



Performance Report

As of

December 31, 2020

TABLE OF CONTENTS

EXHIBITS

Marquette Update I
Market Environment..... II
Portfolio Review..... III
Investment Managers..... IV
Appendix..... V

DISCLOSURE

Marquette Associates, Inc. ("Marquette") has prepared this report for the exclusive use by the client for which it was prepared. The information herein was obtained from various sources, such as the client's custodian(s) accounting statements, commercially available databases, and other economic and financial market data sources.

The sources of information used in this report are believed to be reliable. Marquette has not independently verified all of the information in this report and its accuracy cannot be guaranteed. The market commentary, portfolio holdings, and characteristics are as of the date appearing in this material only and are subject to change without prior notice. Past performance does not guarantee future results. No graph, chart, or formula can, in and of itself, be used to determine which securities or investments to buy or sell.

Your custodian does not review whether the management fee is properly calculated. This report may contain data and content provided by third parties. The information contained in this material has been compiled or arrived at from sources believed to be reliable. We urge clients to compare the information set forth in this statement with the statements you receive directly from the custodian in order to ensure accuracy of all account information.

Forward-looking statements, including without limitation any statement or prediction about a future event contained in this presentation, are based on a variety of estimates and assumptions by Marquette, including, but not limited to, estimates of future operating results, the value of assets and market conditions. These estimates and assumptions, including the risk assessments and projections referenced, are inherently uncertain and are subject to numerous business, industry, market, regulatory, geo-political, competitive and financial risks that are outside of Marquette's control. There can be no assurance that the assumptions made in connection with any forward-looking statement will prove accurate, and actual results may differ materially. The inclusion of any forward-looking statement herein should not be regarded as an indication that Marquette considers forward-looking statements to be a reliable prediction of future events.

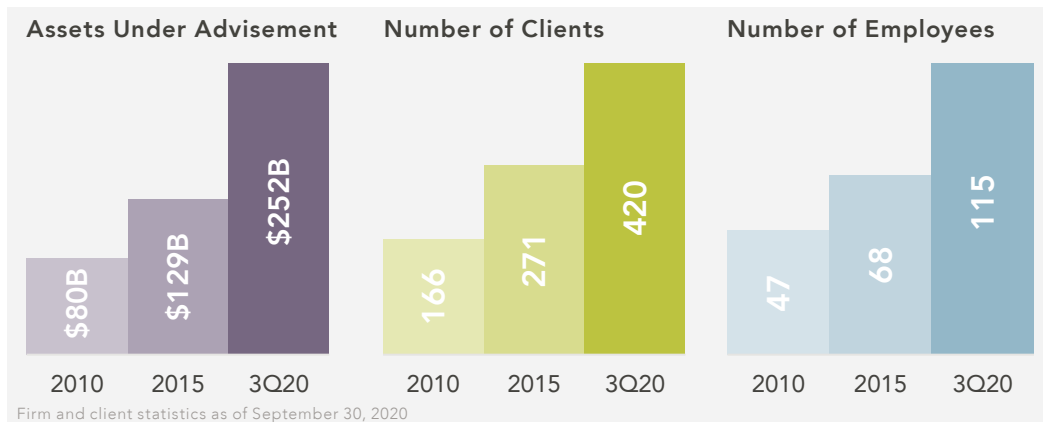
The views contained herein are those of Marquette and should not be taken as financial advice or a recommendation to buy or sell any security. Any forecasts, figures, opinions or investment techniques and strategies described are intended for informational purposes only. They are based on certain assumptions and current market conditions, and although accurate at the time of writing, are subject to change without prior notice. Opinions, estimates, projections and comments on financial market trends constitute our judgment and are subject to change without notice.

I. Marquette Update



Marquette Update

1Q 2021



2021 Market Preview Video: January 21st on YouTube

Follow us on [YouTube](#) [Twitter](#) [LinkedIn](#) | Subscribe to email alerts at MarquetteAssociates.com

Marquette Adds Four New Partners

We are excited to announce the election of four new managing partners. As an employee-owned firm, we are thrilled to not only reward and celebrate the contributions of our employees, but ensure our independence for years to come. Marquette now has 23 full-time owners. Reference our recent client letter for more information.



Christopher Caparelli, CFA
Managing Partner
Joined firm in 2009



Patrick W. Wing, CFA, CIPM
Managing Partner
Joined firm in 2013



Ben Mohr, CFA
Director of Fixed Income,
Managing Partner
Joined firm in 2014



Linsey Schoemehl Payne
Managing Partner
Joined firm in 2016

The opinions expressed herein are those of Marquette Associates, Inc. ("Marquette"), and are subject to change without notice. This material is not financial advice nor an offer to purchase or sell any product. Marquette reserves the right to modify its current investment strategies and techniques based on changing market dynamics or client needs. Marquette is an independent investment adviser registered under the Investment Advisers Act of 1940, as amended. Registration does not imply a certain level of skill or training. More information about Marquette including our investment strategies, fees and objectives can be found in our ADV Part 2, which is available upon request.

Institutional Investing Diversity Cooperative

Marquette has joined more than a dozen fellow institutional investment consulting firms in the formation of the Institutional Investing Diversity Cooperative to increase data and transparency around diversity in the asset management industry. We are committed to pushing for better transparency around diversity within investment teams at the product level, along with more robust data and a broader definition of diversity. Learn more at www.iidcoop.org.



RECENT HIRES

Evan Frazier, CAIA
Research Analyst,
U.S. Equities

Sam McCartney
Research Analyst

Ida DiClemente
Performance Analyst

Kenny Bartow
Performance Analyst

Mackenzie North
HR Coordinator

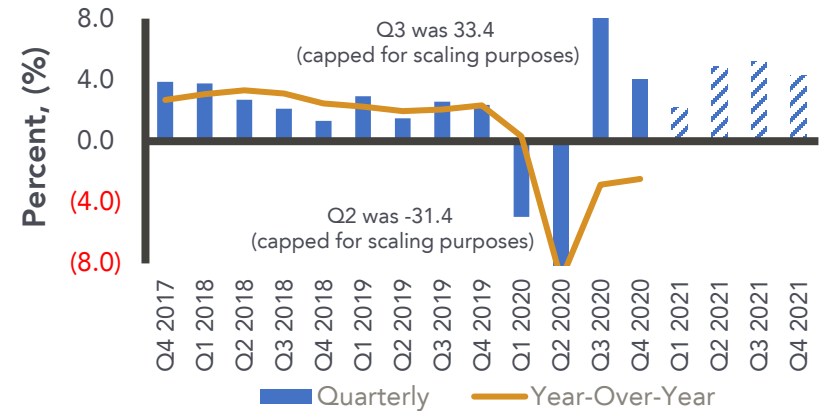
II. Market Environment



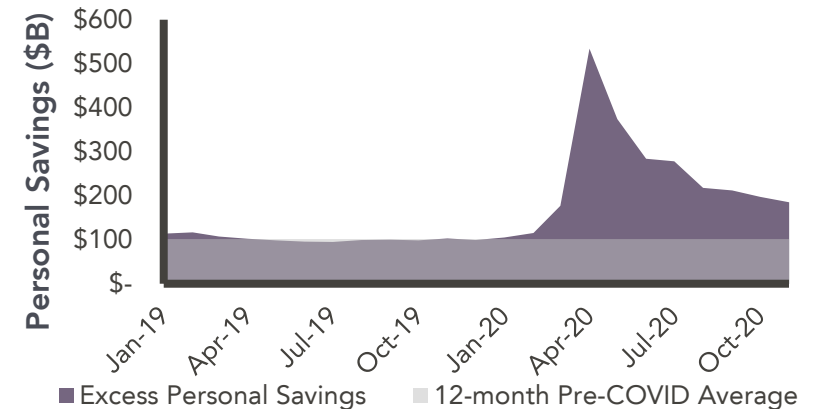
U.S. Economy

- Economic activity moderated considerably in Q4, with real GDP increasing by a healthy annual rate of 4.0%. Economists expect growth to slow further in Q1 given scattered stay-at-home orders throughout the U.S., before accelerating for the remainder of 2021 amid further fiscal stimulus and continued strength in consumer spending, business investment, and housing.
- According to Morgan Stanley, households have received about \$1 trillion in government transfers (thanks to the CARES Act), which will rise further given the fiscal stimulus passed in December. This has led to a large increase in the personal savings rate and more than \$1 trillion in excess personal savings (compared to the 12-month pre-COVID average), leaving a strong likelihood for pent-up consumer demand to drive the economy once it full reopens.

U.S. Real GDP Growth



Personal Savings

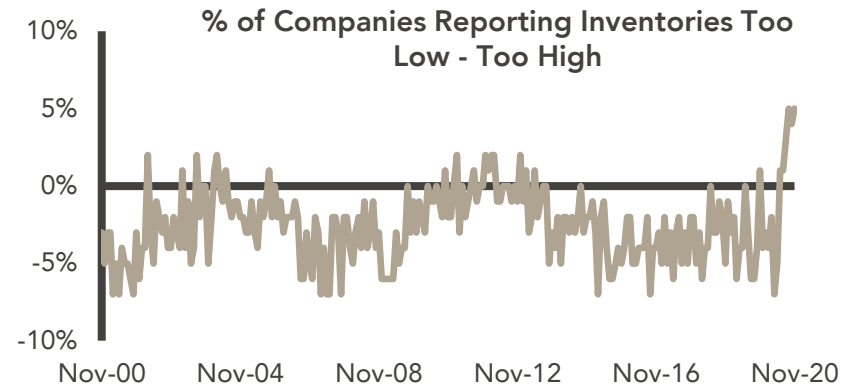


Sources: Refinitiv and The Wall Street Journal. In the "Real GDP Growth" chart, striped bars reflect analyst estimates. The concept for the "Personal Savings" chart sourced from Morgan Stanley's *Don't Underestimate Inflation's Upside Risk*, January 5, 2021.

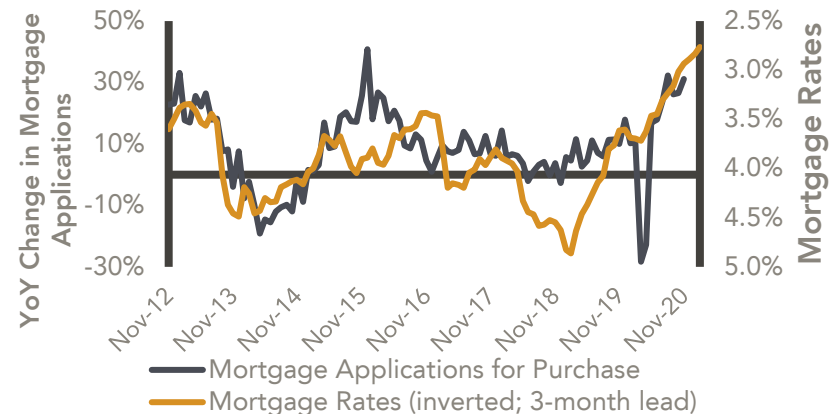
U.S. Economy

- Amid the recession, businesses cut back on employment and capital spending. Now, the percentage of businesses that are reporting their inventories are too low less those that are reporting their inventories are too high is at the highest level in at least 20 years. Given that, the prospects for business investment remain strong.
- While long-term rates have increased slightly, they remain near historic lows, which could continue to act as a tailwind for some of the more cyclical sectors of the economy, particularly those that rely on debt financing. Housing activity, for instance, will likely remain strong amid low mortgage rates.

Business Inventories



Mortgage Rates vs. Mortgage Applications

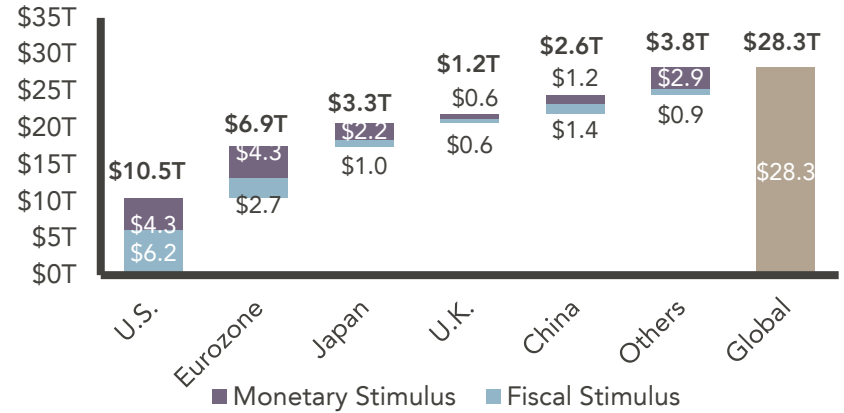


Sources: Refinitiv.

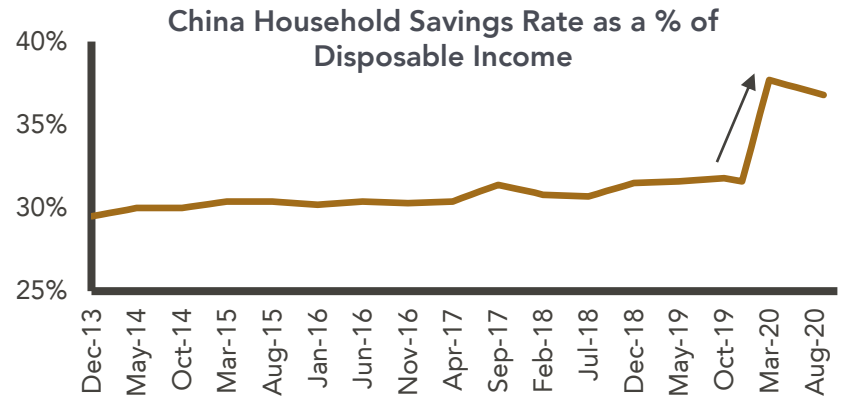
Global Economy

- Growth outside the U.S. slowed as well in Q4, particularly in Europe, where COVID outbreaks have been met with strict lockdowns. Still, a global synchronous recovery in 2021 remains likely amid large-scale stimulus programs.
- According to calculations by the KKR Global Institute, the combined monetary and fiscal stimulus enacted thus far has reached almost \$30 trillion. Further, it seems unlikely that policymakers will implement any austerity in the near term, as was the case after the Global Financial Crisis.
- Like the U.S., household saving in China has spiked recently, meaning that the prospects for near-term spending in China are positive. This bodes well for the global economy, given that China accounts for about one-third of global economic growth.

Global Stimulus



China Household Savings

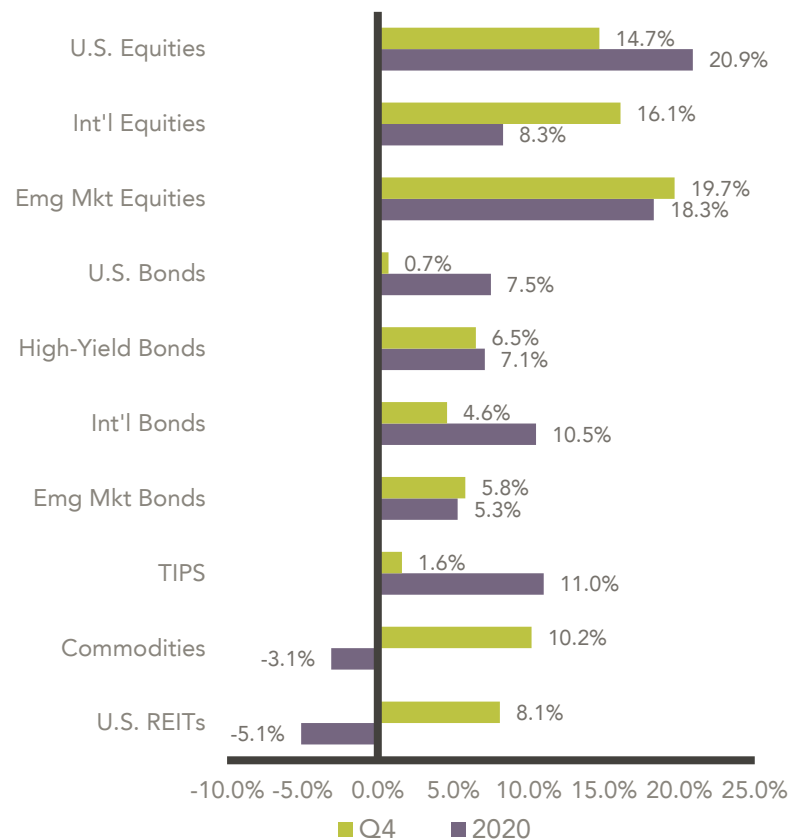


Sources: KKR Global Institute. The concept for the "Global Stimulus" chart sourced from KKR's 2021: *Another Voice*, December 2020.

Global Asset Class Performance

- Global equities** continued to rally in Q4, ending the year with double-digit returns across developed and emerging markets. U.S equities (+14.7%) lagged their international developed (+16.1%) and emerging market equity (+19.7%) counterparts. Year-to-date, however, domestic equities outperformed due largely to the performance of a handful of large-cap stocks.
- Fixed income** markets experienced positive returns across the risk spectrum in Q4. While Treasury yields rose during the quarter, core bonds returned 0.7% as investment-grade credit spreads continued to narrow. High yield (+6.5%) and bank loans (+3.6%) posted strong returns as spreads for both asset classes declined below their long-term averages amid an economic rebound.
- Inflation-sensitive assets** also posted solid results for the quarter. TIPS (+1.6%) were comfortably in the black, outperforming their nominal government bond counterparts as real yields moved deeper into negative territory. REITs (+8.1%) lagged broad equity markets once again amid continued concerns over property values and tenant rent relief. Finally, commodities (+10.2%) rose strongly given increased demand and a weaker U.S. dollar.

Asset Class Returns: Select Asset Class Performance

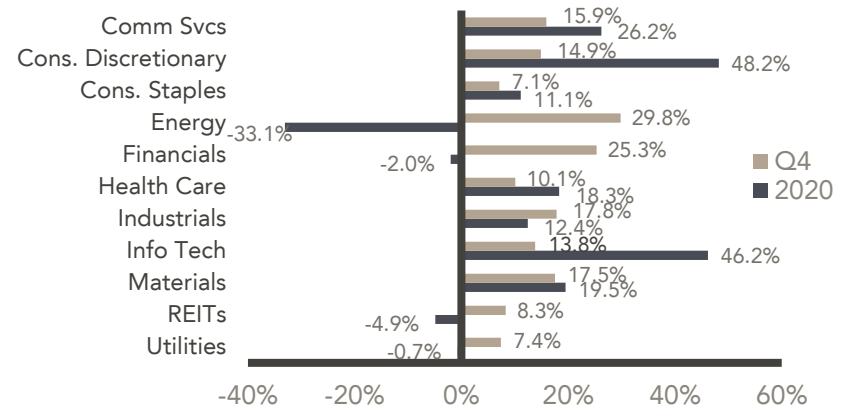


Sources: Markov Processes International

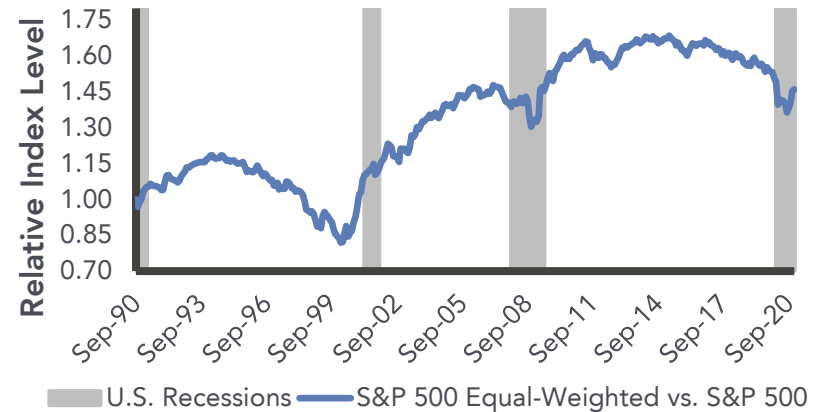
U.S. Equity Markets

- U.S equity markets continued their strength in Q4. After a slight decline in October, equities rallied in the wake of the election. The S&P 500 Index finished the quarter with a return of 12.2%, ending the year at all-time highs.
- All sectors finished the quarter in the black, with more cyclical areas generally outperforming their more defensive counterparts. Energy (+29.8%) and financials (+25.3%) led the way, while utilities (+7.4%) and consumer staples (+7.1%) lagged.
- Value stocks topped growth stocks in the quarter, though the latter outperformed the former by more than 35 percentage points in 2020. Returns were positive across the capitalization spectrum in Q4, with small-cap equities (+31.4%) the clear leaders, while mid- (+19.9%) and large-cap equities (+13.7%) lagged.

Sector Returns



S&P 500 Equal-Weighted vs. S&P 500

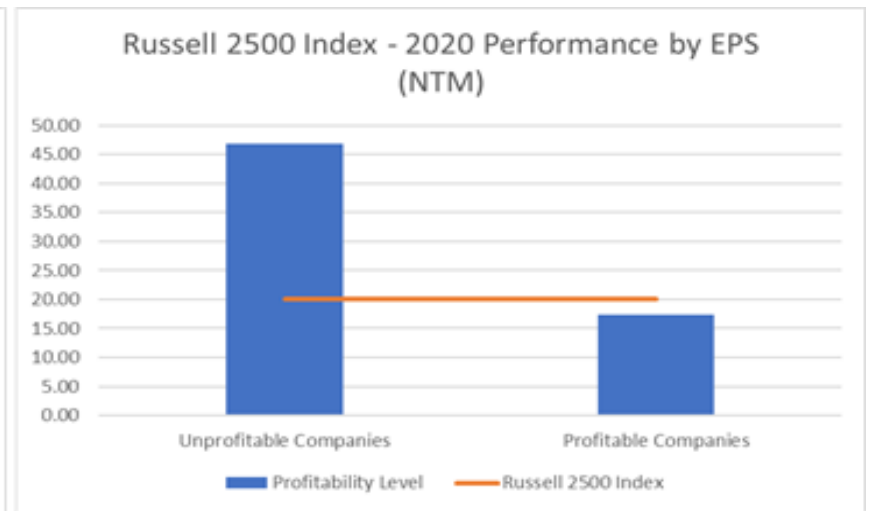
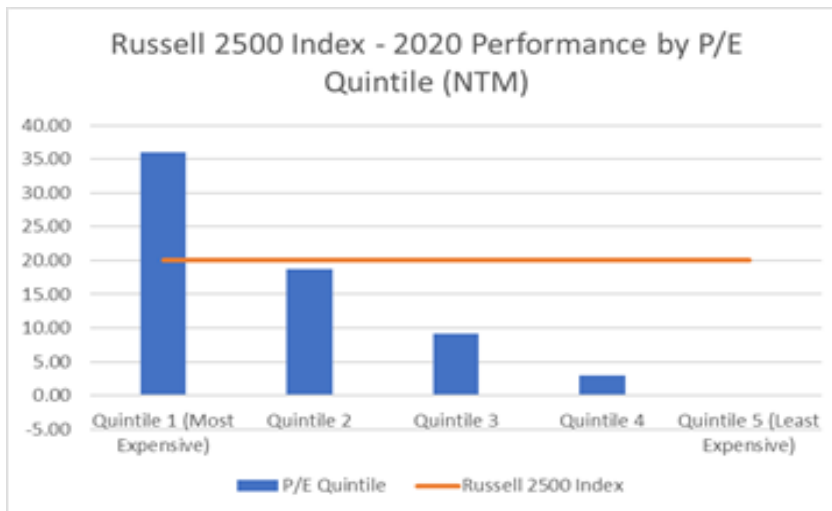


Sources: Markov Processes International and Refinitiv

U.S. Equity Markets

- Share prices have far outpaced the rebound in earnings expectations, leaving the forward P/E ratio at 23.8 as of December—nearly, 45% above its 20-year average of 16.4.
- Despite the slight recovery for value in the fourth quarter, 2020 can be characterized as a strong year for growth and low quality. Companies that began the year with negative earnings expectations (unprofitable) returned 46.9% while those with positive earnings expectations (profitable) returned only 17.4%.

MSCI U.S. IMI Forward Earnings Estimates

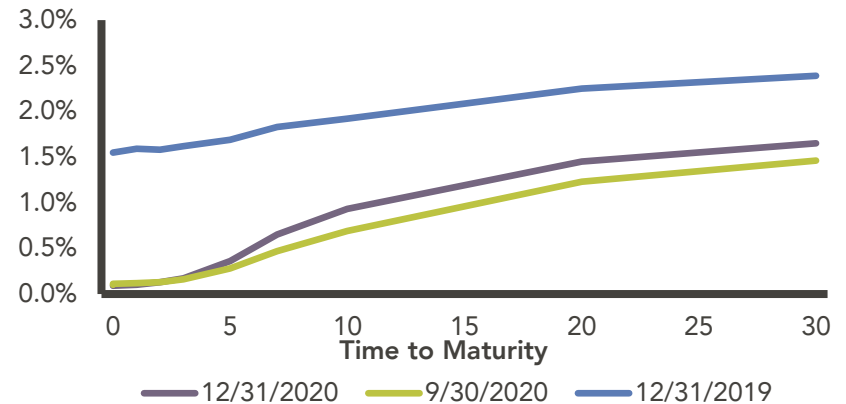


Sources: Refinitiv and FactSet.

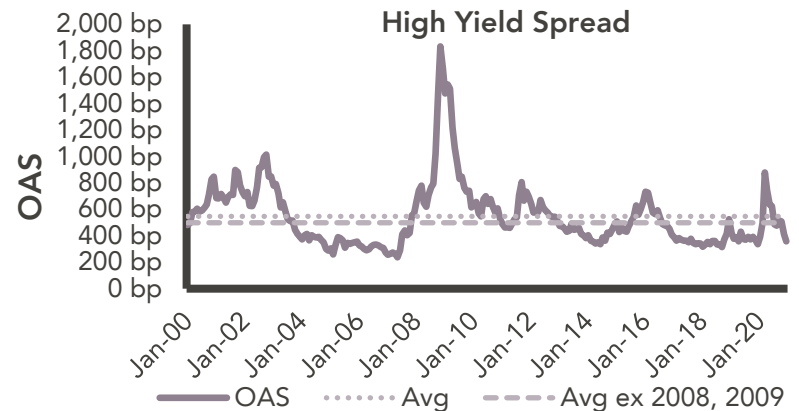
U.S. Fixed Income

- Interest rates rose moderately for intermediate- and long-term Treasuries in Q4, though remain near historic lows across most maturities.
- Treasury returns were in the red for the quarter, with the return of core bonds (+0.7%) due entirely to investment-grade credit.
- Sectors with more credit risk saw continued outperformance in Q4. High yield (+6.5%) and bank loans (+3.6%) posted strong returns as spreads for both asset classes declined below their long-term averages. High yield spreads, for example, ended the quarter at just 360 basis points—well below the long-term average of about 550 basis points.

Yield Curve



High Yield Spread



Sources: Bloomberg Barclays Refinitiv.

What we are watching in 2021

- It's still all about COVID and containment.
- Distribution and efficacy of vaccines – not off to a good start.
- Next stimulus package – size and scope; \$1.9T?
- New administration, new policies.
 - Spending? Infrastructure? Higher taxes?
- Interest rates: Headwinds ahead for fixed income.
 - The larger the stimulus, the greater the rise?
 - Will higher rates help drive a value rotation?
 - Fed has pledged to keep rates low until 2023 (short end only).
- Impact of the retail investor due to democratization of markets.
 - Extended short-term volatility.
 - No meaningful impact on broad global equity markets.

Global Index Returns

U.S. EQUITY	QTR	YTD	1 Year	3 Year	5 Year	10 Year
S&P 500 Index	12.1	18.4	18.4	14.2	15.2	13.9
Russell 3000 Index	14.7	20.9	20.9	14.5	15.4	13.8
Russell 3000 Growth Index	12.4	38.3	38.3	22.5	20.7	16.9
Russell 3000 Value Index	17.2	2.9	2.9	5.9	9.7	10.4
Russell TOP 200 Index	11.6	22.4	22.4	16.0	16.4	14.6
Russell TOP 200 Growth Index	9.8	39.3	39.3	23.7	21.7	18.0
Russell TOP 200 Value Index	14.1	1.6	1.6	6.4	9.8	10.5
Russell 1000 Index	13.7	21.0	21.0	14.8	15.6	14.0
Russell 1000 Growth Index	11.4	38.5	38.5	23.0	21.0	17.2
Russell 1000 Value Index	16.3	2.8	2.8	6.1	9.7	10.5
Russell Mid-Cap Index	19.9	17.1	17.1	11.6	13.4	12.4
Russell Mid-Cap Growth Index	19.0	35.6	35.6	20.5	18.7	15.0
Russell Mid-Cap Value Index	20.4	5.0	5.0	5.4	9.7	10.5
Russell 2000 Index	31.4	20.0	20.0	10.2	13.3	11.2
Russell 2000 Growth Index	29.6	34.6	34.6	16.2	16.4	13.5
Russell 2000 Value Index	33.4	4.6	4.6	3.7	9.7	8.7

U.S. EQUITY BY SECTOR	QTR	YTD	1 Year	3 Year	5 Year	10 Year
Communication Services	15.9	26.2	26.2	16.2	13.9	11.2
Consumer Discretionary	14.9	48.2	48.2	23.4	19.8	18.3
Consumer Staples	7.1	11.1	11.1	9.0	9.1	11.8
Energy	29.8	(33.1)	(33.1)	(16.3)	(6.1)	(3.8)
Financials	25.3	(2.0)	(2.0)	3.8	10.9	10.6
Health Care	10.1	18.3	18.3	15.1	12.7	16.5
Industrials	17.8	12.4	12.4	8.1	13.1	12.2
Information Technology	13.8	46.2	46.2	29.5	27.7	20.3
Materials	17.5	19.5	19.5	7.0	12.9	8.8
Real Estate	8.3	(4.9)	(4.9)	5.5	6.8	9.1
Utilities	7.4	(0.7)	(0.7)	9.1	11.4	11.3

Source: Markov Processes International.

Global Index Returns

INT'L/GLOBAL EQUITY	QTR	YTD	1 Year	3 Year	5 Year	10 Year
MSCI EAFE (Net)	16.0	7.8	7.8	4.3	7.4	5.5
MSCI EAFE Growth (Net)	13.1	18.3	18.3	9.7	10.5	7.5
MSCI EAFE Value (Net)	19.2	(2.6)	(2.6)	(1.2)	4.2	3.4
MSCI EAFE Small Cap (Net)	17.3	12.3	12.3	4.9	9.4	7.8
MSCI AC World Index (Net)	14.7	16.3	16.3	10.1	12.3	9.1
MSCI AC World Index Growth (Net)	13.1	33.6	33.6	17.7	16.9	12.0
MSCI AC World Index Value (Net)	16.6	(0.3)	(0.3)	2.4	7.4	6.1
MSCI Europe ex UK (Net)	15.2	10.9	10.9	5.5	8.2	6.1
MSCI United Kingdom (Net)	16.9	(10.5)	(10.5)	(2.4)	2.6	3.0
MSCI Pacific ex Japan (Net)	20.1	6.6	6.6	4.2	9.0	4.8
MSCI Japan (Net)	15.3	14.5	14.5	6.1	8.7	6.5
MSCI Emerging Markets (Net)	19.7	18.3	18.3	6.2	12.8	3.6

Source: Markov Processes International.

Global Index Returns

FIXED INCOME	QTR	YTD	1 Year	3 Year	5 Year	10 Year
Merrill Lynch 3-month T-Bill	0.0	0.7	0.7	1.6	1.2	0.6
Barclays Intermediate Gbp't./Credit	0.5	6.4	6.4	4.7	3.6	3.1
Barclays Aggregate Bond	0.7	7.5	7.5	5.3	4.4	3.8
Barclays Short Government	0.0	1.8	1.8	2.3	1.7	1.0
Barclays Intermediate Government	(0.2)	5.7	5.7	4.1	2.9	2.5
Barclays Long Government	(3.0)	17.6	17.6	9.8	7.8	7.7
Barclays Investment Grade Corp.	3.0	9.9	9.9	7.1	6.7	5.6
Barclays High Yield Corp. Bond	6.5	7.1	7.1	6.2	8.6	6.8
JPMorgan Global ex US Bond	4.6	10.5	10.5	4.6	5.1	1.9
JPMorgan Emerging Market Bond	5.8	5.3	5.3	5.0	7.1	6.2

INFLATION SENSITIVE	QTR	YTD	1 Year	3 Year	5 Year	10 Year
Consumer Price Index	1.0	1.3	1.4	1.8	1.8	1.8
BC TIPS	1.6	11.0	11.0	5.9	5.1	3.8
Commodities	10.2	(3.1)	(3.1)	(2.5)	1.0	(6.5)
Gold	(0.4)	20.9	20.9	11.5	11.0	2.1
REITs	8.1	(5.1)	(5.1)	5.4	6.7	9.3
FTSE EPRA/NAREIT Global REITs	13.6	(11.3)	(11.3)	0.8	2.9	5.8
NCREIF ODCE*	1.1	0.3	0.3	4.0	5.3	8.9
NCREIF Farmland**	1.0	1.5	3.8	5.3	6.1	10.9
NCREIF Timberland**	0.0	0.2	0.2	2.1	2.6	4.4

*Data are preliminary.

**Data are as of September 30, 2020.

Source: Markov Processes International.

III. Portfolio Review



Observations

- Market Value as of December 31, 2020 was \$3.2 billion
- Q4-20 Return: Total Fund 13.0% (net) vs. Policy Index 12.3%; investment gain of \$365 million; ranking in 4th percentile of peers
- Contributors to Q4-20 Performance:
 - Overweight to Equities
 - Higher Beta portfolio
 - Value positions in U.S. Large Cap Equities
 - Developed Non-U.S. Equities
- Detractors to Q4-20 Performance
 - U.S. Large Cap Growth
 - U.S. Small Cap positions
 - Real Assets
- 1 Year Return: Total Fund 14.5% (net) vs. Policy Index 12.4%; investment gain of \$386 million; ranking in 35th percentile of peers
- 5 Year Return: Total Fund 11.3% (net) vs. Policy Index 9.9%; investment gain of \$1.3 billion; ranking in 6th percentile of peers
- Estimated Annual Plan Investment Management Expenses: 0.40%

Looking Ahead

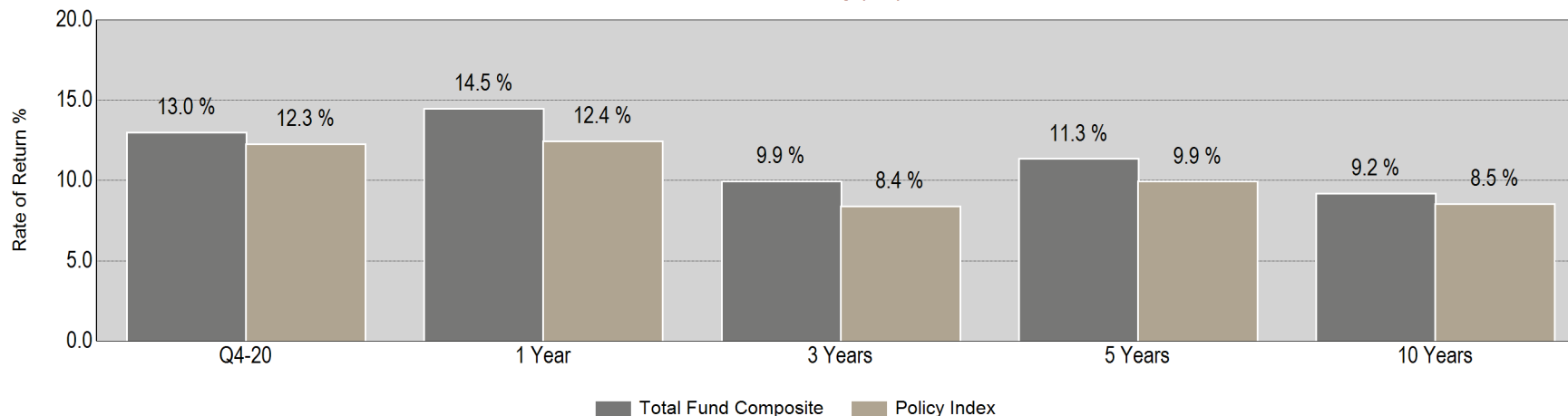
- Investment Policy Statement Review
- Asset Allocation Study Review
- Fiduciary Education for potential new Asset Classes
- Upcoming Investment Manager Searches

As of December 31, 2020

Summary of Cash Flows

	Fourth Quarter	One Year	Three Years	Five Years	Ten Years
Beginning Market Value	\$2,766,945,824	\$2,800,814,336	\$2,500,352,133	\$1,996,572,502	\$1,537,565,751
Net Cash Flow	\$39,541,948	-\$15,089,472	-\$78,178,413	-\$115,126,694	-\$216,243,952
Net Investment Change	\$365,371,919	\$386,134,827	\$749,685,971	\$1,290,413,883	\$1,850,537,892
Ending Market Value	\$3,171,859,691	\$3,171,859,691	\$3,171,859,691	\$3,171,859,691	\$3,171,859,691

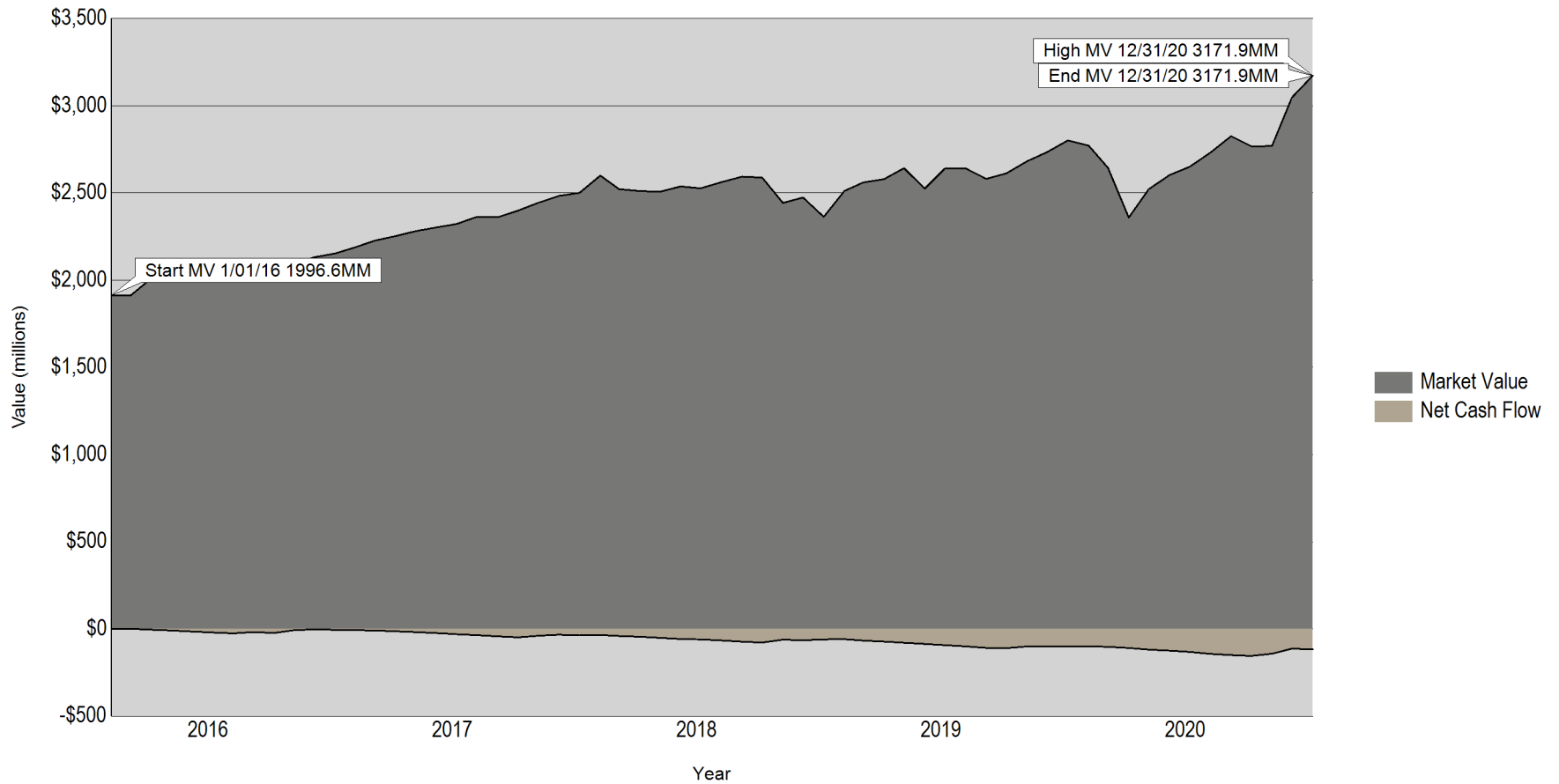
Return Summary (Net)



Asset Allocation vs. Target

	Current	Policy
U.S. Equity	43.8%	40.0%
Non-U.S. Equity	16.2%	15.0%
Emerging Markets	10.3%	10.0%
Real Assets	15.6%	20.0%
U.S. Fixed Income	12.6%	15.0%
Cash Equivalent	1.6%	0.0%
Total	100.0%	100.0%

Market Value History



Pennsylvania Municipal Retirement System

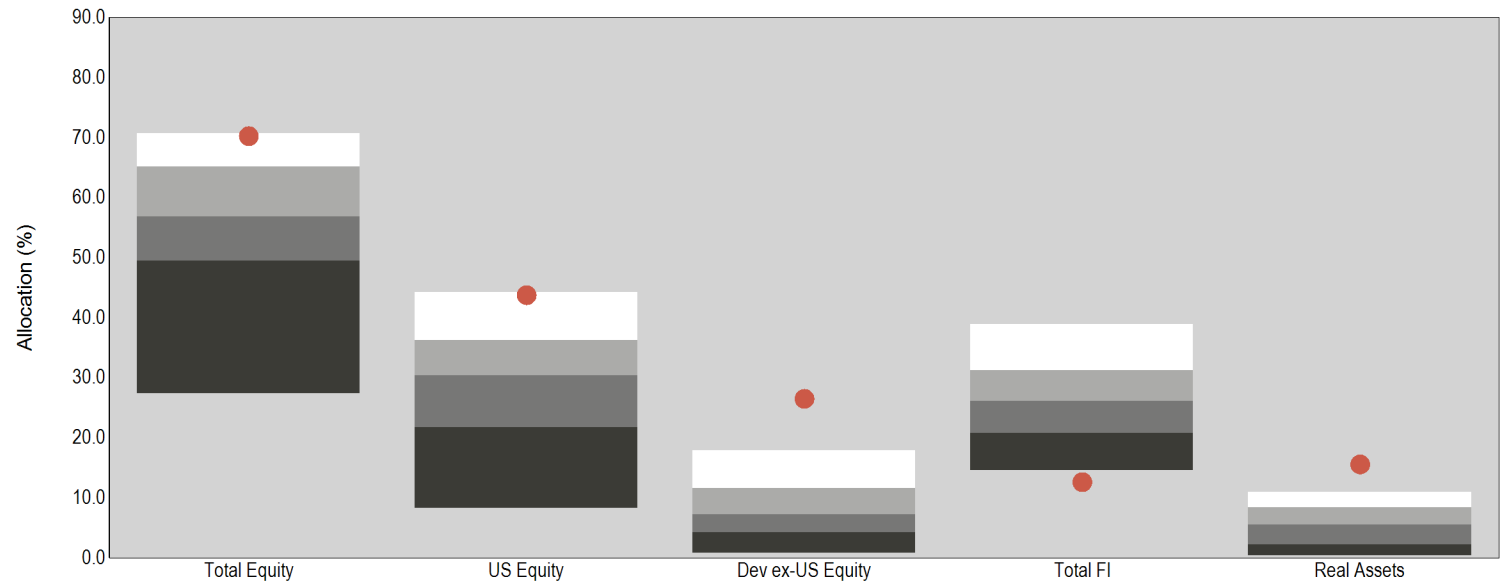
Asset Allocation Summary

As of December 31, 2020

	Market Value	% of Portfolio	Policy %	Policy Difference
Total Fund Composite	3,171,859,691	100.0	100.0	0
Total Equity Composite	2,228,130,848	70.2	65.0	166,422,049
U.S. Equity Composite	1,388,071,718	43.8	40.0	119,327,842
Large Cap U.S. Equity Composite	841,199,603	26.5	25.0	48,234,680
Eagle Asset Mgmt	187,492,599	5.9		
LSV Large Cap Value	177,886,570	5.6		
SSGA S&P 500	138,153,423	4.4		
Polen Focus Growth	268,937,017	8.5		
William & Blair Large Cap Growth	68,729,994	2.2		
Small Cap U.S. Equity Composite	546,872,115	17.2	15.0	71,093,161
LSV Small Cap Value	77,491,991	2.4		
Smith, Graham & Co Small Cap Value	90,353,847	2.8		
SSGA Russell 2000	182,632,053	5.8		
Copeland Small Cap Dividend Growth	51,068,311	1.6		
AMI Small Cap Growth	48,579,801	1.5		
Emerald Small Cap Growth	96,746,112	3.1		
Non-U.S. Equity Composite	840,059,131	26.5	25.0	47,094,208
Developed Non-U.S. Equity Composite	512,920,810	16.2	15.0	37,141,856
SSGA MSCI World ex US	188,392,327	5.9		
Hardman Johnston Int'l Equity	172,918,927	5.5		
HGK Int'l Equity	151,255,266	4.8		
Emerging Markets Composite	327,138,321	10.3	10.0	9,952,352
SSGA MSCI Emerging Markets Index	327,138,321	10.3		
Real Assets Composite	493,870,829	15.6	20.0	-140,501,109
Forest Investment Associates	130,234,184	4.1		
PRISA LP	52,490,938	1.7		
PRISA II	105,185,529	3.3		
PennMuni-Nuveen U.S. Real Estate Fund	203,630,435	6.4		
N. Front Street (Nuveen)	2,329,743	0.1		
Total Fixed Income Composite	399,941,590	12.6	15.0	-75,837,363
SSGA US Aggregate Bond Index	399,941,590	12.6		
Cash Composite	49,916,423	1.6	0.0	49,916,423
Cash Management	5,367,800	0.2		
Pool 999	44,548,623	1.4		

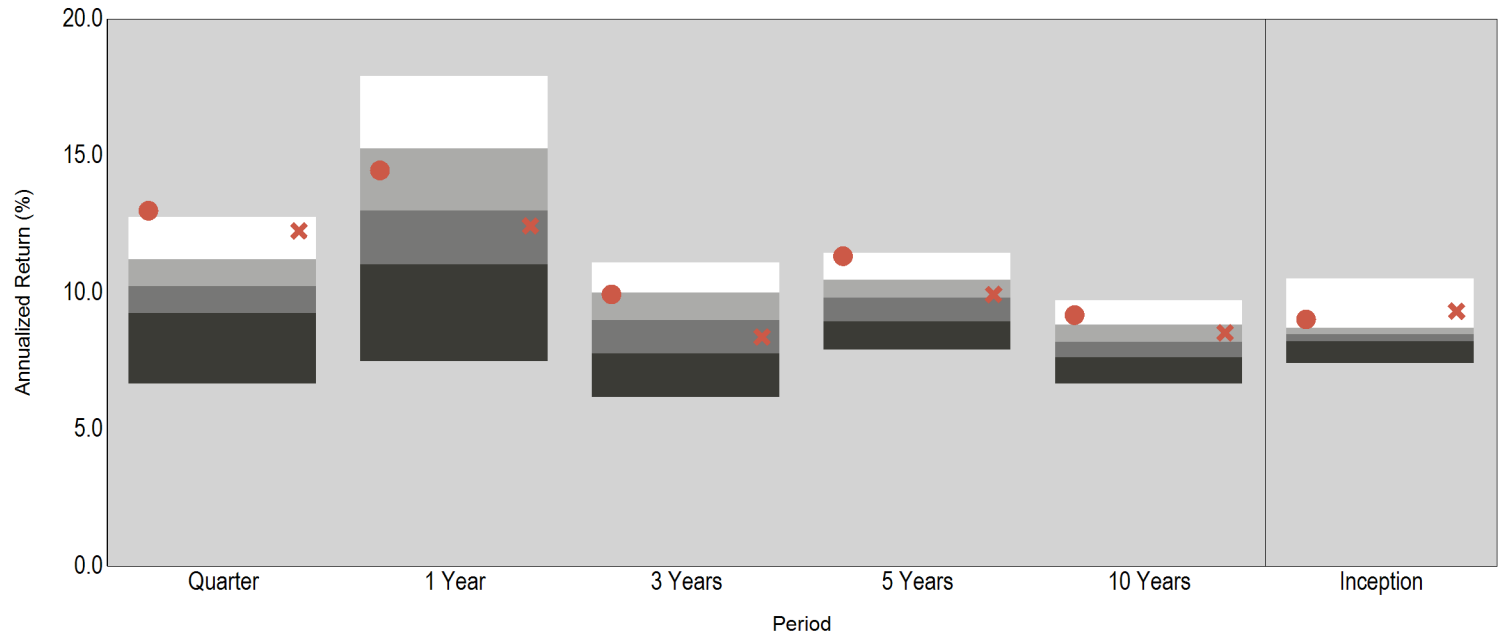
*Residual value for Jarislowsky, Mercator, GlobeFlex and WHV (approx. \$354k) are included in Developed, Non-US Equity and Total Fund Composite values

Total Plan Allocation vs. InvMetrics Public DB Net
As of December 31, 2020



	Allocation (Rank)									
5th Percentile	70.7		44.3		17.9		39.0		11.0	
25th Percentile	65.1		36.2		11.6		31.2		8.4	
Median	56.8		30.4		7.2		26.1		5.5	
75th Percentile	49.5		21.7		4.2		20.8		2.2	
95th Percentile	27.4		8.3		0.8		14.6		0.4	
# of Portfolios	229		132		86		226		62	
● Total Fund Composite	70.2	(7)	43.8	(7)	26.5	(2)	12.6	(98)	15.6	(1)

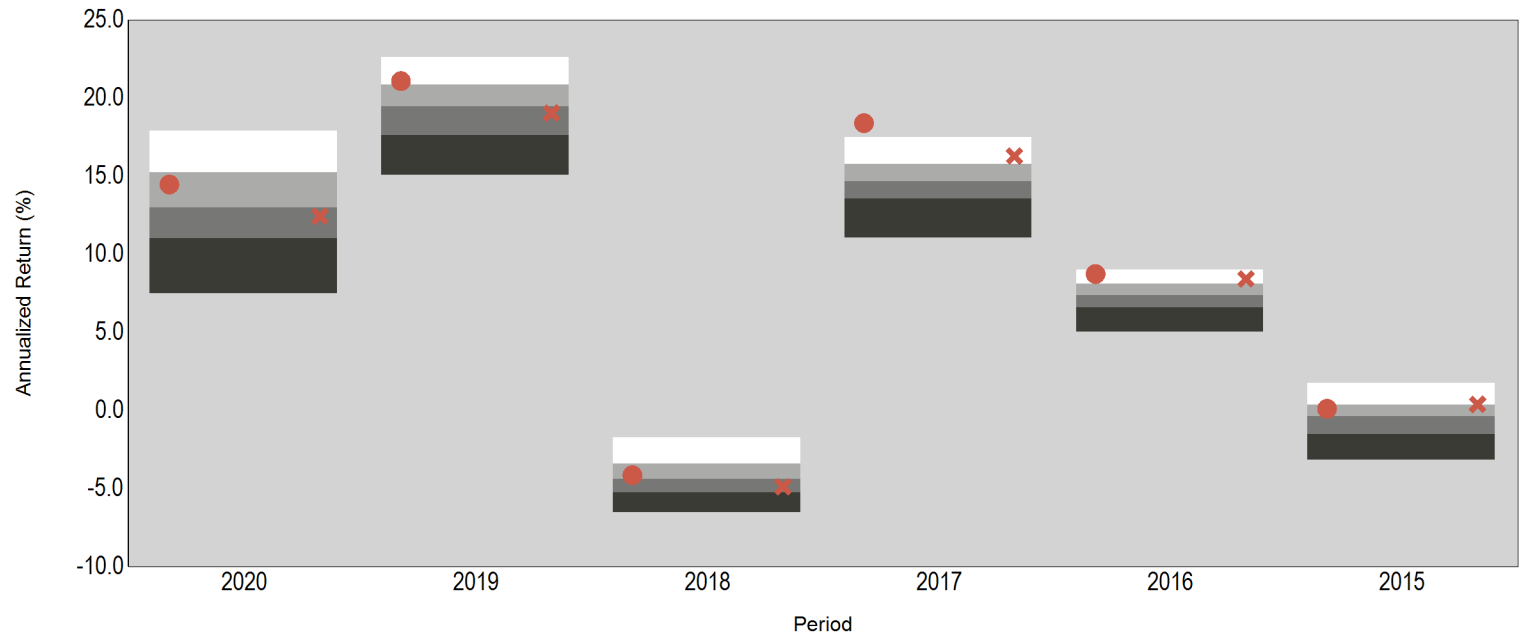
InvMetrics Public DB Net Return Comparison



	Return (Rank)					
	Quarter	1 Year	3 Years	5 Years	10 Years	Inception
5th Percentile	12.8	17.9	11.1	11.4	9.7	10.5
25th Percentile	11.2	15.3	10.0	10.5	8.8	8.7
Median	10.2	13.0	9.0	9.8	8.2	8.5
75th Percentile	9.2	11.0	7.8	8.9	7.6	8.2
95th Percentile	6.7	7.5	6.2	7.9	6.7	7.4
# of Portfolios	600	596	580	561	445	17
● Total Fund Composite	13.0 (4)	14.5 (35)	9.9 (27)	11.3 (6)	9.2 (15)	9.0 (13)
▲ Policy Index	12.3 (10)	12.4 (57)	8.4 (63)	9.9 (44)	8.5 (35)	9.3 (11)

As of December 31, 2020

InvMetrics Public DB Net Return Comparison



Return (Rank)

5th Percentile	17.9	22.6	-1.7	17.5	9.0	1.7
25th Percentile	15.3	20.8	-3.4	15.8	8.1	0.4
Median	13.0	19.5	-4.4	14.7	7.4	-0.4
75th Percentile	11.0	17.6	-5.2	13.6	6.6	-1.5
95th Percentile	7.5	15.1	-6.5	11.1	5.0	-3.2
# of Portfolios	596	550	496	269	269	262
● Total Fund Composite	14.5 (35)	21.1 (23)	-4.1 (44)	18.4 (3)	8.7 (10)	0.1 (31)
▲ Policy Index	12.4 (57)	19.0 (57)	-4.9 (66)	16.3 (18)	8.4 (19)	0.4 (24)

As of December 31, 2020

RISK RETURN STATISTICS
January 01, 2016 Through December 31, 2020

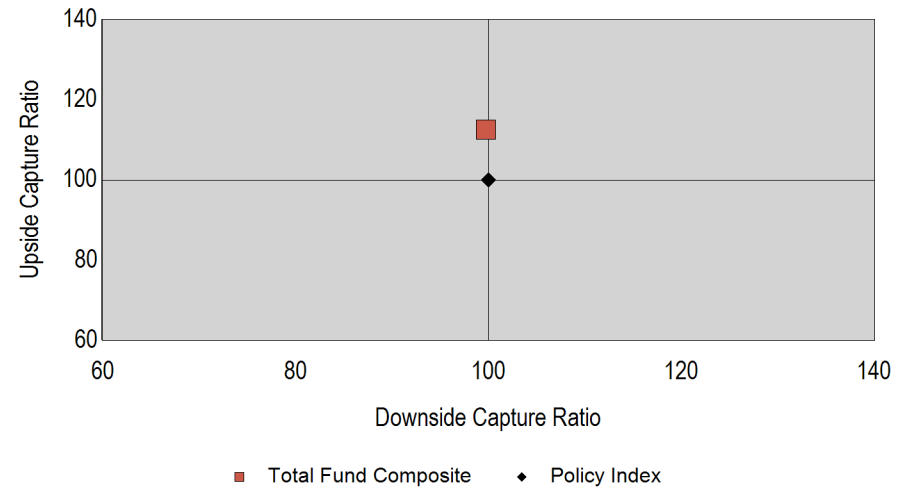
	Total Fund Composite	Policy Index
RETURN SUMMARY STATISTICS		
Number of Periods	20	20
Maximum Return	13.50	12.26
Minimum Return	-15.37	-14.88
Annualized Return	11.34	9.93
Total Return	71.08	60.55
Annualized Excess Return Over Risk Free	10.20	8.80
Annualized Excess Return	1.41	0.00

	Total Fund Composite	Policy Index
RISK SUMMARY STATISTICS		
Beta	1.06	1.00
Upside Deviation	7.88	7.19
Downside Deviation	15.25	14.65

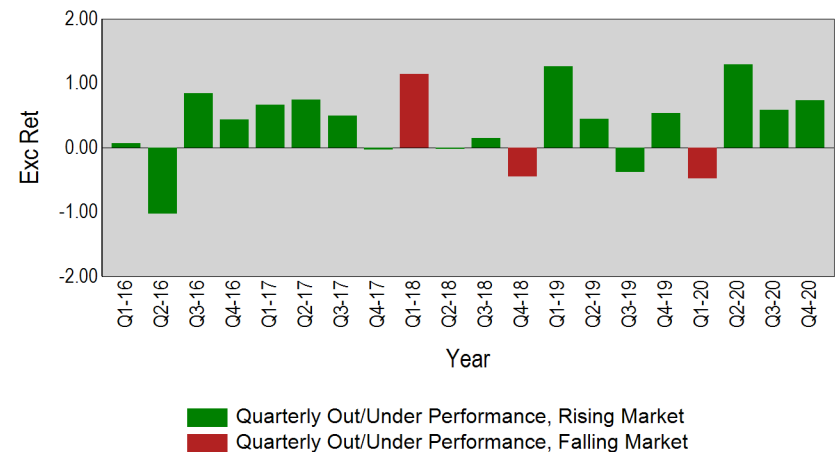
	Total Fund Composite	Policy Index
RISK/RETURN SUMMARY STATISTICS		
Annualized Standard Deviation	13.03	12.21
Alpha	0.18	0.00
Sharpe Ratio	0.78	0.72
Excess Return Over Market / Risk	0.11	0.00
Tracking Error	1.24	0.00
Information Ratio	1.14	--

	Total Fund Composite	Policy Index
CORRELATION STATISTICS		
R-Squared	0.99	1.00
Correlation	1.00	1.00

Upside Capture Ratio vs. Downside Capture Ratio
5 Years Ending December 31, 2020



Quarterly Excess Performance
Total Fund Composite vs. Policy Index



Pennsylvania Municipal Retirement System

Total Equity Composite

As of December 31, 2020

Characteristics

	Portfolio	MSCI ACWI
Number of Holdings	4,893	2,982
Weighted Avg. Market Cap. (\$B)	188.9	306.4
Median Market Cap. (\$B)	4.7	12.2
Price To Earnings	25.2	25.5
Price To Book	3.5	3.7
Price To Sales	1.7	2.0
Return on Equity (%)	10.1	15.8
Yield (%)	1.3	1.8

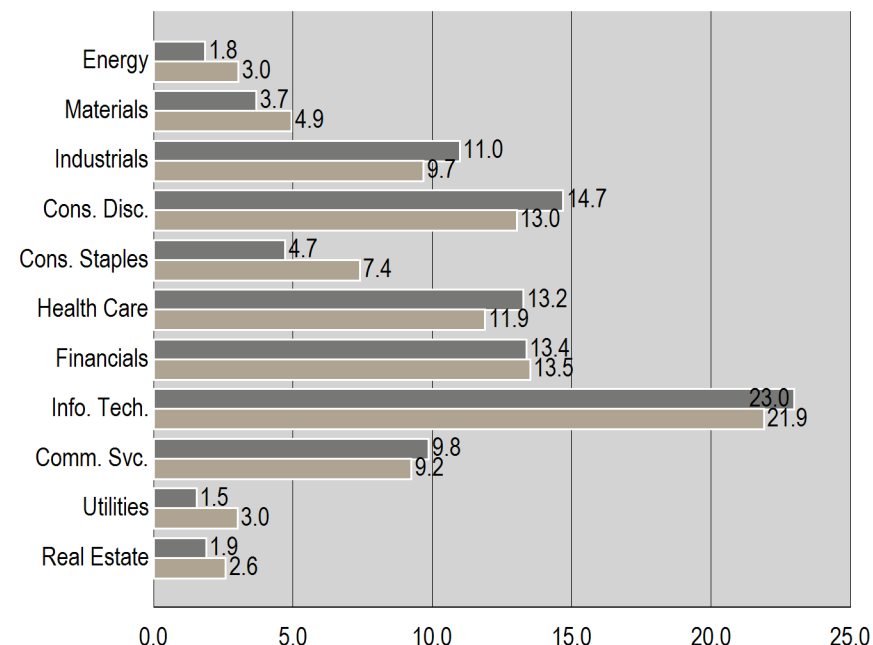
Top Holdings

MICROSOFT CORP	2.3%
ALPHABET INC	1.7%
FACEBOOK INC	1.5%
ALIBABA GROUP HOLDING LTD	1.3%
TENCENT HOLDINGS LTD	1.3%
AMAZON.COM INC	1.0%
TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	1.0%
ADOBE INC	1.0%
UNITEDHEALTH GROUP INC	0.8%
SAMSUNG ELECTRONICS CO LTD	0.8%
Total	12.8%

Market Capitalization

	Small Cap	Mid Cap	Large Cap	Unclassified
Total Equity Composite	26.8%	14.7%	55.9%	2.6%
MSCI ACWI	4.4%	16.2%	79.4%	0.0%
<i>Weight Over/Under</i>	<i>22.5%</i>	<i>-1.5%</i>	<i>-23.5%</i>	<i>2.6%</i>

