Board of Retirement Regular Meeting

Sacramento County Employees' Retirement System

Agenda Item 17

MEETING DATE: December 11, 2024

SUBJECT: ALM Study

SUBMITTED FOR: ___ Consent ___ Deliberation and Action __X__ Receive and File

RECOMMENDATION

Receive and file presentation regarding Asset Liability Modeling (ALM) study by SCERS' general investment consultant, Verus.

PURPOSE

This item supports the 2024 Annual Investment Plan, which identifies initiating an asset liability modeling study in 2024, and supports SCERS' Master Investment Policy Statement, which calls for an ALM study to be conducted at least every five years.

BACKROUND

At the December meeting, SCERS will be initiating an ALM study, which will be conducted by SCERS' general consultant, Verus. The last ALM study was conducted in 2021. During the 2024 calendar year, and in anticipation of the ALM study, a number of initiatives were conducted. This included education by Staff and SCERS' investment consultants on each of SCERS' asset classes within the strategic asset allocation (SAA) during the first half of the year. This education series covered the role and objectives of each asset class, a timeline of the evolution of the asset class within SCERS' portfolio, how the asset class has performed relative to expectations, and trends and considerations within the asset class that could impact the upcoming ALM Study.

At the August meeting, Verus presented an introduction to the ALM study, which provided background, concepts, and considerations related to the ALM process and designing a strategic asset allocation.

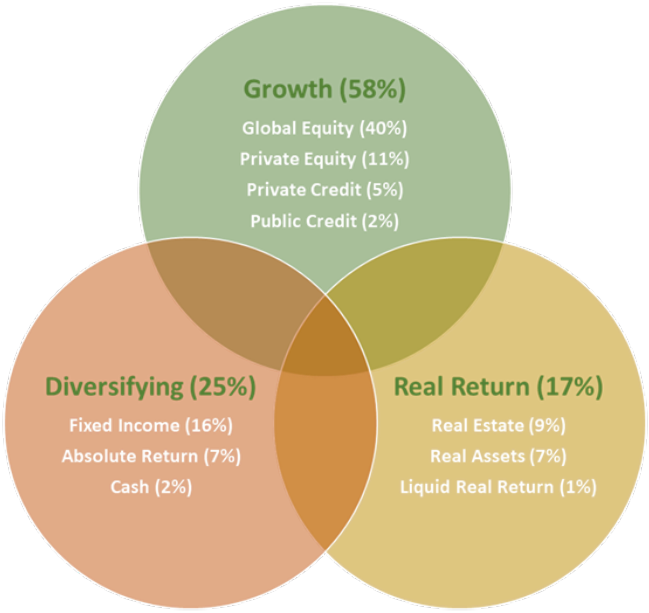
At the September meeting, Verus presented the results of the enterprise risk tolerance (ERT) survey, which was conducted with SCERS' Board members. The ERT survey showed that SCERS continues to have an ability to take risk, and the Board continues to have a willingness to take risk, in a prudent manner that achieves SCERS' broader investment objectives.

The presentation at the December Board meeting will cover the following areas:

- A review of SCERS' historical experience over the past 10 years related to fund performance, net cash flows, and funded status.
- Incorporation of both asset data and liability data from SCERS' actuary consultant Segal.
- Deterministic projections, which take a forward look at the impact on SCERS' funded status and contributions across several return outcomes.
- Modeling by Verus showing several wide-ranging asset allocation mixes.
- A variety of stochastic and risk metrics across Verus' modeled asset allocation mixes, including scenario analysis, stress tests, and the impact on SCERS' funded ratio and contribution rates.

CURRENT STRATEGIC ASSET ALLOCATION

SCERS' current strategic asset allocation takes a functional approach that blends traditional and alternative asset classes, and links asset classes exposed to similar economic environments and risk factors, and which are expected to have similar roles and outcomes in a portfolio. The asset allocation breaks the portfolio into three asset categories, Growth, Diversifying, and Real Return, with greater complexity reserved at the asset class level.



The Growth asset category includes those segments of the portfolio that tend to perform best in a high growth and low/moderate inflationary environment, including most equity and credit investments. In contrast, they tend to perform poorly during recessionary periods, when GDP growth is contracting, or during certain periods when unexpected inflation arises. Growth assets tend to comprise the dominant allocation within most institutional investment portfolios, including that of SCERS. The Diversifying asset category includes those segments of the portfolio which are expected to protect capital and perform better than the Growth asset category during dislocated and stressed market environments, including traditional fixed income and diversifying absolute return strategies. The Real Return asset category includes those segments of the portfolio that protect against inflation, generate cash flow, and provide further portfolio diversification, including real estate, infrastructure, and energy investments.

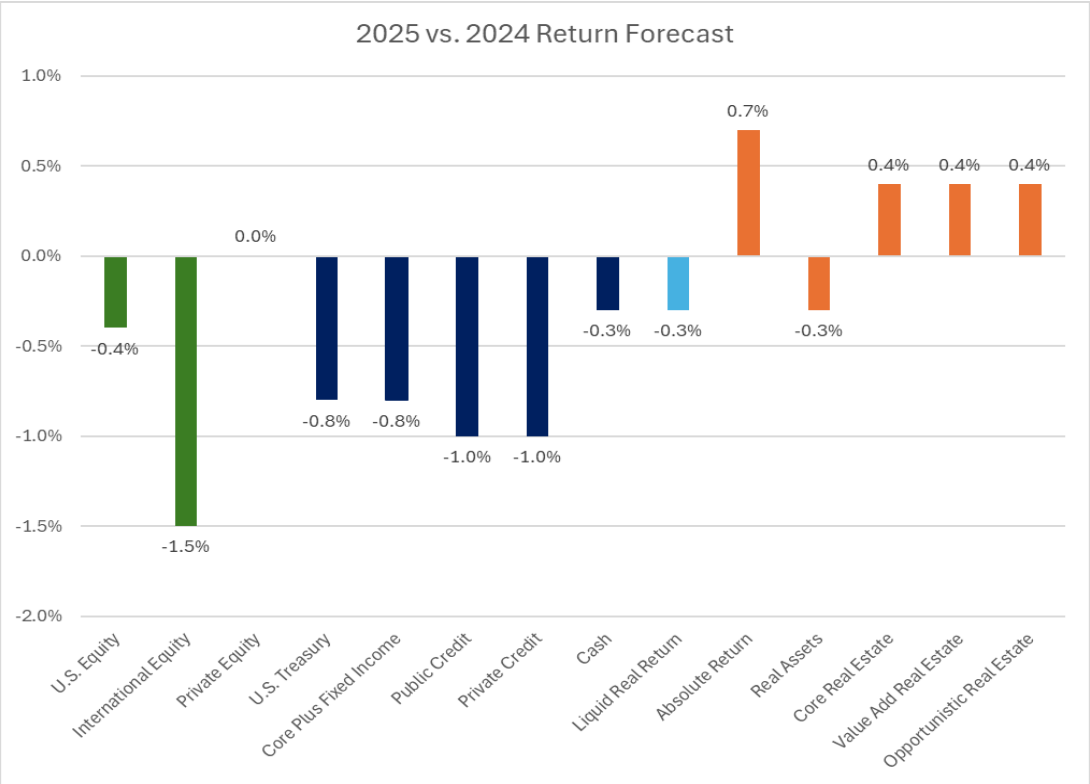
The strategic asset allocation takes a somewhat risk balanced approach that emphasizes having enough return generating, growth, assets to drive performance toward the actuarial rate of return, but also maintaining enough uncorrelated/diversifying, and inflation sensitive assets to reduce downside risk and the range of outcomes that the portfolio is subject to. It also has ample

exposure to cash flowing assets, given that SCERS is a mature public pension plan with negative cash flows (more benefit payments going out than contributions coming in). In addition, it has a meaningful allocation to private/illiquid assets, but a reasonable liquidity profile as measured by an annual liquidity analysis conducted by Verus.

The last asset allocation study in 2021 concluded with moderate changes to SCERS' portfolio. It is anticipated that recommended changes from this ALM study should be evolutionary and build upon the foundation of the strategic asset allocation functional framework that has been in place for several years. Potential changes could focus on revisions to the grouping of asset classes within the functional framework, the sizing of existing assets classes, and portfolio construction modifications within asset classes.

RETURN EXPECTATIONS

Verus capital market assumptions (CMAs) show that several asset classes have seen their expected returns decrease for 2025 versus those in 2024, particularly across public equities and fixed income/credit, as shown in the Verus chart below. Public equities have generated significant returns over the past year, which is leading to lower going forward return expectations. The return expectations for fixed income and credit are lower than last year, as inflation has moderated and central banks have initiated rate cuts for the first time since 2020. Several alternative and private market asset classes assets have slightly higher returns expectations compared to the prior year, such as real estate and absolute return, while others are down, including private credit and real assets.



Source: Verus

As shown below, the private market asset classes generally have return expectations above those of public markets, particularly private equity, private credit, real assets, and real estate. Given the run up in U.S. equities over the past few years, international equities have higher return expectations, though this has been the case for prior years and U.S. equities have still outperformed. Fixed income return expectations have moderated with expectations for further interest rate cuts. The green bars in the chart below are those market segments that have forecasted returns above SCERS' 6.75% actuarial rate, and the orange bars are those market segments that have forecasted returns below.

Source: Verus

As shown in the Verus presentation, using 2025 CMAs, SCERS' current strategic asset allocation models to a 6.7% forecasted return over the next 10 years, slightly below SCERS' 6.75% actuarial rate of return, but well below the modeled returns of 7.4% using 2024 CMAs. The current portfolio has risk as measured by Standard Deviation of 11.9%, which equates to a Sharpe Ratio of 0.30, which is a measure of risk adjusted returns.

ASSET ALLOCATION MIXES

For this early phase of the ALM study, Verus has modeled three wide ranging asset mixes (slide 20 of the Verus presentation) to compare against SCERS' current strategic asset allocation.

The three asset mix alternatives introduce a new and separate row called Multi-Asset Credit. Staff and Verus have been discussing an approach which takes a holistic view of credit by combining public and private credit into one asset class. A Multi-Asset Credit asset class would

primarily be comprised of private credit but have flexibility to allocate the public credit strategies and other forms of credit. Staff and consultants are seeing more blurred lines between pubic and private credit, with many investment managers offering hybrid credit strategies that invest opportunistically across both public and private markets. While traditional private credit strategies would make up most of the asset class, SCERS would also have greater flexibility in implementation with this approach. A Multi-Asset Credit asset class could also incorporate stressed credit strategies that currently reside within SCERS' Private Equity portfolio but might fit better from a risk and return profile within a broader Multi-Asset Credit portfolio. The purposes of including Multi-Asset Credit in this iteration of the ALM modeling is the introduce the concept; however, specific details would be hashed out in future iterations of ALM modeling and asset class structuring.

- **Alt A** – This asset mix reduces risk in the SCERS portfolio by reducing public equities and absolute return in favor of fixed income. The mix decreases Global Equity exposure by 4%, increases Fixed Income by 4%, reduces Absolute Return by 1%, and reduces Real Assets by 1%. The reduction in Absolute Return decreases some of the complexity risk associated with hedge fund strategies for a slightly lower return in traditional fixed income, though Absolute Return would continue to play a key role in SCERS' overall portfolio. This mix was modeled with last year's CMAs in mind where SCERS' portfolio was forecasting a 7.4% return, above SCERS' actuarial rate of 6.75%, and when fixed income forecasted returns were looking more attractive. Using 2024 CMAs, this asset mix models to a similar 6.7% return as SCERS' current portfolio, but with lower risk as measured by a Standard Deviation of 11.2%, though the risk adjusted return remains the same with a Sharpe Ratio of 0.30.

- **Alt B –** This asset mix leaves SCERS' public markets exposure intact but transfers private markets risk from the inflation sensitive Real Return asset category to Credit, mostly in the form of an increase of Multi-Asset Credit. With a moderating inflationary environment, there is potentially less need for Real Return exposure**.** The mix increases Multi-Asset Credit by 2%, reduces Real Estate by 1%, and reduces Real Assets by 1%. This mix has a slightly higher return profile than SCERS' current portfolio (6.8% vs. 6.7%), with slightly lower risk as measured by Standard Deviation (11.8% vs. 11.9%). However, it has similar risk adjusted returns, with a Sharpe Ratio of 0.30.

- **Alt C** – This asset mix gravitates SCERS' portfolio toward higher returning private market assets classes, in particular Private Credit and Private Equity. The increase in illiquid assets is supported by the results of SCERS' recent liquidity study, which showed that SCERS continues to be in a strong liquidity position. This mix reduces Fixed Income, whose expected returns have decreased in a potentially lower interest rate environment. It also reduces Absolute Return slightly. In addition, it reduces SCERS' inflation sensitive Real Return asset category exposure, through a reduction in Real Assets and Liquid Real Return. This mix has the highest forecasted return of 7.0%, but also has a higher risk profile as measured by Standard Deviation. These changes translate to a marginal improvement in risk adjusted returns, with a Sharpe Ratio of 0.31, but they also introduce greater illiquidity risk to the portfolio.

CONCLUSION

With the run up in equity prices over the past year, and higher but now declining interest rates, return expectations across many asset classes have declined and forecasted returns across asset classes are also narrower. This is translating to an environment where achieving SCERS' actuarial rate of return is achievable with the current portfolio, but more difficult than a year ago. This is also translating to a fairly tight range of asset mixes that Verus modeled, fairly in line with those of SCERS' current portfolio. Targeting a higher return than that of the current portfolio entails taking on greater risk, both in the form of market volatility and illiquidity.

Given the current portfolio is currently modeling a 6.7% expected return in line with the 6.75% actuarial rate, the SCERS portfolio doesn't require significant changes from a return perspective. However, it is important to model different asset mixes to determine an optimal strategic asset allocation that factors in a variety of factors including returns, risk, cash flows, performance across economic environments, and exposure to risk factors.

Upcoming ALM modeling by Verus will incorporate feedback and direction from the Board, which will result in more fine-tuned asset mixes. At the conclusion of the ALM study, in the first half of 2025, the Board will be asked to adopt an asset allocation mix for SCERS' portfolio that results in achieving desired outcomes.

ATTACHMENTS

- Board Order
- Verus Asset/Liability Study Presentation

Prepared by:

/S/

Steve Davis
Chief Investment Officer

Reviewed by:

/S/

Eric Stern
Chief Executive Officer

Retirement Board Order
Sacramento County Employees' Retirement System

Before the Board of Retirement
December 11, 2024

AGENDA ITEM:

ALM Study

THE BOARD OF RETIREMENT hereby accepts the recommendation of staff to receive and file presentation regarding Asset Liability Modeling (ALM) study by SCERS' general investment consultant, Verus.

I HEREBY CERTIFY that the above order was passed and adopted on December 11, 2024 by the following vote of the Board of Retirement, to wit:

AYES:

NOES:

ABSENT:

ABSTAIN:

ALTERNATES:
(Present but not voting)

_____
James Diepenbrock
Board President

_____
Eric Stern
Chief Executive Officer and
Board Secretary

Verus

PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS

DECEMBER 2024

Asset-Liability Study

Sacramento County Employees' Retirement System

Table of contents

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Introduction

Executive Summary

Objectives:

— Review asset allocation mixes and provide direction to Staff and Verus for further refined portfolio options

Summary Findings:

— Achieving the actuarial rate of return in the current environment is reasonable but has recently become a bit more challenged

— The current Policy and generally similar portfolios are projected to achieve around the 6.75% actuarial rate of return

— Verus' CMA returns are based on 10-year projections which is far shorter than SCERS' investment horizon

— The difference in projected returns across asset classes is narrower than in the past, primarily due to higher equity valuations and higher interest rates

— The range of projected return outcomes is wide so though we focus on the median return, we would caution against putting too much emphasis on a single number

Asset-liability process overview

Key Inputs:

Liabilities / Actuarial
- *Census data*
- *Demographic and economic assumptions*
- *Funding policy and other actuarial methods*

Assets
- *Starting financial position*
- *Alternative portfolios*
- *Capital market assumptions*

Analytical Modeling Tools:

MPI
Risk and Return Analysis

Asset-Liability Model
Integrated Projections

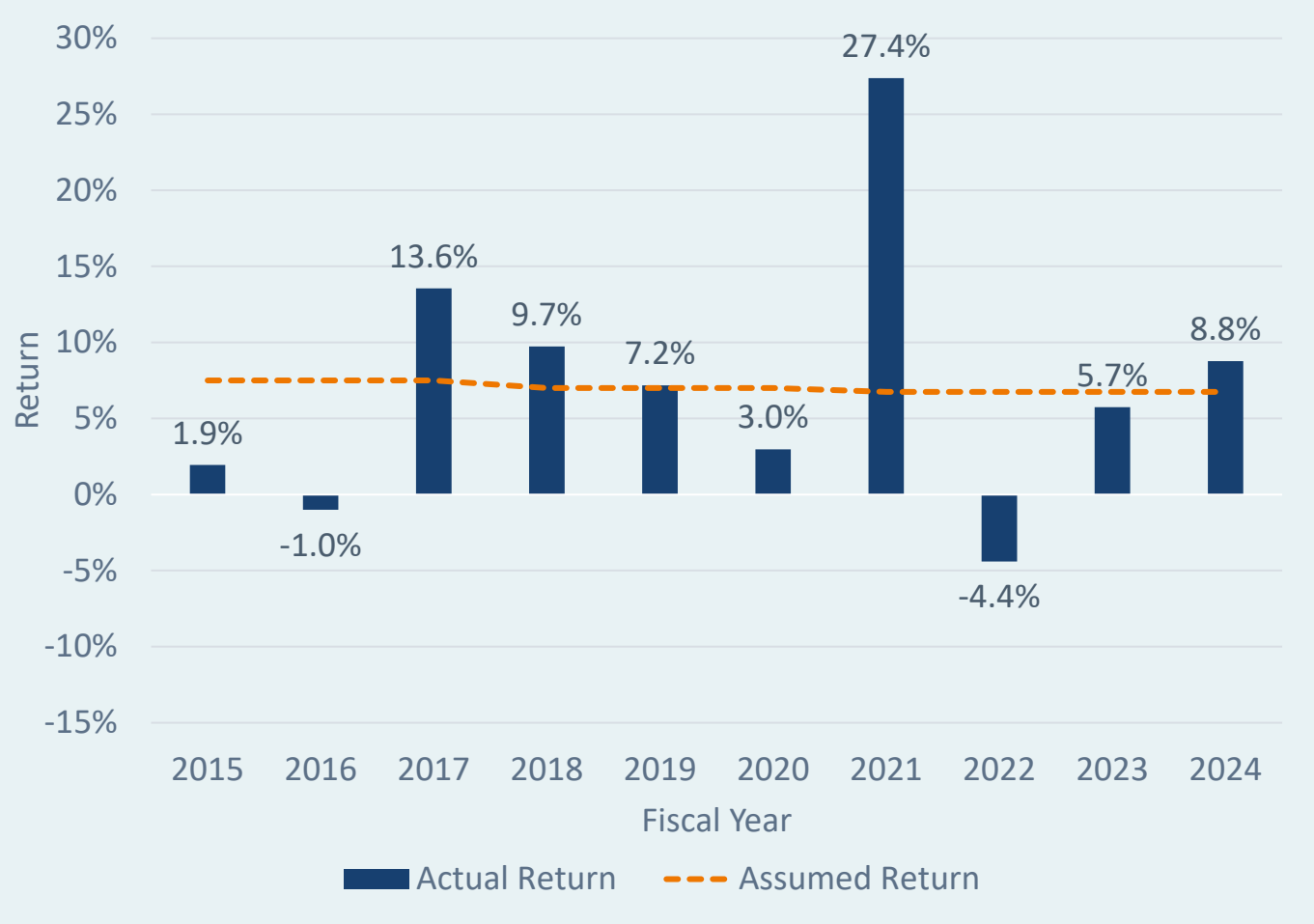
Decision factors:

- Return expectations
- Stress tests
- Scenario analysis
- Funded status
- Contribution requirements
- Total full funding cost

Historical perspective

Investment returns

ACTUAL VS. ASSUMED RETURNS



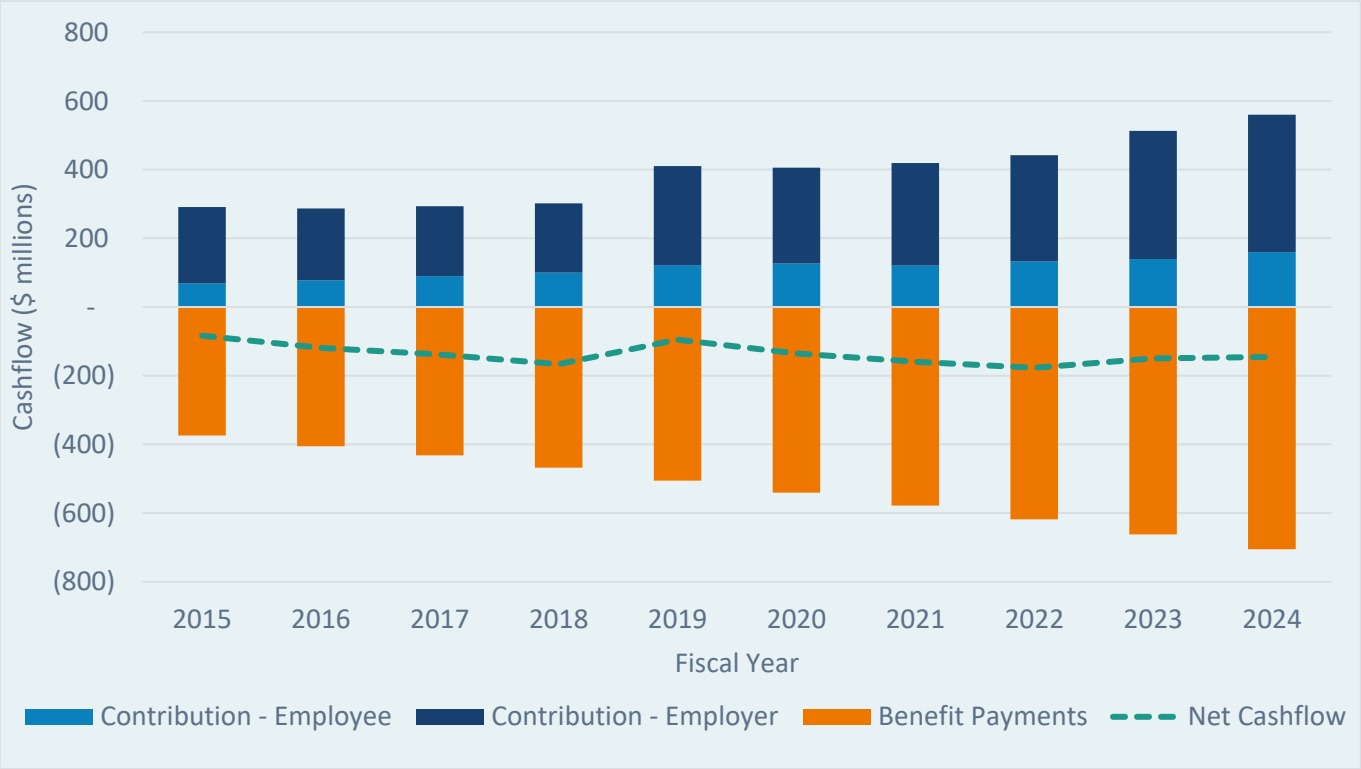
Annualized returns over the prior 10 years were 6.9%

The assumed investment return fell from 7.50% to 7.00% beginning in fiscal 2018 and fell to 6.75% beginning in fiscal 2021.

