



Investment Advisory Committee (IAC) Meeting

[VRS Boardroom](#)
[Bank of America](#)
[Pavilion Building, 3rd Floor](#)

Wednesday, 4/12/2023
9:00 AM - 12:30 PM ET

1. Approval of Minutes (November 30, 2022)

IAC Meeting Minutes 11302022 - Final - Page 2

2. CIO Report

04-12-23 Chief Investment Officer Report - Page 6

Asset Allocation December 2022 - Page 13

Asset Allocation February 2023 - Page 14

Daily Asset Allocation Report 4-6-2023 - Page 15

Performance Summary 12-31-2022 - Page 16

Performance Summary 2-28-2023 - Page 17

Total Fund Tracking Error Report, 12-31-22 - Page 18

New Investments and Terminations 04-12-2023 - Page 19

3. Public Markets Program Review

04-12-23 Public Markets Overview Presentation - Page 21

04-12-23 Public Equity Program Review, Presentation Version - Page 26

04-12-23 Fixed Income Program Review, Presentation Version - Page 53

04-12-23 Public Equity Program Review, Reading Version - Page 70

04-12-23 Fixed Income Program Review, Reading Version - Page 118

4. Discussion on Portfolio Diversification

04-12-23 Risk Profile Enhancement Presentation - Page 139

5. Capital Markets Assumptions Review

04-12-23 Forward Returns, Scenario Analysis Presentation - Page 160

6. Benchmarks Review

04-12-23 Benchmarks Review Presentation - Page 189

Minutes

A meeting of the Investment Advisory Committee of the Virginia Retirement System was held on November 30, 2022 with the following members present:

Larry Kochard, Chairperson
Hance West
Michael Beasley
Theodore Economou
Palmer Garson
Tom Gayner
Nancy Leake
Bryan Lewis
Rod Smyth

The following Board members were present:

A. Scott Andrews
Joseph Montgomery
Brandon Bell
John Bennett
Michael Disharoon
William Garrett

The following staff members were in attendance:

Trish Bishop, Ron Schmitz, Jennifer Schreck, Andrew Junkin, John Alouf, Rory Badura, Daniel Ball, Parham Behrooz, Erica Billingslea, Kevin Bliss, Jeanne Chenault, Tom Coleman, Michael Cooper, Perry Corsello, Sara Denson, Barry Faison, Laurie Fennell, Josh Fox, Katherine Grawe, JT Grier, Dane Honrado, K.C. Howell, De'Von Jones, Ross Kasarda, Kristina Koutrakos, Matt Lacy, Chung Ma, Jennifer MacKnight, Tom Mulvin, Walker Noland, Greg Oliff, Steven Peterson, Steven Ramirez, Jummai Sarki-Hurd, Daniel Schlusser, Jenny Schoeller, Kristy Scott, Michael Scott, Viet Tran, Lisa Turner, Leslie Weldon, Daniel Whitlock, Cindy Wilkinson, and Steve Woodall.

Also in attendance was Lauren Albanese of Financial Investment News; Jamie Bitz with Joint Audit & Review Commission; John Kevin Balaod of With Intelligence; Andrea Cinkovic and Alex Meyer of Goldman Sachs; Brian Deveney and Gary Gammon of the Virginia Auditor of Public Accounts; Madeline Katz of Mandate Wire; Mitchell King and Brigid

Schutsky of BlackRock; Laura Kreutzer with Wall Street Journal; Brian McCleave with Empower; and Bessi Tozluku of Pretium.

Mr. Kochard called the meeting to order at 8:57 a.m.

Mr. Kochard welcomed new Committee member Palmer Garson, replacing Deborah Allen-Hewitt as she retires from the Committee. Mr. Kochard also thanked Mr. Schmitz for his service to VRS as CIO, as this was Mr. Schmitz's last Committee meeting prior to retirement.

Minutes

A motion was made by Mr. Gayner and seconded by Mr. Lewis to approve the minutes for the August 18, 2022 Committee meeting. The motion was unanimously approved.

CIO Report

Mr. Schmitz opened his CIO report commenting on market conditions for the second half of the year. Then Mr. Schmitz presented the Asset Allocation Report, Performance Summary, and Total Fund Tracking Error Report as of September 30, 2022. Last, Mr. Schmitz reviewed the New Investments and Terminations Report.

**Private Markets Team
Program Reviews**

Mr. Howell began by thanking Mr. Schmitz for his service to VRS. Then Mr. Howell moved into providing a general overview of the Private Markets Teams and introduced each program to be covered in the review.

Each Program Director presented their respective reports in two parts: a review of key points for each portfolio and then a discussion of respective program's key dynamics.

Mr. Noland provided a review of the Real Assets program. Review topics included an overview of program objectives, the team, markets, exposures, results, top 10 investment managers, Diverse Investment Management Engagement managers, commitments, and FY2024 plans and priorities.

Mr. Alouf provided a review of the Private Equity program. Review topics included an overview of the team, exposures, markets, results, Diverse Investment Management Engagement managers, and FY2024 plans and priorities.

Mr. Woodall provided a review of the Credit Strategies program. Review topics included an overview of the team, markets, exposures, results, top 10 investment managers, and FY2024 plans and priorities.

Mr. Woodall provided a review of the Private Investment Partnership program. Review topics included an overview of the team, results, and FY2024 plans and priorities.

The Committee members engaged in general discussion throughout the reviews provided.

**Discuss Proposed
Benchmark Changes**

Next, Mr. Schmitz led a discussion on a proposed benchmark change for Real Assets and Risk-Based Investments (RBI). Specifically, Mr. Schmitz recommended eliminating the global REITS from the Real Estate portfolio, as well as from the Total Real Estate Benchmark, and the risk parity from the Risk-Based Investments benchmark. Removing REITS and Risk Parity better aligns Real Assets and Risk-Based Investments, respectively, with each program's main objective of providing meaningful diversification to the Plan. The recommended benchmarks are:

Real Assets: The market value weighted blend of the NCREIF Private Real Estate Benchmark (ODCE Index (net) lagged by three months) and the Other Real Assets Custom Benchmark (the CPI-U Index plus 400 basis points per annum lagged by three months).

Risk-Based Investments: The Bloomberg Barclays US Treasury Bellwethers: 3 month plus 250 basis points per annum.

After some discussion, the committee indicated its agreement with both proposed benchmark changes.

**Asset Liability
Management Kick-off**

Mr. Junkin and Dr. Peterson provided an overview of the Asset Liability Management process and the supporting components including financial condition, cash flow, risk assessment, asset allocation, liquidity, diversification, forward returns, correlation convergence and active management. A timeline of the process leading up to a vote by the Board in June was also provided.

Adjournment

Mr. Beasley made a motion to adjourn the meeting. Mr. Gayner seconded the motion. Mr. Kochard asked for the Committee members to vote on the motion, and the motion passed unanimously.

The meeting was adjourned at 11:40 a.m.

Larry Kochard, Chairperson

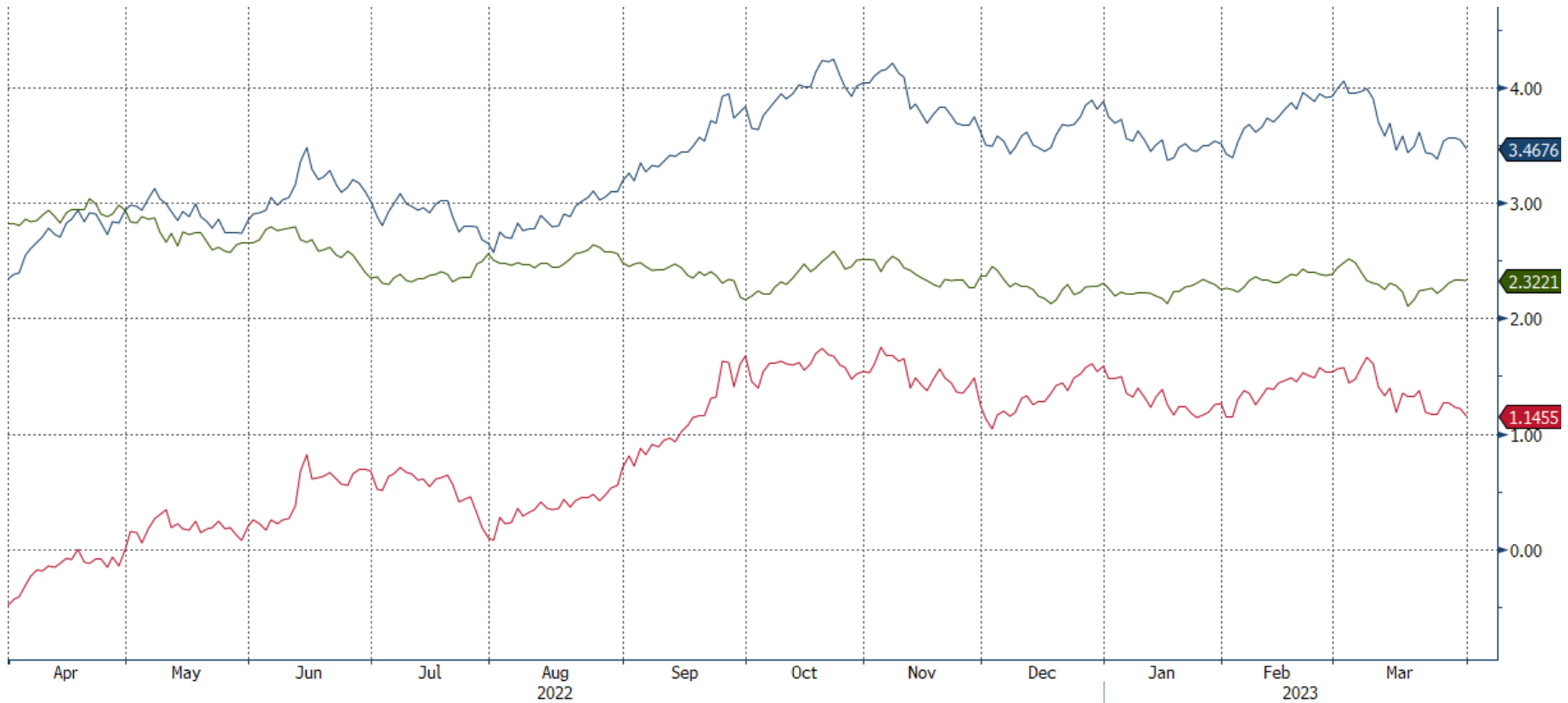
Chief Investment Officer Report Andrew Junkin



Any Signs of Inflation Slowing?

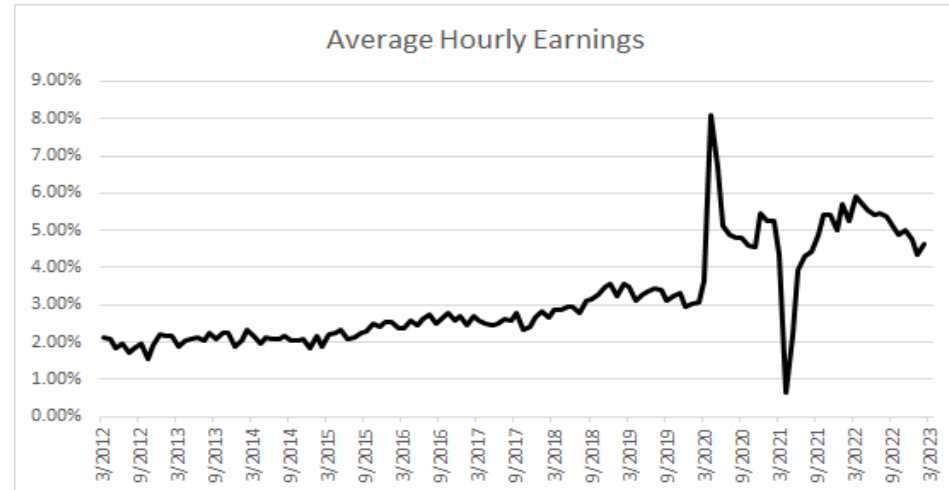
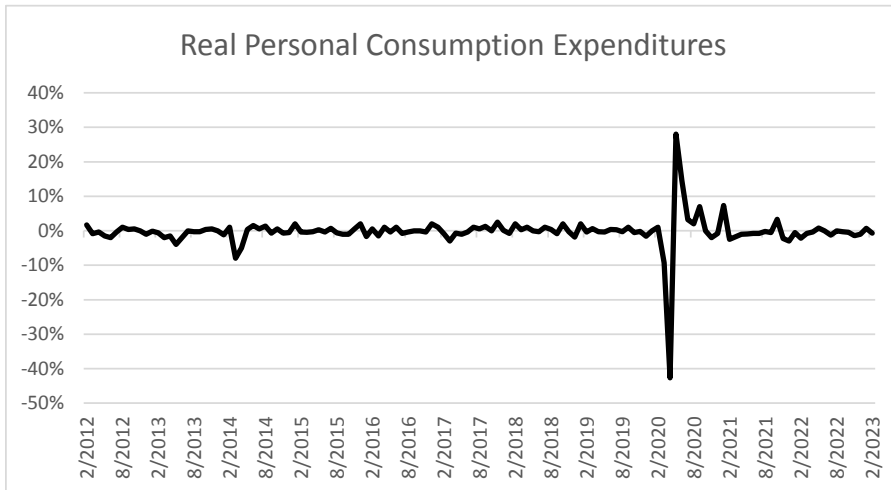
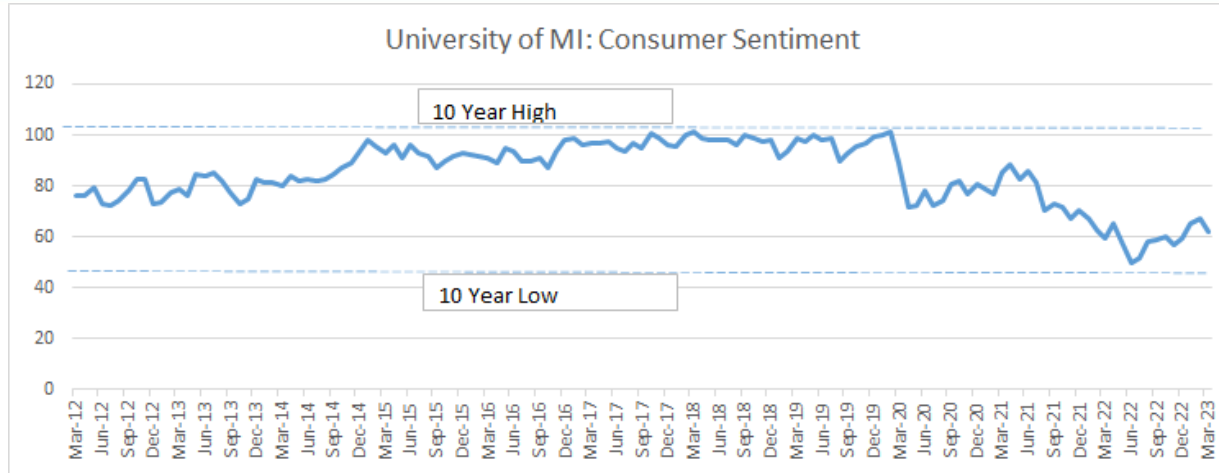


Rate Moves (10Y Nominal, Real & BEI)



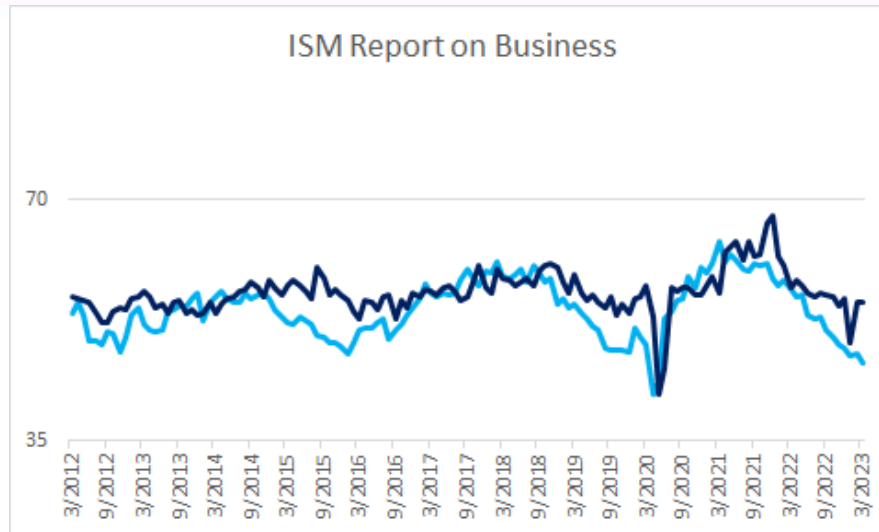
Data Source: Bloomberg

Consumer Activity



Data Source: Bloomberg

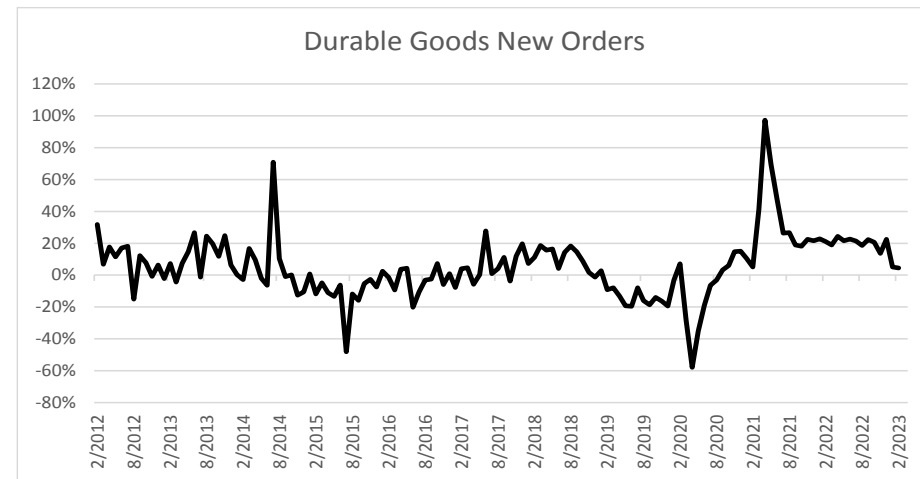
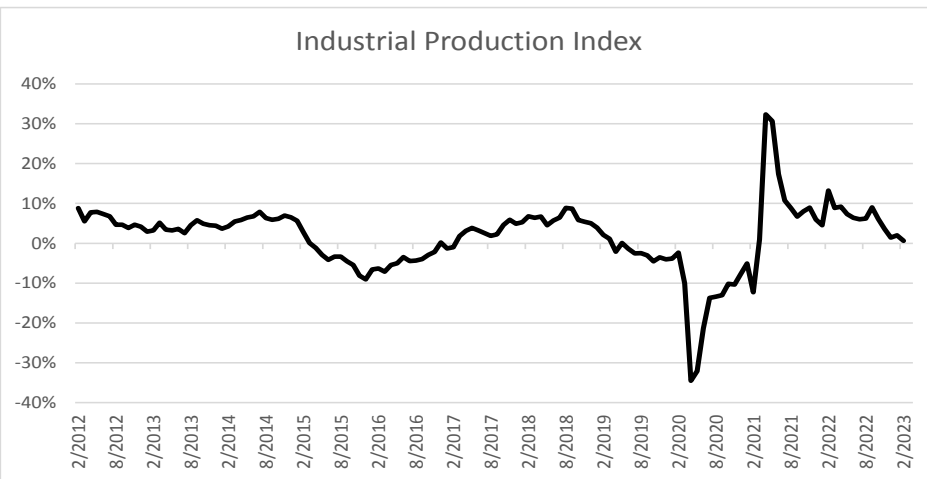
Business Activity



ISM Report (Manufacturing/Services)

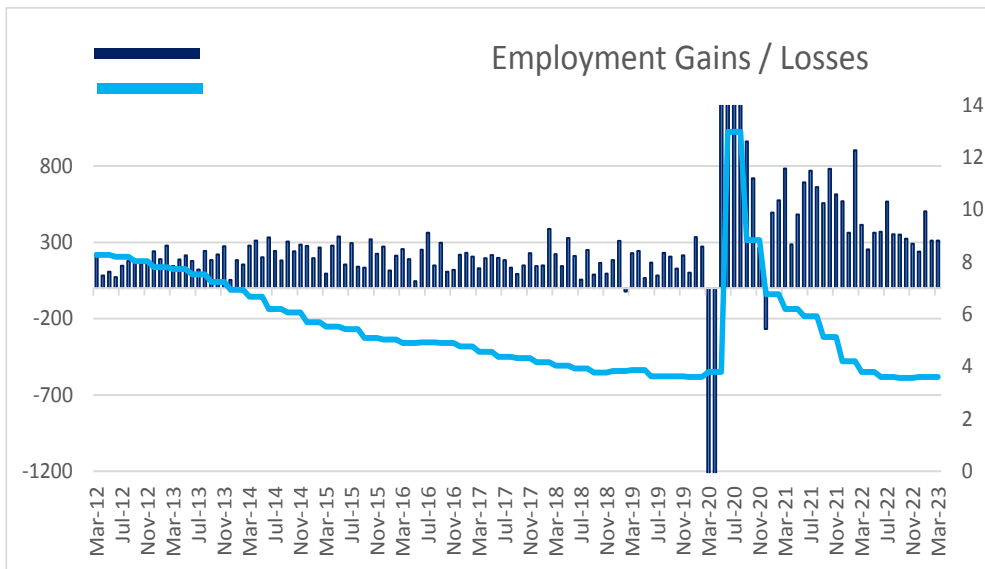
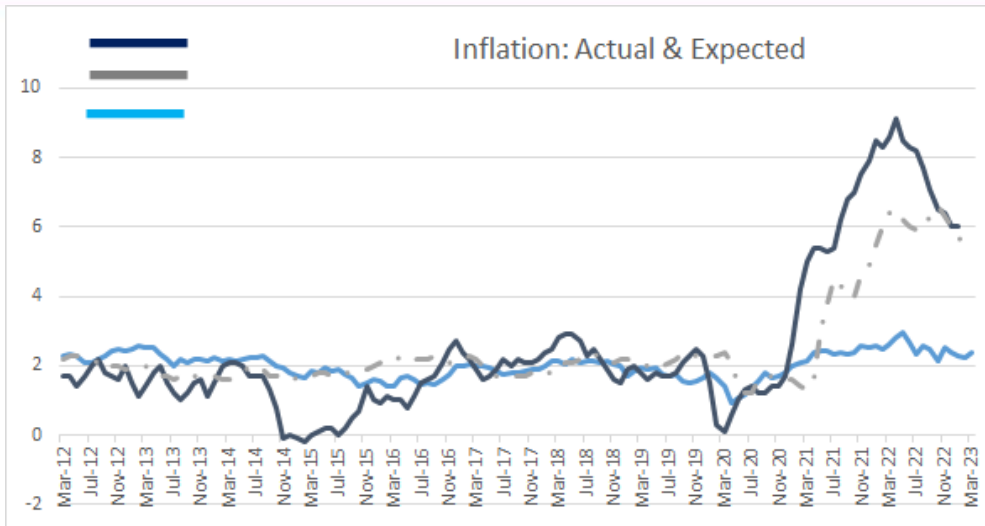
Dark Blue – Services

Light Blue - Manufacturing



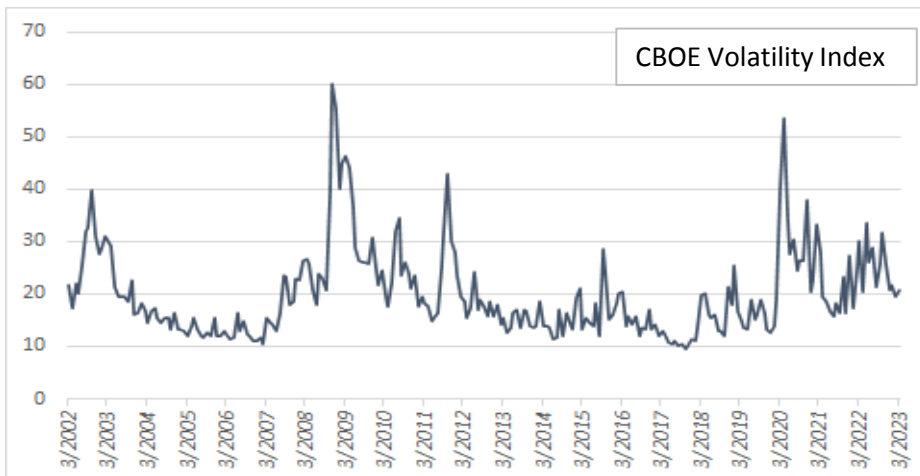
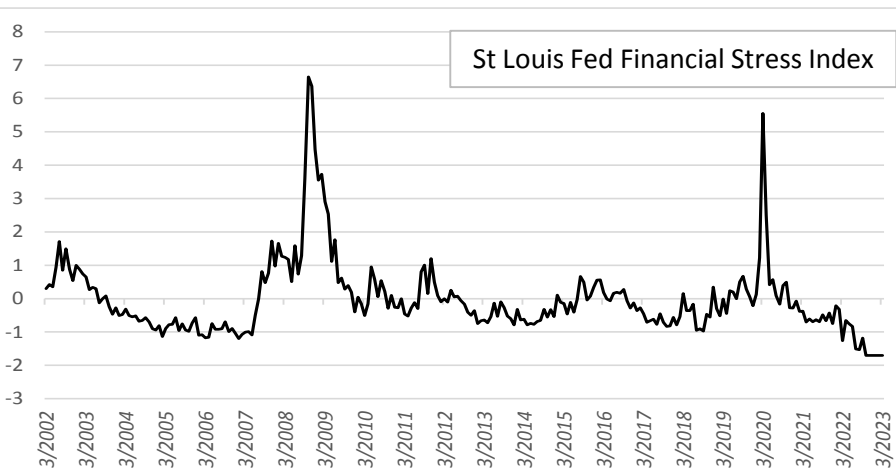
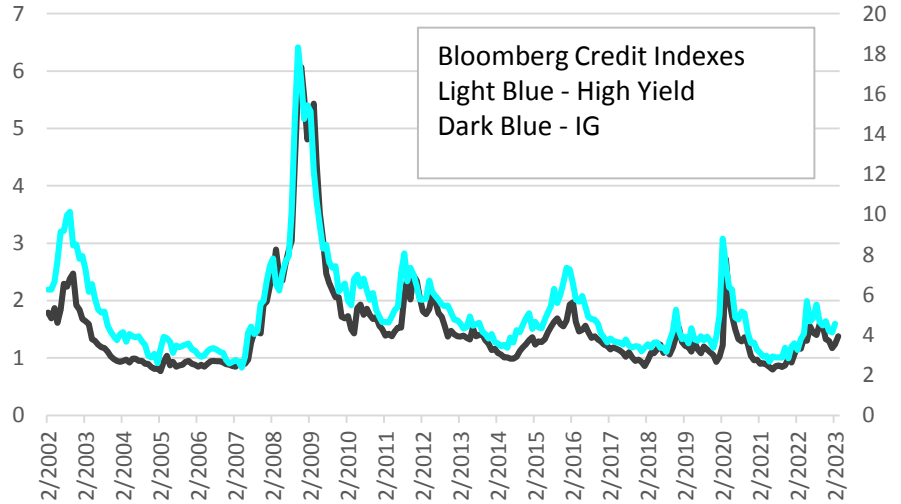
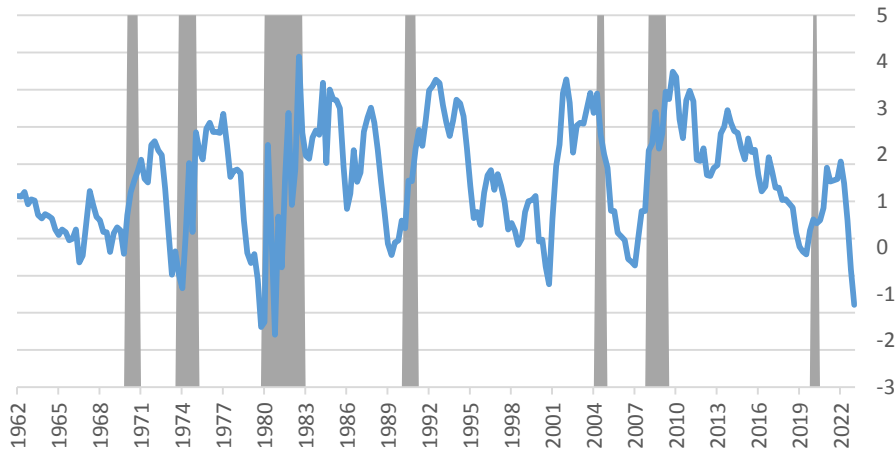
Data Source: Bloomberg

Inflation and Employment



Risk Monitor

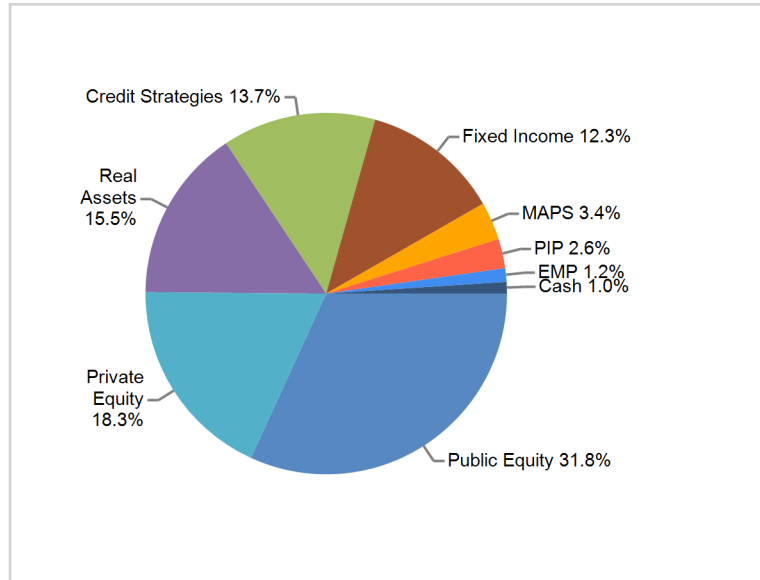
Yield Curve Slope vs Recessions



Asset Allocation Report

December 31, 2022

For Internal Investment Purposes Only



Tracking Error	
3Yr-Total Fund:	2.03%
3Yr-Total Public:	1.74%
5Yr-Total Fund:	1.93%
5Yr-Total Public:	1.43%

	Current \$Bil	Current Weight	Policy Weight	Variance	Allowable Range		Internal %
Total Fund	100.3						28.3%
Public Equity	31.9	31.8%	34.0%	-2.2%	-5%	+5%	47.1%
Fixed Income	12.4	12.3%	15.0%	-2.7%	-3%	+5%	96.3%
Credit Strategies	13.8	13.7%	14.0%	-0.3%	-5%	+5%	
RS Credit	3.1	3.1%	5.6%	-2.5%			
NRS Credit	10.6	10.6%	8.4%	2.2%			
Real Assets	15.6	15.5%	14.0%	1.5%	-5%	+5%	8.7%
Public RE	1.4	1.4%					99.9%
Private RE	9.6	9.6%					
Other RA	4.6	4.6%					
Private Equity	18.3	18.3%	16.0%	2.3%	-5%	+5%	
MAPS	3.4	3.4%	4.0%	-0.6%	-2%	+2%	
DSTRAT	1.6	1.6%					
RBI	1.8	1.8%					0.4%
PIP	2.6	2.6%	2.0%	0.6%	-2%	+2%	
EMP	1.2	1.2%	0.0%	1.2%		+3%	
Cash	1.0	1.0%	1.0%	0.0%	-1%	+4%	

High-Level Exposure	Current \$Bil	Current Weight	Policy Weight	Variance	Allowable Range	
Total Equity	50.3	50.1%	50.0%	0.1%	-10%	10%
Fixed Income + Cash	13.4	13.4%	16.0%	-2.6%	-4%	9%

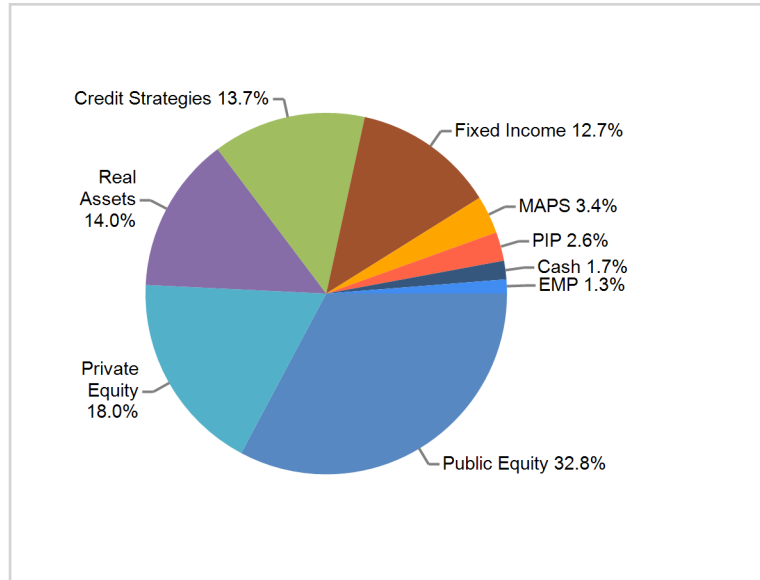
	Current \$Bil	Current Weight	Policy Limit
Hedge Funds	9.8	9.8%	15.0%

* Total Fund includes the following amt held by the Treasurer of VA: \$ 45 million

• The values shown for each asset class on this report may differ from the VRS Monthly Performance Report due to adjustments related to derivative positions in the Rebalance Account, pending transactions, and certain accruals. The values on this report are a more descriptive representation of the Virginia Retirement System's true economic exposure to each asset class.(4 adjustments applied)

*Total Fund and Total Public annualized tracking error is calculated using compounded quarterly returns as of 12/31/2022

* Differences in totals are due to rounding.



Tracking Error	
3Yr-Total Fund:	2.03%
3Yr-Total Public:	1.73%
5Yr-Total Fund:	1.93%
5Yr-Total Public:	1.43%

	Current \$Bil	Current Weight	Policy Weight	Variance	Allowable Range		Internal %
Total Fund	102.1						27.8%
Public Equity	33.5	32.8%	34.0%	-1.2%	-5%	+5%	47.5%
Fixed Income	13.0	12.7%	15.0%	-2.3%	-3%	+5%	96.4%
Credit Strategies	14.0	13.7%	14.0%	-0.3%	-5%	+5%	
RS Credit	3.2	3.1%	5.6%	-2.5%			
NRS Credit	10.8	10.6%	8.4%	2.2%			
Real Assets	14.3	14.0%	14.0%	0.0%	-5%	+5%	
Private RE	9.6	9.4%					
Other RA	4.6	4.5%					
Private Equity	18.4	18.0%	16.0%	2.0%	-5%	+5%	
MAPS	3.5	3.4%	4.0%	-0.6%	-2%	+2%	
DSTRAT	1.6	1.6%					
RBI	1.8	1.8%					0.4%
PIP	2.6	2.6%	2.0%	0.6%	-2%	+2%	
EMP	1.3	1.3%	0.0%	1.3%		+3%	
Cash	1.7	1.7%	1.0%	0.7%	-1%	+4%	

<u>High-Level Exposure</u>	Current \$Bil	Current Weight	Policy Weight	Variance	Allowable Range	
Total Equity	51.9	50.8%	50.0%	0.8%	-10%	10%
Fixed Income + Cash	14.7	14.3%	16.0%	-1.7%	-4%	9%

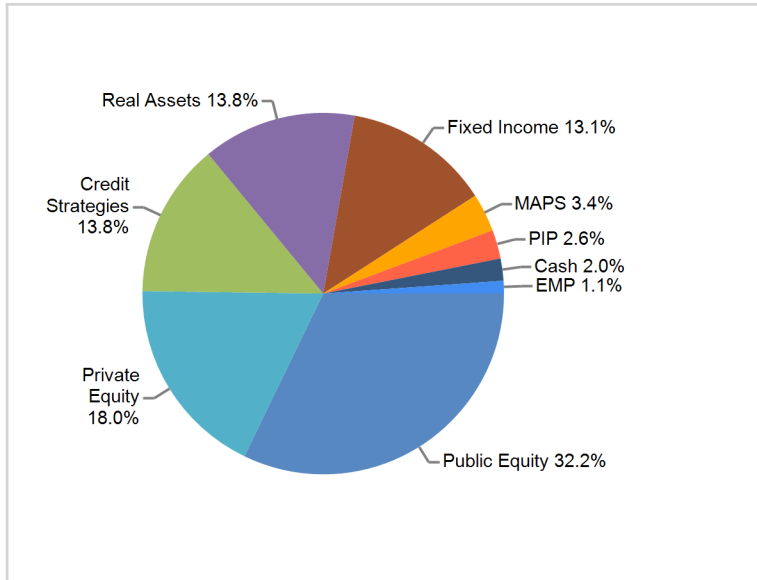
	Current \$Bil	Current Weight	Policy Limit
Hedge Funds	9.9	9.7%	15.0%

* Total Fund includes the following amt held by the Treasurer of VA: \$ 388 million

• The values shown for each asset class on this report may differ from the VRS Monthly Performance Report due to adjustments related to derivative positions in the Rebalance Account, pending transactions, and certain accruals. The values on this report are a more descriptive representation of the Virginia Retirement System's true economic exposure to each asset class.(5 adjustments applied)

*Total Fund and Total Public annualized tracking error is calculated using compounded quarterly returns as of 12/31/2022

* Differences in totals are due to rounding.



Tracking Error	
3Yr-Total Fund:	2.06%
3Yr-Total Public:	1.75%
5Yr-Total Fund:	1.95%
5Yr-Total Public:	1.42%

	Current \$Bil	Current Weight	Policy Weight	Variance	Allowable Range		Internal %
Total Fund	102.5						27.7%
Public Equity	33.0	32.2%	34.0%	-1.8%	-5%	+5%	46.4%
Fixed Income	13.4	13.1%	15.0%	-1.9%	-3%	+5%	96.5%
Credit Strategies	14.2	13.8%	14.0%	-0.2%	-5%	+5%	
RS Credit	3.2	3.1%	5.6%	-2.5%			
NRS Credit	11.0	10.7%	8.4%	2.3%			
Real Assets	14.1	13.8%	14.0%	-0.2%	-5%	+5%	
Private RE	9.3	9.1%					
Other RA	4.8	4.6%					
Private Equity	18.5	18.0%	16.0%	2.0%	-5%	+5%	
MAPS	3.5	3.4%	4.0%	-0.6%	-2%	+2%	
DSTRAT	1.6	1.6%					6.5%
RBI	1.9	1.8%					0.5%
PIP	2.6	2.6%	2.0%	0.6%	-2%	+2%	
EMP	1.2	1.1%	0.0%	1.1%		+3%	
Cash	2.0	2.0%	1.0%	1.0%	-1%	+4%	

<u>High-Level Exposure</u>	Current \$Bil	Current Weight	Policy Weight	Variance	Allowable Range	
Total Equity	51.5	50.2%	50.0%	0.2%	-10%	10%
Fixed Income + Cash	15.5	15.1%	16.0%	-0.9%	-4%	9%

	Current \$Bil	Current Weight	Policy Limit
Hedge Funds	9.8	9.5%	15.0%

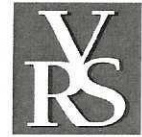
* Total Fund includes the following amt held by the Treasurer of VA: \$ 111 million

• The values shown for each asset class on this report may reflect adjustments related to derivative positions in the Rebalance Account, pending transactions and certain accruals, in order to provide a more descriptive representation of the true economic exposure to each asset class (3 adjustments applied)

*Total Fund and Total Public annualized tracking error is calculated using compounded quarterly returns as of 3/31/2023

* Differences in totals are due to rounding.

