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2019 MAR -7 AM 10: 17

AGENDA REPORT

TO: Sabrina B. Landreth
City Administrator

FROM: Katano Kasaine
Finance Director

SUBJECT: Informational Report on PFRS'
Investment Portfolio and Actuarial
Valuation

DATE: February 13, 2019

City Administrator Approval

Date:

3/6/19

RECOMMENDATION

Staff Recommends That The City Council Receive An Informational Report On The Oakland Police And Fire Retirement System ("PFRS") Investment Portfolio As Of December 31, 2018.

EXECUTIVE SUMMARY

The attached Quarterly Investment Performance report (**Attachment A**) provided by the PFRS Investment Consultant, Pension Consulting Alliance (PCA) summarizes the performance of the PFRS investment portfolio for the quarter ended December 31, 2018.

During the most recent quarter, the PFRS Total Portfolio generated an absolute return of -9.8 percent, gross of fees, outperforming its policy benchmark by 0.4 percent. The portfolio outperformed its benchmark over the latest one- and three-year periods, and underperformed its benchmark in the latest five-year period. This is discussed in more detail in the "Investment Performance" section of this report.

	Quarter	1 Year	3 Year	5 Year
Total Portfolio	-9.8%	-4.8%	7.0%	5.5%
Policy Benchmark	-10.2%	-5.0%	6.6%	5.6%
Excess Return	0.4%	0.2%	0.4%	-0.1%

As of July 1, 2017, the System's Unfunded Actuarial Liability is approximately \$340.07 million and the System had a Funded Ratio of 52.4 percent on a Market Value of Assets (MVA) basis. This is discussed in more detail in the "PFRS Actuarial Valuation" section of this report.

Item: _____
Finance and Management Committee
March 19, 2019

BACKGROUND / LEGISLATIVE HISTORY

The Oakland Police and Fire Retirement System (the "PFRS") is a closed defined benefit plan established by the City of Oakland's (the "City") Charter. PFRS is governed by a board of seven trustees (the "PFRS Board"). PFRS covers the City's sworn police and fire employees hired prior to July 1, 1976. PFRS was closed to new members on June 30, 1976. As of December 31, 2018, PFRS had 813 retired members and no active members.

The System's investment portfolio is governed by the investment policy set by the PFRS Board. The PFRS Board sets an investment policy that authorizes investments in a variety of domestic and international equity and fixed income securities. Twelve external investment managers currently manage the System's portfolio. Most of the portfolio is held in custody at Northern Trust. In accordance with the City Charter, the PFRS Board makes investment decisions in accordance with the prudent person standard as defined by applicable court decisions and as required by the California Constitution.

In March 1997, the City issued Taxable Pension Obligation Bonds, Series 1997 ("1997 POBs") and as a result deposited \$417 million into the System to pay the City's contributions through June 2011. As a result of the funding agreement entered at the time the 1997 POBs were issued, City payments to PFRS were suspended from February 25, 1997 to June 30, 2011. The City of Oakland resumed contributing to PFRS effective July 1, 2011 and contributed \$45.5 million for the fiscal year (FY) ended June 30, 2012.

In July 2012, the City issued \$212.5 million of Taxable Pension Obligation Bonds, Series 2012 ("2012 POBs"). The City subsequently deposited \$210 million into the System and entered a funding agreement with the PFRS Board. Thus, no additional contributions were required until July 1, 2017. As of the most recent actuary study dated July 1, 2017, the System's Unfunded Actuarial Liability is approximately \$340.07 million and the System had a Funded Ratio of 52.4 percent on a Market Value of Assets (MVA) basis. The City of Oakland is currently making monthly payments to the Plan for the FY 2018/2019 required contribution of \$44.82 million.

ANALYSIS AND POLICY ALTERNATIVES

PFRS' Membership

The City Charter establishes plan membership, contribution, and benefit provisions. The System serves the City's sworn employees hired prior to July 1, 1976 who have not transferred to the California Public Employees' Retirement System ("CalPERS"). As of November 30, 2018, the System's membership was 813, as shown on **Table 1** below.

Table 1			
PFRS Membership as of December 31, 2018			
Membership	POLICE	FIRE	TOTAL
Retiree	353	203	556
Beneficiary	131	126	257
Total Membership	484	329	813

PFRS Investment Portfolio

As of December 31, 2018, the PFRS' portfolio had an aggregate value of \$350.05 million as shown in **Table 2**.

Table 2	
PFRS Investment Portfolio as of December 31, 2018 (in thousands)	
Investment	Fair Value
Domestic Equities	\$ 133,535
Fixed Income	99,109
International Equities	41,411
Covered Calls	45,110
Crisis Risk Offset	23,187
Cash and Cash-Equivalents	7,701
Total Portfolio	\$ 350,053

As of December 31, 2018, the PFRS portfolio had an aggregate value of \$350.05 million. This represents an decrease of \$41.4 million in value, including the withdrawal of (\$3.0) million to pay pension payments, over the quarter. During the previous one-year period, the OPFRS Total Portfolio decreased in value by \$30.4 million, including the withdrawal of (\$13.0) million for pension payments as shown in **Table 3** below. The investment drawdowns for benefit payments are less City of Oakland Contributions to the PFRS Plan of \$11.2 million for the Quarter and \$44.8 million for the Year.

Table 3 Change in PFRS Portfolio Valuation as of December 31, 2018 (in thousands)		
Total Plan Value	1 Quarter	1 Year
Beginning Market Value	\$391,498	\$380,459
Investment Drawdowns for Benefit Payments	(3,180)	(12,777)
Gain/Loss on Investment	(38,264)	(17,629)
Ending Market Value	\$350,054	\$350,054

PFRS Investment Performance

During the most recent quarter, the PFRS Total Portfolio generated an absolute return of -9.8%, gross of fees, outperforming its policy benchmark by 0.4 percent. The portfolio outperformed its benchmark by 0.2 percent over the one-year period, 0.4 percent over the three-year period, and underperformed by 0.1 percent over the five-year period.

Over the most recent quarter, the Plan's Domestic Equity allocation underperformed its benchmark by 1.3 percent. The Plan's International Equity allocation underperformed its benchmark by 1.7 percent. The Plan's Fixed Income allocation underperformed its benchmark of 0.2 percent. The Plan's Crisis Risk Offset allocation underperformed its benchmark by 9.4 percent, while the Covered Calls allocation underperformed its benchmark by 0.2 percent. **Table 4** shows PFRS recent investment performance in comparison to its corresponding benchmarks.

Table 4 PFRS Asset Class Performance as of December 31, 2018				
Investment Type	Quarter	1 Year	3 Year	5 Year
PFRS Total Fund	-9.8%	-4.8%	7.0%	5.5%
PFRS Policy Benchmark	-10.2%	-5.0%	6.6%	5.6%
Excess Returns	0.4%	0.2%	0.4%	-0.1%
PFRS Domestic Equity	-15.6%	-6.4%	8.9%	7.7%
Benchmark: Russell 3000	-14.3%	-5.2%	9.0%	7.9%
Excess Returns	-1.3%	-1.2%	-0.1%	-0.2%

Table 4				
PFRS Asset Class Performance as of December 31, 2018 (cont'd)				
Investment Type	Quarter	1 Year	3 Year	5 Year
PFRS International Equity	-13.1%	-15.2%	4.4%	1.6%
Benchmark: MSCI ACWI Ex US	-11.4%	-13.8%	5.0%	1.1%
Excess Returns	-1.7%	-1.4%	-0.6%	0.5%
PFRS Fixed Income	1.0%	0.4%	3.4%	3.2%
Benchmark: Bloomberg Barclays Universal	1.2%	-0.3%	2.6%	2.7%
Excess Returns	-0.2%	0.7%	0.8%	0.5%
PFRS Crisis Risk Offset	-10.0%	-	-	-
Benchmark: SG Multi Alternative Risk Premia	0.6%	-	-	-
Excess Returns	-9.4%	-	-	-
PFRS Covered Calls	-11.0%	-4.8%	6.6%	-
Benchmark: CBOE BXM	-10.8%	-4.8%	4.8%	-
Excess Returns	-0.2%	0.0%	1.8%	-
Cash	0.6%	1.9%	1.2%	0.7%
Citigroup 3 Month T-Bill Index	0.6%	1.9%	1.0%	0.6%
Excess Returns	0.0%	0.0%	0.2%	0.1%

Table 5 compares PFRS Total Portfolio performance to other pension funds and benchmarks.

Table 5				
PFRS Total Fund Performance as of December 31, 2018				
	Quarter	1 Year	3 Year	5 Year
PFRS Fund (Gross of Fees)	-9.82%	-4.83%	6.98%	5.51%
Comparisons:				
PFRS Actuarial Expected Rate of Return (blend) (a) (b)	1.47%	6.00%	6.33%	6.43%
Policy Target (blend) (c)	-10.22%	-5.03%	6.56%	5.56%
Median Fund (d)	-8.57%	-4.54%	5.67%	4.70%
CalPERS Investment Returns (Net of Fees)	-6.20%	-3.50%	6.30%	5.10%
CalSTRS Investment Returns (Gross of Fees)	-6.36%	-3.22%	6.91%	5.97%
East Bay Mud Investment Returns (Gross of Fees)	-8.61%	-4.14%	6.67%	5.87%
San Joaquin County Investment Returns (Gross of Fees)(e)	-3.66%	-1.35%	6.05%	4.48%
a) 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. b) The quarterly actuarial expected rate of return is calculated based on the 6.50% annual return assumption. c) The Policy Benchmark consists of 48% Russell 3000, 12% MSCI ACWI ex U.S., 20% BC Universal, 20% CBOE BXM. d) Preliminary.				

PFRS Actuarial Valuation

As of the latest actuarial valuation dated July 1, 2017, the PFRS Funded Ratio (actuarial value of assets divided by present value of future benefits) is 52.4 percent. As a result of the funding agreement and the City's deposit of \$210 million in 2012 POBs to the System, no contributions were required until fiscal year 2017/2018. The City resumed contributions to the System on July 1, 2017. The required contribution for fiscal year 2018/2019 is \$44.82 million. **Table 6** below shows a summary of the July 1, 2017 PFRS Actuarial valuation results.

Table 6	
Summary of Plan Results (\$ in thousands)	
July 01, 2017	
Actuarial Liability	\$ 673,441
Less: Actuarial Value of Assets	(333,373)
Unfunded Actuarial Liability	\$ 340,068
Funded Ratio (MVA) liability	52.4%

Projected City of Oakland Contributions

Article XXVI Section 2619 (6) required that the City fully fund the PFRS Plan by 2026. **Table 7** summarizes the projected employer contributions.

Table 7	
Projected Employer Contributions Police and Fire Retirement System (in millions)	
Fiscal Year Ending	Employer Contribution
2017	\$ 0.0
2018	44.9
2019	44.8
2020	45.7
2021	46.6
2022	47.6
2023	48.5
2024	49.4
2025	50.2
2026	50.4

FISCAL IMPACT

This is an informational report. There are no budget implications associated with this report.

PUBLIC OUTREACH / INTEREST

This item did not require public outreach other than the required posting on the City's website.

COORDINATION

This report was prepared in coordination with the PFRS' Investment Consultant (PCA) and PFRS' Actuary (Cheiron).

SUSTAINABLE OPPORTUNITIES

Economic: Whenever possible, the PFRS Board seeks to benefit the local Oakland based economy. In 2006, the PFRS Board, along with staff, created the PFRS Local Broker provision. This provision mandates that the PFRS Investment Managers consider using Oakland based brokers for all trades conducted on behalf of the fund based on best execution. This program aims to regenerate some of the commissions generated by the System into the Oakland economy.

Environmental: The PFRS Board supports a sustainable environment. On June 29, 2016, the PFRS Board passed Resolution No. 6927 prohibiting PFRS investment managers from investing PFRS funds in any publicly-traded company which derives at least 50 percent of its revenue from the mining and extracting of thermal coal.


Social Equity: There are no social equity opportunities associated with this report.

ACTION REQUESTED OF THE CITY COUNCIL

Staff recommends that the Council receive this informational report on the Oakland Police and Fire Retirement System ("PFRS") Investment Portfolio as of December 31, 2018.

For questions regarding this report, please contact Katano Kasaine, Director of Finance, at (510) 238-2989.

Respectfully submitted,



KATANO KASAINE
Director of Finance

Prepared by:
Téir Jenkins,
Investment Officer

Reviewed by:
David Jones,
Treasury Administrator

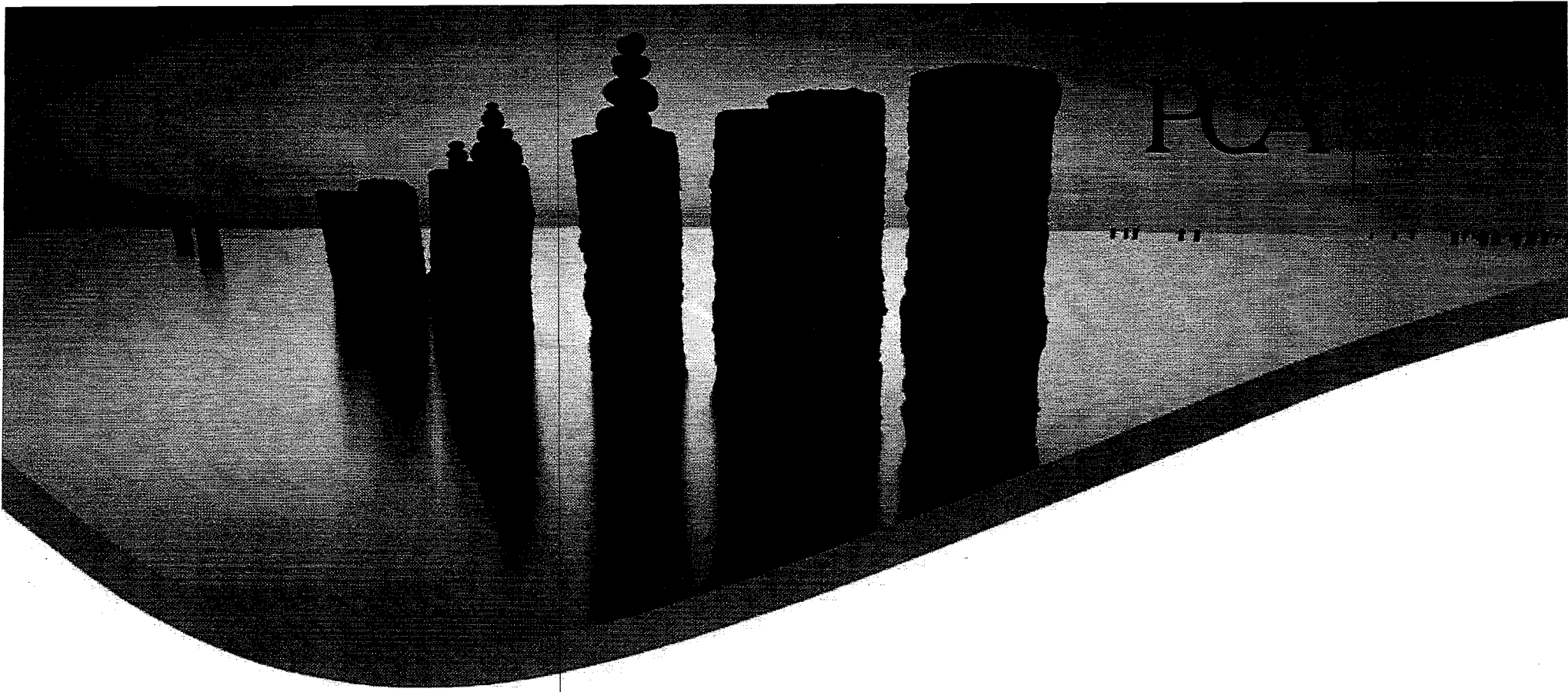
Attachments (2):

Attachment A: Oakland Police and Fire System Quarterly Investment Performance Report as of December 31, 2018

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**ATTACHMENT A:
PFRS INVESTMENT PERFORMANCE
REPORT
AS OF DECEMBER 31, 2018**



Q4 2018

Oakland Police and Fire Retirement System

Quarterly Report

This report is solely for the use of client personnel. No part of it may be circulated, quoted, or reproduced for distribution outside the client organization without prior written approval from Pension Consulting Alliance, LLC.

Nothing herein is intended to serve as investment advice, a recommendation of any particular investment or type of investment, a suggestion of purchasing or selling securities, or an invitation or inducement to engage in investment activity.

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TOTAL PORTFOLIO SUMMARY

As of December 31, 2018, the City of Oakland Police and Fire Retirement System (OPFRS) portfolio had an aggregate value of \$350.1 million. This represents a (\$38.3) million decrease in investment value, and (\$3.2) million in benefit payments, over the quarter. During the previous one-year period, the OPFRS Total Portfolio decreased in value by (\$17.6) million and withdrew (\$12.8) million for benefit payments.

Asset Allocation Trends

The asset allocation targets (see table on page 21) reflect those as of December 31, 2018. 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 and Cash, while underweight Domestic Equity, International Equity, Fixed Income, and Crisis Risk Offset.**

Recent Investment Performance

During the most recent quarter, the OPFRS Total Portfolio generated an absolute return of (9.8%), gross of fees, outperforming its policy benchmark by 40 basis points. The portfolio outperformed its benchmark by 20 and 42 basis points over the 1- and 3-year periods, respectively, while underperforming by (5) basis points over the 5-year period.

The Total Portfolio underperformed the Median fund's return over the quarter and 1-year periods but outperformed the median fund over the 3- and 5-year periods. Performance differences with respect to the Median Fund continue to be attributed largely to differences in asset allocation.

	Quarter	Fiscal YTD	1 Year	3 Year	5 Year
Total Portfolio ¹	-9.8	-6.2	-4.8	7.0	5.5
Policy Benchmark ²	-10.2	-6.2	-5.0	6.6	5.6
Excess Return	0.4	0.0	0.2	0.4	0.1
Reference: Median Fund ³	-8.6	-5.5	-4.6	5.6	4.7
Reference: Total Net of Fees ⁴	-9.9	-6.3	-5.0	6.7	5.2

¹ Gross of Fees. Performance since 2005 includes securities lending.

² Evolving Policy Benchmark consists of 48% Russell 3000, 12% MSCI ACWI ex U.S., 20% Bbg BC Universal, and 20% CBOE BXM

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)

ECONOMIC & MARKET OVERVIEW – 4Q 2018

Overview: Real U.S. GDP increased by 3.4% (third estimate) in the third quarter of 2018. GDP growth was driven by increases in personal consumption expenditures, private inventory investments, government spending, and nonresidential fixed investment, while a decrease in exports and residential fixed investments detracted from GDP growth over the quarter. At quarter-end, the unemployment rate increased to 3.9%. The seasonally adjusted Consumer Price Index for All Urban Consumers increased by 1.2% on an annualized basis during the quarter. Commodities fell during the second quarter, and the 1-year return for a basket of commodities was negative at -11.2%. Global equity returns were negative for the quarter at -12.7% (MSCI ACWI). The U.S. Dollar appreciated against the Euro and Pound by 1.2% and 2.1%, respectively. The Dollar depreciated against the Yen by 3.5%.

Economic Growth

- Real GDP increased at an annualized rate of 3.4 percent in the third quarter of 2018.
- Real GDP growth was driven by increases in personal consumption expenditures, private inventory investments, government spending, and nonresidential fixed investment.
- GDP growth was partially offset during the quarter by a decrease in exports and residential fixed investments.

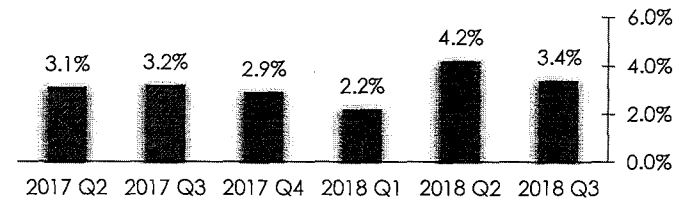
Inflation

- The Consumer Price Index for All Urban Consumers (CPI-U) increased by 1.2 percent during the fourth quarter on an annualized basis after seasonal adjustment.
- Quarterly percentage changes may be adjusted between data publications due to periodic updates in seasonal factors.
- Core CPI-U increased by 2.5 percent for the quarter on an annualized basis after seasonal adjustment.
- Over the last 12 months, core CPI-U increased by 2.2 percent after seasonal adjustment.

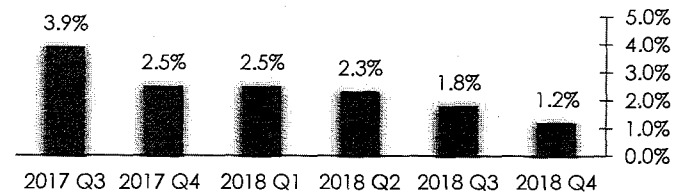
Unemployment

- The U.S. economy gained approximately 762,000 jobs in the fourth quarter of 2018.
- The unemployment rate increased to 3.9% at quarter-end.
- The majority of jobs gained occurred in education and health services, professional and business services, and leisure and hospitality. No sectors suffered from job loss, however, information and utilities had the lowest job growth over the quarter.

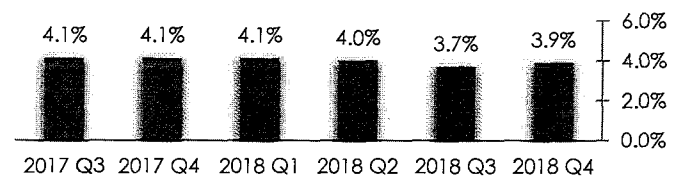
Annualized Quarterly GDP Growth



CPI-U After Seasonal Adjustment



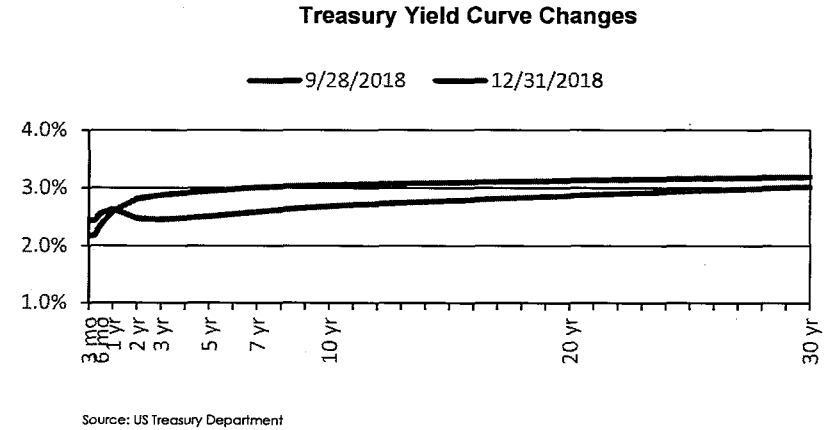
Unemployment Rate



ECONOMIC & MARKET OVERVIEW – 4Q 2018

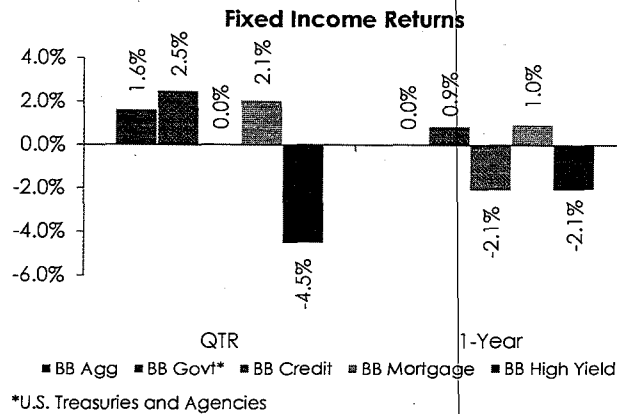
Interest Rates & US Dollar

- Certain parts of the yield curve slightly inverted over the quarter with shorter yields rising while intermediate and long-term yields decreased over the quarter.
- On December 19th, the Federal Reserve raised the federal funds rate for the third time in 2018. The current target is between 2.25 and 2.50 percent.
- The U.S. Dollar appreciated against the Euro and Pound by 1.2% and 2.1%, respectively, but depreciated against the Yen by 3.5%.



Fixed Income

- Investment Grade bonds performed well over the quarter. High Yield provided relatively weak performance as they were down -4.5% for the quarter while Government bonds provided the strongest returns during the period with a return of 2.5%.
- Over the trailing 1-year period, High Yield and Credit lagged all other sectors with a -2.1% return. Conversely, Mortgages provided the strongest return over the 1-year period with 1.0%.



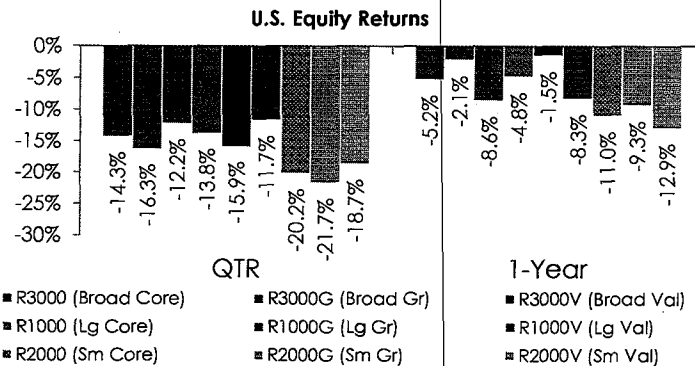
US Fixed Income Sector Performance (BB Aggregate Index)			
Sector	Weight	QTR	1 Year
Governments*	42.2%	2.4%	0.8%
Agencies	2.8%	1.2%	0.3%
Inv. Grade Credit	24.3%	-0.2%	-2.5%
MBS	28.2%	-2.1%	1.0%
ABS	0.5%	1.2%	1.8%
CMBS	2.0%	1.7%	0.8%

*U.S. Treasuries and Government Related

ECONOMIC & MARKET OVERVIEW – 4Q 2018

U.S. Equities

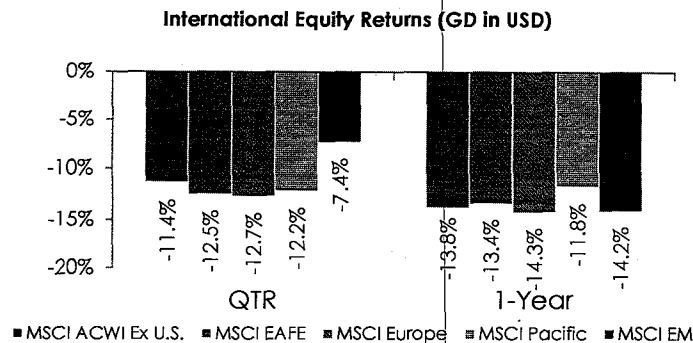
- U.S. equities performed poorly over the quarter as they provided double digit negative returns across market capitalization and style. Value outperformed growth stocks across market capitalizations. In terms of market capitalization, large cap stocks provided the strongest returns across styles. Large cap value stocks returned this quarter's strongest return at -11.7%, and small cap growth stocks provided the weakest result at -21.7%.
- During the trailing 1-year period, U.S. equities produced negative returns. Large cap growth stocks were the top performer, returning -1.5%. Conversely, small cap value trailed all other market caps and styles with a return of -12.9%.