Source: SCERS' actuarial valuation reports.

Cash flows

TOTAL CASH INFLOWS VS. OUTFLOWS



Net Cashflow	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
$M	-84	-119	-139	-167	-95	-135	-159	-177	-150	-146
% of BOY Assets	-1.1%	-1.5%	-1.8%	-1.9%	-1.0%	-1.4%	-1.6%	-1.4%	-1.3%	-1.2%

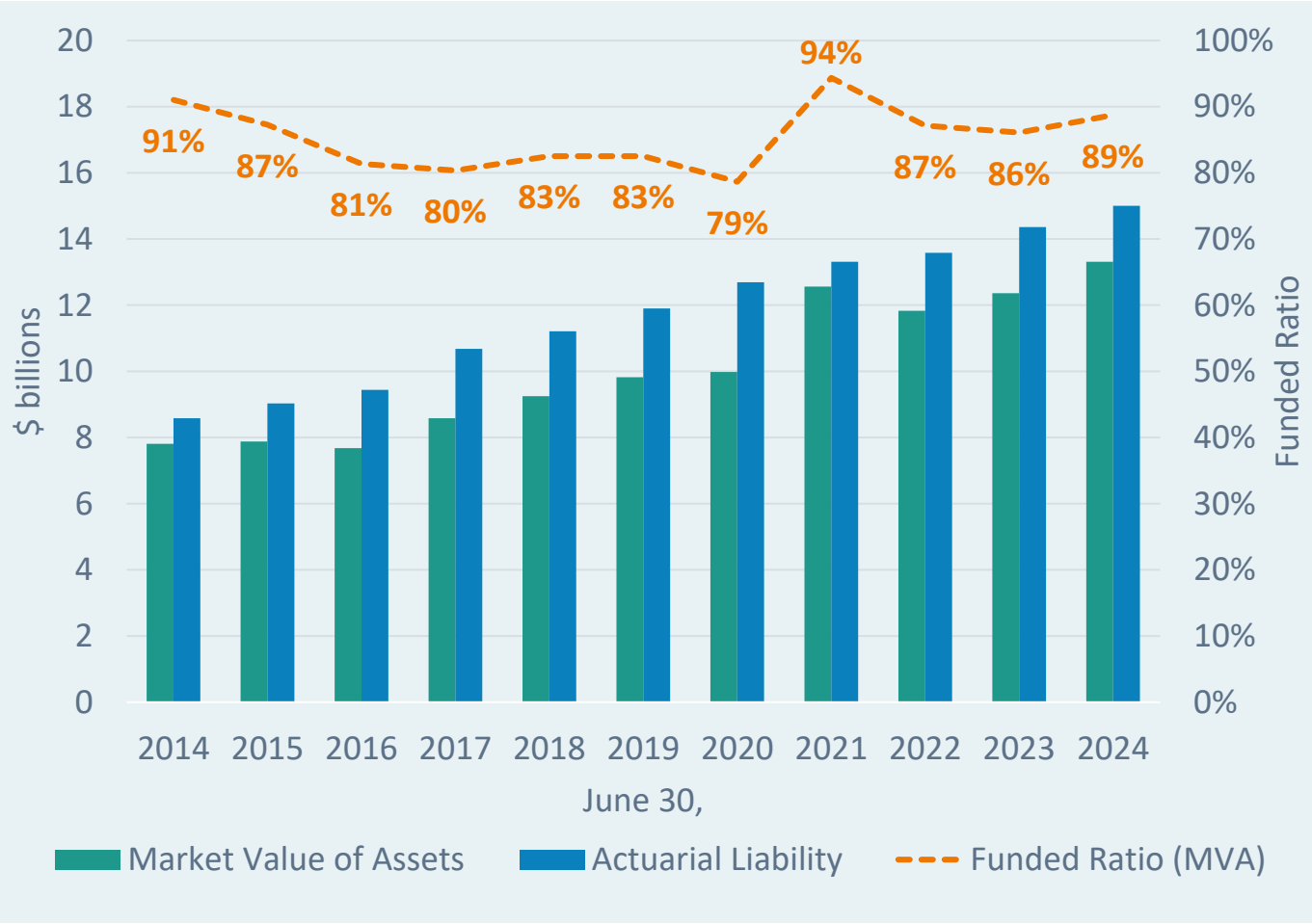
SCERS has made contributions in accordance with the actuarial funding policy over the last ten years.

As a percentage of assets, the cash outflow position has remained a relatively stable 1-2%.

Source: SCERS' actuarial valuation reports.

Funded status

ACTUARIAL VALUE OF ASSETS VS. ACTUARIAL LIABILITIES



The asset growth has kept pace with liability growth and the funding levels have remained relatively stable over the last 10 years on a market basis.

Without decreasing the assumed investment return by 0.75% over the period, the plan would be 97% funded today.

Source: SCERS' actuarial valuation reports.

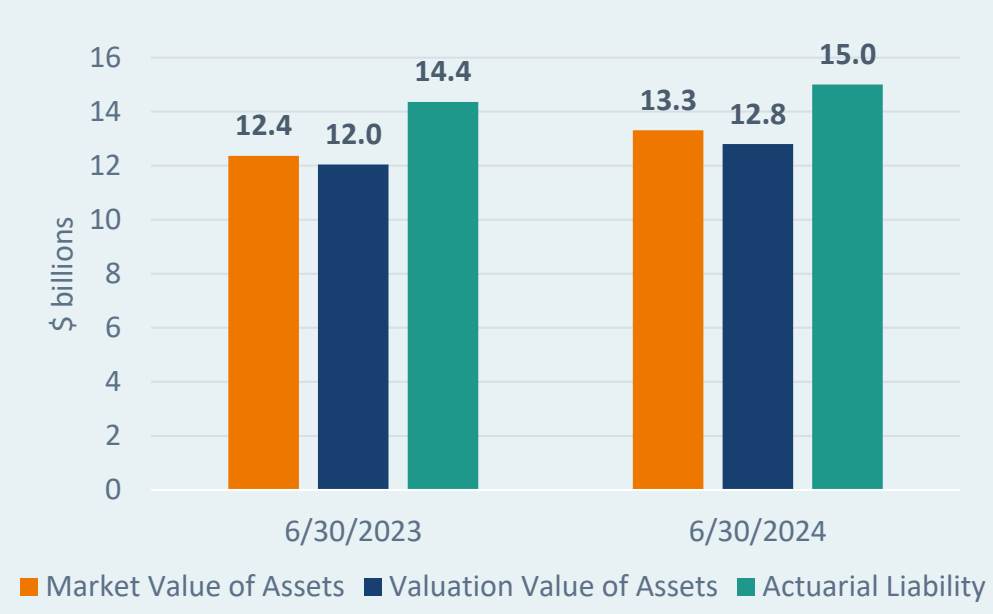
Current state

2025 vs. 2024 return forecast

Source: Verus, as of 9/30/24

Current state

ASSETS AND LIABILITIES ($ BILLIONS)[1]



6/30/2023		6/30/2024
86%	MVA Funded Ratio	89%
84%	VVA Funded Ratio	85%
6.75%	Discount Rate	6.75%

	Policy
Allocation	
Total Growth	58.0
Total Diversifying	25.0
Total Real Return	17.0
Portfolio Metrics	
Forecast 10-Year Return	6.7
Standard Deviation	11.9
Return / Std. Deviation	0.57
1st Percentile Return	-17.5
Sharpe Ratio	0.30
% Illiquid	39%

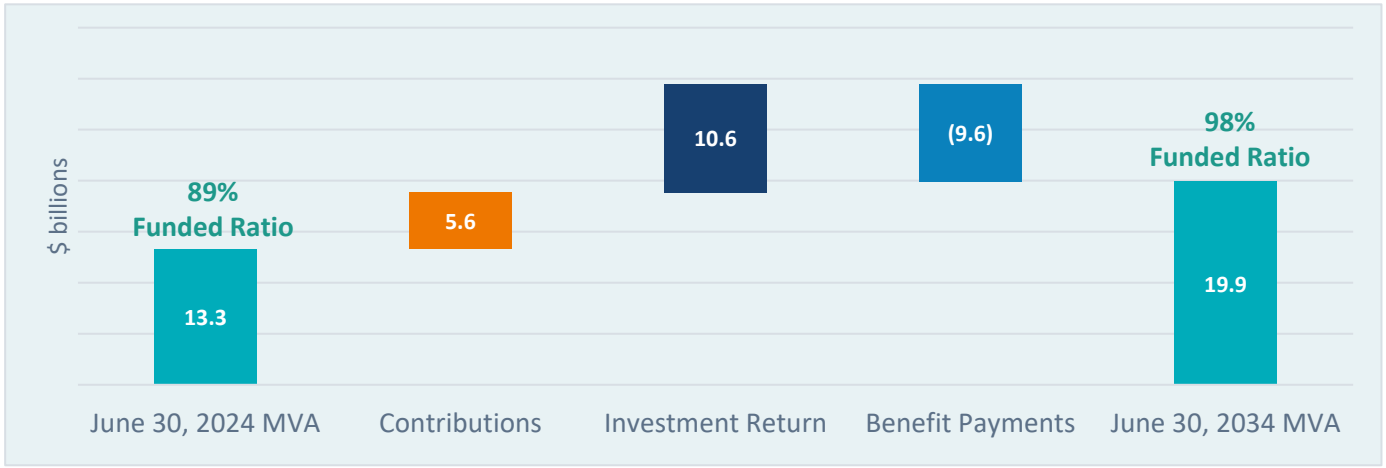
- SCERS' funding levels improved during fiscal 2024
- Contributions equaling the ADC are expected in the future
- A portion of excess returns on an AVA basis are allocated to the contingency reserve, which reduces valuation value of assets[2]
- Return forecast of policy allocation is 6.7%, relative to a 6.75% actuarial return assumption

[1]Based on SCERS' 2024 actuarial valuation reports.

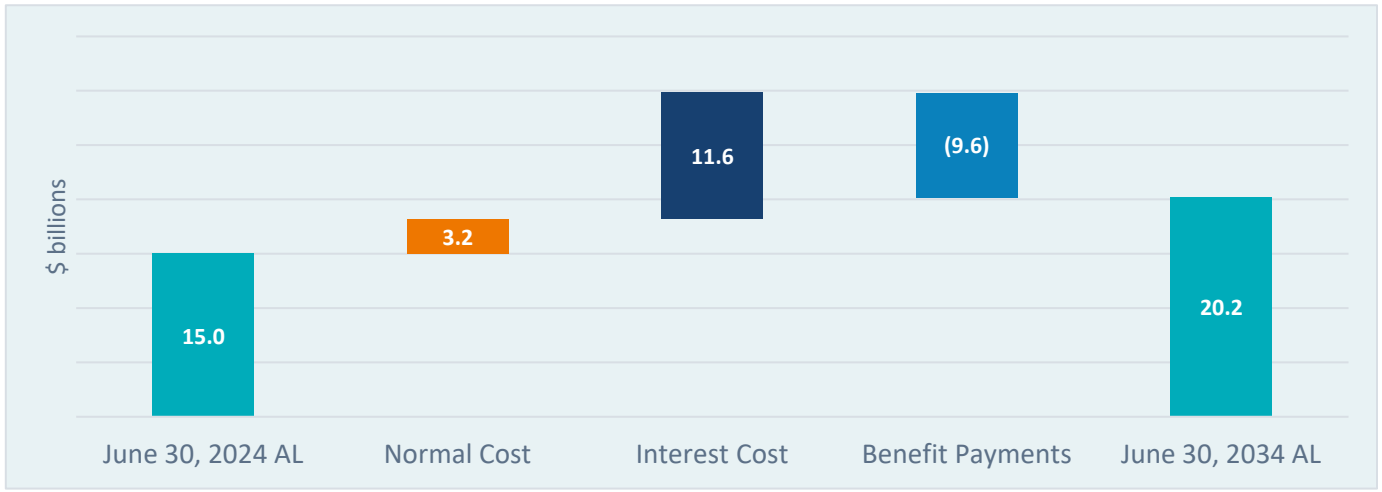
[2]Contingency reserve is credited with excess returns until it reaches 3% of the market value of assets. Reserve is $399M at 6/30/2024.

Median stochastic projection

10-YEAR MEDIAN STOCHASTIC MARKET VALUE OF ASSET PROJECTION



10-YEAR MEDIAN STOCHASTIC ACTUARIAL LIABILITY PROJECTION



Metric	Median	1-in-20 Worst Case
2034 MVA Funded Ratio	98%	52%
10-Year Total Employer Contributions	$4.0B	$4.6B
2034 Employer Contribution ($M)	$395M	$585M
2034 Employer Contribution (% of Pay)	23%	33%

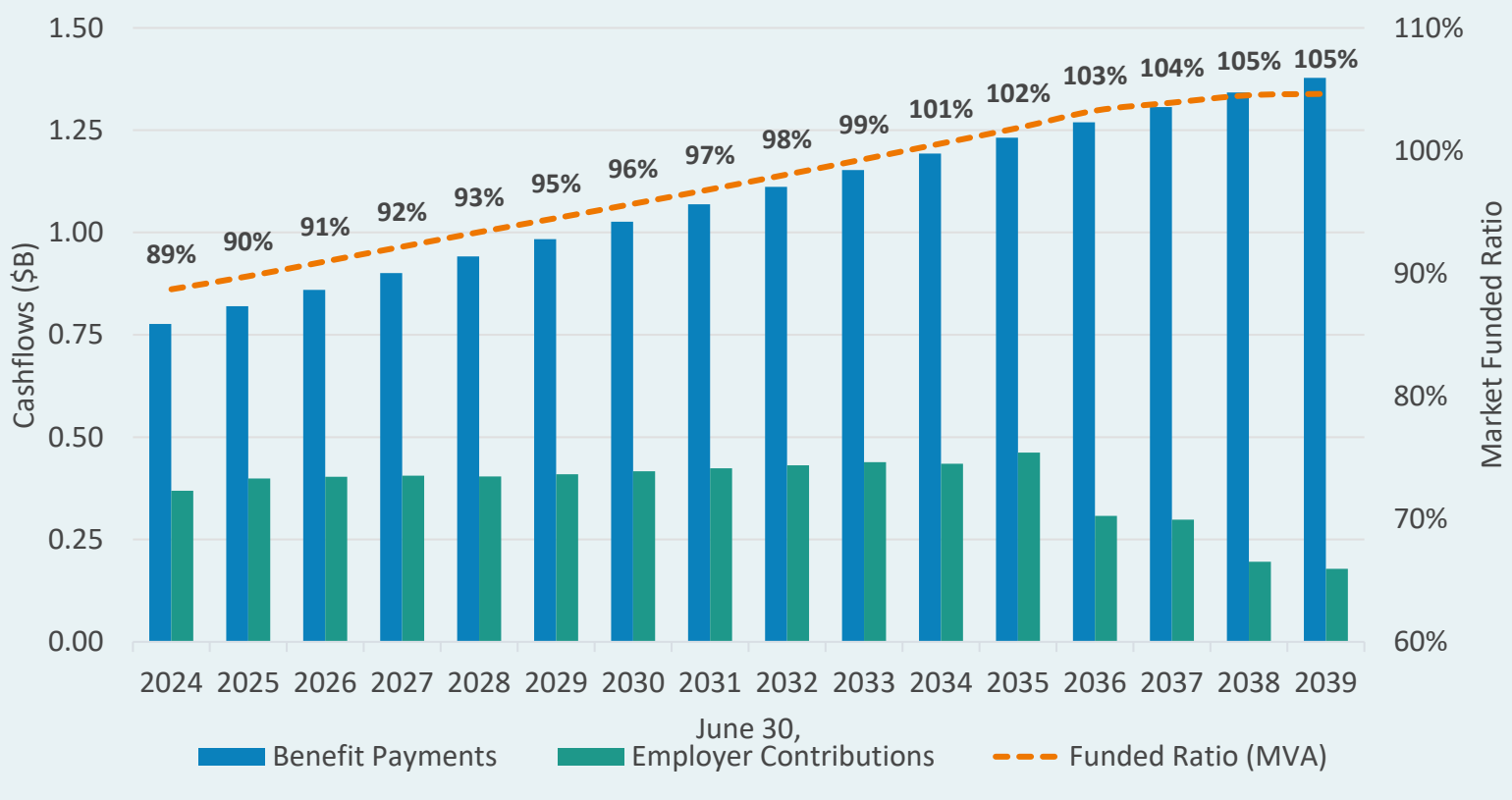
Under the policy allocation, the Plan's funded ratio is expected to improve to 98% in ten years.

Reflects the median stochastic projection under the policy allocation. See appendix for additional details.

Deterministic projections

Funded status and cashflow projection

Baseline return scenario



Net Cashflow	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
$B	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5	-0.6	-0.6	-0.8	-0.8	-1.0	-1.0
% of BOY Assets	-2.0%	-1.9%	-2.1%	-2.2%	-2.4%	-2.5%	-2.6%	-2.6%	-2.7%	-2.8%	-2.9%	-2.8%	-3.6%	-3.6%	-4.1%	-4.2%

Assumes returns of 6.7% each year. See appendix for additional details.