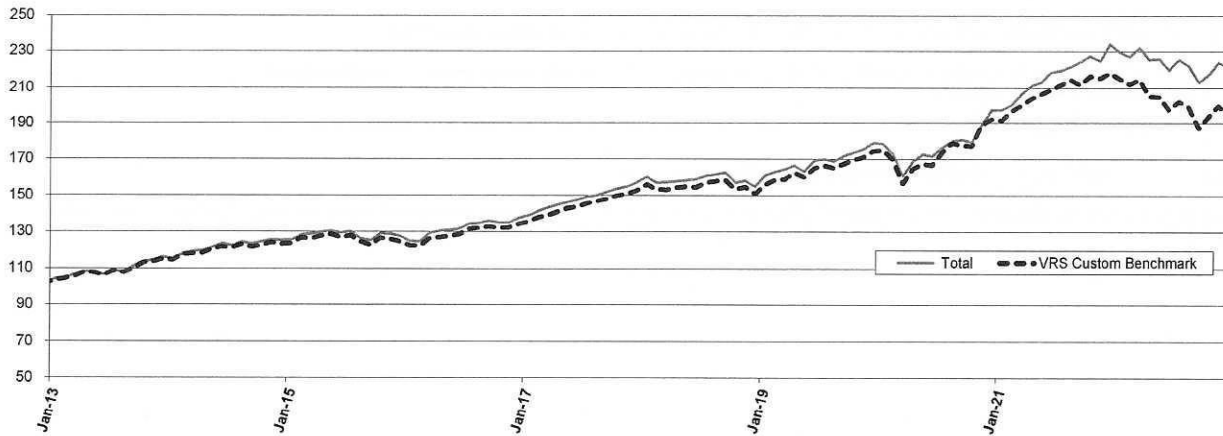
PERFORMANCE SUMMARY
Rolling Periods Ending
December 31, 2022



TOTAL FUND PERFORMANCE

	10 Yr	5 Yr	3 Yr	1 Yr	Qtr	Month	Fiscal YTD	Cal YTD	Market Value (\$MM)
Total Public Equity Strategies	8.4	5.1	4.7	-15.2	10.5	-2.9	3.9	-15.2	30,427
<i>Benchmark</i>	8.2	5.4	4.4	-18.1	10.0	-3.8	2.8	-18.1	
Total Fixed Income	1.8	1.1	-1.2	-12.6	2.8	-0.2	-2.0	-12.6	12,379
<i>Benchmark</i>	1.1	0.1	-2.7	-13.1	2.3	-0.4	-2.3	-13.1	
Total Credit Strategies	5.9	5.6	5.5	-2.0	1.3	0.2	0.7	-2.0	13,756
<i>Benchmark</i>	4.4	3.4	1.5	-4.9	3.2	0.0	3.4	-4.9	
Total Real Assets	10.7	9.9	10.9	14.4	1.5	0.6	3.4	14.4	15,557
<i>Benchmark</i>	8.9	8.2	9.2	12.9	1.3	-0.1	4.0	12.9	
Total Private Equity	16.4	18.2	20.4	0.0	-0.9	-1.2	-4.9	0.0	18,344
<i>Benchmark</i>	10.6	7.1	5.0	-20.9	-6.5	-9.6	-21.2	-20.9	
Total Private Investment Partnerships	n/a	9.4	10.9	3.5	0.0	0.0	-1.2	3.5	2,636
<i>Benchmark</i>	n/a	6.8	6.6	-3.4	-0.7	-3.1	-4.4	-3.4	
Total Multi-Asset Public Strategies	n/a	n/a	3.1	-4.9	4.7	-0.9	2.5	-4.9	3,412
<i>Benchmark</i>	n/a	n/a	2.5	-9.8	4.7	-1.6	1.1	-9.8	
Total Fund	8.1	7.1	7.4	-5.3	4.0	-1.1	0.7	-5.3	100,252
<i>VRS Custom Benchmark</i>	6.7	4.9	3.6	-11.2	3.5	-3.0	-1.8	-11.2	

10-Year Performance
Indexed to 100



Effective July 2013, the VRS Custom Benchmark is a blend of the Asset Class Benchmarks at policy weights.

The VRS Cash Account, the Treasurer Short-Term Investment Account, the VRS Rebalancing Account, transition activity and accounts with market values of less than \$1 million are included in the Total Fund's market value. Differences in market value totals are due to rounding.

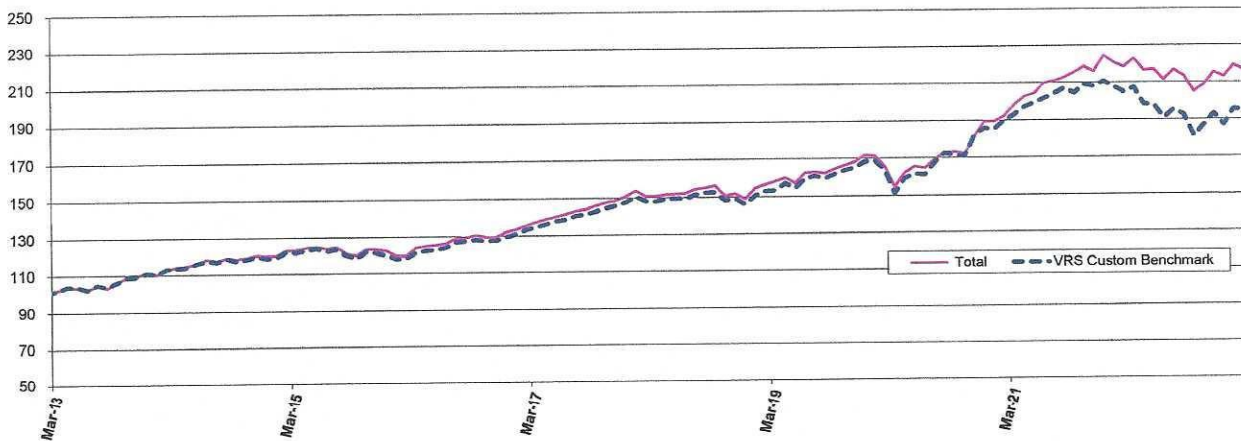
PERFORMANCE SUMMARY
Rolling Periods Ending
February 28, 2023



TOTAL FUND PERFORMANCE

	10 Yr	5 Yr	3 Yr	1 Yr	Qtr	Month	Fiscal YTD	Cal YTD	Market Value (\$MM)
Total Public Equity Strategies	8.2	5.8	9.4	-5.6	0.9	-2.3	8.0	4.0	31,615
<i>Benchmark</i>	8.1	6.2	9.4	-7.7	0.5	-2.7	7.3	4.4	
Total Fixed Income	1.9	1.6	-2.1	-8.7	0.5	-2.4	-1.3	0.7	12,961
<i>Benchmark</i>	1.1	0.6	-3.6	-9.5	0.1	-2.5	-1.8	0.5	
Total Credit Strategies	5.8	5.7	5.9	0.3	1.3	0.0	1.9	1.2	13,983
<i>Benchmark</i>	4.5	3.8	2.5	-0.9	2.7	-0.3	6.1	2.7	
Total Real Assets	10.6	10.1	11.3	15.3	0.6	-0.1	3.4	0.0	14,271
<i>Benchmark</i>	8.5	7.7	8.5	7.7	-2.1	-1.1	1.9	-2.1	
Total Private Equity	16.4	18.1	20.5	0.1	-1.3	-0.2	-5.0	-0.1	18,367
<i>Benchmark</i>	12.1	9.1	7.9	-11.4	3.3	7.7	-10.0	14.3	
Total Private Investment Partnerships	n/a	9.4	10.9	3.5	0.0	0.0	-1.2	0.0	2,636
<i>Benchmark</i>	n/a	7.8	7.4	-0.3	1.5	2.0	0.1	4.7	
Total Multi-Asset Public Strategies	n/a	n/a	5.7	-0.1	2.2	0.5	5.6	3.1	3,465
<i>Benchmark</i>	n/a	n/a	4.0	-4.4	0.4	-0.9	3.2	2.0	
Total Fund	8.0	7.5	9.3	-0.8	0.6	-1.1	2.4	1.7	102,130
<i>VRS Custom Benchmark</i>	6.8	5.6	6.0	-4.9	1.0	-0.3	2.2	4.1	

10-Year Performance
Indexed to 100



Effective July 2013, the VRS Custom Benchmark is a blend of the Asset Class Benchmarks at policy weights.

The VRS Cash Account, the Treasurer Short-Term Investment Account, the VRS Rebalancing Account, transition activity and accounts with market values of less than \$1 million are included in the Total Fund's market value. Differences in market value totals are due to rounding.

Total Fund Tracking Error



Figure 1: Policy Tracking Error Rolling Three Year - Plan (as of 12/31/2022)

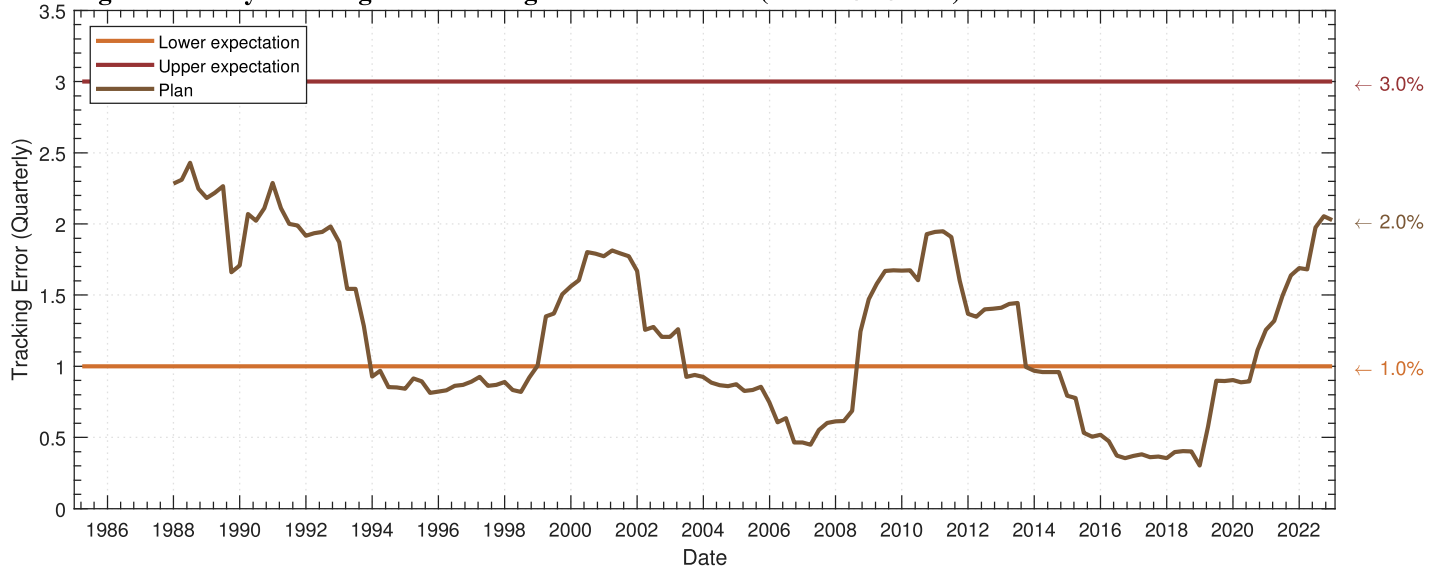
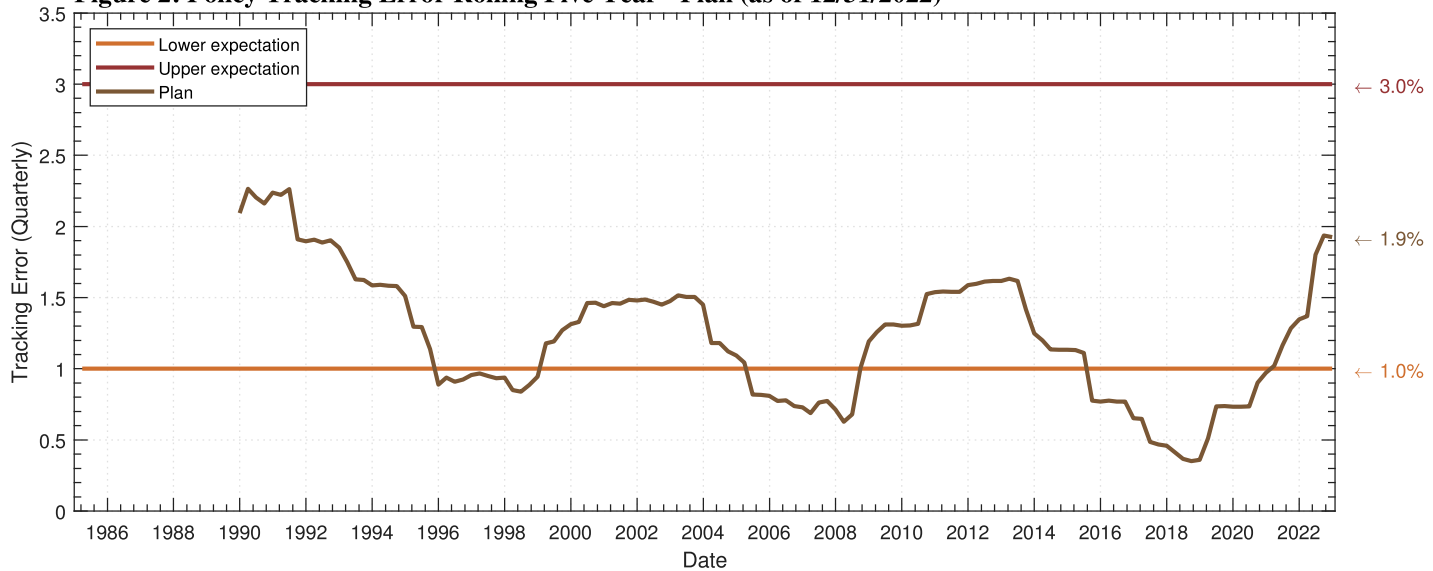


Figure 2: Policy Tracking Error Rolling Five Year - Plan (as of 12/31/2022)



Virginia Retirement System

The VRS Defined Benefit Plan Investment Policy Statement established the total fund tracking error range as the allowable observed tracking error calculated quarterly using 5 years of history.

Program	Action	Effective Date	Commitment/Current Value	Funding/Defunding Period	Description
Total Fund	Manager acquired active currency manager	11/29/2022	\$1.8 Billion	Immediate	* Systematica Investments – a quantitative active currency manager specializing in G10 currency.
Risk-Based Investments	Terminated	12/31/2022	\$159 Million	Immediate	AQR Risk Parity – an actively managed risk parity mandate.
Risk-Based Investments	Hired	03/01/2023	\$300 Million	Immediate	Man AHL – a custom mix of various trend following strategies.
Public Equity	Closed	01/03/2023	\$2.1 Billion	Immediate	Matoaka – Internal non-U.S. large cap account.
Public Equity	Closed	02/28/2023	\$1 Billion	Immediate	Potomac – Internal U.S. large cap account.
Public Equity	Opened	03/01/2023	\$300 Million	Immediate	Amherst – An internally managed REIT strategy with swap overlay.
Real Assets	Closed	01/03/2023	\$520 Million	Immediate	Montalto – An internally managed international REIT account.
Real Assets	Closed	01/03/2023	\$830 Million	Immediate	Monroe – An internally managed U.S. focused REIT account.
Real Assets	Hired	02/07/2023	\$125 Million	3 Years	Penwood Select Industrial Partners VII, LP – A closed end fund investing in industrial real estate.
Real Assets	Hired	03/15/2023	\$350 Million	5 Years	VA - Pantheon Infrastructure III – A separate account investing in infrastructure funds.
Private Equity	Hired	03/30/2023	\$300 Million	6 Years	Hellman and Friedman XI – A mega buyout fund that will target high quality businesses with defensible competitive positions, strong economic profiles, and a growth orientation in the U.S. and Europe.

* The manager is considered Diverse Investment Management Engagement (DIME) under the Commonwealth of Virginia definition, which defines ownership threshold of 51% or more.

April 12, 2023 IAC Meeting

Program	Action	Effective Date	Commitment/Current Value	Funding/Defunding Period	Description
Credit Strategies	Hired	03/17/2023	\$150 Million	4 Years	Ares Capital Europe VI – A closed-end fund that will directly originate and provide one-stop, flexible and scaled debt capital to European middle market companies.
Credit Strategies	Hired	03/31/2023	\$250 Million	3 Years	Ares Pathfinder II – An alternative credit fund investing in performing assets that have predictable cash flows and are directly originated by the manager.
Credit Strategies	Hired	03/31/2023	\$150 Million	3 Years	Oaktree Opportunities Fund XII – A closed-end fund focused on investing in both private and public corporate distressed debt opportunities.
Credit Strategies	Hired	03/31/2023	\$250 Million	3 Years	Oak Street Real Estate Capital VI – A closed-end fund seeking income generation through sale-leasebacks with investment grade tenants.

* The manager is considered Diverse Investment Management Engagement (DIME) under the Commonwealth of Virginia definition, which defines ownership threshold of 51% or more.

April 12, 2023 IAC Meeting



Virginia
Retirement
System

Investment Advisory Committee Public Market Assets Program Reviews

April 12, 2023



Overview

(J.T. Grier, Managing Director)

Program Reviews

- **Public Equity**

(Dan Whitlock, Program Director)

- **Internal Equity Management Public Equity**

(Dan Schlussler, Program Director)

- **Fixed Income**

(Parham Behrooz & Greg Oliff, Co-Directors)

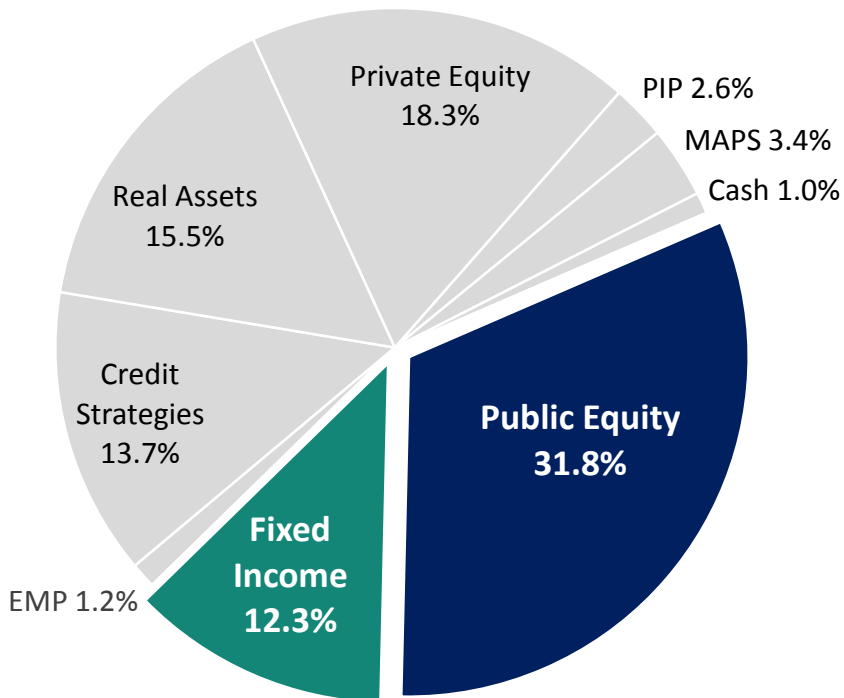
Public Market Program Overview

J.T. Grier
Managing Director, Public Markets



Overview: Public Market Assets

Public Market Assets: 44.1%



Public Equity

- 23 Developed Mkts
- 27 Emerging Mkts

Internal Equity Management

- ≈45% of Public Equity
- Invested in 50 Global Mkts

Fixed Income

- U.S. Core Focus
- USD EMD
- High Yield

Market values as of 12/31/2022; source: BNY Mellon data

Overview: Preview Of Agenda Items



Public Equity

Dan Whitlock and Dan Schlusser
Program Directors

“Basically, experience in finance with a discount rate near zero is like having studied physics except without gravity.”

- Mathematician Nassim Nicholas Taleb



Agenda: Public Equity Annual Review Topics



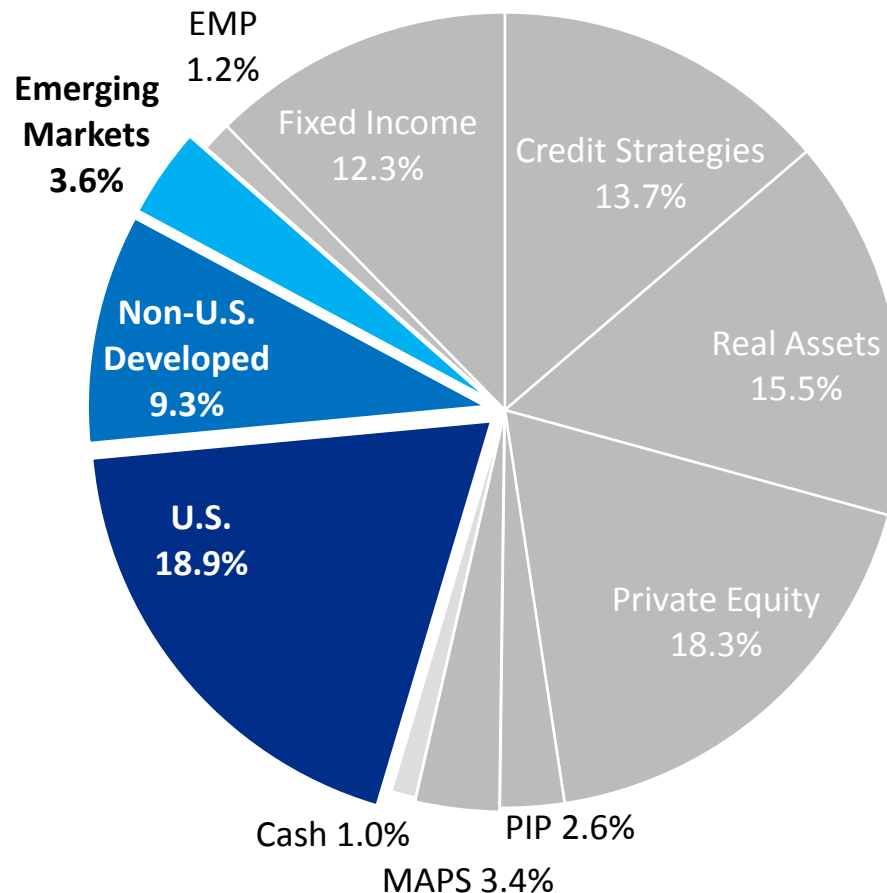
- Overview
- Markets
- Exposures
- Results
- Mandates
- Looking Forward

Overview: Public Equity Team Members



Professional	Position	Highest Degree	Professional Certifications	Investment Experience	VRS Tenure
Dan Whitlock	Director	MBA	CFA, CAIA	21	21
Stephen Adelaar	Portfolio Manager	MS	CFA	23	16
Holly Glass	Portfolio Manager	MA	CFA	22	22
Olga Zozulya	Investment Officer	MBA	CFA	10	10
Korey Turner	Senior Investment Analyst	MS/MBA		3	3
Kelly Baker	Portfolio Assistant	AAS		13	8
Additional Resources	The entire Internal Equity Team, Portfolio Solutions Group, Governance Team, Management Committee, Operations Team, Compliance Team, and Legal/Regulatory Team.				

Overview: Public Equity Asset Allocation as of 12/31/22



U.S. Equity	18.9%
Non-U.S. Developed	9.3%
Emerging Market	3.6%
Total Public Equity	31.8%

Overview: Public Equity Philosophy



- **Primary Objective**
Gain exposure to global economic growth & the global equity risk premium
- **Specific Return Objective**
Outperform the strategic benchmark over three to five years
- **Approach**
Risk-adjusted, using both equity hedge funds & low-volatility equity mandates
- **Strategic Benchmark**
MSCI All-Country World Index Investible Markets Index (MSCI ACWI IMI)

Exposures: Public Equity Positioning as of 12/31/22

\$30.4 Billion
30.4% of Plan Assets

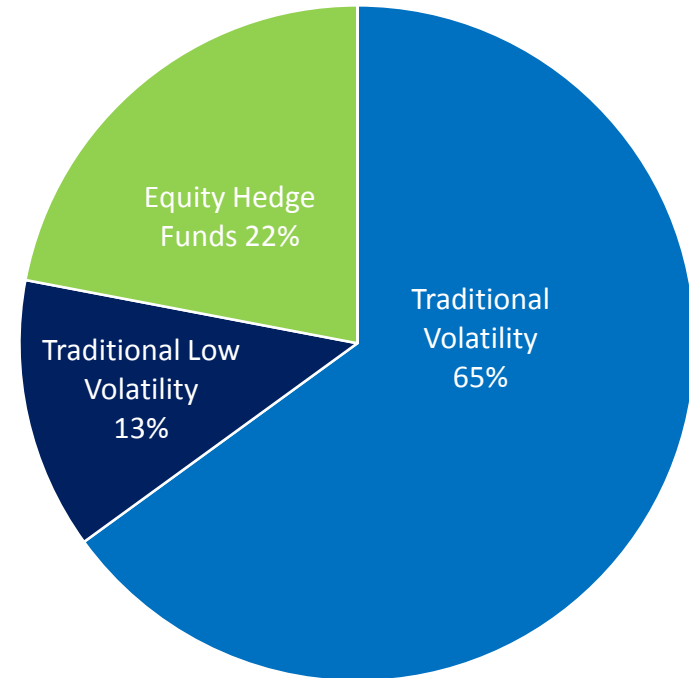
57% Domestic (-2.1% vs. bmk)
31% Non-US Developed (+2.0% vs. bmk)
12% Emerging Markets (+0.2% vs. bmk)

69% Active
31% Enhanced

45% Internal
55% External

65% Traditional Volatility
13% Traditional Low Volatility
22% Equity Hedge Funds

0.94 Beta
1.70% Forecasted Active Risk (Barra)



27 External Mandates (13 Traditional & 14 HFs)

21 External Managers (9 Traditional & 12 HFs)

Exposures: Public Equity Portfolio Changes as of 12/31/22



2022 was a Year of Action:

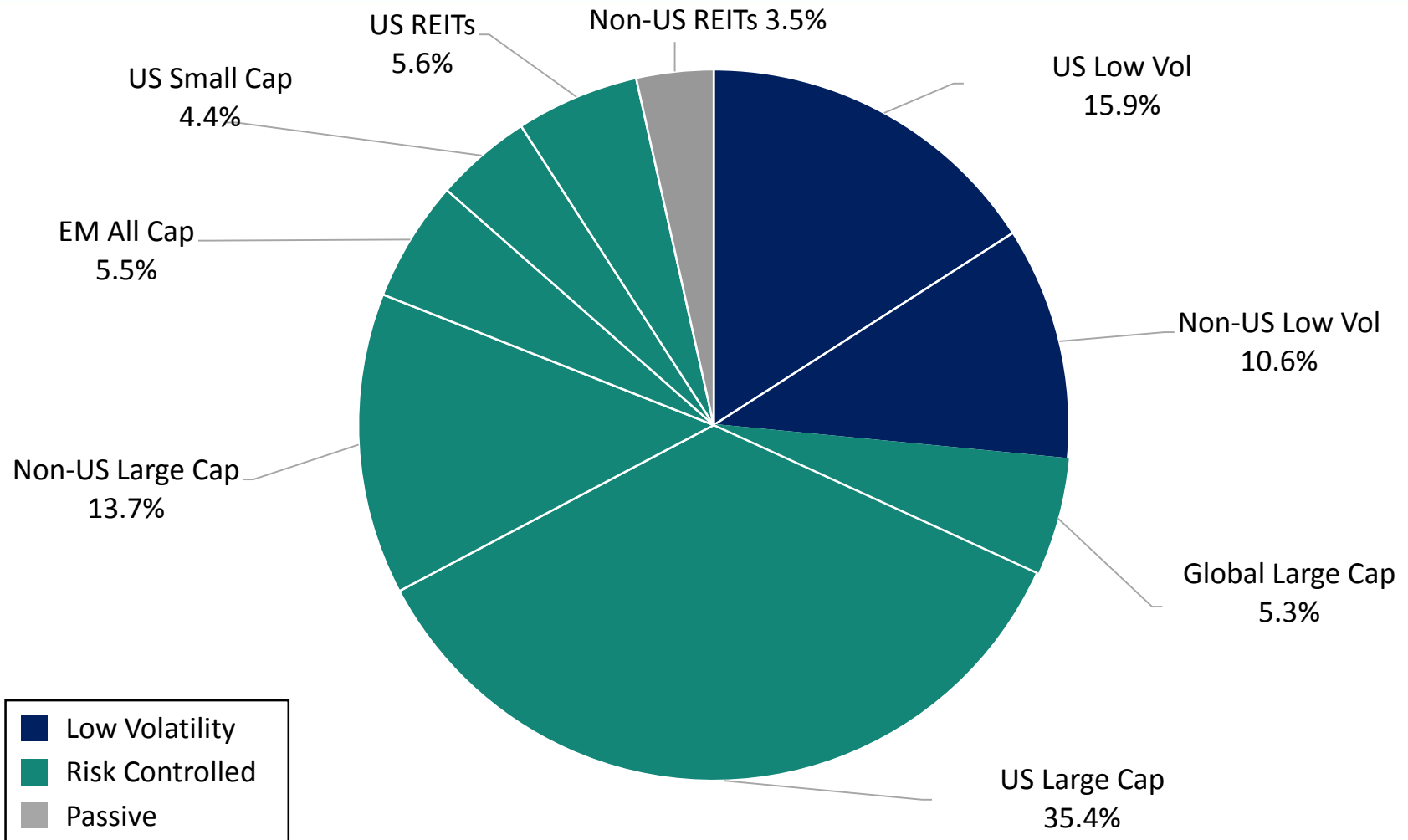
Raised ~\$1.6 billion for plan needs

Rebalanced another ~\$2.1 billion within Public Equity

Out of this, a combined ~\$3.2 billion of flows came from HF's and Low Vol to lower active risk, lock in relative gains during selloff, gain liquidity.

Total PE	2021	2022	Difference
Traditional	58%	65%	7%
Low Volatility	18%	13%	-5%
Hedge Funds	24%	22%	-2%
Active	74%	69%	-5%
Enhanced	26%	31%	5%
Internal	39%	45%	6%
External	61%	55%	-6%
AUM (billions)	38	30	(7)
% of Total Fund	35%	30%	-5%

Overview: Internal Equity Asset Allocation as of 12/31/22



Overview: Internal Equity Asset Allocation Changes



2022 – 2023 Portfolio Actions:

Launched Global Enhanced Index Strategy in September

Began reallocation of US and non-US Developed Large Cap assets to Global Enhanced in 1st Quarter 2023

Reallocated most of REIT strategy assets and completed redesign of US component for Public Equity

Total IEM	2021	2022	2023 (Feb)	Difference
Risk Controlled				
US Large Cap	40%	35%	7%	-33%
Non-US Large Cap	14%	14%	0%	-14%
Global Lap Cap	0%	5%	52%	52%
Total Large Cap Developed	54%	54%	60%	5%
US Small Cap	5%	4%	5%	0%
EM All Cap	3%	5%	6%	3%
US REITs	5%	6%	2%	-3%
Total Risk Controlled	68%	70%	73%	5%
Low Volatility				
US Low Vol	18%	16%	16%	-1%
Non-US Low Vol	12%	11%	11%	0%
Total Low Volatility	29%	27%	28%	-2%
Total Active	97%	96%	100%	4%
Non-US REITs (Passive)	3%	4%	0%	-3%

Overview: Internal Equity Team Members

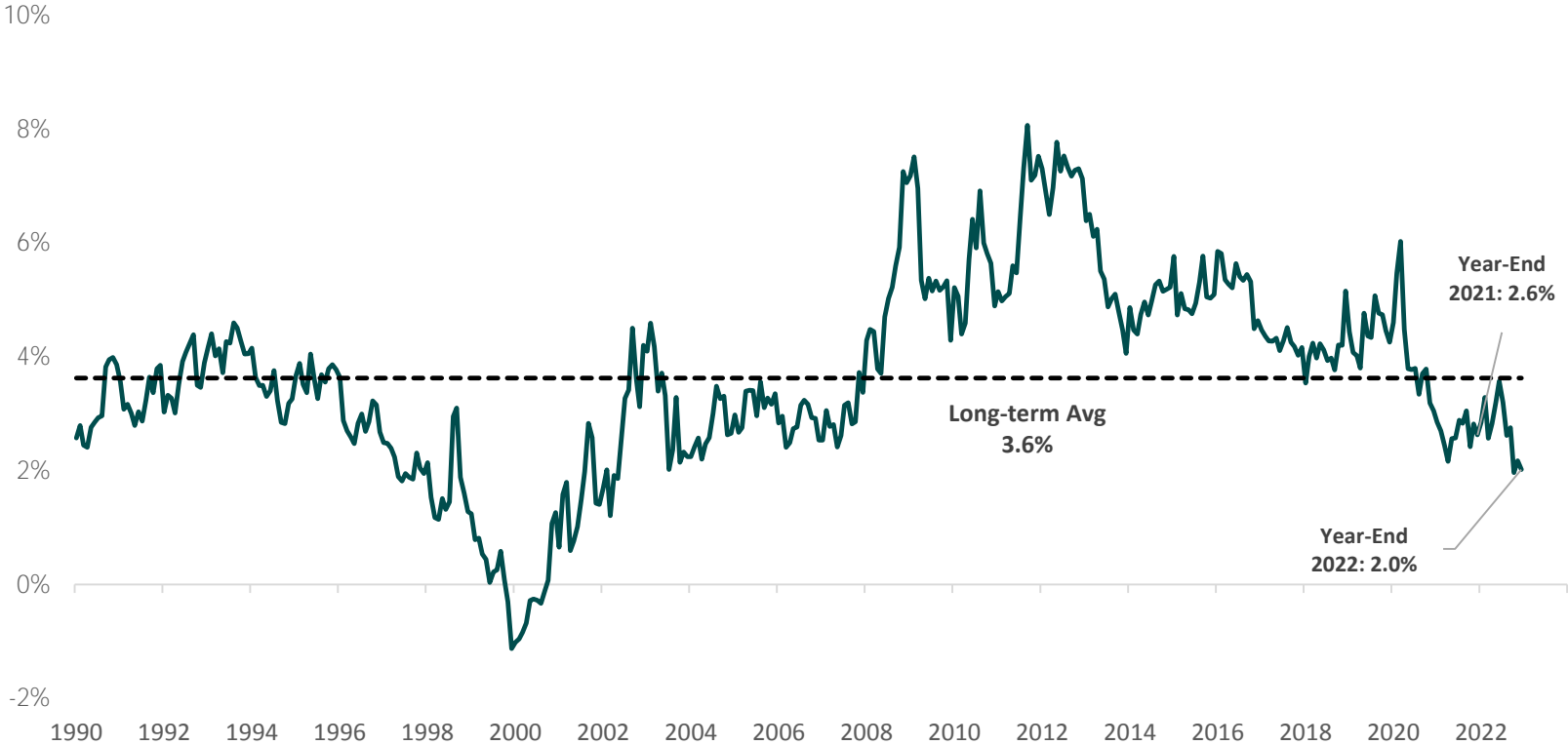


Professional	Position	Area(s) of Focus	Highest Degree	Professional Certifications	Investment Experience	VRS Tenure
Dan Schlussler	Program Director	Non-U.S. Dev Low Vol, Research	MBA	CFA	27	10
Joe Kennebeck	Sr. Investment Officer	Head Trader	BA		30	16
Ryan Carlson	Portfolio Manager	U.S. REIT & Small Cap, Investment Tools	BS	CFA	20	3
Aaron Lazar	Investment Officer	Currency Hedge, Global Enhanced Transition, U.S. REIT, Swaps & Equity Trading	MA	Passed CFA Level 1	9	9
Vu Le	Portfolio Manager	Global Enhanced, Research, Currency Hedge	PhD	CFA	12	11
Alex Muniz	Sr. Portfolio Manager	U.S. Low Volatility, Research	MA	CFA	22	22
Garret Rhodes	Investment Officer	Non-U.S. Dev Low Vol, Global Enhanced, Currency Hedge, Swaps Trading	MS	CFA	4	4
Larry Tentor	Portfolio Manager	Global Enhanced Transition, Data Infrastructure	PhD	FRM	21	15
Weldon Wirick	Portfolio Manager	Emerging Markets, Trading	MA	CFA	21	17
Matthew Lacy	Director of Portfolio Integration (PSG)	U.S. Large Cap	MA	CFA	24	24
Additional Resources	Investment Operations Department Portfolio Solutions Group Investment Decision Support					

Markets: Equity Risk Premium



US Equity Risk Premium

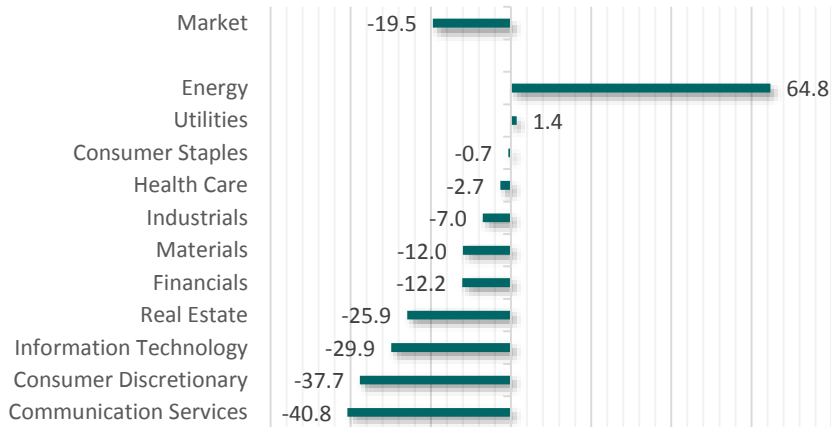


Source: Credit Suisse HOLT

Markets: Market Performance

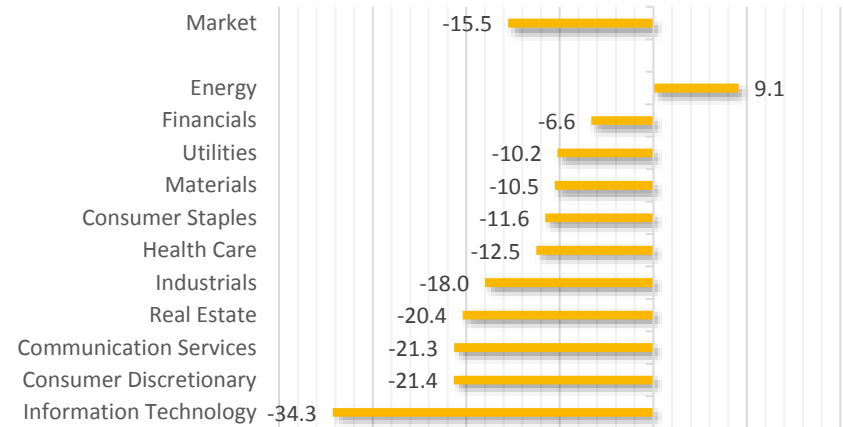
United States

Total Return: 2022



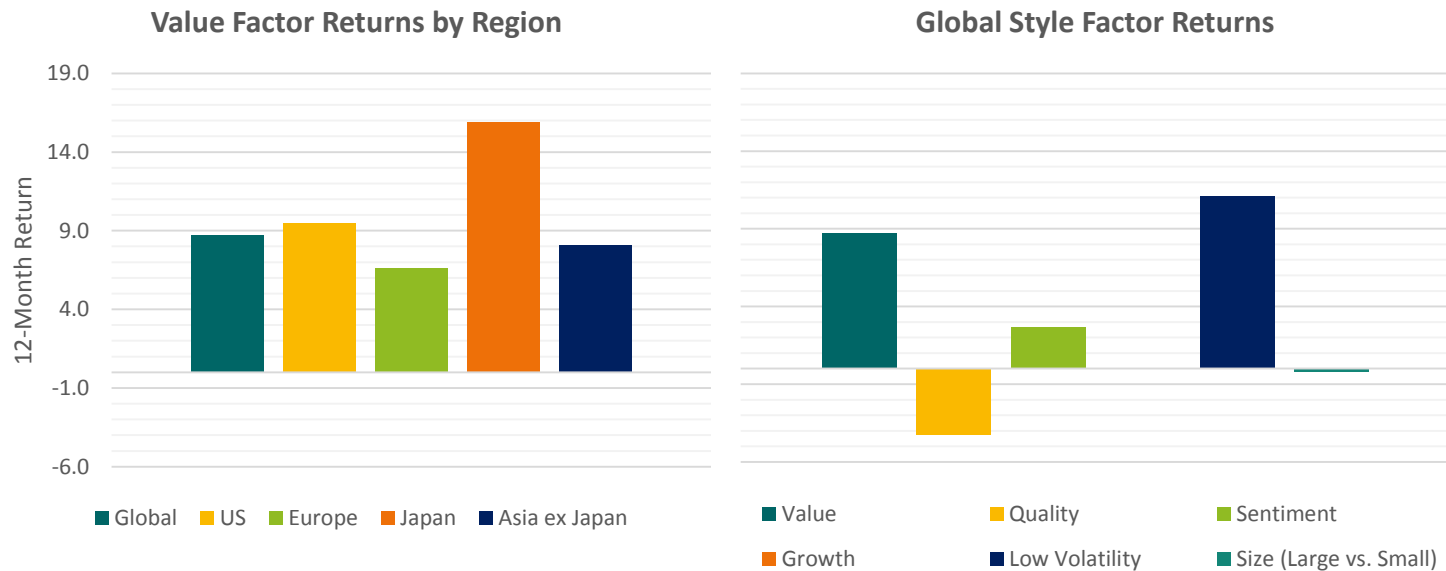
All-Country World ex USA

Total Return (USD): 2022



Source: MSCI, Bloomberg

Markets: Factor Returns (2022)

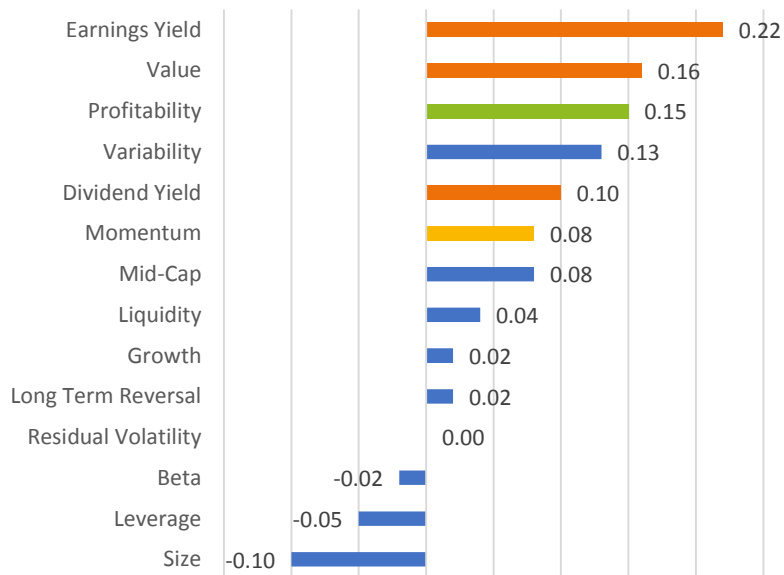


Source: UBS
Long Minus Benchmark. Region, size and sector neutral, cap-weighted

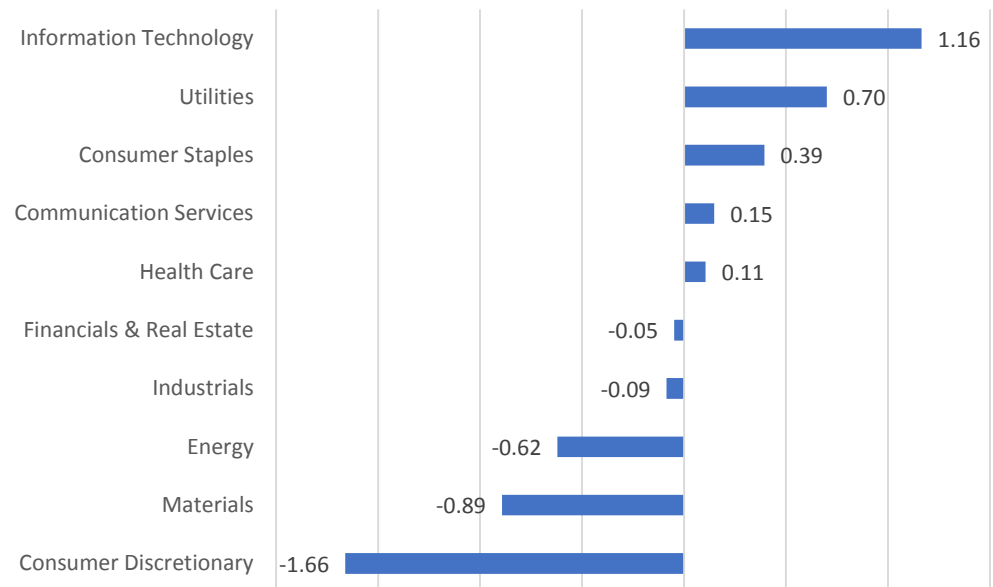
Exposures: Internal Equity Style Factor & Sector Allocations



Factor Active Weights



Sector Active Weights (%)



*Data as of 12/16/2022.