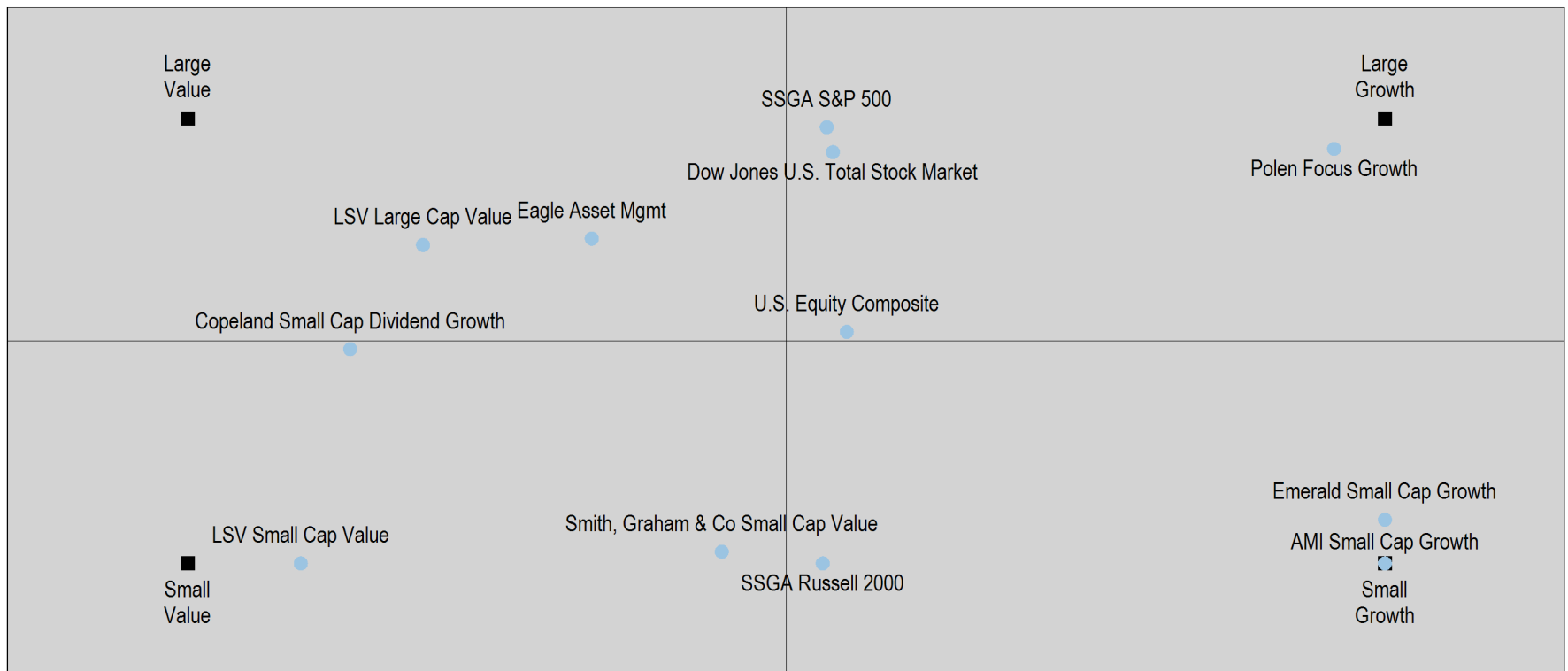
Sector Allocation (%) vs MSCI ACWI



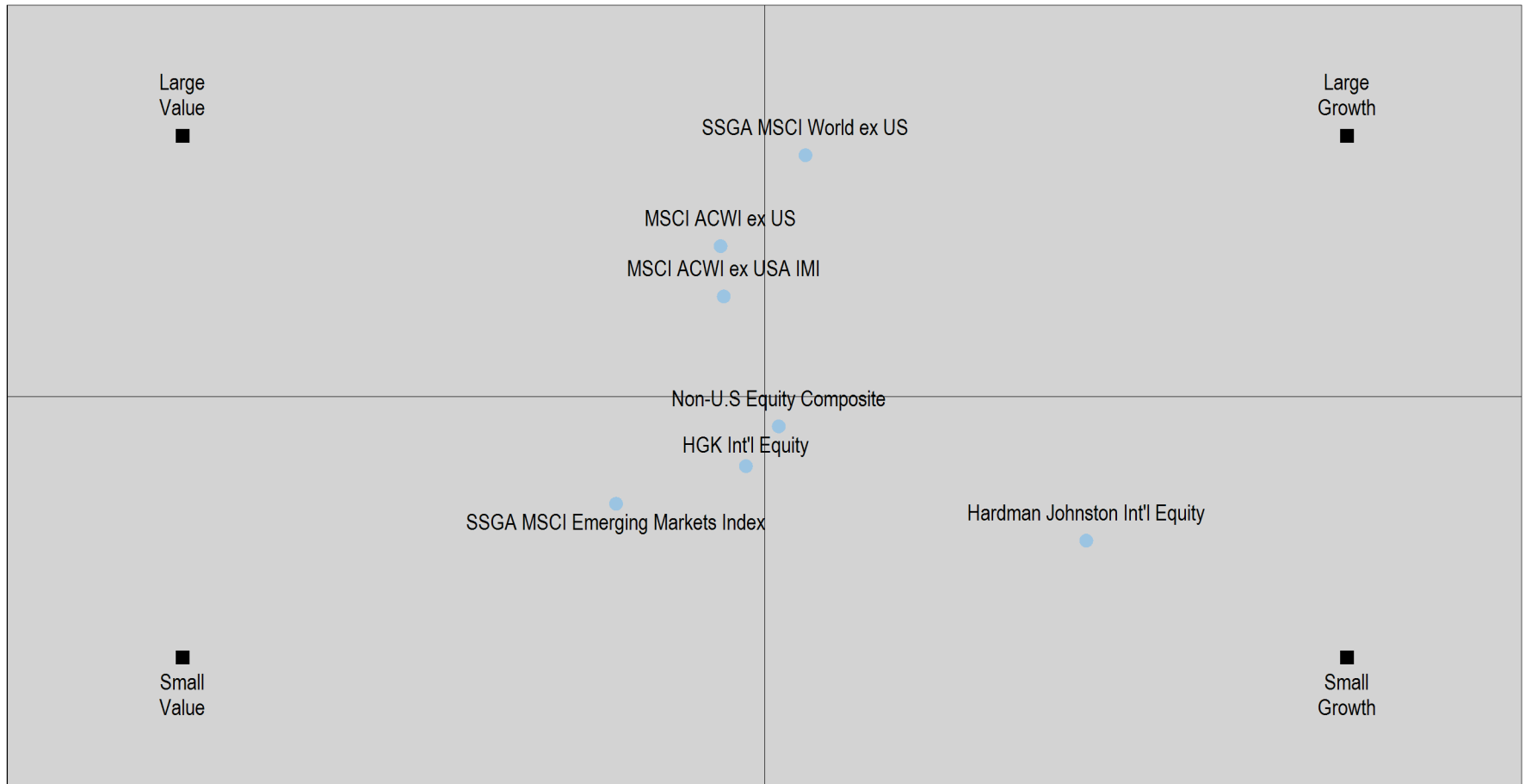
Region Allocation Summary

Region	% of Total	% of Bench	% Diff
North America ex U.S.	1.0%	2.7%	-1.7%
United States	60.3%	57.3%	3.0%
Europe Ex U.K.	9.5%	12.9%	-3.4%
United Kingdom	2.8%	3.8%	-0.9%
Pacific Basin Ex Japan	3.4%	3.1%	0.3%
Japan	4.2%	6.8%	-2.6%
Emerging Markets	18.3%	13.2%	5.1%
Other	0.5%	0.2%	0.3%
Total	100.0%	100.0%	0.0%

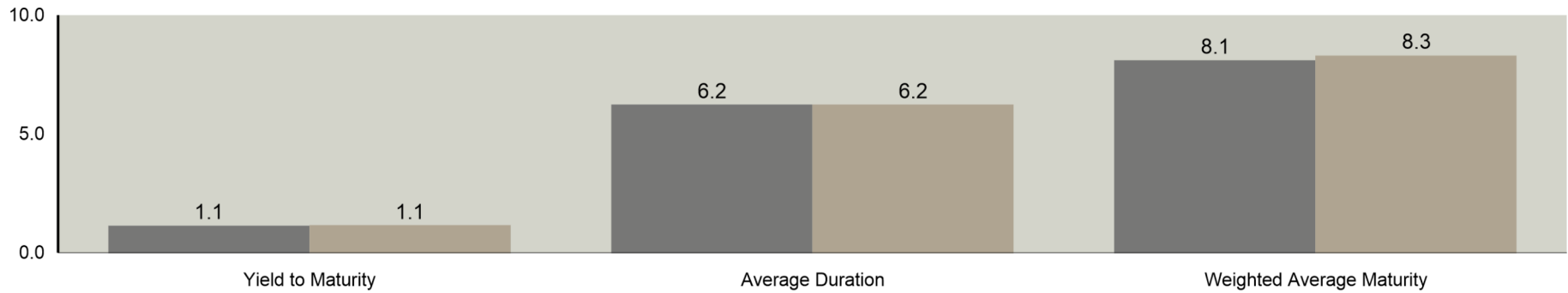
Style Map
3 Years Ending December 31, 2020



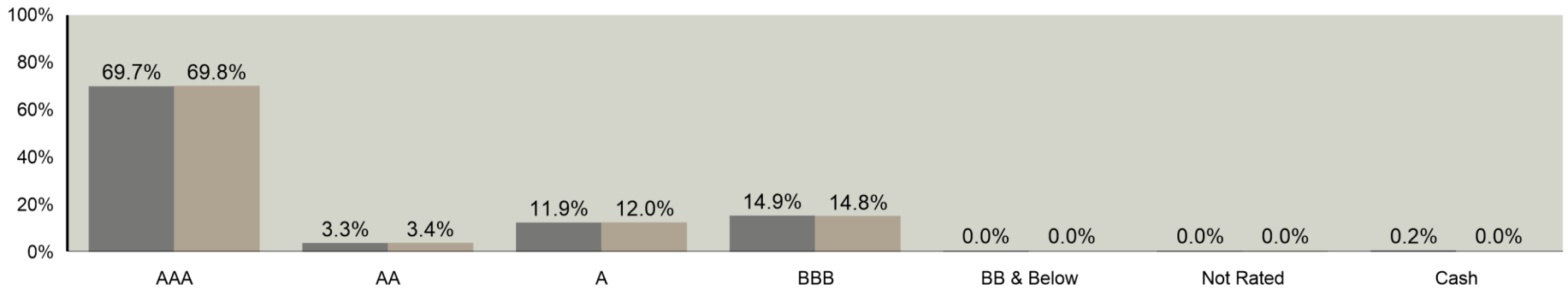
Style Map
3 Years Ending December 31, 2020



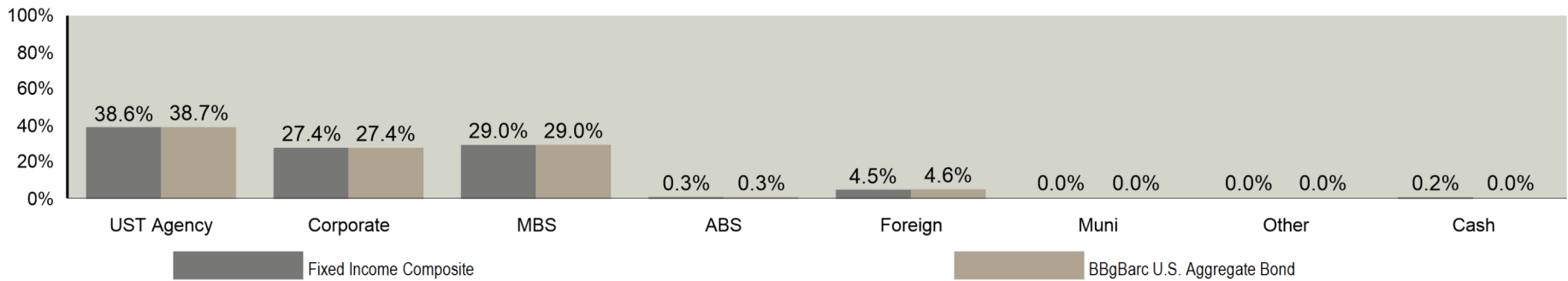
Summary Characteristics



Credibility Quality Allocation



US Sector Allocation



Pennsylvania Municipal Retirement System

Performance Summary (Net)

As of December 31, 2020

	3 Mo	1 Yr	3 Yrs	5 Yrs	10 Yrs	Inception	Inception Date
Total Fund Composite	13.0	14.5	9.9	11.3	9.2	9.0	Jan-86
<i>Policy Index</i>	12.3	12.4	8.4	9.9	8.5	9.3	Jan-86
<i>InvMetrics Public DB Net Rank</i>	4	35	27	6	15	13	Jan-86
Total Equity Composite	19.2	--	--	--	--	19.2	Oct-20
<i>MSCI ACWI IMI Net USD</i>	15.7	--	--	--	--	15.7	Oct-20
U.S. Equity Composite	19.7	19.9	14.4	15.3	12.9	9.3	Jan-06
<i>Russell 3000</i>	14.7	20.9	14.5	15.4	13.8	10.0	Jan-06
<i>InvMetrics Public DB US Eq Net Rank</i>	5	19	13	16	48	51	Jan-06
Large Cap U.S. Equity Composite	14.3	20.5	16.9	16.6	14.7	11.3	Jan-86
<i>S&P 500</i>	12.1	18.4	14.2	15.2	13.9	11.1	Jan-86
<i>Eagle Asset Mgmt</i>	19.1	14.7	13.1	--	--	17.7	Feb-16
<i>Russell 1000 Value</i>	16.3	2.8	6.1	--	--	11.1	Feb-16
<i>eV US Large Cap Value Equity Net Rank</i>	22	10	5	--	--	2	Feb-16
<i>LSV Large Cap Value</i>	18.9	1.7	4.0	9.2	10.6	8.1	Apr-04
<i>Russell 1000 Value</i>	16.3	2.8	6.1	9.7	10.5	7.8	Apr-04
<i>S&P 500</i>	12.1	18.4	14.2	15.2	13.9	9.7	Apr-04
<i>Large Value MStar MF Rank</i>	22	61	78	60	36	36	Apr-04
<i>SSGA S&P 500</i>	12.1	18.3	14.1	15.1	13.8	8.8	Feb-97
<i>S&P 500</i>	12.1	18.4	14.2	15.2	13.9	8.8	Feb-97
<i>eV US Large Cap Core Equity Net Rank</i>	41	29	20	14	14	64	Feb-97
<i>Polen Focus Growth</i>	10.0	34.3	26.4	21.1	18.0	18.7	Oct-10
<i>Russell 1000 Growth</i>	11.4	38.5	23.0	21.0	17.2	18.0	Oct-10
<i>eV US Large Cap Growth Equity Net Rank</i>	67	49	16	23	9	9	Oct-10
<i>William & Blair Large Cap Growth</i>	12.0	--	--	--	--	28.5	Jun-20
<i>Russell 1000 Growth</i>	11.4	--	--	--	--	31.6	Jun-20
<i>eV US Large Cap Growth Equity Net Rank</i>	37	--	--	--	--	40	Jun-20

Pennsylvania Municipal Retirement System

Performance Summary (Net)

As of December 31, 2020

	3 Mo	1 Yr	3 Yrs	5 Yrs	10 Yrs	Inception	Inception Date
Small Cap U.S. Equity Composite	28.9	16.6	9.0	12.6	10.9	10.7	Jan-93
<i>Russell 2000</i>	31.4	20.0	10.2	13.3	11.2	9.6	Jan-93
LSV Small Cap Value	31.6	-1.0	1.0	--	--	3.4	Dec-16
<i>Russell 2000 Value</i>	33.4	4.6	3.7	--	--	5.7	Dec-16
<i>Russell 2000</i>	31.4	20.0	10.2	--	--	11.8	Dec-16
<i>eV US Small Cap Value Equity Net Rank</i>	34	81	72	--	--	79	Dec-16
Smith, Graham & Co Small Cap Value	29.4	13.7	6.7	--	--	7.5	Dec-16
<i>Russell 2000 Value</i>	33.4	4.6	3.7	--	--	5.7	Dec-16
<i>eV US Small Cap Value Equity Net Rank</i>	53	15	23	--	--	27	Dec-16
SSGA Russell 2000	31.3	19.9	10.2	13.3	11.2	8.8	Mar-97
<i>Russell 2000</i>	31.4	20.0	10.2	13.3	11.2	8.8	Mar-97
<i>eV US Small Cap Core Equity Net Rank</i>	15	30	33	35	45	99	Mar-97
Copeland Small Cap Dividend Growth	21.1	6.8	9.7	--	--	10.3	Sep-17
<i>Russell 2000</i>	31.4	20.0	10.2	--	--	10.5	Sep-17
<i>eV US Small Cap Equity Net Rank</i>	92	71	42	--	--	42	Sep-17
AMI Small Cap Growth	28.3	29.5	8.7	--	--	10.3	Sep-17
<i>Russell 2000 Growth</i>	29.6	34.6	16.2	--	--	17.9	Sep-17
<i>eV US Small Cap Growth Equity Net Rank</i>	36	76	93	--	--	95	Sep-17
Emerald Small Cap Growth	26.7	38.0	17.3	17.7	16.0	12.0	Oct-98
<i>Russell 2000 Growth</i>	29.6	34.6	16.2	16.4	13.5	9.2	Oct-98
<i>eV US Small Cap Growth Equity Net Rank</i>	51	58	64	64	31	58	Oct-98
Non-U.S. Equity Composite	18.5	17.7	7.6	12.2	--	9.3	May-12
<i>MSCI ACWI ex US</i>	17.0	10.7	4.9	8.9	--	8.0	May-12
<i>InvMetrics Public DB Gbl Eq Net Rank</i>	9	7	77	11	--	86	May-12
Developed Non-U.S. Equity Composite	18.2	17.5	8.7	11.7	7.7	8.2	Jan-93
<i>MSCI EAFE</i>	16.0	7.8	4.3	7.4	5.5	6.2	Jan-93
SSGA MSCI World ex US	15.9	8.0	4.6	8.0	--	6.7	Apr-12
<i>MSCI World ex USA</i>	15.8	7.6	4.2	7.6	--	6.3	Apr-12
<i>eV All ACWI ex-US Equity Net Rank</i>	55	75	63	69	--	70	Apr-12
Hardman Johnston Int'l Equity	22.2	35.8	16.0	17.1	--	12.3	Apr-12
<i>MSCI EAFE</i>	16.0	7.8	4.3	7.4	--	6.6	Apr-12
<i>eV EAFE All Cap Core Net Rank</i>	3	3	1	1	--	1	Apr-12
HGK Int'l Equity	16.5	11.4	6.6	10.1	--	9.9	Feb-12
<i>MSCI EAFE</i>	16.0	7.8	4.3	7.4	--	7.1	Feb-12
<i>eV EAFE All Cap Core Net Rank</i>	18	33	19	9	--	17	Feb-12

Pennsylvania Municipal Retirement System

Performance Summary (Net)

As of December 31, 2020

	3 Mo	1 Yr	3 Yrs	5 Yrs	10 Yrs	Inception	Inception Date
Emerging Markets Composite							
SSGA MSCI Emerging Markets Index	19.1	18.2	6.1	12.8	3.5	9.3	Nov-08
MSCI Emerging Markets	19.7	18.3	6.2	12.8	3.6	9.5	Nov-08
eV Emg Mkts Equity Net Rank	60	49	47	44	60	65	Nov-08
Real Assets Composite							
NFI	0.4	0.3	4.0	5.1	7.1	7.5	Apr-93
InvMetrics Public DB Real Assets/Commodities Net Rank	1.1	0.3	4.0	5.3	8.9	--	Apr-93
Forest Investment Associates	84	55	48	36	20	--	Apr-93
NCREIF Timberland Property Index	0.1	-1.0	1.2	2.5	3.3	3.7	Mar-99
PRISA LP	0.6	0.8	1.8	2.3	4.5	5.9	Mar-99
NFI	1.2	1.6	4.8	5.8	9.5	6.2	Jan-86
PRISA II	1.1	0.3	4.0	5.3	8.9	--	Jan-86
NFI	1.4	-0.1	4.8	6.1	10.6	3.5	Jul-07
PennMuni-Nuveen U.S. Real Estate Fund	1.1	0.3	4.0	5.3	8.9	4.3	Jul-07
NFI	-0.2	1.7	6.1	7.3	9.9	5.1	Dec-08
N. Front Street (Nuveen)	1.1	0.3	4.0	5.3	8.9	5.0	Dec-08
Consumer Price Index	0.0	0.0	-0.8	--	--	-3.4	Mar-17
	0.1	1.4	1.9	--	--	1.8	Mar-17
Total Fixed Income Composite							
SSGA US Aggregate Bond Index	0.7	7.6	5.4	4.4	3.8	5.3	Apr-97
BBgBarc US Aggregate TR	0.7	7.5	5.3	4.4	3.8	5.3	Apr-97
eV US Core Fixed Inc Net Rank	78	74	68	74	75	67	Apr-97
Cash Composite							
Cash Management							
Pool 999							

IV. Investment Managers



Manager Summary: Concentrated portfolio (25-35 names) focused on finding undervalued companies that have high growth potential yet low risk of significant downside loss. 8 member team performs bottom-up fundamental analysis, all generalists: 4 member committee that meets weekly to discuss the portfolio. Low portfolio turnover around 20%. Cap of 10% for any single name. Sectors cannot go above 35% of portfolio.

Characteristics

	Portfolio	Russell 1000 Value
Number of Holdings	28	854
Weighted Avg. Market Cap. (\$B)	479.3	133.9
Median Market Cap. (\$B)	94.6	11.6
Price To Earnings	26.9	22.8
Price To Book	3.3	2.7
Price To Sales	2.2	1.9
Return on Equity (%)	18.3	12.0
Yield (%)	0.8	2.2

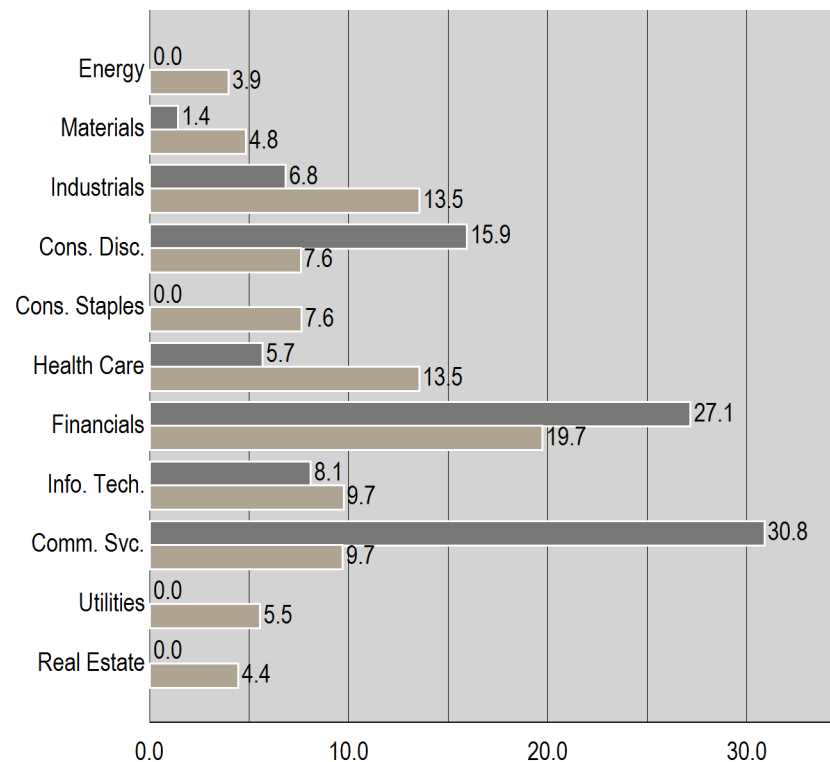
Top Holdings

ALPHABET INC	9.1%
MICROSOFT CORP	8.4%
COMCAST CORP	7.1%
AMAZON.COM INC	6.0%
BERKSHIRE HATHAWAY INC	5.5%
MARRIOTT INTERNATIONAL INC	5.2%
FACEBOOK INC	5.0%
AON PLC	4.8%
GOLDMAN SACHS GROUP INC (THE)	4.8%
WELLS FARGO & CO	4.6%
Total	60.6%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
Eagle Asset Mgmt	0.0%	8.6%	91.4%
Russell 1000 Value	1.0%	32.5%	66.5%
<i>Weight Over/Under</i>	<i>-1.0%</i>	<i>-23.9%</i>	<i>24.8%</i>

Sector Allocation (%) vs Russell 1000 Value



Manager Summary: Quantitative model that selects deep value stocks. Model ranks stocks based on fundamental measures of value and indicators of price recovery. The model contains three basic blocks of variables: 1) Cheapness/Fundamentals (60%), 2) Past Long-Term Performance/Contrarian (15%) and 3) Momentum (25%). The top 15% of stocks are ranked by expected return and then optimized for risk control. The resulting portfolio consists of approximately 100-150 stocks.

Characteristics

	Portfolio	S&P 500
Number of Holdings	150	505
Weighted Avg. Market Cap. (\$B)	66.3	491.3
Median Market Cap. (\$B)	13.4	26.9
Price To Earnings	17.0	29.7
Price To Book	2.5	4.6
Price To Sales	0.9	2.9
Return on Equity (%)	17.4	27.9
Yield (%)	2.4	1.5

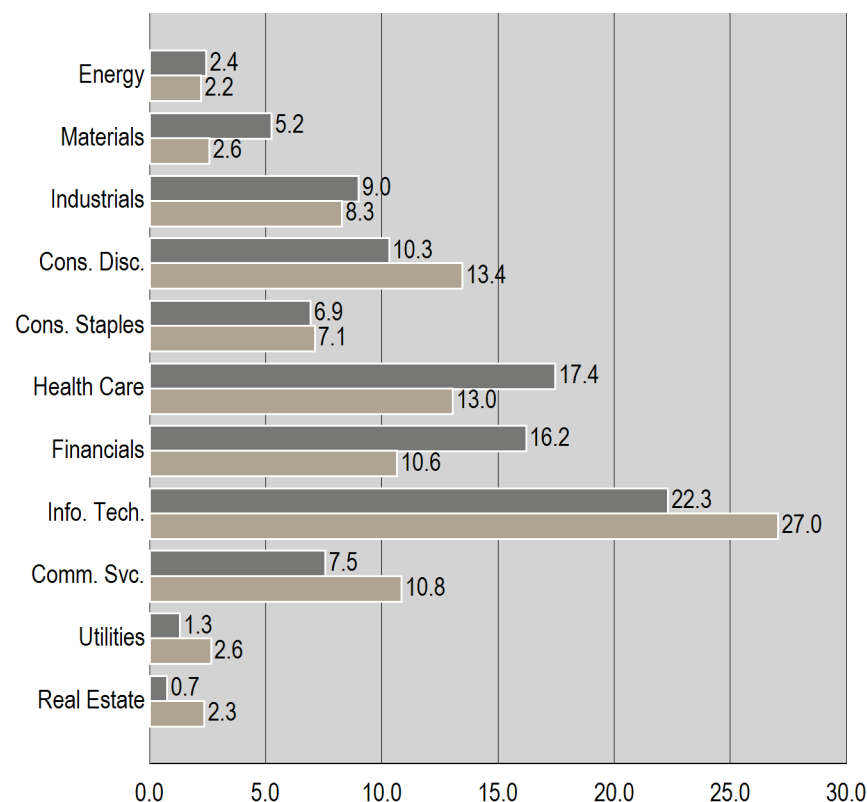
Top Holdings

INTEL CORP	2.0%
ORACLE CORP	2.0%
VERIZON COMMUNICATIONS INC	2.0%
MERCK & CO INC	2.0%
CISCO SYSTEMS INC	1.9%
AT&T INC	1.8%
PFIZER INC	1.8%
COMCAST CORP	1.7%
AMGEN INC	1.6%
HCA HEALTHCARE INC	1.5%
Total	18.3%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
LSV Large Cap Value	5.7%	51.8%	42.5%
S&P 500	0.0%	15.7%	84.3%
<i>Weight Over/Under</i>	5.6%	36.2%	-41.8%

Sector Allocation (%) vs S&P 500



Manager Summary: Passive strategy that seeks to replicate the return of the Standard & Poor's 500 index. This strategy is a low-cost option to gain diversified exposure to U.S. domiciled companies by owning the 500 largest companies by market capitalization in the U.S.

Characteristics

	Portfolio	S&P 500
Number of Holdings	507	505
Weighted Avg. Market Cap. (\$B)	483.4	491.3
Median Market Cap. (\$B)	26.9	26.9
Price To Earnings	29.6	29.7
Price To Book	4.6	4.6
Price To Sales	2.9	2.9
Return on Equity (%)	27.9	27.9
Yield (%)	1.5	1.5

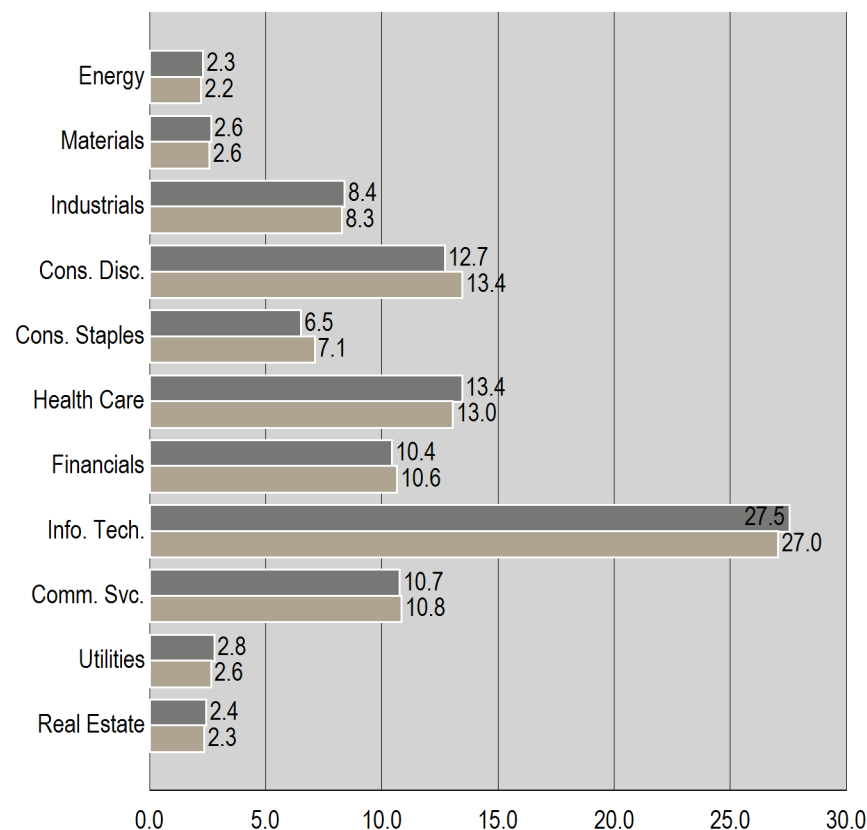
Top Holdings

APPLE INC	6.7%
MICROSOFT CORP	5.3%
AMAZON.COM INC	4.4%
FACEBOOK INC	2.1%
TESLA INC	1.7%
ALPHABET INC	1.7%
ALPHABET INC	1.6%
BERKSHIRE HATHAWAY INC	1.4%
JOHNSON & JOHNSON	1.3%
JPMORGAN CHASE & CO	1.2%
Total	27.4%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
SSGA S&P 500	0.0%	15.8%	84.2%
S&P 500	0.0%	15.7%	84.3%
<i>Weight Over/Under</i>	<i>0.0%</i>	<i>0.2%</i>	<i>-0.1%</i>

Sector Allocation (%) vs S&P 500



As of December 31, 2020

Manager Summary: Concentrated U.S. large cap growth portfolio with 20-30 names. Investment process begins with negative screening, only including names with robust financials, strong management and attractive earnings growth potential. Then team of generalists perform bottom-up fundamental analysis reviewing industry dynamics, competitive advantage, free cash flow modeling, meet with mgmt. and perform worst case scenarios. High active share. Position limit: 10% of portfolio and 50% limit on sector exposure. Low portfolio turnover (30%).

Characteristics

	Portfolio	Russell 1000 Growth
Number of Holdings	24	453
Weighted Avg. Market Cap. (\$B)	416.7	713.2
Median Market Cap. (\$B)	175.1	16.7
Price To Earnings	43.0	40.0
Price To Book	10.0	12.1
Price To Sales	7.8	5.9
Return on Equity (%)	35.7	36.3
Yield (%)	0.5	0.8

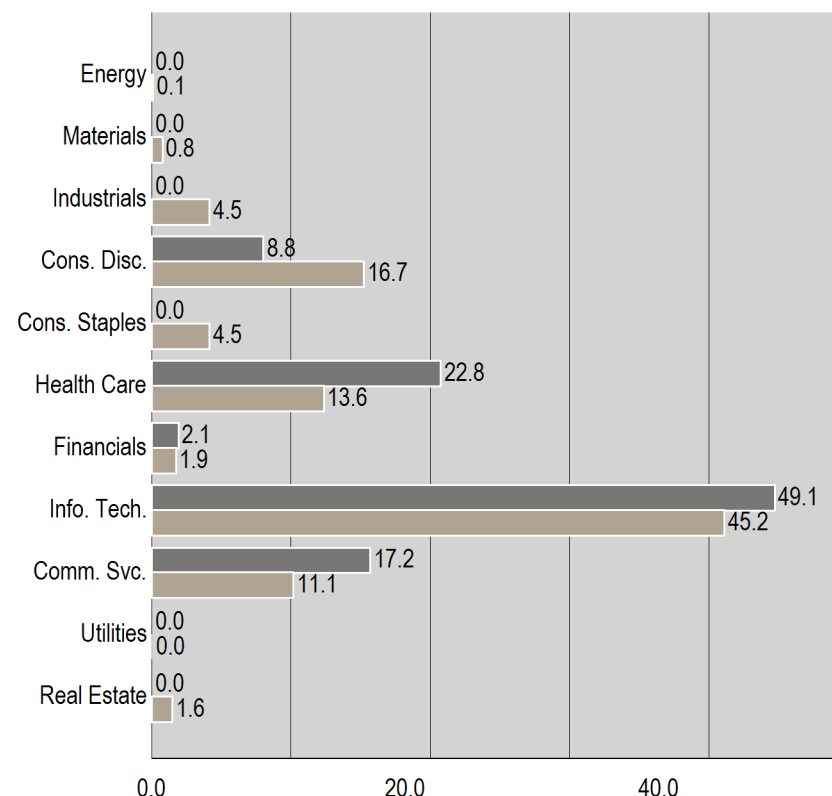
Top Holdings

FACEBOOK INC	8.2%
MICROSOFT CORP	8.0%
ADOBE INC	7.0%
ALPHABET INC	6.9%
ABBOTT LABORATORIES	5.4%
VISA INC	4.9%
MASTERCARD INC	4.8%
ACCENTURE PLC	4.6%
AUTODESK INC.	4.6%
ZOETIS INC	4.5%
Total	58.9%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
Polen Focus Growth	0.0%	2.4%	97.6%
Russell 1000 Growth	0.2%	13.6%	86.2%
<i>Weight Over/Under</i>	<i>-0.2%</i>	<i>-11.2%</i>	<i>11.4%</i>

Sector Allocation (%) vs Russell 1000 Growth



Manager Summary: U.S. large cap growth strategy with concentrated portfolio of 30-40 names. Invest in companies with long term earnings growth over a 3-5 year time horizon. Approximately 90% of their portfolio is based on quality growth and 10% fallen quality which may have some short term event which has caused undervaluation. The strategy is market and sector neutral to the Russell 1000 Growth. Position limit is 7% in any single name. Names must have a market cap \$5bn<.

Characteristics

	Portfolio	Russell 1000 Growth
Number of Holdings	34	453
Weighted Avg. Market Cap. (\$B)	501.9	713.2
Median Market Cap. (\$B)	110.3	16.7
Price To Earnings	48.5	40.0
Price To Book	9.8	12.1
Price To Sales	5.5	5.9
Return on Equity (%)	27.1	36.3
Yield (%)	0.7	0.8

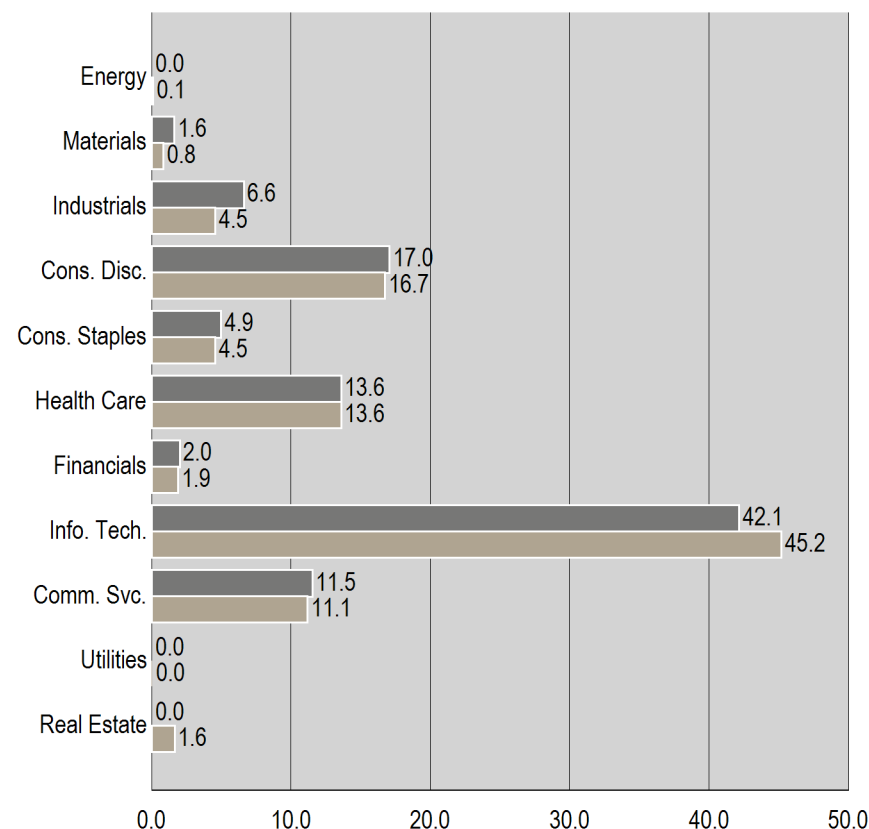
Top Holdings

MICROSOFT CORP	10.0%
AMAZON.COM INC	9.3%
ALPHABET INC	5.4%
PAYPAL HOLDINGS INC	4.8%
MASTERCARD INC	4.4%
NIKE INC	3.8%
UNITEDHEALTH GROUP INC	3.6%
ADOBE INC	3.3%
ACCENTURE PLC	3.3%
TEXAS INSTRUMENTS INC	3.2%
Total	51.2%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
William & Blair Large Cap Growth	0.0%	13.5%	86.5%
Russell 1000 Growth	0.2%	13.6%	86.2%
<i>Weight Over/Under</i>	<i>-0.2%</i>	<i>-0.1%</i>	<i>0.3%</i>

Sector Allocation (%) vs Russell 1000 Growth



Manager Summary: Quantitative model focuses on maximizing returns for given level of tracking error. The model ranks stocks based on fundamental measures of value and indicators of a recent recovery. Same model approach as LCV. The top 15% of stocks are ranked by expected return and then optimized for risk control. The resulting portfolio consists of approximately 175-225 stocks.

Characteristics

	Portfolio	Russell 2000
Number of Holdings	223	2,041
Weighted Avg. Market Cap. (\$B)	2.7	3.3
Median Market Cap. (\$B)	1.5	0.9
Price To Earnings	14.8	22.7
Price To Book	1.9	3.0
Price To Sales	0.7	1.5
Return on Equity (%)	5.6	-8.4
Yield (%)	1.8	1.0

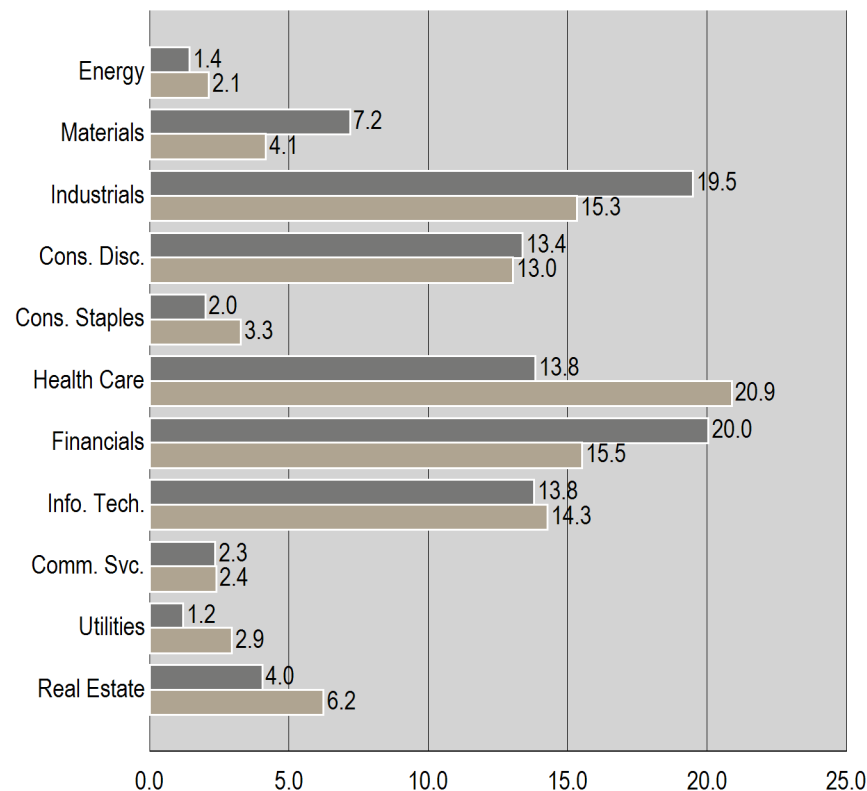
Top Holdings

SELECT MEDICAL HOLDINGS CORP	1.8%
BUILDERS FIRSTSOURCE INC	1.5%
CNO FINANCIAL GROUP INC	1.4%
TENET HEALTHCARE CORP	1.4%
UNITED THERAPEUTICS CORP	1.3%
ATKORE INC	1.2%
ACADIA HEALTHCARE CO INC	1.2%
SYKES ENTERPRISES INC	1.1%
KB HOME	1.1%
RELIANCE STEEL & ALUMINUM CO	1.1%
Total	13.4%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
LSV Small Cap Value	72.5%	27.5%	0.0%
Russell 2000	66.8%	33.2%	0.0%
<i>Weight Over/Under</i>	5.6%	-5.6%	0.0%

Sector Allocation (%) vs Russell 2000



Manager Summary: Minority-owned investment management firm with fundamental bottom-up process. Stocks are first screened based on earnings, book value, and cash flow criteria with fundamental analysis performed on the top 20% within each respective sector. Sell candidates are companies that have dropped to the bottom 40% of their screen. The strategy holds 50-75 positions and is typically within plus/minus 5% of index sector weightings.

Characteristics

	Portfolio	Russell 2000 Value
Number of Holdings	67	1,485
Weighted Avg. Market Cap. (\$B)	2.7	2.5
Median Market Cap. (\$B)	2.1	0.8
Price To Earnings	20.2	17.3
Price To Book	2.4	1.9
Price To Sales	0.7	1.0
Return on Equity (%)	-7.9	-4.6
Yield (%)	1.2	1.7

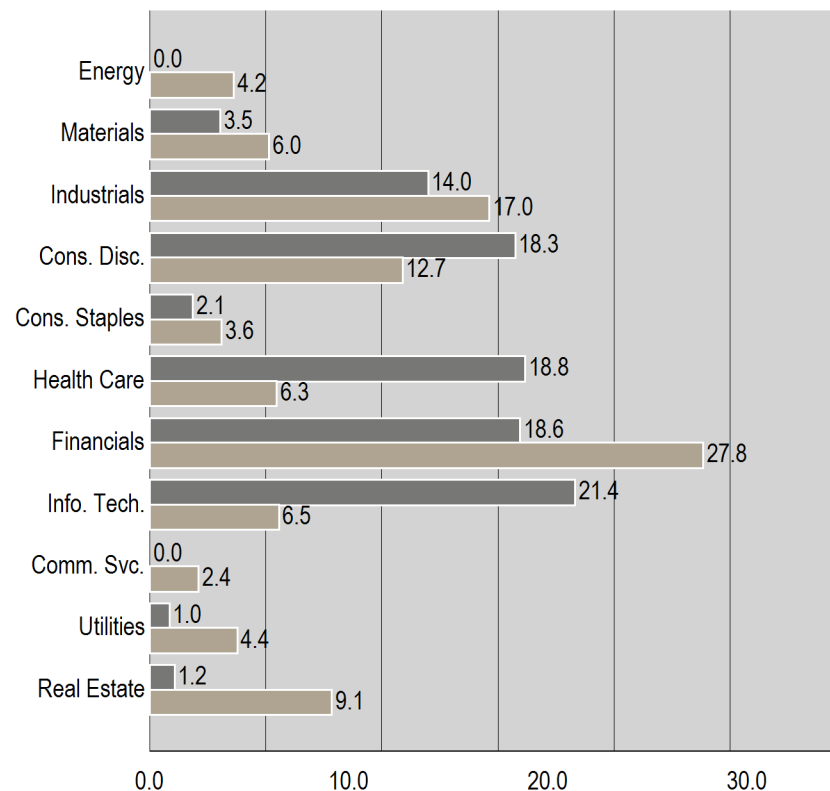
Top Holdings

LITHIA MOTORS INC.	2.7%
DYCOM INDUSTRIES INC.	2.6%
SELECT MEDICAL HOLDINGS CORP	2.6%
HIBBETT SPORTS INC	2.5%
DECKERS OUTDOOR CORP	2.4%
OWENS & MINOR INC.	2.3%
NEXTGEN HEALTHCARE INC	2.3%
DIEBOLD NIXDORF INC	2.2%
B&G FOODS INC	2.2%
M.D.C. HOLDINGS INC.	2.1%
Total	24.1%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
Smith, Graham & Co Small Cap Value	77.3%	22.7%	0.0%
Russell 2000 Value	80.8%	19.2%	0.0%
<i>Weight Over/Under</i>	-3.6%	3.6%	0.0%

Sector Allocation (%) vs Russell 2000 Value



Manager Summary: Passive strategy that seeks to replicate the return of the Russell 2000 index. This strategy is a low-cost option to gain diversified exposure to U.S. domiciled companies through owning the 2,000 smallest American companies by market capitalization in the Russell 3000 index.

Characteristics

	Portfolio	Russell 2000
Number of Holdings	2,069	2,041
Weighted Avg. Market Cap. (\$B)	3.3	3.3
Median Market Cap. (\$B)	0.9	0.9
Price To Earnings	22.8	22.7
Price To Book	3.0	3.0
Price To Sales	1.5	1.5
Return on Equity (%)	-8.6	-8.4
Yield (%)	1.0	1.0

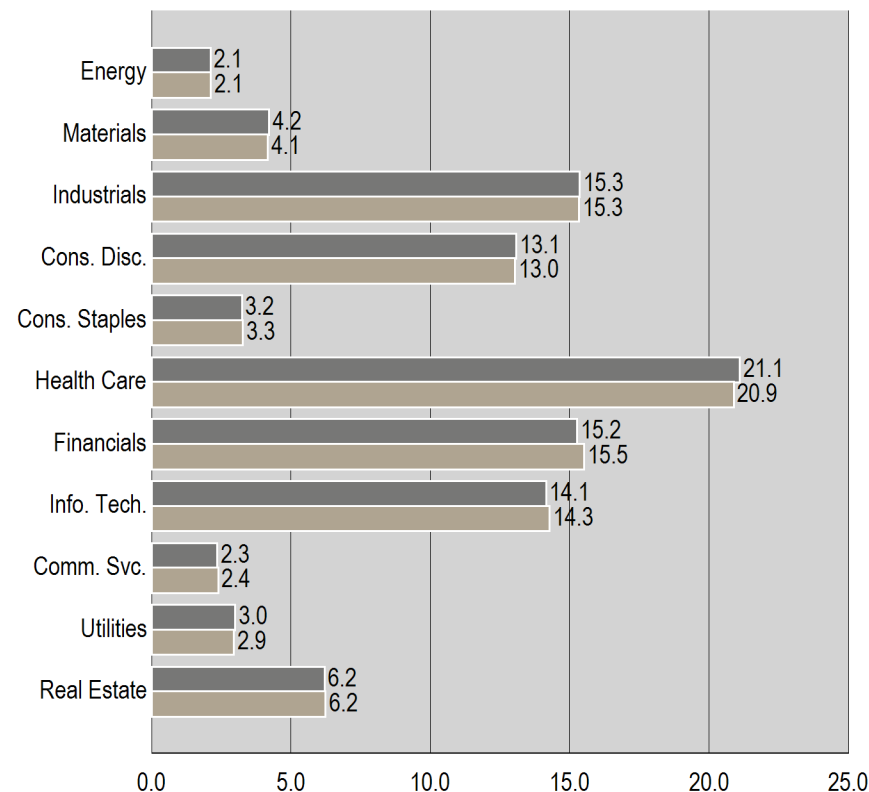
Top Holdings

PENN NATIONAL GAMING INC	0.5%
CAESARS ENTERTAINMENT INC	0.5%
PLUG POWER INC	0.5%
SUNRUN INC	0.4%
MIRATI THERAPEUTICS INC	0.4%
DARLING INGREDIENTS INC	0.4%
ULTRAGENYX PHARMACEUTICAL INC	0.3%
DECKERS OUTDOOR CORP	0.3%
II VI INC	0.3%
ARROWHEAD PHARMACEUTICALS INC	0.3%
Total	4.1%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
SSGA Russell 2000	66.3%	33.7%	0.0%
Russell 2000	66.8%	33.2%	0.0%
<i>Weight Over/Under</i>	<i>-0.6%</i>	<i>0.6%</i>	<i>0.0%</i>

Sector Allocation (%) vs Russell 2000



Manager Summary: A bottom-up fundamental manager who views dividend growth as a litmus test for earnings quality and focuses on attributes such as dividend coverage, cash flow strength, earnings growth, and return on capital. Fundamental research is focused on identifying companies with strong competitive positions that support steadily rising dividends. Strategy invests in larger, more established small cap firms while tending to underweight the lower market cap ranges. The strategy seeks sector diversification with 45-50 holdings.

Characteristics

	Portfolio	Russell 2000
Number of Holdings	57	2,041
Weighted Avg. Market Cap. (\$B)	4.0	3.3
Median Market Cap. (\$B)	3.4	0.9
Price To Earnings	26.0	22.7
Price To Book	3.2	3.0
Price To Sales	1.9	1.5
Return on Equity (%)	12.4	-8.4
Yield (%)	1.7	1.0

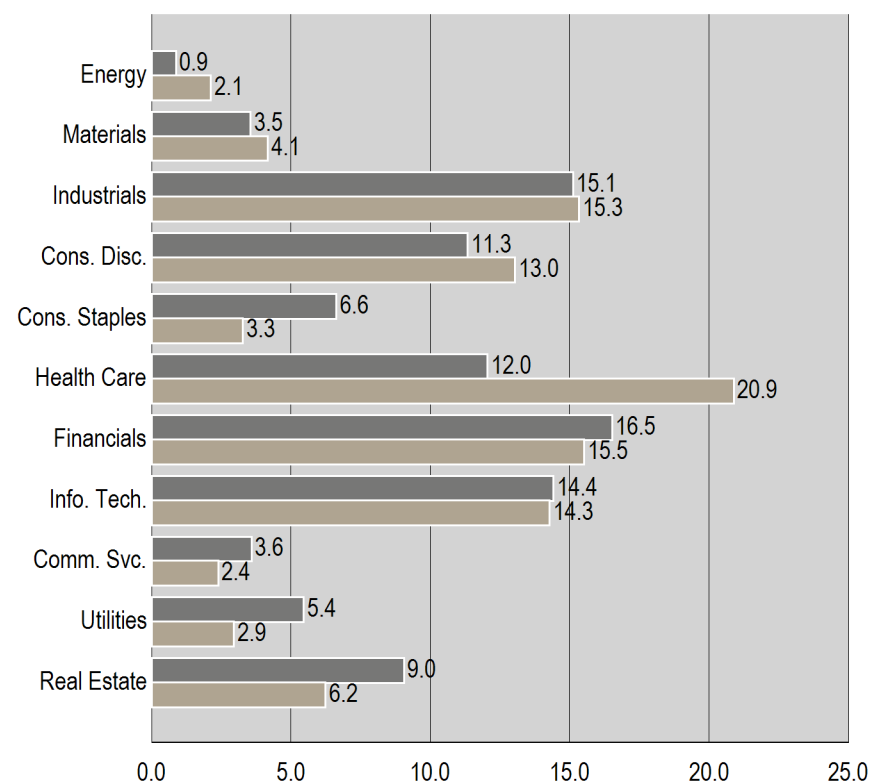
Top Holdings

ENSIGN GROUP INC (THE)	3.2%
ENCOMPASS HEALTH CORP	2.7%
EVERCORE INC	2.6%
INNOVATIVE INDUSTRIAL PROPERTIES INC	2.5%
CHEMED CORP	2.4%
LEMAITRE VASCULAR INC	2.4%
QUAKER CHEMICAL CORP	2.2%
BRUNSWICK CORP	2.2%
NEXSTAR MEDIA GROUP INC.	2.2%
STANDEX INTERNATIONAL CORP	2.2%
Total	24.5%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
Copeland Small Cap Dividend Growth	49.8%	50.2%	0.0%
Russell 2000	66.8%	33.2%	0.0%
<i>Weight Over/Under</i>	<i>-17.0%</i>	<i>17.0%</i>	<i>0.0%</i>

Sector Allocation (%) vs Russell 2000



Manager Summary: Strategy invests in companies with recurring revenues. Considered a Growth at a Reasonable Price "GARP" strategy, owning companies at attractive valuations and temporary mispricing. Portfolio will traditionally hold 30-35 names in the portfolio. Turnover of the portfolio is 40-50%.

Characteristics

	Portfolio	Russell 2000 Growth
Number of Holdings	36	1,128
Weighted Avg. Market Cap. (\$B)	4.2	4.0
Median Market Cap. (\$B)	4.1	1.2
Price To Earnings	43.2	34.0
Price To Book	3.8	5.4
Price To Sales	2.7	2.9
Return on Equity (%)	13.5	-12.1
Yield (%)	0.3	0.4

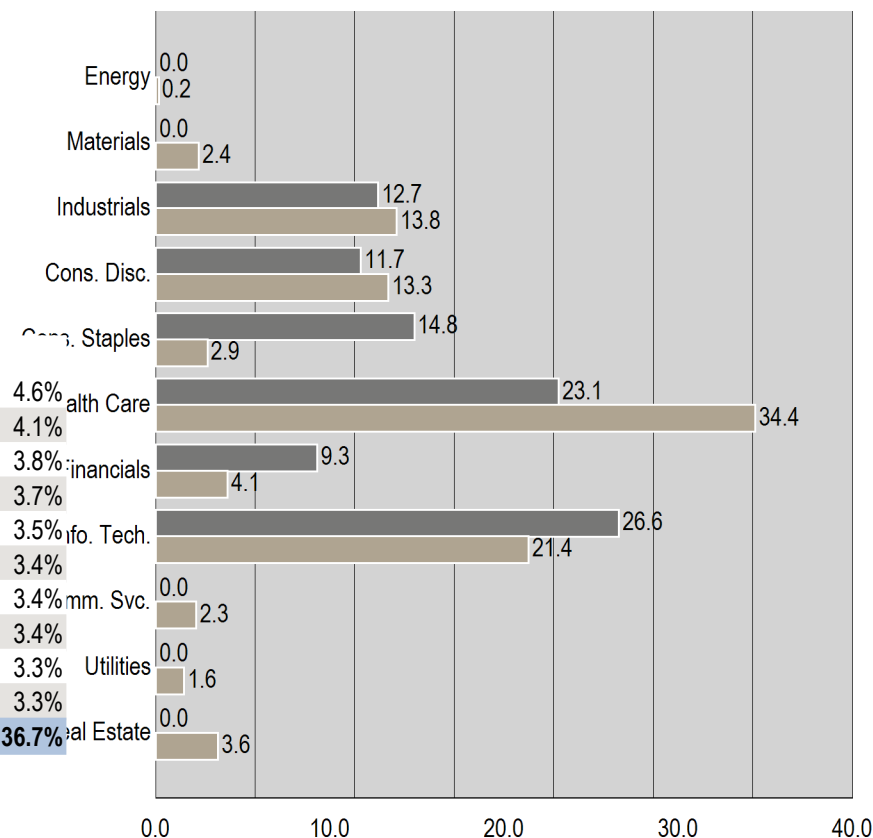
Top Holdings

HALOZYME THERAPEUTICS INC	4.6%
SIMPLY GOOD FOODS CO (THE)	4.1%
MERIT MEDICAL SYSTEMS INC	3.8%
PERFICIENT INC	3.7%
SYNEOS HEALTH INC	3.5%
MIMECAST LTD	3.4%
GREEN DOT CORP	3.4%
WILLSCOT MOBILE MINI HOLDINGS CORP	3.4%
ITRON INC	3.3%
VERINT SYSTEMS INC	3.3%
Total	36.7%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
AMI Small Cap Growth	44.0%	56.0%	0.0%
Russell 2000 Growth	53.7%	46.3%	0.0%
<i>Weight Over/Under</i>	<i>-9.7%</i>	<i>9.7%</i>	<i>0.0%</i>

Sector Allocation (%) vs Russell 2000 Growth



As of December 31, 2020

Manager Summary: Core growth strategy, fundamental, bottom-up process seeking companies with a competitive advantage, market leadership, growth rates exceeding peers, differentiated growth drivers, and low research coverage. Analysts work across the market cap spectrum supporting small, mid, and all-cap strategies with coverage of dynamic sectors. The strategy holds 110-125 companies and portfolio construction limits of no more than 15% in any one industry group.

Characteristics

	Portfolio	Russell 2000 Growth
Number of Holdings	121	1,128
Weighted Avg. Market Cap. (\$B)	4.2	4.0
Median Market Cap. (\$B)	3.1	1.2
Price To Earnings	43.4	34.0
Price To Book	4.8	5.4
Price To Sales	3.4	2.9
Return on Equity (%)	-11.6	-12.1
Yield (%)	0.3	0.4

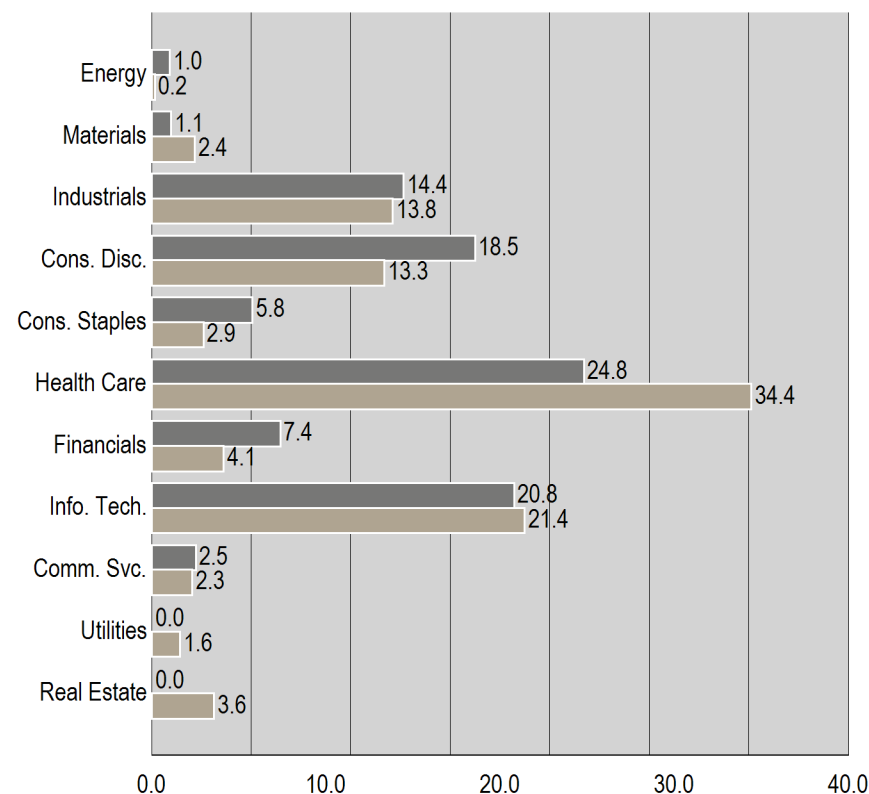
Top Holdings

NEOGENOMICS INC	2.5%
CHEGG INC	2.5%
FRESHPET INC	2.4%
RAPID7 INC	2.1%
VARONIS SYSTEMS INC	2.0%
MACOM TECHNOLOGY SOLUTIONS HOLDINGS INC	1.8%
KRATOS DEFENSE & SECURITY SOLUTIONS INC	1.8%
CHURCHILL DOWNS INC	1.7%
SIMPLY GOOD FOODS CO (THE)	1.7%
CHART INDUSTRIES INC	1.7%
Total	20.1%

Market Capitalization

	Small Cap	Mid Cap	Large Cap
Emerald Small Cap Growth	48.9%	51.1%	0.0%
Russell 2000 Growth	53.7%	46.3%	0.0%
Weight Over/Under	-4.8%	4.8%	0.0%

Sector Allocation (%) vs Russell 2000 Growth



Pennsylvania Municipal Retirement System

SSGA MSCI World ex US

As of December 31, 2020

Manager Summary: Passive strategy that seeks to replicate the returns of the MSCI ACWI ex US index. This strategy is a low-cost option to gain diversified exposure to internationally based companies.