Sector	Weight	QTR	1 Year
Information Tech.	19.8%	-17.4%	3.2%
Health Care	15.1%	-10.9%	-12.8%
Financials	14.2%	-13.5%	5.2%
Consumer Disc.	10.2%	-16.4%	-14.2%
Industrials	10.1%	-18.1%	-1.0%
Comm. Services	8.9%	-13.3%	-6.2%
Consumer Staples	6.6%	-5.6%	-8.3%
Energy	5.2%	-25.8%	-19.7%
Real Estate	3.8%	-6.3%	-4.5%
Utilities	3.1%	0.8%	-17.0%
Materials	3.0%	-14.9%	4.4%

International Equities

- International equities provided negative returns across the board in the fourth quarter. Europe modestly trailed all other regions with a return of -12.7%.
- Over the trailing 1-year period, the Pacific led all other regions with a return of -11.8%, while Europe slightly trailed all other regions with a -14.3% return.



Sector	Weight	QTR	1 Year
Europe Ex. UK	30.7%	-13.0%	-14.4%
Emerging Markets	26.0%	-7.4%	-14.2%
Japan	16.6%	-14.2%	-12.6%
United Kingdom	11.4%	-11.8%	-14.1%
Pacific Ex. Japan	8.4%	-7.9%	-10.2%
Canada	6.5%	-15.1%	-16.6%

ECONOMIC & MARKET OVERVIEW – 4Q 2018

Market Summary – Multi-term Performance*

Indexes	Month	Quarter	1 Year	3 Years	5 Years	10 Years	20 Years
Global Equity							
MSCI AC World Index	-7.0%	-12.7%	-8.9%	7.2%	4.8%	10.0%	5.0%
Domestic Equity							
S&P 500	-9.0%	-13.5%	-4.4%	9.3%	8.5%	13.1%	5.6%
Russell 3000	-9.3%	-14.3%	-5.2%	9.0%	7.9%	13.2%	6.0%
Russell 3000 Growth	-8.8%	-16.3%	-2.1%	10.9%	10.0%	15.2%	5.1%
Russell 3000 Value	-9.8%	-12.2%	-8.6%	7.0%	5.8%	11.1%	6.3%
Russell 1000	-9.1%	-13.8%	-4.8%	9.1%	8.2%	13.3%	5.9%
Russell 1000 Growth	-8.6%	-15.9%	-1.5%	11.1%	10.4%	15.3%	5.1%
Russell 1000 Value	-9.6%	-11.7%	-8.3%	7.0%	5.9%	11.2%	6.2%
Russell 2000	-11.9%	-20.2%	-11.0%	7.4%	4.4%	12.0%	7.4%
Russell 2000 Growth	-11.7%	-21.7%	-9.3%	7.2%	5.1%	13.5%	6.1%
Russell 2000 Value	-12.1%	-18.7%	-12.9%	7.4%	3.6%	10.4%	8.2%
Russell Microcap	-12.1%	-22.1%	-13.1%	5.8%	3.1%	11.7%	—
Alerian MLP Index	-9.4%	-17.3%	-12.4%	-1.1%	-7.3%	9.6%	—
CBOE BXM Index	-7.7%	-10.8%	-4.8%	4.8%	5.1%	8.0%	5.0%
International Equity							
MSCI AC World Index ex USA	-4.5%	-11.4%	-13.8%	5.0%	1.1%	7.1%	4.6%
MSCI EAFE	-4.8%	-12.5%	-13.4%	3.4%	1.0%	6.8%	4.0%
MSCI Europe	-4.6%	-12.7%	-14.3%	2.7%	0.0%	6.8%	3.7%
MSCI Pacific	-5.1%	-12.2%	-11.8%	4.8%	3.0%	7.0%	4.5%
MSCI EM (Emerging Markets)	-2.6%	-7.4%	-14.2%	9.7%	2.0%	8.4%	8.8%
Fixed Income							
BB Universal	1.6%	1.2%	-0.3%	2.6%	2.7%	4.1%	4.8%
Global Agg. - Hedged	1.4%	1.7%	1.8%	2.9%	3.4%	3.8%	4.6%
BB Aggregate Bond	1.8%	1.6%	0.0%	2.1%	2.5%	3.5%	4.5%
BB Government	2.1%	2.5%	0.9%	1.4%	2.0%	2.1%	4.1%
BB Credit Bond	1.5%	0.0%	-2.1%	3.2%	3.2%	5.5%	5.2%
BB Mortgage Backed Securities	1.8%	2.1%	1.0%	1.7%	2.5%	3.1%	4.6%
BB High Yield	-2.1%	-4.5%	-2.1%	7.2%	3.8%	11.1%	6.6%
BCBWGIL All Maturities - Hedged	1.2%	0.5%	0.1%	4.5%	4.2%	4.6%	—
Emerging Markets Debt	1.4%	-0.2%	-2.5%	5.1%	4.2%	8.5%	9.0%
Real Estate							
NCREIF	0.6%	1.8%	8.4%	8.2%	10.4%	7.0%	8.6%
FTSE NAREIT All Equity Index	-7.7%	-6.1%	-4.1%	4.6%	8.3%	12.4%	9.6%
Commodity Index							
Bloomberg Commodity Index	-6.9%	-9.4%	-11.2%	0.3%	-8.8%	-3.8%	1.8%

*Performance is annualized for periods greater than one year.

ECONOMIC & MARKET OVERVIEW – 4Q 2018

Annual Asset Class Performance

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Best	26.0	34.5	32.6	39.8		79.0	35.9	29.9	18.6	33.6			18.3	37.8	
	20.7				24.0	76.4	19.2		17.9	27.6	25.1		17.5	25.6	0.0
	16.7	14.0	26.9	12.7	5.2	57.5	16.9	13.9	16.8	23.4	12.6	0.5	12.7	24.6	-1.3
	15.8	11.4	26.1		-2.4	35.4		13.6	16.4	23.3		0.5	11.6	21.1	-1.8
			21.5	12.2		32.5	15.2	7.8	15.6		6.0	-0.4		8.5	-2.3
	11.9	6.5		11.6	-26.4	28.3	13.2	4.4			4.8	-1.2	8.5		-5.2
	10.9	6.3	15.7	11.6	-36.9	11.4	9.4	1.0	7.0	7.4	4.7	-1.4		7.5	-8.9
	8.5	6.1	11.8	9.8	-37.3	5.9	8.2	-6.9	4.8	-2.0	3.6	-1.8	4.7	3.5	
	7.7	2.8	4.3	7.0	-41.8				4.2	-2.3	2.5	-4.6	2.6	3.0	-12.4
		2.7	1.8	5.1	-43.1	-12.9	6.5	-11.7	3.6	-8.6	-1.8	-14.6	1.5		-13.4
Worst	4.3	2.4	0.5	2.2	-53.2		6.3	-18.2		-12.7	-4.5	-32.6	1.3	-6.5	-14.2
	MSCI ACWI	Russell 3000 Index	Alerian MLP Index	MSCI EAFE Index	MSCI Emerging Markets	BB Agg	ICE BofAML High Yield	BB Long Treasury	BB TIPS Index						

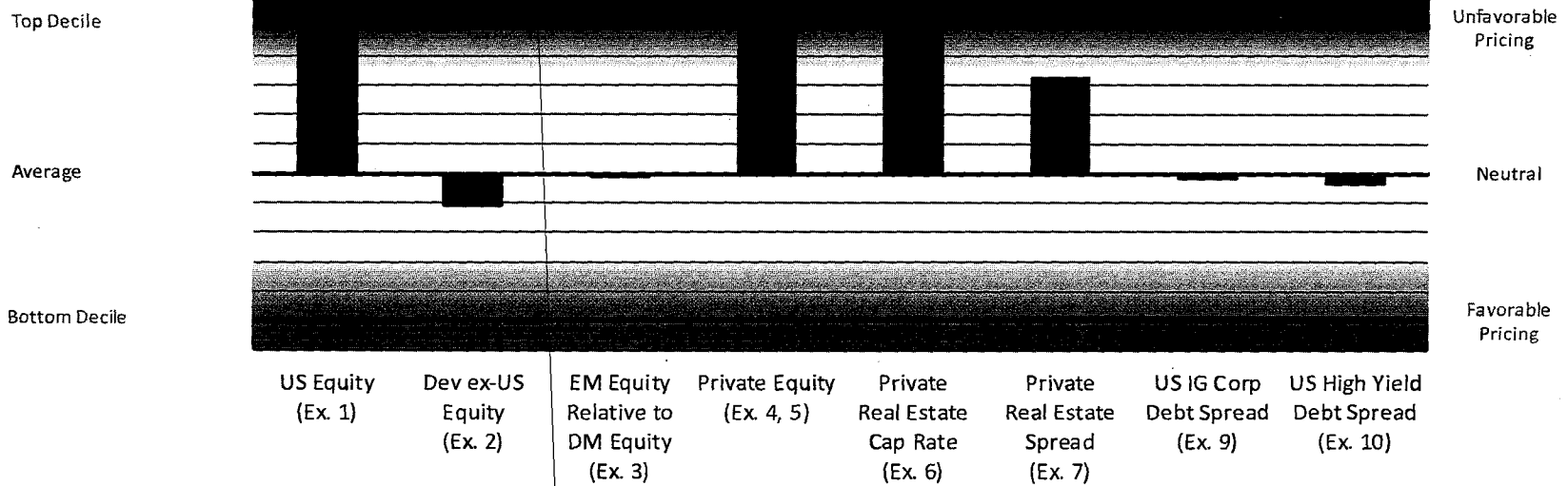
Investment Market Risk Metrics

Takeaways

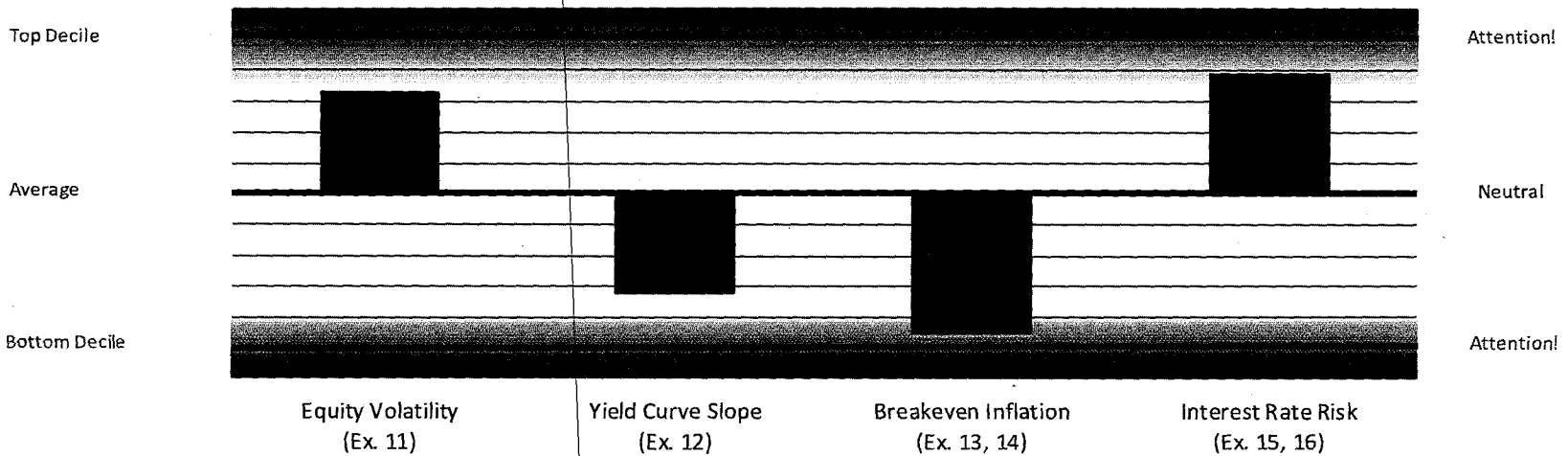
- The fourth quarter completed what proved to be a challenging year for nearly all risk-based assets. While calendar year returns for most markets were well within expectations (albeit negative), the rampant volatility of October and December culminated in a historically poor quarter for global equity markets.
- Despite recent market declines, U.S. Equity markets remain expensive whereas non-U.S. markets remain reasonably valued.
- U.S. Credit spreads have widened to historical average levels.
- Coinciding with severe equity market declines in December was the strong performance of U.S. Treasury bonds. As a result of this activity, duration risk has increased and the yield curve has continued to flatten.
- Risk assets have entered a higher risk regime that appears to be gaining traction. Implied equity market volatility (i.e., VIX) spent the majority of the fourth quarter above its long-term average level of 19.3, including spending several days above 30 near quarter-end.
- PCA's Market Sentiment Indicator flipped to negative (**red**) in December as a result of negative one-year returns in equity markets and corporate bond spreads.
- **Economies and markets appear to be in transition.** Diverging global economic growth, diverging global monetary policy, and ongoing geopolitical turmoil has resulted in a high degree of uncertainty in the global capital markets.

¹ See Appendix for the rationale for selection and calculation methodology used for the risk metrics.

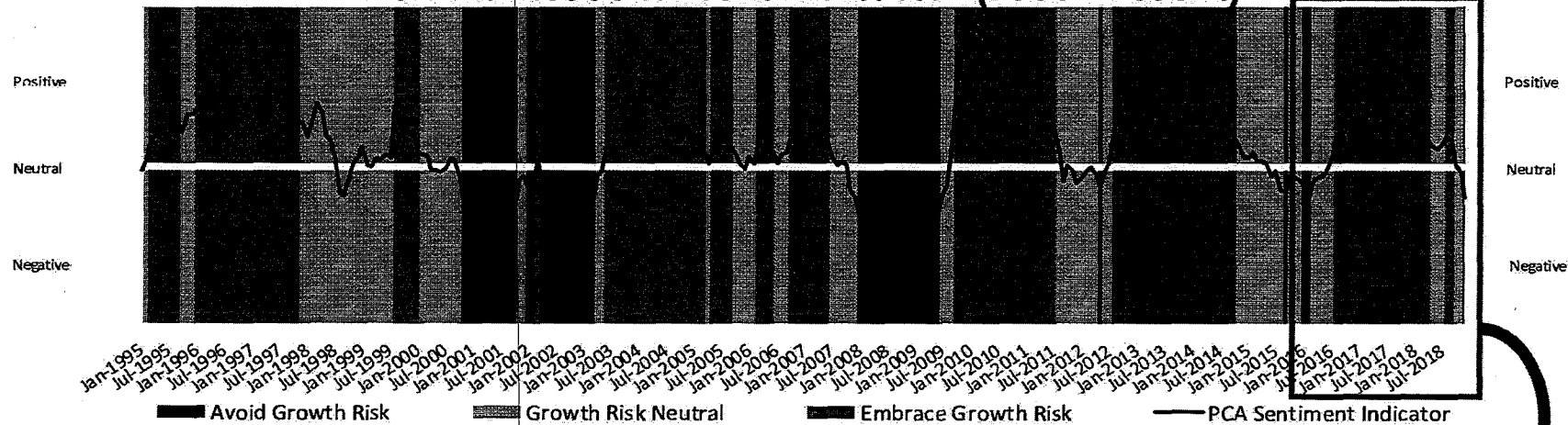
Valuation Metrics versus Historical Range A Measure of Risk



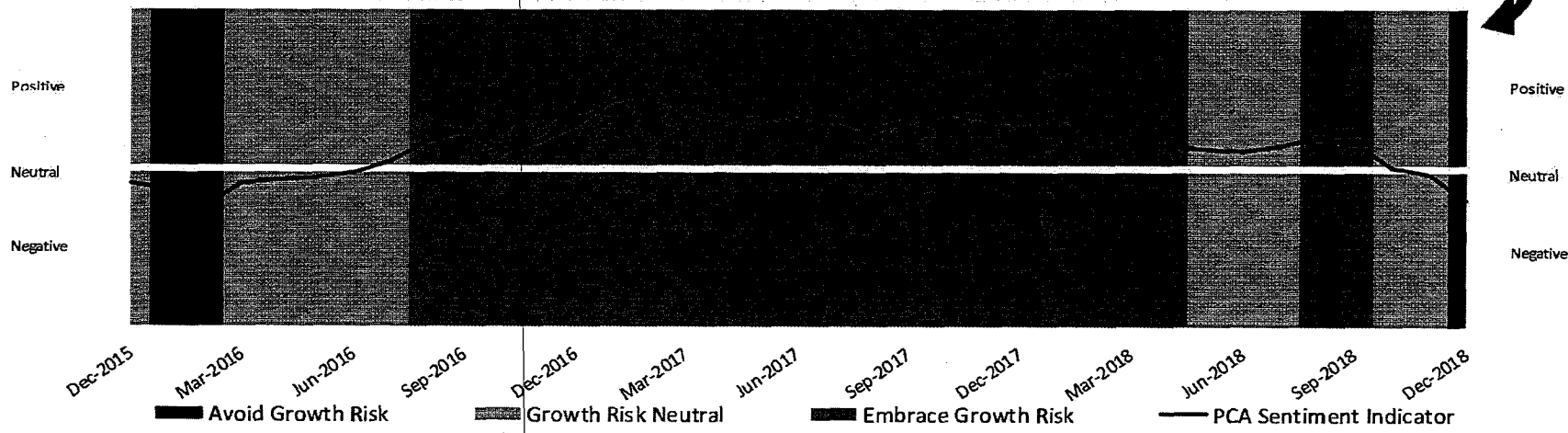
Other Important Metrics within their Historical Ranges Pay Attention to Extreme Readings



PCA Market Sentiment Indicator (1995-Present)



PCA Market Sentiment Indicator - Most Recent 3-Year Period



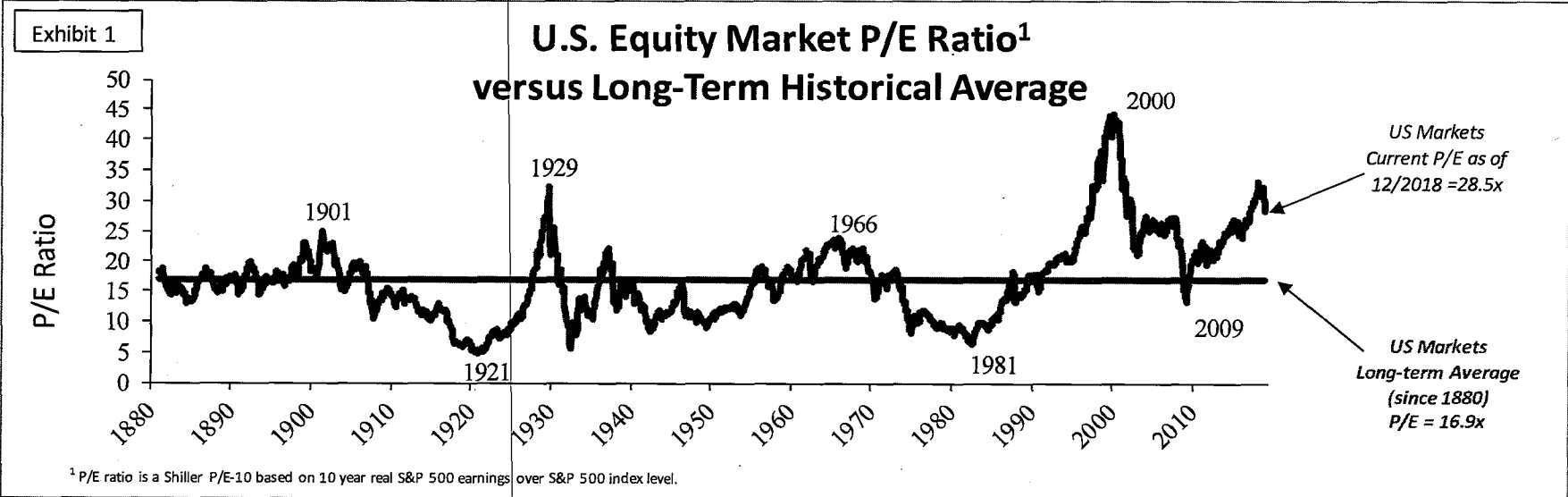
Information Behind Current Sentiment Reading

Bond Spread Momentum Trailing-Twelve Months	Negative
Equity Return Momentum Trailing-Twelve Months	Negative
Agreement Between Bond and Equity Momentum Measures?	Agree

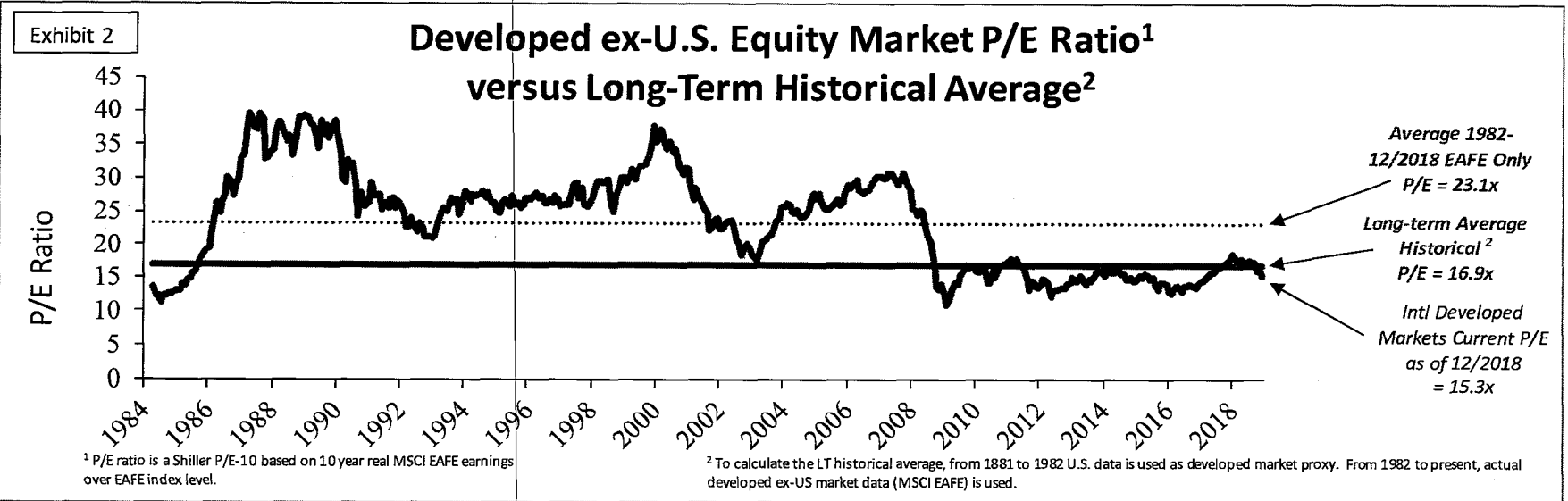
Growth Risk Visibility (Current Overall Sentiment)

Negative

Developed Public Equity Markets



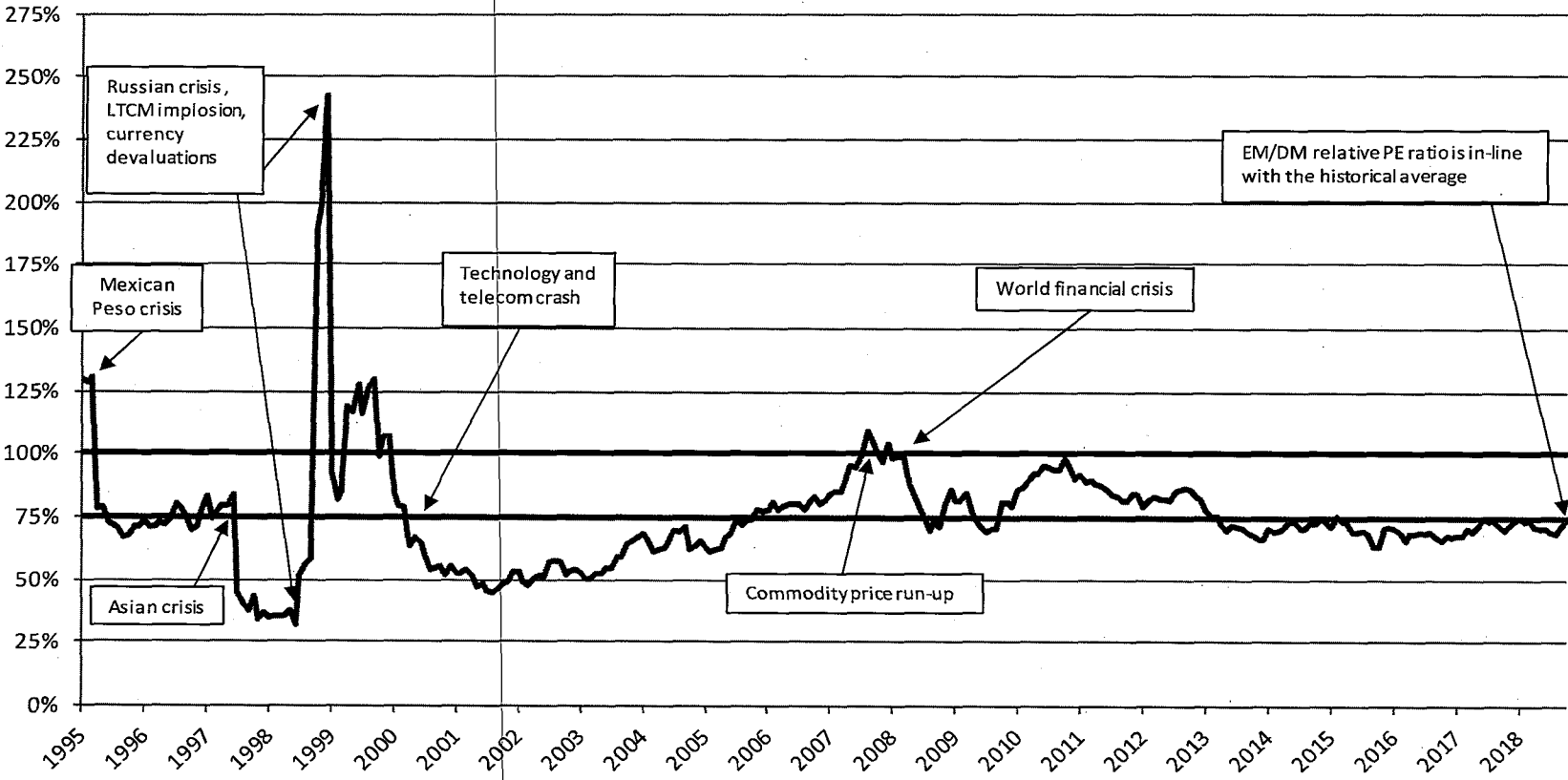
(Please note different time scales)



Emerging Markets Public Equity Markets

Exhibit 3

Emerging Markets PE / Developed Markets PE
(100% = Parity between PE Ratios)



