DISTRIBUTION DATE: May 21, 2020

CITY OF OAKLAND

MEMORANDUM

TO: HONORABLE MAYOR & CITY COUNCIL

FROM: Adam Benson Director of Finance

SUBJECT: Oakland PFRS's Investment Portfolio and Actuarial Valuation Reports

DATE: May 11, 2020

INFORMATION

As a continued best practice and in accordance with the City of Oakland Charter, the Finance Department will publish a quarterly informational report on the performance of Oakland Police and Fire Retirement System's ("PFRS") investment portfolio to the City Council. In addition, staff will present the PFRS annual actuarial valuation when available.

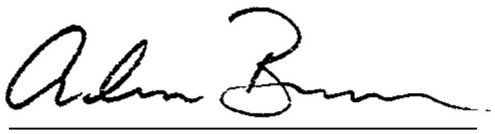
For the quarter ended December 31, 2019, the PFRS Investment Portfolio had a balance of $408.22 million and yielded a quarterly return of 5.3 percent, gross of fees, outperforming its policy benchmark by 0.4 percent. The portfolio outperformed its benchmark by 1.5 percent over the one-year period, 1.1 percent over the three-year period, and 0.5 percent over the five-year period.

Subsequent to the production of this report, the S&P 500 index declined by 20% for the 1st quarter 2020, due to the coronavirus. This decline marked the sharpest quarterly decrease since the 2008 financial crisis. The equity markets have rebounded since the March 2020 lows; however, volatility remains elevated as the federal government implement various stimulus packages, states begin the reopening process and investors anticipate a second wave of COVID-19 cases. We will provide an update to the 2nd quarter 2020 PFRS investment portfolio results after the summer recess.

As of the most recent PFRS actuarial valuation dated July 1, 2019, the PFRS Funded Ratio (actuarial value of assets divided by present value of future benefits) is 61.8 percent. The City is currently making annual required contributions to PFRS. The required contribution for fiscal year 2019/2020 is $43.65 million. The City funds these contributions from a voter approved ad valorem tax on all property within the City of Oakland. This tax is specifically dedicated to fund PFRS pension obligations.

The attached PFRS Quarterly Investment Performance report (***Attachment A***) provided by the PFRS Investment Consultant, Meketa Investment Group (MIG) summarizes the performance of the PFRS investment portfolio for the quarter ended December 31, 2019. In addition, the Council is being provided the recently updated PFRS' Actuarial Valuation (***Attachment B***) as of July 1, 2019.

Respectfully submitted,



ADAM BENSON
Director of Finance, Finance Department

For questions regarding this report, please contact Adam Benson, Finance Director, at (510) 238-2026

Attachments (2):

Attachment A: Oakland Police and Fire System Quarterly Investment Performance Report as of December 31, 2019

Attachment B: Oakland Police and Fire System Actuarial Valuation Report as of July 1, 2019

Q4 2019

Oakland Police and Fire Retirement System

Quarterly Report

TOTAL PORTFOLIO SUMMARY

As of December 31, 2019, the City of Oakland Police and Fire Retirement System (OPFRS) portfolio had an aggregate value of $408.2 million. This represents a $20.4 million increase in investment value and ($3.5) million in benefit payments over the quarter. During the previous one-year period, the OPFRS Total Portfolio increased in value by $72.3 million and withdrew ($14.1) million for benefit payments.

Asset Allocation Trends

The asset allocation targets (see table on page 21) reflect those as of December 31, 2019. Target weightings reflect the interim phase (CRO = 10%) of the Plan's previously approved asset allocation (effective 5/31/2017).

With respect to policy targets, the portfolio ended the latest quarter ***overweight Covered Calls, Cash, Domestic Equity and International Equity, while underweight Fixed Income and Crisis Risk Offset.***

Recent Investment Performance

During the most recent quarter, the OPFRS Total Portfolio generated an absolute return of 5.3%, gross of fees, outperforming its policy benchmark by 40 basis points. The portfolio outperformed its benchmark by 1.5% and 1.1% over the 1- and 3-year periods, respectively, and outperformed by 50 basis points over the 5-year period.

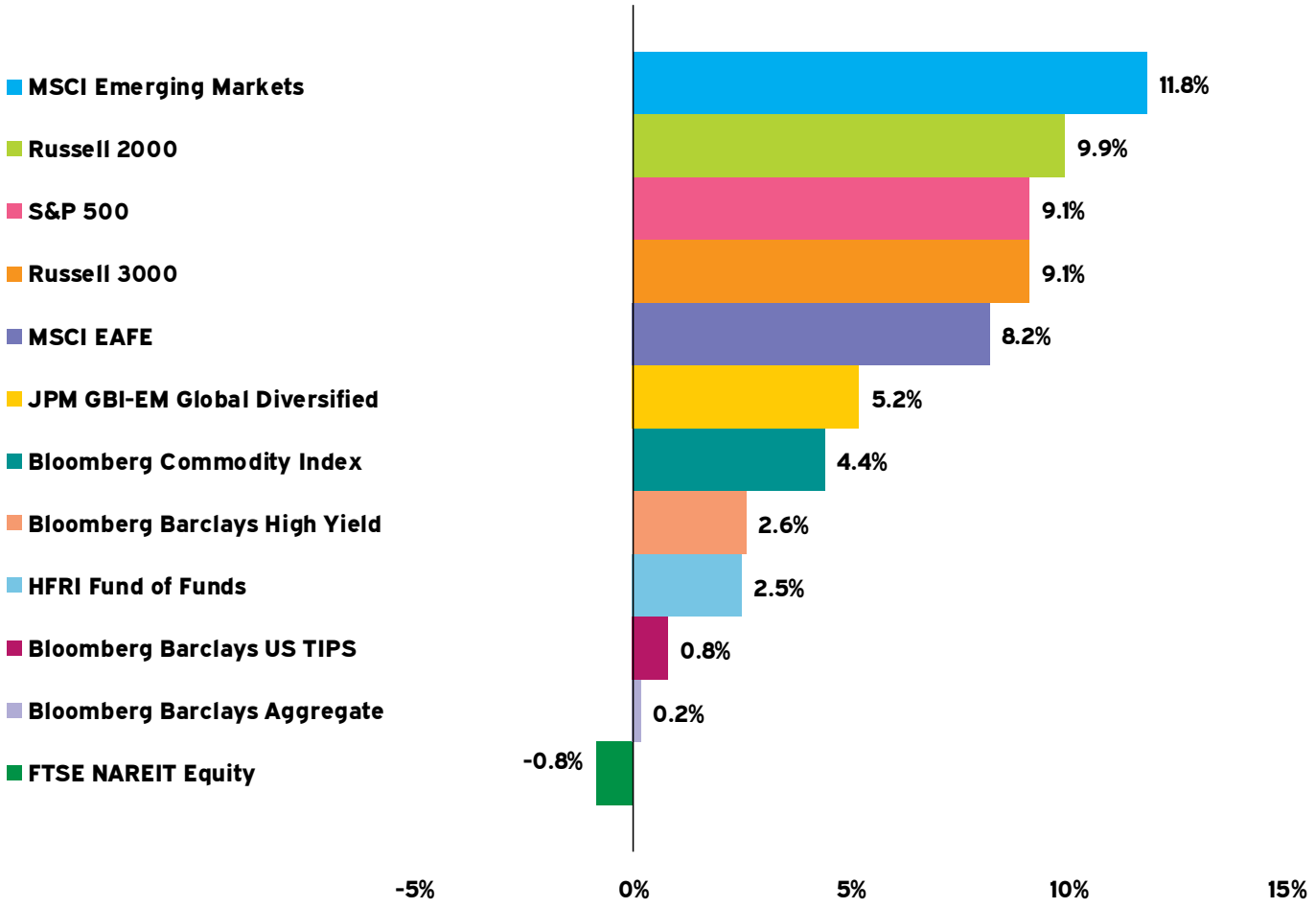
The Total Portfolio outperformed the Median fund's return over the most recent quarter. The Total Portfolio outperformed the Median fund over the 1-, 3- and 5-year periods by 2.0%, 1.5% and 1.2% respectively. Performance differences with respect to the Median Fund continue to be attributed largely to differences in asset allocation.

	Quarter	Fiscal Year	1 Year	3 Year	5 Year
Total Portfolio[1]	5.3	7.0	21.1	10.9	8.3
Policy Benchmark[2]	*4.9*	*6.4*	*19.6*	*9.8*	*7.8*
Excess Return	**0.4**	**0.6**	**1.5**	**1.1**	**0.5**
Reference: Median Fund[3]	5.3	6.2	19.1	9.4	7.1
Reference: Total Net of Fees[4]	5.2	6.8	20.8	10.6	8.0

[1] Gross of Fees. Performance since 2005 includes securities lending.
[2] Evolving Policy Benchmark consists of 40% Russell 3000, 12% MSCI ACWI ex U.S., 33% Bbg BC Universal, 5% CBOE BXM , 6.7% SG Multi Asset Risk Premia, 3.3% Bbg BC Long Treasury
[3] Investment Metrics < $1 Billion Public Plan Universe.
[4] Longer-term (>1 year) Net of fee returns are estimated based on OPFRS manager fee schedule (approximately 34 bps)

The World Markets
Fourth Quarter of 2019

The World Markets[1]
Fourth Quarter of 2019



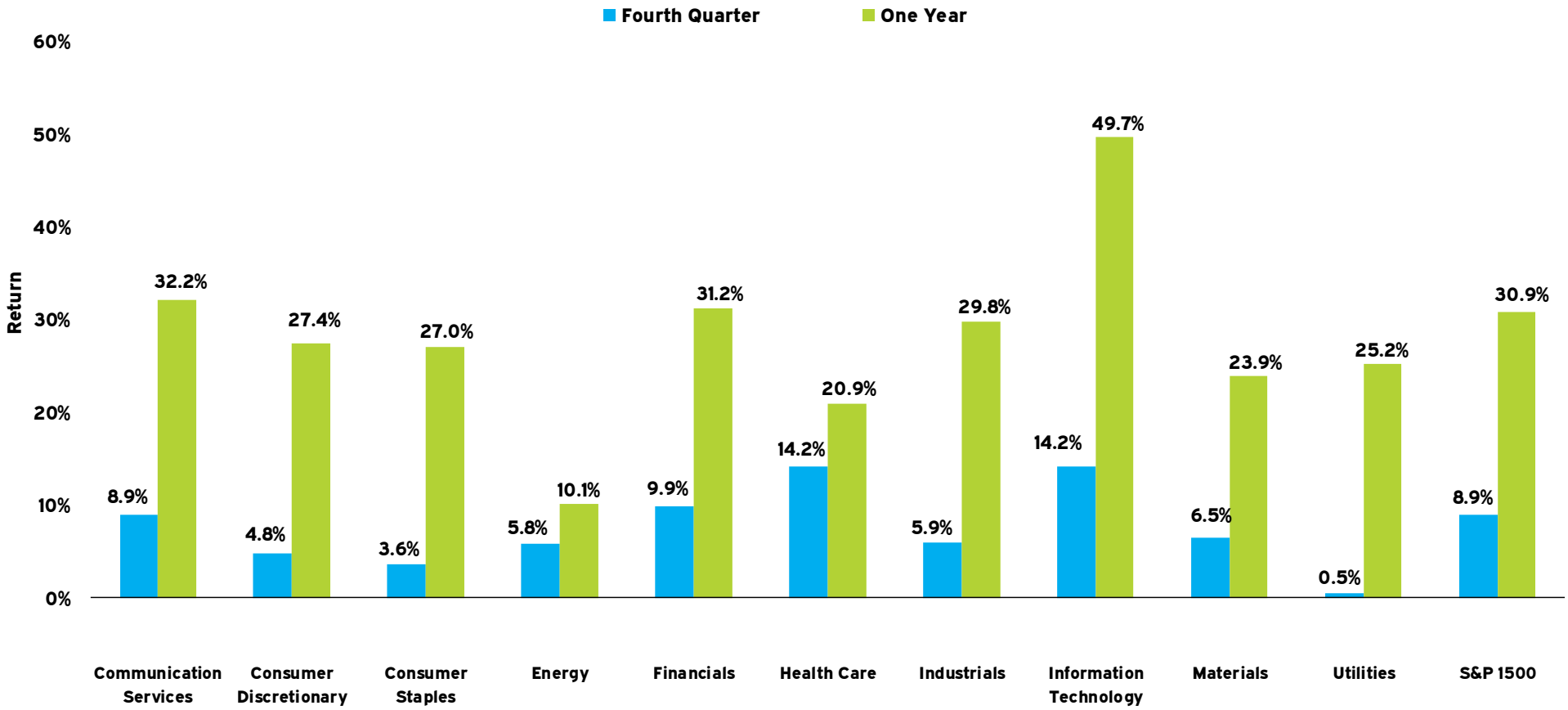
[1] Source: InvestorForce.

Index Returns[1]

	4Q19 (%)	1 YR (%)	3 YR (%)	5 YR (%)	10 YR (%)
Domestic Equity					
S&P 500	9.1	31.5	15.3	11.7	13.6
Russell 3000	9.1	31.0	14.6	11.2	13.4
Russell 1000	9.0	31.4	15.0	11.5	13.5
Russell 1000 Growth	10.6	36.4	20.5	14.6	15.2
Russell 1000 Value	7.4	26.5	9.7	8.3	11.8
Russell MidCap	7.1	30.5	12.1	9.3	13.2
Russell MidCap Growth	8.2	35.5	17.4	11.6	14.2
Russell MidCap Value	6.4	27.1	8.1	7.6	12.4
Russell 2000	9.9	25.5	8.6	8.2	11.8
Russell 2000 Growth	11.4	28.5	12.5	9.3	13.0
Russell 2000 Value	8.5	22.4	4.8	7.0	10.6
Foreign Equity					
MSCI ACWI (ex. US)	8.9	21.5	9.9	5.5	5.0
MSCI EAFE	8.2	22.0	9.6	5.7	5.5
MSCI EAFE (Local Currency)	5.2	21.7	7.7	6.7	7.2
MSCI EAFE Small Cap	11.5	25.0	10.9	8.9	8.7
MSCI Emerging Markets	11.8	18.4	11.6	5.6	3.7
MSCI Emerging Markets (Local Currency)	9.5	18.1	11.5	7.5	6.1
Fixed Income					
Bloomberg Barclays Universal	0.5	9.3	4.3	3.4	4.1
Bloomberg Barclays Aggregate	0.2	8.7	4.0	3.0	3.7
Bloomberg Barclays US TIPS	0.8	8.4	3.3	2.6	3.4
Bloomberg Barclays High Yield	2.6	14.3	6.4	6.1	7.6
JPM GBI-EM Global Diversified	5.2	13.5	7.0	2.8	2.7
Other					
FTSE NAREIT Equity	-0.8	26.0	8.1	7.2	11.9
Bloomberg Commodity Index	4.4	7.7	-0.9	-3.9	-4.7
HFRI Fund of Funds	2.5	7.8	3.7	2.2	2.8

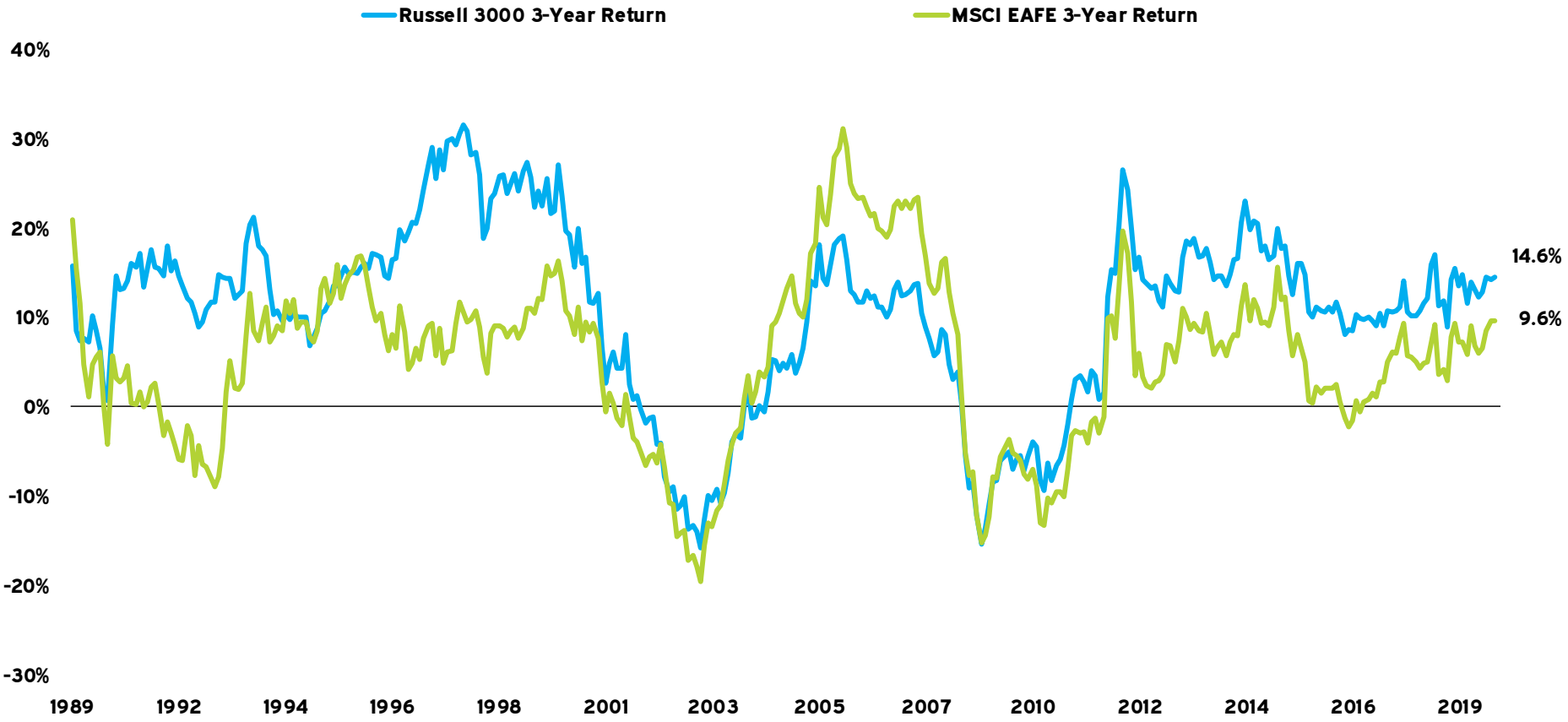
[1] Source: InvestorForce.

S&P Sector Returns[1]



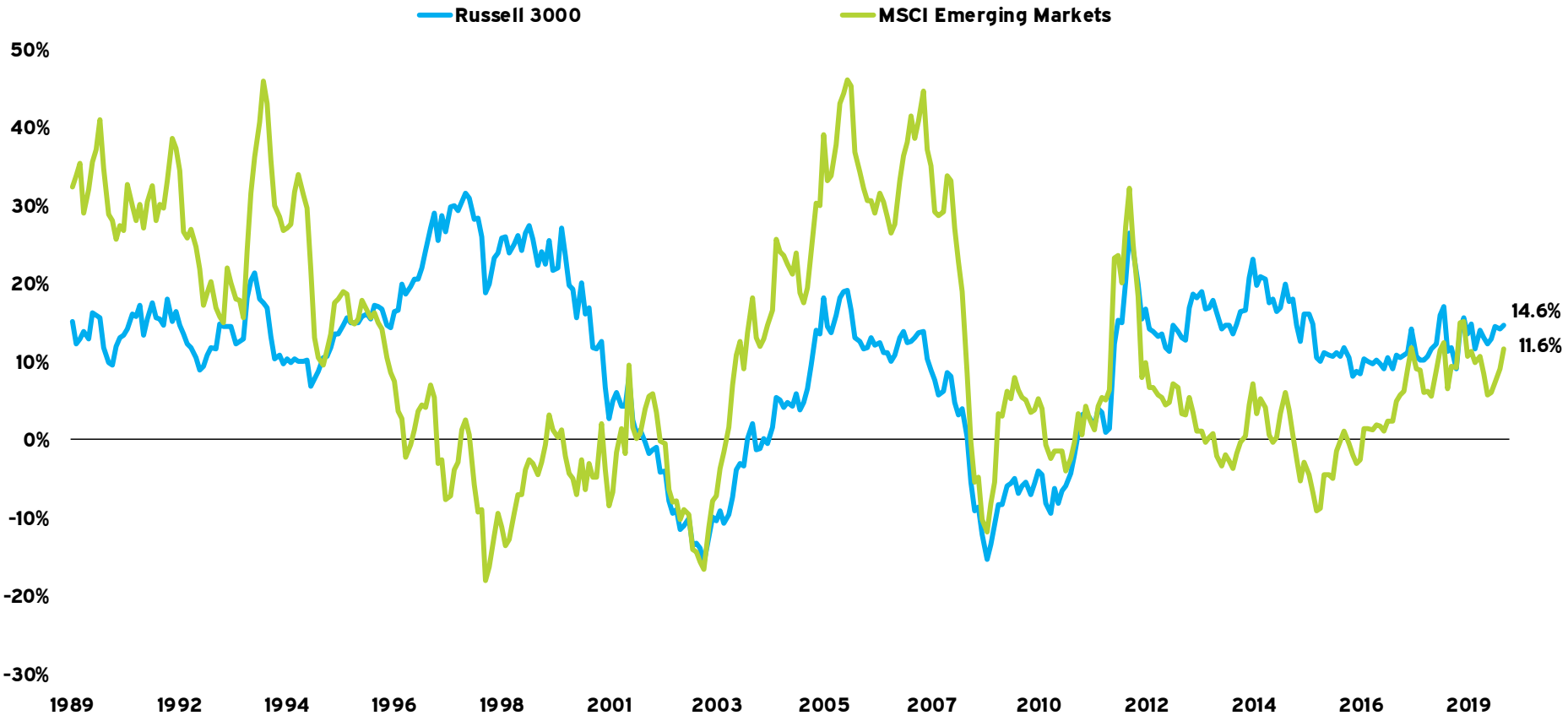
[1] Source: InvestorForce. Represents S&P 1500 (All Cap) data.

US and Developed Market Foreign Equity Rolling Three-Year Returns[1]



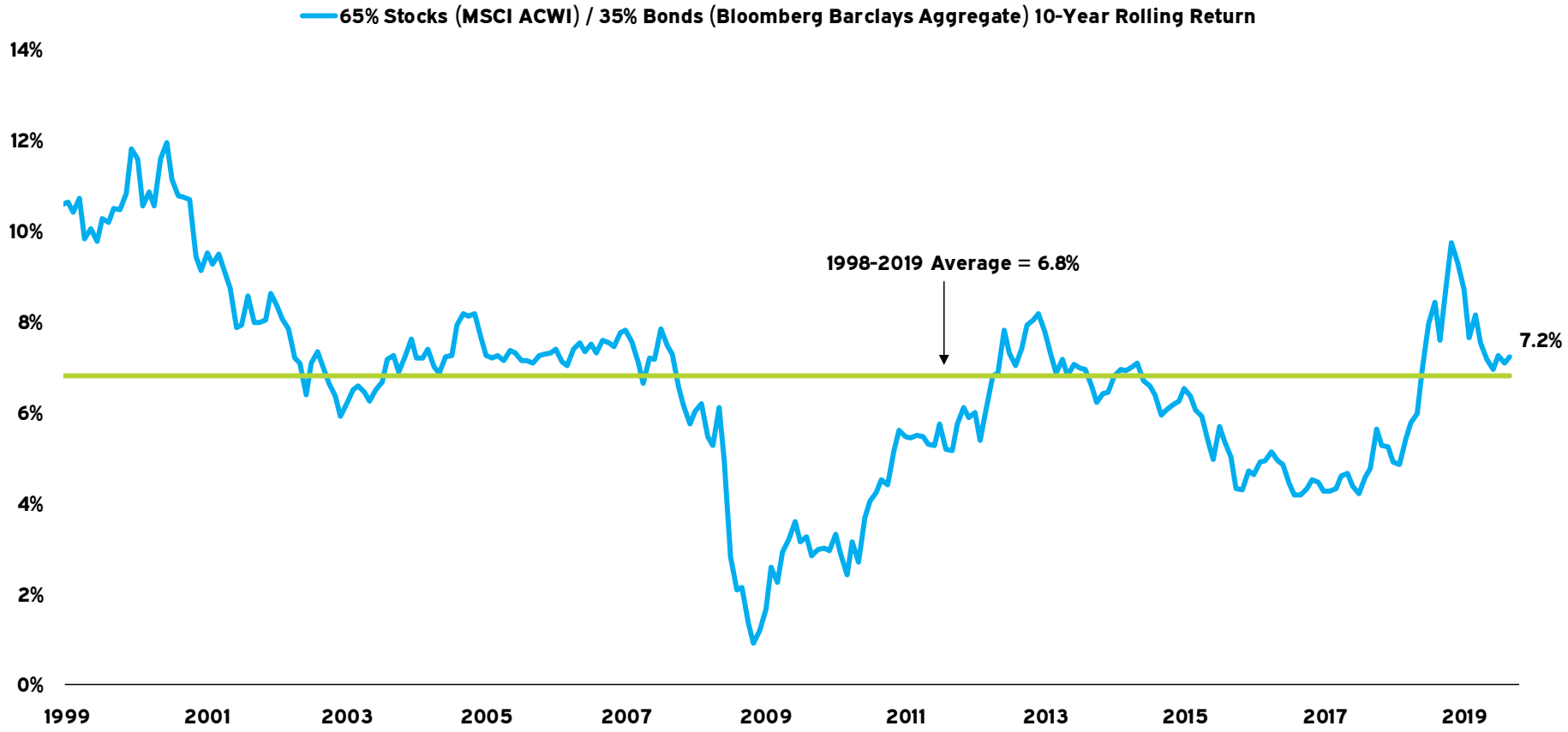
[1] Source: InvestorForce.

US and Emerging Market Equity Rolling Three-Year Returns[1]



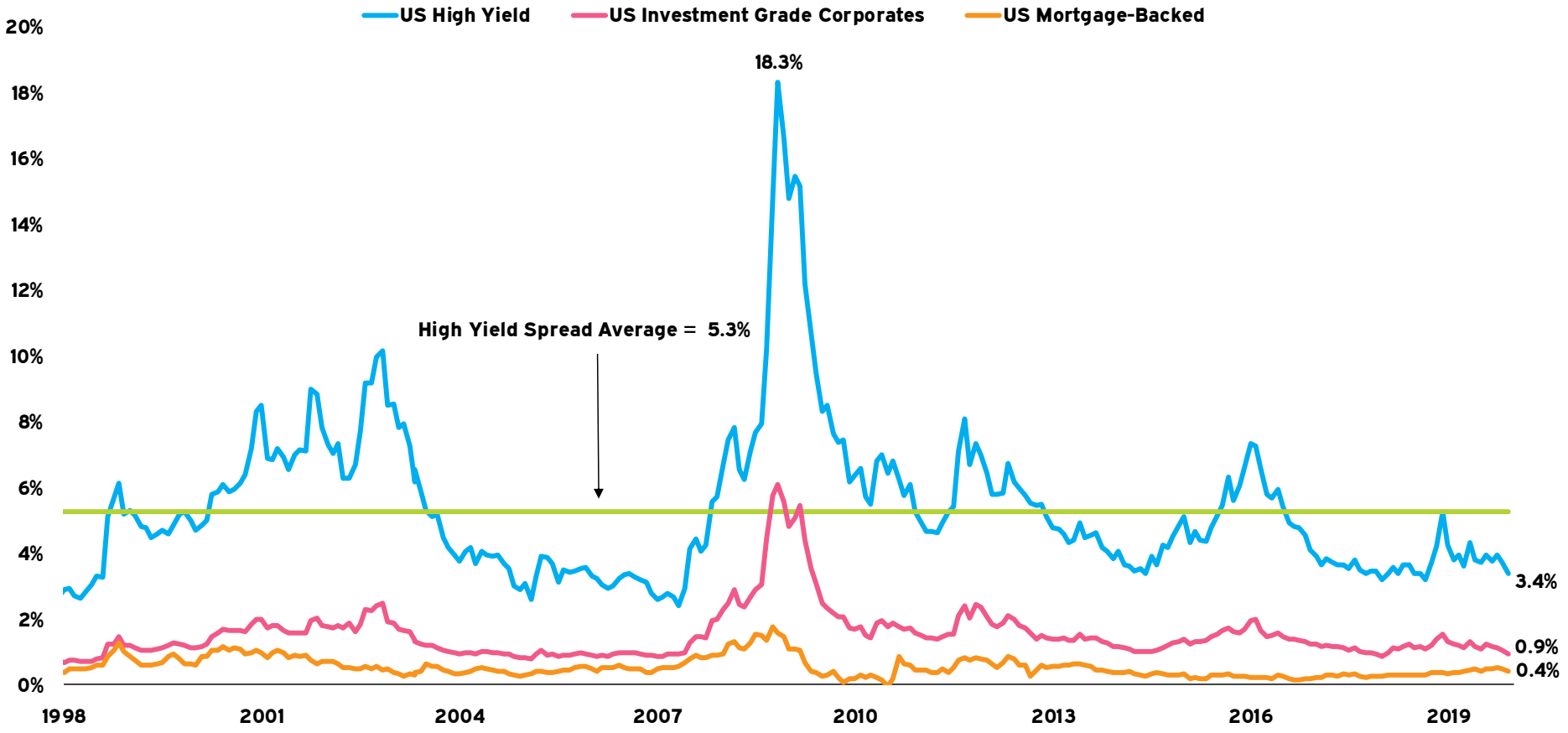
[1] Source: InvestorForce.

Rolling Ten-Year Returns: 65% Stocks and 35% Bonds[1]



[1] Source: InvestorForce.

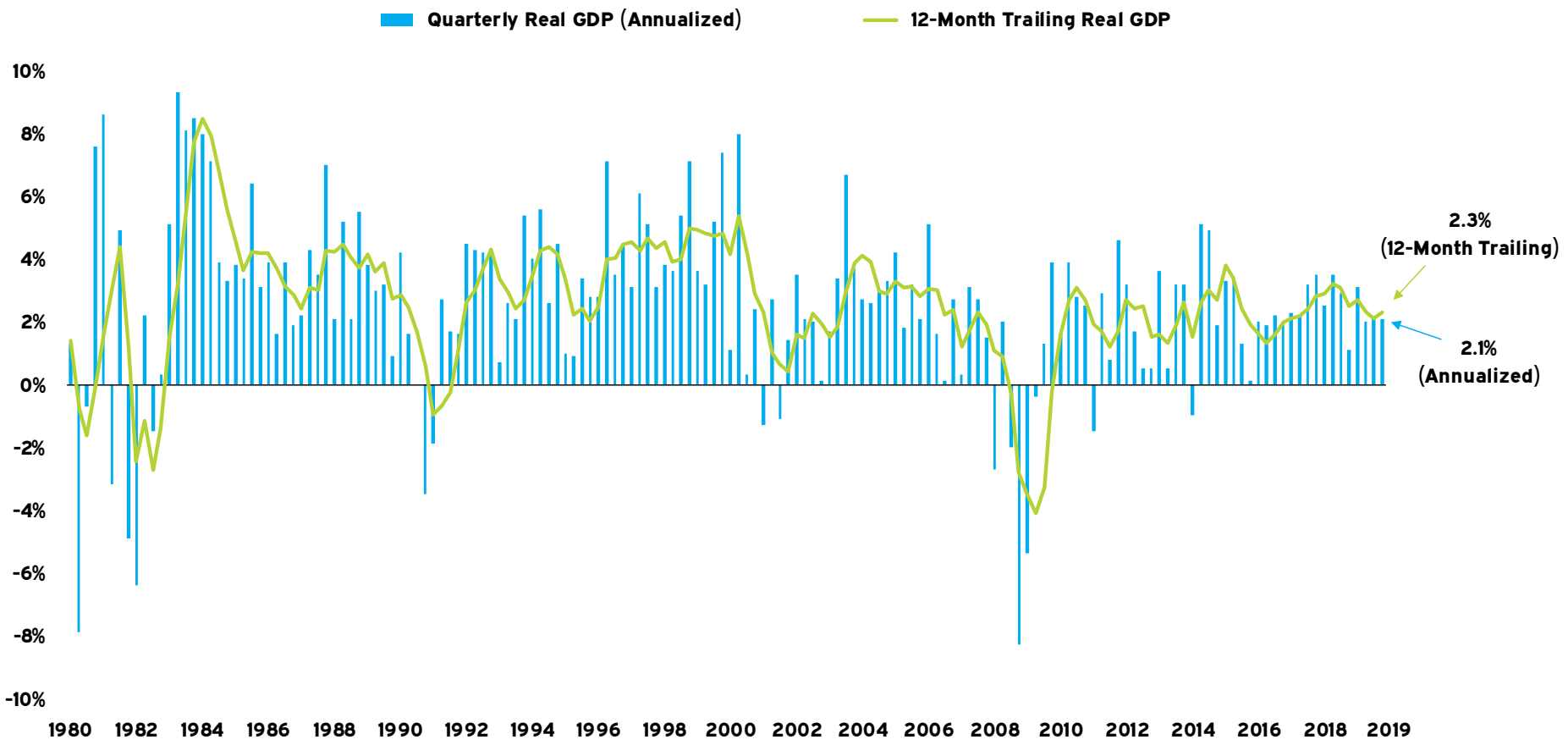
Credit Spreads vs. US Treasury Bonds[1,2]



1 Source: Barclays Live. Data represents the OAS.

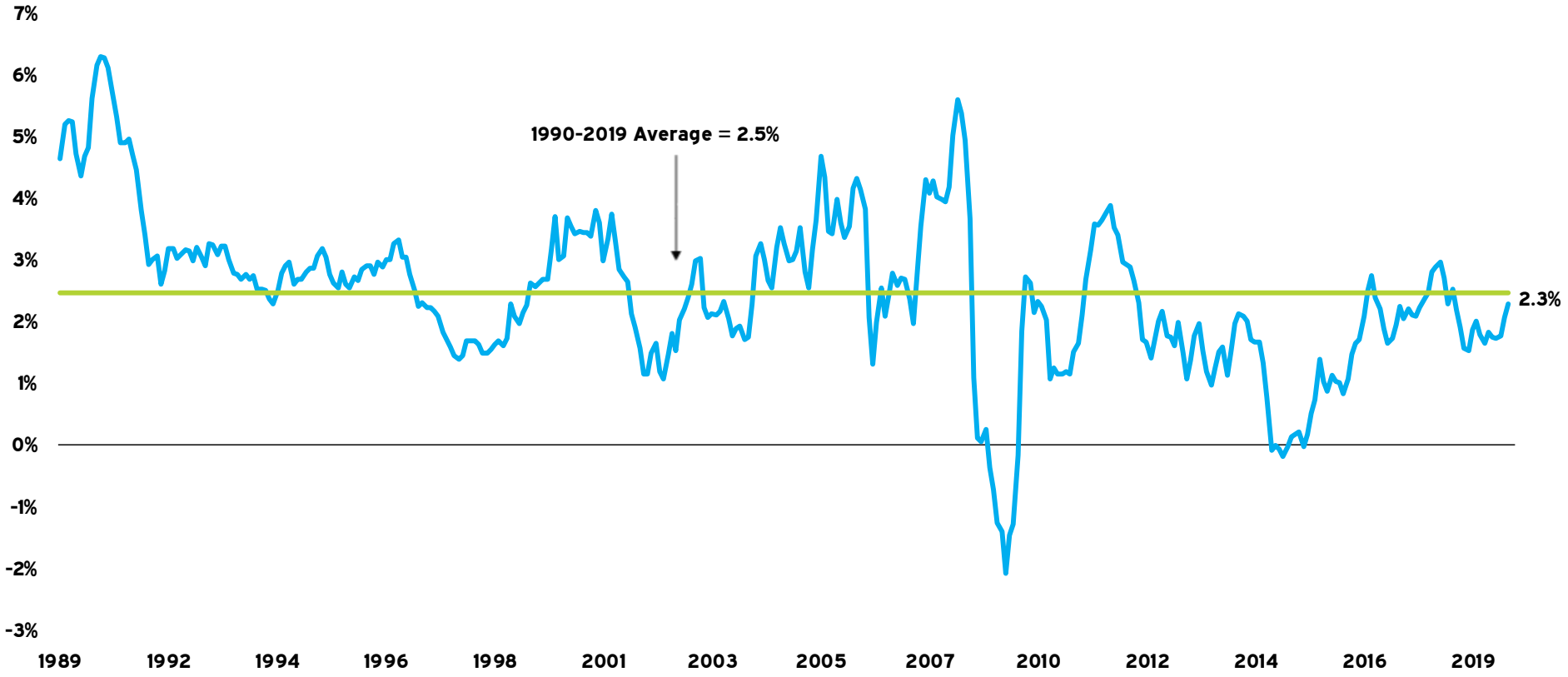
2 The median high yield spread was 4.7% from 1997-2019.