Characteristics

	Portfolio	MSCI ACWI ex USA
Number of Holdings	1,843	2,361
Weighted Avg. Market Cap. (\$B)	100.0	100.4
Median Market Cap. (\$B)	9.8	9.5
Price To Earnings	21.0	20.9
Price To Book	2.8	2.7
Price To Sales	1.3	1.3
Return on Equity (%)	10.6	10.4
Yield (%)	2.2	2.3

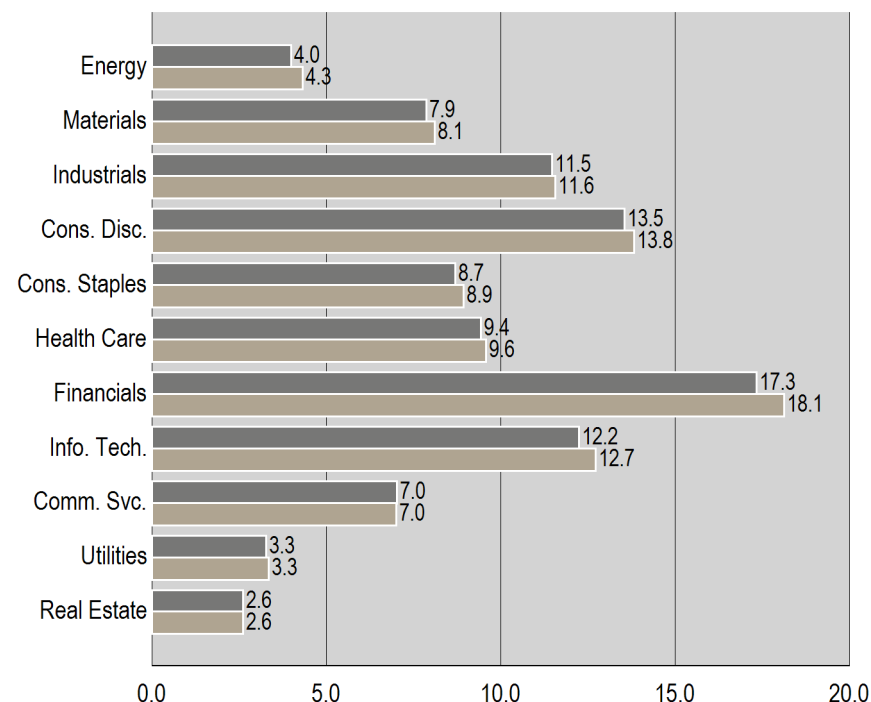
Top Holdings

ISHARES TRUST - ISHARES MSCI INDIA ETF	2.5%
TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	1.8%
ALIBABA GROUP HOLDING LTD	1.7%
TENCENT HOLDINGS LTD	1.7%
SAMSUNG ELECTRONICS CO LTD	1.4%
NESTLE SA, CHAM UND VEVEY	1.3%
ROCHE HOLDING AG	1.0%
NOVARTIS AG	0.8%
ASML HOLDING NV	0.8%
LVMH MOET HENNESSY LOUIS VUITTON SE	0.7%
Total	13.8%

Market Capitalization

	Small Cap	Mid Cap	Large Cap	Unclassified
SSGA MSCI World ex US	10.3%	22.5%	62.8%	4.3%
MSCI ACWI ex USA	9.9%	23.5%	66.6%	0.0%
<i>Weight Over/Under</i>	<i>0.5%</i>	<i>-1.0%</i>	<i>-3.8%</i>	<i>4.3%</i>

Sector Allocation (%) vs MSCI ACWI ex USA



Region Allocation Summary

Region	% of Total	% of Bench	% Diff
North America ex U.S.	6.3%	6.3%	0.0%
United States	0.1%	0.0%	0.1%
Europe Ex U.K.	31.6%	30.3%	1.3%
United Kingdom	7.5%	8.8%	-1.3%
Pacific Basin Ex Japan	8.3%	7.3%	1.0%
Japan	15.8%	15.9%	0.0%
Emerging Markets	29.3%	30.9%	-1.5%
Other	1.0%	0.6%	0.5%
Total	100.0%	100.0%	0.0%

Manager Summary: Concentrated portfolio (20-30 names). Utilizes fundamental research invests in quality companies with 10% EPS growth and market leaders, invest at attractive valuation. Turnover is between 20-30%. Maximum position is 5%. Given the concentrated nature of the portfolio, high idiosyncratic risk in the portfolio and sizable tracking error. High active share (around 90-95%). No currency hedge.

Characteristics

	Portfolio	MSCI EAFE
Number of Holdings	25	876
Weighted Avg. Market Cap. (\$B)	118.7	71.4
Median Market Cap. (\$B)	55.5	12.4
Price To Earnings	46.1	22.2
Price To Book	6.2	2.7
Price To Sales	3.9	1.2
Return on Equity (%)	1.1	10.2
Yield (%)	0.5	2.4

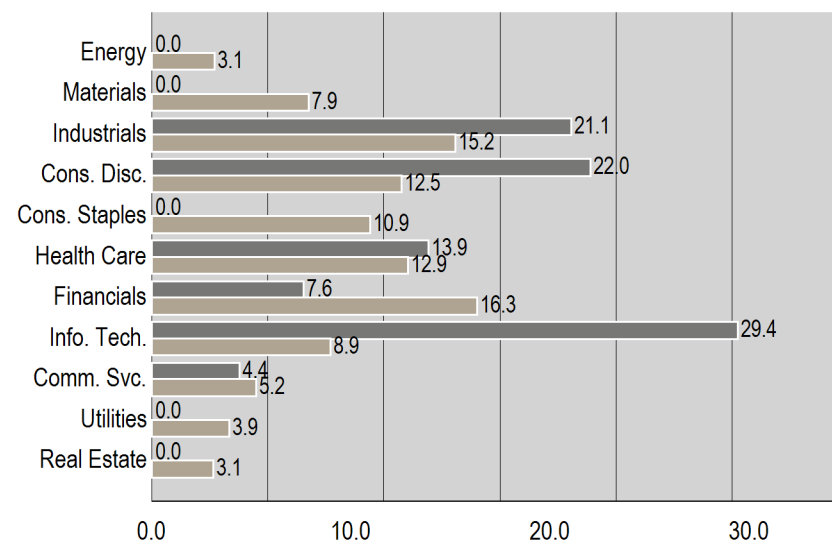
Top Holdings

WUXI BIOLOGICS (CAYMAN) INC	6.2%
KEYENCE CORP	5.7%
AFTERPAY LTD	5.7%
ATLASSIAN CORP PLC	5.5%
ASML HOLDING NV	5.3%
DAIFUKU CO LTD	5.2%
MURATA MANUFACTURING CO LTD	5.0%
NIDEC CORP	4.8%
TENCENT HOLDINGS LTD	4.5%
GENMAB A/S	4.4%
Total	52.4%

Market Capitalization

	Small Cap	Mid Cap	Large Cap	Unclassified
Hardman Johnston Int'l Equity	0.0%	17.3%	81.1%	1.6%
MSCI EAFE	5.7%	23.8%	70.5%	0.0%
<i>Weight Over/Under</i>	-5.7%	-6.6%	10.6%	1.6%

Sector Allocation (%) vs MSCI EAFE



Region Allocation Summary

Region	% of Total	% of Bench	% Diff
North America ex U.S.	0.0%	0.0%	0.0%
United States	0.0%	0.0%	0.0%
Europe Ex U.K.	33.8%	48.3%	-14.5%
United Kingdom	7.4%	14.1%	-6.6%
Pacific Basin Ex Japan	19.5%	11.7%	7.8%
Japan	20.7%	25.3%	-4.6%
Emerging Markets	18.6%	0.0%	18.6%
Other	0.0%	0.6%	-0.6%
Total	100.0%	100.0%	0.0%

As of December 31, 2020

Manager Summary: Bottom-up fundamental manager looking for businesses that are undergoing structural change. Analysts are generalists who are unconstrained in their candidates. Looking for upside over a time horizon of 2-3 years through assessing and predicting earnings estimates. Concentrated portfolio: 30-35 names equally weighted with a max of 5% allocation. Sector and countries limits of 30%. Turnover is roughly 30-40%. No currency hedge.

Characteristics

	Portfolio	MSCI EAFE
Number of Holdings	35	876
Weighted Avg. Market Cap. (\$B)	47.6	71.4
Median Market Cap. (\$B)	22.6	12.4
Price To Earnings	23.1	22.2
Price To Book	2.5	2.7
Price To Sales	1.7	1.2
Return on Equity (%)	9.4	10.2
Yield (%)	1.6	2.4

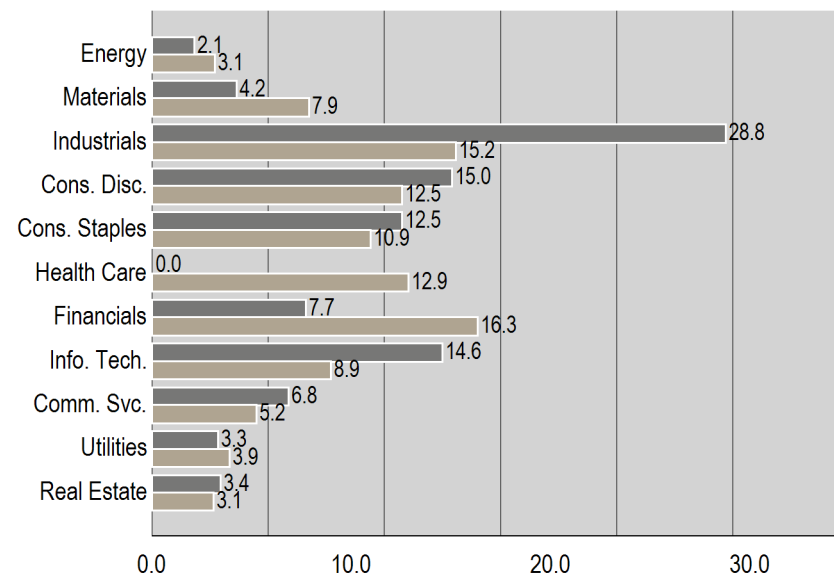
Top Holdings

SHIMANO INC	4.3%
SK HYNIX INC	4.2%
NINTENDO CO LTD	4.1%
TECHTRONIC INDUSTRIES CO LTD	4.0%
GETLINK SE	3.9%
ASML HOLDING NV	3.7%
CAPGEMINI SE	3.7%
DEUTSCHE WOHNEN SE	3.5%
COCA-COLA EUROPEAN PARTNERS PLC	3.4%
TOYOTA MOTOR CORP	3.4%
Total	38.3%

Market Capitalization

	Small Cap	Mid Cap	Large Cap	Unclassified
HGK Int'l Equity	3.9%	40.2%	51.9%	4.1%
MSCI EAFE	5.7%	23.8%	70.5%	0.0%
<i>Weight Over/Under</i>	<i>-1.8%</i>	<i>16.4%</i>	<i>-18.6%</i>	<i>4.1%</i>

Sector Allocation (%) vs MSCI EAFE



Region Allocation Summary

Region	% of Total	% of Bench	% Diff
North America ex U.S.	5.8%	0.0%	5.8%
United States	0.0%	0.0%	0.0%
Europe Ex U.K.	46.3%	48.3%	-2.1%
United Kingdom	14.7%	14.1%	0.6%
Pacific Basin Ex Japan	9.4%	11.7%	-2.2%
Japan	17.7%	25.3%	-7.6%
Emerging Markets	6.1%	0.0%	6.1%
Other	0.0%	0.6%	-0.6%
Total	100.0%	100.0%	0.0%

Manager Summary: Passive strategy that seeks to replicate the return of the MSCI Emerging Markets index. This strategy is a low-cost option to gain diversified exposure to emerging market based companies.

Characteristics

	Portfolio	MSCI Emerging Markets
Number of Holdings	1,231	1,397
Weighted Avg. Market Cap. (\$B)	173.0	171.5
Median Market Cap. (\$B)	6.9	6.9
Price To Earnings	19.3	19.1
Price To Book	3.1	3.1
Price To Sales	1.4	1.4
Return on Equity (%)	11.1	11.1
Yield (%)	2.0	2.0

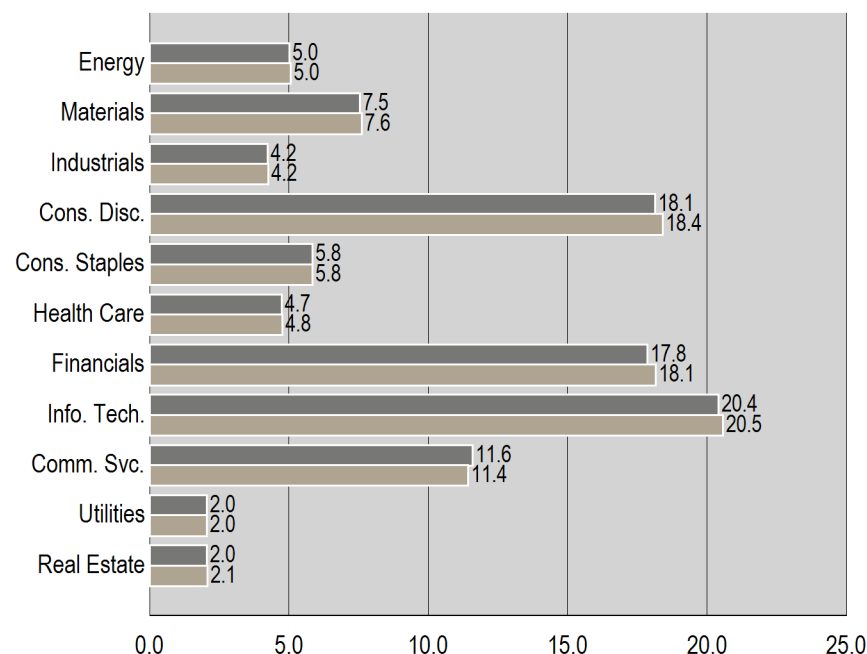
Top Holdings

TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	5.9%
ALIBABA GROUP HOLDING LTD	5.6%
TENCENT HOLDINGS LTD	5.3%
SAMSUNG ELECTRONICS CO LTD	4.5%
MEITUAN DIANPING USD0.00001 A B CLASS ISIN KYG596691041	1.7%
NASPERS LTD	1.1%
RELIANCE INDUSTRIES LTD	1.0%
JD.COM INC	1.0%
CHINA CONSTRUCTION BANK CORP	0.9%
PING AN INSURANCE GROUP	0.9%
Total	28.0%

Market Capitalization

	Small Cap	Mid Cap	Large Cap	Unclassified
SSGA MSCI Emerging Markets Index	3.9%	19.1%	71.1%	5.9%
MSCI Emerging Markets	8.4%	19.3%	72.3%	0.0%
<i>Weight Over/Under</i>	-4.5%	-0.2%	-1.2%	5.9%

Sector Allocation (%) vs MSCI Emerging Markets



Region Allocation Summary

Region	% of Total	% of Bench	% Diff
North America ex U.S.	0.0%	0.0%	0.0%
United States	0.4%	0.0%	0.4%
Europe Ex U.K.	0.3%	0.1%	0.1%
United Kingdom	0.1%	0.0%	0.1%
Pacific Basin Ex Japan	3.7%	0.0%	3.7%
Japan	0.0%	0.0%	0.0%
Emerging Markets	94.2%	99.3%	-5.0%
Other	1.3%	0.6%	0.7%
Total	100.0%	100.0%	0.0%

Characteristics

Fund GAV (\$MM)	\$26,179.1
Fund NAV (\$MM)	\$20,301.7
Cash (% of NAV)	3.2%
# of Investments	266
% in Top 10 by NAV	27.4%
Leverage %	23.0%
Occupancy	89.9%
# of MSAs	42
1-Year Dividend Yield	3.3%
As of Date	31-Dec-20

Strategy Breakdown

	% of Portfolio
Pre-Development	0.5%
Development	5.1%
Initial Leasing	1.8%
Operating	92.4%
Re-Development	
Other	0.2%

Top Five Metro Areas	% of NAV
Los Angeles-Long Beach, CA	16.9%
New York-Newark, NY-NJ-CT-F	15.6%
Washington-Baltimore-Arlington	12.2%
San Jose-San Francisco-Oakland	9.2%
Boston-Worcester-Providence	6.9%

Queue In:

Contribution Queue (\$MM)	\$955.00
Anticipated Drawdown (Months)	

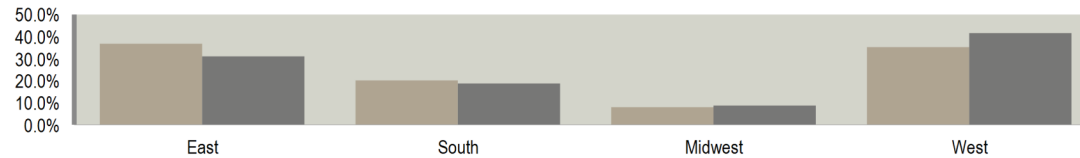
Queue Out:

Redemption Queue (\$MM)	\$442.02
Anticipated Payout (Months)	

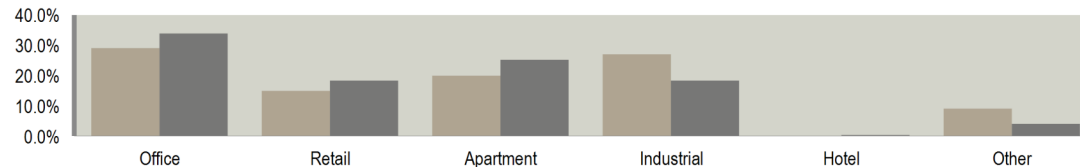
Top Ten Holdings Investment Detail

#	Property	Type	Location	% of Fund NAV
1	ESS Storage Portfolio	Other	Various	6.7%
2	International Place	Office	Boston	5.3%
3	Avalon Portfolio	Other	Alpharetta	2.6%
4	11 Madison	Office	New York	2.5%
5	Eleven Times Square - Office	Office	New York	2.3%
6	Wareham Portfolio	Office	Emeryville	1.8%
7	Post Montgomery Tower	Office	San Francisco	1.8%
8	Mission Towers	Office	Santa Clara	1.7%
9	500 8th Street	Office	Washington	1.6%
10	Central Place	Office	Arlington	1.1%
Total				27.4%

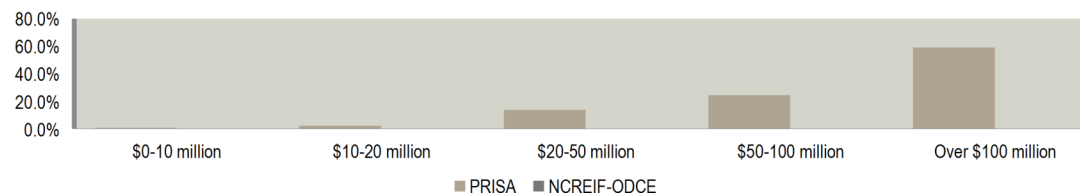
Regional Breakdown by NAV (Excluding Cash & Debt)



Property Type Breakdown by NAV (Excluding Cash & Debt)



Property Size Breakdown by NAV (Excluding Cash & Debt)



■ PRISA ■ NCREIF-ODCE

Characteristics

Fund GAV (\$MM)	\$13,454.0
Fund NAV (\$MM)	\$8,238.0
Cash (% of NAV)	2.3%
# of Investments	154
% in Top 10 by NAV	25.4%
Leverage %	37.0%
Occupancy	85.6%
# of MSAs	70
1-Year Dividend Yield	3.1%
As of Date	31-Dec-20

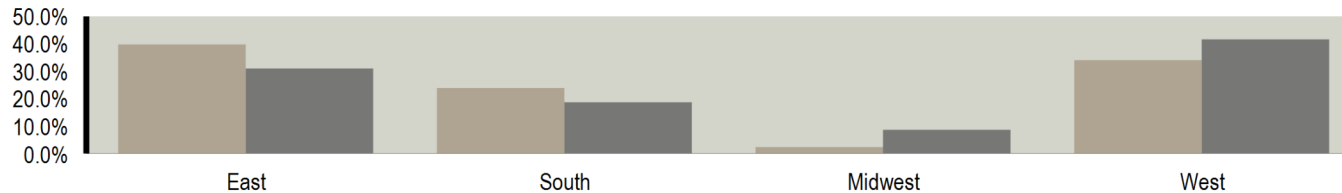
Strategy Breakdown

	% of Portfolio	Top Five Metro Areas	% of NAV
Pre-Development	7.7%	Washington DC	8.1%
Development	5.0%	San Francisco, CA	7.6%
Initial Leasing	14.9%	Northern NJ	7.2%
Operating	70.8%	Boston, MA	6.6%
Re-Development		San Jose, CA	6.4%
Other	1.6%		
Queue In:		Queue Out:	
Contribution Queue (\$MM)	\$0.00	Redemption Queue (\$MM)	\$322.30
Anticipated Drawdown (Months)	0	Anticipated Payout (Months)	0

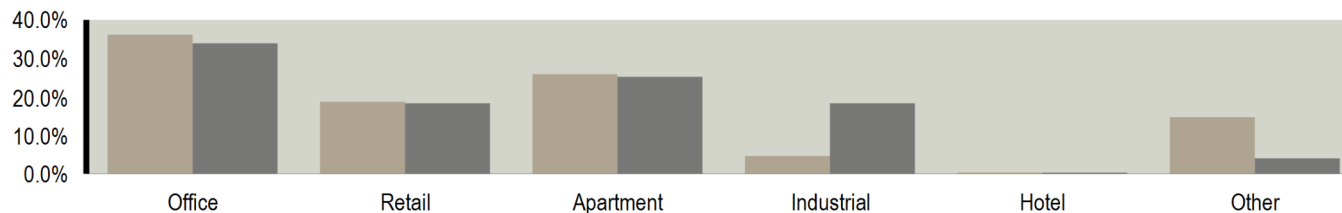
Top Ten Holdings Investment Detail

#	Property	Type	Location	% of Fund NAV
1	Great America Commons	Office	Santa Clara, CA	4.0%
2	Citigroup Center	Office	San Francisco, CA	3.8%
3	Twenty 20	Apartment	Cambridge, MA	2.5%
4	Redwood LIFE	Office	Redwood Shores, CA	2.5%
5	1015 Half Street	Office	Washington, DC	2.3%
6	Tremley Point Logistics Center	Other	Linden, NJ	2.2%
7	The MET (MetroCenter at South Coast)	Office	Costa Mesa, CA	2.2%
8	Regions Plaza	Office	Atlanta, GA	2.1%
9	Franklin Square North	Office	Washington, DC	2.0%
10	Sayreville Seaport	Other	Sayreville, NJ	2.0%
Total				25.4%

Regional Breakdown by NAV (Excluding Cash & Debt)



Property Type Breakdown by NAV (Excluding Cash & Debt)



Characteristics

Fund GAV (\$MM)	\$273.8
Fund NAV (\$MM)	\$253.8
Cash (% of NAV)	0.0%
# of Investments	8
Occupancy	98.0%
1-yr Income	5.5%
Loan to Value	7.0%
As of Date	12/31/2020

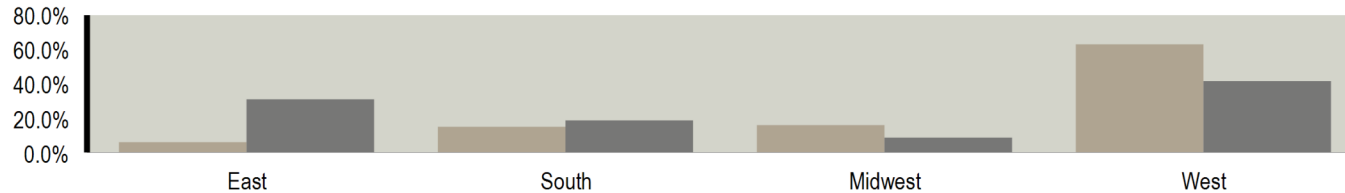
Asset Summary

Property	Acquisition
Copley Corporate Center	2010
SR Ranch	2011
Des Peres Corners	2010
708 Uptown	2014
Fairway Center II	2016
Republic Distribution Center	2013
526 Route 46	2014
Shoppes at Monarch Lakes	2010

Portfolio Allocation

#	Property	Type	Location	% of Fund NAV
1	Copley Corporate Center	Office	San Diego, CA	18.4%
2	SR Ranch	Retail	San Diego, CA	16.4%
3	Des Peres Corners	Retail	Des Peres, MO	16.0%
4	708 Uptown	Apartment	Seattle, WA	14.8%
5	Fairway Center II	Office	Brea, CA	13.6%
6	Republic Distribution Center	Industrial	Houston, TX	9.5%
7	526 Route 46	Industrial	Teterboro, NJ	6.2%
8	Shoppes at Monarch Lakes	Retail	Miramar, FL	5.1%
Total				100.0%

Regional Breakdown by NAV



Property Type Breakdown by NAV



Net Assets (\$MM) \$130.2

Portfolio Allocation

#	Property	Type	Location	% of Fund NAV
1	Coquille	Douglas Fir/Cedar	Oregon	17.5%
2	Dupont	Pine	Georgia	17.3%
3	Black River	Pine	South Carolina	16.3%
4	Bucktails	Maple/Oak/Cherry	Pennsylvania	13.3%
5	North River	Douglas Fir/Hemlock	Washington	12.6%
6	Carter Pasture	Pine	Texas	7.2%
7	Bennetts Creek	Pine	North Carolina	6.6%
8	Bear Island	Pine	Virginia	5.4%
9	Fitz-Weller	Maple/Oak	New York	3.8%
Total				100.0%

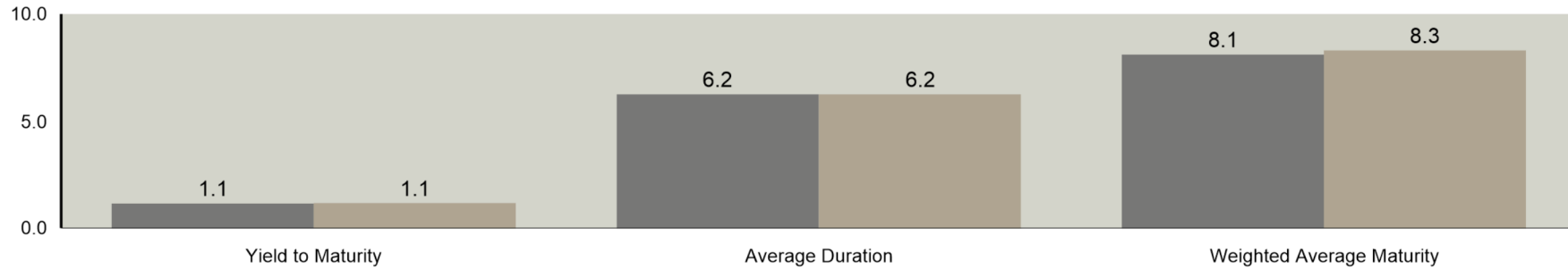
Regional Breakdown by NAV



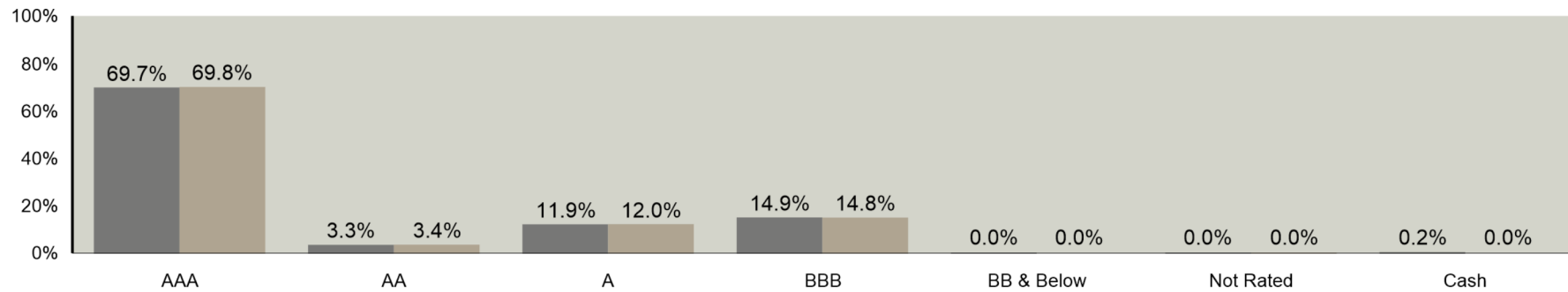
Manager Summary

Passive strategy, tracks the BBgBarc U.S. Aggregate Bond Index. Using statistical sampling techniques based on duration, maturity, interest rate sensitivity, security structure, and credit quality to attempt to replicate the returns of the Index using a smaller number of securities.

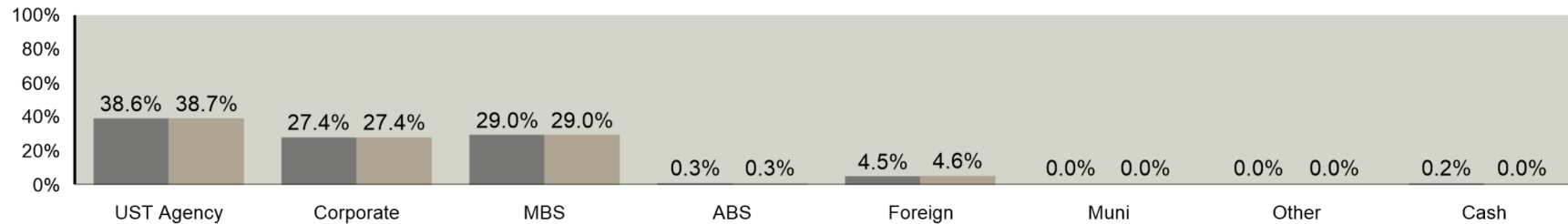
Summary Characteristics



Credibility Quality Allocation



US Sector Allocation



SSGA BBG Barclays Aggregate

BBgBarc U.S. Aggregate Bond

V. Appendix

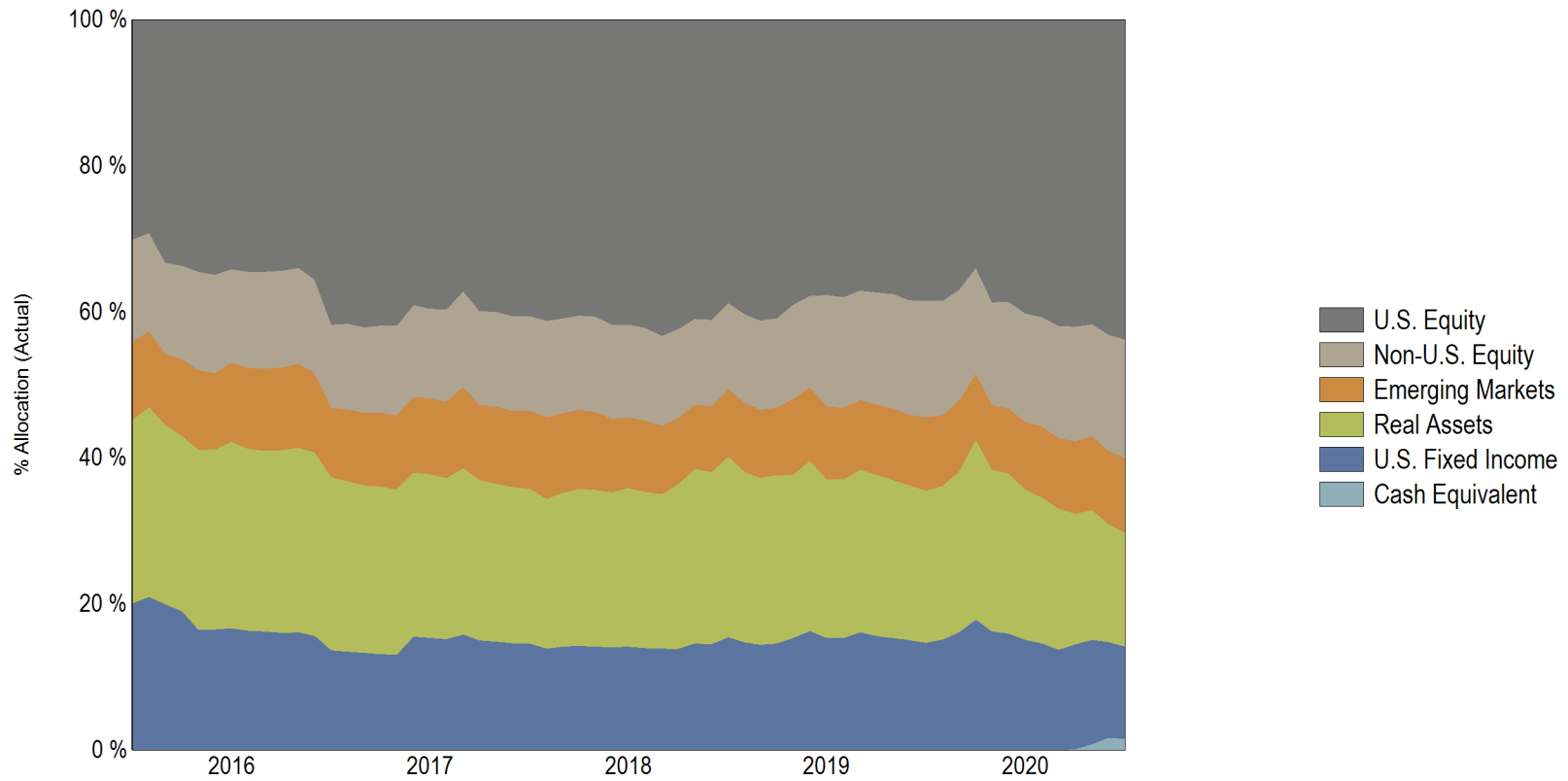


As of December 31, 2020

Cash Flow Summary by Manager From October 01, 2020 to December 31, 2020

	Beginning Market Value	Net Cash Flow	Net Investment Change	Ending Market Value
Eagle Asset Mgmt	\$157,473,759	-\$302,967	\$30,321,807	\$187,492,599
LSV Large Cap Value	\$149,594,931	\$0	\$28,291,639	\$177,886,570
SSGA S&P 500	\$123,204,781	\$9,269	\$14,939,373	\$138,153,423
Polen Focus Growth	\$244,381,075	-\$243,799	\$24,799,742	\$268,937,017
William & Blair Large Cap Growth	\$61,300,453	\$0	\$7,429,541	\$68,729,994
LSV Small Cap Value	\$58,865,490	\$0	\$18,626,501	\$77,491,991
Smith, Graham & Co Small Cap Value	\$69,818,093	\$0	\$20,535,753	\$90,353,847
SSGA Russell 2000	\$139,041,532	\$12,141	\$43,578,381	\$182,632,053
Copeland Small Cap Dividend Growth	\$42,158,274	\$0	\$8,910,037	\$51,068,311
AMI Small Cap Growth	\$37,856,691	\$0	\$10,723,111	\$48,579,801
Emerald Small Cap Growth	\$76,447,072	-\$98,511	\$20,397,551	\$96,746,112
SSGA MSCI World ex US	\$162,537,922	\$20,363	\$25,834,043	\$188,392,327
Hardman Johnston Int'l Equity	\$141,148,046	\$0	\$31,770,881	\$172,918,927
HGK Int'l Equity	\$129,807,459	-\$64	\$21,447,871	\$151,255,266
Jarislowsky, Fraser Limited	\$315,076	\$0	\$13,195	\$328,271
Mercator Asset Management	\$18,951	\$0	\$823	\$19,774
GlobeFlex Capital	\$3,552	\$0	-\$578	\$2,974
WHV Investment Management	\$3,134	\$0	\$136	\$3,271
SSGA MSCI Emerging Markets Index	\$274,578,761	\$38,105	\$52,521,454	\$327,138,321
Forest Investment Associates	\$130,626,418	-\$800,000	\$407,766	\$130,234,184
PRISA LP	\$51,854,386	\$0	\$636,552	\$52,490,938
PRISA II	\$103,711,028	\$0	\$1,474,501	\$105,185,529
PennMuni-Nuveen U.S. Real Estate Fund	\$206,119,761	-\$2,489,326	\$0	\$203,630,435
N. Front Street (Nuveen)	\$2,329,743	\$0	\$0	\$2,329,743
SSGA US Aggregate Bond Index	\$397,218,043	\$20,228	\$2,703,320	\$399,941,590
Cash Management	\$2,448,188	\$2,911,091	\$8,521	\$5,367,800
Pool 999	\$4,083,205	\$40,465,418	\$0	\$44,548,623
Total	\$2,766,945,824	\$39,541,948	\$365,371,919	\$3,171,859,691

Asset Allocation History



Policy Index History

Total Fund Composite		
10/1/2020	Present	25% S&P 500 / 15% Russell 2000 / 15% MSCI EAFE / 10% MSCI Emerging Markets / 20% NFI / 15% BBgBarc US Aggregate TR
Total Equity Composite		
10/1/2020	Present	MSCI ACWI IMI Net USD
U.S. Equity Composite		
1/1/2006	Present	Russell 3000
Large Cap U.S. Equity Composite		
1/1/1986	Present	S&P 500
Small Cap U.S. Equity Composite		
1/1/1993	Present	Russell 2000
Non-U.S Equity Composite		
5/31/2012	Present	MSCI ACWI ex USA IMI
Developed Non-U.S. Equity Composite		
1/1/1993	Present	MSCI EAFE
Emerging Markets Composite		
1/1/2009	Present	MSCI Emerging Markets
Real Assets Composite		
4/1/1993	Present	NFI
Total Fixed Income Composite		
1/31/1986	Present	BBgBarc US Aggregate TR
Cash Composite		
	Present	91 Day T-Bills

Pennsylvania Municipal Retirement System

Fee Summary

As of December 31, 2020

Account	Fee Schedule	% of Portfolio	Estimated Annual Fee (\$)	Estimated Annual Fee (%)
Eagle Asset Mgmt	1.00% of First 5.0 Mil, 0.75% Thereafter	5.9%	\$1,418,694	0.76%
LSV Large Cap Value	0.60% of First 25.0 Mil, 0.50% of Next 25.0 Mil, 0.40% of Next 50.0 Mil, 0.30% of Next 100.0 Mil, 0.30% Thereafter	5.6%	\$708,660	0.40%
SSGA S&P 500	0.03% of Assets	4.4%	\$41,446	0.03%
Polen Focus Growth	0.40% of Assets	8.5%	\$1,075,748	0.40%
William & Blair Large Cap Growth	0.50% of First 50.0 Mil, 0.35% of Next 50.0 Mil, 0.30% of Next 150.0 Mil, 0.25% Thereafter	2.2%	\$315,555	0.46%
LSV Small Cap Value	0.75% of First 25.0 Mil, 0.65% of Next 25.0 Mil, 0.55% Thereafter	2.4%	\$501,206	0.65%
Smith, Graham & Co Small Cap Value	0.75% of First 50.0 Mil, 0.60% Thereafter	2.8%	\$617,123	0.68%
SSGA Russell 2000	0.04% of First 50.0 Mil, 0.03% Thereafter	5.8%	\$59,790	0.03%
Copeland Small Cap Dividend Growth	0.50% of Assets	1.6%	\$255,342	0.50%
AMI Small Cap Growth	0.90% of First 10.0 Mil, 0.80% of Next 15.0 Mil, 0.70% of Next 25.0 Mil, 0.60% Thereafter	1.5%	\$375,059	0.77%
Emerald Small Cap Growth	0.60% of First 10.0 Mil, 0.55% of Next 5.0 Mil, 0.50% Thereafter	3.1%	\$496,231	0.51%

Pennsylvania Municipal Retirement System

Fee Summary

As of December 31, 2020

Account	Fee Schedule	% of Portfolio	Estimated Annual Fee (\$)	Estimated Annual Fee (%)
SSGA MSCI World ex US	0.05% of Assets	5.9%	\$94,196	0.05%
Hardman Johnston Int'l Equity	0.75% of First 25.0 Mil, 0.60% Thereafter	5.5%	\$1,075,014	0.62%
HGK Int'l Equity	0.90% of First 5.0 Mil, 0.80% of Next 5.0 Mil, 0.70% of Next 15.0 Mil, 0.65% Thereafter	4.8%	\$1,010,659	0.67%
SSGA MSCI Emerging Markets Index	0.08% of Assets	10.3%	\$261,711	0.08%
Forest Investment Associates	0.75% of Assets	4.1%	\$976,756	0.75%
PRISA LP	1.00% of First 25.0 Mil, 0.95% of Next 25.0 Mil, 0.85% of Next 50.0 Mil, 0.75% of Next 100.0 Mil, 0.70% of Next 100.0 Mil, 0.65% Thereafter	1.7%	\$508,673	0.97%
PRISA II	1.20% of First 25.0 Mil, 1.15% of Next 25.0 Mil, 1.05% of Next 50.0 Mil, 0.95% of Next 100.0 Mil, 0.90% of Next 100.0 Mil, 0.85% Thereafter	3.3%	\$1,161,763	1.10%
PennMuni-Nuveen U.S. Real Estate Fund	0.85% of Assets	6.4%	\$1,730,859	0.85%
N. Front Street (Nuveen)	0.85% of Assets	0.1%	\$19,803	0.85%
SSGA US Aggregate Bond Index	0.02% of Assets	12.6%	\$79,988	0.02%
Cash Management	No Fee	0.2%	--	--
Pool 999	No Fee	1.4%	--	--
Investment Management Fee		100.0%	\$12,784,274	0.40%

Characteristics

	Portfolio	Russell 3000
Number of Holdings	2,694	3,058
Weighted Avg. Market Cap. (\$B)	228.0	407.2
Median Market Cap. (\$B)	1.7	2.0
Price To Earnings	26.6	29.1
Price To Book	3.7	4.4
Price To Sales	1.7	2.7
Return on Equity (%)	11.4	16.0
Yield (%)	1.1	1.4

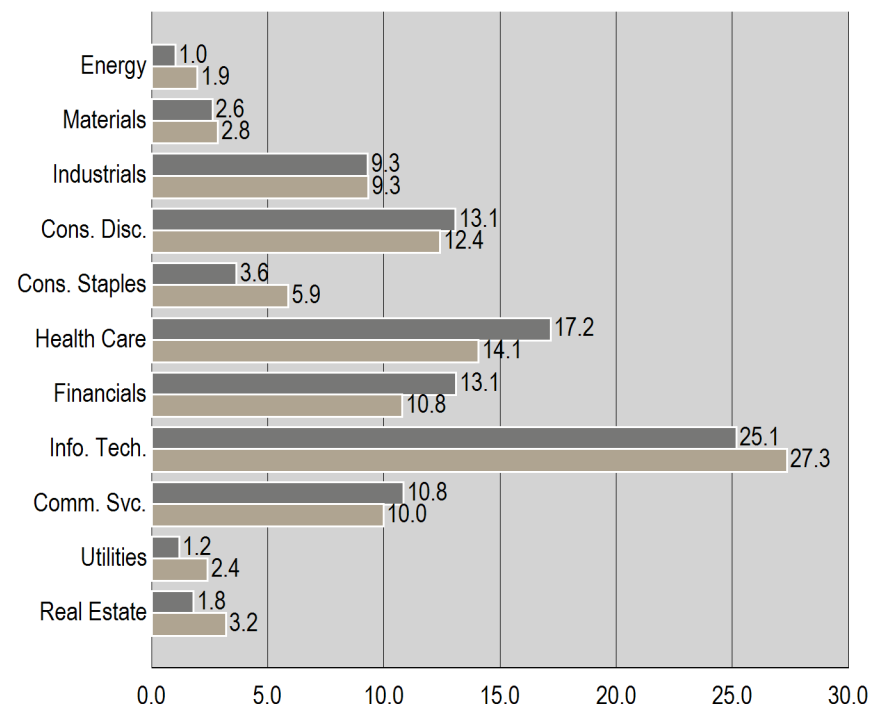
Top Holdings

MICROSOFT CORP	3.7%
ALPHABET INC	2.8%
FACEBOOK INC	2.5%
AMAZON.COM INC	1.7%
ADOBE INC	1.6%
UNITEDHEALTH GROUP INC	1.3%
MASTERCARD INC	1.3%
COMCAST CORP	1.2%
ABBOTT LABORATORIES	1.2%
PAYPAL HOLDINGS INC	1.2%
Total	18.4%

Market Capitalization

	Small Cap	Mid Cap	Large Cap	Unclassified
U.S. Equity Composite	24.9%	25.0%	48.6%	1.5%
Russell 3000	4.8%	23.5%	71.7%	0.0%
<i>Weight Over/Under</i>	20.1%	1.5%	-23.1%	1.5%

Sector Allocation (%) vs Russell 3000



Common Holdings Matrix

	<i>Eagle Asset Mgmt</i>		<i>LSV Large Cap Value</i>		<i>SSGA S&P 500</i>		<i>Polen Focus Growth</i>		<i>William & Blair Large Cap Growth</i>		<i>LSV Small Cap Value</i>		<i>Smith, Graham & Co Small Cap Value</i>		<i>SSGA Russell 2000</i>		<i>Copeland Small Cap Dividend Growth</i>		<i>AMI Small Cap Growth</i>		<i>Emerald Small Cap Growth</i>		
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	
Eagle Asset Mgmt	--	--	6	6	24	21	4	26	5	25	0	0	0	0	0	0	0	0	0	0	0	0	0
LSV Large Cap Value	6	19	--	--	94	16	1	2	1	3	24	13	1	1	21	2	3	5	0	0	2	1	
SSGA S&P 500	24	90	94	78	--	--	24	100	31	96	1	1	1	1	0	0	1	1	0	0	0	0	
Polen Focus Growth	4	25	1	1	24	20	--	--	14	50	0	0	0	0	0	0	0	0	0	0	0	0	
William & Blair Large Cap Growth	5	31	1	1	31	23	14	63	--	--	0	0	0	0	0	0	0	0	0	0	0	0	
LSV Small Cap Value	0	0	24	9	1	0	0	0	0	0	--	--	16	24	174	9	5	9	0	0	5	3	
Smith, Graham & Co Small Cap Value	0	0	1	1	1	0	0	0	0	0	16	10	--	--	58	5	2	3	3	9	4	3	
SSGA Russell 2000	0	0	21	6	0	0	0	0	0	0	174	75	58	89	--	--	39	66	25	71	106	85	
Copeland Small Cap Dividend Growth	0	0	3	1	1	0	0	0	0	0	5	3	2	3	39	4	--	--	0	0	2	2	
AMI Small Cap Growth	0	0	0	0	0	0	0	0	0	0	0	0	3	5	25	3	0	0	--	--	6	5	
Emerald Small Cap Growth	0	0	2	1	0	0	0	0	0	0	5	4	4	7	106	11	2	3	6	21	--	--	

Characteristics

	Portfolio	S&P 500
Number of Holdings	569	505
Weighted Avg. Market Cap. (\$B)	373.6	491.3
Median Market Cap. (\$B)	27.0	26.9
Price To Earnings	28.7	29.7
Price To Book	4.5	4.6
Price To Sales	2.3	2.9
Return on Equity (%)	25.2	27.9
Yield (%)	1.2	1.5

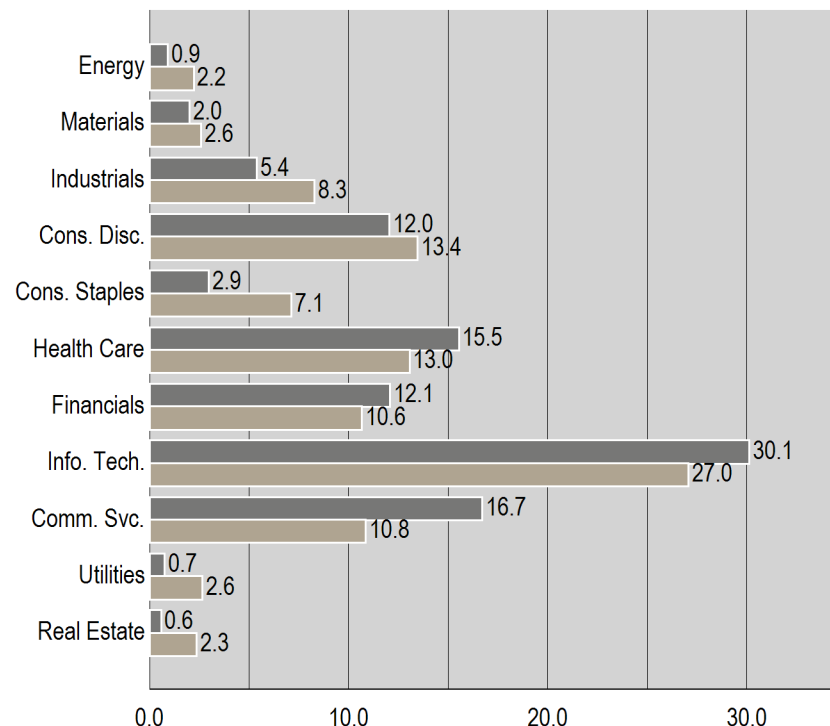
Top Holdings

MICROSOFT CORP	6.1%
ALPHABET INC	4.6%
FACEBOOK INC	4.1%
AMAZON.COM INC	2.8%
ADOBE INC	2.7%
UNITEDHEALTH GROUP INC	2.2%
MASTERCARD INC	2.1%
COMCAST CORP	2.0%
ABBOTT LABORATORIES	2.0%
PAYPAL HOLDINGS INC	1.9%
Total	30.4%

Market Capitalization

	Small Cap	Mid Cap	Large Cap	Unclassified
Large Cap U.S. Equity Composite	1.2%	17.3%	80.3%	1.2%
S&P 500	0.0%	15.7%	84.3%	0.0%
<i>Weight Over/Under</i>	1.2%	1.6%	-4.0%	1.2%

Sector Allocation (%) vs S&P 500



Common Holdings Matrix

	<i>Eagle Asset Mgmt</i>		<i>LSV Large Cap Value</i>		<i>SSGA S&P 500</i>		<i>Polen Focus Growth</i>		<i>William & Blair Large Cap Growth</i>	
	#	%	#	%	#	%	#	%	#	%
Eagle Asset Mgmt	--	--	6	6	24	21	4	26	5	25
LSV Large Cap Value	6	19	--	--	94	16	1	2	1	3
SSGA S&P 500	24	90	94	78	--	--	24	100	31	96
Polen Focus Growth	4	25	1	1	24	20	--	--	14	50
William & Blair Large Cap Growth	5	31	1	1	31	23	14	63	--	--

Characteristics

	Portfolio	Russell 2000
Number of Holdings	2,162	2,041
Weighted Avg. Market Cap. (\$B)	3.4	3.3
Median Market Cap. (\$B)	1.1	0.9
Price To Earnings	22.9	22.7
Price To Book	2.9	3.0
Price To Sales	1.2	1.5
Return on Equity (%)	-3.7	-8.4
Yield (%)	1.0	1.0

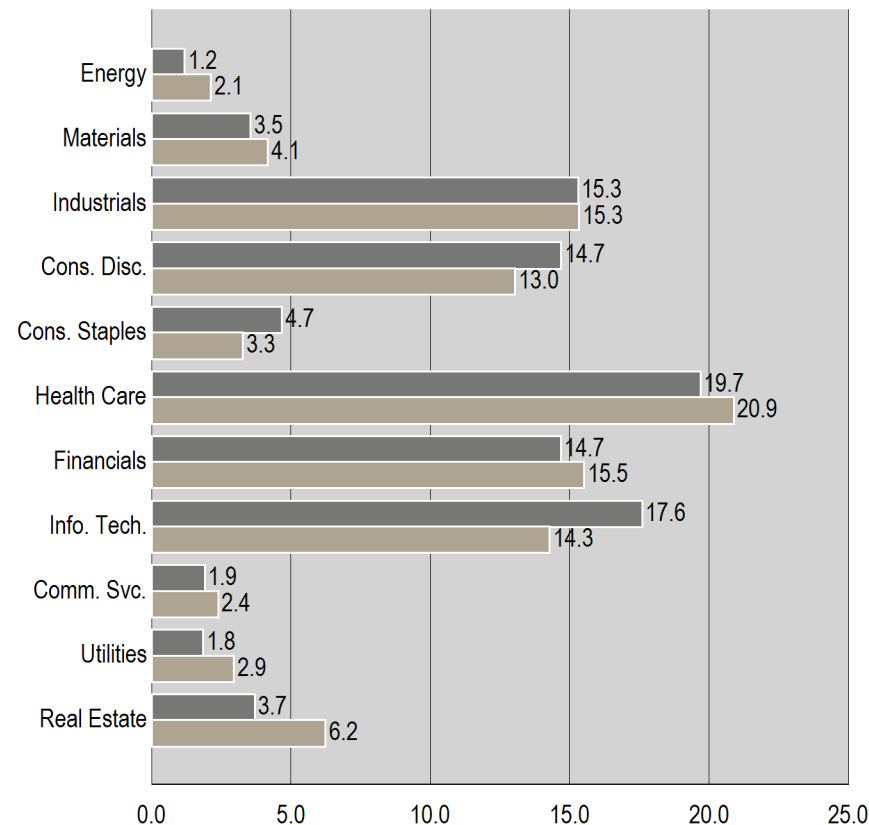
Top Holdings

TETRA TECH INC	0.7%
SELECT MEDICAL HOLDINGS CORP	0.7%
GREEN DOT CORP	0.7%
SIMPLY GOOD FOODS CO (THE)	0.7%
ITRON INC	0.6%
LITHIA MOTORS INC.	0.6%
NATIONAL VISION HOLDINGS INC	0.5%
INTEGER HOLDINGS CORP	0.5%
NEOGENOMICS INC	0.5%
DECKERS OUTDOOR CORP	0.5%
Total	6.1%

Market Capitalization

	Small Cap	Mid Cap	Large Cap	Unclassified
Small Cap U.S. Equity Composite	61.3%	36.7%	0.0%	2.0%
Russell 2000	66.8%	33.2%	0.0%	0.0%
<i>Weight Over/Under</i>	<i>-5.5%</i>	<i>3.5%</i>	<i>0.0%</i>	<i>2.0%</i>

Sector Allocation (%) vs Russell 2000



Common Holdings Matrix

	<i>LSV Small Cap Value</i>		<i>Smith, Graham & Co Small Cap Value</i>		<i>SSGA Russell 2000</i>		<i>Copeland Small Cap Dividend Growth</i>		<i>AMI Small Cap Growth</i>		<i>Emerald Small Cap Growth</i>	
	#	%	#	%	#	%	#	%	#	%	#	%
LSV Small Cap Value	--	--	16	24	174	9	5	9	0	0	5	3
Smith, Graham & Co Small Cap Value	16	10	--	--	58	5	2	3	3	9	4	3
SSGA Russell 2000	174	75	58	89	--	--	39	66	25	71	106	85
Copeland Small Cap Dividend Growth	5	3	2	3	39	4	--	--	0	0	2	2
AMI Small Cap Growth	0	0	3	5	25	3	0	0	--	--	6	5
Emerald Small Cap Growth	5	4	4	7	106	11	2	3	6	21	--	--

Characteristics

	Portfolio	MSCI ACWI ex USA
Number of Holdings	2,204	2,361
Weighted Avg. Market Cap. (\$B)	122.4	100.4
Median Market Cap. (\$B)	8.9	9.5
Price To Earnings	23.1	20.9
Price To Book	3.3	2.7
Price To Sales	1.6	1.3
Return on Equity (%)	10.2	10.4
Yield (%)	1.6	2.3

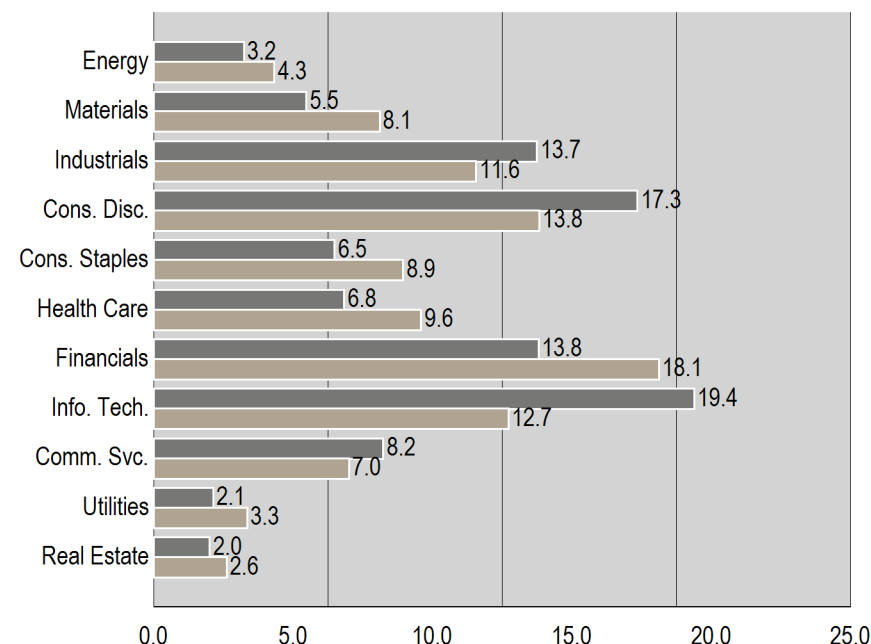
Top Holdings

ALIBABA GROUP HOLDING LTD	3.4%
TENCENT HOLDINGS LTD	3.4%
TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	2.7%
SAMSUNG ELECTRONICS CO LTD	2.1%
WUXI BIOLOGICS (CAYMAN) INC	1.5%
AIA GROUP LTD	1.5%
KEYENCE CORP	1.3%
AFTERPAY LTD	1.2%
ATLISSIAN CORP PLC	1.1%
SK HYNIX INC	1.1%
Total	19.3%

Market Capitalization

	Small Cap	Mid Cap	Large Cap	Unclassified
Non-U.S Equity Composite	8.5%	24.5%	62.7%	4.4%
MSCI ACWI ex USA	9.9%	23.5%	66.6%	0.0%
<i>Weight Over/Under</i>	<i>-1.3%</i>	<i>1.0%</i>	<i>-4.0%</i>	<i>4.4%</i>

Sector Allocation (%) vs MSCI ACWI ex USA



Region Allocation Summary

Region	% of Total	% of Bench	% Diff
North America ex U.S.	2.5%	6.3%	-3.9%
United States	0.2%	0.0%	0.2%
Europe Ex U.K.	22.4%	30.3%	-7.9%
United Kingdom	5.9%	8.8%	-2.9%
Pacific Basin Ex Japan	9.0%	7.3%	1.7%
Japan	11.0%	15.9%	-4.9%
Emerging Markets	48.4%	30.9%	17.5%
Other	0.7%	0.6%	0.2%
Total	100.0%	100.0%	0.0%

Common Holdings Matrix

	<i>SSGA MSCI World ex US</i>		<i>Hardman Johnston Int'l Equity</i>		<i>HGK Int'l Equity</i>		<i>SSGA MSCI Emerging Markets Index</i>	
	#	%	#	%	#	%	#	%
SSGA MSCI World ex US	--	--	20	80	30	89	859	90
Hardman Johnston Int'l Equity	20	7	--	--	1	3	3	11
HGK Int'l Equity	30	5	1	4	--	--	2	1
SSGA MSCI Emerging Markets Index	859	28	3	15	2	6	--	--



Pennsylvania Municipal Retirement System

Monthly Performance Report

February 28, 2021

TABLE OF CONTENTS

EXHIBITS

Market Environment..... I
Portfolio Review..... II

I. Market Environment



Market Tracker

February 2021

U.S. Equity Returns

	Feb	YTD	1 Yr
S&P 500	2.8%	1.7%	31.3%
Russell 3000	3.1%	2.7%	35.3%
NASDAQ	1.0%	2.5%	55.3%
Dow Jones	3.4%	1.4%	24.4%

Non-U.S. Equity Returns

	Feb	YTD	1 Yr
ACWI	2.3%	1.9%	30.2%
ACWI ex. US	2.0%	2.2%	26.2%
EAFE Index	2.2%	1.2%	22.5%
EAFE Local	2.6%	2.2%	13.5%
EAFE Growth	-0.3%	-1.7%	28.0%
EAFE Value	4.8%	3.9%	16.0%
EAFE Small Cap	2.6%	2.3%	31.2%
Emerging Markets	0.8%	3.9%	36.0%
EM Small Cap	6.0%	6.0%	41.8%

Regional Returns

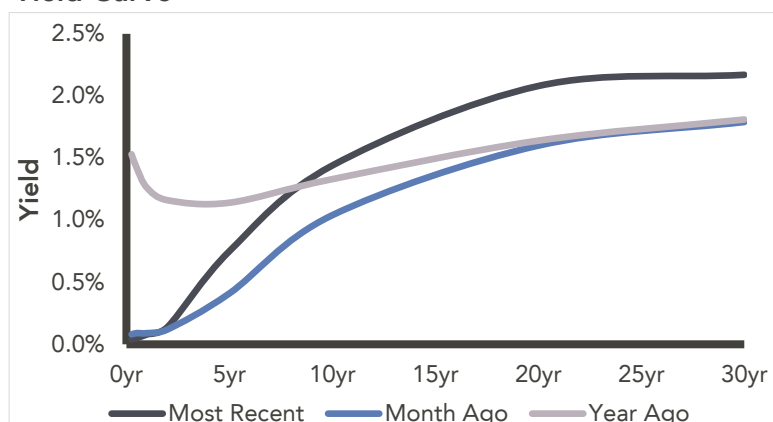
	Feb	YTD	1 Yr
Europe	2.4%	0.9%	19.8%
Asia ex-Japan	1.2%	5.4%	42.0%
EM Latin America	-3.0%	-9.5%	-6.0%
U.K	3.6%	3.3%	9.2%
Germany	2.0%	0.1%	27.0%
France	5.0%	1.7%	20.3%
Japan	1.5%	0.5%	28.4%
China	-1.0%	6.3%	43.1%
Brazil	-6.3%	-13.7%	-13.1%
India	5.2%	2.8%	29.1%

Real Estate Returns*

	Qtr	YTD	1 Yr
NCREIF NPI National	1.2%	1.6%	1.6%
FTSE NAREIT	9.2%	-5.9%	-5.9%

*Returns as of December 2020

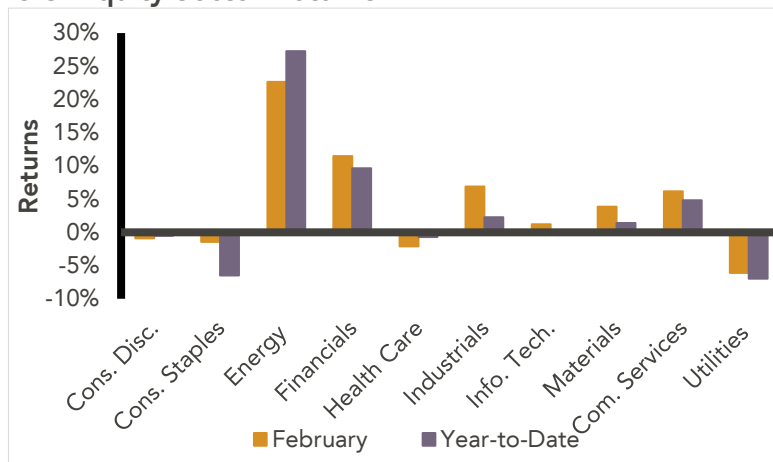
Yield Curve



Style Index Returns

	February			Year-to-Date		
	Value	Core	Growth	Value	Core	Growth
Large	6.0%	2.9%	0.0%	5.1%	2.1%	-0.8%
Mid	7.7%	5.6%	1.7%	7.5%	5.3%	1.4%
Small	9.4%	6.2%	3.3%	15.2%	11.6%	8.3%

U.S. Equity Sector Returns



Fixed Income Returns

	Feb	YTD	1 Yr
Aggregate	-1.4%	-2.2%	1.4%
Universal	-1.3%	-1.9%	2.1%
Government	-1.8%	-2.7%	0.0%
Treasury	-1.8%	-2.8%	-0.1%
Long Gov/Credit	-4.2%	-7.0%	-1.4%
TIPS	-1.6%	-1.3%	5.8%
Municipal 5 Year	-1.1%	-0.7%	1.7%
High Yield	0.4%	0.7%	9.4%
Bank Loans	0.7%	1.9%	5.7%
Global Hedged	-1.6%	-2.1%	0.3%
EM Debt Hard Currency	-2.6%	-3.6%	0.9%

Hedge Fund Returns

	Feb	YTD	1 Yr
HFRX Fund Weighted	1.9%	1.7%	9.8%
Hedged Equity	3.1%	2.0%	11.3%
Event Driven	1.6%	2.2%	11.3%
Macro	2.3%	1.7%	6.5%
Relative Value	0.4%	0.6%	7.4%
CBOE PutWrite	1.4%	1.7%	13.3%

Commodity Returns

	Feb	YTD	1 Yr
GSCI Total	10.6%	16.0%	8.4%
Precious Metals	-5.5%	-7.0%	16.5%
Livestock	3.3%	4.8%	-3.4%
Industrial Metals	10.1%	10.2%	41.9%
Energy	15.4%	21.7%	-7.5%
Agriculture	3.8%	8.7%	35.9%
WTI Crude Oil	18.1%	26.8%	-14.9%
Gold	-6.6%	-9.0%	7.2%



DISCLOSURE

The sources of information used in this report are believed to be reliable. Marquette Associates, Inc. has not independently verified all of the information and its accuracy cannot be guaranteed. Opinions, estimates, projections and comments on financial market trends constitute our judgment and are subject to change without notice. References to specific securities are for illustrative purposes only and do not constitute recommendations. Past performance does not guarantee future results.