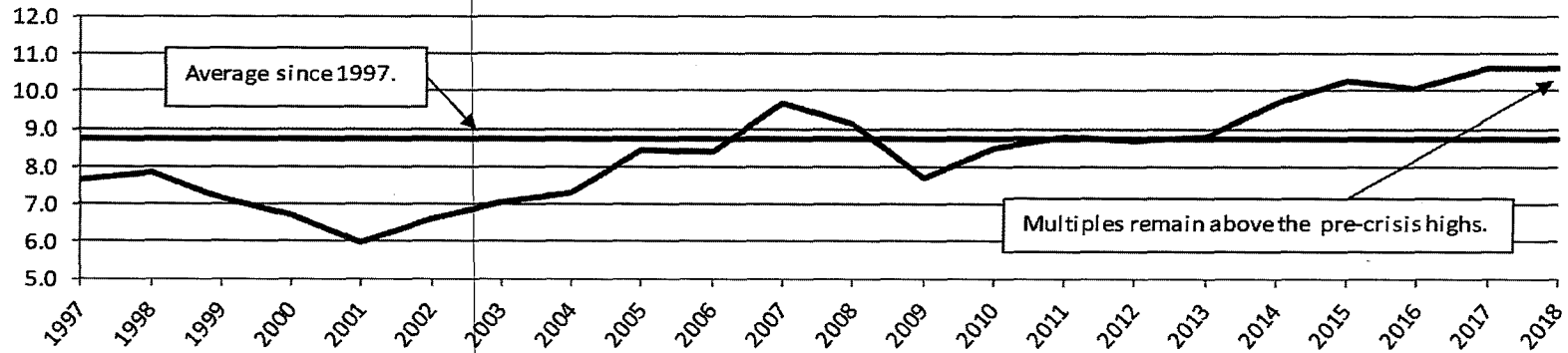
Source: Bloomberg, MSCI World, MSCI EMF

EM/DM PE Average EM/DM PE Parity

U.S. Private Equity Markets

Exhibit 4

Price to EBITDA Multiples Paid in LBOs

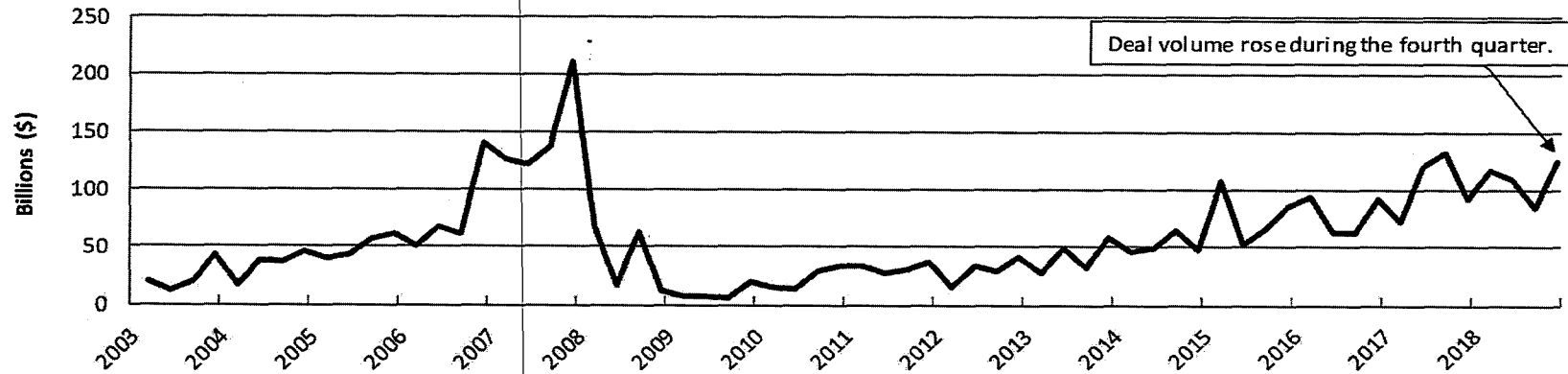


Source: S&P LCD study

(Please note different time scales)

Exhibit 5

Disclosed U.S. Quarterly Deal Volume*

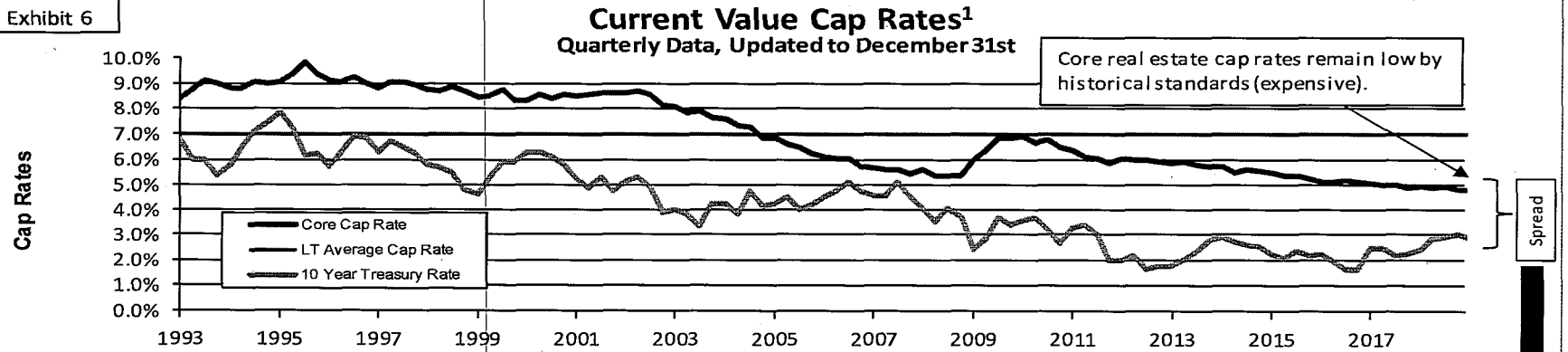


Source: Thomson Reuters Buyouts

* quarterly total deal size (both equity and debt)

Private Real Estate Markets

Exhibit 6



Source: NCREIF

¹A cap rate is the current annual income of the property divided by an estimate of the current value of the property. It is the current yield of the property. Low cap rates indicate high valuations.

Exhibit 7

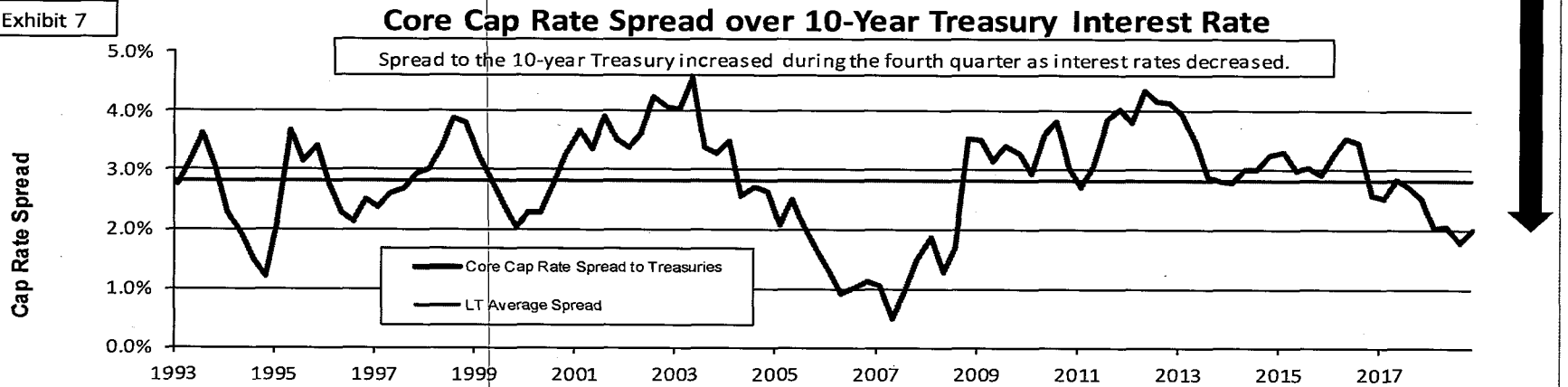
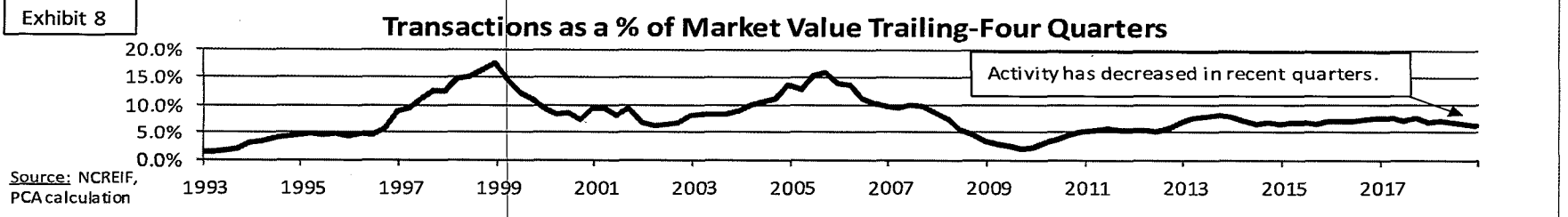


Exhibit 8

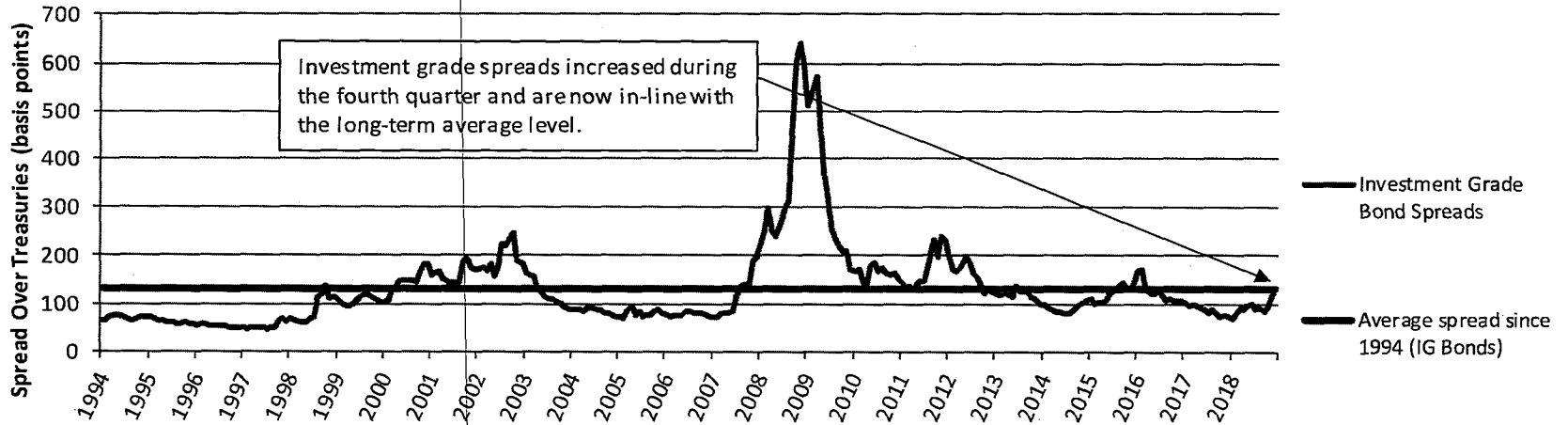


Source: NCREIF,
PCA calculation

Credit Markets U.S. Fixed Income

Exhibit 9

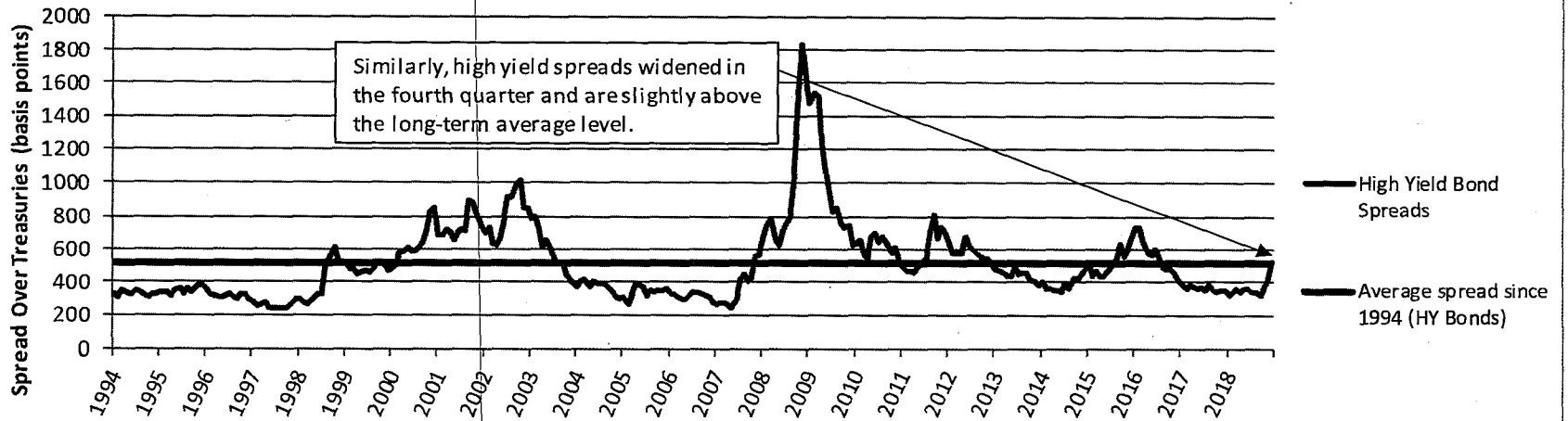
Investment Grade Corporate Bond Spreads



Source: LehmanLive: Barclays Capital US Corporate Investment Grade Index Intermediate Component.

Exhibit 10

High Yield Corporate Bond Spreads

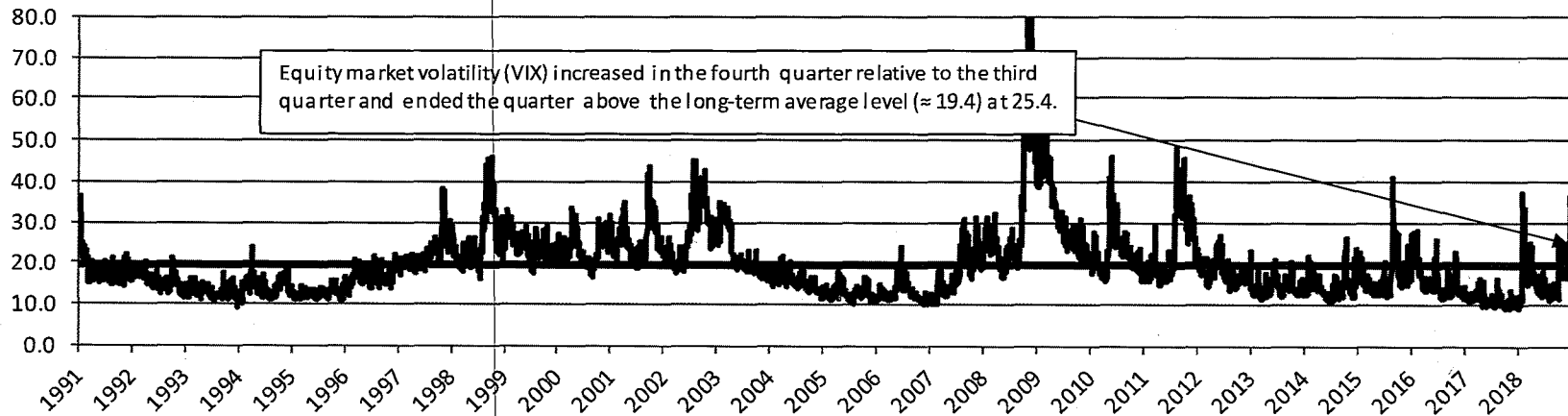


Source: LehmanLive: Barclays Capital U.S. Corporate High Yield Index.

Other Market Metrics

Exhibit 11

VIX - a measure of equity market fear / uncertainty

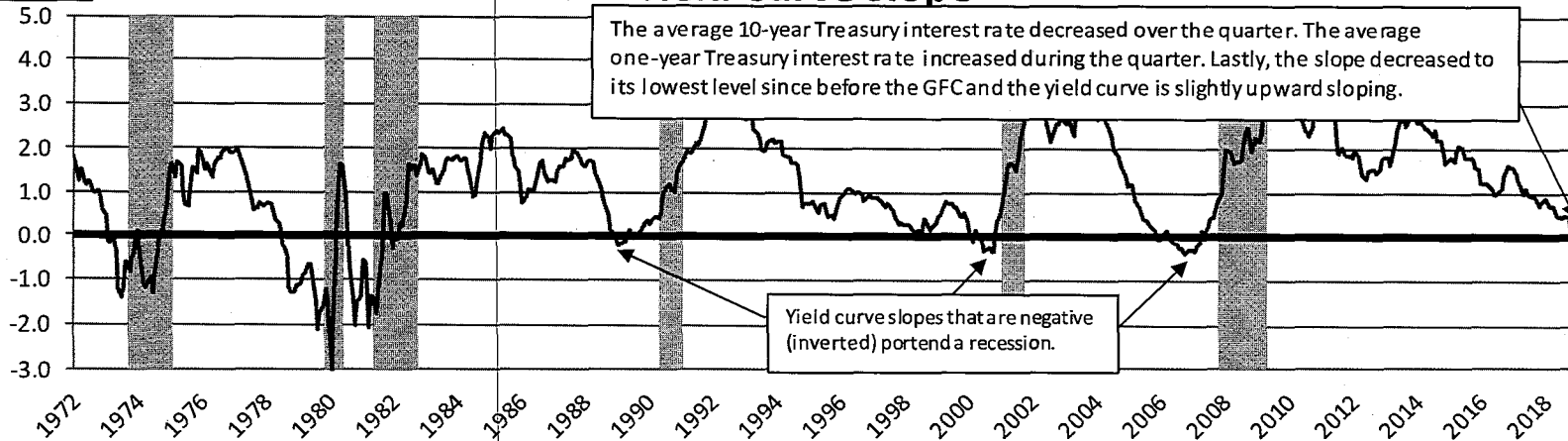


Source: <http://www.cboe.com/micro/vix/historical.aspx>

(Please note different time scales)

Exhibit 12

Yield Curve Slope



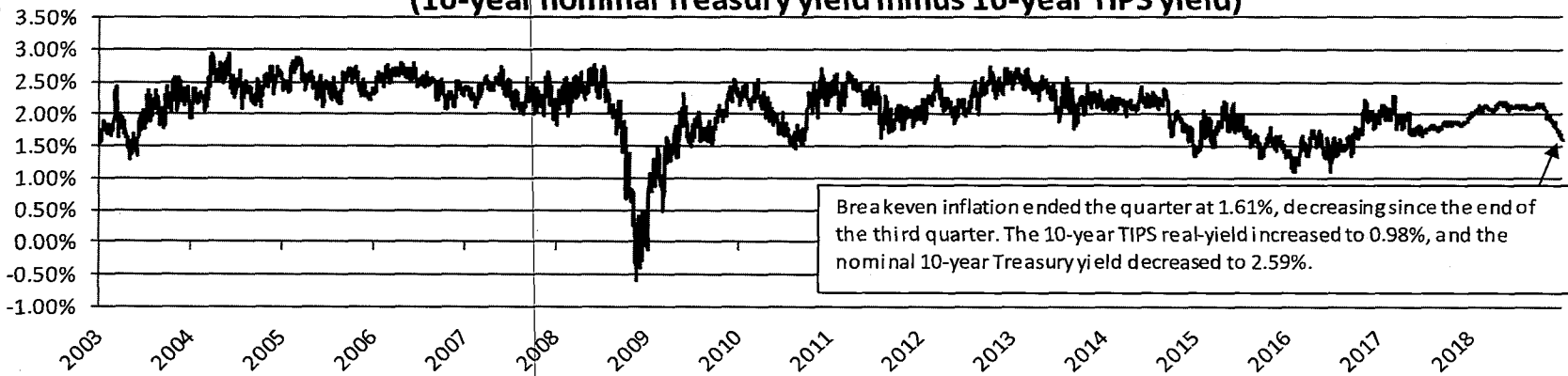
Source: www.ustreas.gov (10-year treasury yield minus 1-year treasury yield)

Recession Dating: NBER <http://www.nber.org/cycles.html>

Measures of Inflation Expectations

Exhibit 13

10-Year Breakeven Inflation (10-year nominal Treasury yield minus 10-year TIPS yield)



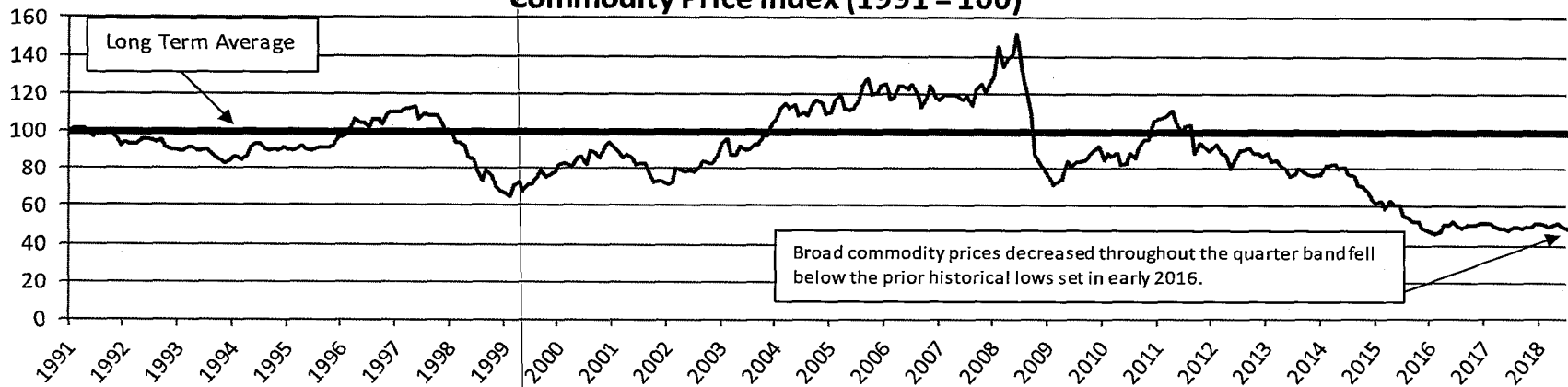
Source: www.ustreas.gov

Daily Yield Curve Rates (10-year nominal treasury yield minus 10-year TIPS yield)

(Please note different time scales)

Exhibit 14

Inflation Adjusted Bloomberg Commodity Price Index (1991 = 100)

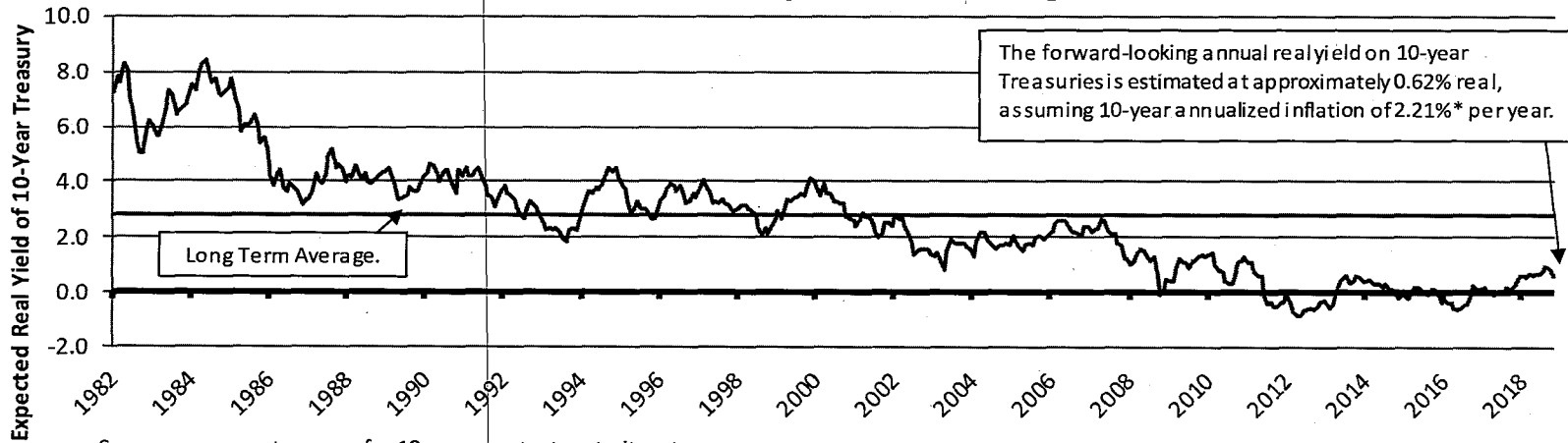


Source: Bloomberg Commodity Index, St. Louis Fed for US CPI all urban consumers.