US Real Gross Domestic Product (GDP) Growth[1]



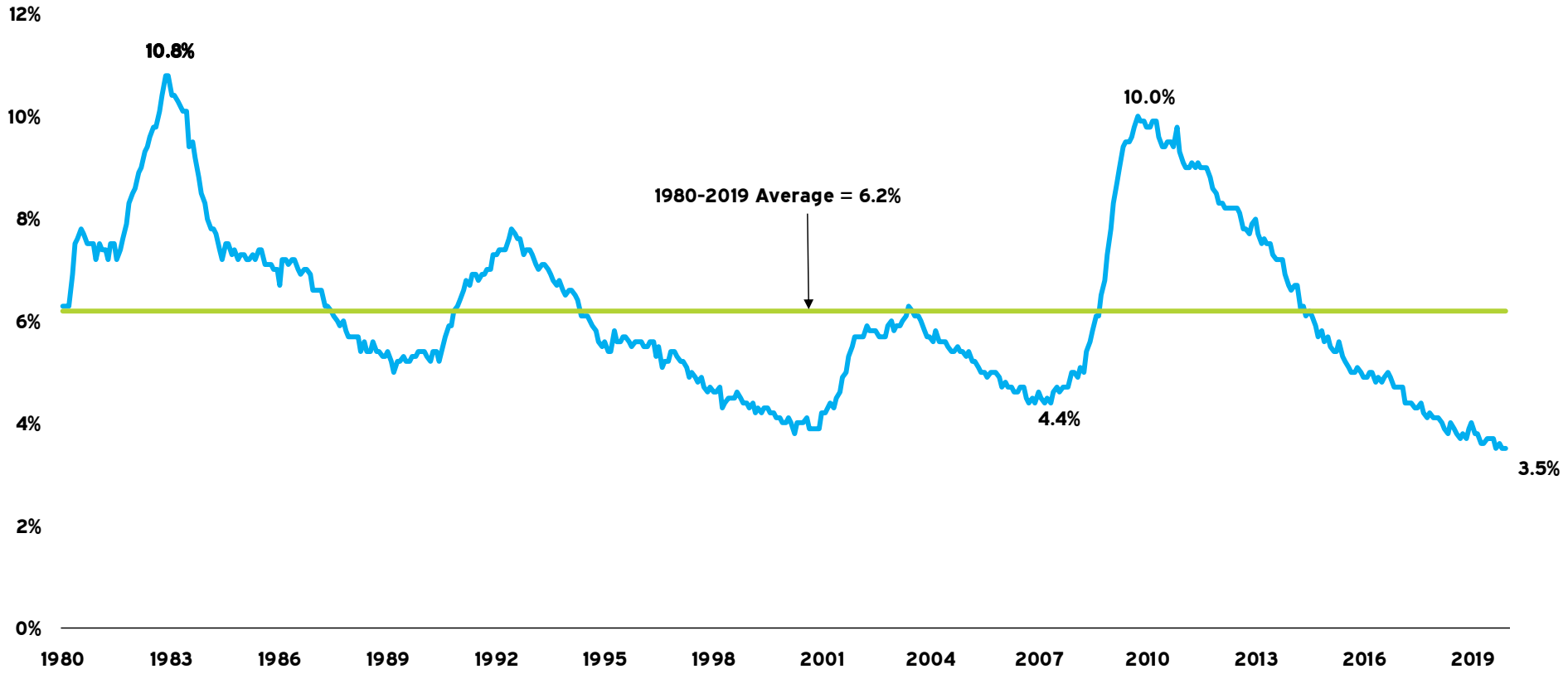
[1] Source: Bureau of Economic Analysis. Data is as of Q4 2019 and represents the first estimate.

US Inflation (CPI)
Trailing Twelve Months[1]



[1] Source: Bureau of Labor Statistics. Data is non-seasonally adjusted CPI, which may be volatile in the short-term. Data is as of December 31, 2019.

US Unemployment[1]



[1] Source: Bureau of Labor Statistics. Data is as of December 31, 2019.

Capital Markets Outlook & Risk Metrics

As of December 31, 2019

Capital Markets Outlook

Takeaways

- December capped off a historically strong year for most risk-oriented markets. Global equity markets generally produced gains in the 2-4% range during the month, with full calendar year returns ending up approximately in the 18-32% range.
- With the exception of long-term interest rates (which ticked up during the month), the yield curve remained relatively stable in December. On a trailing one-year basis, however, interest rates declined by a material margin as the Federal Reserve lowered rates three times in 2019. From a performance perspective, broad investment grade bonds produced one-year returns in the high single-digits whereas long US Treasury bonds generated a return of nearly 15% for the year.
- Due in part to strong returns across nearly all asset classes in 2019, investors should anticipate that long-term, forward-looking returns will be lower as of early-2020 when compared to early-2019 capital market assumptions.
- US equity markets remain expensive whereas non-US equity markets remain reasonably valued relative to their histories. US credit and emerging markets debt spreads remain reasonably valued relative to their histories, although the richness of US high yield has recently increased (i.e., is now more expensive).
- Relative to their counterparts (growth and large cap), value and small cap equities continue to remain attractive from a valuation perspective.

Capital Markets Outlook

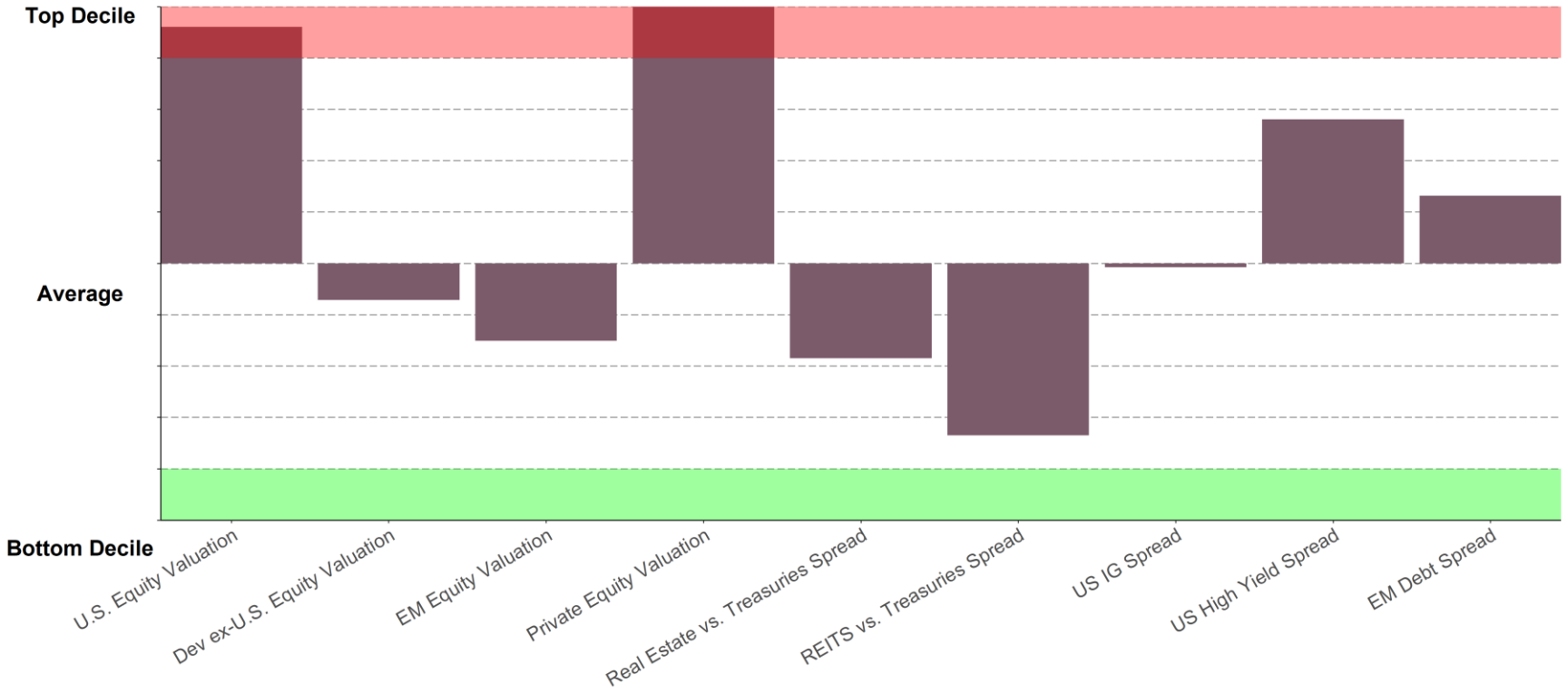
Takeaways

- Implied equity market volatility[1] remained at relatively low levels throughout December, generally staying in the 12-16 range throughout the entire month (the historical average is ~19).
- The Market Sentiment Indicator[2] stayed green at month end.

[1] As measured by VIX Index.

[2] See Appendix for the rationale for selection and calculation methodology used for the risk metrics.

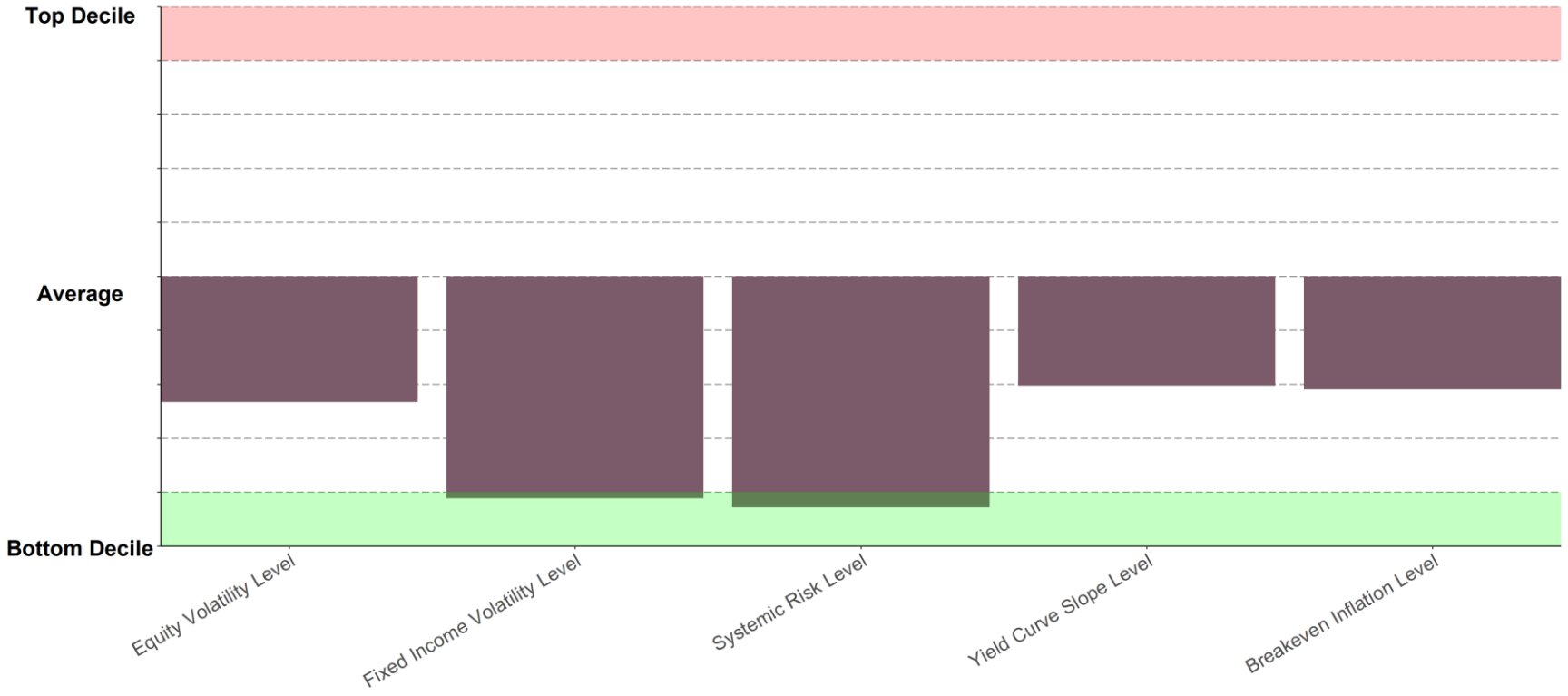
Risk Overview/Dashboard (1)
(As of December 31, 2019)[1]



- Dashboard (1) summarizes the current state of the different valuation metrics per asset class relative to their own history.

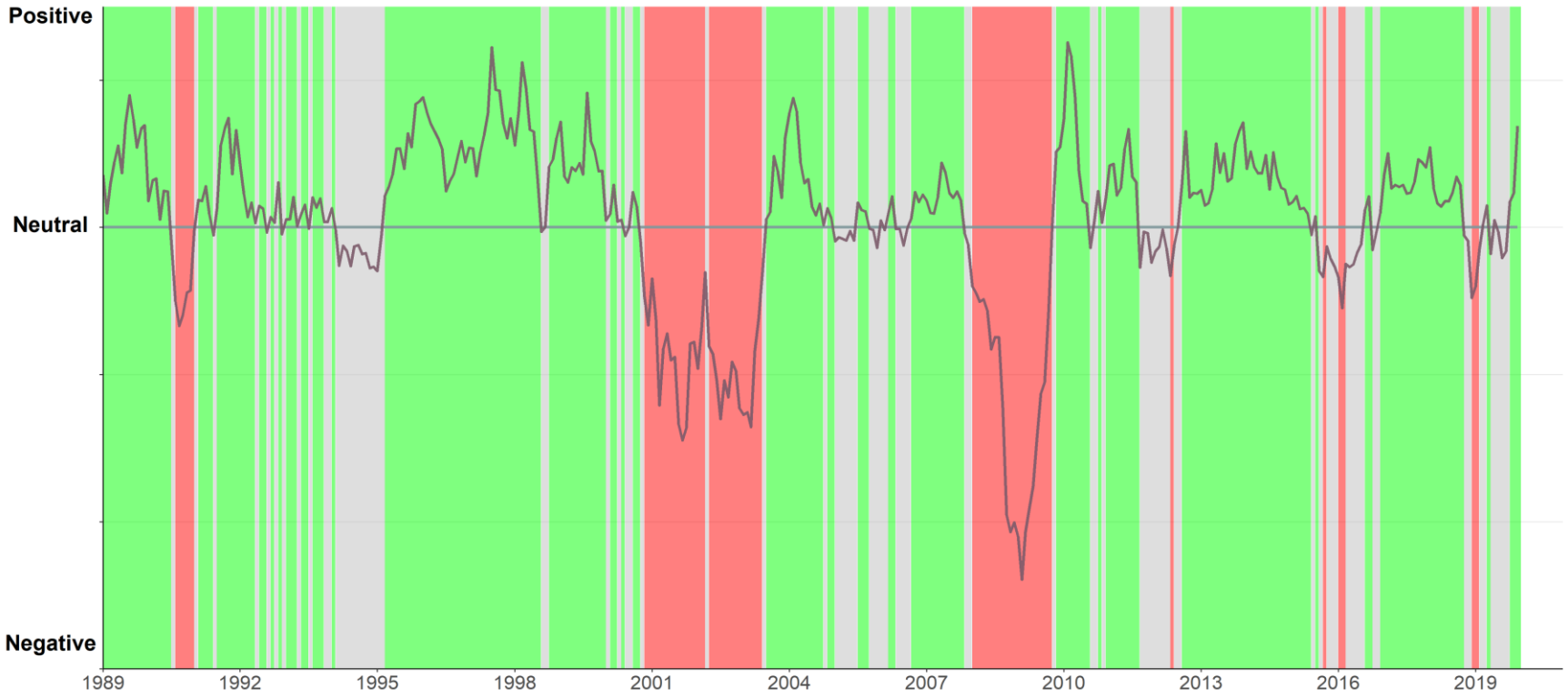
[1] With the exception of Private Equity Valuation, that is YTD as of November 30, 2019.

Risk Overview/Dashboard (2)
(As of December 31, 2019)

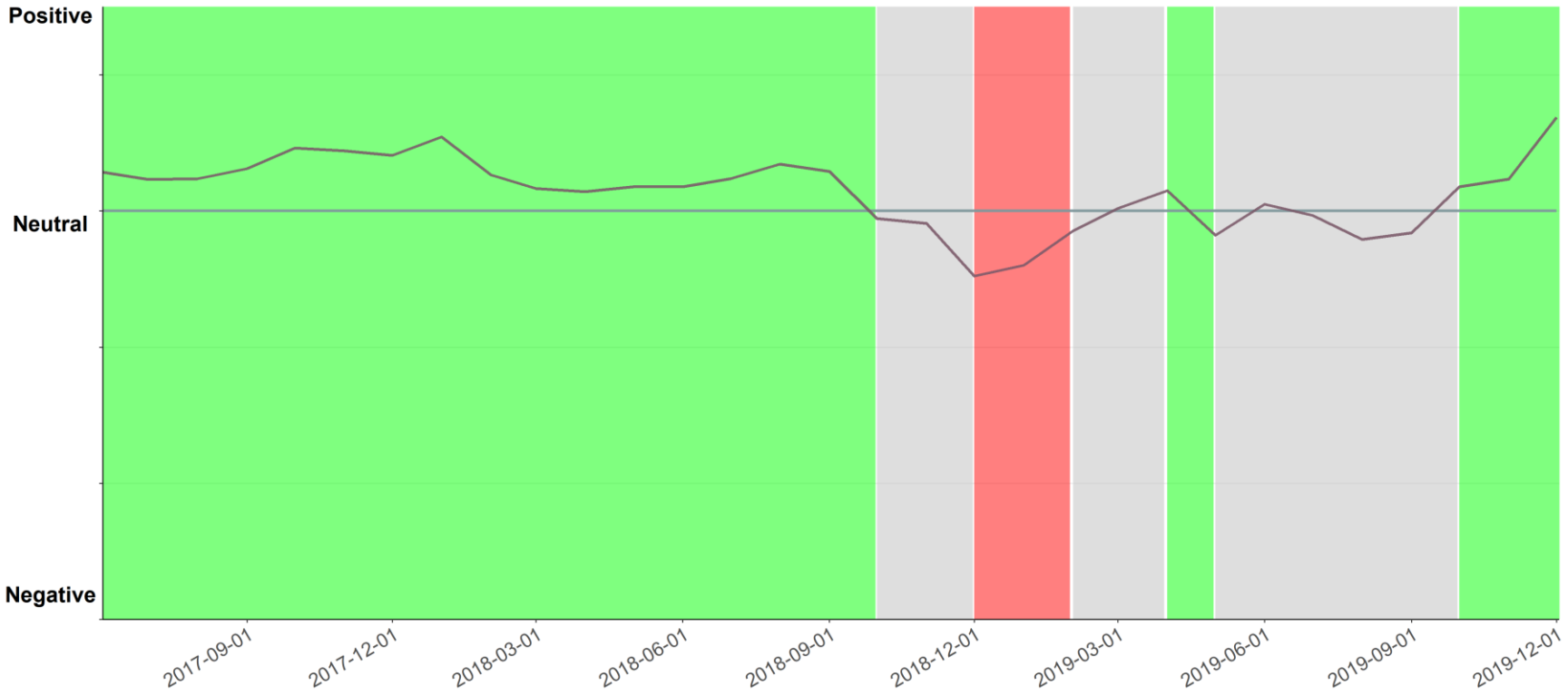


- Dashboard (2) shows how the current level of each indicator compares to its respective history.

Market Sentiment Indicator (All History)
(As of December 31, 2019)



Market Sentiment Indicator (Last Three Years)
(As of December 31, 2019)

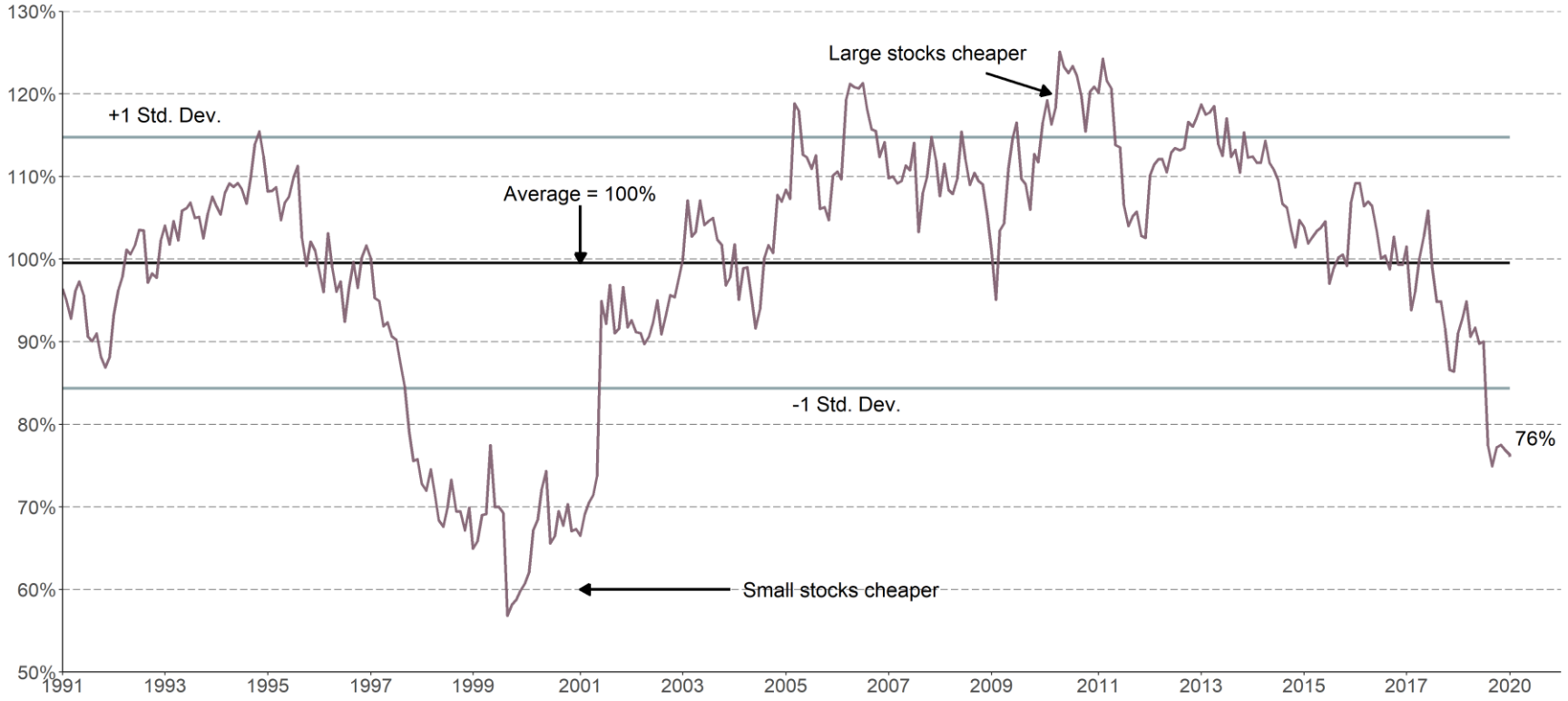


US Equity Cyclically Adjusted P/E[1]
(As of December 31, 2019)

- This chart details one valuation metric for US equities. A higher (lower) figure indicates more expensive (cheaper) valuation relative to history.

[1] US Equity Cyclically Adjusted P/E on S&P 500 Index – Source: Robert Shiller, Yale University and Meketa Investment Group.

Small Cap P/E vs. Large Cap P/E[1]
(As of December 31, 2019)



- This chart compares the relative attractiveness of small cap US equities vs. large cap US equities on a valuation basis. A higher (lower) figure indicates that large cap (small cap) is more attractive.

[1] Small Cap P/E (Russell 2000 Index) vs. Large Cap P/E (Russell 1000 Index) - Source: Russell Investments. Earnings figures represent 12-month "as reported" earnings.

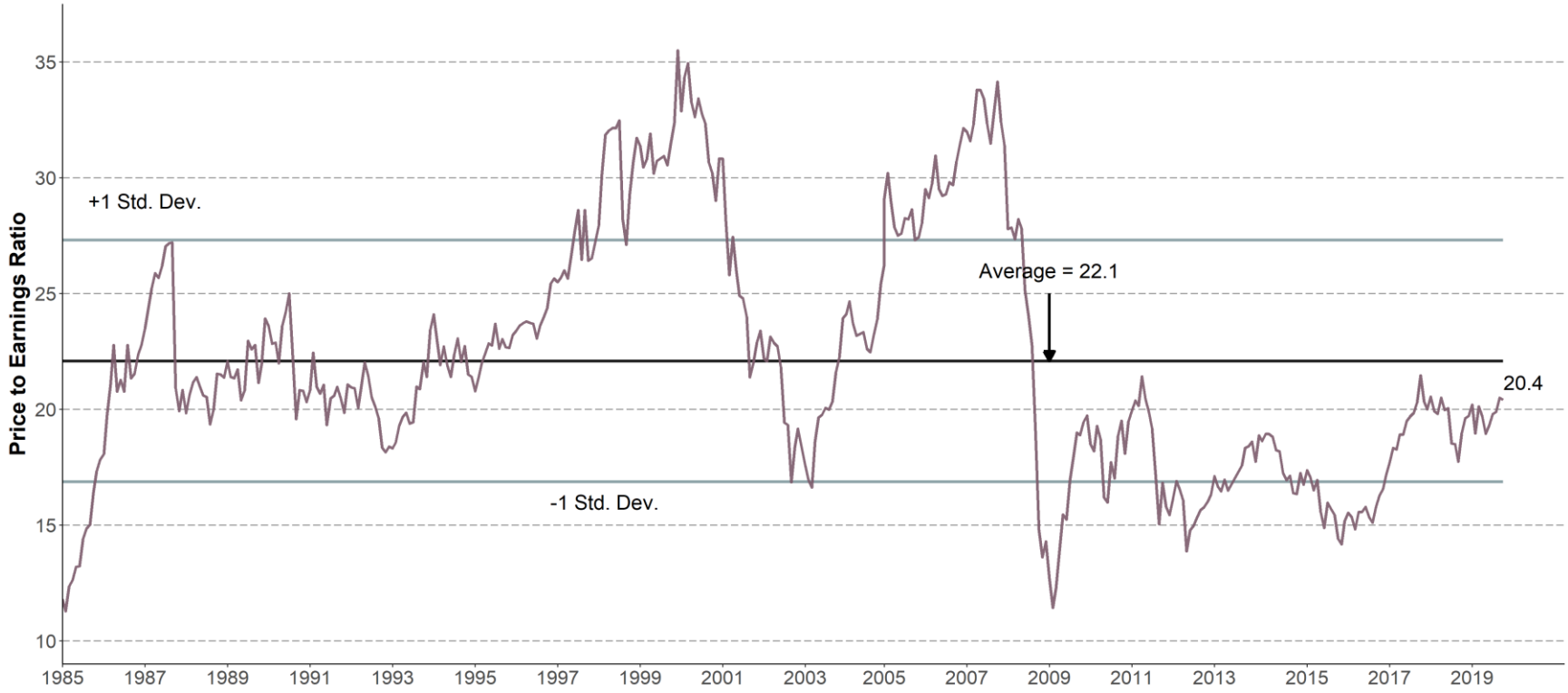
Growth P/E vs. Value P/E[1]
(As of December 31, 2019)

- This chart compares the relative attractiveness of US growth equities vs. US value equities on a valuation basis. A higher (lower) figure indicates that value (growth) is more attractive.

[1] Growth P/E (Russell 3000 Growth Index) vs. Value (Russell 3000 Value Index) P/E - Source: Bloomberg, MSCI, and Meketa Investment Group. Earnings figures represent 12-month "as reported" earnings.

Developed International Equity Cyclically Adjusted P/E[1]

(As of December 31, 2019)



- This chart details one valuation metric for developed international equities. A higher (lower) figure indicates more expensive (cheaper) valuation relative to history.

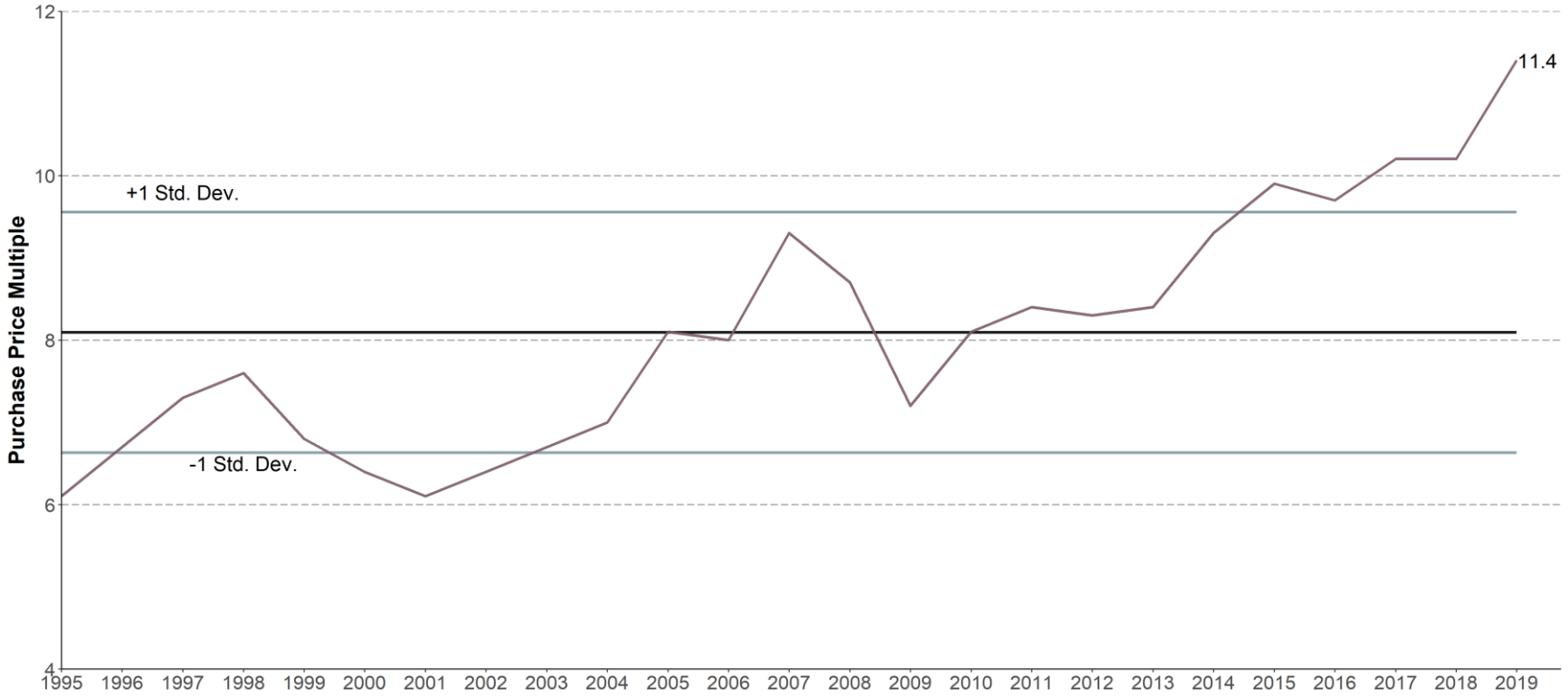
[1] Developed International Equity (MSCI EAFE ex Japan Index) Cyclically Adjusted P/E – Source: MSCI and Bloomberg. Earnings figures represent the average of monthly "as reported" earnings over the previous ten years.

Emerging Market Equity Cyclically Adjusted P/E[1]
(As of December 31, 2019)

- This chart details one valuation metric for emerging markets equities. A higher (lower) figure indicates more expensive (cheaper) valuation relative to history.

[1] Emerging Market Equity (MSCI Emerging Markets Index) Cyclically Adjusted P/E – Source: MSCI and Bloomberg. Earnings figures represent the average of monthly "as reported" earnings over the previous ten years.

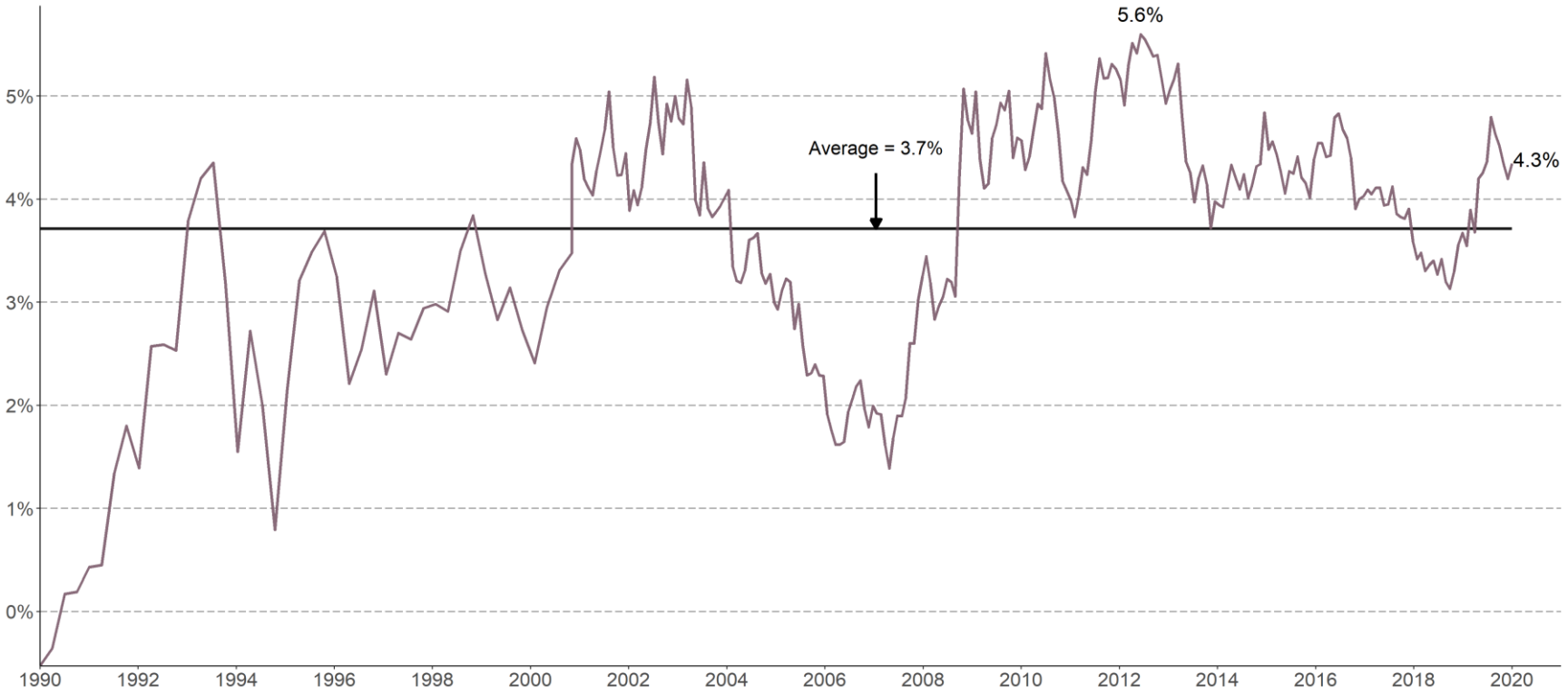
Private Equity Multiples[1]
(As of November 30, 2019)[2]



- This chart details one valuation metric for the private equity market. A higher (lower) figure indicates more expensive (cheaper) valuation relative to history.

[1] Private Equity Multiples – Source: S&P LCD Average EBITDA Multiples Paid in All LBOs.
[2] Annual figures, except for 2019 (YTD).

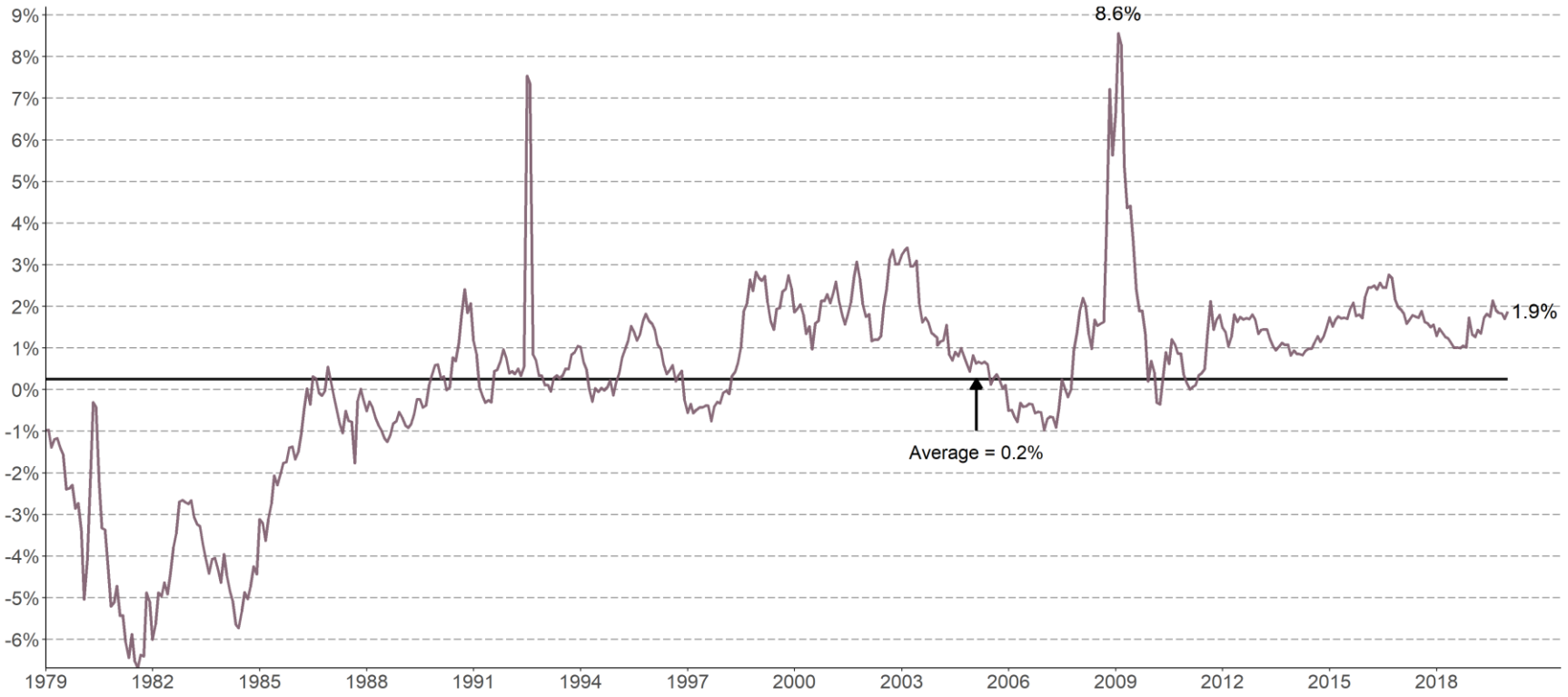
Core Real Estate Spread vs. Ten-Year Treasury[1]
(As of December 31, 2019)



- This chart details one valuation metric for the private core real estate market. A higher (lower) figure indicates cheaper (more expensive) valuation.