Marquette is an independent investment adviser registered under the Investment Advisers Act of 1940, as amended. Registration does not imply a certain level of skill or training. More information about Marquette including our investment strategies, fees and objectives can be found in our ADV Part 2, which is available upon request.

PREPARED BY MARQUETTE ASSOCIATES

180 North LaSalle St, Ste 3500, Chicago, Illinois 60601
CHICAGO BALTIMORE MILWAUKEE PHILADELPHIA ST. LOUIS

PHONE 312-527-5500
WEB MarquetteAssociates.com



II. Portfolio Review



Observations

- Market Value as of February 28, 2021 was \$3,270,150,015
- Feb '21 Return: Total Fund 2.9% (net) vs. Policy Index 1.8%; investment gain of \$92 million
- Contributors Feb '21 Performance:
 - Overweight to U.S. Small Cap Equities
 - Deep value positions in U.S. Equities
 - Very strong relative equity portfolio performance (4.8%) compared to broad market returns of MSCI ACWI IMI (2.7%).
- Detractors Feb '21 Performance
 - Emerging Market Equities
 - Fixed Income
- 1 Year Return: Total Fund 32.2% (net) vs. Policy Index 22.4%; investment gain of \$653 million
- 5 Year Return: Total Fund 11.9% (net) vs. Policy Index 11.4%; investment gain of \$1.5 billion
- Estimated Annual Plan Investment Management Expenses: 0.40%

Looking Ahead

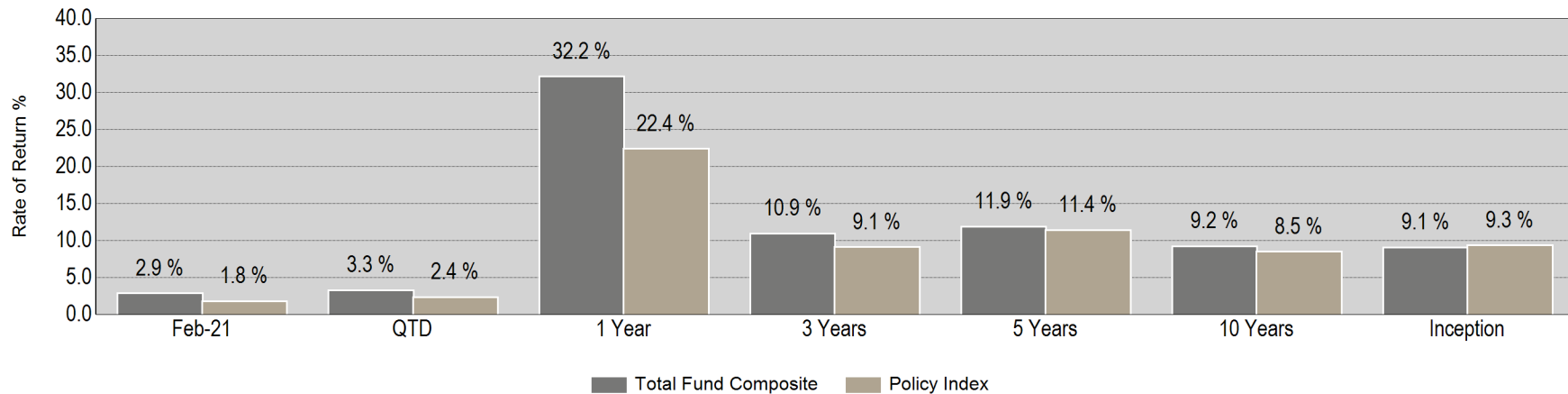
- Investment Policy Statement Review
- Asset Allocation Study Review
- Fiduciary Education for potential new Asset Classes
- Upcoming Investment Manager Searches

As of February 28, 2021

Summary of Cash Flows

	Last Month	Quarter-To-Date	One Year	Three Years	Five Years	Ten Years
Beginning Market Value	\$3,179,540,691	\$3,171,859,691	\$2,643,035,690	\$2,521,393,585	\$1,912,251,144	\$1,579,018,372
Net Cash Flow	-\$1,283,524	-\$6,951,519	-\$25,948,630	-\$112,342,534	-\$174,011,078	-\$310,918,881
Net Investment Change	\$91,892,849	\$105,241,843	\$653,062,955	\$861,098,964	\$1,531,909,949	\$2,002,050,524
Ending Market Value	\$3,270,150,015	\$3,270,150,015	\$3,270,150,015	\$3,270,150,015	\$3,270,150,015	\$3,270,150,015

Return Summary (Net)



Asset Allocation vs. Target

	Current	Policy	Difference*
U.S. Equity	41.3%	40.0%	\$41,052,245
Non-U.S. Equity	14.8%	15.0%	-\$6,791,175
Emerging Markets	9.8%	10.0%	-\$7,594,429
Real Assets	15.1%	20.0%	-\$161,006,832
U.S. Fixed Income	17.8%	15.0%	\$90,873,491
Cash Equivalent	1.3%	--	\$43,466,701
Total	100.0%	100.0%	

*Difference between Policy and Current Allocation

Pennsylvania Municipal Retirement System

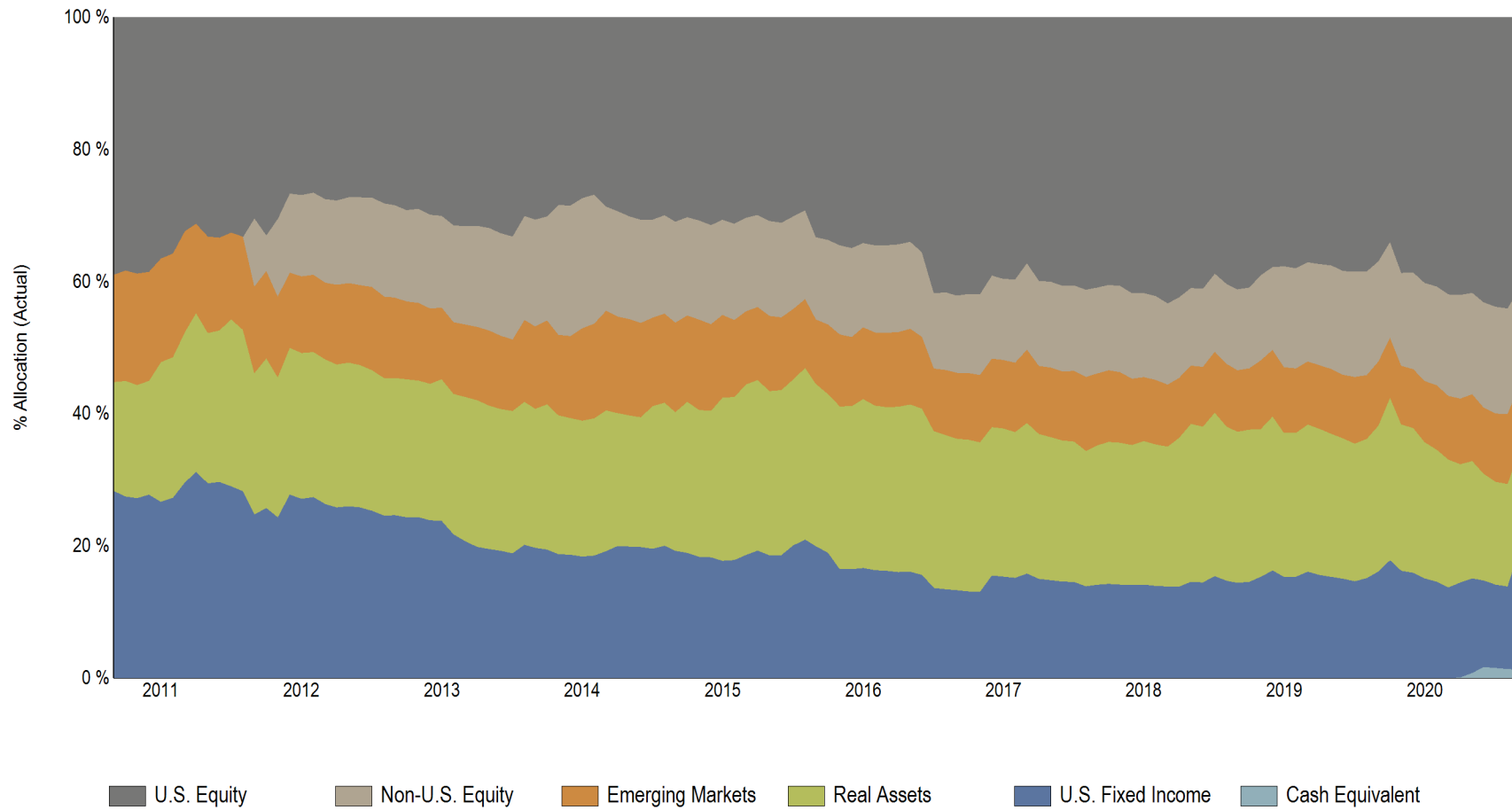
Asset Allocation Summary

As of February 28, 2021

	Market Value	% of Portfolio	Policy %	Policy Difference
Total Fund Composite	3,270,150,015	100.0	100.0	0.0
Total Equity Composite	2,152,264,150	65.8	65.0	0.8
U.S. Equity Composite	1,349,112,251	41.3	40.0	1.3
Large Cap U.S. Equity Composite	833,645,070	25.5	25.0	0.5
Eagle Asset Mgmt	199,237,973	6.1		
LSV Large Cap Value	192,768,299	5.9		
SSGA S&P 500	102,487,170	3.1		
Polen Focus Growth	269,720,190	8.2		
William & Blair Large Cap Growth	69,431,439	2.1		
Small Cap U.S. Equity Composite	515,467,180	15.8	15.0	0.8
LSV Small Cap Value	89,273,674	2.7		
Smith, Graham & Co Small Cap Value	104,419,995	3.2		
SSGA Russell 2000	112,727,531	3.4		
Copeland Small Cap Dividend Growth	55,943,741	1.7		
AMI Small Cap Growth	50,908,868	1.6		
Emerald Small Cap Growth	102,193,372	3.1		
Non-U.S Equity Composite	803,151,899	24.6	25.0	-0.4
Developed Non-U.S. Equity Composite	483,731,327	14.8	15.0	-0.2
SSGA MSCI World ex US	155,596,833	4.8		
Hardman Johnston Int'l Equity	173,603,012	5.3		
HGK Int'l Equity	154,182,112	4.7		
Emerging Markets Composite	319,420,572	9.8	10.0	-0.2
SSGA MSCI Emerging Markets Index	319,420,572	9.8		
Real Assets Composite	493,023,171	15.1	20.0	-4.9
Forest Investment Associates	130,234,184	4.0		
PRISA LP	52,490,938	1.6		
PRISA II	105,185,529	3.2		
PennMuni-Nuveen U.S. Real Estate Fund	202,820,828	6.2		
N. Front Street (Nuveen)	2,291,692	0.1		
Total Fixed Income Composite	581,395,993	17.8	15.0	2.8
SSGA US Aggregate Bond Index	581,395,993	17.8		
Cash Composite	43,466,701	1.3	--	1.3
Cash Management	5,869,597	0.2		
Pool 999	37,597,104	1.1		

* Residual Value for Jarislowsky, Mercator, Globeflex and WHV (approx. \$350k) are included in Developed, Non-US Equity and Total Fund Composite values

Asset Allocation History
10 Years Ending February 28, 2021



Pennsylvania Municipal Retirement System

Annualized Performance (Net)

As of February 28, 2021

	1 Mo	QTD	1 Yr	3 Yrs	5 Yrs	10 Yrs	Inception	Inception Date
Total Fund Composite	2.9	3.3	32.2	10.9	11.9	9.2	9.1	Jan-86
<i>Policy Index</i>	1.8	2.4	22.4	9.1	11.4	8.5	9.3	Jan-86
Total Equity Composite	4.8	5.5	--	--	--	--	25.8	Oct-20
<i>MSCI ACWI IMI Net USD</i>	2.7	2.5	--	--	--	--	18.6	Oct-20
U.S. Equity Composite	6.5	7.3	55.5	16.9	17.1	13.2	9.7	Jan-06
<i>Russell 3000</i>	3.1	2.7	35.3	15.0	17.4	13.4	10.1	Jan-06
Large Cap U.S. Equity Composite	5.4	3.9	46.0	17.9	17.5	14.7	11.3	Jan-86
<i>S&P 500</i>	2.8	1.7	31.3	14.1	16.8	13.4	11.1	Jan-86
Eagle Asset Mgmt	8.4	6.3	32.2	13.9	17.8	--	18.5	Feb-16
<i>Russell 1000 Value</i>	6.0	5.1	22.2	8.2	12.0	--	11.8	Feb-16
LSV Large Cap Value	7.0	8.3	28.8	6.2	12.0	10.7	8.5	Apr-04
<i>Russell 1000 Value</i>	6.0	5.1	22.2	8.2	12.0	10.4	8.0	Apr-04
SSGA S&P 500	2.8	1.7	31.2	14.1	16.7	13.4	8.8	Feb-97
<i>S&P 500</i>	2.8	1.7	31.3	14.1	16.8	13.4	8.8	Feb-97
Polen Focus Growth	2.9	0.3	39.3	24.5	22.5	17.7	18.4	Oct-10
<i>Russell 1000 Growth</i>	0.0	-0.8	44.3	21.0	22.2	16.4	17.6	Oct-10
William & Blair Large Cap Growth	4.2	1.0	--	--	--	--	29.8	Jun-20
<i>Russell 1000 Growth</i>	0.0	-0.8	--	--	--	--	30.6	Jun-20
Small Cap U.S. Equity Composite	8.3	12.9	70.7	13.8	15.7	11.6	11.1	Jan-93
<i>Russell 2000</i>	6.2	11.6	51.0	14.9	17.9	11.9	10.0	Jan-93
LSV Small Cap Value	10.5	15.1	36.6	6.9	--	--	6.8	Dec-16
<i>Russell 2000 Value</i>	9.4	15.2	41.1	10.1	--	--	9.0	Dec-16
Smith, Graham & Co Small Cap Value	8.0	15.6	53.7	12.9	--	--	10.9	Dec-16
<i>Russell 2000 Value</i>	9.4	15.2	41.1	10.1	--	--	9.0	Dec-16
SSGA Russell 2000	6.3	11.6	50.9	14.8	17.9	11.9	9.2	Mar-97
<i>Russell 2000</i>	6.2	11.6	51.0	14.9	17.9	11.9	9.3	Mar-97
Copeland Small Cap Dividend Growth	6.8	9.5	30.0	14.0	--	--	12.7	Sep-17
<i>Russell 2000</i>	6.2	11.6	51.0	14.9	--	--	13.6	Sep-17
AMI Small Cap Growth	0.8	4.8	45.1	9.7	--	--	11.3	Sep-17
<i>Russell 2000 Growth</i>	3.3	8.3	58.9	18.9	--	--	19.6	Sep-17
Emerald Small Cap Growth	4.2	5.6	56.6	19.9	22.1	15.8	12.1	Oct-98
<i>Russell 2000 Growth</i>	3.3	8.3	58.9	18.9	21.1	13.8	9.5	Oct-98

*Policy Index: 25% S&P 500, 15% Russell 2000, 15% MSCI EAFE, 10% MSCI Em Mrks, 20% NFI ODCE, 15% BBG Barc Agg

Pennsylvania Municipal Retirement System

Annualized Performance (Net)

As of February 28, 2021

	1 Mo	QTD	1 Yr	3 Yrs	5 Yrs	10 Yrs	Inception	Inception Date
Non-U.S Equity Composite	2.0	2.6	33.7	7.8	14.7	--	9.5	May-12
Developed Non-U.S. Equity Composite	2.6	1.5	42.6	9.4	12.4	7.6	8.2	Jan-93
<i>MSCI EAFE</i>	2.2	1.2	22.5	4.6	9.7	5.0	6.2	Jan-93
SSGA MSCI World ex US	2.6	1.5	22.6	5.2	10.2	--	6.7	Apr-12
<i>MSCI World ex USA</i>	2.5	1.5	22.1	4.8	9.8	--	6.4	Apr-12
Hardman Johnston Int'l Equity	0.5	0.4	49.4	15.7	20.0	--	12.1	Apr-12
<i>MSCI EAFE</i>	2.2	1.2	22.5	4.6	9.7	--	6.6	Apr-12
HGK Int'l Equity	4.1	1.9	27.1	6.5	12.6	--	10.0	Feb-12
<i>MSCI EAFE</i>	2.2	1.2	22.5	4.6	9.7	--	7.1	Feb-12
Emerging Markets Composite								
SSGA MSCI Emerging Markets Index	0.7	3.8	35.2	6.5	15.2	4.3	9.5	Nov-08
<i>MSCI Emerging Markets</i>	0.8	3.9	36.0	6.4	15.2	4.4	9.7	Nov-08
Real Assets Composite	0.0	0.0	-0.4	3.2	4.7	6.9	7.4	Apr-93
<i>NFI</i>	0.0	0.0	-0.2	3.5	5.0	8.6	--	Apr-93
Forest Investment Associates	-0.2	-0.2	-1.2	1.2	2.4	3.3	3.6	Mar-99
<i>NCREIF Timberland Property Index</i>	0.0	0.0	0.8	1.8	2.3	4.5	5.8	Mar-99
PRISA LP	0.0	0.0	1.6	4.8	5.8	9.5	6.2	Jan-86
<i>NFI</i>	0.0	0.0	-0.2	3.5	5.0	8.6	--	Jan-86
PRISA II	0.0	0.0	-0.1	4.8	6.1	10.6	3.5	Jul-07
<i>NFI</i>	0.0	0.0	-0.2	3.5	5.0	8.6	4.3	Jul-07
PennMuni-Nuveen U.S. Real Estate Fund	0.0	0.0	1.7	6.1	7.3	9.9	5.0	Dec-08
<i>NFI</i>	0.0	0.0	-0.2	3.5	5.0	8.6	4.9	Dec-08
N. Front Street (Nuveen)	0.0	0.1	0.1	-0.8	--	--	-3.3	Mar-17
<i>Consumer Price Index</i>	0.5	1.0	1.7	1.8	--	--	1.9	Mar-17
Total Fixed Income Composite								
SSGA US Aggregate Bond Index	-1.5	-2.2	1.4	5.3	3.6	3.6	5.2	Apr-97
<i>BBgBarc US Aggregate TR</i>	-1.4	-2.2	1.4	5.3	3.6	3.6	5.2	Apr-97
Cash Composite								
Cash Management								
Pool 999								

*PennMuni Nuveen RE valued as of 9-30-20; N. Front Street valued as of 12-31-19

Pennsylvania Municipal Retirement System:

Asset Class Assumptions

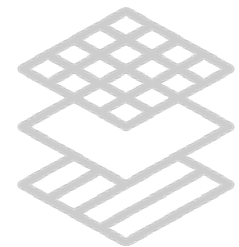
Presented by

Gregory Leonberger, FSA, EA, MAAA



Table of Contents

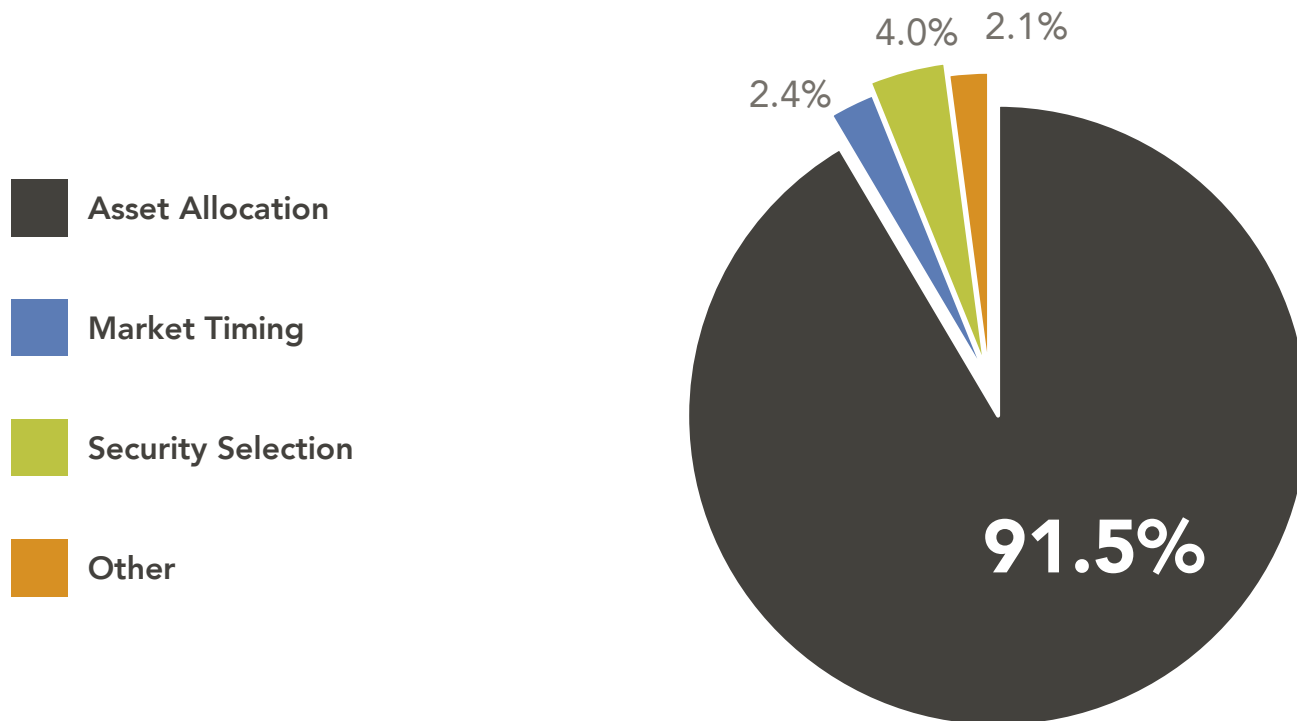
- Asset Allocation Background
- 12-31-20 Asset Class Assumptions
- Fixed Income Trends
- U.S. Equity Trends
- Non-U.S. Equity Trends
- Volatility vs. Target Rate of Return



Asset Allocation: Background

Asset allocation controls portfolio risk

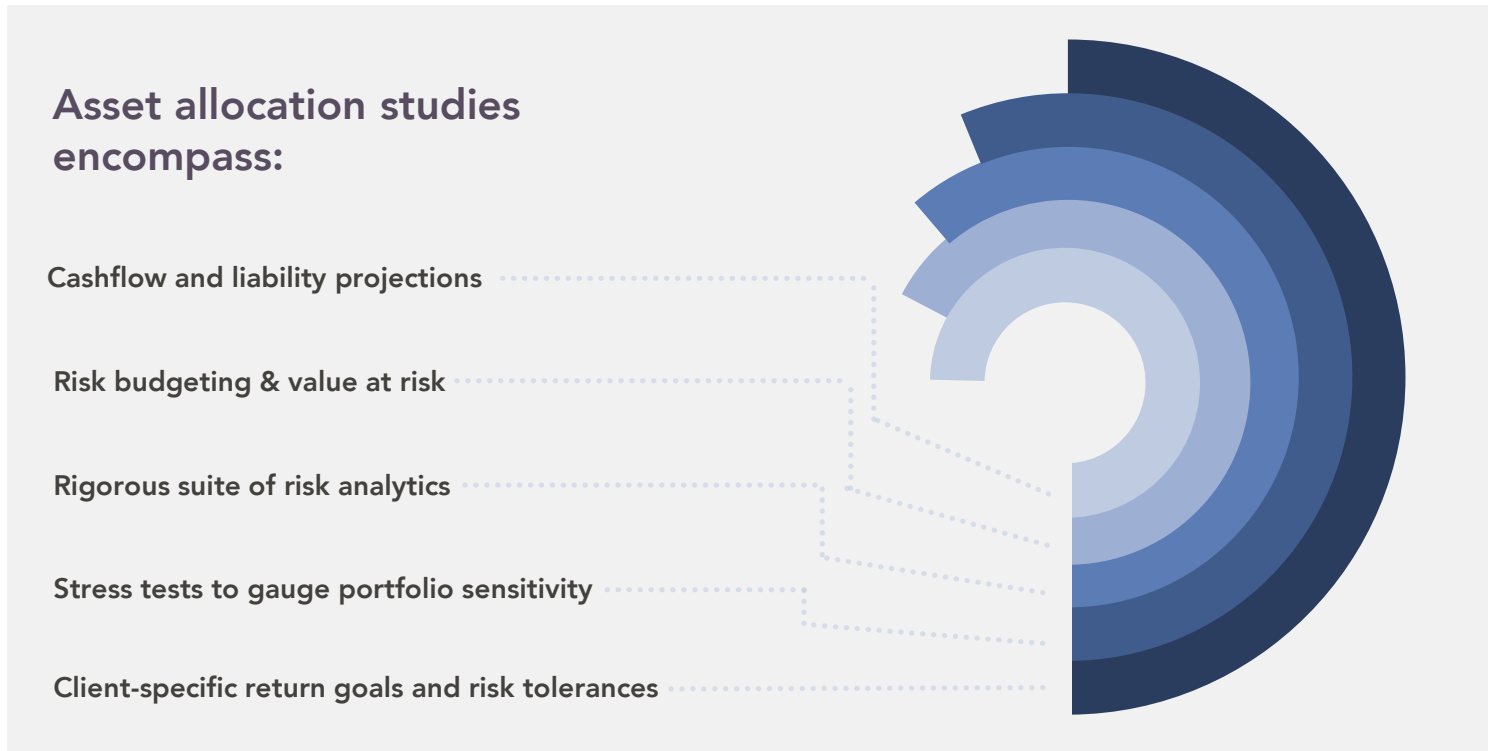
Portfolio return variability (%)



Source: Gary P. Brinson, L. Randolph Hood, and Gilbert L. Beebower, "Determinants of Portfolio Performance," Financial Analysts Journal, July/August 1986. Gary P. Brinson, Brian D. Singer, and Gilbert L. Beebower, "Determinants of Portfolio Performance II: An Update," Financial Analysts Journal, May/June 1991.

A comprehensive approach to asset allocation

Holistic approach contributes to optimal portfolios for each client's unique circumstances



Client-specific return goals and risk tolerances

Studies reflect client-specific inputs which are reflected in robust analytics package

CLIENT SPECIFIC VARIABLES

- Target rate of return
- Risk tolerance
- Cash flows
- Liabilities
- Liquidity constraints
- Suitable asset classes
- Spending policy
- Debt covenants

SOFTWARE MODELING

- Monte-Carlo model utilizes over 25 variables:
 - Interest Rates
 - Default Rates
 - Corporate Spreads
 - Dividend Yields
 - Property Yields
- Dynamic correlations
- Reflects current market environment
- Objective inputs and outputs – no building block

STUDY

- Monte Carlo analysis: 1,000 scenarios produce a range of outcomes
- Downside risk and downside deviation
- Value-at-risk
- Includes analysis of funding ratio or spending policy
- Stress testing
- Portfolio optimization
- Customized reports to best-suit client needs

12-31-20 Assumptions

12/31/2020 assumptions – since 3Q:

- Rates on the longer end of the curve moved higher during 4Q, so longer duration Treasury returns have shifted upwards 15-20 bps; returns for shorter duration Treasuries are mostly unchanged;
- Credit strategies are generally 20-30 bps lower, with below IG strategies dropping more as the degree of spread tightening for below IG was more pronounced;
- Equity returns are 10-30 basis points lower, which reflect the further rally in 4Q and future earnings outlook going forward;
- Hedge funds, real assets, and private markets are relatively unchanged from their September 30th values

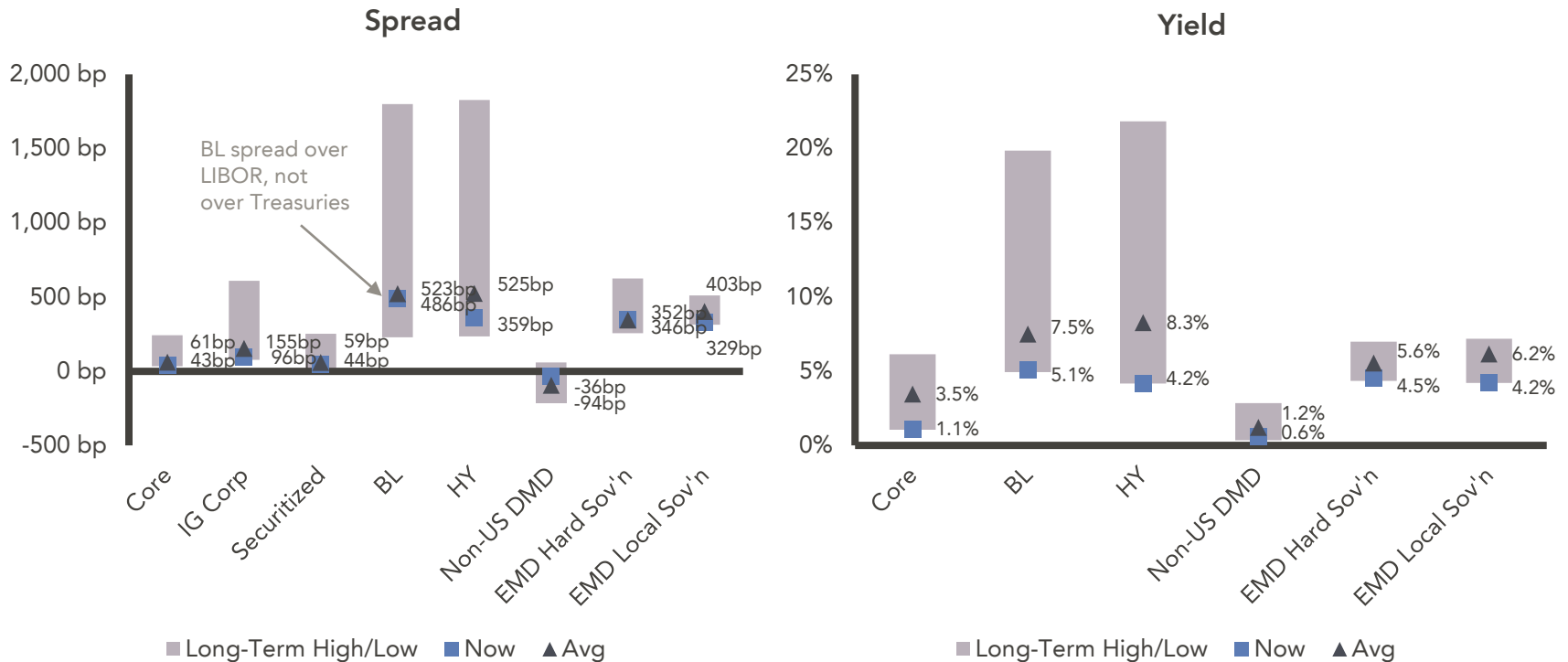
12/31/2020 assumptions – since 12/31/2018:

- Return expectations have trended down as markets have rallied and rates have fallen:
 - 10-yr: 0.93% vs. 2.69%
 - Agg: 1.70% vs. 3.30%
 - U.S. Equities (Russell 3000): 7.10% vs. 7.60%
 - Non-U.S. Equities (ACWI ex-U.S.): 7.50% vs. 7.80%
 - Core Real Estate: 5.60% vs. 7.20%
 - Most other alternatives have been relatively flat
- As a reminder, our assumptions are outputs of a model that simulates more than 25 variables so there is no one single factor which we can point to as causing these changes

Fixed Income Trends

Limited upside for fixed income sectors

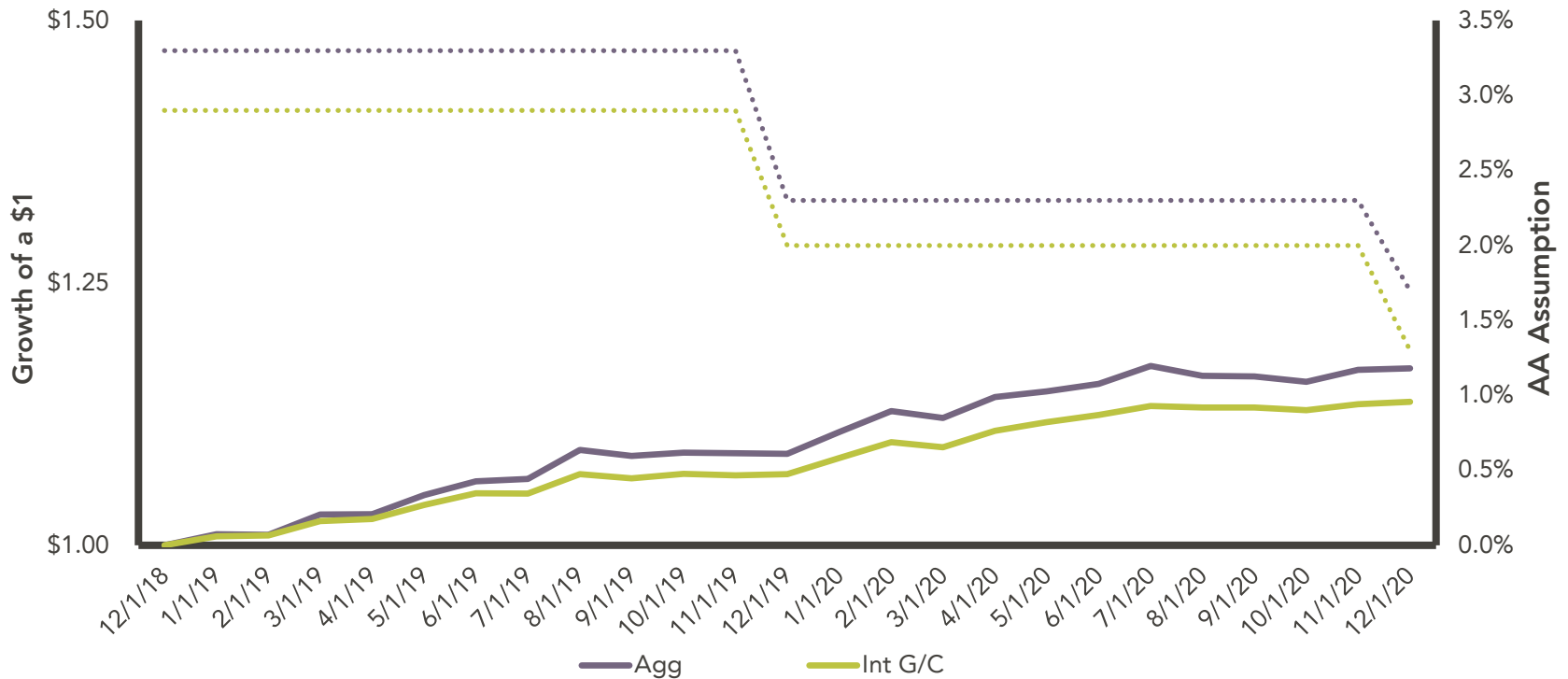
Rates are low and spreads are tight which limits the return opportunities for most fixed income sectors



Note: Long-term high, low and average based on longest available data for each index
Sources: Bloomberg Barclays, Credit Suisse, Deutsche, JPMorgan, as of December 31, 2020

Fixed Income: Portfolio anchors (Agg and Int G/C)

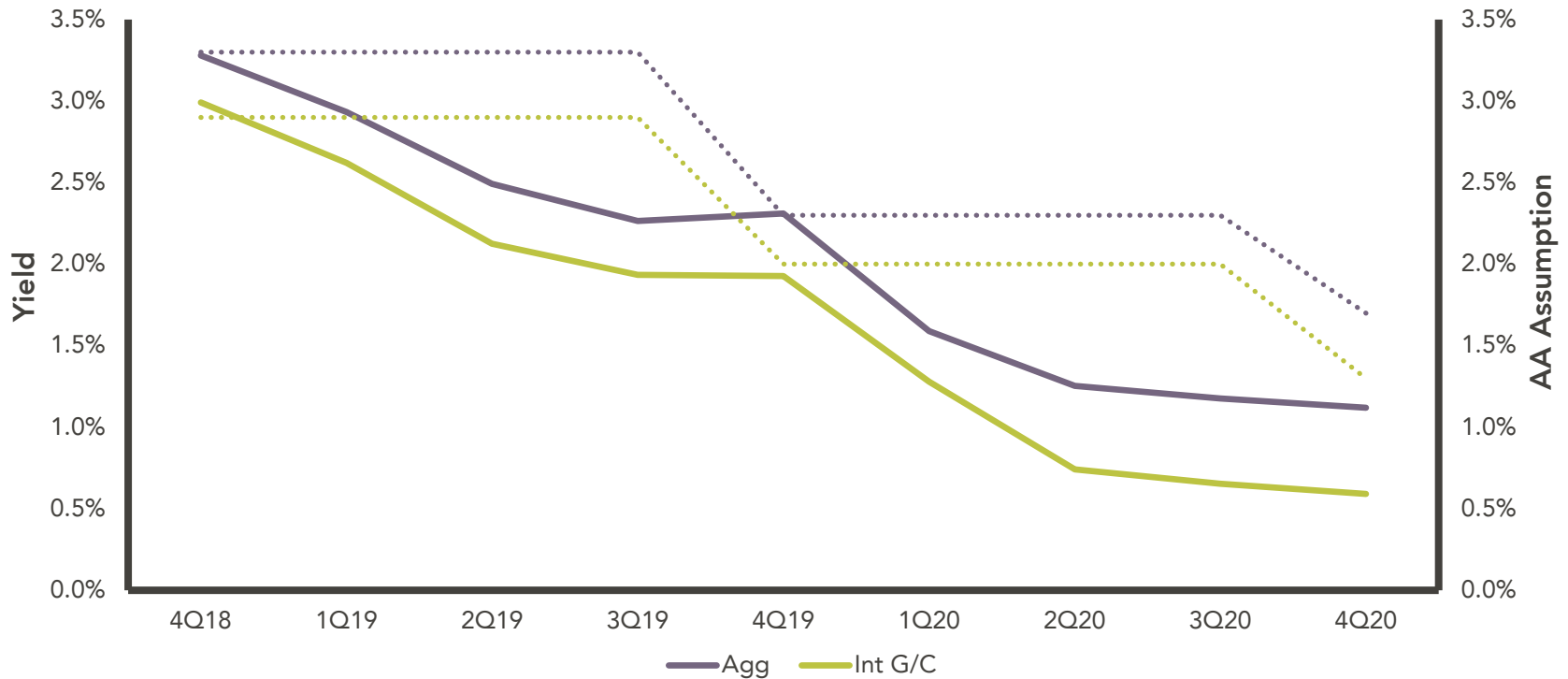
As yields have fallen and bonds have appreciated, expected returns for bonds have fallen



Dotted line represents Asset Allocation assumption; Agg is the Bbg Barclays Aggregate Index (broad fixed income) ; Int G/C is the Bbg Barclays Intermediate Government Credit Index

Fixed Income: Portfolio anchors (Agg and Int G/C)

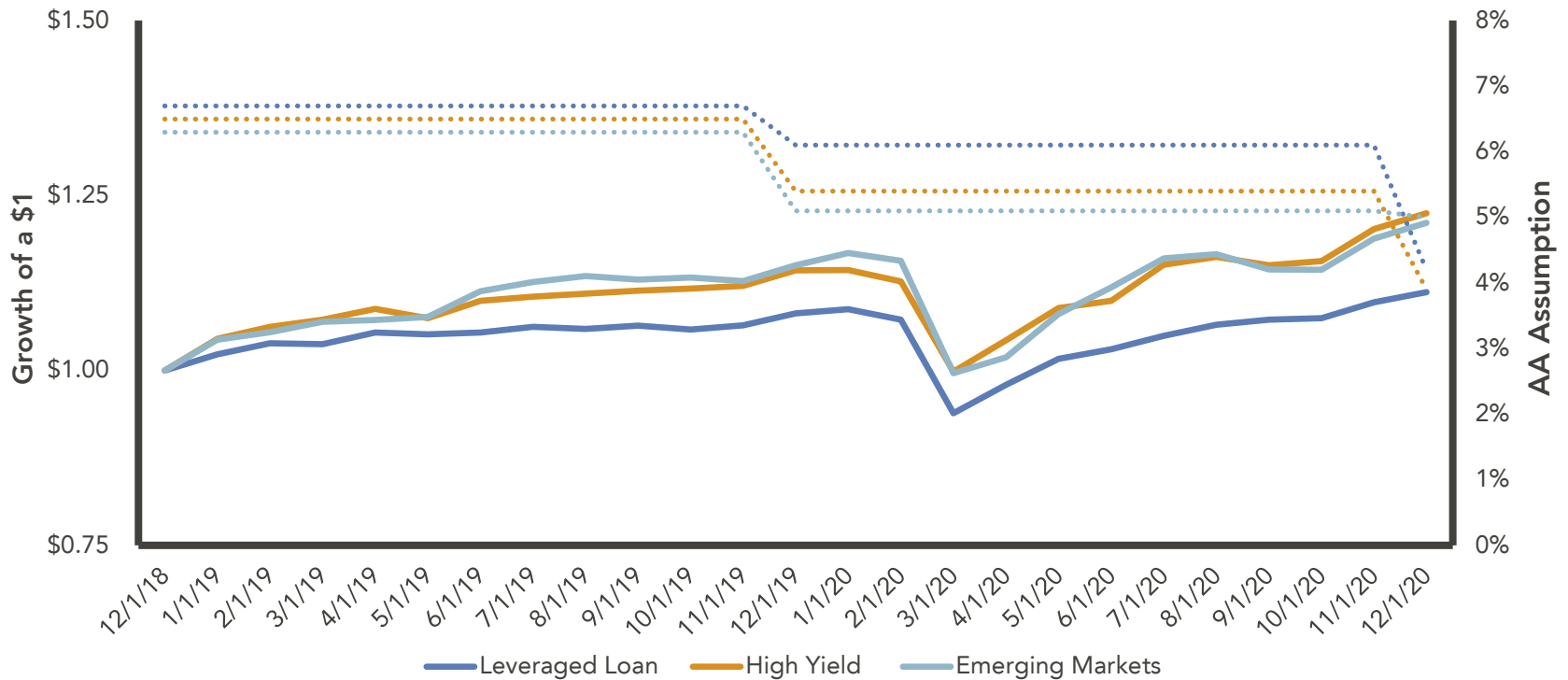
As yields have fallen and bonds have appreciated, expected returns for bonds have fallen



Dotted line represents Asset Allocation assumption; Agg is the Bbg Barclays Aggregate Index (broad fixed income) ; Int G/C is the Bbg Barclays Intermediate Government Credit Index

Fixed Income: Below Investment Grade (HY, BL, EMD)

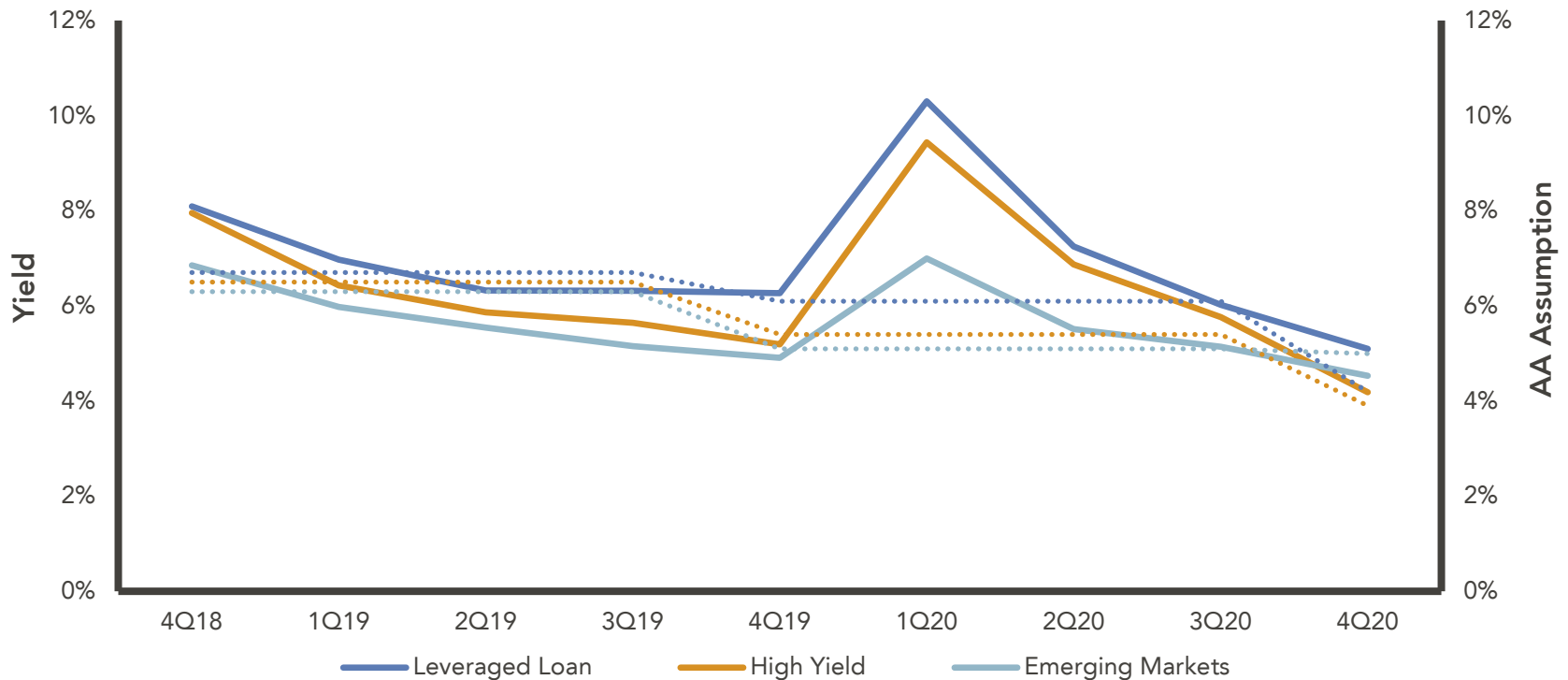
As yields/spreads have fallen and bonds have appreciated, expected returns for bonds have fallen



Dotted line represents Asset Allocation assumption

Fixed Income: Below Investment Grade (HY, BL, EMD)

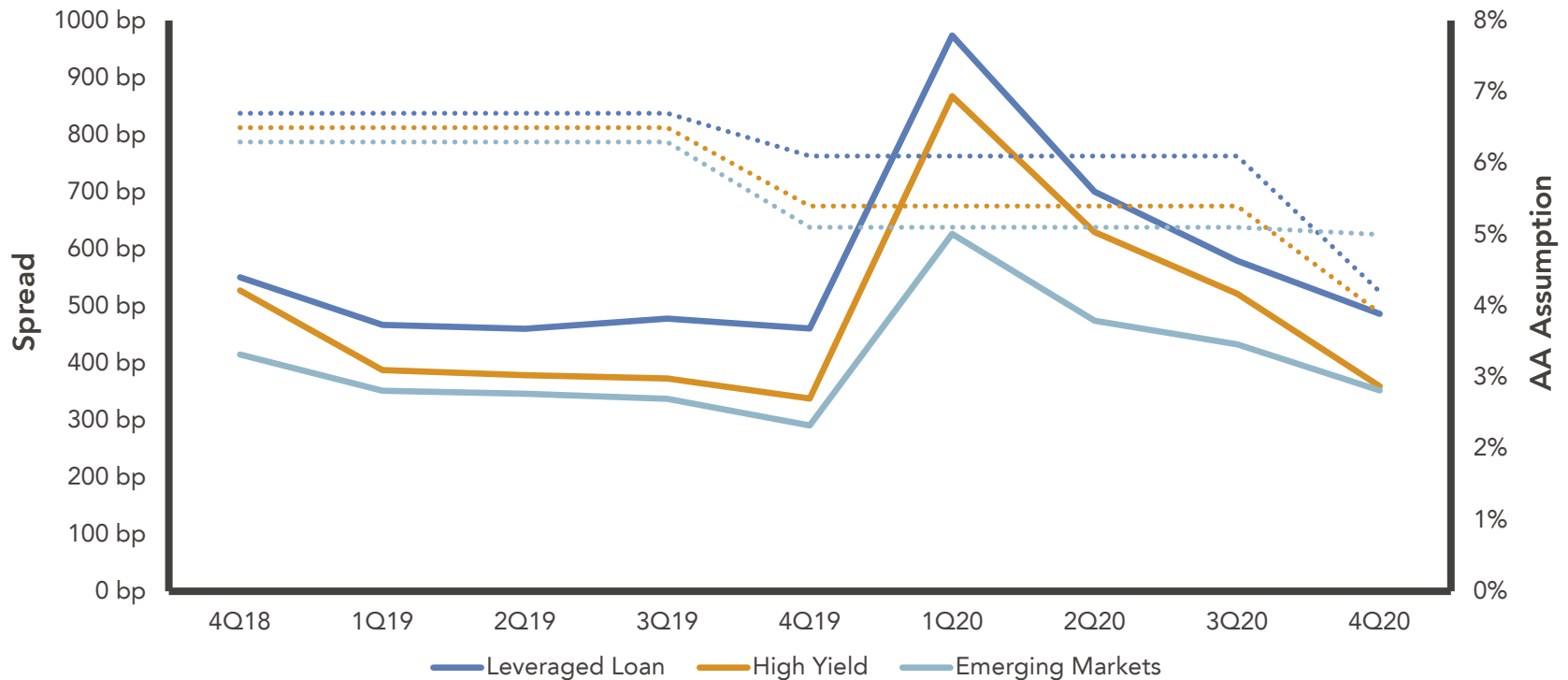
As yields/spreads have fallen and bonds have appreciated, expected returns for bonds have fallen



Dotted line represents Asset Allocation assumption

Fixed Income: Below Investment Grade (HY, BL, EMD)

As yields/spreads have fallen and bonds have appreciated, expected returns for bonds have fallen



Dotted line represents Asset Allocation assumption

U.S. Equity Trends

Valuations return to historic highs post-Nov. surge

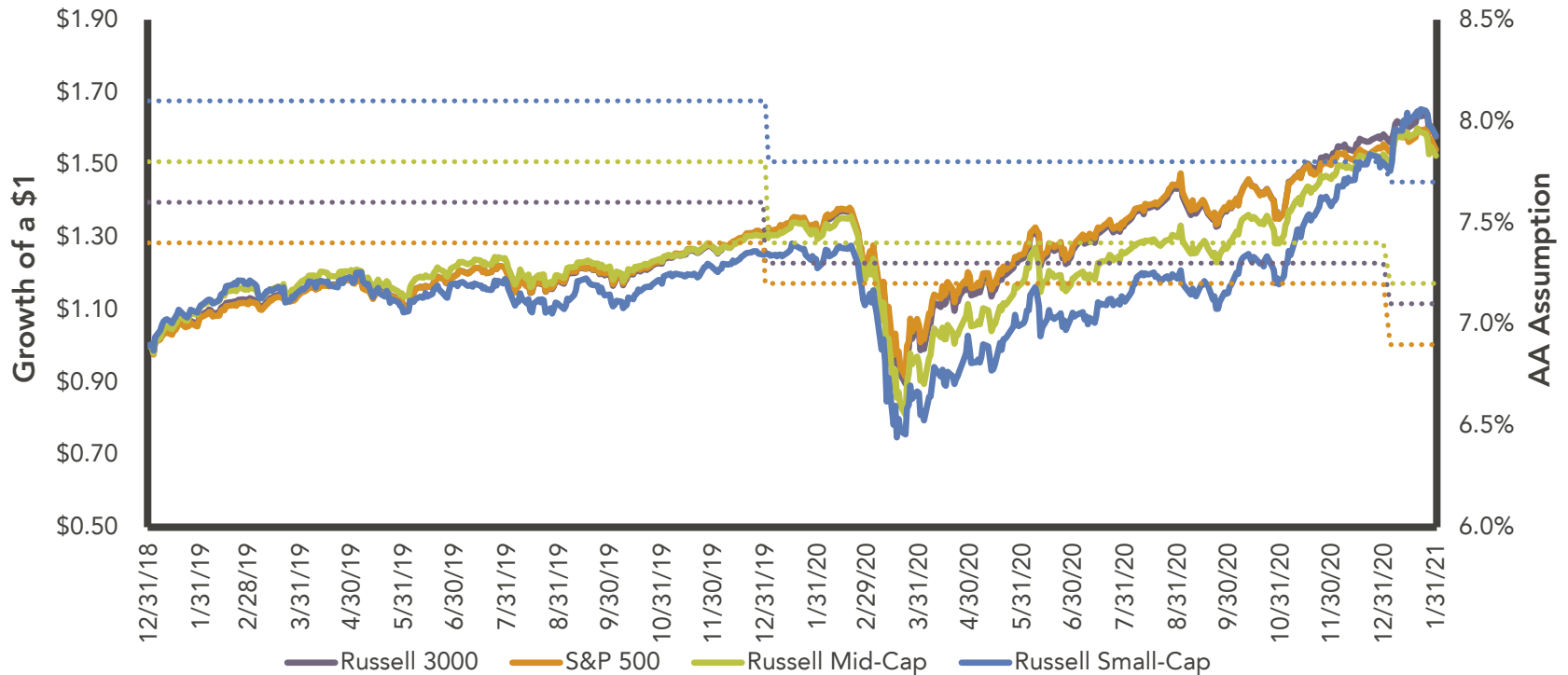
U.S. equity core index valuations as of December 31, 2020

Valuation Metrics	S&P 500		Russell 1000 (Lrg Cap)		Russell Mid Cap		Russell 2000 (Sm Cap)	
	Current	Historical Percentile (%)	Current	Historical Percentile (%)	Current	Historical Percentile (%)	Current	Historical Percentile (%)
P/E	27.4	96	27.2	99	23.2	100	20.8	91
Forward P/E	22.1	96	22.8	100	23.3	100	17.9	98
P/B	4.1	90	4.1	94	3.2	100	2.5	97
P/S	2.8	100	2.8	100	2.0	100	1.4	100
P/CF	16.2	95	16.6	97	14.7	98	15.5	85
EV/EBITDA	18.7	100	19.5	100	23.4	100	35.1	100
Average		96		98		100		95

Source: Bloomberg. TTM P/E is adjusted for negative earnings. Small-cap forward P/E is adjusted for negative earnings. Percentiles are based on data Jan. 1995 – Dec. 2020

U.S. Equities: Expected returns fall as market goes up

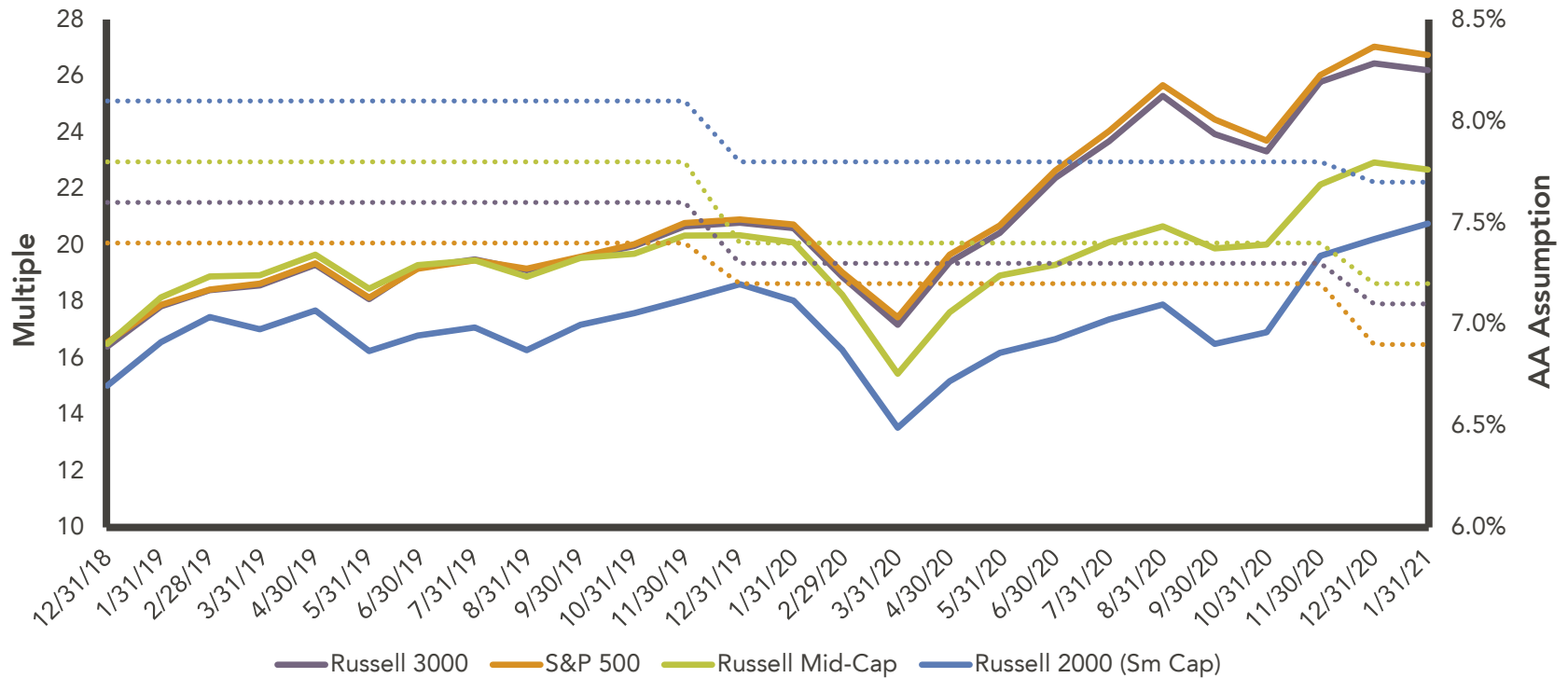
Expected returns have fallen 40-60 basis points since 12/31/2018



Dotted line represents AA assumption

U.S. Equities: Expected returns fall as market goes up

As market has become more expensive (shown here by trailing P/E), expected returns have fallen



Dotted line represents AA assumption

Non-U.S. Equity Trends

Non-U.S. equities are also expensive

Emerging Markets are equally expensive as U.S. equities and other indices are also expensive by historical standards

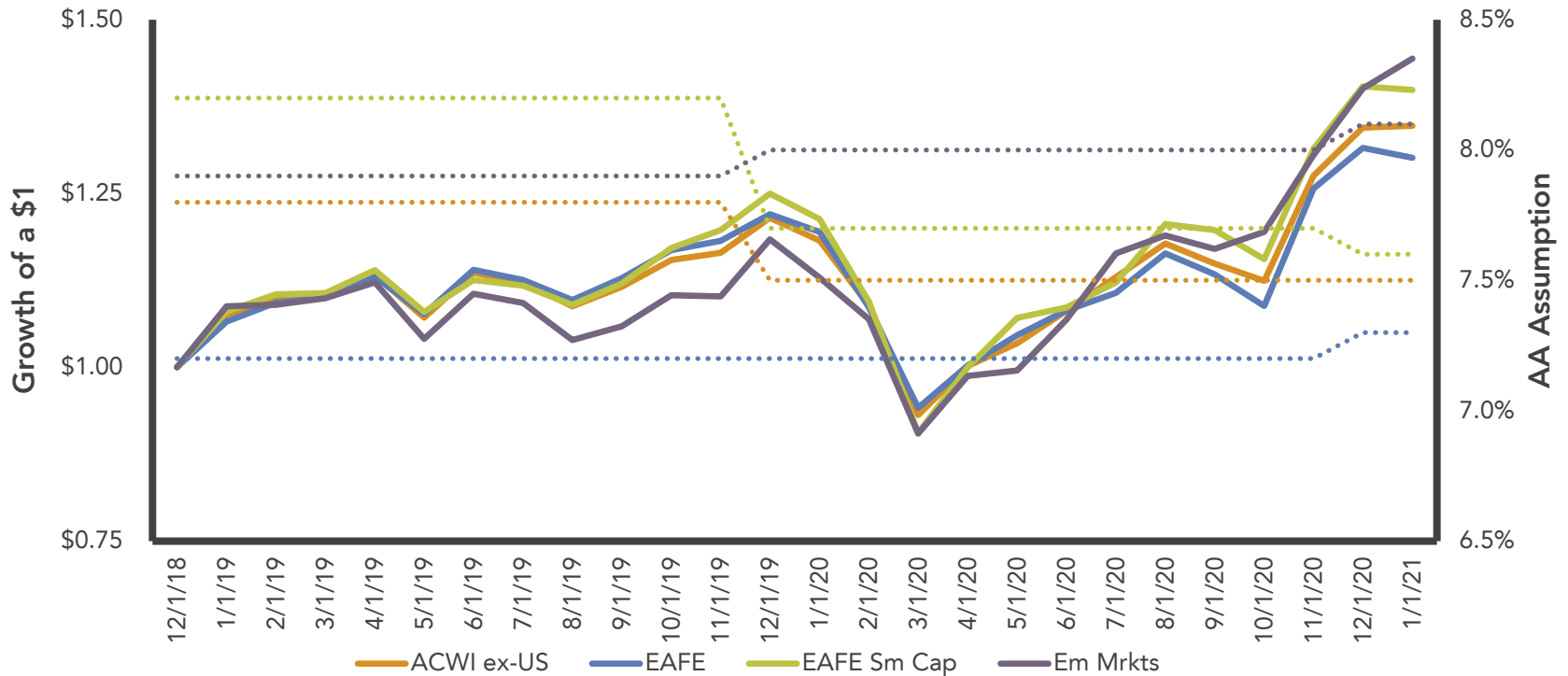
Valuation Metrics	S&P 500		MSCI EAFE		MSCI Em Mrkts		MSCI EAFE Sm Cap	
	Current	Historical Percentile (%)	Current	Historical Percentile (%)	Current	Historical Percentile (%)	Current	Historical Percentile (%)
P/E	27.5	97	23.2	96	20.4	100	20.2	100
Forward P/E	27.0	100	22.8	100	20.0	100	30.4	100
P/B	4.2	93	1.8	64	2.1	87	1.4	49
P/S	2.8	100	1.4	100	1.8	96	1.0	96
P/CF	16.2	95	7.3	25	12.5	99	10.5	68
EV/EBITDA	18.7	100	13.5	95	13.4	100	14.4	97
Average		97		80		97		85

Source: Bloomberg through December 31, 2020, as of January 8, 2021

P/E is adjusted for negative earnings; percentiles are based on data going back to 1999 except for FP/E which goes back to 2005.

