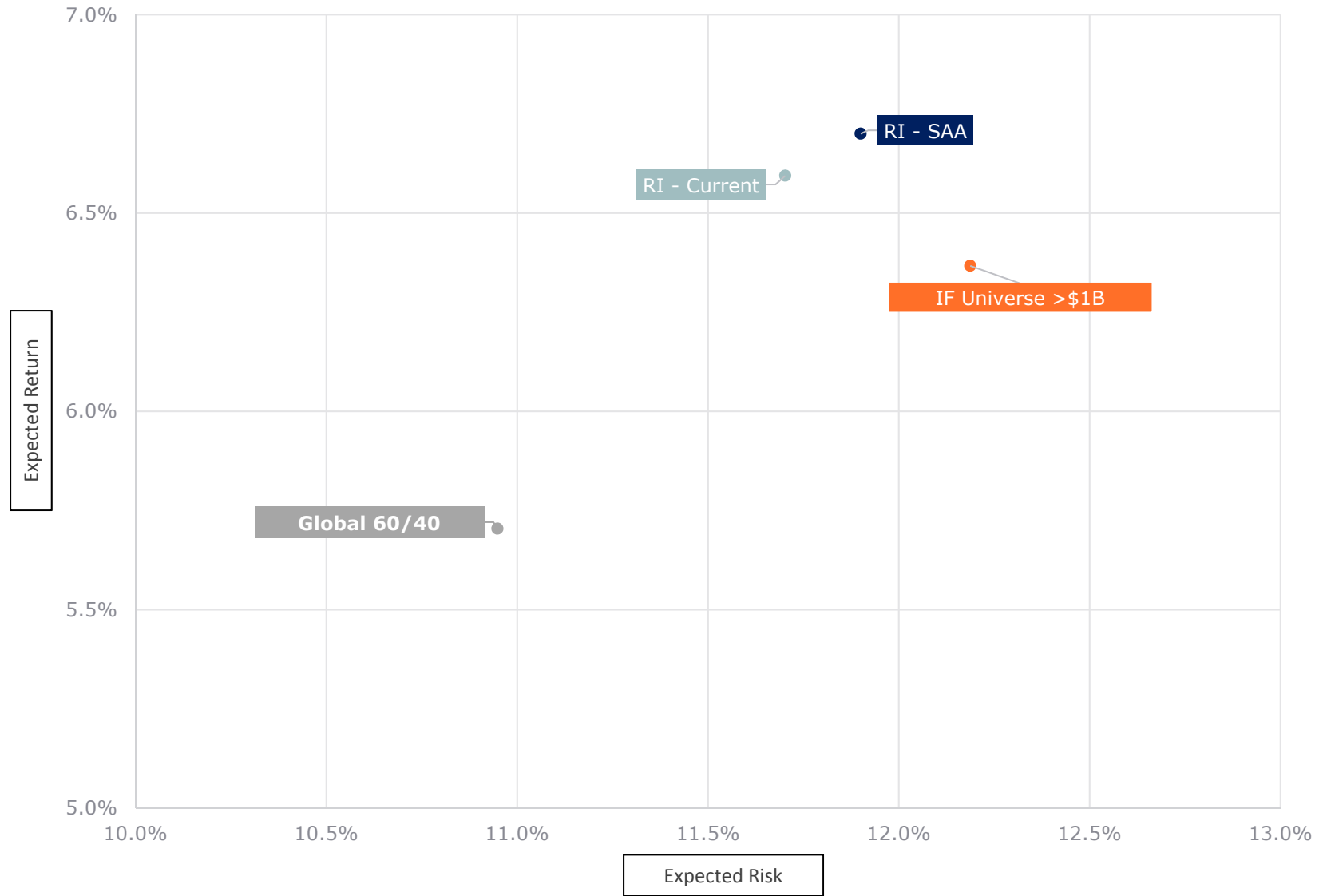
Achieve a more stable return path by managing and mitigating risks accordingly

- Limit the probability of funding level falling below 50% in next 5 years (current funding level 54%) to ~15%
- Limit the probability of a 2% absolute increase in employer contribution rate (expressed as a percentage of payroll) to ~25% in any given year within next 10 years
 - Note that the discount rate has been updated from 7.5% to 7.0% from the previous objective which was set in September 2016
- Within 90% confidence, maintain at least 3x the annual benefit payment amount in assets with daily/weekly liquidity profile in a recessionary scenario



*The above figures were presented as part of the September 2019 SIC Asset Allocation meeting

SIC ASSET ALLOCATION: 5 YR. EXPECTED RISK & RETURN

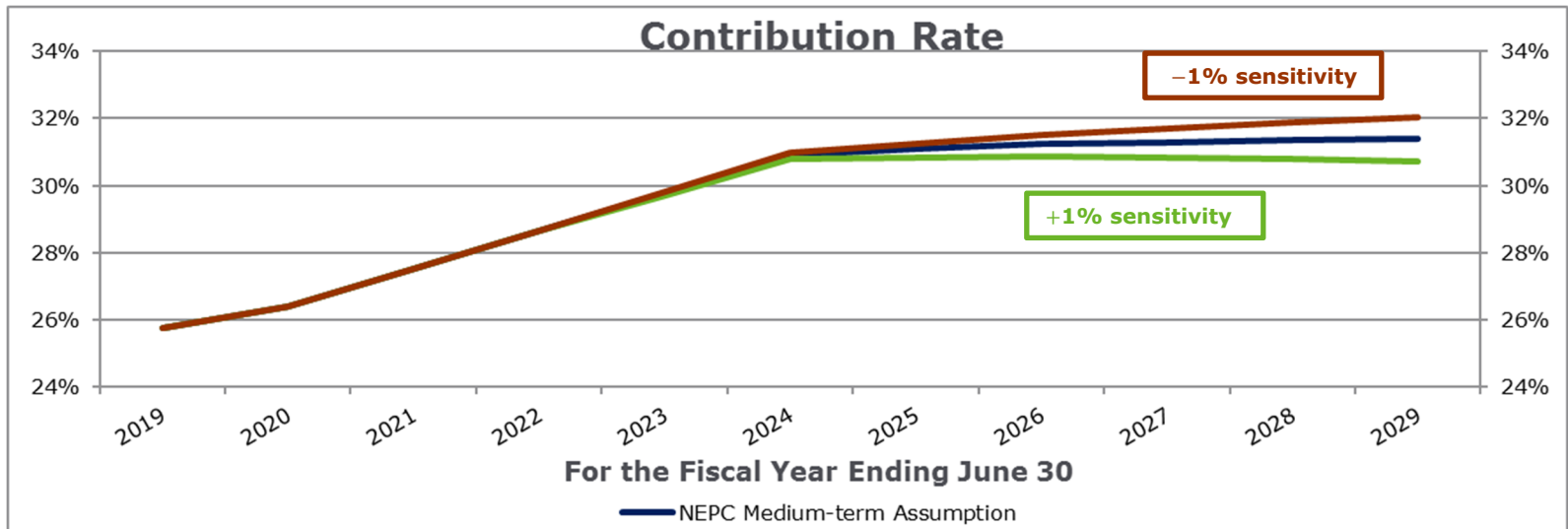
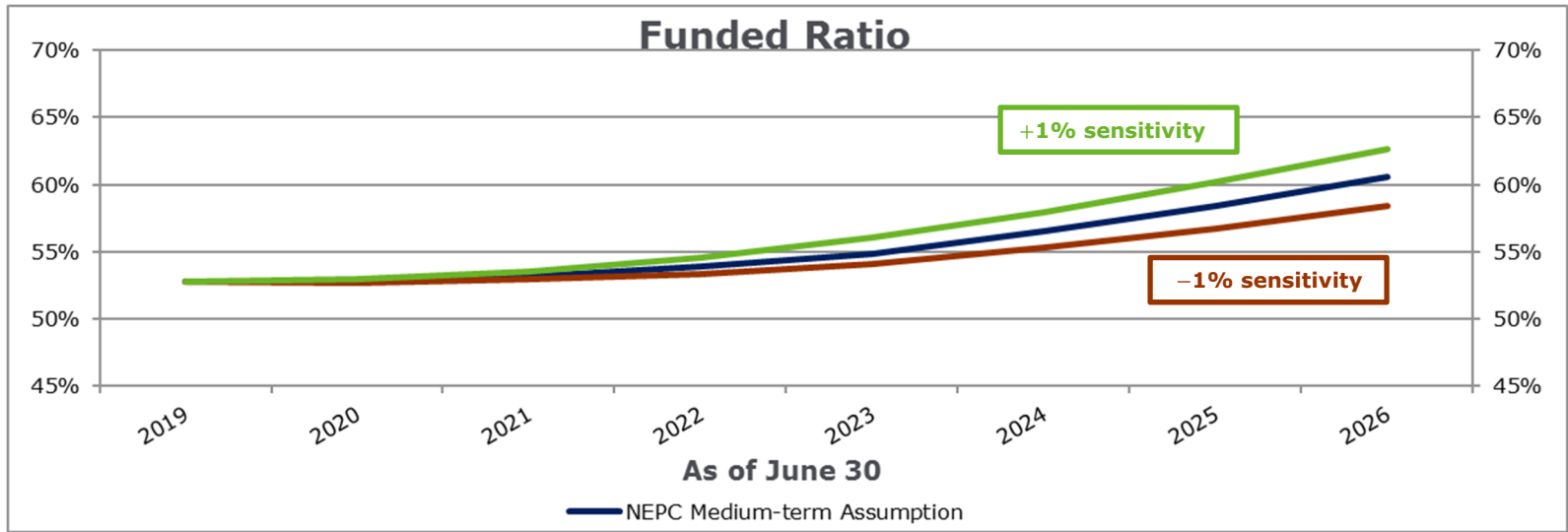


*The IF Universe represents a collection of defined benefit pension public funds with assets greater than \$1 billion. NEPC return & risk assumptions applied to median universe allocation.

As of March 31, 2019

MEDIUM-TERM – STATE EMPLOYEES

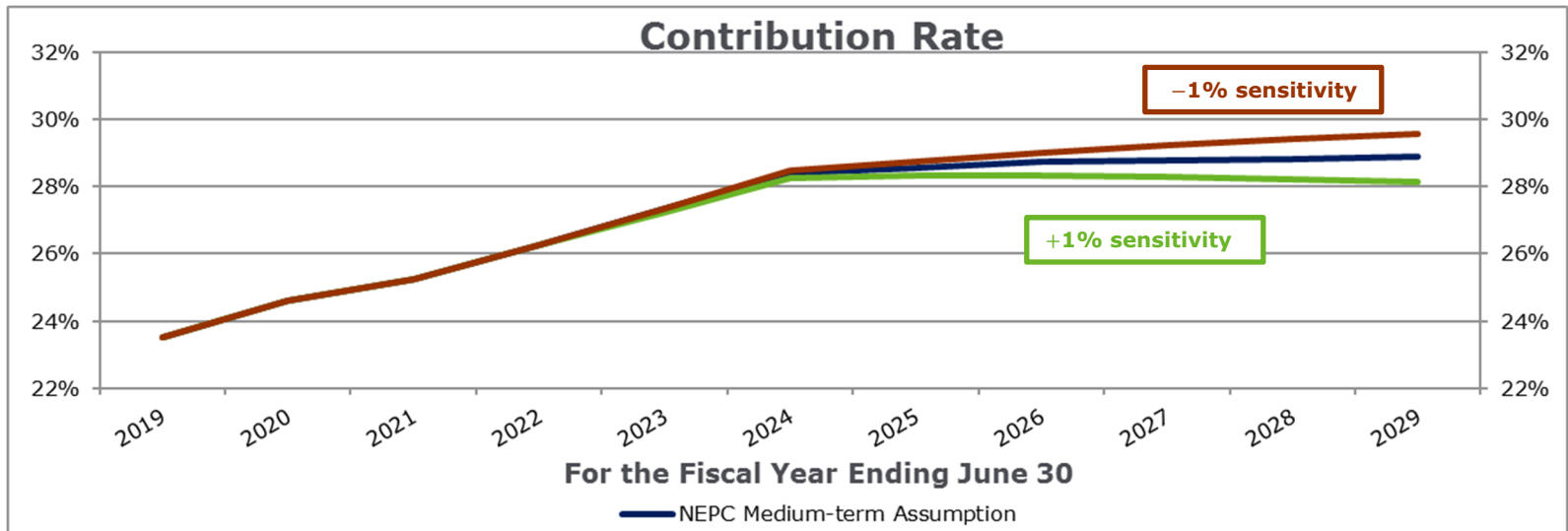
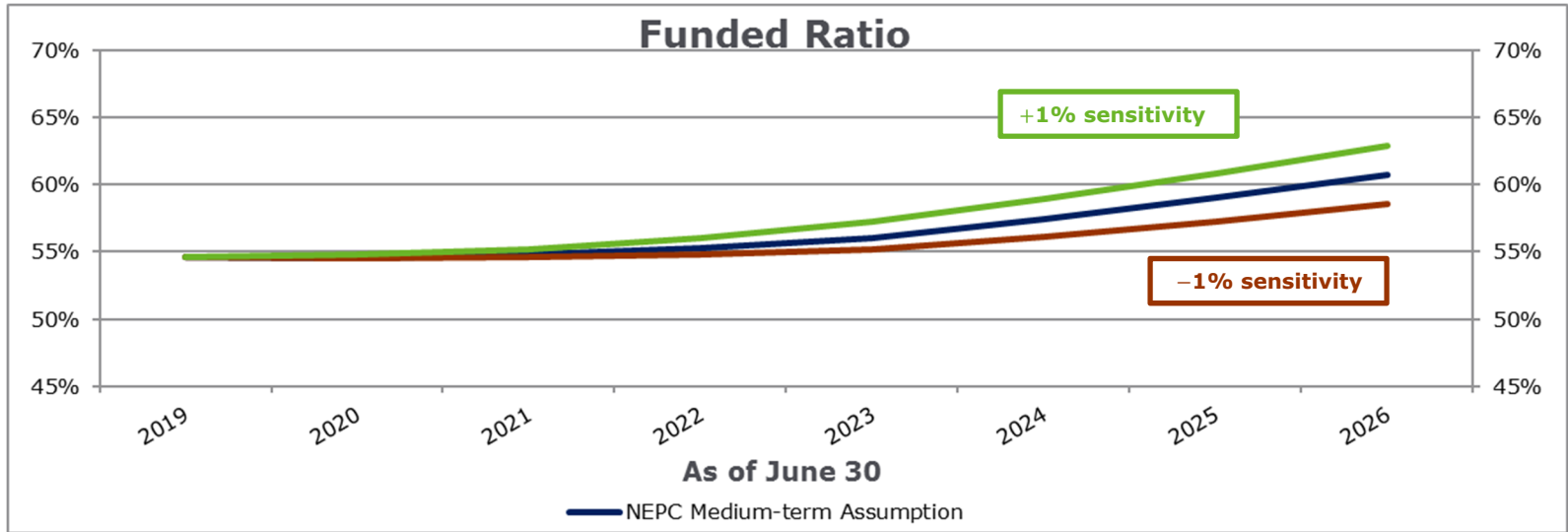
Using NEPC's 5-7 Year Expected Return Assumption of 6.7%



Sensitivity paths assume a 7.7% (+1%) and 5.7% (-1%) return each year.