Measures of U.S. Treasury Interest Rate Risk

Exhibit 15

Estimate of 10-Year Treasury Forward-Looking Real Yield

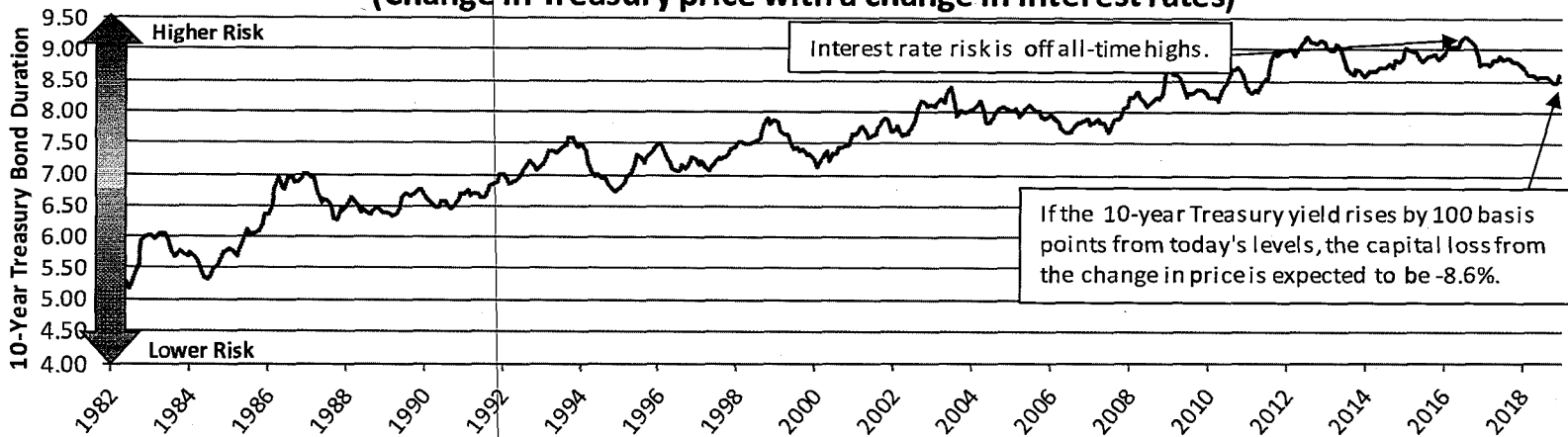


Sources: www.ustreas.gov for 10-year constant maturity rates

*Federal Reserve Bank of Philadelphia survey of professional forecasts for inflation estimates

Exhibit 16

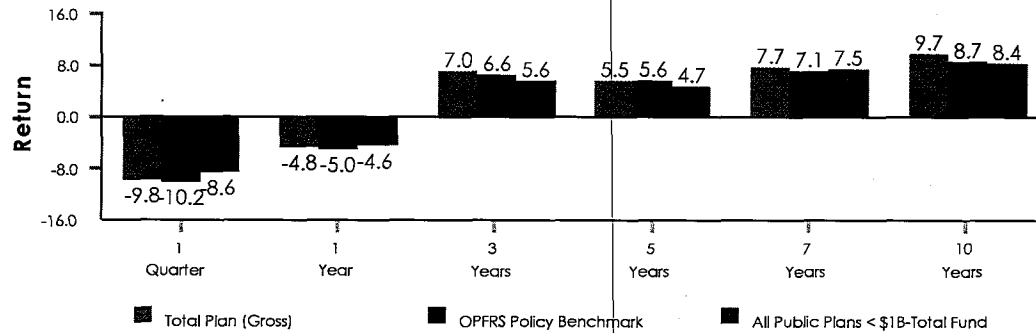
10-Year Treasury Duration (Change in Treasury price with a change in interest rates)



Source: www.ustreas.gov for 10-year constant maturity rates, calculation of duration

Performance and Market Values As of December 31, 2018

Investment Performance



Portfolio Valuation (000's)

	1 Quarter	1 Year
OPFRS Total Plan		
Beginning Market Value	391,498	380,459
Net Contributions	-3,180	-12,777
Gain/Loss	-38,264	-17,629
Ending Market Value	350,053	350,053

Asset Class Performance (gross of fees)

	1 Quarter	1 Year	3 Years	5 Years	7 Years	10 Years
OPFRS Total Plan	-7.3	-4.8	7.0	5.5	7.7	9.7
OPFRS Policy Benchmark*	-10.2	-5.0	6.6	5.6	7.1	8.7
Excess Return	0.4	0.2	0.4	0.1	0.6	1.0
Domestic Equity	-15.6	-6.4	8.9	7.7	12.3	13.6
Russell 3000 (Blend)**	-14.3	-5.2	9.0	7.9	12.5	13.2
Excess Return	-1.3	-1.2	-0.1	-0.2	-0.2	0.4
International Equity	-13.1	-15.2	4.4	1.6	6.2	7.5
MSCI ACWI Ex US (Blend)^	-11.4	-13.8	5.0	1.1	5.3	7.1
Excess Return	-1.7	-1.4	-0.6	0.5	0.9	0.4
Fixed Income	1.0	0.4	3.4	3.2	2.9	5.5
Bloomberg Barclays Universal (Blend)^^	1.2	-0.3	2.6	2.7	2.5	4.1
Excess Return	-0.2	0.7	0.8	0.5	0.4	1.4
Crisis Risk Offset	-10.0	-	-	-	-	-
SG Multi Alternative Risk Premia	-0.6	-	-	-	-	-
Excess Return	-9.4	-	-	-	-	-
Covered Calls	-11.0	-4.8	6.6	-	-	-
CBOE BXM	-10.8	-4.8	4.8	-	-	-
Excess Return	-0.2	0.0	1.8	-	-	-
Cash	0.6	1.9	1.2	0.7	0.5	-
FTSE 3 Month T-Bill	0.6	1.9	1.0	0.6	0.5	-
Excess Return	0.0	0.0	0.2	0.1	0.0	-

* Starting on 5/1/2016, Policy Benchmark consists of 48% Russell 3000, 12% MSCI ACWI ex U.S., 20% BC Universal, 20% CBOE BXM

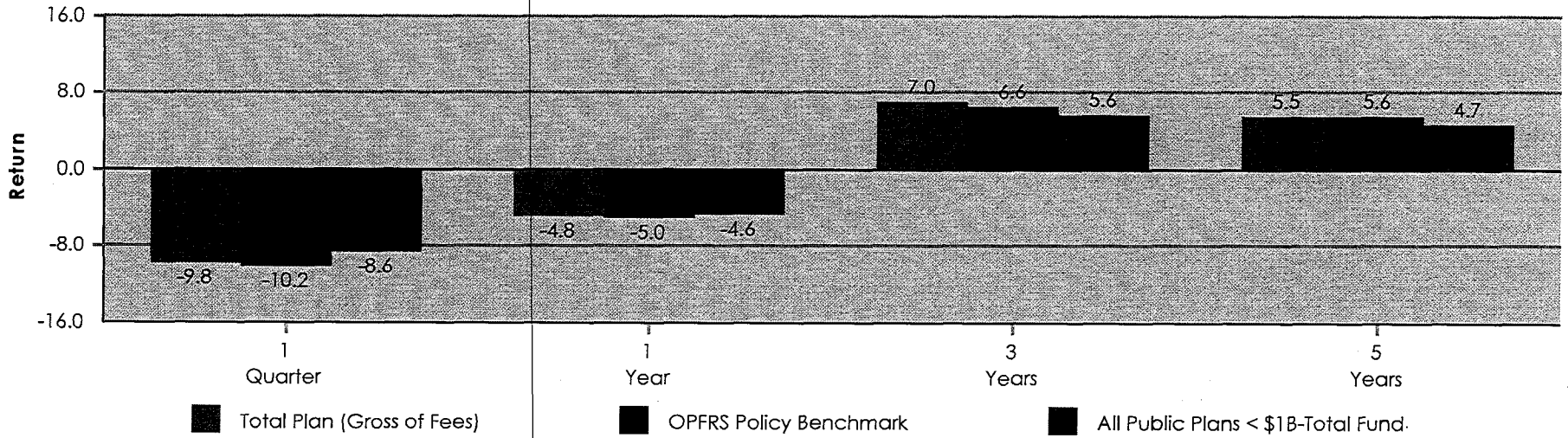
** Domestic Equity Benchmark consists of S&P 500 thru 3/31/98, 10% R1000, 20% R1000V, 5% RMC from 4/1/98 - 12/31/04, and Russell 3000 from 1/1/05 to present

^ International Equity Benchmark consists of MSCI EAFE thru 12/31/04, and MSCI ACWI x US thereafter.

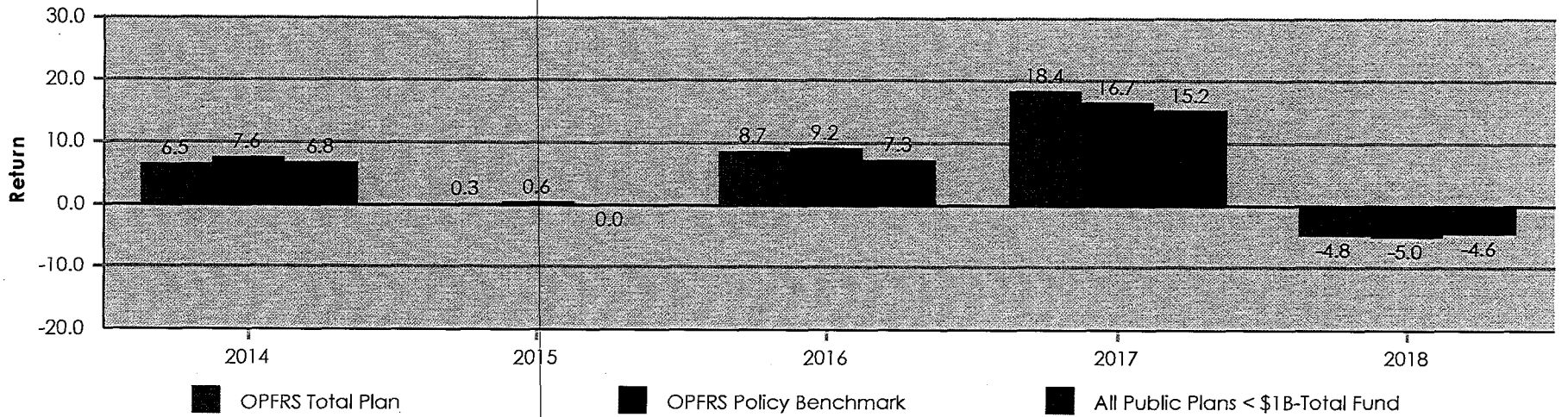
^^ Fixed Income Benchmark consists of Bbg BC Aggregate prior to 4/1/06, and Bbg BC Universal thereafter.

OPFRS Portfolio Relative Performance Results
As of December 31, 2018

Trailing Period Performance (annualized)



12-month Performance- As of December 31, 2018



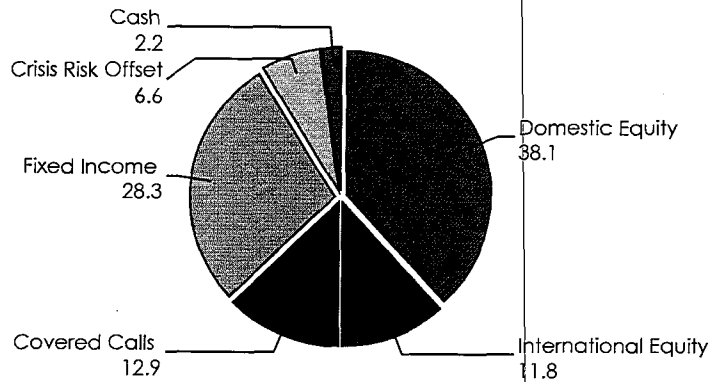
Actual vs. Target Allocation
As of December 31, 2018

	Asset Allocation (\$000)	Asset Allocation (%)	Target Allocation* (%)	Variance (%)
OPFRS Total Plan	350,053	100.0	100.0	0.0
Domestic Equity	133,534	38.1	40.0	-1.9
International Equity	41,411	11.8	12.0	-0.2
Total Fixed Income	99,109	28.3	33.0	-4.7
Covered Calls	45,110	12.9	5.0	7.9
Crisis Risk Offset	23,187	6.6	10.0	-3.4
Cash	7,701	2.2	0.0	2.2

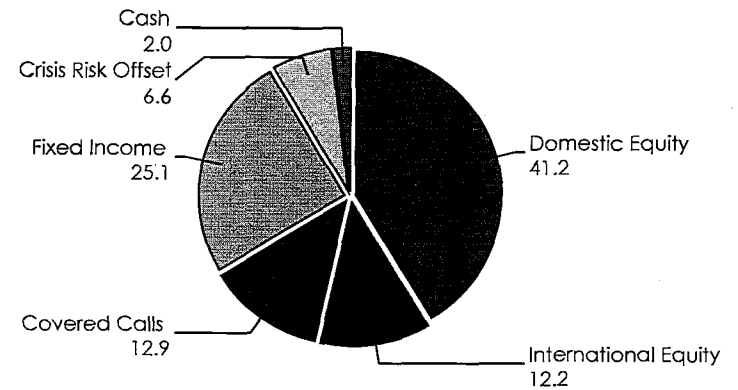
*Target weightings reflect the Plan's evolving asset allocation (effective 3/31/2014).

Actual Asset Allocation Comparison

December 31, 2018 : \$350,053,340



September 30, 2018 : \$391,497,604



Manager Performance - Gross of Fees
As of December 31, 2018

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	72,965	-13.8	-4.7	9.0	8.2	12.4	06/2010
Russell 1000 Index		-13.8	-4.8	9.1	8.2	12.4	
Excess Return		0.0	-0.1	-0.1	0.0	0.0	
Large Cap Value							
SSgA Russell 1000 Value Index	7,287	-11.7	-8.2	7.0	---	4.7	11/2014
Russell 1000 Value Index		-11.7	-8.3	7.0	---	4.6	
Excess Return		0.0	-0.1	0.0	---	-0.1	
Large Cap Growth							
SSgA Russell 1000 Growth Index	8,338	-15.9	-1.5	11.2	---	9.9	11/2014
Russell 1000 Growth Index		-15.9	-1.5	11.1	---	9.9	
Excess Return		0.0	0.0	-0.1	---	0.0	
Mid Cap Core							
EARNEST Partners - Active	25,676	-16.7 (42)	-9.7 (37)	9.9 (8)	8.2 (19)	8.2 (26)	04/2006
Russell Midcap Index		-15.4	-9.1	7.0	6.3	7.3	
Excess Return		-1.3	-0.6	2.9	1.9	0.9	
Small Cap Value							
NWQ - Active	8,203	-21.3 (83)	-17.8 (81)	4.4 (80)	3.9 (57)	6.1 (82)	02/2006
Russell 2000 Value Index		-18.7	-12.9	7.4	3.6	5.4	
Excess Return		-2.6	-4.9	-3.0	-0.3	0.7	
Small Cap Growth							
Rice Hall James - Active	11,066	-22.0 (69)	-6.2 (61)	---	---	3.7 (54)	07/2017
Russell 2000 Growth Index		-21.7	-9.3	---	---	0.5	
Excess Return		-0.3	3.1	---	---	3.2	

Over the latest three-month period ending December 31, 2018, all three of OPFRS's active Domestic Equity managers underperformed their respective benchmarks.

All of OPFRS's passive Domestic Equity mandates continue to perform in-line with 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, 2018

Domestic Equity

SSgA Russell 1000 Value, the Plan's passive large cap value account, has continued to perform within expectations for a passive mandate.

SSgA Russell 1000 Growth, the Plan's passive large cap growth account, has continued to perform within expectations for a passive mandate.

EARNEST Partners, the Plan's mid cap core manager, underperformed its Russell Midcap benchmark by (1.3%), placing it in the 42nd percentile of its peer group. The portfolio has also underperformed its benchmark over the 1-year period by (0.6%) but continues to outperform over the 3- and 5-year periods by 2.9% and 1.9% respectively.

NWQ, the Plan's small cap value manager, underperformed the Russell 2000 Value Index by (2.6%) over the latest quarter, placing the portfolio in the 83rd percentile of its peer group. NWQ has also underperformed over the 1- and 3-year periods by (4.9%) and (3.0%), respectively. NWQ continues to outperform its benchmark over the 5-year period by 0.3% with an annualized return of 3.9%.

Rice Hall James, the Plan's small cap growth manager, underperformed its Russell 2000 Growth benchmark over the most recent quarter by (0.3%), placing the portfolio in the 69th percentile of its peer group. The portfolio was down (6.2%) over the most recent 1-year period but did outperform its benchmark by 3.1%.

Manager Performance - Gross of Fees
As of December 31, 2018

International Equity

Manager - Style	Mkt Value (\$000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Active International							
Fisher Investments	14,306	-13.3 (57)	-15.5 (65)	3.9 (33)	1.6 (41)	2.9 (82)	04/2011
MSCI AC World ex USA		-11.4	-13.8	5.0	1.1	2.4	
Excess Return		-1.9	-1.7	-1.1	0.5	0.5	
Hansberger	14,150	-13.5 (38)	-16.5 (74)	5.8 (26)	2.3 (48)	3.6 (73)	02/2006
MSCI AC World ex USA		-11.4	-13.8	5.0	1.1	3.2	
Excess Return		-2.1	-2.7	0.8	1.2	0.4	
Passive International							
SSgA	12,955	-12.5	-13.5	3.2	0.9	6.5	08/2002
MSCI EAFE Index		-12.5	-13.4	3.4	1.0	6.5	
Excess Return		0.0	-0.1	-0.2	-0.1	0.0	

Over the latest three-month period ending December 31, 2018, both of OPFRS's two active International Equity managers underperformed their respective benchmark.

The **SSgA** account has performed roughly in-line with its benchmark over all time periods measured. This performance is within expectations for a passive mandate.

Hansberger, one of OPFRS' active international equity managers, underperformed the MSCI ACWI x US Index during the quarter by (2.1%), placing the fund in the 38th percentile of its peer group. Over the 12-month period, Hansberger underperformed its benchmark by (2.7%) with an absolute return of (16.5%). Hansberger continues to outperform over the 3- and 5-year periods with excess returns of 0.8% and 1.2%, respectively.

Fisher, one of OPFRS' active international equity managers, underperformed the MSCI ACWI x US Index by (1.9%) during the quarter, ranking the fund in the 57th percentile of its peer group. Over the most recent 1- and 3-year periods, Fisher has underperformed its benchmark by (1.7%) and (1.1%), respectively, but continues to outperform by 0.5% over the five year period.

Manager Performance - Gross of Fees

As of December 31, 2018

Fixed Income

Manager - Style	Mkt Value (\$000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Core Fixed Income							
Ramirez	68,493	1.0 (81)	-0.1 (73)	---	---	2.5 (15)	01/2017
Blmbg. Barc. U.S. Aggregate Index		1.6	0.0	---	---	1.8	
Excess Return		-0.6	-0.1	---	---	-0.7	
Core-Plus Fixed Income							
Reams	23,000	2.5 (1)	1.5 (3)	2.9 (60)	2.8 (68)	5.5 (47)	02/1998
Bbg Barclays Universal (Hybrid)		1.2	-0.3	2.6	2.7	4.8	
Excess Return		1.3	1.8	0.3	0.1	0.7	
High Yield / Bank Loans							
DDJ Capital	7,616	-3.4 (29)	0.6 (21)	9.3 (6)	---	5.8 (5)	02/2015
ICE BofAML High Yield Master II		-4.7	-2.3	7.3	---	4.1	
Excess Return		1.3	2.9	2.0	---	1.7	

Over the latest three-month period, ending December 31, 2018, two of OPFRS's three active Fixed Income managers outperformed their respective benchmarks.

Ramirez, the Plan's core fixed income manager, returned 1.0% compared to the benchmark return of 1.6% during the quarter. Over the 1-year period, Ramirez has slightly underperformed its benchmark by (0.1%) and ranked in the 73rd percentile of its peer group.

Reams, the Plan's core plus fixed income manager, outperformed its benchmark by 1.3% during the quarter and ranked in the top percentile of its peer group. Strong recent performance has allowed Reams to outperform its benchmark over the 1-, 3-, and 5-year periods by 1.8%, 0.3% and 0.1%, respectively.

DDJ, the Plan's High Yield & Bank Loan manager, returned (3.4%) during the most recent quarter while outperforming its benchmark by 1.3% and ranking in the 29th percentile of its peer group. DDJ has also outperformed over the 1- and 3-year periods by 2.9% and 2.0%, respectively.

Manager Performance - Gross of Fees
As of December 31, 2018

Covered Calls

Manager - Style	Mkt Value (\$000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Covered Calls Composite							
Covered Calls	45,110	-11.0	-4.8	6.6	—	6.2	04/2014
CBOE BXM		-10.8	-4.8	4.8	—	4.8	
Excess Return		-0.2	0.0	1.8	—	1.4	
CC - Passive Allocation							
Parametric BXM	22,745	-9.0	-3.9	5.8	—	5.6	04/2014
CBOE BXM		-10.8	-4.8	4.8	—	4.8	
Excess Return		1.8	0.9	1.0	—	0.8	
CC - Active Allocation							
Parametric DeltaShift	22,366	-12.9	-5.8	7.4	—	7.5	04/2014
CBOE BXM		-10.8	-4.8	4.8	—	4.8	
Excess Return		-2.1	-1.0	2.6	—	2.7	

During the latest three-month period ending December 31, 2018, OPFRS' aggregate Covered Calls portfolio underperformed its benchmark by (0.2%).

Parametric BXM Portfolio, the Plan's passive covered calls allocation outperformed its CBOE BXM index by 1.8% over the most recent quarter. Over the most recent 1-year period the portfolio has outperformed by 0.9% and has also outperformed over the 3-year period by 1.0%.

Parametric Delta Shift Portfolio, the Plan's active covered calls allocation has underperformed the CBOE BXM benchmark by (2.1%) over the most recent quarter and has underperformed by (1.0%) over the 1-year period. The portfolio continues to outperform over the 3-year period with an annualized 7.4% absolute return.

Manager Performance - Gross of Fees
As of December 31, 2018

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	23,187	-10.0	—	—	—	-7.0	09/2018
CRO Composite Benchmark		-0.6	---	---	---	-0.4	
Excess Return		-9.4	---	---	---	-6.6	
CRO - Risk Premia / Trend Following							
Parametric S.A.R.P.	23,187	-10.0	—	—	—	-7.0	09/2018
SG Multi Alternative Risk Premia		-0.6	---	---	---	-0.4	
Excess Return		-9.4	---	---	---	-6.6	
CRO - Long Duration							
Pending Long Duration Manager	—	—	—	—	—	—	12/2018

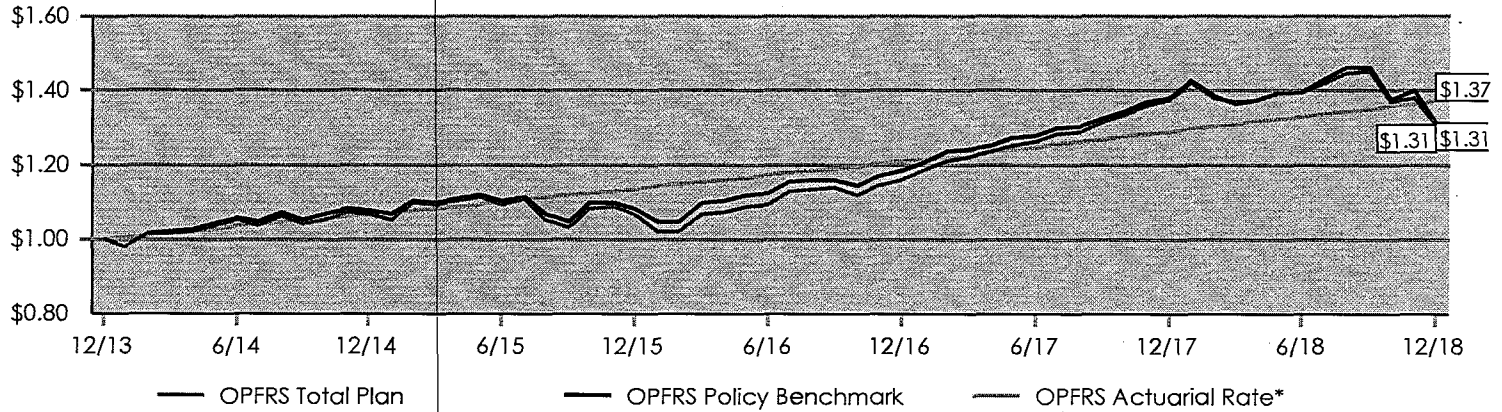
During the latest three-month period ending December 31, 2018, OPFRS's partially funded aggregate Crisis Risk Offset portfolio underperformed its benchmark by (9.4%).

Parametric Systematic Alternative Risk Premia, the Plan's Risk Premia / Trend Following manager underperformed its benchmark by (9.4%) during its first full quarter in the portfolio. The portfolio's negative return was due almost entirely to its long positions in commodities markets which suffered heavy losses during the quarter.

Pending Long Duration Manager, the Plan's Long Duration manager remains unfunded pending upcoming discussions with OPFRS's current fixed income managers.

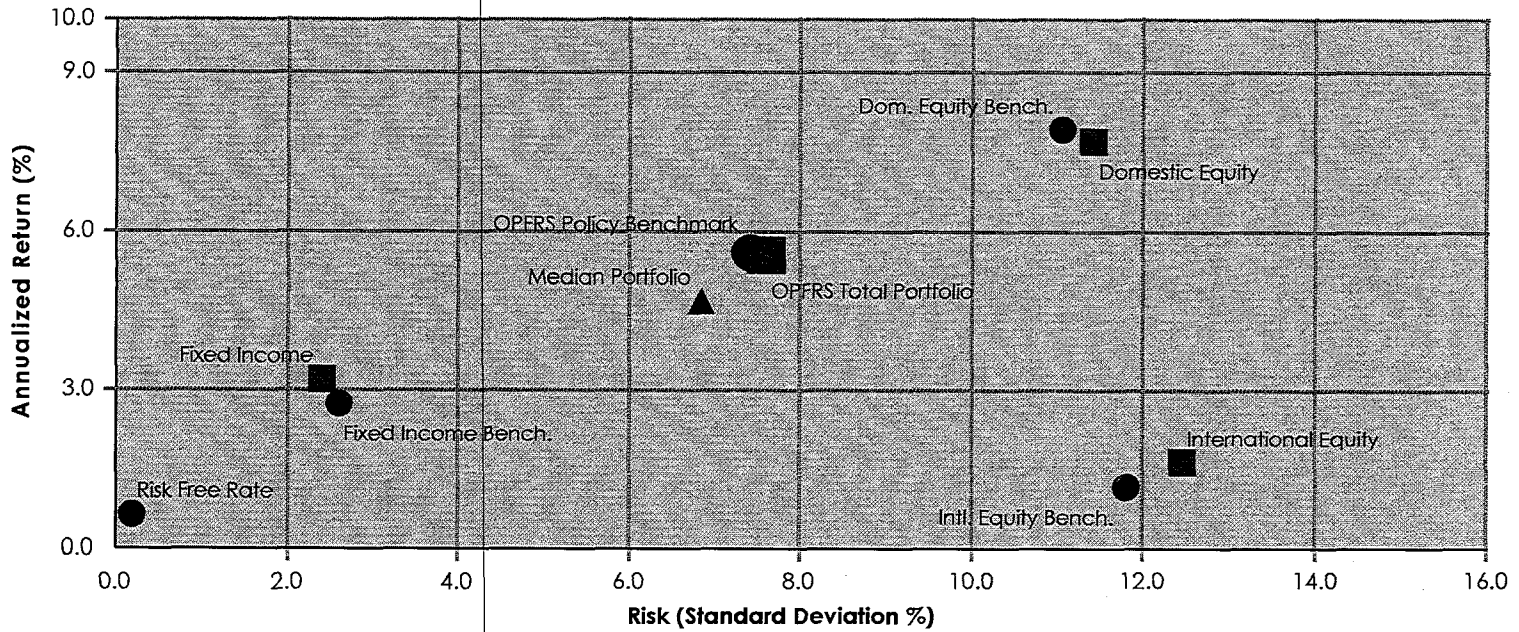
OPFRS Total Portfolio 5-Year Performance
As of December 31, 2018

Growth of \$1 (5-year)