Non-U.S. Equities: Changes are more varied

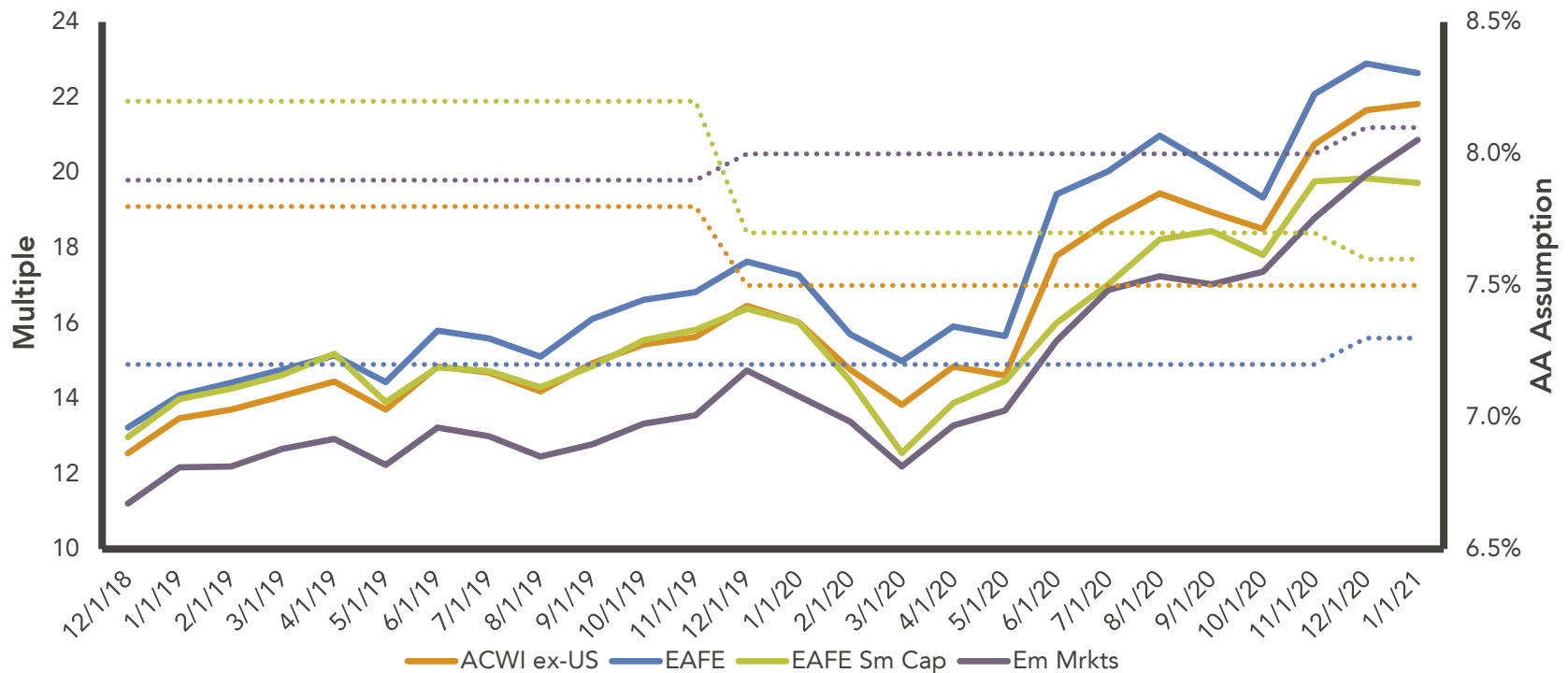
Since 12/31/18, EAFE and Emerging Markets have risen slightly (10-20 bps) while EAFE Sm Cap and broad market have fallen 30-60 bps



Dotted line represents AA assumption

Non-U.S. Equities: Changes are more varied

Trailing P/E ratios have risen while expected returns haven't moved uniformly but some returns were at a low base at 12/31/18

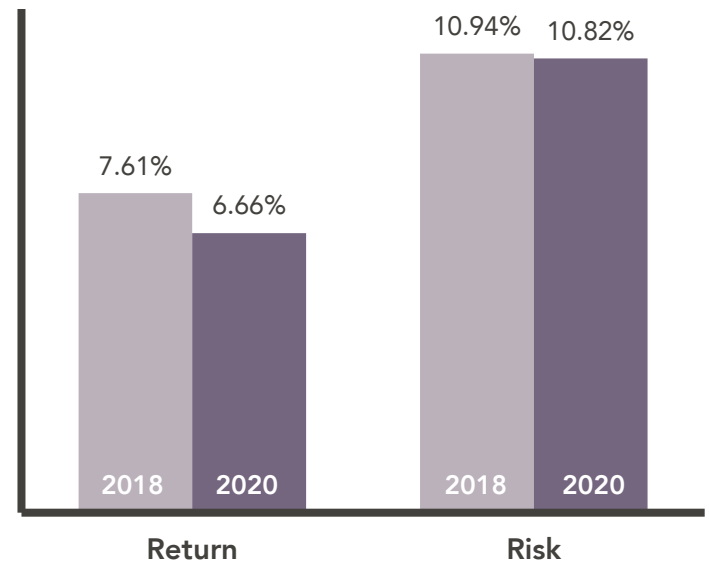
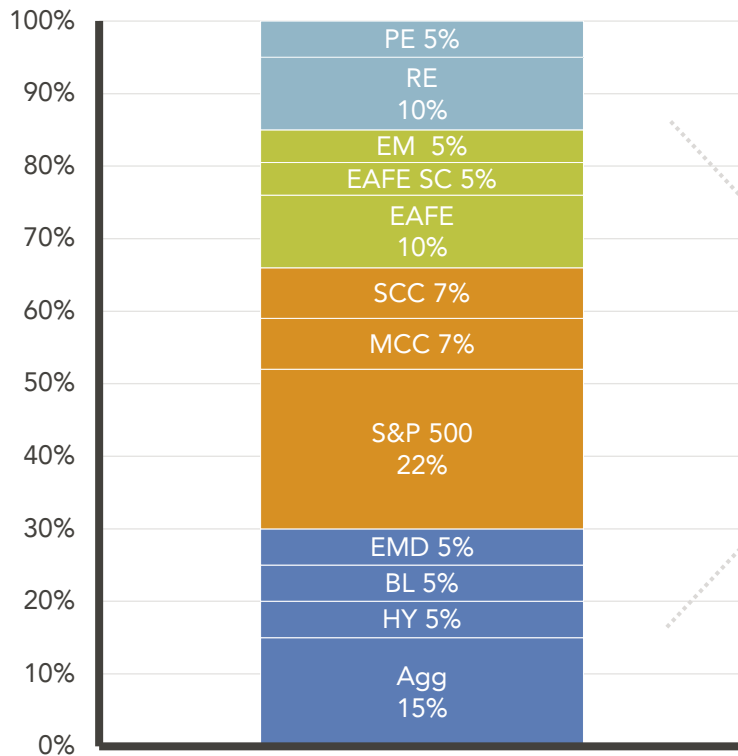


Dotted line represents AA assumption

Volatility vs. Target Rate of Return

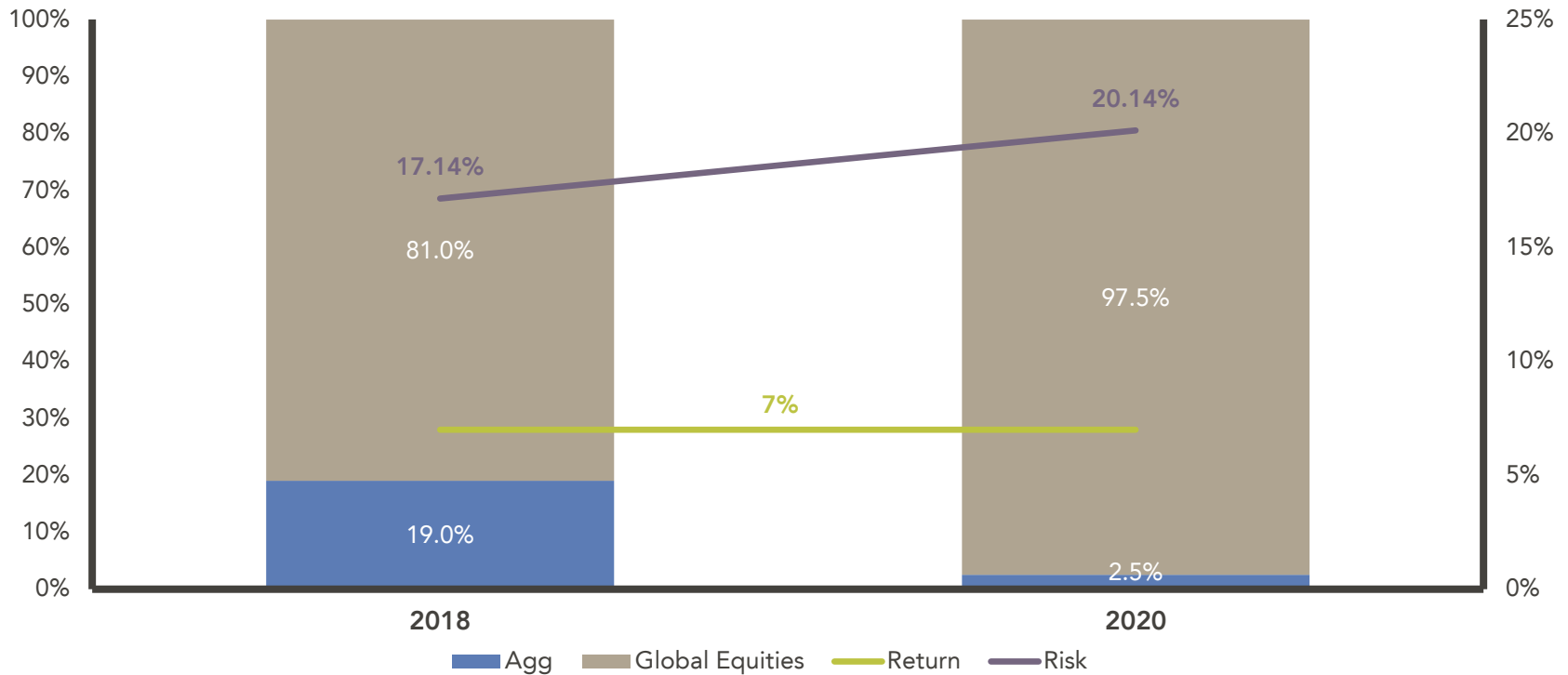
Expected returns trend lower, vol is steady

12/31/20 vs 12/31/18: the same portfolio has about the same volatility profile but expected return is 95 basis points lower



12/31/2018 vs. 12/31/20 risk and return profile

Using basic stocks and bonds, a portfolio must be allocated to **97.5% equities** to achieve a **7% target rate of return** as of 12/31/20



Expected returns: 12/31/20: Agg = 1.7%, Global Equities = 7.1%; 12/31/18: Agg = 3.3%, Global Equities = 7.6%

Conclusion

- Expected returns are lower
- Pros/cons of lowering return target
- Use of alternative asset classes
- Each client faces a unique set of circumstances

The sources of information used in this report are believed to be reliable. Marquette Associates, Inc. has not independently verified all of the information and its accuracy cannot be guaranteed. Opinions, estimates, projections and comments on financial market trends constitute our judgment and are subject to change without notice. References to specific securities are for illustrative purposes only and do not constitute recommendations. Past performance does not guarantee future results.

Marquette is an independent investment adviser registered under the Investment Advisers Act of 1940, as amended. Registration does not imply a certain level of skill or training. More information about Marquette including our investment strategies, fees and objectives can be found in our ADV Part 2, which is available upon request.

About Marquette Associates

Marquette Associates is an independent investment consulting firm that guides institutional investment programs with a focused client service approach and careful research. For more than 30 years Marquette has served this mission in close collaboration with clients – enabling institutions to be more effective investment stewards. Marquette is a completely independent and 100% employee-owned consultancy founded with the sole purpose of advising institutions. For more information, please visit www.marquetteassociates.com.

Pennsylvania Municipal Retirement System:

Active vs. Passive Education

Presented by

Nat Kellogg, CFA



What exactly is active & passive management?

	Active Management	Passive Management
Objective	Outperform the relevant index on an absolute or risk-adjusted basis	Match the return of the relevant index (a.k.a benchmark)
Return	Driven by Individual Securities	Equal to the index
Risk	Target less than the relevant benchmark	Equal to the index
Approach	Stock-picking through either a top-down or bottom-up approach	Rules-Based through replication or sampling
Decision Makers	Portfolio Managers and Analysts	Index Provider or Committee
Portfolio Construction	Conviction-Weighted	Market-Cap Weighted
Cost	Higher	Lower

Key criteria for an index

Terms “benchmark” and “index” are often used interchangeably when discussing active vs. passive management



Replicable and investable – investors should be able to invest in and closely replicate the performance of a given index






Representative of the investment universe – a well constructed index will approximate the characteristics and performance of the market it is meant to represent



Maintained – an index must be maintained to address changes to the companies in the index (mergers, acquisitions, bankruptcies)

Examples of widely followed indices

	S&P 500	Russell 3000	Russell 2000	MSCI EAFE	MSCI ACWI
Representative Market	U.S. Large-Cap Stocks	All U.S. Stocks	U.S. Small-Cap Stocks	Developed World Non-U.S. Large-Cap Stocks	All Large-Cap Global Stocks
Geography	United States	United States	United States	Non-U.S.	Global
Market Value	\$34 Trillion	\$43 Trillion	\$3.4 Trillion	\$16 Trillion	\$69 Trillion
Holdings	505	3,041	2,028	874	2,964
Methodology	Cap-weighted	Cap-weighted	Cap-weighted	Cap-weighted	Cap-weighted
Index Provider	S&P Dow Jones Indices <small>A Division of S&P Global</small>				

Source: Bloomberg. Data as of February 28, 2021.

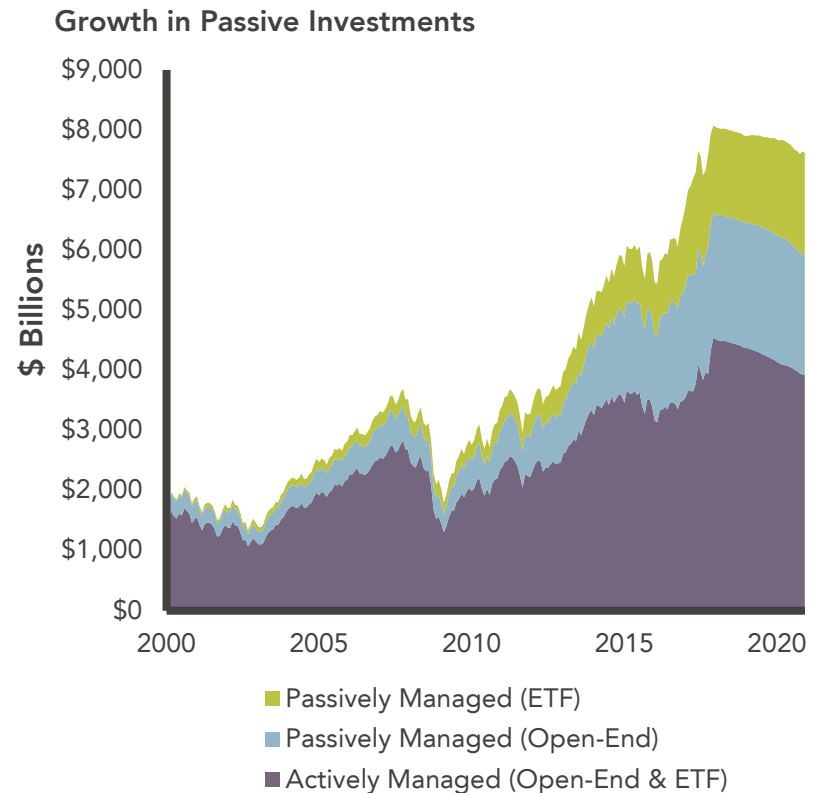
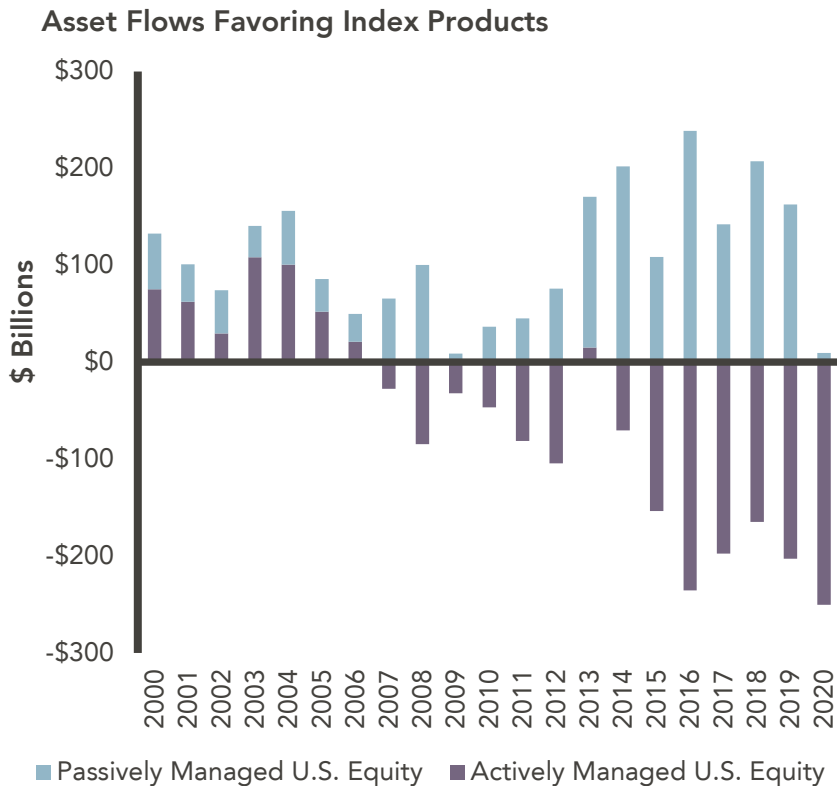
Active and passive management styles in practice

S&P 500	S&P 500 Weight (%)	Active Manager Weight (%)	Passive Manager Weight (%)
1. Apple	6.68	0.00	6.68
2. Microsoft	5.29	7.30	5.30
3. Amazon.com, Inc.	4.37	6.38	4.38
4. Facebook A	2.07	2.86	2.07
5. Tesla, Inc	1.68	0.00	1.69
6. Alphabet A	1.66	1.51	1.66
7. Alphabet C	1.60	5.55	1.60
8. Berkshire Hathaway B	1.42	0.00	1.40
9. Johnson & Johnson	1.30	0.00	1.31
10. JPMorgan Chase & Co.	1.22	0.00	1.22

Source: Factset, data as of December 31, 2020; SPY ETF used as a proxy for the S&P 500

Passive management gaining in popularity

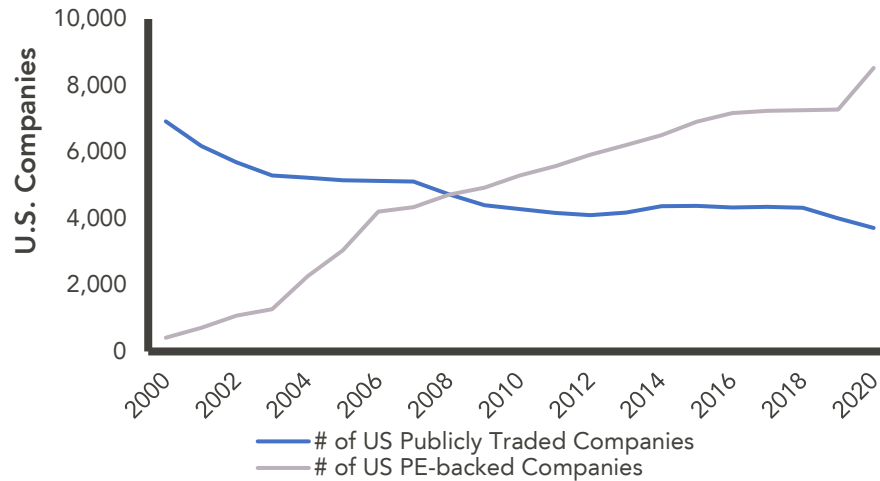
Passive management is widely used by institutional investors



Source: Morningstar as of December 31, 2020

Markets have become more efficient over time

↳ Fewer IPOs



↳ Access to information

Bloomberg

FACTSET

↳ More regulation



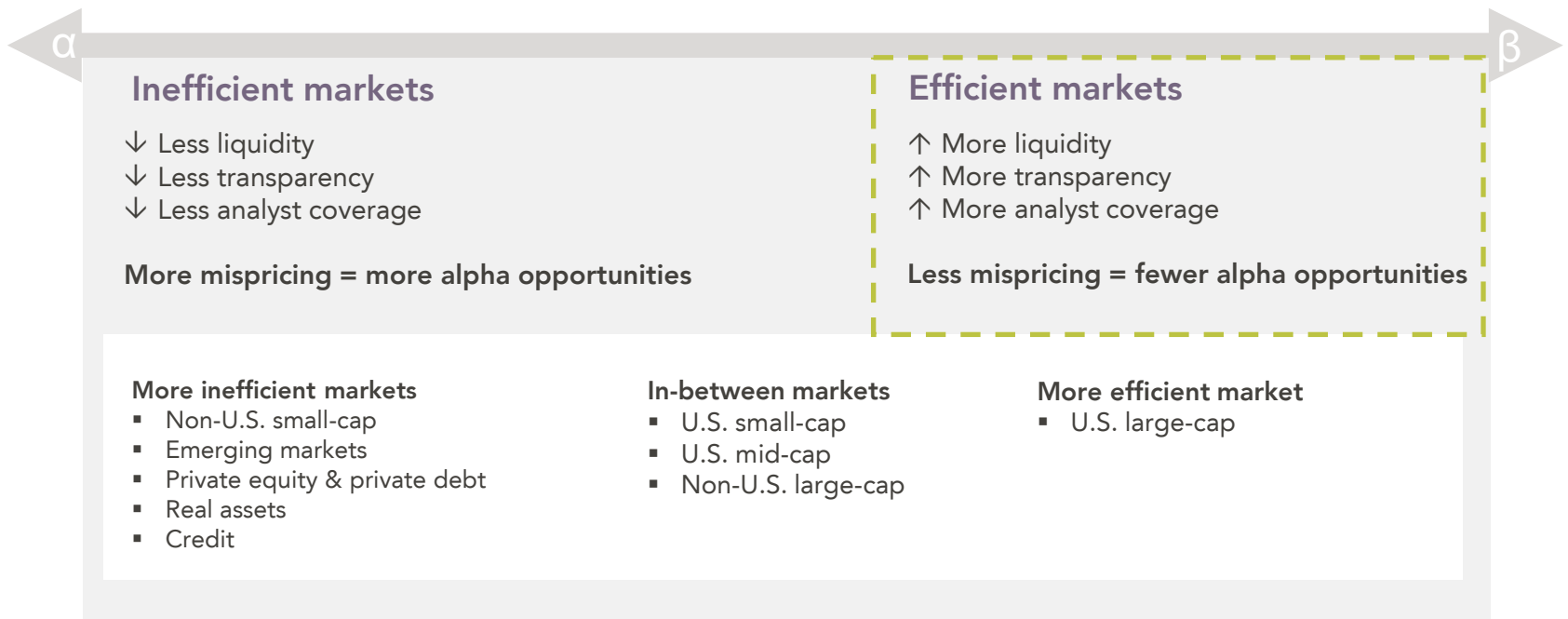
↳ High frequency trading



Chart sources: Worldbank and Pitchbook as of December 31, 2020

Inefficient & efficient markets

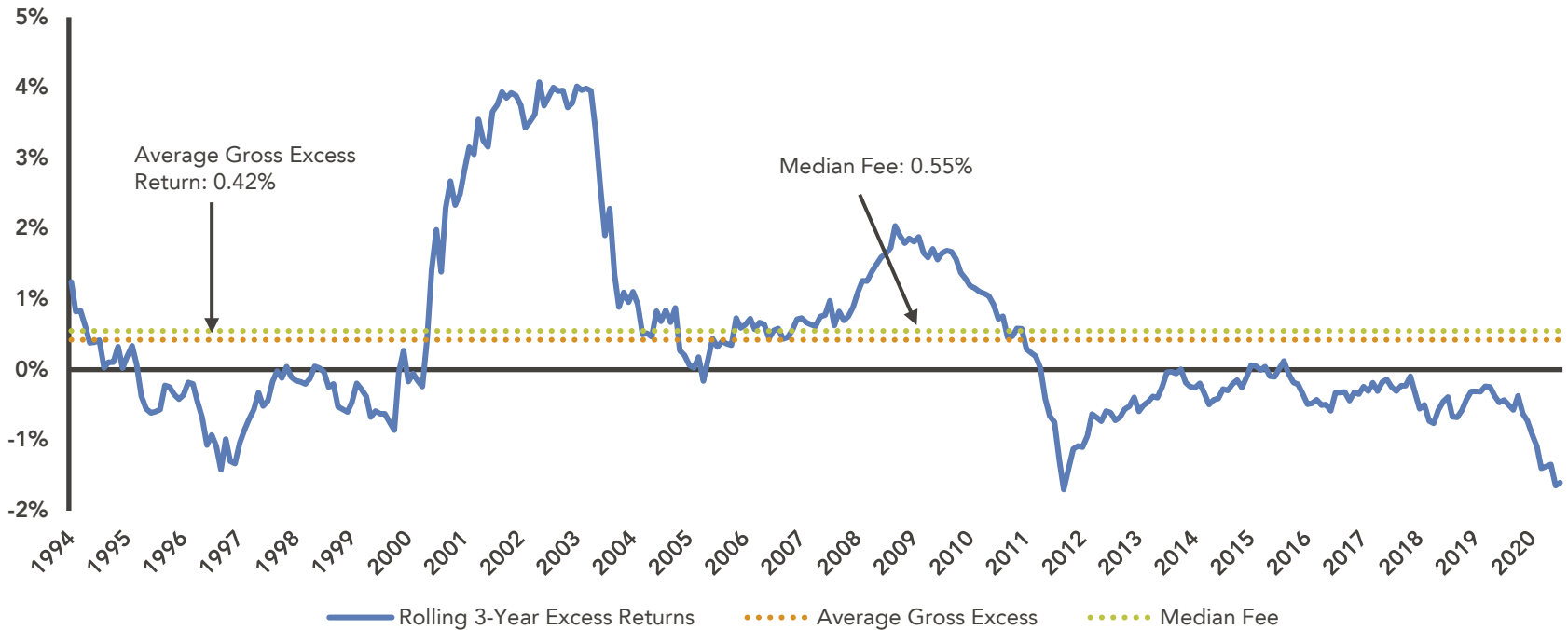
Market efficiency measures the degree to which market prices reflect all available and relevant information, allowing investors to measure and strategically maximize the impact of active and passive management



Rolling 3-Year excess returns over Russell 1000

Based on median performance over the past 20+ years, the median large-cap manager has slightly underperformed the benchmark, net of fees

▣ eVestment U.S. Large-Cap Core Equity



Source: eVestment, data through December 31, 2020

Efficient markets: U.S. Large cap

Median Portfolio vs. Benchmark

Based-off median performance, Large Cap active managers have had difficulty beating the index over the past 10 Years

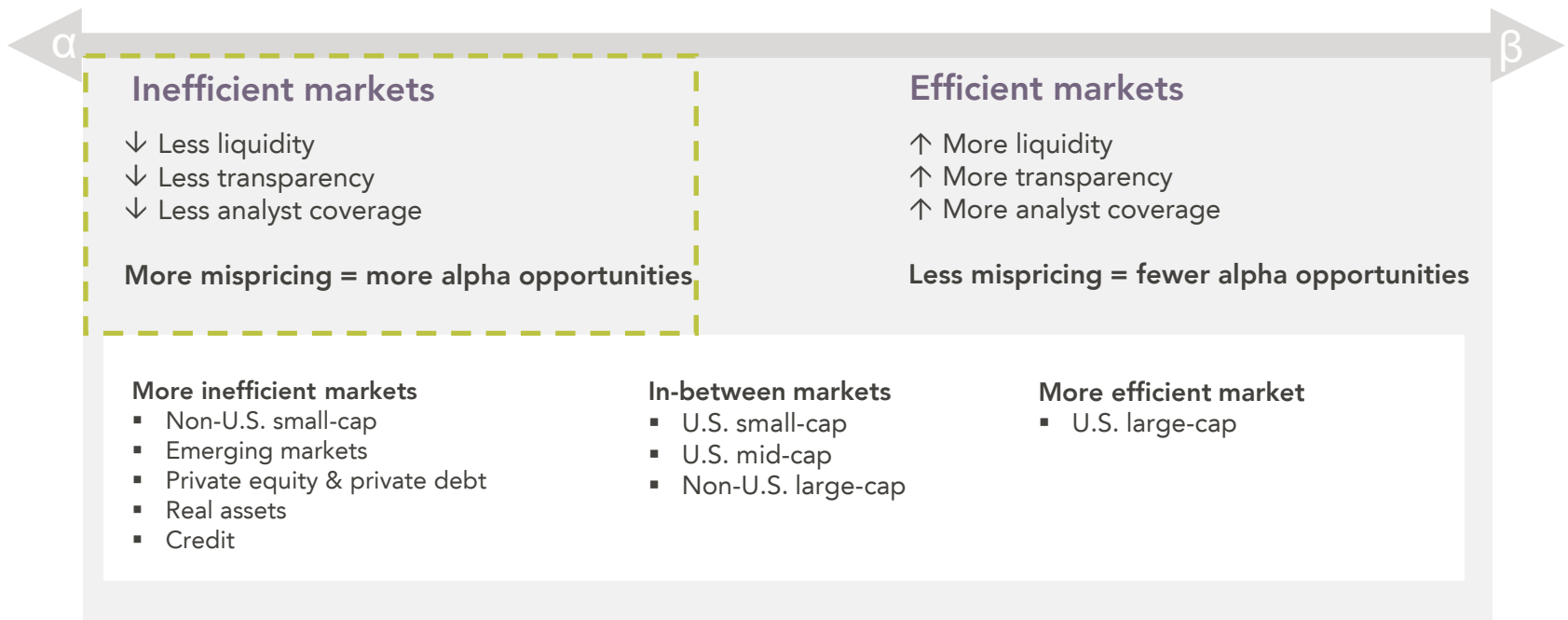
	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	Avg. Annual Excess Return
Large Cap Core US Equity	14.2%	29.1%	-5.6%	21.3%	9.7%	0.8%	12.3%	31.9%	14.3%	1.3%	-1.7%
Russell 1000 Index	21.0%	31.4%	-4.8%	21.7%	12.1%	0.9%	13.2%	33.1%	16.4%	1.5%	---
Large Cap Growth US Equity	34.1%	33.3%	-1.2%	28.8%	3.4%	4.7%	11.0%	34.4%	15.4%	-0.8%	-1.8%
Russell 1000 Growth Index	38.5%	36.4%	-1.5%	30.2%	7.1%	5.7%	13.1%	33.5%	15.3%	2.6%	---
Large Cap Value US Equity	3.6%	26.2%	-8.9%	16.6%	14.0%	-3.0%	11.4%	33.1%	15.1%	0.1%	-0.4%
Russell 1000 Value Index	2.8%	26.5%	-8.3%	13.7%	17.3%	-3.8%	13.5%	32.5%	17.5%	0.4%	---

	Qtr	1 Year	3 Year	5 Year	7 Year	10 Year
Large Cap Core US Equity	11.8%	14.2%	11.7%	13.4%	11.3%	12.7%
Russell 1000 Index	13.7%	21.0%	14.8%	15.6%	13.0%	14.0%
Large Cap Growth US Equity	11.4%	34.1%	21.2%	18.7%	15.7%	15.6%
Russell 1000 Growth Index	11.4%	38.5%	23.0%	21.0%	17.5%	17.2%
Large Cap Value US Equity	15.8%	3.6%	6.0%	9.8%	8.1%	10.4%
Russell 1000 Value Index	16.3%	2.8%	6.1%	9.7%	8.2%	10.5%

Note: Median manager and peer rankings from eVestment manager database. Performance as of 12/31/20 and is net of investment management fees.

Inefficient & efficient markets

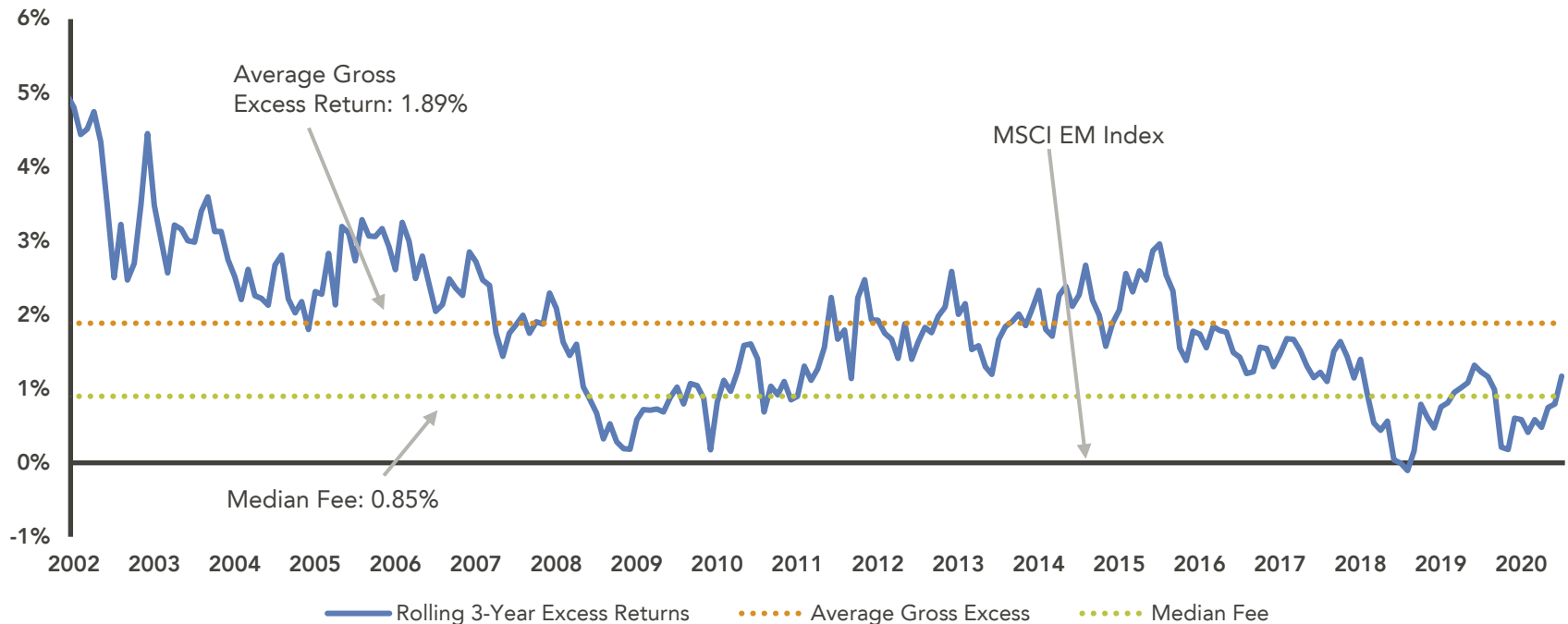
Market efficiency measures the degree to which market prices reflect all available and relevant information, allowing investors to measure and strategically maximize the impact of active and passive management



Rolling 3-Year excess returns over MSCI EM

Based-off median performance over the past 15+ years, the median EM equity manager has outperformed the benchmark once we account for fees

▣ eVestment EM All-Cap Equity



Source: eVestment, data as of December 31, 2020

Less efficient areas: Emerging Markets

Median Portfolio vs. Benchmark

Based-off median performance, emerging markets active managers have had success beating the index over the past 10 Years

	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	Avg. Annual Excess Return
Emerging Markets Equity	18.7%	21.5%	-15.8%	37.1%	8.7%	-12.9%	-1.2%	0.5%	19.5%	-18.6%	0.68%
MSCI EM	18.3%	18.4%	-14.6%	37.3%	11.2%	-14.9%	-2.2%	-2.6%	18.2%	-18.4%	---

	Qtr	1 Year	3 Year	5 Year	7 Year	10 Year
Emerging Markets Equity	20.0%	18.7%	6.9%	13.2%	6.6%	4.3%
MSCI EM	19.7%	18.3%	6.2%	12.8%	6.2%	3.6%

Note: Median manager and peer rankings from eVestment manager database. Performance as of December 31, 2020 and is net of investment management fees.

Active management

Potential Advantages

- Potential for outperformance relative to index
- Ability to customize portfolio to client needs
- Managers can hold cash or less risky securities that potentially provide better downside protection than the index
- Access to any asset class

Potential Disadvantages

- Higher fees and operating expenses
- Managers can underperform and make mistakes – manager selection and ongoing monitoring is key
- Active strategies can deviate from intended market exposures over time

Passive management

Advantages

- Lower fees
- Market performance – passive funds will approximate the index
- Easier to model out the expected return and risk when performing asset allocation studies

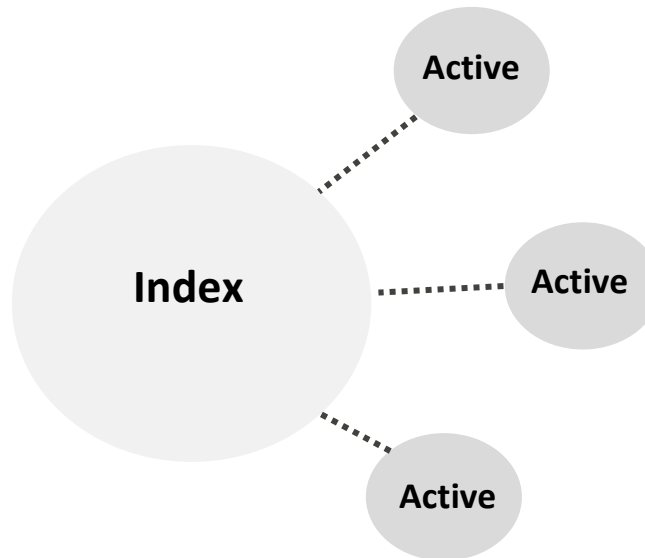
Disadvantages

- Investors can only achieve market returns
- Index fund managers are usually prohibited from using defensive measures so in periods of downturns, experience the full return downside of index
- Not all asset class can be easily and efficiently replicated with passive strategies

Marquette's approach: Core and Satellite

A complementary approach to portfolio construction which minimizes cost and can generate relative outperformance

- **Core Investment:** a passive investment in an index (such as the S&P 500) which represents the largest portion of the portfolio
- **Satellite Investments:** numerous smaller allocations to skilled investment managers which, in aggregate, provides the opportunity to outperform the broad market and creates a holistic approach to portfolio management.



Disclosures

The sources of information used in this report are believed to be reliable. Marquette Associates, Inc. has not independently verified all of the information and its accuracy cannot be guaranteed. Opinions, estimates, projections and comments on financial market trends constitute our judgment and are subject to change without notice. References to specific securities are for illustrative purposes only and do not constitute recommendations. Past performance does not guarantee future results.

About Marquette Associates

Marquette Associates is an independent investment consulting firm that guides institutional investment programs with a focused client service approach and careful research. For over 30 years Marquette has served this mission in close collaboration with clients – enabling institutions to be more effective investment stewards. Marquette is a completely independent and 100% employee-owned consultancy founded with the sole purpose of advising institutions. For more information, please visit www.marquetteassociates.com.

Pennsylvania Municipal Retirement System:

Fixed Income

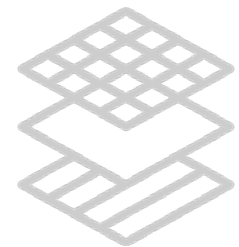


Presented by

Ben Mohr, CFA
Director of Fixed Income,
Managing Partner

Table of Contents

- Introductions
- Marquette: Fixed income framework
- C.S. McKee: Opportunities in investment grade
- Shenkman: Investing in below-investment grade
- Appendix



Introductions

Ben Mohr, CFA

- Director of Fixed Income, Managing Partner, Marquette
- 22 years of experience
- Vice Chair of Traditional Investment Manager Search Committee
- Focus: Assisting clients with fixed income strategic and tactical management, asset allocation, manager due diligence/selection
- MBA – University of Chicago Booth School of Business
- BS – Caltech

Brian Allen, CFA, CMT

- Sr. Vice President, Portfolio Manager, C.S. McKee
- 35 years of experience
- Focus: Core Bonds, Securitized Bonds, RMBS, CMBS, ABS, TIPS
- MBA - Wharton School, University of Pennsylvania
- BBA – James Madison University

Justin Slatky

- Chief Investment Officer and Sr. Portfolio Manager, Shenkman
- 22 years of experience
- Focus: Multi-Sector Credit, High Yield Bonds, Bank Loans, Convertible Bonds, Stressed Credit
- MBA - Wharton School, University of Pennsylvania
- BBA – University of Pennsylvania

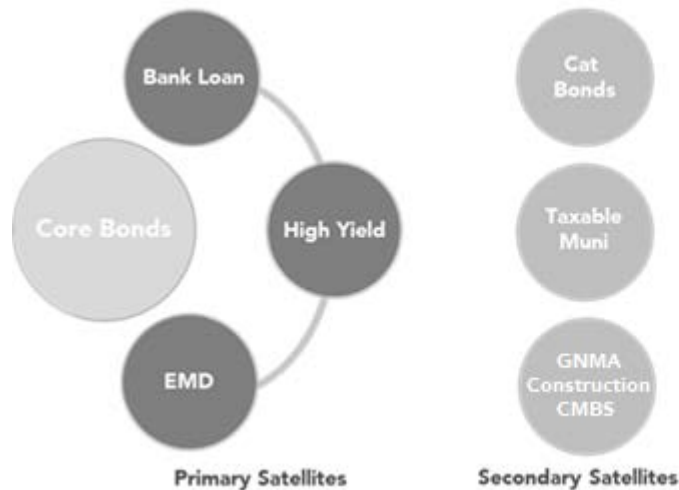
Marquette: Fixed Income Framework

Marquette's fixed income framework

What we expect from fixed income

- Income
- Diversification
- Stability & principal protection

How we build a fixed income portfolio

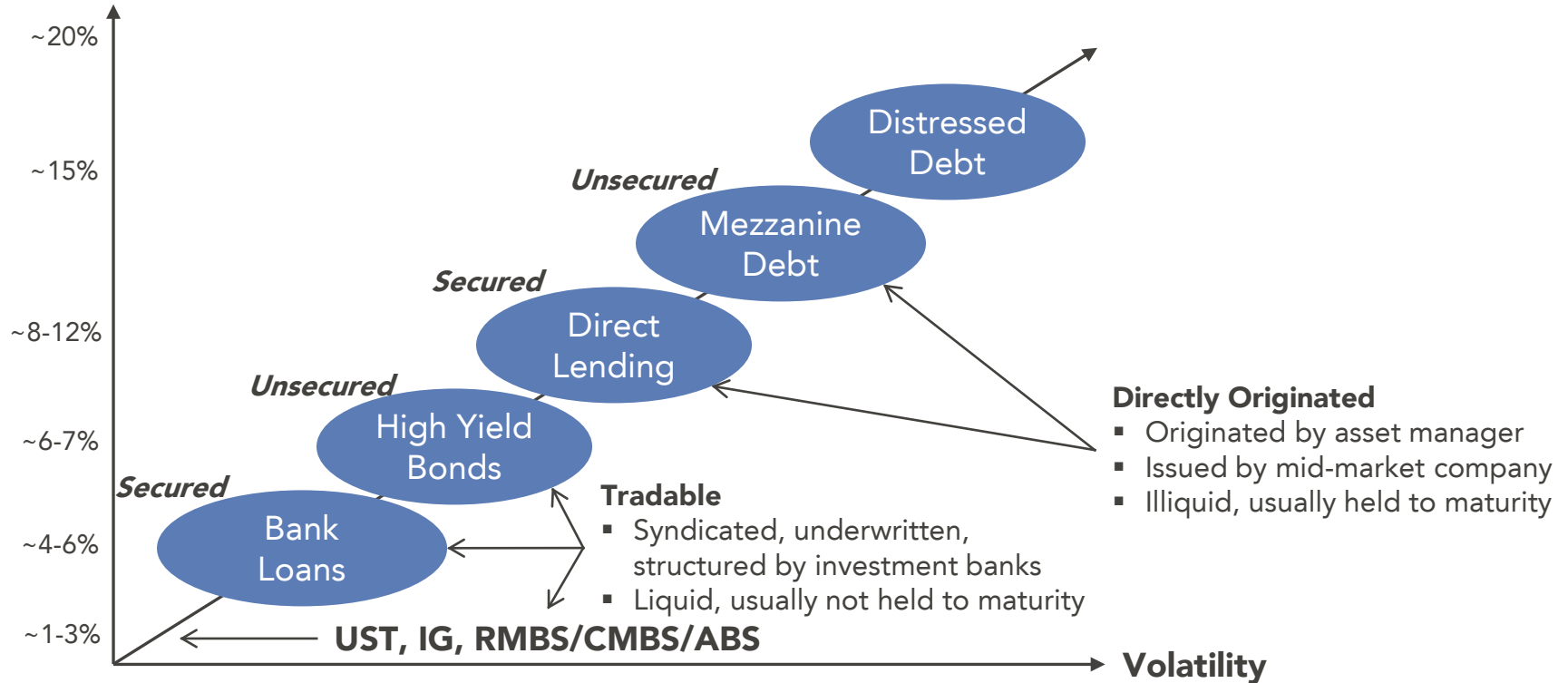


- Core fixed income for principal protection
- Satellites for added income & diversification to optimize Sharpe ratio
- Improves transparency and isolates risk
- Market environment drives portfolio tilts

Additional secondary satellites may include private credit (direct lending), mezzanine debt and distressed debt, which are credit risk/return sources as an extension of bank loans and high yield, but include privately-originated and illiquidity risk premia

Fixed income spectrum

Historical Returns

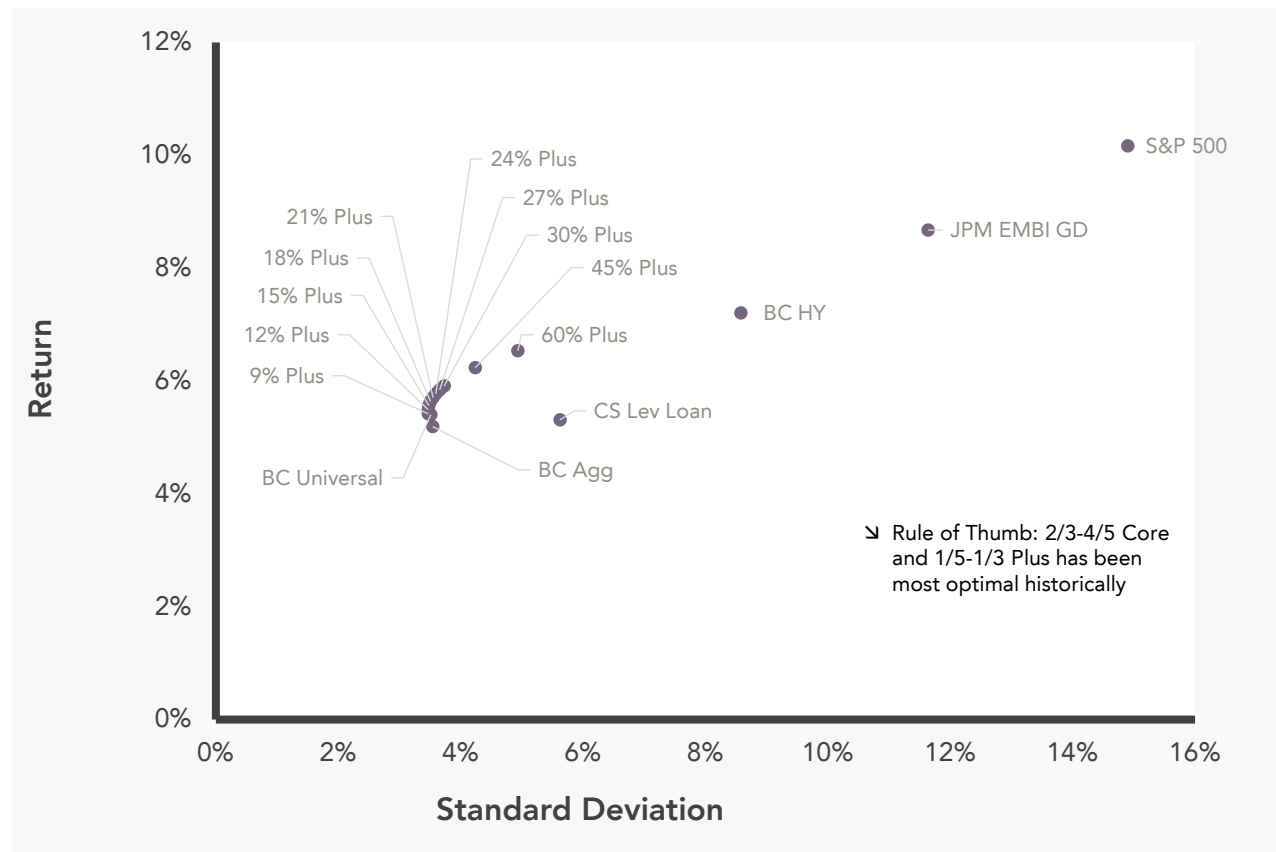


Other plus sector satellites EMD, cat bonds, taxable munis, GNMA construction
 CMBS provide risk/return profile like that of bank loans and high yield bonds

Fixed income and the efficient frontier

Marquette tracks monthly

Optimal Historical Portfolio (Core and % Plus Sectors)

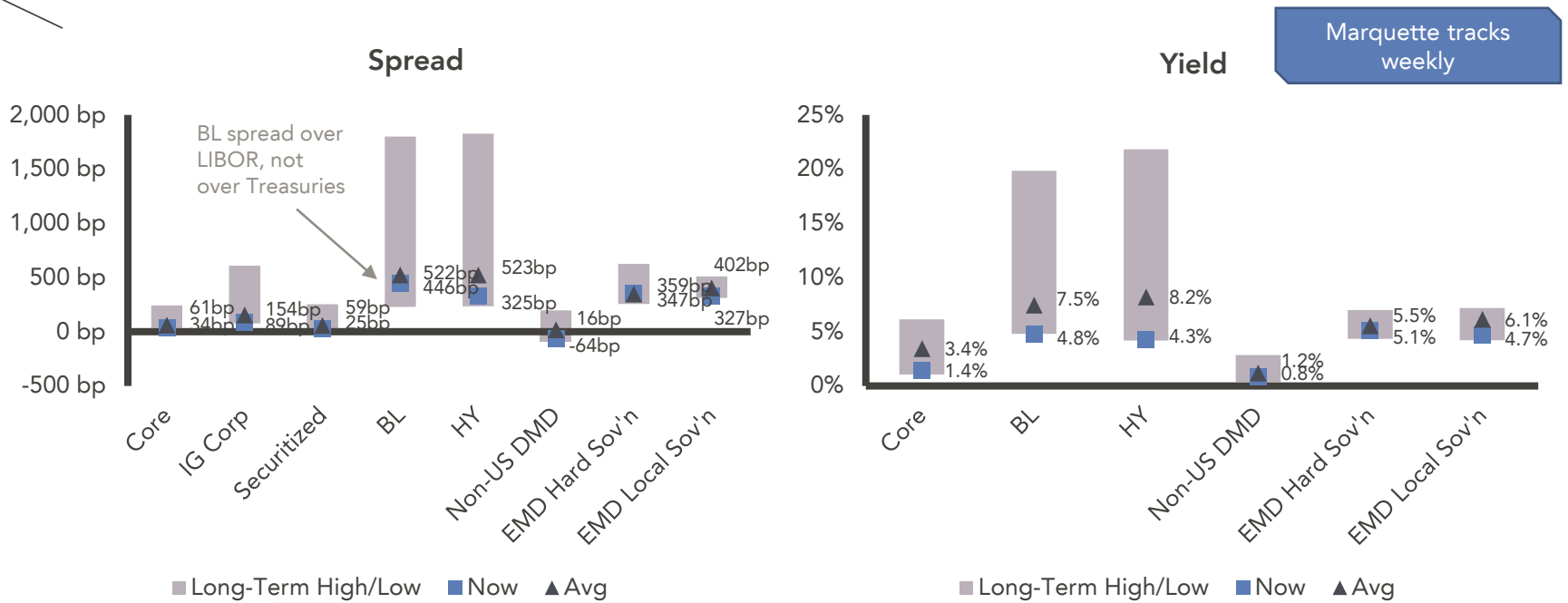


	Sharpe Ratio 1/1994- 2/2021
9% Plus	0.89
12% Plus	0.91
15% Plus	0.93
18% Plus	0.94
21% Plus	0.95
24% Plus	0.95
27% Plus	0.96
30% Plus	0.96
45% Plus	0.92
60% Plus	0.85
BC Universal	0.87
BC Agg	0.80
CS Lev Loan	0.53
BC HY	0.57
JPM EMBI GD	0.54
S&P 500	0.53

Source: eVestment monthly data January 1994 – February 2021

Note: Plus sectors BL/HY/EMD have equal weight for all portfolios, all portfolios rebalanced annually

Marquette tracks weekly trim/addback spread levels



Spread Entry/Exit Points as of February 28, 2021

	Current Spreads	Entry Point	Addback Levels	Trim Levels	Exit Point
BL	446bp	525bp	525bp 575bp 625bp	488bp 469bp 450bp	450bp
HY	325bp	500bp	500bp 575bp 650bp	400bp 375bp 350bp	350bp
EMD	359bp	325bp	325bp 350bp 375bp	300bp 288bp 275bp	275bp

Source: Bloomberg Barclays, Credit Suisse, Deutsche, JPMorgan, as of February 28, 2021

Note: Long-term high, low and average based on longest available data for each index. Entry/exit points based on backtests yielding most optimal tactical approach that outperforms static approach and entire history of each respective index with spread levels producing most optimal historical go-forward returns

Scenario analysis based on rate/spread shifts

Marquette tracks monthly

Scenario Analysis

	Duration Constrained	Duration Unconstrained
	Core + 13% Long UST + 30% Plus	Core + 30% Plus
Weighted Duration	6.3	5.5
1 Year Expected Total Return		
Steady State	2.5%	2.4%
1 Year Expected Total Return (Yield + Price Change)		
Interest Rate Shift		
-50 basis points parallel	6.0%	5.6%
-25 basis points parallel	4.2%	4.0%
+25 basis points parallel	0.8%	0.9%
+50 basis points parallel	-0.8%	-0.6%
Spread Shift		
-50bp IG OAS & -250bp HY OAS	6.4%	6.7%
-25bp IG OAS & -125bp HY OAS	4.4%	4.5%
+250bp IG OAS & +125bp HY OAS	0.7%	0.4%
+50bp IG OAS & +250bp HY OAS	-1.1%	-1.5%
Equal-Weight Average Portfolio Total Return	2.6%	2.5%

- By constraining the duration of the portfolio to that of the Agg, the returns vary more based on interest rate shifts. Vice versa for duration unconstrained portfolios, where the returns vary more based on spread shifts.

