Investment Advisory Committee (IAC) Meeting

Virtual Meeting
GoToWebinar

Wednesday, 8/12/2020
10:00 AM - 1:00 PM ET

I. Welcome and Introductions

II. Public Comment

III. Approve Meeting Minutes (June 2, 2020)

IAC Meeting Minutes June 2 2020 - Page 2

IV. CIO Report

CIO Report - IAC Meeting - August 2020 - Page 6

V. Forward Return and Scenario Analysis

Forward Return & Scenario Analysis - Page 11

VI. Program Reviews - Portfolio Solutions Group (PSG)

IAC Aug 12 2020 - PSG Program Review - Page 32

- **Risk Based Investing (RBI)**
- **Dynamic Strategies Portfolio (DSTRAT)**
- **Currency Management**

VII. Adjournment

Minutes

An electronic meeting, held in accordance with § 2.2-3700 et seq. of the *Code of Virginia* and Chapter 1283 of the 2020 Acts of Assembly, of the Investment Advisory Committee of the Virginia Retirement System was held on June 2, 2020 with the following members present:

Larry Kochard, Chairperson
Deborah Allen Hewitt
Michael Beasley
Theodore Economou
Tom Gayner
Nan Leake
Bryan Lewis
Rod Smyth

The following Board members were present:

O'Kelly McWilliams
Diana Cantor
Brandon Bell
William Garrett
Wallace Harris
Brett Hayes
William Leighty
Joseph Montgomery
Troilen Seward

The following staff members were in attendance:

Trish Bishop, Ron Schmitz, John Alouf, Rory Badura, Parham Behrooz, Jeanne Chenault, Michael Cooper, Kevin Cronin, Sara Denson, Valerie Disanto, Laurie Fennell, Josh Fox, Brian Goodman, JT Grier, Dane Honrado, K.C. Howell, Ross Kasarda, Kristina Koutrakos, Matt Lacy, Chung Ma, Curt Mattson, Jennifer MacKnight, Steve McClelland, Walker Noland, Greg Oliff, Cat Pelletier, Steven Peterson, Dan Schlussler, Jennifer Schreck, Kristy Scott, Jillian Sherman, Lisa Turner, Dan Whitlock, and Cindy Wilkinson.

Also in attendance was James Rosatelli of the Virginia Senate Finance & Appropriations Committee; Kimberly Sarte of JLARC; Michael Jay of the Virginia House Appropriations Committee; John Meier and Eileen Neill of Verus; Ronan Burke of Capital Group; and Zack Cziryak of Financial Investment News.

Ms. Sherman served as host and walked participants through the logistics of an electronic meeting. Ms. Sherman turned the meeting over to Mr. Kochard to call the meeting to order.

Mr. Kochard called the meeting to order at 11:14 a.m. Mr. Kochard noted that given the current circumstances related to COVID-19, the IAC was unable to meet in person. However, utilizing electronic means, the IAC could hold this meeting in accordance with § 2.2-3700 et seq. of the *Code of Virginia* and Chapter 1283 of the 2020 Acts of Assembly as it relates to conducting business during the pandemic.

Mr. Kochard took a roll call of each IAC member for attendance purposes:

Mr. Beasley – present
Mr. Economou – present
Dr. Hewitt – present
Ms. Leake – present
Mr. Lewis – present
Mr. Smyth – present
Mr. Kochard – present

Minutes

A motion was made by Mr. Smyth and seconded by Mr. Economou to approve the minutes for the November 13, 2019 and April 15, 2020 Committee meetings. The motion was unanimously approved via roll call:

Mr. Beasley – approve
Mr. Economou – approve
Dr. Hewitt – approve
Ms. Leake – approve
Mr. Lewis – approve
Mr. Smyth – approve
Mr. Kochard - approve

Mr. Gayner entered the meeting at 11:20 A.M.

CIO Report

Mr. Schmitz gave a brief overview of economic and market conditions. Mr. Schmitz presented the Performance Summary, Asset Allocation Report, and Total Fund Tracking Error as of March 31, 2020. Mr. Schmitz then gave an update on current market conditions considering market movement during the pandemic. Mr. Schmitz noted he will request the Board to approve a revised asset allocation at the June 11, 2020 meeting in order to correct a transposition of the Proposed FY 2021 Targets between PIP and MAPS. He also noted that he had received the TUCS Public Fund data, and compared VRS to the TUCS data. Last, Mr. Schmitz reviewed the New Investments and Terminations Report.

Macro Update

Dr. Peterson provided a macro update illustrating several investment scenarios, largely COVID-19 driven. Dr. Peterson noted that the onset of this pandemic has disrupted the global economy on a virtually unprecedented scale. Dr. Peterson presented three prospective recovery path scenarios and their implication for funded status, contribution rates and liquidity.

Fixed Income Benchmark Phase-In

Mr. Schmitz led a discussion regarding the Fixed Income Benchmark phase-in approach and a proposed change to the approach. The previous asset allocation implementation plan had VRS moving from 100% Aggregate Index to an 80/10/10 with the 10% pieces being High Yield and Emerging Markets Debt. The plan included an interim phase at a 90/5/5 weighting of the benchmark components. Due to recent market action caused by the COVID-19 pandemic and related economic impacts affecting the Fund, Mr. Schmitz recommended Fixed Income stay at the interim phase benchmark of 90/5/5, and consider it to be the permanent benchmark. The Committee agreed this approach sounds reasonable, and supported Mr. Schmitz's recommendation.

Benchmark/Hurdle Study Review and Discussion

John Meier with Verus presented the results of the Benchmark and Performance Hurdle Analysis. Mr. Meier began his presentation by reviewing the characteristics of a good benchmark per the CFA Institute: unambiguous, investable, measurable, appropriate, specified in advance, and reflective of current investment options. He then noted excess return objectives should reflect the strategies and current capabilities of staff within each program as well as for the total fund. Mr. Meier reviewed his findings, to include the various recommended changes, and stated his findings were based on careful analysis of the risks and opportunities of the underlying markets and an analysis of the practices of peer funds, within the universe of public funds. The Committee agreed the recommended changes to benchmarks and performance hurdles were reasonable, and supported the changes.

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

Adjournment

Mr. Gayner made a motion to adjourn the meeting. Mr. Beasley seconded the motion. Mr. Kochard asked for each Committee member to vote on the motion:

Mr. Beasley – aye
Mr. Economou – aye
Mr. Gayner – aye
Dr. Hewitt – aye
Ms. Leake – aye
Mr. Lewis – aye
Mr. Smyth - aye
Mr. Kochard – aye

The motion to adjourn the meeting passed.

The meeting was adjourned at 12:47 p.m.

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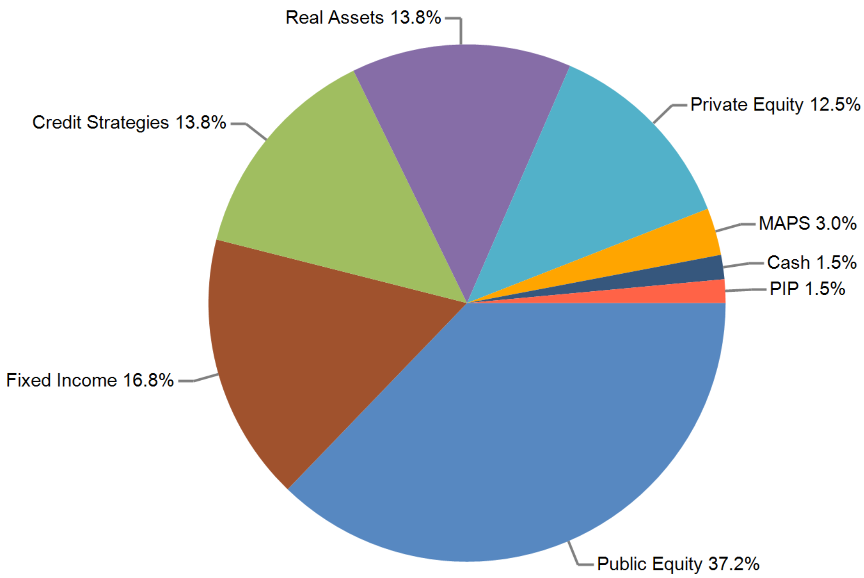
Larry Kochard, Chairperson

Virginia Retirement System

Asset Allocation Report

June 30, 2020

For Internal Investment Purposes Only



	Current $Bil	Current Weight	Policy Weight	Variance	Allowable Range		Internal %
TOTAL FUND	**81.6**						**31.1%**
Public Equity	**30.4**	**37.2%**	**37.0%**	**0.2%**	**-5%**	**+5%**	**38.6%**
Fixed Income	**13.7**	**16.8%**	**16.0%**	**0.8%**	**-3%**	**+5%**	**93.7%**
Credit Strategies	**11.3**	**13.8%**	**14.0%**	**-0.2%**	**-5%**	**+5%**	
RS Credit	4.9	6.0%	5.6%	0.4%			
NRS Credit	6.4	7.8%	8.4%	-0.6%			
Real Assets	**11.2**	**13.8%**	**14.0%**	**-0.2%**	**-5%**	**+5%**	**5.8%**
Public RE	1.2	1.4%					56.1%
Private RE	6.7	8.2%					
Other RA	3.4	4.2%					
Private Equity	**10.2**	**12.5%**	**13.0%**	**-0.5%**	**-5%**	**+5%**	
MAPS	**2.4**	**3.0%**	**3.0%**	**0.0%**	**-1%**	**+1%**	
DSTRAT	1.1	1.4%					
RBI	1.3	1.6%					18.5%
PIP	**1.2**	**1.5%**	**2.0%**	**-0.5%**	**-1%**	**+2%**	
Cash	**1.2**	**1.5%**	**1.0%**	**0.5%**	**-1%**	**+4%**	

	Current $Bil	Current Weight	Policy Limit
Hedge Funds	**8.5**	**10.4%**	**15.0%**

3 Year Tracking Error	
Total Fund:	**1.48%**
Total Public:	**0.59%**

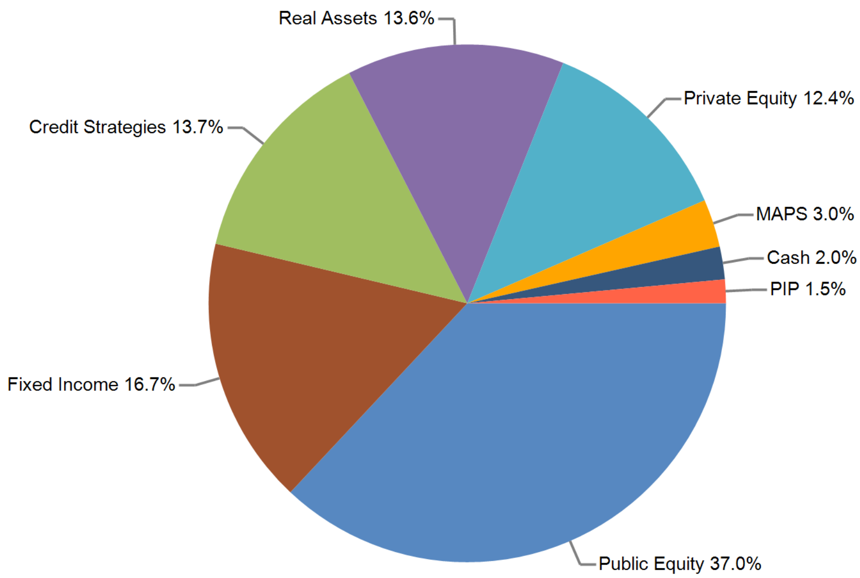
*Total Fund includes the following amt held by the Treasurer of VA: $ 362 million

• 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 th Virginia Retirement System's true economic exposure to each asset class.(6 adjustments applied)

*Total Fund and Total Public tracking error are calculated using monthly returns, then annualized

* Differences in Totals are due to rounding

Daily Asset Allocation Report
August 07, 2020
For Internal Investment Purposes Only



	Current $Bil	Current Weight	Policy Weight	Variance	Allowable Range		Internal %
TOTAL FUND	**83.8**						**32.3%**
Public Equity	**31.0**	**37.0%**	**37.0%**	**0.0%**	**-5%**	**+5%**	**42.3%**
Fixed Income	**14.0**	**16.7%**	**16.0%**	**0.7%**	**-3%**	**+5%**	**93.5%**
Credit Strategies	**11.5**	**13.7%**	**14.0%**	**-0.3%**	**-5%**	**+5%**	
RS Credit	5.1	6.1%	5.6%	0.5%			
NRS Credit	6.4	7.6%	8.4%	-0.8%			
Real Assets	**11.4**	**13.6%**	**14.0%**	**-0.4%**	**-5%**	**+5%**	**5.9%**
Public RE	1.2	1.5%					54.8%
Private RE	6.7	8.0%					
Other RA	3.4	4.1%					
Private Equity	**10.4**	**12.4%**	**13.0%**	**-0.6%**	**-5%**	**+5%**	
MAPS	**2.5**	**3.0%**	**3.0%**	**0.0%**	**-1%**	**+1%**	
DSTRAT	1.2	1.4%					
RBI	1.3	1.6%					18.6%
PIP	**1.2**	**1.5%**	**2.0%**	**-0.5%**	**-1%**	**+2%**	
Cash	**1.7**	**2.0%**	**1.0%**	**1.0%**	**-1%**	**+4%**	

	Current $Bil	Current Weight	Policy Limit
Hedge Funds	**8.2**	**9.8%**	**15.0%**

3 Year Tracking Error	
Total Fund:	**1.50%**
Total Public:	**0.60%**

*Total Fund includes the following amt held by the Treasurer of VA: $ 73 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 (7 adjustments applied)

*Total Fund and Total Public tracking error are calculated using monthly returns, then annualized