MEDIUM-TERM – TEACHERS

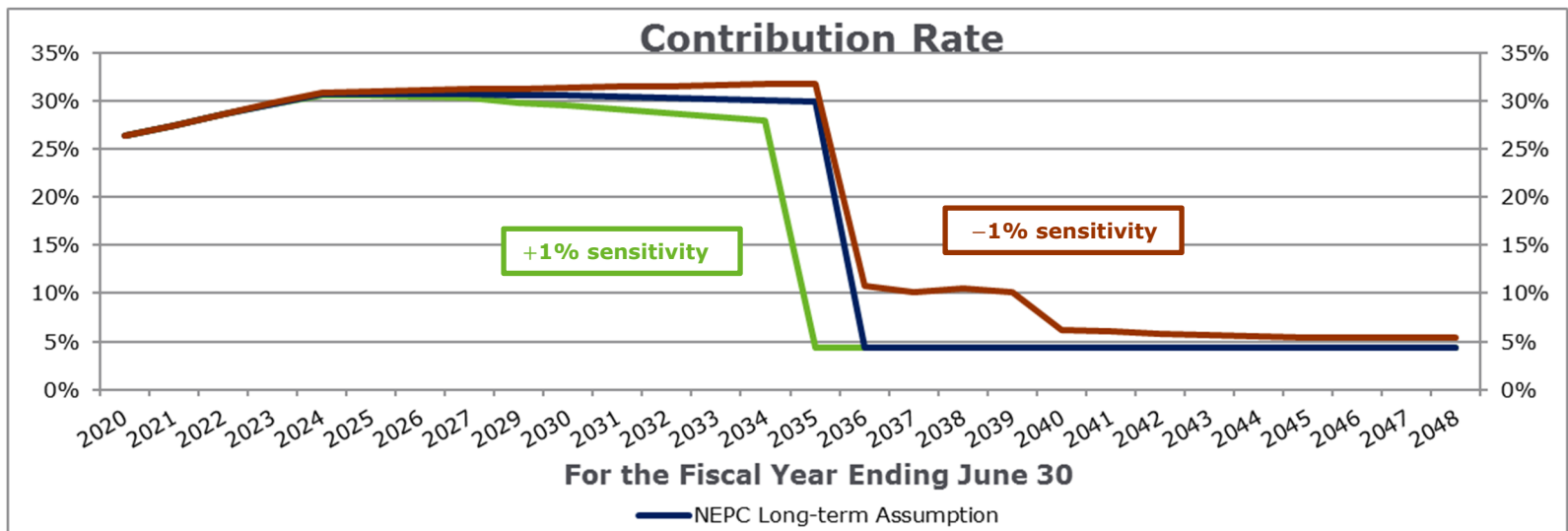
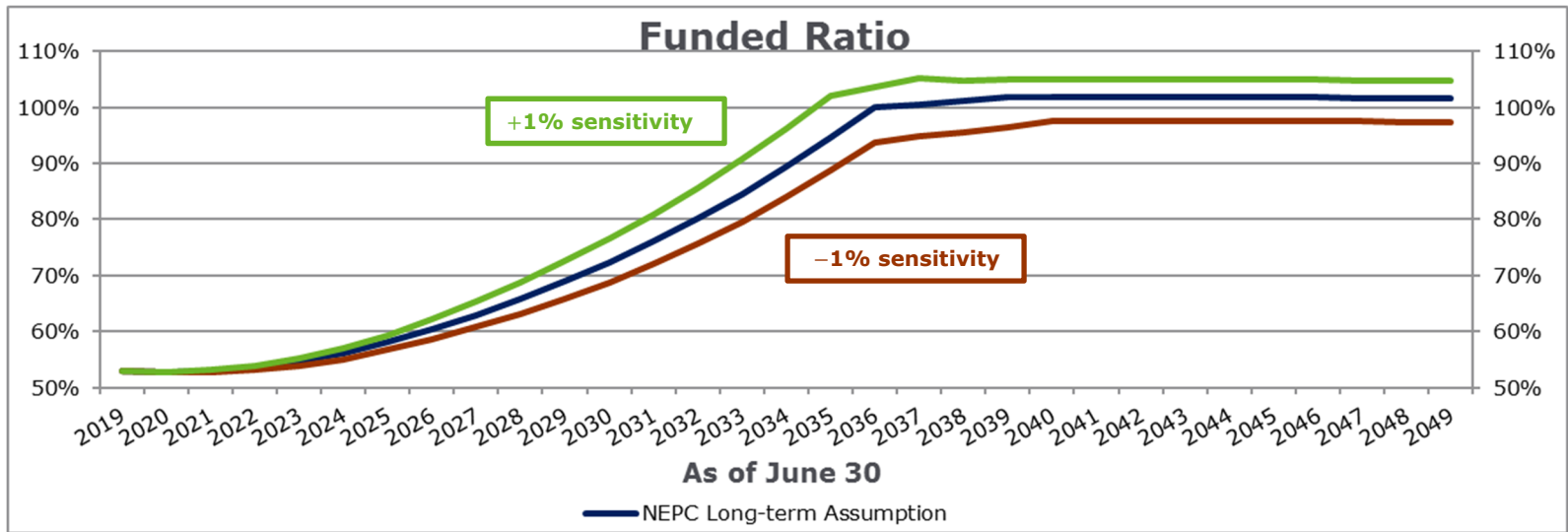
Using NEPC's 5-7 Year Expected Return Assumption of 6.7%



Sensitivity paths assume a 7.7% (+1%) and 5.7% (-1%) return each year.

LONG-TERM – STATE EMPLOYEES

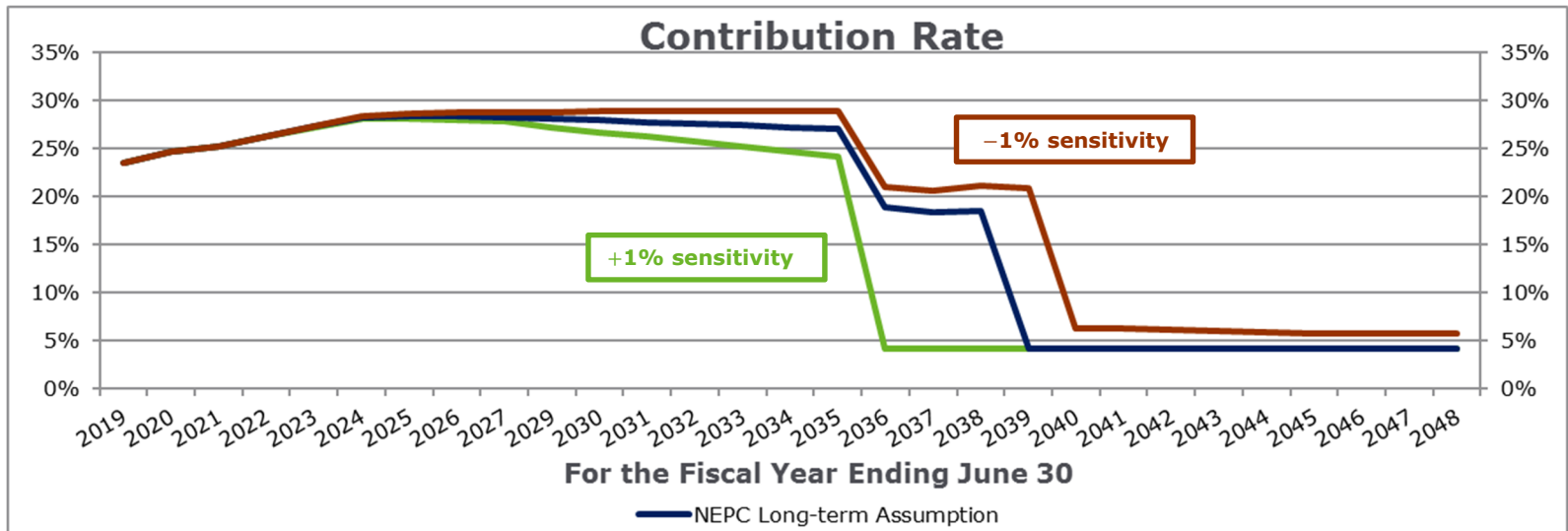
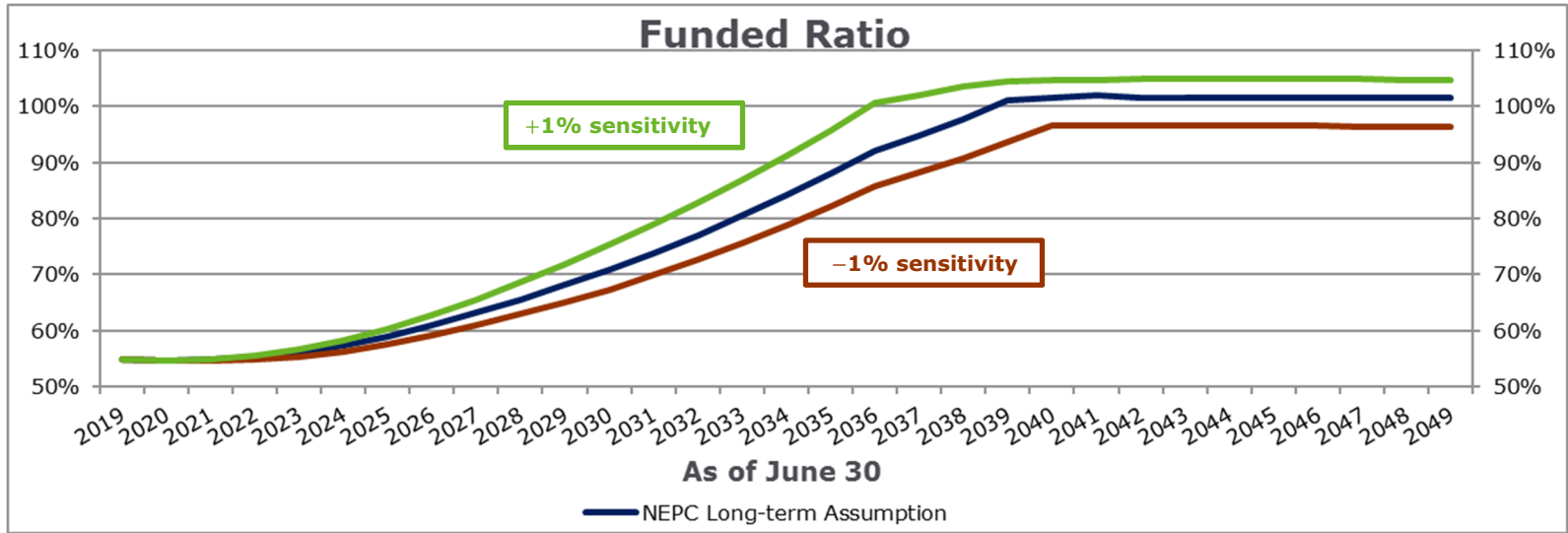
Using NEPC's 30 Year Expected Return Assumption of 7.8%



Sensitivity paths assume a 8.8% (+1%) and 6.8% (-1%) return each year.

LONG-TERM – TEACHERS

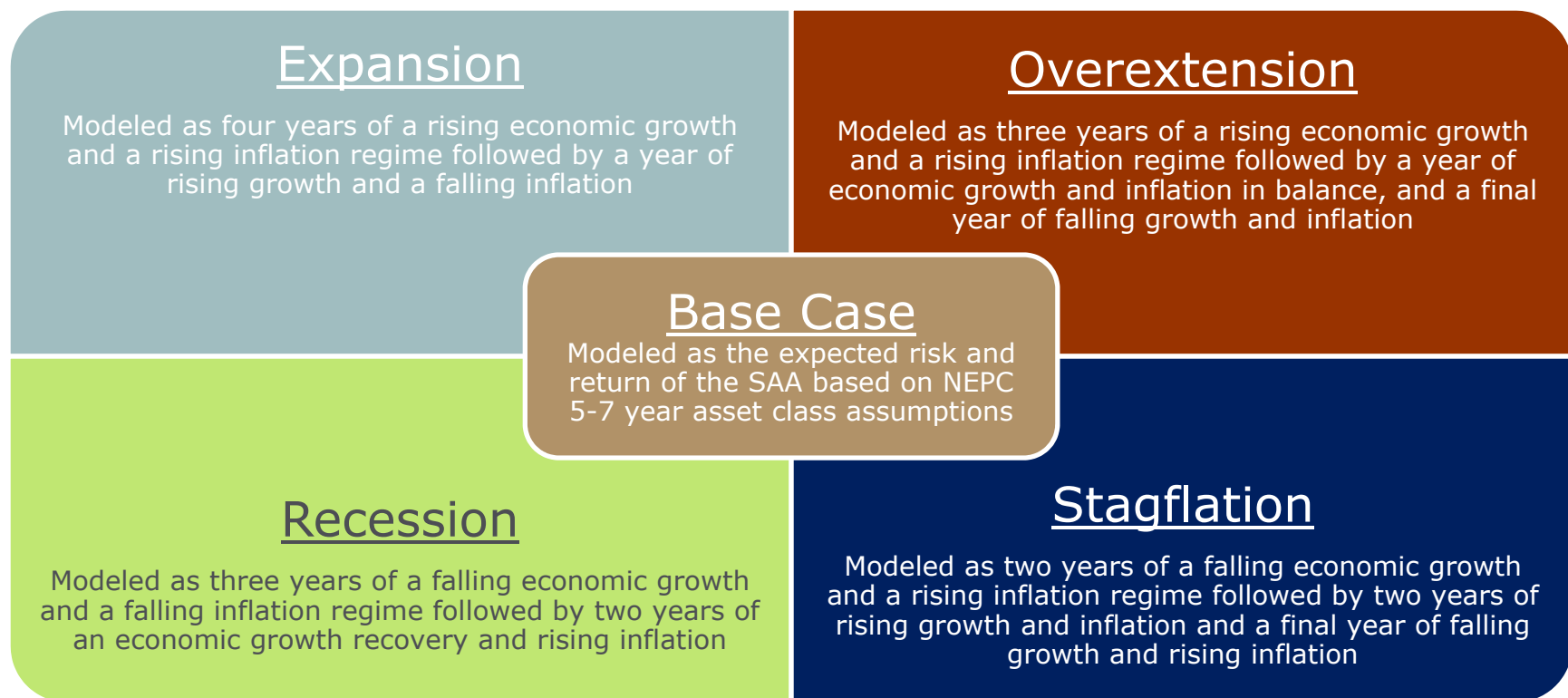
Using NEPC's 30 Year Expected Return Assumption of 7.8%



Sensitivity paths assume a 8.8% (+1%) and 6.8% (-1%) return each year.