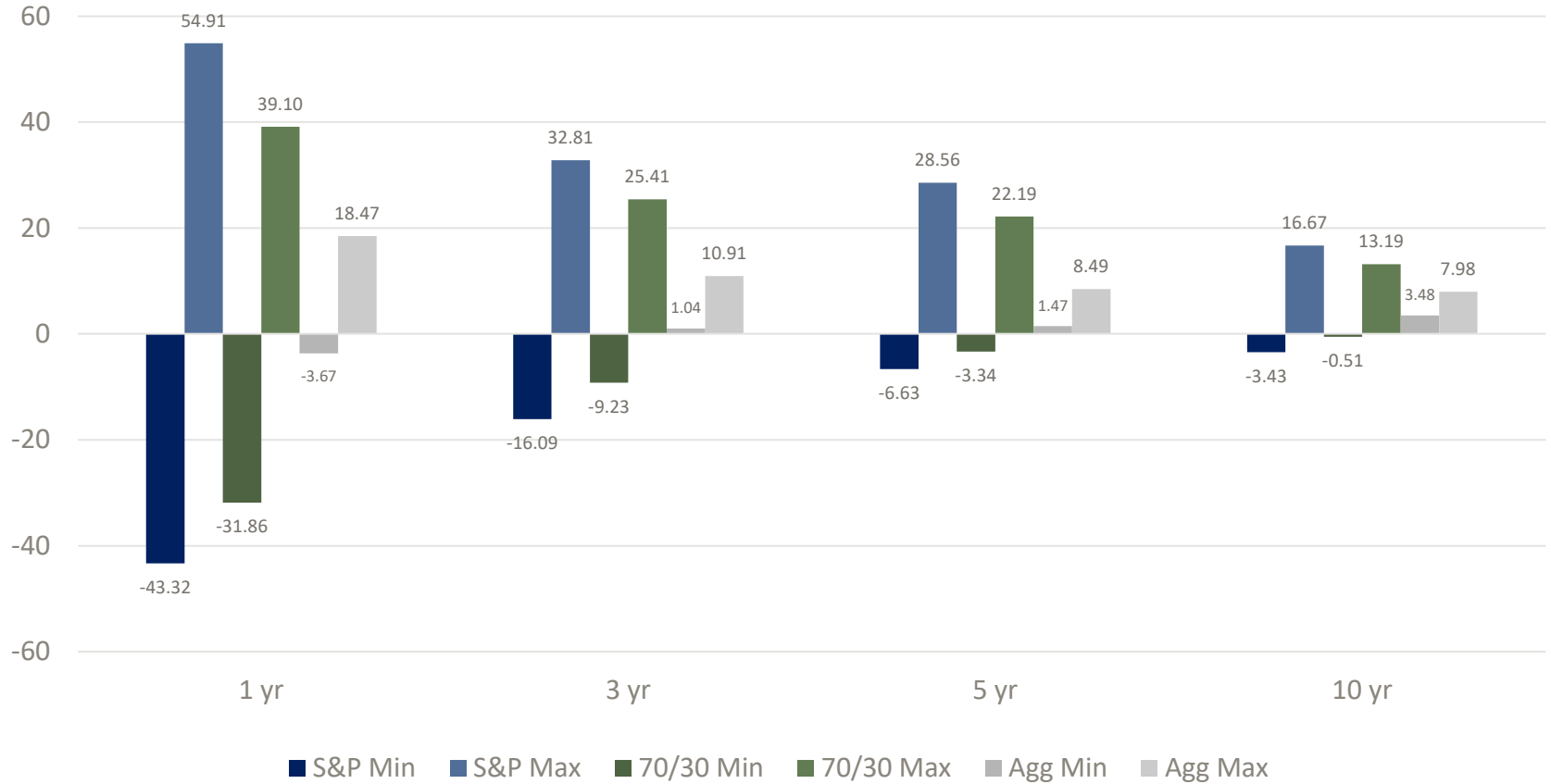
Source: Bloomberg PORT as of February 2021

Note: Duration constrained includes UST ballast to bring overall duration to same as Agg's, plus sectors BL/HY/EMD have equal weight for all portfolios

C.S. McKee

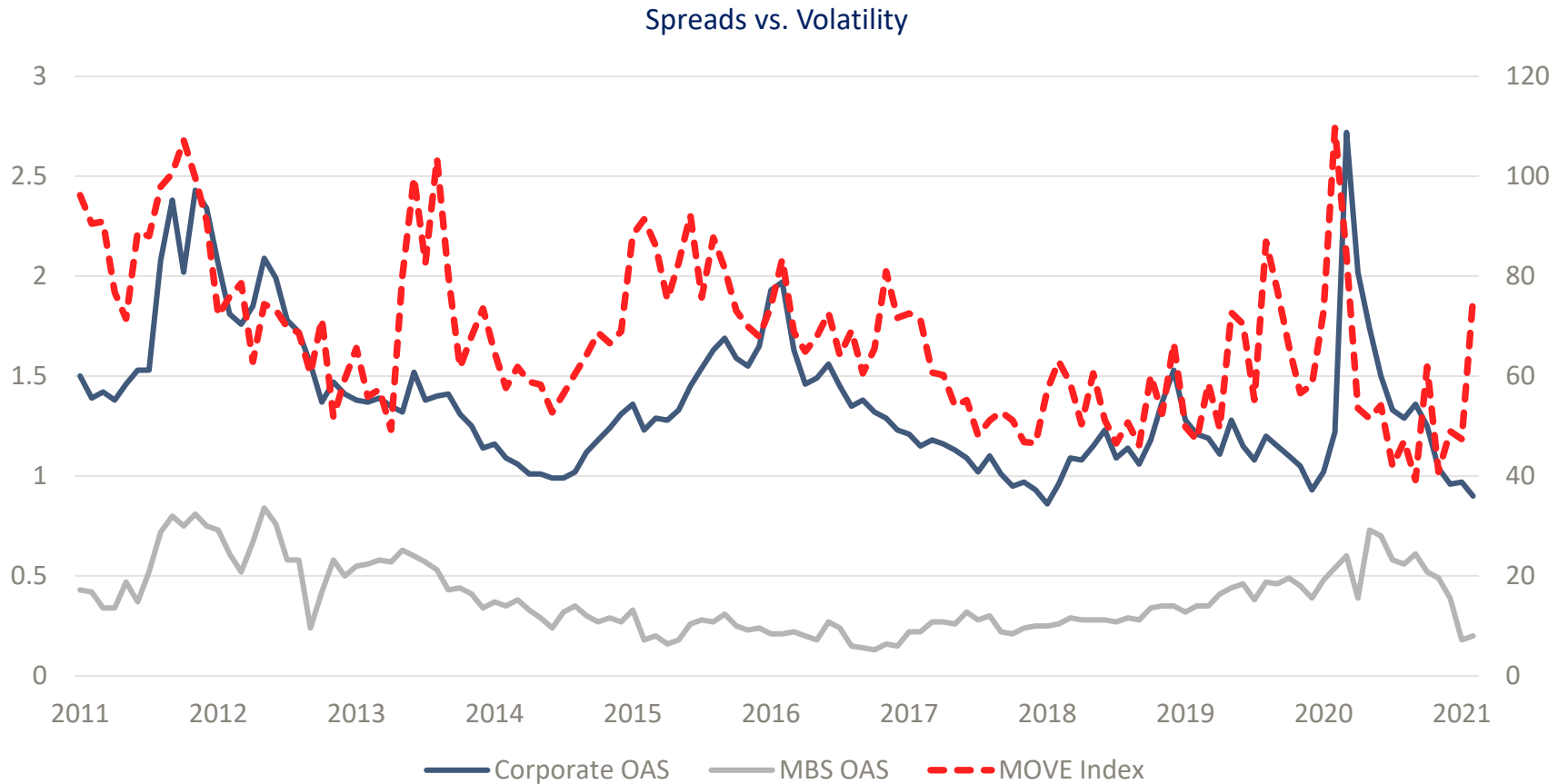
Diversification Benefits of Core Fixed Income

Dispersion of Rolling Returns – past 30 years



Source: Bloomberg, CS McKee

Opportunities in a Volatile Environment



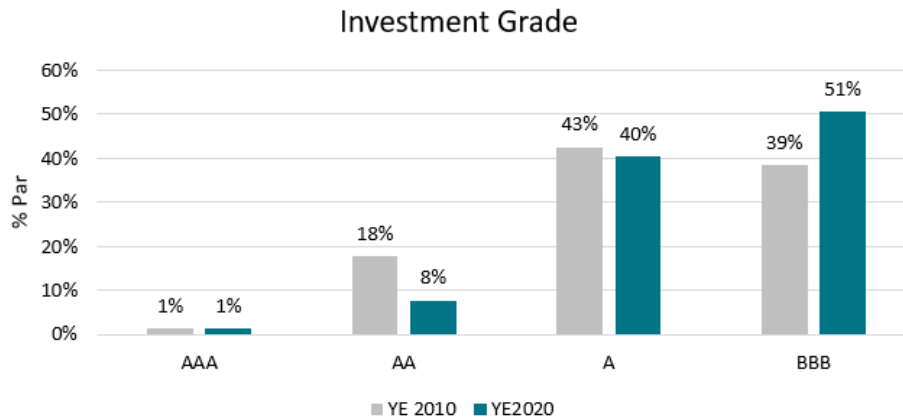
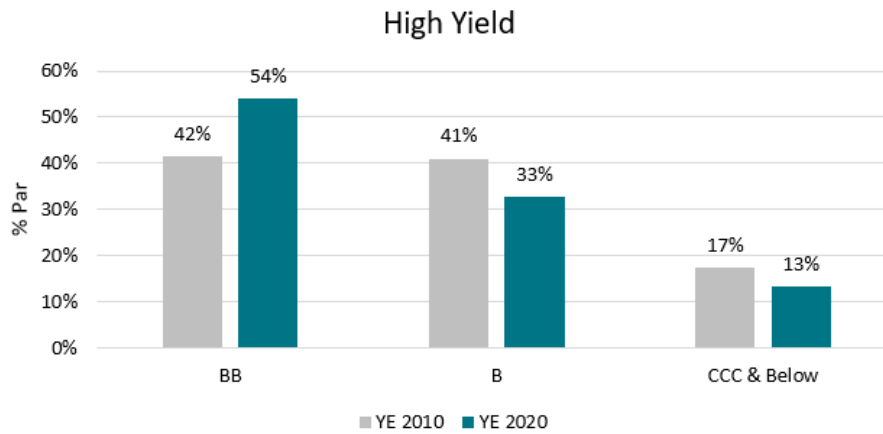
Source: Bloomberg, CS McKee



Shenkman

Rating Profile Transitions

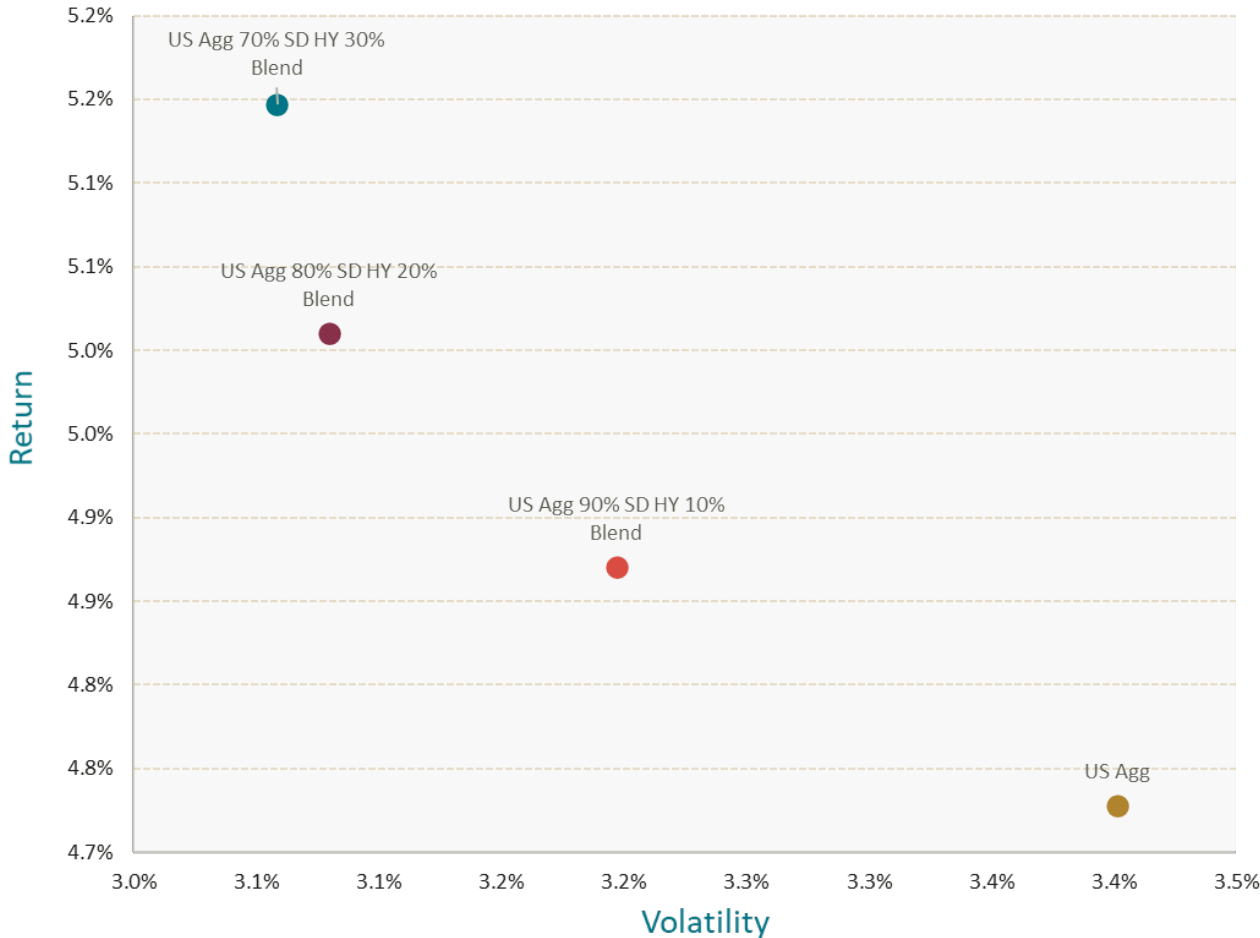
SHIFT IN CREDIT QUALITY



	Bloomberg Barclays	
Feb '21	US HY	US Agg
Coupon	5.95	2.68
OAS	326	34
YTW	4.25	1.42
Mod Dur	3.79	6.31
YTW/Dur	1.12	0.23

Source: ICE BofA US High Yield Index (H0A0), ICE BofA US Corporate Index (C0A0)

Different Approaches to High Yield



Today's environment highlights the benefits of adding short duration high yield to a fixed income portfolio

Source: Bloomberg annualized data January 1999- February 2021

Note: SD HY represents ICE BofA 0-2 Year Duration BB-B U.S. HY Constrained Index/ US Agg represents Bloomberg Barclays US Aggregate Bond Index

Appendix

What exactly is active & passive management?

	Active Management	Passive Management
Objective	Outperform benchmark on absolute or risk-adjusted basis	Match return of benchmark
Return	Based on Individual Securities	Equal to broad market
Risk	Greater or less than broad market	Equal to broad market
Approach	Bond-picking through a top-down and/or bottom-up approach	Rules-Based through replication or sampling
Decision Makers	Portfolio Managers and Analysts	Index Provider
Portfolio Construction	Conviction-Weighted	Market-Cap Weighted
Cost	Higher	Lower

Q: Shouldn't we go with a 100% passive portfolio?

A:

- Alpha opportunities still exist through Manager Selection
- In certain less efficient Asset Classes and Strategies, alpha opportunities still exist
- Larger institutional investors are in a better position to negotiate favorable fee concessions from active managers
- Index replication means that you definitely hold "losing" names
- Some active managers can protect on the downside (for example some "lower-volatility" or "quality" managers can outperform the benchmark in a bear market)

Active management: potential pros and cons

Potential Advantages

- **Expert analysis** – Some managers can make informed decisions based on experience and prevailing market trends
- **Possibility of higher than index returns**
- **Active Managers can employ defensive measures** – for example, an active fixed income manager can adjust their duration/average credit quality whereas a passive manager must imitate the index

Potential Disadvantages

- Higher fees and operating expenses
- Managers can underperform and make mistakes – manager selection and ongoing monitoring is key

Passive management: pros and cons

Advantages

- Lower fees
- Market performance – passive funds will approximate the index

Disadvantages

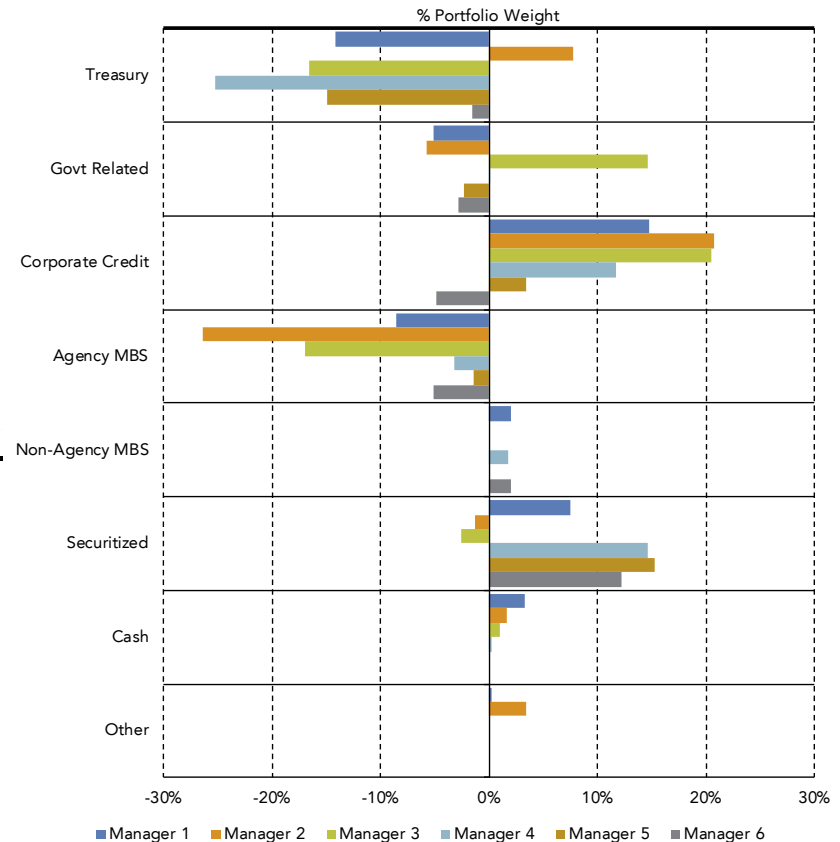
- Investors can only achieve market returns
- Index fund managers are usually prohibited from using defensive measures

Characteristics: Active Core vs. Agg

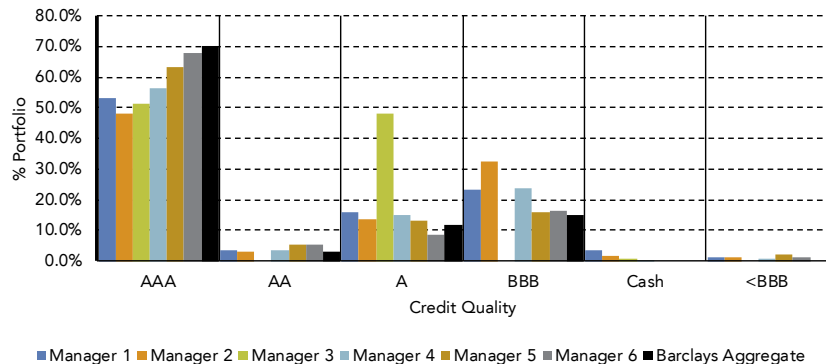
Portfolio Characteristics

Firm	# of Holdings	Yield to Worst	Current Coupon	Time to Maturity	Avg Effective Duration	Average Quality
Manager 1	1,454	1.2%	3.2%	7.9	6.2	AA-
Manager 2	338	1.2%	2.4%	9.6	7.1	AA-
Manager 3	32	0.9%	2.4%	7.0	4.7	AA-
Manager 4	283	1.4%	3.2%	8.2	6.1	A+
Manager 5	630	1.3%	2.5%	8.0	6.2	AA-
Manager 6	404	1.3%	2.4%	7.4	5.9	AA
Barclays Aggregate	11,984	1.1%	2.9%	8.3	6.2	AA+/AA

Sector Comparison Relative to the Barclays Aggregate



Credit Quality Comparison



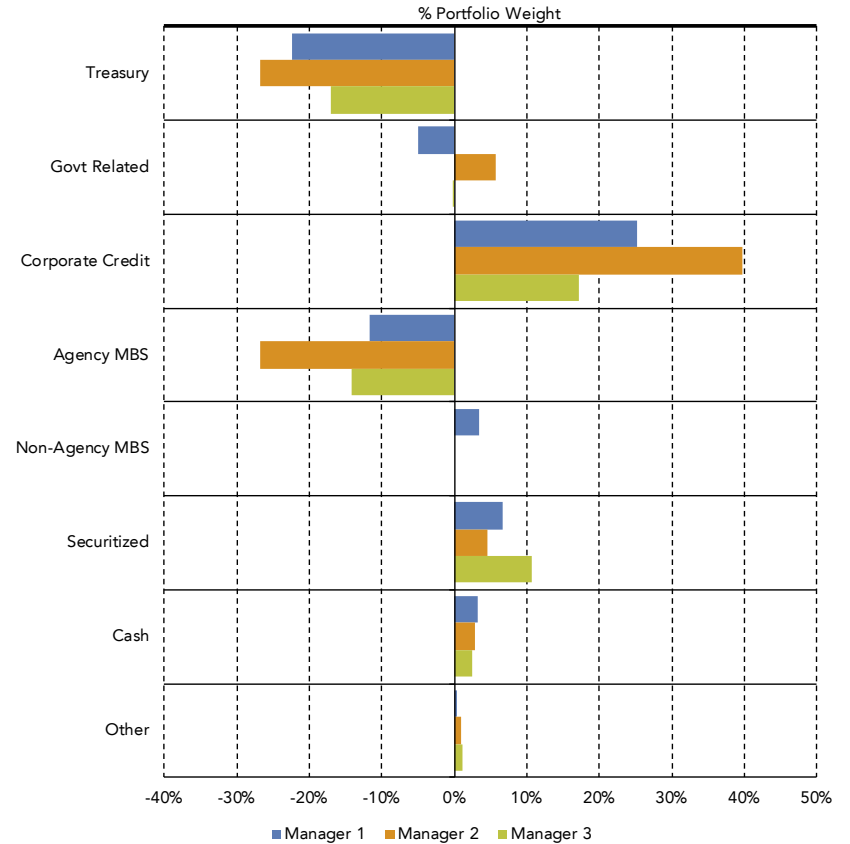
Source: Individual managers, Bloomberg, as of December 31, 2021

Characteristics: Active Core Plus vs. Agg

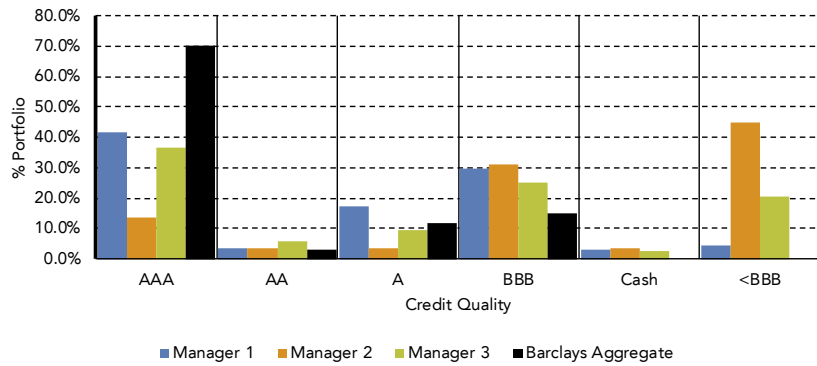
Portfolio Characteristics

Firm	# of Holdings	Yield to Worst	Current Coupon	Time to Maturity	Avg Effective Duration	Average Quality
Manager 1	1,606	1.4%	3.4%	7.7	6.1	A+
Manager 2	1,302	3.5%	5.3%	23.0	6.9	A-
Manager 3	821	2.1%	3.6%	9.6	6.3	A
Barclays Aggregate	11,984	1.1%	2.9%	8.3	6.2	AA+/AA

Sector Comparison Relative to the Barclays Aggregate



Credit Quality Comparison



Source: Individual managers, Bloomberg, as of December 31, 2021

Performance: Active Core vs. Agg

Median Portfolio vs. Benchmark

Based on median performance, Core active managers have consistently beat the index over the past 10 Years

As of 4Q20, Net of Stated Fees	1 Year	3 Years	5 Years	7 Years	10 Years
eVestment Core Universe Median	8.3%	5.6%	4.8%	4.3%	4.2%
Bloomberg Barclays US Aggregate	7.5%	5.3%	4.4%	4.1%	3.8%

As of 4Q20, Net of Stated Fees	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	Avg. Annual Excess Return
eVestment Core Universe Median	8.3%	9.0%	-0.2%	3.8%	3.1%	0.6%	5.9%	-1.7%	6.0%	7.4%	0.3%
Bloomberg Barclays US Aggregate	7.5%	8.7%	0.0%	3.5%	2.6%	0.5%	6.0%	-2.0%	4.2%	7.8%	

Source: eVestment

Performance: Active Core Plus vs. Agg

Median Portfolio vs. Benchmark

Based on median performance, Core Plus active managers have consistently beat the index over the past 10 Years

As of 4Q20, Net of Stated Fees	1 Year	3 Years	5 Years	7 Years	10 Years
eVestment Core Plus Universe Median	8.6%	5.9%	5.3%	4.7%	4.7%
Bloomberg Barclays US Aggregate	7.5%	5.3%	4.4%	4.1%	3.8%

As of 4Q20, Net of Stated Fees	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	Avg. Annual Excess Return
eVestment Core Plus Universe Median	8.6%	9.7%	-0.6%	4.6%	4.4%	0.0%	5.8%	-0.6%	8.5%	7.0%	0.8%
Bloomberg Barclays US Aggregate	7.5%	8.7%	0.0%	3.5%	2.6%	0.5%	6.0%	-2.0%	4.2%	7.8%	

Source: eVestment

Key takeaways

- Strong active core/core plus fixed income managers have proven over time to consistently deliver alpha of 30 to 80 bp (net of fees) above key indices such as the Agg
- They do this through selective tilts in sector, duration, yield curve and off-benchmark exposure
- Most core/core plus bond managers have an overweight to corporate or securitized bonds to gain a yield advantage over the Agg, which has a large allocation to Treasuries, however, certain managers would tactically allocation more to Treasuries when the market environment calls for it
- Security selection is also key to active management as the Agg has nearly 10,000 bonds, while managers typically gain adequate diversification with about 200 bonds
- Managers' credit research teams are pivotal for finding the right credits that out-yield the Agg, providing spread-tightening for price appreciation, and avoiding credits that are likely to default—index funds would not provide this level of intelligence
- Duration management and yield curve positioning is also important to generating alpha as managers can find relative value between shorter- or longer-dated bonds
- Our rigorous four-phase manager research process at Marquette where we prosecute and monitor strategies based on the firm, team, investment process, philosophy, IT infrastructure, compliance and culture helps us find and maintain the strong active fixed income strategies
- Most of Marquette's clients take advantage of active management in all fixed income asset classes
- However, there are a few clients that have risk budgets where it makes sense to use more of their budget for equities and alternatives, and less for fixed income—in these cases, they have indexed core fixed income, but, in general, active fixed income management is still more optimal than passive fixed income management

Disclosures

The sources of information used in this report are believed to be reliable. Marquette Associates, Inc. has not independently verified all of the information and its accuracy cannot be guaranteed. Opinions, estimates, projections and comments on financial market trends constitute our judgment and are subject to change without notice. References to specific securities are for illustrative purposes only and do not constitute recommendations. Past performance does not guarantee future results.

About Marquette Associates

Marquette Associates is an independent investment consulting firm that guides institutional investment programs with a focused client service approach and careful research. For over 30 years Marquette has served this mission in close collaboration with clients – enabling institutions to be more effective investment stewards. Marquette is a completely independent and 100% employee-owned consultancy founded with the sole purpose of advising institutions. For more information, please visit www.marquetteassociates.com.

Pennsylvania Municipal Retirement System:

A Case for Global Equity



Presented by

Nicole Johnson-Barnes, CFA
Sr. Research Analyst

Table of Contents

- Introductions
- Marquette: Global Equity Background
- William Blair: Global Growth Investing Post-Covid
- Dodge & Cox: Global Value Opportunities
- Marquette: Global Low Volatility
- Appendix



Introductions

Nicole Johnson-Barnes, CFA

- Marquette Associates
- Sr. Research Analyst, Global Equities
- B.B.A., University of Michigan
- CFA Charterholder

Olga Bitel

- William Blair
- Partner, Global Equity Strategist at William Blair
- B.A., University of Chicago
- M.Sc. – Economics, London School of Economics and Political Science

Steven Voorhis, CFA

- Dodge & Cox
- Vice President, Associate Director of Research
- B.A. and M.A., Stanford University
- M.B.A., Harvard Business School
- CFA Charterholder

The background is a light gray color with a subtle grid pattern. A thin, dark gray diagonal line runs from the top-left towards the bottom-right. The word "Background" is centered in a large, white, sans-serif font.

Background

Case for global equity

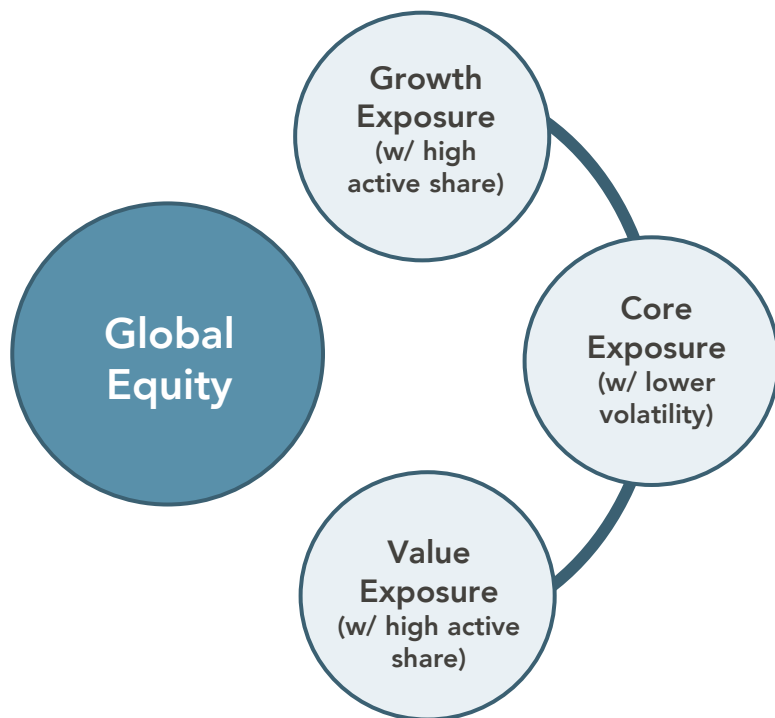
- Global equity mandates have the latitude to invest in stocks across the globe without facing the constraints of a regional benchmark exposures.
- Why global equity?
 - Larger opportunity set
 - Focused on the most compelling values and opportunities globally
 - Flexibility to avoid specific countries or regions
- Avg expense ratio: 75 – 80 bps

25 th Percentile Manager	10-Year Annualized Alpha	10-Year Information Ratio
U.S. Large Cap (vs S&P 500)	1.48	0.33
Non-U.S. Large Cap (vs MSCI EAFE)	2.61	0.58
Global Large Cap (vs MSCI ACWI)	3.19	0.66

Source: eVestment as of December 31, 2020.

Marquette's global equity philosophy

Diversified approach

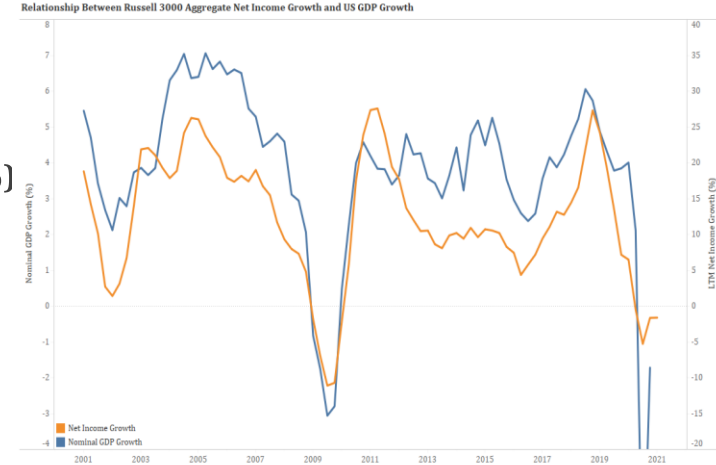
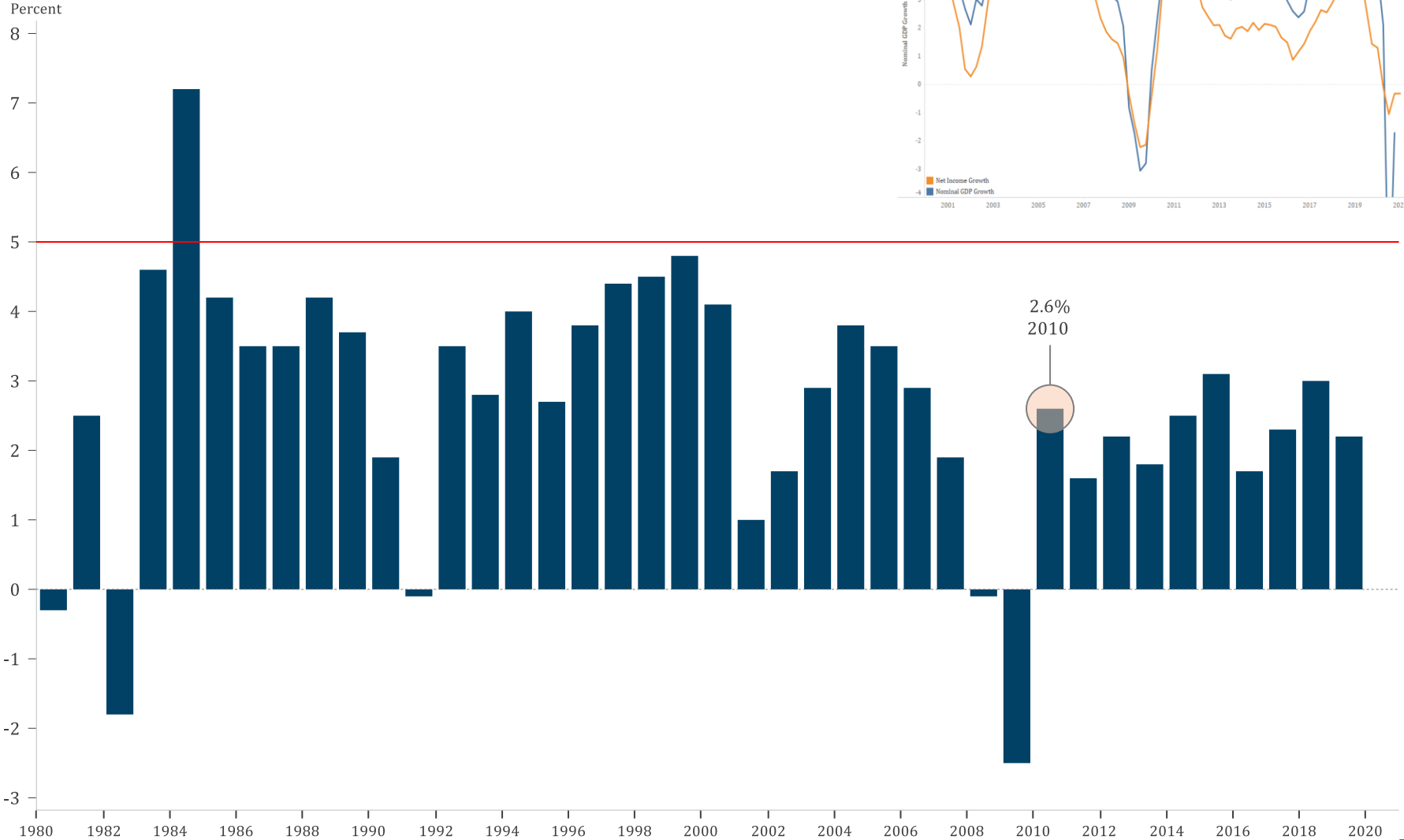


- Mitigate style bias with allocations to Growth, Core and Value managers resulting in a well diversified portfolio
- Allow skilled, active managers to exploit market dislocations
- Improve risk/return profile of portfolio

William Blair

GDP Growth Rebound is likely to be at least **DOUBLE** that of the GFC rebound

US Annual Real GDP Growth (%)

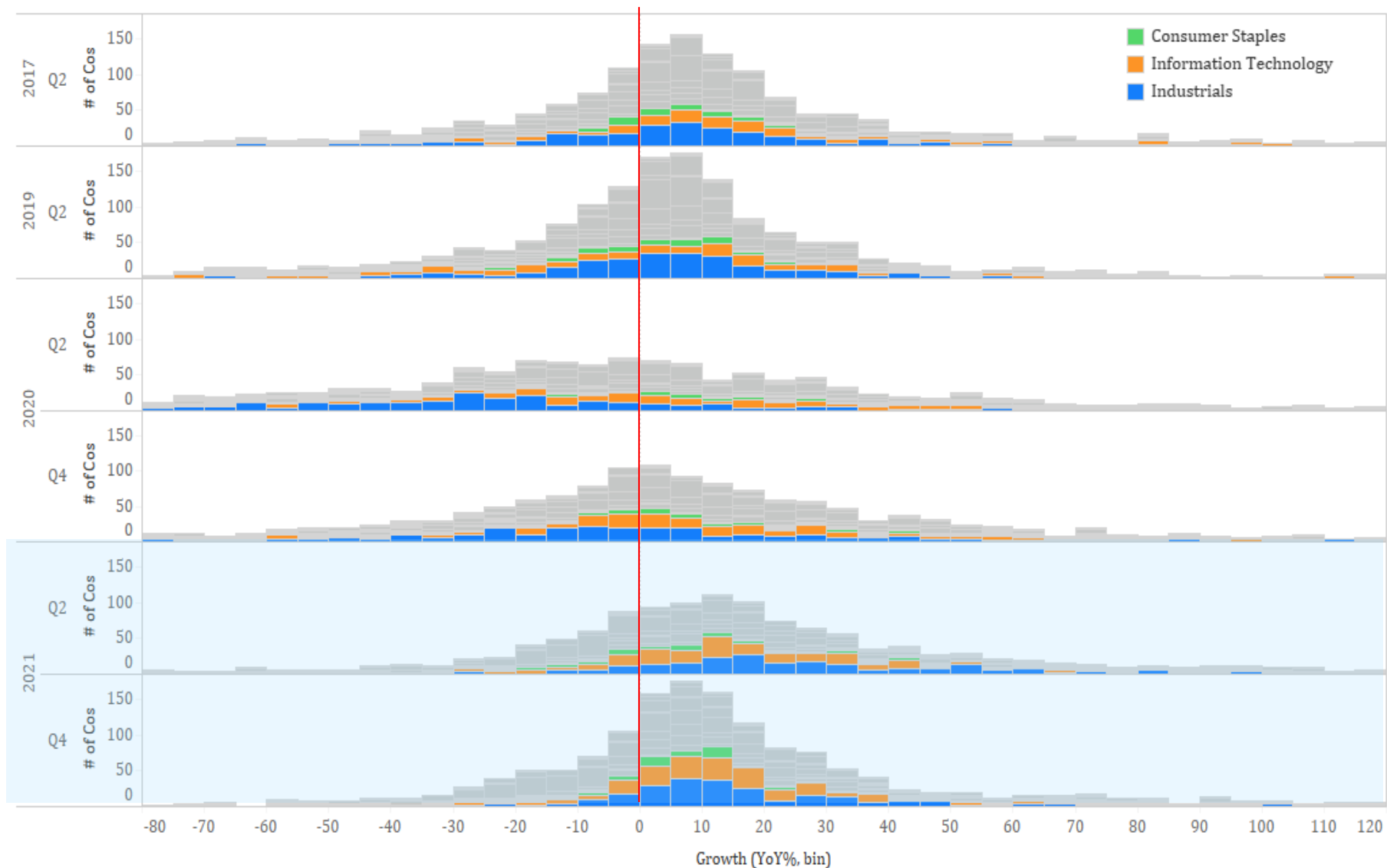


Source: BEA

While estimates have shifted to the right, there is still scope for further upward revisions

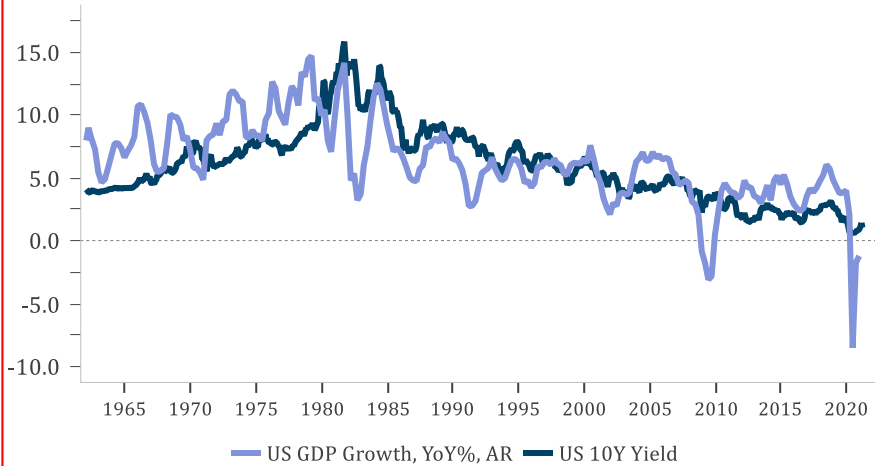
Distribution of EBIT Growth (YoY%)

United States



Rising Rates Are All About Rising Growth Expectations

US Growth & Yields



Source: U.S. Department of Treasury, BEA

US Corp BBB/Baa - Treasury 10 Year Spread



Source: Bloomberg (CSI BBB Index)

U.S. 5yr 5yr Forward Breakeven



Source: Bloomberg (USGG5Y5Y Index)

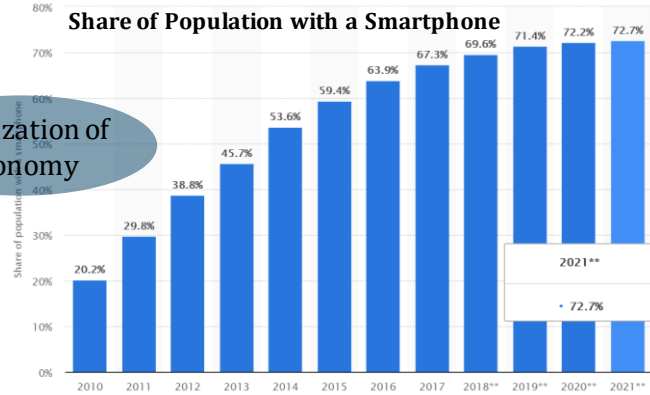
Bloomberg Commodity Index



Source: Bloomberg

The three key ingredients behind spectacular rise of US digital giants are now in place in China

US in 2010s



Digitization of Economy

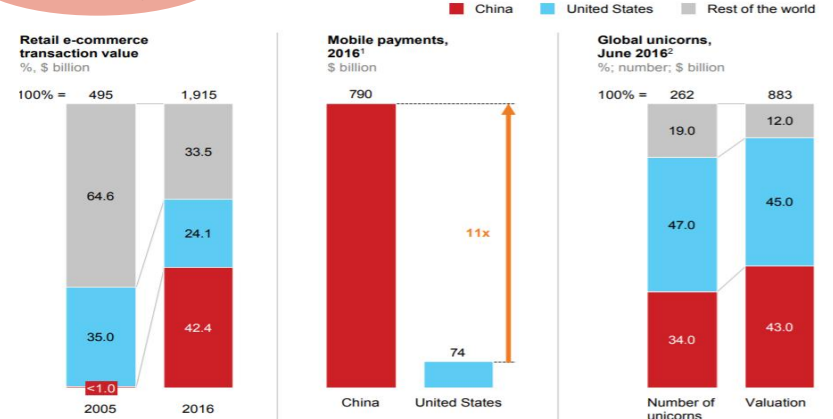
High-Tech Talent

Large Single Market



Digitization of Economy

China in 2020s



¹ Refers to third-party payments conducted through mobile transactions. For China, mobile payments exclude bank or UnionPay credit card transactions, digital wealth management, and digital finance. For the United States, payments are in-person payments on mobile between buyers and sellers, and remote payments on mobile devices.

High-Tech Talent

Large Single Market



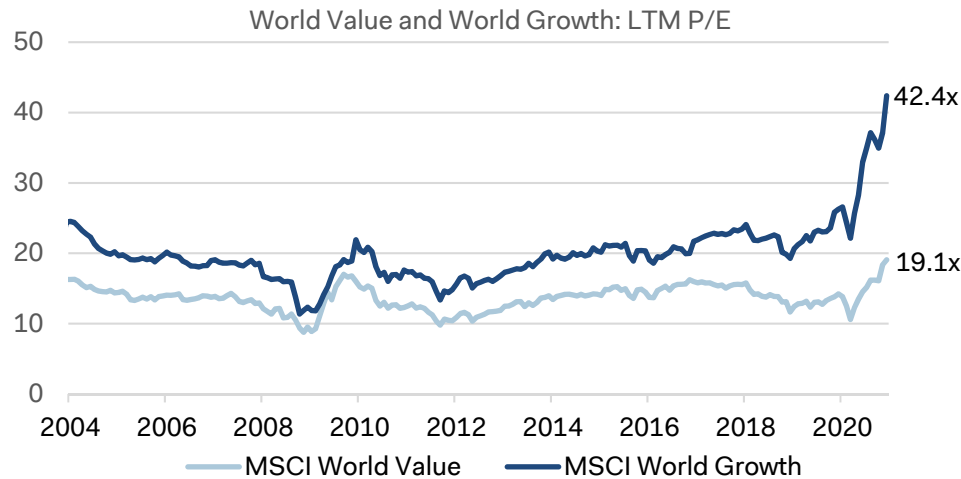


Dodge & Cox

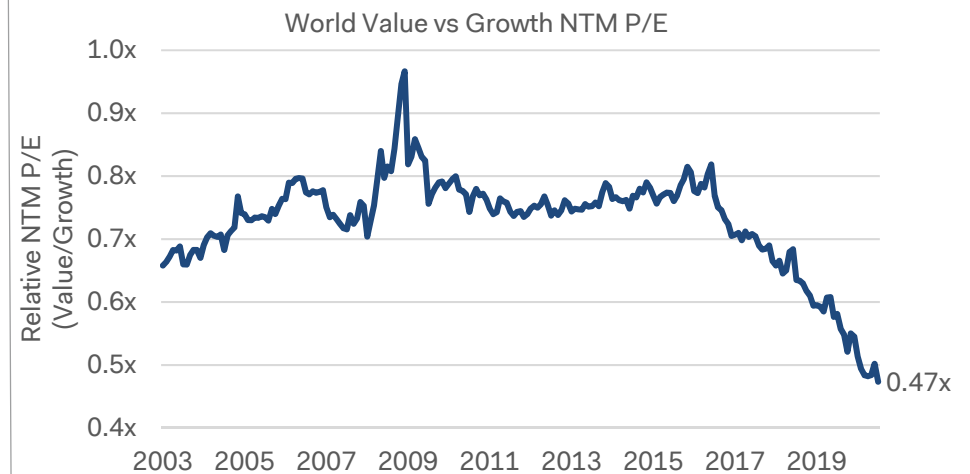
Value is Attractive Despite Underperformance

December 31, 2020

Prices for Value Are Reasonable on an Absolute Basis



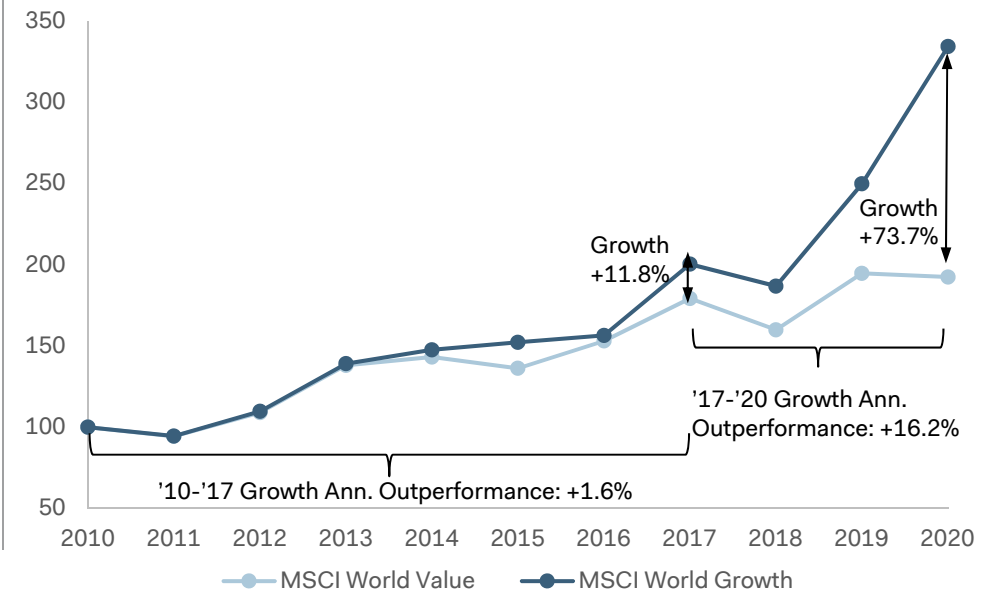
Value Also Looks Attractive on a Relative Basis



Global Value Continues to Underperform



The Past 3 Years Explains Most of Value Underperformance



Source: Factset, MSCI. The above information is not a complete analysis of every material fact concerning any market, industry, or investment. Data has been obtained from sources considered reliable, but Dodge & Cox makes no representations as to the completeness or accuracy of such information. Opinions expressed are subject to change without notice. The above returns represent past performance and do not guarantee future results. Dodge & Cox does not seek to replicate the returns of any index. The actual returns of a Dodge & Cox managed portfolio may differ materially from the returns shown above. Before investing in any Dodge & Cox Fund, you should carefully consider the Fund's investment objectives, risks, and charges and expenses. To obtain a Fund's prospectus and summary prospectus, which contain this and other important information, visit dodgeandcox.com or call 800-621-3979. Please read the prospectus and summary prospectus carefully before investing.

Global Low Volatility

Case for global low volatility equity

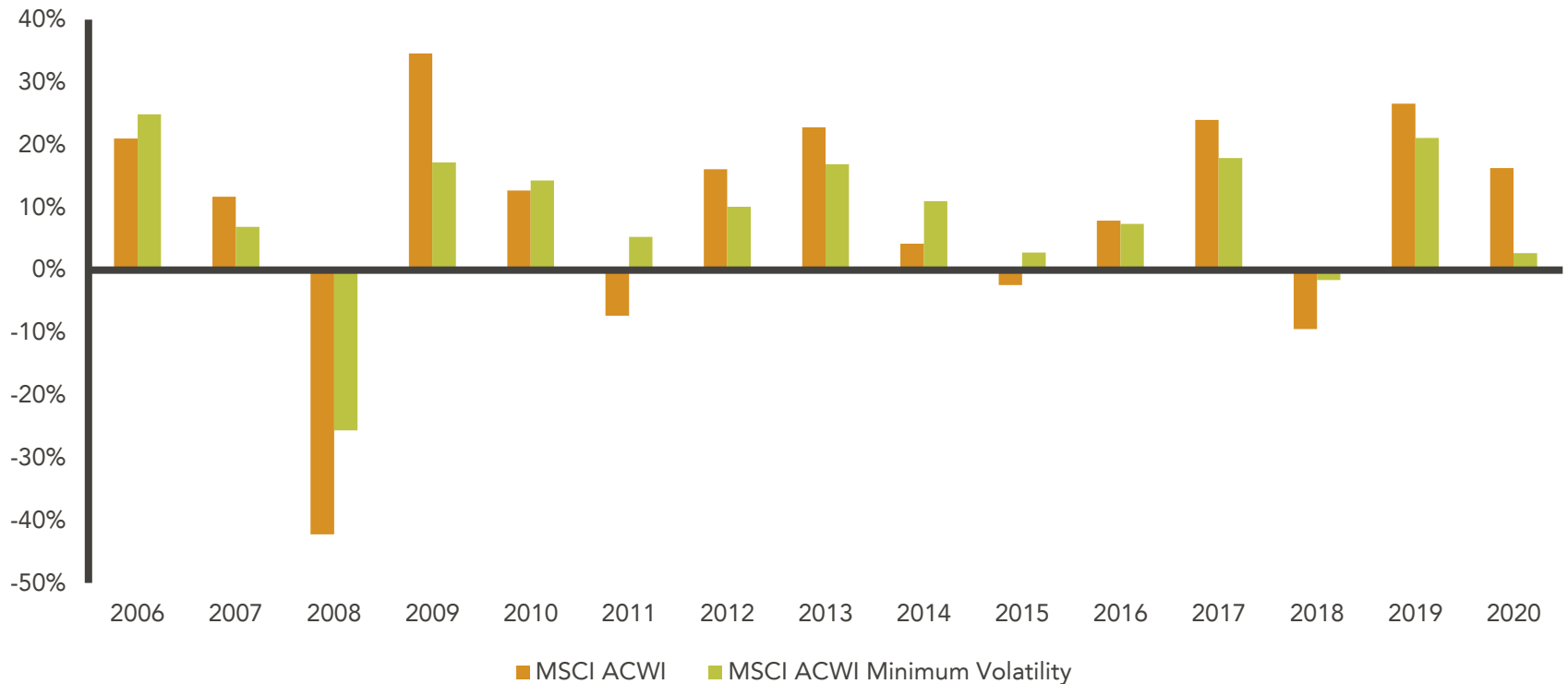
- Global low volatility portfolios are constructed of stocks with historically lower amounts of volatility compared to the universe of global equities
- Why global low volatility?
 - Beta exposure with lower risk and downside protection
 - Long-only investing – no leverage, no shorting, no derivatives
 - Relatively low expense ratio
 - Highly liquid and transparent portfolio

	10-Year Return	10-Year Standard Deviation	10-Year Sharpe Ratio
MSCI ACWI Index	9.1%	14.1%	0.61
MSCI ACWI Minimum Volatility Index	9.1%	9.6%	0.88

Source: eVestment as of December 31, 2020

Global low volatility equity performance

ACWI Minimum Volatility Index has provided protection in recent market down years



Source: eVestment as of December 31, 2020.

Strong results to end 2020

Positive vaccine news led to a strong equity markets rebound

	3-Month (%)	1 Yr (%)	3 Yr (%)	5 Yr (%)	10 Yr (%)	10 Yr Std Dev (%)
Global Equity:						
MSCI ACWI	14.7	16.3	10.1	12.3	9.1	14.1
MSCI ACWI Min Vol	6.4	2.7	7.0	9.2	9.1	9.6
U.S. Equity:						
S&P 500	12.1	18.4	14.2	15.2	13.9	15.2
Russell 3000	14.7	20.9	14.5	15.4	13.8	15.4
International Equity:						
MSCI EAFE	16.1	7.8	4.3	7.5	5.5	15.1
MSCI Emerging Markets	19.7	18.3	6.2	12.8	3.6	17.8

Source: eVestment as of December 31, 2020.

Appendix

Year-end valuations

EAFE appears relatively attractive, while Emerging Markets looks as expensive as U.S.A.

Valuation Metrics	MSCI ACWI		S&P 500		MSCI EAFE		MSCI EM	
	Current	Historical Percentile (%)	Current	Historical Percentile (%)	Current	Historical Percentile (%)	Current	Historical Percentile (%)
P/E	24.2	96	27.5	97	23.2	96	20.4	100
Forward P/E	19.4	99	27.0	100	22.8	100	20.0	100
P/B	2.7	91	4.2	93	1.8	64	2.1	87
P/S	2.1	100	2.8	100	1.4	100	1.8	96
P/CF	11.7	87	16.2	95	7.3	25	12.5	99
EV/EBITDA	16.0	100	18.7	100	13.5	95	13.4	100
Average		95		97		80		97

Source: Bloomberg through December 31, 2020.

Disclosures

The sources of information used in this report are believed to be reliable. Marquette Associates, Inc. has not independently verified all of the information and its accuracy cannot be guaranteed. Opinions, estimates, projections and comments on financial market trends constitute our judgment and are subject to change without notice. References to specific securities are for illustrative purposes only and do not constitute recommendations. Past performance does not guarantee future results.

About Marquette Associates

Marquette Associates is an independent investment consulting firm that guides institutional investment programs with a focused client service approach and careful research. For over 30 years Marquette has served this mission in close collaboration with clients – enabling institutions to be more effective investment stewards. Marquette is a completely independent and 100% employee-owned consultancy founded with the sole purpose of advising institutions. For more information, please visit www.marquetteassociates.com.

Pennsylvania Municipal Retirement System:

Global Infrastructure

Presented by

Will DuPree
Sr. Research Analyst



Contents

- What is infrastructure?
- Benefits
- How to invest in infrastructure



The “backbone” of an economy





The physical assets and networks necessary to operate a society – a prerequisite for sustainable economic, industrial, and social growth & development

Common attributes of infrastructure assets:

- Essential service to society
- Inflation protection
- Long asset life
- Low elasticity of demand
- Monopoly/quasi-monopoly
- Regulatory oversight
- Stable and predictable cash flows



Infrastructure sectors

Economic Infrastructure			Social Infrastructure
Transportation	Energy & Utility	Communications	
Airports	Electricity	Broadcast towers	Municipalities
Bridges	Gas	Cable networks	Universities
Rail	Oil	Mobile towers	Schools
Roads	Pipelines	Satellite networks	Hospitals
Seaports	Water/wastewater		
Tunnels	Solar/wind		
			

Infrastructure characteristics

Economic Infrastructure Assets

Throughput assets

- Derive income per usage
- Prices determined by operator/owner

Ex: roads, airports, rail



Regulated assets

- Derive income per usage
- Prices determined by regulatory body
- Asset owner typically has some pricing power protection

Ex: utilities, water, gas



Contracted assets

- Operated by a contract between operator and entity
- Contract determines pricing system and identifiable revenues

Ex: schools, satellite networks, broadcast towers



Infrastructure Maturity States

Greenfield New construction or development

Brownfield Existing, established asset

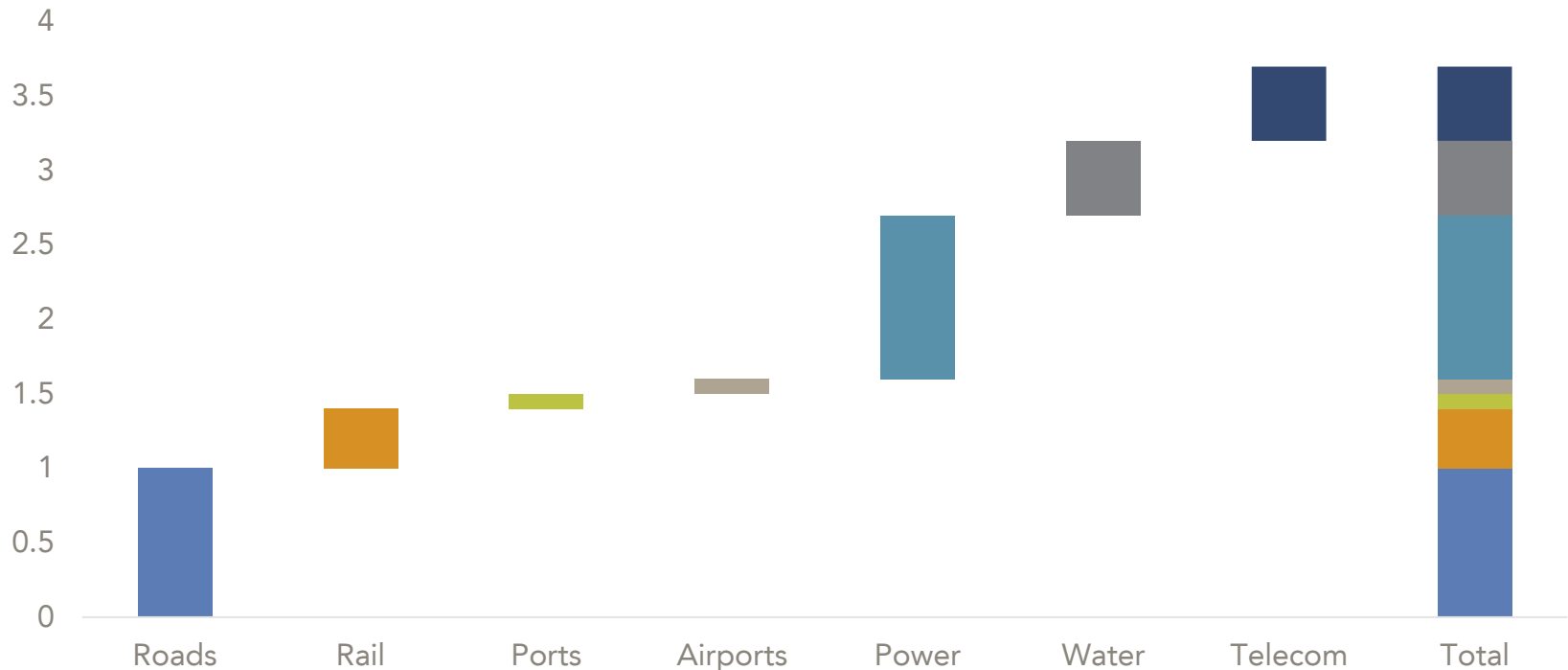
Rehabilitated Brownfield Redevelopment



Attractive opportunity set

The need for infrastructure globally, provides attractive future investment opportunities

▣ Average Annual Infrastructure Need (\$ Trillions)



Source: McKinsey Global Institute, J.P. Morgan Asset Management. Data is based on available information as of November 30, 2020.

Attractive investment profile

Annualized performance

(Common period 1Q09-3Q20)

	Infrastructure	U.S. Stocks	Non-U.S. Stocks	Fixed Income	Real Estate	Timber
Annualized Return	10.7%	14.2%	6.8%	4.3%	6.9%	3.4%
Annualized Risk (Std Dev.)	3.7%	16.5%	18.5%	3.1%	4.4%	3.3%
Sharpe Ratio	2.72	0.83	0.34	1.20	1.45	0.86

Source: Bloomberg. Infrastructure represented by MSCI Global Infrastructure Index; U.S. stocks represented by Wilshire 5000 Index; Non-U.S. stocks represented by MSCI ACWI ex-U.S.; Fixed income represented by Barclays Aggregate; Real estate represented by NCREIF NPI, Timber represented by NCREIF Timberland; Risk-free rate in Sharpe ratio calculation represented by FTSE 3 Month T-Bill

Correlations

Correlation Matrix

(Common period March 2009 – September 2020)

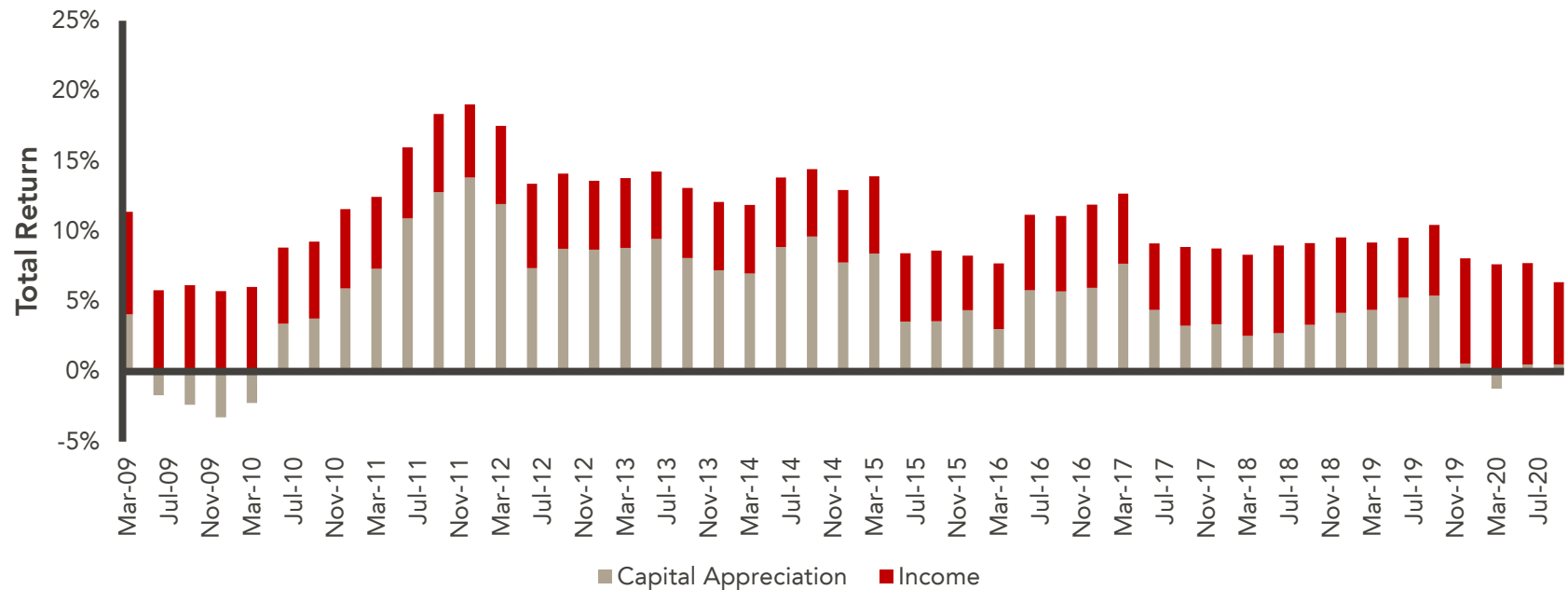
	Infrastructure	U.S. Stocks	Non-U.S. Stocks	Fixed Income	Real Estate	Timber
Infrastructure	1.00					
U.S. Stocks	-0.07	1.00				
Non-U.S. Stocks	-0.15	0.90	1.00			
Fixed Income	0.01	-0.14	-0.05	1.00		
Real Estate	0.40	-0.09	-0.21	-0.10	1.00	
Timber	0.15	-0.05	-0.10	-0.12	0.31	1.00

Source: Bloomberg. Infrastructure represented by MSCI Global Infrastructure Index; U.S. stocks represented by Wilshire 5000 Index; Non-U.S. stocks represented by MSCI ACWI ex-U.S.; Fixed income represented by Barclays Aggregate; Real estate represented by NCREIF NPI; Timber represented by NCREIF Timberland

Sources of global infrastructure returns

Return from income is expected to remain high in 2021, similar to the trend seen in the past decade.