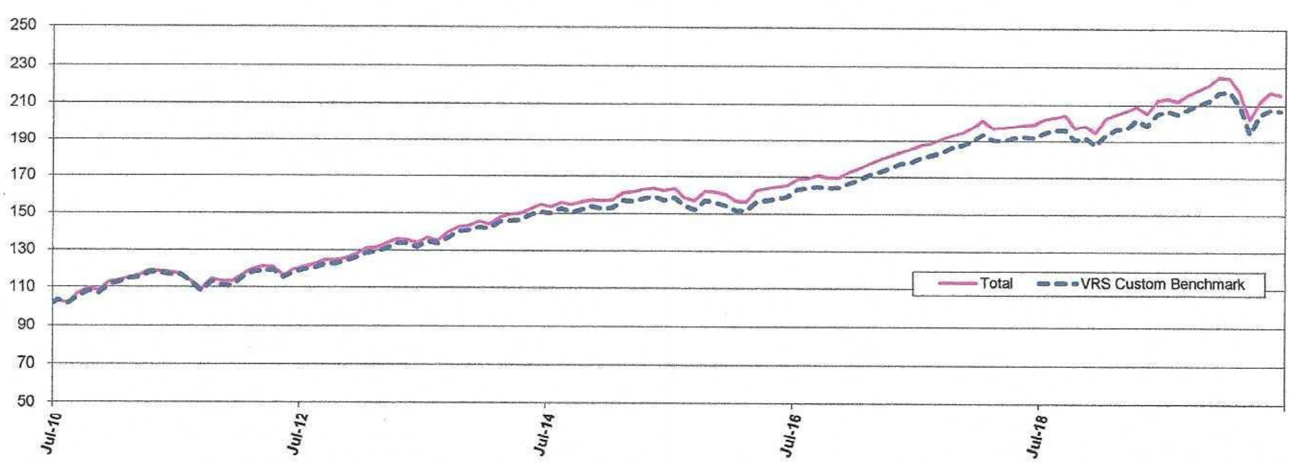
* Differences in Totals are due to Rounding

PERFORMANCE SUMMARY
Rolling Periods Ending
June 30, 2020

TOTAL FUND PERFORMANCE

	10 Yr	5 Yr	3 Yr	1 Yr	Qtr	Month	Fiscal YTD	Cal YTD	Market Value ($MM)
Total Public Equity Strategies	**9.1**	**5.2**	**4.2**	**-0.7**	**18.2**	**2.7**	**-0.7**	**-8.2**	**30,972**
Benchmark	9.0	6.0	5.6	1.3	20.0	3.2	1.3	-6.6	
Total Fixed Income	**4.5**	**4.9**	**5.8**	**9.5**	**5.4**	**1.2**	**9.5**	**6.5**	**12,485**
Benchmark	3.8	4.1	5.1	7.9	3.8	0.8	7.9	5.3	
Total Credit Strategies	**6.2**	**4.7**	**4.1**	**0.3**	**6.0**	**0.0**	**0.3**	**-2.8**	**11,271**
Benchmark	5.7	4.7	4.2	1.3	9.6	1.0	1.3	-2.8	
Total Real Assets	**11.1**	**8.1**	**6.0**	**1.0**	**-0.9**	**-1.9**	**1.0**	**-2.6**	**11,235**
Benchmark	9.7	7.0	5.5	2.3	1.7	0.3	2.3	-0.3	
Total Private Equity	**12.8**	**11.3**	**10.0**	**0.8**	**-9.4**	**-9.5**	**0.8**	**-6.4**	**10,232**
Benchmark	10.9	6.6	5.1	-7.9	-19.9	-13.3	-7.9	-12.8	
Total Private Investment Partnerships	**n/a**	**5.2**	**3.4**	**-6.4**	**-11.6**	**-11.6**	**-6.4**	**-9.7**	**1,201**
Benchmark	n/a	6.3	5.2	-1.7	-6.6	-5.3	-1.7	-5.0	
Total Multi-Asset Public Strategies	**n/a**	**n/a**	**n/a**	**-3.2**	**7.0**	**0.9**	**-3.2**	**-6.7**	**2,408**
Benchmark	n/a	n/a	n/a	3.9	8.4	1.7	3.9	-0.5	
Total Fund	**8.1**	**5.8**	**5.2**	**1.4**	**6.6**	**-0.5**	**1.4**	**-4.0**	**81,600**
VRS Custom Benchmark	7.6	5.6	5.1	1.0	6.4	-0.4	1.0	-4.3	

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.

8/6/2020 10:13 AM

Total Fund Tracking Error

Figure 1: Policy Tracking Error Rolling Three Year - Plan (as of 6/30/2020)

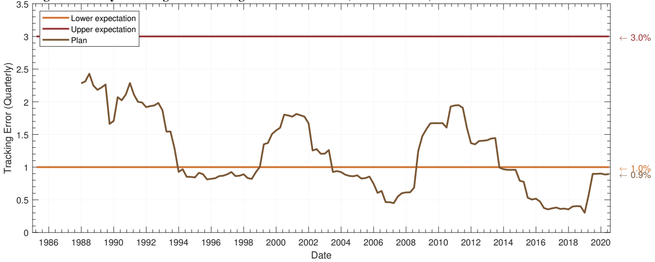
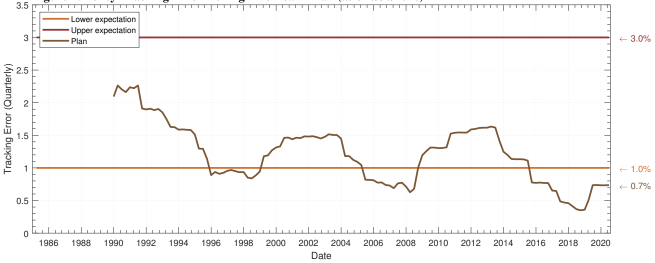


Figure 2: Policy Tracking Error Rolling Five Year - Plan (as of 6/30/2020)



1 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
Public Equity	Terminated	07/01/2020	$300 Million	Immediate	**Highline Capital Partners** – A long/short equity hedge fund.
Fixed Income	Hired	07/01/2020	$100 Million	Immediate	**Man Numeric Systematic High Yield** – A separately managed systematic high yield account to supplement internal high yield efforts.
Credit Strategies	Hired	06/10/2020	$275 Million	5 Years	**PGIM Capital Partners VI** – A closed-end fund investing in middle market subordinated (mezzanine) debt and some equity.
Credit Strategies	Hired	06/17/2020	$750 Million	3 Years	**Aksia Private Credit** – A fund that will invest in small private credit funds.
Credit Strategies	Hired	07/01/2020	$300 Million	3 Years	**Oaktree Opportunities Fund XI** – A closed-end fund focused on investing in both private and public corporate distressed debt opportunities.
Real Assets	Hired	06/18/2020	$135 Million	4 Years	**Carson/VA Industrial J/V III** – A joint venture investing in industrial warehouse properties.
Real Assets	Opened	06/30/2020	$500 Million	Immediate	**Montalto (VRS Internal Equity Management)** – An internally managed non-U.S. REIT passive strategy.
Real Assets	Terminated	06/30/2020	$497 Million	Immediate	**Morgan Stanley** – A global ex-U.S. REIT manager.
Private Equity	Hired	07/01/2020	€200 Million	6 Years	**CVC VIII** – A global mega buyout fund with a focus on well-managed businesses in Western Europe.
Private Equity	Hired	07/14/2020	$45 Million	6 Years	**HIG VI** – A small market buyout fund focused on complex and distressed investments in North America.
Private Equity	Hired	07/14/2020	$150 Million	6 Years	**Thoma Bravo XIV** – A mega buyout fund with an exclusive focus on software and technology enabled services.
Private Equity	Hired	07/31/2020	$125 Million	6 Years	**KKR Asian IV** – A Pan-Asia mega buyout fund that will invest in both control and minority transactions.

Virginia Retirement System

Forward Returns & Scenario Analysis

Steven Peterson
Director of Research

Summary Forward Returns And Scenario Analyses

Virginia Retirement System

- **Forward Returns By Asset Class And Total Fund**
  - Point estimates and confidence bands
  - Building blocks and sources of return
- **External Managers' Forward Returns**
- **COVID-19 Recovery Scenarios (V, U, L recoveries)**
  - Contribution rates
  - Funded status
  - Net cash outflow % total fund*

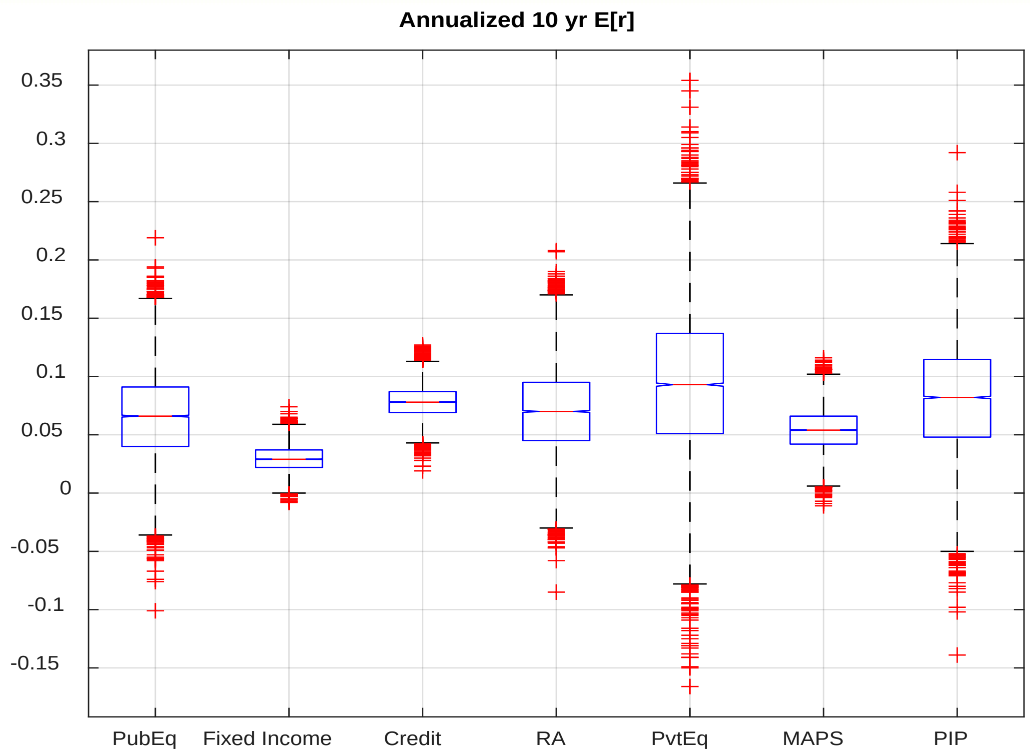
*(Contributions - Benefit Payments)/Market Value of Fund

Forward Returns And Volatilities By Asset Class

Asset Class	Wt.	Current E(r)	E(σ)
Public Equity	34.0%	6.4%	11.9%
Fixed Income	15.0%	2.3%	3.5%
Credit Strategies	14.0%	7.8%	4.3%
Real Assets	14.0%	6.9%	11.5%
Private Equity	14.0%	9.0%	20.0%
MAPS	6.0%	5.4%	5.5%
PIP	3.0%	7.9%	15.4%
Cash	0.0%	0.0%	0.5%
Currency Return Addition		*0.1%*	
Total Fund		**6.5%**	**10.4%**

Asset Class & Strategy	Wt.	Current E(r)	E(σ)
Public Equity	**34.0%**	**6.4%**	**11.9%**
Fixed Income	**15.0%**	**2.3%**	**3.5%**
Government	2%	0.6%	
Securitized	5%	1.7%	
IG Credit	5%	2.3%	
Emerging Market Debt	1%	5.3%	
High Yield Debt	1%	5.8%	
Credit Strategies	**14.0%**	**7.8%**	**4.3%**
Rate Sensitive HY	4%	7.6%	
Rate Sensitive IG	1%	3.0%	
Non-Rate Sensitive	8%	8.8%	
Real Assets	**14.0%**	**6.9%**	**11.5%**
Private Real Estate	8%	6.3%	
Public Real Estate	2%	6.8%	
Other Real Assets	4%	8.2%	
Private Equity	**14.0%**	**9.0%**	**20.0%**
MAPS	**6.0%**	**5.4%**	**5.5%**
PIP	**3.0%**	**7.9%**	**15.4%**
Cash	**0.0%**	**0.0%**	**0.5%**
Currency Return Addition		*0.1%*	
Total Fund		**6.5%**	**10.4%**

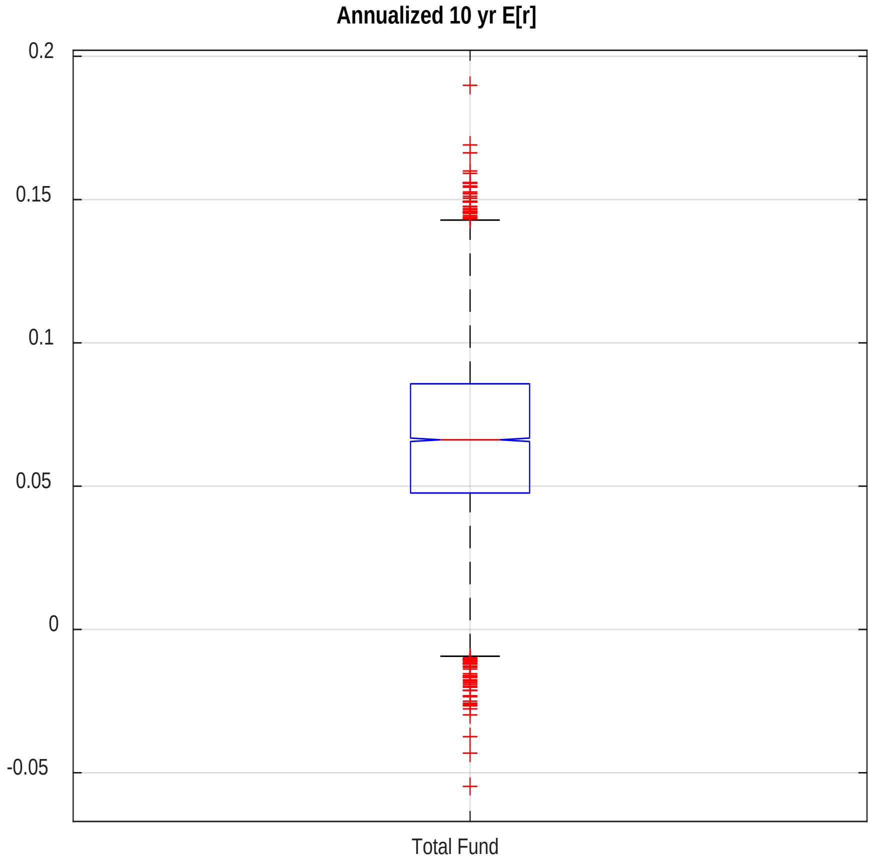
VRS Forward Returns By Asset Class



Quantile	PubEq	FI	CS	RA	PvtEq	MAPS	PIP
p5	0.3%	1.1%	5.6%	1.0%	-1.3%	2.5%	0.1%
p25	4.0%	2.2%	6.9%	4.5%	5.1%	4.2%	4.8%
p50	6.6%	2.9%	7.8%	7.0%	9.3%	5.4%	8.2%
p75	9.1%	3.7%	8.7%	9.5%	13.7%	6.6%	11.5%
p95	12.8%	4.7%	10.1%	13.0%	20.0%	8.2%	16.3%

Forward Return For Total Fund

Virginia Retirement System



Quantile	Total Fund
P5	0.020
p25	0.048
p50	0.066
p75	0.086
p95	0.113
Pr(R_fund<0) = 0.8%	