[1] Core Real Estate Spread vs. Ten-Year Treasury – Source: Real Capital Analytics, US Treasury, Bloomberg, and Meketa Investment Group. Core Real Estate is proxied by weighted sector transaction based indices from Real Capital Analytics and Meketa Investment Group.

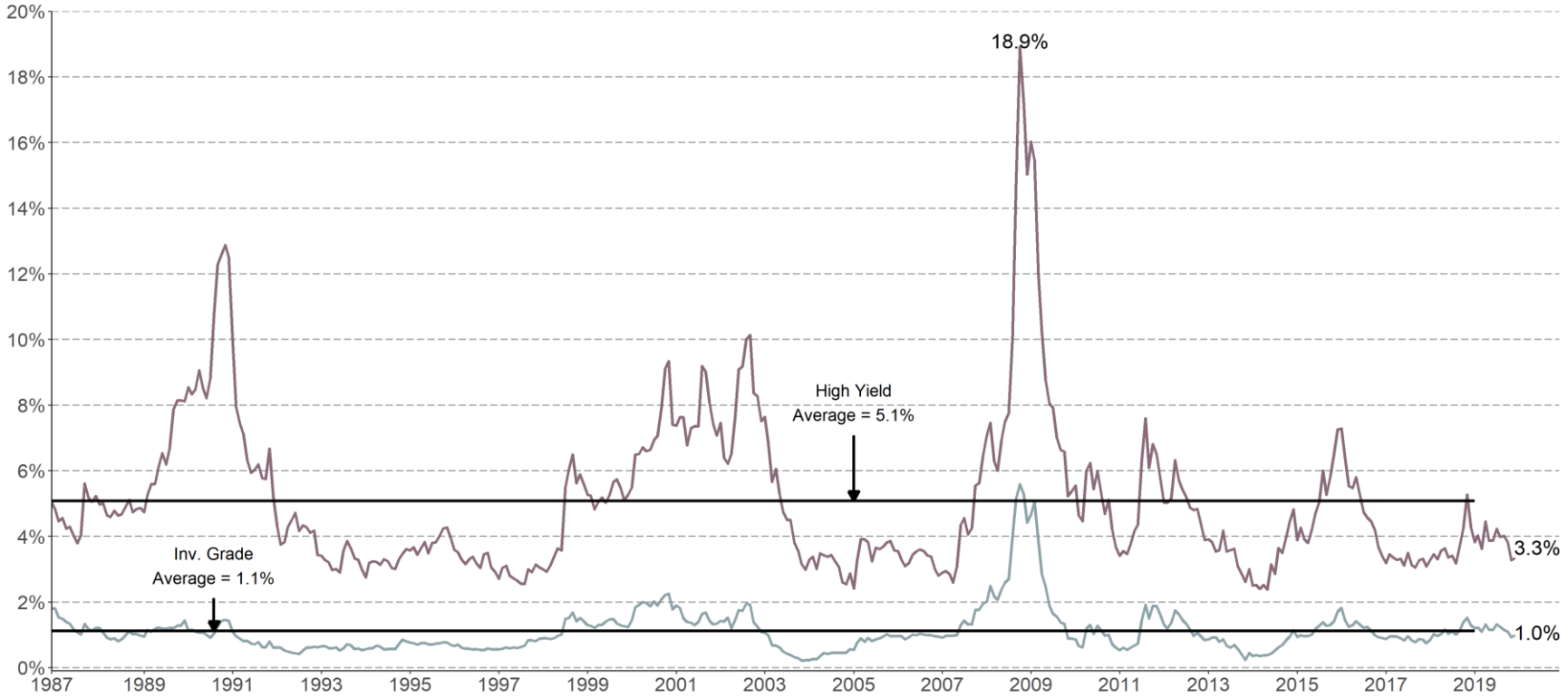
REITs Dividend Yield Spread vs. Ten-Year Treasury[1]
(As of December 31, 2019)



- This chart details one valuation metric for the public REITs market. A higher (lower) figure indicates cheaper (more expensive) valuation.

[1] REITs Dividend Yield Spread vs. Ten-Year Treasury – Source: NAREIT, US Treasury. REITs are proxied by the yield for the NAREIT Equity index.

Credit Spreads[1]
(As of December 31, 2019)



- This chart details one valuation metric for the US credit markets. A higher (lower) figure indicates cheaper (more expensive) valuation relative to history.

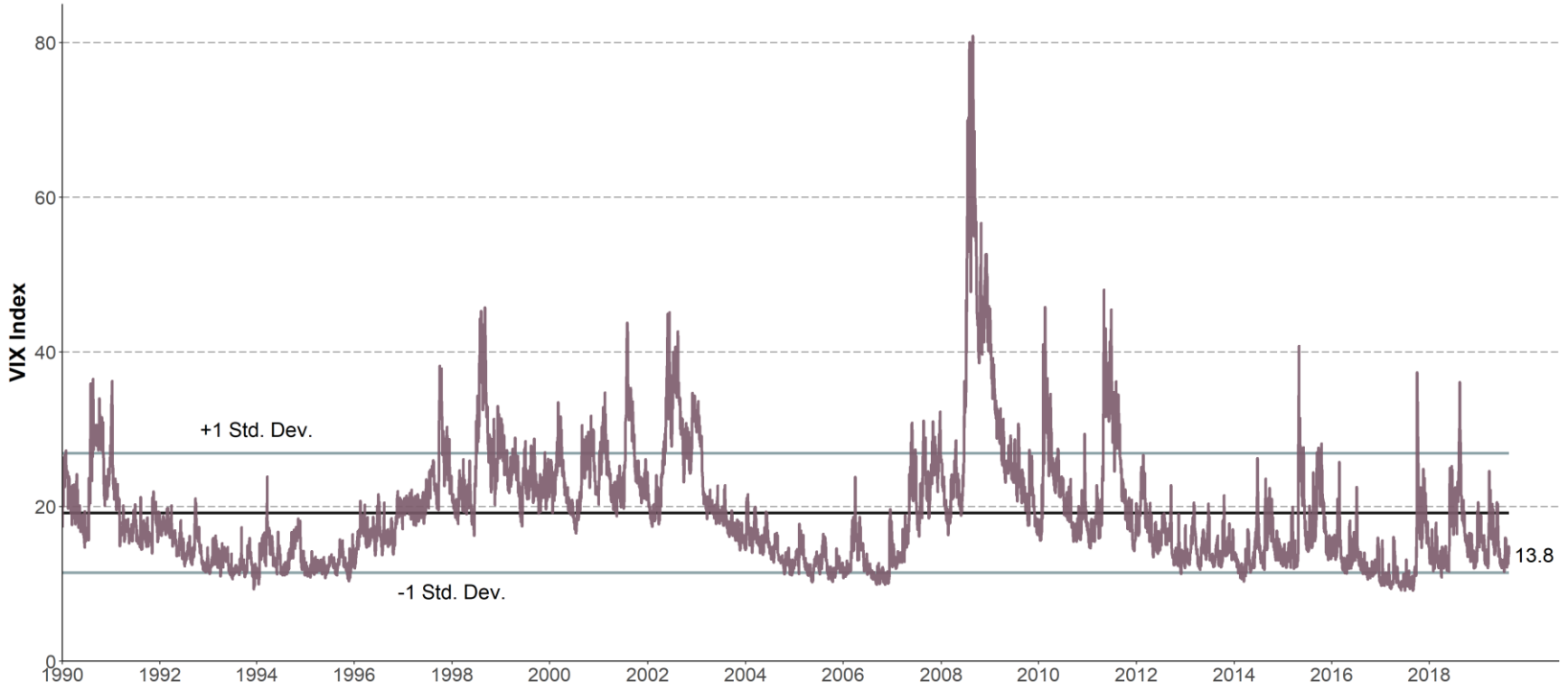
[1] Credit Spreads – Source: Barclays Capital. High Yield is proxied by the Barclays High Yield index and Investment Grade Corporates are proxied by the Barclays US Corporate Investment Grade index.

Emerging Market Debt Spreads[1]
(As of December 31, 2019)

- This chart details one valuation metric for the EM debt markets. A higher (lower) figure indicates cheaper (more expensive) valuation relative to history.

[1] EM Spreads – Source: Bloomberg. Option Adjusted Spread (OAS) for the Bloomberg Barclays EM USD Aggregate Index.

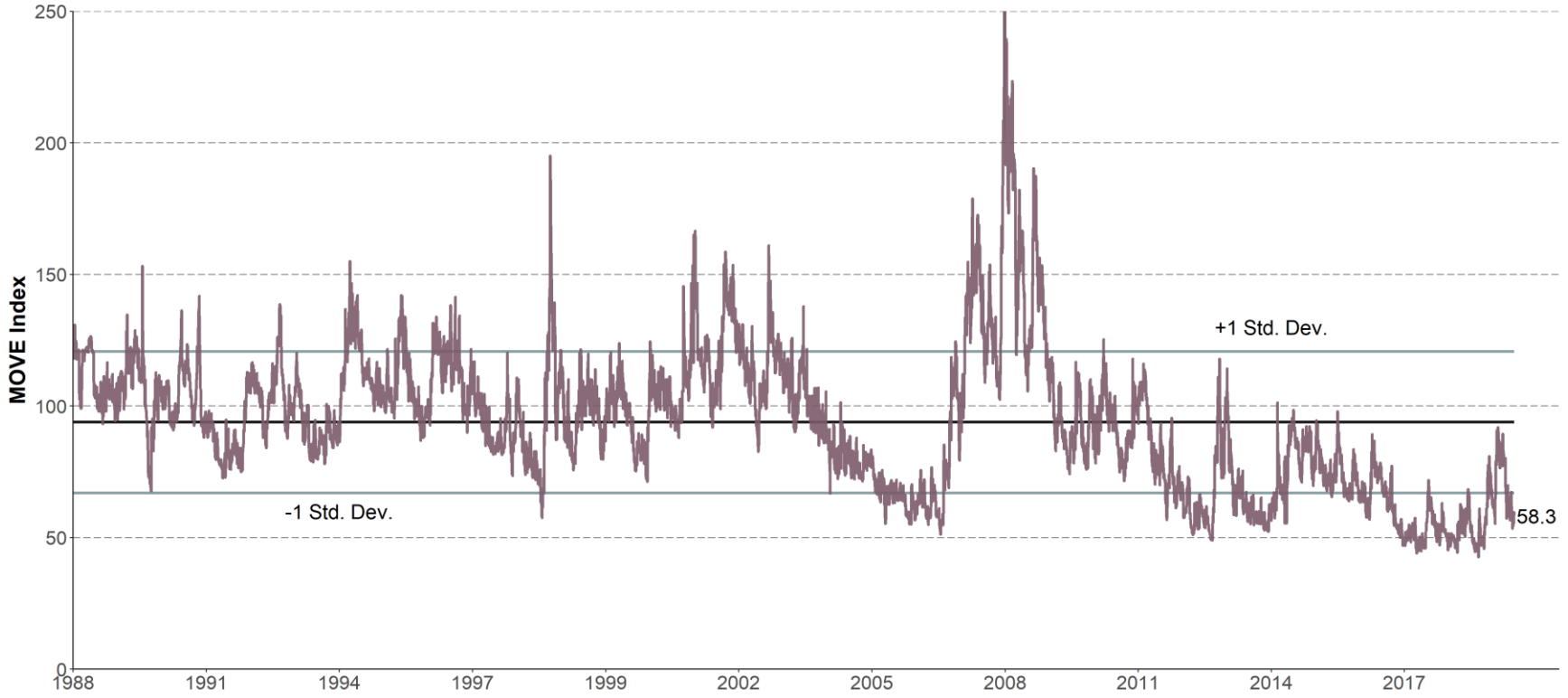
Equity Volatility[1]
(As of December 31, 2019)



- This chart details historical implied equity market volatility. This metric tends to increase during times of stress/fear and while declining during more benign periods.

[1] Equity Volatility – Source: Bloomberg, and Meketa Investment Group. Equity Volatility proxied by VIX Index, a Measure of implied option volatility for US equity markets.

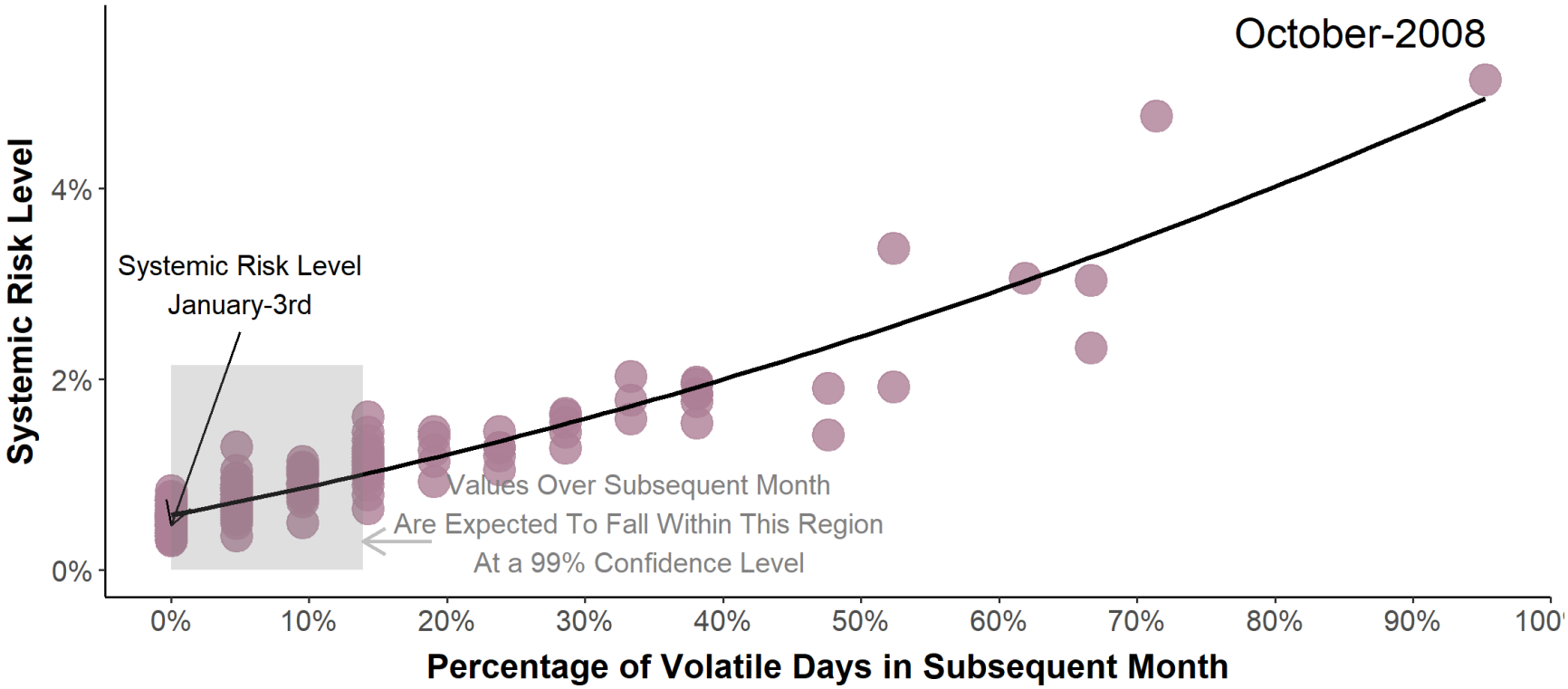
Fixed Income Volatility[1]
(As of December 31, 2019)



- This chart details historical implied fixed income market volatility. This metric tends to increase during times of stress/fear and while declining during more benign periods.

[1] Fixed Income Volatility – Source: Bloomberg, and Meketa Investment Group. Fixed Income Volatility proxied by MOVE Index, a Measure of implied option volatility for US Treasury markets.

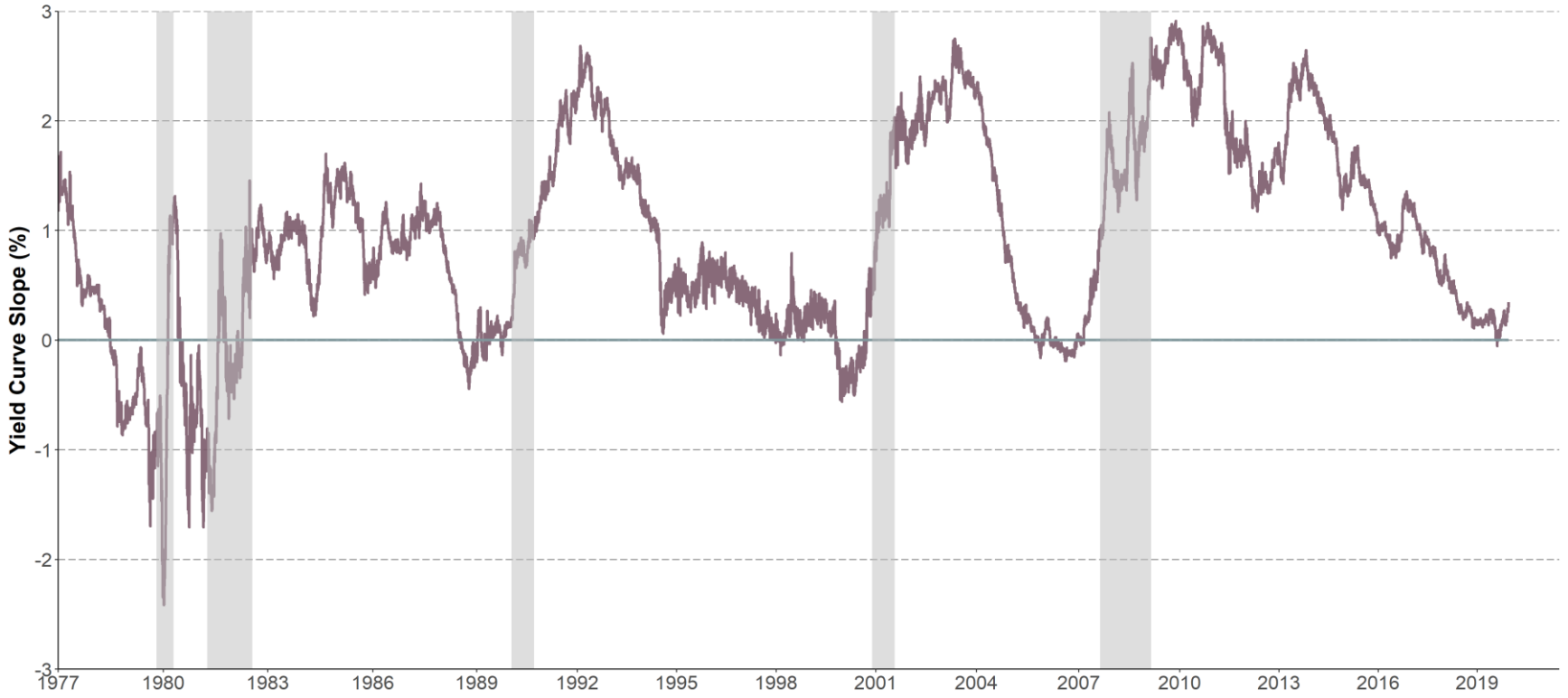
Systemic Risk and Volatile Market Days[1]
(As of January 3, 2020)



- Systemic Risk is a measure of 'System-wide' risk, which indicates herding type behavior.

[1] Source: Meketa Investment Group. Volatile days are defined as the top 10 percent of realized turbulence, which is a multivariate distance between asset returns.

Yield Curve Slope (Ten Minus Two)[1]
(As of December 31, 2019)



- This chart details the historical difference in yields between ten-year and two-year US Treasury bonds/notes. A higher (lower) figure indicates a steeper (flatter) yield curve slope.

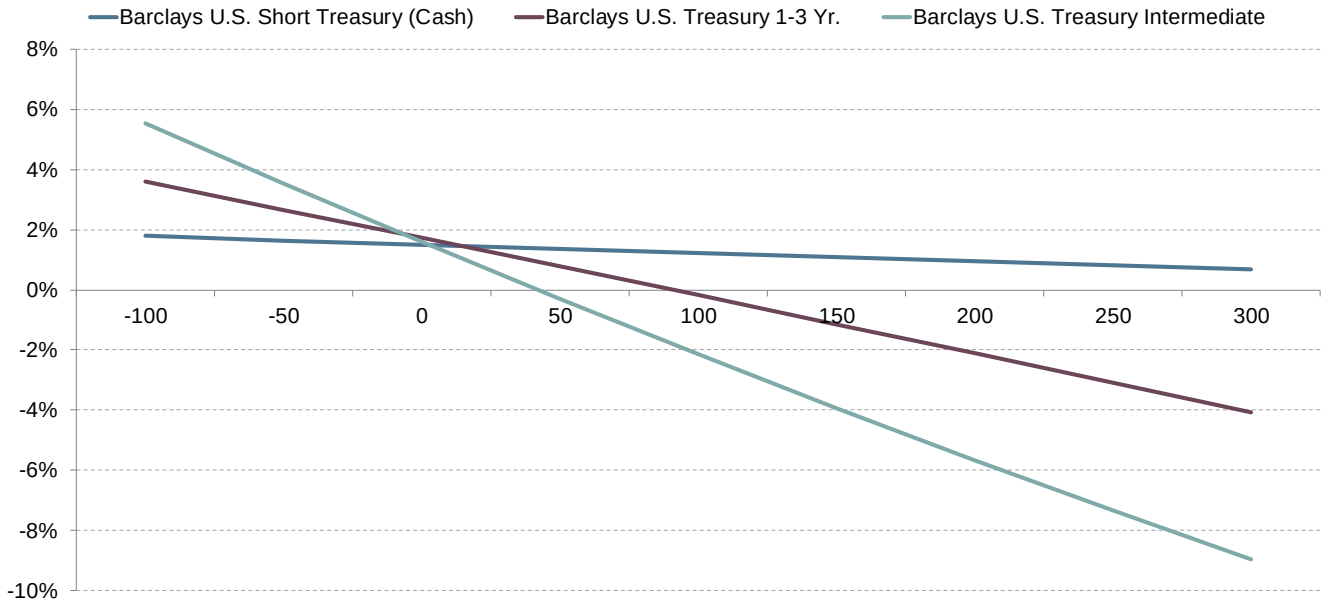
[1] Yield Curve Slope (Ten Minus Two) – Source: Bloomberg, and Meketa Investment Group. Yield curve slope is calculated as the difference between the 10-Year US Treasury Yield and 2-Year US Treasury Yield.

Ten-Year Breakeven Inflation[1]
(As of December 31, 2019)

- This chart details the difference between nominal and inflation-adjusted US Treasury bonds. A higher (lower) figure indicates higher (lower) inflation expectations.

[1] Ten-Year Breakeven Inflation – Source: US Treasury and Federal Reserve. Inflation is measured by the Consumer Price Index (CPI-U NSA).

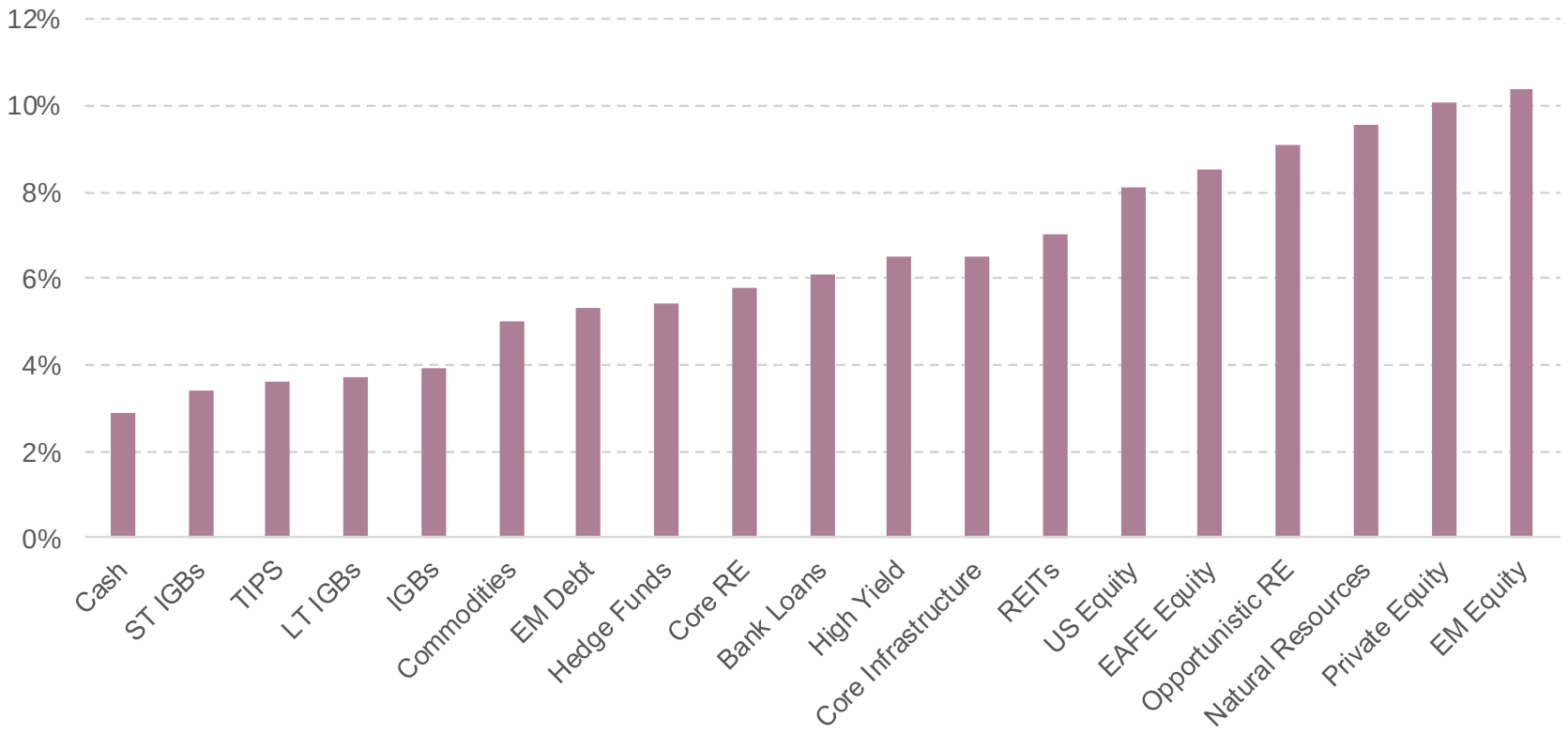
Total Return Given Changes in Interest Rates (bps)[1]
(As of December 31, 2019)



	Total Return for Given Changes in Interest Rates (bps)									Statistics	
	-100	-50	0	50	100	150	200	250	300	Duration	YTW
Barclays US Short Treasury (Cash)	1.9%	1.8%	1.7%	1.5%	1.4%	1.2%	1.1%	1.0%	0.8%	0.7%	0.28
Barclays US Treasury 1-3 Yr.	4.5%	3.6%	2.7%	1.7%	0.8%	-0.2%	-1.1%	-2.1%	-3.1%	-4.1%	1.89
Barclays US Treasury Intermediate	7.6%	5.6%	3.6%	1.6%	-0.3%	-2.1%	-3.9%	-5.7%	-7.3%	-9.0%	3.85
Barclays US Treasury Long	34.1%	22.4%	11.8%	2.2%	-6.3%	-13.9%	-20.3%	-25.7%	-30.1%	-33.4%	18.15

[1] Data represents the expected total return from a given change in interest rates (shown in basis points) over a 12-month period assuming a parallel shift in rates. Source: Bloomberg, and Meketa Investment Group.

Long-Term Outlook – 20-Year Annualized Expected Returns[1]



- This chart details Meketa's long-term forward-looking expectations for total returns across asset classes.

[1] Source: Meketa Investment Group's 2019 Annual Asset Study.

Appendix

Data Sources and Explanations[1]

- US Equity Cyclically Adjusted P/E on S&P 500 Index – Source: Robert Shiller and Yale University.
- Small Cap P/E (Russell 2000 Index) vs. Large Cap P/E (Russell 1000 Index) - Source: Russell Investments. Earnings figures represent 12-month "as reported" earnings.
- Growth P/E (Russell 3000 Growth Index) vs. Value (Russell 3000 Value Index) P/E - Source: Bloomberg, MSCI, and Meketa Investment Group. Earnings figures represent 12-month "as reported" earnings.
- Developed International Equity (MSCI EAFE ex Japan Index) Cyclically Adjusted P/E – Source: MSCI and Bloomberg. Earnings figures represent the average of monthly "as reported" earnings over the previous ten years.
- Emerging Market Equity (MSCI Emerging Markets Index) Cyclically Adjusted P/E – Source: MSCI and Bloomberg. Earnings figures represent the average of monthly "as reported" earnings over the previous ten years
- Private Equity Multiples – Source: S&P LCD Average EBITDA Multiples Paid in All LBOs
- Core Real Estate Spread vs. Ten-Year Treasury – Source: Real Capital Analytics, US Treasury, Bloomberg, and Meketa Investment Group. Core Real Estate is proxied by weighted sector transaction based indices from Real Capital Analytics and Meketa Investment Group.

[1] All Data as of December 31, 2019 unless otherwise noted.

- REITs Dividend Yield Spread vs. Ten-Year Treasury – Source: NAREIT, US Treasury. REITs are proxied by the yield for the NAREIT Equity index.

Appendix

Data Sources and Explanations[1]

- Credit Spreads – Source: Barclays Capital. High Yield is proxied by the Barclays High Yield index and Investment Grade Corporates are proxied by the Barclays US Corporate Investment Grade index.
- EM Debt Spreads – Source: Bloomberg, and Meketa Investment Group. Option Adjusted Spread (OAS) for the Bloomberg Barclays EM USD Aggregate Index.
- Equity Volatility – Source: Bloomberg, and Meketa Investment Group. Equity Volatility proxied by VIX Index, a Measure of implied option volatility for US equity markets.
- Fixed Income Volatility – Source: Bloomberg, and Meketa Investment Group. Equity Volatility proxied by MOVE Index, a Measure of implied option volatility for US Treasury markets.
- Systemic Risk and Volatile Market Days – Source: Meketa Investment Group. Volatile days are defined as the top 10 percent of realized turbulence, which is a multivariate distance between asset returns.
- Systemic Risk, which measures risk across markets, is important because the more contagion of risk that exists between assets, the more likely it is that markets will experience volatile periods.
- Yield Curve Slope (Ten Minus Two) – Source: Bloomberg, and Meketa Investment Group. Yield curve slope is calculated as the difference between the 10-Year US Treasury Yield and 2-Year US Treasury Yield.
- Ten-Year Breakeven Inflation – Source: US Treasury and Federal Reserve. Inflation is measured by the Consumer Price Index (CPI-U NSA).

[1] All Data as of December 31, 2019 unless otherwise noted.

Meketa Market Sentiment Indicator

Explanation, Construction and Q&A

Meketa has created the MIG Market Sentiment Indicator (MIG-MSI) to complement our valuation-focused Risk Metrics. This measure of sentiment is meant to capture significant and persistent shifts in long-lived market trends of economic growth risk, either towards a risk-seeking trend or a risk-aversion trend.

This appendix explores:

- What is the Meketa Market Sentiment Indicator?
- How do I read the indicator graph?
- How is the Meketa Market Sentiment Indicator constructed?
- What do changes in the indicator mean?

Meketa has created a market sentiment indicator for monthly publication (the MIG-MSI – see below) to complement Meketa's Risk Metrics.

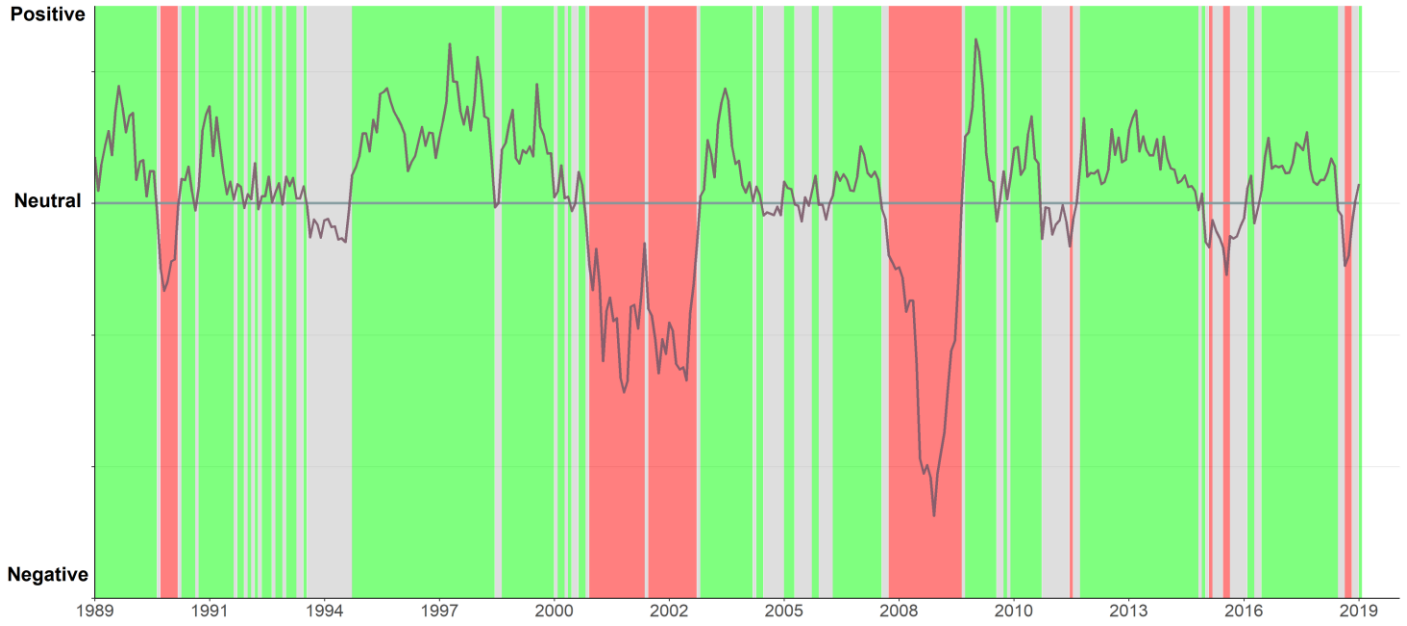
- Meketa's Risk Metrics, which rely significantly on standard market measures of relative valuation, often provide valid early signals of increasing long-term risk levels in the global investment markets. However, as is the case with numerous valuation measures, the Risk Metrics may convey such risk concerns long before a market corrections take place. The MIG-MSI helps to address this early-warning bias by measuring whether the markets are beginning to acknowledge key Risk Metrics trends, and / or indicating non-valuation based concerns. Once the MIG-MSI indicates that the market sentiment has shifted, it is our belief that investors should consider significant action, particularly if confirmed by the Risk Metrics. Importantly, Meketa believes the Risk Metrics and MIG-MSI should always be used in conjunction with one another and never in isolation. The questions and answers below highlight and discuss the basic underpinnings of the Meketa MIG-MSI:

What is the Meketa Market Sentiment Indicator (MIG-MSI)?

- The MIG-MSI is a measure meant to gauge the market's sentiment regarding economic growth risk. Growth risk cuts across most financial assets, and is the largest risk exposure that most portfolios bear. The MIG-MSI takes into account the momentum (trend over time, positive or negative) of the economic growth risk exposure of publicly traded stocks and bonds, as a signal of the future direction of growth risk returns; either positive (risk seeking market sentiment), or negative (risk averse market sentiment).

How do I read the Meketa Market Sentiment Indicator graph?

- Simply put, the MIG-MSI is a color-coded indicator that signals the market's sentiment regarding economic growth risk. It is read left to right chronologically. A green indicator on the MIG-MSI indicates that the market's sentiment towards growth risk is positive. A gray indicator indicates that the market's sentiment towards growth risk is neutral or inconclusive. A red indicator indicates that the market's sentiment towards growth risk is negative. The black line on the graph is the level of the MIG-MSI. The degree of the signal above or below the neutral reading is an indication the signal's current strength.
- Momentum as we are defining it is the use of the past behavior of a series as a predictor of its future behavior.



How is the Meketa Market Sentiment Indicator (MIG-MSI) Constructed?