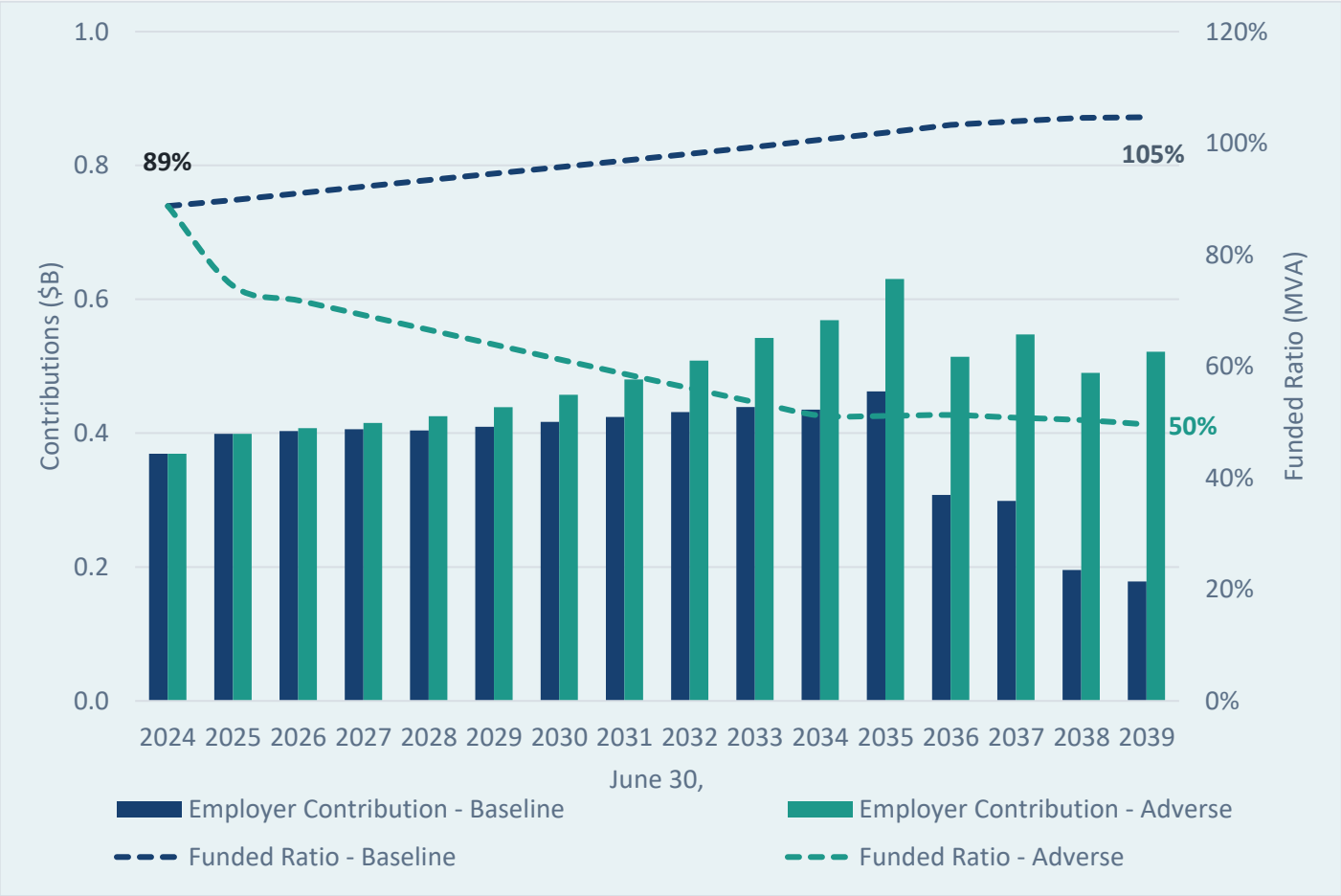
Assuming the 6.7% forecasted return of the policy portfolio is earned annually, the plan reaches full funding in 2034.

Employer contributions are expected to fall by ~$150M after fiscal 2036 and another ~$100M after fiscal 2038

Chart reflects employer contributions only. Annual employee contributions of ~$150M - $200M are expected annually in addition.

Funded status and cashflow projection

Baseline vs. adverse return scenario



The adverse return scenario is intended to represent a 1-in-20 worst case outcome:

Time	Return	Descriptions
Year 1	-11.0%	1-in-20 1-year performance
Year 2-10	2.2%	1-in-20 10-year performance
Year 11+	6.7%	Baseline

Relative to the baseline projection, the adverse scenario results in $1.7B in additional cash and the funded ratio is 55% lower after 15 years.

Assumes returns are as stated each year. See appendix for additional details.

Heat map

Funded status and contributions

Funded Ratio (MVA)																
June 30,	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
1%	89%	85%	81%	77%	74%	70%	67%	63%	60%	56%	53%	50%	47%	44%	40%	36%
2%	89%	86%	83%	80%	77%	74%	71%	68%	65%	63%	60%	57%	54%	51%	48%	45%
3%	89%	87%	84%	82%	80%	78%	76%	74%	72%	69%	67%	65%	63%	60%	57%	54%
Annual 4%	89%	87%	86%	85%	84%	82%	81%	79%	78%	77%	75%	74%	72%	70%	68%	65%
Investment 5%	89%	88%	88%	88%	87%	87%	86%	86%	85%	84%	84%	83%	83%	81%	80%	78%
Return 6%	89%	89%	90%	90%	91%	91%	91%	92%	92%	93%	93%	93%	94%	94%	93%	92%
7%	89%	90%	91%	93%	94%	96%	97%	99%	100%	102%	103%	105%	107%	107%	108%	109%
8%	89%	91%	93%	96%	98%	100%	103%	106%	108%	111%	113%	116%	119%	121%	123%	124%
9%	89%	92%	95%	98%	102%	105%	109%	113%	117%	121%	125%	128%	132%	136%	139%	143%

Annual Employer Contributions ($B)																
Fiscal Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	Total
1%	0.38	0.39	0.41	0.41	0.42	0.43	0.44	0.46	0.48	0.51	0.53	0.59	0.47	0.50	0.44	**6.87**
2%	0.38	0.39	0.41	0.41	0.42	0.43	0.44	0.46	0.48	0.50	0.52	0.57	0.44	0.47	0.41	**6.73**
3%	0.38	0.39	0.41	0.41	0.42	0.43	0.44	0.45	0.47	0.49	0.50	0.55	0.42	0.44	0.37	**6.58**
Annual 4%	0.38	0.39	0.41	0.41	0.42	0.43	0.44	0.45	0.46	0.48	0.49	0.53	0.39	0.41	0.33	**6.41**
Investment 5%	0.38	0.39	0.41	0.41	0.42	0.42	0.43	0.44	0.46	0.47	0.47	0.51	0.37	0.37	0.28	**6.23**
Return 6%	0.38	0.39	0.40	0.41	0.41	0.42	0.43	0.43	0.44	0.45	0.45	0.48	0.33	0.33	0.24	**6.01**
7%	0.38	0.39	0.40	0.40	0.40	0.41	0.41	0.42	0.43	0.43	0.43	0.45	0.29	0.28	0.17	**5.71**
8%	0.38	0.39	0.40	0.40	0.39	0.40	0.40	0.38	0.37	0.36	0.33	0.34	0.16	0.12	0.00	**4.81**
9%	0.38	0.39	0.40	0.40	0.38	0.38	0.37	0.34	0.31	0.28	0.23	0.21	0.01	0.00	0.00	**4.08**

The heat map shows the impacts of varying returns to the plan's funded status and contribution requirements.

Assumes returns are as stated in each year of the projection. See appendix for additional details. Total column reflects cumulative contributions from fiscal 2025 – 2039.

Asset Mixes

Asset mixes for consideration

Shown alongside the current Policy are 3 alternative asset mixes (described below).

Additionally, all 3 alternative asset mixes consolidate Bank Loans, High Yield, and Private Credit into a single Multi-Asset Credit asset class.

- Alt A: similar return target to the Policy but with lower volatility
  - Increases Diversifying assets and decreases both Growth and Real Return assets
- Alt B: slight tilts around the Policy to improve risk/return tradeoff
  - Increases Growth assets and decreases Real Return assets
- Alt C: higher return target but with higher volatility and lower liquidity
  - Increases Growth assets and decreases both Diversifying and Real Return assets

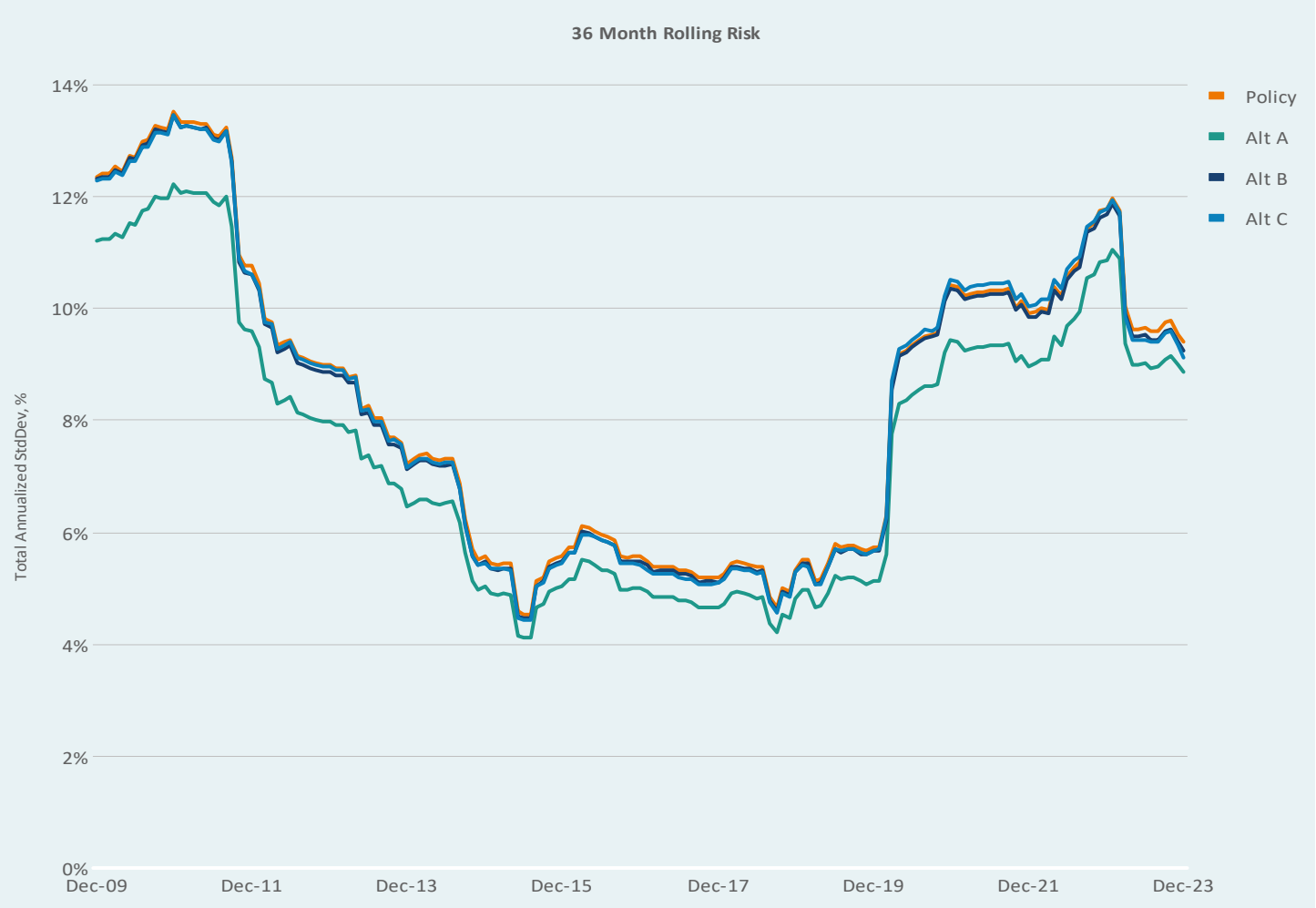
Portfolio alternatives

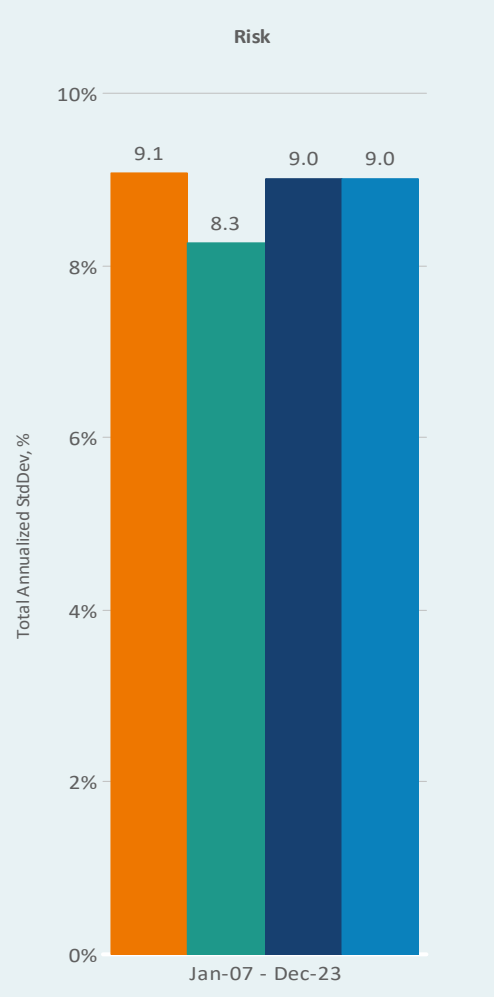
	Policy	A	B	C	Verus 2025 CMAs Return (g)	Standard Deviation	Sharpe Ratio (g)
Global Equity	40	36	40	40	*6.0*	*16.7*	*0.13*
High Yield Corp. Credit	1	-	-	-	*5.6*	*10.8*	*0.35*
Bank Loans	1	-	-	-	*6.9*	*8.8*	*0.16*
Private Equity	11	11	11	15	*8.0*	*10.9*	*0.37*
Private Credit	5	-	-	-	*8.2*	*11.8*	*0.42*
Multi-Asset Credit*	-	7	9	10	*8.2*	*11.8*	*0.42*
Total Growth Assets	***58***	***54***	***60***	***65***			
Core Plus Fixed Income	12	16	12	10	*4.4*	*4.7*	*0.13*
US Treasury	4	6	4	2	*3.8*	*7.1*	*0.00*
Diversifying Absolute Return*	7	6	7	6	*5.4*	*6.3*	*0.25*
Cash	2	2	2	2	*3.8*	*1.1*	-
Total Diversifying	***25***	***30***	***25***	***20***			
Core Real Estate	6	6	6	6	*7.2*	*12.5*	*0.27*
Value Add Real Estate	1.5	1.5	1	1.5	*9.2*	*15.4*	*0.35*
Opportunistic Real Estate	1.5	1.5	1	1.5	*10.2*	*21.2*	*0.30*
Liquid Real Return*	1	1	1	-	*6.3*	*16.0*	*0.16*
Private Real Assets*	7	6	6	6	*8.1*	*16.8*	*0.26*
Total Real Return	***17***	***16***	***15***	***15***			
Total Allocation	**100**	**100**	**100**	**100**			

	Policy	A	B	C
Mean Variance Analysis				
Forecast 10 Year Return	***6.7***	***6.7***	***6.8***	***7.0***
Standard Deviation	11.9	11.2	11.8	12.7
1st percentile ret. 1 year	*-17.5*	*-16.3*	*-17.3*	*-18.6*
Sharpe Ratio	0.30	0.30	0.30	0.31
% in Liquid Assets	61%	61%	59%	54%
% in Illiquid Assets	39%	39%	41%	46%

**Multi-Asset Credit modeled with Private Credit; Diversifying Absolute Return modeled with Asymmetric Hedge Funds; Liquid Real Return modeled with Commodities; Private Real Assets modeled with Infrastructure*

Risk - long term





Left chart illustrates the historical annualized volatility (3-year rolling) of the current portfolio mix over time, if the current portfolio were held for this historical period and rebalanced according to the specified rebalancing frequency.

Performance during historical stress periods

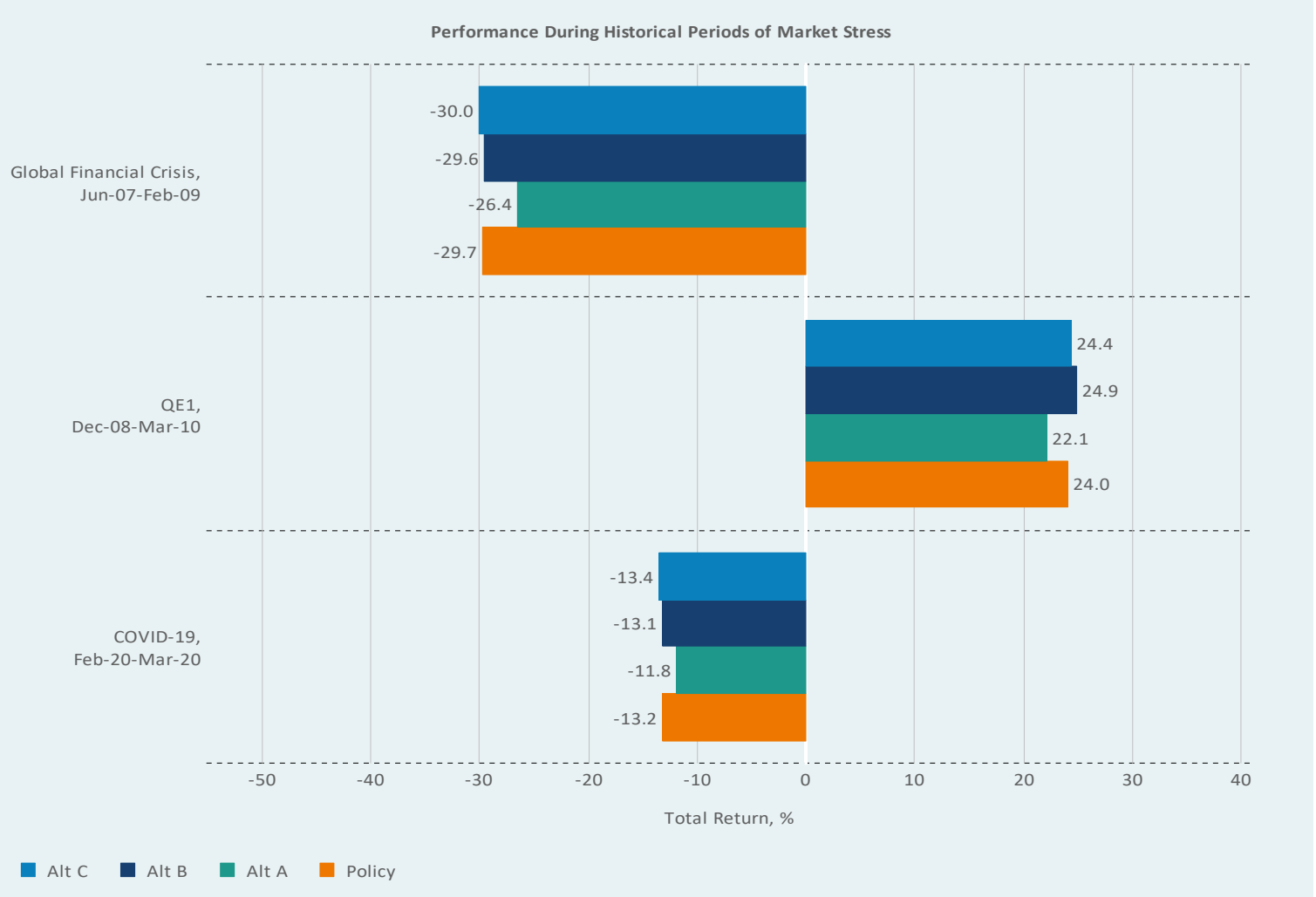


Chart illustrates how each portfolio asset mix performed during a variety of historical periods, given conditions at that historical time, and given the specified