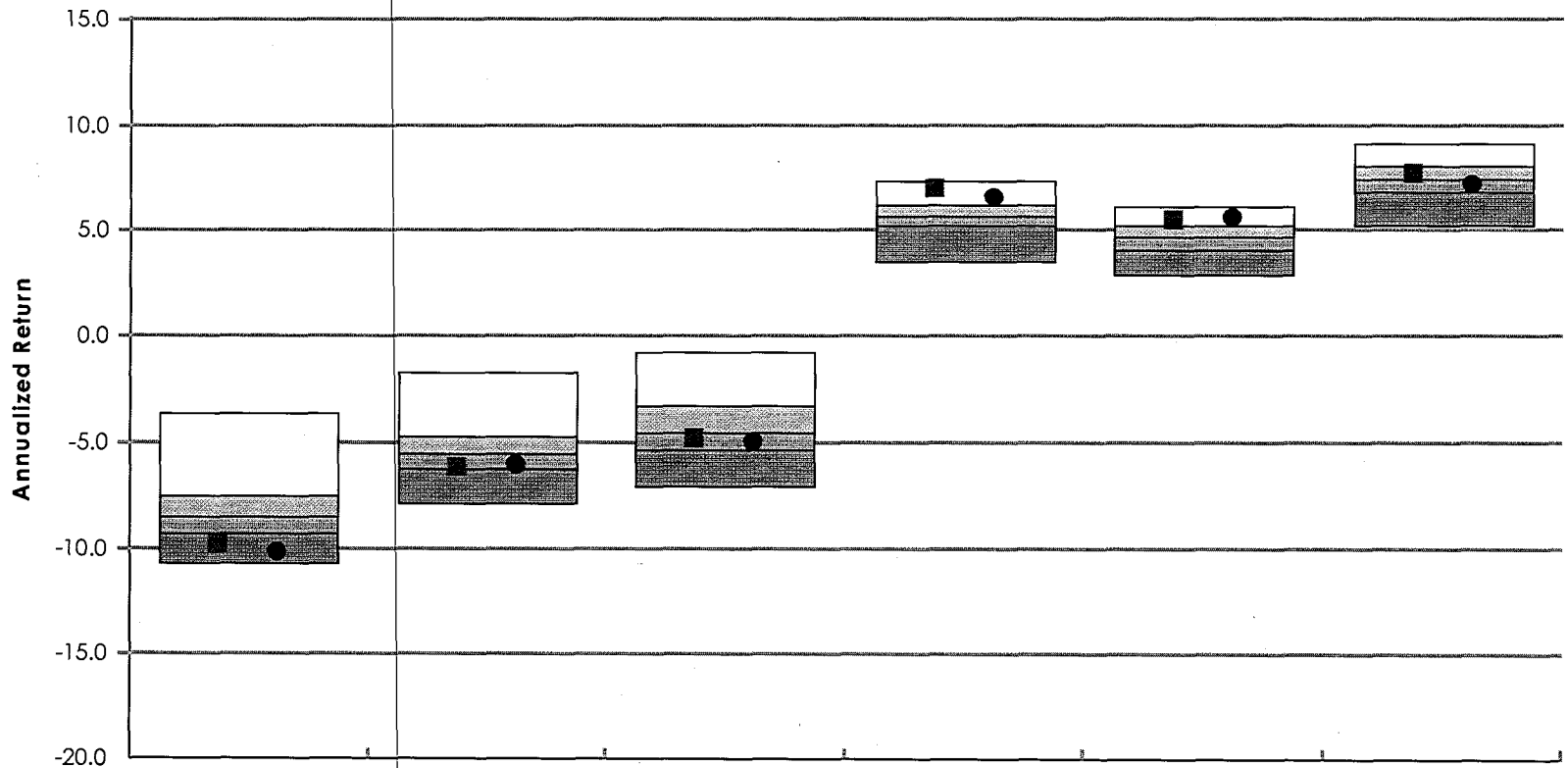


* The actuarial expected rate of return was 8% through 6/30/2009, 7.5% through 6/30/2010, 7% through 6/30/2011, 6.75% through 6/30/2014, and 6.5% currently

Risk/Return Performance (5-year)

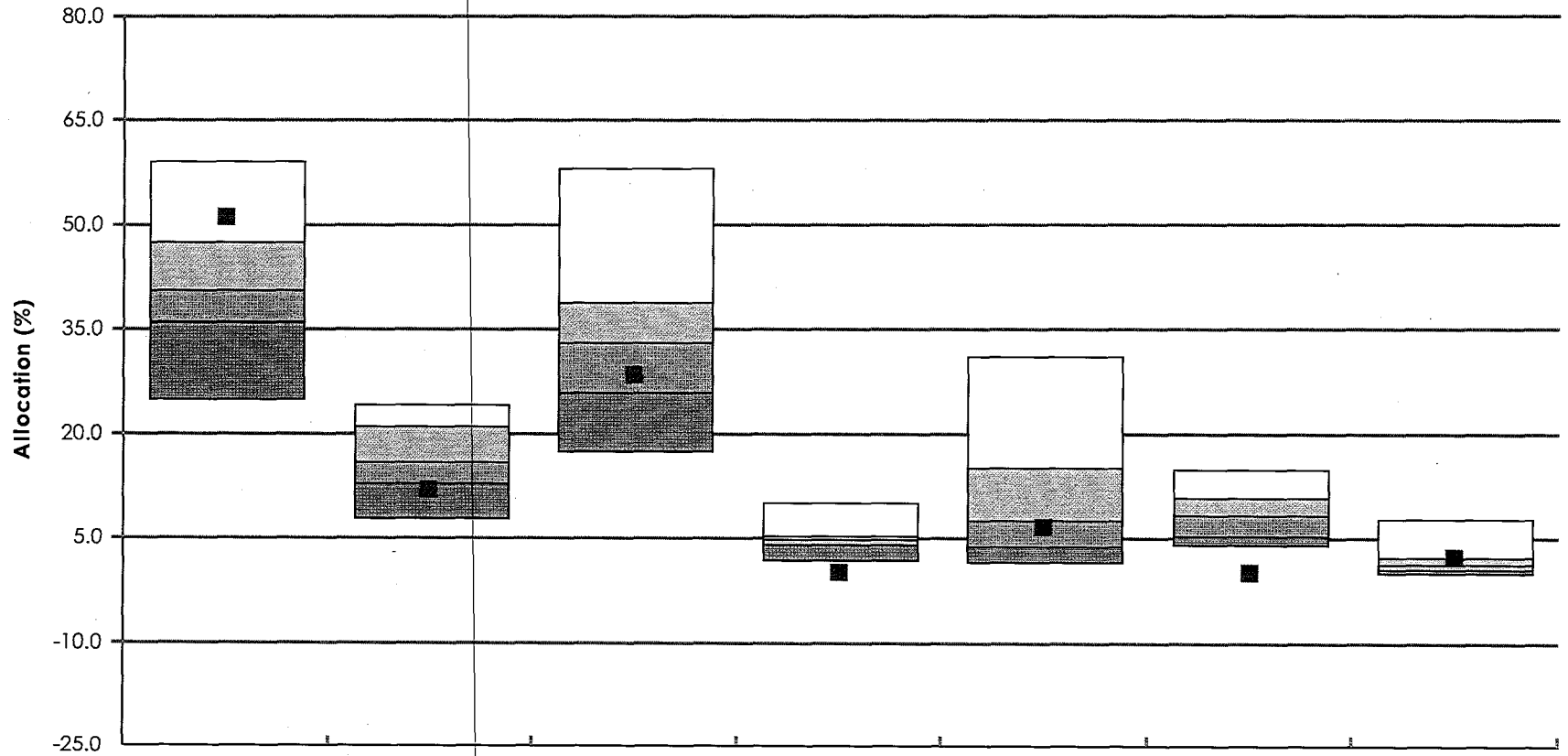


Plan Sponsor Peer Group Analysis
As of December 31, 2018



	1 Quarter	Fiscal YTD	1 Year	3 Years	5 Years	7 Years
■ OPFRS Total Plan	-9.8 (89)	-6.2 (73)	-4.8 (61)	7.0 (10)	5.5 (14)	7.7 (41)
● OPFRS Policy Benchmark	-10.2 (92)	-6.2 (73)	-5.0 (67)	6.6 (16)	5.6 (13)	7.1 (62)
5th Percentile	-3.7	-1.7	-0.7	7.3	6.1	9.1
1st Quartile	-7.6	-4.7	-3.4	6.2	5.2	8.0
Median	-8.6	-5.5	-4.6	5.6	4.7	7.5
3rd Quartile	-9.3	-6.3	-5.4	5.2	4.0	6.8
95th Percentile	-10.8	-7.9	-7.1	3.5	2.9	5.2
Population	426	425	423	412	400	387

**Plan Sponsor TF Asset Allocation
As of December 31, 2018**



	US Equity	Intl. Equity	US Fixed Income	Intl. Fixed Income	Alternative Inv.	Real Estate	Cash
■ OPFRS Total Plan	51.0 (14)	11.8 (80)	28.3 (69)	0.0	6.6 (57)	0.0	2.2 (28)
5th Percentile	59.0	24.0	58.0	10.1	30.9	14.9	7.8
1st Quartile	47.3	20.8	38.9	5.4	15.1	10.8	2.4
Median	40.5	15.8	33.1	4.8	7.6	8.4	1.4
3rd Quartile	36.1	12.8	25.7	4.1	3.9	5.4	0.4
95th Percentile	24.8	7.9	17.3	1.9	1.5	4.0	0.1
Population	561	526	562	126	95	277	510

Parentheses contain percentile rankings.
Calculation based on monthly periodicity.

Monitoring/Probation Status

As of December 31, 2018

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*
Hansberger	On Watch	Organizational	13	-13.3%	64	11/30/2017
MSCI ACWI ex-USA	—	—	13	-11.0%	—	—
NWQ	On Watch	Organizational	11	-16.2%	81	1/31/2018
Russell 2000 Value	—	—	11	-12.7%	—	—

[^]. 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**

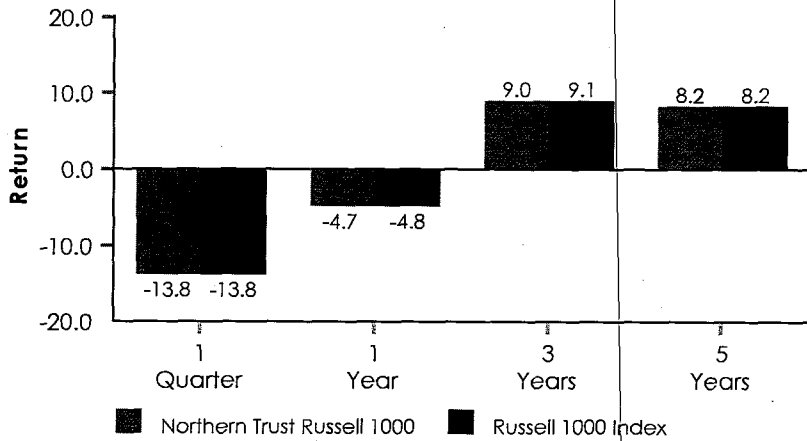
Asset Class	Short-term (rolling 12 mth periods)	Medium-term (rolling 36 mth periods)	Long-term (60 + months)
Active Domestic Equity	Fd return < bench return - 3.5%	Fd annlzd return < bench annlzd return - 1.75% for 6 consecutive months	VRR < 0.97 for 6 consecutive months
Active International Equity	Fd 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.

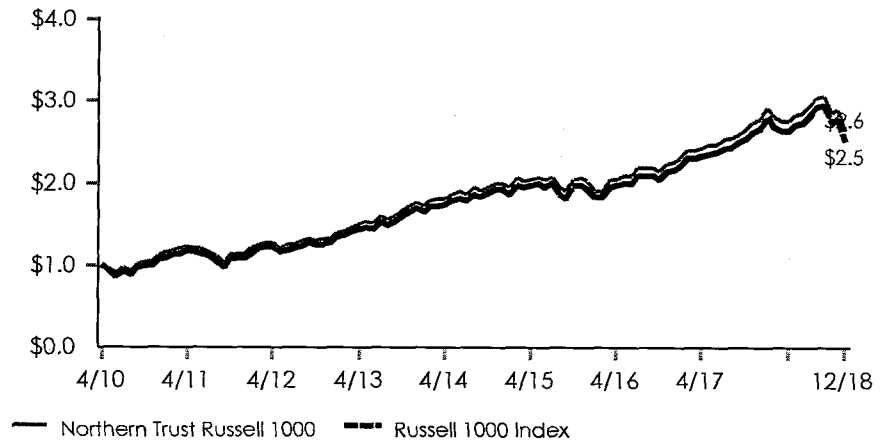
Northern Trust Russell 1000 - gross of fees
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Northern Trust Russell 1000	0.82	0.97	0.33	0.95	1.35	0.99	99.53	95.23	05/01/2010
Russell 1000 Index	0.00	1.00	-	0.89	0.00	1.00	100.00	100.00	05/01/2010

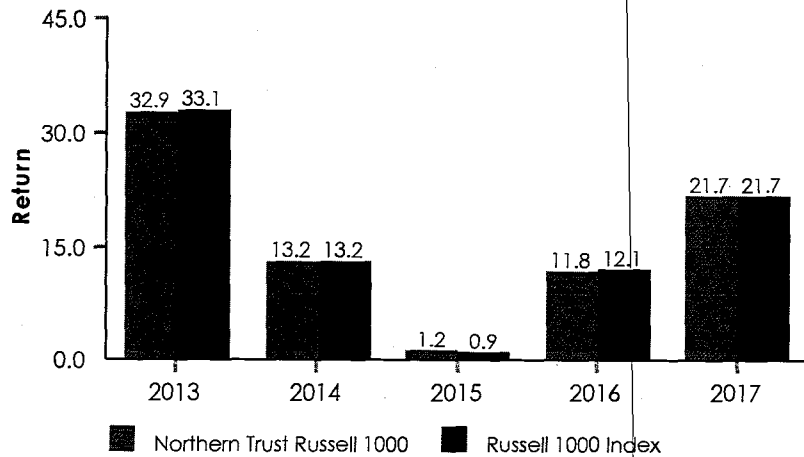
Trailing Period Performance



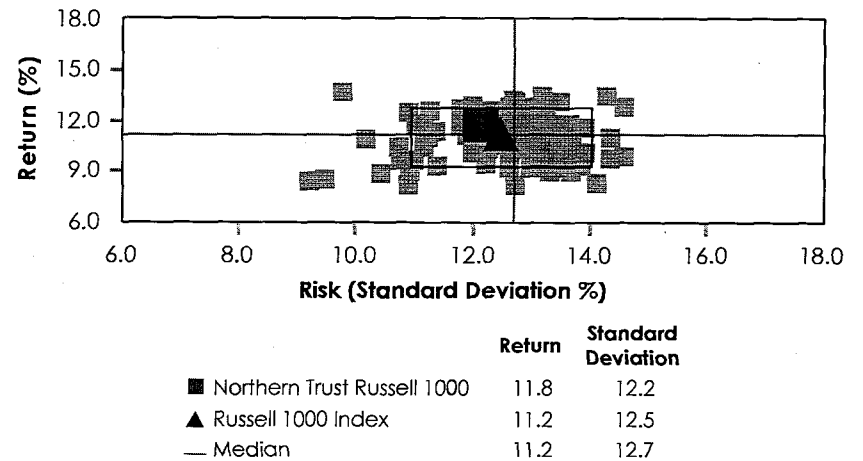
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

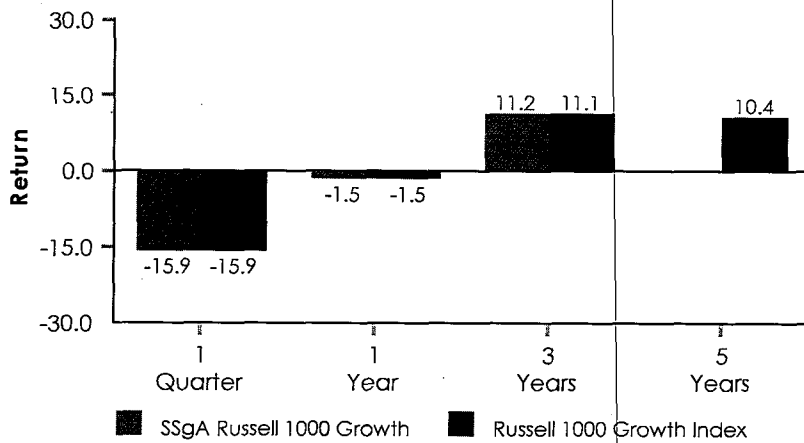


SSgA Russell 1000 Growth - gross of fees

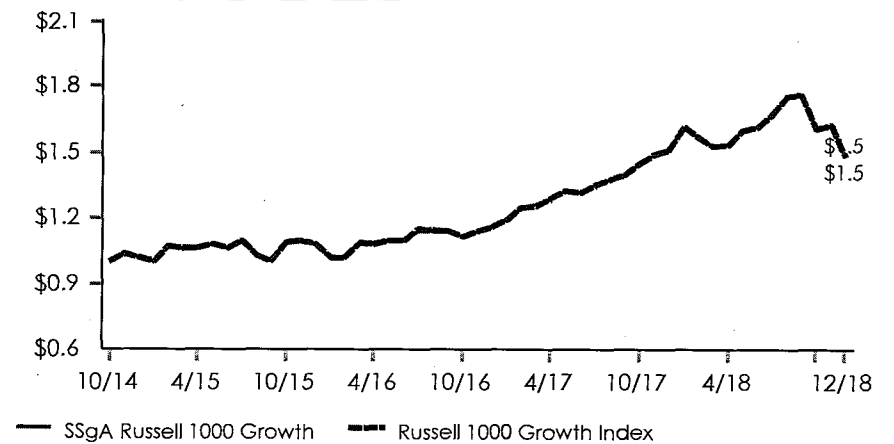
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
SSgA Russell 1000 Growth	0.01	1.00	0.14	0.77	0.04	1.00	100.00	99.96	11/01/2014
Russell 1000 Growth Index	0.00	1.00	-	0.77	0.00	1.00	100.00	100.00	11/01/2014

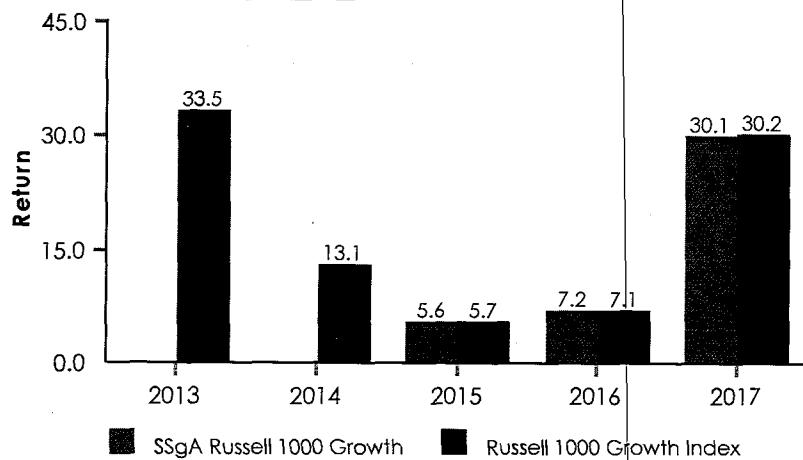
Trailing Period Performance



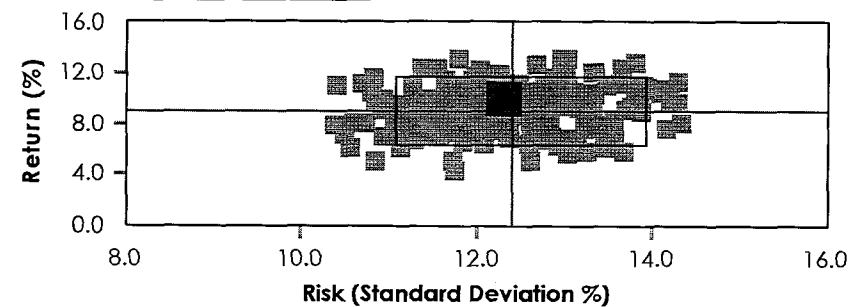
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

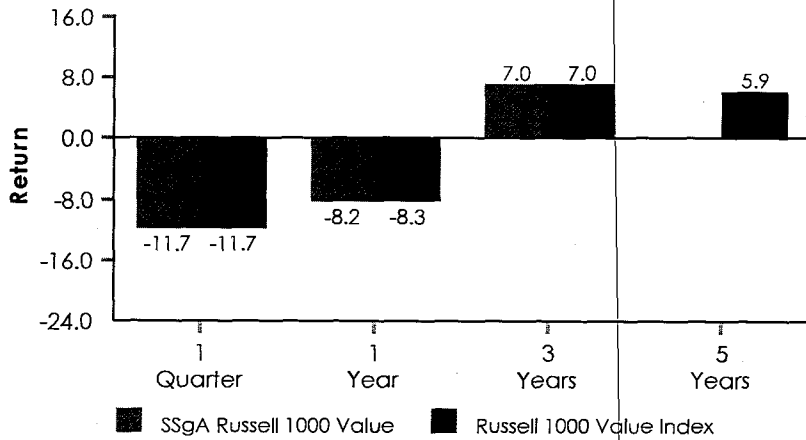


SSgA Russell 1000 Value - gross of fees

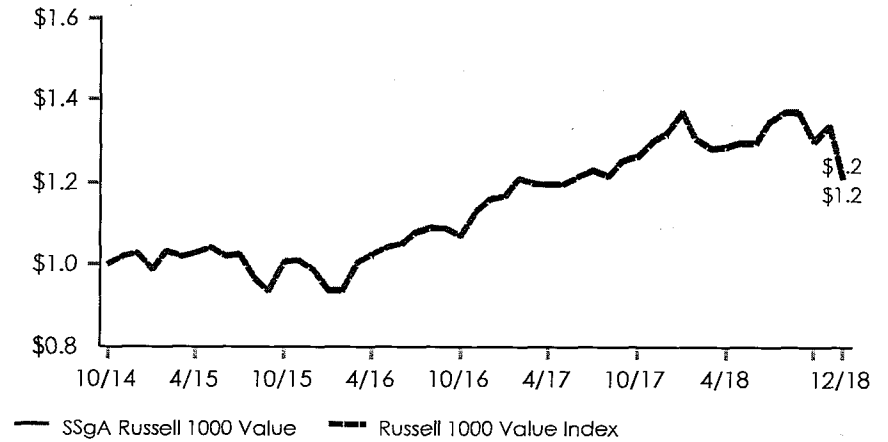
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
SSgA Russell 1000 Value	0.10	1.00	1.40	0.41	0.07	1.00	100.25	99.57	11/01/2014
Russell 1000 Value Index	0.00	1.00	-	0.40	0.00	1.00	100.00	100.00	11/01/2014

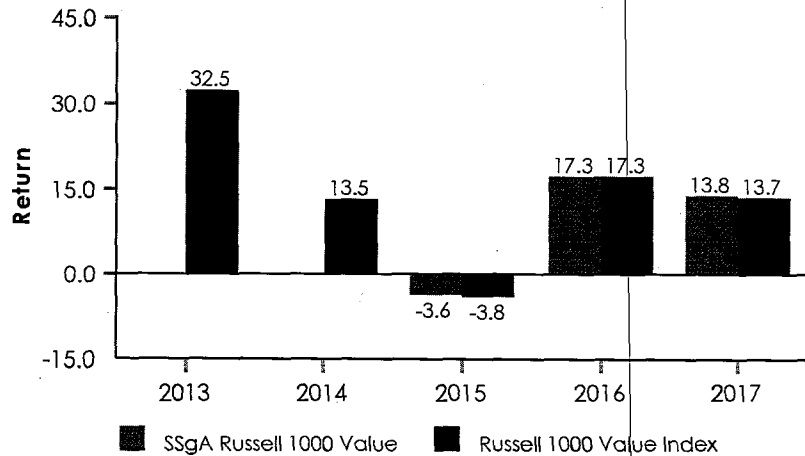
Trailing Period Performance



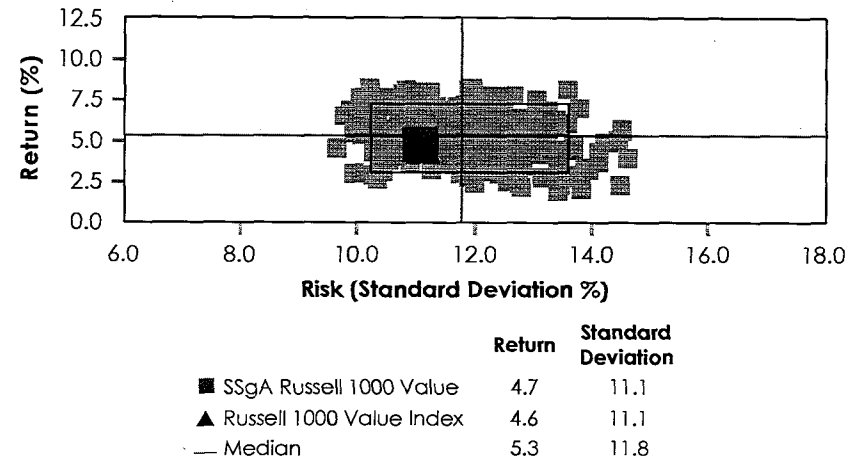
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

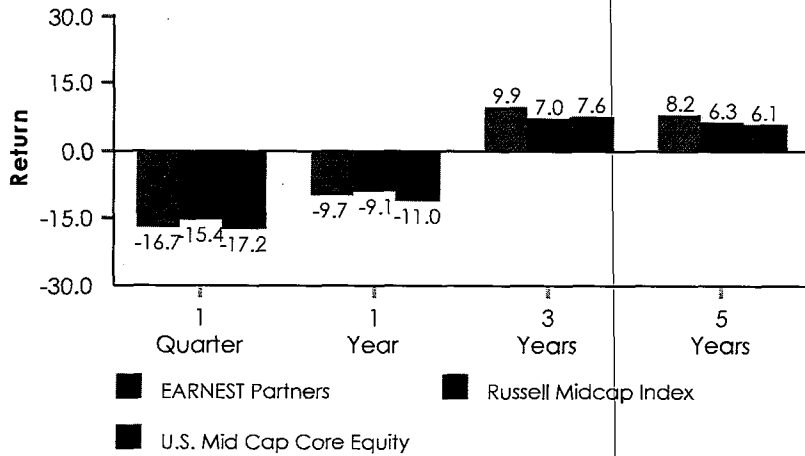


EARNEST Partners - gross of fees

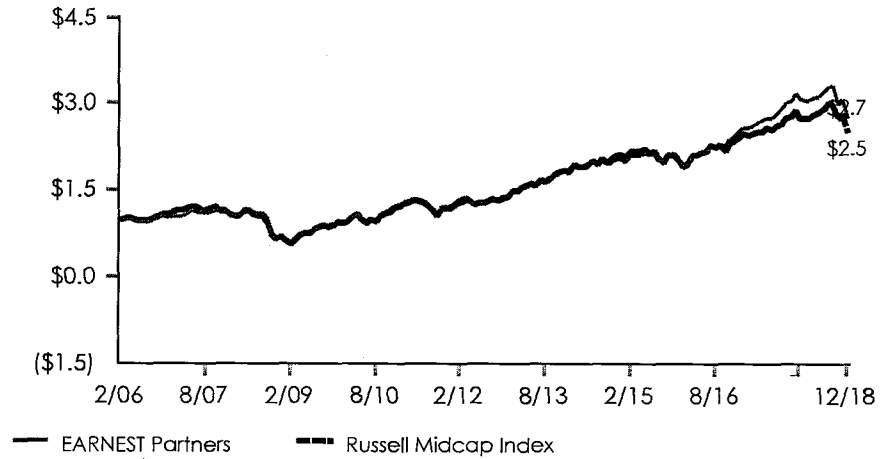
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
EARNEST Partners	0.75	1.00	0.21	0.49	3.37	0.96	99.74	95.42	03/01/2006
Russell Midcap Index	0.00	1.00	-	0.45	0.00	1.00	100.00	100.00	03/01/2006
U.S. Mid Cap Core Equity Median	-	-	-	-	-	-	-	-	-