- The MIG-MSI is constructed from two sub-elements representing investor sentiment in stocks and bonds:
  - Stock return momentum: Return momentum for the S&P 500 Equity Index (trailing 12-months)
  - Bond yield spread momentum: Momentum of bond yield spreads (excess of the measured bond yield over the identical duration US Treasury bond yield) for corporate bonds (trailing 12-months) for both investment grade bonds (75% weight) and high yield bonds (25% weight).
  - Both measures are converted to Z-scores and then combined to get an "apples to apples" comparison without the need of re-scaling.
- The black line reading on the graph is calculated as the average of the stock return momentum measure and the bonds spread momentum measure.[1] The color reading on the graph is determined as follows:
  - If both stock return momentum and bond spread momentum are positive = GREEN (positive)
  - If one of the momentum indicators is positive, and the other negative = GRAY (inconclusive)
  - If both stock return momentum and bond spread momentum are negative = RED (negative)

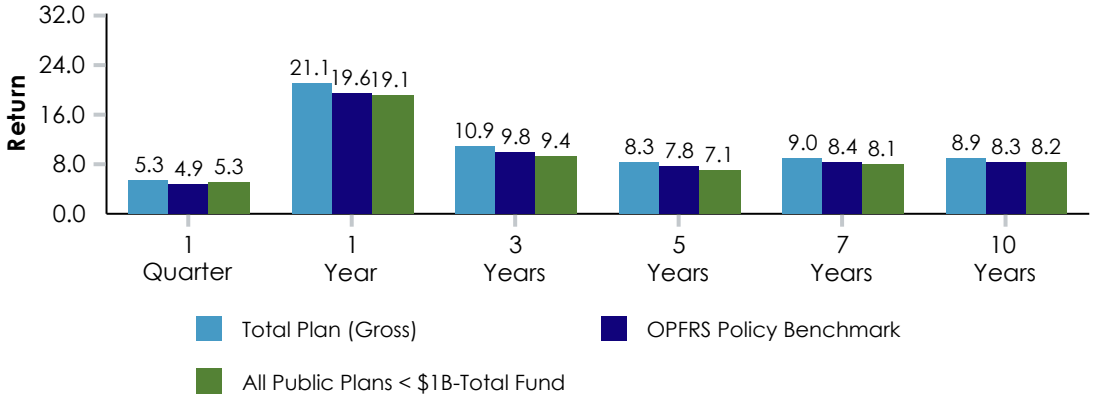
[1] Momentum as we are defining it is the use of the past behavior of a series as a predictor of its future behavior.
"Time Series Momentum" Moskowitz, Ooi, Pedersen, August 2010. *http://pages.stern.nyu.edu/~lpederse/papers/TimeSeriesMomentum.pdf*

What does the Meketa Market Sentiment Indicator (MIG-MSI) mean? Why might it be useful?

- There is strong evidence that time series momentum is significant and persistent. In particular, across an extensive array of asset classes, the sign of the trailing 12-month return (positive or negative) is indicative of future returns (positive or negative) over the next 12-month period. The MIG-MSI is constructed to measure this momentum in stocks and corporate bond spreads. A reading of green or red is agreement of both the equity and bond measures, indicating that it is likely that this trend (positive or negative) will continue over the next 12 months. When the measures disagree, the indicator turns gray. A gray reading does not necessarily mean a new trend is occurring, as the indicator may move back to green, or into the red from there. The level of the reading (black line) and the number of months at the red or green reading, gives the user additional information on which to form an opinion, and potentially take action.

Total Portfolio Performance & Market Value As of December 31, 2019

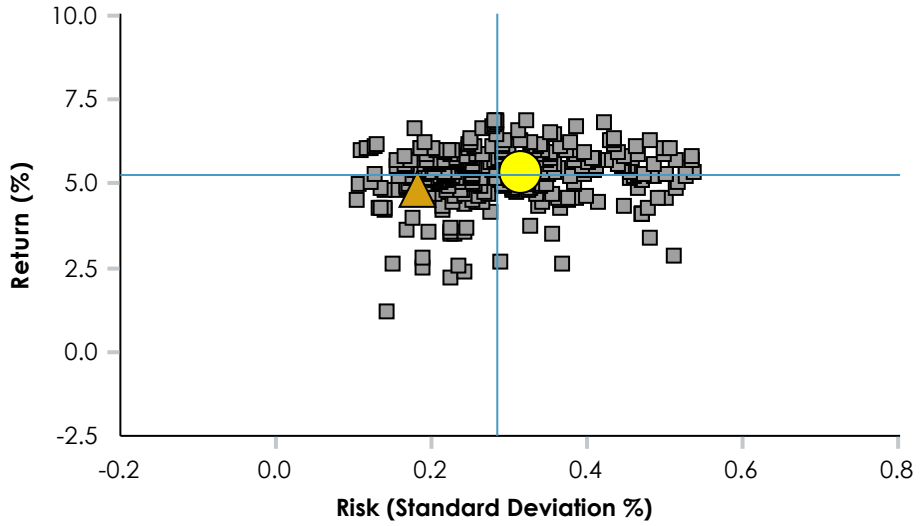
Investment Performance



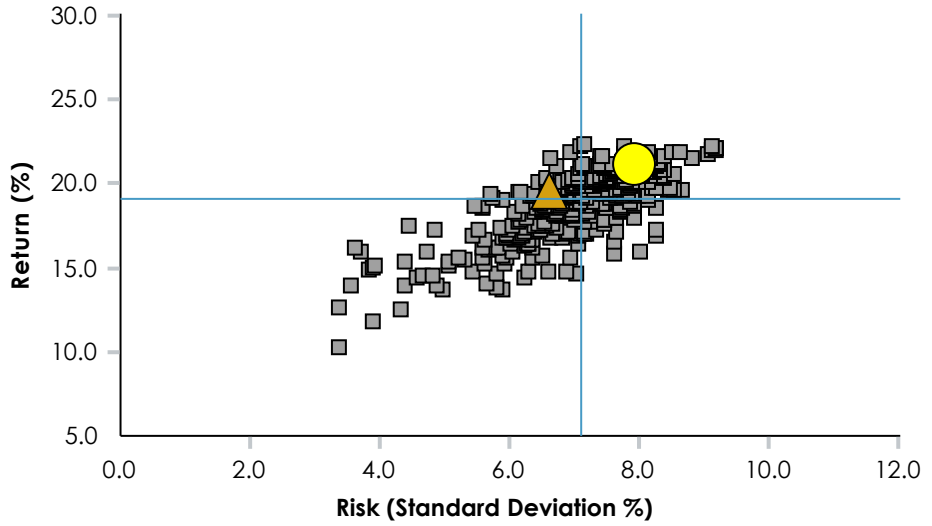
Portfolio Valuation (000's)

	1 Quarter	1 Year
OPFRS Total Plan		
Beginning Market Value	391,244	350,053
Net Contributions	-3,458	-14,139
Gain/Loss	20,440	72,312
Ending Market Value	**408,227**	**408,227**

Quarterly Risk/Return



1-Year Risk/Return



	Return	Standard Deviation
OPFRS Total Plan	5.3	0.3
OPFRS Policy Benchmark	4.9	0.2
Median	5.3	0.3

	Return	Standard Deviation
OPFRS Total Plan	21.1	7.9
OPFRS Policy Benchmark	19.6	6.6
Median	19.1	7.1

Evolving Policy Benchmark consists of 40% Russell 3000, 12% MSCI ACWI ex U.S., 33% Bbg BC Universal, 5% CBOE BXM , 6.7% SG Multi Asset Risk Premia, 3.3% Bbg BC Long Treasury

Asset Class Performance As of December 31, 2019

Investment Performance

Asset Class Performance (gross of fees)

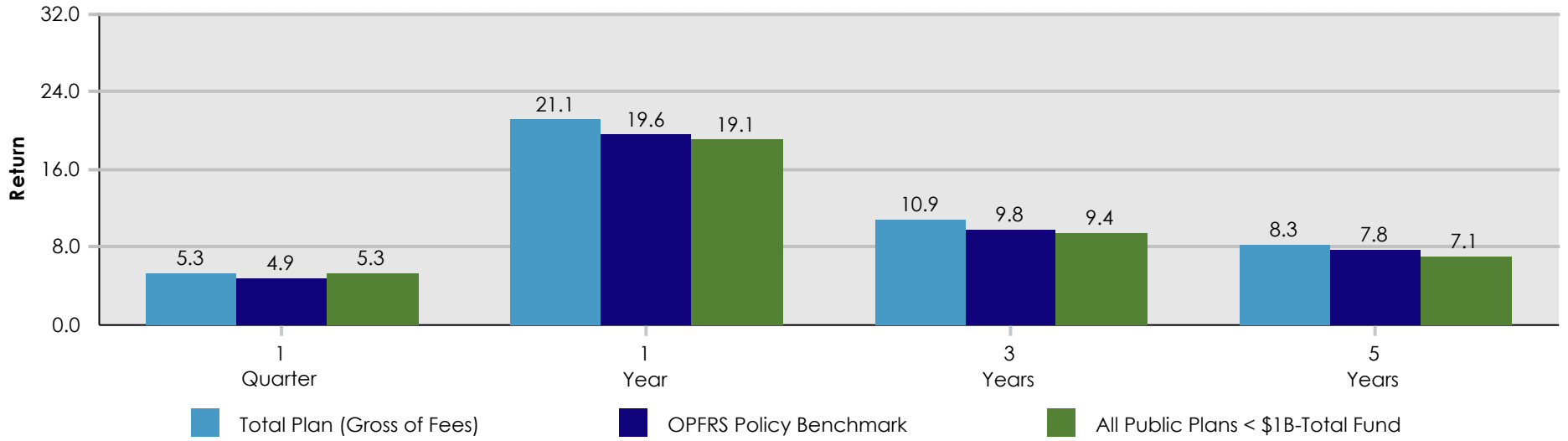
	1 Quarter	1 Year	3 Years	5 Years	7 Years	10 Years
OPFRS Total Plan	5.3	21.1	10.9	8.3	9.0	8.9
*OPFRS Policy Benchmark**	*4.9*	*19.6*	*9.8*	*7.8*	*8.4*	*8.3*
Excess Return	0.4	1.5	1.1	0.5	0.6	0.6
Domestic Equity	8.6	30.6	14.3	11.1	14.2	13.6
*Russell 3000 (Blend)***	*9.1*	*31.0*	*14.6*	*11.2*	*14.4*	*13.4*
Excess Return	-0.5	-0.4	-0.3	-0.1	-0.2	0.2
International Equity	9.7	27.4	12.4	7.7	7.4	6.2
*MSCI ACWI Ex US (Blend)^*	*9.0*	*22.1*	*10.4*	*6.0*	*5.9*	*5.4*
Excess Return	0.7	5.3	2.0	1.7	1.5	0.8
Fixed Income	0.3	9.2	4.8	3.8	3.2	4.4
*Bloomberg Barclays Universal (Blend)^^*	*0.5*	*9.3*	*4.3*	*3.4*	*3.0*	*4.1*
Excess Return	-0.2	-0.1	0.5	0.4	0.2	0.3
Crisis Risk Offset	1.0	12.5	-	-	-	-
SG Multi Alternative Risk Premia	*-0.9*	*3.8*	*-*	*-*	*-*	*-*
Excess Return	1.9	8.7	-	-	-	-
Covered Calls	6.1	22.5	10.5	9.2	-	-
CBOE BXM	*5.1*	*16.6*	*7.8*	*7.2*	*-*	*-*
Excess Return	1.0	5.9	2.7	2.0	-	-
Cash	0.5	2.5	1.8	1.2	0.8	-
FTSE 3 Month T-Bill	*0.5*	*2.3*	*1.7*	*1.0*	*0.8*	*-*
Excess Return	0.0	0.2	0.1	0.2	0.0	-

Evolving Policy Benchmark consists of 40% Russell 3000, 12% MSCI ACWI ex U.S., 33% Bbg BC Universal, 5% CBOE BXM , 6.7% SG Multi Asset Risk Premia, 3.3% Bbg BC Long Treasury
** Domestic Equity Benchmark consists of S&P 500 thru 3/31/98, 10% R1000, 20% R1000V, 5% RMC from 4/1/98 - 12/31/04, and Russell 3000 from 1/1/05 to present
^ International Equity Benchmark consists of MSCI EAFE thru 12/31/04, and MSCI ACWI x US thereafter.
^^ Fixed Income Benchmark consists of Bbg BC Aggregate prior to 4/1/06, and Bbg BC Universal thereafter.

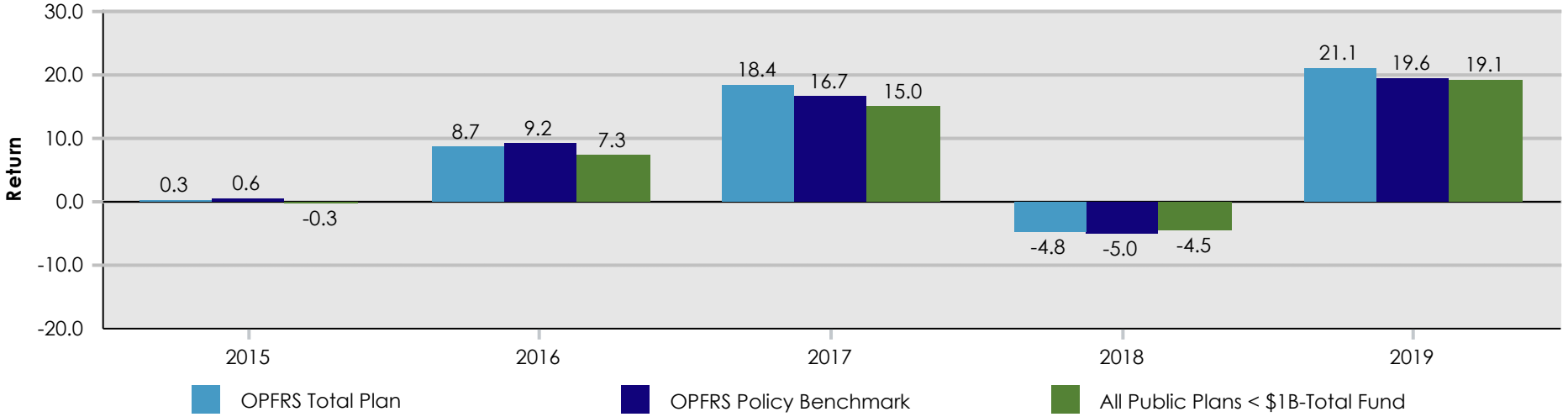
OPFRS Portfolio Relative Performance Results

As of December 31, 2019

Trailing Period Perfomance (annualized)



12-month Performance- As of December 31, 2019



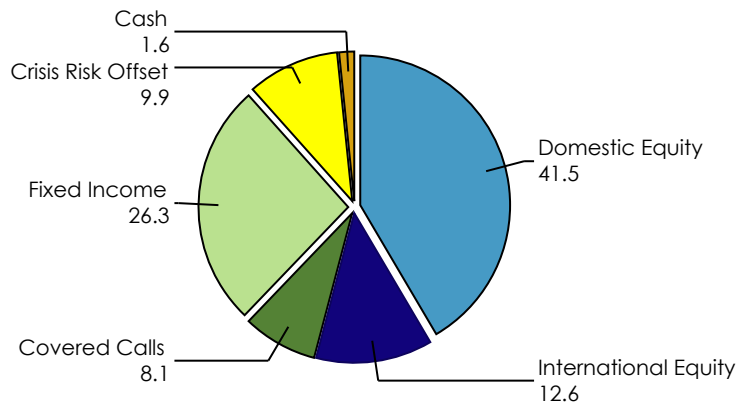
Actual vs. Target Allocation
As of December 31, 2019

	Asset Allocation ($000)	Asset Allocation (%)	Target Allocation* (%)	Variance (%)
OPFRS Total Plan	408,227	100.0	100.0	0.0
Domestic Equity	169,558	41.5	40.0	1.5
International Equity	51,328	12.6	12.0	0.6
Total Fixed Income	107,185	26.3	33.0	-6.7
Covered Calls	32,891	8.1	5.0	3.1
Crisis Risk Offset	40,606	9.9	10.0	-0.1
Cash	6,659	1.6	0.0	1.6

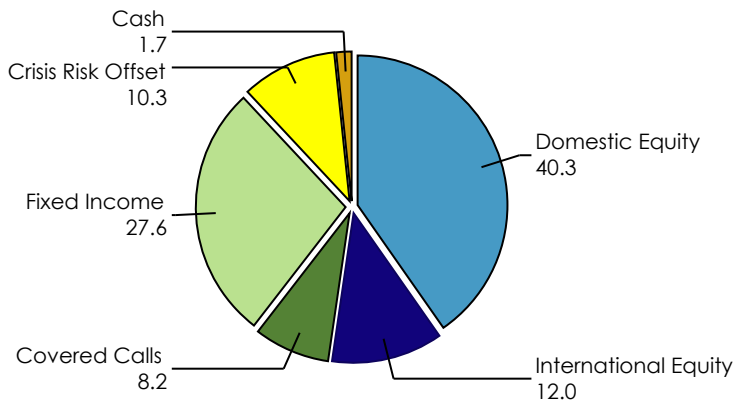
*Target weightings reflect the Plan's evolving asset allocation (effective 5/31/2017).

Actual Asset Allocation Comparison

December 31, 2019 : $408,226,524



September 30, 2019 : $391,243,865



Manager Performance - Gross of Fees

As of December 31, 2019

Domestic Equity

Manager - Style	Mkt Value ($000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception*	Inception Date
Large Cap Core							
Northern Trust Russell 1000 Index	95,888	9.0	31.4	15.1	11.5	14.3	06/2010
Russell 1000 Index		*9.0*	*31.4*	*15.0*	*11.5*	*14.3*	
Excess Return		0.0	0.0	0.1	0.0	0.0	
Mid Cap Core							
EARNEST Partners - Active	33,801	7.7 (26)	38.4 (3)	16.4 (13)	13.2 (9)	10.2 (17)	04/2006
Russell Midcap Index		*7.1*	*30.5*	*12.1*	*9.3*	*8.9*	
Excess Return		0.6	7.9	4.3	3.9	1.3	
Small Cap Value							
Vanguard Russell 2000 Value	8,524	8.4 (42)	---	---	---	8.0 (26)	08/2019
Russell 2000 Value Index		*8.5*	*---*	*---*	*---*	*7.7*	
Excess Return		-0.1	---	---	---	0.3	
Small Cap Growth							
Rice Hall James - Active	12,035	9.8 (48)	18.7 (91)	---	---	9.4 (81)	07/2017
Russell 2000 Growth Index		*11.4*	*28.5*	*---*	*---*	*10.9*	
Excess Return		-1.6	-9.8	---	---	-1.5	
Defensive Equity							
SPI - Active	19,311	7.8 (62)	---	---	---	8.3 (82)	07/2019
S&P 500 Index		*9.1*	*---*	*---*	*---*	*10.9*	
Excess Return		-1.3	---	---	---	-2.6	

Over the latest three-month period ending December 31, 2019, one of OPFRS's three active Domestic Equity managers outperformed their respective benchmarks.

OPFRS's passive Domestic Equity mandates showed mixed results compared to their respective benchmarks.

Northern Trust, the Plan's passive large cap core transition account, continues to perform in-line with its benchmark over all time periods measured. This performance is within expectations for a passive mandate.

Manager Performance - Gross of Fees

As of December 31, 2019

Domestic Equity

EARNEST Partners, the Plan's active mid cap core manager, outperformed its Russell Midcap benchmark by 0.6%, placing it in the 26th percentile of its peer group. The portfolio has also outperformed its benchmark over the 1-year period by 7.9% and continues to outperform over the 3- and 5-year periods by 4.3% and 3.9% respectively. The portfolio also ranks in the top quartile of its peer group over all time periods measured.

Vanguard Russell 2000 Value, the Plan's new passive small cap value manager, underperformed it's benchmark over the recent quarter by (0.1%), placing it in the 42nd percentile of its peer group.

Rice Hall James, the Plan's active small cap growth manager, underperformed its Russell 2000 Growth benchmark over the most recent quarter by (1.6%) placing the portfolio in the 48th percentile of its peer group. The portfolio has underperformed its benchmark over the 1-year period by (9.8%).

SPI, the Plan's new active Defensive Equity manager, underperformed the S&P 500 benchmark by (1.3%) over the recent quarter, placing the portfolio in the 62nd percentile of its peer group.

Manager Performance - Gross of Fees

As of December 31, 2019

International Equity

Manager - Style	Mkt Value ($000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Active Core International							
Vanguard Developed Markets	14,995	8.3	---	---	---	11.7	09/2019
MSCI AC World ex USA		*9.0*	---	---	---	*11.8*	
Excess Return		-0.7	---	---	---	-0.1	
Active International							
iShares MSCI ACWI exUS ETF	35,567	---	---	---	---	0.6	12/2019
MSCI AC World ex USA		---	---	---	---	*4.4*	
Excess Return		---	---	---	---	-3.8	

Over the latest three-month period, ending December 31, 2019, OPFRS terminated Fisher and Hansberger.

Vanguard Developed Markets underperformed it's benchmark by (0.1%) over the quarter. Trailing returns are not available as the mandate opened in August 2019.

iShares MSCI ACWI ex US ETF, the plan's new passive international equity manager does not have a full quarter of performance. The mandate did show a since inception return of 0.6%.

Manager Performance - Gross of Fees

As of December 31, 2019

Fixed Income

Manager - Style	Mkt Value ($000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Core Fixed Income							
Ramirez	74,256	0.1 (69)	9.9 (16)	4.9 (12)	---	4.9 (12)	01/2017
Blmbg. Barc. U.S. Aggregate Index		*0.2*	*8.7*	*4.0*	*---*	*4.0*	
Excess Return		-0.1	1.2	0.9	---	0.9	
Core-Plus Fixed Income							
Reams	24,910	-0.1 (97)	8.3 (93)	4.4 (77)	3.5 (72)	5.6 (57)	02/1998
Bbg Barclays Universal (Hybrid)		*0.5*	*9.3*	*4.3*	*3.4*	*5.0*	
Excess Return		-0.6	-1.0	0.1	0.1	0.6	
High Yield / Bank Loans							
DDJ Capital	8,019	2.8 (29)	5.3 (98)	5.8 (71)	---	5.7 (65)	02/2015
ICE BofAML High Yield Master II		*2.6*	*14.4*	*6.3*	*---*	*6.1*	
Excess Return		0.2	-9.1	-0.5	---	-0.4	

Over the latest three-month period, ending December 31, 2019, two of OPFRS's three active Fixed Income managers outperformed their respective benchmarks.

Ramirez, the Plan's core fixed income manager, returned 0.1% compared to the benchmark return of 0.2% during the quarter, ranking the portfolio in the 69th percentile of its peer group. Over the 1-year period, Ramirez has outperformed its benchmark by 1.2% and ranked in the 16th percentile of its peer group. Over the 3-year period, Ramirez returned 4.9%, besting the benchmark by 0.9% and earning a ranking of 12th in its peer group.

Reams, the Plan's core plus fixed income manager, underperformed its benchmark by (0.6%) during the quarter and ranked in the 97th percentile of its peer group. Over the most recent 12-month period, Reams underperformed its benchmark by (1.0%,) earning a 93rd percentile ranking. Reams did outperform its benchmark over the 3- and 5-year periods by 0.1% respectively.

DDJ, the Plan's High Yield & Bank Loan manager, returned 2.8% during the most recent quarter, outperforming the benchmark by 0.2%. A string of underperforming quarters has left DDJ trailing its benchmark by (9.1%) over the most recent 12-month period and (0.5%) over the 3-year period.

Manager Performance - Gross of Fees

As of December 31, 2019

Covered Calls

Manager - Style	Mkt Value ($000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Covered Calls Composite							
Covered Calls	32,891	6.1	22.5	10.5	9.2	8.9	04/2014
CBOE BXM		*5.1*	*16.6*	*7.8*	*7.2*	*6.8*	
Excess Return		1.0	5.9	2.7	2.0	2.1	
CC - Passive Allocation							
Parametric BXM	15,629	4.6	16.6	8.3	7.9	7.4	04/2014
CBOE BXM		*5.1*	*16.6*	*7.8*	*7.2*	*6.8*	
Excess Return		-0.5	0.0	0.5	0.7	0.6	
CC - Active Allocation							
Parametric DeltaShift	17,262	7.5	28.4	12.6	10.2	10.9	04/2014
CBOE BXM		*5.1*	*16.6*	*7.8*	*7.2*	*6.8*	
Excess Return		2.4	11.8	4.8	3.0	4.1	

During the latest three-month period ending December 31, 2019, OPFRS' aggregate Covered Calls portfolio outperformed its benchmark by 1.0%.

Parametric BXM Portfolio, the Plan's passive covered calls allocation underperformed its CBOE BXM index by (0.5%) over the most recent quarter. Over the most recent 1-year period the portfolio matched the benchmark and has outperformed over both the 3- and 5-year periods by 0.5% and 0.7% respectively.

Parametric Delta Shift Portfolio, the Plan's active covered calls allocation has outperformed the CBOE BXM benchmark by 2.4%over the most recent quarter and has outperformed by 11.8% over the 1-year period. The portfolio outperformed over the 3-year period by 4.8% and has earned an annualized 10.2% over the most recent 5-year period, outperforming its benchmark by 3.0%.

Manager Performance - Gross of Fees

As of December 31, 2019

Crisis Risk Offset

Manager - Style	Mkt Value ($000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Crisis Risk Offset Composite							
Crisis Risk Offset	40,606	1.0	12.5	---	---	3.4	09/2018
CRO Composite Benchmark		*-0.9*	*3.8*	---	---	*1.8*	
Excess Return		1.9	8.7	---	---	1.6	
CRO - Risk Premia / Trend Following							
Parametric S.A.R.P.	26,721	3.9	16.0	---	---	5.8	09/2018
SG Multi Alternative Risk Premia		*-0.9*	*3.8*	---	---	*1.8*	
Excess Return		4.8	12.2	---	---	4.0	
CRO - Long Duration							
Vanguard Long-Term Treasury ETF	13,885	-4.3	---	---	---	3.4	07/2019
Bloomberg Barclays U.S. Gov Float Adjusted: Long		*-4.1*	---	---	---	*3.5*	
Excess Return		-0.2	---	---	---	-0.1	

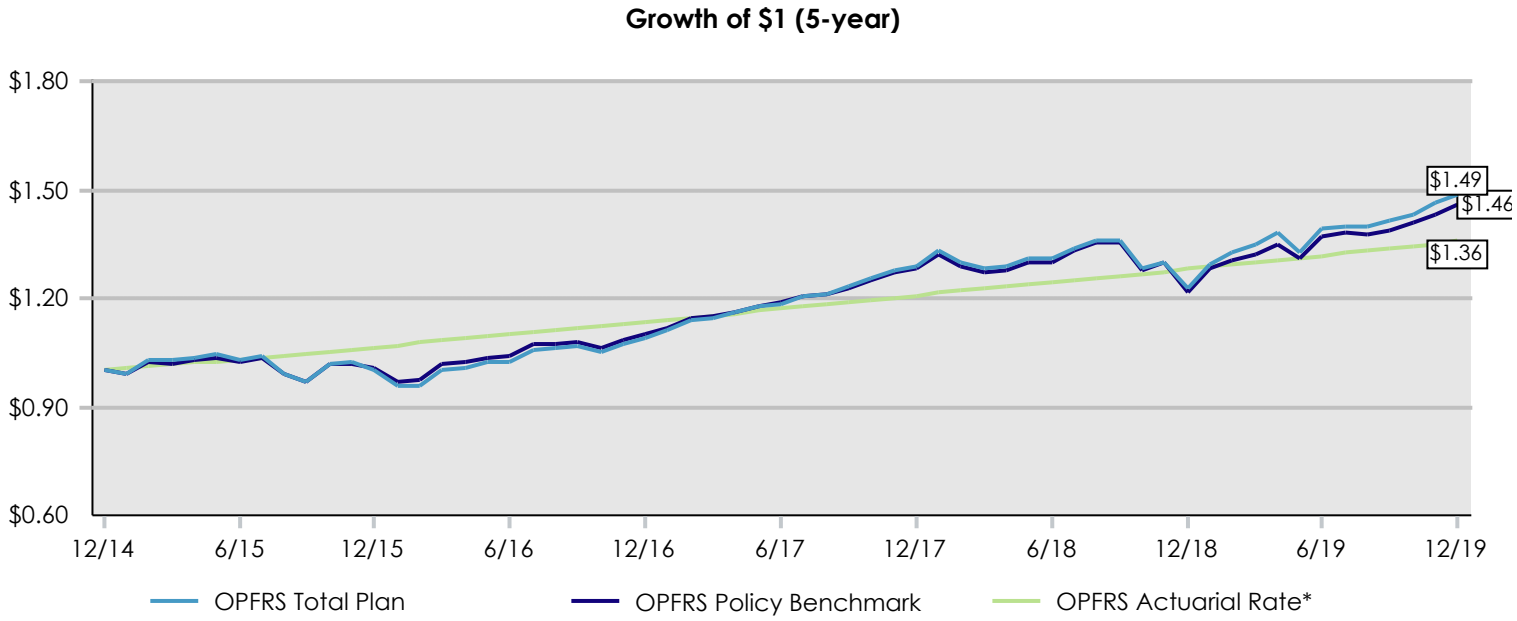
During the latest three-month period ending December 31, 2019, OPFRS's partially funded aggregate Crisis Risk Offset portfolio outperformed its benchmark by 1.9%.

Parametric Systematic Alternative Risk Premia, the Plan's Risk Premia / Trend Following manager outperformed its benchmark by 4.8% during the quarter. The portfolio outperformed it's benchmark over the 1-year period by 12.2%.

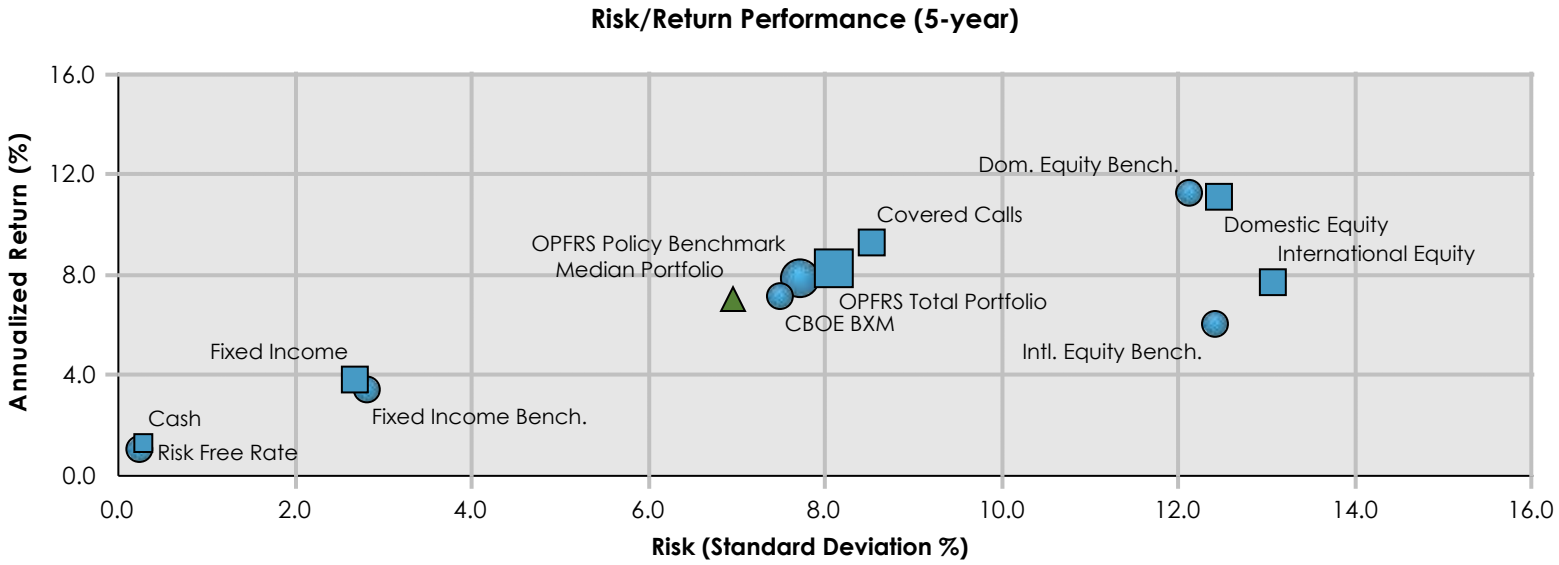
Temporary Long Duration ETF, the Plan's Long Duration allocation was funded in early June 2019 through the use of the Vanguard Long-Term Treasury ETF until a permanent manager can be selected. The portfolio underperformed it's benchmark by (0.2%) over the most recent quarter.

OPFRS Total Portfolio 5-Year Performance

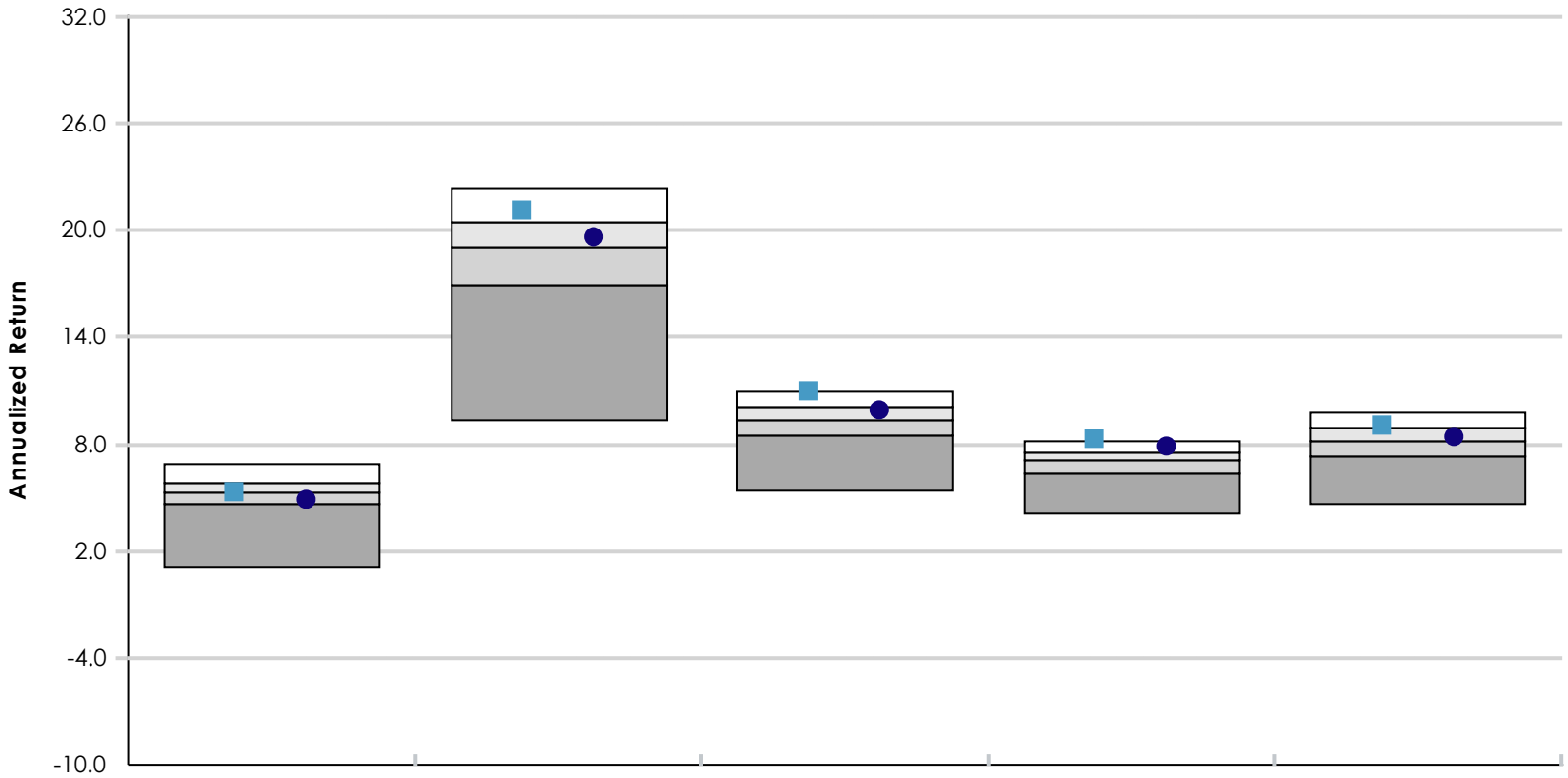
As of December 31, 2019



* The actuarial expected rate of return was 8% through 6/30/2009, 7.5% through 6/30/2010, 7% through 6/30/2011, 6.75% through 6/30/2014, 6.5% through 12/31/2017 and 6.0% currently



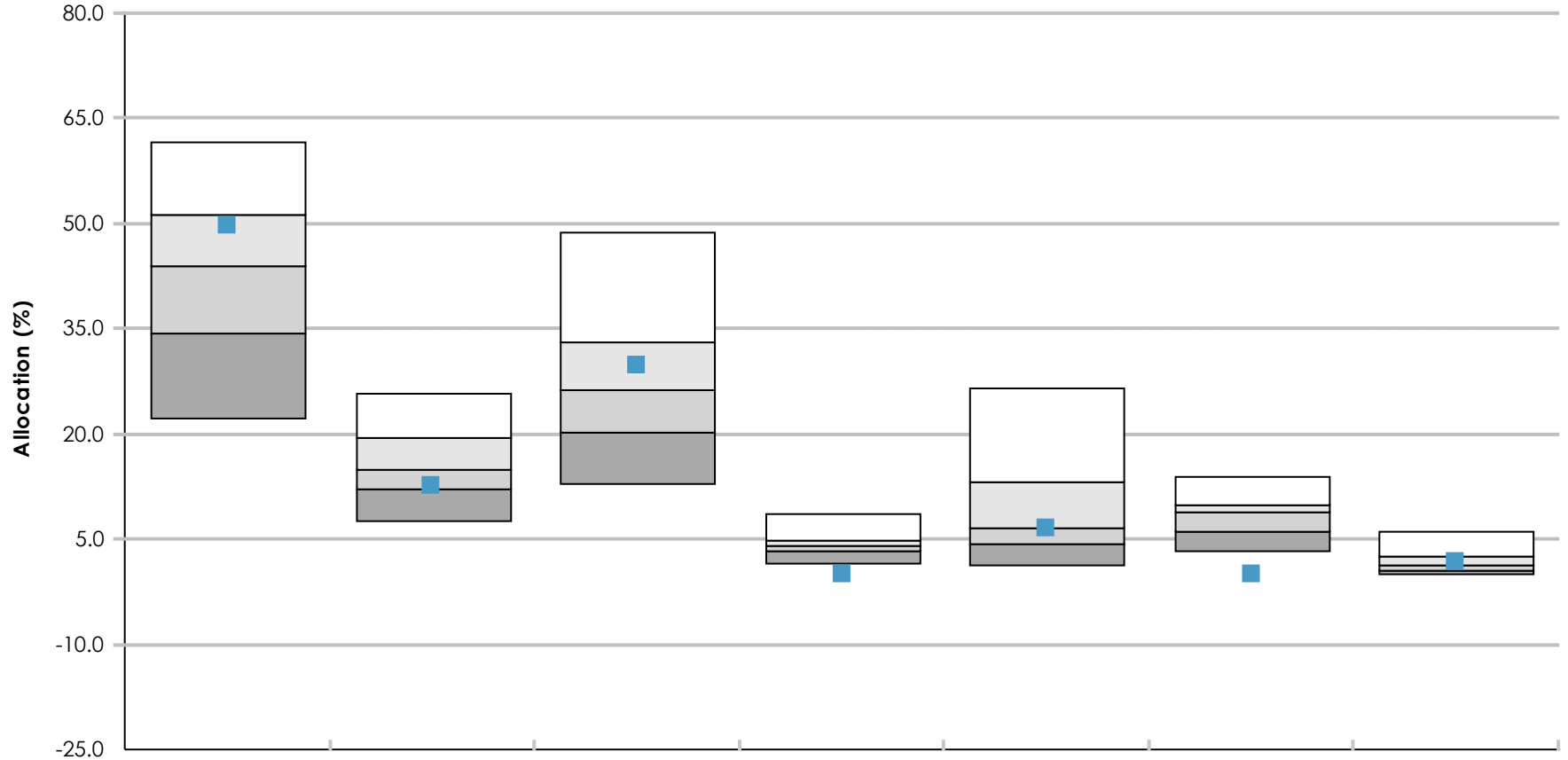
Plan Sponsor Peer Group Analysis
As of December 31, 2019



	1 Quarter	1 Year	3 Years	5 Years	7 Years
OPFRS Total Plan	**5.3 (48)**	**21.1 (16)**	**10.9 (6)**	**8.3 (4)**	**9.0 (17)**
OPFRS Policy Benchmark	*4.9 (70)*	*19.6 (41)*	*9.8 (35)*	*7.8 (13)*	*8.4 (44)*
5th Percentile	6.9	22.4	11.0	8.1	9.8
1st Quartile	5.8	20.4	10.1	7.5	8.9
Median	5.3	19.1	9.4	7.1	8.1
3rd Quartile	4.7	17.0	8.5	6.3	7.3
95th Percentile	1.1	9.4	5.4	4.1	4.6
Population	409	397	373	359	338

Parentheses contain percentile rankings.
Calculation based on monthly periodicity.