▣ Rolling 4-quarter returns from income and capital appreciation (1Q 2009 – 3Q 2020)



Source: MSCI. Infrastructure returns represented by the “low risk” category of the MSCI Global Quarterly Infrastructure Asset Index. Data show rolling 1-year returns from income and capital appreciation. The chart shows the full index history, beginning in the first quarter of 2009.

Mechanics

Private Vehicles/Unlisted Funds

- Open-end fund
- Closed-end fund
- Co-investment or direct investment
- Fund of funds

Public Vehicles/Listed Funds

- Open-end fund
- Listed closed-end fund

Infrastructure unlisted vs listed

Unlisted (Private) Infrastructure

Advantages

- Greater opportunity set
- Direct investing
- Control of asset more likely

Disadvantages

- Limited liquidity
- Potential lack of diversification and high leverage
- High capital requirements

Listed (Public) Infrastructure

Advantages

- Traded on an exchange
- Transparent
- Liquid

Disadvantages

- Limited opportunity set
- Indirect exposure
- Market volatility

Key Takeaways

- Growing opportunity set
- Long asset life, well matched for long-term horizons
- Stable and predictable cash flows
- Hedging qualities
- Provides diversification

Private Infrastructure

Pennsylvania Municipal Retirement System

March 17th, 2021

As of December 31, 2020 and in U.S. dollar terms unless otherwise specified.

FOR INSTITUTIONAL/WHOLESALE/PROFESSIONAL CLIENTS AND QUALIFIED INVESTORS ONLY – NOT FOR RETAIL USE OR DISTRIBUTION

ALTs by

J.P.Morgan
Asset Management

Today's Presenters



Kathryn Pasqualone, Executive Director, is a Client Advisor within J.P. Morgan Asset Management. She oversees client and business development efforts, providing tailored investment solutions for U.S. institutional investors including public and corporate pension plans. Kathryn marshals the firm's extensive resources across a spectrum of alternative (real assets, private equity, hedge funds), and traditional (equities, fixed income) asset classes aiming to exceed the strategic and tactical investment objectives of her clients. Prior to this role, Kathryn was a Relationship Manager within the North America Institutional Group. She has a B.S. in finance and a B.S. in international business from Fairfield University as well as holds FINRA Series 7, 63 and 3 licenses.



Nicholas Moller, Executive Director, is an Investment Specialist in the Infrastructure Investments Group. Nick is a senior member of the team that leads the Infrastructure Investments Group's fundraising and investor relations efforts. Nick has worked at J.P. Morgan since 2006 and joined the Infrastructure Investments Group in early 2014. Prior to joining the Infrastructure Investments Group, Nick was a member of the J.P. Morgan Investment Bank's Public Finance Transportation and Infrastructure Group. In that role Nick advised both public sector and private sector clients on executing infrastructure and Public Private Partnership transactions. In addition, Nick structured and executed several billion dollars of taxable and tax-exempt financings both for publicly and privately owned infrastructure assets. Nick graduated from the University of Auckland (New Zealand) with a Bachelor of Commerce in Finance (First Class Honors).

All listed individuals are employees of JPMAM. There can be no assurance that the professionals currently employed by JPMAM will continue to be employed by JPMAM or that the past performance or success of any such professional serves as an indicator of such professional's future performance or success.

Source: JPMAM, as of March 2021.

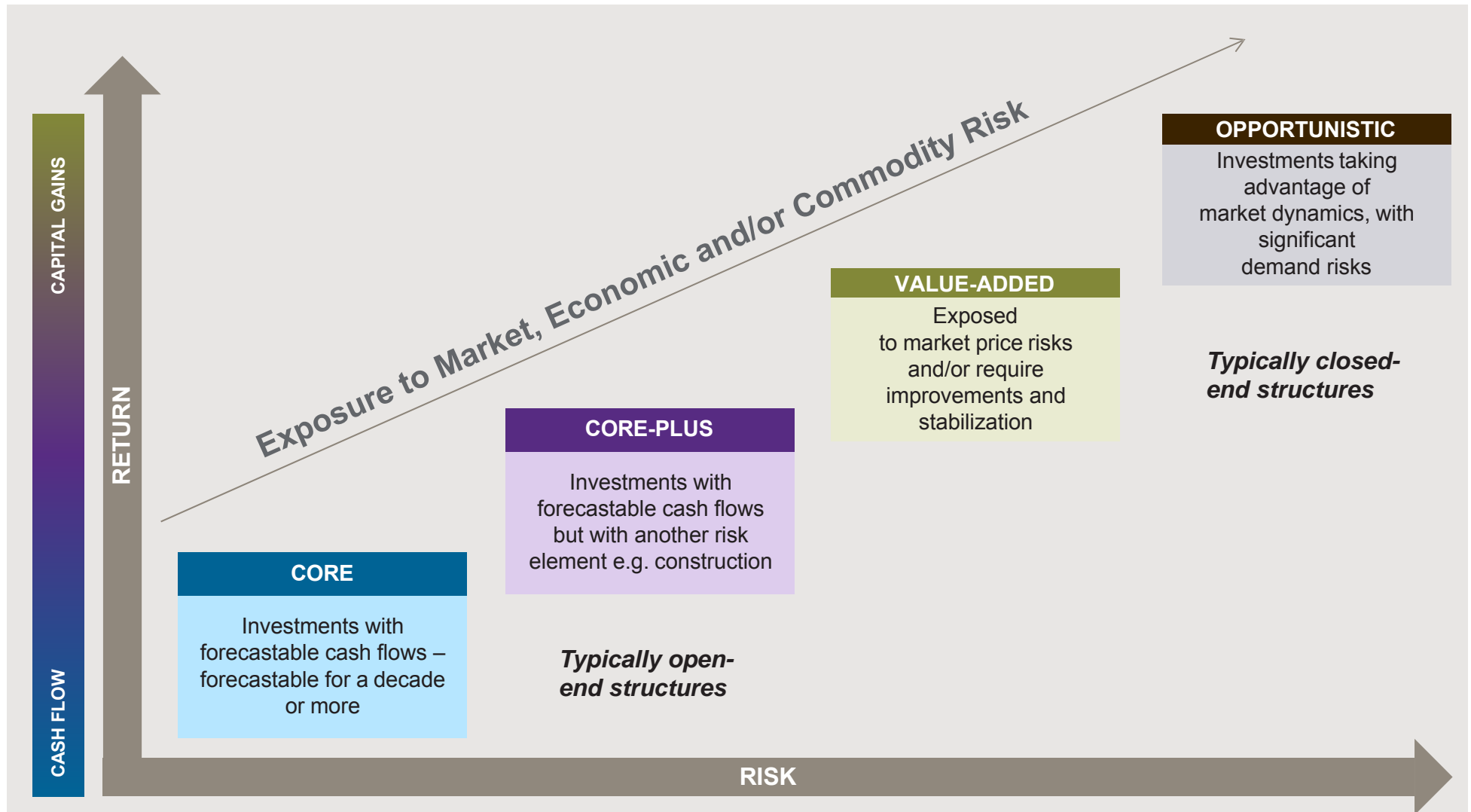
Photo source: JPMAM

2 | FOR INSTITUTIONAL/WHOLESALE/PROFESSIONAL CLIENTS AND QUALIFIED INVESTORS ONLY – NOT FOR RETAIL USE OR DISTRIBUTION

ALTs by

J.P.Morgan
Asset Management

There is a Wide Spectrum of Infrastructure Strategies — This Has Been Further Emphasized By The COVID Crisis



Source: J.P. Morgan Asset Management

Core/Core+ Infrastructure is Essential

Distribution/Regulated Assets

Monopolistic regulatory frameworks give visibility into stable cash flows



Contracted/Power Assets

Long-term contracts with volume minimums



GDP-Sensitive Assets

Mature assets with significant demand history often underpinned by contracts



Essential services that often operate on a monopolistic basis either by regulatory structure or long-term contract, which drives visibility into strong EBITDA margins & cash yield

D Diversification

- Downside protection potential and lower volatility

-0.1 correlation to Global equities¹

I Inflation Protection

- Inflation is a pass-through under many contractual and regulatory structures

Strong historic relationship with utilities returns²

Y Cash Yield

- Strong cash flow generation

**50%+ EBITDA margins
Majority of return in cash yield**

For illustrative purposes only. Diversification does not guarantee investment returns and does not eliminate the risk of loss.

1. Source: JPMAM Guide to Alternatives Q3-2020. 12 year correlation of MSCI AC World Index vs. MSCI Global Quarterly Infrastructure Asset Index

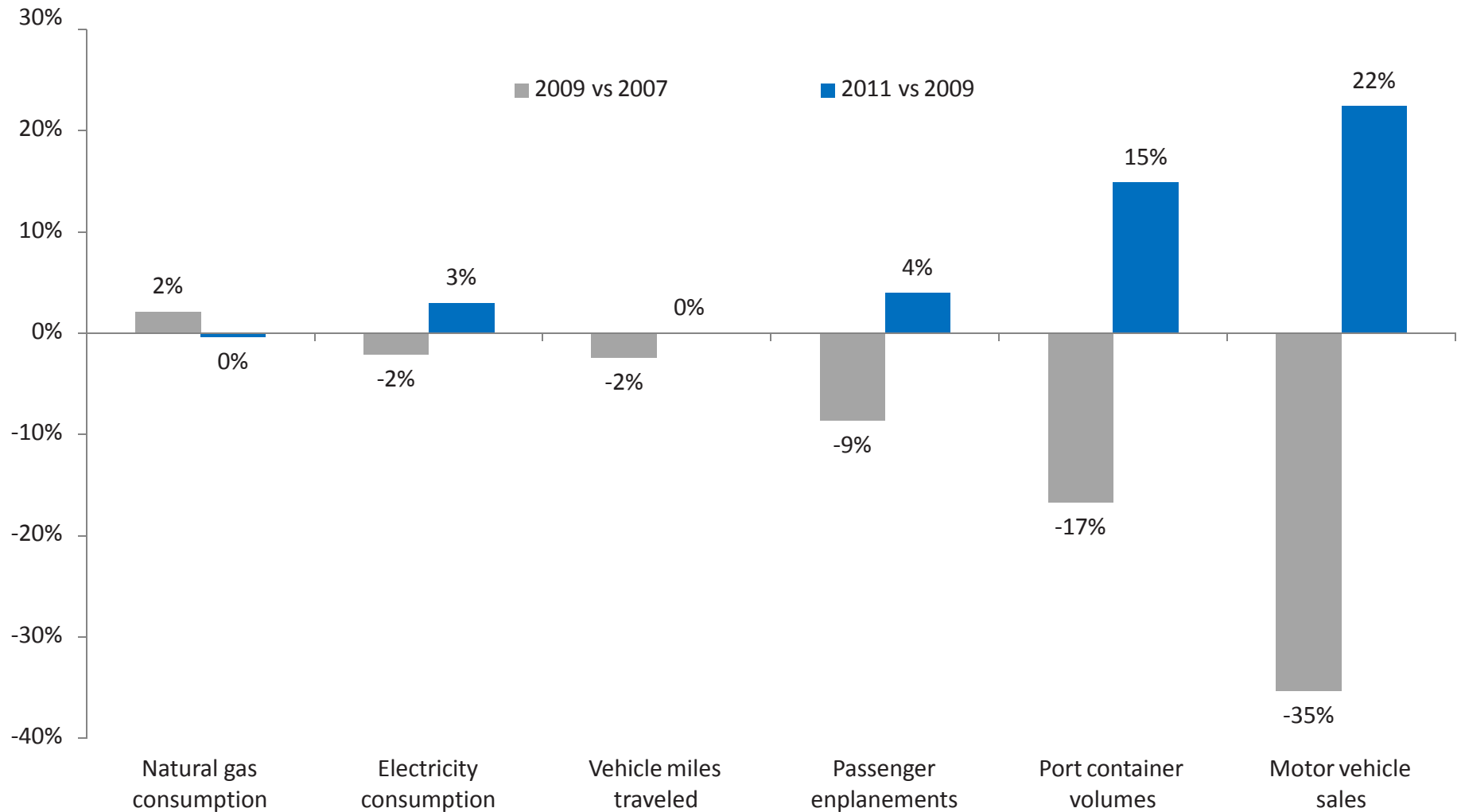
2. Source JPMAM Guide to Alternatives Q1-2020. U.S. utilities' return on equity and inflation ROE (2-year lagged), CPI % change vs. prior year, 1980-2018

ALTs by

J.P.Morgan
Asset Management

Infrastructure Demand was Relatively Resilient During the Great Recession

Consumption volatility in the U.S., 2007 to 2011



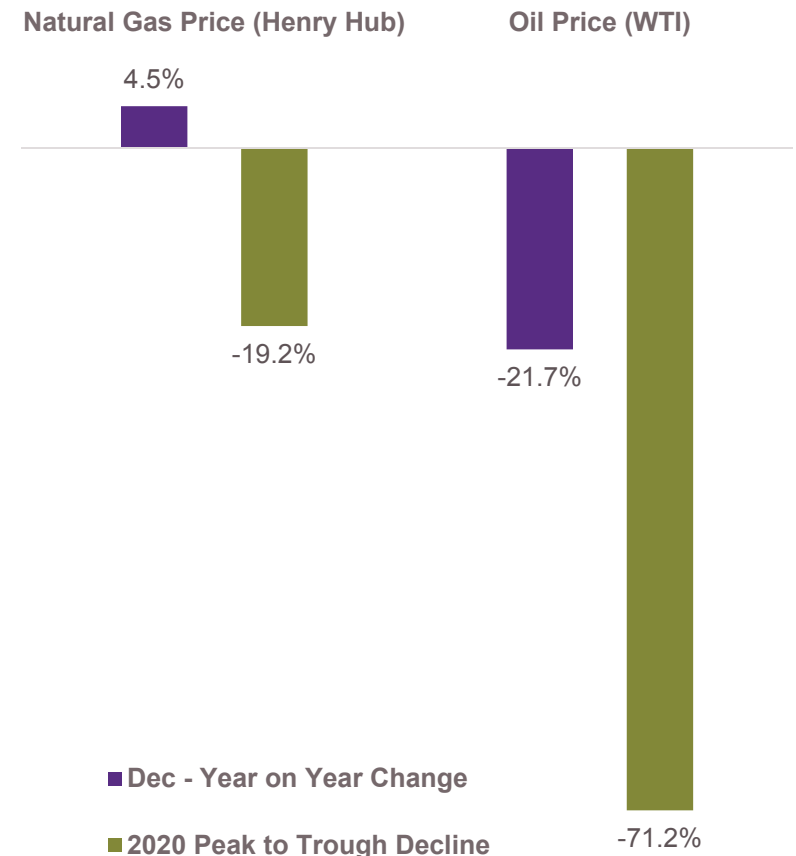
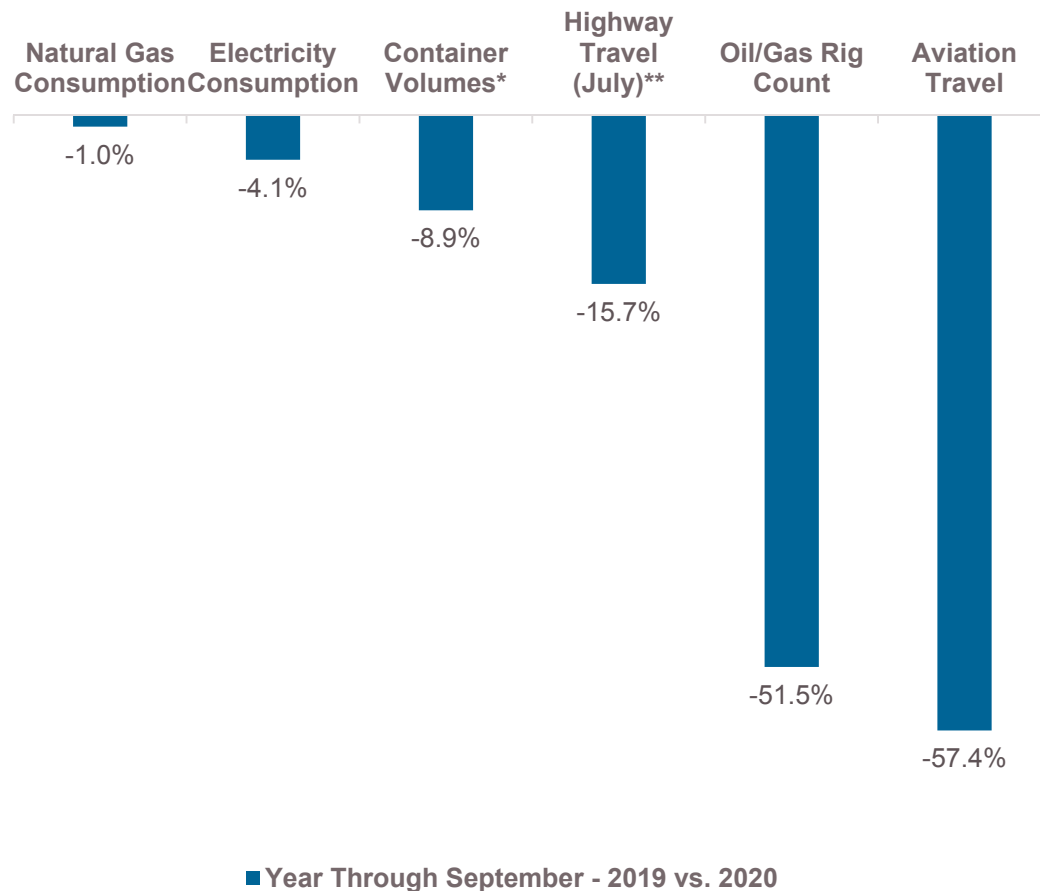
Source: Energy Information Administration for residential and commercial natural gas and electricity consumption, Federal Highway Administration for vehicle miles traveled, Bureau of Transportation Statistics for passenger enplanements, World Bank for port container volumes, St. Louis Federal Reserve for motor vehicle sales. Data as of January 2017.

Key Infrastructure Metrics During COVID-19

The effects of COVID-19 to date on infrastructure have varied both by asset type and level of price exposure

Usage - Year Through September - 2019 vs. 2020 (U.S.)

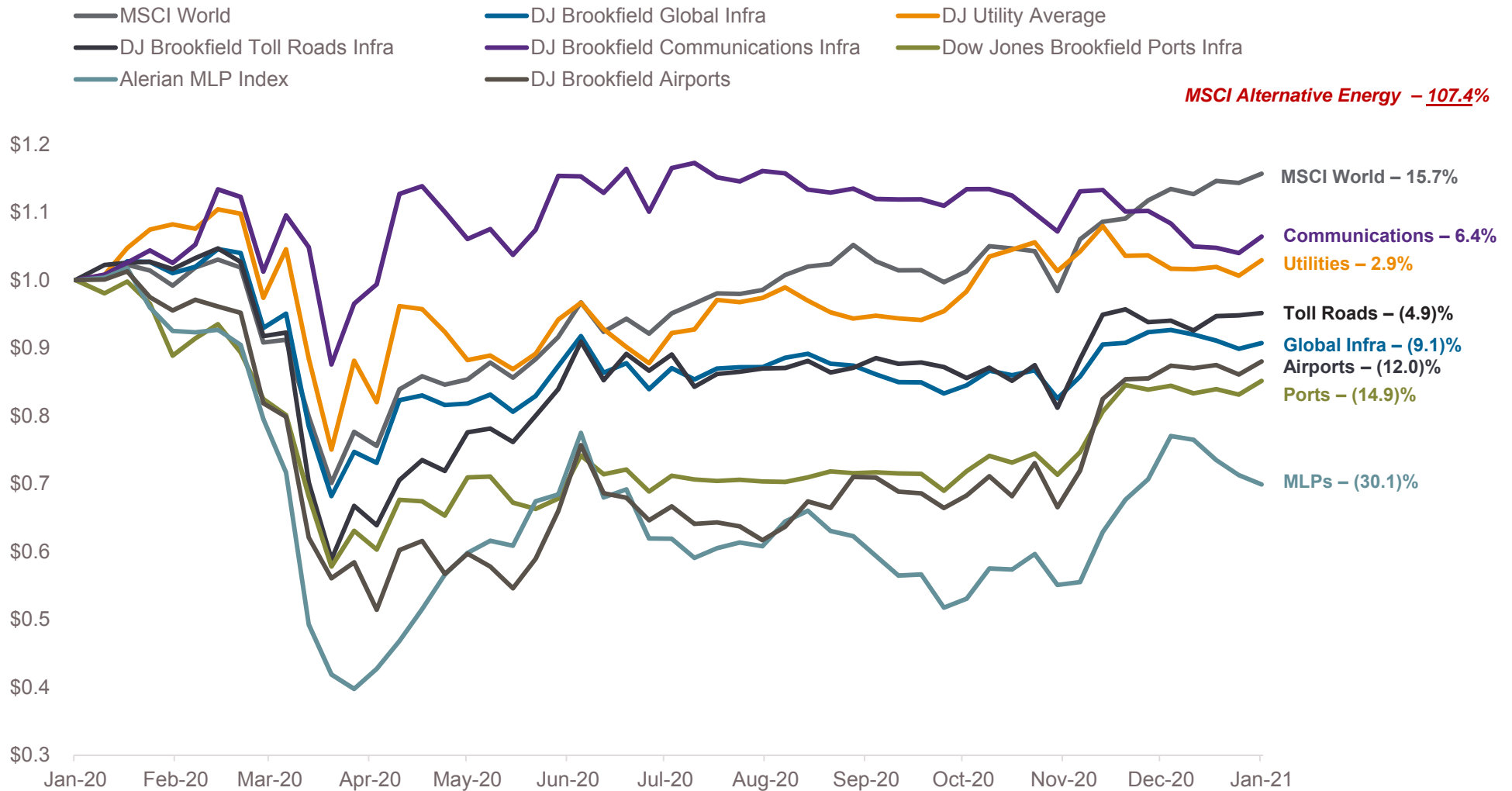
Prices - 2019 vs. 2020



Source: EIA, St Louis Fed, Bureau of Transportation Statistics, Port of Los Angeles. As at December 30, 2020 unless otherwise noted. Represents monthly average for price data.*Port of Los Angeles data, ** Represents July YTD data.

Listed Data Emphasizes The Varied Impacts at the Sector Level During COVID-19

Evolution of USD 1 Invested in Jan 1, 2020



As at January 1st, 2021.

Source: Bloomberg. Represents total return indices. Past performance is not a reliable indicator of current and future results. Indices do not include fees or operating expenses and are not available for actual investment.

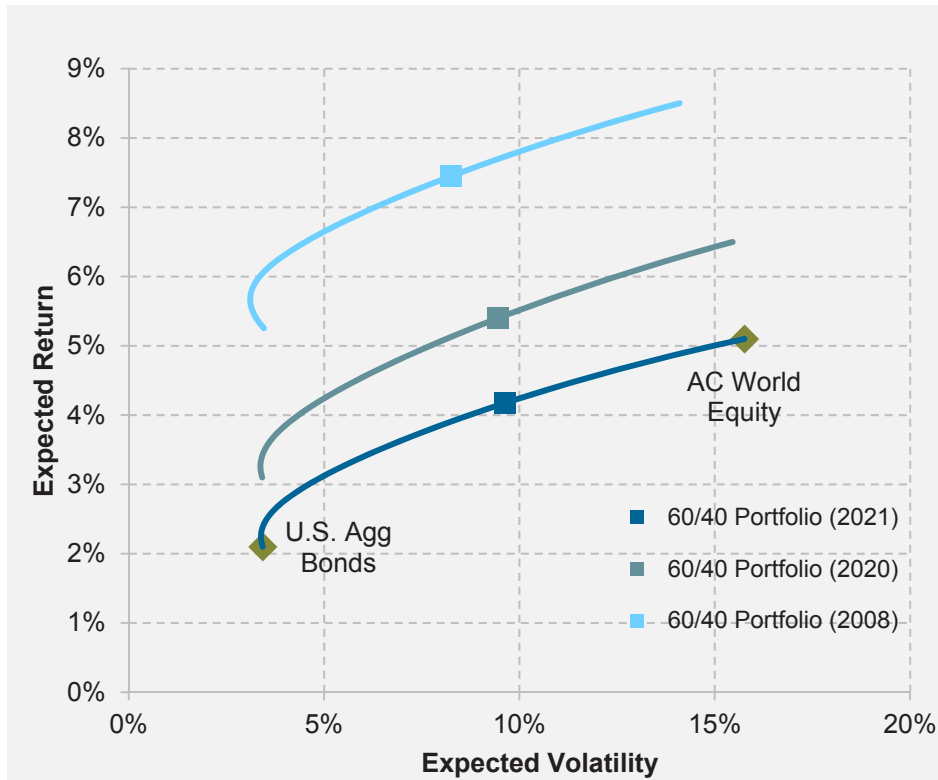
ALTs by

J.P.Morgan
Asset Management

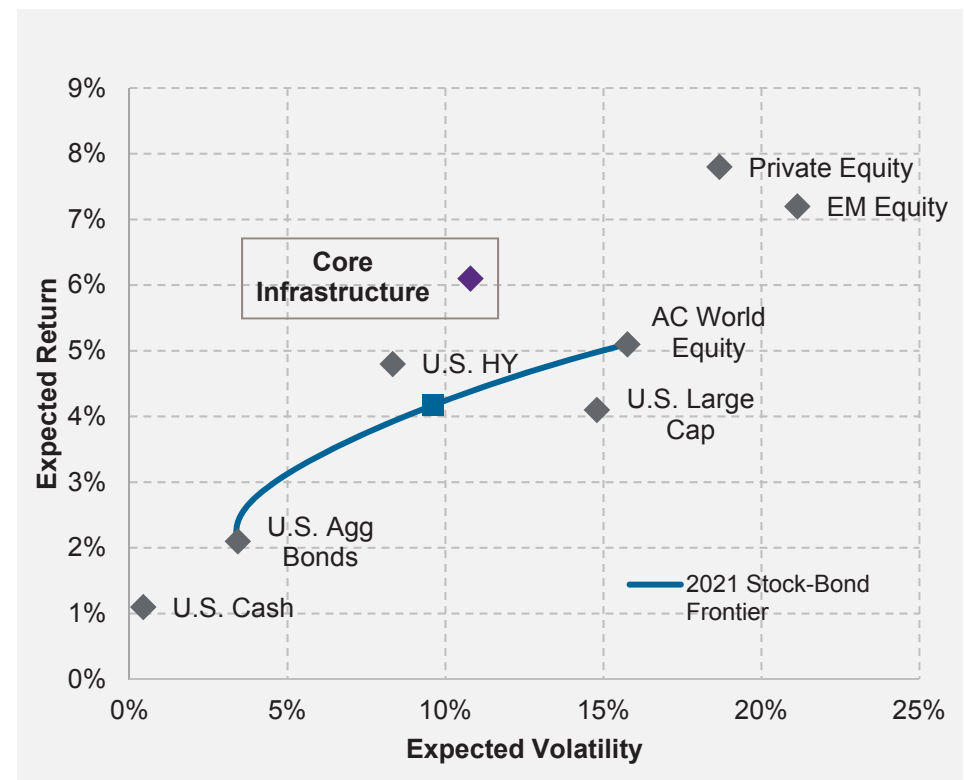
2021 Long-Term Capital Market Assumptions – Private Infrastructure Continues to Remain Attractive on a Risk Adjusted Basis

Expectations for the traditional 60/40 portfolio have continued to move lower however private infrastructure still sits above the efficient frontier

60/40 returns outlook shrinks to 4%



Core infra sits above the stock-bond frontier

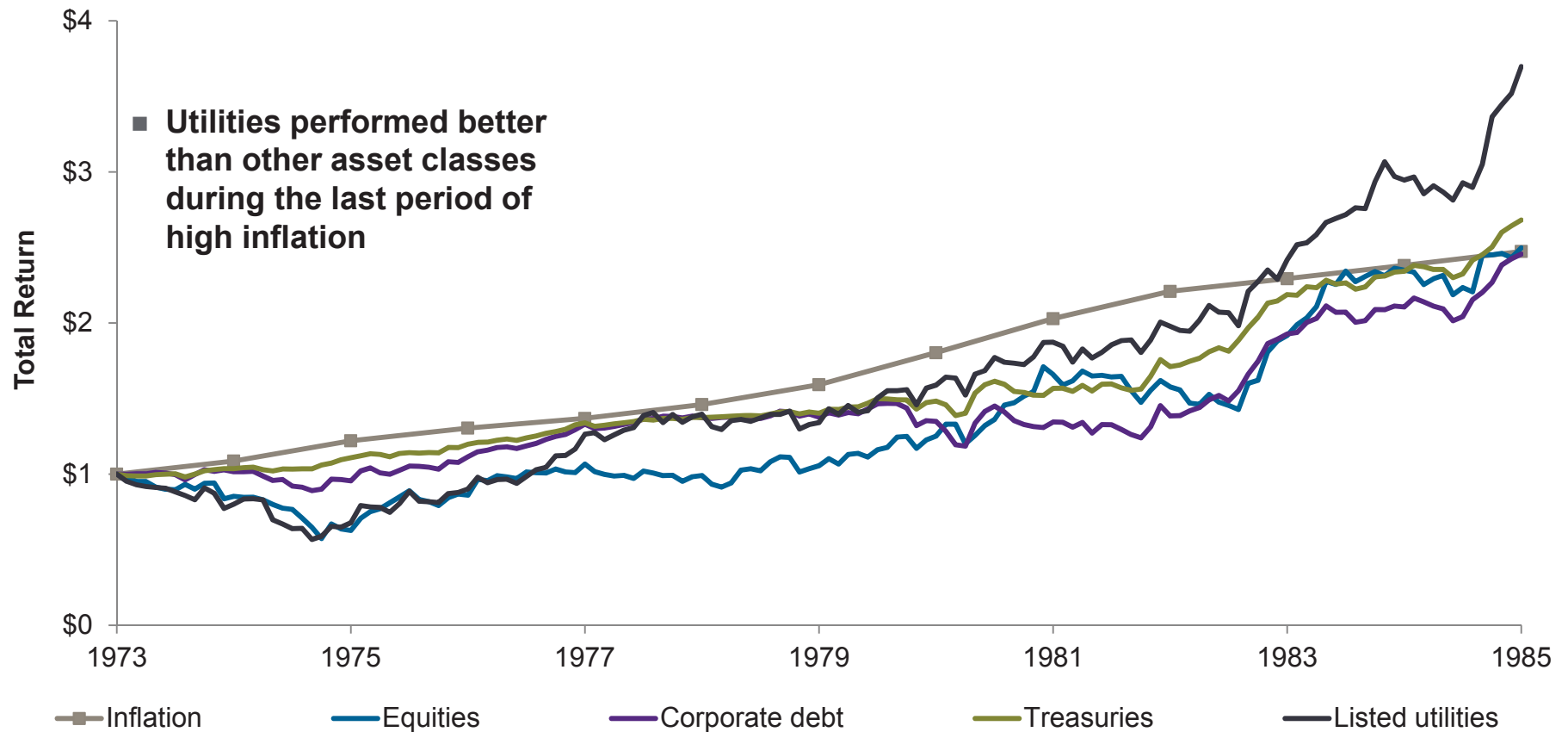


Source: J.P. Morgan Asset Management; estimates as of September 2020, September 2019 and 2007.

Core Infrastructure Has Historically Responded Well to Inflation

Compared to utilities, equities and fixed income investments struggled to regain purchasing power following the last period of high inflation

Last Period of High Inflation: 1973-1985



Source: Bloomberg, SNL.com, JPMAM. Inflation is U.S. CPI YoY, equities is S&P 500, corporate debt is Barclays U.S. Corporate Agg, Treasuries is Barclays U.S. Treasuries Index, and listed utilities is Dow Jones Utility Average. Data accessed December 2016. Past performance is no guarantee of future results. Indices do not include fees or operating expenses and are not available for actual investment.

ALTs by

J.P.Morgan
Asset Management

Expected Returns and Cash Yields Vary Significantly by Sector

Illustrative expected returns for core infrastructure assets by sectors¹

Sector	Relative risk assessment	Average cash yield ²	Average expected return ²
Social infrastructure/ PPPs and PFIs ³	Low	1-3.5%	4-6%
Contracted power generation ⁴	Low-medium	6-8%	6-10%
Regulated utilities	Medium	3-7%	8-10%
Toll roads	Medium	3-6%	6-12%
Airports	Medium	4-7%	8-14%
Midstream	Medium	4-9%	9-14%
Seaports	High	4-7%	10-16%
Freight rail	Medium-high	4-8%	10-14%
Telecommunications infrastructure ⁵	Medium -high	5-7%	8-15%
Merchant power generation ⁵	High	0-4%	12-20%

Source: JPMAM Infrastructure Research, as of Q2-2020

¹ Core infrastructure consists of mature assets with established operational histories in transparent and consistent regulatory environments.

² Assumes sector average loan-to-value ratios, ranging between 40% and 80%.

³ PPP stands for Public Private Partnership and PFI stands for Private Finance Initiative; both terms describe assets with government guaranteed payment mechanisms.

⁴ Assumes contract length of 10 or more years.

⁵ Generally not appropriate for core infrastructure investing, presented for comparison purposes only.

The expected returns are for illustrative purposes only and are subject to significant limitations. An investor should not anticipate achieving actual returns similar to the expected returns shown above. Because of the inherent limitations of the expected returns, potential investors should not rely on them when making a decision on whether or not to invest in the strategy. Infrastructure investments are subject to significant risks. While J.P. Morgan believes that infrastructure investments have compelling risk and return characteristics, past performance is no guarantee of future results, and any risk or return analyses should not be relied upon. Risk/return continuums and other relative comparisons are based on J.P. Morgan's analysis of information available to it on project developments in the referenced asset classes, and such information may not be accurate or complete. Specific investments shown are for illustrative purposes only, and you should not assume that similar investments will be available to or, if available, will be selected for investment.

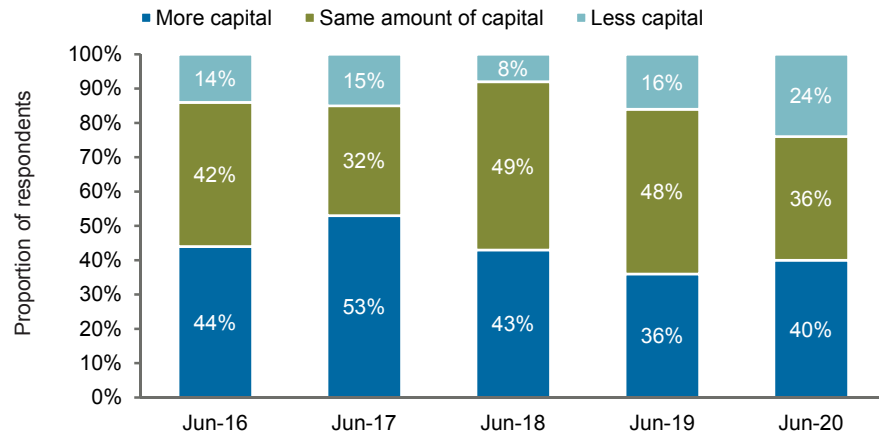
ALTs by

J.P.Morgan
Asset Management

Private Infrastructure Allocations are Expected to Continue to Grow

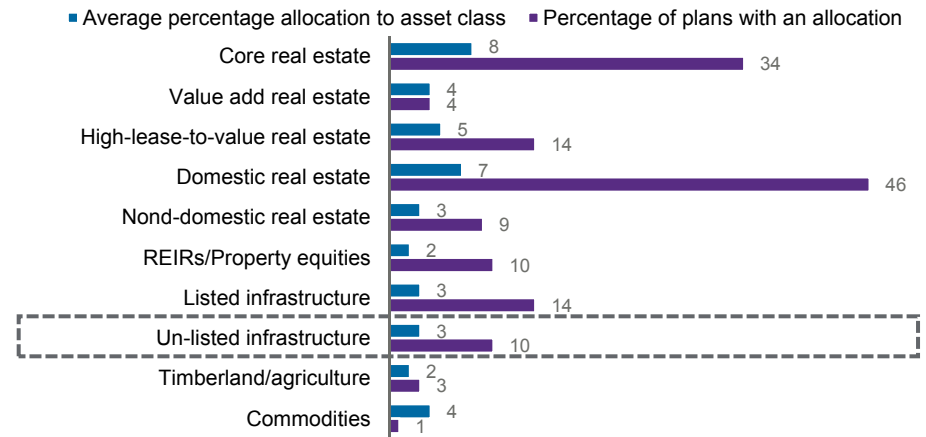
Average allocations are currently ~3% and expected to grow with the majority not having any allocation as yet. U.S. investors appear to continue to be focused on higher risk infrastructure

Investors' expected capital commitments to infrastructure funds in the next 12 months compared to the previous 12 months, 2016-2020



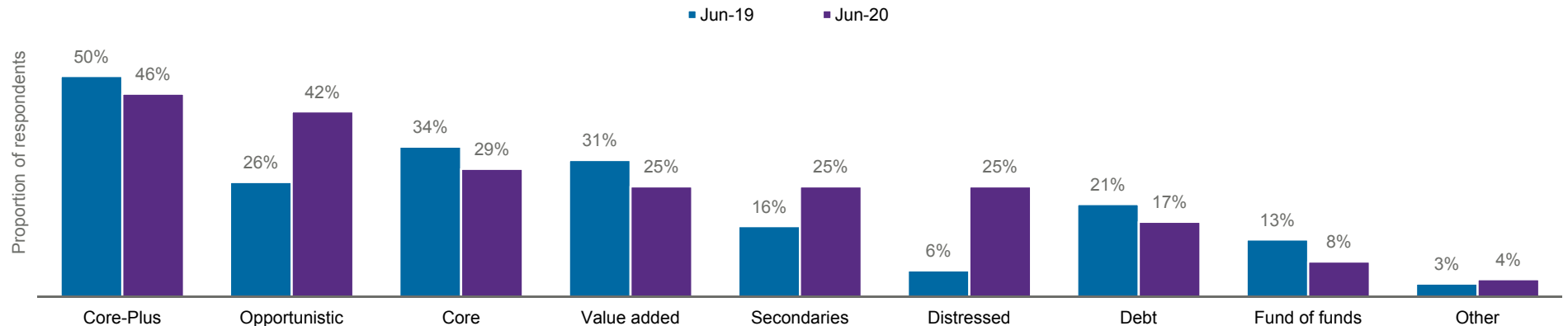
Source: Preqin Investor Update: Alternative Assets, H2 2020

Strategic allocation to real assets



Source: Mercer – European Asset Allocation Insights - 2020

Investor views on fund types presenting the best opportunities in infrastructure, 2019 vs. 2020



Source: Preqin Investor Update: Alternative Assets, H2 2020

Estimates of Global Infrastructure Installed Operating Base

Estimates remain significantly higher than transaction volumes or private capital raised

Estimated Total U.S. Core Infrastructure Stock

		<u>2018 (\$bn)</u>
Private		
Equipment	Communication equipment	597
	Electrical transmission, distribution	577
	Railroad equipment	169
	Engines and turbines	148
	Mining and oilfield machinery	142
Structures	Petroleum and natural gas	1,630
	Electric	1,624
	Communication	677
	Other power	629
	Land (Mostly Railroad)	439
	Other	180
Total	Transportation - Air	56
		6,868
Federal		
Structures	Highways and streets	42
	Transportation	28
	Power	21
Total		90
State & Local		
Structures	Highways and streets	3,692
	Sewer systems	838
	Transportation	834
	Water systems	622
	Power	383
Total		6,369
US Core Infrastructure Estimate (\$bn)		13,328bn

Estimated Total Global Core Infrastructure Stock

Geography	Population (mn)	GDP (USD/Per capita)	Private Infra Size	Total Infra Size	Total Fixed Assets
AUS	25	53,701	0.5	0.9	4.1
GBR	66	41,364	0.9	1.8	8.4
JPN	126	46,973	2.0	3.9	18.2
USA	327	62,853	6.9	13.3	62.9
EU28	513	44,669	7.7	14.9	70.1
OECD	1,302	46,173	\$20.1Tn	\$39.0Tn	\$183.9Tn

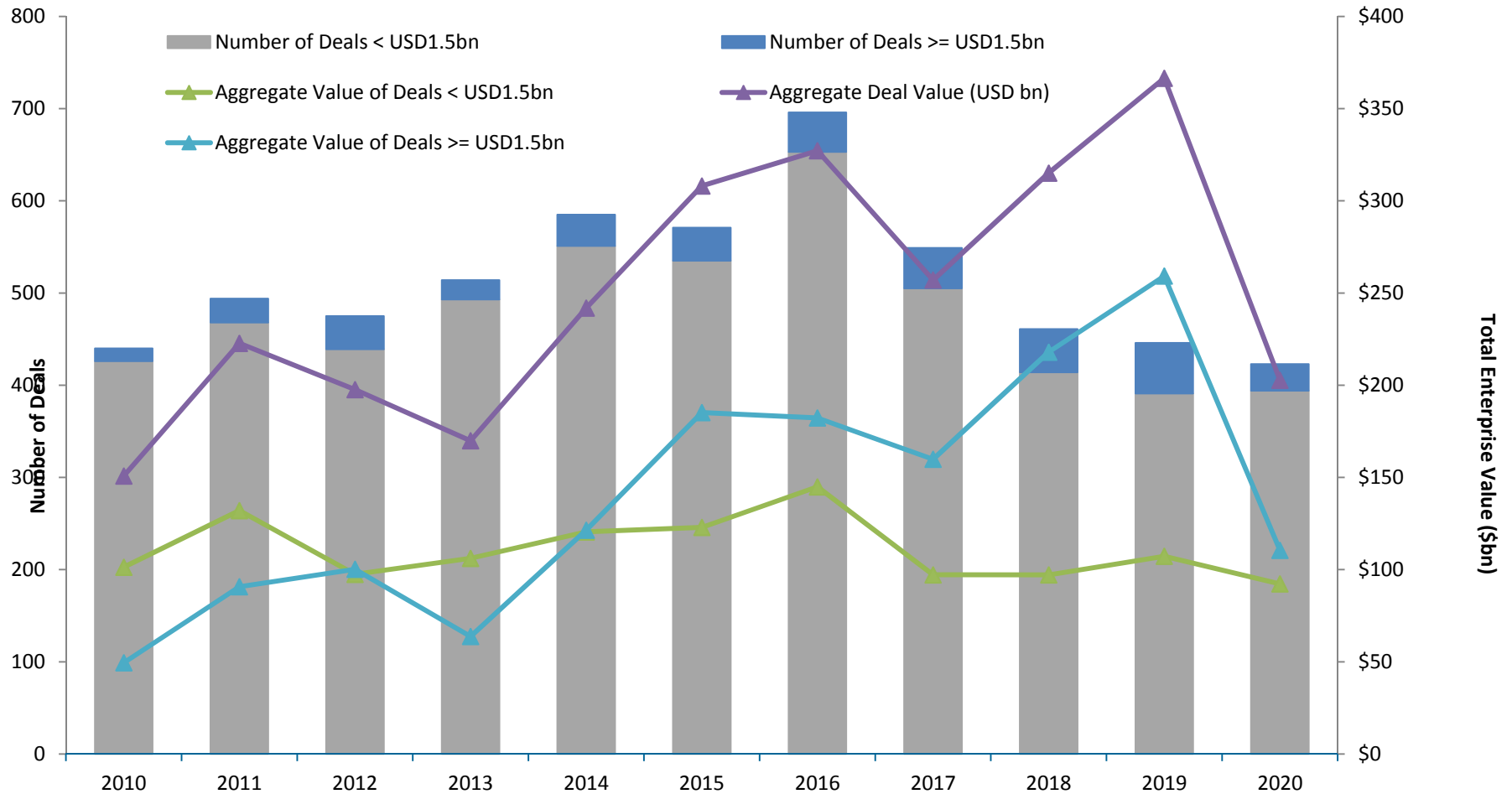
Forecasts, projections and other forward looking statements are based upon current beliefs and expectations. They are for illustrative purposes only and serve as an indication of what may occur. Given the inherent uncertainties and risks associated with forecasts, projections and other forward statements, actual events, results or performance may differ materially from those reflected or contemplated.

Source: US BEA https://apps.bea.gov/iTable/index_FA.cfm, OECD. The BEAs' report on Current Cost of US Fixed assets is used to estimate the size of core infrastructure in the US. BEA does not break out government equipment holdings so they have been excluded from the total. Global Infrastructure size estimated by scaling US estimate by the population and per-capita GDP of respective geographies. Total Infrastructure size is the sum of private and government owned assets.

Infrastructure Transaction Trends

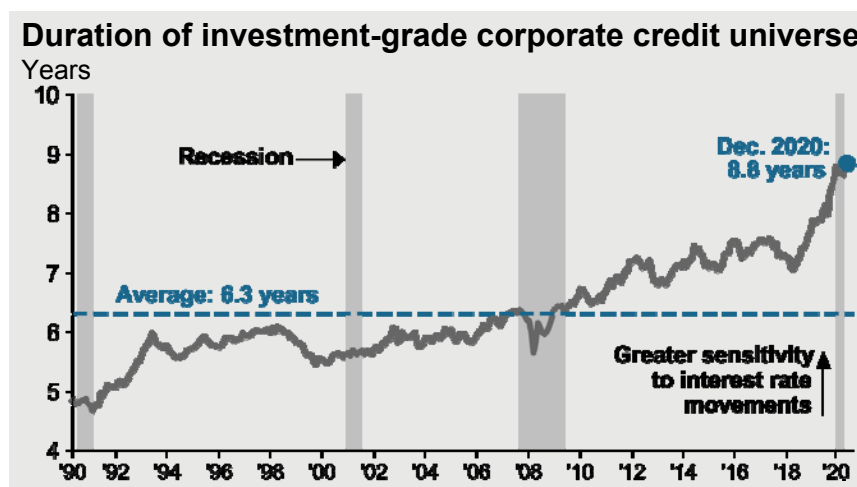
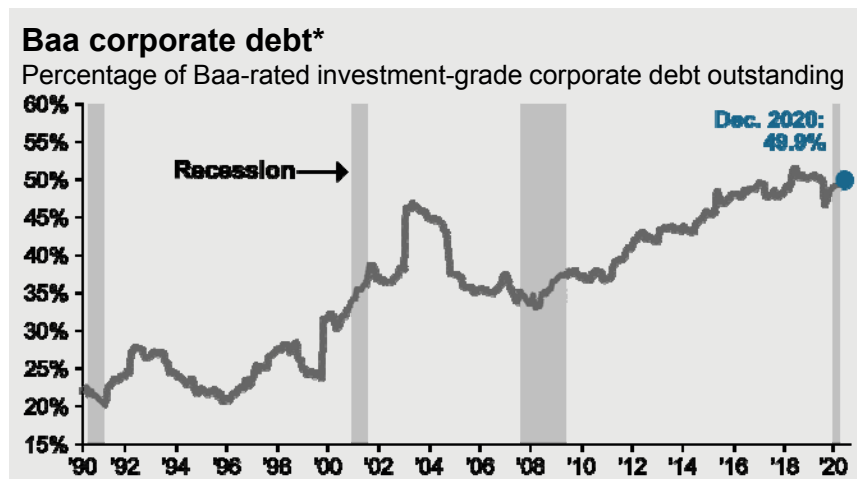
After a pause in early 2020 the market is becoming more active again. Mid-market transactions continue to be the material majority by number of deals

Prequin Infrastructure Transaction Data



Source: Prequin and JPMAM analysis. Data pulled as of Jan 2021. Data may be subject to change as Prequin data evolves.

Transaction Outlook — Elevated Debt Levels Combined with the Effects of COVID-19 Appear to be Driving Corporate Asset Sales



Source: FactSet, J.P. Morgan Asset Management; (Left) Bank for International Settlements (BIS); (Top and bottom right) Barclays, Bloomberg. Government, household and non-financial corporate debt refers to gross debt. General government debt is comprised of core debt instruments that include currency and deposits, loans and debt securities. All debt values are shown at market value. *Baa debt outstanding and duration of investment grade is based on the Bloomberg Barclays U.S. Aggregate Investment Grade Corporate Credit Index. Baa debt is the lowest credit rating issued by Moody's for investment-grade debt.
 Guide to the Markets – U.S. Data are as of December 31, 2020.

Risk and Disclosures

NOT FOR RETAIL DISTRIBUTION: This communication has been prepared exclusively for institutional, wholesale, professional clients and qualified investors only, as defined by local laws and regulations.

The views contained herein are not to be taken as advice or a recommendation to buy or sell any investment in any jurisdiction, nor is it a commitment from J.P. Morgan Asset Management or any of its subsidiaries to participate in any of the transactions mentioned herein. Any forecasts, figures, opinions or investment techniques and strategies set out are for information purposes only, based on certain assumptions and current market conditions and are subject to change without prior notice. All information presented herein is considered to be accurate at the time of production. This material does not contain sufficient information to support an investment decision and it should not be relied upon by you in evaluating the merits of investing in any securities or products. In addition, users should make an independent assessment of the legal, regulatory, tax, credit and accounting implications and determine, together with their own financial professional, if any investment mentioned herein is believed to be appropriate to their personal goals. Investors should ensure that they obtain all available relevant information before making any investment. It should be noted that investment involves risks, the value of investments and the income from them may fluctuate in accordance with market conditions and taxation agreements and investors may not get back the full amount invested. Both past performance and yields are not reliable indicators of current and future results.

J.P. Morgan Asset Management is the brand for the asset management business of JPMorgan Chase & Co. and its affiliates worldwide.

To the extent permitted by applicable law, we may record telephone calls and monitor electronic communications to comply with our legal and regulatory obligations and internal policies. Personal data will be collected, stored and processed by J.P. Morgan Asset Management in accordance with our privacy policies at <https://am.jpmorgan.com/global/privacy>.

This communication is issued by the following entities:

In the United States, by J.P. Morgan Investment Management Inc. or J.P. Morgan Alternative Asset Management, Inc., both regulated by the Securities and Exchange Commission; in Latin America, for intended recipients' use only, by local J.P. Morgan entities, as the case may be. In Canada, for institutional clients' use only, by JPMorgan Asset Management (Canada) Inc., which is a registered Portfolio Manager and Exempt Market Dealer in all Canadian provinces and territories except the Yukon and is also registered as an Investment Fund Manager in British Columbia, Ontario, Quebec and Newfoundland and Labrador. In the United Kingdom, by JPMorgan Asset Management (UK) Limited, which is authorized and regulated by the Financial Conduct Authority; in other European jurisdictions, by JPMorgan Asset Management (Europe) S.à r.l. In Asia Pacific ("APAC"), by the following issuing entities and in the respective jurisdictions in which they are primarily regulated: JPMorgan Asset Management (Asia Pacific) Limited, or JPMorgan Funds (Asia) Limited, or JPMorgan Asset Management Real Assets (Asia) Limited, each of which is regulated by the Securities and Futures Commission of Hong Kong; JPMorgan Asset Management (Singapore) Limited (Co. Reg. No. 197601586K), this advertisement or publication has not been reviewed by the Monetary Authority of Singapore; JPMorgan Asset Management (Taiwan) Limited; JPMorgan Asset Management (Japan) Limited, which is a member of the Investment Trusts Association, Japan, the Japan Investment Advisers Association, Type II Financial Instruments Firms Association and the Japan Securities Dealers Association and is regulated by the Financial Services Agency (registration number "Kanto Local Finance Bureau (Financial Instruments Firm) No. 330"); in Australia, to wholesale clients only as defined in section 761A and 761G of the Corporations Act 2001 (Commonwealth), by JPMorgan Asset Management (Australia) Limited (ABN 55143832080) (AFSL 376919).

For U.S. only: If you are a person with a disability and need additional support in viewing the material, please call us at 1-800-343-1113 for assistance.

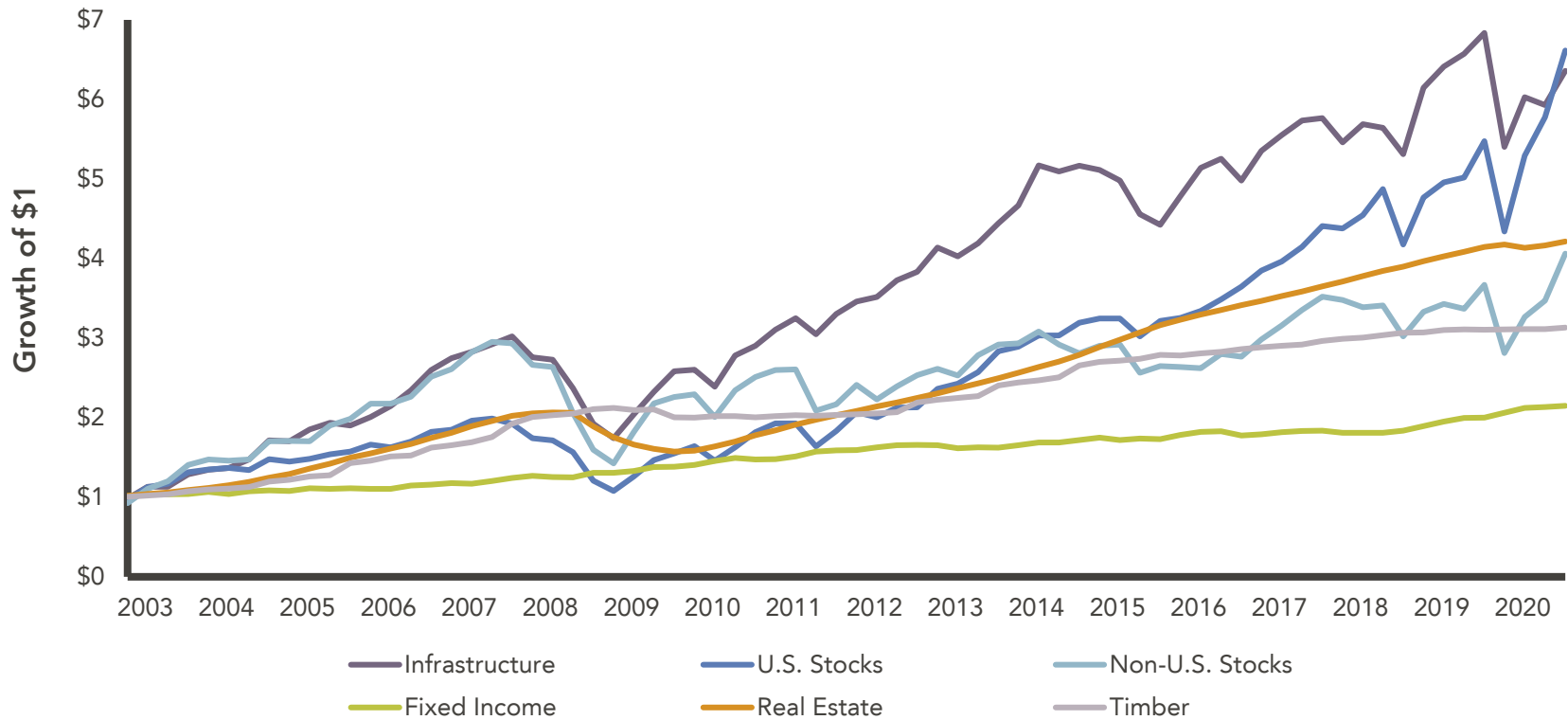
Copyright 2021 JPMorgan Chase & Co. All rights reserved.

21a15f80-5cd7-11eb-a385-eeee0aff9f23 January 29, 2021

Appendix

Historical Returns

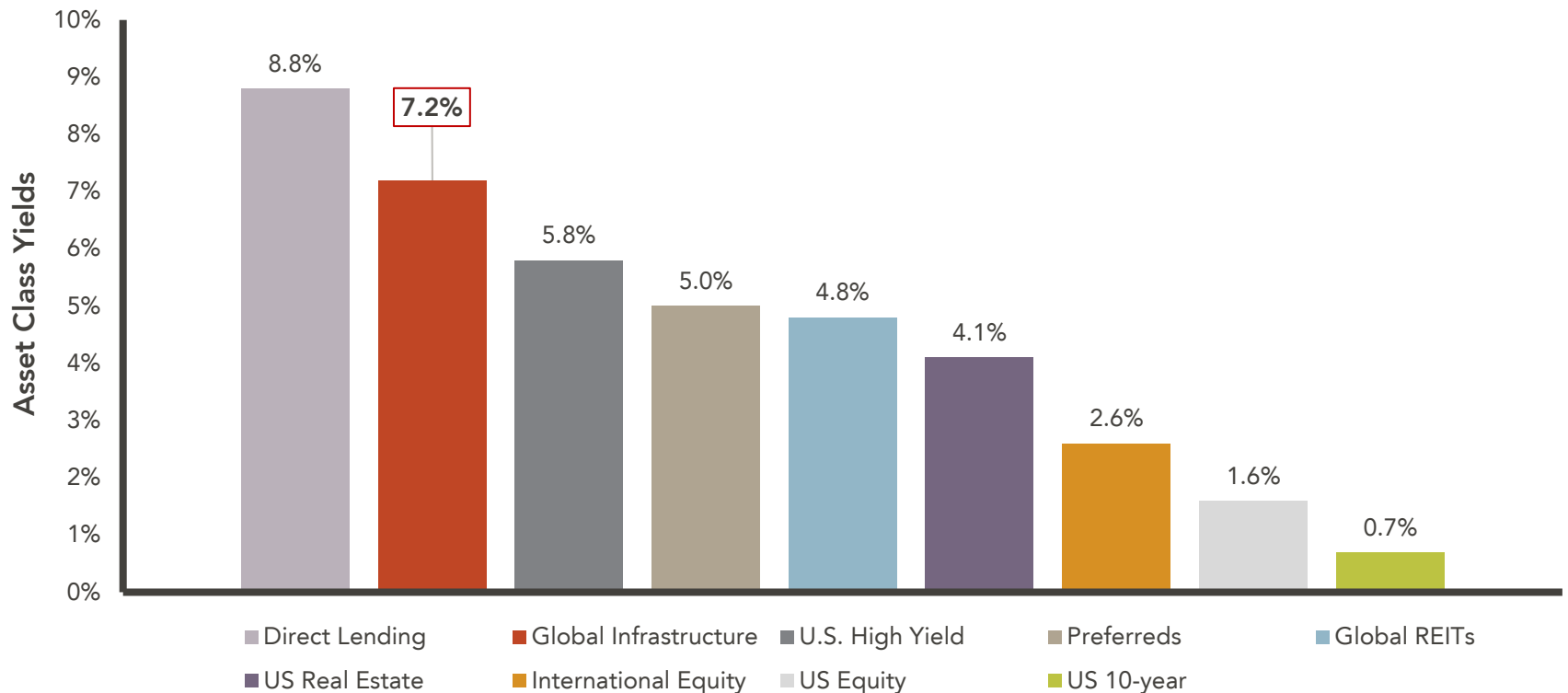
Growth of a dollar, common period March 2003 – December 2020



Source: Bloomberg. Infrastructure represented by Dow Jones Brookfield Global Infrastructure Index; U.S. stocks represented by Wilshire 5000 Index; Non-U.S. stocks represented by MSCI ACWI ex-U.S.; Fixed income represented by Barclays Aggregate; Real estate represented by NCREIF NPI; Timber represented by NCREIF Timberland

Yield Scarcity Appears Likely to Continue

In a world where it appears that income will remain scarce for the foreseeable future, on a relative basis, private infrastructure provides attractive income.