Performance during historical stress scenarios

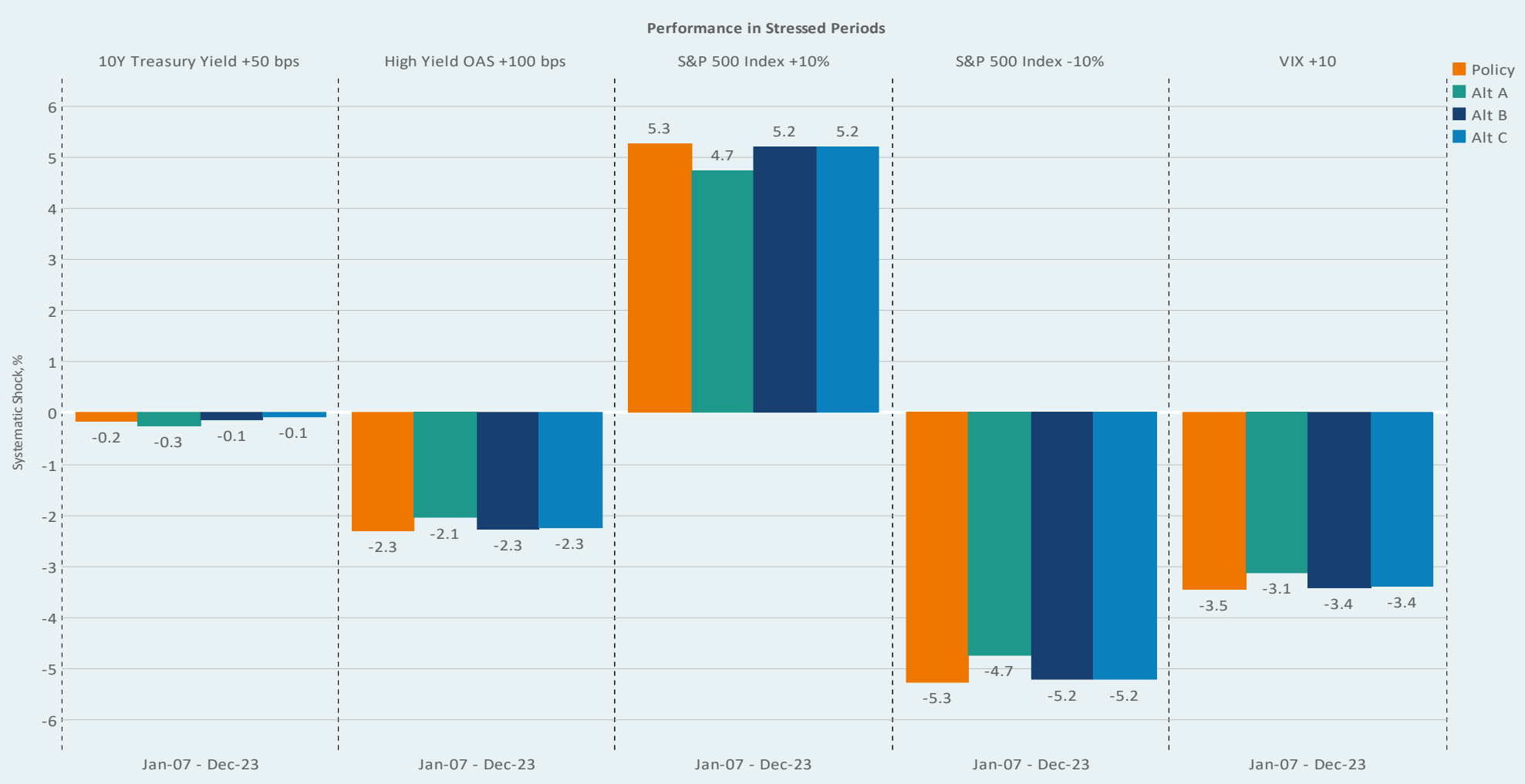
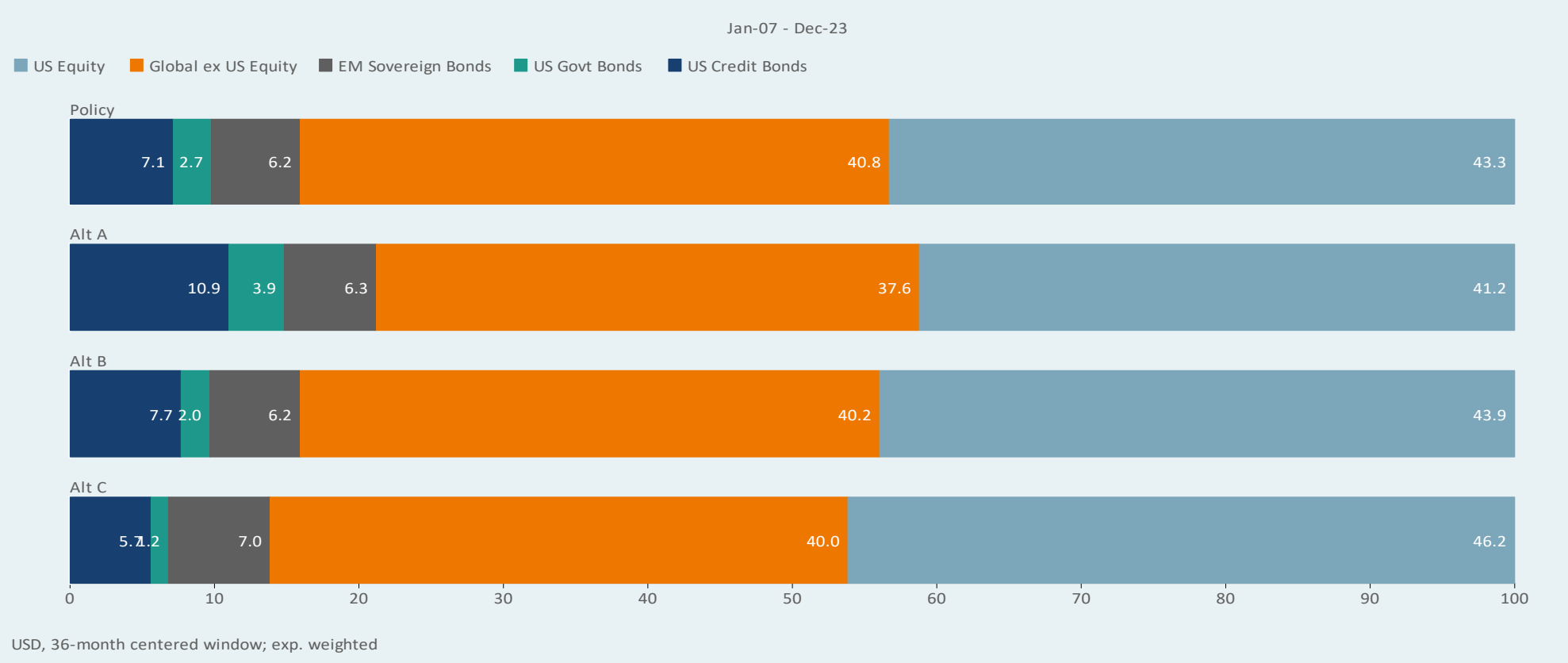


Chart estimates the total portfolio performance of each asset mix, given a specific shock to the portfolio. This is calculated based on the sensitivity of all of the

Historical asset loadings

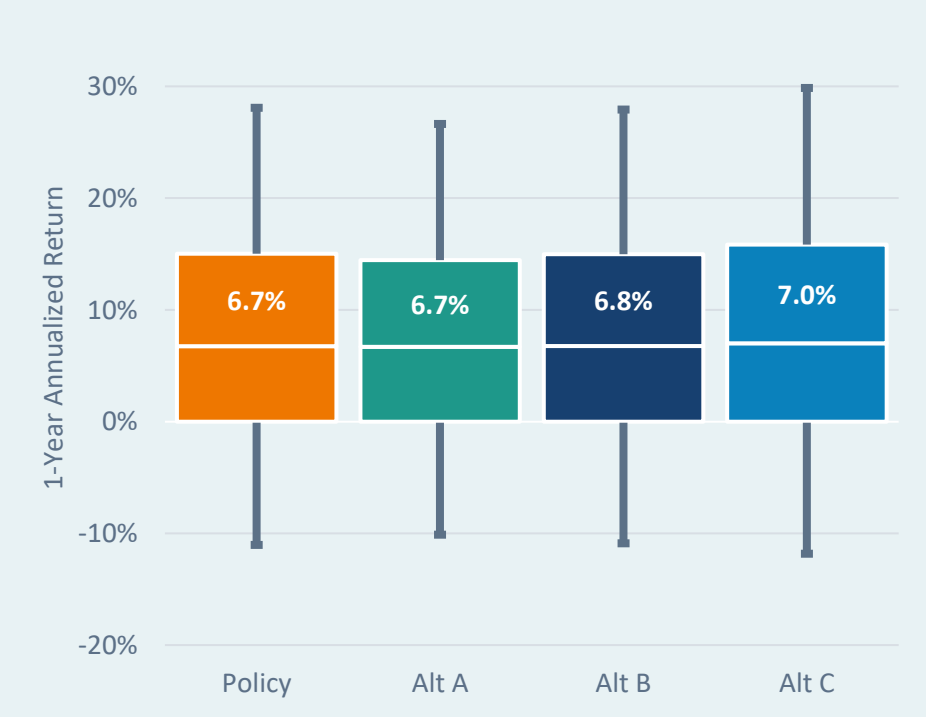


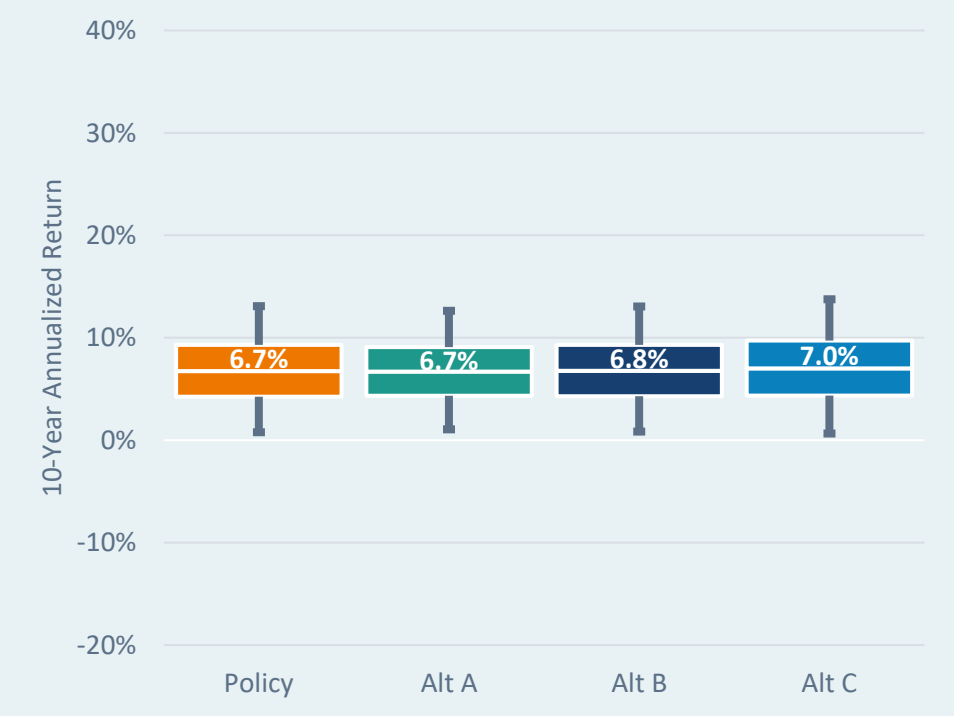
This chart is used to demonstrate the likely allocation of the fund's assets to different factors (US Equity, Global ex-US Equity, U.S Bonds, U.S Credit Bonds, and EM Sovereign Bonds). This chart is exponentially-weighted, meaning more emphasis is placed on more recent market behavior and less emphasis is placed on older

Stochastic projections

Range of potential return outcomes

1 -YEAR					10-YEAR			
Policy	Alt A	Alt B	Alt C	Percentile	Policy	Alt A	Alt B	Alt C
28.1%	26.6%	27.9%	29.9%	95th	13.1%	12.6%	13.1%	13.8%
15.0%	14.5%	15.0%	15.9%	75th	9.3%	9.1%	9.3%	9.7%
6.7%	**6.7%**	**6.8%**	**7.0%**	**50th**	**6.7%**	**6.7%**	**6.8%**	**7.0%**
-0.9%	-0.6%	-0.9%	-1.2%	25th	4.3%	4.3%	4.3%	4.4%
-11.0%	**-10.1%**	**-10.9%**	**-11.8%**	**5th**	**0.8%**	**1.1%**	**0.8%**	**0.7%**

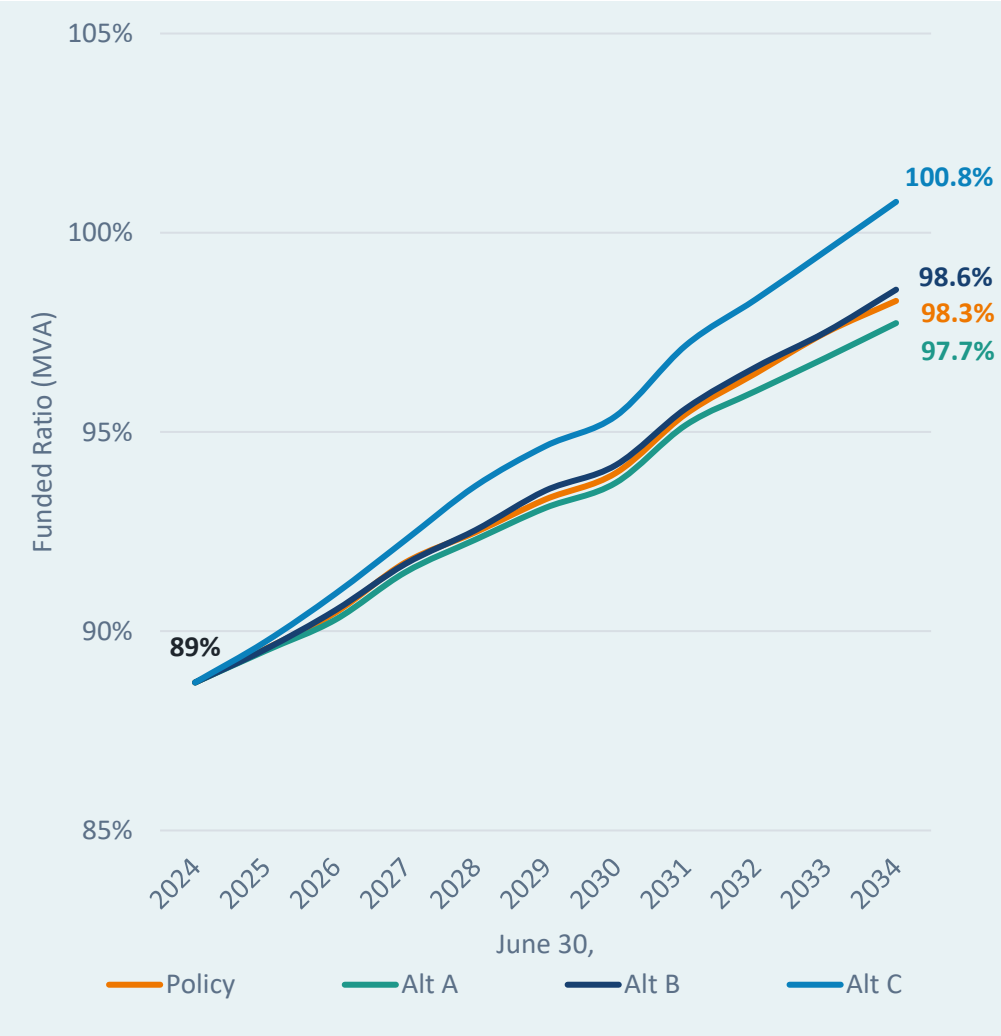




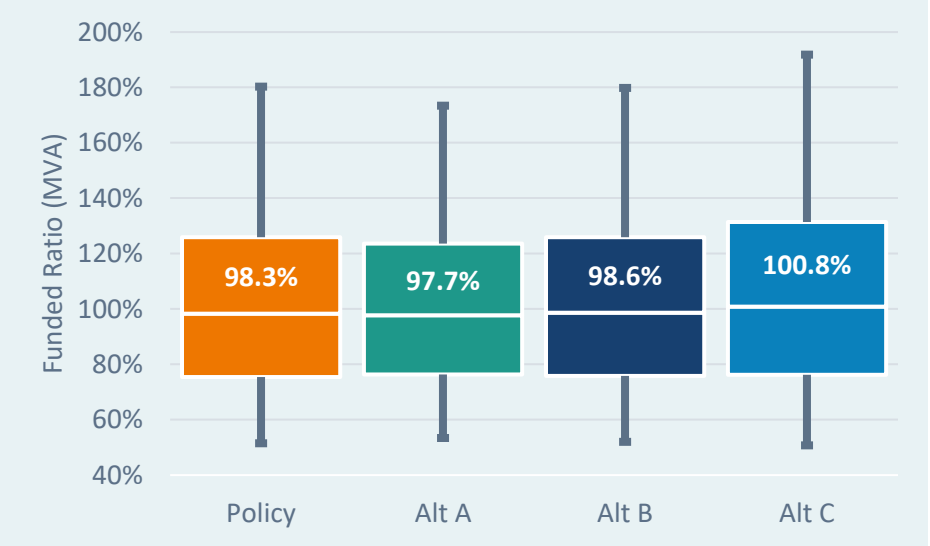
Source: MPI and Verus' 2025 capital market assumptions

Funded ratio (MVA)

FUNDED RATIO (MVA) MEDIAN PROJECTION



JUNE 30, 2034 FUNDED RATIO (MVA) DISTRIBUTION

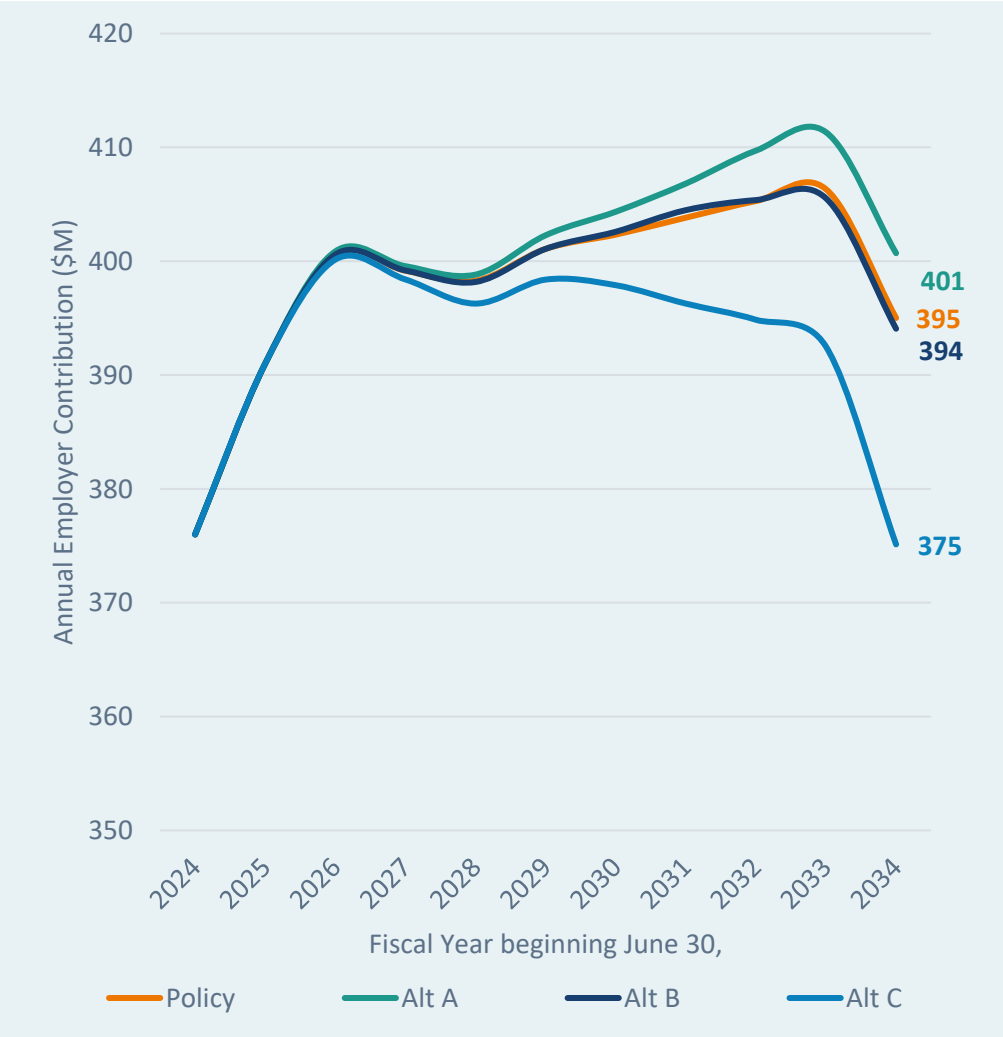


2034 Funded Ratio (MVA)	Policy	Alt A	Alt B	Alt C
Percentile				
95%	180.3%	173.4%	179.8%	191.8%
75%	125.9%	123.6%	125.9%	131.4%
50%	**98.3%**	**97.7%**	**98.6%**	**100.8%**
25%	75.4%	76.3%	75.8%	76.2%
5%	**51.5%**	**53.4%**	**52.0%**	**50.7%**
Probability				
> Policy	N/A	42%	60%	78%
> 100% Funded	48%	48%	49%	51%
> 89% Funded	60%	61%	61%	62%

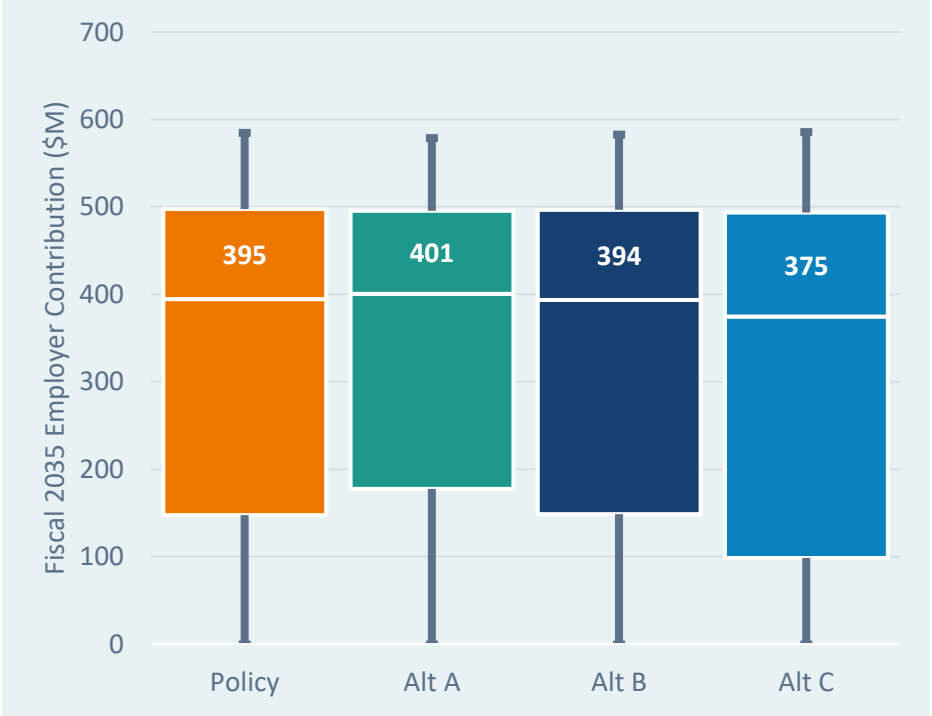
Source: Reflects 5,000 simulations of assets and liabilities based on Verus' 2025 capital market assumptions. See appendix for details.