Plan Sponsor TF Asset Allocation
As of December 31, 2019



	US Equity	Intl. Equity	US Fixed Income	Intl. Fixed Income	Alternative Inv.	Real Estate	Cash
OPFRS Total Plan	**49.6 (33)**	**12.6 (73)**	**29.7 (37)**	**0.0**	**6.5 (50)**	**0.0**	**1.6 (41)**
5th Percentile	61.7	25.7	48.7	8.7	26.4	14.0	5.9
1st Quartile	51.3	19.4	33.2	4.7	13.2	9.9	2.4
Median	43.9	14.9	26.4	4.0	6.5	8.8	1.4
3rd Quartile	34.3	12.2	20.1	3.2	4.3	6.0	0.5
95th Percentile	22.2	7.4	13.0	1.6	1.2	3.4	0.1
Population	551	503	506	164	126	285	380

Parentheses contain percentile rankings.
Calculation based on monthly periodicity.

Monitoring/Probation Status

As of December 31, 2019
Return vs. Benchmark since Corrective Action

Portfolio	Status	Concern	Months Since Corrective Action	Performance^ Since Corrective Action (Gross)	Peer Group Percentile Ranking	Date of Corrective Action*
DDJ Capital	On Watch	Performance	4	2.4	75	5/29/2019
Ice BofAML US High Yield			---	2.9		
Rice Hall James	On Watch	Performance	4	9.3	32	5/29/2019
Russell 2000 Growth	---	---	---	10.5		

^. Annualized performance if over one year.
* Approximate date based on when Board voted to either monitor a manager at a heightened level or place it on probation.

Investment Performance Criteria
For Manager Monitoring/Probation Status

Asset Class	Short-term (rolling 12 mth periods)	Medium-term (rolling 36 mth periods)	Long-term (60 + months)
Active Domestic Equity	Fd return < bench return – 3.5%	Fd annlzd return < bench annlzd return – 1.75% for 6 consecutive months	VRR < 0.97 for 6 consecutive months
Active International Equity	Fd return < bench return – 4.5%	Fd annlzd return < bench annlzd return – 2.0% for 6 consecutive months	VRR < 0.97 for 6 consecutive months
Passive International Equity	Tracking Error > 0.50%	Tracking Error > 0.45% for 6 consecutive months	Fd annlzd return < bench annlzd return – 0.40% for 6 consecutive months
Fixed Income	Fd return < bench return – 1.5%	Fd annlzd return < bench annlzd return – 1.0% for 6 consecutive months	VRR < 0.98 for 6 consecutive months

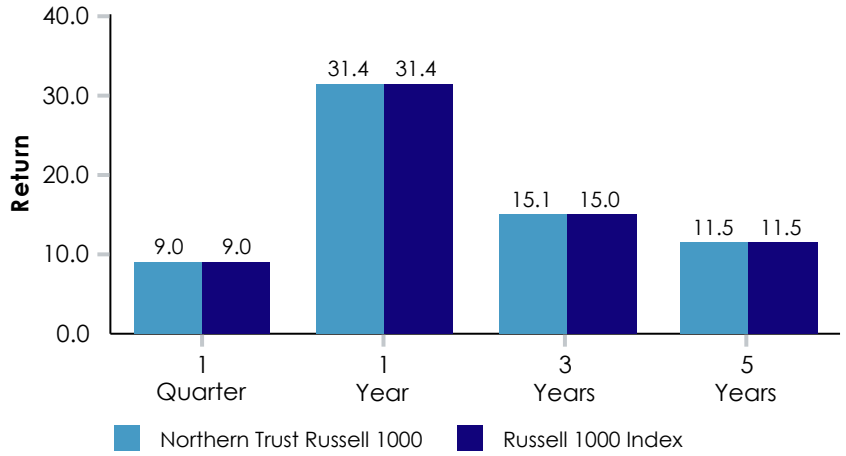
VRR – Value Relative Ratio – is calculated as: manager cumulative return / benchmark cumulative return.

Northern Trust Russell 1000 - gross of fees

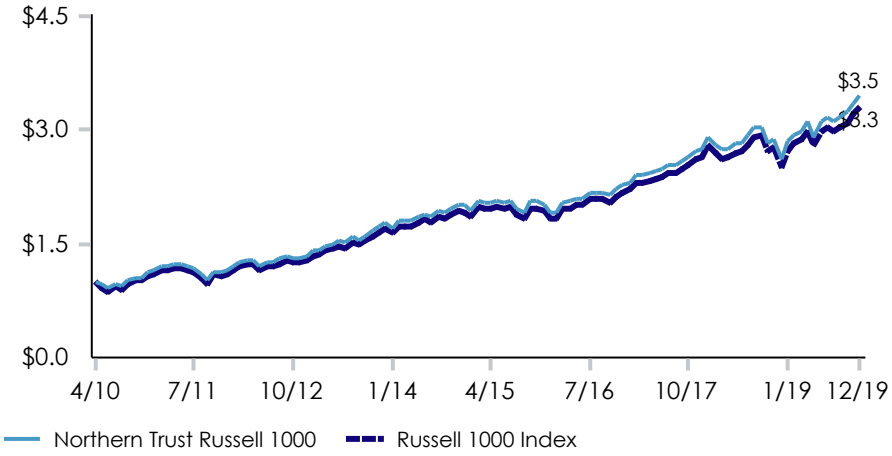
As of December 31, 2019

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Northern Trust Russell 1000	0.79	0.97	0.31	1.06	1.28	0.99	99.60	95.58	05/01/2010
Russell 1000 Index	0.00	1.00	-	1.01	0.00	1.00	100.00	100.00	05/01/2010

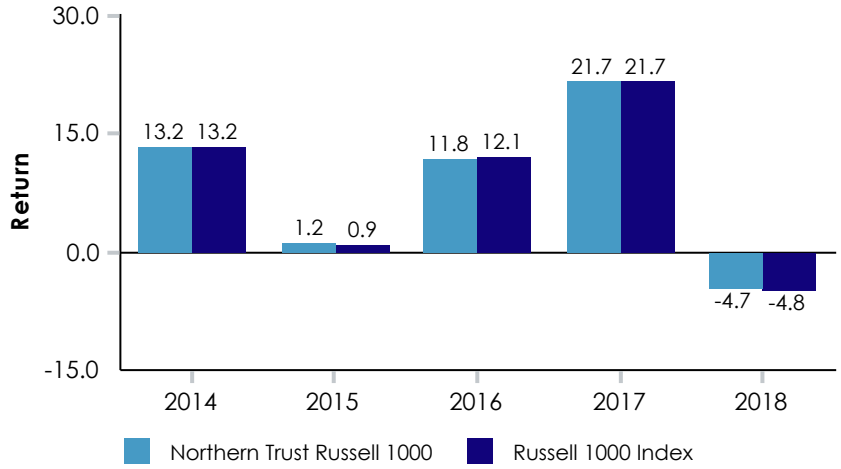
Trailing Period Performance



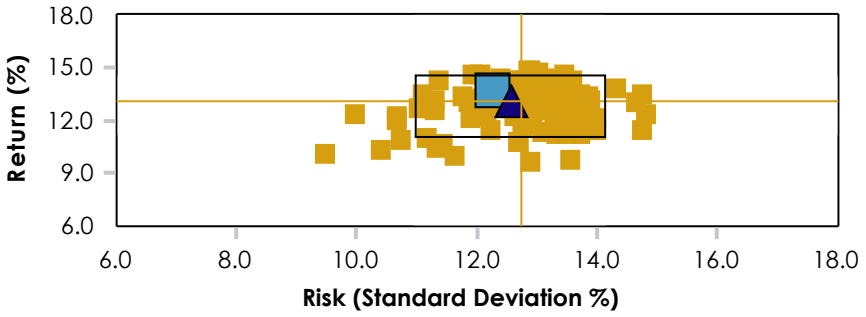
Growth of $1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



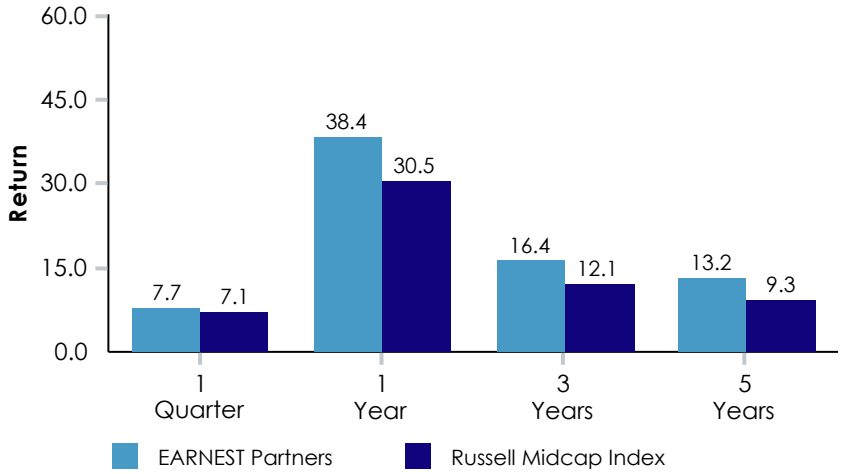
	Return	Standard Deviation
Northern Trust Russell 1000	13.7	12.3
Russell 1000 Index	13.2	12.6
Median	13.1	12.8

EARNEST Partners - gross of fees

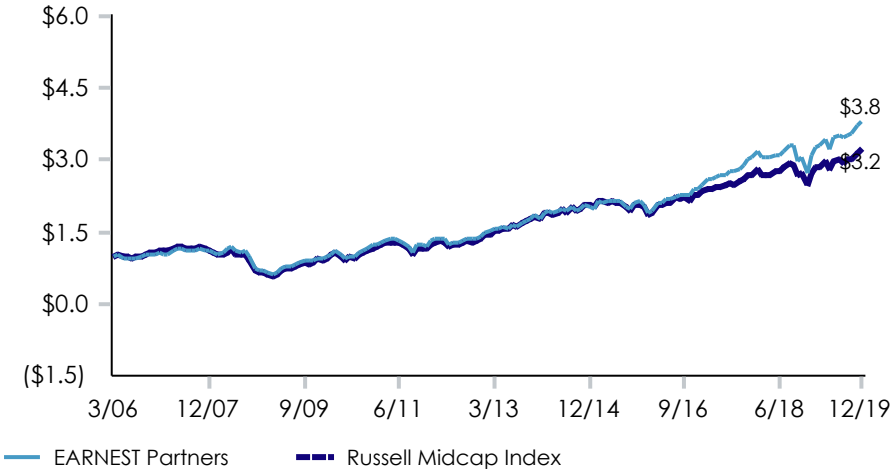
As of December 31, 2019

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
EARNEST Partners	1.27	1.00	0.40	0.59	3.27	0.96	101.57	94.74	04/01/2006
Russell Midcap Index	0.00	1.00	-	0.53	0.00	1.00	100.00	100.00	04/01/2006

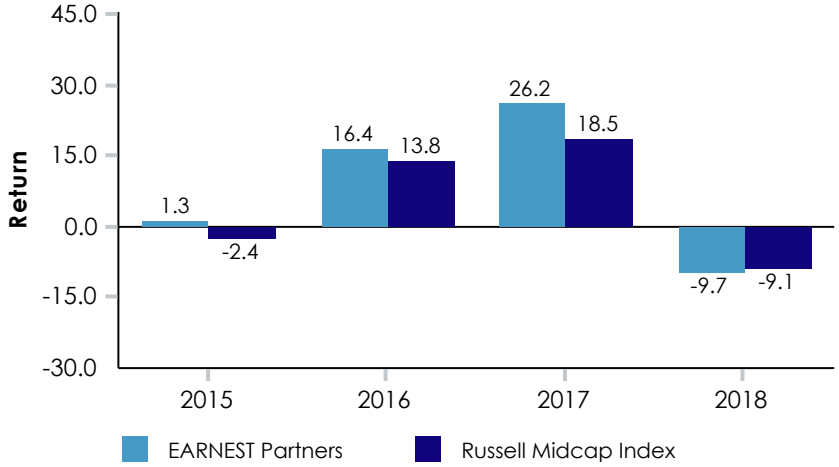
Trailing Period Performance



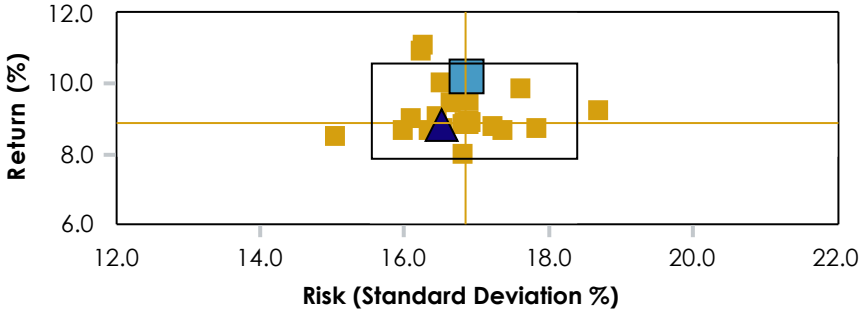
Growth of $1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



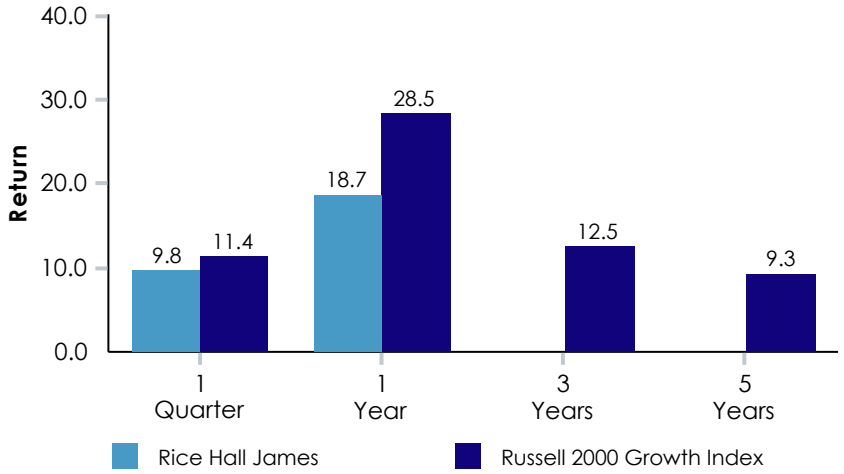
	Return	Standard Deviation
EARNEST Partners	10.2	16.9
Russell Midcap Index	8.9	16.5
Median	8.9	16.8

Rice Hall James - gross of fees

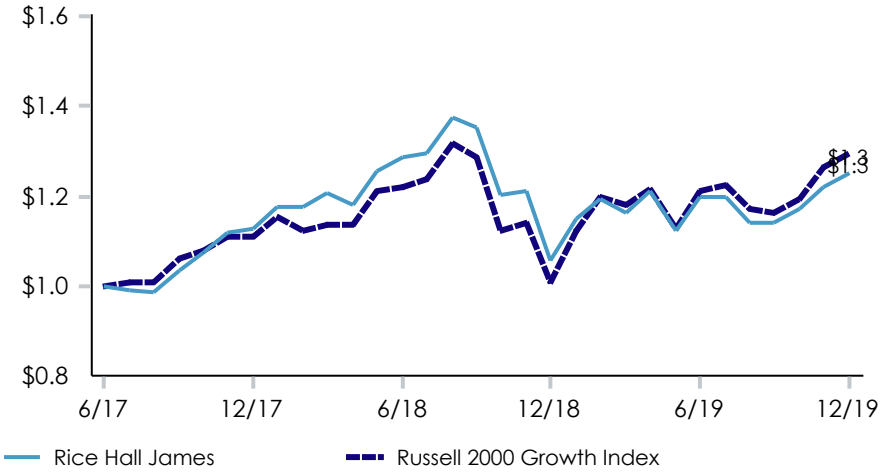
As of December 31, 2019

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Rice Hall James	-0.43	0.91	-0.31	0.51	4.74	0.93	90.99	93.20	07/01/2017
Russell 2000 Growth Index	0.00	1.00	-	0.57	0.00	1.00	100.00	100.00	07/01/2017

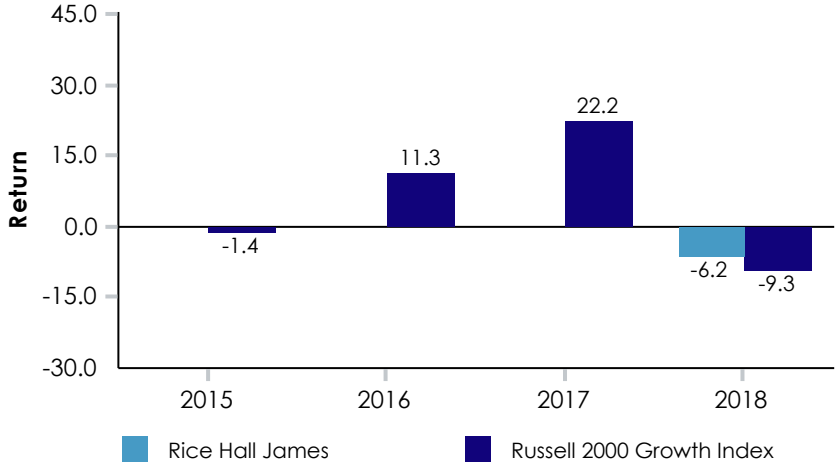
Trailing Period Performance



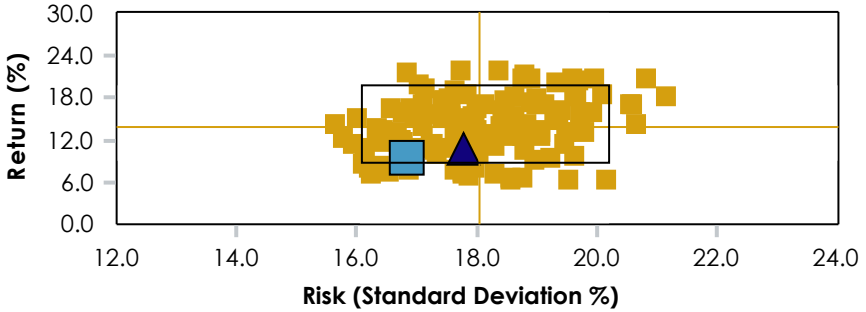
Growth of $1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



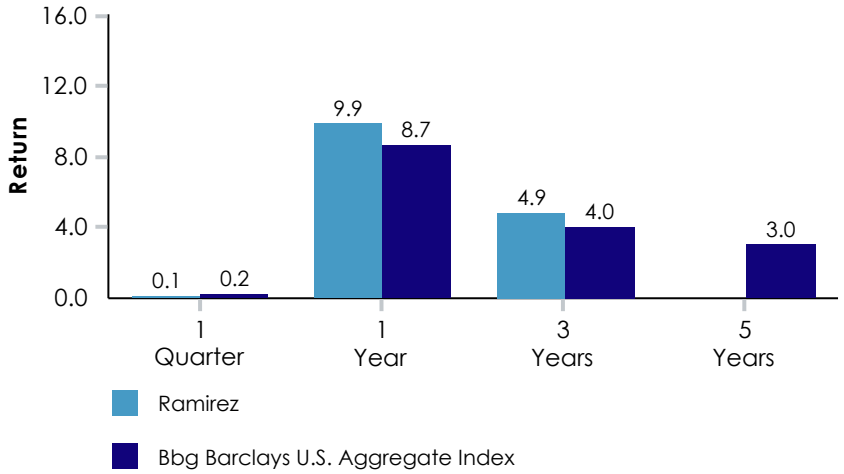
	Return	Standard Deviation
Rice Hall James	9.4	16.9
Russell 2000 Growth Index	10.9	17.8
Median	14.0	18.1

Ramirez - gross of fees

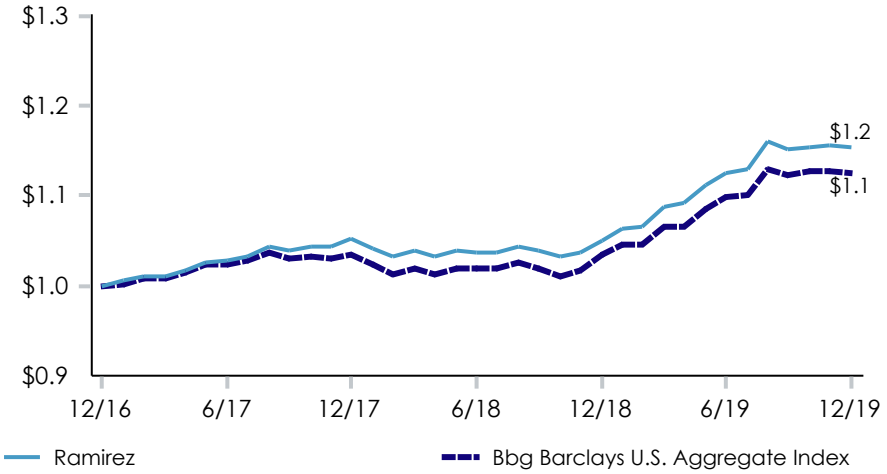
As of December 31, 2019

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Ramirez	1.03	0.95	1.38	1.16	0.61	0.96	106.46	76.99	01/01/2017
Bbg Barclays U.S. Aggregate Index	0.00	1.00	-	0.84	0.00	1.00	100.00	100.00	01/01/2017

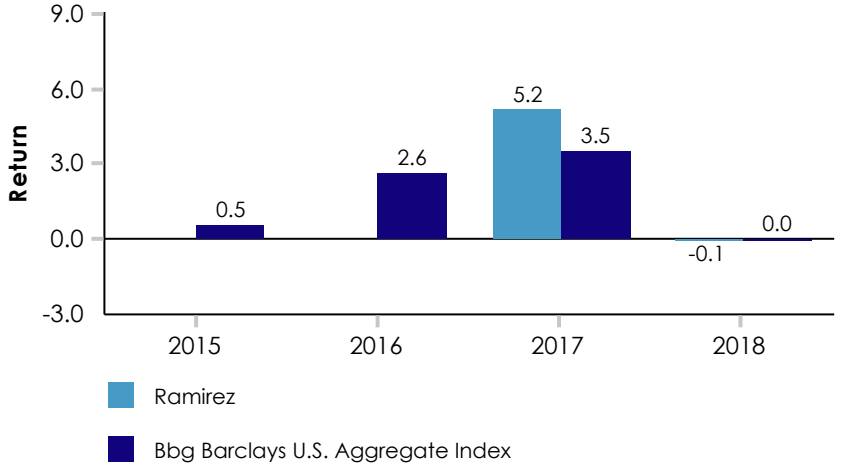
Trailing Period Performance



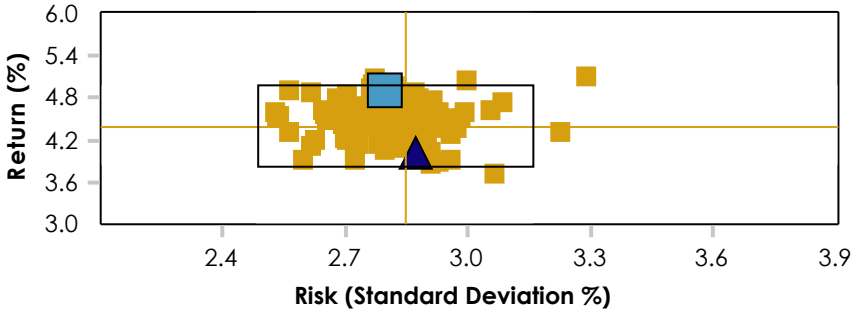
Growth of $1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



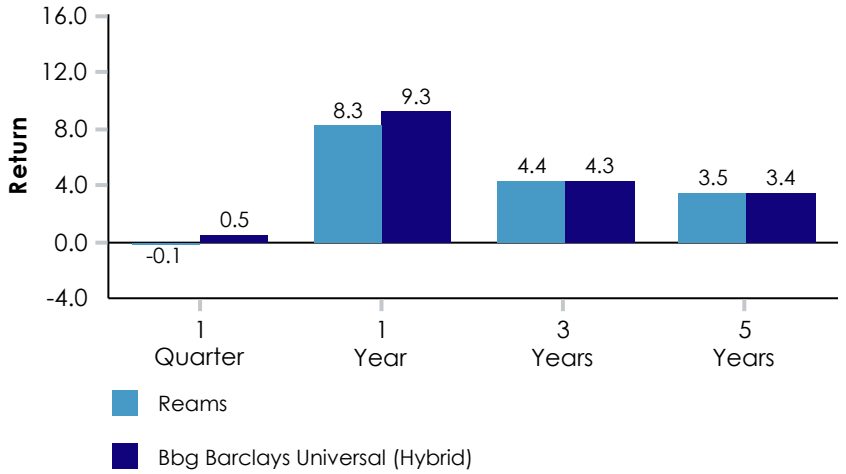
	Return	Standard Deviation
Ramirez	4.9	2.8
Bbg Barclays U.S. Aggregate Index	4.0	2.9
Median	4.4	2.8

Reams - gross of fees

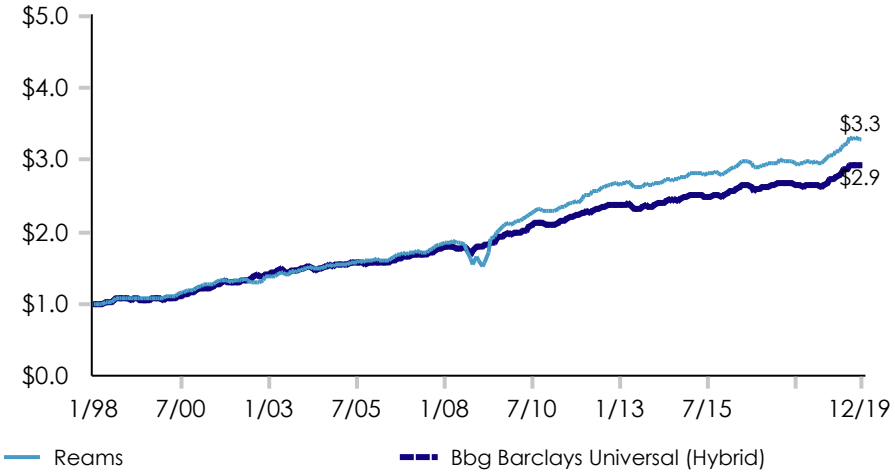
As of December 31, 2019

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Reams	0.29	1.06	0.16	0.69	3.91	0.45	109.38	103.54	02/01/1998
Bbg Barclays Universal (Hybrid)	0.00	1.00	-	0.90	0.00	1.00	100.00	100.00	02/01/1998

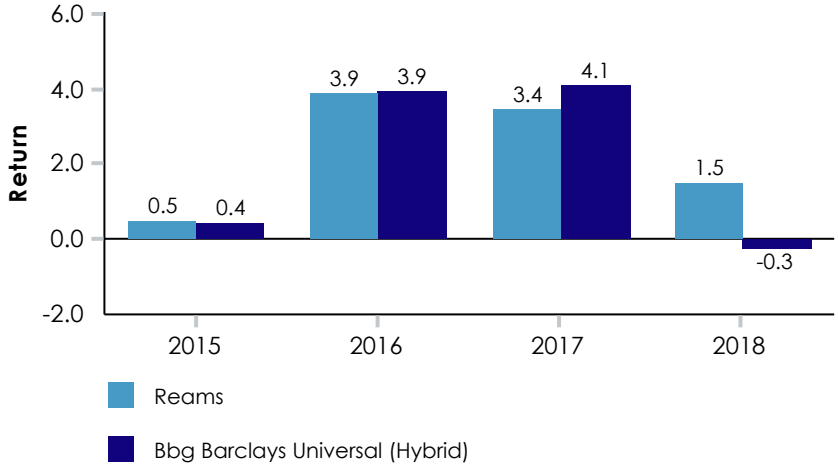
Trailing Period Performance



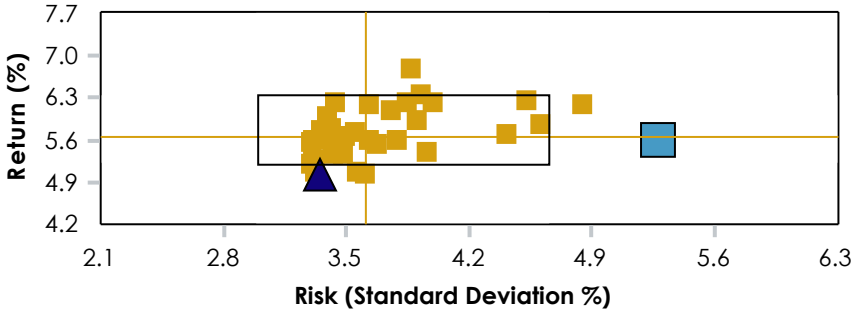
Growth of $1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



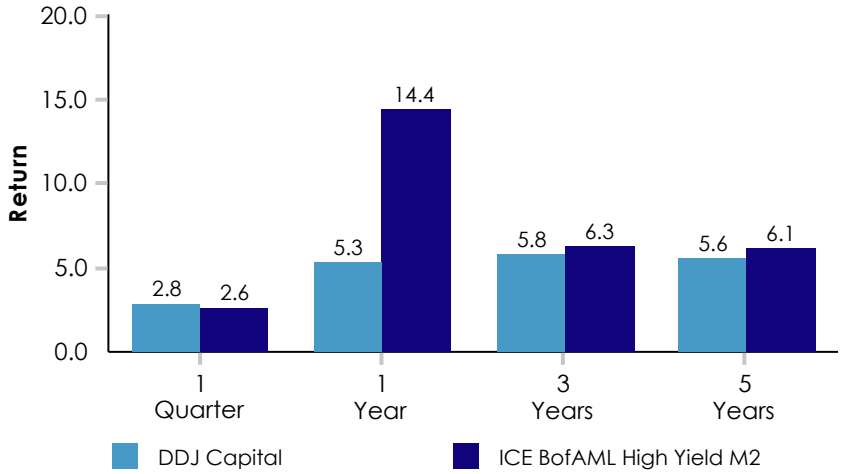
	Return	Standard Deviation
Reams	5.6	5.3
Bbg Barclays Universal (Hybrid)	5.0	3.3
Median	5.7	3.6

DDJ Capital - gross of fees

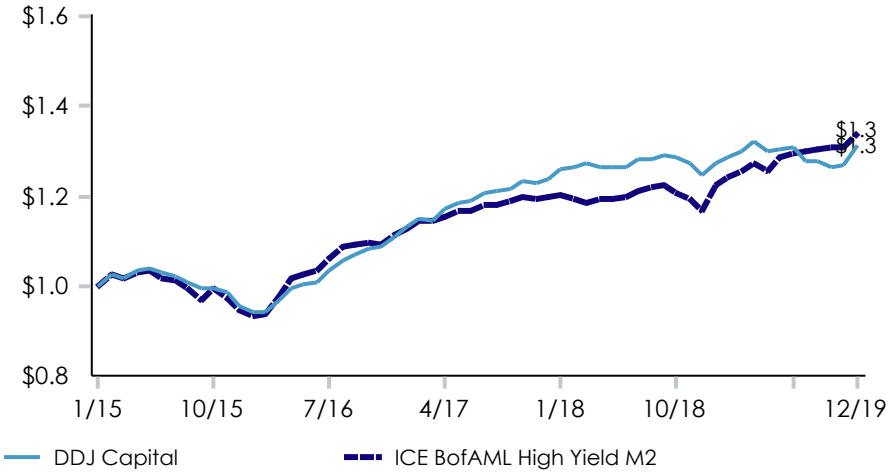
As of December 31, 2019

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
DDJ Capital	1.41	0.70	-0.13	0.96	3.30	0.63	82.76	68.77	02/01/2015
ICE BofAML High Yield M2	0.00	1.00	-	0.94	0.00	1.00	100.00	100.00	02/01/2015

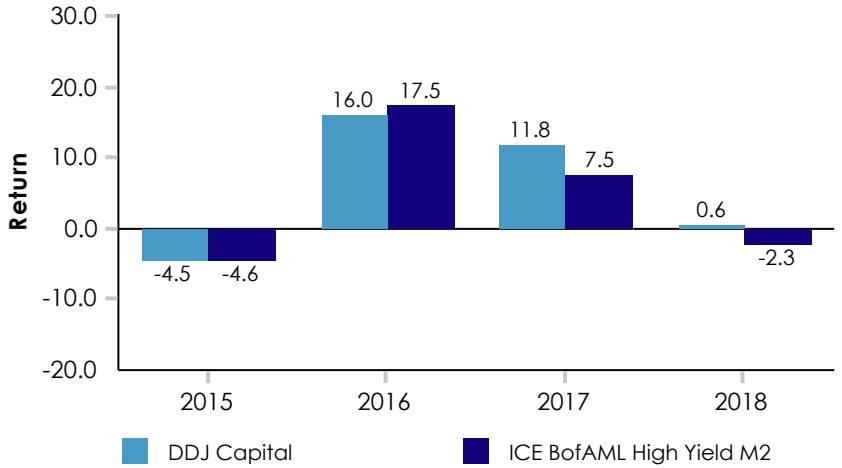
Trailing Period Performance



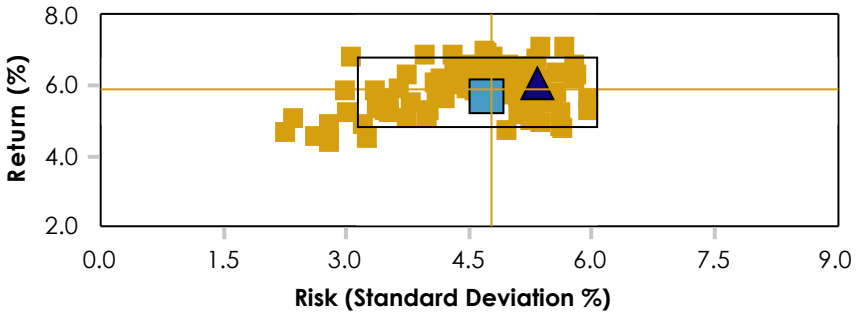
Growth of $1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



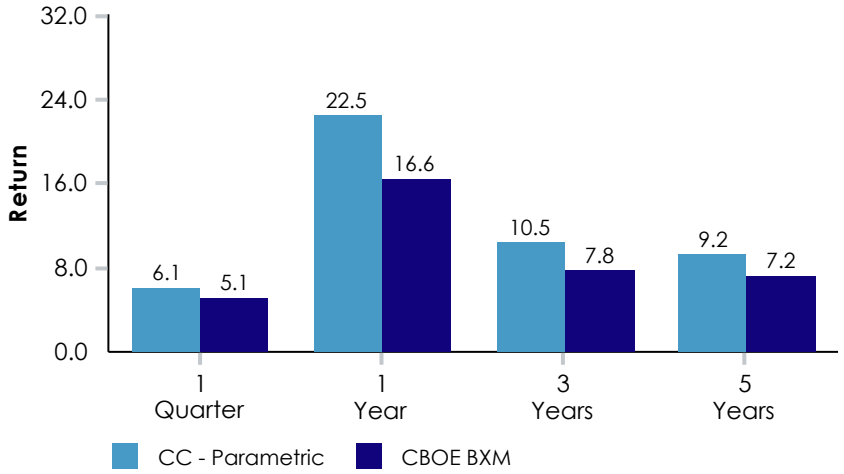
	Return	Standard Deviation
DDJ Capital	5.7	4.7
ICE BofAML High Yield M2	6.1	5.4
Median	5.9	4.8