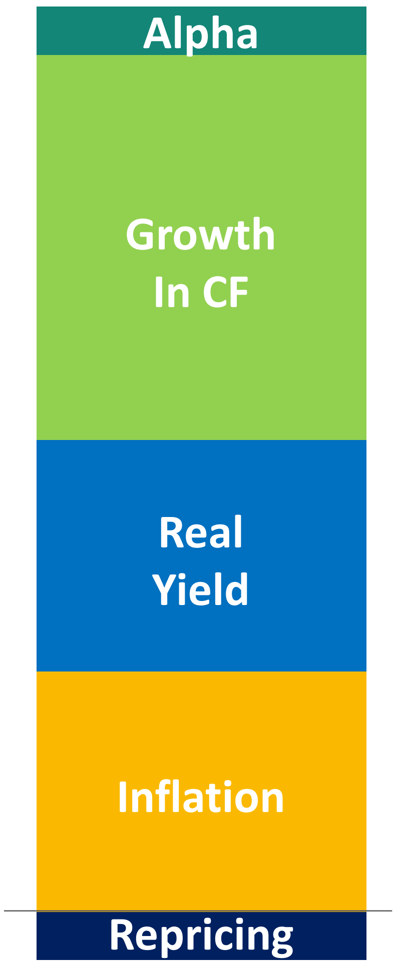
Forward Returns Attribution

	10 Year	CF Yield	Growth in CF	Reprice	Alpha
Global Equity	**6.4%**	**2.5%**	**4.1%**	**-0.5%**	**0.3%**
US Equity	4.8%	2.1%	2.9%	-0.6%	0.3%
Non-US Equity	7.6%	3.2%	4.4%	-0.3%	0.3%
EM Equity	8.8%	2.7%	6.3%	-0.4%	0.3%
Total Real Assets	**6.9%**	**5.2%**	**1.7%**	**-0.5%**	**0.3%**
Private RE	6.3%	4.1%	2.6%	-0.9%	0.3%
Global REITs	6.8%	4.5%	2.0%	0.1%	0.3%
Infrastructure	8.1%	4.2%	2.2%	0.1%	0.5%
Energy & Mining	10.2%	16.7%	-6.0%	0.0%	0.5%
Timberland	4.8%	3.0%	2.5%	-0.2%	0.5%
Farmland	7.5%	6.3%	1.8%	0.0%	0.5%
Tot. ORA	8.2%	7.5%	0.1%	0.0%	0.5%
Total IFI[a]	**2.3%**	**2.4%**	**1.0%**	**-0.4%**	**0.3%**
BC Treasury	0.6%	0.9%	1.0%	-0.4%	0.1%
BC Agency	1.0%	1.2%	1.0%	-0.4%	0.2%
BC MBS	1.2%	1.3%	1.0%	-0.4%	0.3%
BC CMBS	2.1%	2.2%	1.0%	-0.4%	0.3%
BC ABS	2.4%	2.3%	1.0%	-0.2%	0.3%
BC IG Credit	2.3%	2.5%	1.0%	-0.5%	0.3%
BC HY Credit	5.8%	5.9%	1.0%	-0.4%	0.3%
JPM EMBI Core	5.3%	5.7%	1.0%	-0.4%	0.0%

*Gross of expected inflation

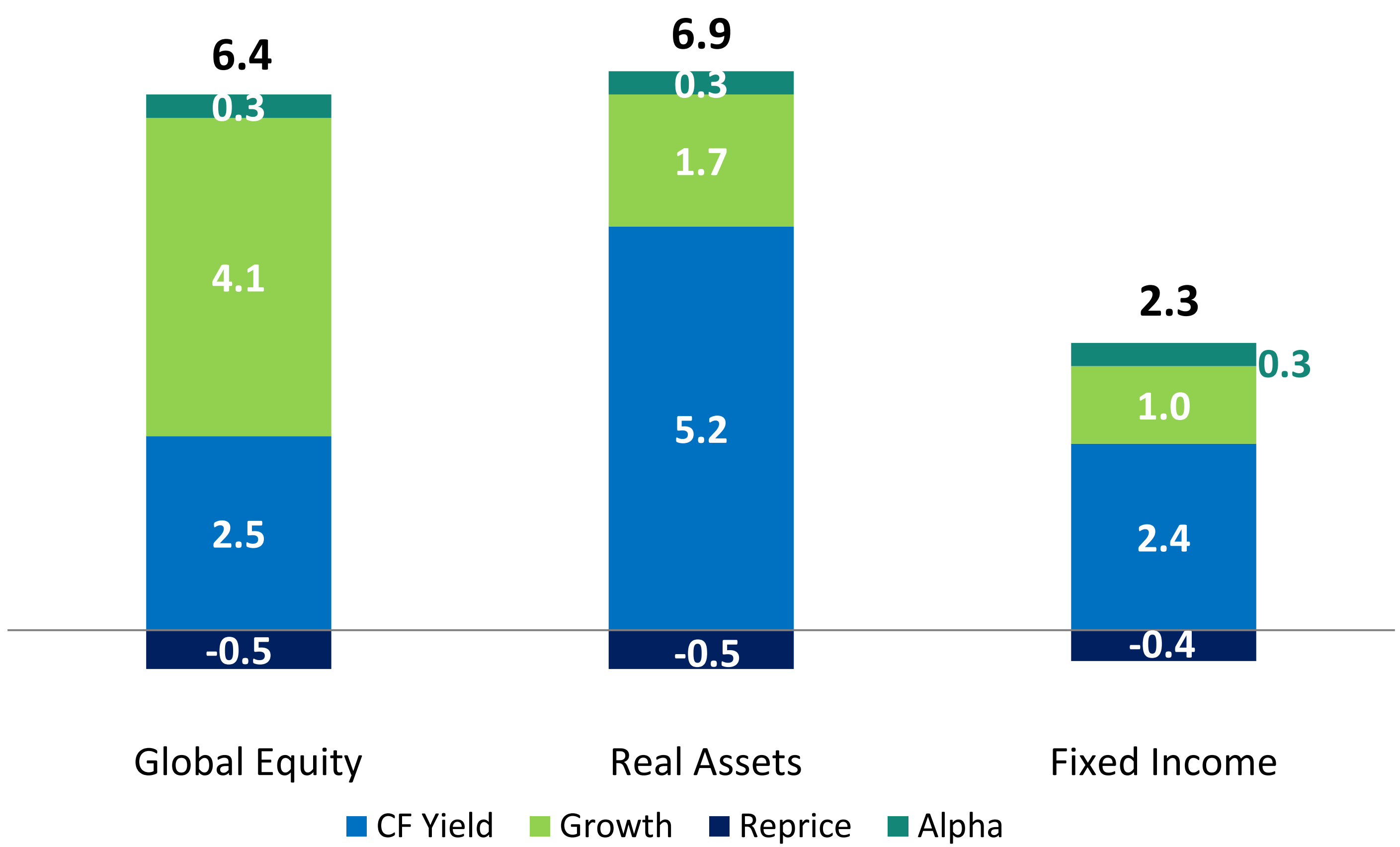
[a]10 Year return = CF Yield + Reprice + Alpha (reprice accounts for growth)

Macro Factor Impact On Forward Returns

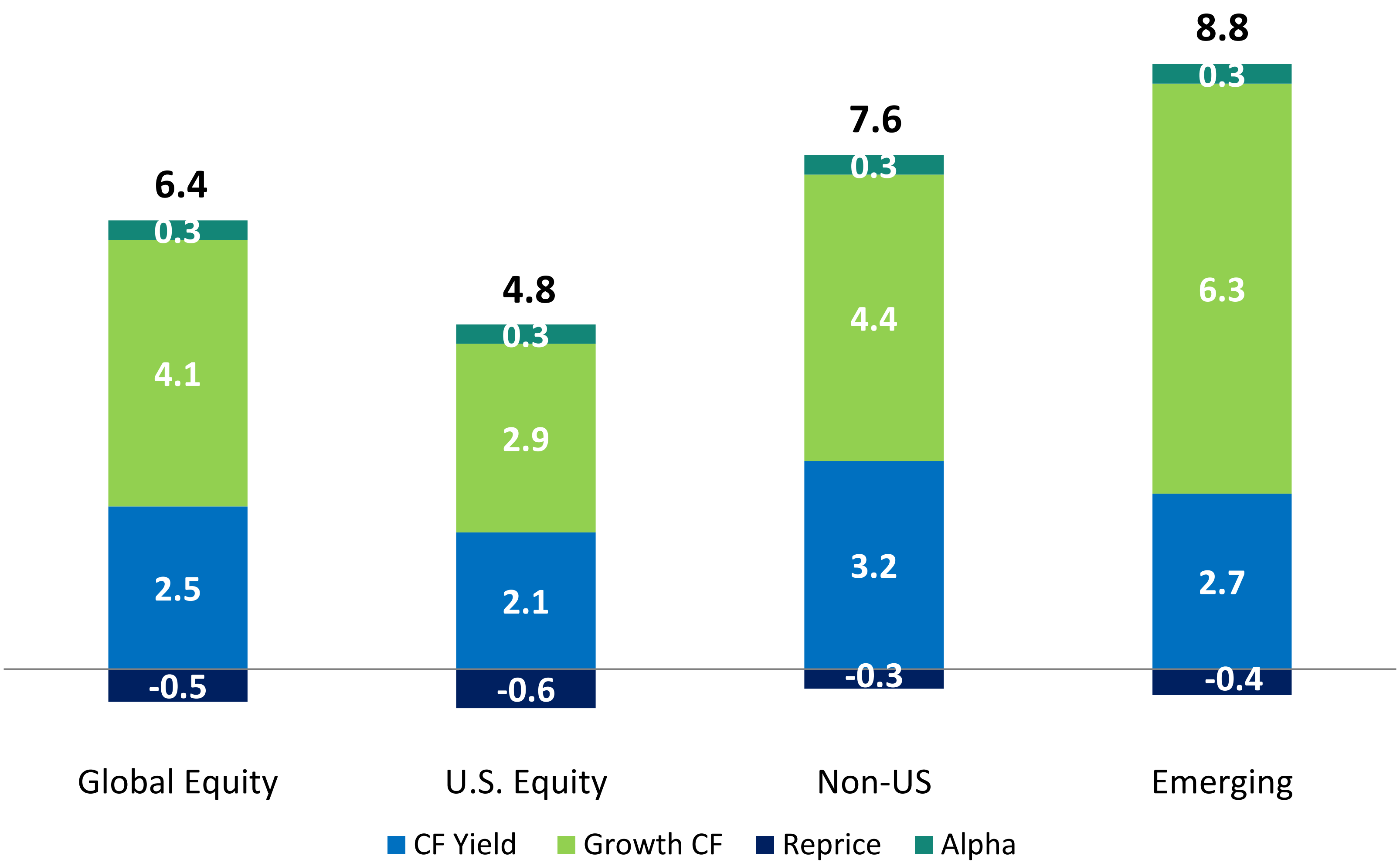


Factor	Impact
Rising Volatility	+
Tax Cuts	+
Post-COVID Entry Point	+
Trade Deficits	-
De-globalization	-
Declining Productivity	-
Central Bank Policies	-
Discount Rates	+
Massive Stimulus	+
Slowing Growth	-
Weaker USD	+
Multiple Reversion	-

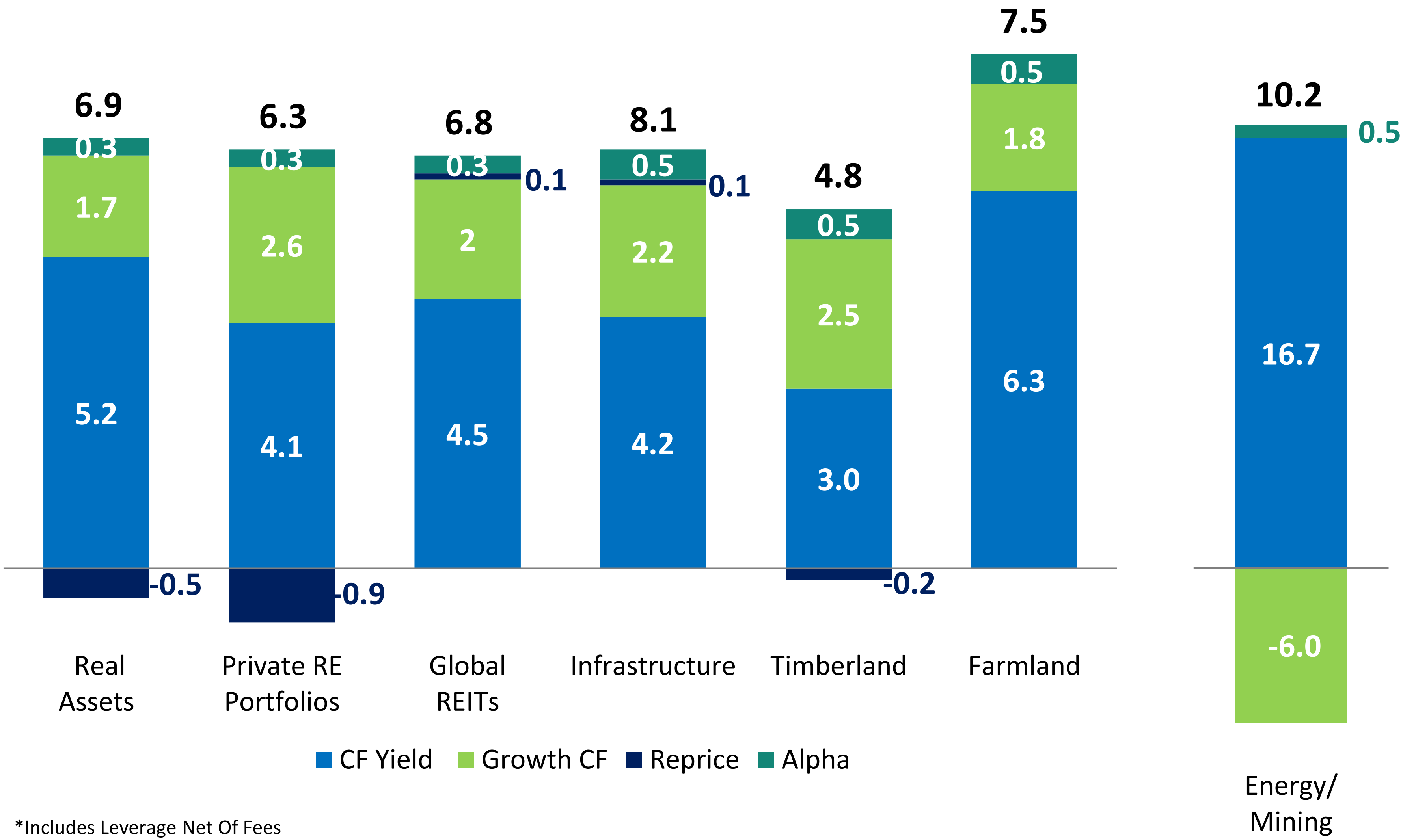
Total Fund Attribution (Percent)