Results: Internal Equity Program Performance (as of 12/31/22)



	IEM Active				IEM Enhanced Index				IEM Low Volatility			
	1 Yr	3 Yr	5 Yr	Incep	1 Yr	3 Yr	5 Yr	Incep	1 Yr	3 Yr	5 Yr	Incep
Total Active Internal Equity	-15.72	4.41	5.56	7.06	-17.75	4.94	5.98	6.68	-10.57	3.31	4.55	10.79
IEM Benchmark	-17.20	4.26	6.12	6.49	-18.55	4.68	6.27	6.41	-13.69	3.43	5.87	8.94
<i>Excess Returns</i>	1.48	0.15	-0.56	0.57	0.80	0.26	-0.30	0.27	3.12	-0.12	-1.32	1.85
<i>Realized Tracking Error</i>	1.44	1.40	1.20	1.06	1.20	1.28	1.07	0.83	2.79	2.22	2.02	2.73
<i>Realized Information Ratio</i>	1.03	0.11	-0.47	0.54	0.66	0.20	-0.28	0.32	1.12	-0.05	-0.66	0.68

Results: Internal Equity Strategy Performance (as of 12/31/22)



	Inception Date	Mkt Value (\$MM)	1-Year Return	1-Year Excess	Since Inc. Excess	Since Inc. Tracking
Risk Controlled Strategies		10,413	-17.75	0.80	0.27	0.83
U.S. Large Cap (Potomac)	Apr-01	5,277	-18.73	0.73	0.35	0.98
Non-U.S. Large Cap (Matoaka)	Sep-10	2,045	-12.47	1.41	0.08	1.28
EM All Cap (Tuckahoe)	Sep-15	814	-19.71	0.09	-0.55	1.82
U.S. Small Cap (Afton)	Jun-05	651	-15.73	1.44	0.39	1.92
U.S. REITs (Monroe)	Dec-05	831	-25.57	-0.72	0.98	1.11
Global Dev. Large Cap (Rivanna)	Sep-22	795	N/A	N/A	1.01	N/M
Less Constrained (Low Vol) Strategies		3,959	-10.57	3.12	1.85	2.73
U.S. Large Cap (Mobjack)	Jun-10	2,375	-11.44	1.94	1.70	3.12
Non-U.S. Large Cap (Piedmont)	Dec-12	1,584	-9.27	4.85	1.18	2.73
Passive Strategies		522	-23.72	0.07	0.12	0.27
Non-U.S. Developed REIT	Jul-20	522	-23.73	0.07	-0.23	0.23
Other Mandates						
Currency Hedging	Apr-09	2,260	N/A	N/A	N/A	N/A

Results: Public Equity as of 12/31/22



	10 Year	5 Year	3 Year	1 Year
Total Public Equity	8.39	5.11	4.67	-15.19
Strategic Benchmark	8.21	5.41	4.39	-18.06
Excess Return	0.18	-0.30	0.28	2.87
Beta vs. Strategic Benchmark*	0.95	0.94	0.93	
Alpha**	0.48	-0.12	0.41	
Active Risk vs. Strategic Benchmark***	1.50	1.98	2.48	
Information Ratio vs. Strategic Benchmark****	0.12	-0.15	0.11	

*Measure of volatility, or systematic risk, of a portfolio in comparison to a benchmark

**Risk-adjusted excess return (accounts for market beta)

***A relative risk measure otherwise known as tracking error, this is the standard deviation of returns relative to a benchmark

****A measure of excess return per unit of relative risk (Portfolio Returns - Benchmark Returns) / Active Risk

VRS Public Equity has outperformed in seven of the last ten calendar years,
underperforming in only 2018 - 2020

Please see endnotes for benchmark information

Results: Public Equity

CY 2022 Attribution Deeper Dive



2022 Performance Factor Attribution

Note: Attribution an estimate and does not contain fees, intra-month trading, t-costs, etc.; some categories that are not material were left off.

Factor Impact Summary:

- An overweight to U.S. Value was the largest contributor to Style.
- The low beta approach was a tailwind in falling markets (after a headwind for several years).
- An underweight to the U.S. added.
- Stock Selection was negative, primarily due to being underweight some energy names that were up a large amount.

Attribution	Value (%)
Portfolio Base Return	-14.8%
Benchmark Base Return	-17.9%
Excess Return	3.1%
Currency	0.0%
Market Timing	1.2%
Country Allocation	0.6%
Selection	1.3%
Industry	0.0%
Style	1.7%
Specific Return	-0.3%

Results: Public Equity 2023 Update



2022/2023 Performance Factor Attribution*

Factor Impact Summary:

- Lower beta that protected capital in 2022 detracted in the first two months of 2023.
- Underweights of growth names in 2022 that contributed to stock outperformance in 2022 led to underperformance in January and February.
- Generally, January 2023 was a low-quality rally by several fundamental metrics.

Attribution	2022	2023 (through Feb)
Portfolio Base Return	-14.8	4.1
Benchmark Base Return	-17.9	4.4
Excess Return	3.1	-0.4
Currency	0.0	0.0
Market Timing	1.2	-0.3
Country Allocation	0.6	0.0
Selection	1.3	-0.1
Industry	0.0	0.0
Style	1.7	0.0
Stock Specific Return	-0.3	-0.2

*Attribution is an estimate and does not contain fees, intra-month trading, t-costs, etc.; some categories that are not material were left off.

Results: External Manager Breakout As of 12/31/22



	10 Year	5 Year	3 Year	1 Year
External Managers (net of fees)	7.70	4.84	4.77	-15.01
Associated Market Cap Benchmarks	7.41	4.70	4.03	-18.32
Excess Return	0.29	0.15	0.73	3.31
Beta vs. Benchmarks*	0.94	0.94	0.92	
Alpha**	0.62	0.29	0.87	
Active Risk vs. Benchmarks***	2.25	2.84	3.49	
Information Ratio vs. Benchmarks****	0.13	0.05	0.21	

*Measure of volatility, or systematic risk, of a portfolio in comparison to a benchmark

**Risk-adjusted excess return (accounts for market beta)

***A relative risk measure otherwise known as tracking error, this is the standard deviation of returns relative to a benchmark

****A measure of excess return per unit of relative risk (Portfolio Returns - Benchmark Returns) / Active Risk

VRS Public Equity external managers have had a low excess return correlation (diversification) to internal management over time and have added value net of all fees.

Managers: Public Equity Hires & Terminations – 1 Year



Action	Effective Date	Commitment/ Current Value	Funding/ Defunding Period	Description
Closed	2/28/2022	\$200 Million	< 1 Month	Kylin* A China, Korea, and Japan oriented equity hedge fund
Terminated	7/18/2022	\$270 Million	Immediate	Nordea Emerging Markets Long only emerging markets manager
Hire	8/1/2022	\$250 Million	Immediate	CET Energy Dynamics A long/short equity hedge fund focused on the energy sector
Terminated	8/4/2022	\$1,200 Million	Immediate	Nordea Global Long only global markets manager
Hire	9/1/2022	\$750 Million	Immediate	Rivanna An internally managed active global equity strategy

*The manager is considered DIME under the Commonwealth of Virginia definition, which defines ownership threshold of 51% or more

Managers: Diverse Investment Management Engagement (DIME)



Women & Minority Owned Management Firms Currently In The Lineup

- Ariel managing VRS assets since 2014
African-American, Asian-American & women-owned global equity manager
- Advent managing VRS assets since 2011, Public Equity assets since 2020
African-American owned convertible manager

Continue To Meet With New Prospects & Consider New Investments

- 86 meetings with minority managers or consultants in last 5 years
- 223 meetings since we started tracking this in late 2009

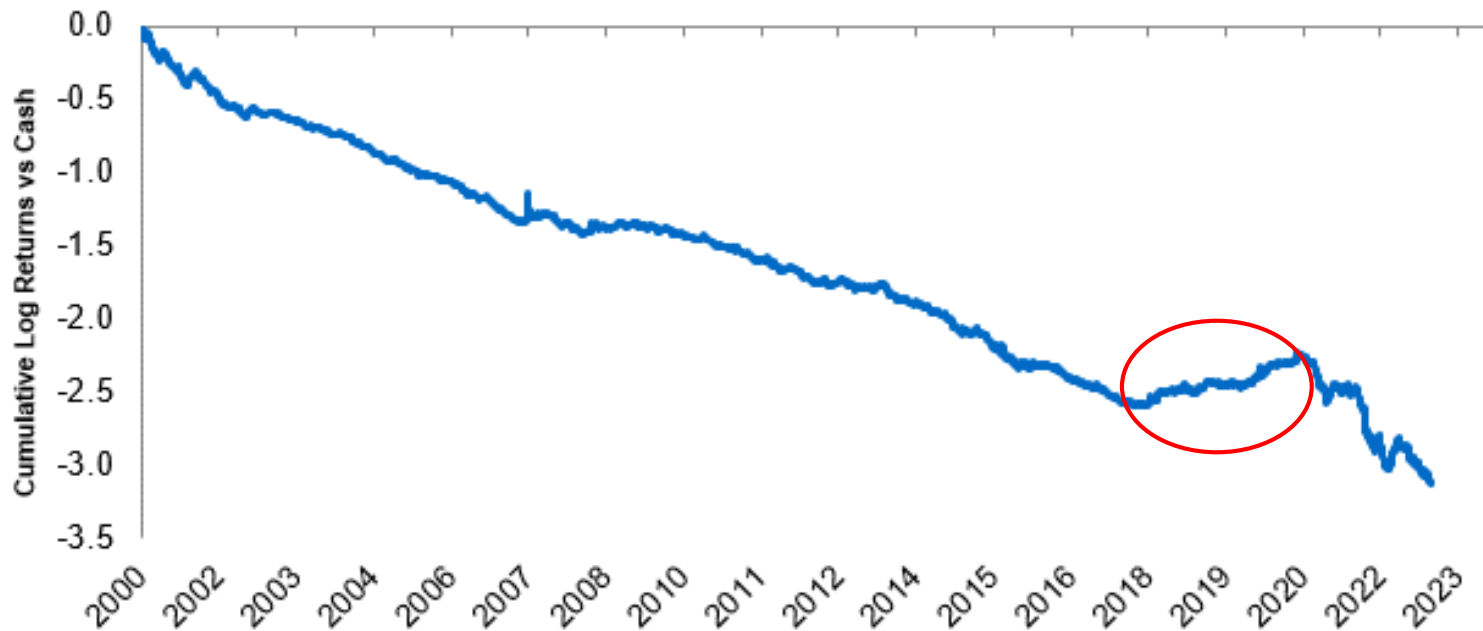
Looking Forward: Remain Opportunistic



- Benchmark Study: Strategic Allocation to Low Vol
- Continue To Work Closely With All Cross Functional Teams
- External
 - Opportunistic Manager and Selection, Portfolio Management, and Risk Management
 - Continue Women & Minority Manager Outreach
- Internal
 - Globalization of Strategies Continues with Low Volatility Next
 - Major Projects to Enhance Our Research Infrastructure and Investment Tools

Appendix

Markets: Costanza Portfolio



Source: AQR. For illustrative purposes only. Hypothetical data has inherent limitations, some of which are described in the disclosures. See detailed explanation in the body of this article, and additional disclosures at the end of this article. This hypothetical performance does not reflect the deduction of any management fees, which as mentioned, would further reduce the actual return. It should not be assumed that the inversion of these charts is illustrative of actual portfolio performance.

A portfolio of the worst fundamentals did best in the 2018 – 2020 time frame. These were the same years Total Public Equity underperformed. Public Equity continued to invest in a diversified, fundamental-based way.

Results: Internal Equity Program Performance (as of 2/28/23)



	IEM Active				IEM Enhanced Index				IEM Low Volatility			
	1 Yr	3 Yr	5 Yr	Incep	1 Yr	3 Yr	5 Yr	Incep	1 Yr	3 Yr	5 Yr	Incep
Total Active Internal Equity	-6.52	9.08	6.39	7.18	-7.53	10.16	6.94	6.85	-4.10	6.70	5.12	10.77
IEM Benchmark	-7.06	8.66	6.89	6.61	-7.74	9.55	7.18	6.57	-5.35	6.70	6.32	8.94
<i>Excess Returns</i>	0.54	0.42	-0.50	0.57	0.21	0.60	-0.24	0.28	1.25	0.00	-1.20	1.83
<i>Realized Tracking Error</i>	0.99	1.41	1.22	1.06	1.01	1.25	1.08	0.83	1.96	2.28	2.05	2.73
<i>Realized Information Ratio</i>	0.54	0.30	-0.41	0.54	0.21	0.48	-0.22	0.33	0.64	0.00	-0.59	0.67

Managers: Public Equity Top 5



Name	Mandates	# of Mandates	% of Program
VRS Internal Equity	Global, U.S., Non-U.S., Emerging	7	45%
LSV	Global, Non-U.S. Small, U.S. Small	3	9%
Arrowstreet	Global	1	8%
Baillie Gifford	Global, Emerging	2	5%
Select Equity	Hedge Fund	2	4%
Total			70%

Fixed Income

Parham Behrooz & Greg Oliff
Co-Directors



Agenda: Fixed Income Annual Review Topics



- Overview
- Markets
- Exposures
- Results
- Looking Forward
- Collaboration

Overview: Team Members



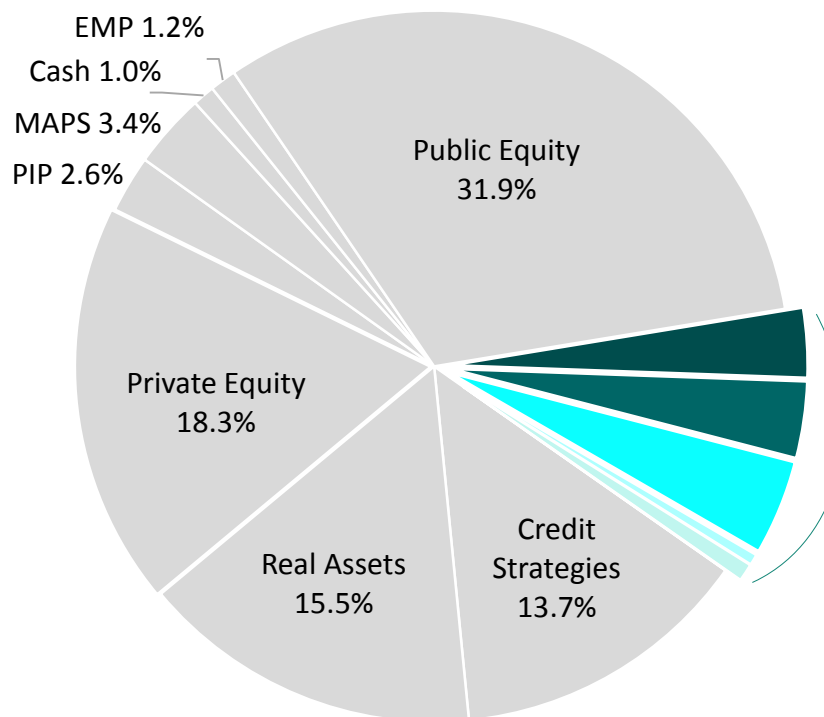
Professional	Position	Highest Degree	Professional Certifications	Investment Experience	VRS Tenure
Parham Behrooz	Co-Director	BS	CFA	26	10
Greg Oliff	Co-Director	MBA	CFA	15	12
Mehtab Haleem	Portfolio Manager	MS		14	2
Teresa Nguyen	Portfolio Manager	MS*	CFA	21	6
Michael Desai	Investment Officer	MS	**	6	2
Moeen Mostafavi	Investment Officer	Ph. D*		<1	<1
Kidus Molla	Investment Analyst	BS	**	1	1
Additional Resources	Investment Operations Department, Portfolio Solutions Group, Management Committee, Operations Team, Compliance Team, and Legal/Regulatory Team.				

* Expected 2023

** CFA Candidate

Overview: Asset Allocation as of 12/31/22

Total Fixed Income = 12.3%



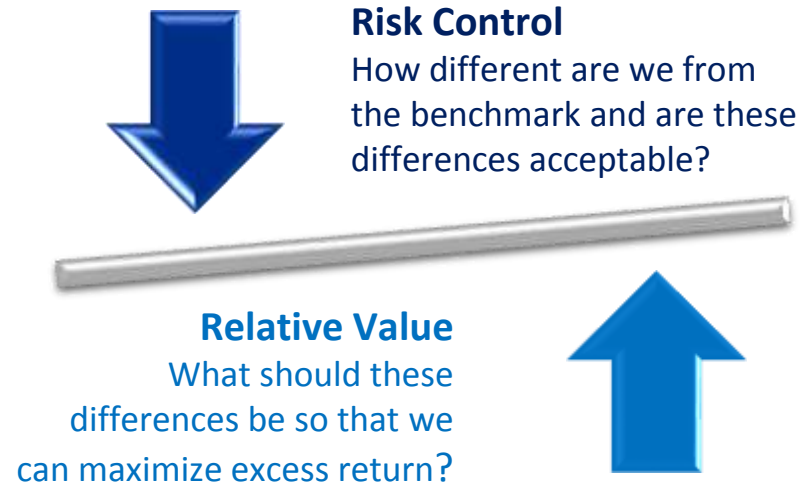
Securitized	4.3%
Government	3.5%
IG Credit	3.1%
Emerging Market Debt	0.8%
High Yield	0.5%
Opportunistic	0.0%
Core Overlay	0.0%
Total FI Overlay	0.0%

Market values as of 12/31/2022; Source: BNY Mellon data

Overview: Philosophy

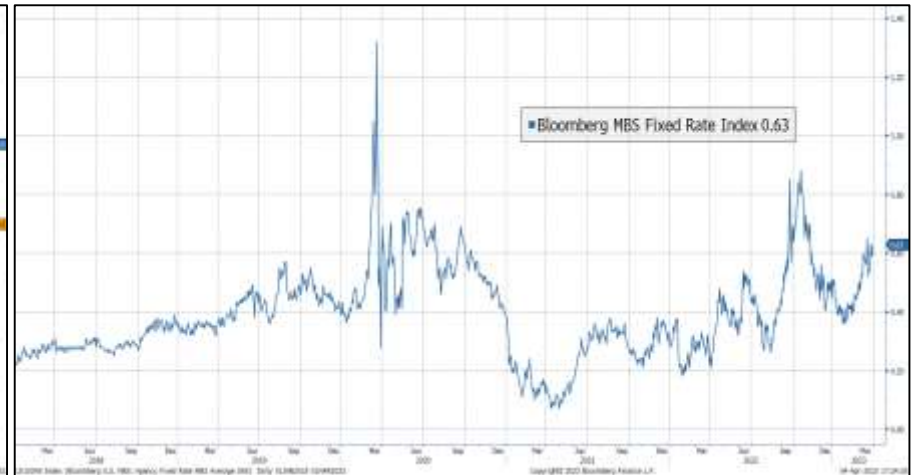
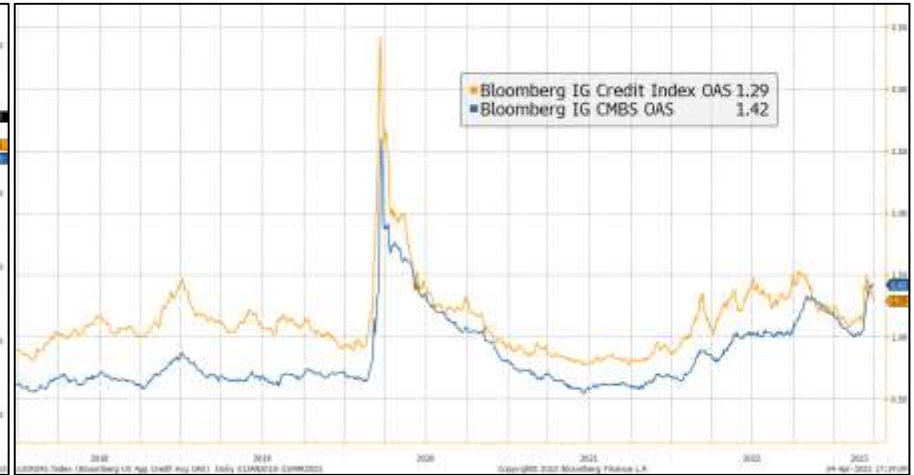
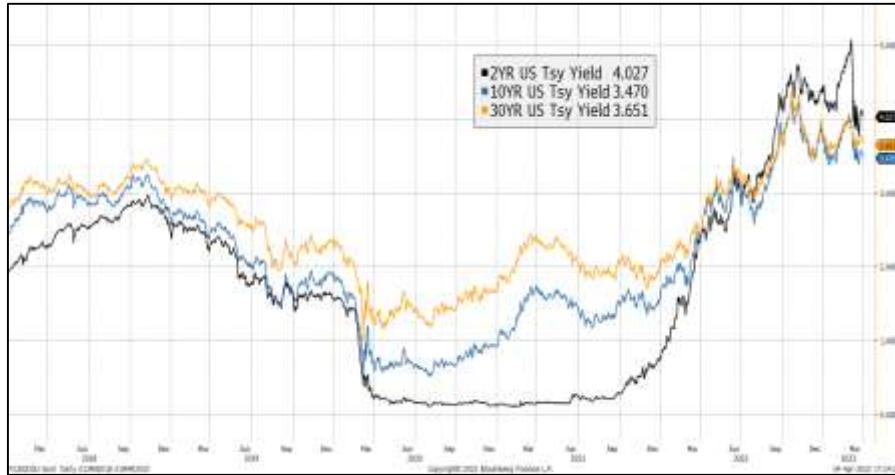
Risk Controlled Relative Value

Market factors provide opportunities to add value through optimal sector allocation and security selection, while managing risk exposures to the benchmark within controlled parameters

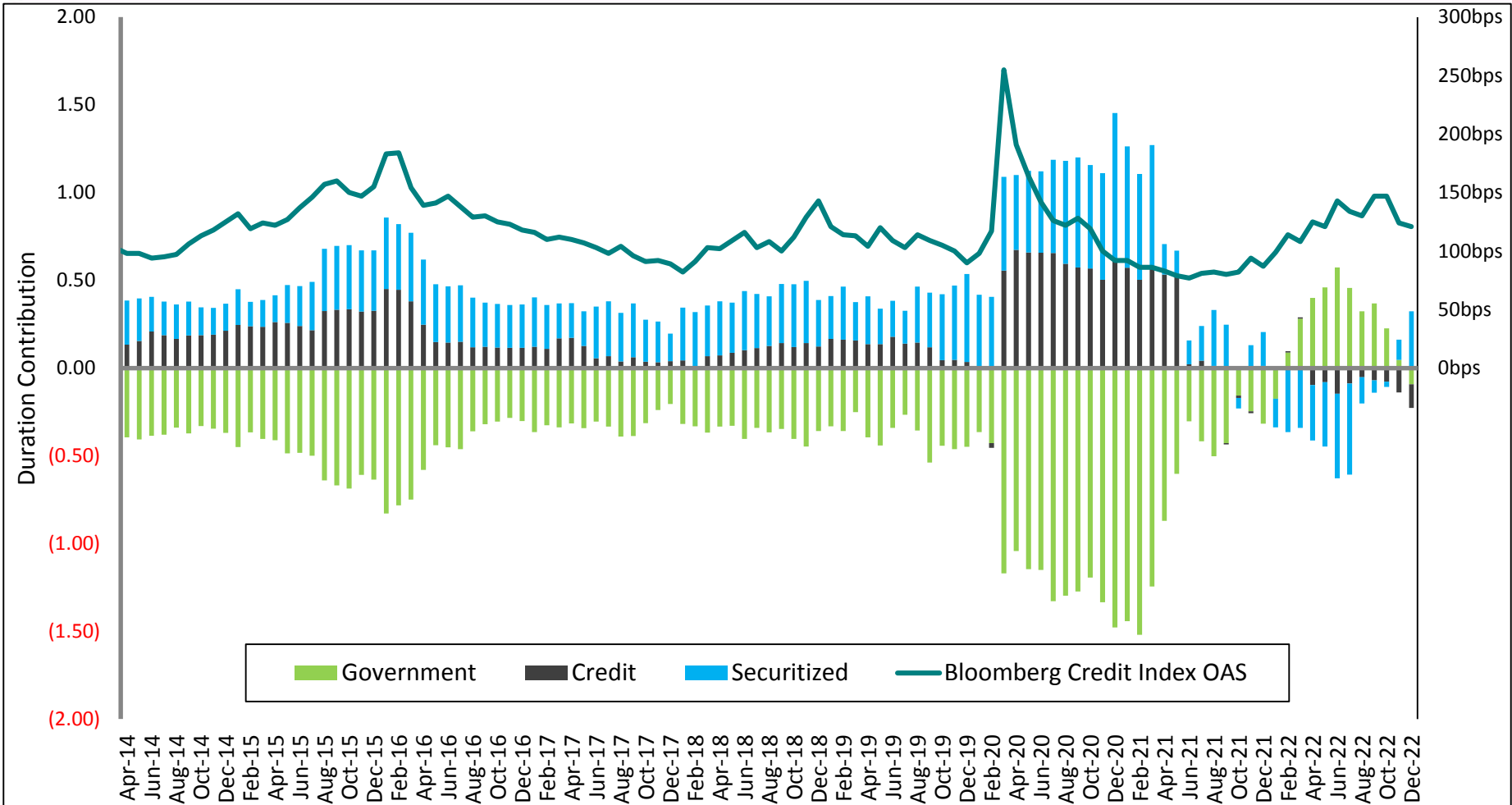


The Fixed Income Program serves as a diversifying asset class, historically providing a hedge against a deflationary economic environment.

Markets: Data: Jan 2018 - Mar 2023

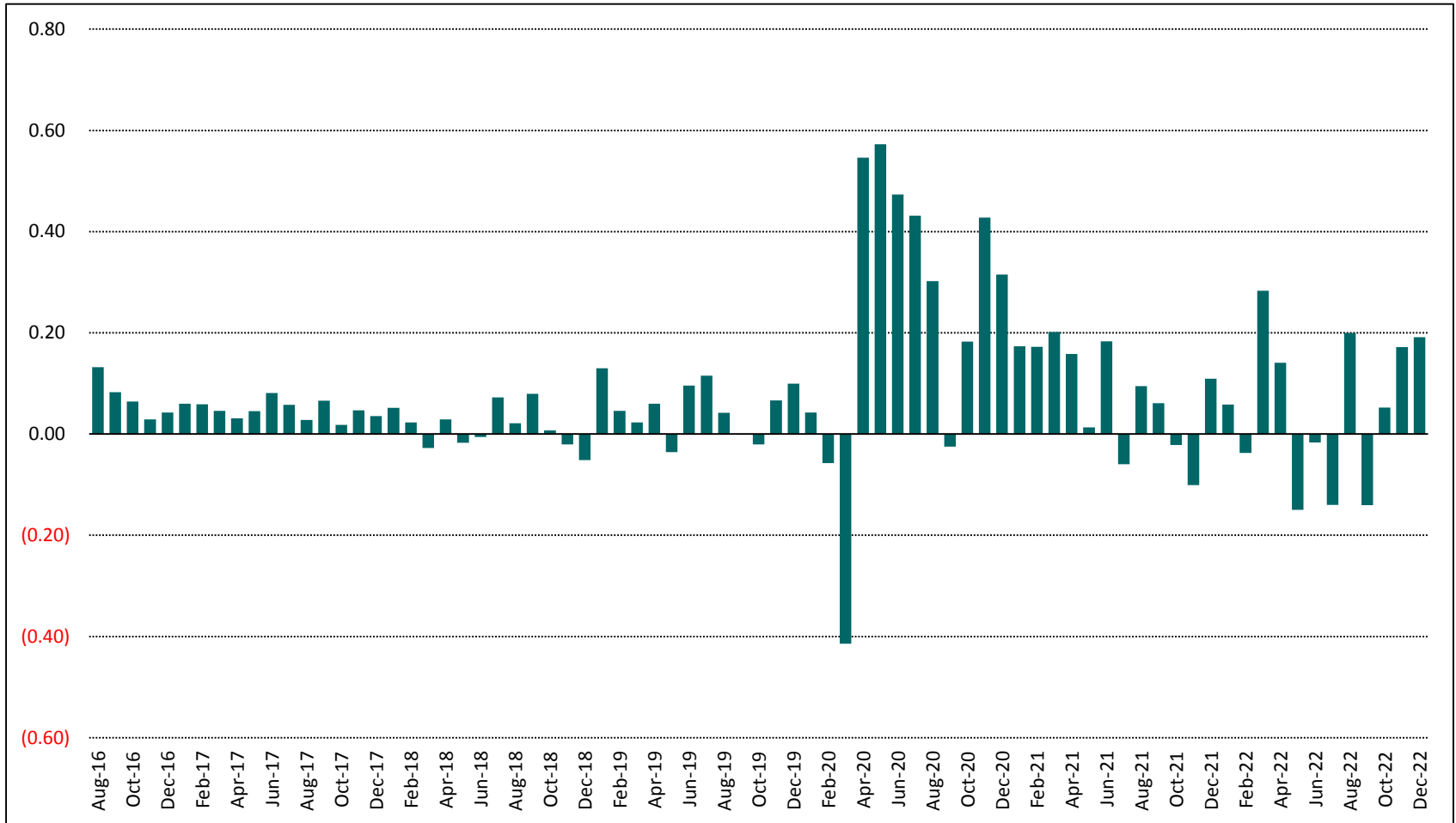


Markets: History of Core Sector Tilts



Source: Aladdin, Bloomberg

Markets: Program Monthly Excess Returns

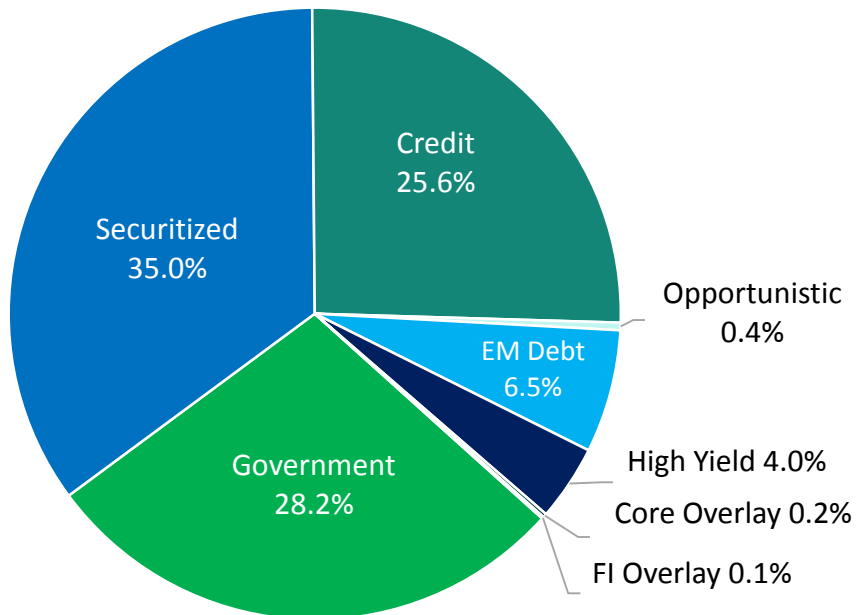


Source: BNY Mellon, VRS

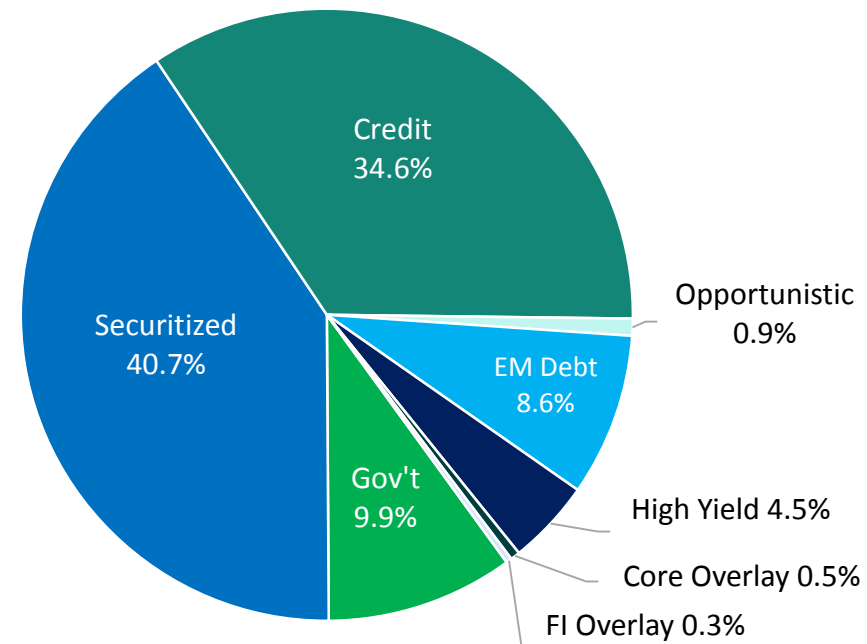
Exposures: Portfolio Positioning Over Time



12/31/2022
\$12.4 Billion



6/30/2020
\$12.5 Billion

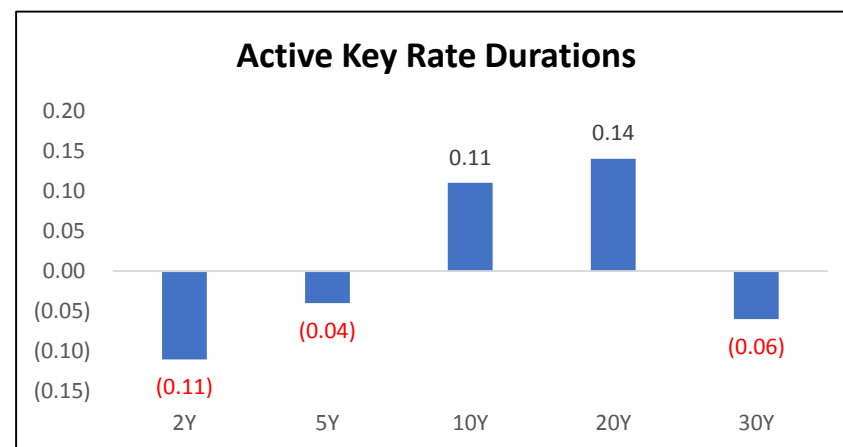
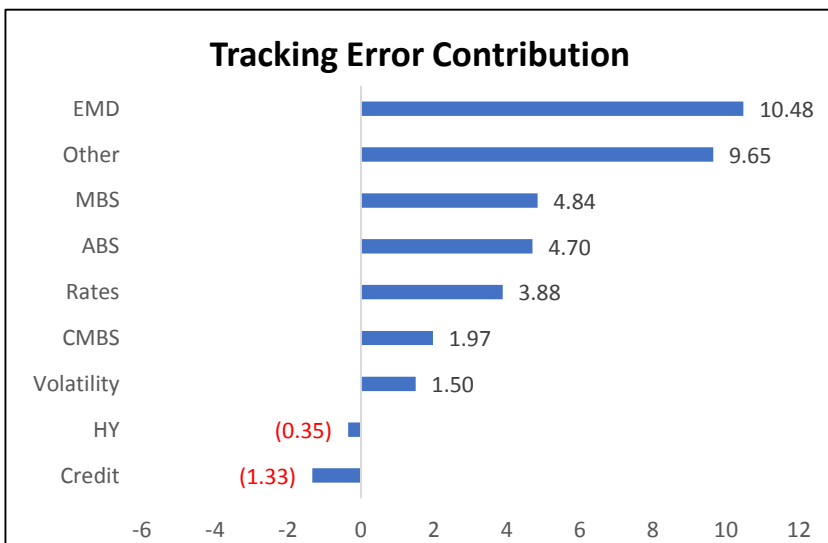
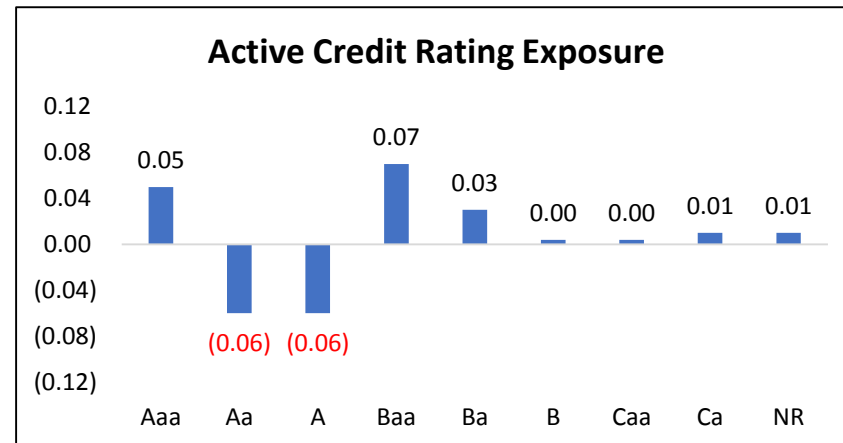


Portfolio	Dec-22	Jun-20	Difference	Portfolio	Dec-22	Jun-20	Difference
Securitized	35.0%	40.7%	(5.7%)	Emerging Market Debt	6.5%	8.6%	(2.1%)
Government	28.2%	9.9%	18.3%	High Yield	4.0%	4.5%	(0.5%)
Credit	25.6%	34.6%	(9.0%)	Opportunistic	0.4%	0.9%	(0.5%)
Core Overlay	0.2%	0.5%	(0.3%)	Total FI Overlay	0.1%	0.3%	(0.2%)

Exposures: Portfolio Characteristics

Total Fixed Income Program Market Value: \$12.4 Billion

Portfolio Characteristics			
	Port	Bench	Diff
Effective Duration	6.34	6.29	0.05
Yield to Maturity	5.17	4.90	0.27
Option Adj. Spread	100	76	24



As of 12/31/2022

Results: Core Portfolio Attribution Factors For CY'22



Program Level

- The Fed tightened rates to a target of 4.25-4.50% into year end
- This substantial tightening resulted in curve inversion, a reduction of monetary stimulus, and elevated rate volatility

Portfolio Level

- Fixed income portfolios opportunistically reallocated to an even more defensive position
- Team worked vigilantly to use active portfolio positioning to take advantage of opportunities and dislocations within sectors
- Security selection added considerably to the Program's excess return for CY'22

Results: FI Program Risk/Return Characteristics



Program Excess Return and Statistics				
	10 Year	5 Year	3 Year	1 Year
Core IFI Program	0.74	1.03	1.44	0.63
Tracking Error	0.42	0.53	0.65	0.38
Information Ratio	1.75	1.95	2.23	1.64
Total FI Program	0.76	1.03	1.43	0.54
Tracking Error	0.47	0.59	0.73	0.52
Information Ratio	1.64	1.74	1.95	1.05

As of 12/31/2022

Batting Average

	Monthly Excess Returns	
Core IFI Program	89/120	74%

Results:

Core Portfolio Risk/Return Characteristics



Portfolio Excess Return and Statistics

	10 Year	5 Year	3 Year	1 Year
Government	0.29	0.30	0.35	0.16
Tracking Error	0.16	0.20	0.26	0.10
Information Ratio	1.75	1.46	1.38	1.57
Securitized	0.76	1.19	1.91	2.46
Tracking Error	0.69	0.94	1.16	1.67
Information Ratio	1.09	1.27	1.65	1.47
Credit	0.71	0.80	0.86	0.39
Tracking Error	0.33	0.30	0.34	0.42
Information Ratio	2.17	2.65	2.52	0.93
Opportunistic	–	1.31	2.07	2.16
Tracking Error	–	1.76	2.16	3.62
Information Ratio	–	0.75	0.96	0.60

As of 12/31/2022

Results: EM/HY Portfolio Risk/Return Characteristics



Portfolio Excess Return and Statistics			
	Since Inception*	3 Year	1 Year
Internal EMD	0.55	0.73	1.14
Tracking Error	0.97	1.03	1.58
Information Ratio	0.57	0.71	0.72
Payden & Rygel EMD	1.12	1.12	1.59
PIMCO EMD	0.98	0.98	1.56
Internal High Yield	0.64	0.46	2.93
Tracking Error	1.27	1.33	1.63
Information Ratio	0.51	0.35	1.80
Man Numeric High Yield	0.71	–	0.02

As of 12/31/2022

*Inception dates: Internal EMD Portfolio 11/2018, Internal HY Portfolio 7/2019, External EMD Portfolio 1/2020, Man Numeric HY 7/2020

Results: 2023 Update



Noteworthy items:

- During February, we reallocated \$500 million from fund level cash into Fixed Income
- Given tight valuations across credit sectors and recent volatility, we used the inflow to further the portfolio's defensive positioning
- Volatility within the fixed income market remains elevated
 - 2/1 and 3/22 – Fed Rate Hikes (+25bps each time)
 - 3/10 – SVB/Signature Events

2023 Program Return Snapshot

	Jan-23	Feb-23
Core FI Portfolio	3.14	(2.48)
Benchmark	3.08	(2.59)
Excess Return	0.06	0.11
Total FI Program	3.18	(2.40)
Benchmark	3.11	(2.52)
Excess Return	0.07	0.12

Looking Forward: Where Are We focusing?