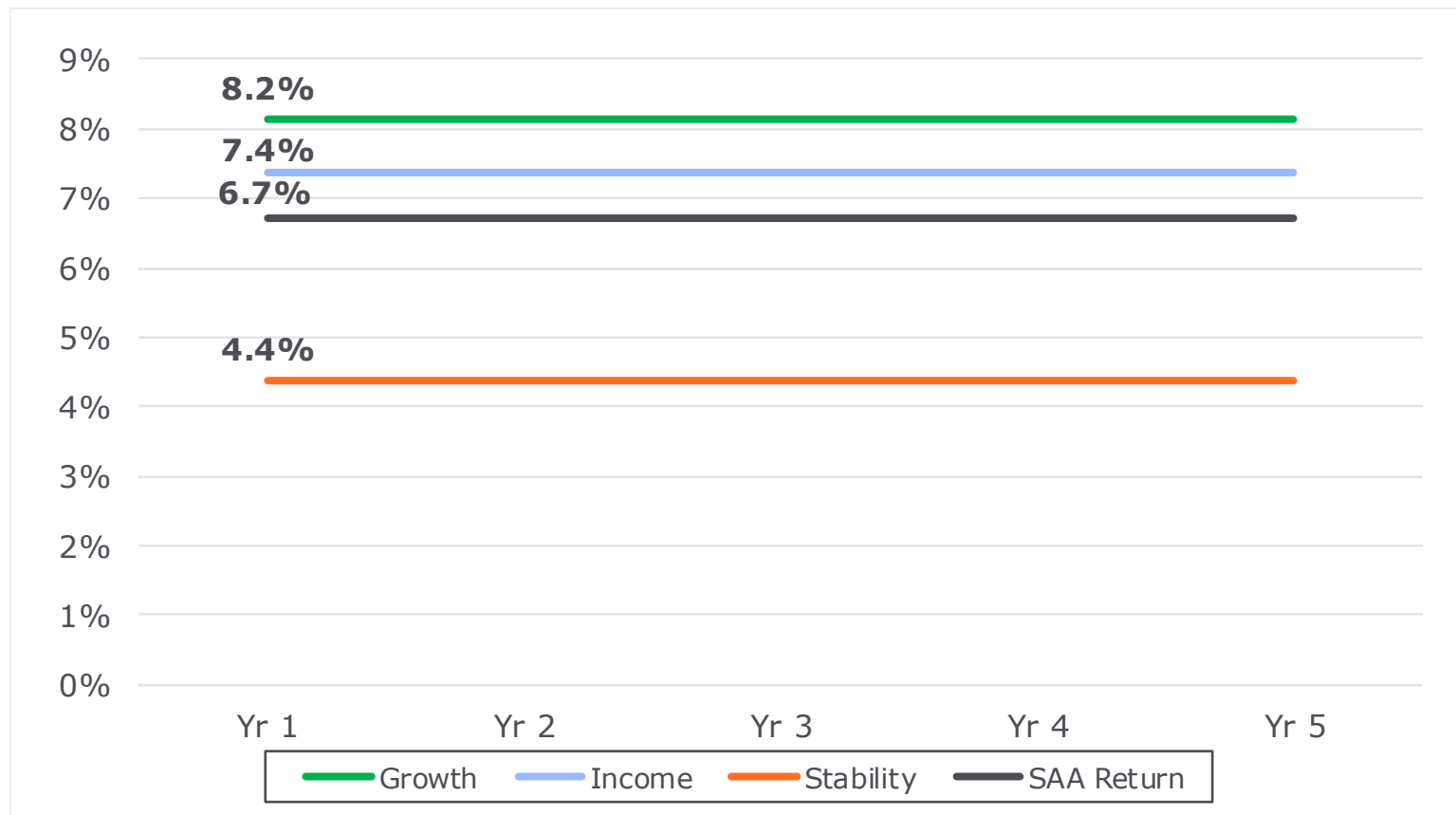
SCENARIO ANALYSIS: REGIME CHANGES

- **NEPC scenario analysis highlights the impact of shifting economic and market regimes on the portfolio and potential asset allocation mixes**
 - Scenario returns are based on asset class beta exposure informed by historical returns classified across market regimes and NEPC's current capital market assumptions
 - Allows for a better understanding of portfolio risk exposures under non-consensus inflation and economic growth outcomes over a five year time horizon



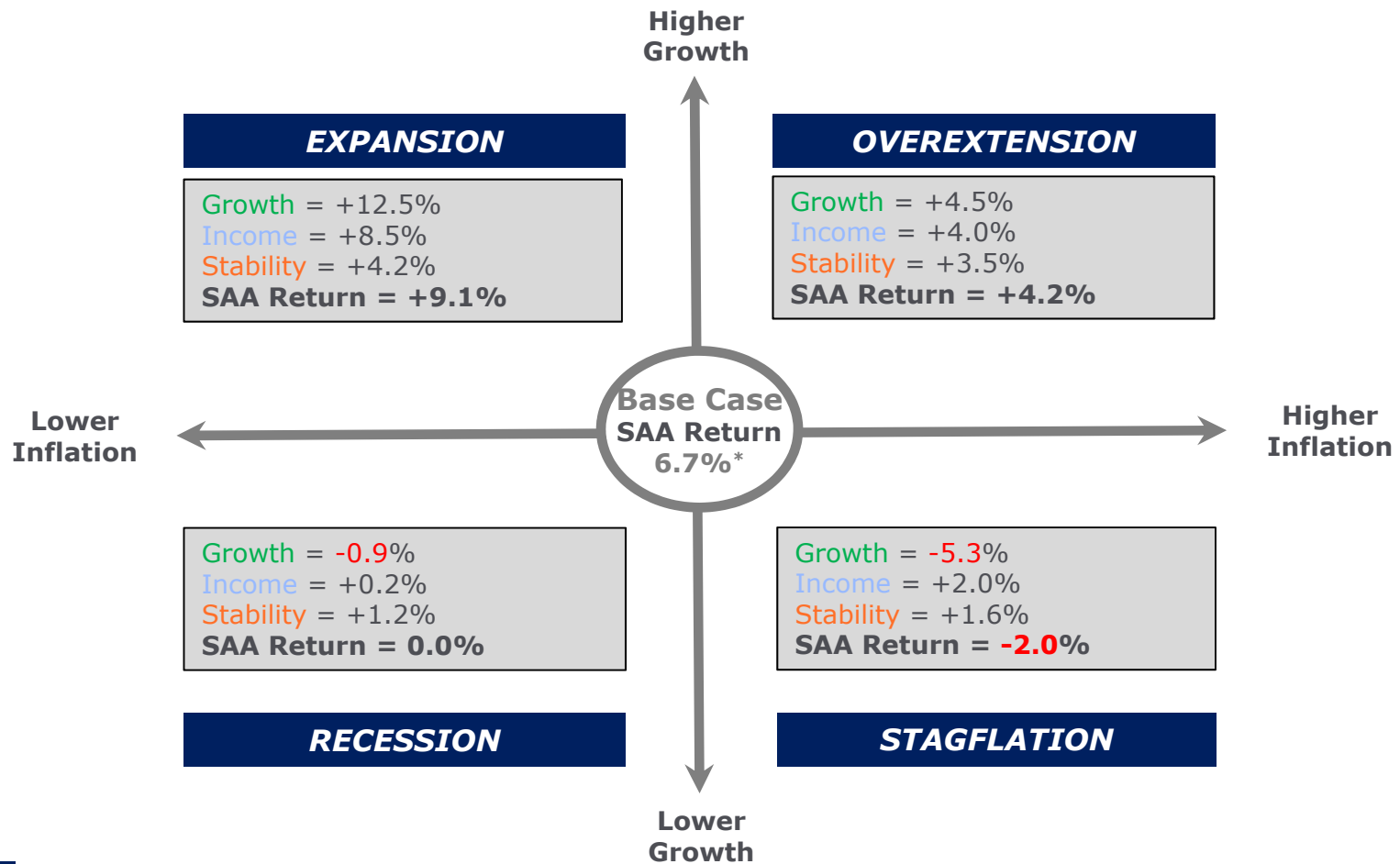
SCENARIO ANALYSIS: **BASE CASE**

- **NEPC Scenario Analysis tests the impact of regime changes and historical events on funded ratio and contribution rates**
 - Allows for a better understanding of risk exposures under contrasting inflation and economic growth regimes (non-consensus forecasts), and under past historical events that have shook markets



SIC ASSET ALLOCATION: SCENARIO ANALYSIS

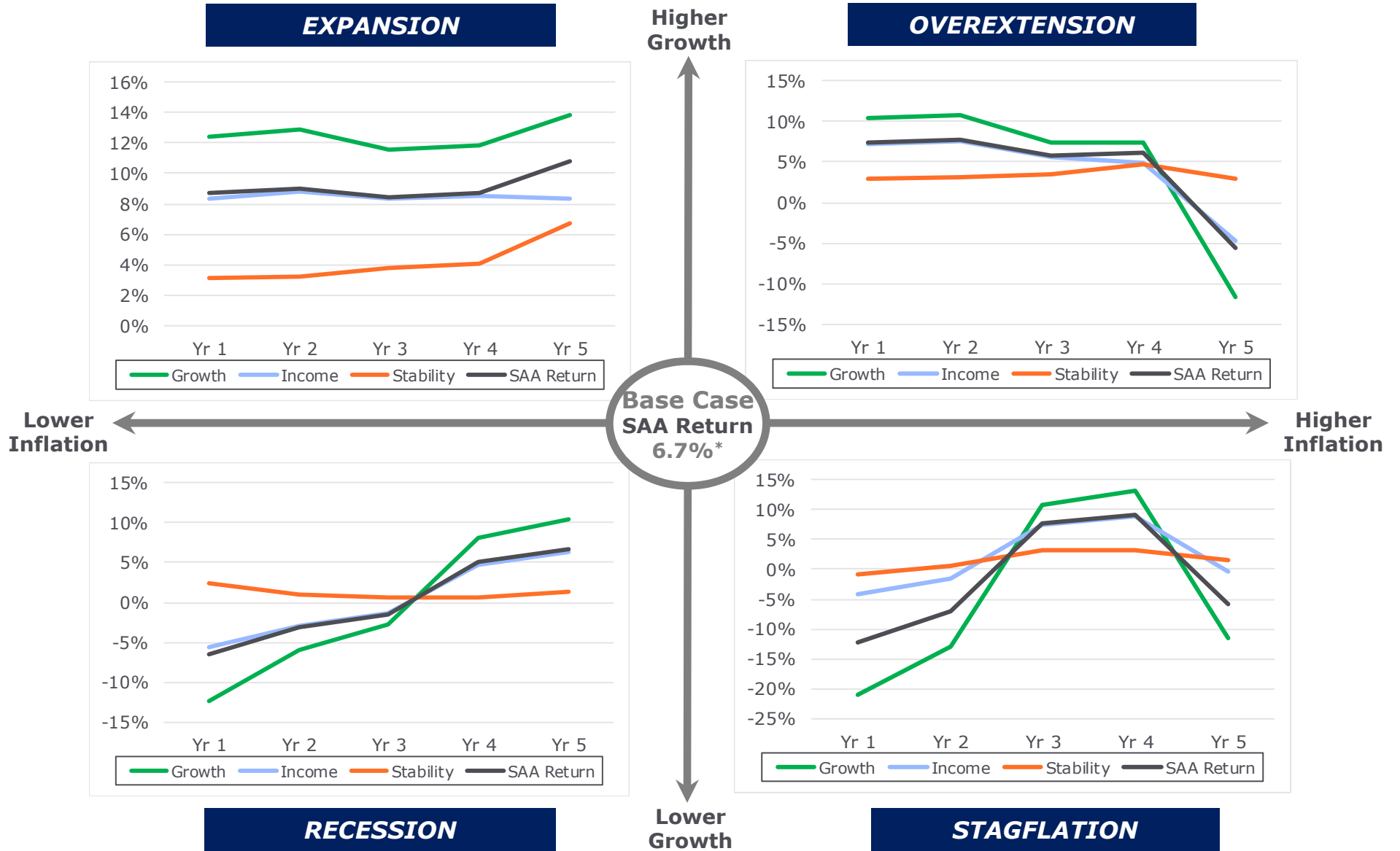
- **NEPC Scenario Analysis models annualized 5-year returns for the portfolio across different regimes**
 - Allows for a better understanding of risk exposures under contrasting inflation and economic growth regimes (non-consensus forecasts)



*The Base Case return is an annualized 6.7% geometric return over a 5 year period



SIC ASSET ALLOCATION: SCENARIO ANALYSIS

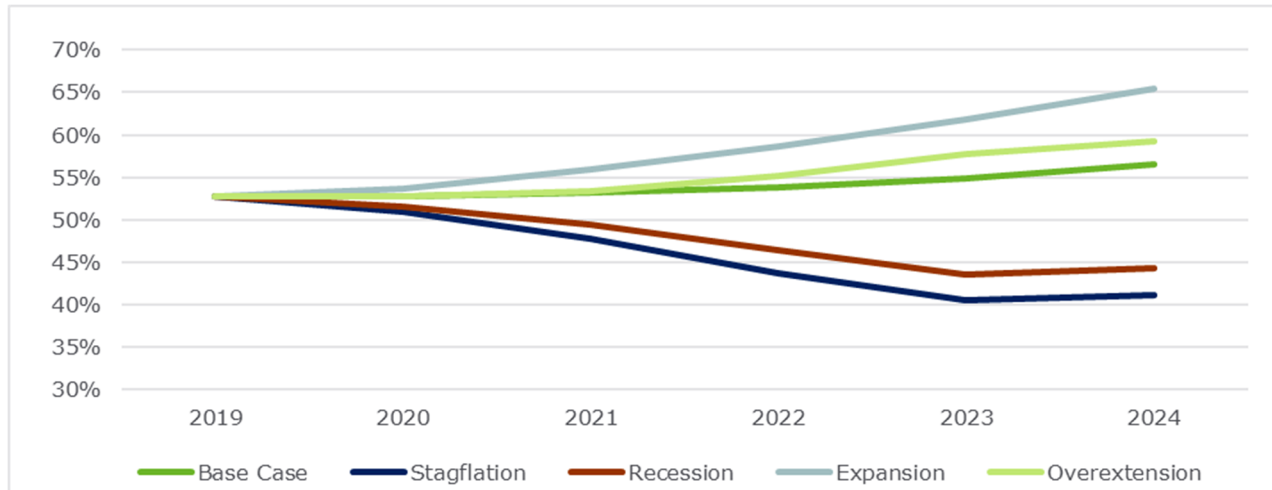


*The Base Case return is an annualized 6.7% geometric return over a 5 year period