Global Equity Attribution (Percent)

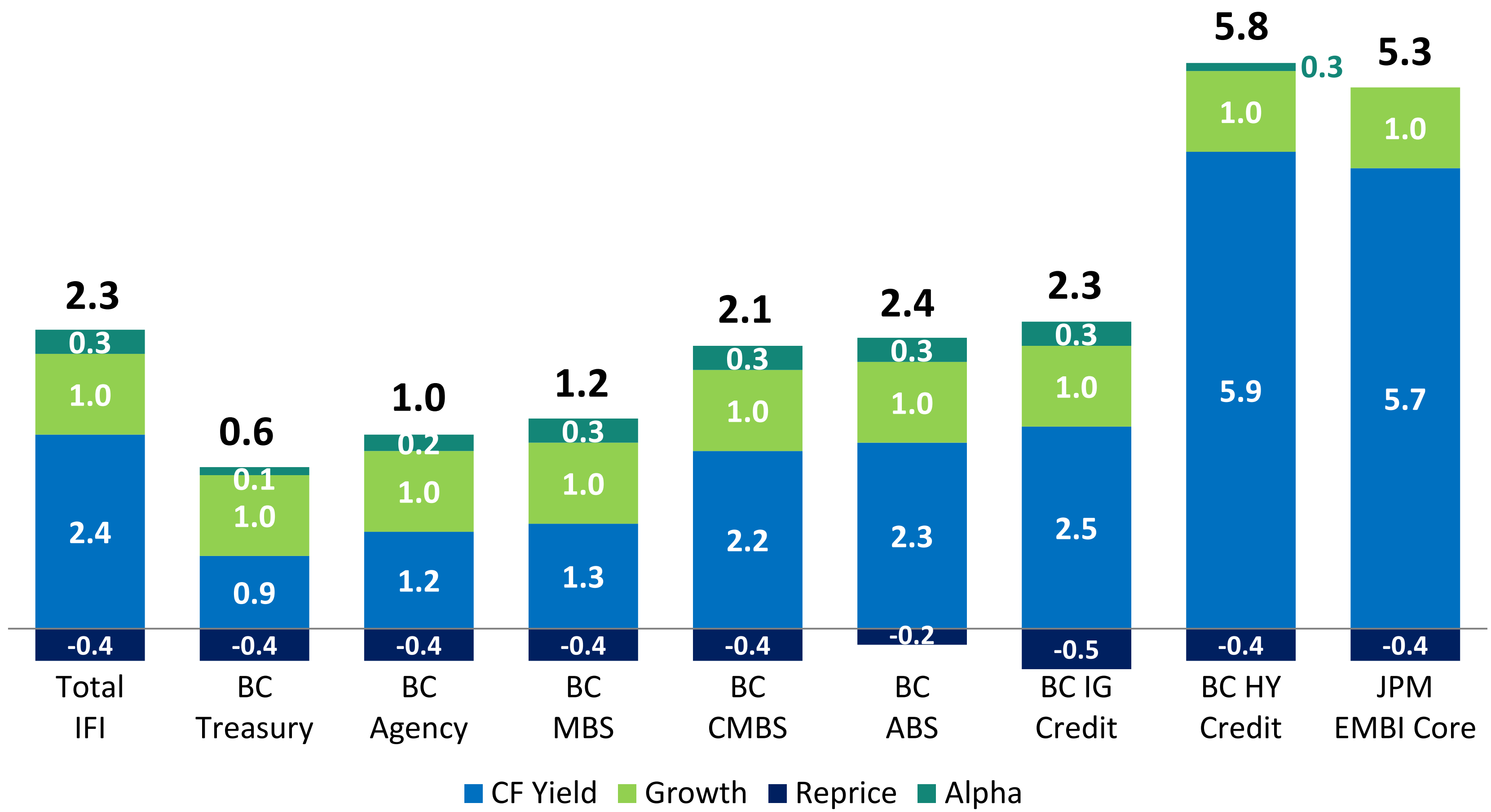


Real Assets Attribution*



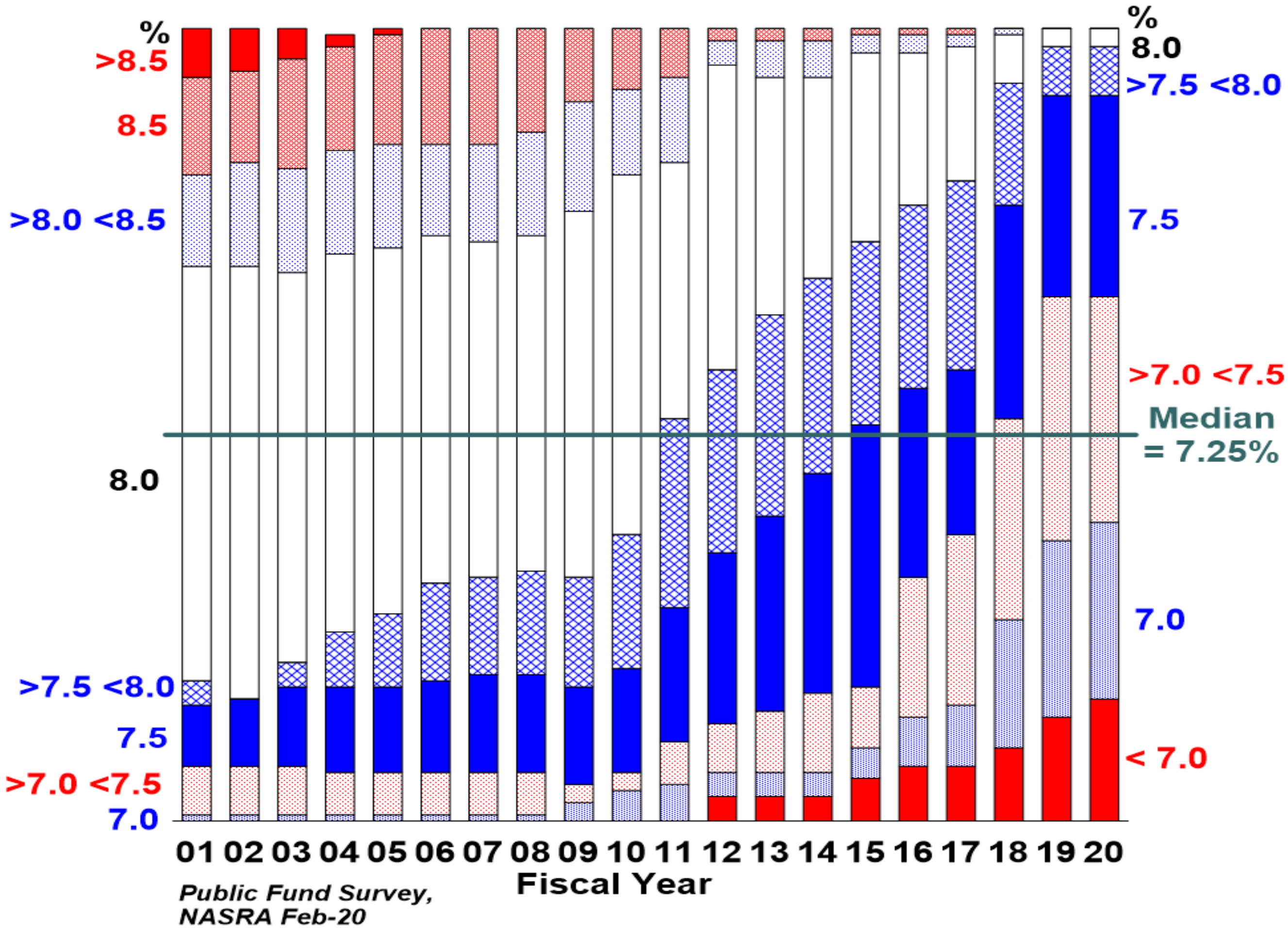
*Includes Leverage Net Of Fees

Fixed Income Attribution*



*Return = CF Yield + Reprice + Alpha

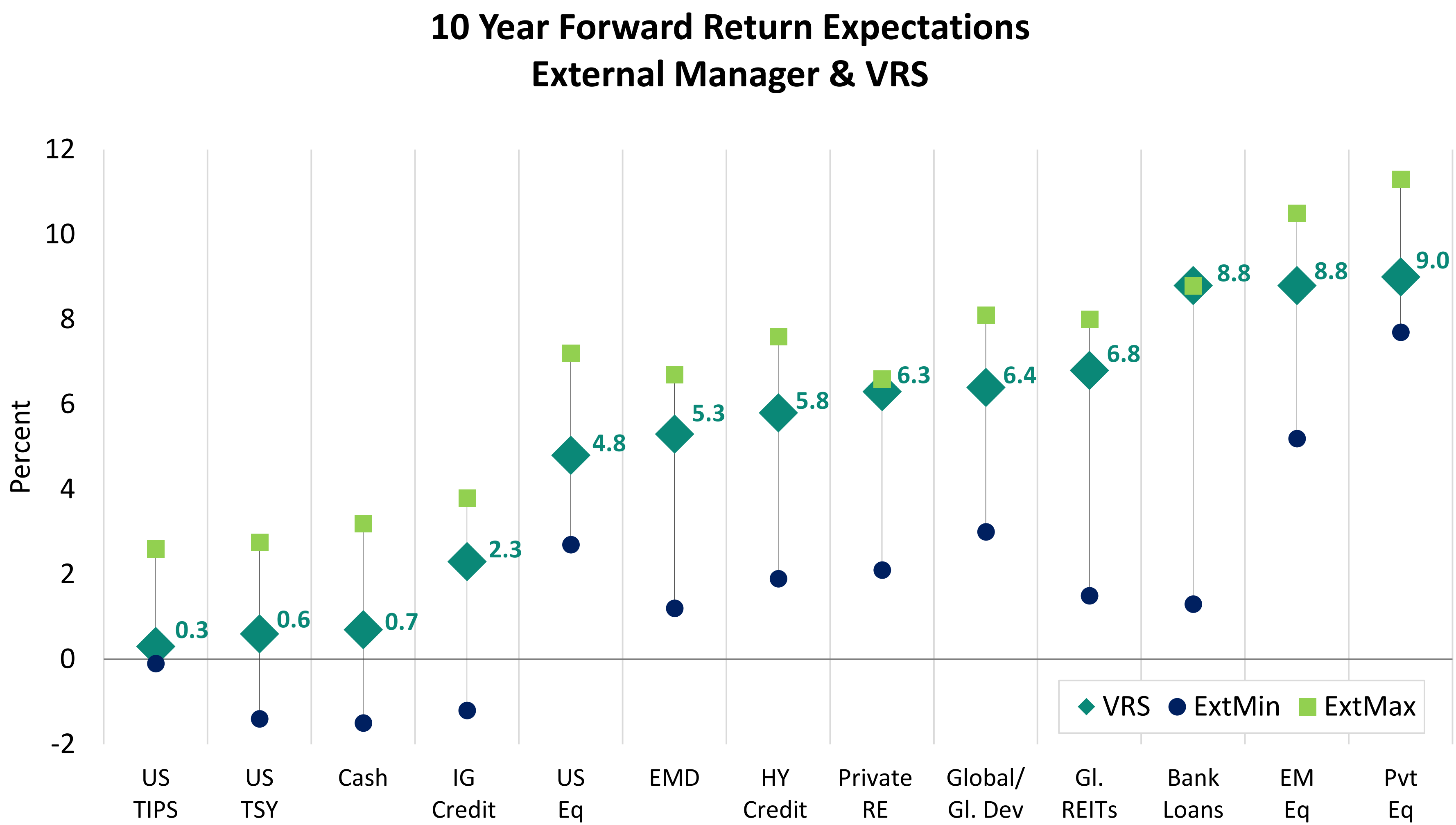
Public Pension Plan Discount Rate Through Time



External Managers' 10-Yr Forward Return Revisions

	2015	2017	2018	2019	2020
U.S. Core Fixed	3.0	3.1	3.1	3.4	1.5
Credit (HY)	5.0	4.6	4.4	5.0	4.8
Core Real Estate	5.4	5.5	5.2	5.7	5.3
U.S. Stocks	6.2	6.0	5.5	5.7	5.5
Int'l Developed Stocks	6.9	6.4	6.8	6.7	6.2
Emerging Stocks	8.4	7.5	7.1	8.2	7.6
Private Equity	8.9	7.2	7.7	9.2	8.9