CC - Parametric - gross of fees

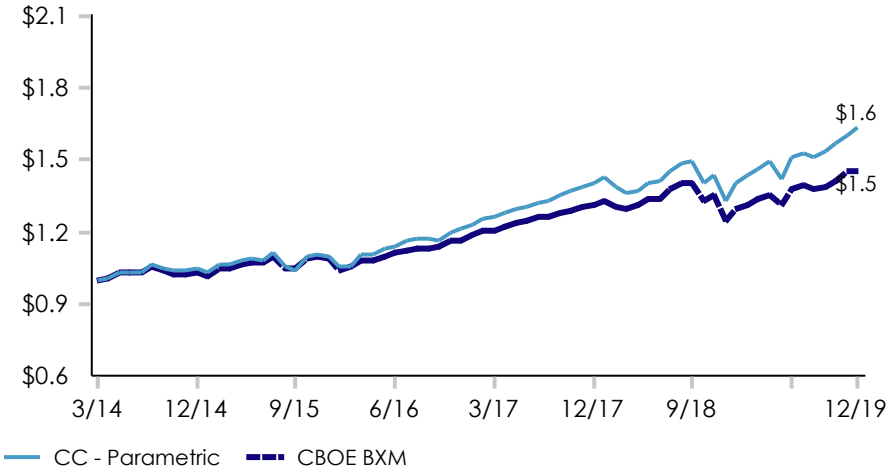
As of December 31, 2019

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
CC - Parametric	1.52	1.08	0.86	0.98	2.39	0.92	120.02	109.08	04/01/2014
CBOE BXM	0.00	1.00	-	0.82	0.00	1.00	100.00	100.00	04/01/2014

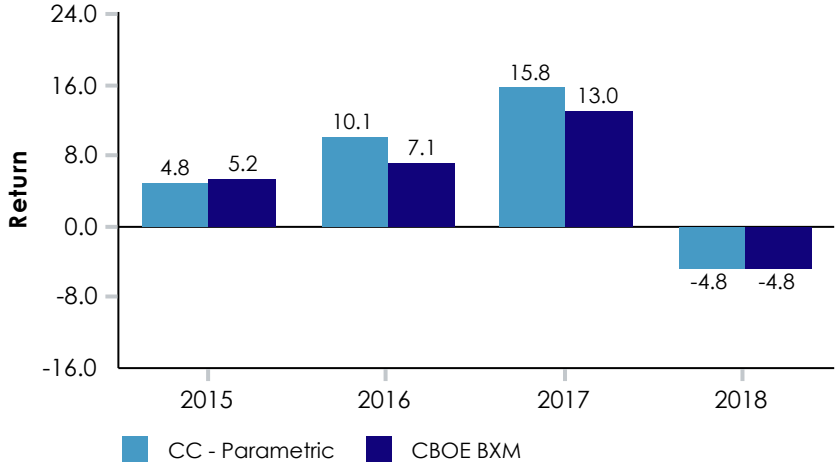
Trailing Period Performance



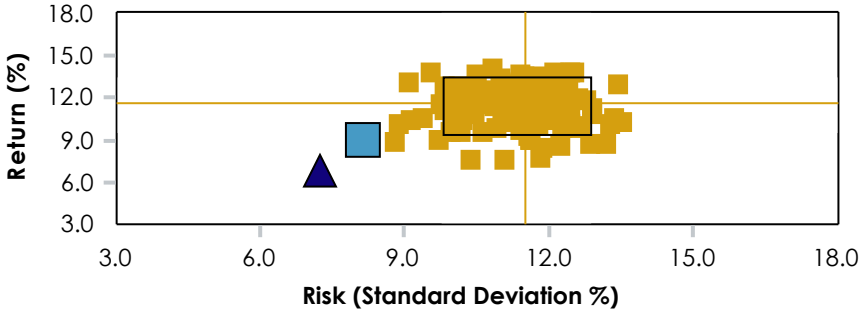
Growth of $1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



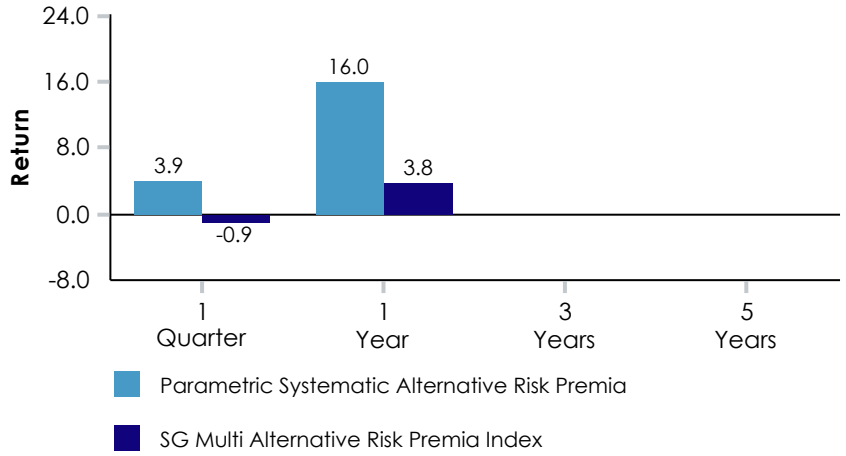
	Return	Standard Deviation
CC - Parametric	8.9	8.1
CBOE BXM	6.8	7.2
Median	11.7	11.5

Parametric Systematic Alternative Risk Premia - gross of fees

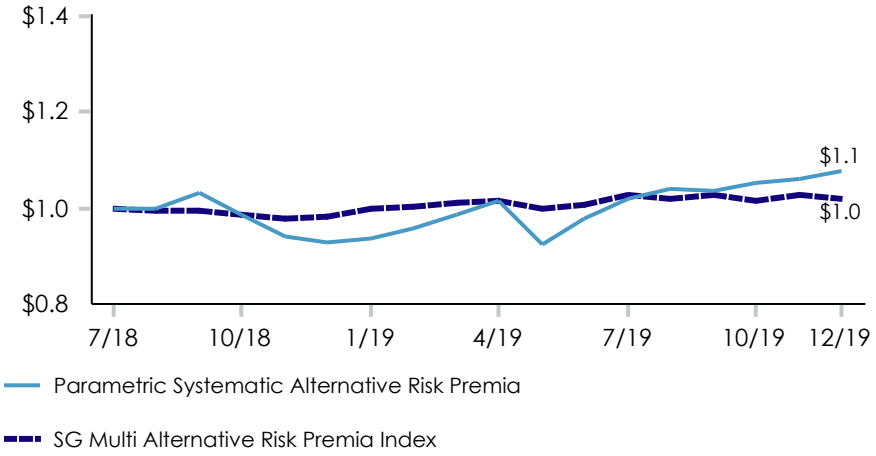
As of December 31, 2019

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Parametric Systematic Alternative Risk Premia	3.39	2.07	0.45	0.32	10.51	0.37	253.28	195.96	08/01/2018
SG Multi Alternative Risk Premia Index	0.00	1.00	-	-0.24	0.00	1.00	100.00	100.00	08/01/2018

Trailing Period Performance



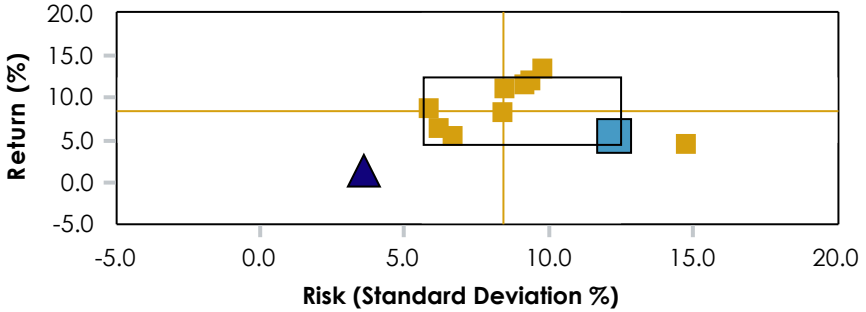
Growth of $1 - Since Inception



Calendar Year Performance

No data found.

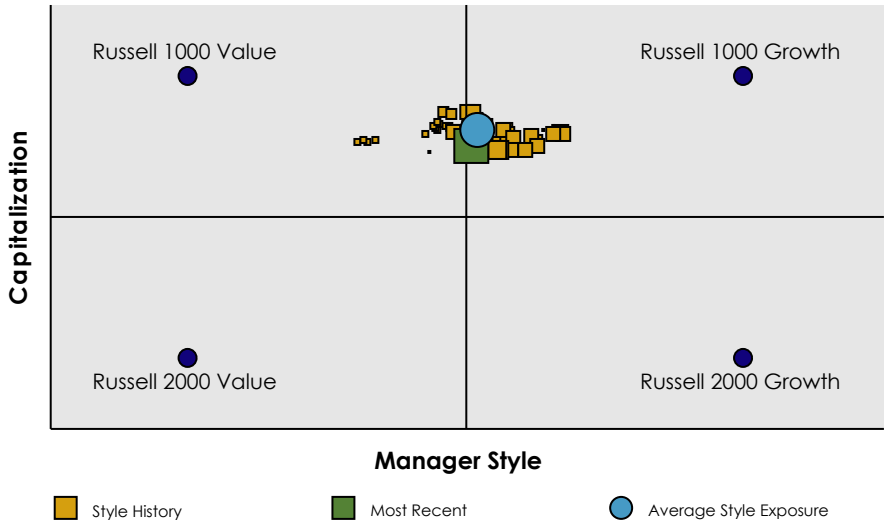
Risk/Return - Since Inception



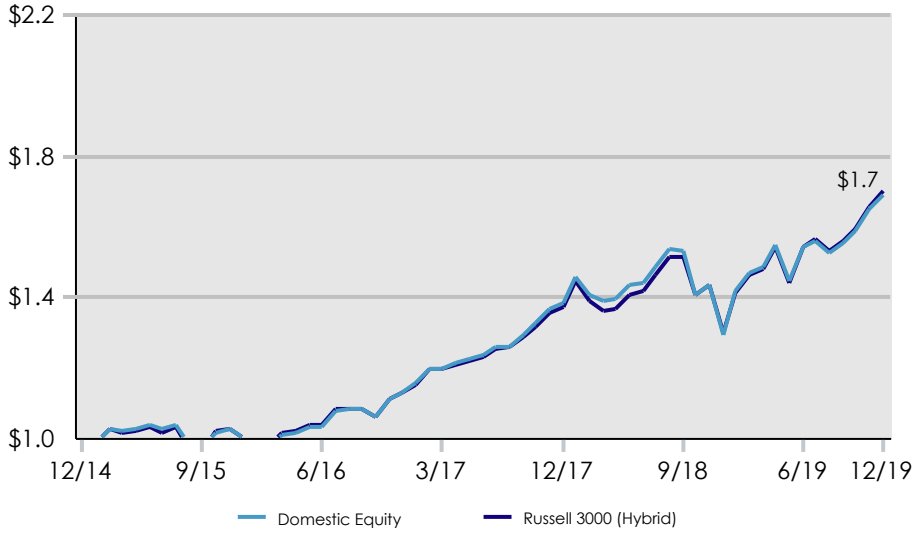
	Return	Standard Deviation
Parametric Systematic Alternative Risk Premia	5.5	12.3
SG Multi Alternative Risk Premia Index	1.3	3.6
Median	8.4	8.5

Domestic Equity Analysis
As of December 31, 2019

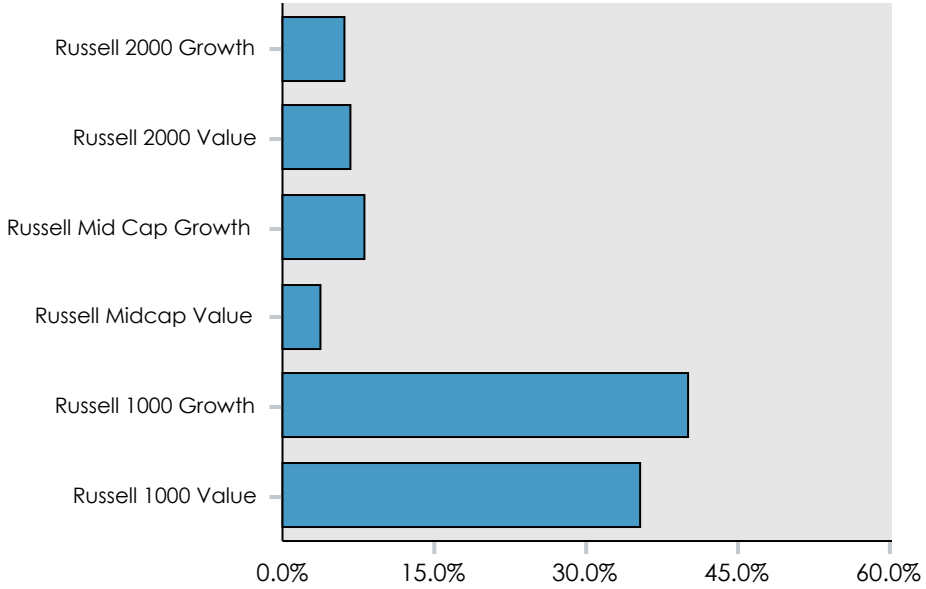
Style Map (5-Year)



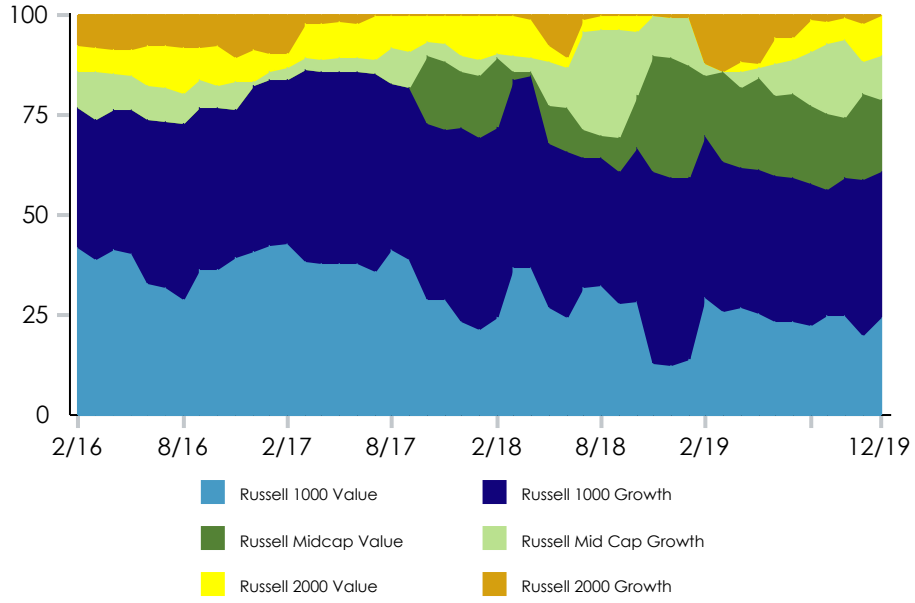
Growth of $1 (5-Year)



Style Exposure

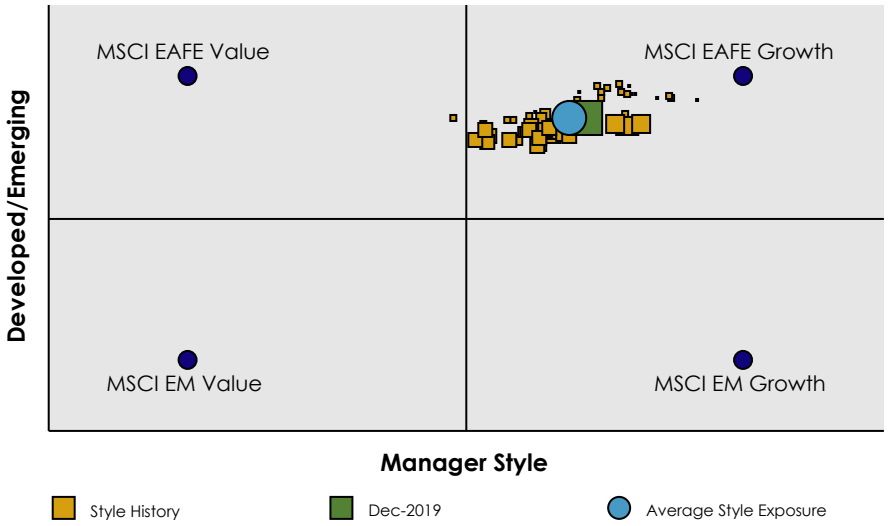


Style History (5-Year)

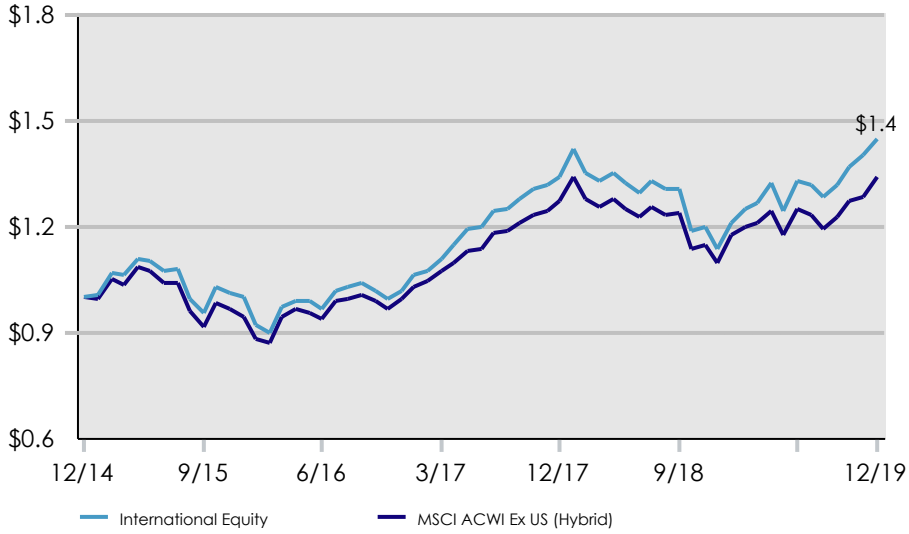


International Equity Analysis
As of December 31, 2019

Style Map (5-Year)



Growth of $1 (5-Year)



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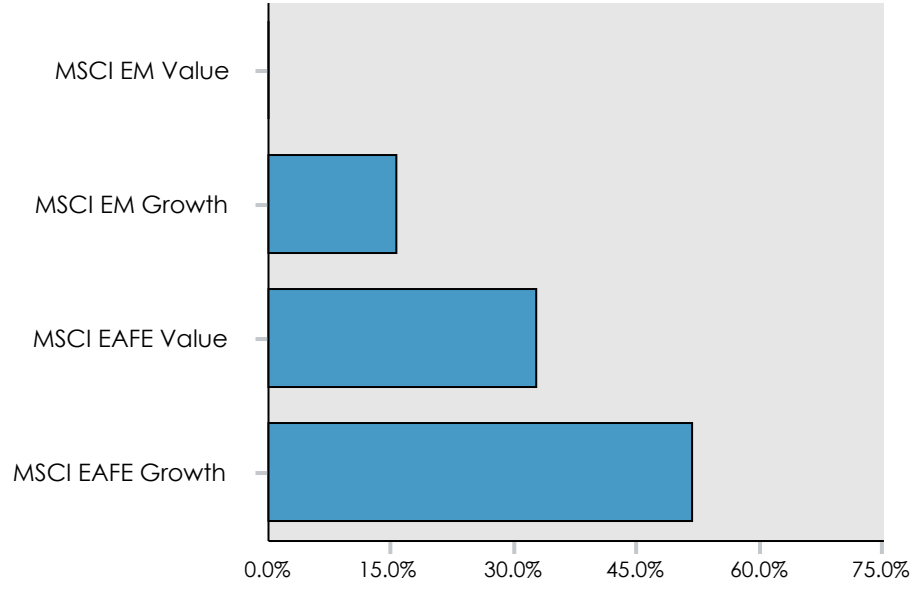
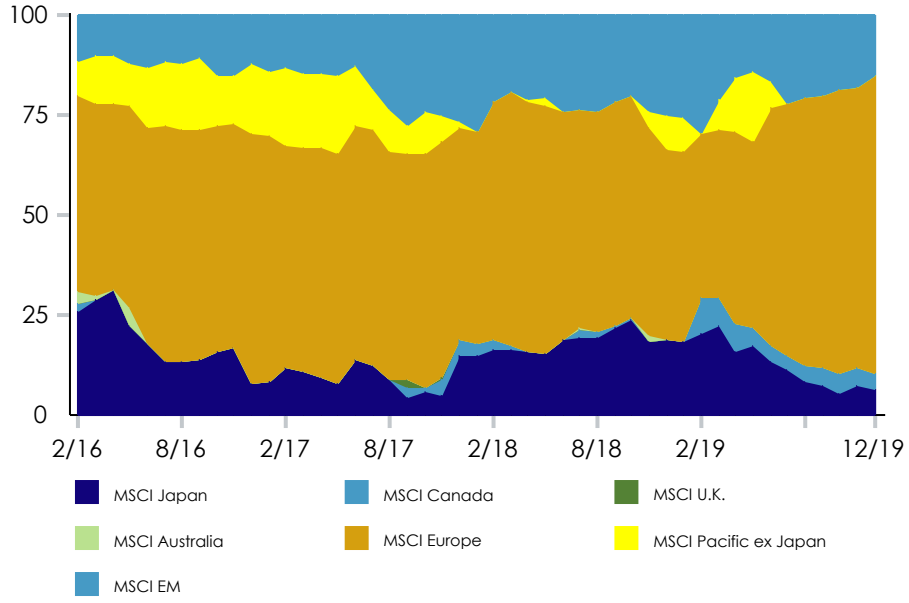
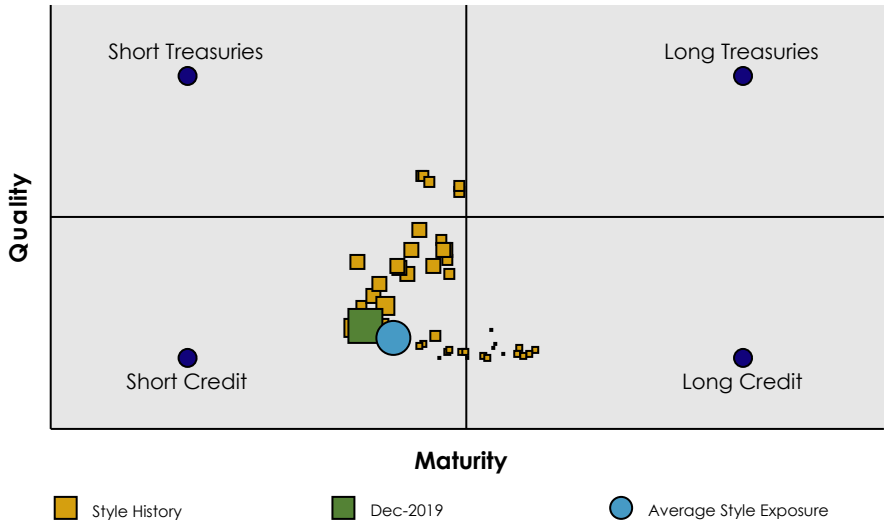


Style History (5-Year)

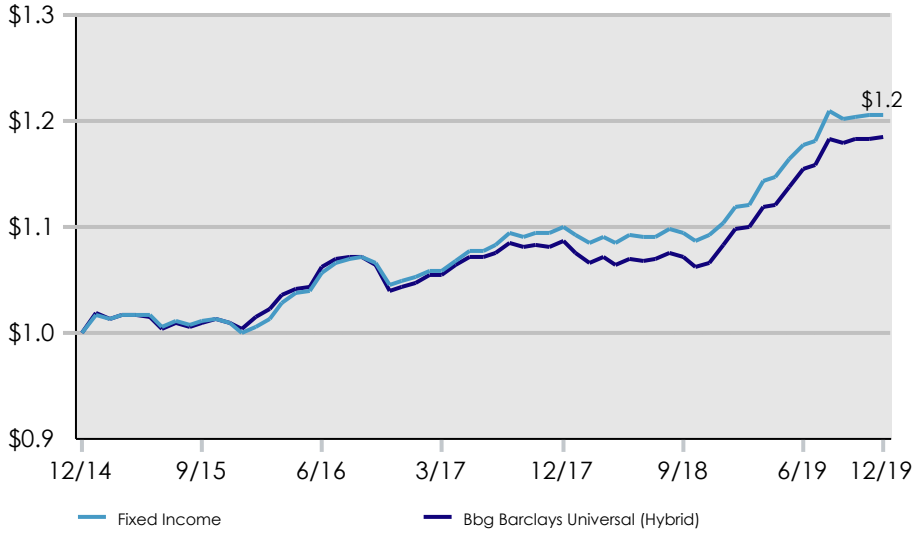


Fixed Income Analysis
As of December 31, 2019

Style Map (5-Year)



Growth of $1 (5-Year)



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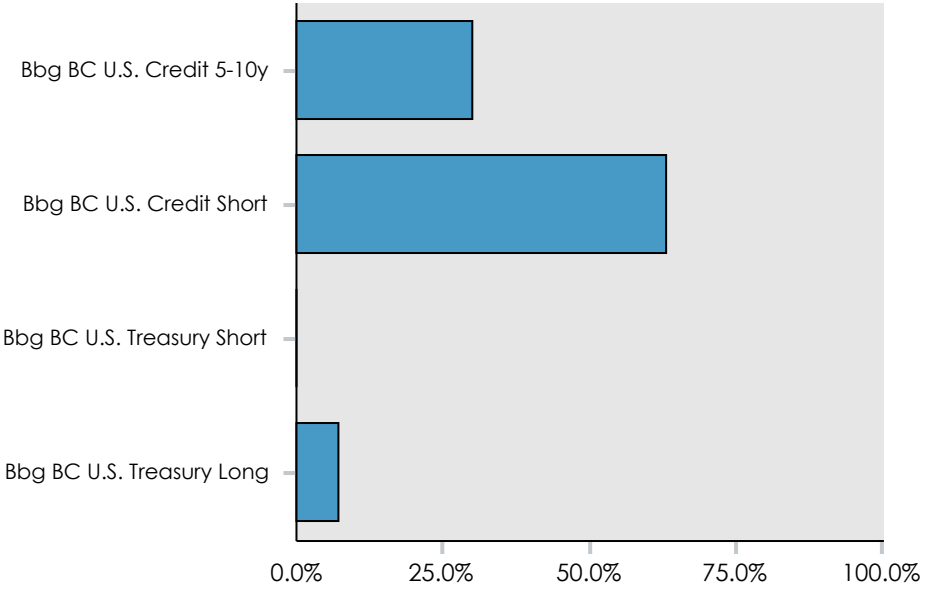

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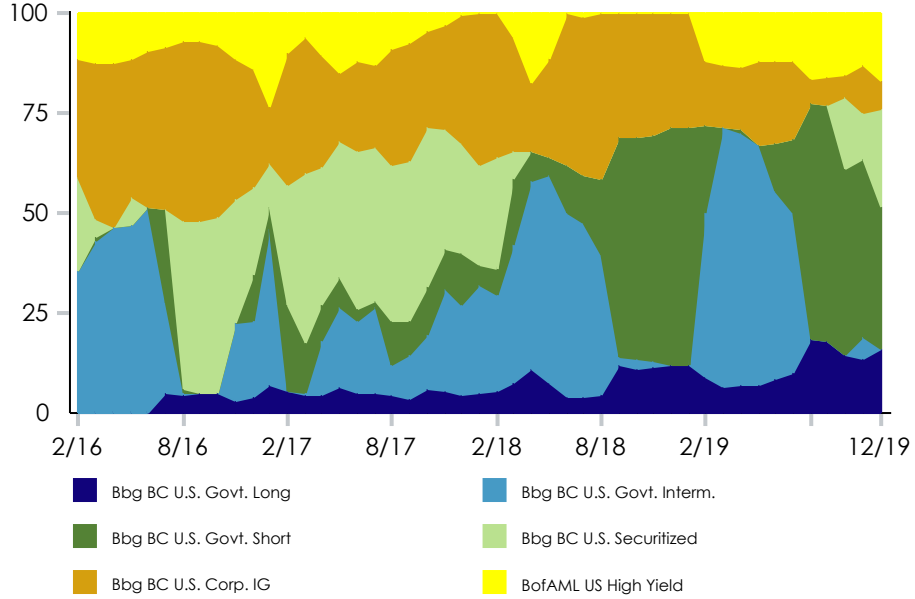


CHEIRON *Classic Values, Innovative Advice*

Oakland Police and Fire Retirement System

Actuarial Valuation Report as of July 1, 2019

Produced by Cheiron

February 2020

TABLE OF CONTENTS

Section *Page*

Letter of Transmittal i

Foreword ii

Section I Executive Summary 1

Section II Identification and Assessment of Risks 9

Section III Assets 18

Section IV Liabilities 22

Section V Contributions 27

Section VI Headcount and Benefit Payment Projections 29

Appendices

Appendix A Membership Information 31

Appendix B Statement of Actuarial Assumptions and Methods 35

Appendix C Summary of Plan Provisions 39

Appendix D Glossary 41

February 19, 2020

City of Oakland Police and Fire
Retirement System Board
150 Frank H. Ogawa Plaza
Oakland, CA 94612

Dear Members of the Board:

At your request, we have conducted an actuarial valuation of the Oakland Police and Fire Retirement System (PFRS, the Plan) as of July 1, 2019. This report contains information on the Plan's assets and liabilities. This report also discloses the employer contributions in accordance with the funding agreement between the City of Oakland and PFRS, based on the current financial status of the Plan. Your attention is called to the Foreword in which we refer to the general approach employed in the preparation of this report.

The purpose of this report is to present the results of the annual actuarial valuation of the Plan. This report is for the use of the Retirement Board and the auditors in preparing financial reports in accordance with applicable law and accounting requirements. Any other user of this report is not an intended user and is considered a third party.

Cheiron's report was prepared solely for the Retirement Board for the purposes described herein, except that the plan auditor may rely on this report solely for the purpose of completing an audit related to the matters herein. Other users of this report are not intended users as defined in the Actuarial Standards of Practice, and Cheiron assumes no duty or liability to such other users.

This report and its contents have been prepared in accordance with generally recognized and accepted actuarial principles and practices and our understanding of the Code of Professional Conduct and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board as well as applicable laws and regulations. Furthermore, as credentialed actuaries, we meet the Qualification Standards of the American Academy of Actuaries to render the opinion contained in this report. This report does not address any contractual or legal issues. We are not attorneys and our firm does not provide any legal services or advice.

Sincerely,
Cheiron

Graham A. Schmidt, ASA, FCA, MAAA, EA
Consulting Actuary

Timothy S. Doyle, ASA, MAAA, EA
Associate Actuary

FOREWORD

Cheiron has performed the actuarial valuation of the Oakland Police and Fire Retirement System (PFRS, the Plan) as of July 1, 2019. The valuation is organized as follows:

- In Section I, the **Executive Summary,** we describe the purpose of an actuarial valuation, summarize the key results found in this valuation, and disclose important trends.

- The **Main Body** of the report presents details on the Plan's

    - Section II – Identification and Assessment of Risks
    - Section III – Assets
    - Section IV – Liabilities
    - Section V – Contributions
    - Section VI – Head Count and Benefit Payment Projections

- In the **Appendices**, we conclude our report with detailed information describing plan membership (Appendix A), actuarial assumptions and methods employed in the valuation (Appendix B), a summary of pertinent plan provisions (Appendix C), and a glossary of key actuarial terms (Appendix D).

The results of this report rely on future experience conforming to the underlying assumptions. To the extent that actual plan experience deviates from the underlying assumptions, the results would vary accordingly.

In preparing our report, we relied on information (some oral and some written) supplied by the Plan's staff. This information includes, but is not limited to, plan provisions, employee data, and financial information. We performed an informal examination of the obvious characteristics of the data for reasonableness and consistency in accordance with Actuarial Standard of Practice No. 23.

SECTION I – EXECUTIVE SUMMARY

The primary purpose of the actuarial valuation and this report is to measure, describe, and identify the following as of the valuation date:

- The financial condition of the Plan,
- Past and expected trends in the financial progress of the Plan, and
- Calculation of the actuarially determined contributions for years beginning in Fiscal Year 2020-2021, and
- An assessment and disclosure of key risks.

In the balance of this Executive Summary, we present (A) the basis upon which this year's valuation was completed, (B) the key findings of this valuation including a summary of all key financial results, (C) an examination of the historical trends, and (D) the projected financial outlook for the Plan.

A. Valuation Basis

This valuation estimates the projected employer contributions in accordance with the funding agreement dated July 1, 2012 between the City of Oakland and the PFRS. Based on that agreement, employer contributions were suspended until fiscal year 2017-2018, at which time they resumed at a level based upon the recommendation of the actuary. Section IV of this report shows the development of the employer contribution for fiscal year 2020-2021.

The Plan's funding policy is to contribute an amount equal to the sum of:

- The normal cost under the Entry Age Normal Cost Method (which is zero, as there are no active members),
- Amortization of the Unfunded Actuarial Liability, and
- The Plan's expected administrative expenses.

This valuation was prepared based on the plan provisions shown in Appendix C. There have been no changes in plan provisions since the prior valuation.

A summary of the assumptions and methods used in the current valuation is shown in Appendix B. The administrative expense assumption was updated and the Longevity Pay assumption for Fire members was removed as Longevity Pay was included in the June 30, 2019 benefits provided by PFRS staff. No other changes were made to the actuarial assumptions or methods.

B. Key Findings of this Valuation

The key results of the July 1, 2019 actuarial valuation are as follows:

- The actuarially determined employer contribution amount for Fiscal Year 2020-2021 is $43.6 million, based on projecting the Actuarial Liabilities and the Actuarial Value of Assets to the end of the 2019-2020 Fiscal Year. This represents a decrease of $0.2 million from the estimated amount in the prior valuation for the same Fiscal Year. The contribution is assumed to be paid in equal installments throughout the year, or on average at approximately January 1, 2021.

- During the year ended June 30, 2019, the return on Plan assets was 5.83% on a market value basis net of investment expenses, as compared to the 6.00% assumption for the 2018-2019 Plan year. This resulted in a market value loss on investments of $2.0 million. The Actuarial Value of Assets (AVA) is calculated as the expected AVA plus 20% of the difference between the market value and the expected AVA. This smoothed value of assets returned 7.74%, for an actuarial asset gain of $5.9 million.

- The Plan experienced a gain on the Actuarial Liability of $5.4 million, the net result of changes in the population and changes in benefits, including recognition of a portion of the lower than expected COLA increases from the most recent Police MOU. Another decrease in the Actuarial Liability resulted from a reduction in the Holiday Pay compensation for PFRS Police members in the ranks of Captain and Deputy Chief. Combining the liability and asset gains, the Plan experienced a total gain of $11.3 million.

- The Plan's smoothed funded ratio, the ratio of Actuarial Value of Assets over Actuarial Liability, increased from 53.7% last year to 58.0% on an AVA basis as of June 30, 2019.

- The Plan's funded ratio increased from 58.1% to 61.8% on a Market Value of Assets (MVA) basis.

- The Unfunded Actuarial Liability (UAL) is the excess of the Plan's Actuarial Liability over the Actuarial Value of Assets. The Plan experienced a decrease in the UAL from $299.8 million to $261.8 million as of July 1, 2019.

- Overall participant membership decreased compared to last year. 23 members died, five of whom had their benefits continue to a surviving spouse. In addition, 21 surviving beneficiaries died. There are no active members of the Plan.

- The administrative expense assumption for Fiscal Year 2019-2020 increased from $1.0 million to $1.6 million after input from PFRS Staff.

SECTION I – EXECUTIVE SUMMARY

- If the contribution were determined using a projected asset value based on the current market (i.e., non-smoothed) value of assets, the contribution for FY 2020-2021 would be $40.0 million. The contribution is smaller than that determined using the projected AVA, because the current market value reflects the full amount of recent investment gains, while under the AVA projection a portion of those gains are deferred until years after FY 2020-2021.

Below we present Table I-1 that summarizes all the key results of the valuation with respect to membership, assets and liabilities, and contributions. The results are presented and compared for both the current and prior plan year.