Annual employer contribution

ANNUAL EMPLOYER CONTRIBUTION ($M)



FISCAL 2035 EMPLOYER CONTRIBUTION ($M) DISTRIBUTION



Fiscal 2035 ER Contribution ($M)	Policy	Alt A	Alt B	Alt C
Percentile				
95%	**585**	**579**	**583**	**586**
75%	498	496	497	494
50%	**395**	**401**	**394**	**375**
25%	148	178	149	99
5%	0	0	0	0

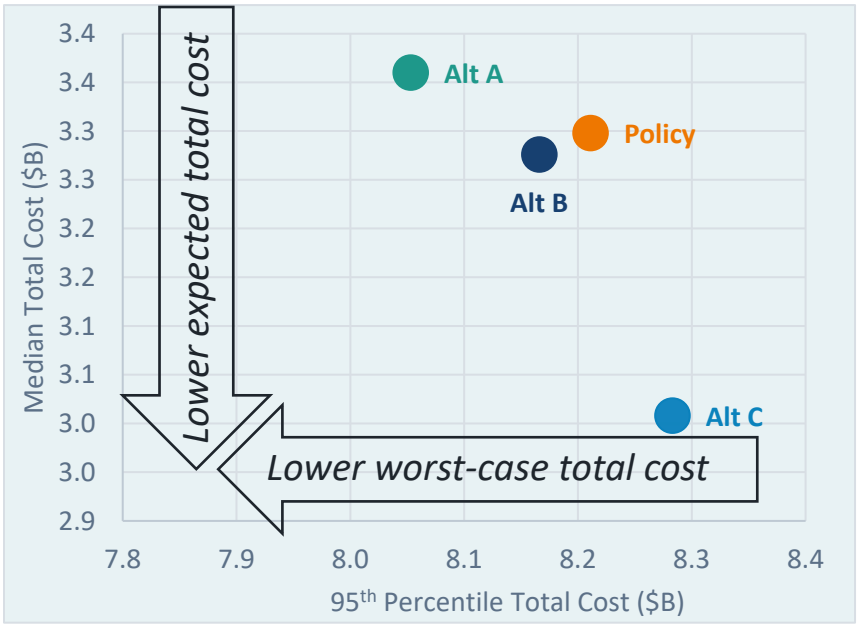
Source: Reflects 5,000 simulations of assets and liabilities based on Verus' 2025 capital market assumptions. See appendix for details.

Total full funding cost

TOTAL COST DISTRIBUTION ($M)

Total full funding cost ($B)	Policy	Alt A	Alt B	Alt C
Percentile				
95%	**8.21**	**8.05**	**8.17**	**8.28**
75%	5.71	5.63	5.67	5.60
50%	**3.30**	**3.36**	**3.28**	**3.01**
25%	1.50	1.57	1.51	1.41
5%	0.59	0.64	0.59	0.51

ILLUSTRATION OF RISK REWARD TRADEOFF



Metric estimates the total cost to achieve full funding, by summing together the following:

- Fiscal 2025 through 2034 cumulative contributions:
  - "What did we contribute during the projection?"
- Remaining deficit at 6/30/2034:
  - "What would we still need to contribute at the end of the projection to achieve full funding?"

Source: Reflects 5,000 simulations of assets and liabilities based on Verus' 2025 capital market assumptions. Metric is calculated on a present value basis with a 6.75% discount rate. See appendix for details.

Conclusions

Summary

- Projected returns across asset classes are narrower than in the past
- Expected returns across most asset classes (2024 vs. 2025 CMAs) has declined
- Achieving higher returns requires taking more of these risks:
  - Increased reliance on manager selection/skill
  - Increased reliance on private investments and illiquid investment structures
  - Increased reliance on use of leverage (implicitly or explicitly)
- Some implications of these risks to consider include:
  - Ability to source, select, and monitor investments with the same level of diligence and care as the current program
  - Higher explicit costs including fees, sourcing, managing, monitoring – private, illiquid investments are not scalable in the same way as liquid, transparent investments
  - Increase to private investments will take several years to achieve, interim asset allocation glidepath decisions should be taken into consideration
  - Growth in negative cash flows as plan matures will require increased liquidity
- However, with narrower projected returns across asset classes, there may be an opportunity to improve efficiency (the risk/return tradeoff).

Since projected returns across asset classes are narrower than in the past, the amount of additional return per a unit of additional risk is lower.

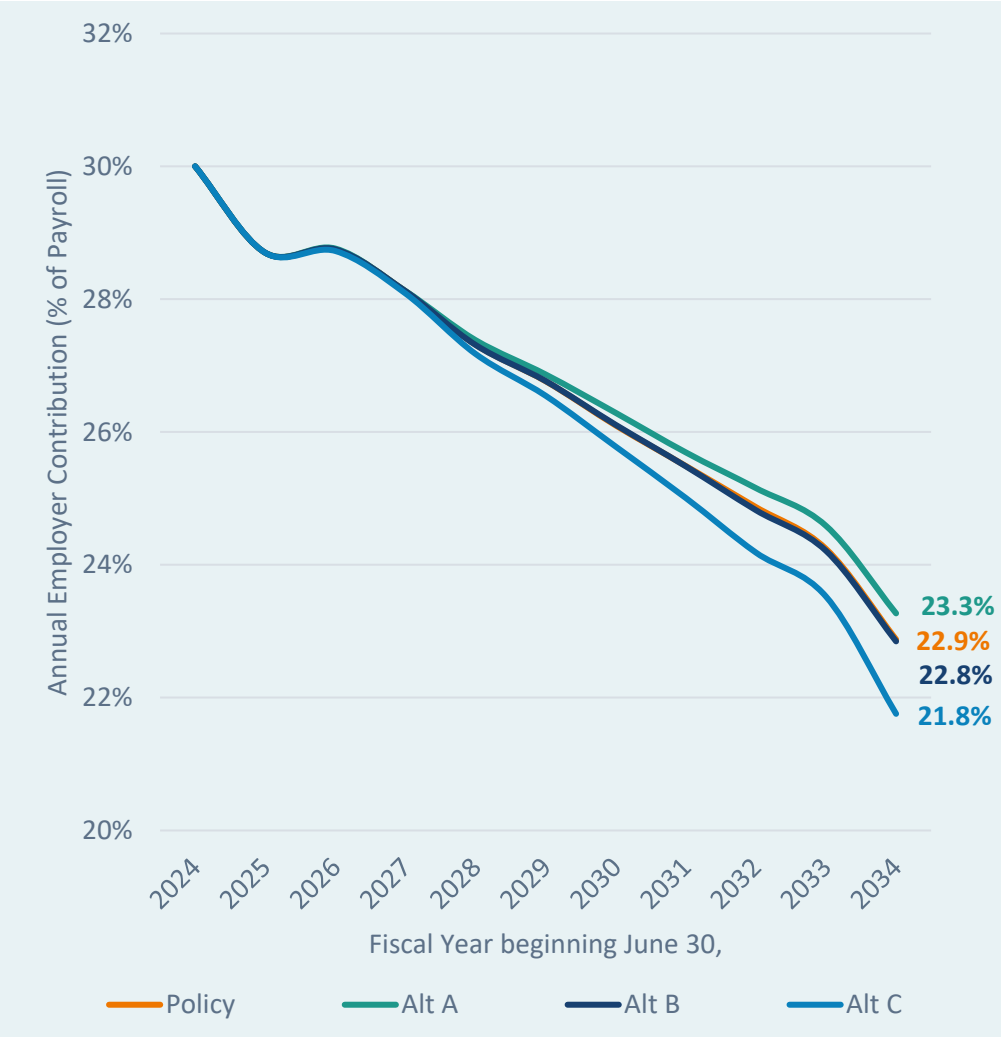
Therefore, targeting a return materially higher than the assumed rate may not be worth the additional risk.

Appendix

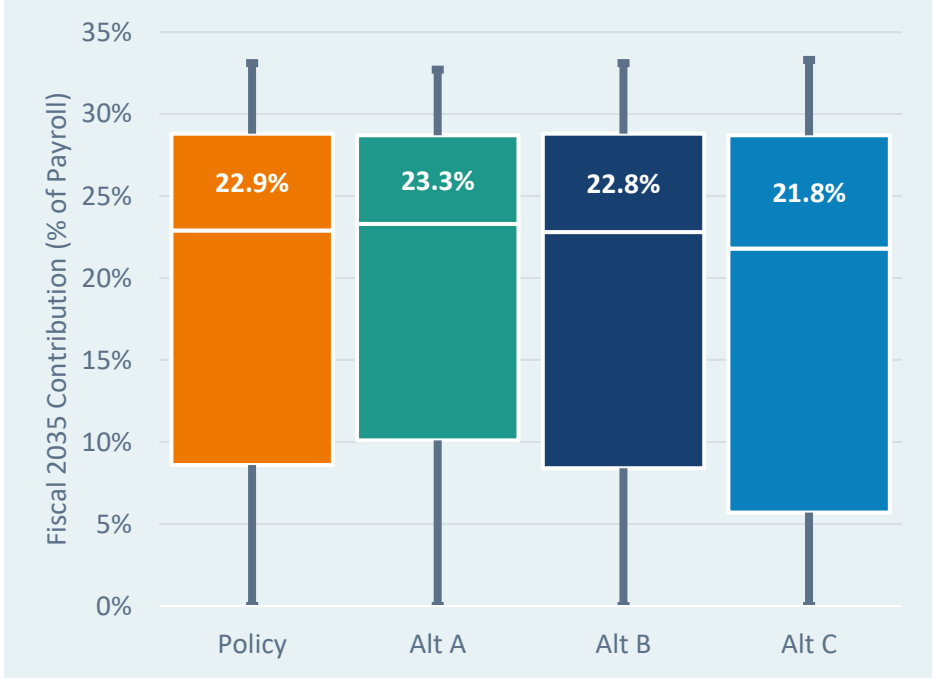
Stochastic projections

Annual employer contribution (% of payroll)

ANNUAL EMPLOYER CONTRIBUTION (% OF PAYROLL)



FISCAL 2035 EMPLOYER CONTRIBUTION (% OF PAYROLL) DISTRIBUTION

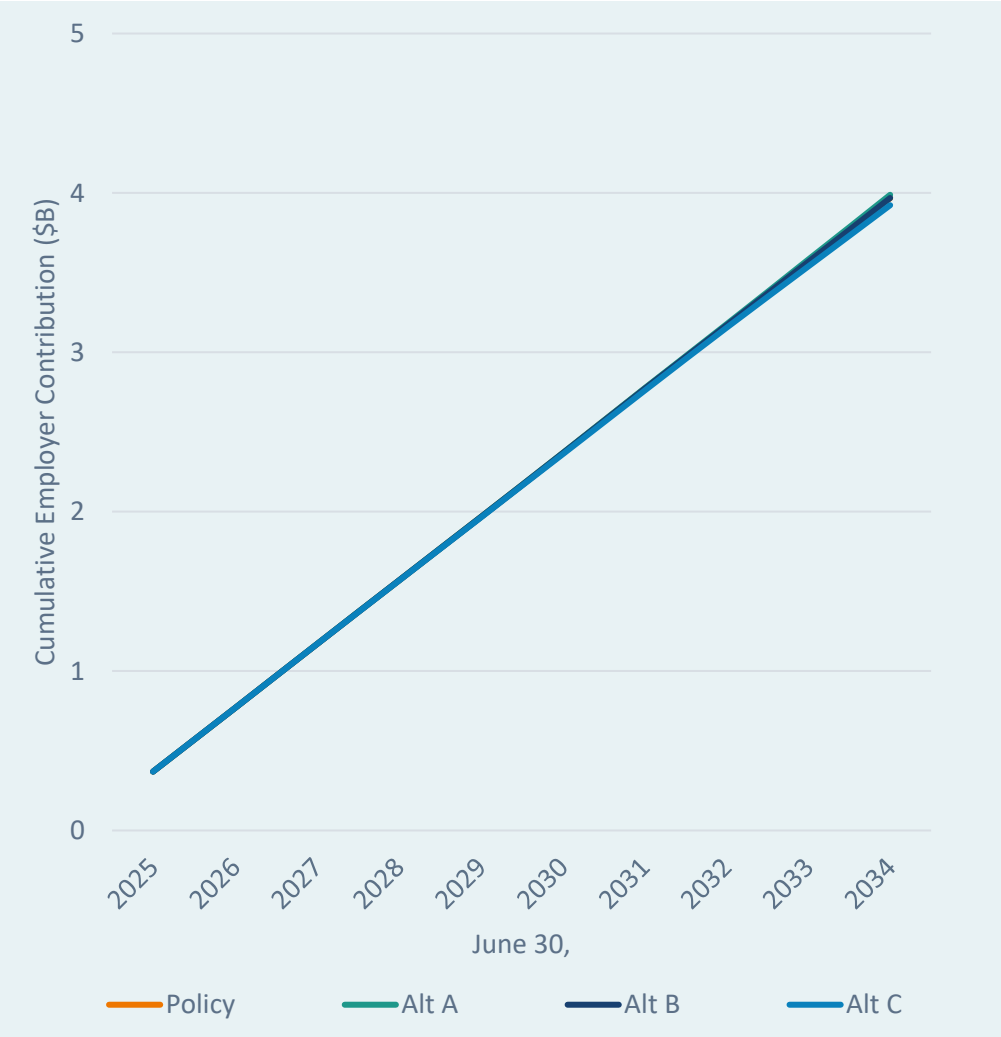


Fiscal 2035 ER Contribution (% of Payroll)	Policy	Alt A	Alt B	Alt C
Percentile				
95%	**33.1%**	**32.7%**	**33.1%**	**33.3%**
75%	28.8%	28.7%	28.8%	28.7%
50%	**22.9%**	**23.3%**	**22.8%**	**21.8%**
25%	8.6%	10.1%	8.4%	5.7%
5%	0.0%	0.0%	0.0%	0.0%

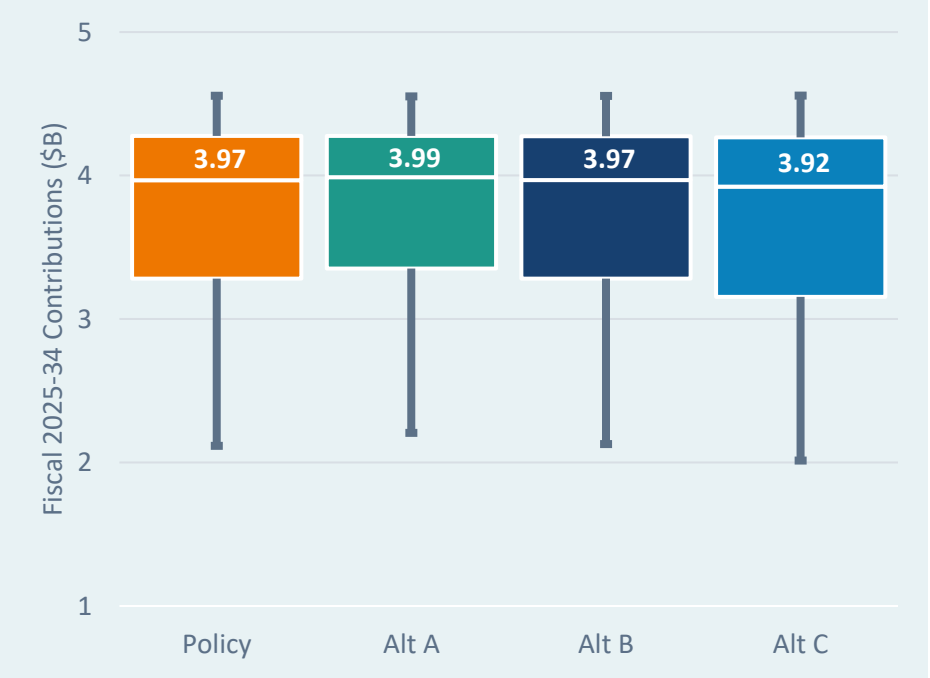
Source: Reflects 5,000 simulations of assets and liabilities based on Verus' 2025 capital market assumptions. See appendix for details.