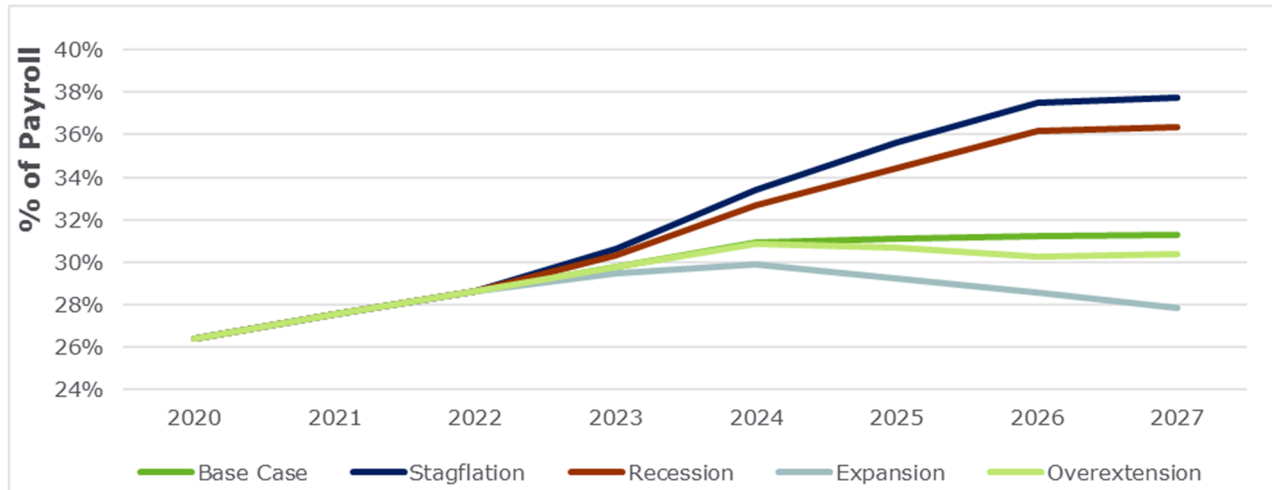


REGIME SCENARIOS – STATE EMPLOYEES

Funded Ratio



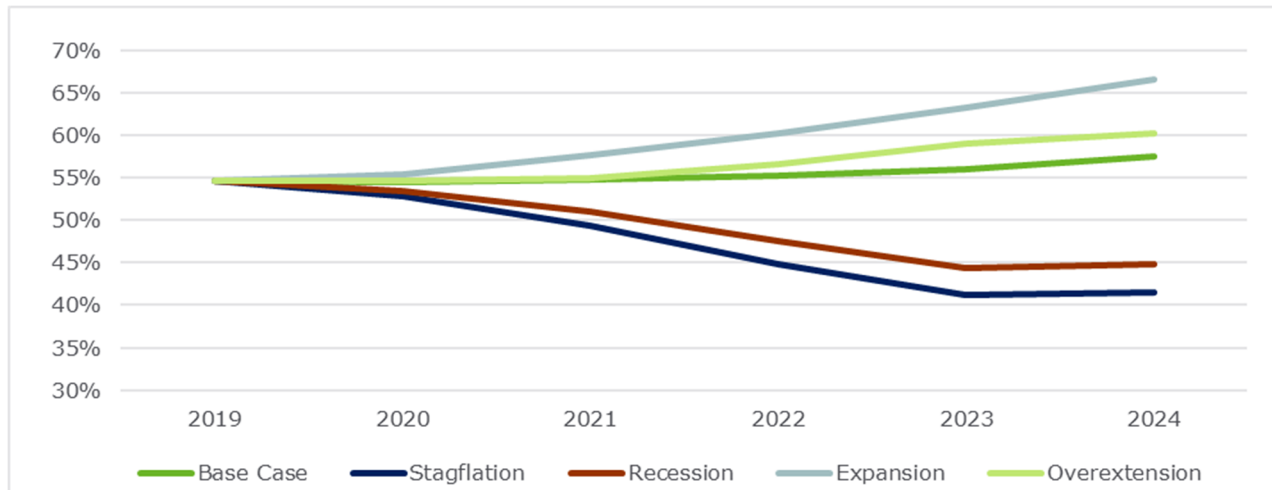
Employer Contribution Rate



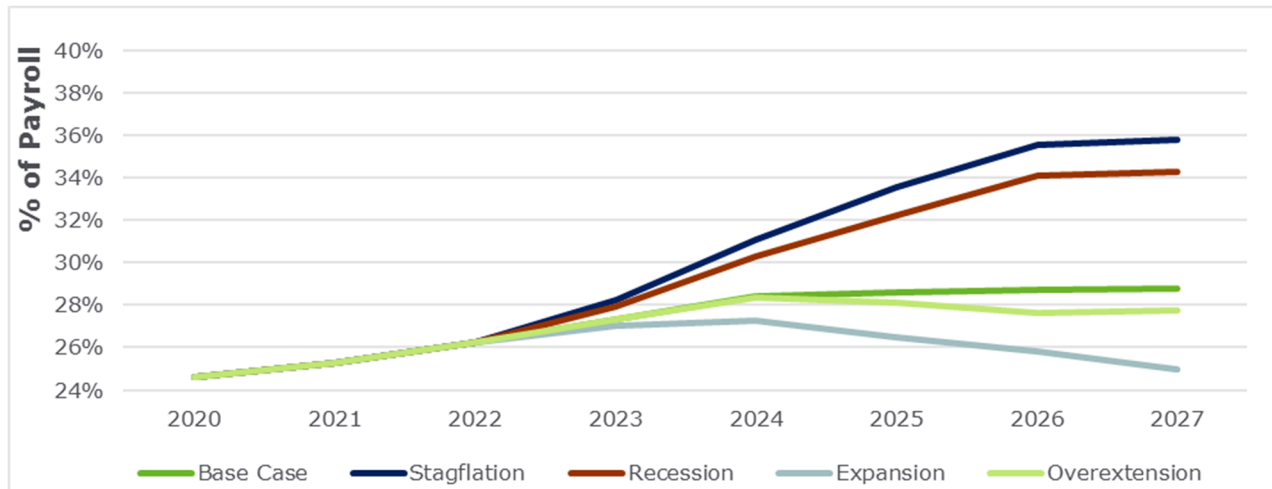
Base Case assumes NEPC's 5-7 year return assumption of 6.7% each year.

REGIME SCENARIOS – TEACHERS

Funded Ratio

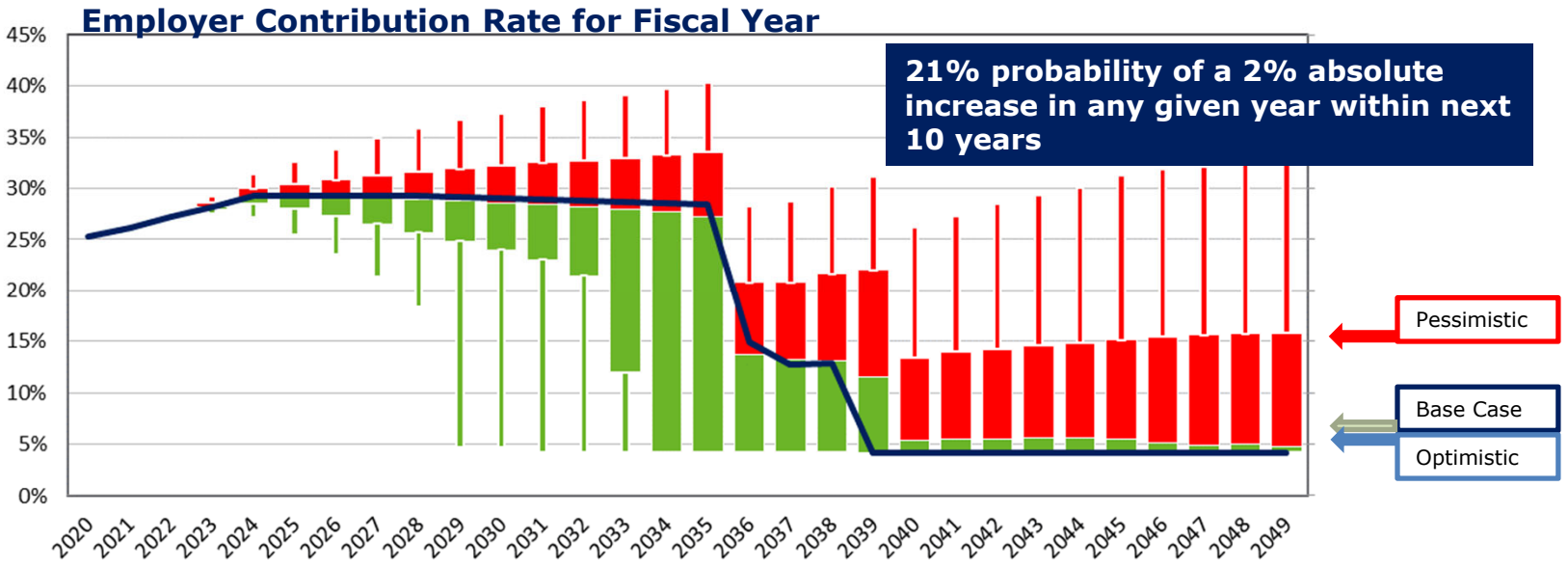
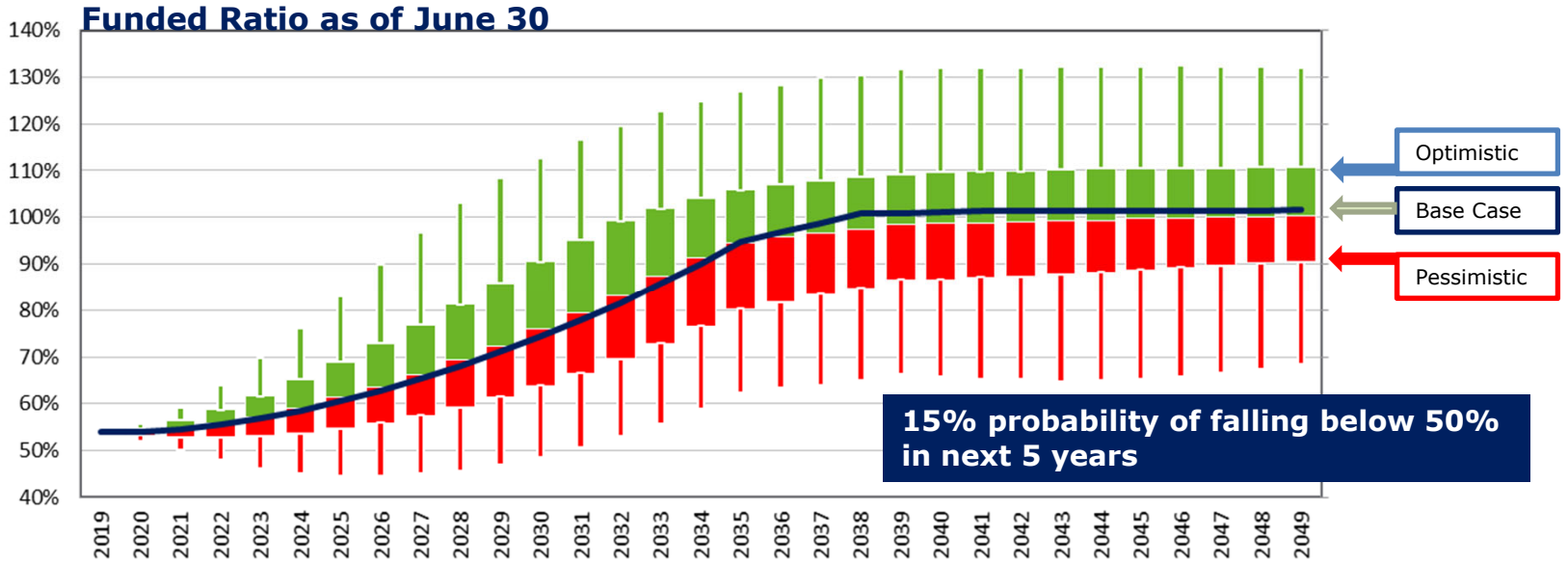


Employer Contribution Rate



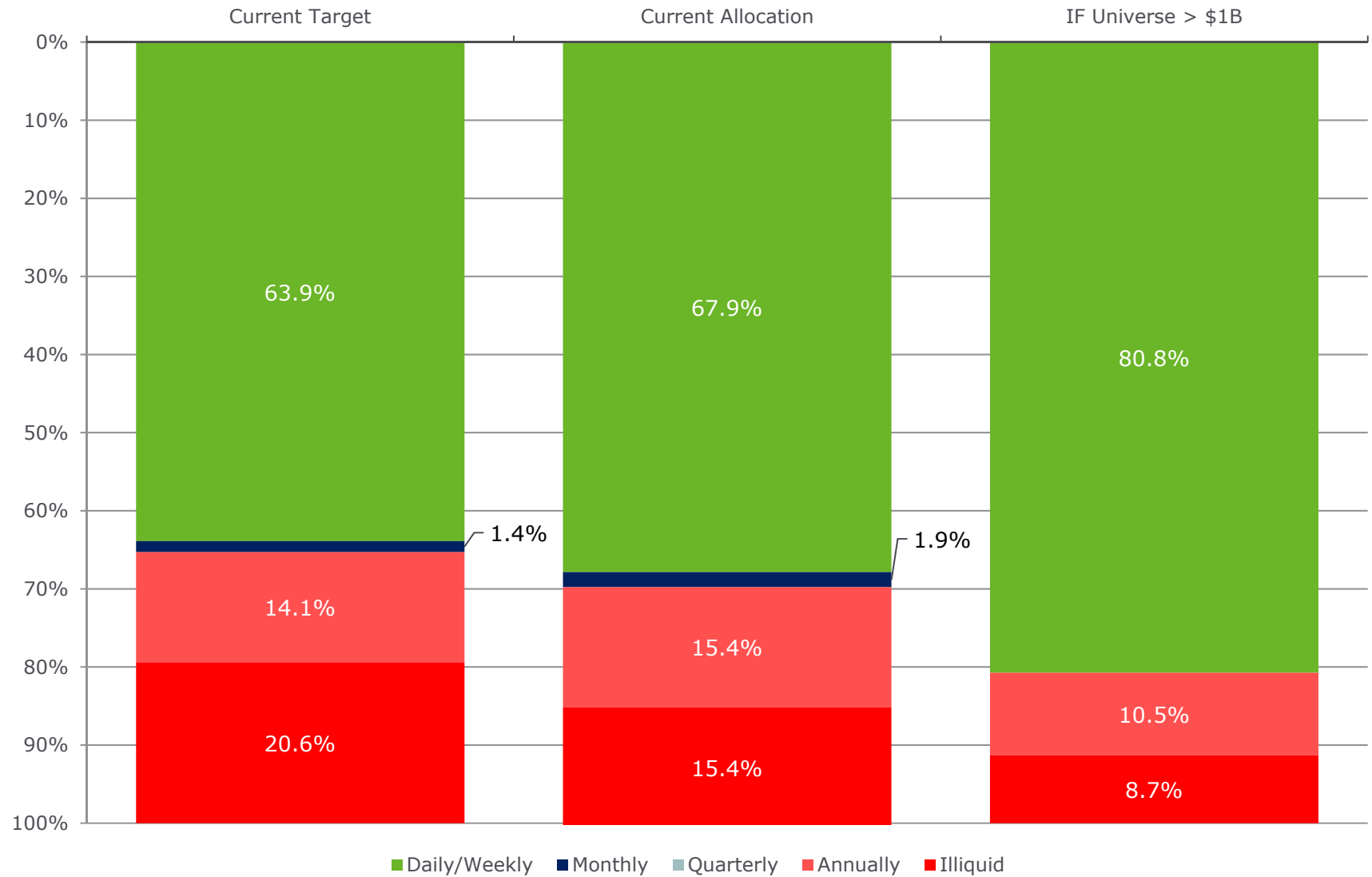
Base Case assumes NEPC's 5-7 year return assumption of 6.7% each year.

STOCHASTIC ANALYSIS



Charts and probabilities represent a 60/40 weighted average between Teachers and State Employees, respectively, based on asset levels.