Continue To Implement Long Term Vision For The Program

Actively Finding Ways To Collaborate Across Teams to Add Value to VRS

On The Radar

- Enhancements to portfolio processes and portfolio management tools
- Emphasize cross training throughout the program
- Cross-asset class working groups to enhance expertise
- Expand into more value-adding ideas in the Opportunistic Portfolio

Collaboration: Across the Fund



Portfolios

- IEM: Systematic High Yield & Total Fund Rebalance Portfolio
- RBI: RBI Risk Hedging Portfolio
- Operations: Collateral Management Portfolio

People

- Intentional Touch Points Across Programs
- External Manager Partnership Sessions
- Factor Based Investing and Quantitative Tool Exploration
- Individual Team Member Collaboration

Public Equity

Dan Whitlock and Dan Schlusser
Program Directors

“Basically, experience in finance with a discount rate near zero is like having studied physics except without gravity.”

- Mathematician Nassim Nicholas Taleb



Agenda: Public Equity Annual Review Topics



- Overview
- Markets
- Exposures
- Results
- Mandates
- Looking Forward

Overview: Public Equity Team Members



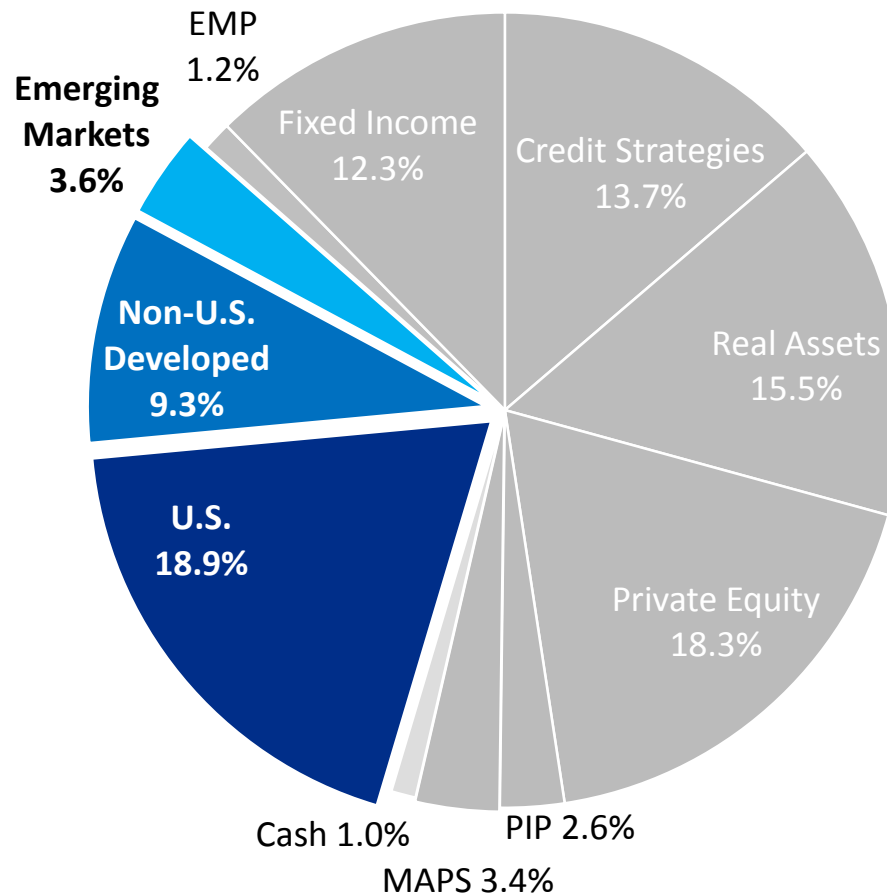
Professional	Position	Highest Degree	Professional Certifications	Investment Experience	VRS Tenure
Dan Whitlock	Director	MBA	CFA, CAIA	21	21
Stephen Adelaar	Portfolio Manager	MS	CFA	23	16
Holly Glass	Portfolio Manager	MA	CFA	22	22
Olga Zozulya	Investment Officer	MBA	CFA	10	10
Korey Turner	Senior Investment Analyst	MS/MBA		3	3
Kelly Baker	Portfolio Assistant	AAS		13	8
Additional Resources	The entire Internal Equity Team, Portfolio Solutions Group, Governance Team, Management Committee, Operations Team, Compliance Team, and Legal/Regulatory Team.				

Overview: Public Equity Team & Process



	<u>Stephen Adelaar</u>	<u>Holly Glass</u>	<u>Korey Turner</u>	<u>Olga Zozulya</u>	<u>Daniel Whitlock</u>
Strategy Lead	Defined Contribution Emerging Markets Hedge Funds	<i>IEM Group (Italics)</i> Risk Management Transition Management United States	Tilt Monitoring	Global Equity International Developed	Total Public Equity
Analyst	Afton (IEM) Arisaig Global EM Cons Baillie Gifford Global Baillie Gifford EM LSV Global LSV Non-U.S. Small Cap LSV U.S. SC Select - SEG Select - Cooper Square	Acadian EM Acadian Small Cap Advent Convertibles Arrowstreet Global Cevian Eminence Hedge Fund Overlay Mobjack (IEM) Piedmont (IEM) Taiyo	Ariel Global Coatue J.P. Morgan LS ValueAct Capital	CET Energy Dynamics Internal EM (IEM) Jackson Square Lansdowne Global Maverick Nitorum Theleme	Farallon Farallon Healthcare Rivanna

Overview: Public Equity Asset Allocation as of 12/31/22



U.S. Equity	18.9%
Non-U.S. Developed	9.3%
Emerging Market	3.6%
Total Public Equity	31.8%

Overview: Public Equity Philosophy



- **Primary Objective**
Gain exposure to global economic growth & the global equity risk premium
- **Specific Return Objective**
Outperform the strategic benchmark over three to five years
- **Approach**
Risk-adjusted, using both equity hedge funds & low-volatility equity mandates
- **Strategic Benchmark**
MSCI All-Country World Index Investible Markets Index (MSCI ACWI IMI)

Overview: Public Equity Manager Evaluation Framework



Sustainable Risk-Adjusted Returns

- Long history, repeatable process, consistent philosophy
- Sustainable team and firm
- Outperformed in a consistently diversified manner
- Outperformed when considering risk profile
- Sizeable allocations will not impact performance

Doing Things Differently

- Low correlations to existing book (quantitative & qualitative)
- Something VRS cannot produce internally
- Something one of VRS' existing external managers cannot provide
- Employ a different way of thinking or different strategies

Terms & Back Office

- Favorable fees, liquidity, etc.
- Robust back office
- Partnership mentality
- Resources to manage sizeable allocations

Markets: 1 Year Ending 12/31/22



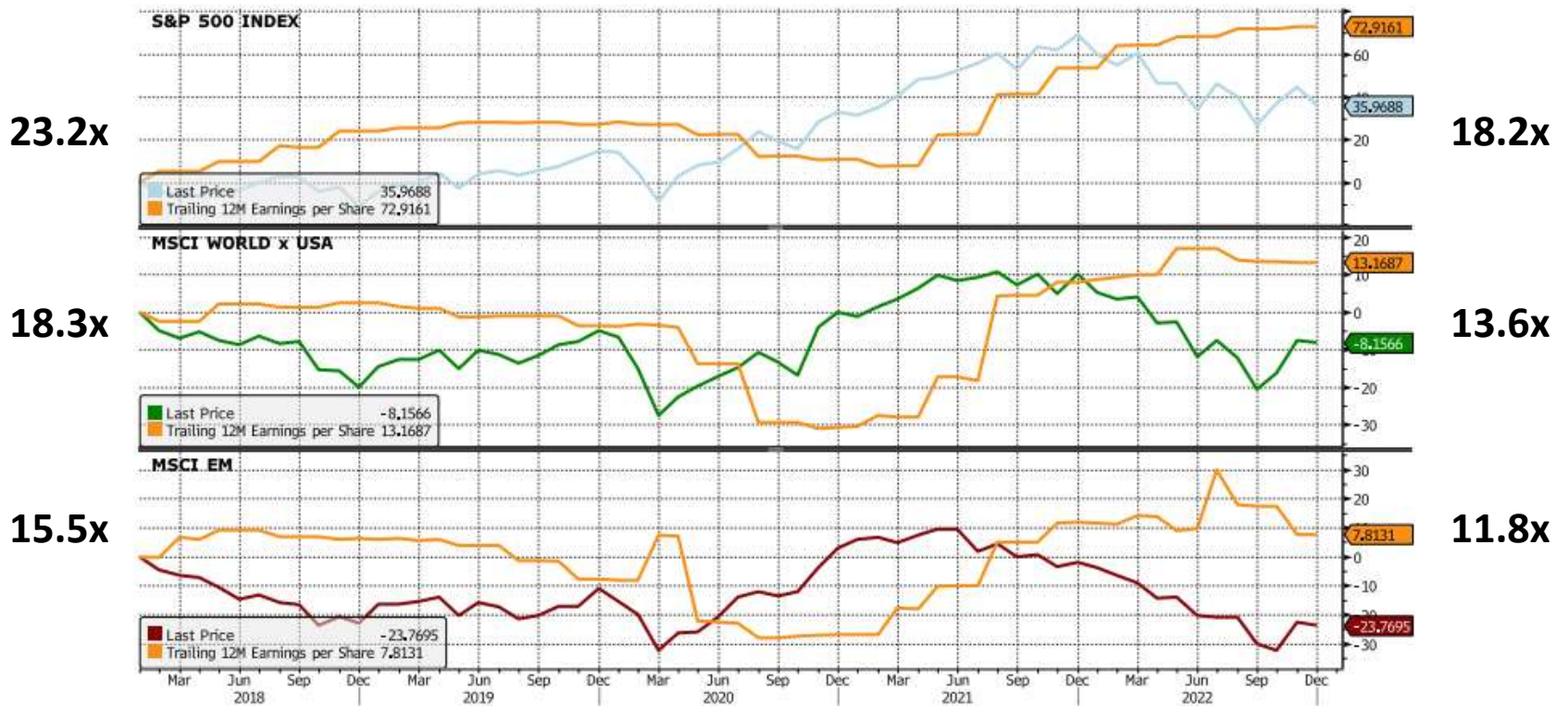
	Global	Developed	Dev ex US	US	EMEA	Pacific	Emerging	EM ASIA	EM LatAm	EM EMEA
All Sectors	-18.4%	-18.1%	-14.3%	-19.9%	-15.2%	-13.0%	-20.1%	-21.1%	8.9%	-28.3%
Energy	33.1%	46.0%	24.6%	62.8%	28.5%	15.3%	-24.3%	2.5%	41.0%	-75.4%
Utilities	-4.7%	-4.7%	-13.1%	0.5%	-13.8%	-13.0%	-4.5%	-6.7%	21.7%	-15.8%
Health Care	-6.1%	-5.4%	-11.3%	-3.1%	-10.2%	-17.3%	-23.5%	-23.8%	-27.1%	-11.4%
Consumer Staples	-6.6%	-6.1%	-12.2%	-1.4%	-13.9%	-11.4%	-10.6%	-11.4%	-1.8%	-21.5%
Financials	-9.8%	-10.2%	-7.0%	-12.7%	-9.2%	-1.6%	-7.9%	-7.1%	17.6%	-16.1%
Materials	-11.6%	-10.8%	-9.5%	-12.5%	-14.8%	-7.8%	-14.9%	-15.2%	11.2%	-31.3%
Industrials	-13.1%	-13.2%	-19.4%	-7.5%	-22.4%	-18.1%	-10.8%	-15.7%	11.1%	35.1%
Real Estate	-24.6%	-25.1%	-21.2%	-26.7%	-41.9%	-15.2%	-18.9%	-24.3%	21.4%	7.5%
Information Technology	-31.1%	-30.8%	-35.5%	-30.1%	-32.8%	-33.3%	-33.4%	-33.5%	2.1%	-36.8%
Consumer Discretionary	-31.8%	-33.4%	-22.0%	-37.8%	-22.0%	-22.9%	-20.8%	-21.6%	-39.6%	-5.2%
Communication Services	-35.5%	-36.9%	-16.1%	-40.9%	-17.6%	-23.2%	-27.0%	-26.5%	-15.4%	-34.7%

Unhedged Total Returns

Sources: MSCI and Bloomberg

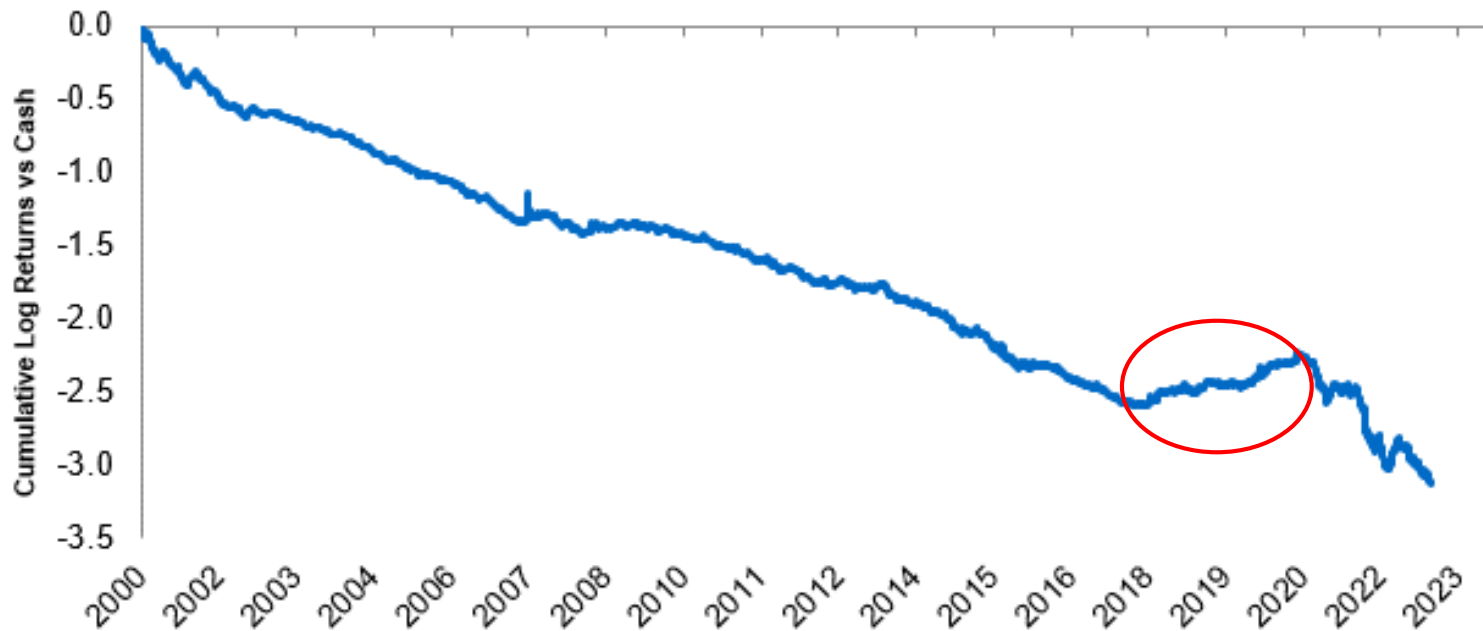
Markets: 5 Years Ending 12/31/22

Percentage Appreciation of Price and Earnings



Source: Bloomberg

Markets: Costanza Portfolio



Source: AQR. For illustrative purposes only. Hypothetical data has inherent limitations, some of which are described in the disclosures. See detailed explanation in the body of this article, and additional disclosures at the end of this article. This hypothetical performance does not reflect the deduction of any management fees, which as mentioned, would further reduce the actual return. It should not be assumed that the inversion of these charts is illustrative of actual portfolio performance.

A portfolio of the WORST fundamentals did best in the 2018 – 2020 time frame. These were the same years Total Public Equity underperformed. Public Equity continued to invest in a diversified, fundamental-based way.

Exposures: Public Equity Positioning as of 12/31/22

\$30.4 Billion
30.4% of Plan Assets

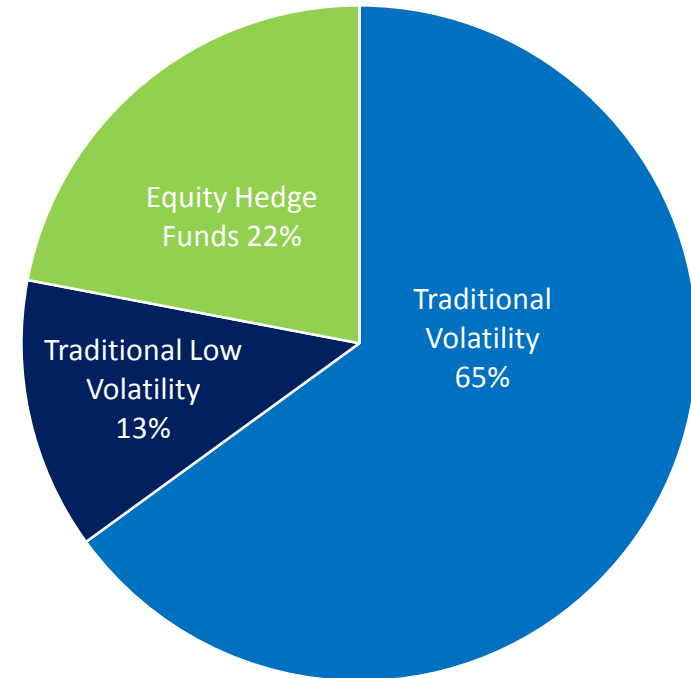
57% Domestic (-2.1% vs. bmk)
31% Non-US Developed (+2.0% vs. bmk)
12% Emerging Markets (+0.2% vs. bmk)

69% Active
31% Enhanced

45% Internal
55% External

65% Traditional Volatility
13% Traditional Low Volatility
22% Equity Hedge Funds

0.94 Beta
1.70% Forecasted Active Risk (Barra)



27 External Mandates (13 Traditional & 14 HFs)
21 External Managers (9 Traditional & 12 HFs)

Exposures: Public Equity Portfolio Changes as of 12/31/22



2022 was a Year of Action:

Raised ~\$1.6 billion for plan needs

Rebalanced another ~\$2.1 billion within Public Equity

Out of this, a combined ~\$3.2 billion of flows came from HF's and Low Vol to lower active risk, lock in relative gains during selloff, gain liquidity.

Total PE	2021	2022	Difference
Traditional	58%	65%	7%
Low Volatility	18%	13%	-5%
Hedge Funds	24%	22%	-2%
Active	74%	69%	-5%
Enhanced	26%	31%	5%
Internal	39%	45%	6%
External	61%	55%	-6%
AUM (billions)	38	30	(7)
% of Total Fund	35%	30%	-5%

Exposures: Public Equity

Portfolio Characteristics as of 12/31/22



Portfolio Characteristics	Program	Benchmark	
Dividend Yield	3.2%	2.8%	●
Price to Book	2.1	2.4	●
Price to Earnings (F12)	13.0	14.5	●
Price to Earnings (T12)	13.7	16.1	●
Return on Equity	15.8%	13.9%	●
Debt to Assets	21.2%	22.7%	●
Sales Growth	10.4%	10.4%	●
Net Income Growth	8.5%	5.6%	●
Profit Margin	9.2%	9.2%	●

Great Value, Better Quality, and Attractive Growth Profiles

Results: Public Equity

As of 12/31/22



	10 Year	5 Year	3 Year	1 Year
Total Public Equity	8.39	5.11	4.67	-15.19
Strategic Benchmark	8.21	5.41	4.39	-18.06
Excess Return	0.18	-0.30	0.28	2.87
Beta vs. Strategic Benchmark*	0.95	0.94	0.93	
Alpha**	0.48	-0.12	0.41	
Active Risk vs. Strategic Benchmark***	1.50	1.98	2.48	
Information Ratio vs. Strategic Benchmark****	0.12	-0.15	0.11	

*Measure of volatility, or systematic risk, of a portfolio in comparison to a benchmark

**Risk-adjusted excess return (accounts for market beta)

***A relative risk measure otherwise known as tracking error, this is the standard deviation of returns relative to a benchmark

****A measure of excess return per unit of relative risk (Portfolio Returns - Benchmark Returns) / Active Risk

VRS Public Equity has outperformed in seven of the last ten calendar years, underperforming in only 2018 - 2020

Results: Public Equity Regional Breakout As of 12/31/22



	10 Year	5 Year	3 Year	1 Year	MV (\$M)
Total Public Equity	8.39	5.11	4.67	-15.19	30,427
Strategic Benchmark ¹	8.21	5.41	4.39	-18.06	
Excess Return	0.18	-0.30	0.28	2.87	
U.S. Program	11.67	8.29	7.00	-17.53	9,891
U.S. Benchmark ²	11.97	8.81	7.17	-19.13	
Excess Return	-0.30	-0.52	-0.17	1.60	
Non-U.S. Developed Program	6.83	1.83	1.43	-11.57	4,609
Non-U.S. Developed Benchmark ³	6.57	2.91	1.67	-14.86	
Excess Return	0.26	-1.07	-0.24	3.29	
Emerging Market Program	1.58	-1.60	-1.53	-18.23	2,142
Emerging Market Benchmark ⁴	1.69	-1.05	-1.78	-19.79	
Excess Return	-0.11	-0.55	0.25	1.56	
Global Program	10.24	6.52	6.20	-12.60	7,135
Global Benchmark ⁵	9.01	6.00	4.50	-18.01	
Excess Return	1.23	0.52	1.71	5.41	
Equity Hedge Fund Program	6.07	4.25	4.35	-15.45	6,643
Equity Hedge Fund Program Benchmark ⁶	5.12	4.04	4.44	-18.06	
Excess Return	0.95	0.21	-0.09	2.61	

Please see endnotes for detail on benchmarks

Results: External Manager Breakout As of 12/31/22



	10 Year	5 Year	3 Year	1 Year
External Managers (net of fees)	7.70	4.84	4.77	-15.01
Associated Market Cap Benchmarks	7.41	4.70	4.03	-18.32
Excess Return	0.29	0.15	0.73	3.31
Beta vs. Benchmarks*	0.94	0.94	0.92	
Alpha**	0.62	0.29	0.87	
Active Risk vs. Benchmarks***	2.25	2.84	3.49	
Information Ratio vs. Benchmarks****	0.13	0.05	0.21	

*Measure of volatility, or systematic risk, of a portfolio in comparison to a benchmark

**Risk-adjusted excess return (accounts for market beta)

***A relative risk measure otherwise known as tracking error, this is the standard deviation of returns relative to a benchmark

****A measure of excess return per unit of relative risk (Portfolio Returns - Benchmark Returns) / Active Risk

VRS Public Equity external managers have had a low excess return correlation (diversification) to internal management over time and have added value net of all fees.

Results: Public Equity

CY 2022 Attribution Deeper Dive



2022 Performance Factor Attribution

Note: Attribution an estimate and does not contain fees, intra-month trading, t-costs, etc.; some categories that are not material were left off.

Factor Impact Summary:

- An overweight to U.S. Value was the largest contributor to Style.
- The low beta approach was a tailwind in falling markets (after a headwind for several years).
- An underweight to the U.S. added.
- Stock Selection was negative, primarily due to being underweight some energy names that were up a large amount.

Attribution	Value (%)
Portfolio Base Return	-14.8%
Benchmark Base Return	-17.9%
Excess Return	3.1%
Currency	0.0%
Market Timing	1.2%
Country Allocation	0.6%
Selection	1.3%
Industry	0.0%
Style	1.7%
Specific Return	-0.3%

Results: Public Equity

As of 12/31/22



	1 Year
Total Public Equity	-15.19
Strategic Benchmark ¹	-18.06
Excess Return	2.87

Large One Year Absolute Return Contributors:

Positive: Non-U.S. program was down -11.6% with a 15% weight

Negative: U.S. Program was down -17.5% with a 33% weight

Large One Year Relative Return Contributors:

Positive: Value exposure, Low Volatility Managers, HF Managers

Negative: Growth exposure

Please see endnotes

Results: Public Equity 2023 Update



2022/2023 Performance Factor Attribution*

Factor Impact Summary:

- Lower beta that protected capital in 2022 detracted in the first two months of 2023.
- Underweights of growth names in 2022 that contributed to stock outperformance in 2022 led to underperformance in January and February.
- Generally, January 2023 was a low-quality rally by several fundamental metrics.

Attribution	2022	2023 (through Feb)
Portfolio Base Return	-14.8	4.1
Benchmark Base Return	-17.9	4.4
Excess Return	3.1	-0.4
Currency	0.0	0.0
Market Timing	1.2	-0.3
Country Allocation	0.6	0.0
Selection	1.3	-0.1
Industry	0.0	0.0
Style	1.7	0.0
Stock Specific Return	-0.3	-0.2

*Attribution is an estimate and does not contain fees, intra-month trading, t-costs, etc.; some categories that are not material were left off.

Managers: Public Equity Top 5



Name	Mandates	# of Mandates	% of Program
VRS Internal Equity	Global, U.S., Non-U.S., Emerging	7	45%
LSV	Global, Non-U.S. Small, U.S. Small	3	9%
Arrowstreet	Global	1	8%
Baillie Gifford	Global, Emerging	2	5%
Select Equity	Hedge Fund	2	4%
Total			70%

Managers: Public Equity Hires & Terminations – 1 Year



Action	Effective Date	Commitment/ Current Value	Funding/ Defunding Period	Description
Closed	2/28/2022	\$200 Million	< 1 Month	Kylin* A China, Korea, and Japan oriented equity hedge fund
Terminated	7/18/2022	\$270 Million	Immediate	Nordea Emerging Markets Long only emerging markets manager
Hire	8/1/2022	\$250 Million	Immediate	CET Energy Dynamics A long/short equity hedge fund focused on the energy sector
Terminated	8/4/2022	\$1,200 Million	Immediate	Nordea Global Long only global markets manager
Hire	9/1/2022	\$750 Million	Immediate	Rivanna An internally managed active global equity strategy

*The manager is considered DIME under the Commonwealth of Virginia definition, which defines ownership threshold of 51% or more

Managers: Diverse Investment Management Engagement (DIME)



Women & Minority Owned Management Firms Currently In The Lineup

- Ariel managing VRS assets since 2014
African-American, Asian-American & women-owned global equity manager
- Advent managing VRS assets since 2011, Public Equity assets since 2020
African-American owned convertible manager

Continue To Meet With New Prospects & Consider New Investments

- 86 meetings with minority managers or consultants in last 5 years
- 223 meetings since we started tracking this in late 2009

Appendix

Due Diligence: Constant Re-Underwriting

Existing Portfolio

- **Qualitative:** long-term relationships, frequent communication, monitor organizations & personnel
- **Quantitative:** monitor exposures & performance & risk, risk budget drives allocation, identify new strategic & tactical tilts

Assess Opportunity

- **Qualitative:** identify attractive investments, identify talented managers, utilize network of contacts
- **Quantitative:** multiple data sources/screen universe, identify potential manager, evaluate performance & risk of prospects

Manager Due Diligence

- **Qualitative:** face to face manager meetings, review firm strategy & process, detailed portfolio reviews, reference checks
- **Quantitative:** due diligence of existing managers, attribution, verify performance, assess risk

Portfolio Construction & Risk Management

- **Qualitative:** bottom-up portfolio construction, look for organizational “cracks” & process changes
- **Quantitative:** review targeted policy allocation & portfolio tilts, determine benchmark & manager allocations, perform risk analysis, monitor exposures



¹Effective February 2020, this is the MSCI ACWI IMI (net VRS tax rates) index; prior periods included several other representative benchmarks.

²Effective March 2017, this is a weighted average of MSCI U.S. Standard and MSCI U.S. Small Cap indices; prior periods are other representative benchmarks

³Effective February 2020, this is a weighted average of MSCI World ex U.S. Standard (net VRS tax rates) and MSCI World ex U.S. Small Cap (net of VRS tax rates) indices; prior periods are other representative benchmarks

⁴Effective April 2009, this is the MSCI Emerging IMI (net of VRS tax rates); prior periods are other representative benchmarks

⁵Effective February 2020, this is the MSCI ACWI Standard (net of VRS tax rates) index; prior periods are other representative benchmarks

⁶Effective February 2020, this is the MSCI ACWI IMI (net of VRS tax rates) index; prior periods are other representative benchmarks

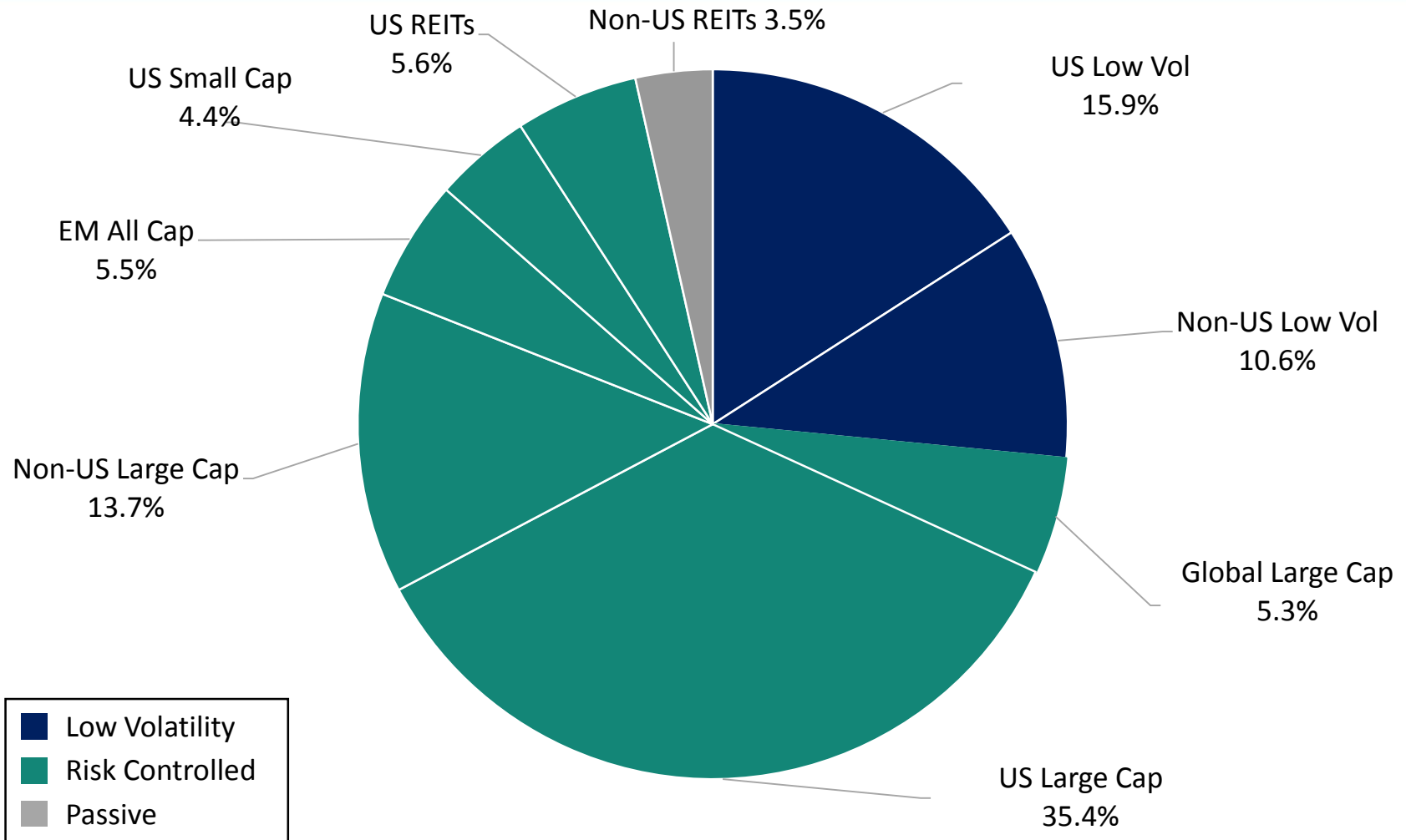
Internal Equity

Overview: Internal Equity Team Members



Professional	Position	Area(s) of Focus	Highest Degree	Professional Certifications	Investment Experience	VRS Tenure
Dan Schlussler	Program Director	Non-U.S. Dev Low Vol, Research	MBA	CFA	27	10
Joe Kennebeck	Sr. Investment Officer	Head Trader	BA		30	16
Ryan Carlson	Portfolio Manager	U.S. REIT & Small Cap, Investment Tools	BS	CFA	20	3
Aaron Lazar	Investment Officer	Currency Hedge, Global Enhanced Transition, U.S. REIT, Swaps & Equity Trading	MA	Passed CFA Level 1	9	9
Vu Le	Portfolio Manager	Global Enhanced, Research, Currency Hedge	PhD	CFA	12	11
Alex Muniz	Sr. Portfolio Manager	U.S. Low Volatility, Research	MA	CFA	22	22
Garret Rhodes	Investment Officer	Non-U.S. Dev Low Vol, Global Enhanced, Currency Hedge, Swaps Trading	MS	CFA	4	4
Larry Tentor	Portfolio Manager	Global Enhanced Transition, Data Infrastructure	PhD	FRM	21	15
Weldon Wirick	Portfolio Manager	Emerging Markets, Trading	MA	CFA	21	17
Matthew Lacy	Director of Portfolio Integration (PSG)	U.S. Large Cap	MA	CFA	24	24
Additional Resources	Investment Operations Department Portfolio Solutions Group Investment Decision Support					

Overview: Internal Equity Asset Allocation as of 12/31/22



Overview: Internal Equity Asset Allocation Changes



2022 – 2023 Portfolio Actions:

Launched Global Enhanced Index Strategy in September

Began reallocation of US and non-US Developed Large Cap assets to Global Enhanced in 1st Quarter 2023

Reallocated most of REIT strategy assets and completed redesign of US component for Public Equity

Total IEM	2021	2022	2023 (Feb)	Difference
Risk Controlled				
US Large Cap	40%	35%	7%	-33%
Non-US Large Cap	14%	14%	0%	-14%
Global Lap Cap	0%	5%	52%	52%
Total Large Cap Developed	54%	54%	60%	5%
US Small Cap	5%	4%	5%	0%
EM All Cap	3%	5%	6%	3%
US REITs	5%	6%	2%	-3%
Total Risk Controlled	68%	70%	73%	5%
Low Volatility				
US Low Vol	18%	16%	16%	-1%
Non-US Low Vol	12%	11%	11%	0%
Total Low Volatility	29%	27%	28%	-2%
Total Active	97%	96%	100%	4%
Non-US REITs (Passive)	3%	4%	0%	-3%

Overview: Internal Equity Philosophy

Provide Cost Effective Access To The Equity Risk Premium



Provide Risk-Controlled Value Added



Provide Insights Into The Capital Markets



Complement The Total Public Equity Program

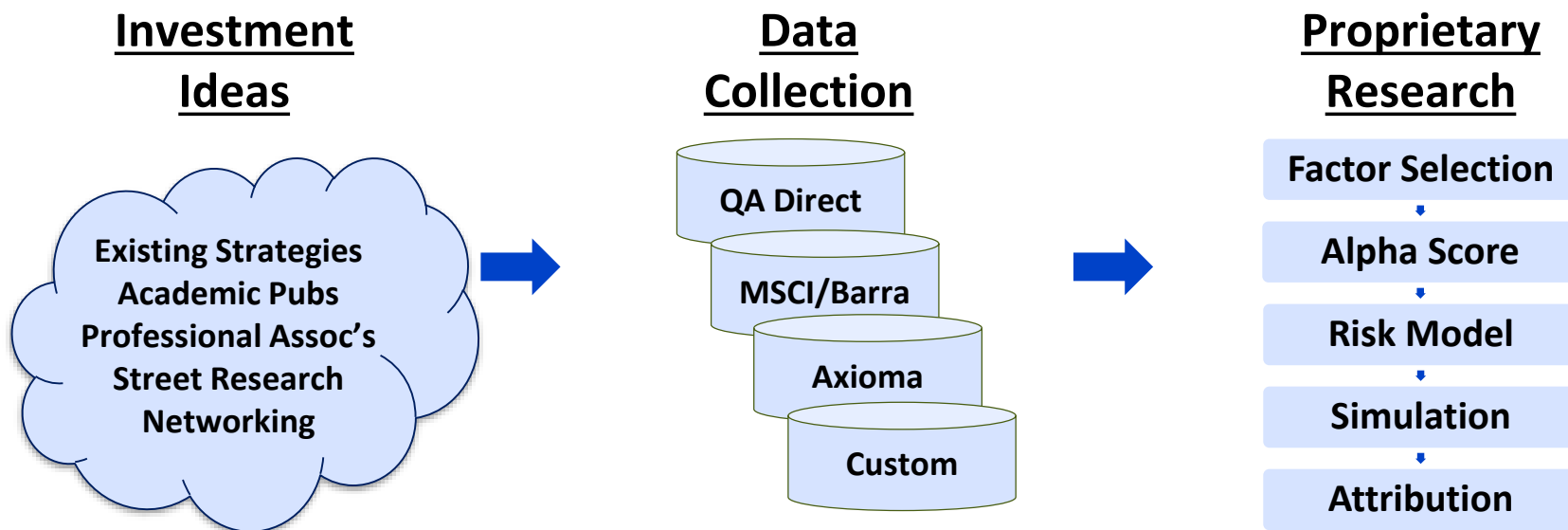
Overview: Internal Equity Philosophy

Philosophy – Risk Controlled Relative Value

- Markets are relatively efficient
- Behavioral biases create exploitable opportunities
- Systematic strategies are effective at capitalizing on these opportunities



Overview: Internal Equity Research Process



Overview: Internal Equity Factor Selection & Alpha Score

Valuation
Discounted Cash Flow
Relative Valuations



Quality
Prudent Accounting
Return on Equity



Market Sentiment
Momentum
Analyst Revisions



Composite Score

- DCF models provide robust estimates of intrinsic value
- RV models compare stocks within cohorts using accounting metrics
- Valuation models identify stocks trading at a discount or premium

- Cash based earnings are preferred to accrual-based earnings
- High & stable profitability help to avoid value traps
- Quality captures accounting strength & management efficiency

- Stock price movements show persistence in the intermediate term
- Analyst revisions have a predictable impact on stock prices
- Market sentiment indicates potential investment opportunities

Composite score identifies stocks that are trading at a discount, have superior management & positive market recognition

Overview: Internal Equity Portfolio & Risk Management



Quantitative

Statistical Risk	<ul style="list-style-type: none">• Fundamental Multifactor Risk Models• PCA Risk Models
Factor Constraints	<ul style="list-style-type: none">• Relative or Total Risk• Return & Risk Factors• Industries, Sectors, Countries, Regions, etc.