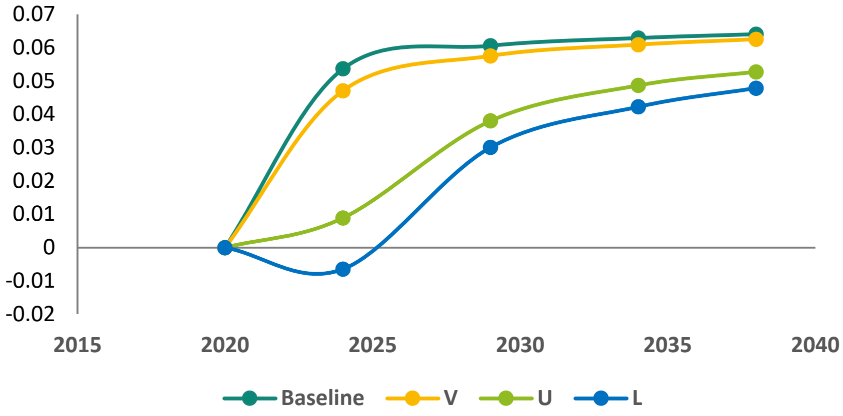
10 Year Forward Return Expectations



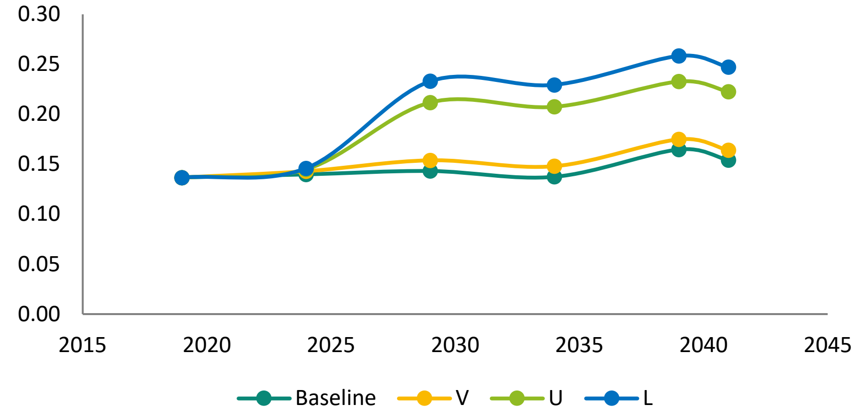
Recovery Scenarios – Median Paths

Virginia Retirement System

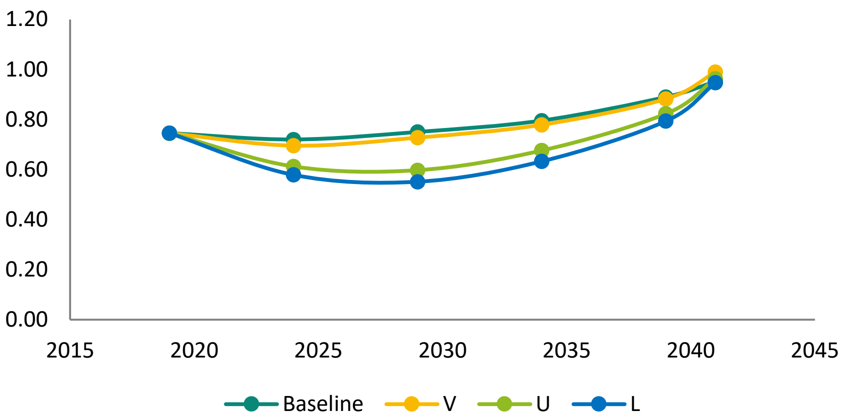
Annualized Cumulative Return



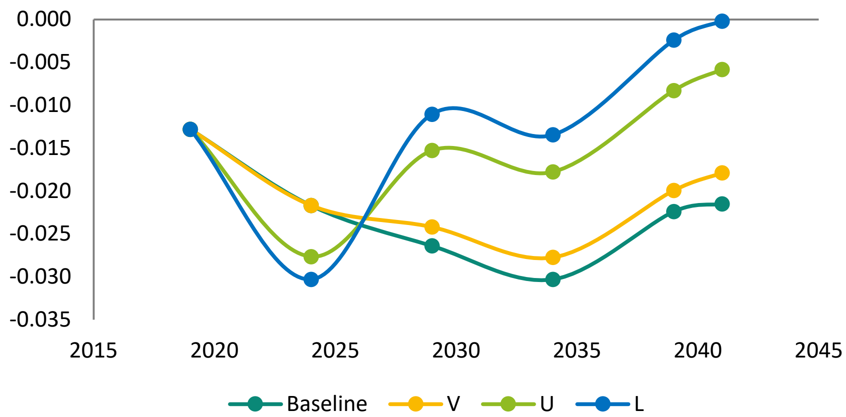
Contribution Rate



Funded Status



Net Cash Outflows % of Total Fund



V: Painful, but short; U: COVID extended; L: COVID redux

Appendix


67,228,166
13,946,511
6,504,606
1,960,477
7,736,223
5,825,769
35,973,586
31,254,580
3,599,566
27,655,014
Dividends
41%
Shares

COVID & Beyond - Scenario Sets - Level I

As of July 27, 2020

Virginia Retirement System

	April COVID Scenarios				
	Really bad **L = COVID Redux** Forward Annualized Return: 4.8%	**Pessimistic** **U = COVID Extended** Forward Annualized Return: 5.2%	**Base case** **New Normal** Forward Annualized Return: 6.5%	**Optimistic** **V = Painful but Short-lived** Forward Annualized Return: 6.3%	**Jul-20** Current update
COVID					
Virus knowledge	Mutation leads to difficulty in understanding/ treating virus across populations. Variations cause delays in understanding the virus' effects on the human body and requires more targeted demographic testing taking 2-4 years.	Mutation leads to difficulty in understanding/ treating virus across populations. Variations cause delays in understanding the virus' effects on the human body and requires more targeted demographic testing taking 2-4 years.	Vulnerability of populations and immune response better known within 3-6 months thereby reducing overall mortality rate, robust understanding of how the virus escalates in the body within the next 1-2 years helpful in targeting treatments and leads to dramatic reduction in mortality rates over that timeframe	Vulnerability of populations better known thereby reducing overall mortality rate within 3-6 months, robust understanding of how the virus escalates in the body within the next 1-2 years helpful in targeting treatments and leads to dramatic reduction in mortality rates.	Daily mortality rates of approximately 0.7 per million around the world have been fairly consistent for the past several months and most localities show improvement after initial spikes from outbreaks. Treatments have been fast-tracked and vulnerability is better understood. Long-term impacts remain a concern.
Virus spread/evolution	Virus mutates and recurs with recurrent outbreaks, no ongoing immunity given mutations	Virus mutates and recurs, limited ongoing immunity, vaccine requires repeated administration (every 2-3 years)	Outbreaks continue but decrease in frequency/severity over the next 6-12 months. Mutation rate roughly half of the flu leads to effective immunity of ~3 years	Low mutation rate, immunity after one infection, response from other related vaccines (Polio, BCG)	The virus seems to mutate relatively slowly although a recent mutation of one of the spikes (G614) seems to have made it more transmissable (though potentially no more deadly). Consensus estimate of effective immunity remains ~2-3 years, similar to SARS.
Social distancing / Mobility Restrictions	Social distancing measures seen as only means to combat the virus and continued outbreaks. WFH in professional settings widely accepted as status quo. International travel cut to essential business only with mandatory quarantine periods	Social distancing measures reapplied to counteract rolling outbreaks that continue to crop up thereby disrupting economies intermittently over the course of the next two years with restrictions continuing to moderate degrees until vaccine is capable of being administered broadly	Sensitive demographics continue to self-isolate until effective treatment/vaccine development. International travel restrictions begin to ease in the next 3-6 months and decline (with occasional backsliding) to relative normality by the middle of 2021.	Earlier treatments available by late summer/fall reduces lockdowns more quickly with virtually all social distancing eliminated by year end	While mobility restrictions have eased in much of the western world, workplace visits still down ~30%. Asia has relaxed many restrictions and workplace visits are closer to -10-20%. International travel remains restricted in many countries with airline departures down 40% in the U.S. and still ~60% in Europe versus early January.
Testing	Serology tests yield inconsistent results over the near-term with reliability >3 months away. Testing agents strained for diagnostic testing limiting number of tests than can be administered globally to only those presenting with symptoms.	Serology tests yield inconsistent results over the near-term with reliability >3 months away. Testing agents strained for diagnostic testing limiting number of tests than can be administered globally to only those presenting with symptoms.	Serology tests (for antibodies/past infections) improve in efficacy/availability over the next 2-4 months. This coupled with broader/reliable diagnostic testing allows for broader understanding of the virus' transmission and enables the easing of quarantines in a safe and controlled manner in Q3.	Serology tests prove effective within the next 1-2 months. No diagnostic testing issues in terms of supply constraints.	The FDA has granted Emergency Use Approval (EUA) to a variety of diagnostic and antibody tests. Official approval still months away and there is limited reliable data on accuracy. Testing in the U.S. around 2.4 per thousand with positive tests around 8% in July. Supply constraints are limited in developed countries.
Treatment/Vaccine	No vaccine for >5 years, effective treatments minimal for high-risk populations, effective geronticide seen throughout the world over the next 2-4 years	Treatments not reliably effective to reduce mortality across diverse populations, particularly high-risk demographics. Vaccine development takes 2-5 years. Limited efficacy from related general vaccines.	Effective treatments within 3-6 months help to improve mortality rates, vaccine development 12-18 months out for preliminary administration to healthcare workers and high-risk populations. Related general vaccines show efficacy in helping to suppress the impacts of the virus and are available broadly in 6-9 months as additional prevention.	Effective treatments available in 3-6 months which reduces mortality rates dramatically, vaccine development aggressive and coordinated internationally with potential for administration to healthcare workers within 12 months.	Two vaccines in Phase III trials and another nine either in or transitioning into Phase II. If effective, earliest expected deployment is late 2020/early 2021. "Herd immunity" unlikely to be reached before late 2021 at the earliest in most countries. Boosters and/or required repeated administration is now widely anticipated.

COVID & Beyond - Scenario Sets - Level I

As of July 27, 2020

Virginia Retirement System

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Public Health					
Healthcare system	Healthcare strain continues given rolling outbreaks, limited immunity, and viral mutation. Prolonged stress increases challenges to contain the spread of the virus. Testing inadequacies, limited treatments, and continued outbreaks lead to establishment of COVID-only care centers.	Healthcare strain continues given rolling outbreaks, limited immunity, and viral mutation. Prolonged stress increases challenges to contain the spread of the virus. Testing inadequacies, limited treatments, and continued outbreaks lead to establishment of COVID-only care centers.	As testing and viral knowledge improves, healthcare systems become better equipped to handle the unique challenges that COVID treatment poses. ICU capacity less strained. Elderly care facilities remain vulnerable until treatment efficacy improves significantly and/or a vaccine is developed.	Healthcare systems continue to mobilize with COVID care centers seen throughout the developed world to counteract remaining infections. Fortification of global health system including increased research into future pandemics and responses.	Limited healthcare strains following early initial outbreaks as public information campaigns and social distancing measures have slowed transmission rates and treatments have improved.
Policy & Politics					
Geopolitics	Domestic pressures around the world increases the risk of international incidents as a global grab for power accompanies the geopolitical vacuum post-COVID. The U.S. and Europe both focus on regional issues as a result of increased social unrest/polarity. European Union is incapable of surviving the fallout.	Domestic challenges post-COVID have many countries turning inward, reducing the strength of multilateral institutions even further. Increased antagonism between the U.S. and China, U.S. political polarity increases, Europe struggles to find cohesion given North/South divide. Failure to contain/manage the virus effectively contributes to increased social unrest throughout the world.	Increased antagonism between the U.S. and China, U.S. political polarity continues to widen, little international cooperation to fight the outbreak in a coordinated manner leaves greater level of overall discord in the public narrative and contributes to sentiment numbers slightly more constrained than pre-crisis.	COVID treated as a global problem triggering increased cooperation across borders	Escalating tensions between the U.S. and China. Acceleration of social unrest as protests rise around the globe on race and equality issues. Polarization increasing with limited communal interaction and thus more segmented/individualized consumption of information. EMU internal coordination improved with passage of EU Recovery Fund, but trade negotiations with the U.S. and the UK a watchpoint over the coming months.
Monetary policy	Japanification of global economy leads to persistent low rates and deflation throughout much of the developed world. In EM as in DM, the need to maintain support further blurs the lines between the fiscal and monetary functions.	Rates remain low as all means of policy are deployed to counteract the ongoing effects of the virus and the ensuing strains on the financial system. The need to maintain support further blurs the lines between the fiscal and monetary functions.	Expect accommodative policy through the 1-2 years following the broad decline of viral disturbance and then a slow process to begin to normalize rates with varying degrees of efficacy only after that time.	Monetary accommodation effective in counteracting financial and liquidity shocks over the near-term. Path to interest rate normalization able to begin by 2022/2023 as economies rebound and inflation increases.	Developed world forward curves pricing rate accomodation continuing through the next three years and sometimes longer.
Fiscal support	Fiscal support withdrawn too early and/or more fiscal aid is needed than is provided to help economies rebound quickly leading to delays in economic recoveries. Politicians succumb to increasing pressure to counter budget deficits further dragging down growth and creating a longer path to recovery.	Fiscal support withdrawn too early and/or more fiscal aid is needed than is provided to help economies rebound quickly leading to delays in economic recoveries. Politicians succumb to increasing pressure to counter budget deficits further dragging down growth and creating a longer path to recovery.	Fiscal support continues with developed nations deploying 50-125% of GDP in stimulus measures. Stimulus proves generally (though not universally) effective in offsetting the virus' impacts on the vast majority of the economy. DM budget deficits exceed levels post-GFC and remain there for the next several years.	Fiscal bazookas prove effective in offsetting the lion's share of impact to the economy. Quick treatment/vaccine development allows for minimal continued support needed. Deficits large but begin to decrease as growth and inflation both rebound.	Stimulus measures continue to be deployed and becoming more targeted and also more contentious. Concerns regarding future deficits, long-term economic impacts, and prolonged unemployment increasing both the pressure and the pushback, particularly in the U.S.
Government revenue	Government revenues fall sharply for the next 2-3 years, increasing pressure to reduce spending and increase tax receipts.	Government revenues fall sharply for the next 2-3 years, increasing pressure to reduce spending and increase tax receipts	Governmental revenues down for much of the next two years given economic impact and slow recovery. By 2022, increased pressure to trim budget deficits begins to enter broad political debate, pressure spending, and heighten potential for tax increases and reduction in profits 3-5 years out.	Significant hit to global government revenue over the next 12 months. Past one year, steady increase in tax receipts given robust recovery, limited changes to tax code/increase in corporate taxes to reduce budget deficits over time, marginal impact to profit margins.	U.S. state revenue expectations thus far released are broadly down single digits for FY2020 and in some cases projecting double digit declines in FY2021.