SIC ASSET ALLOCATION: LIQUIDITY ESTIMATE



*See appendix for details on liquidity categorizations for each allocation

SIC ASSET ALLOCATION: LIQUIDITY ESTIMATE

As of 5/31/19	Current Target	Current Allocation
% of Assets with Daily/Weekly Liquidity Profile	63.9%	67.9%
\$ of Assets with Daily/Weekly Liquidity Profile	\$5,231M	\$5,558M
Total Benefit Payments (FY 2019)	\$943M	\$943M
# Years Worth of Benefit Payments Invested in Assets with Daily/Weekly Liquidity Profile	5.5x	5.9x



*See appendix for details on liquidity categorizations for each allocation

REVIEW OF FUNCTIONAL BUCKETS

NEPC, LLC

ASSET ALLOCATION REVIEW

		Current Target	Current Allocation
Growth	US Equities	22%	14%
	Int'l Equities	13%	9%
	Emerging Int'l Equities	5%	5%
	Global Equity	0%	15%
	Global Equity	40%	43%
	Private Equity	11%	9%
	Non-Core Real Estate	2%	2%
	Opp. Private Credit	2%	1%
	Private Growth	15%	12%
Income	Liquid Credit	2.8%	3.9%
	HY Infrastructure	1%	1%
	REITs	1%	0%
	Private Credit	3.2%	1.7%
	Income	8%	7%
Stability	Long Treasuries	4%	4%
	Systematic Trend	4%	4%
	CPC	8%	8%
	Core Real Estate	3.6%	4.5%
	Private Infrastructure	2.4%	2.0%
	TIPS	1%	2%
	Commodities	1%	0%
	Inflation Protection	8%	8%
	Core Bonds	11.5%	11.8%
	Absolute Return	6.5%	7.0%
	Strategic Cash	3.0%	3%
	Volatility Protection	21%	22%
Other	Short-Term Cash	0%	0%
	Russell Overlay	0%	0%
	Total Cash	0%	0%
	Expected Return 5-7 yrs	6.70%	6.59%
	Expected Return 30 yrs	7.81%	7.70%
	Standard Dev	11.9%	11.7%
	Sharpe Ratio (5-7 years)	0.35	0.35

Individual Asset Classes	
Expected Return 5-7 Year*	Expected Risk
6.1%	17.6%
6.8%	20.5%
9.3%	28.0%
7.0%	17.6%
6.7%	19.8%
10.0%	24.2%
7.0%	17.0%
8.5%	16.0%
9.4%	22.3%
5.4%	10.8%
9.5%	21.0%
6.8%	20.0%
7.6%	12.0%
7.0%	13.7%
1.8%	12.0%
6.0%	9.5%
3.9%	10.8%
6.0%	13.0%
6.3%	12.0%
3.0%	6.5%
4.3%	19.0%
5.5%	12.6%
3.0%	6.1%
5.7%	8.1%
2.5%	1.0%
3.8%	6.0%
2.8%	1.0%
0.5%	1.0%

Functional Buckets	
Expected Return 5-7 Year*	Expected Risk
8.2%	20.4%
7.4%	13.7%
4.4%	8.5%

*Expected Risk/Return figures for each functional bucket and composite is based on the weighted average of the underlying asset classes

**Current allocation is as of May 2019



ASSET ALLOCATION REVIEW: **GROWTH**

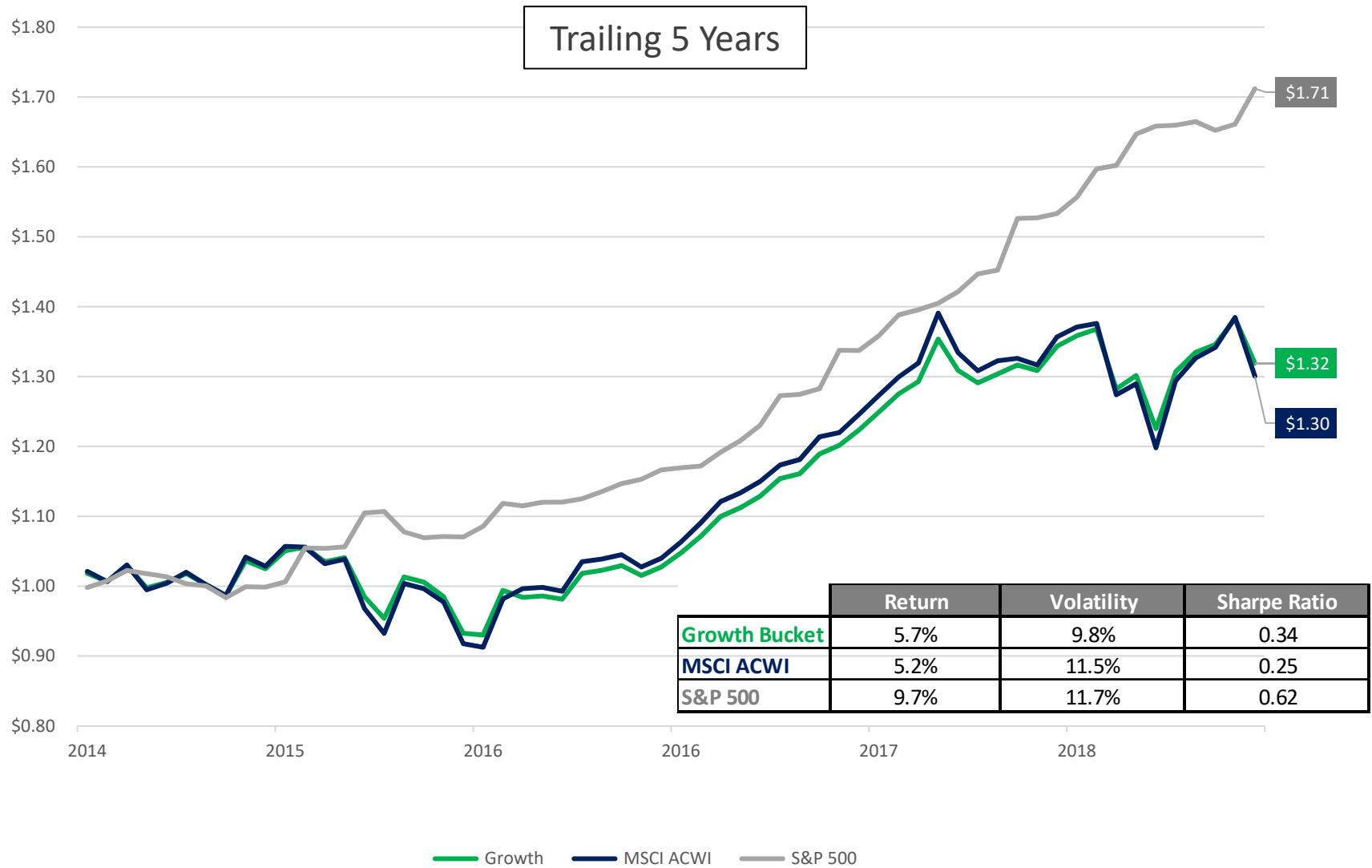
		Current Target	Current Allocation	Characteristics	Objective/Purpose
Growth	US Equities	22%	14%	-Liquid -Passive management -Earns return through both capital appreciation and dividend yield	-Drive portfolio performance and risk
	Int'l Equities	13%	9%		
	Emerging Int'l Equities	5%	5%		
	Global Equity	0%	15%		
	Global Equity	40%	43%		
	Private Equity	11%	9%	-Illiquid; Closed-end vehicles -Predominantly accessed through primary fund commitments (20% of exposure of each asset class may be achieved through secondaries)	-Return generation -Idiosyncratic performance -Access to value creation not accessible in public markets -Capture of illiquidity premium
	Non-Core Real Estate	2%	2%		
	Opp. Private Credit	2%	1%		
	Private Growth	15%	12%		

- **The Growth bucket is the main driver of performance for the Fund given its size and return profile but also presents the most pro-growth risk**
 - Be mindful that this allocation will likely lag the other allocations in an equity market sell-off or an environment with lackluster growth



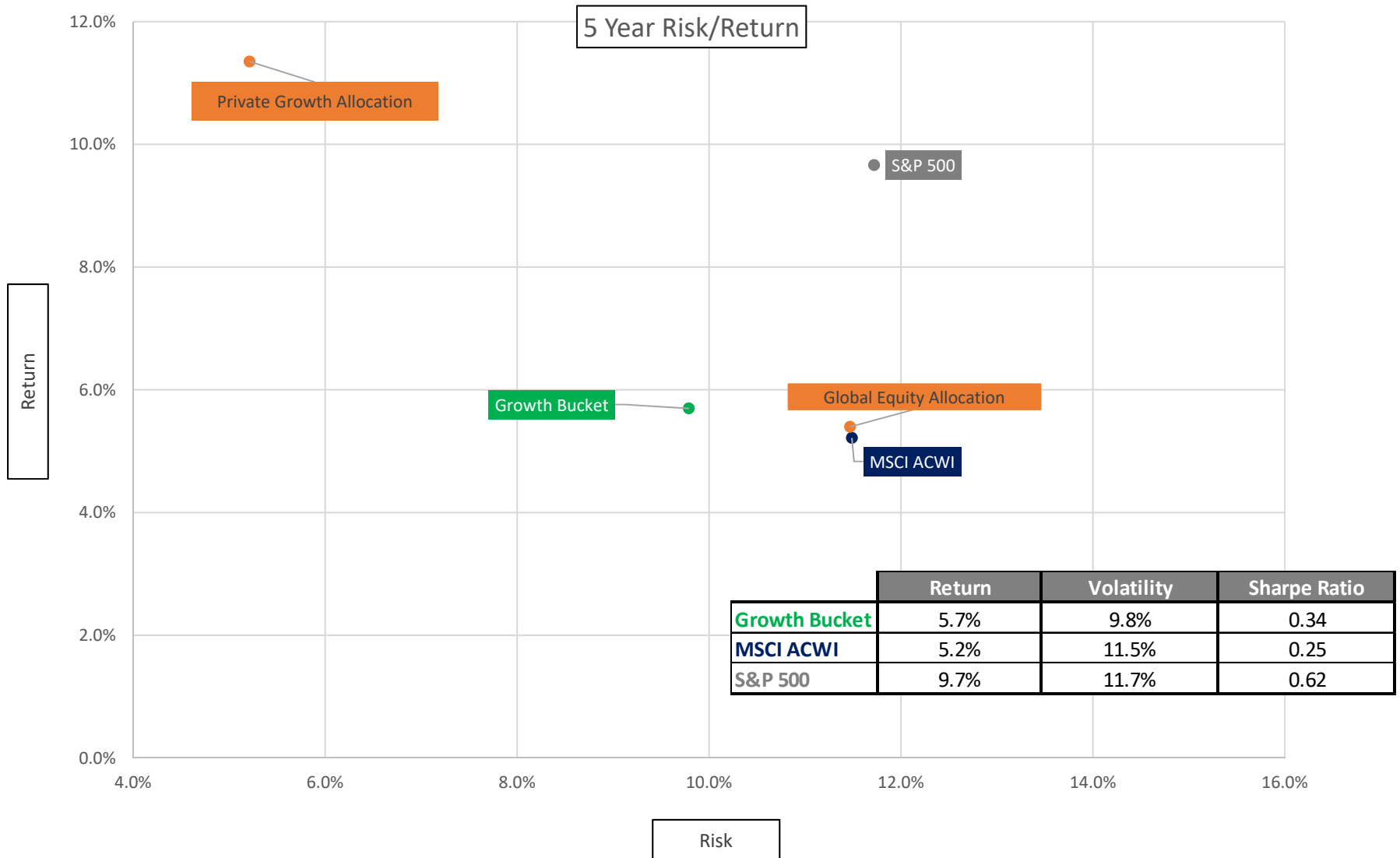
*Current allocation is as of May 2019

HAS THE GROWTH BUCKET MET ITS GOAL?



*Source: Growth bucket performance based on BNY Mellon custodial report
 **Sharpe ratio calculation includes the yield on the 90 Day T-Bill as of May 31, 2019

HAS THE GROWTH BUCKET MET ITS GOAL?



*Source: Growth bucket performance based on BNY Mellon custodial report
 **Sharpe ratio calculation includes the yield on the 90 Day T-Bill as of May 31, 2019

ASSET ALLOCATION REVIEW: INCOME

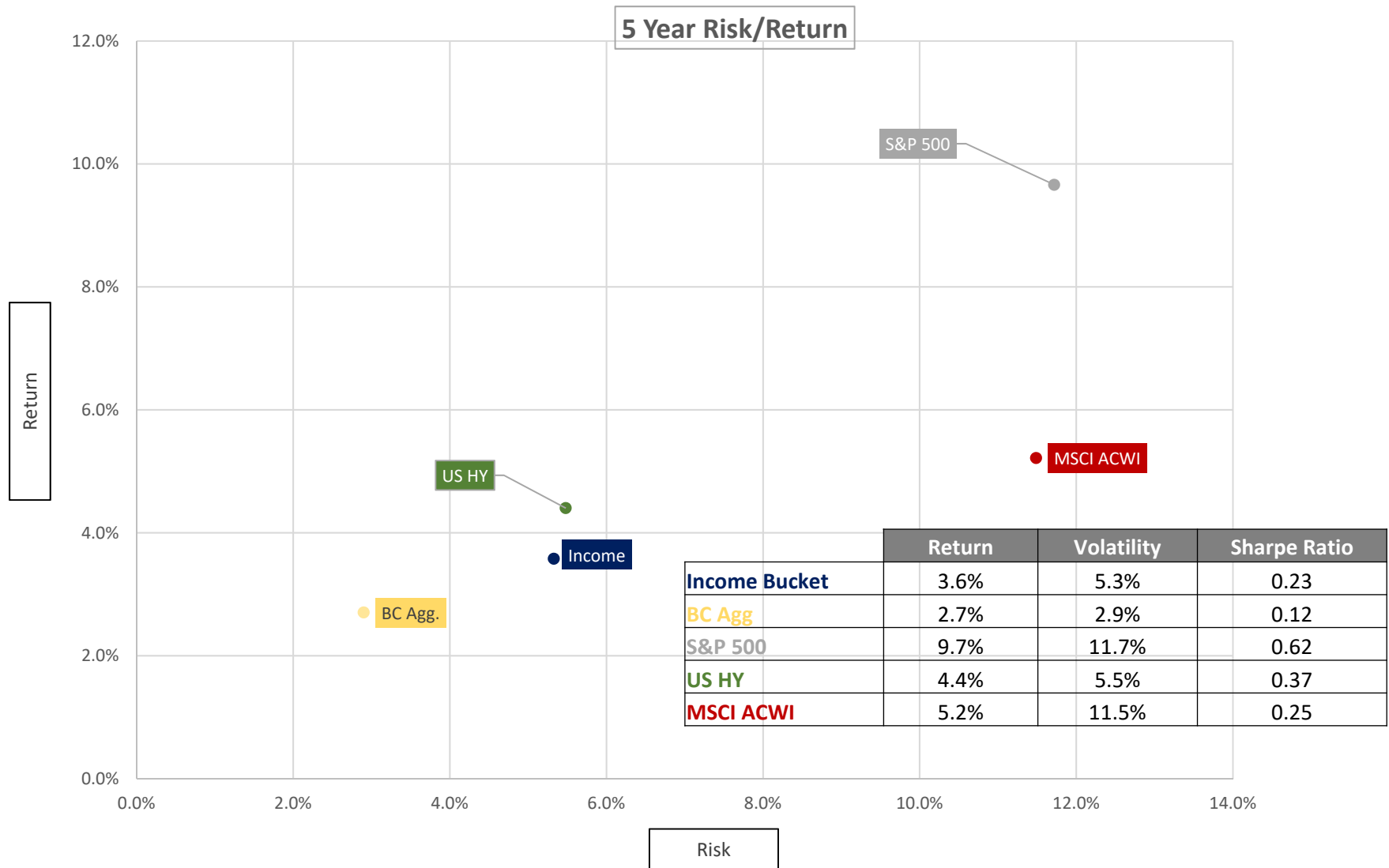
		Current Target	Current Allocation	Characteristics	Objective/Purpose
Income	Liquid Credit	2.8%	3.9%	-Blend of liquid and illiquid asset classes -Active management	-Produce high and stable income return stream to help mitigate system's negative cashflow and reduce the need to sell portfolio assets to meet required benefit payments -Principal appreciation
	HY Infrastructure	1%	1%		
	REITs	1%	0%		
	Private Credit	3.2%	1.7%		
	Income	8%	7%		

- **The Income bucket's sub-allocations are consistent with the goal of providing a stable/high income above the Barclay's Aggregate**
- **Most of the SIC's liquid credit exposure is US focused and may benefit from other complementary exposures**
 - NEPC and Staff to model how the income bucket may benefit from expanding its opportunity set to include other credit segments



*Current allocation is as of May 2019

HAS THE INCOME CLASS MET ITS GOAL?