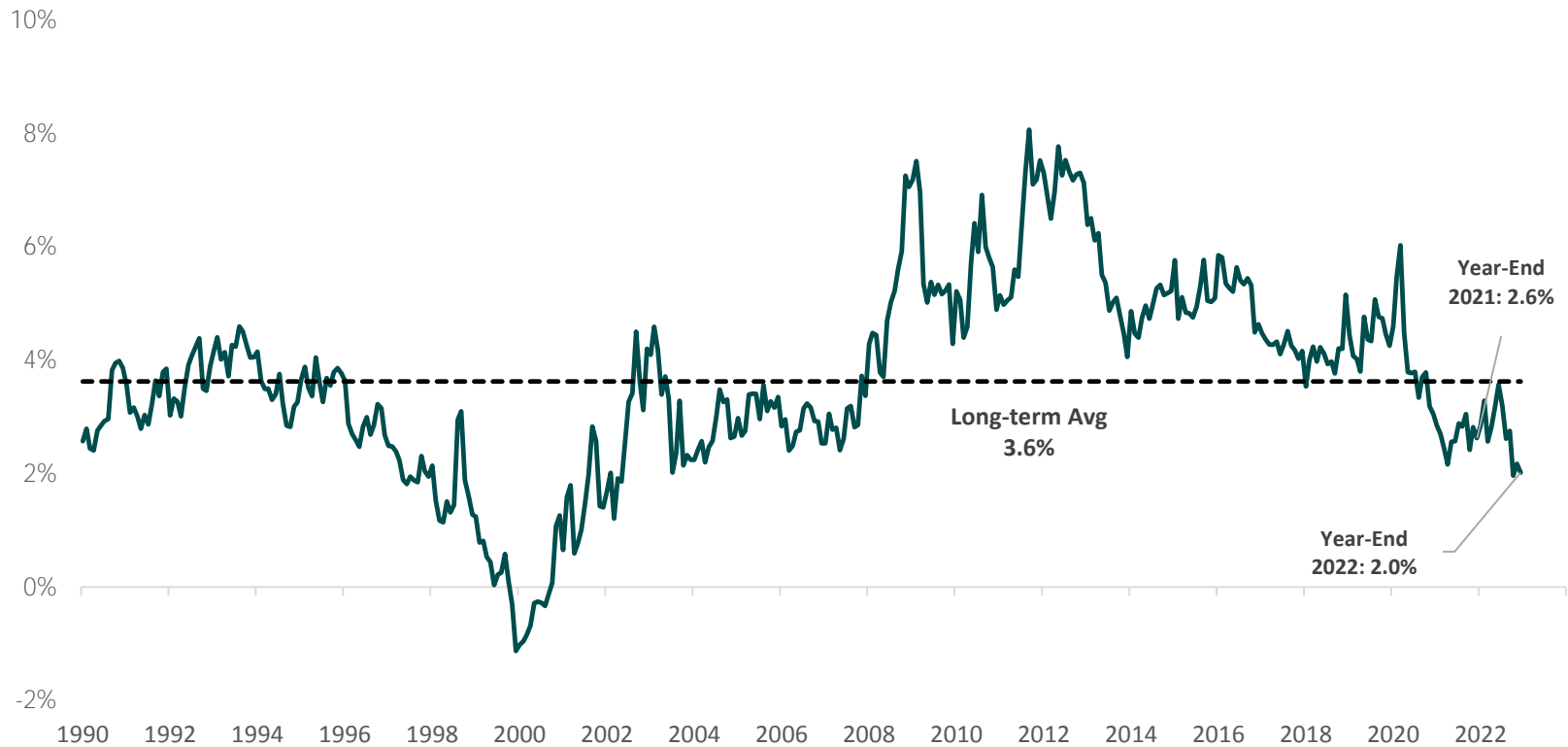
Qualitative

Fundamental & Non-Modeled Risks	<ul style="list-style-type: none">• Forensic Accounting, Shorting Activity, etc.• Individual Stock Modeling Tools
Expert Assessment	<ul style="list-style-type: none">• Continuous Monitoring• Thematic Trend Analysis• Proprietary Research

Markets: Internal Equity Equity Risk Premium



US Equity Risk Premium

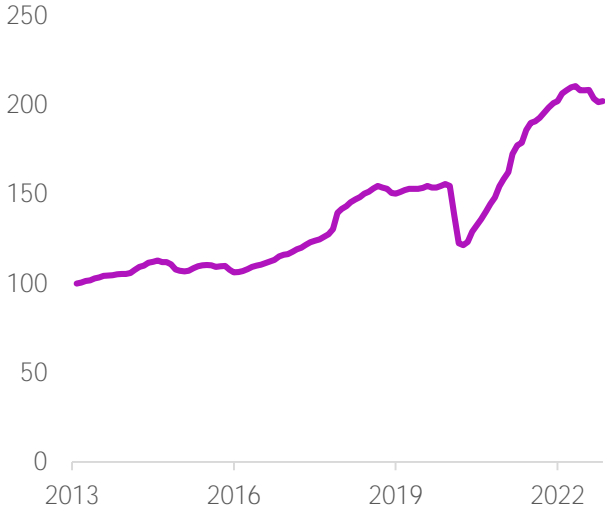


Source: Credit Suisse HOLT

Markets: Internal Equity Equity Risk Premium



Forecast EPS
(Indexed to 100)



US Government Yields

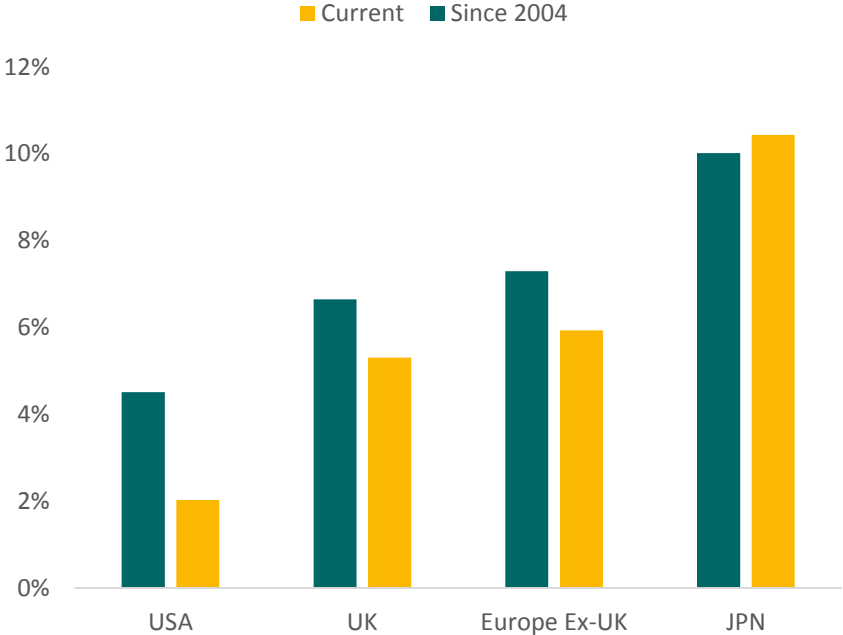


Source: Credit Suisse HOLT

Markets: Internal Equity Equity Risk Premium (As of 12/31/22)

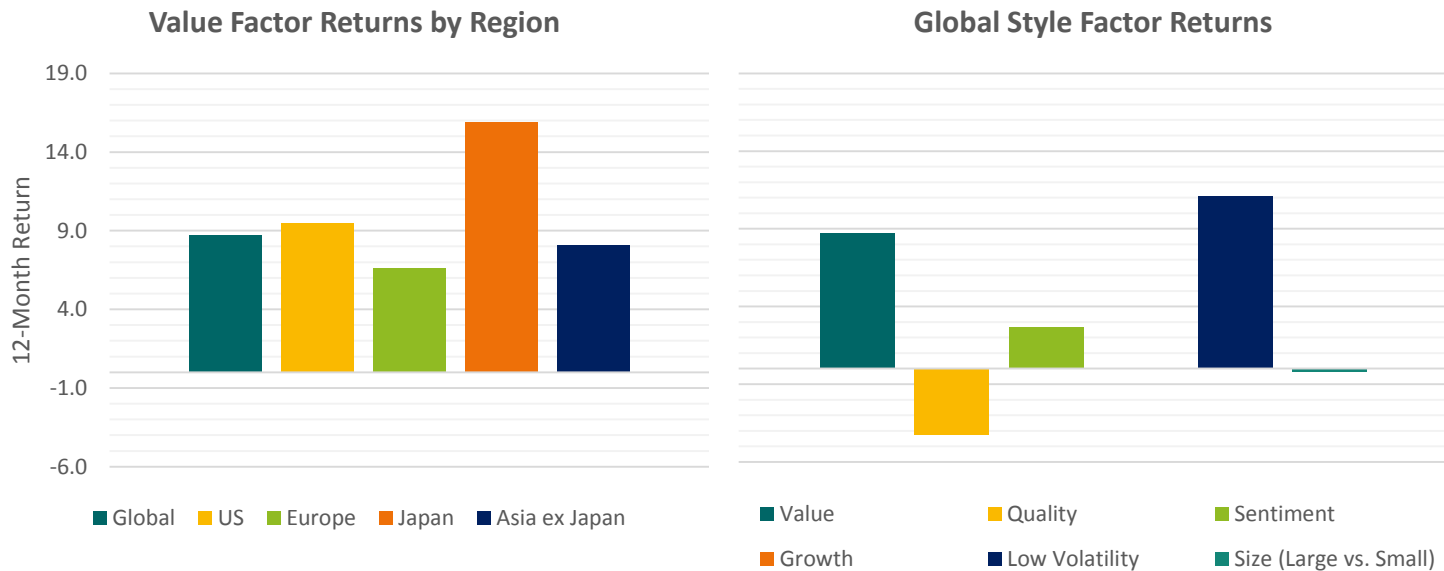


Equity Risk Premium by Region



Source: Credit Suisse HOLT

Markets: Internal Equity Factor Returns (2022)



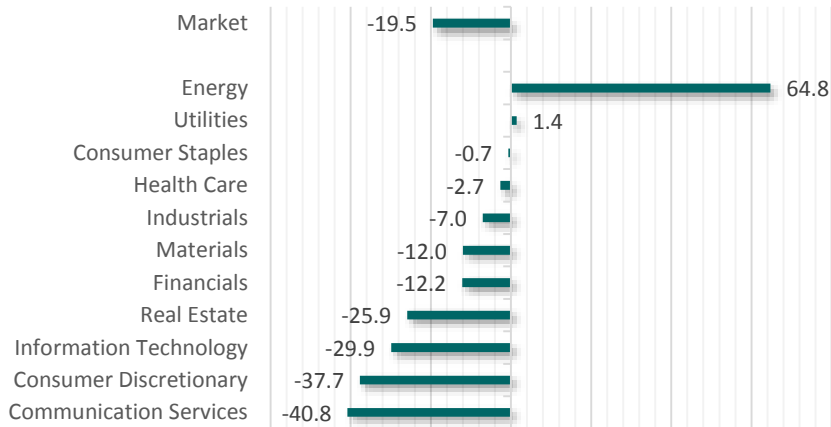
Source: UBS
 Long Minus Benchmark. Region, size and sector neutral, cap-weighted

Markets: Internal Equity Market Performance



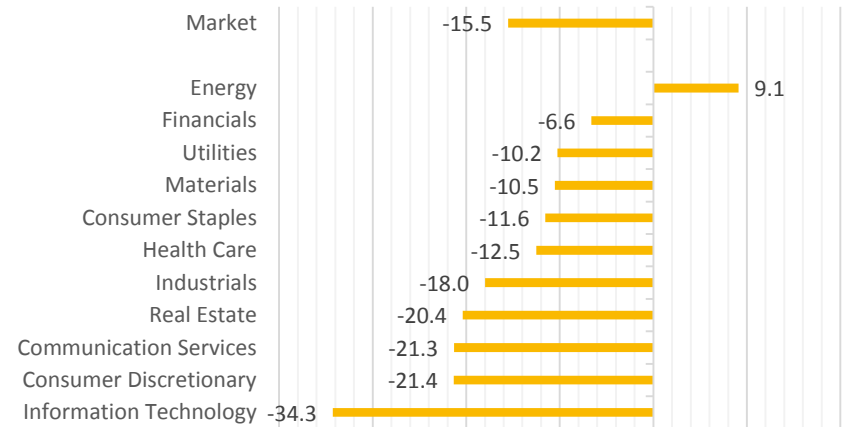
United States

Total Return: 2022



All-Country World ex USA

Total Return (USD): 2022

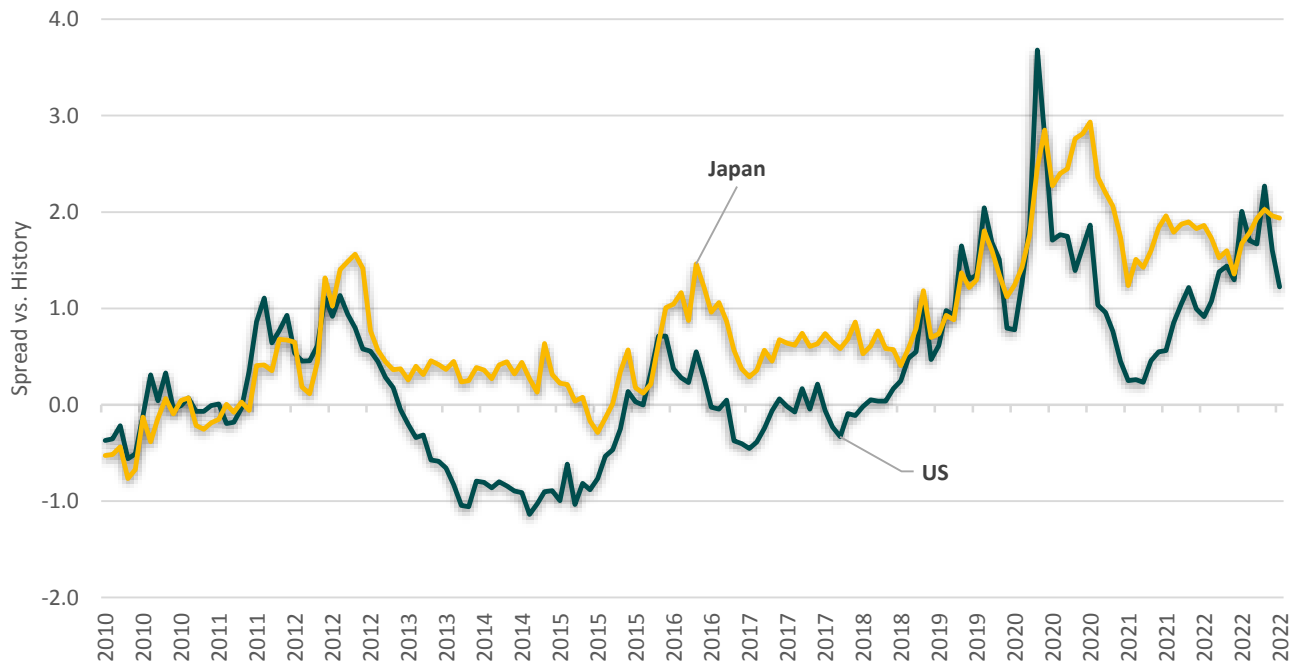


Source: MSCI, Bloomberg

Markets: Internal Equity Value Opportunity

Value Spreads

US vs. Japan



Source: Refinitiv, Credit Suisse HOLT

Exposures: Internal Equity Risk & Positions



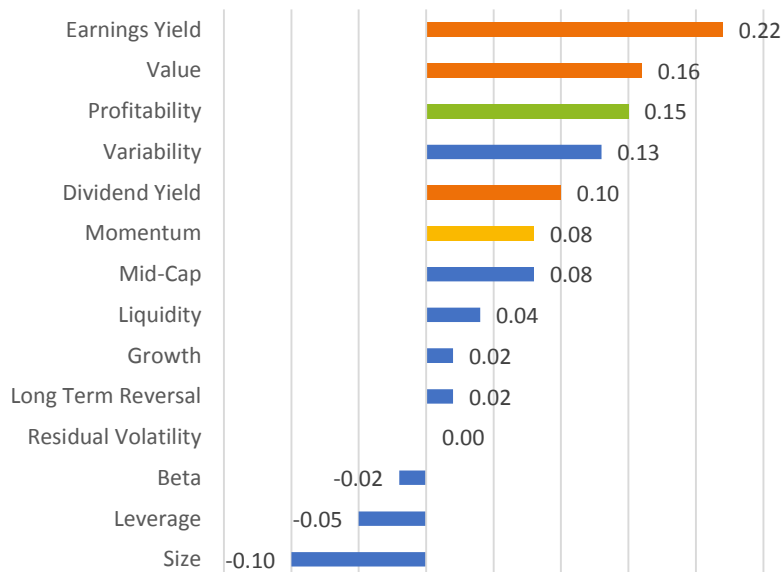
Risk Summary*	Strategy	Mkt Val (\$MM)	Weight	Tracking	CF Risk	Specific	Risk Attrib	% of TE
Program	Composite	14,372	100.0	0.91	0.63	0.37	0.91	100.0
Potomac	US Large Cap	5,277	36.7	0.90	0.36	0.64	0.26	28.6
Afton	US Small Cap	651	4.5	1.21	0.43	0.57	0.03	3.3
Monroe	US REIT	831	5.8	0.70	0.05	0.95	0.01	1.1
Mobjack	US Low Vol	2,375	16.5	2.16	0.21	0.79	0.26	28.6
Matoaka	Non-US Dev. Large Cap	2,045	14.2	1.27	0.56	0.44	0.12	13.2
Tuckahoe	Emerging Markets	814	5.7	1.48	0.53	0.47	0.08	7.6
Piedmont	Non-US Dev. Low Vol	1,584	11.0	1.76	0.42	0.58	0.11	12.1
Rivanna	Global Dev. Standard	795	5.5	1.17	0.47	0.53	0.05	5.5

*Data as of 12/31/2022

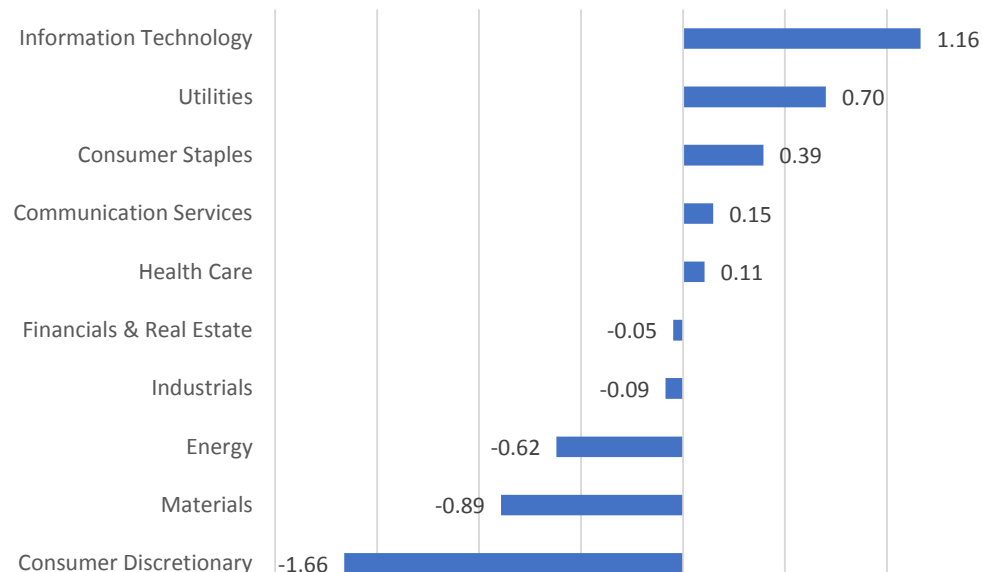
Exposures: Internal Equity Style Factor & Sector Allocations



Factor Active Weights



Sector Active Weights (%)

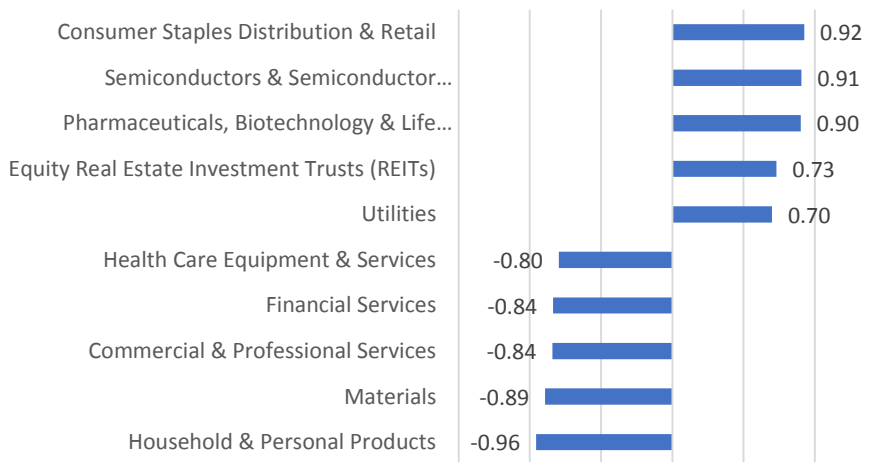


*Data as of 12/16/2022.

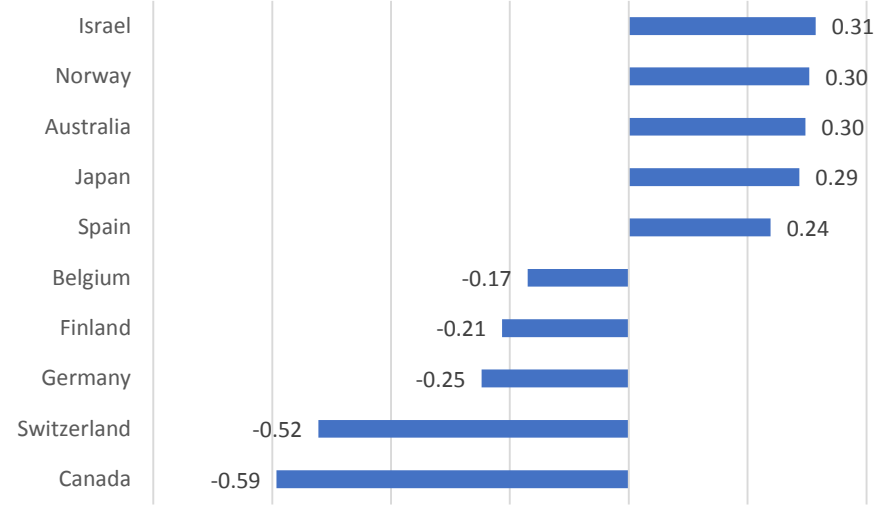
Exposures: Internal Equity Industry & Country Allocations



Top 10 Industry Group Active Weights (%)



Top 10 Country Active Weights (%)



Data as of 12/16/2022

Results: Internal Equity Program Performance (as of 12/31/22)



	IEM Active				IEM Enhanced Index				IEM Low Volatility			
	1 Yr	3 Yr	5 Yr	Incep	1 Yr	3 Yr	5 Yr	Incep	1 Yr	3 Yr	5 Yr	Incep
Total Active Internal Equity	-15.72	4.41	5.56	7.06	-17.75	4.94	5.98	6.68	-10.57	3.31	4.55	10.79
IEM Benchmark	-17.20	4.26	6.12	6.49	-18.55	4.68	6.27	6.41	-13.69	3.43	5.87	8.94
<i>Excess Returns</i>	1.48	0.15	-0.56	0.57	0.80	0.26	-0.30	0.27	3.12	-0.12	-1.32	1.85
<i>Realized Tracking Error</i>	1.44	1.40	1.20	1.06	1.20	1.28	1.07	0.83	2.79	2.22	2.02	2.73
<i>Realized Information Ratio</i>	1.03	0.11	-0.47	0.54	0.66	0.20	-0.28	0.32	1.12	-0.05	-0.66	0.68

Results: Internal Equity Strategy Performance (as of 12/31/22)



	Inception Date	Mkt Value (\$MM)	1-Year Return	1-Year Excess	Since Inc. Excess	Since Inc. Tracking
Risk Controlled Strategies		10,413	-17.75	0.80	0.27	0.83
U.S. Large Cap (Potomac)	Apr-01	5,277	-18.73	0.73	0.35	0.98
Non-U.S. Large Cap (Matoaka)	Sep-10	2,045	-12.47	1.41	0.08	1.28
EM All Cap (Tuckahoe)	Sep-15	814	-19.71	0.09	-0.55	1.82
U.S. Small Cap (Afton)	Jun-05	651	-15.73	1.44	0.39	1.92
U.S. REITs (Monroe)	Dec-05	831	-25.57	-0.72	0.98	1.11
Global Dev. Large Cap (Rivanna)	Sep-22	795	N/A	N/A	1.01	N/M
Less Constrained (Low Vol) Strategies		3,959	-10.57	3.12	1.85	2.73
U.S. Large Cap (Mobjack)	Jun-10	2,375	-11.44	1.94	1.70	3.12
Non-U.S. Large Cap (Piedmont)	Dec-12	1,584	-9.27	4.85	1.18	2.73
Passive Strategies		522	-23.72	0.07	0.12	0.27
Non-U.S. Developed REIT	Jul-20	522	-23.73	0.07	-0.23	0.23
Other Mandates						
Currency Hedging	Apr-09	2,260	N/A	N/A	N/A	N/A

Results: Internal Equity Performance Factors



Piedmont: Non-US Low Volatility

- Piedmont had a very strong year, outperforming its benchmark by over 480 bps.
- Exposure to our value factors delivered nearly half of its performance. Sector defensiveness was also additive.

Mobjack: US Low Volatility

- Similar to the strong year for our non-US Low Volatility strategy, Mobjack outperformed its benchmark by over 190 bps.
- Drivers included underweights to Consumer Discretionary and Technology and strong contribution from our sentiment model.

Afton: US Small Cap Enhanced Index

- Positive performance was driven by most components of its model with value, sentiment and capital management all adding to performance.
- The Healthcare and Industrial sectors delivered good returns.

Monroe: US REIT Enhanced Index

- Monroe underperformed during the year driven partly by negative contribution from our sentiment model.
- Overweights in Storage and Apartments also detracted while an underweight to Office REITs was a contributor.

Results: Internal Equity Program Performance (as of 2/28/23)



	IEM Active				IEM Enhanced Index				IEM Low Volatility			
	1 Yr	3 Yr	5 Yr	Incep	1 Yr	3 Yr	5 Yr	Incep	1 Yr	3 Yr	5 Yr	Incep
Total Active Internal Equity	-6.52	9.08	6.39	7.18	-7.53	10.16	6.94	6.85	-4.10	6.70	5.12	10.77
IEM Benchmark	-7.06	8.66	6.89	6.61	-7.74	9.55	7.18	6.57	-5.35	6.70	6.32	8.94
<i>Excess Returns</i>	0.54	0.42	-0.50	0.57	0.21	0.60	-0.24	0.28	1.25	0.00	-1.20	1.83
<i>Realized Tracking Error</i>	0.99	1.41	1.22	1.06	1.01	1.25	1.08	0.83	1.96	2.28	2.05	2.73
<i>Realized Information Ratio</i>	0.54	0.30	-0.41	0.54	0.21	0.48	-0.22	0.33	0.64	0.00	-0.59	0.67

Looking Forward: Remain Opportunistic



- Benchmark Study: Strategic Allocation to Low Vol
- Continue To Work Closely With All Cross Functional Teams
- External
 - Opportunistic Manager and Selection, Portfolio Management, and Risk Management
 - Continue Women & Minority Manager Outreach
- Internal
 - Globalization of Strategies Continues with Low Volatility Next
 - Major Projects to Enhance Our Research Infrastructure and Investment Tools

Agenda: Fixed Income Annual Review Topics



- Overview
- Markets
- Exposures
- Results
- Looking Forward
- Collaboration

Overview: Team Members



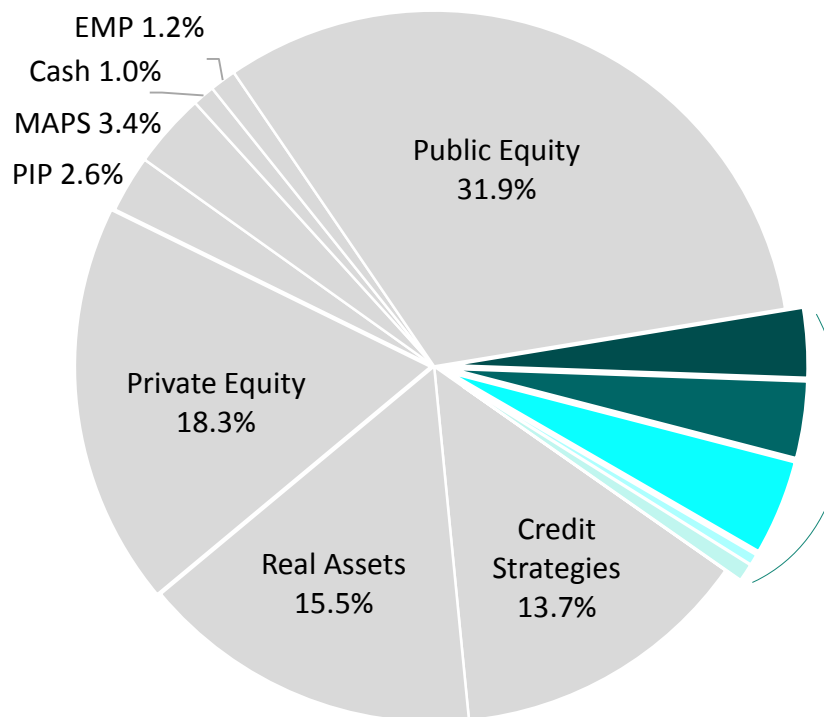
Professional	Position	Highest Degree	Professional Certifications	Investment Experience	VRS Tenure
Parham Behrooz	Co-Director	BS	CFA	26	10
Greg Oliff	Co-Director	MBA	CFA	15	12
Mehtab Haleem	Portfolio Manager	MS		14	2
Teresa Nguyen	Portfolio Manager	MS*	CFA	21	6
Michael Desai	Investment Officer	MS	**	6	2
Moeen Mostafavi	Investment Officer	Ph. D*		<1	<1
Kidus Molla	Investment Analyst	BS	**	1	1
Additional Resources	Investment Operations Department, Portfolio Solutions Group, Management Committee, Operations Team, Compliance Team, and Legal/Regulatory Team.				

* Expected 2023

** CFA Candidate

Overview: Asset Allocation as of 12/31/22

Total Fixed Income = 12.3%



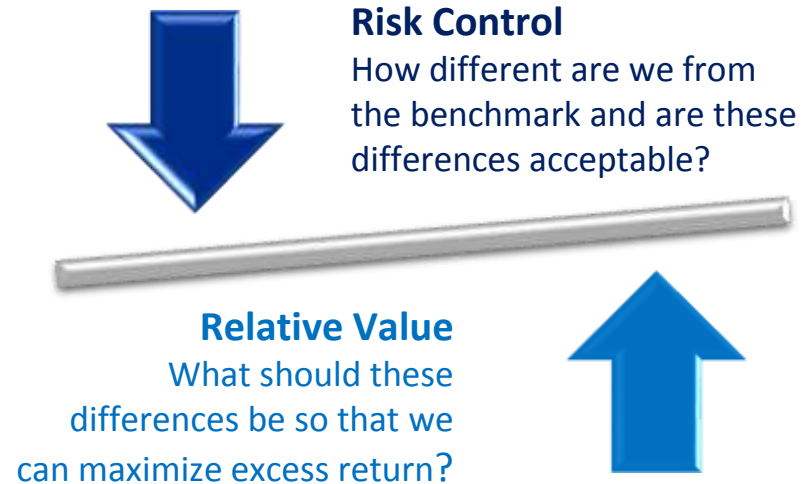
Securitized	4.3%
Government	3.5%
IG Credit	3.1%
Emerging Market Debt	0.8%
High Yield	0.5%
Opportunistic	0.0%
Core Overlay	0.0%
Total FI Overlay	0.0%

Market values as of 12/31/2022; Source: BNY Mellon data

Overview: Philosophy

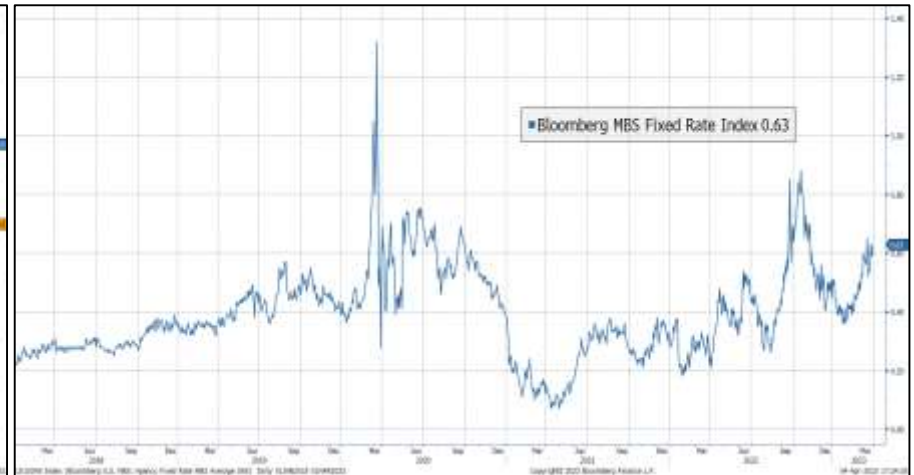
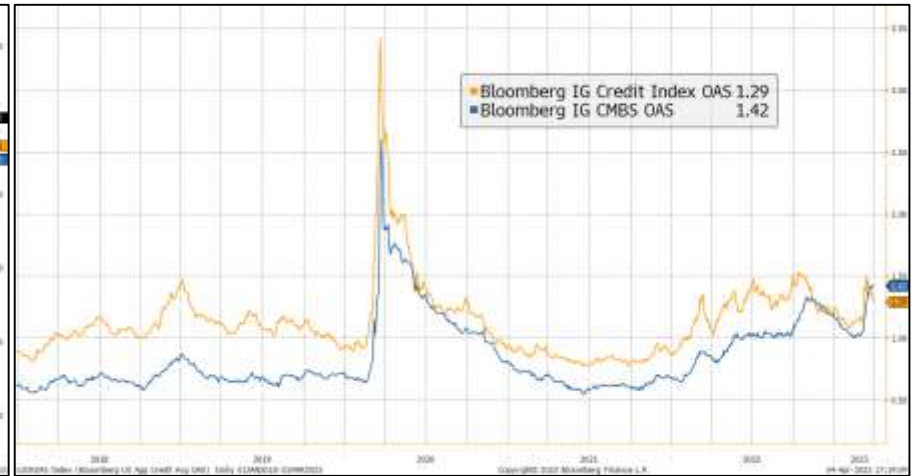
Risk Controlled Relative Value

Market factors provide opportunities to add value through optimal sector allocation and security selection, while managing risk exposures to the benchmark within controlled parameters

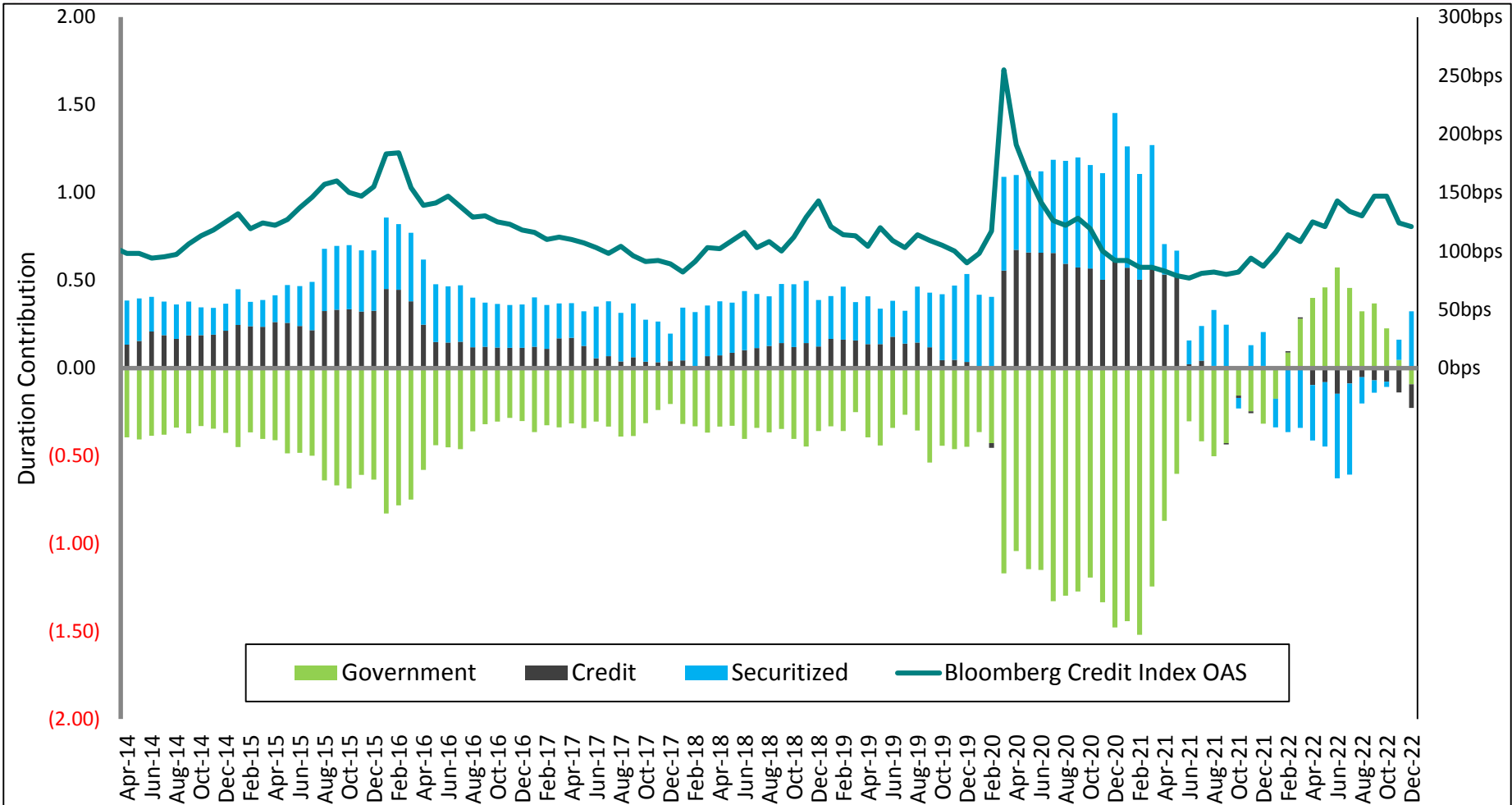


The Fixed Income Program serves as a diversifying asset class, historically providing a hedge against a deflationary economic environment.