COVID & Beyond - Scenario Sets - Level I

As of July 27, 2020

Virginia Retirement System

	April COVID Scenarios				
	Really bad L = COVID Redux Forward Annualized Return: 4.8%	Pessimistic U = COVID Extended Forward Annualized Return: 5.2%	Base case New Normal Forward Annualized Return: 6.5%	Optimistic V = Painful but Short-lived Forward Annualized Return: 6.3%	Jul-20 Current update
Economy					
GDP	2020/2021 Global: -6.1% / 0.5% US: -7.2% / -1.5% DM (not ex-US): -8.5% / -0.7% EM: -3.9% / 3.3% Eurozone: -10.0% / -0.3% trend growth not again seen until after 2024	2020/2021 Global: -5.1% / 2.3% US: -6.9% / -1.0% DM (not ex-US): -7.8% / -0.1% EM: -2.9% / 4.3% Eurozone: -9.0% / 0.6% return to trend late 2022/2023	2020/2021 Global: -4.2% / 4.7% US: -6.6% / 2.8% DM (not ex-US): -7.1% / 2.9% EM: -1.9% / 6.1% Eurozone: -7.8% / 3.5% return to trend following	2020/2021 Global: -3.2% / 5.2% US: -6.5% / 3.6% DM (not ex-US): -6.1% / 3.6% EM: -0.7% / 6.5% Eurozone: -6.1% / 4.1% return to trend following	June IMF projections for global growth for 2020 were -4.9% and +5.4% for 2021. Consensus estimates show a slightly shallower 2020 at -3.7% and 5.1% 2021. Generally the forecast shifts are skewed slightly more pessimistic than the original base case for 2020, but also a sharper recovery than the base case in 2021.
Inflation	A barbelled set of risks in this scenario. Deflationary pressures could be high if demand never materializes after extended lockdowns, while deglobalization could cause an increase in prices. Extended easy policy could also lead to inflation spikes if QE is viewed more as a policy of debt monetization.	Supply chain hit causes higher prices in a number of categories, though offset by lower demand in others. Potential questions about how far central banks will go to keep the cost of debt lower for governments than otherwise, potentially raising a new set of tradeoffs: price stability/debt sustainability.	2020/2021 DM: 0.5% / 1.5% EM: 4.6% / 4.5% Increased pressure on developed markets to hit inflation targets in order to manage debt burden. Potential questions about how far central banks will go to keep the cost of debt lower for governments than otherwise, potentially raising a new set of tradeoffs: price stability/debt sustainability.	2020/2021 DM: 0.8% / 1.8% EM: 4.6% / 5.0% Increased pressure on developed markets to hit inflation targets in order to manage debt burden.	June IMF projections 2020/2021 DM: 0.3% / 1.% EM: 4.4% / 4.5% Inflation projections largely sanguine on expectations of ongoing weakness in aggregate demand. Increasing discussion in capital markets of a potential mispricing of future risks to the upside given policy response and potential continued supply chain disruptions.
Labor market dynamics	Global unemployment peaks high single digits, U.S. peaks mid-teens, with improvement not seen until 1H21 and only a slow decline thereafter as growth remains depressed and populations continue to face mobility restrictions	Global unemployment peaks high single digits, U.S. peaks mid-teens, and maintains largely through the end of 2020 and only begins to improve in early 2021 ending the year roughly 3x as high as Jan 2020	Global unemployment peaks high single digits, U.S. peaks mid-teens, and maintains largely through Q3 beginning to moderate in Q4 and showing improvement in early 2021, albeit slowly, ending 2021 roughly 2-3x as high as Jan 2020	Global unemployment peaks high single digits, U.S. peaks mid-teens, and maintains largely through Q3 beginning to moderate in Q4 and showing improvement of multiple points in early 2021 ending 2021 roughly twice as high as Jan 2020	International Labour Organization showed a 14% drop in global hours worked in 2Q20 with projections for the end of 2020 showing a reduction of 4.9% from the end of 2019 in their base case. Increased discussion around the potential for increased permanent job losses due to shift to remote work and increased reliance on technology.
Supply chains	Deglobalization pressures most intense, global trade patterns disrupted most broadly, with significant redundancy in manufacturing processes. Operational costs skyrocket.	Global trade disrupted given travel and customs restrictions through the end of the year with staggered return to mid 2021. Shift to diversify supply chains in a broader set of industries, with significant impact on profit margins.	Global trade disrupted given travel and customs restrictions through Q3 with return to normalcy late 2020/early 2021. Shift to diversify supply chains in a broader set of industries, with moderate impact on profit margins based on efficacy.	Global trade disrupted given travel and customs restrictions in Q1 & 2, but limited permanent damage to supply chains. Modest shift to diversify supply chains in critical industries only with minimal impact on overall profit margins.	Expectations of ongoing acceleration in supply chain diversification, particularly away from China, but will be slow to manifest. Supply issues prevelant in a variety of industries from manufacturing to agriculture.
Financial conditions	Financial conditions deteriorated to their weakest in a decade according the UBS index, but did not reach GFC levels. Due to immediate central bank actions, they have since improved markedly. Persistent challenges mean market volatility continues despite accomodative policy.	Financial conditions deteriorated to their weakest in a decade according the UBS index, but did not reach GFC levels. Due to immediate central bank actions, they have since improved markedly. Persistent challenges mean market volatility continues despite accomodative policy.	Financial conditions deteriorated to their weakest in a decade according the UBS index, but did not reach GFC levels. Due to immediate central bank actions, they have since improved markedly. Continued improvement over the course of the next 6 months as targeted measures prove their efficacy.	Financial conditions deteriorated to their weakest in a decade according the the UBS index, but did not reach GFC levels. Due to immediate central bank actions, they have since improved markedly. Steadily easing over the course of the next 3-6 months	Financial conditions have rebounded sharply since the start of the crisis as stimulus measures were enacted and much of the market declines have been erased.
Outlook driven by magnitude of the shock and the scale of the response	L-shaped recovery into 2021 with -25%-30% contraction in US Q2 2020, 0% Q3-Q4 2020 and 2% +/- over 2021-2030. Developed economies forced to remain in lock-down mode into 2021. Authoritarianism , disruptions in trade, travel, social interaction push economy into a prolonged severe recessions/depression with attendant uncertainty where unknowns dominate any feasible return to normal. DM ties with China reach all time lows. US-China relations antagonistic with higher likelihood of military confict.	W-shaped recovery with -25% - 30% US contraction Q2, 3% Q3, 0% Q4 2020 - Q2 2021, 2-3% thereafter. Begin with base case recovery but secondary outbreaks more severe than anticipated. Employment gains partially erased, consumer confidence plunges, precautionary consumer behavior spikes along with increased savings, deflation pressures. Policy response is insufficient. DM ties with China deteriorate as authoritarian leaders look to place blame.	U-shaped recovery with -25%-30% contraction Q2 2020 recovering to 2-3% 2nd H 2020 and 2-3% growth in 2021. Intermediate-to-long-term strucutural changes in labor markets and unemployment, on-shoring, trade policy, market operations, work force participation patterns, precautionary savings, declining productivity. Shifts in growth drivers to staples, health care, tech. Deflationary risks and slower growth. US blames China, contributing to increased market uncertainty and volatility.	V-shaped recovery. US economy in Q2 2020 contracts25-30% but easing of restrictions by states produces small resurgence in COVID-19 cases which are easily managed. Testing is more available and faster, treatments come on-line and vaccine research is encouraging; pharma lines up to mass produce innoculating up to 2/3 of global population in the next 2-3 years. Employment surges as retail and hospitality begin to come back on-line. The markets look to 2020 as a transitory shock. Growth recovers in Q3 2020 to 3%.	Expectations centering around a more jagged recovery as the initial spike in growth rebounds are tempered by rolling outbreaks and profit warnings. Structural changes in labor markets likely to be more negative than original baseline forecasts as the pandemic has accelerated preexisting trends in technological adoption. Increased geopolitical volatility and social unrest evident across the globe. Shift in macro drivers from growth to policy as governments seek to address budgetary shortfalls after the pandemic wanes.

Post-COVID Baseline Scenarios

Virginia Retirement System

	Budgetary Normalization	Renewed Gilded Age	New Equilibrium	Stakeholder Capitalism
Narrative	Rapid growth in central bank and government balance sheets awaken fiscal conservatives. Reduction in fiscal support quick to unfold as spending is significantly reduced. Liberals demand tax increases to help compensate defunding safety net. Wealth inequalities persist . Initial withdrawal of fiscal support is not offset by increases in growth and the economy slows.	De-globalization accelerates moves to onshore supply chains leading to increase in trend toward tech substitution for labor inputs. Social unrest increases as wealth inequality widens further. Platform companies continue to gain dominance as regulatory action diminishes. Multinational institutions continue to weaken creating a more fragile geopolitical landscape. Growth rebounds in some industries/sectors but its benefits are skewed primarily to shareholders. Concentration and market power continue to strengthen.	Economies settle into new post-COVID equilibrium over the next 12-18 months. Political power shifts incrementally to the left but polarization continues. Governments faced with the realities of paying for the various stimulus measures leads to an increase in taxes, especially in the U.S. Increased influence of policy on market action. Social unrest persists along with pressure to increase regulations on corporations. Accelerated momentum toward diversifying supply chains which will unfold over the course of the next 5-10 years. Increased antagonism between the west and China.	Corporate objectives broaden beyond share price maximization embracing larger menu of "stakeholder" outcomes targeting optimizing social welfare. Expect targeted tax incentives and regulation on corporate entities and penalties to non-compliance. The shorter term roils markets despite a narrative of longer-term, sustainable growth. Increased scrutiny on corporate behavior, reduction in profit margins, and heightened anti-trust enforcement all weigh on equity returns. Over time, labor share of income increases with broader consumer participation in the economy, but this takes years to be reflected in market sentiment or forward earnings expectation.
Asset & Market Implications	Growth reduction impairs profitability and forward returns across most asset classes and geographies.	Potential for near-term increase of forward returns from base case as additional boost is received to risk assets from low rates and corporate-friendly political environments. Fragility of the system increases with heightened potential for tail risks given societal disparities and unrest.	Slight reduction in forward returns, largely from drop in equity returns given heightened taxes/regulation and pressure on corporate profit margins. Shift in value across real estate sectors as offices adapt to new environment and infrastructure/direct shipping respond to more onshoring/localized supply chains. Pressure on large/mega-caps from anti-trust and ESG-linked investment preferences.	Near-term likely to lead to market sell off with arguments to be made that growth over the longer-term (10+ years) could be more sustainable/robust. Large increase in alpha from ESG-linked sources, lower return on equities than in base case with increased pressure on profit margins. Negative environment for mega-caps. Potential for drop in private assets if tax advantages are removed.

Tail Scenarios & Discussion Topics

	Dark Night	Cyber Collapse	Climate Crisis
Narrative	Lack of ability to contain/control the virus leads to prolonged requirements for social distancing and mobility restrictions. Governmental stimulus, even in advanced economies with zero interest rate policies, is unable to bridge the gap leading to a full-fledged credit crisis. Permanent loss of capital from segments that cannot recover (travel and urban office-linked in particular). Sovereign debt defaults ripple around the world. Worst economic depression in modern history with global GDP unable to recover for a decade.	Large-scale cyber attack or infrastructure impairment leads to a "technological blackout" in the U.S. shutting down the economy for days to weeks. Systemic shock/panic following the fragility already present from the pandemic leads to massive social unrest. Eventually this leads to a global rethink of societal reliance on technology.	Significant weather events over the next year while economies are still recovering from the pandemic create another shock for global capital markets and highlights the frailty of economic growth. Political pressure to reduce global warming accelerates as does pressure on big industry and corporate power, particularly in the U.S. Global re-evaluation of public health and environmental narratives leads to pressure on corporations and governments to nationalize health systems and reduce carbon footprints.
Asset & Market Implications	Credit crisis leads to largest global depression in modern history. Defaults across large swath of the economy, EM sovereign debt, and fragile developed nations. Equity markets fall 50-70%.	Equity market sell-off of 30-50% on both the event as well as the fallout from likely banking crisis. Potential for nationalization of certain technological assets/infrastructure in various countries around the world.	Second exogenous shock in a condensed time period while market is still fragile leads to another sizeable selloff and a slower recovery. Longer-term pressure on corporate profits - particularly in energy and heath care.

Discussion Topics:

- Definitions of risk appropriate given the environment and ranges of uncertainty
- Incorporation of baseline versus tail scenarios in portfolio evaluation
- Forward paths of interest rates
- Implications for tilts or hedges
- Default cycle and market pricing

Investment Advisory Committee Program Reviews: Portfolio Solutions Group

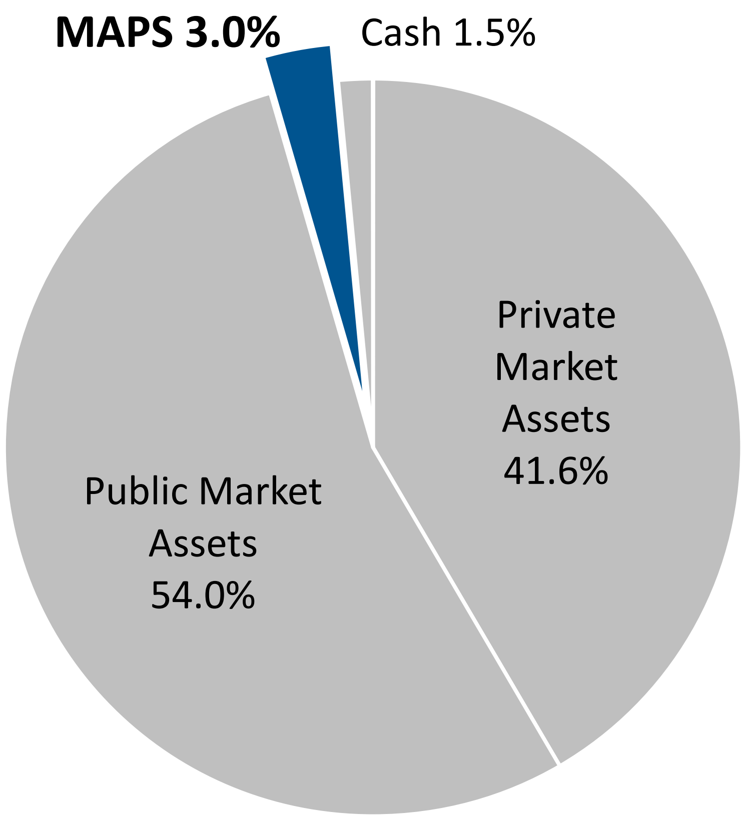
Chung Ma, Managing Director

Ross Kasarda, Director – Risk

Kristina Koutrakos, Director – Portfolio Strategy

August 12, 2020

Portfolio Solutions Group (PSG) – Investment Mandates



MAPS

- Inception date – July 1, 2018
- Two mandates
  - DStrat: $1.1 billion
  - RBI: $1.3 billion
- Diversifying strategies and intellectual capital transfer

FX

- Managing FX risk and diversifying returns

Market values as of 6/30/20; source: BNY Mellon data
Allocations do not sum to 100% due to rounding

IAC Meeting – August 12, 2020

Virginia Retirement System

Risk Based Investments

Ross Kasarda
Director, Risk

Annual Review Topics

- Overview
  - Goals
    - Results
      - Improvements
        - Looking Forward

Team Members

Professional	Position	Highest Degree	Professional Certifications	Investment Experience	VRS Tenure
Ross Kasarda	**Director**	**MA**	**CFA**	**16**	**16**
Moses Maxfield	Investment Officer	MBA	CFA, CAIA	14	14
Greg Hines	Investment Officer	MA	CFA	9	7

Other Resources
Director of Portfolio Integration
Executive Committee
Investment Operations Department
Investment Advisory Committee
Portfolio Assistant

Portfolio Construction Goals

Virginia Retirement System

Limited Reliance On Equity Risk Premium

Target equity beta close to zero and low correlation to Plan

Create An Allocation To Diversifiers That Is Itself Diversified

Target low correlation within the program

Identify Strategic Partners To Help Achieve Plan's Goals

Leverage manager lineup for actionable ideas

Identify Strategies That Offer Meaningful Diversification To The Plan

Portfolio Expectations

- Expected volatility over a cycle of 5%
- Expected tracking error over a cycle of 5%
- Expected equity beta over a cycle of zero
- Expected return over a full cycle of 5%