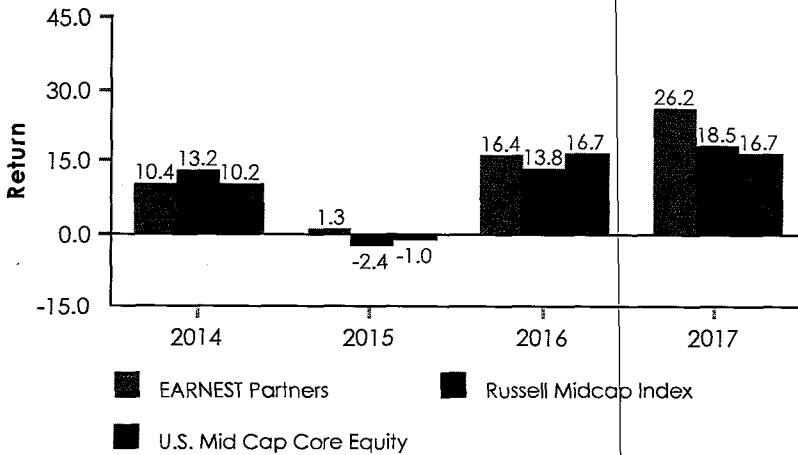
Trailing Period Performance



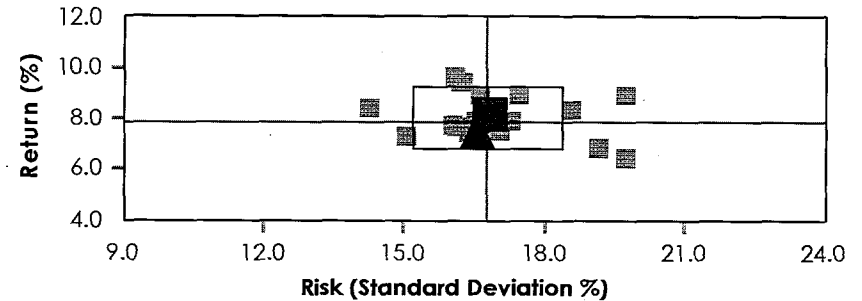
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

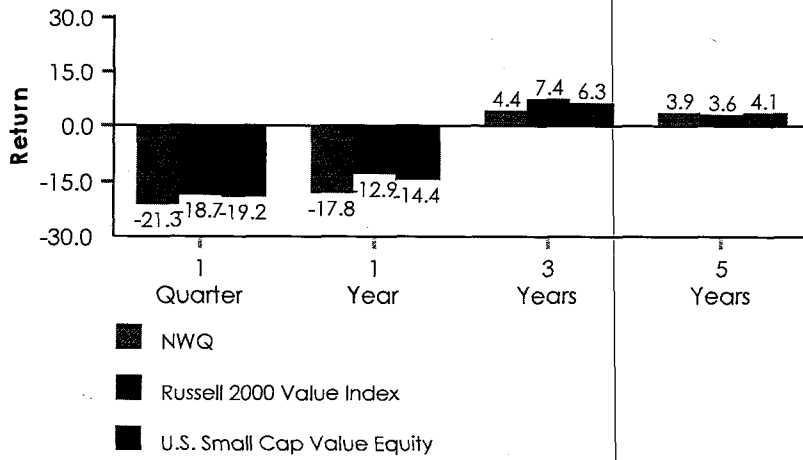


NWQ - gross of fees

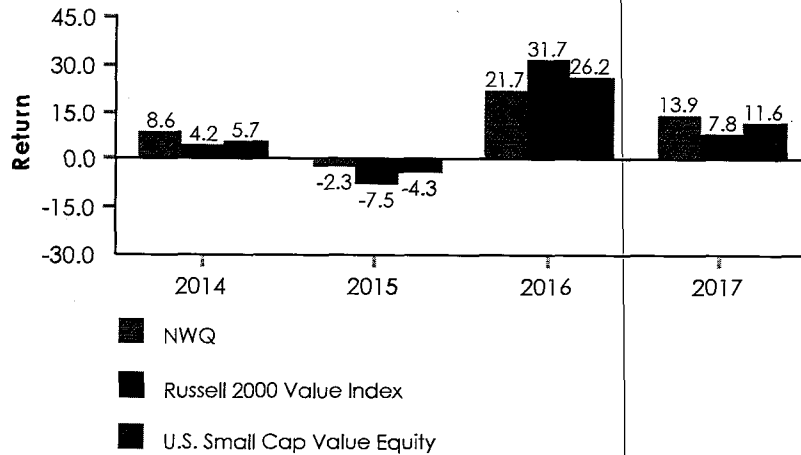
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
NWQ	0.27	1.01	0.05	0.34	6.84	0.89	101.64	100.52	01/01/2006
Russell 2000 Value Index	0.00	1.00	-	0.34	0.00	1.00	100.00	100.00	01/01/2006
U.S. Small Cap Value Equity Median	-	-	-	-	-	-	-	-	-

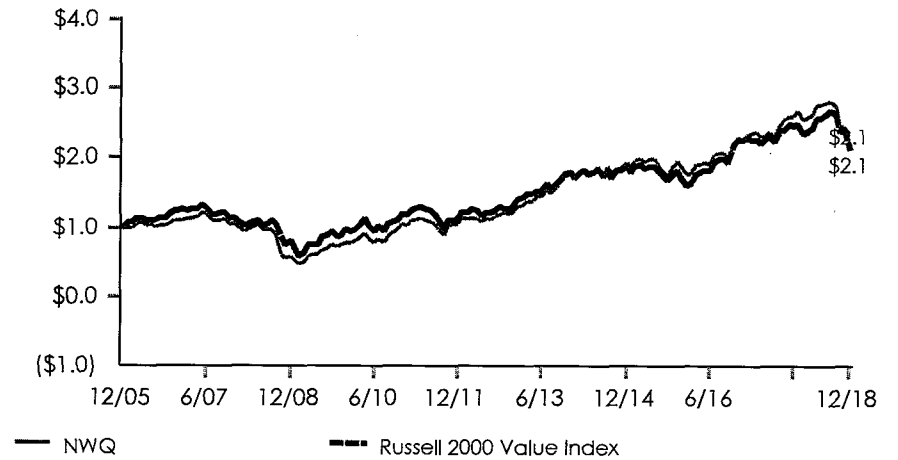
Trailing Period Performance



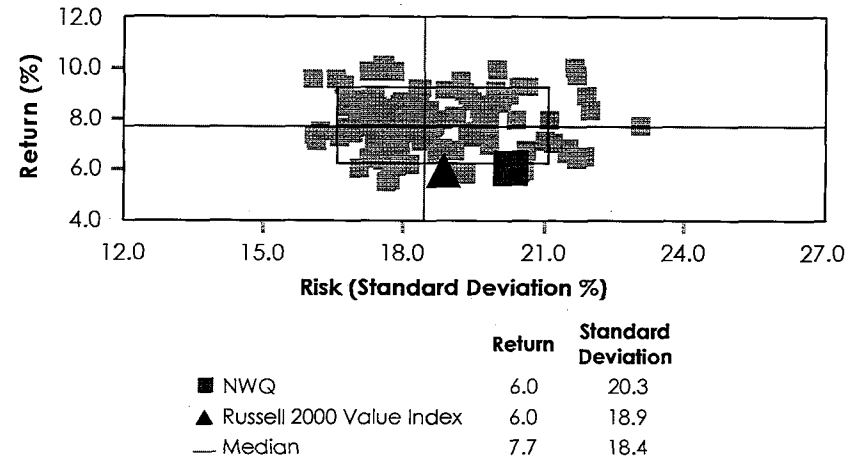
Calendar Year Performance



Growth of \$1 - Since Inception



Risk/Return - Since Inception

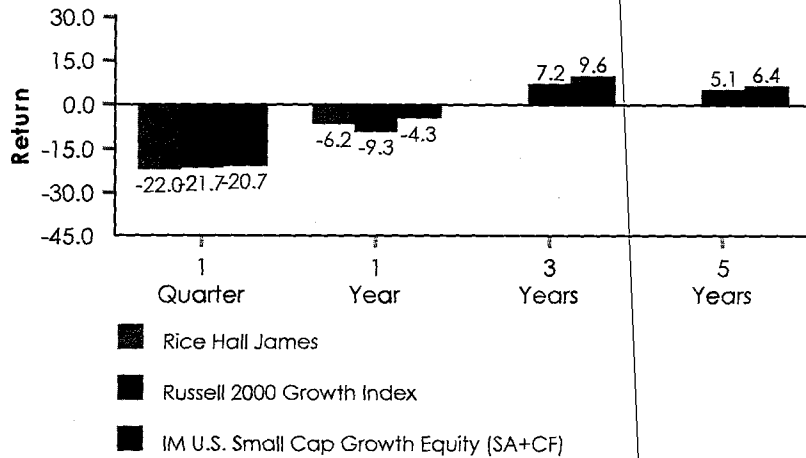


Rice Hall James - gross of fees

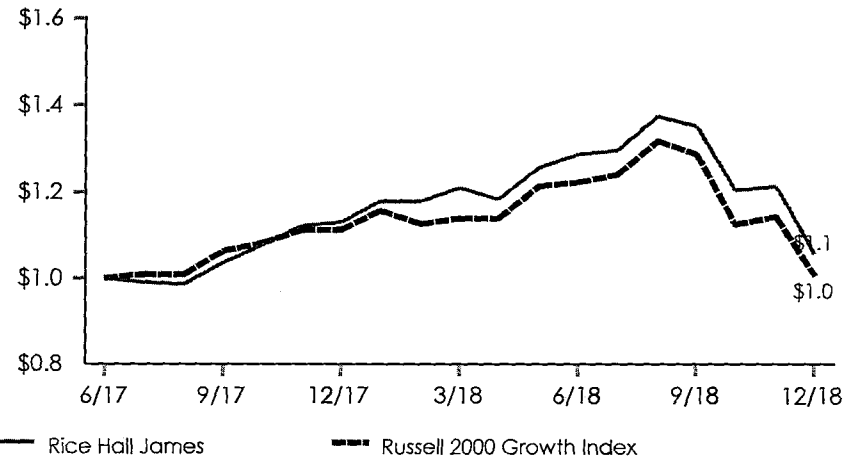
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Rice Hall James	3.26	0.97	0.68	0.21	4.63	0.93	103.21	87.55	07/01/2017
Russell 2000 Growth Index	0.00	1.00	-	0.03	0.00	1.00	100.00	100.00	07/01/2017
IM U.S. Small Cap Growth Equity (SA+CF) Median	-	-	-	-	-	-	-	-	-

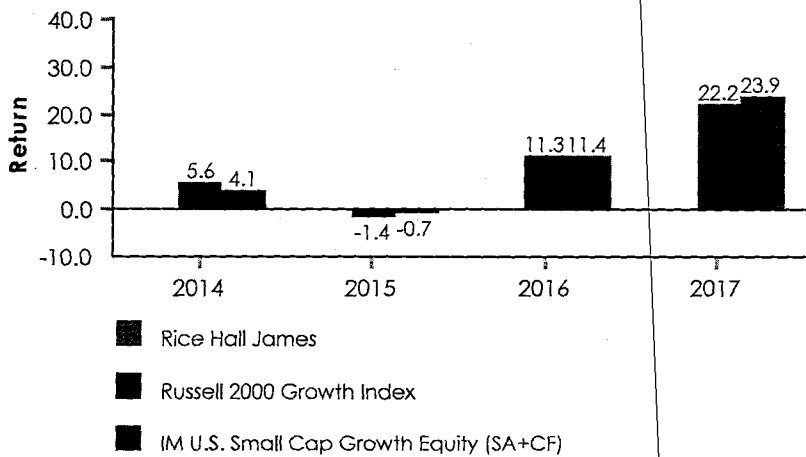
Trailing Period Performance



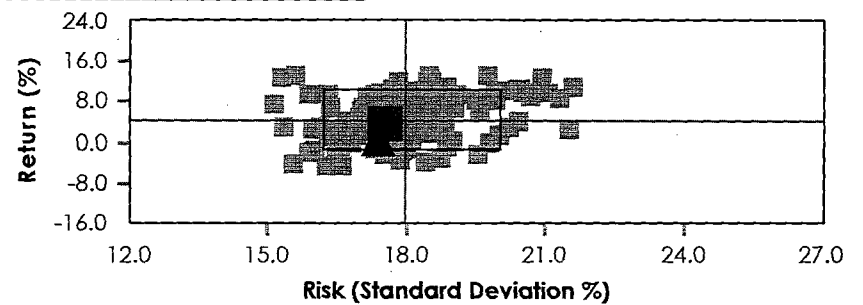
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

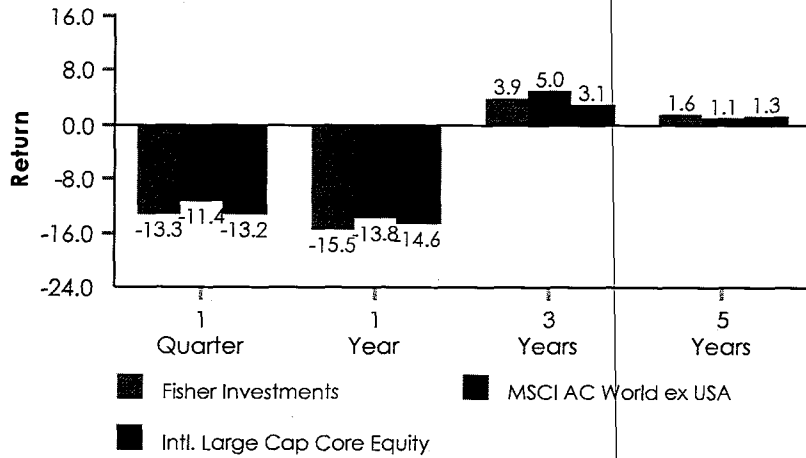


Fisher Investments - gross of fees

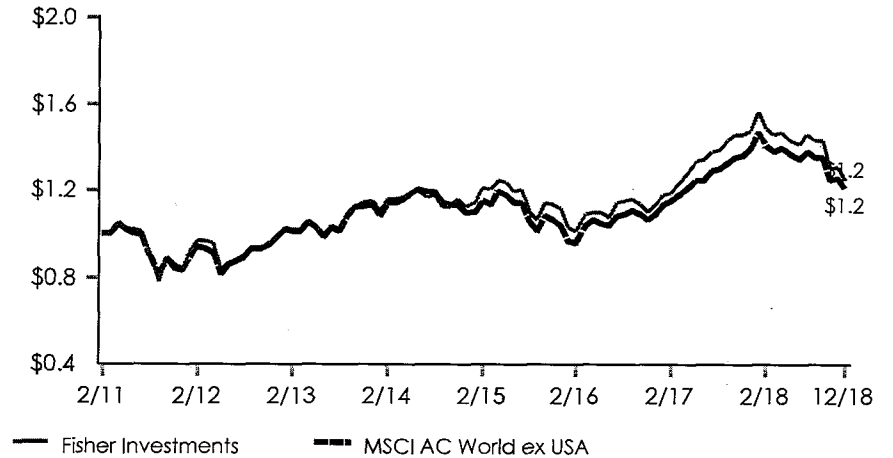
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Fisher Investments	0.39	1.09	0.20	0.23	3.48	0.96	105.85	102.88	03/01/2011
MSCI AC World ex USA	0.00	1.00	-	0.21	0.00	1.00	100.00	100.00	03/01/2011
Intl. Large Cap Core Equity Median	-	-	-	-	-	-	-	-	-

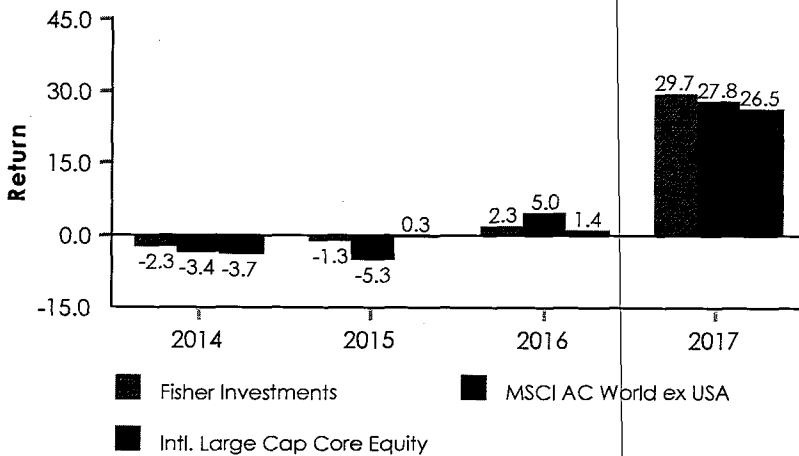
Trailing Period Performance



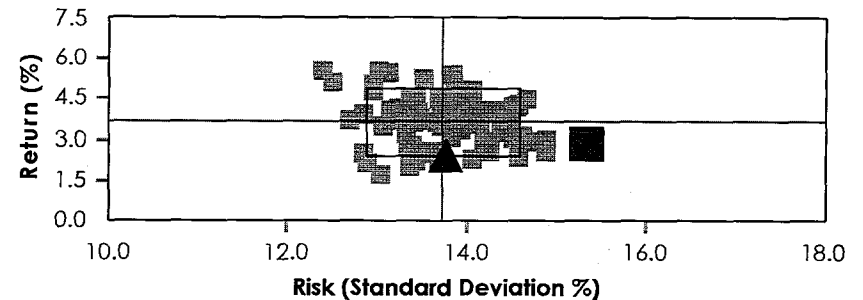
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



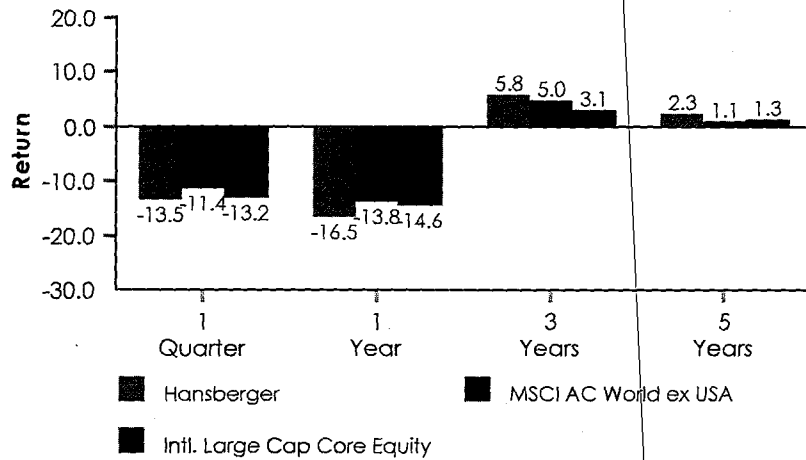
	Return	Standard Deviation
■ Fisher Investments	2.9	15.4
▲ MSCI AC World ex USA	2.4	13.8
— Median	3.7	13.7

Hansberger - gross of fees

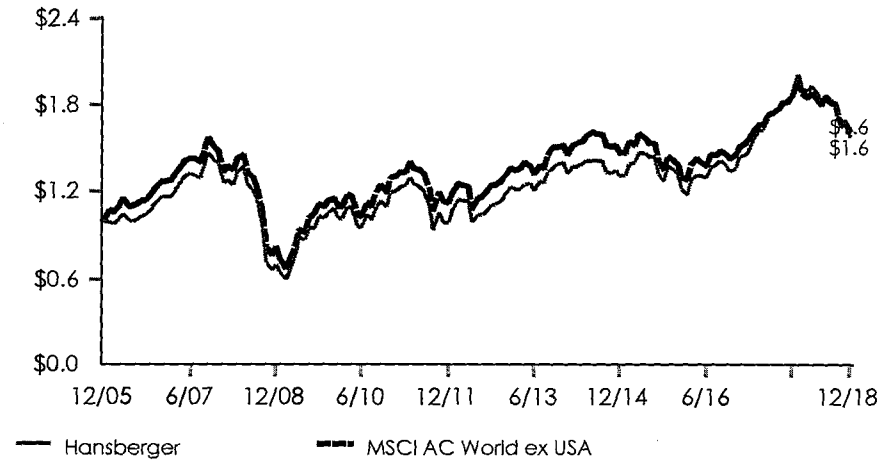
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Hansberger	-0.24	1.08	0.04	0.22	4.43	0.95	105.34	105.81	01/01/2006
MSCI AC World ex USA	0.00	1.00	-	0.24	0.00	1.00	100.00	100.00	01/01/2006
Intl. Large Cap Core Equity Median	-	-	-	-	-	-	-	-	-

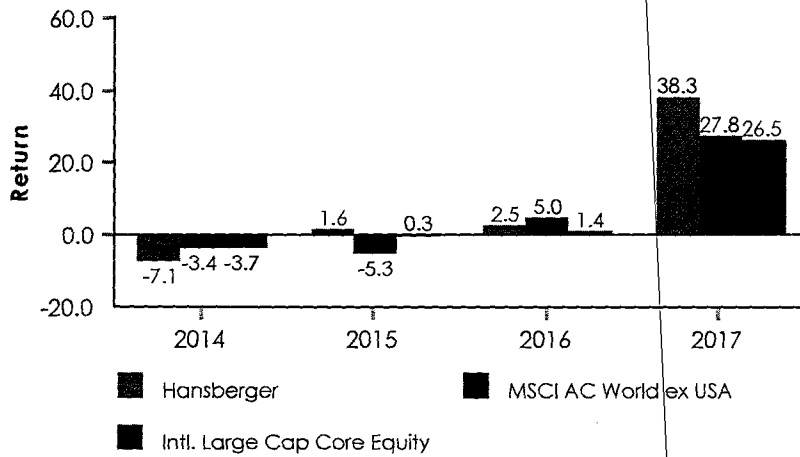
Trailing Period Performance



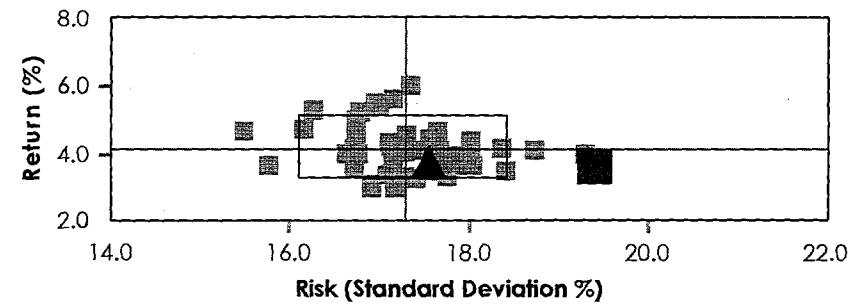
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

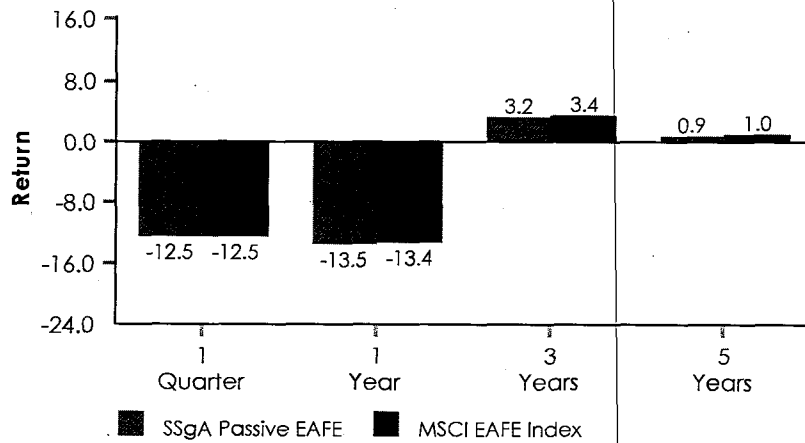


SSgA Passive EAFE - gross of fees

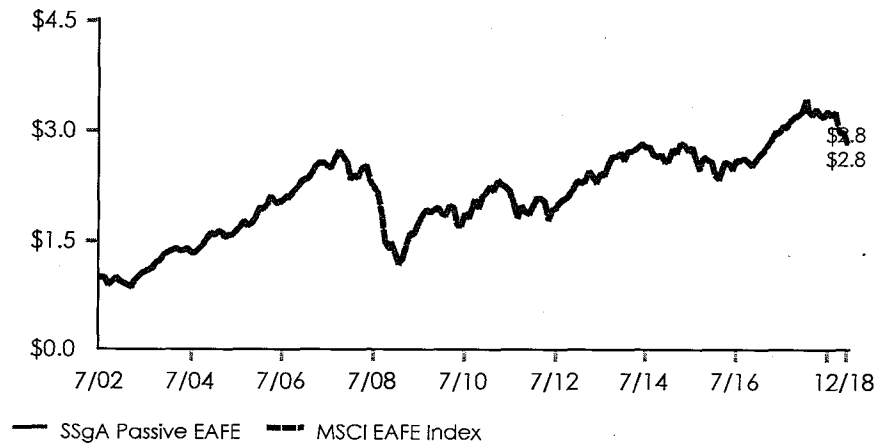
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
SSgA Passive EAFE	-0.01	0.99	-0.15	0.39	0.43	1.00	99.28	99.34	08/01/2002
MSCI EAFE Index	0.00	1.00	-	0.40	0.00	1.00	100.00	100.00	08/01/2002

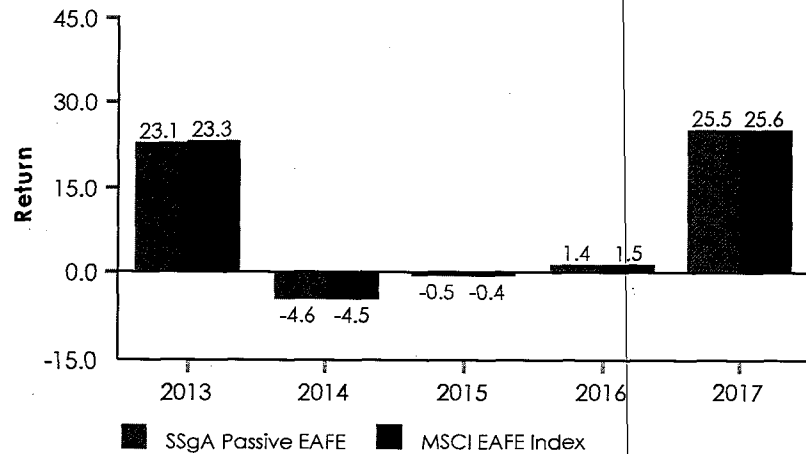
Trailing Period Performance



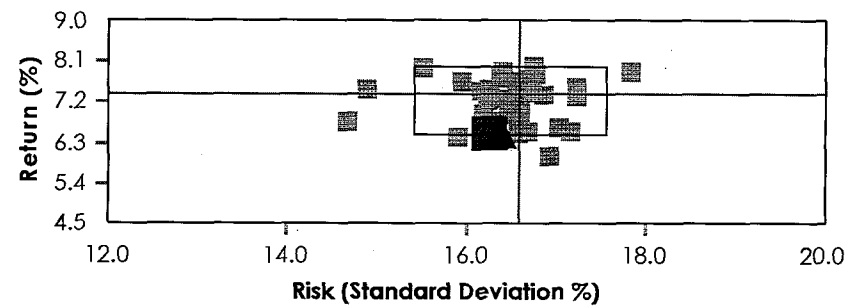
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



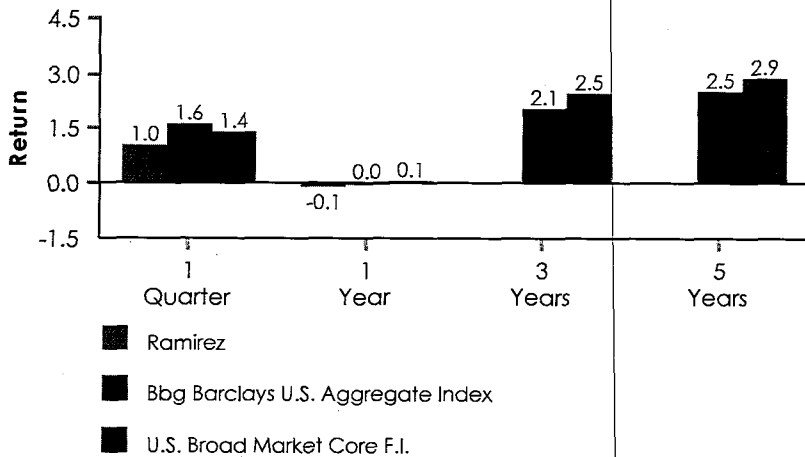
	Return	Standard Deviation
SSgA Passive EAFE	6.5	16.3
MSCI EAFE Index	6.5	16.4
Median	7.4	16.6