Markets: Data: Jan 2018 - Mar 2023

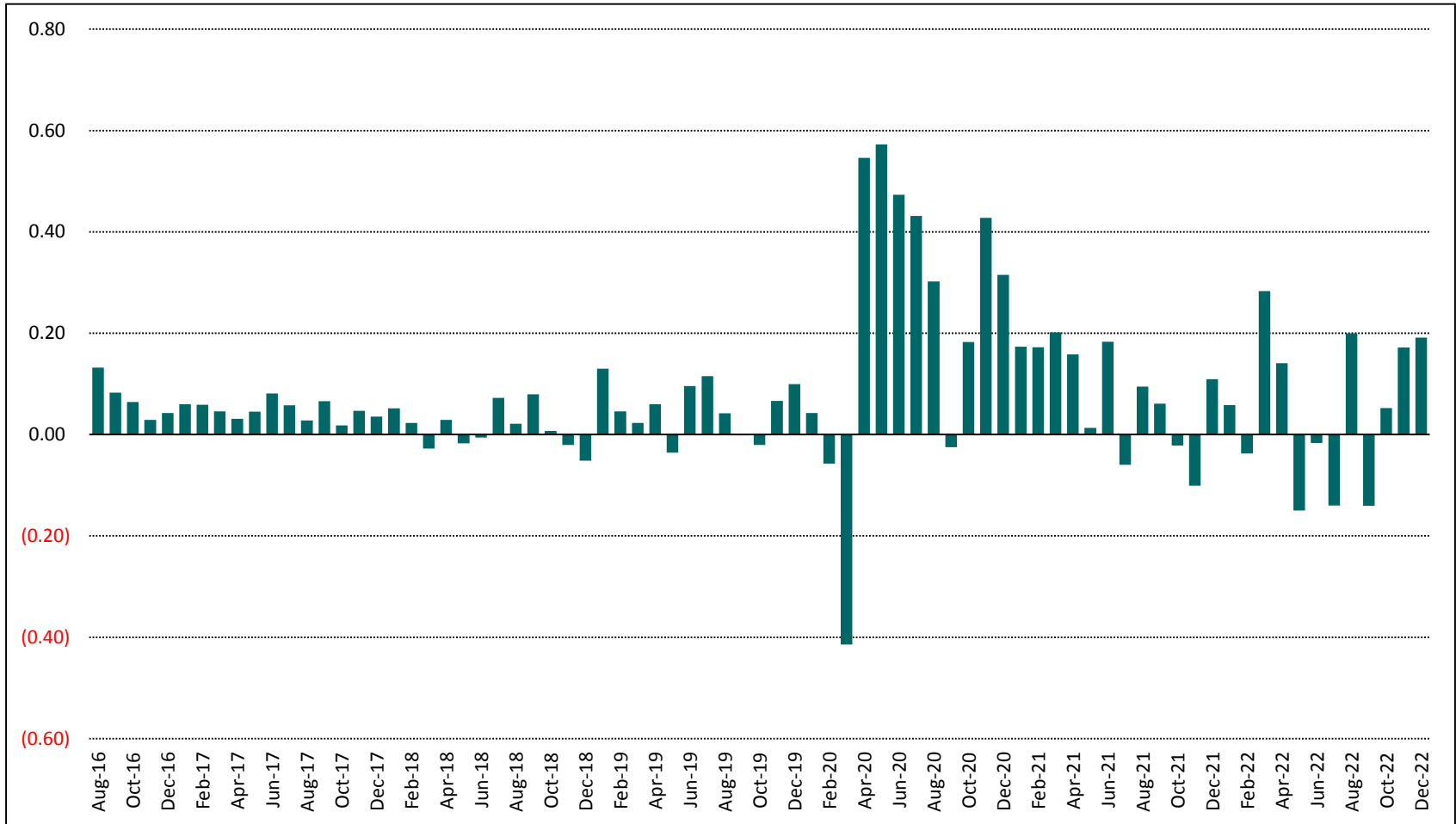


Markets: History of Core Sector Tilts



Source: Aladdin, Bloomberg

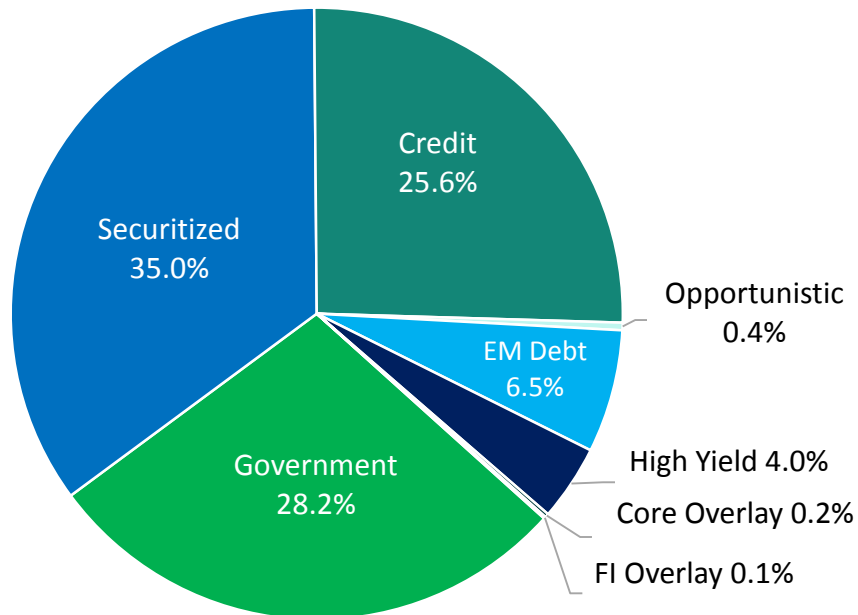
Markets: Program Monthly Excess Returns



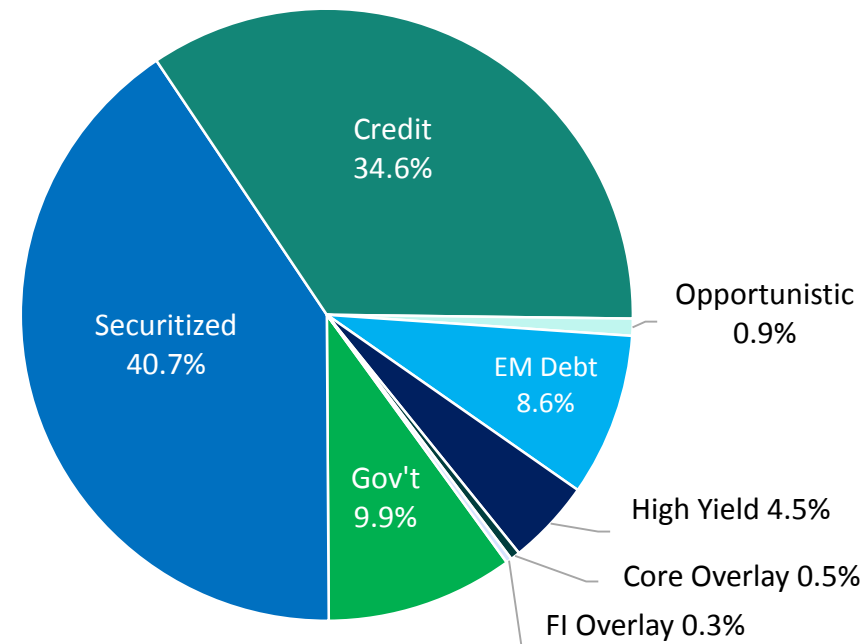
Source: BNY Mellon, VRS

Exposures: Portfolio Positioning Over Time

12/31/2022
\$12.4 Billion



6/30/2020
\$12.5 Billion

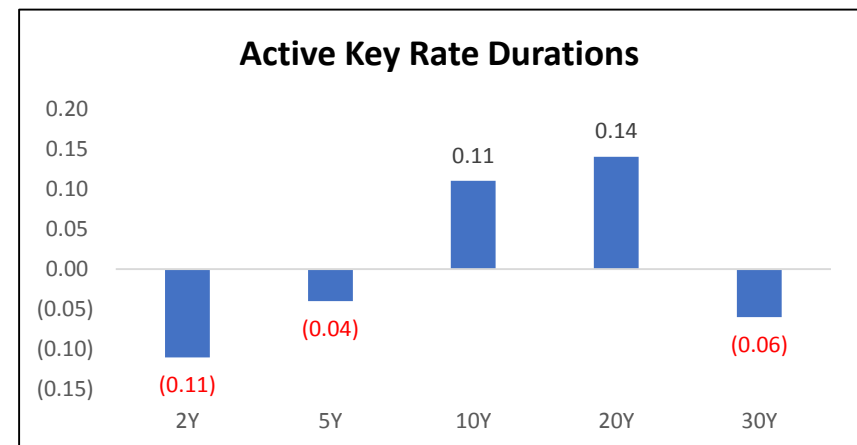
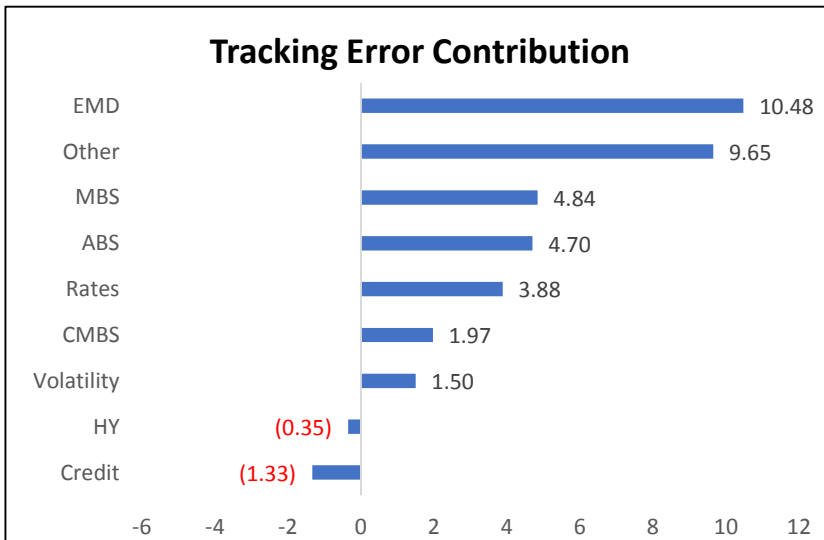
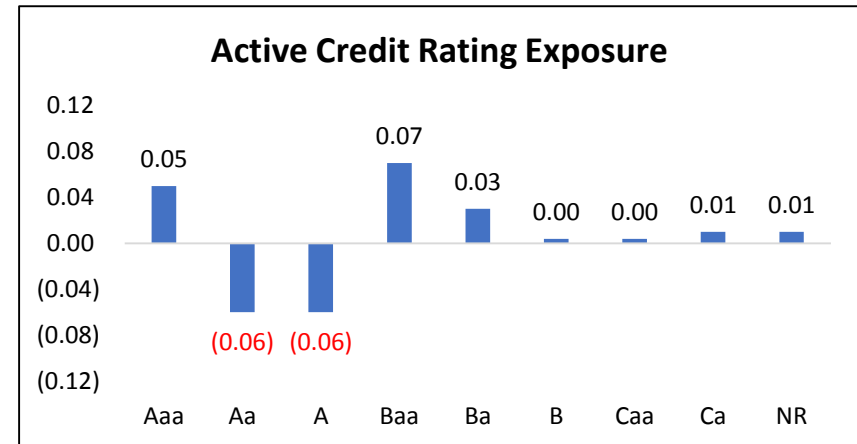


Portfolio	Dec-22	Jun-20	Difference	Portfolio	Dec-22	Jun-20	Difference
Securitized	35.0%	40.7%	(5.7%)	Emerging Market Debt	6.5%	8.6%	(2.1%)
Government	28.2%	9.9%	18.3%	High Yield	4.0%	4.5%	(0.5%)
Credit	25.6%	34.6%	(9.0%)	Opportunistic	0.4%	0.9%	(0.5%)
Core Overlay	0.2%	0.5%	(0.3%)	Total FI Overlay	0.1%	0.3%	(0.2%)

Exposures: Portfolio Characteristics

Total Fixed Income Program Market Value: \$12.4 Billion

Portfolio Characteristics			
	Port	Bench	Diff
Effective Duration	6.34	6.29	0.05
Yield to Maturity	5.17	4.90	0.27
Option Adj. Spread	100	76	24



As of 12/31/2022

Results:

Core Portfolio Attribution Factors For CY'22



Program Level

- The Fed tightened rates to a target of 4.25-4.50% into year end
- This substantial tightening resulted in curve inversion, a reduction of monetary stimulus, and elevated rate volatility

Portfolio Level

- Fixed income portfolios opportunistically reallocated to an even more defensive position
- Team worked vigilantly to use active portfolio positioning to take advantage of opportunities and dislocations within sectors
- Security selection added considerably to the Program's excess return for CY'22

Results: FI Program Risk/Return Characteristics



Program Excess Return and Statistics				
	10 Year	5 Year	3 Year	1 Year
Core IFI Program	0.74	1.03	1.44	0.63
Tracking Error	0.42	0.53	0.65	0.38
Information Ratio	1.75	1.95	2.23	1.64
Total FI Program	0.76	1.03	1.43	0.54
Tracking Error	0.47	0.59	0.73	0.52
Information Ratio	1.64	1.74	1.95	1.05

As of 12/31/2022

Batting Average

	Monthly Excess Returns	
Core IFI Program	89/120	74%

Results:

Core Portfolio Risk/Return Characteristics



Portfolio Excess Return and Statistics

	10 Year	5 Year	3 Year	1 Year
Government	0.29	0.30	0.35	0.16
Tracking Error	0.16	0.20	0.26	0.10
Information Ratio	1.75	1.46	1.38	1.57
Securitized	0.76	1.19	1.91	2.46
Tracking Error	0.69	0.94	1.16	1.67
Information Ratio	1.09	1.27	1.65	1.47
Credit	0.71	0.80	0.86	0.39
Tracking Error	0.33	0.30	0.34	0.42
Information Ratio	2.17	2.65	2.52	0.93
Opportunistic	–	1.31	2.07	2.16
Tracking Error	–	1.76	2.16	3.62
Information Ratio	–	0.75	0.96	0.60

As of 12/31/2022

Results: EM/HY Portfolio Risk/Return Characteristics



Portfolio Excess Return and Statistics			
	Since Inception*	3 Year	1 Year
Internal EMD	0.55	0.73	1.14
Tracking Error	0.97	1.03	1.58
Information Ratio	0.57	0.71	0.72
Payden & Rygel EMD	1.12	1.12	1.59
PIMCO EMD	0.98	0.98	1.56
Internal High Yield	0.64	0.46	2.93
Tracking Error	1.27	1.33	1.63
Information Ratio	0.51	0.35	1.80
Man Numeric High Yield	0.71	–	0.02

As of 12/31/2022

*Inception dates: Internal EMD Portfolio 11/2018, Internal HY Portfolio 7/2019, External EMD Portfolio 1/2020, Man Numeric HY 7/2020

Results: 2023 Update



Noteworthy items:

- During February, we reallocated \$500 million from fund level cash into Fixed Income
- Given tight valuations across credit sectors and recent volatility, we used the inflow to further the portfolio's defensive positioning
- Volatility within the fixed income market remains elevated
 - 2/1 and 3/22 – Fed Rate Hikes (+25bps each time)
 - 3/10 – SVB/Signature Events

2023 Program Return Snapshot

	Jan-23	Feb-23
Core FI Portfolio	3.14	(2.48)
Benchmark	3.08	(2.59)
Excess Return	0.06	0.11
Total FI Program	3.18	(2.40)
Benchmark	3.11	(2.52)
Excess Return	0.07	0.12

Looking Forward: Where Are We focusing?



Continue To Implement Long Term Vision For The Program

Actively Finding Ways To Collaborate Across Teams to Add Value to VRS

On The Radar

- Enhancements to portfolio processes and portfolio management tools
- Emphasize cross training throughout the program
- Cross-asset class working groups to enhance expertise
- Expand into more value-adding ideas in the Opportunistic Portfolio

Collaboration: Across the Fund



Portfolios

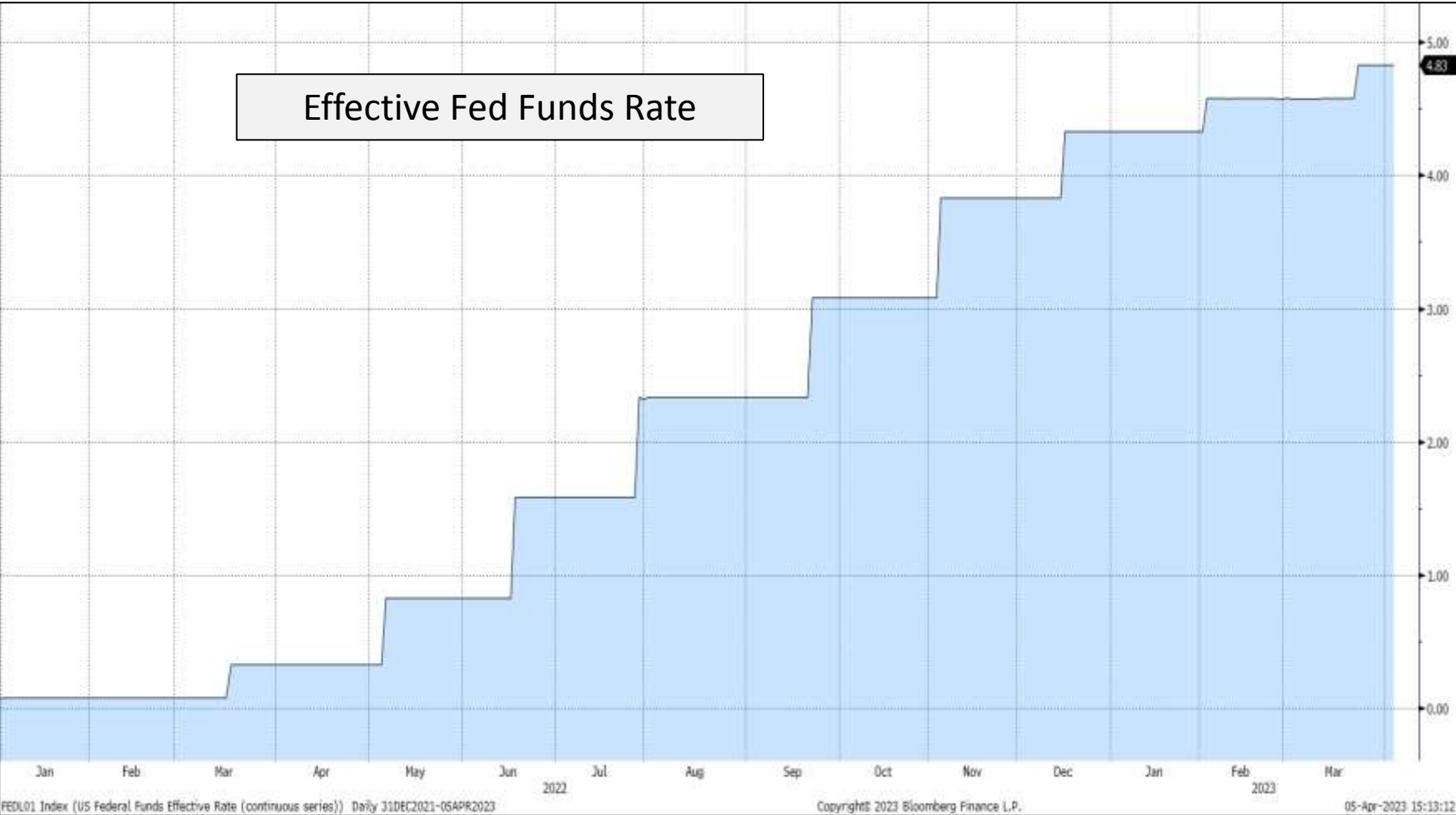
- IEM: Systematic High Yield & Total Fund Rebalance Portfolio
- RBI: RBI Risk Hedging Portfolio
- Operations: Collateral Management Portfolio

People

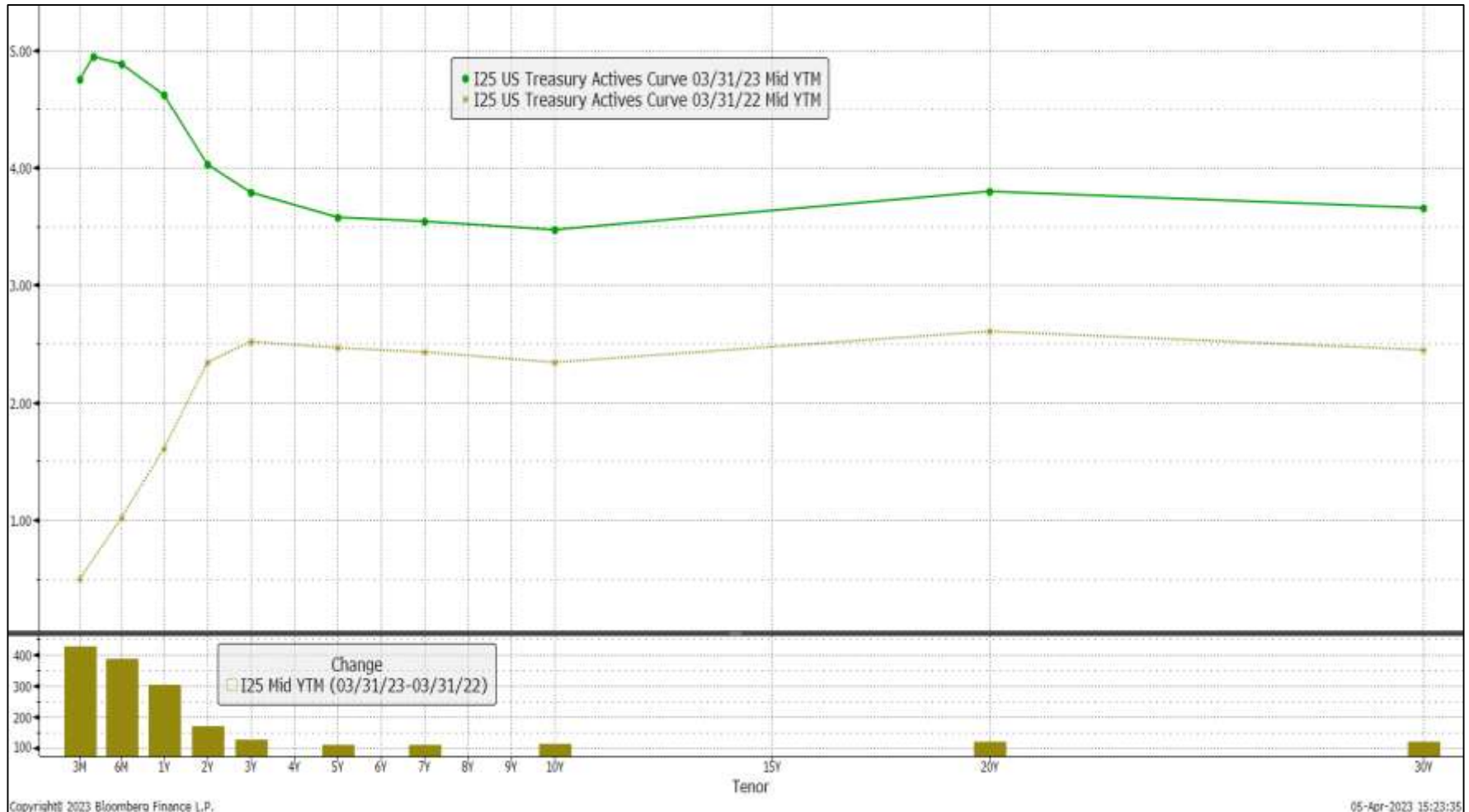
- Intentional Touch Points Across Programs
- External Manager Partnership Sessions
- Factor Based Investing and Quantitative Tool Exploration
- Individual Team Member Collaboration

Appendix

Markets: Fed Rate Hike Cycle



Markets: Yield Curve Inversion



Markets: Interest Rate Volatility Elevated

MOVE Index
(Measure of Interest Rate Volatility)



MOVE Index (ICE BofA MOVE Index) Daily 31DEC2021-05APR2023

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Risk Profile Enhancement *Using Leverage for Diversification*

Andrew Junkin and Chung Ma

April 12, 2023



- Motivation
- Definition of leverage
- Portfolio diversification using asset allocation leverage
- Implementation options
- Takeaways

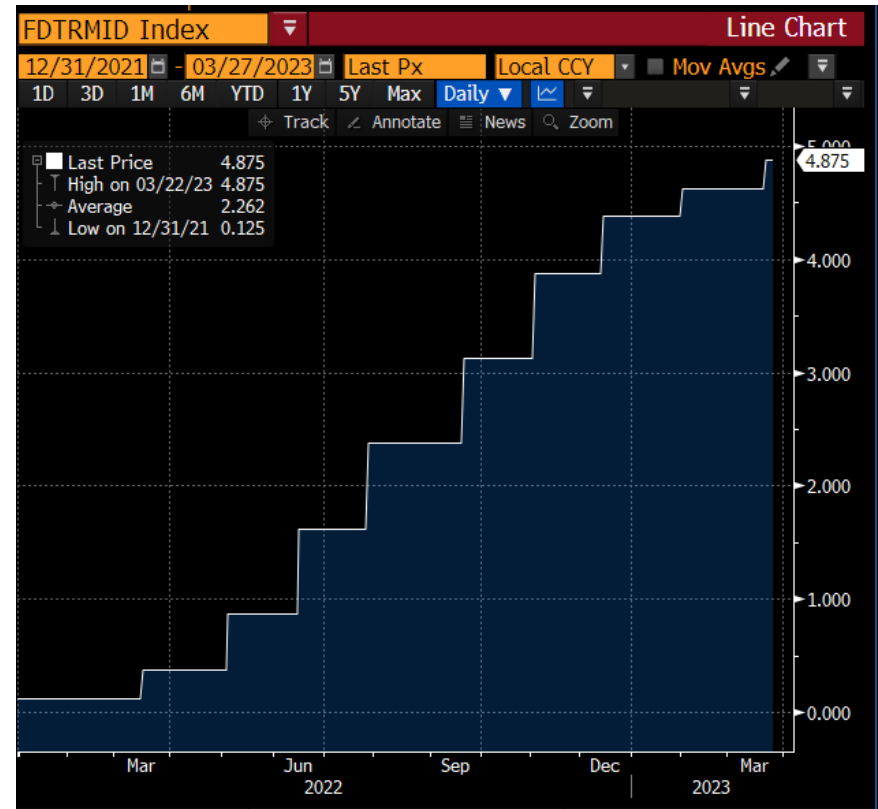
Equity Markets Have Run



Partly Driven by Stimulative Policy



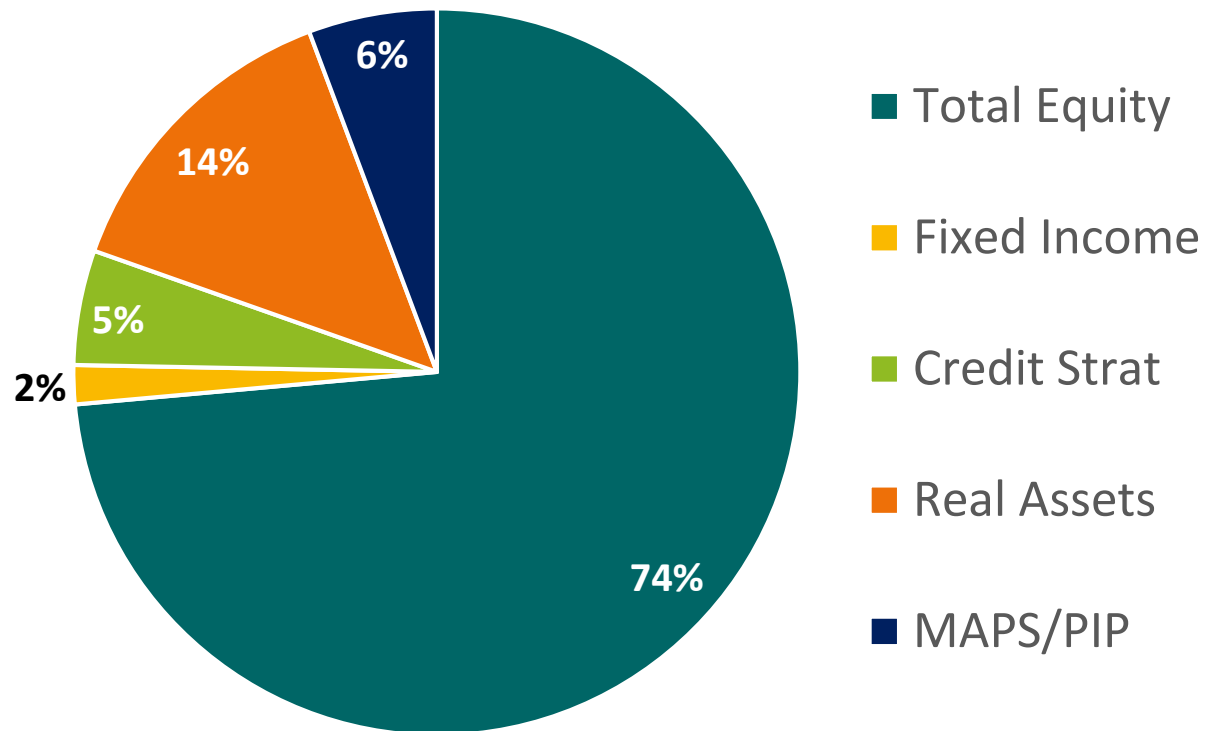
But Liquidity Conditions Have Tightened



- A potential regime change
- Expectation of future lower returns and wider range of outcomes
- Macro risks abound, volatility ahead
- Potential solutions
 - Active management
 - Tactical opportunities
 - Rebalance policy to more diversifying assets
 - Prudent use of leverage

Portfolio Risk Dominated by Growth

Total Risk Contribution*



* BarraOne, as of December 31, 2022

MAPS – Multi-asset Public Strategies, Private Investment Partnership

Two main types for VRS

Implementation Leverage

- Within and specific to certain asset classes
- Leverage on commercial real estate, for example
- Non-recourse to VRS
- No cross collateralization

Asset Allocation Leverage

- The sum of the target weights of the strategic asset allocation is greater than 100%
- Successful use requires that *total fund* return exceeds cost of leverage over the long term

- Use leverage to defend the fund
 - Better risk balance
 - Help mitigate drawdown risk
 - Ability to hold positions – don't be a forced seller of assets

- Liquidity management is critical

- Don't use leverage to increase public equity exposure

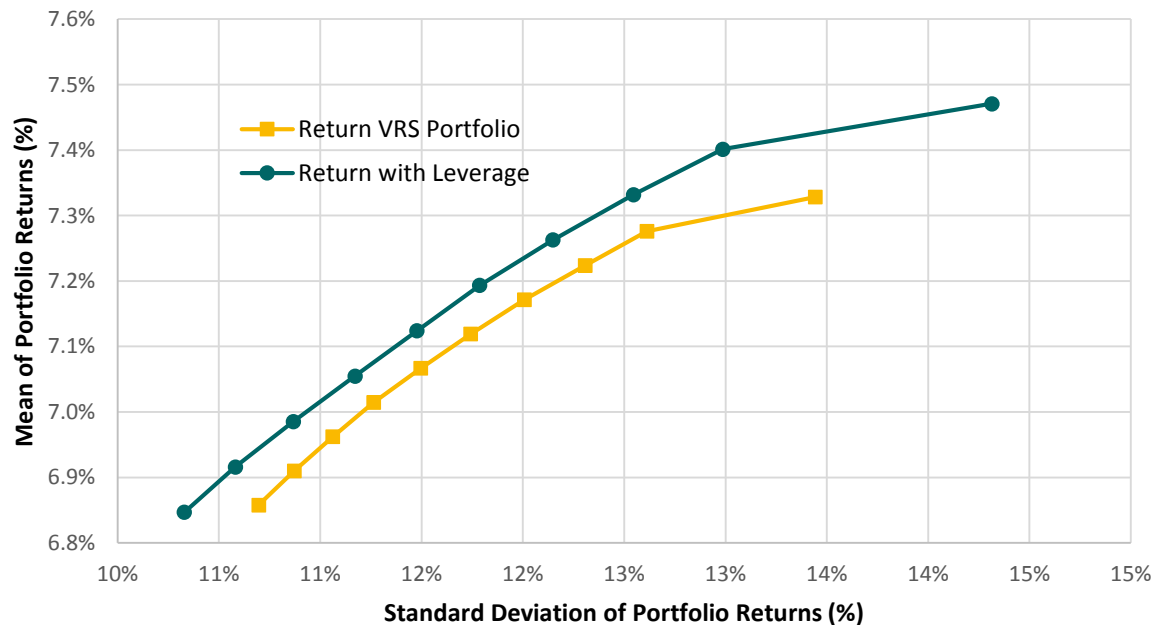
What is Asset Allocation Leverage?

- Leverage – strategic asset allocation weights adding to over 100%
- Would take time to implement, likely 3 years

	Current Target	Unlevered	Modestly Diversifying	Less Liquid	More Diversifying
Public Equity	34%	33%	33%	29%	29%
Private Equity	16%	15%	15%	16%	15%
Total Equity	50%	48%	48%	45%	44%
Real Assets	14%	15%	15%	16%	16%
Credit Strategies	14%	15%	15%	16%	16%
Private Inv Partnership	2%	1%	1%	1%	1%
Risk-Based Investment:	2%	3%	5%	3%	5%
Dynamic Strategies	2%	1%	1%	2%	1%
Total MAPS	4%	4%	6%	5%	6%
Fixed Income	15%	15%	16%	18%	18%
Cash	1%	2%	2%	2%	2%
Total Cash+FI	16%	17%	18%	20%	20%
Total Fund	100%	100%	103%	103%	103%
Leverage	0%	0%	-3%	-3%	-3%
Total Fund (lev)	100%	100%	100%	100%	100%

Higher Efficient Frontier

- Can be thought of as a new asset
- More diversification
- Creates more efficient portfolios



Diversification Can Mitigate Drawdowns

	Current Target	Unlevered	Modestly Diversifying	Less Liquid	More Diversifying
Return	7.0%	7.0%	7.2%	7.2%	7.1%
Volatility	12.6%	12.1%	12.2%	12.0%	11.7%
Return/Volatility	0.56	0.58	0.59	0.60	0.61
Worst Cases					
25th Percentile	-1.5%	-1.2%	-1.0%	-1.0%	-0.8%
5th Percentile	-13.7%	-13.0%	-12.9%	-12.6%	-12.1%
Largest Drawdown	-40.8%	-38.9%	-38.7%	-37.8%	-36.5%

- Asset Allocation Leverage should be used to better balance portfolio risks
- Drawdown risk is mitigated through prudent use of Asset Allocation Leverage

Data based on Monte Carlo simulations using VRS capital market assumptions

Benefits

- Can be used to improve diversification and create better risk balance
- Increase odds of achieving investment goal
- Potential to have a more efficient portfolio (e.g., better Sharpe Ratio)
- Potential to increase return (especially if used for growth assets)

Considerations

- Increase operational complexity
- Will not always outperform, depending on market environment
- Potential to increase volatility versus an unlevered portfolio, amplify gains and losses
- Increases importance on risk management, especially with liquidity considerations

Higher Cost/Lower Complexity

- Line of credit
- Private notes
- Bank loans
- Pension obligation bonds – not allowed under statute

Lower Cost/Higher Complexity

- Repurchase agreements
- Securities lending program
- Futures
- Total return swaps

Current Situation – An Example

34% Policy Allocation to Public Equity (EQ)

Cash (\$34B)

Buy

Physical EQ Exposure (\$34B)

Economic Exposure



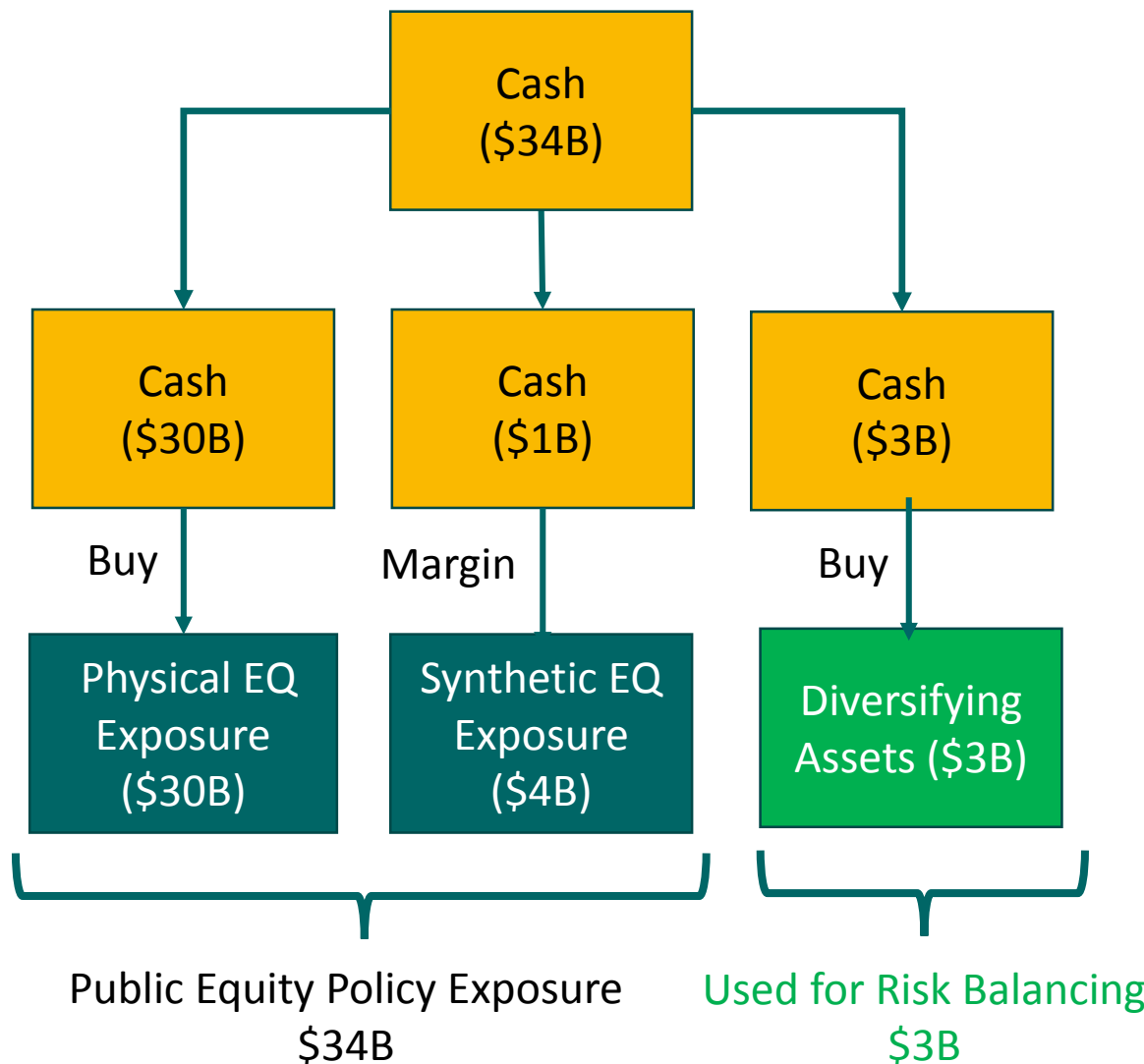
Public Equity Policy Exposure
\$34B

Use of Synthetics – An Example

34% Policy Allocation to Public Equity (EQ)