Cumulative employer contribution

CUMULATIVE EMPLOYER CONTRIBUTION ($B)



FISCAL 2025-34 EMPLOYER CONTRIBUTION ($B) DISTRIBUTION

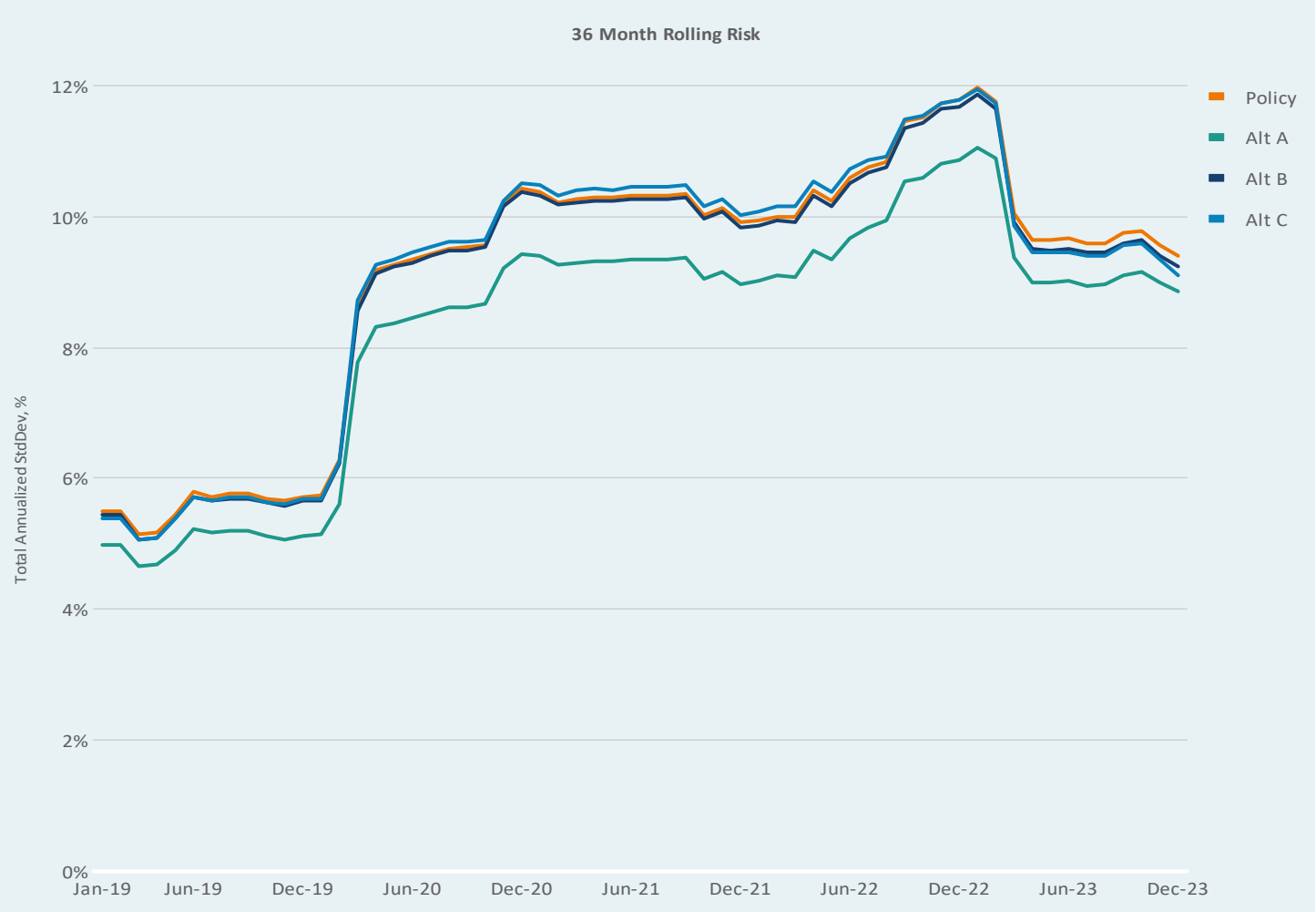


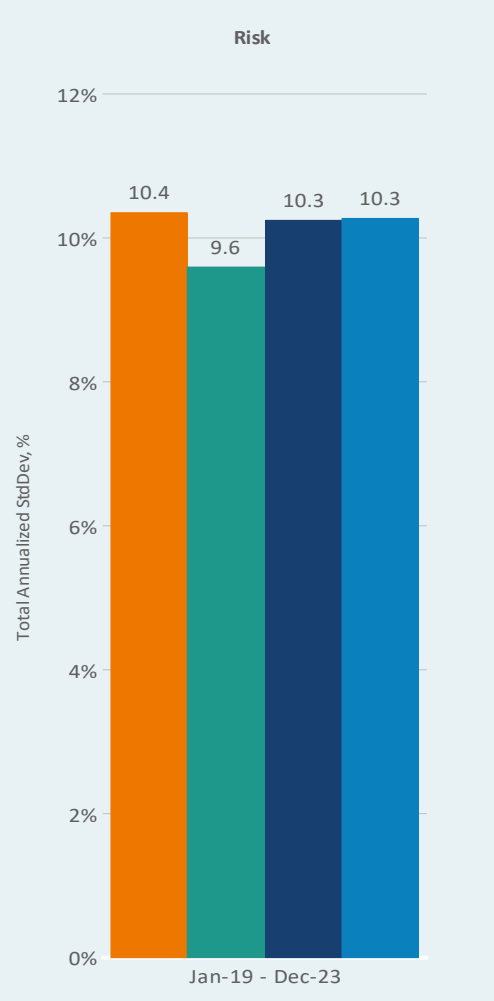
Fiscal 2025-34 ER Contribution	Policy	Alt A	Alt B	Alt C
Percentile				
95%	**4.56**	**4.55**	**4.56**	**4.56**
75%	4.28	4.28	4.27	4.27
50%	**3.97**	**3.99**	**3.97**	**3.92**
25%	3.28	3.35	3.28	3.15
5%	2.12	2.21	2.13	2.01

Source: Reflects 5,000 simulations of assets and liabilities based on Verus' 2025 capital market assumptions. See appendix for details.

Portfolio risk analytics

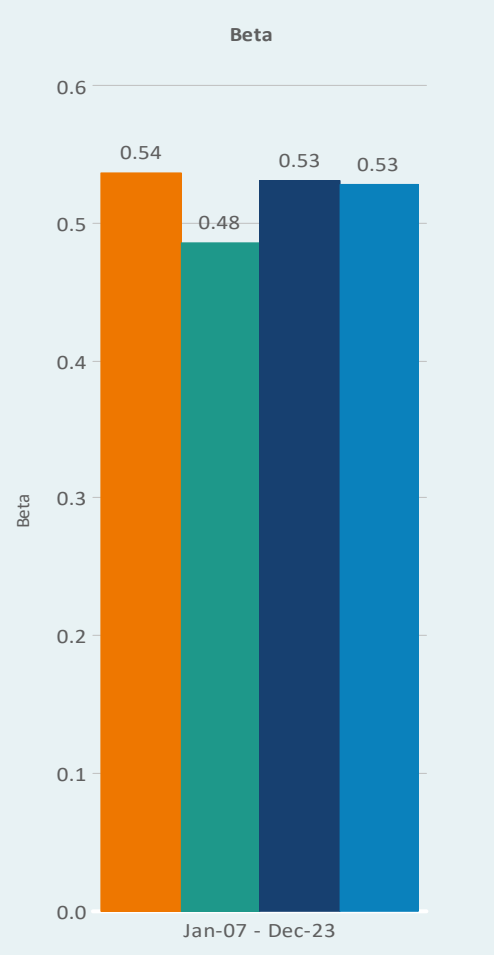
Risk - short term





Left chart illustrates the historical annualized volatility (3-year rolling) of the current portfolio mix over time, if the current portfolio were held for this historical period and rebalanced based on the specified rebalancing frequency.

Beta vs S&P 500 Index



Left chart illustrates the equity Beta (3-year rolling) of the current portfolio mix over time, if the current portfolio asset mix was held for this historical period and rebalanced according to the specified rebalancing frequency. Beta is calculated based on every exposure in the portfolio and how sensitive each exposure has been to equity market movements through history, using a regression of monthly returns.

Performance during historical stress scenarios

Scenario Name	Description
Bond Market Stress	Treasury rates at 2-Year, 5-Year, and 20-Year maturities rise simultaneously with investment grade and high yield spreads, all by 100 bps. (Note: This shock will only work appropriately in Stylus v11.5 and above)
Yield Curve Parallel +100 bps	Parallel upward shift of the yield curve at 2-Year, 5-Year, and 20-Year constant maturity rates. (Note: This shock will only work appropriately in Stylus v11.5 and above)
Yield Curve Steepens 2Y, 5Y, 20Y	Upward steepening of the Treasury yield curve with 2-Year, 5-Year, and 20-Year constant maturity rates. (Note: This shock will only work appropriately in Stylus v11.5 and above)

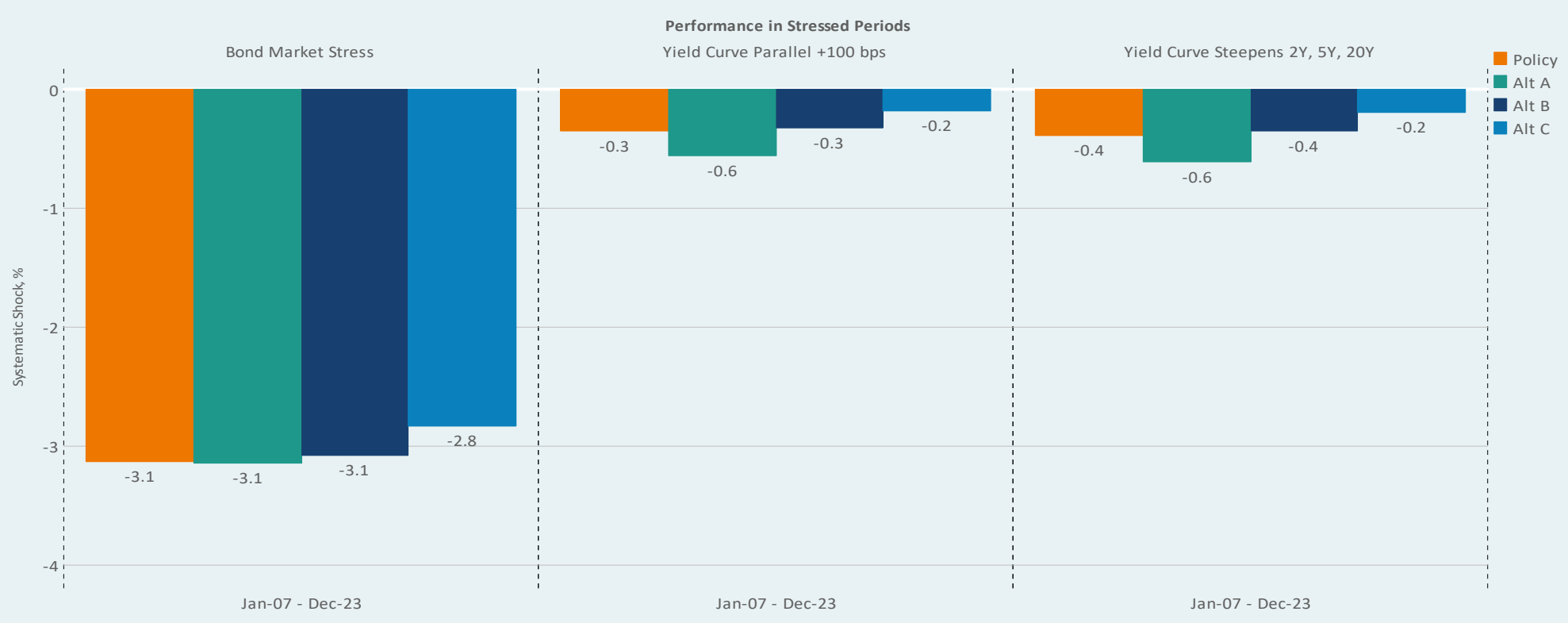
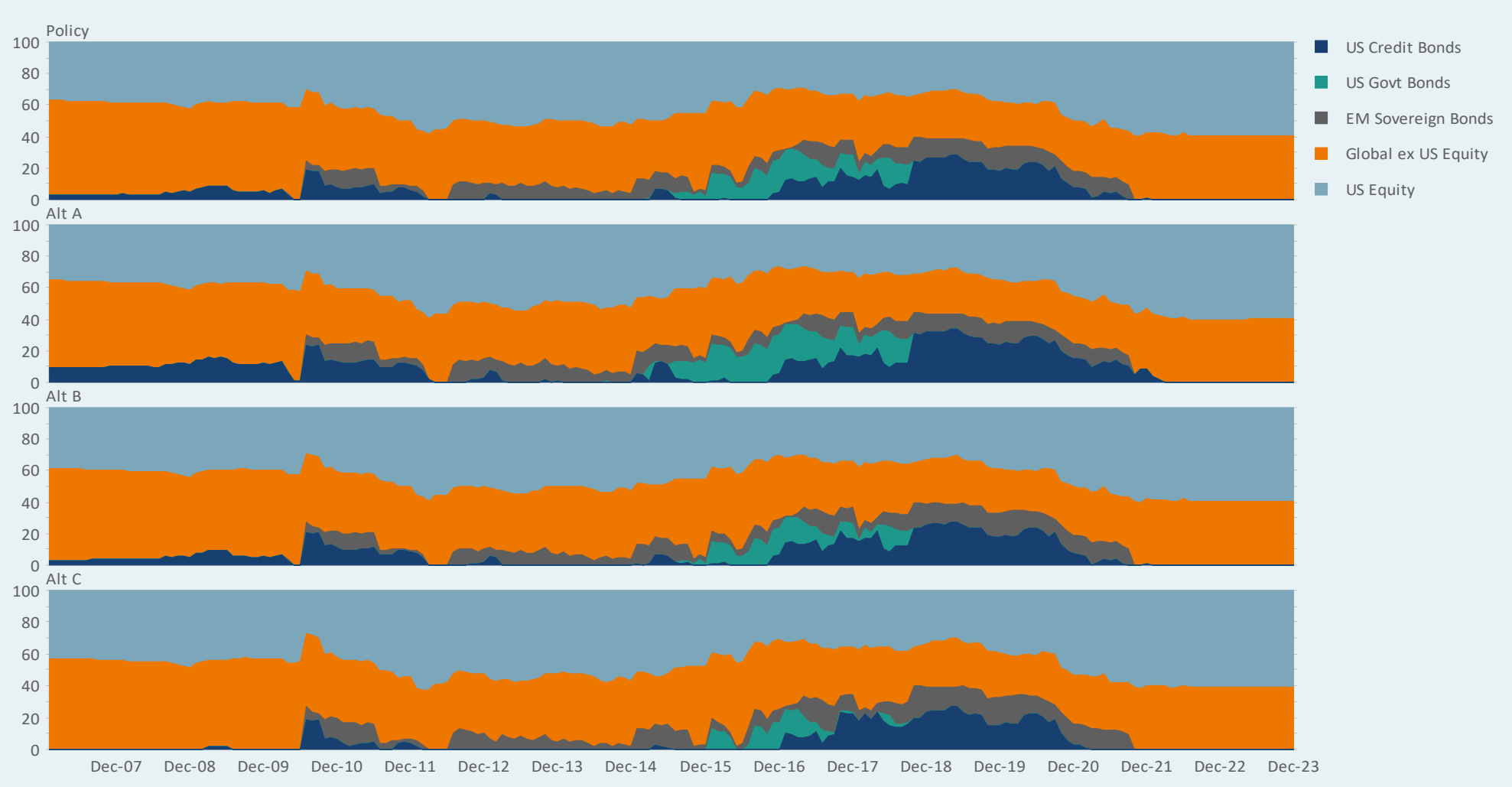


Chart estimates the total portfolio performance of each asset mix, given a specified shock to the portfolio. This is calculated based on the current asset loadings of the portfolio across all asset classes, which then estimates the sensitivity of total portfolio to a given shock. For example, the historical sensitivity of all asset classes

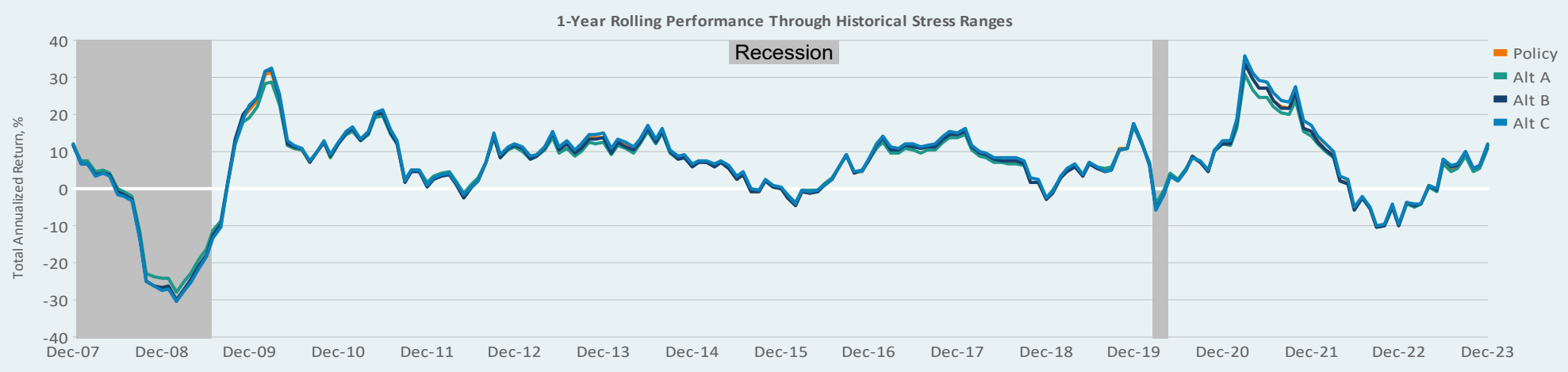
Historical asset loadings - 3yr rolling

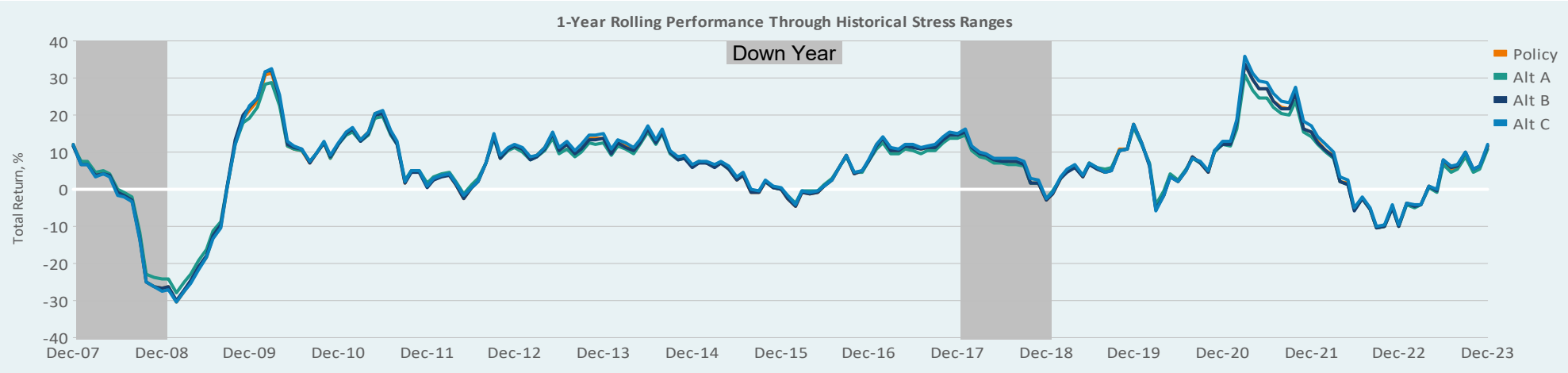


This chart is used to demonstrate the likely allocation of the fund's assets to different factors (US Equity, Global ex-US Equity, U.S Bonds, U.S Credit Bonds, and EM

Returns during recession & S&P 500 down years

Regime Group	Description
Market Up/Down Years	Positive and Negative Calendar Year Returns for the S&P 500
Recession/Expansion	Recession regimes using NBER based Recession Indicators for the United States.

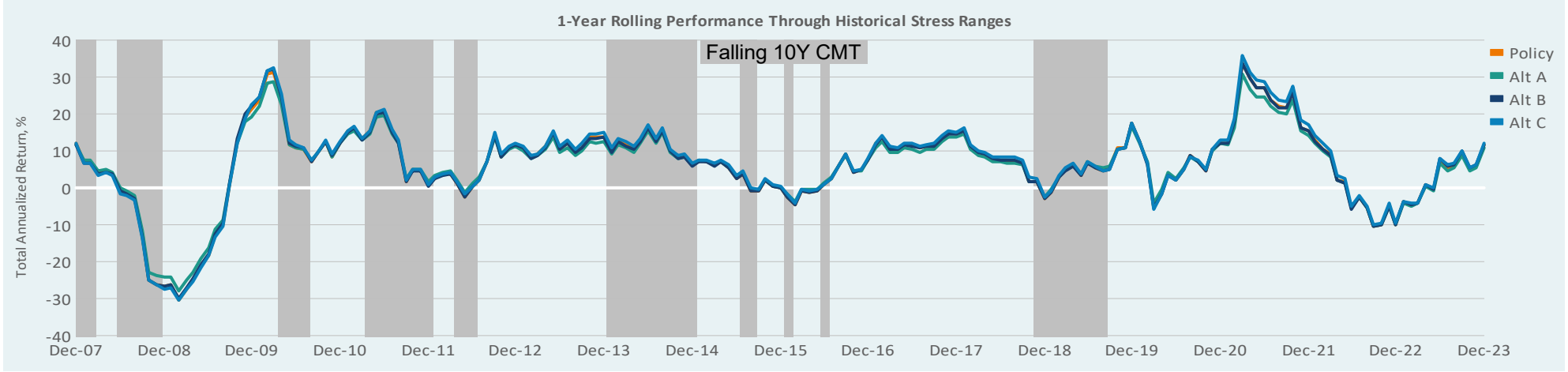


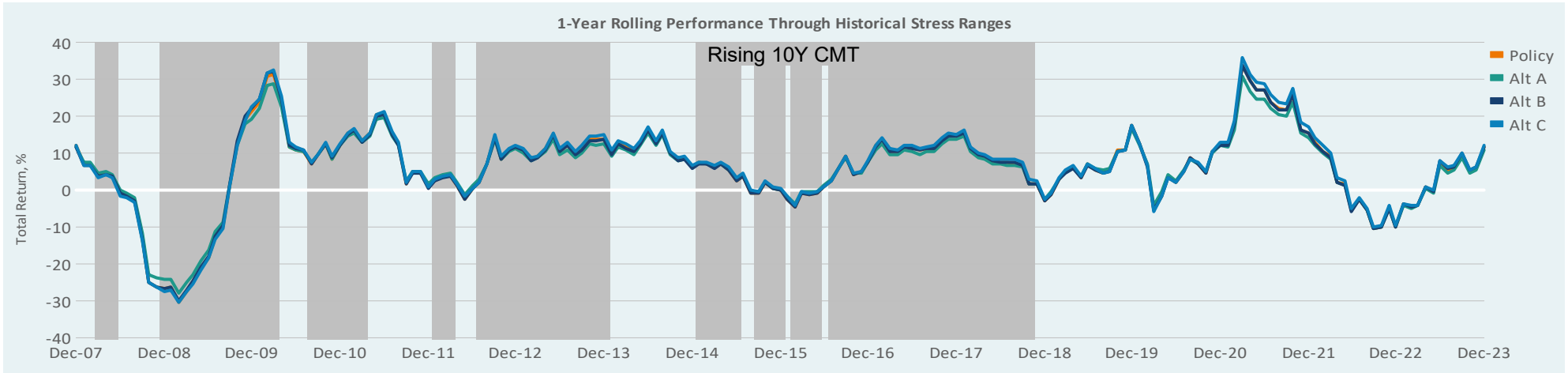


This chart shows 1 year rolling performance of the portfolio, assuming current asset mix weights. Then, times of Recession or market Down Years are highlighted in

Returns during rising/falling 10y yields

Regime Group	Description
Rising/Fallling 10Y CMT Rate	Rate regimes by 10-Year Constant Maturity Rate increase or decrease by more than 5% of its previous level over rolling 3-month periods.