TABLE I-1
Summary of Principal Plan Results
($ in thousands)

	July 1, 2018	July 1, 2019	% Change
Participant Counts			
Active Participants	0	0	
Participants Receiving a Benefit	837	798	-4.7%
Total	**837**	**798**	**-4.7%**
Annual Pay of Active Members	$ 0	$ 0	
Assets and Liabilities			
Actuarial Liability (AL)	$ 647,251	$ 622,836	-3.8%
Actuarial Value of Assets (AVA)	347,467	361,037	3.9%
Unfunded Actuarial Liability (UAL)	$ 299,784	$ 261,798	-12.7%
Funded Ratio (AVA)	53.7%	58.0%	4.3%
Funded Ratio (MVA)	58.1%	61.8%	3.7%
Contributions			
Employer Contribution (FY2019-20)	$ 43,409	N/A	
Employer Contribution (FY2020-21)	$ 43,835	$ 43,648	-0.4%

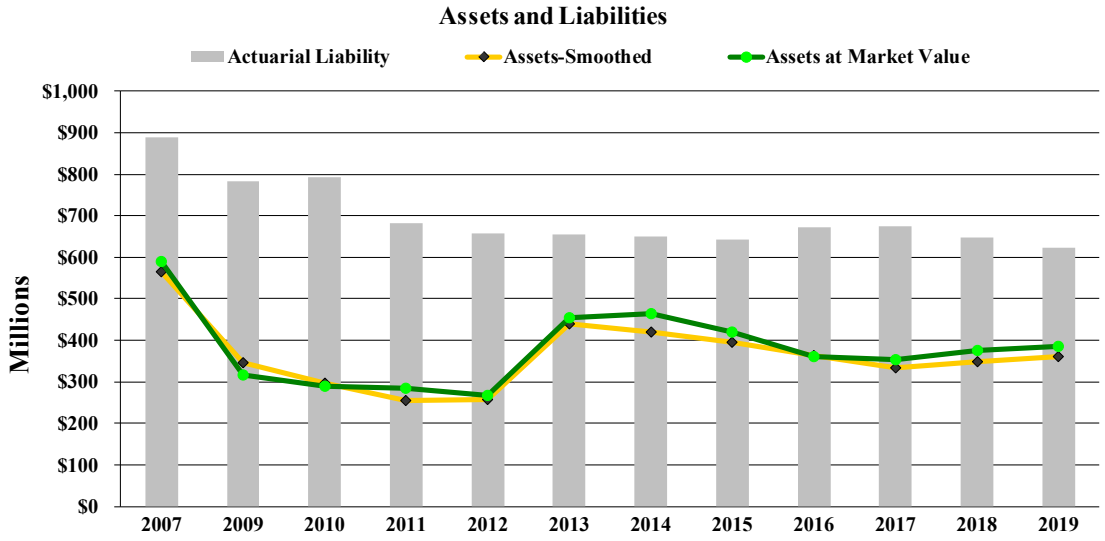
C. Historical Trends

Despite the fact that for most retirement plans the greatest attention is given to the current valuation results and in particular, the size of the current Unfunded Actuarial Liability and the employer contribution, it is important to remember that each valuation is merely a snapshot in the long-term progress of a pension fund. It is more important to judge a current year's valuation result relative to historical trends, as well as trends expected into the future.

Assets and Liabilities

The chart below compares the Market Value of Assets (MVA) and Actuarial Value of Assets (AVA) to the Actuarial Liabilities. The percentages shown in the table below the chart are the ratios of the Actuarial Value of Assets to the Actuarial Liability (the funded ratio). We note that for the GASB disclosure report, this ratio is disclosed using the MVA.

The funded ratio declined from 63.7% in 2007 to 37.5% in 2011 due to negative market returns and no contributions being made in that period ($417 million in proceeds from a POB were deposited in 1997 that acted as prepayments for 15 years of contributions). The funded ratio increased between 2012 and 2013 due to a $210 million contribution in July 2012. The funded ratio decreased from 67.2% to 49.5% between 2013 and 2017 due to assumption changes, liability losses, new Police MOUs, and the lack of contributions since the July 2012 payment. The funded ratio has increased from 49.5% to 58.0% over the past two years due to recommencement of contributions, and to a lesser extent, asset and liability gains.

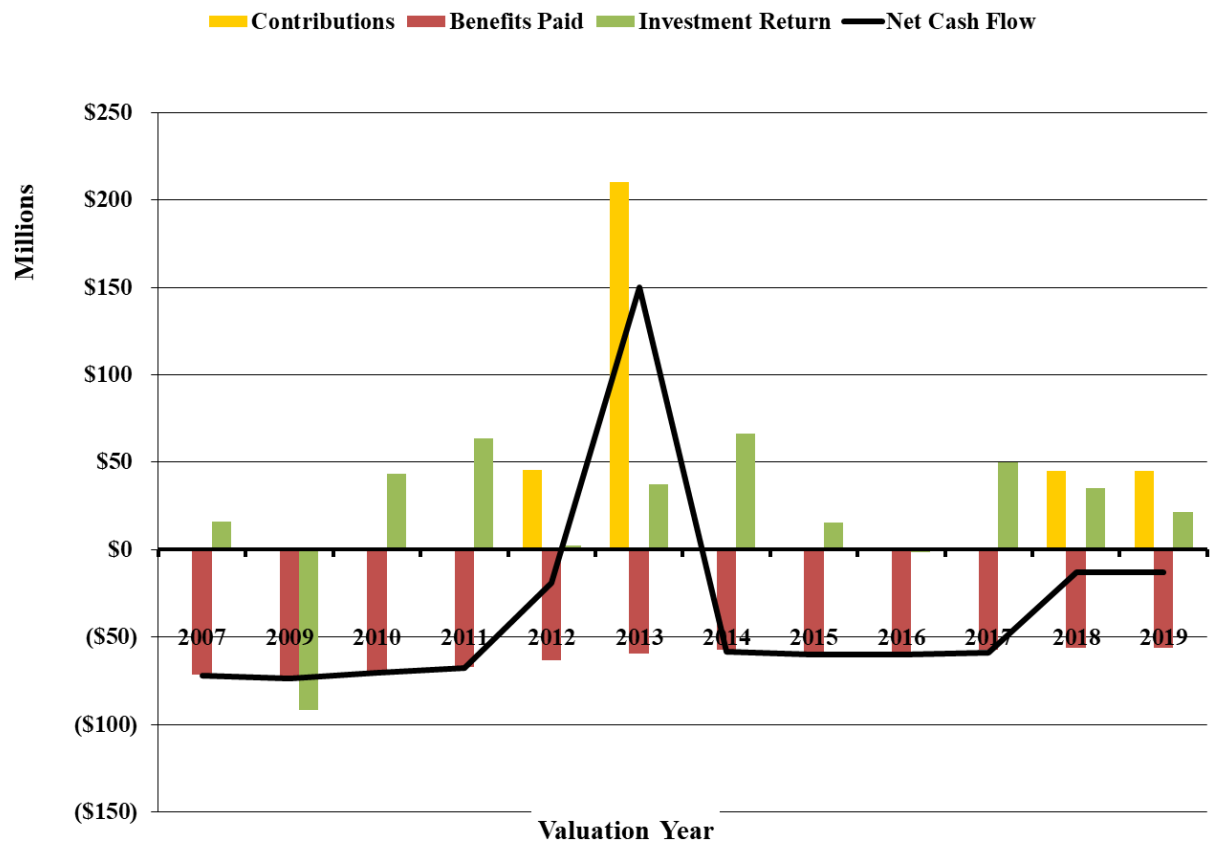


Valuation Year	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AVA Funded Ratio	63.7%	44.4%	37.6%	37.5%	39.1%	67.2%	64.6%	61.4%	54.0%	49.5%	53.7%	58.0%
UAL (Millions)	$ 322.1	$ 435.3	$ 494.4	$ 426.8	$401.1	$ 215.0	$230.2	$247.5	$ 309.4	$340.1	$299.8	$261.8

SECTION I – EXECUTIVE SUMMARY

Cash Flows

The chart below shows the Plan's cash flow, excluding investment returns (i.e., contributions less benefit payments and expenses). This is a critical measure, as it reflects the ability to have funds available to meet benefit payments without having to make difficult investment decisions, especially during volatile markets.



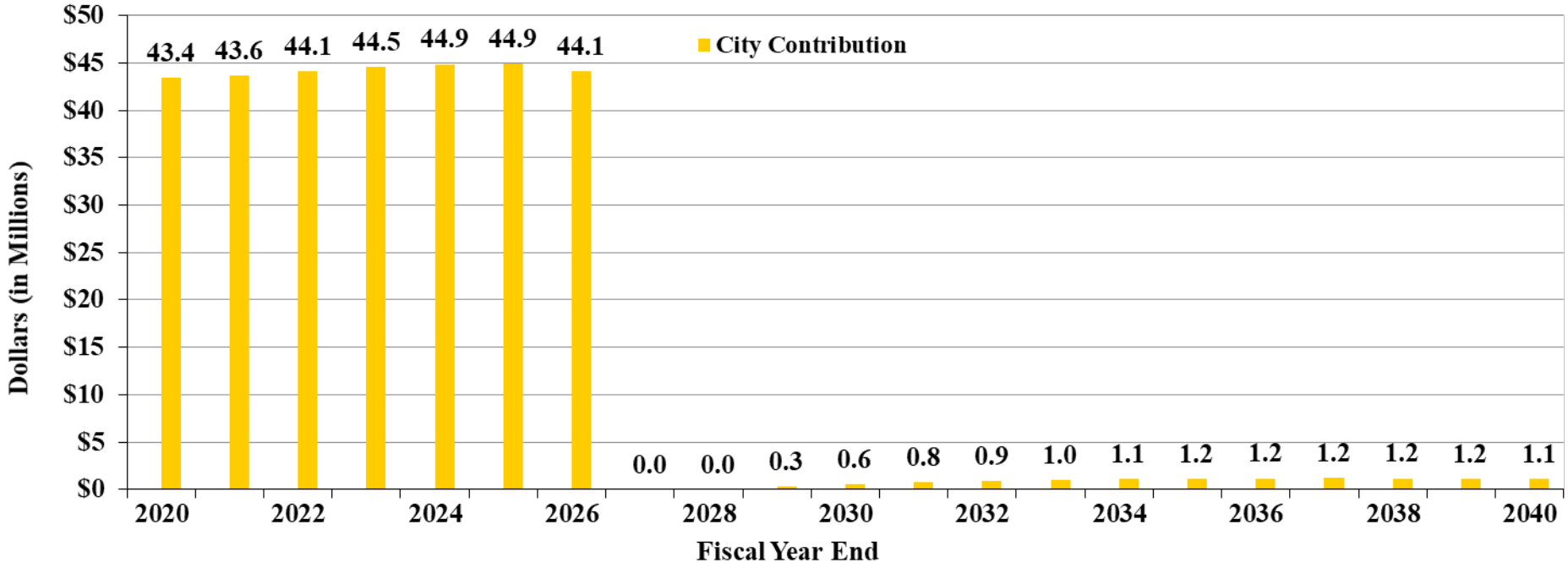
The contributions, benefit payments, investment returns, and net cash flow (NCF) excluding investment returns and expenses are represented by the scale on the left. The Plan's net cash flow has been negative 11 of the last 12 fiscal years, primarily due to the lack of contributions except in 2013 and in the most recent two years. Even with the recommencing of contributions under the Plan's funding policy, benefit payments exceeded contributions for the prior two years.

A negative cash flow magnifies the losses during a market decline, hindering the Plan in its ability to absorb market fluctuations. The implications of a plan in negative cash flow are that the impact of market fluctuations can be more severe: as assets are being depleted to pay benefits in down markets, there is less principal available to be reinvested during favorable return periods. The Plan is expected to remain in a negative cash flow position going forward, since the Plan is closed.

D. Future Expected Financial Trends

The analysis of projected financial trends is perhaps the most important component of this valuation. In this section, we present our assessment of the implications of the July 1, 2019 valuation results in terms of benefit security (assets over liabilities) and contribution levels. All the projections in this section are based on the assumption that the Plan will exactly achieve the assumed rate of return each year (6.0% per year until 2027, then trending down to an annual return of 3.25% over 10 years).

Projection of Employer Contributions



The above graph shows that the City's required contribution increased from $43.4 million in fiscal year 2020 to $43.6 million in fiscal year 2021, and then is expected to increase slightly as the current unfunded liability is fully amortized. This assumes that the annual

SECTION I – EXECUTIVE SUMMARY

payments by the City will equal the administrative expenses, plus an amount needed to amortize the remaining unfunded liability as a level percentage of overall Safety payroll by July 1, 2026, as is required under the City's charter.

After July 1, 2026, the UAL is expected to be fully amortized, and the contribution would generally be equal to the administrative expense, beginning in 2026-2027. However, under the current asset smoothing method there are still expected to be some deferred asset gains, which will not be recognized until after 2026; the deferred recognition of these gains is expected to offset a portion of the administrative expenses in the final years of the graph on the previous page.

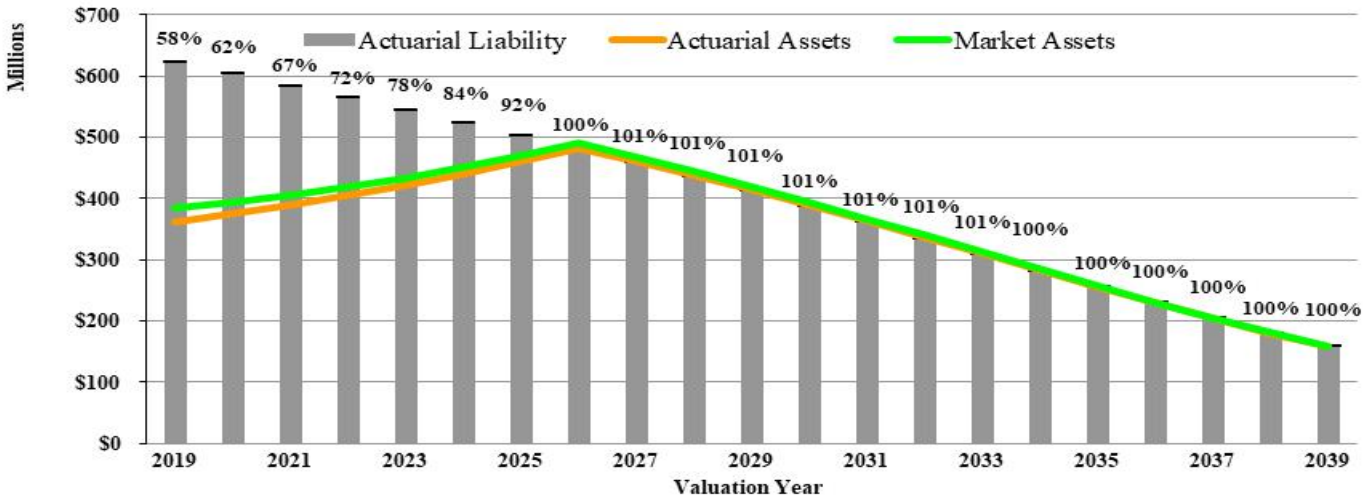
Note that the graph on the previous page does not forecast any future actuarial gains or losses or changes to the amortization policy. Even relatively modest losses could push the employer contribution over $50 million in the next few years. We also note that the occurrence of any future gains or losses in the years leading up to or following the required full amortization date (July 1, 2026) may require a reconsideration of the funding policy for those gains or losses, as otherwise these changes would need to be recognized over an extremely short period.

SECTION I – EXECUTIVE SUMMARY

Asset and Liability Projections:

The following graph shows the projection of assets and liabilities assuming that assets will earn the assumed rate of return each year during the projection period.

Projection of Assets and Liabilities



The graph shows that the projected funded status increases as the current unfunded liability is fully amortized, assuming all actuarial assumptions are met. Once the Plan is projected to reach full funding, both the assets and liabilities are expected to decline as the Plan continues to mature.

SECTION II – IDENTIFICATION AND ASSESSMENT OF RISKS

Actuarial valuations are based on a set of assumptions about future economic and demographic experience. These assumptions represent a reasonable estimate of future experience, but actual future experience will undoubtedly be different and may be significantly different. This section of the report is intended to identify the primary risks to the plan, provide some background information about those risks, and provide an assessment of those risks.

Identification of Risks

The fundamental risk to a pension plan is that the contributions needed to pay the benefits become unaffordable. While the Plan cannot determine on its own what contribution level is unaffordable, we can project expected contributions and illustrate the potential impact of key sources of risk on those contribution rates so the City can assess affordability. While there are a number of factors that could lead to contribution amounts becoming unaffordable, we believe the primary sources are:

- Investment risk,
- COLA risk,
- Longevity risk, and
- Contribution risk.

Other risks that we have not identified may also turn out to be important.

Investment Risk is the potential for investment returns to be different than expected. Lower investment returns than anticipated will increase the Unfunded Actuarial Liability necessitating higher contributions in the future unless there are other gains that offset these investment losses. In contrast, higher investment returns than anticipated may create a potentially significant surplus that could be difficult to use until all benefits have been paid. Expected future investment returns and their potential volatility are determined by the Plan's asset allocation.

COLA Risk is the potential for future COLAs to increase contributions. Retirement allowances are based on the pensionable compensation attached to the average rank held during the three years immediately preceding retirement. Cost-of-living adjustments are therefore based on salary increases for current employees with the retiree's same rank at retirement. Salary increases less than or greater than those assumed cause gains or losses, respectively. COLA increases different from those expected over the last 7 years are reflected in the "MOU Changes" column in the chart on the next page.

Longevity risk is the potential for mortality experience to be different than expected. Generally, longevity risk emerges slowly over time and is often exceeded by other changes, particularly those due to investment returns. However, for a closed plan such as PFRS the mortality experience will have a significant impact on future cash flows. The chart below shows the demographic gains and losses over the last 7 years compared to the total change in the UAL for each year, a portion of which is associated with mortality experience.

SECTION II – IDENTIFICATION AND ASSESSMENT OF RISKS

Contribution risk is the potential for actual future actuarially determined contributions to deviate from expected future contributions. The City Charter sets the Plan's contribution policy. It requires the unfunded liability of the plan to be fully amortized by June 20, 2026. The Actuarially Determined Contribution (ADC) is based on a short remaining amortization period. As a result, a significant loss or change in assumptions may cause a large increase in the ADC. Furthermore, any change to the contribution policy would necessitate an amendment to the City Charter, which requires voter approval.

The table below shows a 7-year history of changes in the UAL by source.

TABLE II-1
UAL Change by Source
($ in Thousands)

FYE	MOU Changes	Assumption Changes	Contributions vs. Tread Water	Investments	Liability Experience	Total UAL Change
2013	$ 4,091	$ 0	$ (188,922)	$ (3,803)	$ 2,592	(186,042)
2014	0	30,598	15,146	(10,729)	(19,869)	15,147
2015	0	0	17,023	(6,171)	6,522	17,374
2016	43,480	0	15,033	486	2,830	61,829
2017	0	22,730	22,888	(4,958)	(9,959)	30,702
2018	(1,475)	0	(24,214)	(7,128)	(7,467)	(40,284)
2019	(7,173)	0	(26,691)	(5,919)	1,797	(37,986)
Total	**$ 38,923**	**$ 53,328**	**$ (169,736)**	**$ (38,222)**	**$ (23,553)**	**$ (139,260)**

The UAL reduced by approximately $139.3 million over the last seven years. Contributions in excess of the "tread water" level (i.e. interest on the UAL plus administrative expenses) reduced the UAL by $169.7 million, liability experience reduced the UAL by $23.6 million, and investment returns decreased the UAL by $38.2 million. Meanwhile changes to MOUs increased the UAL by $38.9 million and assumption changes increased the UAL by $53.5 million.

Plan Maturity Measures

The future financial condition of a mature pension plan is more sensitive to each of the risks identified above than a less mature plan. Before assessing each of these risks, it is important to understand the maturity of the plan.

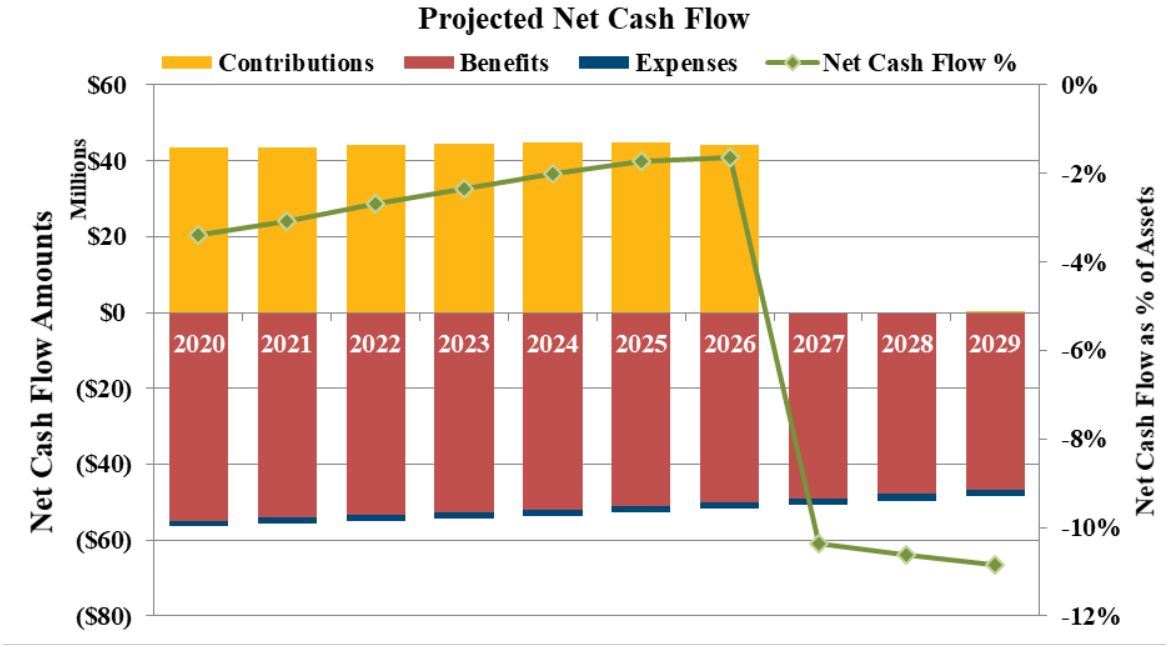
Plan maturity can be measured in a variety of ways, but they all get at one basic dynamic – the larger the plan is compared to the contribution or revenue base that supports it; the more sensitive the plan will be to risk. Given that the Plan has been closed to new entrants since 1976 with no remaining active members, the Plan considered as a standalone entity is very mature, though because of the diminishing benefit cash flows it is expected to have a declining impact on the overall City finances.

SECTION II – IDENTIFICATION AND ASSESSMENT OF RISKS

Net Cash Flow

The net cash flow of the plan as a percentage of the beginning of year assets indicates the sensitivity of the plan to short-term investment returns. Net cash flow is equal to contributions less benefit payments and administrative expenses. Mature plans can have large amounts of benefit payments compared to contributions, particularly if they are well funded.

The chart below shows the projected net cash flow for the next 10 fiscal years. The bars represent the dollar amounts of the different components of the projected net cash flow, and the line represents the net cash flow as a percentage of the assets as of the beginning of the fiscal year.



The Plan's contributions are expected to cease following the 2025-2026 Fiscal Year once the unfunded liability has been paid off, other than for payments needed to cover the administrative expenses. Beyond that point, the negative net cash flows are expected to continue until all benefits are paid.

The first issue this change presents to the Plan is a need for liquidity in the investments so that benefits can be paid. When the cash flow was positive or close to neutral, benefits could be paid out of contributions without liquidating investments. As net cash flow becomes increasingly negative, the benefit payments will require liquidation of some investments (at least to the extent the bond portfolio doesn't generate sufficient cash income).

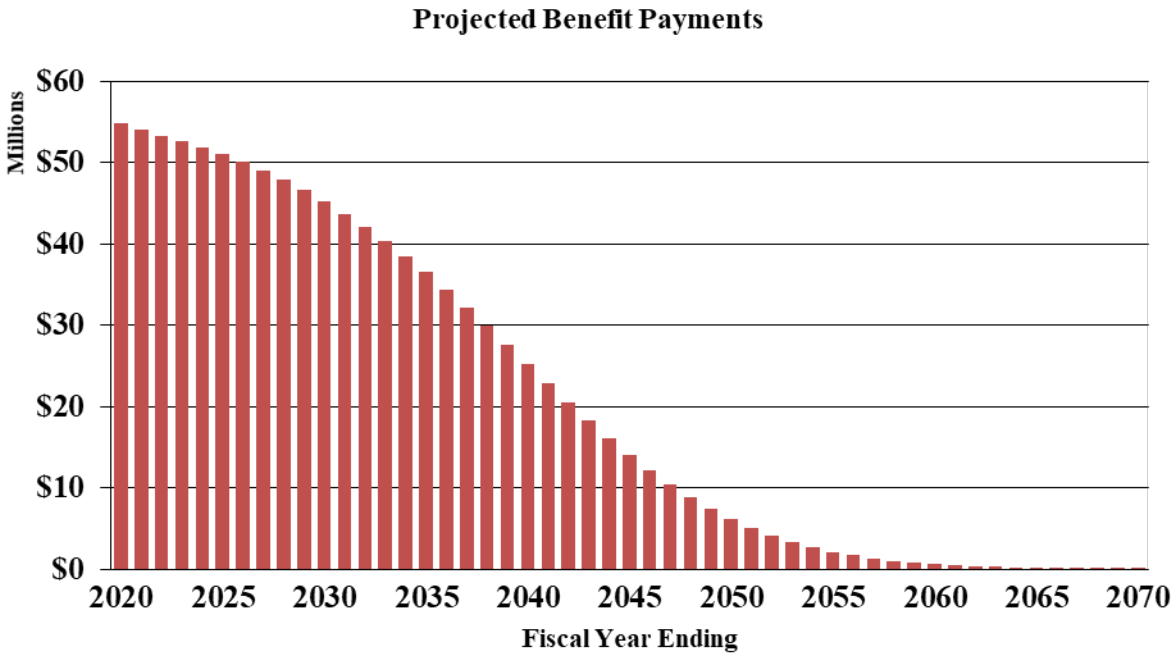
The other change of note is the sensitivity to short-term investment returns. Investment losses in the short term are compounded by the net withdrawal from the plan leaving a smaller asset base to try to recover from the investment losses. On the other hand, large investment gains in the

short term also tend to have a longer beneficial effect as any future losses are relative to a smaller liability base due to the negative cash flow.

Assessing Costs and Risks

A closed pension plan will ultimately either end up with excess assets after all benefits have been paid or run out of assets before all benefits have been paid. The declining investment return assumption adopted by the Board implies an expectation the Plan will pursue a strategy of de-risking the Plan to minimize the impact of these scenarios, potentially by reducing the risk in its investment portfolio, immunizing investments, and/or purchase annuities to settle the remaining obligation.

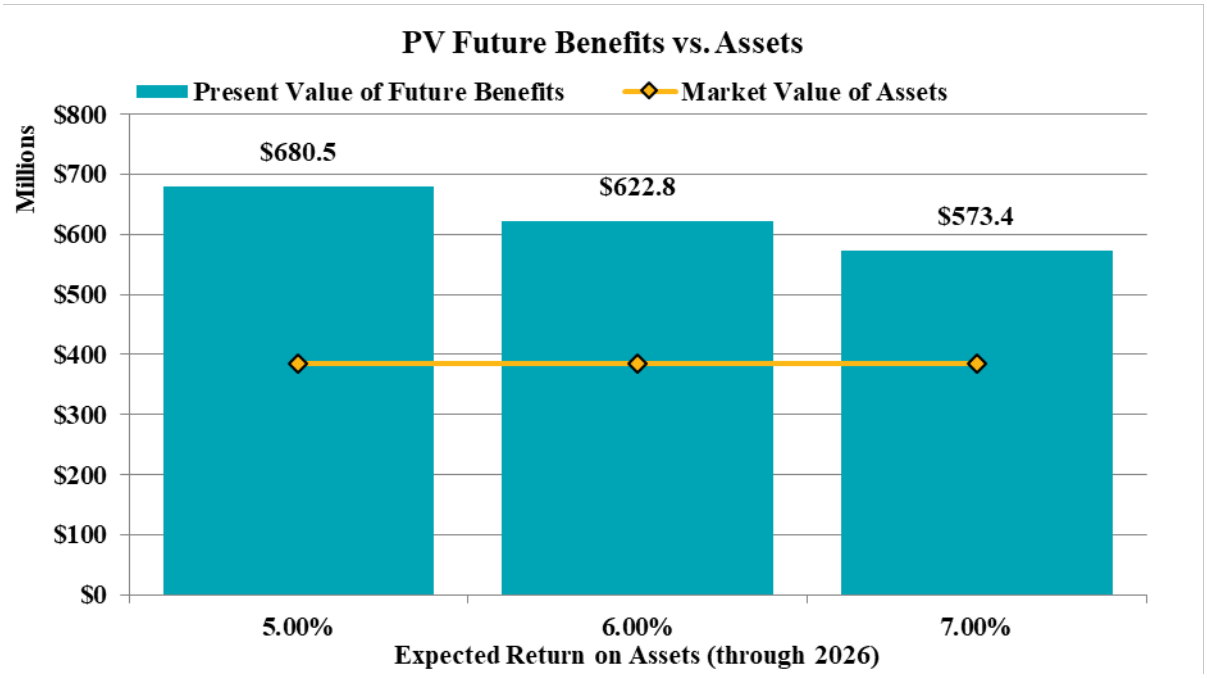
However, even if the Plan were to run out of assets, PFRS would be forced to pay benefits directly on a pay-as-you-go basis. As long as PFRS (and the City) can afford the pay-as-you-go costs, benefits would remain secure. The chart below shows a projection of expected benefit payments for the closed plan.



Sensitivity to Investment Returns

The chart on the next page compares assets to the present value of all projected future benefits discounted at the current expected rates of return – starting at 6.00% through 2026 and trending down to 3.25% over the next 10 years - and at investment returns 100 basis points above and below the expected rates of return. The present value of future benefits is shown as a teal bar and the Market Value of Assets is shown by the gold line.

SECTION II – IDENTIFICATION AND ASSESSMENT OF RISKS



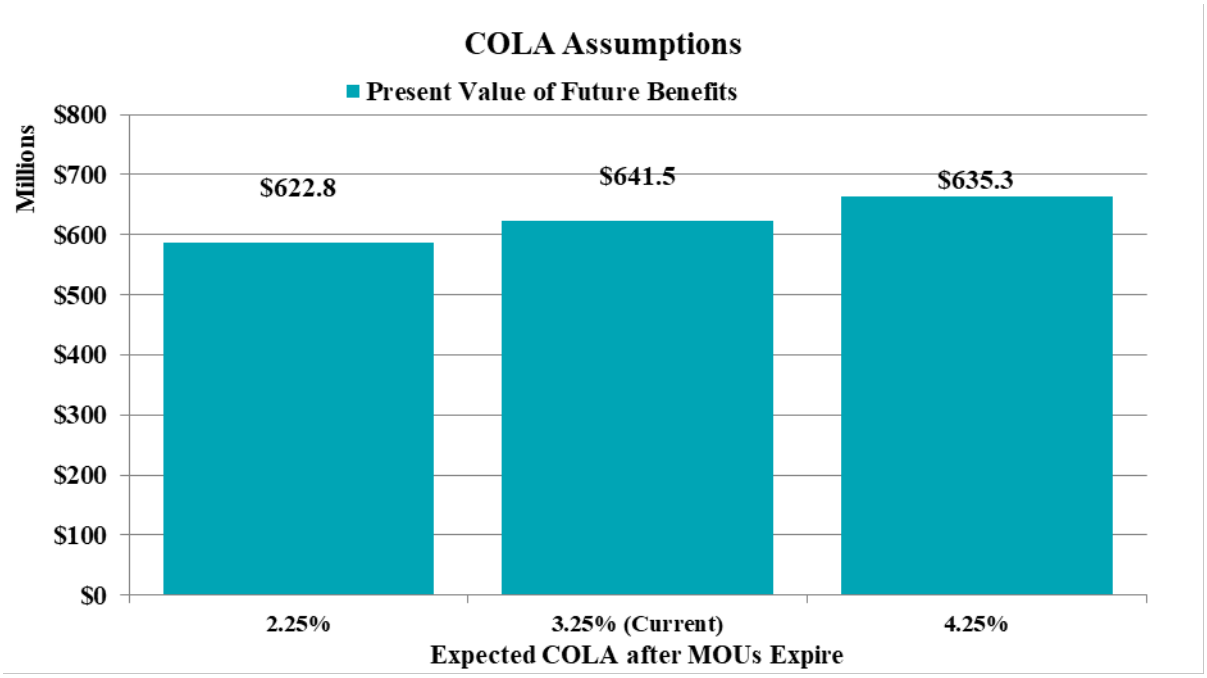
If actual investment returns meet the expected returns annually, the Plan would need approximately $623 million in assets today to pay all projected benefits compared to current assets of $385 million. If investment returns are 100 basis points lower each year, the Plan would need approximately $681 million in assets today, and if investment returns are 100 basis points higher, the Plan would need approximately $573 million in assets today.

Sensitivity to COLA Changes

The present value of future benefits shown above assumes annual COLA increases of 3.25% per year once the current MOUs have expired. If COLA inflation is higher (because of higher than expected increases in the salaries of active employees); more assets would be needed to pay the benefits, and if COLA inflation is lower; fewer assets would be needed to pay benefits.

The chart on the next page is similar to the one above - comparing assets to the present value of all projected future benefits (discounted using the current expected rates of return) based on annual COLA increases of 3.25% per year once the current MOUs have expired - and at COLA increases 100 basis points above and below the current COLA assumptions. The present value of future benefits is shown as a teal bar and the Market Value of Assets is shown by the gold line.

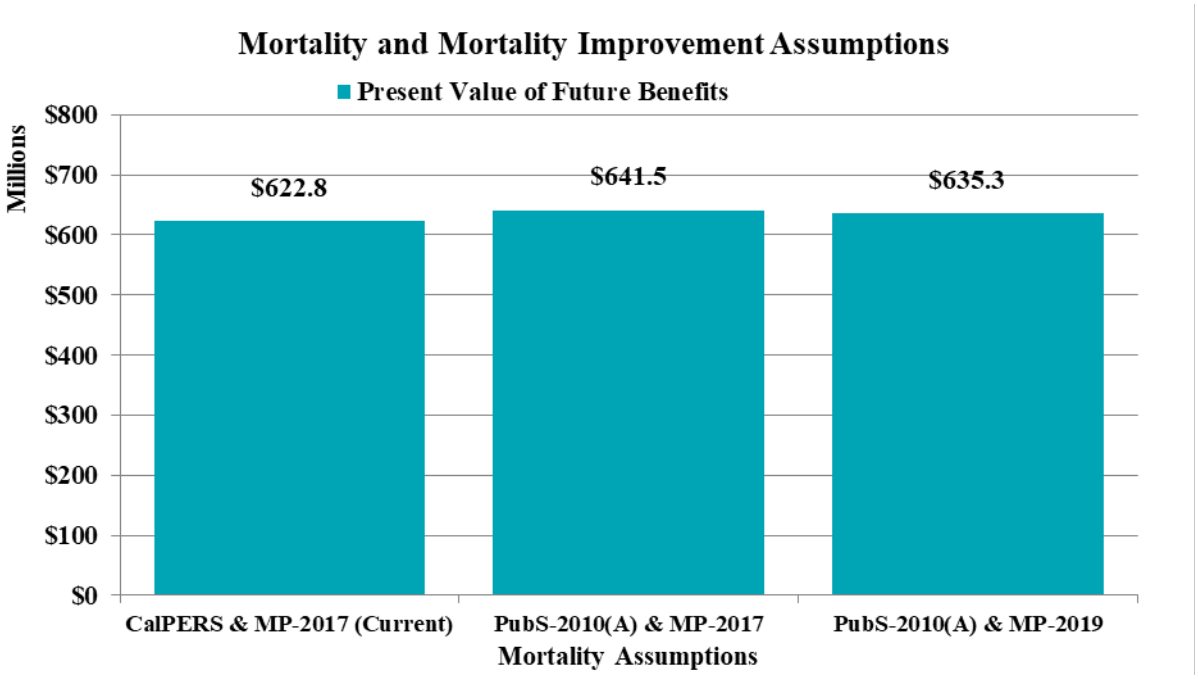
SECTION II – IDENTIFICATION AND ASSESSMENT OF RISKS



Sensitivity to Mortality Assumption Changes

The following chart shows the sensitivity of the Plan to longevity / mortality experience. In the first bar we have shown the present value of benefits using the Plan's current mortality assumptions (i.e. using the most recent CalPERS mortality assumptions, with projections for generational improvements using the Society of Actuary's MP-2017 improvement scales). In the second bar, we have shown the impact on the present value of benefits if actual longevity experience follows an alternative set of assumptions, reflecting new tables that have been developed using the experience Public Safety employees of U.S. public employers. In the third bar we have shown an additional alternative, using the Public Sector table described above, but also reflecting a slower rate of future improvements in longevity, as reflected by the Society of Actuary's latest improvement scale (MP-2019). As always, actual experience will drive costs, but this exhibit provides an example of the level of sensitivity of the Plan's liabilities to recent changes in outlooks on mortality.