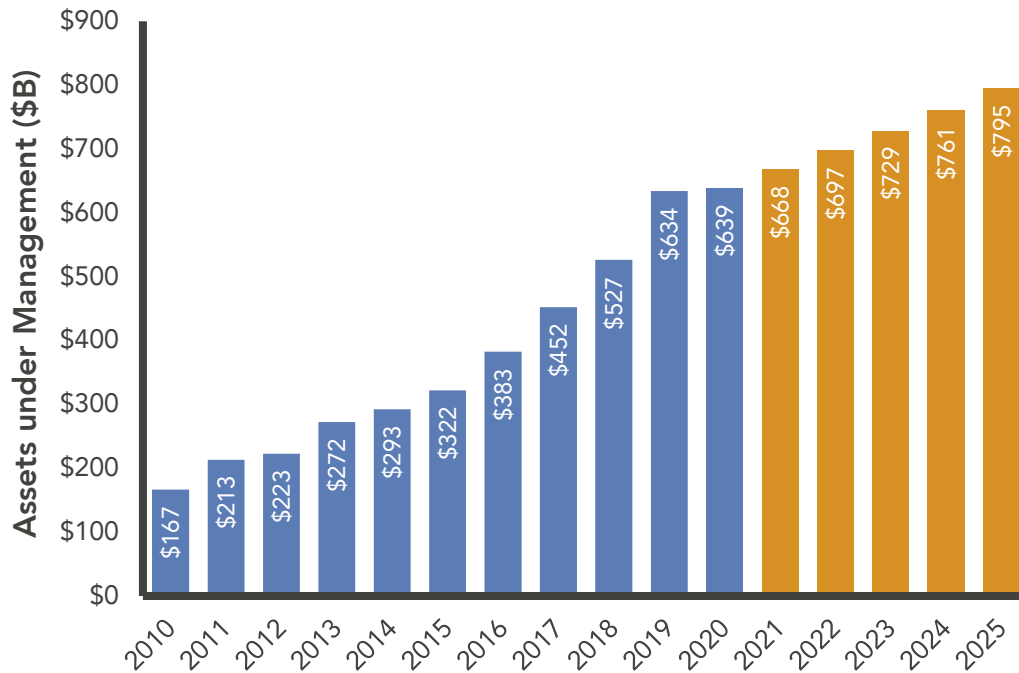


Sources: JP Morgan Asset Management, BAML, Barclays FTSE, MSCI, NCREIF, Factset
Data is based on availability as of 11/30/20; Yields are as of 9/30/20, excluding direct lending, which is as of 6/30/20.

All signs point to expansion

Over the next five years, investors are expected to continue increasing their overall infrastructure assets at a significant pace. This will likely accelerate the growth of mega funds and thus increase the scope for larger deals.

Unlisted Infrastructure AUM Forecast 2021–2025*



Investor Plans for Infrastructure Allocation by 2025

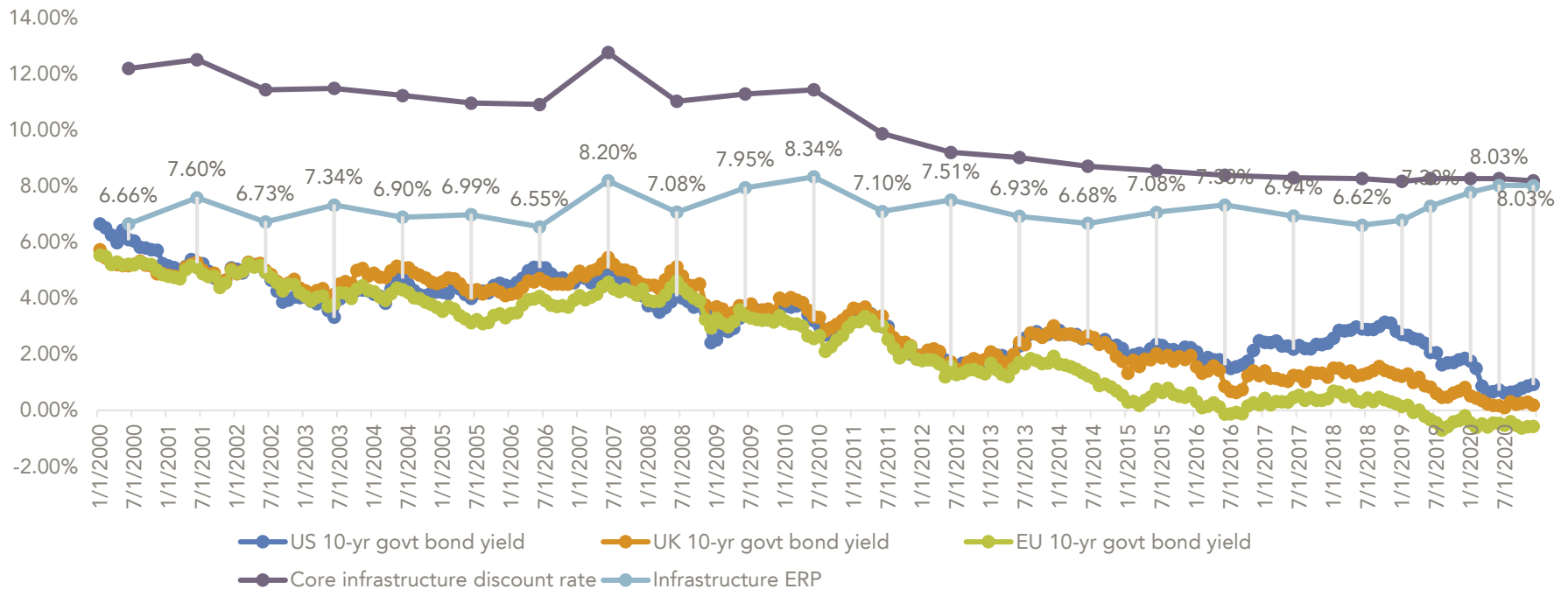


Source: Preqin Pro as of September 30, 2020

Infrastructure expected to provide a risk premium of 8.03% moving into 2021

Even as discount rates for private infrastructure have declined in concert with global yields, the equity risk premium in private infrastructure has remained stable, averaging 7.2% since 2000

Estimates for core infrastructure discount rates vs. risk-free rate proxies



Source: Bloomberg, JPMAM. 2019 discount rate represents year-to-date transactions. Equity risk premiums represent the difference between the core infrastructure discount rate and the geographically weighted annual average government bond yields. Data as of February 2020. ERP = Equity Risk Premium.

Infrastructure benefits vs risks

Infrastructure Benefits

- Growing opportunity set
- Long asset life
- Stable predictable cash flows
- Potential hedge against inflation
- Strong and consistent performance
- Low correlation to other asset classes

Infrastructure Risks

Fund Level

- Concentration
- Currency
- Financing
- Interest Rate
- Liquidity
- Valuation

System Level

- Demand/ patronage
- Inflation
- Political
- Public perception
- Regulatory

Unsystematic

- Disaster
- Environmental
- Obsolescence

Disclosures

The sources of information used in this report are believed to be reliable. Marquette Associates, Inc. has not independently verified all of the information and its accuracy cannot be guaranteed. Opinions, estimates, projections and comments on financial market trends constitute our judgment and are subject to change without notice. References to specific securities are for illustrative purposes only and do not constitute recommendations. Past performance does not guarantee future results.

About Marquette Associates

Marquette Associates is an independent investment consulting firm that guides institutional investment programs with a focused client service approach and careful research. For over 30 years Marquette has served this mission in close collaboration with clients – enabling institutions to be more effective investment stewards. Marquette is a completely independent and 100% employee-owned consultancy founded with the sole purpose of advising institutions. For more information, please visit www.marquetteassociates.com.

Pennsylvania Municipal Retirement System:

Asset Class Study



Presented by

Lee Martin, Ph. D.
Managing Director

William Torre, CFA, CAIA
Assistant Vice President

Table of Contents

- Asset Allocation Study
- Scenario Analysis



Asset Allocation Study

Asset Allocation Study Results

Asset Class	Current Target	Current Allocation	Option 1	Option 2	Option 3
Total Equity	65.0%	65.0%	60.0%	55.0%	55.0%
U.S. Equity	40.0%	40.0%	38.5%	32.5%	32.5%
U.S. Large Cap	25.0%	25.0%	31.0%	26.0%	26.0%
U.S. Small Cap	15.0%	15.0%	7.5%	6.5%	6.5%
Global Equity	0.0%	0.0%	0.0%	5.0%	5.0%
Global Equity	0.0%	0.0%	0.0%	2.5%	2.5%
Global Low Volatility	0.0%	0.0%	0.0%	2.5%	2.5%
Non-U.S. Equity	25.0%	25.0%	21.5%	17.5%	17.5%
Dev Non-U.S. Equity	15.0%	15.0%	16.0%	13.0%	13.0%
Emerging Markets	10.0%	10.0%	5.5%	4.5%	4.5%
Real Assets	20.0%	15.0%	15.0%	15.0%	15.0%
Real Est – Core	15.0%	10.0%	10.0%	10.0%	8.0%
Timber	5.0%	5.0%	5.0%	5.0%	2.5%
Global Infrastructure	0.0%	0.0%	0.0%	0.0%	4.5%
Fixed Income	15.0%	20.0%	25.0%	30.0%	30.0%
Cash	0.0%	0.0%	1.0%	1.0%	1.0%
Core Bonds	15.0%	20.0%	24.0%	24.0%	24.0%
Opp Credit	0.0%	0.0%	0.0%	5.0%	5.0%

	Current Target	Current Allocation	Option 1	Option 2	Option 3
Avg Ann Return	6.88%	6.69%	6.21%	6.06%	6.10%
Avg Ann Risk (St Dev)	11.94%	11.89%	10.78%	9.77%	10.07%
Return/Risk	0.58	0.56	0.58	0.62	0.61

Current Target: Reflects the current plan target allocation

Current Allocation: Reflects the current plan actual allocation

Option 1 (Target Return: 6.2%): Decreases portfolio risk

- Equity allocations more closely aligned with market cap weighted index: US: Large/ Small Cap & Non-US: Developed / Emerging
- Reduces U.S. Equity by 1.5%, Non-U.S. Equity by 3.5%, aligns Real Estate target with actual allocation (decrease 5%) and increases target to Core Bonds by 9% and includes 1% target Cash position

Option 2 (Target Return 6.0%): Decreases portfolio risk & enhances return/risk ratio

- Reduces U.S. Equity by 6% & Non-U.S. Equity by 4%, adds dedicated 2.5% Global Equity, 2.5% Global Low Volatility & 5% Opp Credit

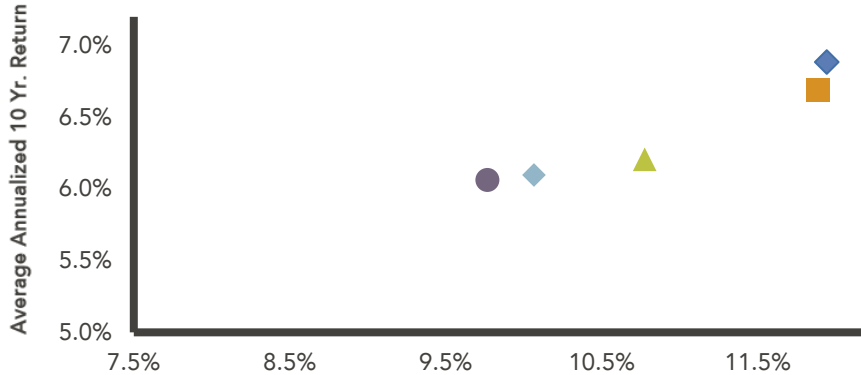
Option 3 (Target Return 6.0%): Adds Real Asset diversification & increases expected return

- Reduces Timber by 2.5% & Real Estate by 2%, adds dedicated 4.5% Global Infrastructure allocation

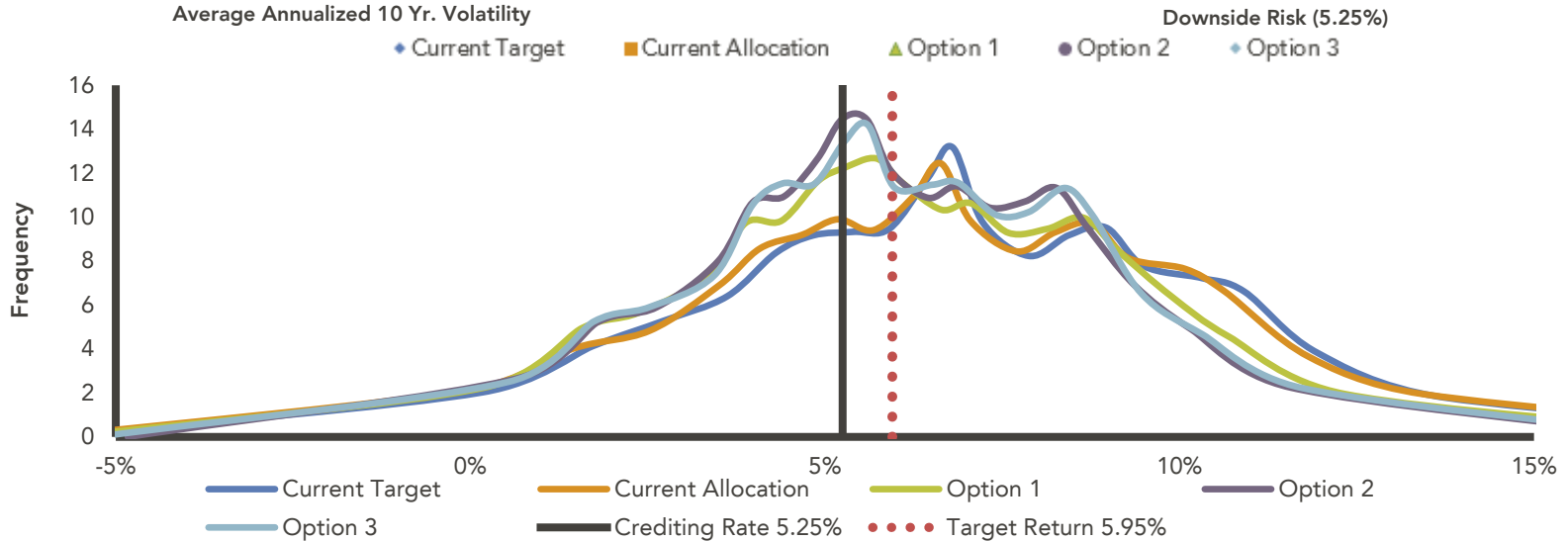
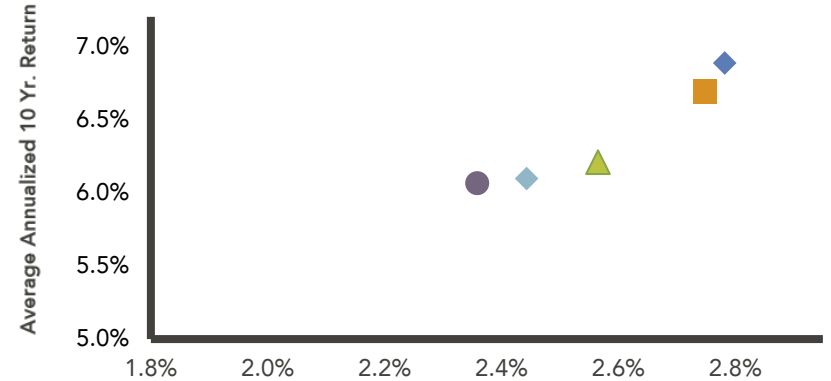
Source: Marquette Associates – 12-31-20 Asset Allocation Study

Summary of Portfolio Statistics

Average Annualized 10 Yr. Return/Volatility



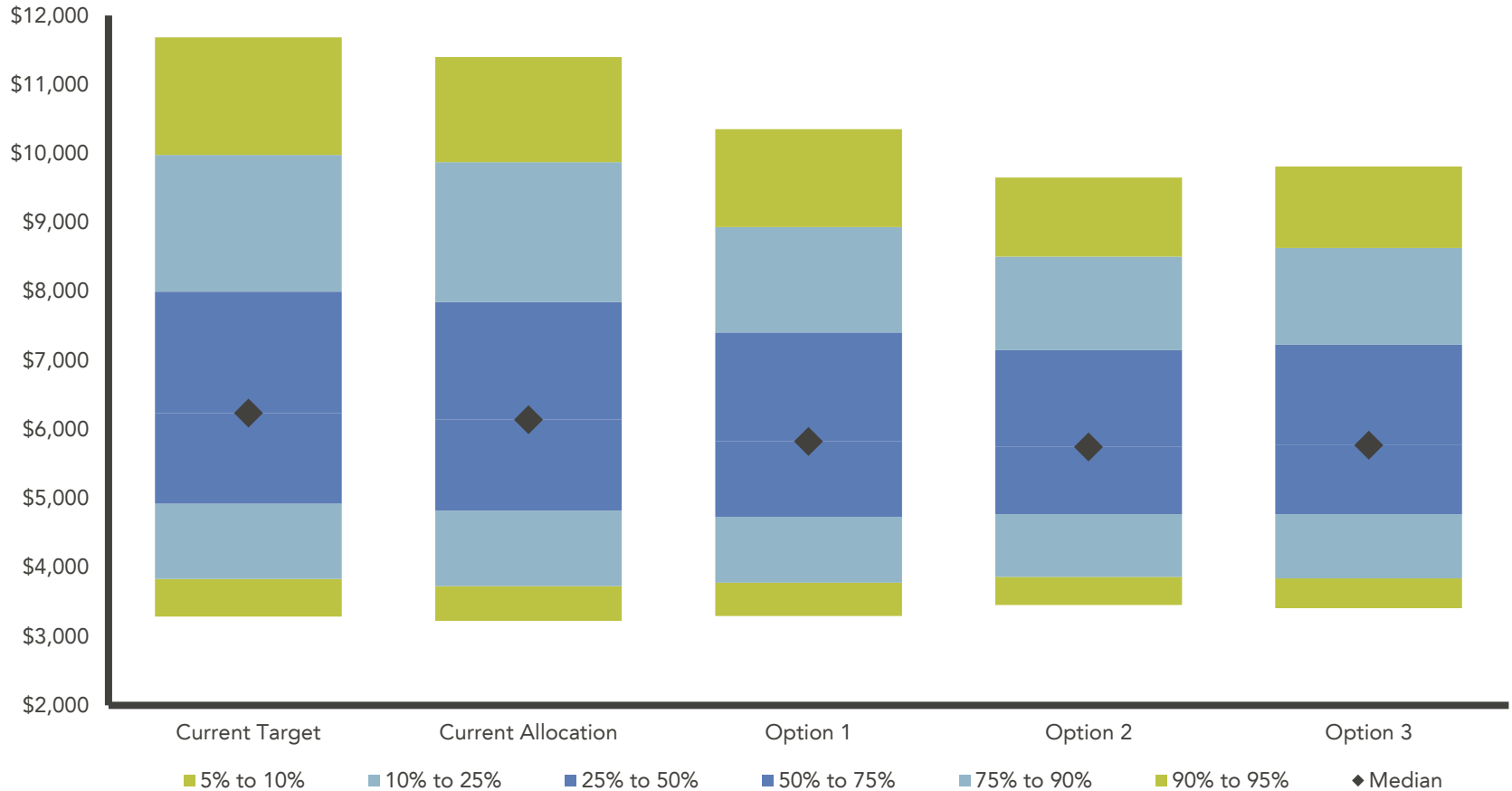
Average Annualized 10 Yr. Return/Downside Risk



Source: Marquette Associates – 12-31-20 Asset Allocation Study

Market Value Distributions

Distribution of Year 10 Market Values (\$ Millions)



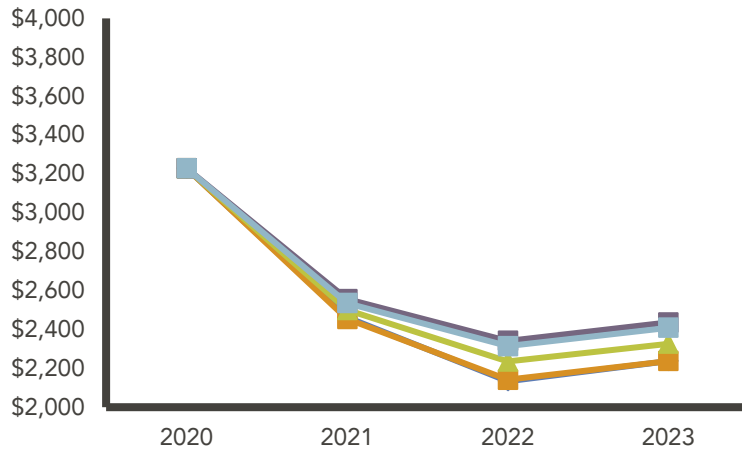
Source: Marquette Associates – 12-31-20 Asset Allocation Study

Scenario Analysis

Designed to evaluate portfolio performance during adverse market conditions. The tool examines portfolios in a number of worst case scenarios to assist in understanding the downside risk in their allocations. It is critical to understand the unpredictable nature of financial markets and that any downturn will not exactly match prior or hypothetical scenarios.

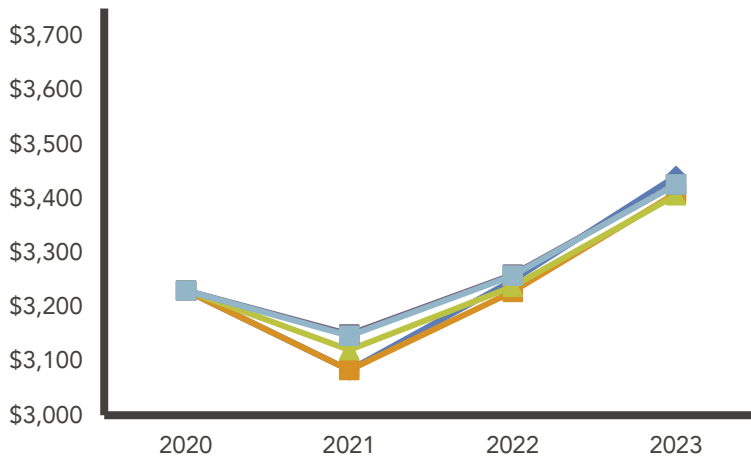
Scenario Analysis: Comparative

2008 Financial Crisis



	Cumulative Returns			Annualized 3 Year Return
	Year 1	Year 2	Year 3	
Current Target	-23.8%	-33.9%	-30.7%	-11.5%
Current Allocation	-24.0%	-33.7%	-30.7%	-11.5%
Option 1	-22.6%	-30.8%	-28.0%	-10.4%
Option 2	-20.9%	-27.5%	-24.6%	-9.0%
Option 3	-21.5%	-28.4%	-25.4%	-9.3%

2011 U.S. Debt Crisis

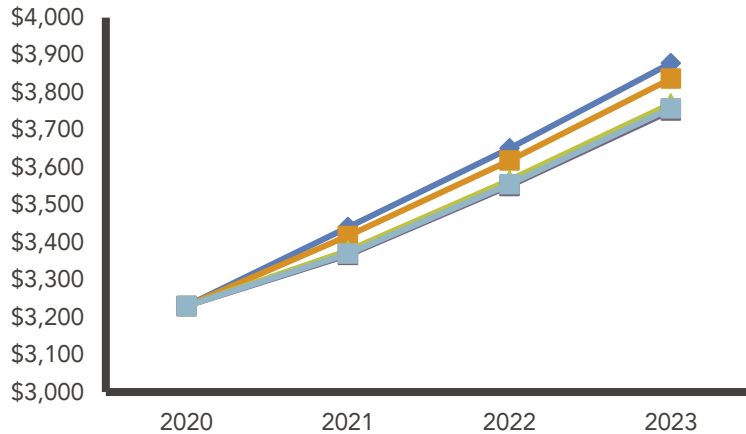


	Cumulative Returns			Annualized 3 Year Return
	Year 1	Year 2	Year 3	
Current Target	-4.5%	0.6%	6.5%	2.1%
Current Allocation	-4.5%	-0.1%	5.6%	1.8%
Option 1	-3.4%	0.2%	5.4%	1.8%
Option 2	-2.5%	0.9%	6.1%	2.0%
Option 3	-2.6%	0.8%	6.1%	2.0%

◆ Current Target ■ Current Allocation ▲ Option 1 ● Option 2 ◆ Option 3

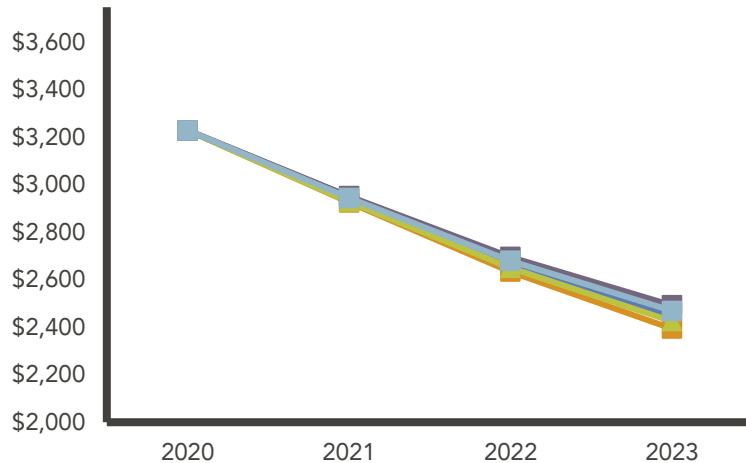
Source: Marquette Associates – 12-31-20 Asset Allocation Study

Scenario Analysis: Comparative



Rates Rise 1% for 1 Year

	Cumulative Returns			Annualized 3 Year Return
	Year 1	Year 2	Year 3	
Current Target	6.5%	13.0%	20.1%	6.3%
Current Allocation	5.8%	12.0%	18.8%	5.9%
Option 1	4.6%	10.4%	16.7%	5.3%
Option 2	4.2%	9.9%	16.2%	5.1%
Option 3	4.3%	10.1%	16.4%	5.2%



Perfect Storm for 3 Years

	Cumulative Returns			Annualized 3 Year Return
	Year 1	Year 2	Year 3	
Current Target	-8.7%	-17.1%	-24.3%	-8.9%
Current Allocation	-9.4%	-18.4%	-25.9%	-9.5%
Option 1	-9.3%	-17.9%	-24.9%	-9.1%
Option 2	-8.6%	-16.5%	-22.8%	-8.3%
Option 3	-8.8%	-17.0%	-23.6%	-8.6%

◆ Current Target ■ Current Allocation ▲ Option 1 ● Option 2 ◆ Option 3

Source: Marquette Associates – 12-31-20 Asset Allocation Study

Stress Scenarios

Baseline: Normal market conditions. Note the results of this scenario may differ from the asset allocation study: the asset allocation study is a stochastic Monte Carlo simulation whereas the stress scenarios are deterministic.

2008 Financial Crisis (October 2007 – Feb 2009): The financial crisis of 2007–09 is considered by many economists to have been the worst financial crisis since the Great Depression of the 1930s. It threatened the collapse of large financial institutions, which was prevented by the bailout of banks by national governments, but stock markets still dropped worldwide. Equities around the world dropped 40% - 50% and the 10-year U.S. Treasury fell from 4.5% to 3.1%.

Black Monday (October 1987): On Monday, October 19, 1987, stock markets around the world crashed. The crash began in Hong Kong and spread west to Europe, hitting the United States after other markets had already declined by a significant margin. The Dow Jones Industrial Average (DJIA) fell exactly 508 points to 1,738.74 (-22.6%) and the 10-year U.S. Treasury dropped from 9.6% to 8.9%.

2011 U.S. Debt Ceiling Crisis and Downgrade (June through September 2011): The United States debt-ceiling crisis of 2011 was a stage in the ongoing political debate in the United States Congress about the appropriate level of government spending and its effect on the national debt and deficit. Ultimately, this led to the credit-rating agency Standard & Poor's downgrading the credit rating of the United States government for the first time in the country's history. The S&P 500 declined by almost 15%.

1994 Interest Rate Spike (December 1993 - December 1994): Yields on 30-year Treasuries jumped some 200 basis points in the first nine months of the year, hammering investors and financial firms. The accepted story is that an over-eager Federal Reserve raised interest rates too soon. Equities fell slightly with the S&P 500 down 1.5%.

1981 Interest Rate Spike (July 1980 – July 1981): The 1970's and early 80's featured stagnant growth coupled with high inflation (i.e. stagflation). In an effort to help contain the rampant inflation, the newly elected Fed Chairman, Paul Volcker, undertook a rapid series of rate hikes. While this process was ultimately successful - inflation dropped from 14.8% in March of 1980 all the way down to 3% by 1983 - the rapid rates decimated many fixed income investors, as the 10-year U.S. Treasury yield rose from 10.3% to 14.3%. However, equities were strong during this time, with the S&P 500 up over 7.5%.

Interest Rates Rise 1% for 1 Year: Treasuries up 1% in year 1 and flat in years 2 and 3.

Interest Rates Rise 1% Annually for 3 Years: Treasuries up 1% for each of the 3 years.

Equities Decline 20% for 1 Year: This is the definition of a bear market. Assumes that corporate spreads widen out by 1% as well, which is roughly the average spread change during equity downturns. Equities are as expected for years 2 and 3, while spreads remain unchanged.

Equities Decline 15% Annually for 3 Years: Equities fall 15% in each of the 3 years with corporate spreads widening 1% each year. This is designed to model out a prolonged downturn in the market.

Perfect Storm for 1 Year: Treasuries and spreads increase 1% in year 1, flat in years 2 and 3. Equities fall 20% in year 1 and as are expected for year 2 and 3.

Perfect Storm for 3 Years: Treasury and spreads increase 1% in each of the 3 years. Equities fall 15% each year.

Disclosures

The sources of information used in this report are believed to be reliable. Marquette Associates, Inc. has not independently verified all of the information and its accuracy cannot be guaranteed. Opinions, estimates, projections and comments on financial market trends constitute our judgment and are subject to change without notice. References to specific securities are for illustrative purposes only and do not constitute recommendations. Past performance does not guarantee future results.

About Marquette Associates

Marquette Associates is an independent investment consulting firm that guides institutional investment programs with a focused client service approach and careful research. For over 30 years Marquette has served this mission in close collaboration with clients – enabling institutions to be more effective investment stewards. Marquette is a completely independent and 100% employee-owned consultancy founded with the sole purpose of advising institutions. For more information, please visit www.marquetteassociates.com.

Pennsylvania Municipal Retirement Systems

Investment Policy Statement



March 18, 2021

TABLE OF CONTENTS

INTRODUCTION..... 2

BACKGROUND 2

PURPOSE..... 2

SCOPE 3

STANDARD OF CARE..... 3

 PRUDENCE..... 3

 ETHICS..... 3

 DELEGATION OF INVESTMENT AUTHORITY 4

DISTINCTION OF RESPONSIBILITIES 4

 RESPONSIBILITIES OF THE BOARD 4

 RESPONSIBILITIES OF THE INVESTMENT COMMITTEE 4

 RESPONSIBILITIES OF THE INVESTMENT CONSULTANT 5

 RESPONSIBILITIES OF ANY INVESTMENT MANAGER(S)..... 5

 RESPONSIBILITIES OF THE CUSTODIAN 6

INVESTMENT OBJECTIVES 7

 RETURN OBJECTIVES..... 7

 RISK TOLERANCE 7

INVESTMENT POLICY..... 8

 ASSET ALLOCATION 8

 REBALANCING AND EVALUATING THE ASSET ALLOCATION 8

 DIVERSIFICATION 8

 DIVERSITY, EQUITY AND INCLUSION..... 8

 PROXY VOTING 8

INVESTMENT MANAGER SELECTION CRITERIA 9

INVESTMENT GUIDELINES..... 9

 GENERAL 9

 EQUITIES 10

 FIXED INCOME 10

 REAL ESTATE..... 11

 TIMBER..... 12

 MUTUAL AND OTHER COMMINGLED FUNDS 12

 TRANSITION MANAGEMENT 12

 PROHIBITED INVESTMENTS..... 12

REVIEW PROCEDURES..... 13

 REVIEW OF INVESTMENT OBJECTIVES 13

 REVIEW OF INVESTMENT PERFORMANCE 13

 REVIEW OF INVESTMENT SERVICES CONSULTANT AND OTHER SERVICE PROVIDERS 13

SIGNATURES..... 14

ATTACHMENTS..... 15

INTRODUCTION

This Investment Policy Statement (“IPS”) is designed to provide a framework within which to manage the investments for the Pennsylvania Municipal Retirement System (“PMRS”). This document will assist the Pennsylvania Municipal Retirement Board (“PMRB”) in fulfilling its fiduciary responsibility. The provisions of this IPS are intended to aid PMRS employees and financial professionals retained by the PMRB in making decisions about investment matters related to the assets of the PMRS.

Background

The PMRS is a state affiliated agency created by the Pennsylvania General Assembly and authorized by Act 15 of 1974 “Pennsylvania Municipal Retirement Law”. Its purpose is to administer public pension plans for municipalities and political subdivisions as authorized by Section 110: Management and Investment of Fund; Interest Credits, of the aforementioned Act. The Treasurer of the Commonwealth of Pennsylvania is custodian of the Fund and has retained a third-party custodian bank to custody the Fund’s assets. The third-party Custodian(s) shall be responsible for safekeeping of the Fund. This responsibility includes all security transaction settlements and deliveries, recordkeeping and reporting.

The Pennsylvania Municipal Retirement System was enacted in 1974. The PMRB is required to establish the regular interest it will credit the accounts on an annual basis in advance of the fiscal year. In determining this rate, the PMRB takes into consideration expected future returns of the portfolio net of all expenses over a typical market cycle (5-10 years). This rate is reviewed annually by the PMRB and updated within **Attachment I** of these guidelines. Excess investment earnings are allocated to plan members on an equalized basis after netting administrative expenses. Policies for determining the amount and allocation of any excess investment earnings is specified in the PMRB policy statement (Excess Interest Award Process) and PMRB policy statement (Allocation of Excess Interest) respectively. Both documents can be found on the PMRS website.

Purpose

This IPS has been adopted by the PMRB in order to:

- Define and generally assign the responsibilities of all involved parties.
- Establish a clear understanding of the investment goals and objectives of the Fund.
- Establish the relevant investment horizon for which the Fund’s assets will be managed.
- Establish a target asset allocation and re-balancing procedures for the Fund.
- Offer guidance and limitations to all third-party investment funds/managers (“Investment Managers”) regarding the investment of assets.
- Establish a basis for evaluating the Fund’s investment results.

In developing this IPS, the PMRB considered pertinent factors such as plan liquidity requirements, investment diversification, actuarial assumptions and the financial impact (including the possibility of significant loss) of a range of asset allocations. This IPS will be updated from time to time as determined by the PMRB within their discretion. Further, changing market conditions, economic trends or business needs may necessitate modification to this IPS. In addition, PMRB may also include a study of portfolio design for optimal diversification and comparisons with peer practices. For this purpose, any such modifications shall be deemed to be made part of this IPS as of the date deemed appropriate by the PMRB.

In general, the purpose of this IPS is to outline a philosophy which will guide the investment management of the Fund's assets toward the desired outcomes. It is intended to be sufficiently specific, yet flexible enough to be practical and to ensure that sufficient prudence and care are exercised in the investment program. This IPS is intended to serve as a reference tool, an operating code, and a communication link between and among the PMRB, plan staff, the Investment Consultant and the Investment Managers. As appropriate, the Investment Fiduciaries will consult with the Funds' actuary(ies) to align investment decisions with the funding obligations of the PMRS.

Scope

This IPS applies to all assets within the PMRS Fund. The investment strategy for the Fund reflects a unique application of the principles of Prudent Person investing, crafted specifically to balance the investment criteria in an appropriate manner for the Fund investors.

This IPS is not intended, and shall not be deemed, to expand the duties of the Funds' fiduciaries or to create duties that do not exist under applicable law or the documents governing the PMRS. If any term of this IPS conflicts with applicable law or those documents, applicable law and the governing Plan documents shall control.

For purposes of this IPS, "Investment Fiduciary(ies)" means any individual or group of individuals that exercise authority or control over the management, disposition or administration of the Plan which includes but is not limited to: the PMRB, plan staff, the Investment Consultant, Investment Managers and Custodian.

STANDARD OF CARE

Prudence

Guidelines respecting prudence have been developed in light of investment objectives related to the Fund. Current actuarial, investment, economic, and market conditions are factors that affect meeting those objectives. Accordingly, these guidelines are, as a part of this IPS, intended to present broad and balanced considerations to guide incumbent and successor PMRB trustees and all other parties concerned, seeking appropriate investment, safekeeping, monitoring and evaluation of the Fund assets.

Plan fiduciaries shall discharge their responsibilities and assets shall be invested in a manner consistent with this IPS, and generally accepted fiduciary standards. All transactions undertaken on behalf of the Fund shall be solely in the interest of Plan participants and their beneficiaries.

In making investments for the Fund, the PMRB is charged with exercising that degree of judgment and care that experienced investors of prudence, discretion, and intelligence employ in the management of their own affairs regarding permanent disposition of their assets. Implementation of this investment standard, commonly called the Prudent Person test (20 Pa. C.S. § 7301), requires the exercise of careful judgment in determining those investments that are appropriate for the Fund based upon income needs, cash flow requirements, investment time horizons, risk tolerance, and other investment criteria. Investment decisions must also reflect any legal standards that authorize or limit the particular kinds of investments that the Fund may hold.

Ethics and Conflicts of Interest

PMRB members and PMRS employees involved in the investment process shall refrain from any personal business activity that could conflict with the proper execution and management of the Fund or that could impair their ability to make impartial decisions. PMRB members and PMRS employees shall

provide all disclosures required by 65 Pa.C.S. § 1101 et seq., commonly known as the Public Official and Employee Ethics Act, which prohibits by way of example PMRS employees receiving anything of value from a vendor or anyone doing business with the PMRS. Financial professionals shall disclose in writing to the PMRB any material interests they hold in financial institutions with which they conduct business or any other sources of potential conflicts of interest. Such written disclosure shall be made immediately upon discovery of the potential conflict.

Delegation of Authority

Authority to manage the Fund assets is granted to the Investment Manager(s). Investment Manager(s) shall act as an agent of the PMRS and must abide by the same ethics and standards as the PMRB. No person may engage in an investment transaction except as provided under the terms of this IPS and/or the Investment Manager Agreement(s). The Investment Manager(s) shall be responsible for all transactions undertaken and shall establish a system of controls to regulate the activities of subordinate officials.

DISTINCTION OF RESPONSIBILITIES

Responsibilities of the PMRB

The PMRB is charged with overall responsibility for investment of the Fund. To assist the PMRB in this function, the PMRB is authorized and permitted to appoint Investment Manager(s), Investment Consultant(s) and other financial experts, including for this purpose: banks, insurance companies, and firms registered under the Investment Advisers Act of 1940 and/or Delaware law, to manage, acquire and dispose of the Plan's assets. The PMRB may consult with legal counsel as necessary.

Any Investment Manager(s) and Investment Consultant the PMRB appoints must agree to act in accordance with all applicable state and federal laws as now apply or may apply in the future.

The PMRB shall develop policies and guidelines regarding Fund investments. These policies and guidelines shall include (but are not restricted to) establishment of:

- Investment Objectives, Investment Policy, Investment Guidelines, Strategic Asset Allocation and Review Procedures as set forth herein.
- Standards for measuring, monitoring, evaluating, and comparing investment performance of the Fund and appointed Investment Managers.
- Procedures for authorization, reporting, control, review and general governance to ensure that Fund investment policies and guidelines are reviewed on a regular basis.
- A management structure and contractual relationships which will ensure appropriate investment management, custody, and compliance procedures.

The PMRB shall examine this statement no less than annually and make appropriate revisions, if necessary. All modifications of policies and/or guidelines shall be in writing, signed by appropriate PMRB signatories.

Responsibilities of the Investment Committee

The Investment Committee consists of the Treasurer of the Commonwealth of Pennsylvania and no less than three current PMRB members. The Investment Committee's purpose is to assist the PMRB in fulfilling its investment responsibilities and has been delegated all necessary power and authority by the PMRB to assist in performing specific investment functions for the PMRB including (but not limited to):

- Review of the Investment Policy, Investment Guidelines and Strategic Asset Allocation.

- Monitoring, evaluating, and comparing investment performance of the Fund and appointed Investment Managers.
- Review of plan procedures and general governance including Proxy Voting.
- Monitoring of management structure and contractual relationships to ensure appropriate investment management, custody, investment advisement and compliance procedures are adequately met.

The Investment Committee shall meet at least four times annually and present summary reports of their activities, findings, recommendations, and other relevant issues to the PMRB.

Responsibilities of the Investment Consultant

PMRB may select and retain the services of an Investment Consultant for the purpose of:

- Investment policy development.
- Asset allocation studies and recommendations on strategic asset allocation.
- Investment manager due diligence, screening, recommendation for selection and termination.
- Advice on implementing the investment policy and asset strategy.
- Recommendations for rebalancing the assets.
- Evaluating and reviewing investment performance of the Fund and appointed Investment Managers.
- Providing results through monthly reporting and prepare topical studies (as needed).

The observations and recommendations of the Investment Consultant will be considered by the PMRB in conjunction with other available information for the purpose of making informed and prudent decisions.

The Investment Consultant must agree to act in accordance with all applicable state and federal laws as now apply or may apply in the future. The Investment Consultant must adhere to the applicable Investment Consultant Contract and perform all duties required of the Investment Consultant under such contract.

Responsibilities of any Investment Manager(s)

The management of the Fund and the responsibilities for investment decisions are delegated to the appointed Investment Manager(s). Any Investment Manager(s) shall exercise complete discretion, consistent with the Investment Objectives, Investment Policies, and Investment Guidelines set forth in this Statement, over the Fund assets that have been assigned, within the limits established by this Statement and their Investment Manager contract. Accordingly, the Investment Manager shall comply with all laws and regulations in effect during the term of their agreement. Particular attention should be given to the fiduciary duties established by the prudent person doctrine.

Investment Manager(s) must agree to act in accordance with all applicable state and federal laws as now apply or may apply in the future.

Investment Manager(s) must be currently registered and maintain registration as an investment advisor under the Investment Advisors Act of 1940 (the “Act”), a bank (as defined in the Act), or an insurance company qualified to perform investment management services under the laws of more than one state unless otherwise approved on an exception basis.

Applicable terms, conditions, limitations, and restrictions notwithstanding, any Investment Manager(s) serving the Fund shall:

- Discharge all duties relating to the Fund solely in the interest of Plan participants and beneficiaries.
- Diversify the investments of any Fund portfolio(s) so as to minimize the risk of substantial loss.

Any Investment Manager shall also consider the composition of the Investment Manager's portfolio(s) with regard to:

- Diversification.
- Liquidity relative to the Plan's cash flow requirements.
- Projected total return relative to benchmark and peer group.
- Potential losses and gains.

All investment performance data submitted by, or on behalf of, any Investment Manager to the PMRB or the PMRB's designee, shall conform with the Performance Presentation Standards and/or Global Investment Performance Standards established by the CFA Institute.

PMRB has retained a proxy voting service, to vote all domestic proxies on behalf of the Fund. International Investment Manager(s) must exercise the proxy voting rights related to securities held in its portfolio in a manner consistent with the economic best interests of the Fund and in line with the PMRS proxy voting policy statement which is located on the PMRS website.

Any Investment Manager(s) shall demonstrate insurance coverage and bonding at such levels as set by the PMRB from time to time.

Investment Managers shall comply with reasonable requests without delay, including document production requests, from the PMRB.

If, at any time, an Investment Manager(s) believes this Statement inhibits its ability to effectively perform its investment assignment, it is the Investment Manager's responsibility to communicate this view to the PMRB and Investment Consultant.

Any Investment Manager will promptly notify the PMRB and Investment Consultant, in writing, regarding all material matters or significant changes including but not limited to:

- Changes in investment strategy, portfolio structure, tactical approaches, and market value of managed assets.
- Material changes in ownership, organizational structure, financial condition, and/or professional staff of the investment firm.
- All material legal, SEC, and/or other regulatory proceedings affecting the firm.

Responsibilities of the Custodian

The Treasurer of the Commonwealth of Pennsylvania serves as statutory custodian of the funds of virtually all state agencies, with the responsibility for monitoring and safeguarding money and securities, according to the Fiscal Code 72 P.S. § 303. The Treasurer has broad authority to place these moneys in any investments subject to a standard of prudence and diligence. PMRS is required by law to utilize the Pennsylvania State Treasury as the depository.

The Treasurer of the Commonwealth of Pennsylvania has retained a third-party custodian bank to custody the Fund's assets. The Custodian(s) shall be responsible for safekeeping of the Fund. This

responsibility includes all security transaction settlements and deliveries, recordkeeping and reporting. Recordkeeping and reporting shall include providing ready access to information to the PMRB and staff and any custom recordkeeping, record retention, or reporting reasonably required by the PMRB or staff. Transaction records shall be maintained on a trade date basis. Nationally accepted asset pricing should be daily and reported not less often than monthly.

The custodian bank is acting in a fiduciary capacity in the performance of its duties. The Custodian Bank shall exercise the same care and diligence that it would devote to its own property in like circumstances.

INVESTMENT OBJECTIVES

Return Objectives

Investment objectives are long-term in nature. All parties recognize securities markets can be volatile and unlikely to provide consistently favorable investment conditions when assessing on a shorter-term basis.

Given this, long-term objectives are:

- The performance objective of PMRS is to meet or exceed the regular interest rate of return net of all program fees, documented in **Attachment I**, over a full market cycle, with a level of risk deemed appropriate by the PMRB.
- Total annualized net investment return from all investments of the Funds and each asset class of the Funds is expected to meet or exceed the annualized return of the designated benchmark/s over a full market cycle.

Investment performance objectives for the Funds are, as stated above, long-term in nature. Concern respecting market value or investment return volatility and other measures reflecting investment uncertainty, will be addressed through asset (class) allocations, investment management processes or “styles”, portfolio diversification, and other investment management guidelines and/or restrictions.

Risk Tolerance

The PMRB recognizes that some level of risk is necessary to produce long-term investment results sufficient to meet the goals and objectives of this IPS. However, the Investment Managers are to make reasonable efforts to control risk, and they will be evaluated regularly by the Investment Consultant to ensure that the risk taken is commensurate with the given investment style and their stated objectives. With that background in mind, the PMRS’s risk tolerance is outlined below:

- Accept prudent levels of short and long-term volatility consistent with the near-term cash flow needs, and the long-term liability structure of PMRS.
- Tolerate appropriate levels of downside risk relative to the PMRS target rate of return. In doing so, the Investment Consultant, in conjunction with the PMRB, will attempt to minimize the probability of underperforming the target rate of return over the long-term and to minimize a funding shortfall in the event such underperformance occurs.
- Accept certain variances in the asset allocation structure of PMRS relative to the broader financial markets and peer groups.
- Tolerate certain levels of short-term underperformance by the Investment Managers if comfortable with the causes for the underperformance.

INVESTMENT POLICY

Investment Policy delineates controls and the associated monitoring intended to enhance the likelihood of meeting Investment Objectives.

Asset Allocation

Asset class allocation decisions are intended to identify an appropriate investment approach for achieving PMRS's Investment Objectives while limiting investment risk through diversification (and other factors deemed relevant by the Investment Fiduciaries). The asset class targets delineated in **Attachment I** provide a framework through which the Plan's investments may be adjusted to meet economic and/or investment market conditions while continuing to be invested within the broader allocation framework deemed appropriate to the PMRS's long-term Investment Objectives. The progression from current asset class targets to the ones delineated in **Attachment I** is intended to be a thoughtful and deliberate process.

Rebalancing and Evaluating the Asset Allocation

The asset allocation range established by this investment policy represents a long-term perspective. As such, rapid unanticipated market shifts or changes in economic conditions may cause the asset mix to fall outside the policy range. These divergences should be of a short-term nature. The PMRB, along with assistance from the Investment Consultant, will monitor the asset allocation in relation to the Funds long-term strategic asset allocation. The Fund will be rebalanced back to strategic asset allocation targets at the end of each quarter and in circumstances when total equities exceed +/-5% of their target allocation. Under/over weights to illiquid investments will be allocated to both equity and fixed income in proportions consistent with their overall risk/return characteristics.

At any time, the PMRB may adjust cash flows or assets to achieve appropriate allocation levels to meet the immediate needs of the fund.

Diversification

Investments must be broadly diversified to minimize the risk of substantial loss unless under the circumstances it is clearly not prudent to do so. Significant diversification can be accomplished through asset allocation, portfolio structure, and the selection of unique Investment Managers (among other things). This IPS includes certain restrictions intended to optimize investment diversification.

Diversity, Equity and Inclusion Diversity is a critical risk management tool, which will be applied to the PMRS portfolio and its partners in implementing our investment objectives. Numerous studies have found an association between diversity and improved financial performance and corporate governance. In an effort to identify and mitigate potential issues of enterprise risk stemming from a lack of diversity, and to be consistent with the Commonwealth's Department of General Services procurement policies, PMRS will include diversity among the factors considered when selecting investment partners and service providers. In addition, ongoing due diligence of and reporting by Investment Managers will include the gender, racial, and ethnic diversity of various aspects (ownership, management, and employee base) of these firms.

Proxy Voting

The PMRB takes full responsibility for exercising the voting privilege contained in proxy solicitations generated by companies domiciled in the United States per its proxy voting policy statement. The PMRS has retained a proxy voting service, to vote all domestic proxies on behalf of the Fund. Proxy solicitations by non-United States domiciled companies shall be handled by the investment manager that holds the security of that company in their portfolio.

The PMRB may enter into contracts with third party providers of research relating to the issues for which the PMRB's vote is being solicited. The PMRS staff shall report at least annually to the PMRB on the proxies voted. The PMRB shall adopt specific guidelines for staff guidance. The proxy guidelines as adopted and hereafter amended shall be considered an integral part of these investment guidelines.

INVESTMENT MANAGER SELECTION CRITERIA

The PMRB, with consultation from the Investment Consultant and the PMRS Investment Committee, will select, assess, and replace Investment Managers to invest the assets of PMRS, done in a prudent manner and for the exclusive benefit of the PMRS. If the PMRB determines that an Investment Manager should be selected or replaced, the below criteria will be used as a guide (among other factors the PMRB deems prudent) to evaluate potential alternatives:

- Overall firm strength.
- Investment professional's tenure and depth of the investment manager's team.
- Well-articulated and consistent application of investment philosophy and process.
- Portfolio characteristics and sector weightings relative to style benchmark.
- Consistent long-term performance relative to style benchmark and style universe.
- Portfolio's long-term risk/reward profile compared to style benchmark and industry style universe.
- Investment management fees compared to industry average.

The PMRB recognizes further opportunities to achieve its investment goals by diversification by manager selection and/or scoring investment managers similar to the Commonwealth's Department of General Services small diverse program. Diversification by manager is defined as including minority- and/or woman-owned investment management firm in which ownership is more than 50% *Black, Latino, Pacific Islander, or Native American, or female*. To achieve said manager diversity, the Board may employ the Small/Diverse Business guidelines as promulgated by the Commonwealth's Department of General Services, or a derivative thereof.

Notwithstanding any other provision of this IPS to the contrary, the PMRB may place any Investment Manager under formal performance review, or the Investment Manager can be immediately terminated at any time and for any reason.

INVESTMENT GUIDELINES

General

The Investment Manager(s) shall conform to the Investment Guidelines set forth below. Any departure from the Guidelines must be submitted in writing to the PMRB and Investment Consultant for formal approval, as must any change in the "style" or investment philosophy, process, or practices approved by the PMRB at the time any Investment Manager was retained to serve PMRS.

- Each Investment Manager shall select investments in conformity with criteria normally applied in its decision-making process and previously reviewed and approved by the PMRB.
- Any security purchased in compliance with the standards cited in this Statement or in the Investment Manager (s) contract, but no longer meeting Investment Guideline standards and/or causing portfolio non-compliance, may, in lieu of immediate sale, be reported by any

Investment Manager (s) to the PMRB and Investment Consultant, with background information and an intended future course of action. The PMRB may, upon review, approve temporary or indefinite retention or, in the PMRB's best judgment, order disposition of the security and a return to full compliance. For any individual Investment Manager, securities retained under such circumstances shall constitute no more than five (5) percent of the market value of securities of the assets managed by the Investment Manager (5 percent "basket clause").

- Any Investment Manager (s) managing active portfolios will be assigned indices or other types of benchmarks deemed suitable for their investment assignment and agreed upon with the PMRB, PMRS staff and Investment Consultant. As a general expectation investment performance of those Investment Managers should exceed their assigned benchmarks, net of fees, on an annualized basis over a full market cycle.

Equities

The objective of equity investments is return generation either through dividend income or capital appreciation while displaying reasonable amounts of risk. Investment Manager(s) are expected to purchase marketable equity securities listed on national securities exchanges. Equity investments can be made through separately managed accounts, commingled investment trusts, exchange-traded funds (ETFs), mutual funds and/or pooled trusts (and such other forms deemed appropriate by the PMRB and Investment Manager(s)).

Investment Managers are given latitude in security selection subject to the following:

- Permissible equity investments include, but are not limited to, common equity, convertible securities, publicly traded REITs and American Depositary Receipts.
- Sector, industry, regional and individual security diversification should be maintained.
- Active Investment Managers shall not invest on a market value basis more than (the greater of seven and five-tenths (7.5%) percent of their assigned portfolio in the security (-ies) of a single corporation or group of directly affiliated corporations. If a particular security's weighting within the Investment Manager(s) benchmark is greater than 7.5%, the Investment Manager(s) can invest up to 10% greater than the weighting of the security within the index. For example, if a security has a 10% weighting within their respective index, the Investment Manager(s) may invest up to 11% of their portfolio in that security. If this level is breached, the Investment Manager must notify the Investment Consultant and PMRS staff.
- No active Investment Manager may use assigned funds to make or maintain an investment equaling or exceeding ten (10) percent ownership of the outstanding equity security(-ies) of a single corporation, or group of directly affiliated corporations.
- Stock options may be utilized by an Investment Manager(s) managing U.S. equity securities in "covered" or hedging postures but not in "naked" or speculative postures, provided it is specifically part of the investment mandate the manager was hired to execute;
- Hedging to protect against currency impact upon a security position is permissible. Nevertheless, the purchase of speculative or "naked" currency contracts (i.e., currency trading or related risk taking), undertaken without a demonstrable exposed investment position to be hedged in a specific currency, is prohibited.

Fixed Income

The objective of fixed income investments is to provide income generation and pricing stability in periods of heightened market volatility. Fixed income investments shall be marketable securities including, but are not limited to, U.S. Treasury and Federal agency securities, municipal securities, marketable debt securities of U.S. corporations, domestic and Yankee certificates of deposit, banker's acceptances,

commercial paper, or other generally utilized money market or cash equivalent investments, including money market mutual funds meeting the quality standards delineated below. Fixed Income investments can be made separately managed accounts, commingled investment trusts, exchange-traded funds (ETFs), mutual funds and/or pooled trusts (and such other forms deemed appropriate by the PMRB and Investment Manager(s)).

The effective duration of fixed income securities, said average for active investment managers including any investments considered to be reserve or cash equivalent assets specific to any fixed income portfolio, shall be no more than ten (10) percent greater nor twenty (20) percent less than the effective duration of the policy benchmark.

Investment Managers are given latitude in security selection subject to the following:

- No issuer, other than the U.S. Government or Federal agencies, may represent more than five (5) percent of the total market value of the fixed income portfolio managed by any Investment Manager(s).
- There is no limit upon investment in U.S. Treasury securities as a percentage of fixed income investments, except that any single issue thereof may constitute no more than twenty-five (25) percent of any Investment Manager(s)' fixed income investments at market value and any single Treasury zero coupon issue ten (10) percent at market value. Federal Agency securities are hereby limited to twenty-five (25) percent per agency, and to ten (10) percent, at market value, per any single Federal Agency issue.
- Non-investment grade bonds (below Baa) are permissible but may not constitute more than twenty (20) percent of the fixed income portfolio.
- Cash and equivalents are the only permissible form of investment that is to be used for operating capital necessary for daily operations and reserves. Investments in cash and equivalents shall be in U.S. dollars in either:
 - Money market mutual funds or,
 - FDIC-insured Deposit Accounts or,
 - Cash sweep vehicles or money market mutual funds held within SIPC-protected brokerage accounts.

Real Estate

The objective of the real estate portfolio is to provide portfolio diversification and stable cash flows with modest asset appreciation over a full market cycle. Real estate assets are currently held through direct equity participation in separately managed accounts and open-ended commingled funds. The PMRS may also invest in publicly traded Real Estate Investment Trusts (REITs) or closed-end private real estate commingled funds. Specific investment processes as well as specific investment constraints will be identified in the individual real estate contract.

Separately managed mandates will focus on income generation and proper portfolio diversification in terms of number of assets, sector and geographic allocation. A proposed investment shall exhibit institutional quality which is defined as like investments made by similar style pension funds. All investments shall be underwritten, managed by and (when necessary) disposed of by a qualified real estate investment manager. Property acquisition, management and disposition shall be guided by the prudent expert standard.

Pooled real estate investment funds will diversify their exposures by property type and location in an attempt to limit exposure to any single property type or to any single geographic area. It is expected that at various points in time, the portfolio may be more heavily exposed to a single property type or location

by virtue of opportunities in the market that are expected to generate excess return above long-term expectations.

All real estate investments shall be valued by a qualified independent appraiser(s) at regular intervals, but no less often than annually. Managers shall estimate the market value of each property investment in those periods independent appraisals are not performed and this manager valuation shall be used for performance measurement purposes. The firm/appraiser must be a state certified general real estate appraiser for the state in which the property to be appraised is located. For purposes of tracking value and performance, an annual update appraisal in each of the two interim years shall also be conducted. The same independent appraiser who performs the comprehensive appraisal may also perform the update appraisals. The same firm/appraiser may not perform successive comprehensive (non-update) appraisals.

The diversification of all real estate portfolios will be compared to the composition of its peer benchmark the NCREIF ODCE Index. Limited use of leverage is permissible to enhance investment returns and to mirror the NCREIF ODCE Index as laid out in each of the manager's contracts.

Timber

The objective of timber assets is to provide stable cash flows with modest property appreciation over a full market cycle. Investment in timber assets are currently owned through direct equity participation but the PMRS could also invest in closed or open-end private timber commingled funds. The portfolio should maintain diversification through types of timber and geographic locations.

All timber shall be managed by and disposed of (if necessary) by a qualified timber investment management organization (TIMO). Acquisition, management, and disposition of investments shall be guided by the prudent expert standard. All timber properties shall be valued by an independent third-party appraiser annually and changed at least once every three years. The firm/appraiser selected must be a state certified general real estate appraiser for the state in which the timber to be appraised is located. For purposes of tracking value and performance, an annual update appraisal in each of the two interim years shall also be conducted. The same independent appraiser who performs the comprehensive appraisal may also perform the update appraisals. The same firm/appraiser may not perform successive comprehensive (non-update) appraisals.

The diversification of the timber portfolio will be compared to the composition of its peer benchmark the NCREIF Timberland Property Index.

Commingled Funds

Given the nature of commingled fund investment vehicles (commingled investment trusts, mutual funds, limited partnerships, etc.), it is recognized that there may be deviations between the objectives, intent or specific requirement of this IPS and the stated objectives, intent or content of any commingled fund. However, reasonable efforts shall be made, to the extent practical, prudent and appropriate, to select commingled funds that have investment objectives and policies that align with this IPS.

Portfolio Transition Management

In periods of portfolio transitioning into and out of investment managers, the PMRB may hire transition managers to assist with portfolio trades to alleviate possible negative trading impact on the portfolio. These transition managers will adhere to their specific manager guidelines.

Prohibited Investments

Securities having the following characteristics, unless stated otherwise in an investment management agreement, are not authorized and shall not be purchased: letter stock and other unregistered securities, commodities or commodity contracts where the Funds are a counterparty, short sales, and margin

transactions. Further, derivatives, options, futures, or any other investment for the sole purpose of direct portfolio leveraging are prohibited. Direct ownership of oil, gas or mineral rights (outside of the mineral rights that come with the purchase of timber lands) and the purchase of collectibles is also prohibited.

Notwithstanding anything in the Investment Guidelines to the contrary, only an investment permitted by applicable law may be considered and, then, only if such investment is determined to be prudent and in the best interests of Plan participants and beneficiaries.

REVIEW PROCEDURES

Review of Investment Objectives

The Investment Consultant shall periodically review and report to the PMRB, not less frequently than annually, the appropriateness of this IPS for achieving the PMRS's stated objectives. It is not expected that this IPS will change frequently. In particular, short-term changes in the financial markets generally should not require an adjustment in this IPS.

Review of Investment Performance

The Investment Consultant shall report on a monthly basis to the PMRB to review the investment performance of PMRS. In addition, the Investment Consultant will be responsible for keeping the PMRB and PMRS staff advised of any material change in investment strategy, Investment Managers, and other pertinent information potentially affecting performance of PMRS.

The Investment Consultant shall compare the investment results on a quarterly basis to appropriate peer universe benchmarks, as well as market indices in both equity and fixed income markets.

Review of Investment Consultant and Other Service Providers

The PMRB shall periodically, and not less frequently than annually, review the performance of the Investment Consultant and other service providers to PMRS.

SIGNATURES

The effective date of this Investment Policy Statement is March 18, 2021.

Adopted by the Pennsylvania Municipal Retirement System Board on March 18, 2021.

ATTEST

**PENNSYLVANIA MUNICIPAL
RETIREMENT BOARD**

Signature

Name

ATTACHMENT I – Pennsylvania Municipal Retirement System

<u>Asset Class</u>	<u>Minimum, %</u>	<u>Target, %</u>	<u>Maximum, %</u>	<u>Benchmark</u>
Equities	55.0	65.0	75.0	
Domestic	35.0	40.0	45.0	Russell 3000
International	20.0	25.0	30.0	MSCI ACWI ex U.S. IMI (net)
Real Estate	0.0	12.5	15.0	NCREIF ODCE
Timber	0.0	7.5	10.0	NCREIF Timberland
Fixed Income	10.0	15.0	25.0	
Investment Grade	10.0	15.0	20.0	Bbg Barclays Aggregate
Cash	0.0	0.0	10.0	BofAML 90-Day T-Bill

*Note current crediting rate is 5.25%