Ramirez - gross of fees

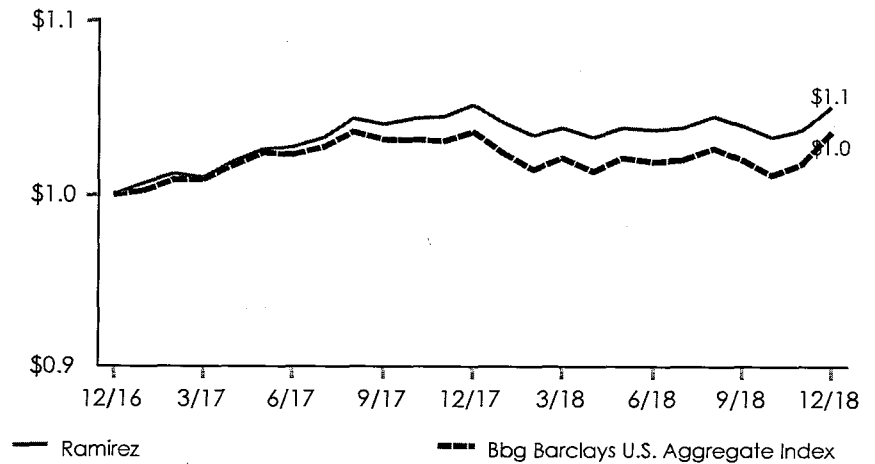
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Ramirez	0.98	0.85	1.13	0.54	0.63	0.94	103.56	78.25	01/01/2017
Bbg Barclays U.S. Aggregate Index	0.00	1.00	-	0.18	0.00	1.00	100.00	100.00	01/01/2017
U.S. Broad Market Core F.I. Median	-	-	-	-	-	-	-	-	-

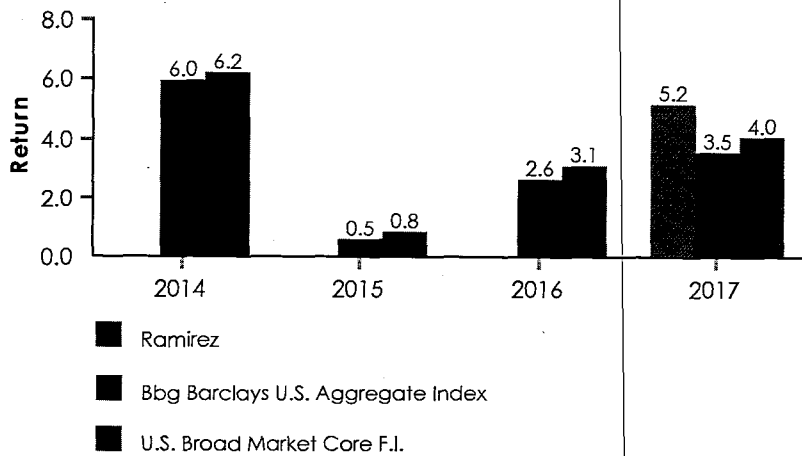
Trailing Period Performance



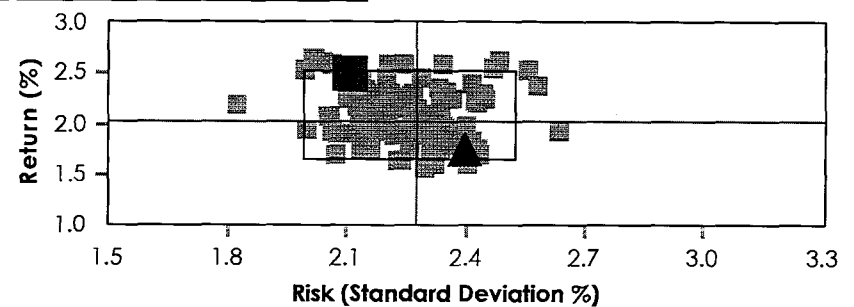
Growth of \$1 - Since Inception



Calendar Year Performance



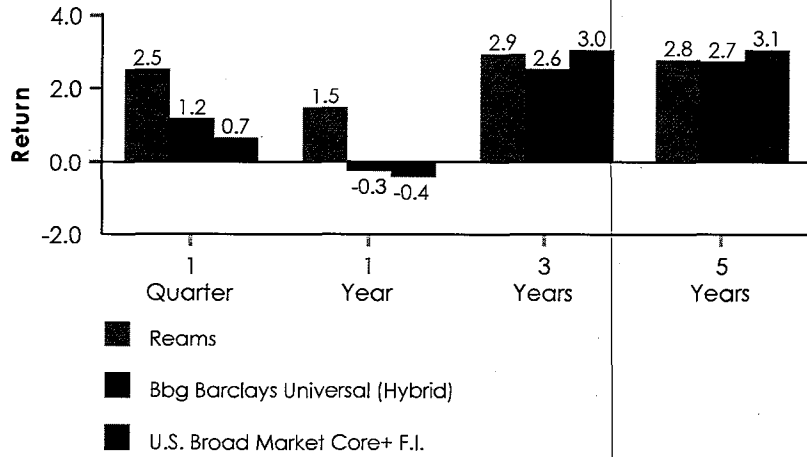
Risk/Return - Since Inception



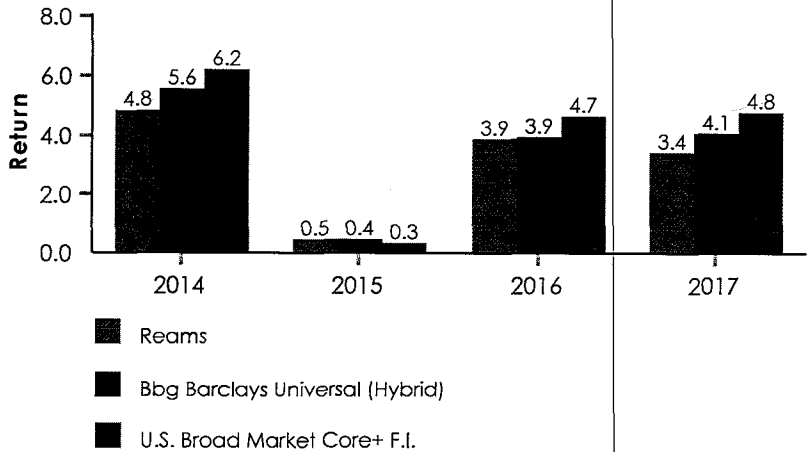
Reams - gross of fees
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Reams	0.34	1.06	0.15	0.65	4.00	0.44	109.57	103.42	01/01/1998
Bbg Barclays Universal (Hybrid)	0.00	1.00	-	0.86	0.00	1.00	100.00	100.00	01/01/1998
U.S. Broad Market Core+ F.I. Median	-	-	-	-	-	-	-	-	-

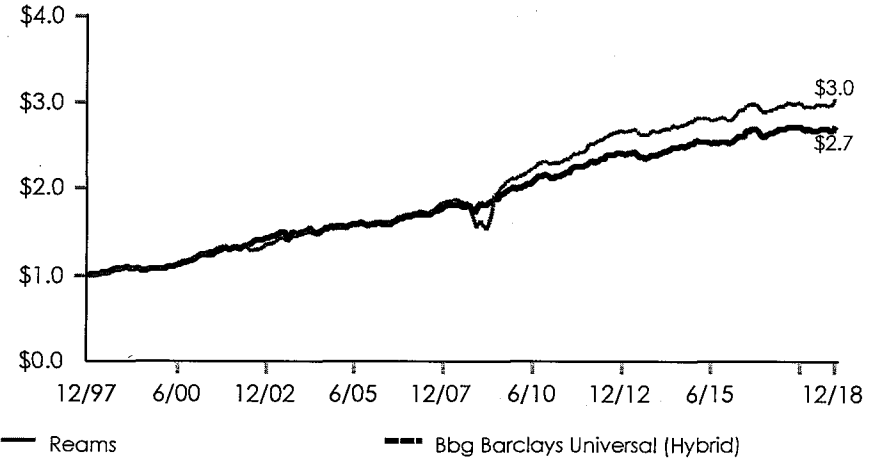
Trailing Period Performance



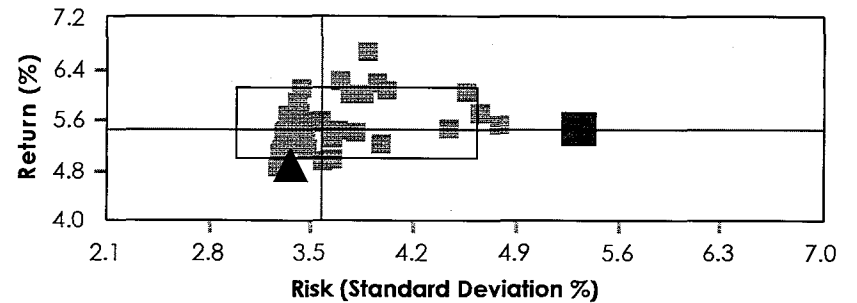
Calendar Year Performance



Growth of \$1 - Since Inception



Risk/Return - Since Inception



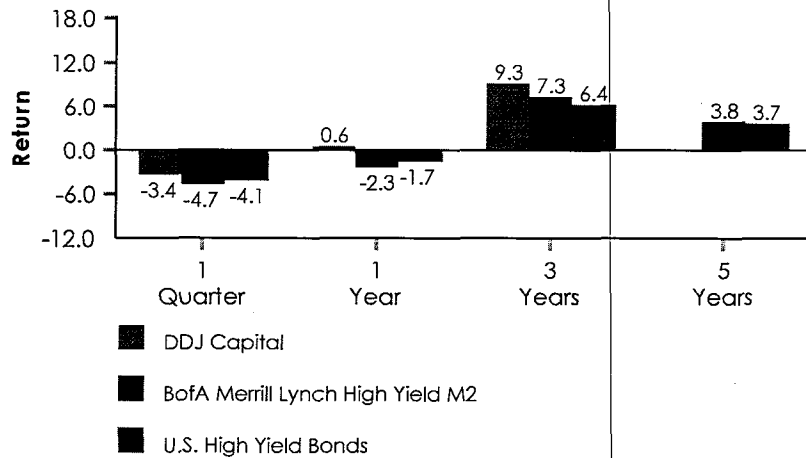
	Return	Standard Deviation
■ Reams	5.4	5.3
▲ Bbg Barclays Universal (Hybrid)	4.9	3.4
— Median	5.4	3.6

DDJ Capital - gross of fees

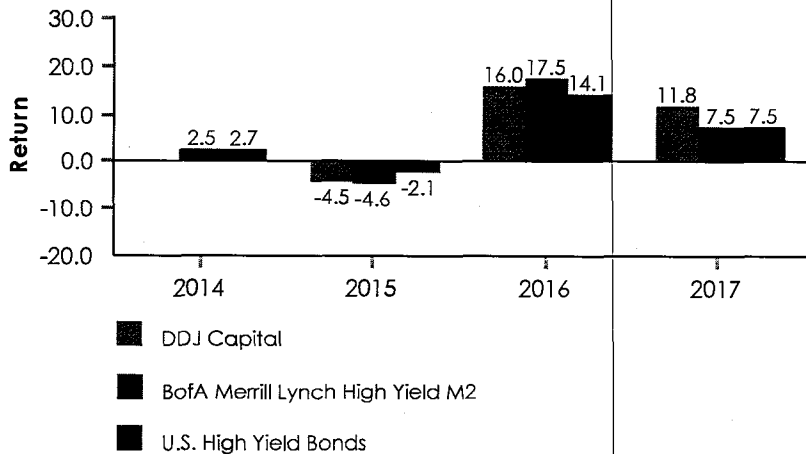
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
DDJ Capital	2.60	0.72	0.49	1.07	2.82	0.71	95.31	64.46	01/01/2015
BofA Merrill Lynch High Yield M2	0.00	1.00	-	0.65	0.00	1.00	100.00	100.00	01/01/2015
U.S. High Yield Bonds Median	-	-	-	-	-	-	-	-	-

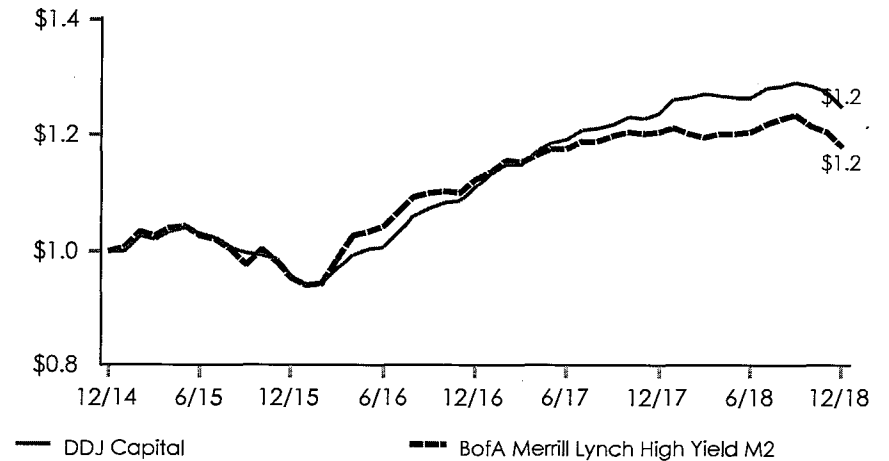
Trailing Period Performance



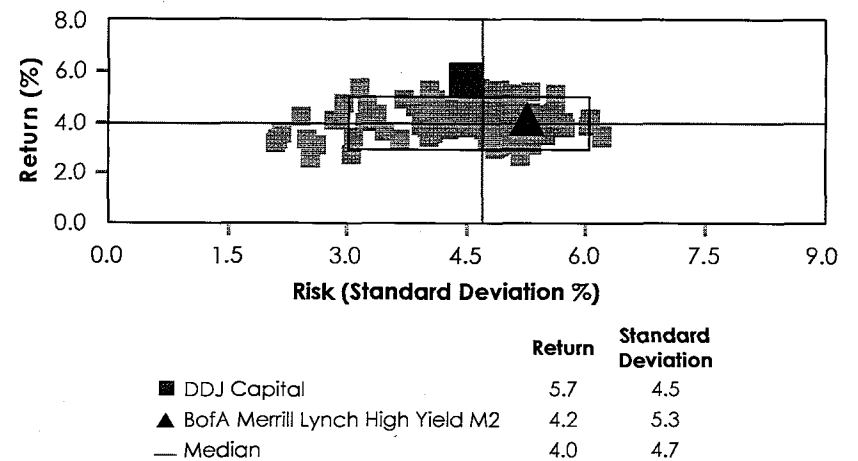
Calendar Year Performance



Growth of \$1 - Since Inception



Risk/Return - Since Inception

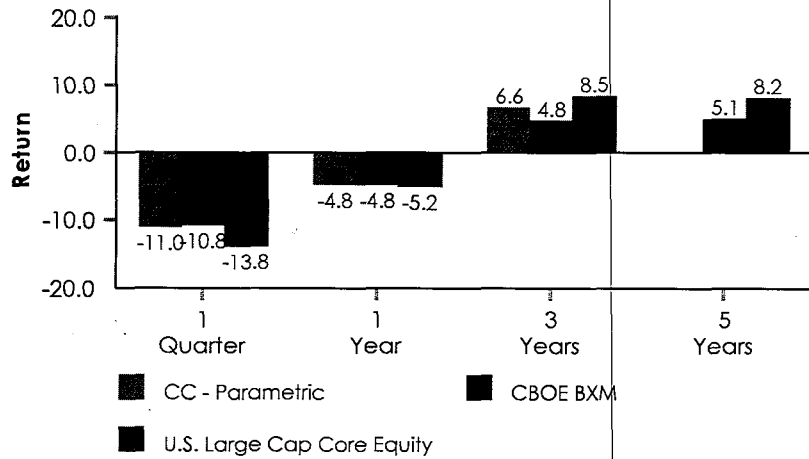


CC - Parametric - gross of fees

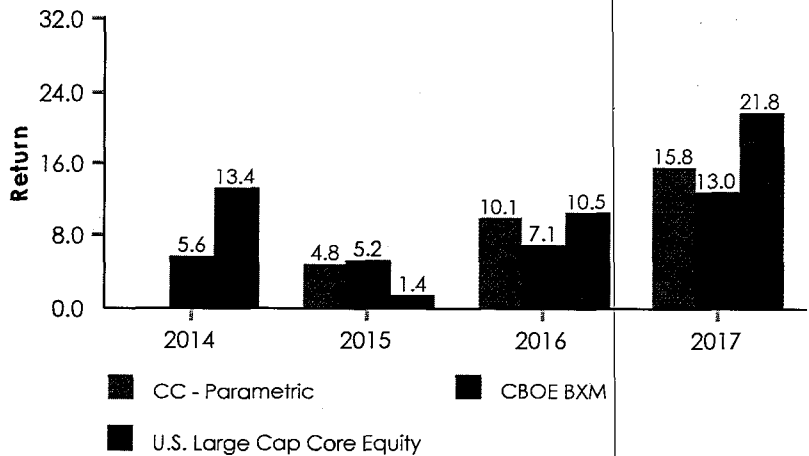
As of December 31, 2018

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
CC - Parametric	0.96	1.05	0.55	0.71	2.16	0.92	114.12	106.51	03/01/2014
CBOE BXM	0.00	1.00	-	0.61	0.00	1.00	100.00	100.00	03/01/2014
U.S. Large Cap Core Equity Median	-	-	-	-	-	-	-	-	-

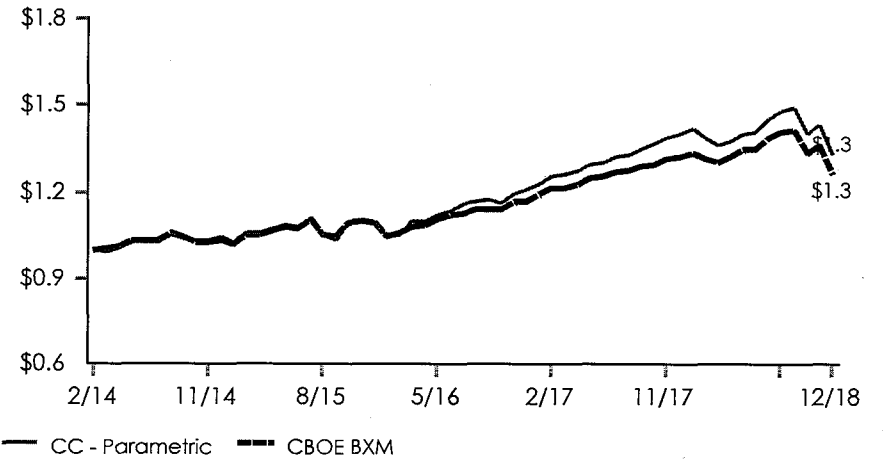
Trailing Period Performance



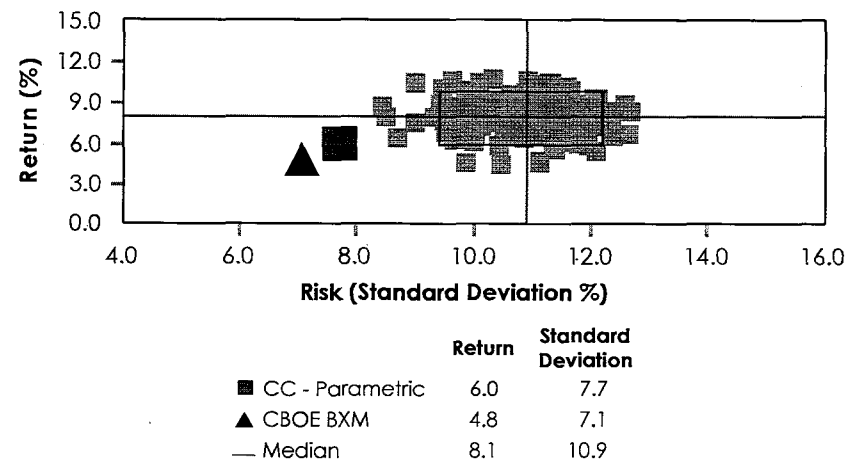
Calendar Year Performance



Growth of \$1 - Since Inception

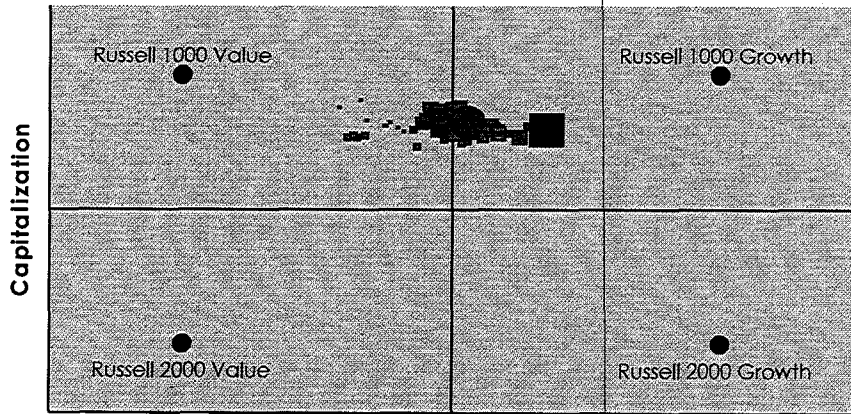


Risk/Return - Since Inception



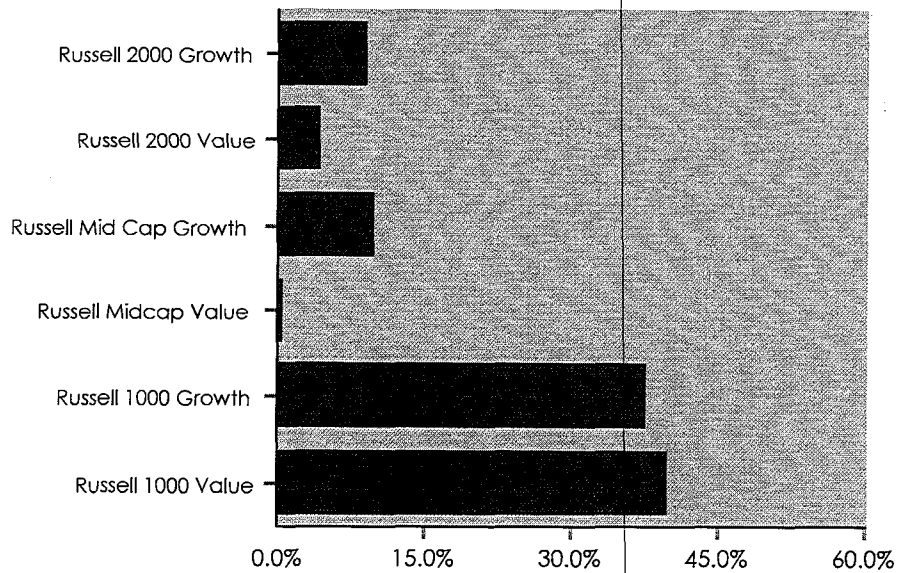
**Domestic Equity Analysis
As of December 31, 2018**

Style Map (5-Year)

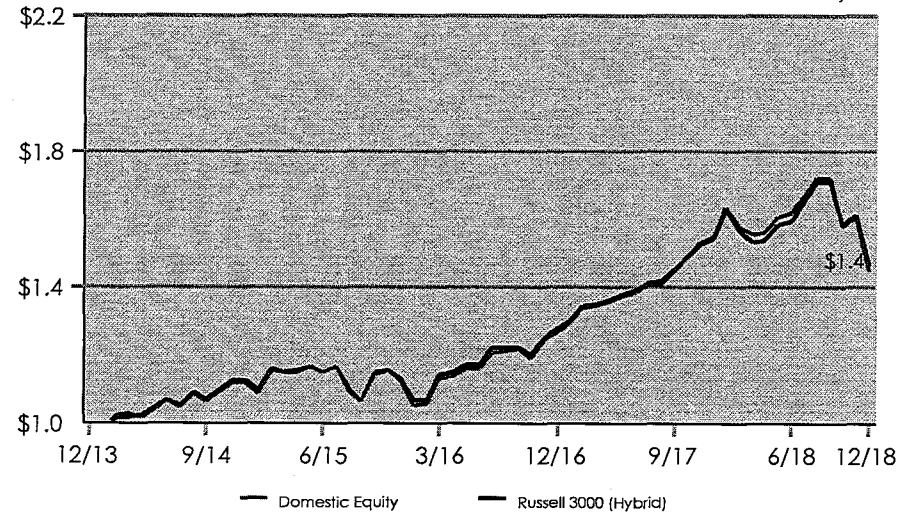


Style History
 Most Recent
 Average Style Exposure

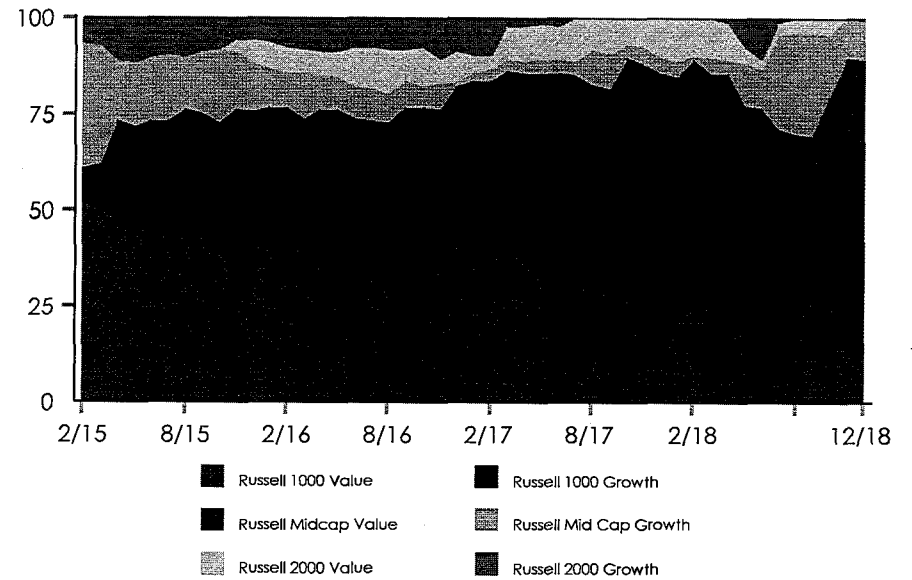
Style Exposure



Growth of \$1 (5-Year)