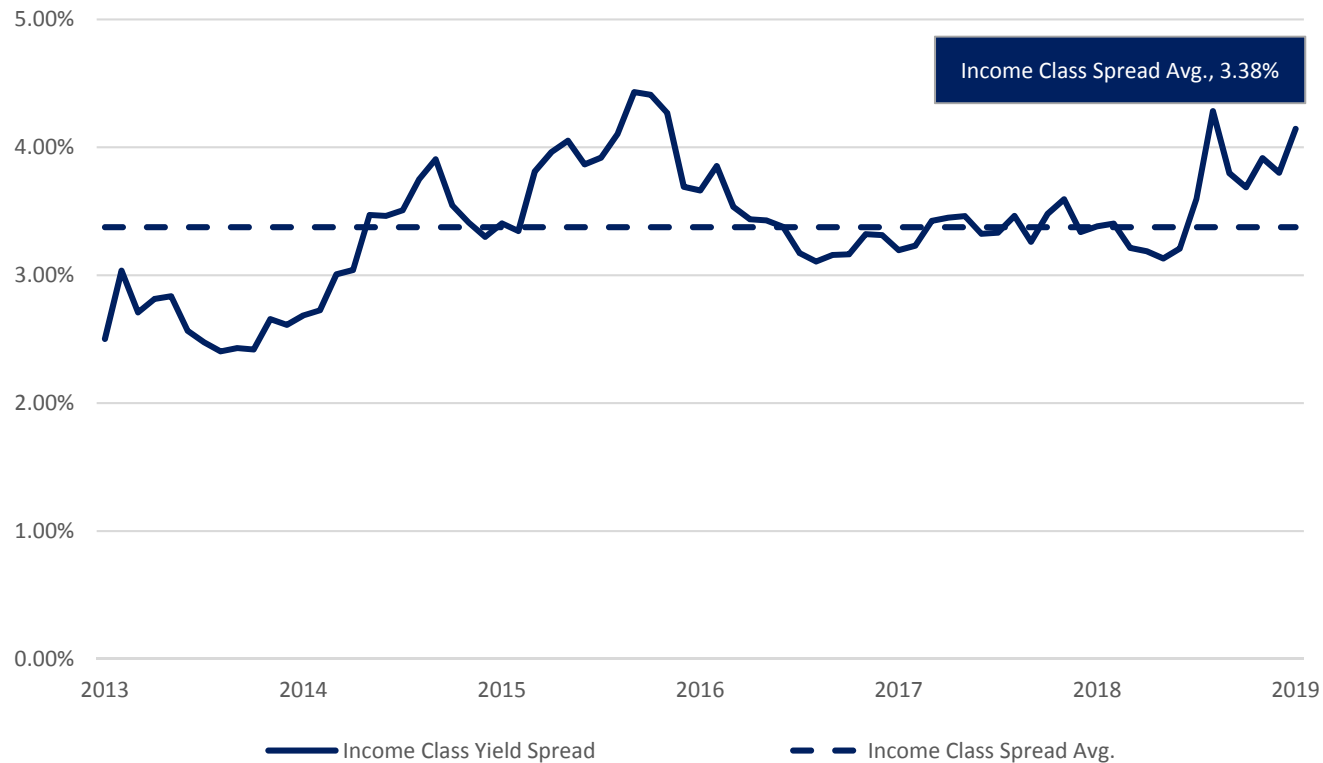
*Source: Income bucket performance based on BNY Mellon custodial report. Income class returns prior to July 2017 were calculated using the individual asset class benchmark returns weighted according to the Plan's target allocations

** Sharpe ratio calculation includes the yield on the 90 Day T-Bill as of May 31, 2019



HAS THE INCOME CLASS MET ITS GOAL?

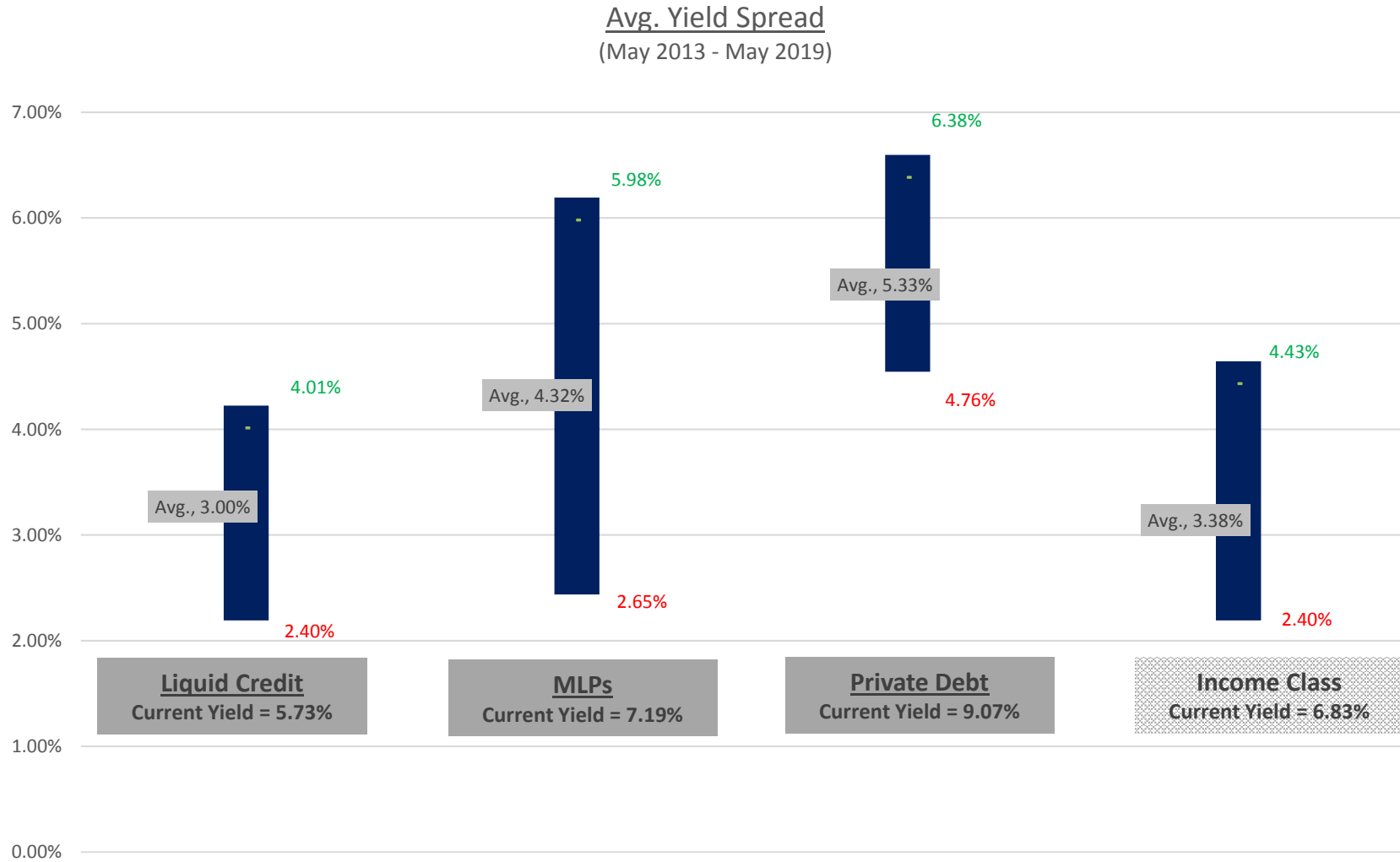
- **On average, the Income Class as a whole has slightly lagged its goal of delivering a yield of 4% above the BC Agg.**
 - This is in part due to the fact that the Private Debt program is still being built out and will take time to reach its strategic policy target
 - In addition, the SIC recently voted to fund its REITs allocation which will help contribute to the yield on the Income class moving forward



*The Income Class Yield is a weighted average of the actual/approximated yields of the managers within the Income class (HY, Bank Loans, Private Debt, MLPs); The weights are determined by each manager's market values from May 2013 to May 2019

As of May 31, 2019

HAS THE INCOME CLASS MET ITS GOAL?



* The current yield of the BC Agg. is 2.7% as of 5.31.19

ASSET ALLOCATION REVIEW: **STABILITY**

		Current Target	Current Allocation
Stability	Long Treasuries	4%	4%
	Systematic Trend	4%	4%
	CPC	8%	8%
	Core Real Estate	3.6%	4.5%
	Private Infrastructure	2.4%	2.0%
	TIPS	1%	2%
	Commodities	1%	0%
	Inflation Protection	8%	8%
	Core Bonds	11.5%	11.8%
	Absolute Return	6.5%	7.0%
	Strategic Cash	3.0%	3%
Volatility Protection	21%	22%	

Characteristics	Objective/Purpose
-Liquid -Active management	-Protect the portfolio during a significant and sustained market crisis by appreciating in value during periods of significant equity market declines
-Blend of liquid and illiquid asset classes -Active management	-Protect against unanticipated spikes in inflation -Produce ~3% real return across a full market cycle -Diversification -Principal appreciation
-Blend of asset classes with high to moderate liquidity -Active management	-Protect against unanticipated spikes in volatility -Diversification -Capital Preservation

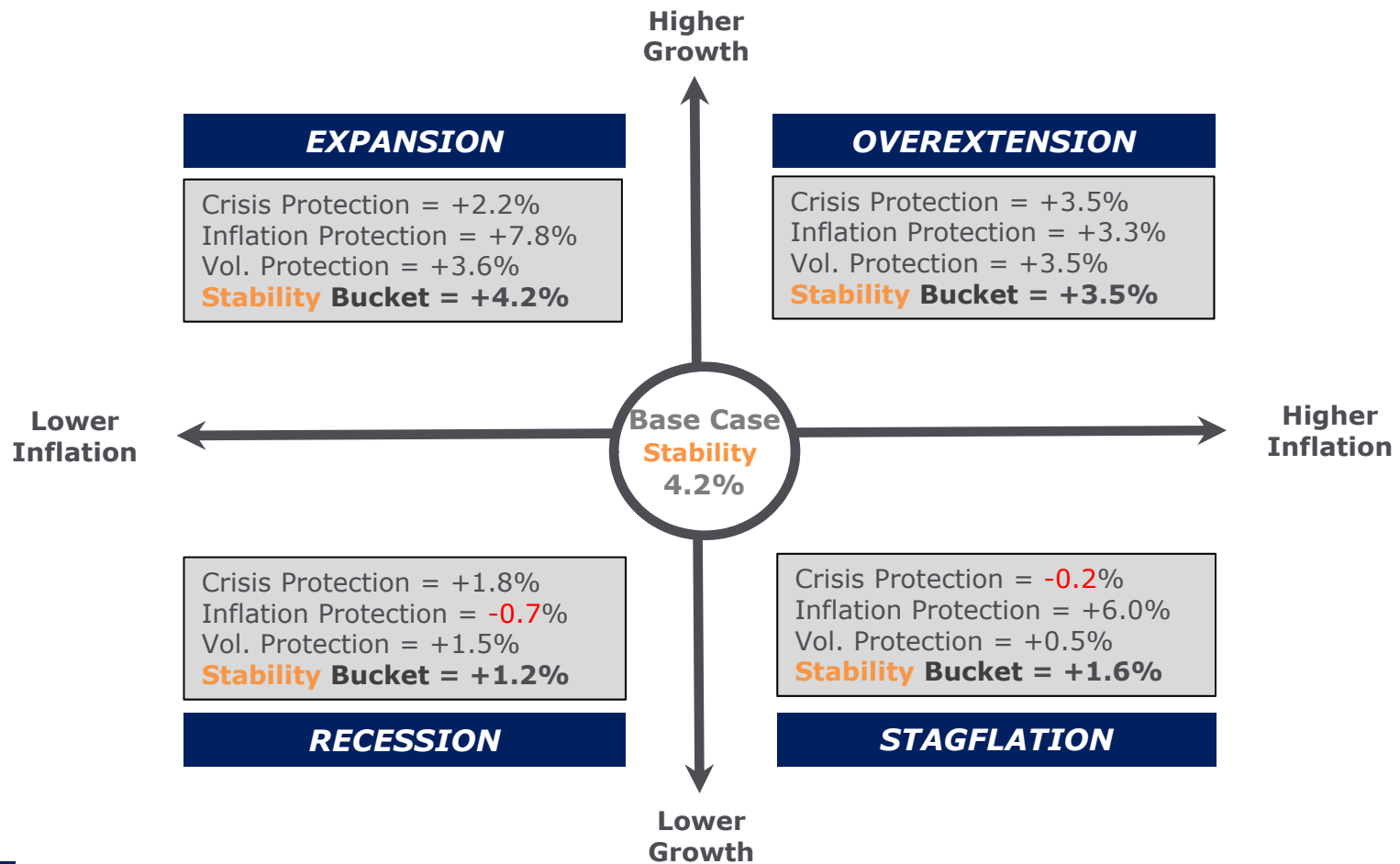
- **The CPC program and its implementation remains an area of focus**
 - Reaffirm what we’re trying to hedge against and see if there are more efficient ways to do so
- **Revisit the sizing of the current Cash allocation which remains a strategic part of the Volatility Protection bucket**
- **The allocation to Commodities is fairly small and has yet to be funded**
 - Does our view on Commodities and the size of the allocation warrant looking at alternatives?



*Current allocation is as of May 2019

SCENARIO ANALYSIS: **STABILITY** BUCKET:

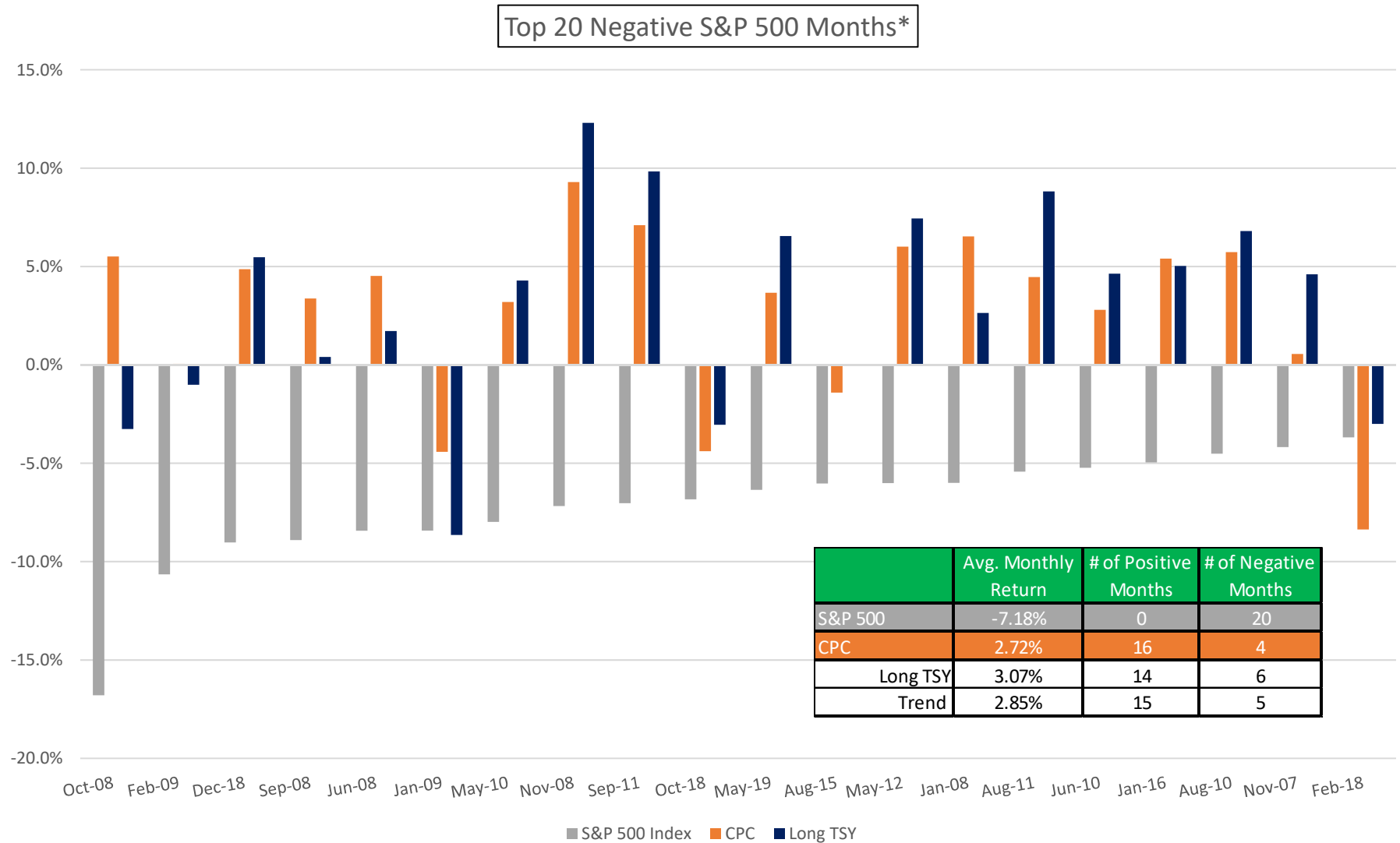
- As part of the evaluation of the Stability bucket, NEPC modeled how each underlying allocation would perform through different regimes



*The Base Case return is an annualized 4.2% geometric return over a 5 year period



HAS THE CPC ALLOCATION MET ITS GOAL?