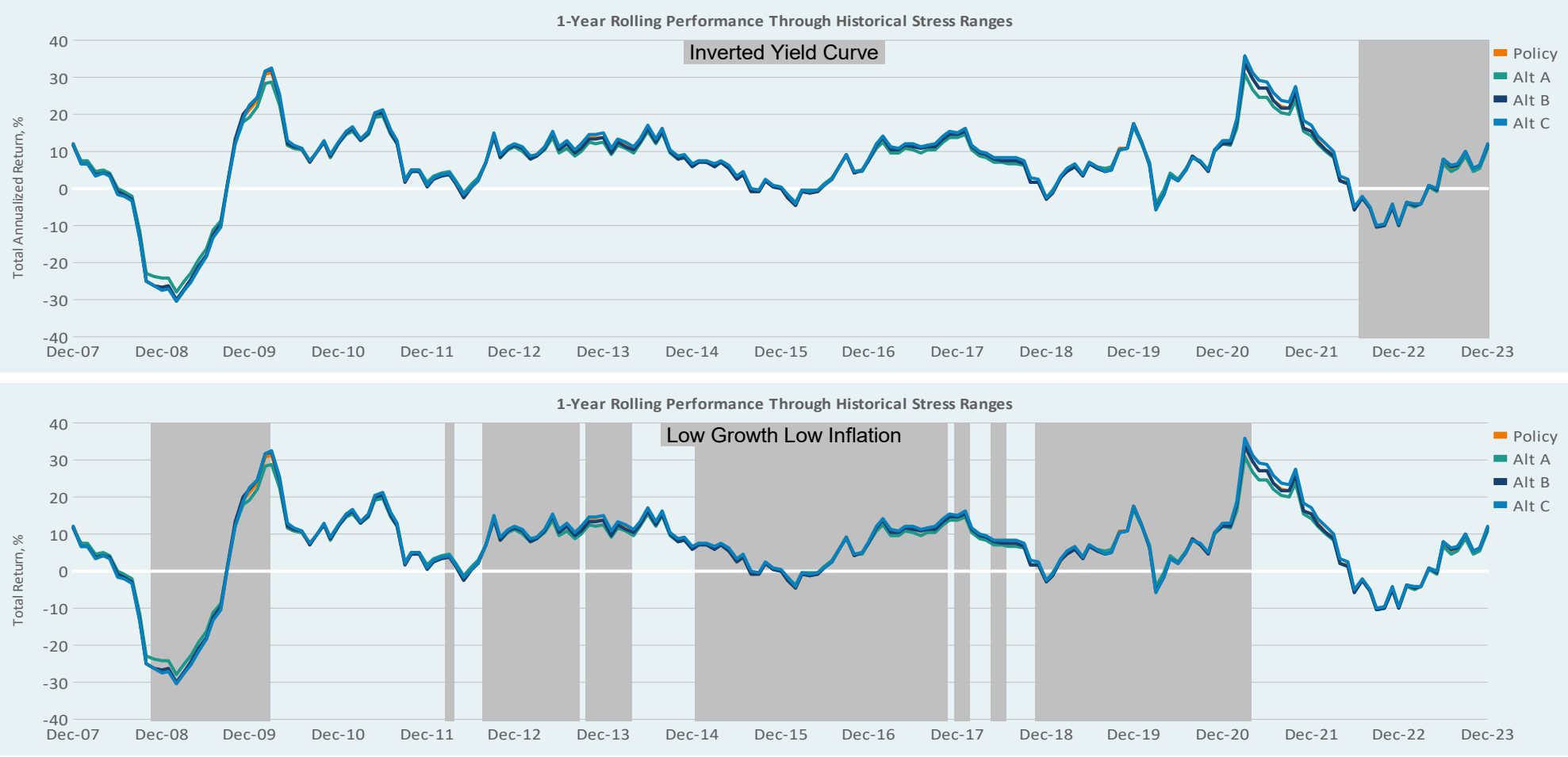




This chart shows 1 year rolling performance of the portfolio, assuming current asset mix weights. Then, times of Falling 10-Year US Treasury Yields or Rising 10-Year

Returns during inversion & low growth/ inflation

Regime	Rule
Normal/Flat/Inverted Yield Curve	Yield curve regimes by 10-Year minus 2-Year Treasury Constant Maturity Rate Spread with breaks at 0% and 0.8%.
Low Growth Low Inflation	Industrial Production Index and Consumer Price Index for all Urban Consumers: All Items are both equal to or below 50th percentile YoY



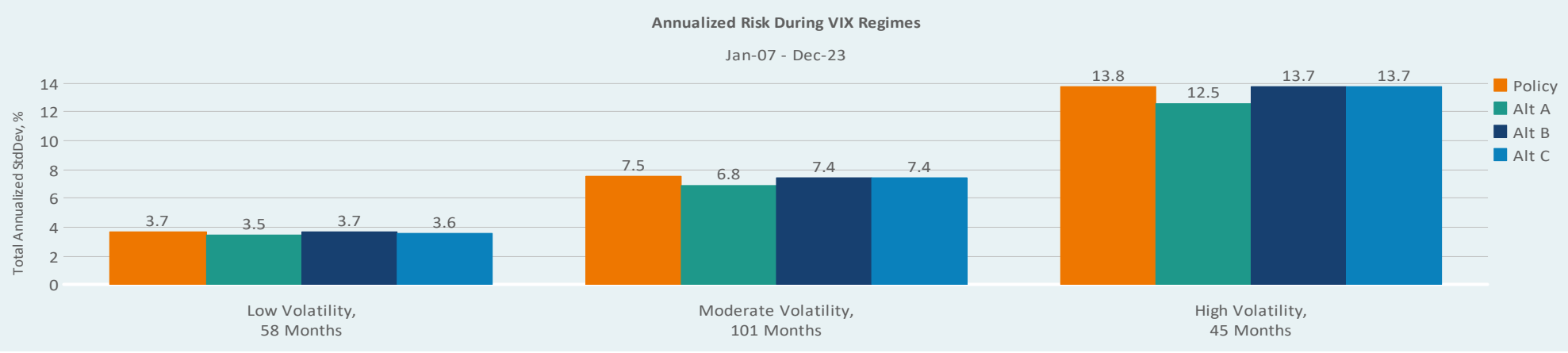
This chart shows 1 year rolling performance of the portfolio, assuming current asset mix weights. Then, times of an Inverted Yield Curve or Low Growth / Low

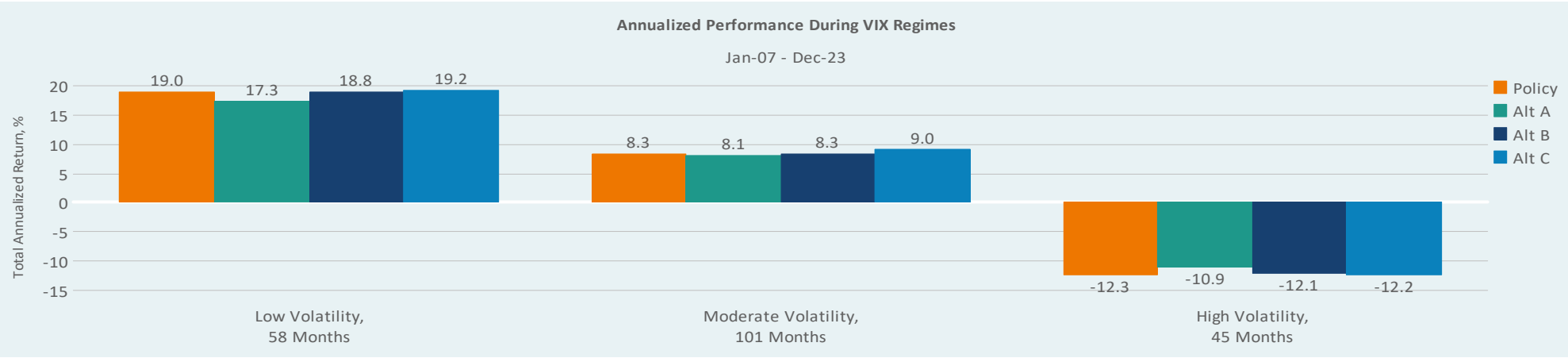
Return during inflation & growth regimes

This chart illustrates annualized return during different market inflation & growth environments. Each month in history is bucketed into different inflation and growth regimes.

Risk and return during VIX regimes

Regime Group	Description
Volatility by Threshold	Volatility regimes by CBOE VIX with breaks at 15 and 25.

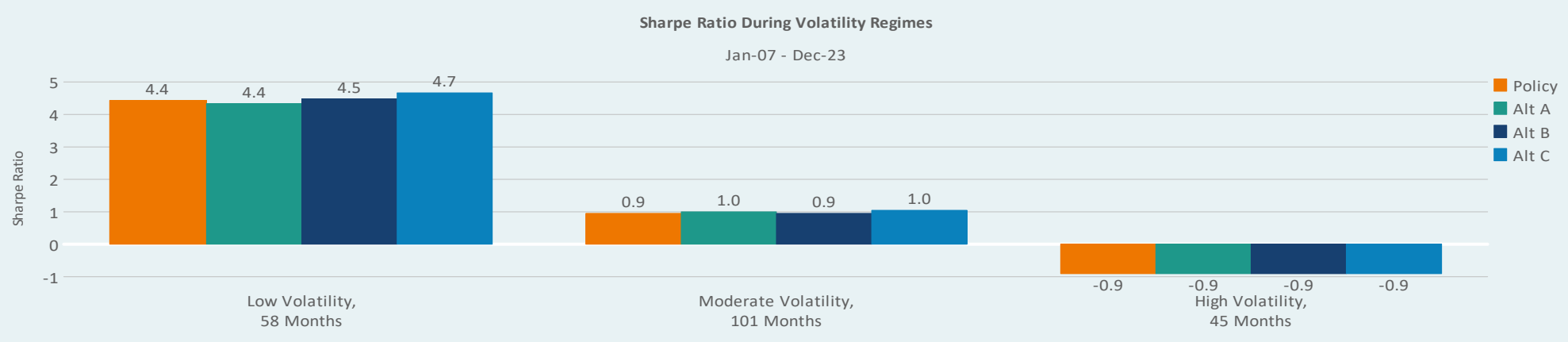


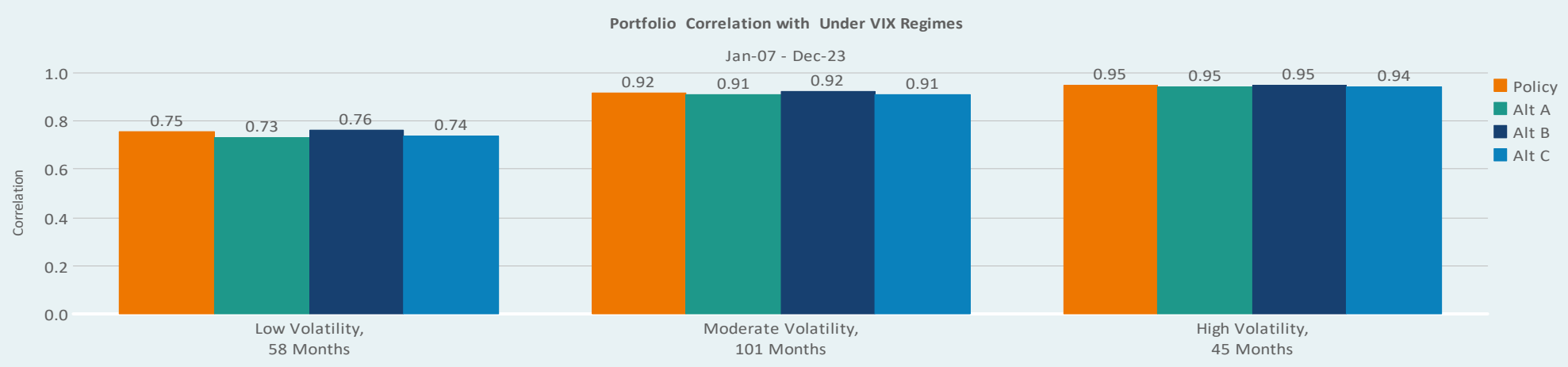


The top chart illustrates portfolio volatility during different market volatility environments. Markets often go through extended periods of muted or elevated volatility. Each month in history is bucketed into either Low, Moderate, or High Volatility, and the average characteristics of all of those months are shown. The bottom chart illustrates the performance of each portfolio during each of these market volatility environments. Lower volatility environments tend to coincide

Sharpe and equity correlation during VIX regimes

Regime Group	Description
Volatility by Threshold	Volatility regimes by CBOE VIX with breaks at 15 and 25.





The top chart illustrates portfolio Sharpe Ratio during different market volatility environments. Each month in history is bucketed into either Low, Moderate, or High Volatility, and the average characteristics of all of those months are shown.

The bottom chart illustrates the correlation of each portfolio with the US Equity market during each of these market volatility environments. Correlations tend to be

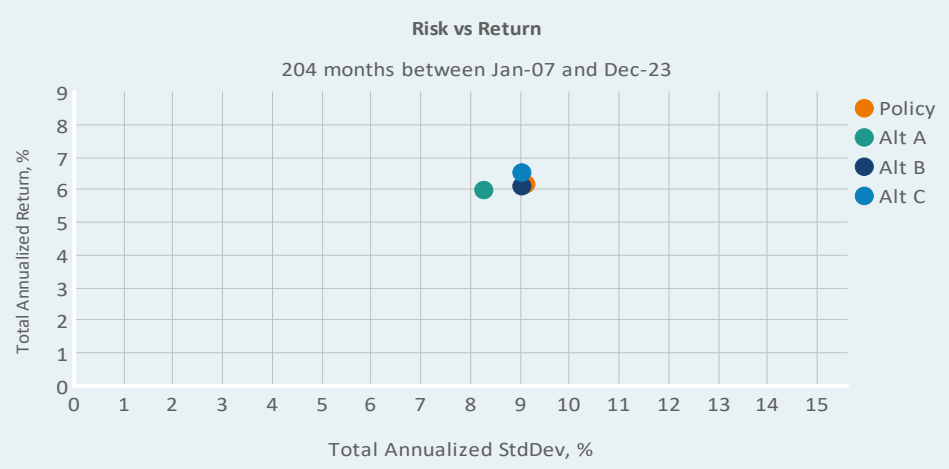
Performance extremes during VIX regimes

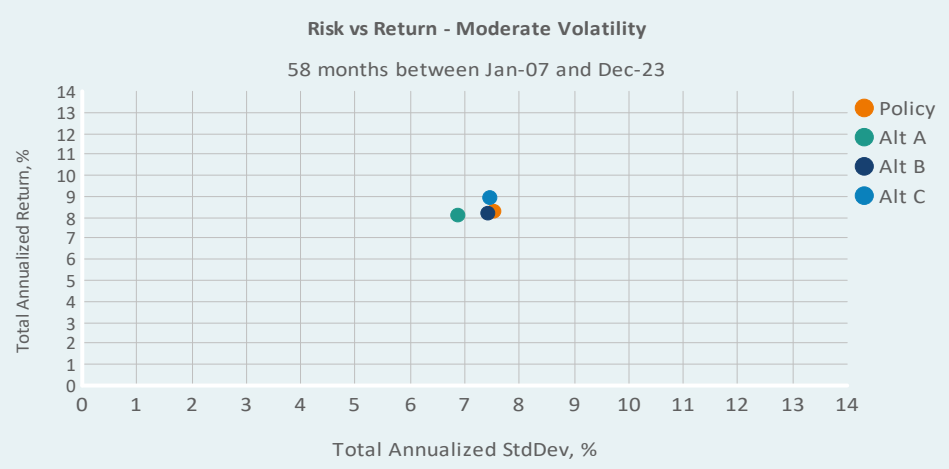
Regime Group	Description
Volatility by Threshold	Volatility regimes by CBOE VIX with breaks at 15 and 25.

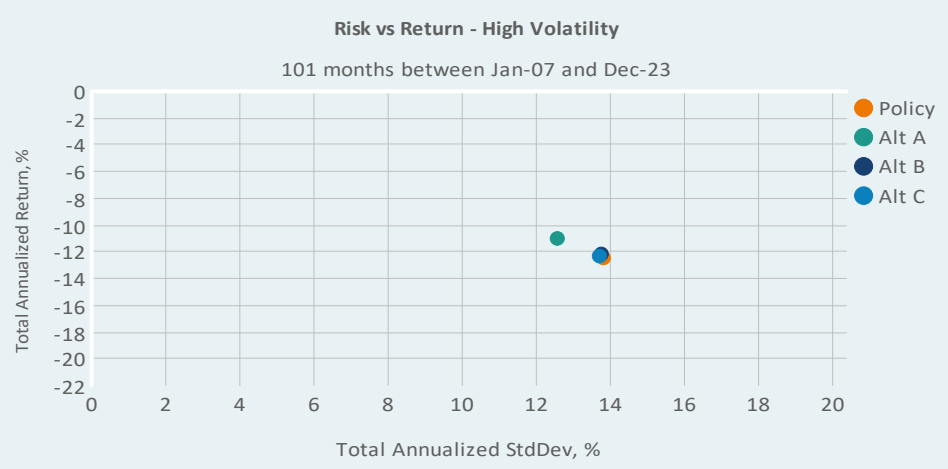
This chart illustrates the best and worst portfolio monthly returns during different market volatility environments. High volatility environments of course tend to

Risk v Return

Regime Group	Description
Volatility by Threshold	Volatility regimes by CBOE VIX with breaks at 15 and 25.

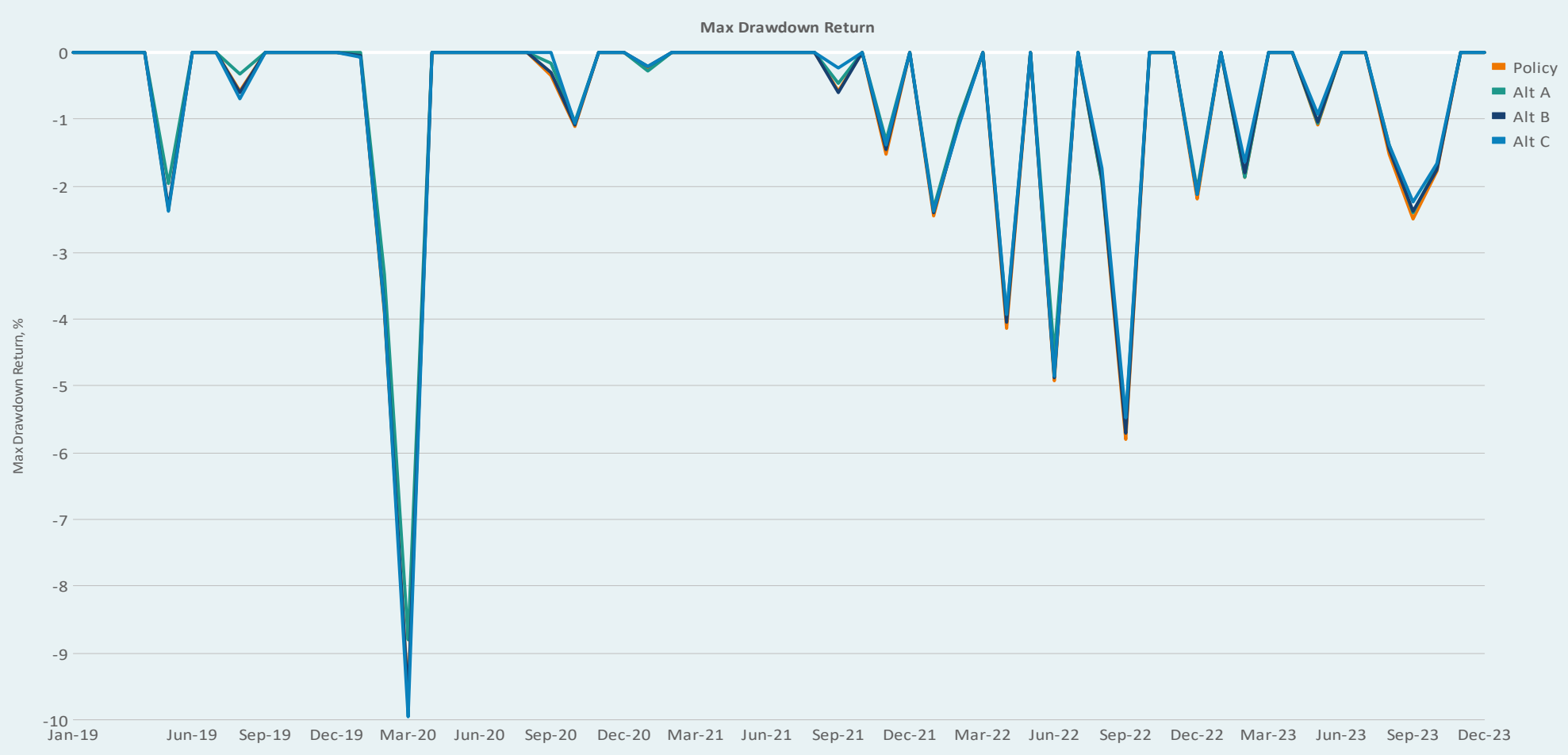






Top left chart illustrates the average historical annualized monthly return of each portfolio mix.