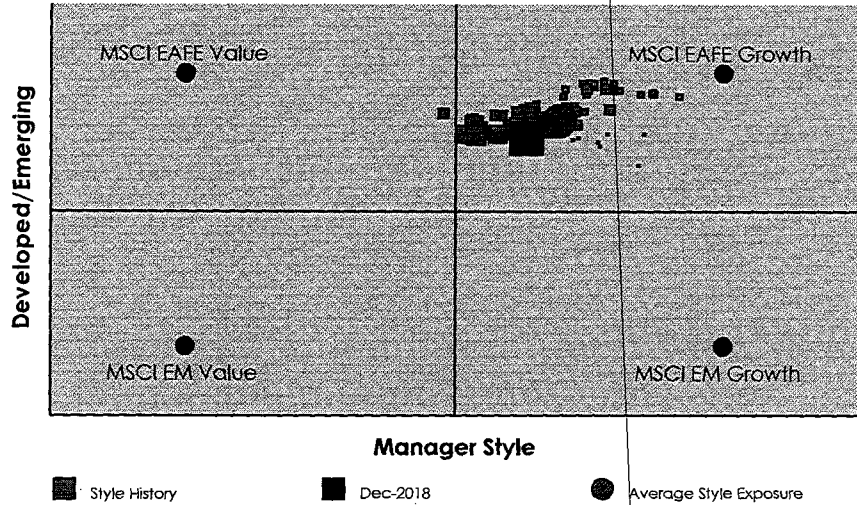


Style History (5-Year)

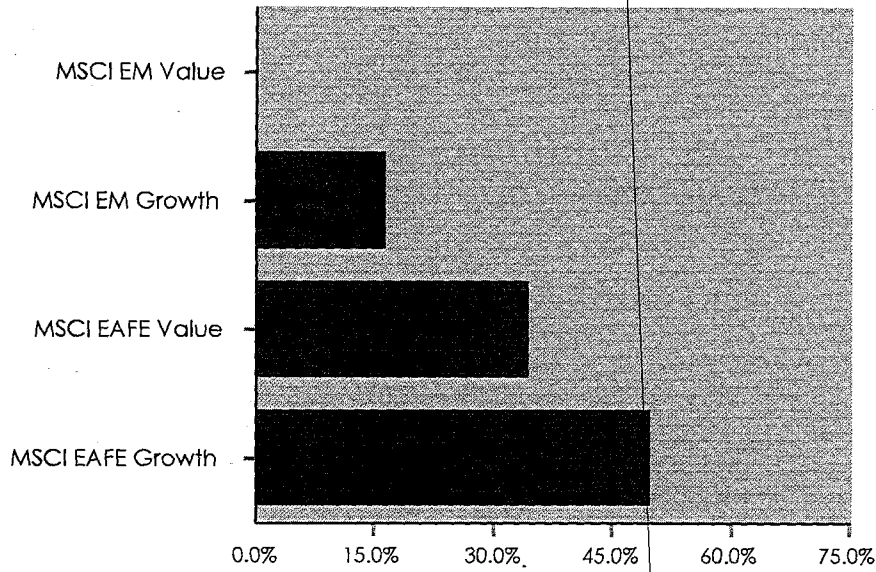


International Equity Analysis
As of December 31, 2018

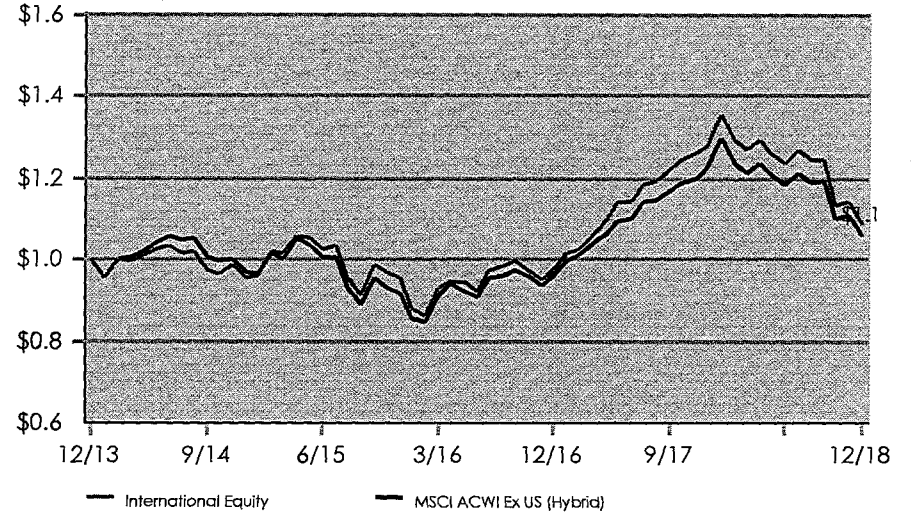
Style Map (5-Year)



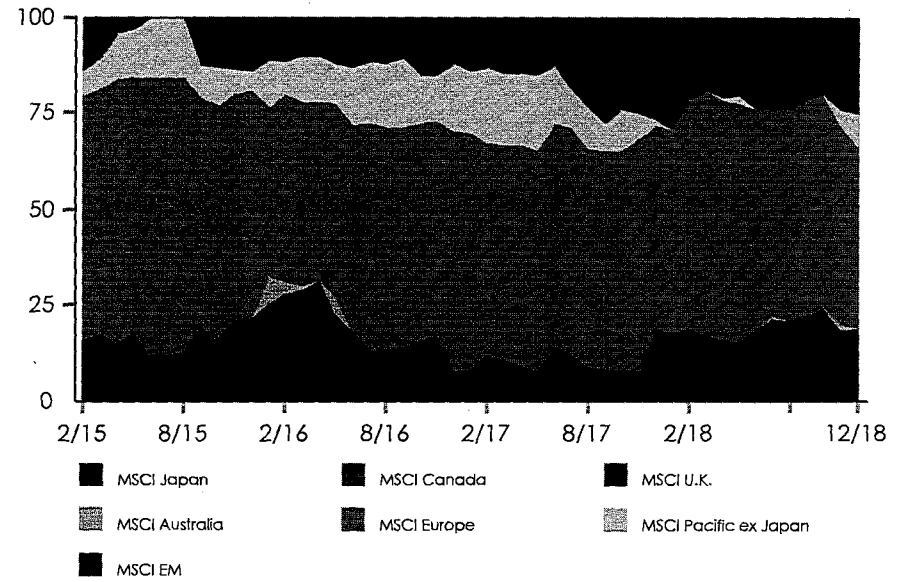
Style Exposure



Growth of \$1 (5-Year)

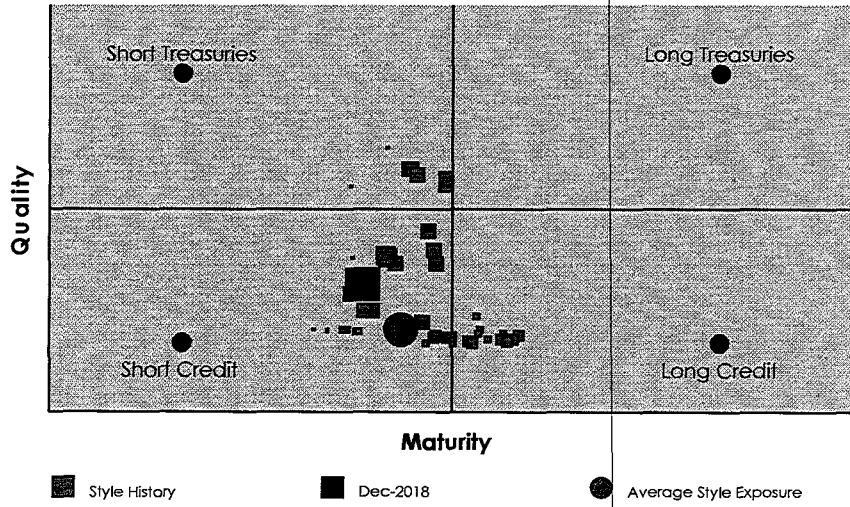


Style History (5-Year)

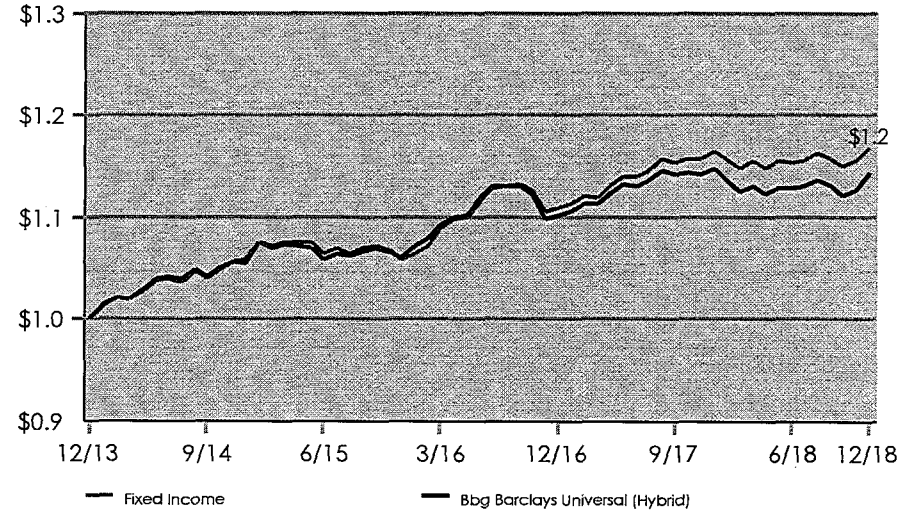


Fixed Income Analysis
As of December 31, 2018

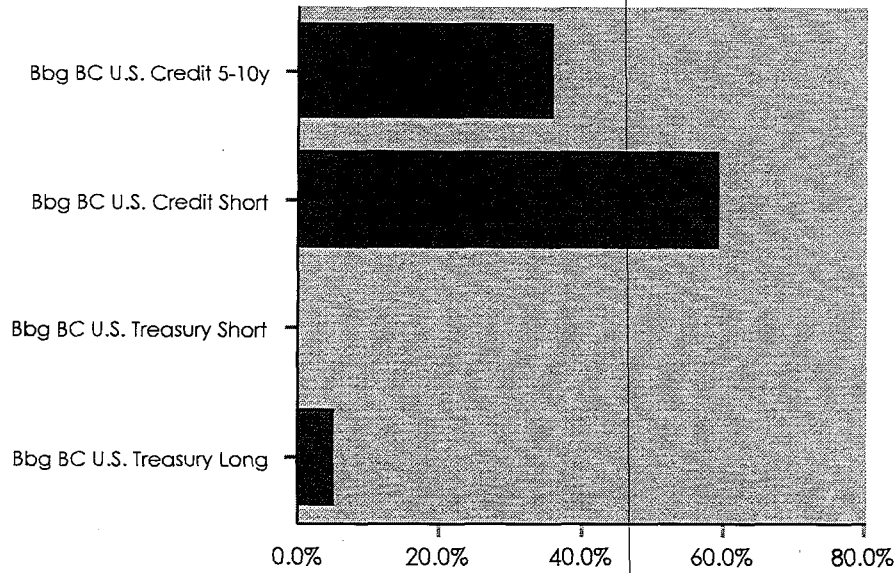
Style Map (5-Year)



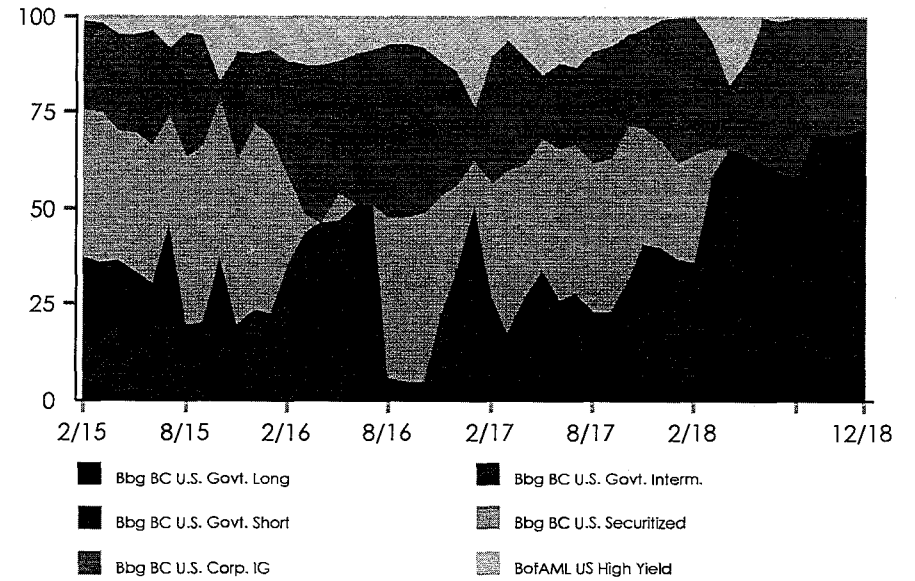
Growth of \$1 (5-Year)



Style Exposure



Style History (5-Year)



Glossary

Alpha

The premium an investment earns above a set standard. This is usually measured in terms of a common index (i.e., how the stock performs independent of the market). An Alpha is usually generated by regressing excess return on the S&P 500 excess return.

Annualized Performance

The annual rate of return that when compounded (t) times generates the same (t) period holding return as actually occurred from periods (1) to period (t).

Batting Average

Percentage of periods a portfolio outperforms a given index.

Beta

The measure of an asset's risk in relation to the Market (for example, the S&P 500) or to an alternative benchmark or factors. Roughly speaking, a security with a Beta of 1.5 will have moved, on average, 1.5 times the market return.

Bottom-up

A management style that de-emphasizes the significance of economic and market cycles, focusing instead on the analysis of individual stocks.

Dividend Discount Model

A method to value the common stock of a company that is based on the present value of the expected future dividends.

Growth Stock

Common stock of a company that has an opportunity to invest money and earn more than its opportunity cost of capital.

Information Ratio

The ratio of annualized expected residual return to residual risk. A central measurement for active management, value added is proportional to the square of the information ratio.

R - Squared

Square of the correlation coefficient. The proportion of the variability in one series that can be explained by the variability of one or more other series in a regression model. A measure of the quality of fit. 100% R-square means a perfect predictability.

Standard Deviation

The square root of the variance. A measure of dispersion of a set of data from its mean.

Sharpe Ratio

A measure of a portfolio's excess return relative to the total variability of the portfolio.

Style Analysis

A returns-based analysis using a multi-factor attribution model. The model calculates a product's average exposure to particular investment styles over time (i.e., the products normal style benchmark).

Top-Down

Investment style that begins with an assessment of the overall economic environment and makes a general asset allocation decision regarding various sectors of the financial markets and various industries.

Tracking Error

The standard deviation of the difference between the returns of a portfolio and an appropriate benchmark.

Turnover

For mutual funds, a measure of trading activity during the previous year, expressed as a percentage of the average total assets of the fund. A turnover rate of 25% means that the value of trades represented (1/4) of the assets of the fund.

Value Stock

Stocks with low price/book ratios or price/earnings ratios. Historically, value stocks have enjoyed higher average returns than growth stocks (stocks with high price/book or price/earnings ratios) in a variety of countries.

Benchmark Definitions

Bloomberg Barclays Capital Universal: includes market coverage by the Aggregate Bond Index fixed rate debt issues, which are rated investment grade or higher by Moody's Investor Services, Standard and Poor's Corporation, or Fitch Investor's Service, in that order with all issues having at least one year to maturity and an outstanding par value of at least \$100 million) and includes exposures to high yield CMBS securities. All returns are market value weighted inclusive of accrued interest.

MSCI ACWI x US: MSCI ACWI (All Country World Index) Free excluding US (gross dividends): is a free-floating adjusted market capitalization index designed to measure equity performance in the global developed and emerging markets. As of April 2002, the index consisted of 49 developed and emerging market country indices.

MSCI EAFE (Europe, Australasia, Far East): is a free float-adjusted market capitalization index that is designed to measure developed market equity performance, excluding the US & Canada.

Russell 1000: measures the performance of the 1,000 largest securities in the Russell 3000 Index. Russell 1000 is highly correlated with the S&P 500 Index and capitalization-weighted.

Russell 1000 Growth: measures the performance of those Russell 1000 securities with a greater-than-average growth orientation. Securities in this index tend to exhibit higher price-to-book and price-earnings ratios, lower dividend yields and higher forecasted growth values than the Value universe.

Russell 1000 Value: measures the performance of those Russell 1000 securities with a less-than-average growth orientation. Securities in this index tend to exhibit lower price-to-book and price-earnings ratios, higher dividend yields and lower forecasted growth values than the Growth universe.

Russell Mid-Cap: measures the performance of the smallest 800 companies in the Russell 1000 Index, as ranked by total market capitalization.

Russell 2000: measures the performance of the 2,000 smallest securities in the Russell 3000 Index. Russell 2000 is market capitalization-weighted.

Russell 2000 Growth: measures the performance of those Russell 2000 securities with a greater-than-average growth orientation. Securities in this index tend to exhibit higher price-to-book and price-to-earnings ratios.

Russell 2000 Value: measures the performance of those Russell 2000 securities with a less-than-average growth orientation. Securities in this index tend to exhibit lower price-to-book and price-to-earnings ratios.

CBOE BXM: measures the performance of a hypothetical buy-write strategy on the S&P 500 Index.

BofA ML U.S. High Yield Master II: Tracks the performance of US dollar denominated below investment grade rated corporate debt publically issued in the US domestic market. To qualify for inclusion in the index, securities must have a below investment grade rating (based on an average of Moody's, S&P, and Fitch) and an investment grade rated country of risk (based on an average of Moody's, S&P, and Fitch foreign currency long term sovereign debt ratings). Each security must have greater than 1 year of remaining maturity, a fixed coupon schedule, and a minimum amount outstanding of \$100 million.

RISK METRIC DESCRIPTION – Rationale for selection and calculation methodology

US Equity Markets:

Metric: P/E ratio = Price / "Normalized" earnings for the S&P 500 Index

To represent the price of US equity markets, we have chosen the S&P 500 index. This index has the longest published history of price, is well known, and also has reliable, long-term, published quarterly earnings. The price=P of the P/E ratio is the current price of the market index (the average daily price of the most recent full month for the S&P 500 index). Equity markets are very volatile. Prices fluctuate significantly during normal times and extremely during periods of market stress or euphoria. Therefore, developing a measure of earnings power (E) which is stable is vitally important, if the measure is to provide insight. While equity prices can and do double, or get cut in half, real earnings power does not change nearly as much. Therefore, we have selected a well known measure of real, stable earnings power developed by Yale Professor Robert Shiller known as the Shiller E-10. The calculation of E-10 is simply the average real annual earnings over the past 10 years. Over 10 years, the earnings shenanigans and boom and bust levels of earnings tend to even out (and often times get restated). Therefore, this earnings statistic gives a reasonably stable, slow-to-change estimate of average real earnings power for the index. Professor Shiller's data and calculation of the E-10 are available on his website at <http://www.econ.yale.edu/~shiller/data.htm>. We have used his data as the base for our calculations. Details of the theoretical justification behind the measure can be found in his book *Irrational Exuberance* [Princeton University Press 2000, Broadway Books 2001, 2nd ed., 2005].

Developed Equity Markets Excluding the US:

Metric: P/E ratio = Price / "Normalized" earnings for the MSCI EAFE Index

To represent the price of non-US developed equity markets, we have chosen the MSCI EAFE index. This index has the longest published history of price for non-US developed equities. The price=P of the P/E ratio is the current price of the market index (the average daily price of the most recent full month for the MSCI EAFE index). The price level of this index is available starting in December 1969. Again, for the reasons described above, we elected to use the Shiller E-10 as our measure of earnings (E). Since 12/1972, a monthly price earnings ratio is available from MSCI. Using this quoted ratio, we have backed out the implied trailing-twelve month earnings of the EAFE index for each month from 12/1972 to the present. These annualized earnings are then inflation adjusted using CPI-U to represent real earnings in US dollar terms for each time period. The Shiller E-10 for the EAFE index (10 year average real earnings) is calculated in the same manner as detailed above.

However, we do not believe that the pricing and earnings history of the EAFE markets are long enough to be a reliable representation of pricing history for developed market equities outside of the US. Therefore, in constructing the Long-Term Average Historical P/E for developed ex-US equities for comparison purposes, we have elected to use the US equity market as a developed market proxy, from 1881 to 1982. This lowers the Long-Term Average Historical P/E considerably. We believe this methodology provides a more realistic historical comparison for a market with a relatively short history.

Emerging Market Equity Markets

Metric: Ratio of Emerging Market P/E Ratio to Developed Market P/E Ratio

To represent the Emerging Markets P/E Ratio, we have chosen the MSCI Emerging Market Free Index, which has P/E data back to January 1995 on Bloomberg. To represent the Developed Markets PE Ratio, we have chosen the MSCI World Index, which also has data back to January 1995 on Bloomberg. Although there are issues with published, single time period P/E ratios, in which the denominator effect can cause large movements, we feel that the information contained in such movements will alert investors to market activity that they will want to interpret.

RISK METRIC DESCRIPTION – Rationale for selection and calculation methodology

US Private Equity Markets:

Metrics: S&P LCD Average EBITDA Multiples Paid in LBOs and US Quarterly Deal Volume

The Average Purchase Price to EBITDA multiples paid in LBOs is published quarterly by S&P in their LCD study. This is the total price paid (both equity and debt) over the trailing-twelve month EBITDA (earnings before interest, taxes, depreciation and amortization) as calculated by S&P LCD. This is the relevant, high-level pricing metric that private equity managers use in assessing deals. Data is published monthly.

US quarterly deal volume for private equity is the total deal volume in \$ billions (both equity and debt) reported in the quarter by Thomson Reuters Buyouts. This metric gives a measure of the level of activity in the market. Data is published quarterly.

U.S Private Real Estate Markets:

Metrics: US Cap rates and Annual US Real Estate Deal Volume

Real estate cap rates are a measure of the price paid in the market to acquire properties versus their annualized income generation before financing costs (NOI=net operating income). The data is published by NCREIF. We chose to use current value cap rate. These are capitalization rates from properties that were revalued during the quarter. While this data does rely on estimates of value and therefore tends to be lagging, (estimated prices are slower to rise and slow to fall than transaction prices), the data series goes back to 1979, providing a long data series for valuation comparison. Data is published quarterly.

Annual US real estate deal volume is the total deal transaction volume in \$ billions (both equity and debt) reported by Real Capital Analytics during the trailing-twelve months. This metric gives the level of activity in the market. Data is published monthly.

Measure of Equity Market Fear / Uncertainty

Metric: VIX – Measure of implied option volatility for U.S. equity markets

The VIX is a key measure of near-term volatility conveyed by implied volatility of S&P 500 index option prices. VIX increases with uncertainty and fear. Stocks and the VIX are negatively correlated. Volatility tends to spike when equity markets fall.

Measure of Monetary Policy

Metric: Yield Curve Slope

We calculate the yield curve slope as the 10 year treasury yield minus the 1 year treasury yield. When the yield curve slope is zero or negative, this is a signal to pay attention. A negative yield curve slope signals lower rates in the future, caused by a contraction in economic activity. Recessions are typically preceded by an inverted (negatively sloped) yield curve. A very steep yield curve (2 or greater) indicates a large difference between shorter-term interest rates (the 1 year rate) and longer-term rates (the 10 year rate). This can signal expansion in economic activity in the future, or merely higher future interest rates.

RISK METRIC DESCRIPTION – Rationale for selection and calculation methodology

Definition of “extreme” metric readings

A metric reading is defined as “extreme” if the metric reading is in the top or bottom decile of its historical readings. These “extreme” reading should cause the reader to pay attention. These metrics have reverted toward their mean values in the past.

Credit Markets US Fixed Income:

Metric: Spreads

The absolute level of spreads over treasuries and spread trends (widening / narrowing) are good indicators of credit risk in the fixed income markets. Spreads incorporate estimates of future default, but can also be driven by technical dislocations in the fixed income markets. Abnormally narrow spreads (relative to historical levels) indicate higher levels of valuation risk, wide spreads indicate lower levels of valuation risk and / or elevated default fears. Investment grade bond spreads are represented by the Barclays Capital US Corporate Investment Grade Index Intermediate Component. The high yield corporate bond spreads are represented by the Barclays Capital US Corporate High Yield Index.

Measures of US Inflation Expectations

Metrics: Breakeven Inflation and Inflation Adjusted Commodity Prices

Inflation is a very important indicator impacting all assets and financial instruments. Breakeven inflation is calculated as the 10 year nominal treasury yield minus the 10 year real yield on US TIPS (treasury inflation protected securities). Abnormally low long-term inflation expectations are indicative of deflationary fears. A rapid rise in breakeven inflation indicates acceleration in inflationary expectations as market participants sell nominal treasuries and buy TIPS. If breakeven inflation continues to rise quarter over quarter, this is a signal of inflationary worries rising, which may cause Fed action and / or dollar decline.

Commodity price movement (above the rate of inflation) is an indication of anticipated inflation caused by real global economic activity putting pressure on resource prices. We calculate this metric by adjusted in the Dow Jones UBS Commodity Index (formerly Dow Jones AIG Commodity Index) by US CPI-U. While rising commodity prices will not necessarily translate to higher US inflation, higher US inflation will likely show up in higher commodity prices, particularly if world economic activity is robust.

These two measures of anticipated inflation can, and often are, conflicting.

Measures of US Treasury Bond Interest Rate Risk

Metrics: 10-Year Treasury Forward-Looking Real Yield and 10-Year Treasury Duration

The expected annualized real yield of the 10 year US Treasury Bond is a measure of valuation risk for US Treasuries. A low real yield means investors will accept a low rate of expected return for the certainty of receiving their nominal cash flows. PCA estimates the expected annualized real yield by subtracting an estimate of expected 10 year inflation (produced by the Survey of Professional Forecasters as collected by the Federal Reserve Bank of Philadelphia), from the 10 year Treasury constant maturity interest rate.

Duration for the 10-Year Treasury Bond is calculated based on the current yield and a price of 100. This is a measure of expected percentage movements in the price of the bond based on small movements in percentage yield. We make no attempt to account for convexity.

RISK METRIC DESCRIPTION – Rationale for selection and calculation methodology

What is the PCA Market Sentiment Indicator (PMSI)?

The PMSI 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 PMSI 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 PCA Market Sentiment Indicator (PMSI) graph?

Simply put, the PMSI 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 PMSI 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 PMSI. The degree of the signal above or below the neutral reading is an indication the signal's current strength.

How is the PCA Market Sentiment Indicator (PMSI) Constructed?

The PMSI is constructed from two sub-elements representing investor sentiment in stocks and bonds:

1. Stock return momentum: Return momentum for the S&P 500 Equity Index (trailing 12-months)
2. Bond yield spread momentum: Momentum of bond yield spreads (excess of the measured bond yield over the identical duration U.S. Treasury bond yield) for corporate bonds (trailing 12-months) for both investment grade bonds (75% weight) and high yield bonds (25% weight). The scale of this measure is adjusted to match that of the stock return momentum measure.

The black line reading on the graph is calculated as the average of the stock return momentum measure and the bonds spread momentum measure. The color reading on the graph is determined as follows:

1. If both stock return momentum and bond spread momentum are positive = GREEN (positive)
2. If one of the momentum indicators is positive, and the other negative = GRAY (inconclusive)
3. If both stock return momentum and bond spread momentum are negative = RED (negative)

What does the PCA Market Sentiment Indicator (PMSI) 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 PMSI 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.

Momentum is defined as the persistence of relative performance. There is a significant amount of academic evidence indicating that positive momentum (e.g., strong performing stocks over the recent past continue to post strong performance into the near future) exists over near-to-intermediate holding periods. See, for example, "Understanding Momentum," *Financial Analysts Journal*, Scowcroft, Sefton, March, 2005.

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