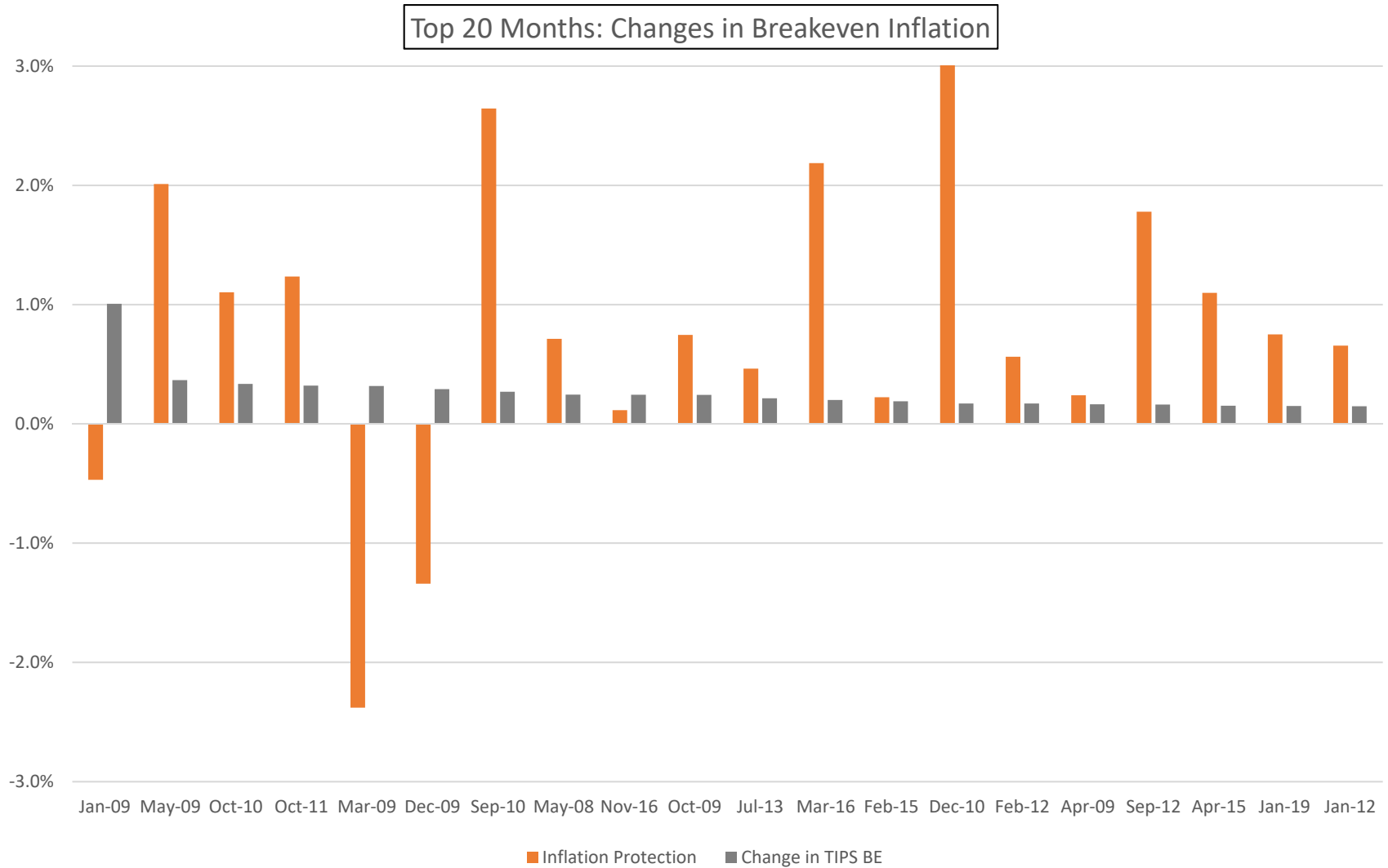


*The above is based on the trailing 11 year period: May 2019 – June 2007

**Source: CPC Allocation performance based on BNY Mellon custodial report. CPC Allocation returns prior to June 2017 were calculated using the individual asset class benchmark returns weighted according to the Plan's target allocations



HAS THE INFLATION PROTECTION ALLOCATION MET ITS GOAL?

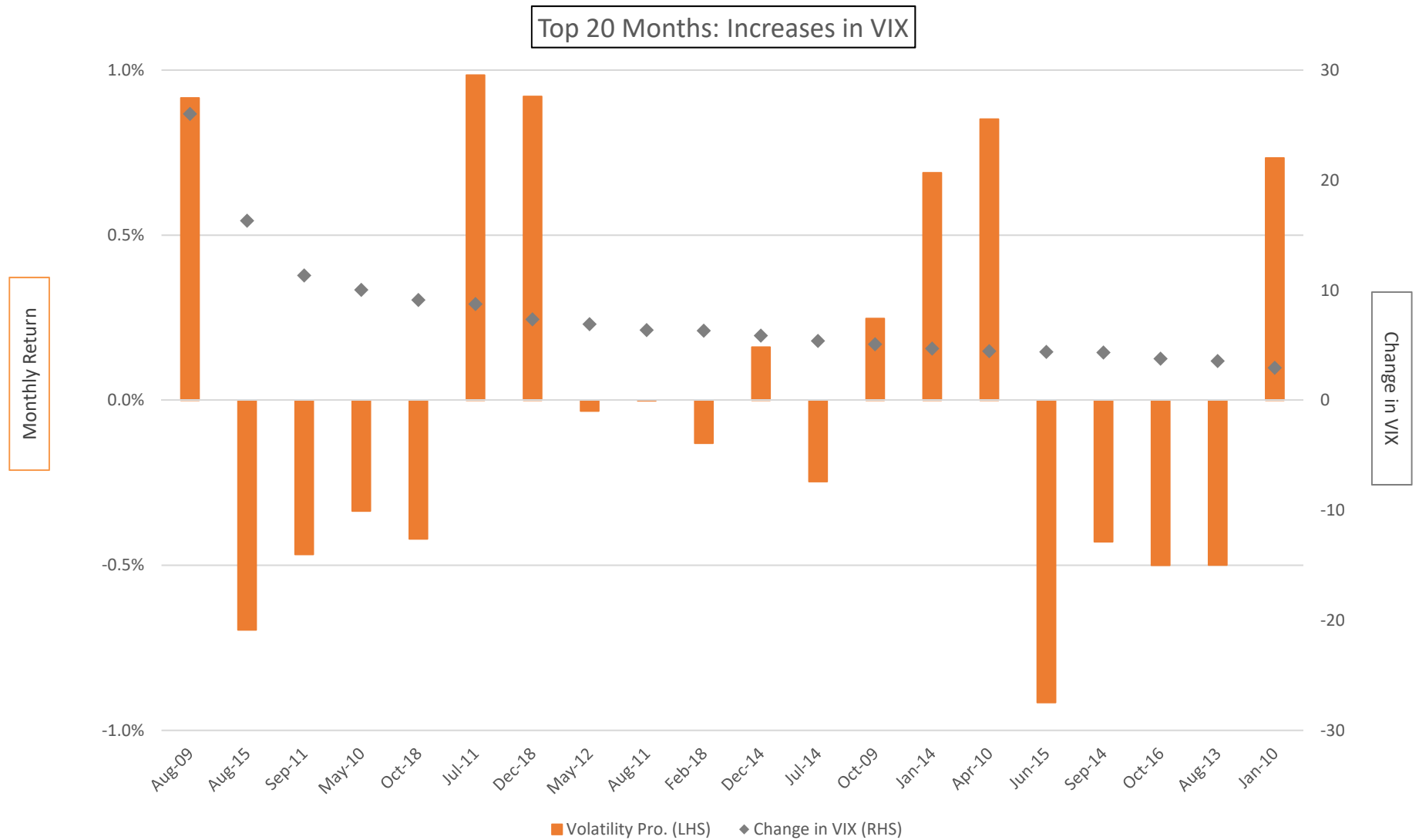


*The above is based on the trailing 11 year period: May 2019 – June 2007

**Source: Inflation Protection performance based on BNY Mellon custodial report. Inflation Protection returns prior to July 2017 were calculated using the individual asset class benchmark returns weighted according to the Plan's target allocations



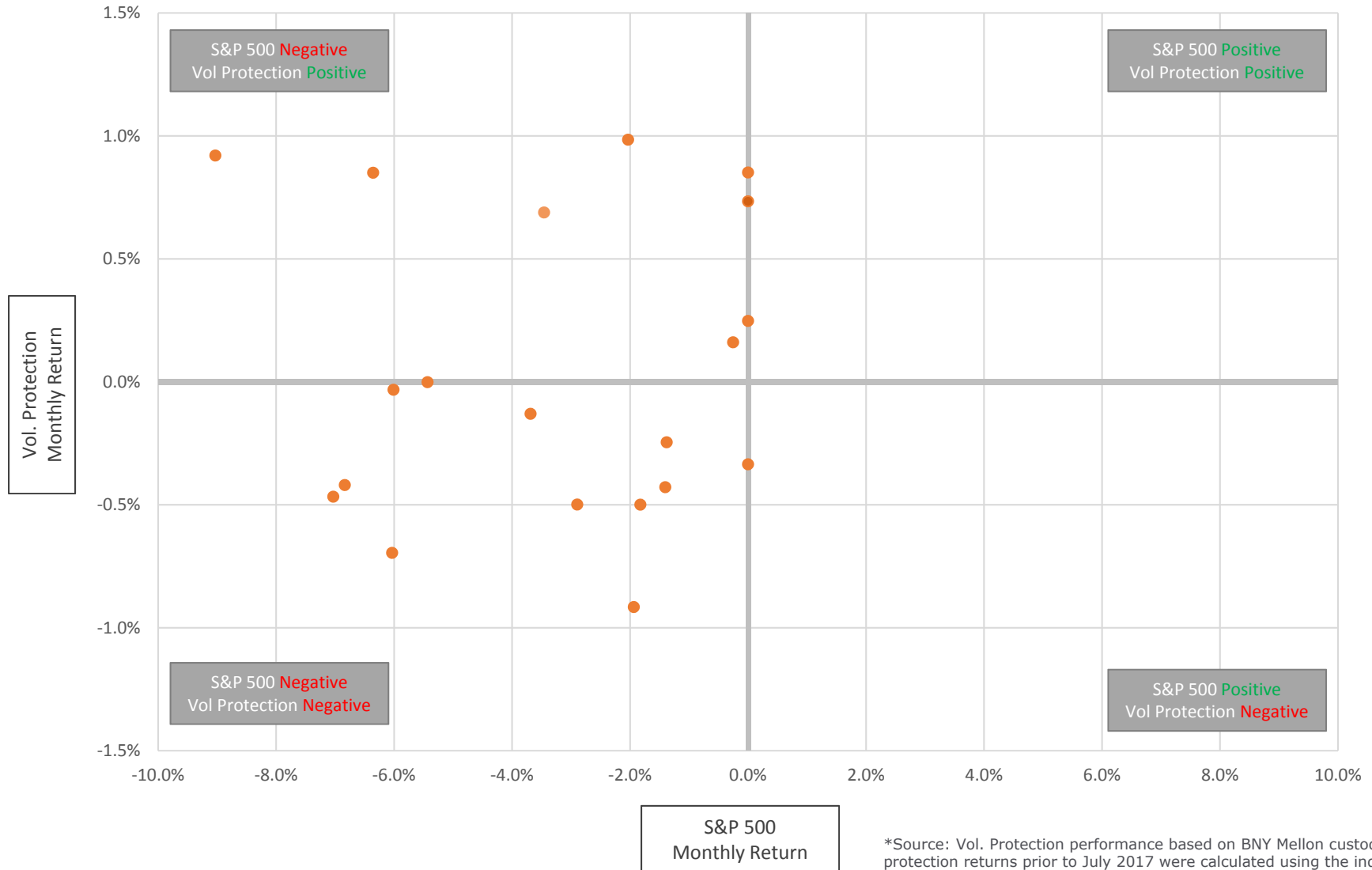
HAS THE VOL. PROTECTION ALLOCATION MET ITS GOAL?



*Source: Vol. Protection performance based on BNY Mellon custodial report. Vol. protection returns prior to July 2017 were calculated using the individual asset class benchmark returns weighted according to the Plan's target allocations



HAS THE VOL. PROTECTION ALLOCATION MET ITS GOAL?