Max drawdown



The Max Drawdown statistics show the highest percentage loss a fund investor could have realized on their investment, assuming they bought at the peak and sold

Assumptions and documentation

Assumptions and methods

Unless otherwise stated, all assumptions and methods are consistent with SCERS' 2023 actuarial valuation report.

Assets	**Cashflows:** Contributions are assumed to be made at the beginning of the fiscal year. Benefit payments and administrative expenses are assumed to occur at mid-year. **Stochastic assumptions:** Modeled using Verus 2025 CMAs. See appendix for details. Returns in stochastic scenarios are modeled randomly starting June 30, 2024. **Allocation:** Allocations are assumed to remain constant during projection. **Contingency Reserve Transfers:** Excess returns on an actuarial basis are credited to the contingency reserve, until it reaches 3% of the market value of assets. The contingency reserve offsets the valuation value of assets and is not assumed to be used for any purpose.
Liabilities	**Actuarial projection provider:** Liability projections were provided by Segal. **Actuarial Cost Method:** Entry Age Normal **Census Date:** June 30, 2023 **Discount Rate:** 6.75% Adjustments were made to reflect the actual starting assets and liabilities based on the June 30, 2024 valuation, which was produced after Segal furnished Verus with the requested information but before the asset-liability analysis was finalized.
Funding Methodology (ADC)	Future valuation gains and losses are amortized over a 20-year period, as a level percent of pay.
Actuarial Value of Assets	Six-year smoothing, subject to 30% corridor

Methodology

SUMMARY OF THE VERUS APPROACH

— We use a fundamental building block approach to forecast asset class returns, based on several inputs. These include practitioner best-in-class thinking, historical data, and academic research. Each year Verus conducts an in-depth review of our methodology, analyzing new industry research findings and evaluating alternative forecasting approaches to determine whether an improvement to our methodology might be warranted. We maintain flexibility and openness to adjusting our approach if strong evidence suggests change is appropriate.
— For most asset classes, we use the long-term historical volatility after adjusting for autocorrelation.
— Correlations between asset classes are calculated based on the last 10 years. For illiquid assets, such as private equity and private real estate, we use BarraOne correlation estimates.

Asset	Return Methodology	Volatility Methodology*
Inflation	25% weight to the University of Michigan Survey 5-10 year ahead inflation expectation and the Survey of Professional Forecasters (Fed Survey), and the remaining 50% to the market's expectation for inflation as observed through the 10-year TIPS breakeven rate	-
Cash	1/3 * current federal funds rate + 1/3 * U.S. 10-year Treasury yield + 1/3 * Federal Reserve long-term interest rate target	Long-term volatility
Bonds	Nominal bonds: current yield; Real bonds: real yield + inflation forecast	Long-term volatility
International Bonds	Current yield	Long-term volatility
Credit	Current option-adjusted spread + U.S. 10-year Treasury – effective default rate	Long-term volatility
International Credit	Current option-adjusted spread + foreign 10-year Treasury – effective default rate	Long-term volatility
Private Credit	Levered gross return (SOFR + spread + original issuance discounts) – management fees – carried interest	Estimated volatility
Equity	Current yield + real earnings growth (historical average) + inflation on earnings (inflation forecast) + expected P/E change	Long-term volatility
Intl Developed Equity	Current yield + real earnings growth (historical average) + inflation on earnings (intl. inflation forecast) + expected P/E change	Long-term volatility
Private Equity**	US large cap domestic equity forecast * 1.85 beta adjustment	Implied annualized volatility, using actual historical private equity performance distribution
Commodities	Collateral return (cash) + spot return (inflation forecast) + roll return (assumed to be zero)	Long-term volatility
Hedge Funds	Return coming from traditional market betas + historical idiosyncratic/alpha return	Long-term volatility
Core Real Estate	Cap rate + real income growth – capex + inflation forecast	65% of REIT volatility
REITs	Core real estate	Long-term volatility
Value-Add Real Estate	Core real estate + 2%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Opportunistic Real Estate	Core real estate + 3%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Infrastructure	Current yield + real income growth + inflation on earnings (inflation forecast)	Long-term volatility
Risk Parity	Modeled as the 10-year return expectations of a *representative selection of Risk Parity strategies*	Target volatility

**Long-term historical volatility data is adjusted for autocorrelation (see Appendix)*

***Private Equity is modeled assuming an 8.0% floor for expected return, and a 3% return premium ceiling over U.S. Large Cap Equity. These adjustments are in place to recognize that higher interest rates (cost of leverage) act as a drag on expected Private Equity returns but that this drag has had limits historically, and to recognize that future Private Equity total universe performance is likely to be more anchored to public equity performance than in past times, given a more competitive market environment*

10-year return & risk assumptions

Asset Class	Index Proxy	Ten Year Return Forecast		Standard Deviation Forecast	Sharpe Ratio Forecast (g)	Sharpe Ratio Forecast (a)	10-Year Historical Sharpe Ratio (g)	10-Year Historical Sharpe Ratio (a)
		Geometric	Arithmetic					
Equities								
U.S. Large	S&P 500	5.3%	6.4%	15.5%	0.10	0.17	0.77	0.80
U.S. Small	Russell 2000	6.3%	8.4%	21.3%	0.12	0.22	0.35	0.44
International Developed	MSCI EAFE	6.7%	8.1%	17.5%	0.17	0.25	0.27	0.33
International Small	MSCI EAFE Small Cap	8.8%	10.8%	21.4%	0.23	0.33	0.27	0.35
Emerging Markets	MSCI EM	7.0%	9.6%	24.2%	0.13	0.24	0.14	0.22
Global Equity	MSCI ACWI	6.0%	7.3%	16.7%	0.13	0.21	0.52	0.57
Global Equity ex USA	MSCI ACWI ex USA	7.0%	8.7%	19.3%	0.17	0.25	0.24	0.31
Private Equity	CA Private Equity	8.0%	10.9%	26.0%	0.16	0.27	-	-
Private Equity Direct	CA Private Equity	9.0%	11.9%	26.0%	0.20	0.31	-	-
Private Equity (FoF)	CA Private Equity	7.0%	10.0%	26.0%	0.12	0.23	-	-
Fixed Income								
Cash	30 Day T-Bills	3.8%	3.8%	1.1%	-	-	-	-
U.S. TIPS	Bloomberg U.S. TIPS 5-10	4.0%	4.2%	5.5%	0.04	0.07	0.18	0.20
Non-U.S. Inflation Linked Bonds	Bbg World Govt. Inflation Linked ex U.S.	3.4%	3.7%	7.4%	-0.05	-0.01	-0.03	0.01
U.S. Treasury	Bloomberg Treasury 7-10 Year	3.8%	4.0%	7.1%	0.00	0.03	-0.02	0.01
Long U.S. Treasury	Bloomberg Treasury 20+ Year	4.1%	4.9%	13.4%	0.02	0.08	-0.06	0.01
Global Sovereign ex U.S.	Bloomberg Global Treasury ex U.S.	2.2%	2.7%	10.0%	-0.16	-0.11	-0.30	-0.26
Global Aggregate	Bloomberg Global Aggregate	3.4%	3.6%	6.7%	-0.06	-0.03	-0.17	-0.14
Core Fixed Income	Bloomberg U.S. Aggregate Bond	4.3%	4.4%	4.7%	0.11	0.13	0.04	0.06
Core Plus Fixed Income	Bloomberg U.S. Universal	4.4%	4.5%	4.7%	0.13	0.15	0.10	0.13
Investment Grade Corp. Credit	Bloomberg U.S. Corporate IG	4.6%	4.9%	8.4%	0.10	0.13	0.19	0.22
Short-Term Gov't/Credit	Bloomberg U.S. Gov't/Credit 1-3 Year	3.9%	3.9%	3.6%	0.03	0.03	0.00	0.00
Short-Term Credit	Bloomberg Credit 1-3 Year	4.2%	4.3%	3.6%	0.11	0.14	0.28	0.29
Intermediate Credit	Bloomberg U.S. Intermediate Credit	4.3%	4.5%	5.9%	0.08	0.12	0.19	0.25
Long-Term Credit	Bloomberg Long U.S. Credit	4.6%	5.2%	11.1%	0.07	0.13	0.13	0.19
High Yield Corp. Credit	Bloomberg U.S. Corporate High Yield	5.6%	6.1%	10.8%	0.17	0.21	0.45	0.47
Bank Loans	S&P/LSTA Leveraged Loan	6.9%	7.3%	8.8%	0.35	0.40	0.58	0.59
Global Credit	Bloomberg Global Credit	4.1%	4.4%	7.8%	0.04	0.08	0.07	0.10
Emerging Markets Debt (Hard)	JPM EMBI Global Diversified	7.7%	8.2%	10.5%	0.37	0.42	0.18	0.22
Emerging Markets Debt (Local)	JPM GBI-EM Global Diversified	5.8%	6.5%	12.1%	0.17	0.22	-0.10	-0.04
Securitized Credit	Bloomberg U.S. Securitized	4.7%	4.8%	4.0%	0.23	0.25	-0.03	-0.01

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

10-year return & risk assumptions

Asset Class	Index Proxy	Ten Year Return Forecast		Standard Deviation Forecast	Sharpe Ratio Forecast (g)	Sharpe Ratio Forecast (a)	10-Year Historical Sharpe Ratio (g)	10-Year Historical Sharpe Ratio (a)
		Geometric	Arithmetic					
Fixed Income (continued)								
Private Credit	S&P LSTA Leveraged Loan Index	8.2%	8.8%	11.8%	0.37	0.42	-	-
Private Credit (Direct Lending - Unlevered)	S&P LSTA Leveraged Loan Index	7.1%	7.5%	8.8%	0.38	0.42	-	-
Private Credit (Direct Lending - Levered)	S&P LSTA Leveraged Loan Index	8.3%	8.9%	11.8%	0.38	0.43	-	-
Private Credit (Credit Opportunities)	S&P LSTA Leveraged Loan Index	8.8%	9.6%	13.4%	0.37	0.43	-	-
Private Credit (Junior Capital / Mezzanine)	S&P LSTA Leveraged Loan Index	8.6%	9.4%	12.9%	0.37	0.43	-	-
Private Credit (Distressed)	S&P LSTA Leveraged Loan Index	9.1%	12.7%	29.1%	0.18	0.31	-	-
Other								
Commodities	Bloomberg Commodity	6.3%	7.4%	16.0%	0.16	0.23	-0.11	-0.04
Hedge Funds	HFRI Fund Weighted Composite	5.0%	5.3%	7.5%	0.16	0.20	0.55	0.56
Hedge Fund of Funds	HFRI Fund of Funds Composite	4.0%	4.3%	7.5%	0.03	0.07	0.39	0.41
Hedge Funds (Equity Style)	Custom HFRI Benchmark Mix*	5.4%	6.3%	13.9%	0.12	0.18	0.37	0.42
Hedge Funds (Credit Style)	Custom HFRI Benchmark Mix*	5.2%	5.6%	9.2%	0.15	0.20	0.61	0.62
Hedge Funds (Assymetric Style)	Custom HFRI Benchmark Mix*	5.4%	5.6%	6.3%	0.25	0.29	0.55	0.56
Real Estate Debt	Bloomberg CMBS IG	6.8%	7.1%	7.4%	0.41	0.45	0.20	0.22
Core Real Estate	NCREIF Property	7.2%	7.9%	12.5%	0.27	0.33	-	-
Value-Add Real Estate	NCREIF Property + 200bps	9.2%	10.3%	15.4%	0.35	0.42	-	-
Opportunistic Real Estate	NCREIF Property + 300bps	10.2%	12.1%	21.2%	0.30	0.39	-	-
REITs	Wilshire REIT	7.2%	8.8%	19.2%	0.18	0.26	0.34	0.41
Global Infrastructure	S&P Global Infrastructure	8.1%	9.4%	16.8%	0.26	0.33	0.24	0.31
Risk Parity**	S&P Risk Parity 10% Vol Index	6.3%	7.1%	10.0%	0.25	0.33	0.40	0.44
Currency Beta	MSCI Currency Factor Index	2.2%	2.3%	3.3%	-0.48	-0.45	-0.30	-0.28
Inflation		2.4%	-	-	-	-	-	-
60/40 Portfolio	MSCI ACWI / Bbg U.S. Agg	5.5%	6.0%	10.9%	0.16	0.20	0.50	0.53

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

**To represent hedge fund styles, we use a combination of HFRI benchmarks: Equity Style = 33% HFRI Fundamental Growth, 33% HFRI Fundamental Value, 33% HFRI Activist. Credit Style = 20% HFRI Distressed/Restructuring, 20% HFRI Credit Arbitrage, 20% HFRI Fixed Income-Corporate, 20% HFRI Fixed Income-Convertible Arbitrage, 20% HFRI Fixed Income-Asset Backed. Asymmetric Style = 50% HFRI Relative Value, 50% HFRI Macro*

***The Risk Parity forecast shown here assumes a 10% target volatility strategy. We recommend customizing this forecast to the target volatility specifications of the risk parity strategy that an investor wishes to model. Please speak with your Verus consultants for customization needs.*

Correlation assumptions

	Cash	US Large	US Small	Intl Large	Intl Small	EM	Global Equity	PE	US TIPS	US Treasury	Global Sovereign ex-US	US Core	Core Plus	Short-Term Gov't/Credit	Short-Term Credit	Long-Term Credit	US HY	Bank Loans	Global Credit	EM Debt USD	EM Debt Local	Commodities	Hedge Funds	Real Estate	REITs	Infrastructure	Currency Beta	Risk Parity
Cash	1.0																											
US Large	0.0	1.0																										
US Small	-0.1	0.9	1.0																									
Intl Large	0.0	0.9	0.8	1.0																								
Intl Small	0.0	0.9	0.8	1.0	1.0																							
EM	0.0	0.7	0.6	0.8	0.8	1.0																						
Global Equity	0.0	1.0	0.9	0.9	0.9	0.8	1.0																					
PE	-0.1	0.7	0.7	0.6	0.6	0.6	0.7	1.0																				
US TIPS	0.0	0.5	0.4	0.5	0.5	0.4	0.5	0.2	1.0																			
US Treasury	0.1	0.1	0.0	0.1	0.1	0.1	0.1	-0.1	0.8	1.0																		
Global Sovereign ex-US	0.2	0.4	0.3	0.5	0.5	0.5	0.5	0.1	0.7	0.6	1.0																	
US Core	0.1	0.4	0.3	0.4	0.4	0.4	0.4	0.0	0.8	0.9	0.8	1.0																
Core Plus	0.2	0.5	0.4	0.5	0.5	0.5	0.5	0.1	0.8	0.9	0.8	1.0	1.0															
Short-Term Gov't/Credit	0.3	0.2	0.1	0.3	0.3	0.3	0.3	0.0	0.7	0.8	0.6	0.8	0.8	1.0														
Short-Term Credit	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.2	0.7	0.5	0.7	0.7	0.8	0.7	1.0													
Long-Term Credit	0.1	0.6	0.5	0.6	0.6	0.6	0.6	0.2	0.8	0.7	0.8	0.9	0.9	0.7	0.8	1.0												
US HY	0.0	0.8	0.8	0.8	0.8	0.7	0.8	0.5	0.6	0.2	0.5	0.5	0.6	0.4	0.6	0.7	1.0											
Bank Loans	0.0	0.6	0.6	0.6	0.7	0.6	0.6	0.5	0.3	-0.1	0.2	0.2	0.3	0.1	0.5	0.4	0.8	1.0										
Global Credit	0.1	0.7	0.6	0.7	0.8	0.7	0.7	0.3	0.8	0.6	0.8	0.8	0.9	0.7	0.8	0.9	0.8	0.6	1.0									
EMD USD	0.1	0.7	0.6	0.7	0.7	0.7	0.7	0.4	0.6	0.4	0.7	0.6	0.7	0.5	0.7	0.8	0.8	0.7	0.9	1.0								
EMD Local	0.1	0.5	0.4	0.7	0.7	0.8	0.7	0.4	0.5	0.3	0.7	0.5	0.6	0.4	0.5	0.6	0.7	0.5	0.8	0.8	1.0							
Commodities	-0.1	0.4	0.4	0.4	0.4	0.5	0.5	0.3	0.2	-0.2	0.2	-0.1	0.0	-0.1	0.1	0.1	0.5	0.5	0.3	0.3	0.4	1.0						
Hedge Funds	0.0	0.8	0.9	0.8	0.9	0.8	0.9	0.6	0.4	-0.1	0.3	0.2	0.4	0.1	0.5	0.5	0.8	0.8	0.7	0.7	0.6	0.5	1.0					
Real Estate	-0.2	0.6	0.5	0.5	0.5	0.4	0.6	0.4	0.2	0.0	-0.1	0.1	0.1	0.0	-0.1	0.2	0.4	0.4	0.3	0.4	0.3	0.2	0.5	1.0				
REITs	-0.1	0.8	0.7	0.7	0.7	0.5	0.7	0.6	0.6	0.4	0.4	0.5	0.6	0.3	0.4	0.7	0.7	0.5	0.7	0.7	0.5	0.3	0.7	0.6	1.0			
Infrastructure	0.0	0.8	0.7	0.8	0.8	0.7	0.8	0.6	0.5	0.2	0.5	0.4	0.5	0.3	0.5	0.6	0.8	0.7	0.8	0.8	0.7	0.5	0.8	0.5	0.7	1.0		
Currency Beta	-0.1	0.0	-0.1	-0.2	-0.2	-0.2	-0.1	0.1	-0.2	-0.1	-0.3	-0.2	-0.2	-0.2	-0.3	-0.2	-0.2	-0.1	-0.3	-0.2	-0.3	-0.1	-0.1	0.1	0.0	-0.1	1.0	
Risk Parity	0.1	0.7	0.7	0.8	0.7	0.6	0.8	0.4	0.7	0.4	0.7	0.6	0.7	0.4	0.7	0.7	0.8	0.5	0.8	0.7	0.6	0.5	0.7	0.1	0.7	0.7	-0.2	1.0

Note: as of 9/30/24 - Correlation assumptions are based on the last ten years. Private Equity and Real Estate correlations are especially difficult to model due to appraisal-based pricing and lag problems that exist in the data – we have therefore used BarraOne correlation data to strengthen these correlation estimates.

Range of likely 10-year outcomes

10-YEAR RETURN 90% CONFIDENCE INTERVAL

Source: Verus 2025 Capital Market Assumptions, MPI

Notices & disclosures

Past performance is no guarantee of future results. *This document is provided for informational purposes only and is directed to institutional clients and eligible institutional counterparties only and is not intended for retail investors. Nothing herein constitutes investment, legal, accounting or tax advice, or a recommendation to buy, sell or hold a security or pursue a particular investment vehicle or any trading strategy. This document may include or imply estimates, outlooks, projections and other "forward-looking statements." No assurance can be given that future results described or implied by any forward looking information will be achieved. Investing entails risks, including possible loss of principal. Additional information about Verus Advisory, Inc. is available on the SEC's website at www.adviserinfo.sec.gov.*

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