SECTION II – IDENTIFICATION AND ASSESSMENT OF RISKS

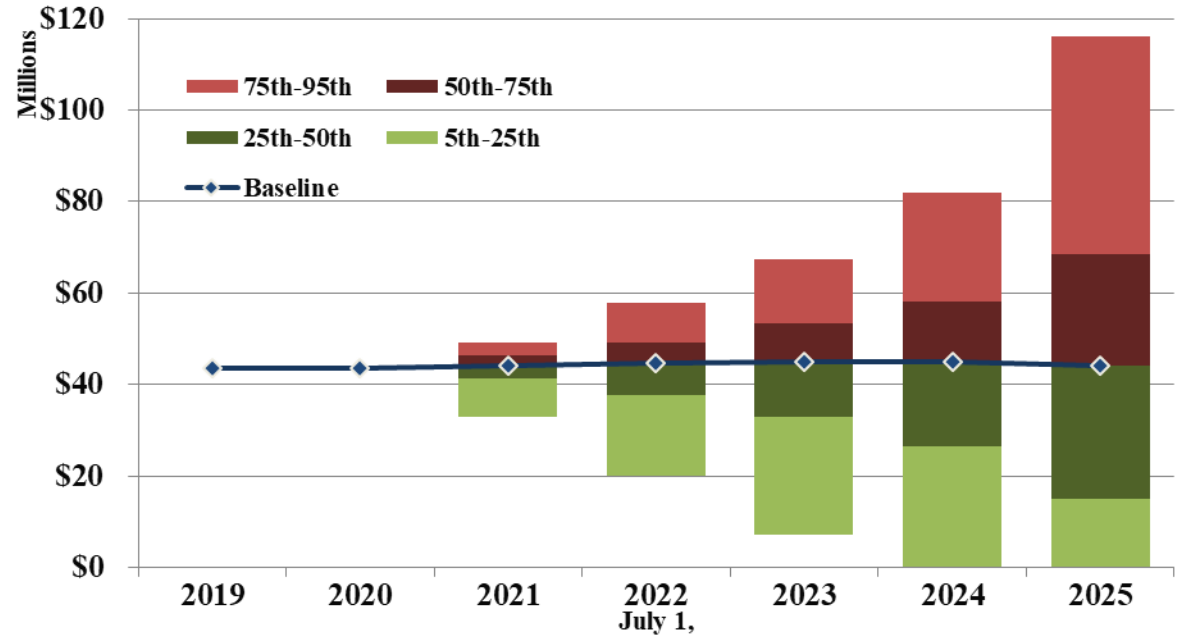


Stochastic Projections

The stochastic projections of contributions through the full funded date (June 30, 2026) in the chart on the following page shows a very wide range in future ADC's. This range is driven both by the volatility of investment returns (assumed to be 11.0% in these projections, based on the most recent information provided by Meketa) and by the short amortization period used to calculate the ADC. We note that if the Plan is required to remain fully funded after 2026, the contributions required will also vary widely.

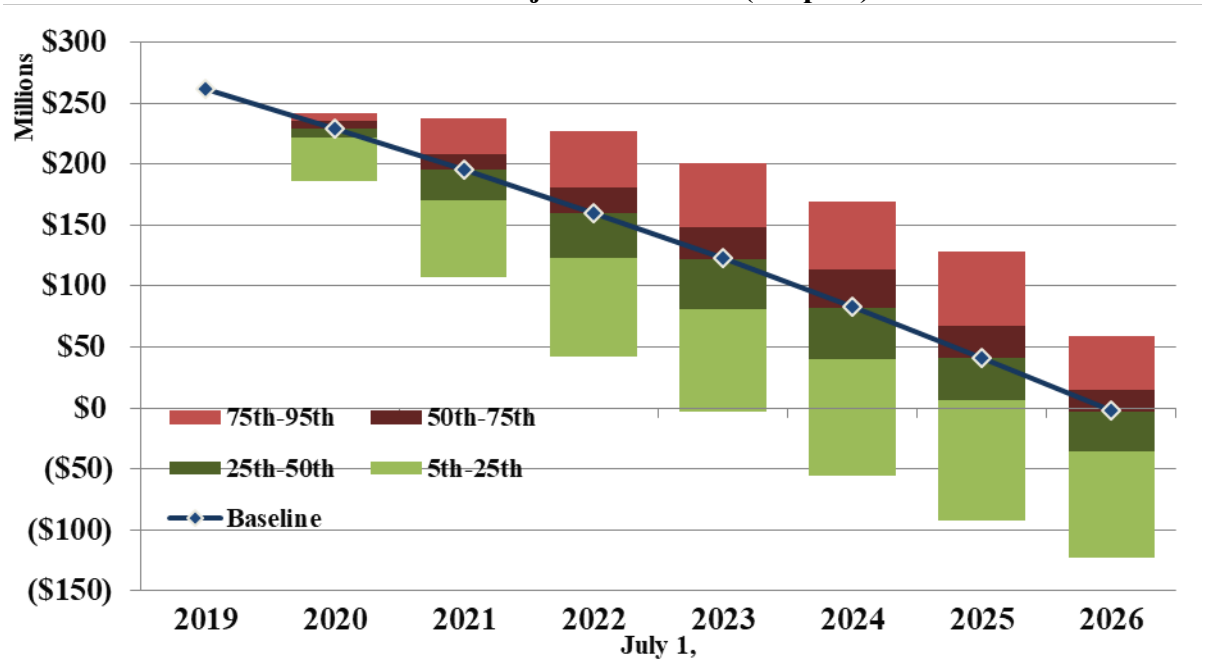
SECTION II – IDENTIFICATION AND ASSESSMENT OF RISKS

Stochastic Projection of Actuarially Determined Contribution (ADC)



The chart below shows the projection of the UAL through the full funding date. While the UAL is projected in the baseline to be eliminated by 2026, because of the statutory requirement to fully fund the Plan by that time, there is still a wide range of potential outcomes.

Stochastic Projection of UAL/(Surplus)



SECTION II – IDENTIFICATION AND ASSESSMENT OF RISKS

More Detailed Assessment

A detailed assessment of risk would be valuable in understanding the risks identified above, especially given the closed nature of the plan. We encourage the Board to consider a more detailed analysis of some of the risks identified above, in particularly in developing a funding strategy to deal with changes in the UAL after the required full funding date.

SECTION III – ASSETS

Pension Plan assets play a key role in the financial operation of the Plan and in the decisions the Board may make with respect to future deployment of those assets. The level of assets, the allocation of assets among asset classes, and the methodology used to measure assets will likely impact benefit levels, employer contributions, and the ultimate security of participants' benefits.

In this section, we present detailed information on Plan assets including:

- **Disclosure** of Plan assets as of June 30, 2018 and June 30, 2019,
- Statement of the **changes** in market values during the year, and
- Development of the **Actuarial Value of Assets**.

Disclosure

There are two types of asset values disclosed in the valuation, the Market Value of Assets and the Actuarial Value of Assets. The market value represents "snap-shot" or "cash-out" values, which provide the principal basis for measuring financial performance from one year to the next. Market values, however, can fluctuate widely with corresponding swings in the marketplace. As a result, market values are sometimes not as suitable for long-range planning as are the Actuarial Value of Assets, which reflect smoothing of annual investment returns.

Table III-1 discloses and compares each component of the market asset value as of June 30, 2018 and June 30, 2019.

TABLE III-1
Statement of Assets at Market Value
June 30,
(in thousands)

	2018	2019
Cash and Cash Equivalents	$ 7,821	$ 6,484
Receivables	6,288	4,428
Investments, at Fair Value	415,919	420,245
Total Assets	$ 430,027	$ 431,157
Liabilities	54,051	46,446
Market Value of Assets	**$ 375,976**	**$ 384,711**

SECTION III – ASSETS

Changes in Market Value

The components of asset change are:

- Contributions (employer and employee)
- Benefit payments
- Expenses (investment and administrative)
- Investment income (realized and unrealized)

Table III-2 shows the components of a change in the Market Value of Assets during 2018 and 2019.

TABLE III-2
Changes in Market Values
June 30,
(in thousands)

	2018	2019
Contributions		
Contributions of Plan Members	$ 0	$ 0
Contributions from the City	44,860	44,821
Total Contributions	44,860	44,821
Investment Income		
Miscellaneous Income	20	20
Investment Income	35,435	21,552
Total Investment Income	35,455	21,572
Disbursements		
Benefit Payments	(55,999)	(56,212)
Administrative Expenses	(1,543)	(1,446)
Total Disbursements	(57,542)	(57,658)
Net increase (Decrease)	22,773	8,734
Net Assets Held in Trust for Benefits:		
Beginning of Year	353,203	375,976
End of Year	$ 375,976	$ 384,711
Approximate Return	10.2%	5.8%

SECTION III – ASSETS

Actuarial Value of Assets (AVA)

The Actuarial Value of Assets represents a "smoothed" value developed by the actuary to reduce the volatile results, which could develop due to short-term fluctuations in the Market Value of Assets. For this Plan, the Actuarial Value of Assets is calculated on a modified market-related value. The Actuarial Value of Assets recognizes one-fifth of the difference between the expected asset value (based on the 6.00% return assumption from 2018-2019) and the actual market value each year. The actuarial value is restricted to fall between 90% and 110% of the market value.

Table III-3
Development of Actuarial Value of Assets
(in thousands)

1. Calculate Expected Actuarial Value of Assets	
a. Value of Actuarial Value of Assets - July 1, 2018	$ 347,467
b. Total Contributions and Misc Income	44,841
c. Administrative Expense	(1,446)
d. Benefit Payments	(56,212)
e. Expected Investment Earnings	20,469
f. Expected Actuarial Value of Assets - July 1, 2019 [1a + 1b + 1c + 1d + 1e]	$ 355,119
2. Calculate Final Actuarial Value of Assets	
a. Value of Market Value of Assets - July 1, 2019	$ 384,711
b. Excess of MVA over Expected AVA [2a - 1f]	29,592
c. Preliminary AVA [1f + 0.2 * 2b]	361,037
d. 90% of MVA [90% * 2a]	346,240
e. 110% of MVA [110% * 2a]	423,182
3. Final Actuarial Value of Assets [2c, not less than 2d or greater than 2e]	**$ 361,037**

SECTION III – ASSETS

Investment Performance

The following table calculates the investment related gain/loss for the plan year on both a market value and an actuarial value basis. The market value gain/loss is an appropriate measure for comparing the actual asset performance to the previous valuation's 6.00% assumption.

TABLE III-4
Asset Gain/(Loss)
(in thousands)

	Market Value	Actuarial Value
July 1, 2018 value	**$ 375,976**	**$ 347,467**
Contributions of Plan Members	0	0
Contributions from the City	44,821	44,821
Miscellaneous Income	20	20
Benefit Payments	(56,212)	(56,212)
Administrative Expenses	(1,446)	(1,446)
Expected Investment Earnings (6.00%)	23,544	20,469
Expected Value June 30, 2019	**$ 386,703**	**$ 355,119**
Investment Gain / (Loss)	(1,992)	5,918
July 1, 2019 value	**384,711**	**$ 361,037**
Return	5.83%	7.74%

SECTION IV – LIABILITIES

In this section, we preset detailed information on Plan liabilities including:

- **Disclosure** of Plan liabilities at July 1, 2018 and July 1, 2019
- Statement of **changes** in these liabilities during the year

Disclosure

Several types of liabilities are typically shown in an actuarial valuation report. Each type is distinguished by the people ultimately using the figures and the purpose for which they are using them. Note that these liabilities are not applicable for settlement purposes, including the purchase of annuities and the payment of lump sums.

- **Present Value of Future Benefits:** Used for measuring all future Plan obligations, the obligations of the Plan earned as of the valuation date and those to be earned in the future by current plan participants under the current Plan provisions, if all assumptions are met.

- **Actuarial Liability:** Used for funding calculations, this liability is calculated taking the Present Value of Future Benefits and subtracting the Present Value of Future Normal Costs under an acceptable actuarial funding method. Because the Plan has no active members, the Actuarial Liability is equal to the Present Value of Future Benefits (i.e., all benefits are fully accrued).

- **Unfunded Actuarial Liability:** The excess of the Actuarial Liability over the Actuarial Value of Assets.

Table IV-1 on the next page discloses each of these liabilities for the current and prior valuations.

SECTION IV – LIABILITIES

TABLE IV-1
Liabilities/Net (Surplus)/Unfunded
(in thousands)

	July 1, 2018	July 1, 2019
Present Value of Future Benefits		
Active Participant Benefits	$ 0	$ 0
Retiree and Inactive Benefits	647,251	622,836
Present Value of Future Benefits (PVB)	**$ 647,251**	**$ 622,836**
Actuarial Liability		
Present Value of Future Benefits (PVB)	$ 647,251	$ 622,836
Present Value of Future Normal Costs (PVFNC)	0	0
Actuarial Liability (AL = PVB – PVFNC)	**$ 647,251**	**$ 622,836**
Actuarial Value of Assets (AVA)	347,467	361,037
Net (Surplus)/Unfunded (AL – AVA)	**$ 299,784**	**$ 261,798**

SECTION IV – LIABILITIES

Changes in Liabilities

Each of the liabilities disclosed in the prior table is expected to change at each valuation. The components of that change, depending upon which liability is analyzed, can include:

- New hires since the last valuation (not applicable for this Plan)
- Benefits accrued since the last valuation (not applicable for this Plan)
- Plan amendments
- Passage of time which adds interest to the prior liability
- Benefits paid to retirees since the last valuation
- Participants retiring, terminating, dying, or receiving COLA adjustments at rates different than expected
- A change in actuarial or investment assumptions
- A change in the actuarial funding method or software

Unfunded liabilities will change because of all of the above and also due to changes in Plan assets resulting from:

- Employer contributions different than expected
- Investment earnings different than expected
- A change in the method used to measure plan assets

TABLE IV-2
Changes in Actuarial Liability
(in thousands)

Actuarial Liability at July 1, 2018	$	647,251
Actuarial Liability at July 1, 2019	$	622,836
Liability Increase (Decrease)	$	(24,415)
Change due to:		
Plan Design Changes	$	0
Assumption Change		0
Accrual of Benefits		0
Actual Benefit Payments		(56,212)
Interest		37,173
Data Corrections		0
Actuarial Liability (Gain)/Loss	$	(5,376)

SECTION IV – LIABILITIES

Table IV-3
Liabilities by Group as of July 1, 2019
(in thousands)

	Police	Fire	Total
Actuarial Accrued Liability			
Active	$ 0	$ 0	$ 0
Service Retirees	235,757	80,035	315,792
Disabled Retirees	95,781	85,840	181,621
Beneficiaries	66,097	59,325	125,423
Total Accrued Liability	$ 397,635	$ 225,201	$ 622,836

SECTION IV – LIABILITIES

TABLE IV-4
Development of Actuarial Gain / (Loss)
(in thousands)

1. Unfunded Actuarial Liability at Start of Year (not less than zero)	$	299,784
2. Employer Normal Cost at Start of Year		0
3. Interest on 1. and 2. to End of Year		17,987
4. Contributions and Miscellaneous Income for Prior Year		44,841
5. Administrative Expenses		(1,446)
6. Interest on 4. and 5. to End of Year		1,283
7. Change in Unfunded Actuarial Liability Due to Changes in Assumptions		0
8. Change in Unfunded Actuarial Liability Due to Changes in Actuarial Methods		0
9. Change in Unfunded Actuarial Liability Due to Changes in Plan Design		0
10. Change in Unfunded Actuarial Liability Due to Data Corrections		0
11. Expected Unfunded Actuarial Liability at End of Year [1. + 2. + 3. - 4. - 5. - 6. + 7. + 8. + 9. + 10.]	$	273,093
12. Actual Unfunded Actuarial Liability at End of Year (not less than zero)		261,798
13. Unfunded Actuarial Liability Gain / (Loss) [11. – 12.]	$	11,295

SECTION V – CONTRIBUTIONS

In the process of evaluating the financial condition of any pension plan, the actuary analyzes the assets and liabilities to determine what level (if any) of contributions is needed to properly maintain the funding status of the Plan. Typically, the actuarial process will use a funding technique that will result in a pattern of contributions that are both stable and predictable.

For this Plan, the actuarial funding method used to determine the normal cost and the Unfunded Actuarial Liability is the **Entry Age Normal** cost method.

The normal cost rate is determined with the normal cost percentage equal to the total Projected Value of Benefits at Entry Age, divided by Present Value of Future Salary at Entry Age. Since there are no longer any active employees, the normal cost for this plan is $0.

The Unfunded Actuarial Liability is the difference between the EAN Actuarial Liability and the Actuarial Value of Assets. For the contribution projections, the UAL payment is based on the unfunded liability of the Plan being fully amortized by June 30, 2026, in accordance with the City Charter. Amortization payments are determined based on an assumption that payments will increase by 3.25% each year, reflecting the assumed ultimate rate of increase in overall City Safety member salaries.

An amount equal to the expected administrative expenses for the Plan is added directly to the actuarial cost calculation.

Table V-1 on the next page shows the employer contribution amount for the 2020-2021 Fiscal Year. The projected assets and liabilities assume that all actuarial assumptions are met and that contributions are made as expected between now and June 30, 2020.

For this calculation, we have shown the contribution amount using both the projected actuarial and Market Value of Assets. The current funding policy uses the AVA to determine the UAL and the associated amortization payment. We have included the contribution amount as determined using the current Market Value of Assets to demonstrate what the actuarial cost would be if all deferred asset gains were fully recognized at the time the contributions commence. In both cases, the contribution is based on an assumption that the investment returns will exactly equal the assumed rate of return during the 2019-2020 Fiscal Year.

SECTION V – CONTRIBUTIONS

TABLE V-I
Development of Projected 2020-2021 Employer Contribution Amount
(in thousands)

	Actuarial Value of Assets	Market Value of Assets
1. Value of Assets at June 30, 2019:	$ 361,037	$ 384,711
a. Expected Contributions and Misc Income	$ 43,409	$ 43,409
b. Expected Administrative Expense	$ (1,600)	$ (1,600)
c. Expected Benefit Payments	$ (54,662)	$ (54,662)
d. Expected Investment Earnings	$ 21,282	$ 22,703
2. Expected Value of Assets at June 30, 2020:	$ 369,467	$ 394,561
a. Excess of Expected MVA over Expected AVA	$ 25,094	
b. Preliminary AVA [Expected AVA + 20% * 2a]	$ 374,486	
c. 90% of Expected MVA	$ 355,105	
d. 110% of Expected MVA	$ 434,017	
3. Final Expected AVA [2b, not less than 2c or greater than 2d]	$ 374,486	$ 394,561
4. Entry Age Liability at June 30, 2019	$ 622,836	$ 622,836
5. Expected Benefit Payments	$ (54,662)	$ (54,662)
6. Expected Interest	$ 35,754	$ 35,754
7. Expected Entry Age Liability at June 30, 2020	$ 603,928	$ 603,928
8. Projected Unfunded Actuarial Liability: (7) - (3)	229,443	209,367
9. Funded Ratio: (3) / (7)	62.0%	65.3%
10. Unfunded Actuarial Liability Amortization at Middle of Year as a Level Percentage of Payroll (6 Years Remaining) as of June 30, 2020	42,003	38,328
11. Expected Administrative Expenses for Fiscal 2020-2021	1,646	1,646
12. Total Contribution: (10) + (11)	43,648	39,973

SECTION VI – HEADCOUNT AND BENEFIT PAYMENT PROJECTIONS

Table VI-1
Benefit Payment and Headcount Projection

Fiscal Year Ending June 30,	Police		Fire		Total	
	Count	Benefits (in thousands)	Count	Benefits (in thousands)	Count	Benefits (in thousands)
2020	475.0	$ 32,855	323.0	$ 21,807	798.0	54,662
2021	460.2	$ 32,518	306.7	$ 21,422	766.9	53,940
2022	445.5	$ 32,303	290.6	$ 20,867	736.1	53,170
2023	430.8	$ 32,201	275.0	$ 20,292	705.8	52,493
2024	416.2	$ 32,050	259.7	$ 19,698	675.9	51,748
2025	401.5	$ 31,766	244.9	$ 19,089	646.4	50,855
2026	386.7	$ 31,421	230.6	$ 18,464	617.2	49,885
2027	371.7	$ 31,007	216.7	$ 17,824	588.4	48,831
2028	356.5	$ 30,515	203.3	$ 17,167	559.9	47,682
2029	341.1	$ 29,939	190.3	$ 16,493	531.4	46,432
2030	325.4	$ 29,271	177.8	$ 15,800	503.1	45,070
2031	309.3	$ 28,504	165.6	$ 15,085	474.8	43,589
2032	292.8	$ 27,632	153.7	$ 14,349	446.5	41,981
2033	275.9	$ 26,652	142.2	$ 13,590	418.1	40,242
2034	258.6	$ 25,565	131.0	$ 12,809	389.6	38,375
2035	241.1	$ 24,375	120.1	$ 12,009	361.2	36,384
2036	223.3	$ 23,089	109.5	$ 11,193	332.8	34,282
2037	205.5	$ 21,717	99.2	$ 10,366	304.7	32,082
2038	187.7	$ 20,272	89.4	$ 9,534	277.0	29,806
2039	170.1	$ 18,772	79.9	$ 8,705	250.0	27,477
2040	152.9	$ 17,237	70.9	$ 7,887	223.8	25,123
2041	136.2	$ 15,687	62.4	$ 7,088	198.6	22,775
2042	120.3	$ 14,146	54.5	$ 6,317	174.8	20,463
2043	105.2	$ 12,636	47.2	$ 5,582	152.4	18,219
2044	91.1	$ 11,178	40.5	$ 4,891	131.6	16,069
2045	78.2	$ 9,788	34.4	$ 4,248	112.6	14,036
2046	66.3	$ 8,484	29.0	$ 3,658	95.3	12,142
2047	55.7	$ 7,277	24.2	$ 3,123	80.0	10,400
2048	46.3	$ 6,176	20.1	$ 2,643	66.4	8,819
2049	38.1	$ 5,186	16.4	$ 2,219	54.5	7,405

SECTION VI – HEADCOUNT AND BENEFIT PAYMENT PROJECTIONS

Table VI-1
Benefit Payment and Headcount Projection (Continued)

Fiscal Year Ending June 30,	Police		Fire		Total	
	Count	Benefits (in thousands)	Count	Benefits (in thousands)	Count	Benefits (in thousands)
2050	31.0	$ 4,310	13.4	$ 1,847	44.4	6,157
2051	25.0	$ 3,546	10.8	$ 1,526	35.8	5,072
2052	19.9	$ 2,888	8.6	$ 1,252	28.5	4,141
2053	15.7	$ 2,330	6.9	$ 1,021	22.6	3,351
2054	12.3	$ 1,862	5.4	$ 827	17.7	2,689
2055	9.5	$ 1,474	4.2	$ 667	13.7	2,141
2056	7.3	$ 1,158	3.3	$ 534	10.6	1,692
2057	5.6	$ 902	2.5	$ 426	8.1	1,328
2058	4.2	$ 699	2.0	$ 338	6.2	1,037
2059	3.2	$ 538	1.5	$ 267	4.7	805
2060	2.4	$ 411	1.1	$ 210	3.5	621
2061	1.8	$ 313	0.9	$ 164	2.6	477
2062	1.3	$ 236	0.6	$ 127	1.9	363
2063	0.9	$ 176	0.5	$ 98	1.4	274
2064	0.7	$ 131	0.4	$ 74	1.0	205
2065	0.5	$ 96	0.3	$ 56	0.7	151
2066	0.4	$ 69	0.2	$ 41	0.5	110
2067	0.2	$ 49	0.1	$ 30	0.4	79
2068	0.2	$ 34	0.1	$ 21	0.3	55
2069	0.1	$ 23	0.1	$ 14	0.2	37
2070	0.1	$ 14	0.0	$ 9	0.1	24
2071	0.0	$ 8	0.0	$ 6	0.1	14
2072	0.0	$ 5	0.0	$ 4	0.0	8
2073	0.0	$ 2	0.0	$ 2	0.0	4
2074	0.0	$ 1	0.0	$ 1	0.0	2
2075	0.0	$ 0	0.0	$ 0	0.0	1
2076	0.0	$ 0	0.0	$ 0	0.0	0
2077	0.0	$ 0	0.0	$ 0	0.0	0
2078	0.0	$ 0	0.0	$ 0	0.0	0

APPENDIX A – MEMBERSHIP INFORMATION

Summary of Participant Data as of

	July 1, 2018			July 1, 2019		
Active Participants	**Police**	**Fire**	**Total**	**Police**	**Fire**	**Total**
Number	0	0	0	0	0	0
Number Vested	0	0	0	0	0	0
Average Age	0.0	0.0	0.0	0.0	0.0	0.0
Average Service	0.0	0.0	0.0	0.0	0.0	0.0
Average Pay	$0	$0	$0	$0	$0	$0
Service Retirees						
Number	250	110	360	241	100	341
Average Age	75.0	80.8	76.8	75.7	80.9	77.2
Average Annual Benefit	$77,420	$77,216	$77,358	$76,879	$80,605	$77,972
Disabled Retirees						
Number	109	101	210	107	99	206
Average Age	74.2	75.6	74.9	75.2	76.4	75.8
Average Annual Benefit	$73,959	$72,635	$73,322	$73,598	$74,879	$74,214
Beneficiaries						
Number	133	134	267	127	124	251
Average Age	80.5	83.4	82.0	80.6	83.2	81.8
Average Annual Benefit	$55,952	$54,306	$55,126	$54,889	$55,549	$55,215
All Inactives						
Number	492	345	837	475	323	798
Average Age	76.3	80.3	77.9	76.9	80.4	78.3
Average Annual Benefit	$70,850	$66,976	$69,253	$70,261	$69,231	$69,844

Data pertaining to active and inactive Members and their beneficiaries as of the valuation date was supplied by the Plan Administrator on electronic media.

APPENDIX A – MEMBERSHIP INFORMATION

Changes in Plan Membership: Police

	Actives	Service Retirees	Disabled Retirees	Beneficiaries	Total
July 1, 2018	0	250	109	133	492
Retired	0	0	0	0	0
Disabled	0	0	0	0	0
Deceased	0	(9)	(2)	(10)	(21)
New Beneficiary	0	0	0	4	4
July 1, 2019	**0**	**241**	**107**	**127**	**475**

Changes in Plan Membership: Fire

	Actives	Service Retirees	Disabled Retirees	Beneficiaries	Total
July 1, 2018	0	110	101	134	345
Retired	0	0	0	0	0
Disabled	0	0	0	0	0
Deceased	0	(10)	(2)	(11)	(23)
New Beneficiary	0	0	0	1	1
July 1, 2019	**0**	**100**	**99**	**124**	**323**

Changes in Plan Membership: All

	Actives	Service Retirees	Disabled Retirees	Beneficiaries	Total
July 1, 2018	0	360	210	267	837
Retired	0	0	0	0	0
Disabled	0	0	0	0	0
Deceased	0	(19)	(4)	(21)	(44)
New Beneficiary	0	0	0	5	5
July 1, 2019	**0**	**341**	**206**	**251**	**798**

APPENDIX A – MEMBERSHIP INFORMATION

Service Retired Participants

Age	Police		Fire		Total	
	Number	Total Annual Benefit	Number	Total Annual Benefit	Number	Total Annual Benefit
< 50	0	$0	0	$0	0	$0
50-54	0	$0	0	$0	0	$0
55-59	0	$0	0	$0	0	$0
60-64	0	$0	0	$0	0	$0
65-69	32	$2,478,381	2	$141,947	34	$2,620,329
70-74	93	$7,094,911	23	$1,638,511	116	$8,733,422
75-79	75	$5,507,600	31	$2,524,962	106	$8,032,562
80-84	22	$1,931,751	13	$1,150,005	35	$3,081,755
85-89	11	$820,048	13	$986,182	24	$1,806,230
90-94	6	$530,159	13	$1,237,336	19	$1,767,494
95-99	2	$165,066	5	$381,536	7	$546,602
100+	0	$0	0	$0	0	$0
Total	241	$18,527,915	100	$8,060,478	341	$26,588,393

Disability Retired Participants

Age	Police		Fire		Total	
	Number	Total Annual Benefit	Number	Total Annual Benefit	Number	Total Annual Benefit
< 50	0	$0	0	$0	0	$0
50-54	0	$0	0	$0	0	$0
55-59	0	$0	0	$0	0	$0
60-64	0	$0	0	$0	0	$0
65-69	9	$631,236	11	$727,128	20	$1,358,364
70-74	56	$4,108,597	37	$2,631,149	93	$6,739,746
75-79	26	$1,867,605	31	$2,350,391	57	$4,217,996
80-84	10	$748,019	9	$787,392	19	$1,535,411
85-89	5	$407,755	8	$670,644	13	$1,078,399
90-94	1	$111,785	2	$182,354	3	$294,138
95-99	0	$0	1	$63,958	1	$63,958
100+	0	$0	0	$0	0	$0
Total	107	$7,874,996	99	$7,413,016	206	$15,288,012

APPENDIX A – MEMBERSHIP INFORMATION

Beneficiaries

Age	Police		Fire		Total	
	Number	Total Annual Benefit	Number	Total Annual Benefit	Number	Total Annual Benefit
< 50	0	$0	0	$0	0	$0
50-54	0	$0	0	$0	0	$0
55-59	1	$69,896	1	$83,666	2	$153,562
60-64	3	$166,930	4	$208,384	7	$375,315
65-69	15	$786,304	9	$551,554	24	$1,337,858
70-74	28	$1,445,175	14	$797,000	42	$2,242,175
75-79	21	$1,061,570	17	$962,928	38	$2,024,497
80-84	12	$736,686	16	$922,431	28	$1,659,117
85-89	14	$840,522	24	$1,162,612	38	$2,003,134
90-94	26	$1,464,351	30	$1,710,967	56	$3,175,318
95-99	6	$324,839	7	$359,756	13	$684,594
100+	1	$74,685	2	$128,824	3	$203,509
Total	127	$6,970,958	124	$6,888,121	251	$13,859,080

APPENDIX B – STATEMENT OF ACTUARIAL ASSUMPTIONS AND METHODS

The assumptions and methods used in the actuarial valuation as of July 1, 2019 are:

Actuarial Method

The Entry Age Normal Actuarial Cost Method is used. Under this method, the Plan's Actuarial Liability (AL) is determined as the Present Value of Future Benefits (PVFB) less the Present Value of Future Normal Costs (PVFNC). Since all of the Plan's members are retired, the AL and the PVFB are the same.

The excess of the AL over the Actuarial Value of Assets (AVA) is the Unfunded Actuarial Liability (UAL). In accordance with the Plan's funding agreement with the City of Oakland, the UAL must be amortized by July 1, 2026, with contributions resuming in the 2017-2018 fiscal year. The projected fiscal year 2020-2021 contribution has been calculated using level percent of pay amortization, based on total projected City payroll for all Safety employees.

Actuarial Value of Plan Assets

In determining the recommended employer contribution to the PFRS, we use a smoothed Actuarial Value of Assets. The asset smoothing method dampens the volatility in asset values that could occur because of the fluctuations in market conditions. Use of an asset smoothing method is consistent with the long-term nature of the actuarial valuation process. Assets are assumed to be used exclusively for the provision of retirement benefits and expenses.

The Actuarial Value of Assets is equal to 100% of the *expected Actuarial Value of Assets* plus 20% of the difference between the current Market Value of Assets and the expected Actuarial Value of Assets. In no event will the Actuarial Value of Assets ever be less than 90% of the Market Value of Assets or greater than 110% of the Market Value of Assets.

The expected Actuarial Value of Assets is equal to the prior year's Actuarial Value of Assets increased with actual contributions made, decreased with actual disbursements made, all items (prior assets, contributions, and disbursements) further adjusted with expected investment returns for the year.

APPENDIX B – STATEMENT OF ACTUARIAL ASSUMPTIONS AND METHODS

Actuarial Assumptions

The assumptions used in this report reflect the results of an experience study performed by Cheiron covering the period from July 1, 2014 through June 30, 2017 and adopted by the Board. More details on the rationale for the demographic and economic assumptions can be found in the experience analysis presented to the Board on February 28, 2018.

1. Rate of Return

The expected annual rates of return, net of investment expenses, on all Plan assets are shown in the table below. The equivalent single discount rate for these returns using the Plan's expected projected benefit payments is 5.50%.

Benefit Payment Year	Expected Return
2019-2026	6.000%
2027	5.725%
2028	5.450%
2029	5.175%
2030	4.900%
2031	4.625%
2032	4.350%
2033	4.075%
2034	3.800%
2035	3.525%
2036+	3.250%

2. Inflation

The assumed rate of general inflation is 2.75% (entire US) and local inflation is 2.85% (Bay Area). The general inflation rate is used in the determination of the investment return assumptions. The local inflation rate is used in the determination of the growth in expenses and salaries (which determine the COLA increases).

3. Administrative Expenses

Administrative expenses for the Fiscal Year Ending June 30, 2020 are assumed to be $1,600,000, growing at 2.85% per year.

4. Cost-of-Living Adjustments and Long-Term Salary Increases

Cost-of-living adjustments are based on salary increases for a retiree's rank at retirement.

APPENDIX B – STATEMENT OF ACTUARIAL ASSUMPTIONS AND METHODS

The long-term rate of salary increase is assumed to be 3.25% (2.85% inflation plus 0.4% productivity). The following schedule shows salary increases based on the current Police contract that expires on June 30, 2023 and the Fire contract that expires on October 31, 2020. All increases shown after those dates are assumptions (we have assumed a 3.25% increase for Fire will occur in FY2020-21).

Post-Retirement Benefit Increases (Based on Salary Increases for Rank at Retirement)

Date of Increase	Police	Fire
November 1, 2019	0.00%	2.00%
July 1, 2020	2.50%	3.25%
July 1, 2021	3.00%	3.25%
July 1, 2022	3.50%	3.25%
July 1, 2023	3.50%	3.25%
Annual Increases Starting July 1, 2024	3.25%	3.25%

5. Rates of Termination

None

6. Rates of Disability

None

7. Rates of Retirement

None

8. Rates of Mortality for Healthy Lives

CalPERS Healthy Annuitant Table from the 2012-2015 experience study, excluding the 15-year projection using 90% of Scale MP-2016.

9. Rates of Mortality for Disabled Retirees

CalPERS Industrial Disability Mortality Table from the 2012-2015 experience study, excluding the 15-year projection using 90% of Scale MP-2016.

APPENDIX B – STATEMENT OF ACTUARIAL ASSUMPTIONS AND METHODS

10. Mortality Improvement

The mortality tables are projected to improve with MP-2017 generational mortality improvement tables, with improvements projected from a base year of 2014 (the mid-point of the CalPERS base tables).

11. Survivor Continuance

30% of disabled retirees' deaths are assumed to be related to injuries arising out of the performance of duty, entitling the surviving spouse to a 100% continuance.

12. Changes in Assumptions Since the Last Valuation

The administrative expense assumption increased to $1.6 million and the Longevity Pay assumption for Fire members was removed, as Longevity Pay was included in the June 30, 2019 benefits provided by PFRS staff. No other changes were made to the actuarial assumptions.

APPENDIX C – SUMMARY OF PLAN PROVISIONS

1. Plan Year

July 1 to June 30.

2. Membership

The Plan has been closed to new members since June 30, 1976.

3. Salary

Retirement allowances are based on the pensionable compensation attached to the average rank held during the three years immediately preceding retirement.

4. Employee Contributions

There are no active employees in the Plan, and thus no employee contributions.

5. Service Retirement

Eligibility
25 years of service, or 20 years of service and age 55, or age 65. A reduced early retirement is available with 20 years of service.

Benefit Amount
50% of Salary plus 1.67% for each additional year of service beyond that required for service retirement eligibility, to a maximum of 10 years. For retirements with less than 20 years of service, benefits are pro-rated.

6. Duty-Related Disability Retirement

Equivalent to service retirement benefit if 25 or more years of service.

7. Non-Duty Related Disability Retirement

Equivalent to service retirement benefit if age 55 is attained.

8. Post-Retirement Death Benefit

For retirees without a spouse at death, a $1,000 lump sum is paid to designated beneficiary.

9. Cost-of-Living Adjustments

Benefit increases are based on increases in salary for rank at retirement (see above definition of Salary).

APPENDIX C – SUMMARY OF PLAN PROVISIONS

10. Benefit Forms

Benefit is paid for the lifetime of the member. For non-duty related deaths after retirement, a 66-2/3% continuance is paid for the lifetime of the spouse. If the death is duty-related, a continuance of 100% is paid.

11. Changes in Plan Provisions Since the Last Valuation

None

APPENDIX D – GLOSSARY

1. Actuarial Assumptions

Assumptions as to the occurrence of future events affecting pension costs such as mortality, withdrawal, disability, retirement, changes in compensation, and rates of investment return.

2. Actuarial Cost Method

A procedure for determining the actuarial present value of pension plan benefits and expenses and for developing an allocation of such value to each year of service, usually in the form of a normal cost and an Actuarial Liability.

3. Actuarial Gain (Loss)

The difference between actual experience and that expected based upon a set of actuarial assumptions during the period between two actuarial valuation dates, as determined in accordance with a particular actuarial cost method.

4. Actuarial Liability

The portion of the Actuarial Present Value of Projected Benefits that will not be paid by future normal costs. It represents the value of the past normal costs with interest to the valuation date.

5. Actuarial Present Value (Present Value)

The value as of a given date of a future amount or series of payments. The actuarial present value discounts the payments to the given date at the assumed investment return and includes the probability of the payment being made.

6. Actuarial Valuation

The determination, as of a specified date, of the normal cost, Actuarial Liability, Actuarial Value of Assets, and related actuarial present values for a pension plan.

7. Actuarial Value of Assets

The value of cash, investments, and other property belonging to a pension plan as used by the actuary for the purpose of an actuarial valuation. The purpose of an Actuarial Value of Assets is to smooth out fluctuations in market values.

8. Actuarially Equivalent

Of equal actuarial present value, determined as of a given date, with each value based on the same set of actuarial assumptions.

APPENDIX D – GLOSSARY

9. Amortization Payment

The portion of the pension plan contribution that is designed to pay interest and principal on the Unfunded Actuarial Liability in order to pay for that liability in a given number of years.

10. Entry Age Normal Actuarial Cost Method

A method under which the Actuarial Present Value of the Projected Benefits of each individual included in an actuarial valuation is allocated on a level basis over the earnings of the individual between entry age and assumed exit ages.

11. Funded Ratio

The ratio of the Actuarial Value of Assets to the Actuarial Liabilities.

12. Normal Cost

That portion of the actuarial present value of pension plan benefits and expenses that is allocated to a valuation year by the actuarial cost method.

13. Projected Benefits

Those pension plan benefit amounts which are expected to be paid in the future under a particular set of actuarial assumptions, taking into account such items as increases in future compensation and service credits.

14. Unfunded Actuarial Liability

The excess of the Actuarial Liability over the Actuarial Value of Assets.

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