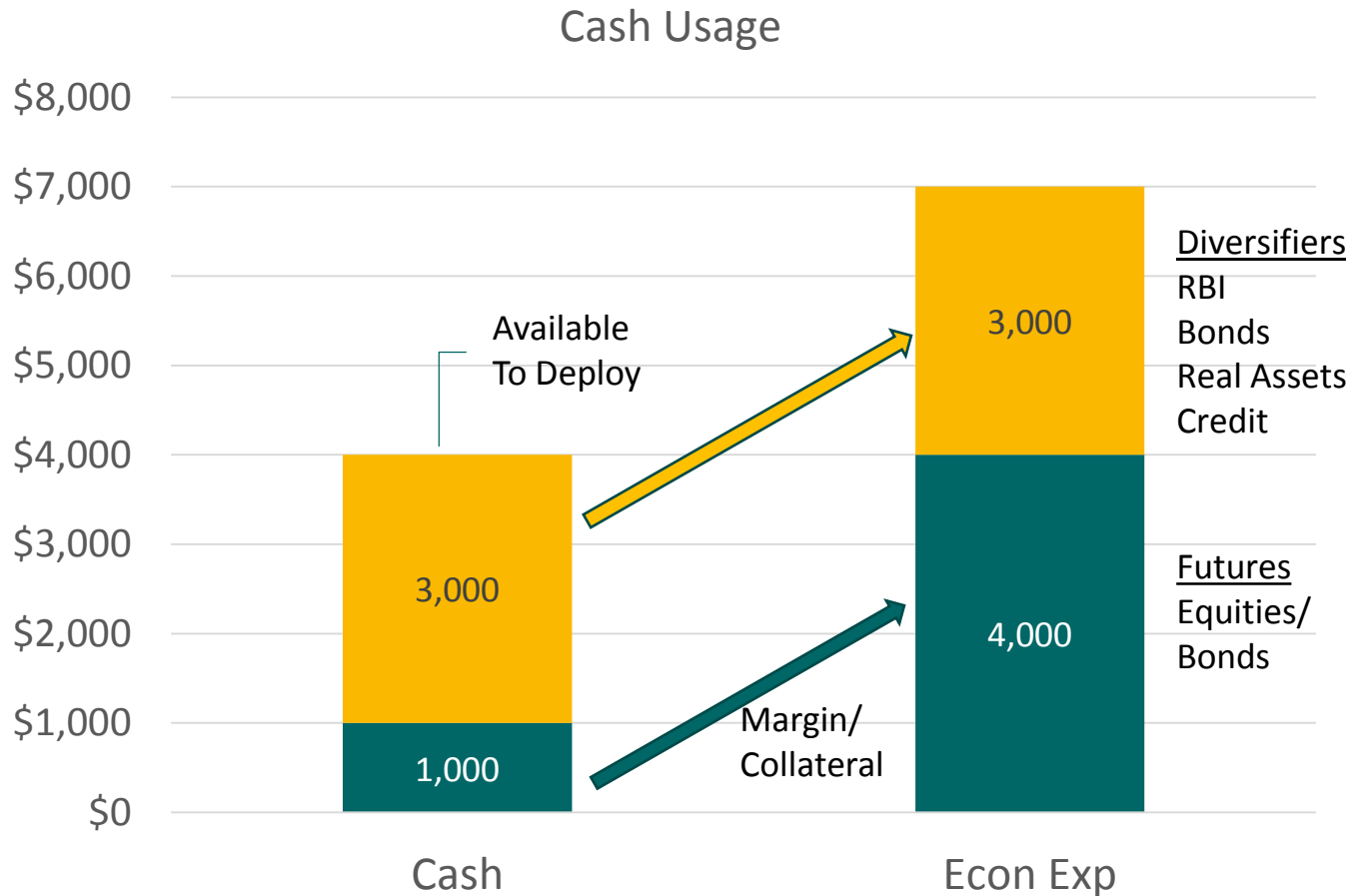
Allocate Cash to Exposures (\$34B)

Economic Exposures* (\$37B)



Cash Management - Synthetic Case Study

Synthetic exposure allows for re-allocation to other assets



Illustrative, numbers are in US dollars, millions

Portfolio construction allows for drawdown mitigation

Scenario	Current Target	Unlevered	Modestly Diversifying	Less Liquid	More Diversifying
Global Financial Crisis (2007-09)	-28.9	-28.1	-28.1	-26.9	-26.3
Tech Crash	-18.2	-17.5	-17.3	-15.7	-15.3
1987 Market Crash (Aug-Nov)	-7.2	-6.9	-6.9	-6.6	-6.4
2011 US Debt Ceiling Act	-7.8	-7.5	-7.5	-7.0	-6.8

- Over time, hire additional FTEs (1-3) and design for efficiency
- Risk management oversight is essential
 - Liquidity
 - Collateral
 - Funding
 - Rebalancing
- Need external and internal tools to monitor
- Communicate regularly to management

- Aligning portfolio priorities - use leverage to create a better risk balance (desired outcome-more predictable contribution rates, protect funded ratio, defend the fund) and to not be a forced seller
- Increase odds of achieving assumed rate of return over time, by potentially reducing drawdown risk
- Glide path to 3%, starting small to stress test process and systems with continuous re-evaluation
- Critical success factors
 - Strong governance
 - Risk management
 - Implementation capabilities and tools
 - Appreciation of pitfalls
- *Desire to consider **strategic asset allocation** and **rebalancing leverage** in candidate portfolios*

Forward Returns & Scenario Analysis

Steven Peterson
Program Director – Research

Rory Badura
Senior Actuary



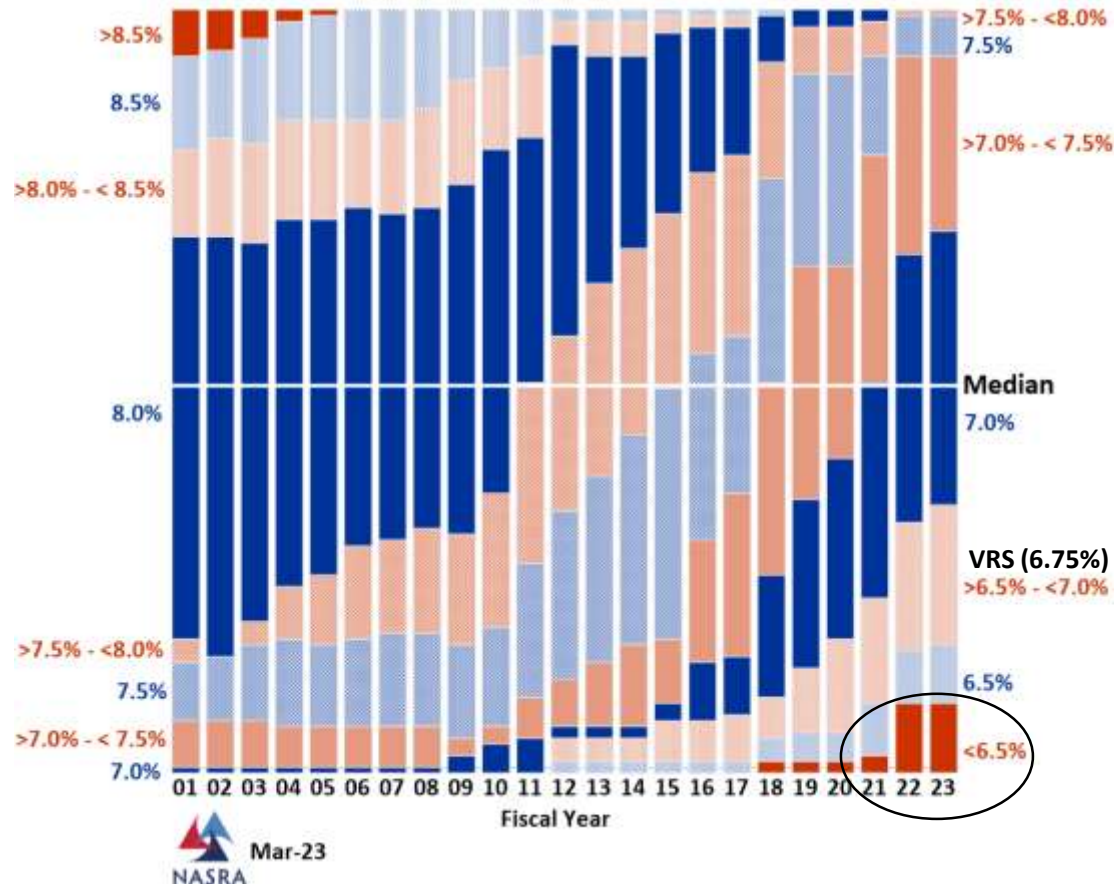
Summary Forward Returns And Scenario Analysis



- State Plans' Forward Returns Summary
- External Managers' Forward Returns Comparison
- VRS Long Term Forward Returns
- Forward Returns Attribution
- Scenarios (Impact on Funded Status, Contribution Rates, Liquidity)
 - Baseline
 - Soft Landing
 - Hard Landing
 - No Landing
 - Lost Decade (Japan)

Public Pension Plan Discount Rate Revisions Over Time (2023)

Distribution of Nominal Investment Return Assumptions, FY 01 to Latest



History of External Managers' Forward Returns Forecasts

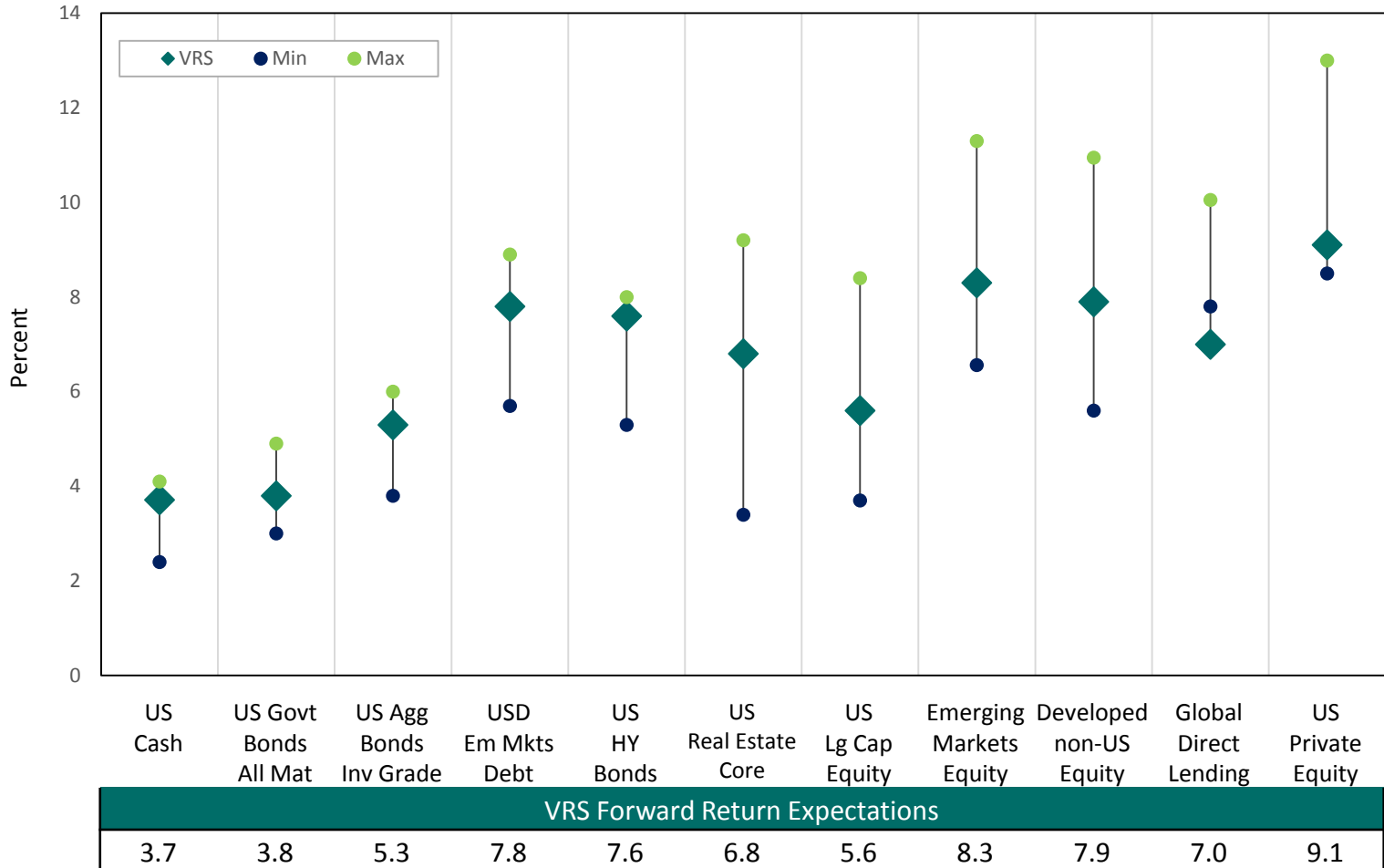


	2015	2017	2018	2019	2020	2021	2022	2023
U.S. Core Fixed	3.0	3.1	3.1	3.4	1.5	1.6	2.7	4.1
Credit (HY)	5.0	4.6	4.4	5.0	4.8	3.5	4.8	6.3
Core Real Estate	5.4	5.5	5.2	5.7	5.3	5.9	5.2	5.4
U.S. Stocks	6.2	6.0	5.5	5.7	5.5	4.0	5.2	6.8
Int'l Developed Stocks	6.9	6.4	6.8	6.7	6.2	6.2	6.6	8.1
Emerging Stocks	8.4	7.5	7.1	8.2	7.6	6.6	7.5	9.2
Private Equity	8.9	7.2	7.7	9.2	8.9	9.5	9.3	9.8

Current Year External Managers' Forward Returns Expectations Range



Long Term Forward Return Expectations External Manager & VRS



Forward Returns and Volatilities By Asset Class (20 year)



Asset Class	Wt.	Current		Allowable	
		E(r)	E(σ)	Min	Max
Public Equity	34.0%	7.0%	18.1%	-5.0%	5.0%
Fixed Income	15.0%	4.9%	5.6%	-3.0%	5.0%
Credit Strategies	14.0%	7.9%	6.4%	-5.0%	5.0%
Real Assets	14.0%	6.5%	14.3%	-5.0%	5.0%
Private Equity	16.0%	9.0%	23.1%	-5.0%	5.0%
PIP	2.0%	7.8%	19.4%	-2.0%	2.0%
Dstrat	2.0%	6.7%	12.4%	-2.0%	2.0%
RBI	2.0%	6.2%	5.1%	-2.0%	2.0%
Cash	1.0%	3.7%	0.5%	-1.0%	4.0%
<i>Currency Return Addition</i>		0.1%			
Total Fund		7.1%	12.6%		

Asset Class and Strategy	Wt.	Current	
		E(r)	E(σ)
Public Equity	34.0%	7.0%	18.1%
Fixed Income	15.0%	4.9%	5.6%
Treasury	5.4%	3.8%	
Agency	0.1%	4.7%	
MBS	4.1%	4.8%	
CMBS	0.3%	6.6%	
ABS	0.2%	6.1%	
IG	3.4%	5.3%	
HY	0.6%	7.6%	
JPM EMBI Core	1.0%	7.8%	
Credit Strategies	14.0%	7.9%	6.4%
Rate Sensitive HY	4.2%	6.5%	
Rate Sensitive IG	1.4%	4.5%	
Non-Rate Sensitive	8.4%	7.9%	
Real Assets	14.0%	6.5%	14.3%
Private Real Estate	9.4%	6.8%	
Public Real Estate	0.0%	8.1%	
Other Real Assets	4.6%	6.1%	
Private Equity	16.0%	9.0%	23.1%
PIP	2.0%	7.8%	19.4%
Dstrat	2.0%	6.7%	12.4%
RBI	2.0%	6.2%	5.1%
Cash	1.0%	3.7%	0.5%
<i>Currency Return Addition</i>		0.1%	
Total Fund		7.1%	12.6%

E(r) = Expected Return
E(σ) = Expected Volatility

Forward Returns and Volatilities By Asset Class (20 year)



2023

Asset Class	Wt.	Current		Allowable	
		E(r)	E(σ)	Min	Max
Public Equity	34.0%	7.0%	18.1%	-5.0%	5.0%
Fixed Income	15.0%	4.9%	5.6%	-3.0%	5.0%
Credit Strategies	14.0%	7.9%	6.4%	-5.0%	5.0%
Real Assets	14.0%	6.5%	14.3%	-5.0%	5.0%
Private Equity	16.0%	9.0%	23.1%	-5.0%	5.0%
PIP	2.0%	7.8%	19.4%	-2.0%	2.0%
Dstrat	2.0%	6.7%	12.4%	-2.0%	2.0%
RBI	2.0%	6.2%	5.1%	-2.0%	2.0%
Cash	1.0%	3.7%	0.5%	-1.0%	4.0%
<i>Currency Return Addition</i>		0.1%			
Total Fund		7.1%	12.6%		

2022

Asset Class	Wt.	Current		Allowable	
		E(r)	E(σ)	Min	Max
Public Equity	34.0%	6.8%	16.8%	-5.0%	5.0%
Fixed Income	15.0%	4.4%	4.7%	-3.0%	5.0%
Credit Strategies	14.0%	7.1%	5.4%	-5.0%	5.0%
Real Assets	14.0%	6.0%	14.0%	-5.0%	5.0%
Private Equity	14.0%	8.8%	26.2%	-5.0%	5.0%
MAPS	6.0%	5.9%	7.9%	-2.0%	2.0%
PIP	3.0%	7.3%	18.9%	-2.0%	2.0%
Cash	0.0%	0.0%	0.5%	-1.0%	4.0%
<i>Currency Return Addition</i>		0.1%			
Total Fund		6.7%	13.8%		

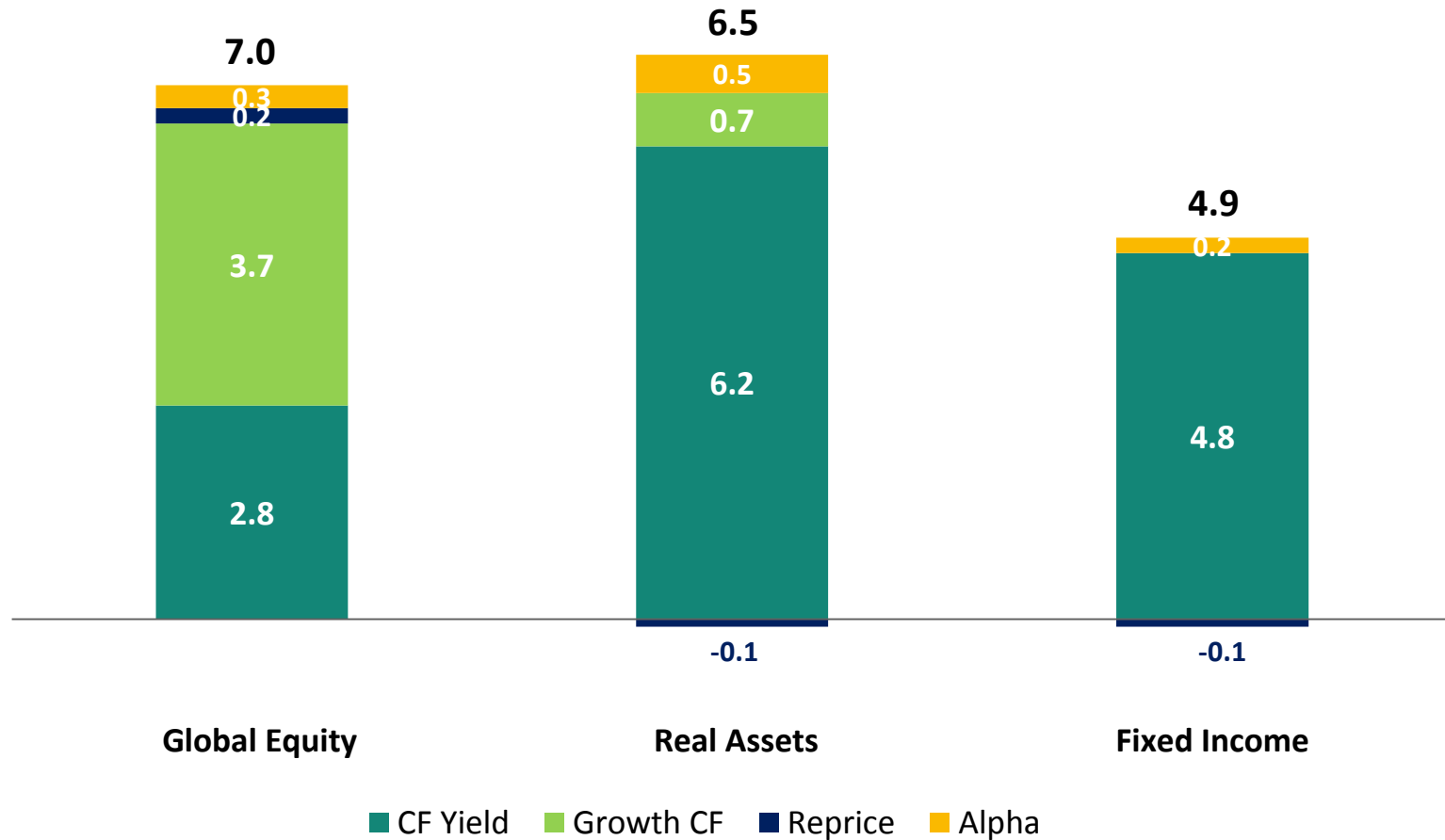
E(r) = Expected Return
E(σ) = Expected Volatility

Forward Returns Attribution

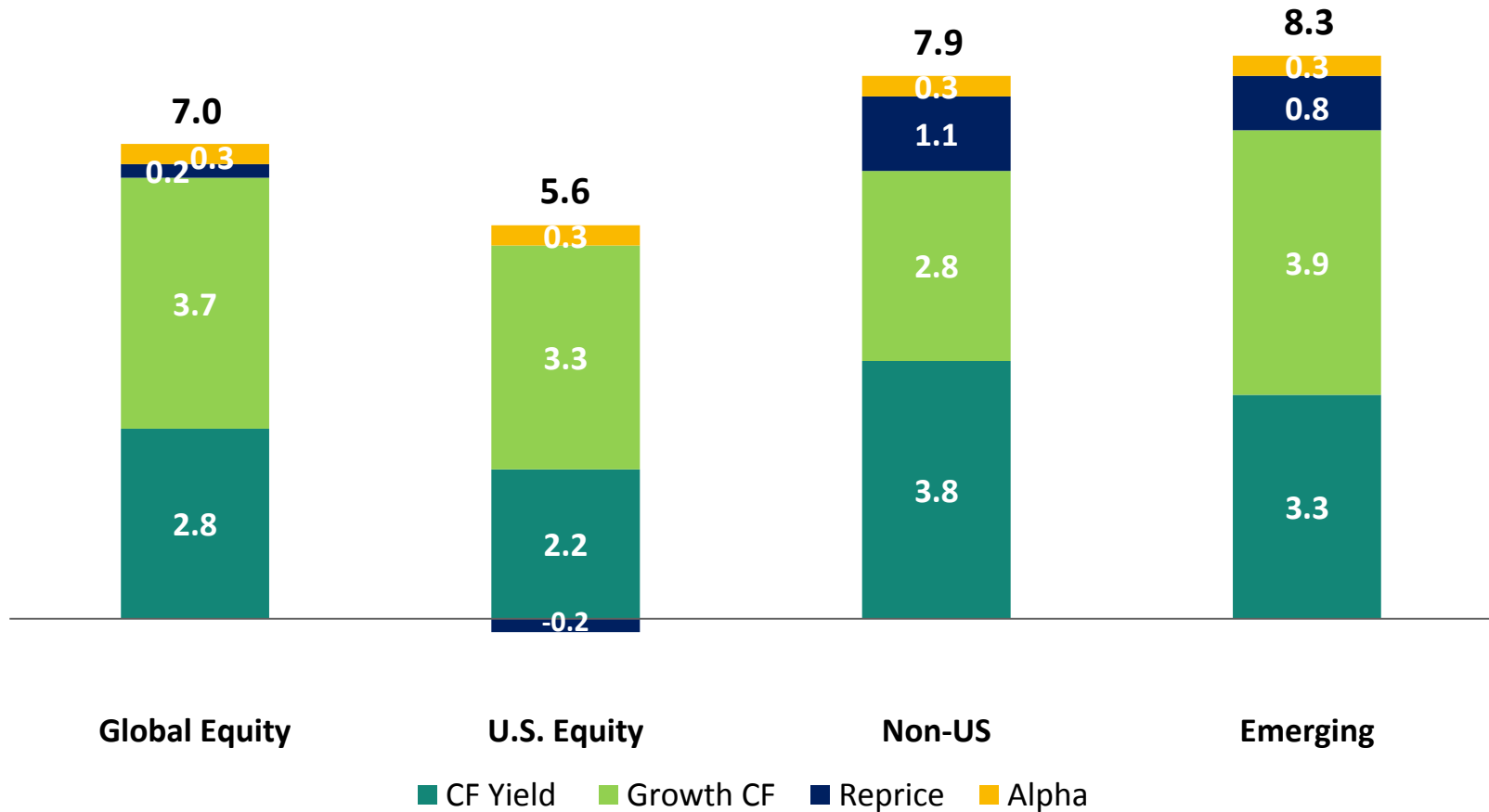
	Return	CF Yield	Growth in CF	Reprice	Alpha
Global Eq (10 yr)	7.0%	2.8%	3.7%	0.2%	0.3%
US Eq	5.6%	2.2%	3.3%	-0.2%	0.3%
Non_US Eq	7.9%	3.8%	2.8%	1.1%	0.3%
EM Eq	8.3%	3.3%	3.9%	0.8%	0.3%
Real Assets (20 yr)	6.5%	6.2%	0.7%	-0.1%	0.5%
Private RE	6.8%	4.3%	2.7%	-0.2%	0.4%
Global REITs	8.1%	2.8%	5.2%	-0.1%	0.3%
Infrastructure	5.4%	3.7%	2.4%	-0.1%	0.7%
Energy & Mining	7.8%	25.0%	-17.0%	0.0%	0.7%
Timberland	5.0%	3.0%	2.5%	-0.2%	0.7%
Farmland	5.9%	4.8%	1.8%	0.0%	0.7%
Tot. ORA	6.1%	10.2%	-3.6%	-0.1%	0.7%
Total IFI (20 yr)	4.9%	4.8%	0.0%	-0.1%	0.2%
BC Treasury	3.8%	3.8%	0.0%	-0.1%	0.1%
BC Agency	4.7%	4.6%	0.0%	-0.1%	0.2%
BC MBS	4.8%	4.6%	0.0%	-0.1%	0.4%
BC CMBS	6.6%	6.4%	0.0%	-0.2%	0.4%
BC ABS	6.1%	5.9%	0.0%	-0.1%	0.4%
BC IG Credit	5.3%	5.1%	0.0%	-0.2%	0.4%
BC HY Credit	7.6%	7.7%	0.0%	-0.5%	0.4%
JPM EMBI Core	7.8%	7.9%	0.0%	-0.4%	0.2%

Notes: RA is net of leverage; IFI CF Yield includes growth in CF

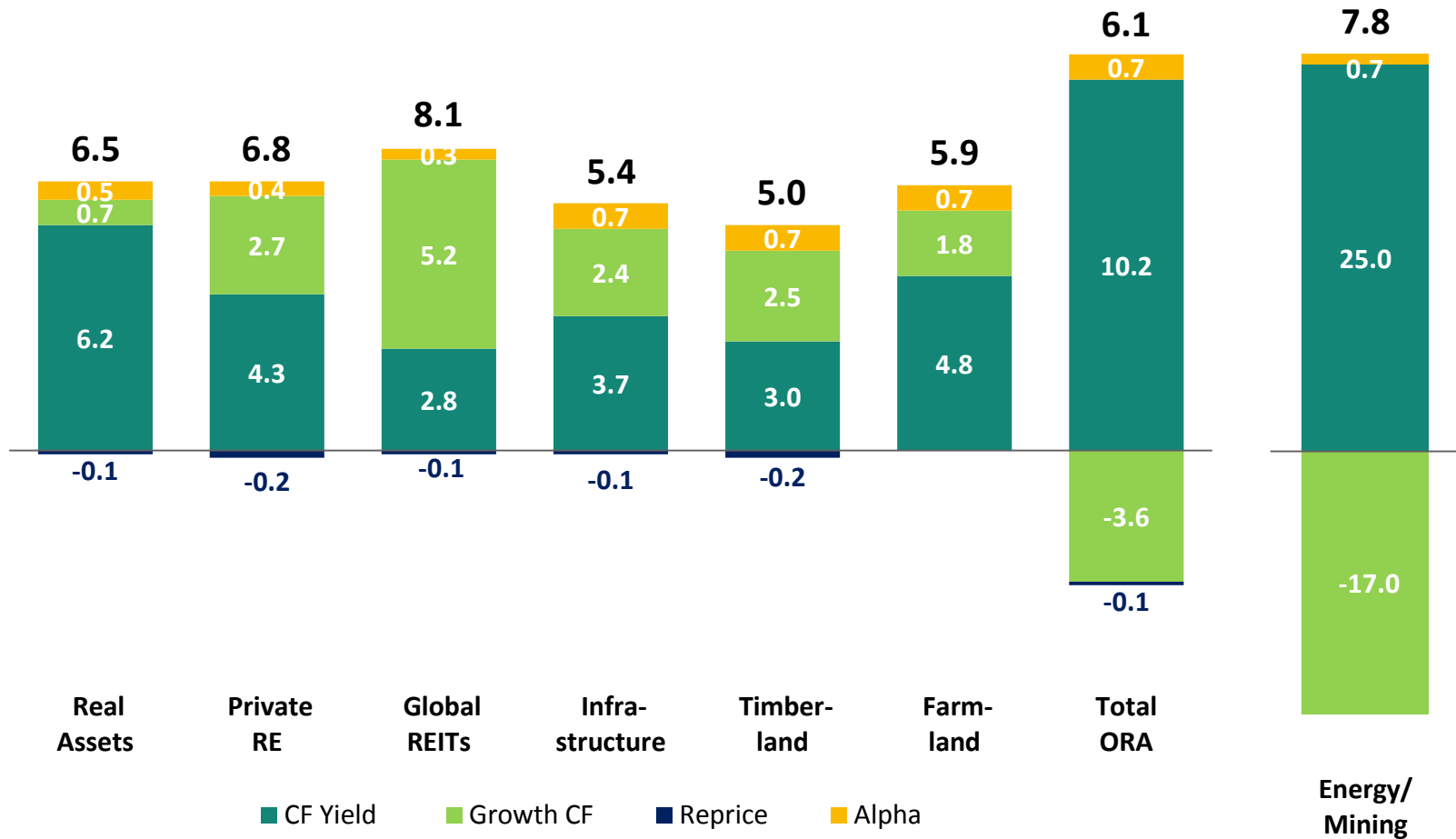
Total Fund – Selected Attribution (Percent)



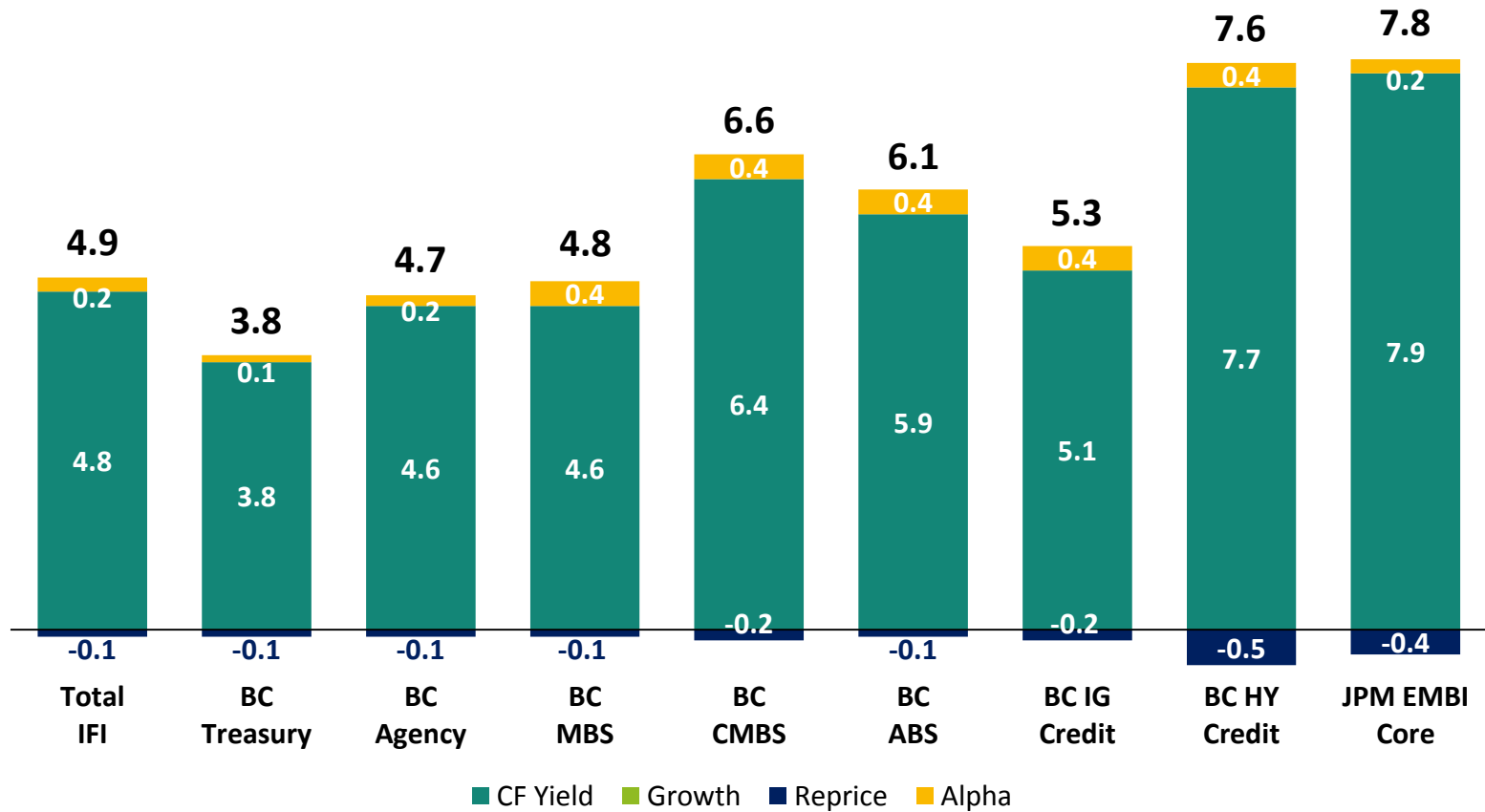
Global Equity Attribution (Percent)



Real Assets Attribution (Percent)



Fixed Income Attribution (Percent)



Macro Factor Impact on Forward Returns

	Factor	Impact
Alpha	Elevated Vol	+
	Taxes	-
Growth In Yield	Productivity	-
	De-Globalization	-
	Nominal Rates	+
	Rates v Inflation	+/-
Real Yield	Discount Factor	-
	Fed QT	-
Inflation	Commodity Prices	+
	Nominal Wage Growth	-
	Oil	+
	P/E Mean Reversion	-
Revaluation	Risk Aversion	-

Scenario Analysis



Hard Landing— The Fed fails to achieve a soft landing. While the first half of 2022 was largely about downward revisions in equity valuations, the second half was about downward revisions in (real) earnings forecasts. Growth expectations retracted, inflation is persistent especially in services, and higher nominal rates result in a significant slowdown in housing and consumer durables. Households continue to spend down savings inventoried during the pandemic while real incomes continue to fall off. The Fed is forced into a more aggressive rate hiking cycle that is not priced into the market. Real economic growth is hit hard along with risk assets which take 4 years to recover to pre-landing levels.

Soft Landing - This is a Goldilocks case in which inflation responds immediately to Fed policy moves and is back to a targeted 2.5% by the end of 2023. Both inflation and real growth surprise to the upside along with earnings growth and sentiment drives returns on all asset classes above expectations for years 1-2 before settling back to the baseline.

No Landing - inflation persists and Fed policy is ineffective at achieving a non-inflationary equilibrium. Short rates (and inflation) therefore remain 'elevated' though not excessive and real growth equilibrates around its historical average of 3%. While risk assets do comparatively well (above expectations), fixed income and credit as well as real assets take several years to return to their long run target returns.

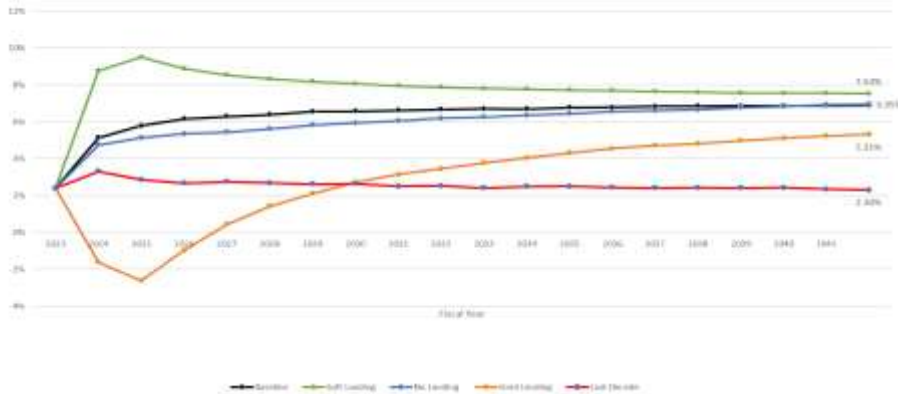
Japan - Lost Decade - The economy collapses into an extended low growth, deflationary equilibrium similar to Japan's experience beginning in the 1990's. Risk assets such as public equity and real assets are especially hit hard. Fund returns equilibrate around 2.5% annually with very little volatility. Policy is ineffectual.

Baseline – current FY 2023 estimates followed by latest forward return estimates.