IAC Meeting – August 12, 2020

Manager & Strategy Lineup

Virginia Retirement System

AQR Capital

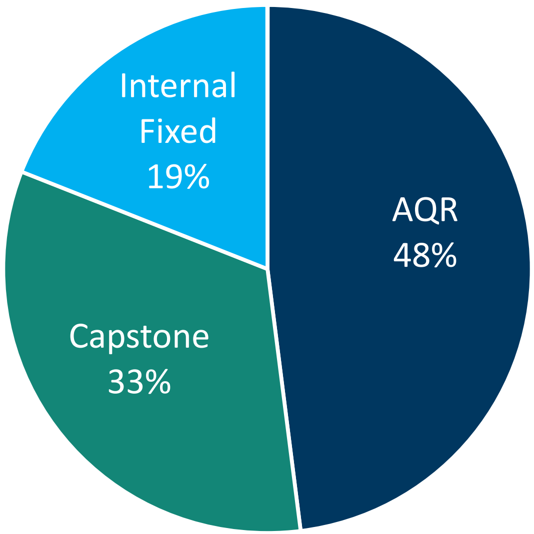
- 9 mandates
- Uncorrelated, factor and trend based approaches
- Invested since 2013

Capstone Investment Advisors

- 1 mandate
- Relative value volatility strategy
- Invested since February 2019

Internal Fixed Income

- 1 mandate
- Long duration treasury strategy
- Invested since 2018



RBI Mandates (as of 06/30/2020)		
	$ MM	%
AQR	615	48%
Capstone	422	33%
Internal FI	236	19%
Total RBI	1,273	

Results

Program Return

	Since July 2018	1 Year
Risk Based Investments	**-3.4**	**-5.9**
Benchmark	4.6	4.1
Excess Return	-7.9	-10.0

Results - Mandates

Program Return

	Since July 2018	1 Year
AQR Multi-Strategy	-8.3	-10.2
AQR Risk Parity	-0.5	-20.1
Bridgewater*	-8.1	-17.3
Capstone*	7.7	6.9
Internal Fixed Income	27.3	41.3

**Bridgewater return from 7/2018 to 4/2020, Capstone return from 2/2019*

High Level Attribution

Virginia Retirement System

- Long Duration Treasuries performed as expected during flight to quality
- Volatility relative value has performed well
- Historically tough period for quantitative factor based investing; value drawdown historically bad (next slide)
- Fundamental Macro has time varying beta to equity

AQR Multi Strategy Attribution

Virginia Retirement System

Portfolio Attribution by Theme

July 1, 2019 – June 30, 2020

	Stocks & Industries	Equity Indices	Fixed Income	Currencies	Commodities	Total
Value	-12.8%	0.9%	1.4%	0.4%	-0.7%	-10.8%
Momentum	1.9%	-0.7%	1.8%	0.2%	1.6%	4.7%
Carry	--	0.3%	-1.9%	-1.0%	-1.3%	-3.9%
Defensive	2.9%	-2.5%	-2.2%	--	--	-1.8%
Trend	1.8%	-0.6%	1.8%	-1.2%	-0.1%	1.6%
Arbitrage	0.7%	0.0%	0.0%	--	--	0.7%
Volatility	--	-0.5%	-0.2%	--	-0.2%	-0.8%
Opportunistic	-2.1%	-0.1%	0.6%	0.8%	0.1%	-0.7%
Other	-0.1%	-0.3%	0.3%	0.4%	0.5%	0.7%
Total	**-7.8%**	**-3.4%**	**1.5%**	**-0.3%**	**-0.2%**	**-10.2%**

Source: AQR

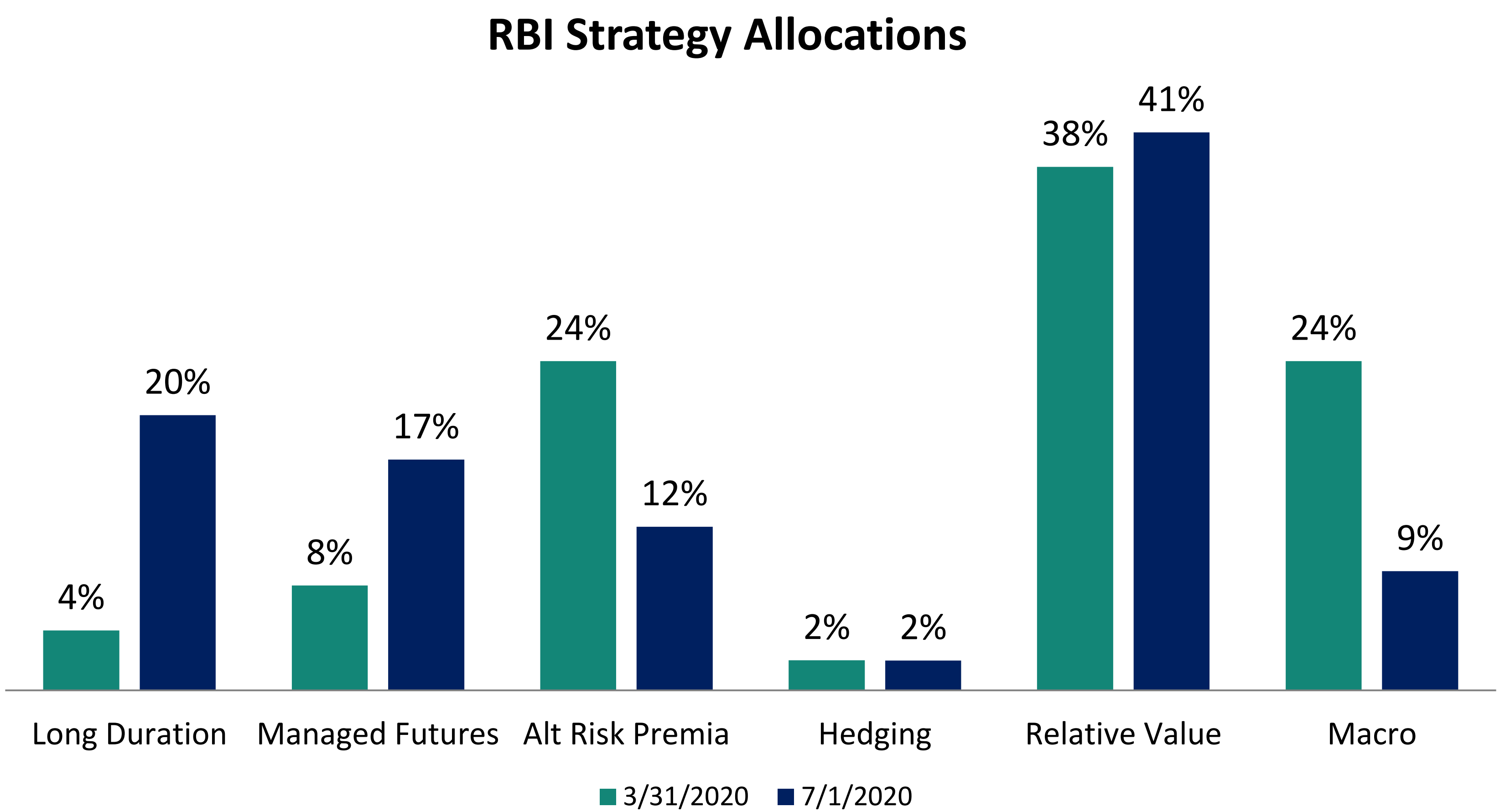
RBI Continues To Evolve

- RBI is evolving as we learn more
- The benefits to uncorrelated investments need to be emphasized during tough periods for the Plan's absolute return while still targeting Cash + 2.5% in normal times

Portfolio Change	Characteristic
+	Strategies that can earn returns when equities suffer
+	Opportunistic investments in dislocated assets
−	Correlations in total and excess return space
−	Fundamental Macro investments which can become highly correlated to equity and rely on manager skill

RBI Should Emphasize Being a Complement to the Plan

Strategy Allocation Changes



Mindshare Examples – Beyond Returns

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Capstone

- Frequent dialog and color regarding volatility and options markets
- Bespoke options advice for Total Fund trade ideas (worked closely on implementation of an equity risk reversal trade)
- Energy hedging discussions with real assets team

AQR Capital

- High yield factor research – Internal Fixed Income
- Counterparty risk dashboard –Internal Equity team
- Stock selection research – Public Equity and Plan level Value discussions
- Risk parity research

First Quadrant (Active Currency)

- Plan level FX factor models and inputs to hedging decisions
- Research and insight into Natural Language Processing and Flows based metrics

Identify Managers That Offer Actionable Knowledge Transfer

Looking Ahead

Virginia Retirement System

- Enhance current relationships to increase mindshare
- Continue learning and adapting to improve odds
- Integrate best practices with risk management effort

Appendix

Diversification Benefits

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Total Return Correlations	RBI	FI	Prv Eq	Pub Eq	RA	PIP	Dstrat	CS	Plan
RBI	1								
Fixed Income	0.6	1							
Private Equity	0.3	0.4	1						
Public Equity	0.3	0.5	0.8	1					
Real Assets	0.3	0.6	0.7	0.9	1				
PIP	0.3	0.5	1.0	0.9	0.8	1			
Dstrat	0.4	0.6	0.8	1.0	0.9	0.9	1		
Credit Strategies	0.3	0.7	0.7	0.8	0.8	0.8	0.8	1	
Total Plan	0.4	0.6	0.9	1.0	0.9	1.0	1.0	0.9	1

Active Return Correlations	RBI	FI	Prv Eq	Pub Eq	RA	PIP	Dstrat	CS	Plan
RBI	1								
Fixed Income	-0.2	1							
Private Equity	-0.1	0.2	1						
Public Equity	0.2	-0.6	-0.2	1					
Real Assets	-0.2	0.6	0.2	-0.8	1				
PIP	-0.2	0.4	0.8	-0.5	0.6	1			
Dstrat	-0.2	0.5	0.2	-0.5	0.7	0.5	1		
CS	-0.1	0.5	0.5	-0.4	0.5	0.6	0.4	1	
Total Plan	-0.1	0.3	1.0	-0.2	0.4	0.9	0.3	0.7	1

Framing The Changes

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Strategy	RBI 3/31 Allocation	Current	Ability to Provide Protection: Most Effective	Ability to Provide Protection: Least Effective	Volatility	Beta
Long Duration	4.0%	18.5%	Sudden Drawdowns	Rising Rates	Equity Like	Zero to Negative
Managed Futures	7.0%	15.5%	Trending Markets	Choppy Markets	Variable	Variable
Alternative Risk Premia	22.0%	11.0%	Non-Trending Markets	Coincident Premia Drawdowns	60/40 Like	Low
Tail Risk Hedging	2.0%	2.0%	Sudden Drawdowns	Slow, Shallow Drawdowns	5-6% with Much Higher Crisis Vol	Strongly Negative
Relative Value & Arbitrage	35.0%	37.5%	Identifiable Catalysts	Timing is Wrong	1/2 of Equity Vol	Zero
Global Macro	22.0%	8.0%	Identifiable Catalysts	Timing is Wrong	Equity Like	Variable
Risk Parity	7.5%	7.5%	N/A	N/A	Equity Like	Moderate
RBI	100%	100%	robust to most drawdowns	Volatile Drawdowns	5%	Zero

AQR Multi Strategy Attribution

Virginia Retirement System

Portfolio Attribution by Theme

July 1, 2018 – June 30, 2020

	Stocks & Industries	Equity Indices	Fixed Income	Currencies	Commodities	Total
Value	-8.9%	-0.5%	0.5%	0.1%	-0.6%	-9.4%
Momentum	-1.0%	0.4%	1.7%	0.4%	0.2%	1.7%
Carry	--	0.3%	-1.7%	-0.2%	-1.1%	-2.7%
Defensive	3.5%	-1.0%	-0.8%	--	--	1.6%
Trend	0.9%	-0.1%	1.9%	-1.0%	-1.3%	0.5%
Arbitrage	0.5%	0.0%	0.0%	--	--	0.5%
Volatility	--	-0.3%	0.0%	--	-0.1%	-0.4%
Opportunistic	-1.3%	0.0%	0.2%	0.5%	0.1%	-0.5%
Other	-0.2%	-0.1%	0.2%	0.2%	0.2%	0.3%
Total	-6.5%	-1.5%	2.0%	0.1%	-2.4%	-8.3%

Source: AQR

Virginia Retirement System

Dynamic Strategies
Kristina Koutrakos
Director, Portfolio Strategy

Team Members

Professional	Position	Highest Degree / Credentials	Investment Experience	VRS Tenure
Kristina Koutrakos	**Director, Portfolio Strategies**	**MBA, CAIA**	**21**	**4**
Katherine Grawe	Senior Investment Officer	MBA	21	2
Additional Resources	Portfolio Solutions Group VRS Investment Staff External Managers & Research Partners Investment Operations Department Portfolio Assistant			

Annual Review Topics

- Objectives
- Overview
- Mandates
- Environment
- Results
- Looking Forward

Dynamic Strategies Goals

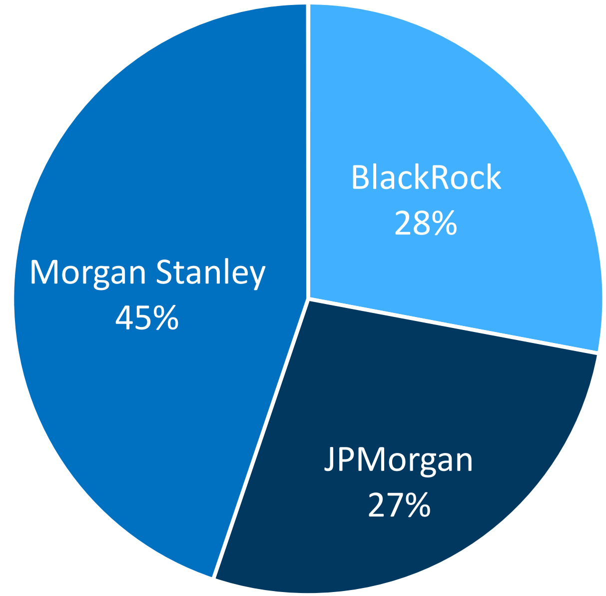
Virginia Retirement System

Build out a framework such that additional excess returns can be achieved through active management of the overall asset allocation of the Plan within the policy boundaries established by the Board of Trustees.