*Source: Vol. Protection performance based on BNY Mellon custodial report. Vol. protection returns prior to July 2017 were calculated using the individual asset class benchmark returns weighted according to the Plan's target allocations

** The above is based on the trailing 10 year period



APPENDIX

NEPC, LLC

ASSET ALLOCATION TIMELINE: SIC MEETINGS

June SIC Meeting

Asset Allocation Intro & Timeline

- NEPC to provide SIC with perspective on the work to be done around the upcoming asset allocation review
- Identify SIC objectives and philosophies
- NEPC assumptions applied to current portfolio
- Peer comparison – realized and forward looking given NEPC assumptions

July SIC Meeting

Initial Findings

- Fiscal Year End performance review
- Identify specific concerns in the current portfolio that the SIC would like to explore
- Work with SIC to identify risk tolerance and constraints for modeling process

September SIC Meeting

Formal Presentation of Asset Allocation Recommendation (Part I)

- Asset allocation modeling – model various portfolios
- Scenario analysis on model portfolio
- SIC feedback

October SIC Meeting

Formal Presentation of Asset Allocation Recommendation (Part II)

- The final phase of the asset allocation review
- SIC chooses portfolio
- Risk contribution and implementation discussion



SIC ASSET ALLOCATION: LIQUIDITY BREAKOUT DETAIL

Liquidity Profile	Current Target	Current Allocation
Daily/Weekly	63.9%	67.9%
Monthly	1.4%	1.9%
Annually	14.1%	15.4%
Illiquid	20.6%	15.4%

		Liquidity Profile	Current Target	Current Allocation
Growth	US Equities	Daily	22%	14%
	Int'l Equities	Daily	13%	9%
	Emerging Int'l Equities	Daily	5%	5%
	Global Equity	Daily	0%	15%
	Global Equity		40%	43%
	Private Equity	Illiquid	11%	9%
	Non-Core Real Estate	Illiquid	2%	2%
	Opp. Private Credit	Illiquid	2%	1%
	Private Growth		15%	12%
Income	Liquid Credit	50% Daily; 50% Monthly	2.8%	3.9%
	HY Infrastructure	Daily	1%	1%
	REITs	Daily	1%	0%
	Private Credit	Illiquid	3.2%	1.7%
	Income		8%	7%
Stability	Long Treasuries	Daily	4%	4%
	Systematic Trend	Annually	4%	4%
	CPC		8%	8%
	Core Real Estate	Annually	3.6%	4.5%
	Private Infrastructure	Illiquid	2.4%	2.0%
	TIPS	Daily	1%	2%
	Commodities	Daily	1%	0%
	Inflation Protection		8%	8%
	Core Bonds	Daily	11.5%	11.8%
	Absolute Return	Annually	6.5%	7.0%
	Strategic Cash	Daily	3.0%	3%
	Volatility Protection		21%	22%
Other	Short-Term Cash	Daily	0%	0%
	Russell Overlay	Daily	0%	0%
	Total Cash		0%	0%

*The current allocation and its liquidity profile percentages may not sum to 100% due to rounding



IF UNIVERSE > \$1B ALLOCATION: LIQUIDITY BREAKOUT DETAIL

Liquidity Profile	IF Universe > \$1B
Daily/Weekly	80.8%
Monthly	0.0%
Annually	10.5%
Illiquid	8.7%

		IF Universe > \$1B
Cash	Daily	1.8%
Total Cash		1.8%
Large Cap Equities	Daily	17.8%
Small/Mid Cap Equities	Daily	4.4%
Int'l Equities (Unhedged)	Daily	17.2%
Emerging Int'l Equities	Daily	3.9%
Global Equity	Daily	5.4%
Private Equity	Illiquid	8.7%
Total Equity		57.4%
Core Bonds	Daily	15.7%
EMD	Weekly	1.4%
Global Bonds (Unhedged)	Weekly	2.4%
Diversified Fixed Income	Weekly	4.2%
Total Fixed Income		23.6%
Real Assets (Liquid)	Weekly	2.0%
Core Real Estate	Annually	6.5%
Total Real Assets		8.5%
Hedge Funds	Annually	4.1%
Global Asset Allocation	Weekly	4.7%
Total Multi Asset		8.8%

*The current allocation and its liquidity profile percentages may not sum to 100% due to rounding



SIC ASSET ALLOCATION: LIQUIDITY BREAKOUT DETAIL

Liquidity Profile	Current Target	Current Allocation	IF Universe > \$1B
Daily/Weekly	63.9%	67.9%	80.8%
Monthly	1.4%	1.9%	0.0%
Annually	14.1%	15.4%	10.5%
Illiquid	20.6%	15.4%	8.7%



*The current allocation and its liquidity profile percentages may not sum to 100% due to rounding

ASSUMPTIONS AND METHODOLOGY

- **Liability calculations follow a roll-forward methodology based on the June 30, 2018 actuarial valuation by GRS**
 - Accrued Liability and Normal Cost rolled forward each year
 - Discount rate is assumed to remain at 7.00% each year
 - Benefit payments as projected by the plan’s actuary
 - Accrued liability and benefit payments adjusted for differences in projected COLA vs. assumed COLA
 - Other than those described herein, all assumptions remain unchanged from the actuarial valuation report
- **Actual asset returns through May 31, 2019 (2.9%)¹ assumed for FY2019, thereafter:**
 - 5-7 year return assumption of 6.7% for medium-term projections
 - 30 year return assumption of 7.8% for long-term projections
- **Employer contributions are based on the plan’s funding policy**
 - Employer normal cost plus amortization of the unfunded liability
 - Future gains and losses are laddered and amortized over 20 years
 - “Staggering” of losses due to 2016 assumption changes
 - Once 100% funded, all amortization bases are assumed to be fully amortized
 - Employer normal cost contribution will always be made (the effective minimum employer contribution)
- **Employee contribution rates are assumed to remain level**
- **Fiscal year contributions are budgeted based on the valuation year three years prior**
 - E.g., FYE 2021 contribution is determined by the FYE 2018 valuation



¹ Per May 31, 2019 Flash Report

SIC ASSET ALLOCATION: SCENARIO ANALYSIS

EXPANSION					
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Large Cap	11.8%	12.3%	11.1%	11.3%	13.9%
EM Equity	12.7%	13.2%	11.8%	12.0%	12.7%
Treasuries	-0.8%	-2.1%	0.1%	0.4%	6.3%
IG Credit	3.7%	2.3%	2.0%	2.1%	8.1%
Commodities	11.3%	11.8%	10.7%	10.9%	5.3%
Core Real Estate	9.4%	9.9%	9.2%	9.4%	8.6%

OVEREXTENSION					
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Large Cap	10.0%	10.3%	7.0%	7.4%	-6.5%
EM Equity	10.7%	11.0%	7.4%	7.5%	-20.0%
Treasuries	-0.9%	-0.5%	2.0%	5.0%	10.7%
IG Credit	4.2%	2.7%	3.1%	6.2%	1.8%
Commodities	9.5%	9.9%	6.8%	4.2%	-19.6%
Core Real Estate	8.1%	8.4%	6.1%	4.8%	-5.4%

RECESSION					
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Large Cap	-7.4%	-3.6%	-1.7%	7.6%	9.8%
EM Equity	-20.1%	-9.6%	-4.7%	8.3%	10.7%
Treasuries	9.1%	3.2%	0.9%	-3.0%	-3.5%
IG Credit	4.2%	5.0%	4.8%	1.8%	5.2%
Commodities	-20.4%	-9.4%	-4.6%	7.2%	9.3%
Core Real Estate	-6.3%	-3.2%	-1.5%	5.7%	7.4%

STAGFLATION					
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Large Cap	-18.6%	-11.3%	10.3%	12.4%	-10.1%
EM Equity	-22.9%	-14.2%	11.0%	13.3%	-12.9%
Treasuries	-0.8%	-0.2%	-0.3%	-2.5%	0.8%
IG Credit	-1.2%	0.7%	2.9%	2.2%	0.1%
Commodities	25.5%	18.1%	9.9%	11.9%	19.4%
Core Real Estate	-5.6%	-2.6%	8.4%	10.1%	-1.4%



2019 5-7 YEAR RETURN FORECASTS

Geometric Expected Return			
Asset Class	2019	2018	2019-2018
Cash	2.50%	2.00%	+0.50%
Large Cap Equities	6.00%	5.25%	+0.75%
Small/Mid Cap Equities	6.25%	5.75%	+0.50%
Int'l Equities (Unhedged)	6.75%	7.50%	-0.75%
Int'l Sm Cap Equities (Unhedged)	7.25%	7.75%	-0.50%
Emerging Int'l Equities	9.25%	9.00%	+0.25%
Emerging Int'l Sm Cap Equities	9.50%	9.25%	+0.25%
Hedge Funds - Long/Short	5.50%	6.25%	-0.75%
TIPS	3.00%	3.25%	-0.25%
Treasuries	2.50%	2.25%	+0.25%
IG Corp Credit	4.00%	3.50%	+0.50%
MBS	2.75%	2.50%	+0.25%
High-Yield Bonds	5.25%	3.75%	+1.50%
Bank Loans	5.50%	4.50%	+1.00%
EMD (External)	4.75%	4.25%	+0.50%
EMD (Local Currency)	6.50%	6.00%	+0.50%
Municipal Bonds	3.00%	2.50%	+0.50%
High-Yield Municipal Bonds	3.00%	3.75%	-0.75%
Hedge Funds – Credit	5.50%	5.00%	+0.50%



2019 5-7 YEAR RETURN FORECASTS

Geometric Expected Return			
Asset Class	2019	2018	2019-2018
Long Treasuries	1.75%	2.00%	-0.25%
Long Credit	3.50%	4.00%	-0.50%
IG CLO	4.00%	N/A	N/A
HY CLO	6.00%	N/A	N/A
Commodities	4.25%	4.75%	-0.50%
Midstream Energy	8.25%	7.25%	+1.00%
REITs	6.75%	6.50%	+0.25%
Core Real Estate	6.00%	5.75%	+0.25%
Non-Core Real Estate	7.00%	7.00%	-
Private RE Debt	5.75%	N/A	N/A
Private Real Assets - Energy/Metals	9.50%	8.00%	+1.50%
Private Real Assets - Infra/Land	6.25%	6.00%	+0.25%
Hedge Funds - Macro	6.00%	6.25%	-0.25%
<i>Global Equity*</i>	<i>6.99%</i>	<i>6.88%</i>	<i>+0.11%</i>
<i>Private Equity*</i>	<i>10.01%</i>	<i>8.00%</i>	<i>+2.01%</i>
<i>Core Bonds*</i>	<i>3.04%</i>	<i>2.75%</i>	<i>+0.29%</i>
<i>Private Debt*</i>	<i>7.60%</i>	<i>6.50%</i>	<i>+1.10%</i>
<i>Long Govt/Credit*</i>	<i>2.84%</i>	<i>3.26%</i>	<i>-0.42%</i>
<i>Hedge Funds*</i>	<i>5.74%</i>	<i>5.83%</i>	<i>-0.09%</i>

*Multi-asset assumptions derived from the sum of underlying equity, credit, and real asset building blocks



2019 VOLATILITY FORECASTS

Volatility			
Asset Class	2019	2018	2019-2018
Cash	1.00%	1.00%	-
Large Cap Equities	16.50%	17.50%	-1.00%
Small/Mid Cap Equities	20.00%	21.00%	-1.00%
Int'l Equities (Unhedged)	20.50%	21.00%	-0.50%
Int'l Sm Cap Equities (Unhedged)	22.00%	22.00%	-
Emerging Int'l Equities	28.00%	28.00%	-
Emerging Int'l Sm Cap Equities	31.00%	31.00%	-
Hedge Funds - Long/Short	11.00%	11.00%	-
TIPS	6.50%	6.50%	-
Treasuries	5.50%	5.50%	-
IG Corp Credit	7.50%	7.50%	-
MBS	7.00%	7.00%	-
High-Yield Bonds	12.50%	13.00%	-0.50%
Bank Loans	9.00%	9.00%	-
EMD (External)	13.00%	13.00%	-
EMD (Local Currency)	13.00%	13.00%	-
Municipal Bonds	7.00%	7.00%	-
High-Yield Municipal Bonds	12.00%	12.00%	-
Hedge Funds - Credit	9.50%	9.50%	-



2019 VOLATILITY FORECASTS

Volatility			
Asset Class	2019	2018	2019-2018
Long Treasuries	12.00%	12.00%	-
Long Credit	12.00%	12.00%	-
IG CLO	7.50%	N/A	N/A
HY CLO	11.00%	N/A	N/A
Commodities	19.00%	19.00%	-
Midstream Energy	18.50%	19.00%	-0.50%
REITs	20.00%	21.00%	-1.00%
Core Real Estate	13.00%	13.00%	-
Non-Core Real Estate	17.00%	17.00%	-
Private RE Debt	11.00%	N/A	N/A
Private Real Assets - Energy/Metals	21.00%	21.00%	-
Private Real Assets - Infra/Land	12.00%	12.00%	-
Hedge Funds - Macro	9.50%	9.50%	-
<i>Global Equity*</i>	<i>17.57%</i>	<i>18.22%</i>	<i>-0.65%</i>
<i>Private Equity*</i>	<i>24.16%</i>	<i>23.00%</i>	<i>+1.16%</i>
<i>Core Bonds*</i>	<i>6.10%</i>	<i>5.99%</i>	<i>+0.11%</i>
<i>Private Debt*</i>	<i>11.97%</i>	<i>13.00%</i>	<i>-1.03%</i>
<i>Long Gov/Credit*</i>	<i>11.26%</i>	<i>11.25%</i>	<i>+0.01%</i>
<i>Hedge Funds*</i>	<i>8.15%</i>	<i>9.07%</i>	<i>-0.92%</i>

*Multi-asset assumptions derived from the sum of underlying equity, credit, and real asset building blocks



2019 30 YEAR RETURN FORECASTS

Geometric Expected Return			
Asset Class	2019	2018	2019-2018
Cash	3.00%	2.75%	+0.25%
Large Cap Equities	7.50%	7.50%	-
Small/Mid Cap Equities	7.75%	7.75%	-
Int'l Equities (Unhedged)	7.75%	7.75%	-
Int'l Sm Cap Equities (Unhedged)	8.00%	8.00%	-
Emerging Int'l Equities	9.25%	9.25%	-
Emerging Int'l Sm Cap Equities	9.50%	9.50%	-
Hedge Funds - Long/Short	6.50%	7.25%	-0.75%
TIPS	4.00%	3.75%	+0.25%
Treasuries	3.75%	3.25%	+0.50%
IG Corp Credit	5.75%	4.75%	+1.00%
MBS	3.75%	3.25%	+0.50%
High-Yield Bonds	6.50%	5.50%	+1.00%
Bank Loans	5.50%	5.50%	-
EMD (External)	6.25%	5.00%	+1.25%
EMD (Local Currency)	6.75%	6.50%	+0.25%
Municipal Bonds	3.75%	3.50%	+0.25%
High-Yield Municipal Bonds	5.25%	5.50%	-0.25%
Hedge Funds - Credit	6.75%	5.25%	+1.50%



2019 30 YEAR RETURN FORECASTS

Geometric Expected Return			
Asset Class	2019	2018	2019-2018
Long Treasuries	3.75%	3.50%	+0.25%
Long Credit	6.00%	5.25%	+0.75%
IG CLO	4.50%	N/A	N/A
HY CLO	6.25%	N/A	N/A
Commodities	5.50%	5.50%	-
Midstream Energy	7.50%	7.50%	-
REITs	7.00%	6.75%	+0.25%
Core Real Estate	6.25%	6.50%	-0.25%
Non-Core Real Estate	7.25%	7.50%	-0.25%
Private RE Debt	6.25%	N/A	N/A
Private Real Assets - Energy/Metals	9.50%	7.75%	+1.75%
Private Real Assets - Infra/Land	7.00%	6.25%	+0.75%
Hedge Funds - Macro	6.50%	6.25%	+0.25%
<i>Global Equity*</i>	<i>8.18%</i>	<i>8.24%</i>	<i>-0.06%</i>
<i>Private Equity*</i>	<i>11.15%</i>	<i>9.50%</i>	<i>+1.65%</i>
<i>Core Bonds*</i>	<i>4.37%</i>	<i>3.75%</i>	<i>+0.62%</i>
<i>Private Debt*</i>	<i>8.11%</i>	<i>7.50%</i>	<i>+0.61%</i>
<i>Long Gov/Credit*</i>	<i>5.14%</i>	<i>4.62%</i>	<i>+0.52%</i>
<i>Hedge Funds*</i>	<i>6.76%</i>	<i>6.34%</i>	<i>+0.42%</i>

*Multi-asset assumptions derived from the sum of underlying equity, credit, and real asset building blocks.