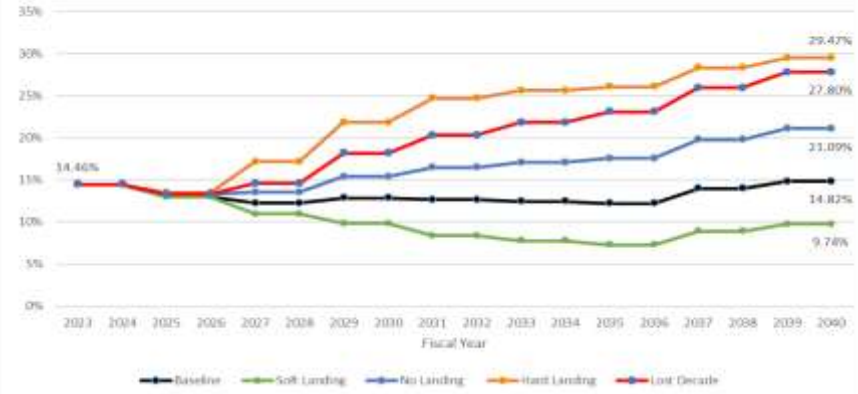
Scenarios – Median Paths (State)



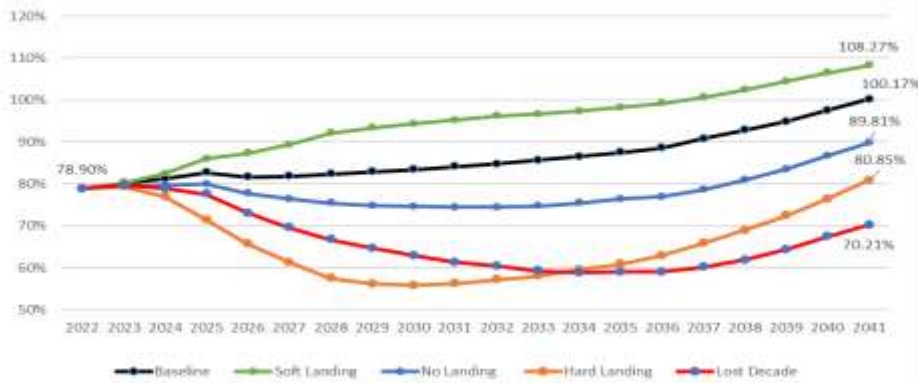
Comparison of Cumulative Investment Returns
State Plan



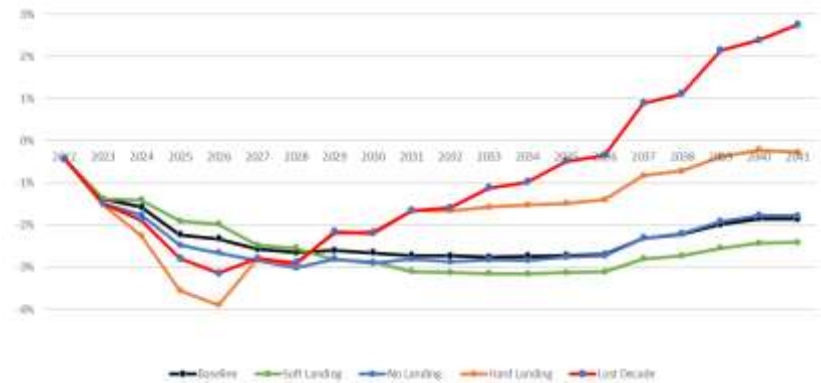
Comparison of Estimated Employer Contribution Rates
State Plan



Comparison of Estimated Funded Status
State Plan

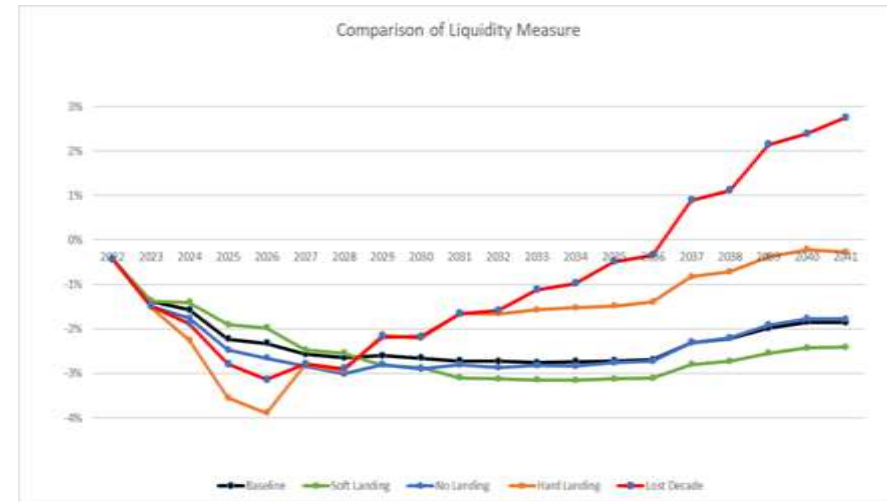
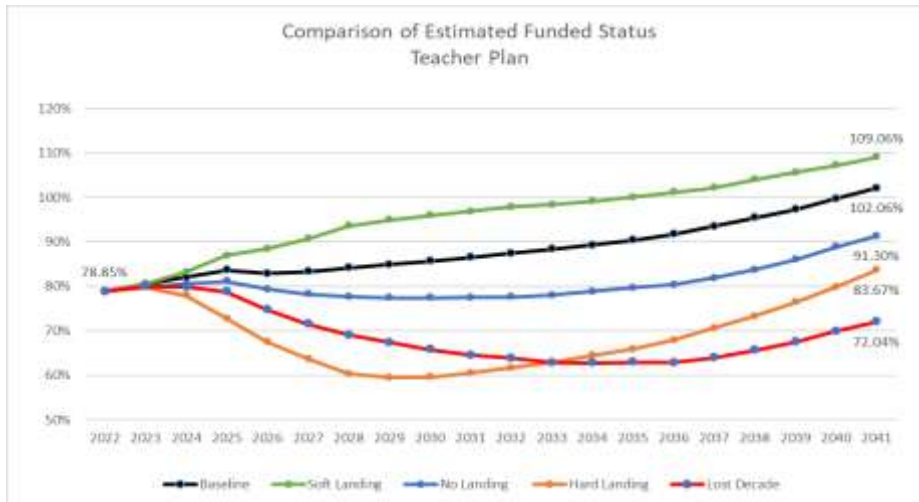
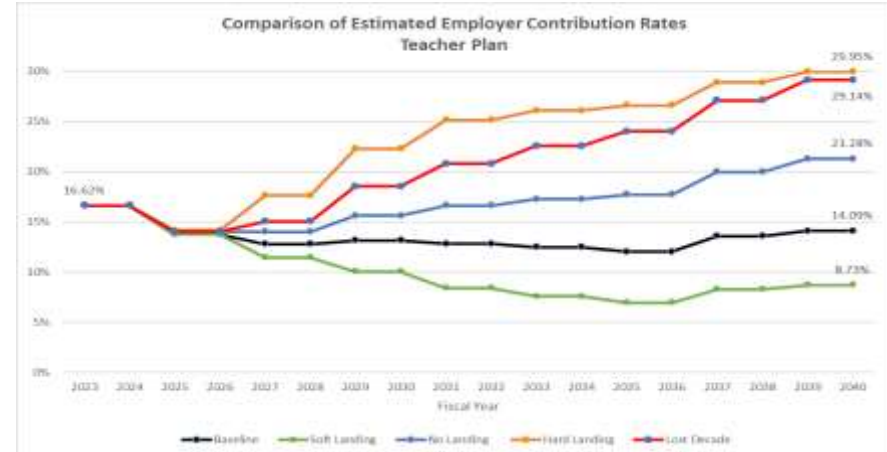


Comparison of Liquidity Measure



- Results include estimated 2023 investment return of 2.4%.
- Projections reflect measures from 2022 Appropriation Act which include additional contributions made in June 2022 and maintaining of prior employer rates for State and Teacher plans. They also include additional cash infusions scheduled for June 2023 from the 2023 proposed budget.

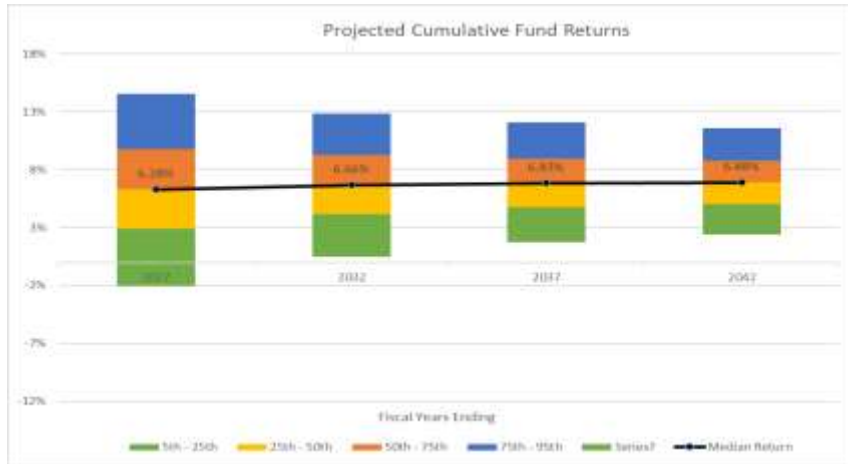
Scenarios – Median Paths (Teachers)



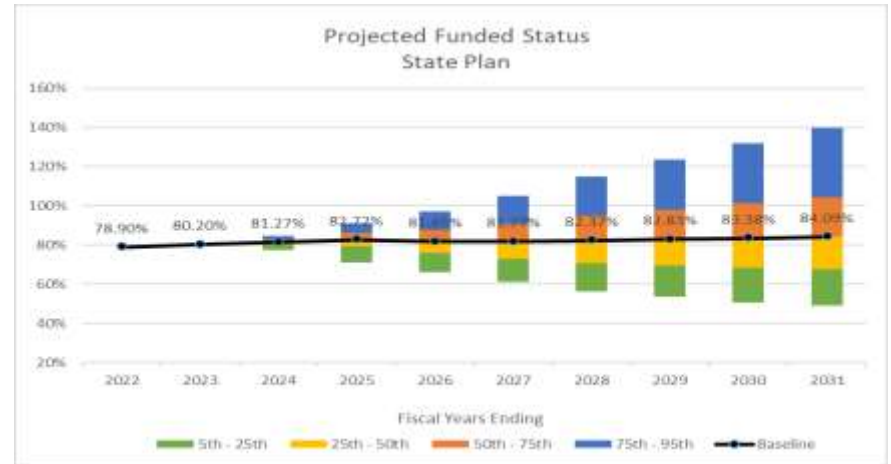
- Results include estimated 2023 investment return of 2.4%.
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Baseline - State Plan

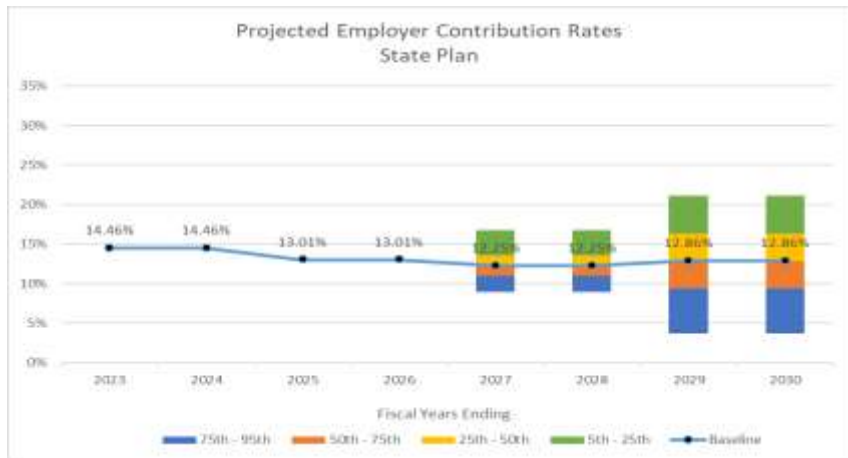
Rates of Return



Funded Status – Actuarial Asset Basis



Contribution Rates



Liquidity



- Results include estimated 2023 investment return of 2.4%.
- Projections reflect measures from 2022 Appropriation Act which include additional contributions made in June 2022 and maintaining of prior employer rates for State and Teacher plans. They also include additional cash infusions scheduled for June 2023 from the 2023 proposed budget.

Soft Landing – State Plan

Rates of Return



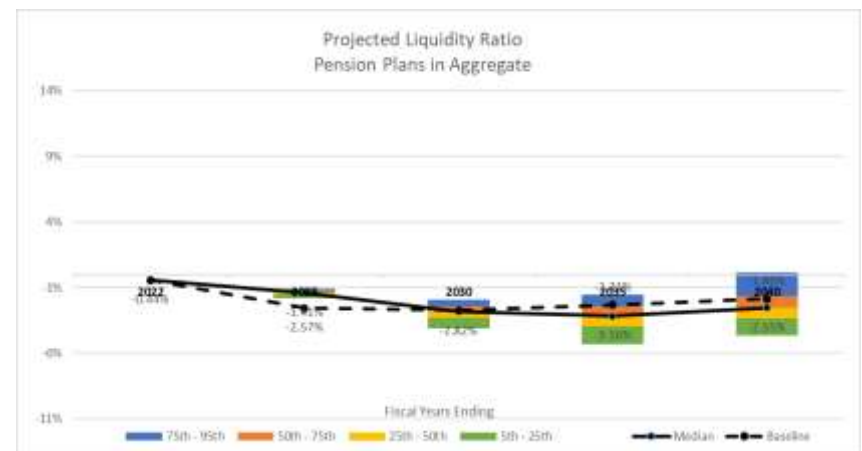
Funded Status – Actuarial Asset Basis



Contribution Rates



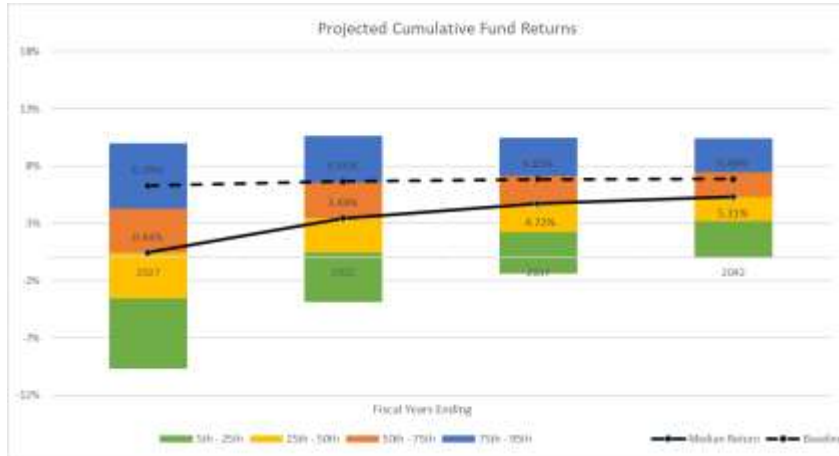
Liquidity



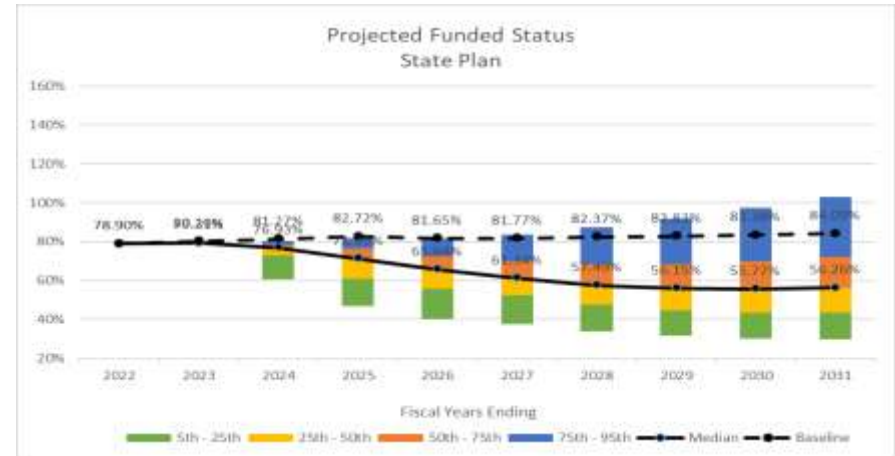
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Hard Landing– State Plan

Rates of Return



Funded Status – Actuarial Asset Basis



Contribution Rates



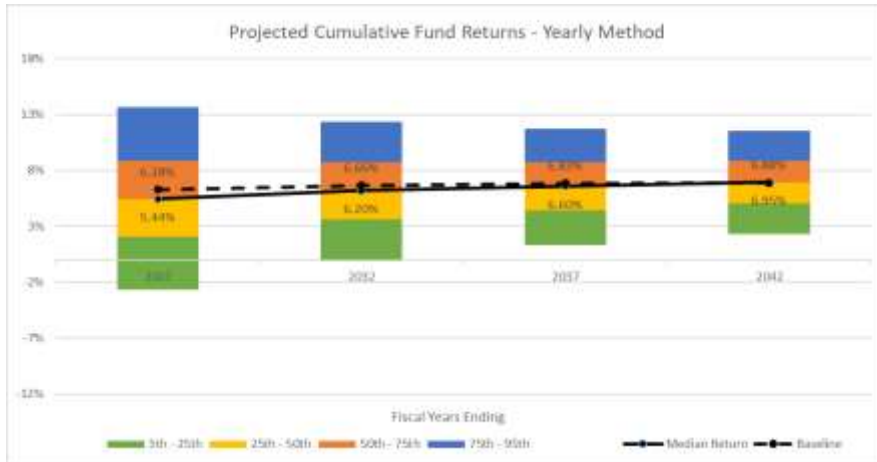
Liquidity



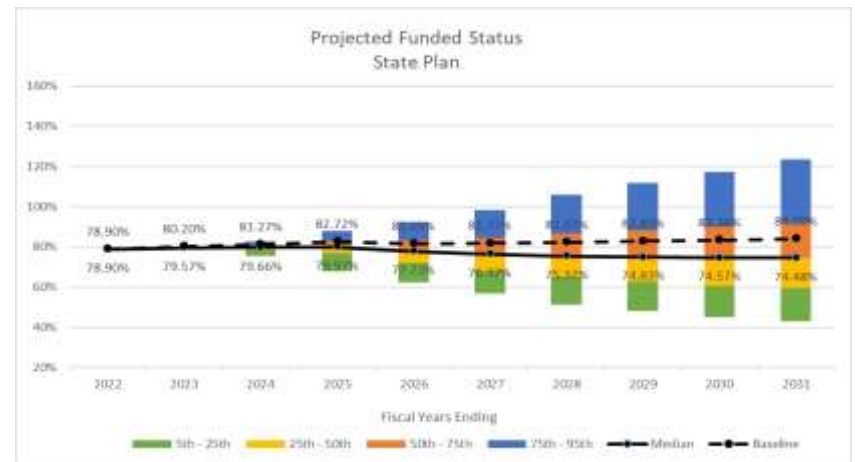
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No Landing— State Plan

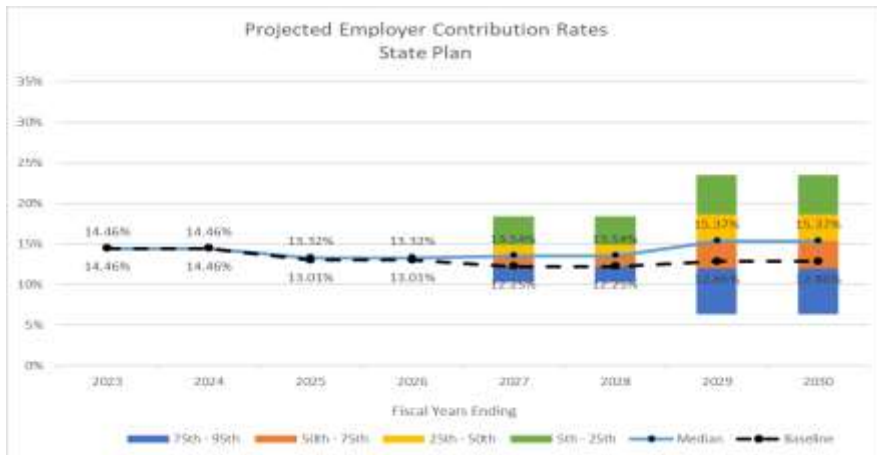
Rates of Return



Funded Status – Actuarial Asset Basis



Contribution Rates



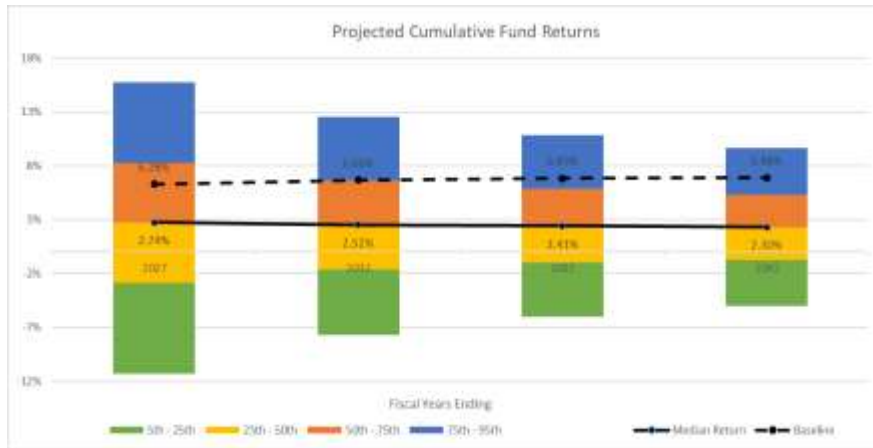
Liquidity



- Results include estimated 2023 investment return of 2.4%.
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Lost Decade – State Plan

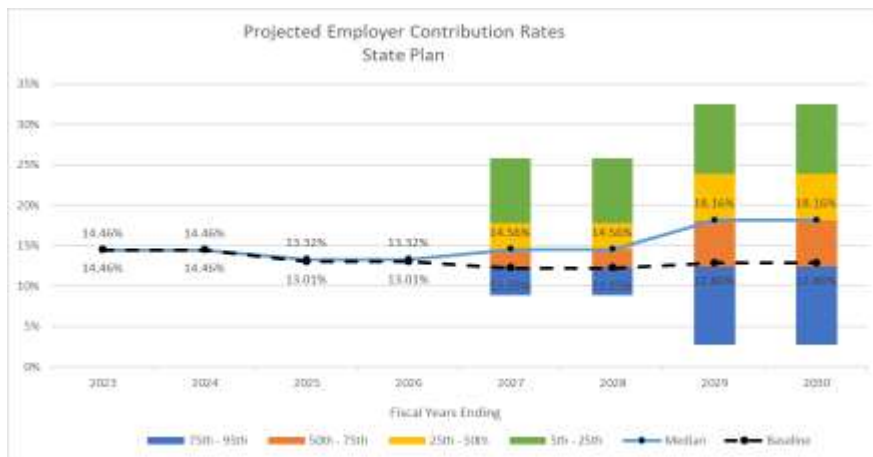
Rates of Return



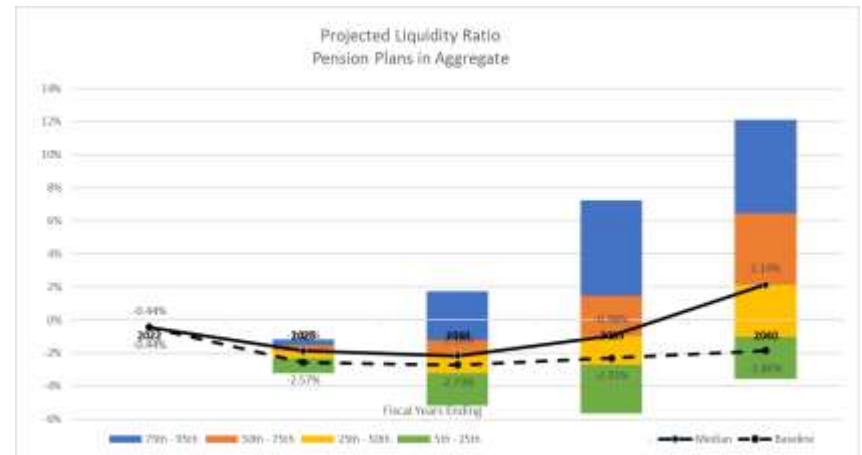
Funded Status – Actuarial Asset Basis



Contribution Rates



Liquidity



- Results include estimated 2023 investment return of 2.4%.
- Projections reflect measures from 2022 Appropriation Act which include additional contributions made in June 2022 and maintaining of prior employer rates for State and Teacher plans. They also include additional cash infusions scheduled for June 2023 from the 2023 proposed budget.

Appendix

Changes in the Policy Mix – Impact on Scenario Mean Returns



(WEIGHTS)

	Pub Eq	FI	CS	RA	Pvt Eq	PIP	Dstrat	RBI	Cash
Aggressive	40%	10%	11%	15%	18%	2%	2%	2%	0%
Policy	34%	15%	14%	14%	16%	2%	2%	2%	1%
Conservative	25%	31%	11%	10%	10%	3%	3%	3%	4%

(RETURNS)

	Pub Eq	FI	CS	RA	Pvt Eq	PIP	Dstrat	RBI	Cash	Conservative	Policy	Aggressive
Baseline	7.0%	4.9%	7.9%	6.5%	9.0%	7.8%	6.7%	6.2%	3.7%	6.5%	7.0%	7.2%
Soft Landing	7.6%	5.1%	7.9%	7.4%	8.8%	7.4%	6.9%	6.2%	3.7%	6.7%	7.3%	7.5%
No Landing	5.8%	3.8%	6.4%	5.2%	7.0%	6.7%	5.2%	5.2%	3.7%	5.2%	5.7%	5.8%
Hard Landing	5.2%	3.1%	5.9%	4.5%	6.4%	5.3%	4.9%	6.2%	3.7%	4.6%	5.1%	5.2%
Japan	5.3%	1.0%	3.1%	4.0%	6.6%	4.6%	4.1%	5.4%	3.7%	3.6%	4.3%	4.6%

Global Annualized Sensitivity

GLOBAL ANNUALIZED FORWARD RETURNS SENSITIVITY

Terminal Global Div. Yield	1.8%	7.1%	8.2%	9.2%	10.3%	11.3%	12.4%	13.4%	Terminal Global P/E	25x
	2.0%	6.4%	7.4%	8.4%	9.5%	10.5%	11.6%	12.6%		23x
	2.2%	5.5%	6.5%	7.6%	8.6%	9.6%	10.7%	11.7%		21x
	2.4%	4.6%	5.6%	6.6%	7.7%	8.7%	9.7%	10.7%		19x
	2.7%	3.6%	4.6%	5.6%	6.6%	7.6%	8.7%	9.7%		17x
	3.0%	2.5%	3.5%	4.5%	5.5%	6.5%	7.5%	8.5%		15x
	3.5%	1.3%	2.3%	3.2%	4.2%	5.2%	6.2%	7.2%		13x
	4.1%	-0.1%	0.8%	1.8%	2.8%	3.7%	4.7%	5.7%		11x
		0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%		
	10-year Annualized Nominal Global Earnings Growth									

US Annualized Sensitivity

U.S. ANNUALIZED FORWARD RETURNS SENSITIVITY

Terminal U.S. Div. Yield	1.8%	5.1%	6.1%	7.1%	8.2%	9.2%	10.2%	11.3%	Terminal U.S. P/E
	2.0%	4.3%	5.3%	6.3%	7.4%	8.4%	9.4%	10.4%	
	2.1%	3.5%	4.5%	5.5%	6.5%	7.5%	8.5%	9.5%	
	2.4%	2.5%	3.6%	4.6%	5.6%	6.6%	7.6%	8.6%	
	2.6%	1.5%	2.5%	3.5%	4.5%	5.5%	6.5%	7.5%	
	3.0%	0.4%	1.4%	2.4%	3.4%	4.4%	5.3%	6.3%	
	3.5%	-0.8%	0.2%	1.1%	2.1%	3.1%	4.0%	5.0%	
	4.1%	-2.2%	-1.3%	-0.3%	0.6%	1.6%	2.5%	3.5%	
		0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%	

25x
23x
21x
19x
17x
15x
13x
11x

10-year Annualized Nominal U.S. Earnings Growth

Developed Markets (non-US) Annualized Sensitivity

NON-U.S. ANNUALIZED FORWARD RETURNS SENSITIVITY

Terminal Dev. Non-U.S. Div. Yield	2.0%	8.4%	9.5%	10.6%	11.6%	12.7%	13.8%	14.8%	Terminal Dev. Non-U.S. P/E
	2.2%	7.7%	8.7%	9.8%	10.9%	11.9%	13.0%	14.0%	
	2.4%	6.9%	7.9%	9.0%	10.0%	11.1%	12.1%	13.2%	
	2.6%	6.0%	7.0%	8.1%	9.1%	10.1%	11.2%	12.2%	
	2.9%	5.0%	6.0%	7.1%	8.1%	9.1%	10.1%	11.2%	
	3.3%	4.0%	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%	
	3.8%	2.8%	3.8%	4.8%	5.8%	6.8%	7.8%	8.8%	
	4.5%	1.4%	2.4%	3.4%	4.4%	5.3%	6.3%	7.3%	
		-1.0%	0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	
10-year Annualized Nominal Dev. Non-U.S. Earnings Growth									

Developed Markets Annualized Sensitivity



EM ANNUALIZED FORWARD RETURNS SENSITIVITY

Terminal EM Div. Yield	1.8%	10.0%	11.0%	12.1%	13.2%	14.2%	15.3%	16.3%	Terminal EM P/E
	1.9%	9.0%	10.0%	11.1%	12.1%	13.2%	14.2%	15.3%	
	2.2%	7.9%	8.9%	10.0%	11.0%	12.0%	13.1%	14.1%	
	2.5%	6.7%	7.7%	8.7%	9.7%	10.8%	11.8%	12.8%	
	2.9%	5.3%	6.3%	7.3%	8.3%	9.3%	10.3%	11.4%	
	3.5%	3.7%	4.7%	5.7%	6.7%	7.7%	8.7%	9.7%	
	4.4%	1.9%	2.8%	3.8%	4.8%	5.7%	6.7%	7.7%	
	5.8%	-0.5%	0.5%	1.4%	2.4%	3.3%	4.3%	5.2%	
		0.9%	1.9%	2.9%	3.9%	4.9%	5.9%	6.9%	

10-year Annualized Nominal EM Earnings Growth

20x
18x
16x
14x
12x
10x
8x
6x

Private Equity Objectives:

(1) Earn a meaningful long term return premium over the public equity markets and (2) provide diversification to the total fund.

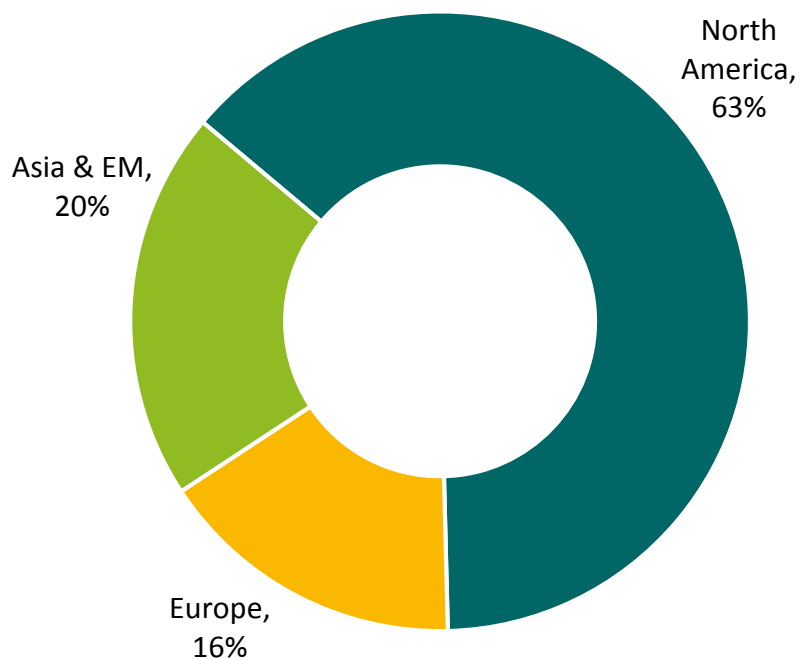
Private Equity Benchmark Proposal:

Adjust the regional weights of the current benchmark to better reflect the global private equity opportunity set.

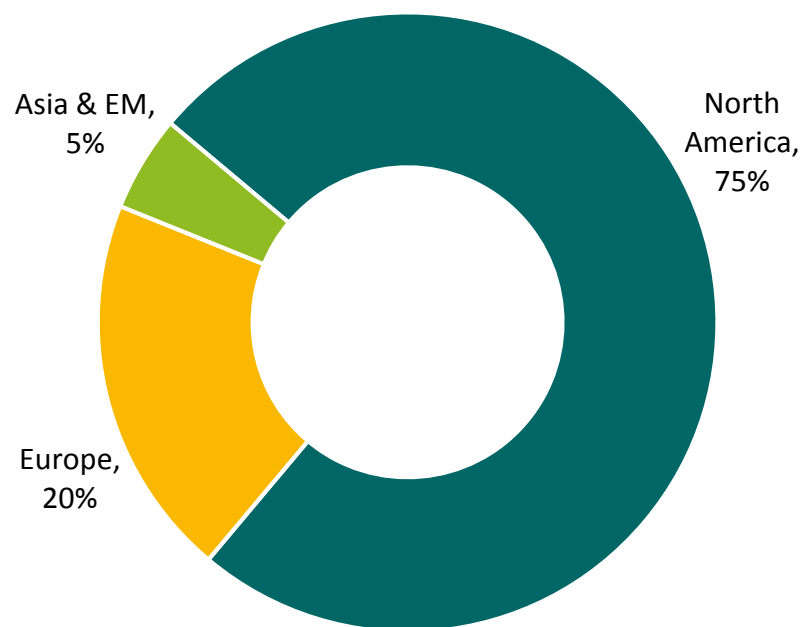
Private Equity Benchmark Proposal

Regional Composition

Current¹



Proposed²



1: Current Private Equity benchmark = MSCI ACWI IMI index (net of VRS tax rate).

2: Proposed Private Equity benchmark = the regional benchmarks of the MSCI ACWI IMI index, weighted to reflect the Private Equity opportunity set (currently 75%/20%/5% as shown above) with weights re-evaluated as part of VRS ALM process.

Pros

- The private equity opportunity set does not coincide with the regional weighting of the public equity markets.
- The private equity program is not managed to the benchmark geographic mix.
- The change removes unintended geographic market and currency exposures.

Cons

- The switch moves away from a straightforward comparison to a well-known public equity index.
- The change provides limited historical reduction in tracking error and volatility.

Adjusting the geographic allocation removes unintended risks while still comparing returns to the component pieces of the existing MSCI ACWI benchmark

Credit Strategies Benchmark Modification

Andrew Junkin
Chief Investment Officer



Credit Strategies Objective:

Earn a meaningful long term return premium over the public high-yield credit markets.

Credit Strategies Benchmark Proposal:

Remove Investment Grade (IG) from the Credit Strategies portfolio and benchmark.

Reweight Credit Strategies benchmark to 50% High Yield Bonds and 50% Bank Loans, effective July 1, 2023.

Current Benchmark

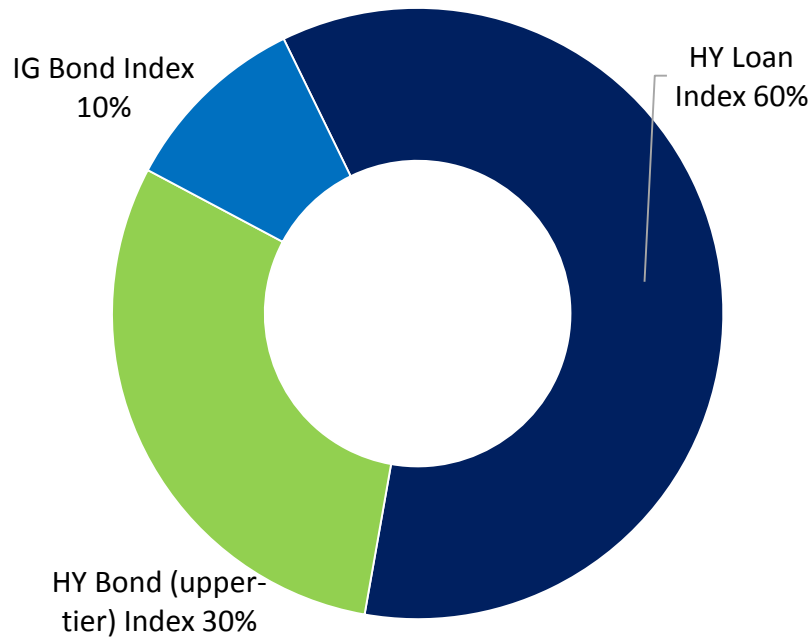
- 60% Morningstar LSTA Performing Loan Index
- 30% Bloomberg US High Yield BB/B 2% Issuer Cap Index
- 10% Bloomberg US Aggregate Bond Index

Proposed Benchmark

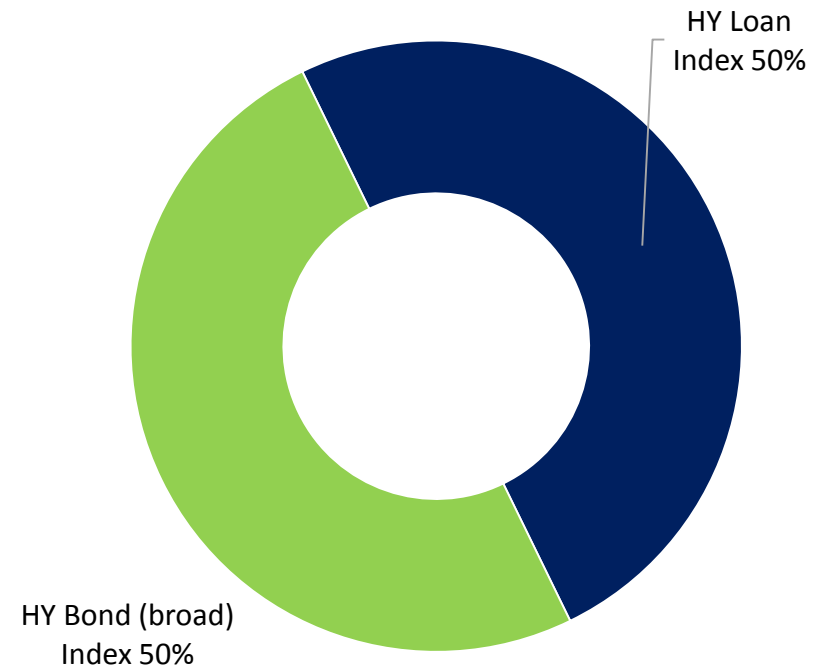
- 50% Morningstar LSTA Performing Loan Index
- 50% Bloomberg U.S. Corporate High Yield Index

Credit Strategies Benchmark Composition

Current

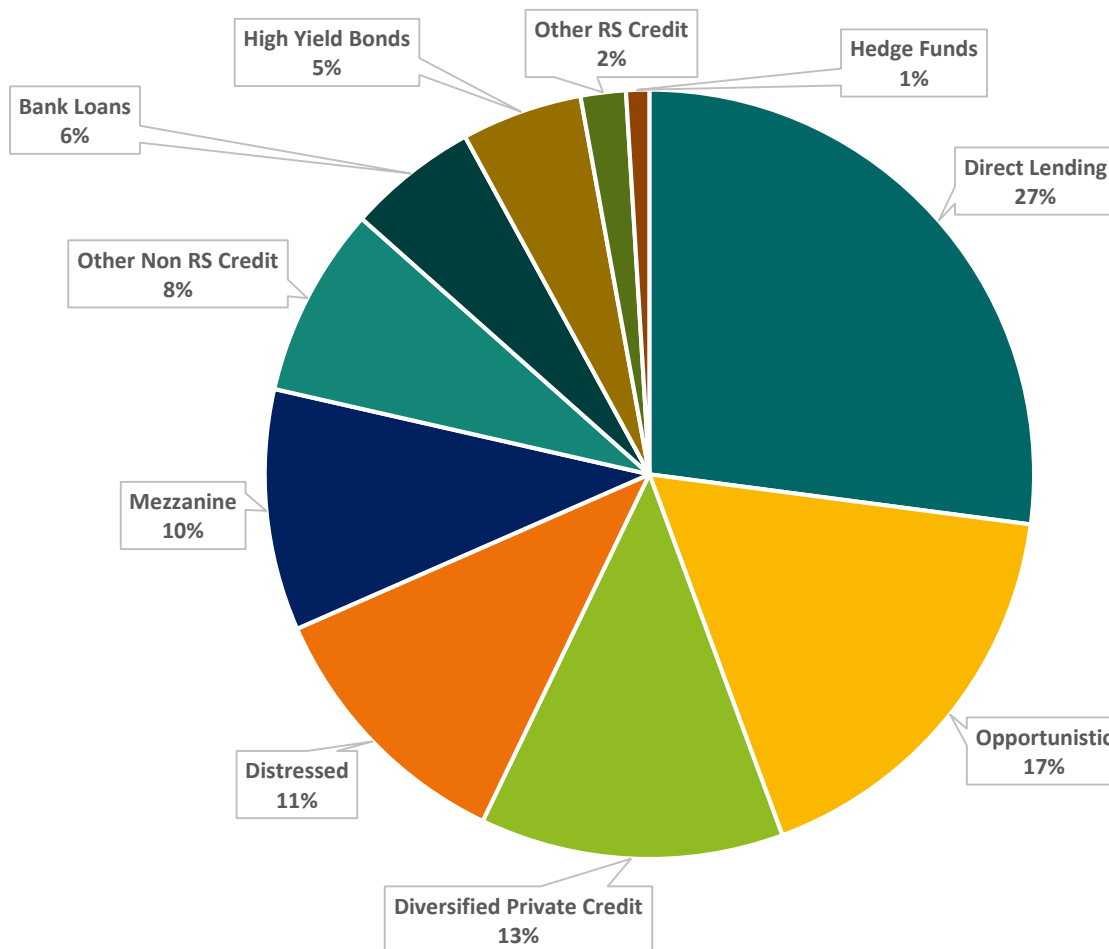


Proposed



Credit Strategies Portfolio Composition

Pro Forma – 7/1/23



Pros

- The new benchmark is simpler and more representative of the opportunity set targeted by Credit Strategies, while remaining an investable benchmark.
- The removal of IG from the program will free up capital that will be deployed into strategies with higher levels of income and that are less correlated with existing Plan exposures.
- The long term expected return of the program increases modestly.

Cons

- Credit Strategies volatility and tracking error increase modestly as the lowest risk/tracking error component of the existing portfolio is removed.

Public Equity Benchmark Adjustment

Andrew Junkin
Chief Investment Officer



Public Equity Objectives:

The objective of Public Equity program is to gain exposure to global economic growth and the global equity risk premium.

Philosophically, the program has embraced global and low-volatility exposure.

VRS should seek to avoid large drawdowns so a strategic allocation to lower volatility strategies is appropriate

Public Equity Benchmark Proposal:

The proposal is to study alternative ways to benchmark Public Equity.

Pros

- The MSCI ACWI IMI is a broad global opportunity set and is widely accepted, thus representing opportunity cost.
- This benchmark is easy to understand and explain.
- There are many off-the-shelf investment products available for this benchmark.

Cons

- Low volatility strategies reduce absolute risk but produce high levels of relative risk against the current benchmark.
- The current benchmark may hinder the Total Plan from investing in larger exposures to low volatility strategies if desirable.

A benchmark study will be conducted to examine the tradeoffs involved in modifying the Public Equity benchmark as the program continues to embrace low volatility strategies.