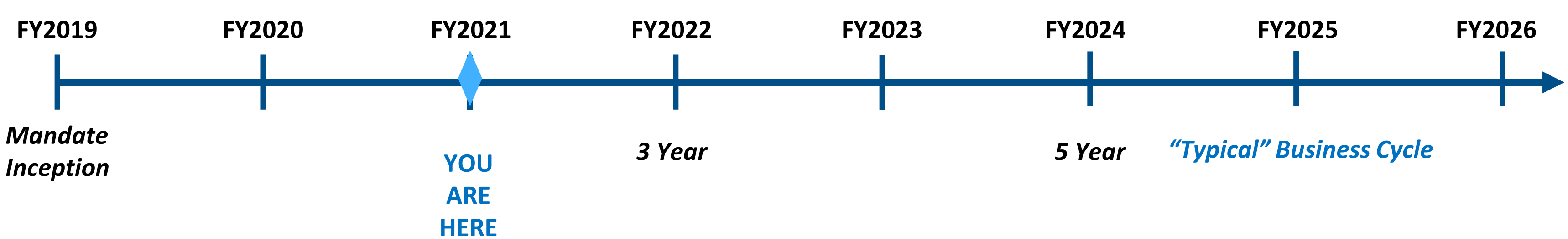
- Expand asset allocation capabilities
- Increase diversification given low expected correlation to other excess return sources
- Provide insights into manager allocation processes that can be transferred to the management of the overall VRS plan

Portfolio Overview

Dynamic Strategies Mandate (as of 6/30/2020)		
	Market Value ($, MM)	Market Value (%)
BlackRock	$317	28%
JPMorgan	$309	27%
Morgan Stanley	$508	45%
Total	$1,133	



Program Timeline



Partnerships

Virginia Retirement System

BlackRock

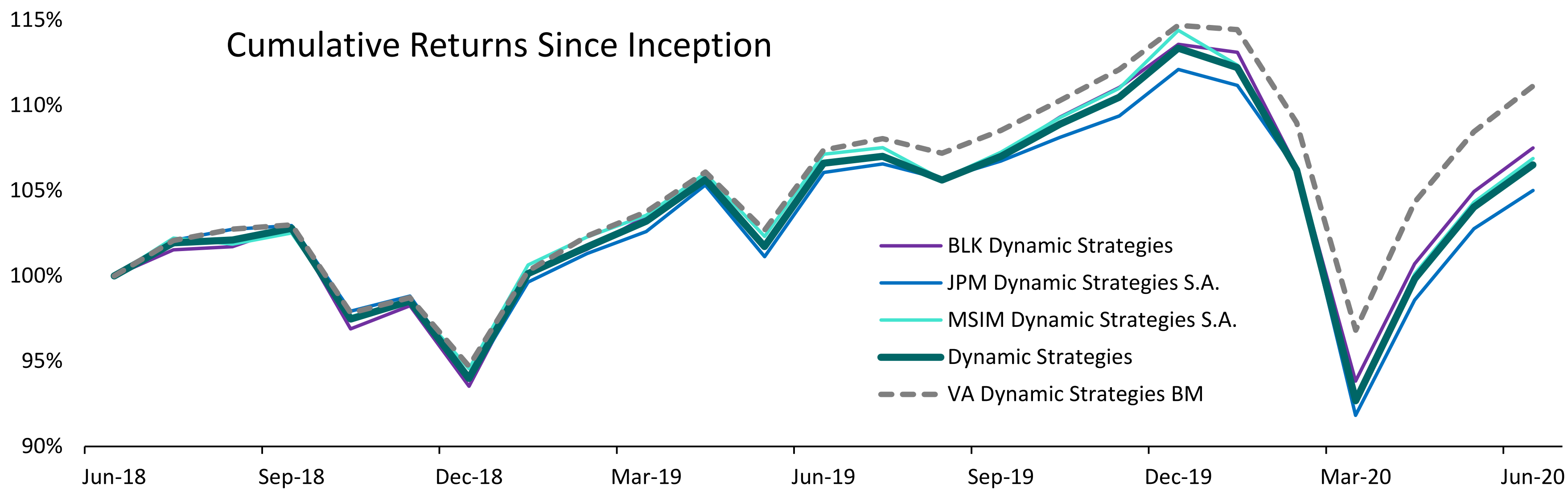
J.P.Morgan

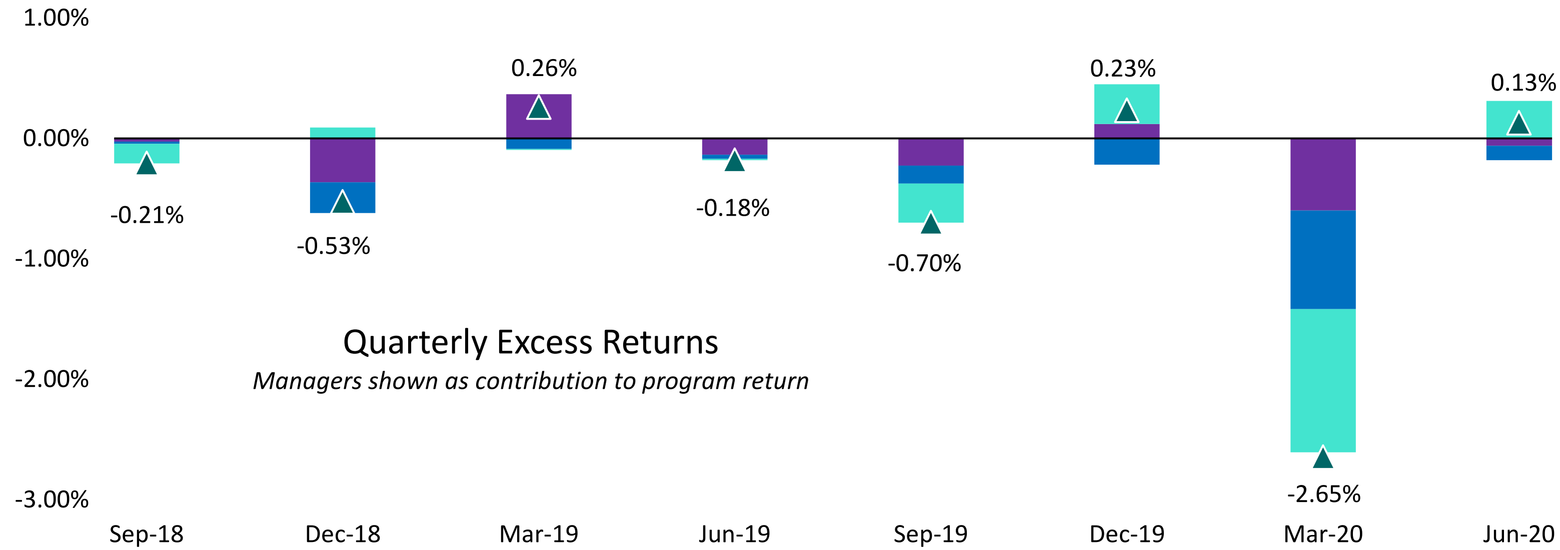
Morgan Stanley

Investment Themes

Pre-COVID	Post-COVID
• Weak global growth environment coming out of 2018 into early 2019 with leading indicators bottoming in late 2019 • Resolution of key geopolitical risks in the second half of 2019 – Brexit, U.S./China trade negotiations • Global monetary policy accommodation • Shift to pro-cyclical positioning across all three managers in improving macroeconomic backdrop	• Pandemic-focused viewpoints now shifting towards longer-term, structural positioning • Focus on dislocations between market pricing and forward earnings/risks over the coming years • Cautious pro-cyclical positioning with risk spend generally on relative opportunities rather than directional • Emphasis on stimulus measures versus economic impact • Expectation of the acceleration of structural change across economies (energy, technology, ESG)

Program Performance





Program Performance

As of June 30, 2020	COVID Qtr (1Q20)	FY2020	Since Inception (annualized)	*Long-term Expectations*
Dynamic Strategies Mandate	-18.24%	-0.10%	3.20%	
Dynamic Strategies Custom Benchmark	-15.59%	3.50%	5.42%	
Total Excess Return	-265 bps	-360 bps	-222 bps	*100-120 bps*
Active Risk		183 bps	164 bps	*200 bps*
Information Ratio		-1.97	-1.35	*0.5 - 0.6*

Active Return Correlations	DStrat	RBI	CS	FI	Prv Eq	Pub Eq	RA	PIP	Plan
RBI	**0.0**	*1*							
Credit Strategies	**0.4**	0.1	*1*						
Fixed Income	**0.5**	0.1	0.5	*1*					
Private Equity	**0.2**	0.0	0.5	0.2	*1*				
Public Equity	**-0.6**	-0.2	-0.4	-0.5	-0.2	*1*			
Real Assets	**0.7**	0.1	0.5	0.6	0.2	-0.7	*1*		
PIP	**0.5**	0.1	0.6	0.4	0.8	-0.5	0.6	*1*	
Total Plan	**0.3**	0.1	0.7	0.3	1.0	-0.3	0.4	0.9	*1*

Barra data as of May 2020

FY2021 Plans & Priorities

- Continue to strengthen relationships with the three strategic partners
- Partner with staff across the plan to identify opportunities
- Incorporate thematic framework into the portfolio construction of the dynamic strategies program
- Continue progress on targeted internal portfolio to capitalize upon dislocations and opportunities in the markets

Shenandoah

VRS Strategic Advantages:

- Information flow and access to a broad and flexible set of insights
- Long-term investment horizon

Shenandoah Philosophy:

- Temporal diversification – invest over multiple horizons
- Incorporate thematic drivers and potential structural change
- Flexible and adaptive approach taking the investment environment and VRS opportunity set into account

Harness **best ideas** across asset classes and geographies
to create a **total portfolio**
capable of achieving the objective to **outperform** a reference portfolio
with an **appropriate level of risk**.

Virginia Retirement System

Currency Management

Chung Ma

Managing Director,
Portfolio Solutions Group

FY 2020 Review

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Strategic hedge removed.

Signs of fundamental mis-valuation surfacing after liquidity squeeze. Early signs encouraging.

First Quadrant providing diversified returns.

Putting Odds In Our Favor

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We recognize that the dollar is overvalued. In such cases, we would expect fundamental forces to push dollar back to equilibrium.

When dollar is overvalued by 1 standard deviation

- It depreciates 87% of the time in the next 3 years
- It depreciates by more than 5% in 81% of the time in the next 3 years
- It depreciates by more than 10% in 72% of the time in the next 3 years

Trade-weighted majors dollar index, From January 1973 through June 2019. Depreciation probability over the next 5 year period is higher than next 3 years.

Partnerships – First Quadrant

Virginia Retirement System

Producing Returns When Needed The Most

Negatively-correlated Experience

Timeframe	Return*
YTD	4.06
1 Year	4.56
3 Year (ann.)	0.74
5 Year (ann.)	0.81

Intellectual Capital Transfer

- Macro environment indicators
- Insight into behavioral flow research
- Assistance with hedge ratio analysis

* Through July 2020. July performance is estimated and not official.

First Quadrant - Positioning

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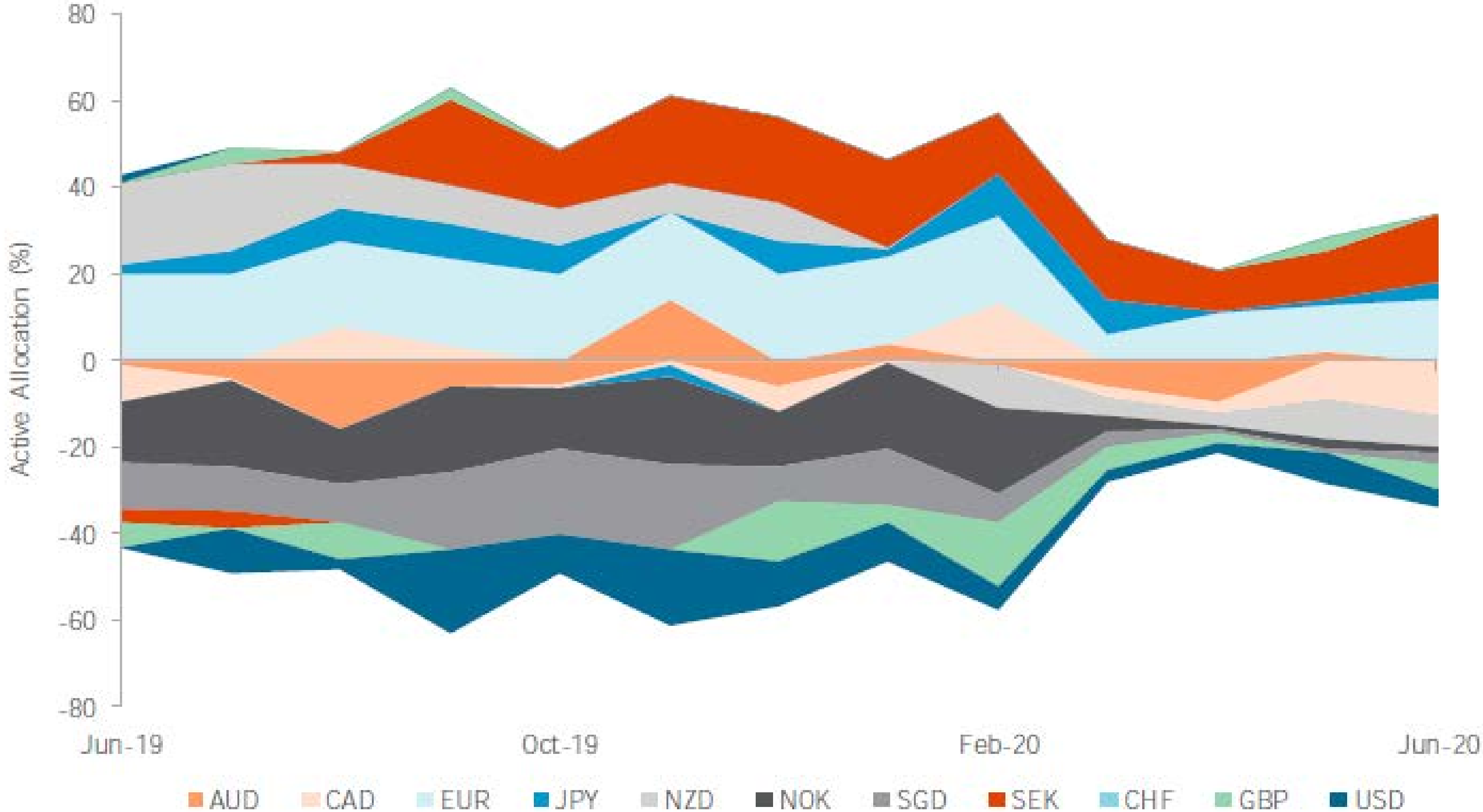

Summary Thoughts

Virginia Retirement System

Managing FX risk beneficial for VRS. Balance of in-house and external management continues to be an effective model to manage our FX risk.

- Less FX volume traded leaves a smaller footprint
- CMT transitioning to more focused sub-groups
- Continued development of FX tools to help with in-house currency discussion