

**ATTACHMENT A:
PFRS INVESTMENT PERFORMANCE
AS OF DECEMBER 31, 2016**



PENSION
CONSULTING
ALLIANCE



Q4 2016

Oakland Police and Fire Retirement System

Quarterly Report

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TOTAL PORTFOLIO SUMMARY

As of December 31, 2016, the City of Oakland Police and Fire Retirement System (OPFRS) portfolio had an aggregate value of \$355.6 million. This represents a (\$7.6) million decrease in value, which includes (\$15) million in benefit payments, over the quarter. During the previous one-year period, the OPFRS Total Portfolio decreased by (\$31.1) million, including (\$60) million in withdrawals during the period.

Asset Allocation Trends

The asset allocation targets (see table on page 20) reflect those as of December 31, 2016. Target weightings reflect the Plan's evolving asset allocation (effective 3/31/2014).

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

Recent Investment Performance

During the most recent quarter, the OPFRS Total Portfolio generated an absolute return of 2.1%, gross of fees, outperforming its policy benchmark. The portfolio underperformed its benchmark over the 1- and 3-year periods while outperforming over the 5-year period.

The Total Portfolio outperformed the Median fund's return over the most recent quarter, Fiscal YTD, 1-, and 3-year periods while trailing the Median fund over the 5-year period. 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	2.1	6.4	8.7	5.1	8.3
Policy Benchmark ²	1.9	5.5	9.2	5.8	7.9
Excess Return	0.2	0.9	(0.5)	(0.7)	0.4
Reference: Median Fund ³	0.7	4.0	7.1	4.6	8.5
Reference: Total Net of Fees ⁴	2.0	6.2	8.3	4.7	7.9

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% BC Universal, and 20% CBOE BXM

³ Investment Metrics < \$1 Billion Public Plan Universe.

⁴ Net of fee returns are estimated based on OPFRS manager fee schedule (approximately 42 bps).

Investment Market Risk Metrics

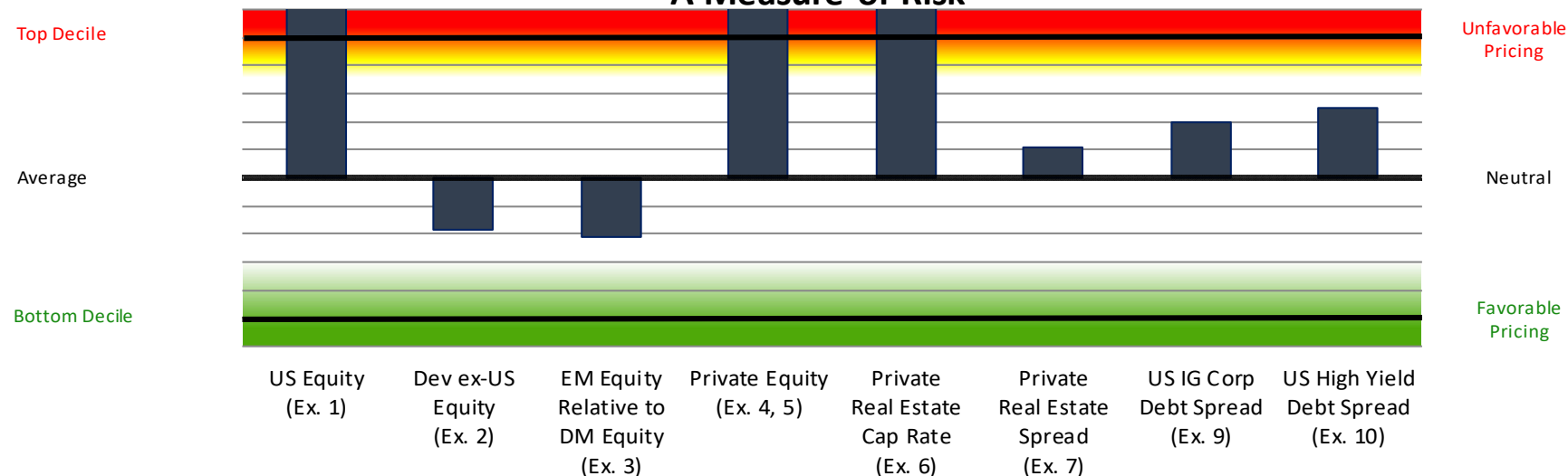
Takeaways

- U.S. public equity and private equity valuation became even more extended in December.
- U.S. credit spreads narrowed in both investment grade and high yield in December.
- Non-U.S. developed and emerging market valuations are historically cheap relative to their own histories and relative to U.S. levels, even after appreciating into year-end.
- At quarter-end, the 10-year Treasury interest rate moved up sharply from earlier in the year to 2.5%.
- Fundamental momentum remains positive in most U.S. markets and rents are expected to move up with interest rates. However, historically high private-real-estate valuations may be worth examining, given the 100 basis point rise in rates since October. Real estate financing tends to be driven by expectations for the 10-year Treasury rates.
- Inflation indicators moved up at year-end off of decade low levels.
- Real yields moved up and into positive territory for the first time in over a year, indicating growth concerns easing somewhat in the U.S.
- The yield curve slope steepened, potentially indicting higher levels of uncertainty concerning rates / growth / inflation.
- PCA's sentiment indicator became significantly more positive by year end, as risk assets rallied strongly from earlier in the year. The sentiment indicator remains **green**.

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

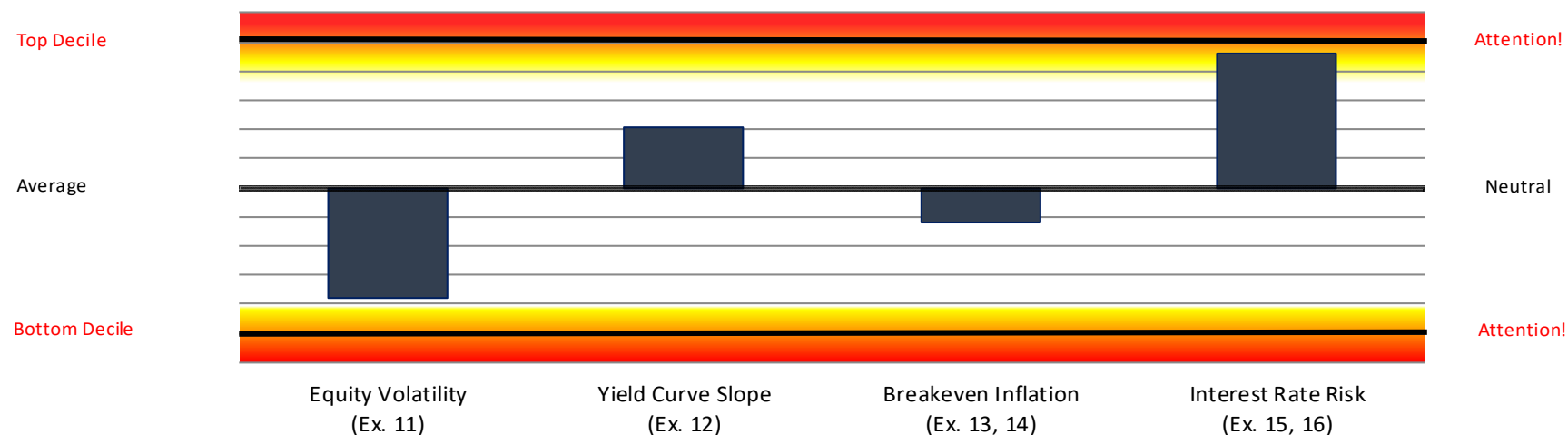
Valuation Metrics versus Historical Range

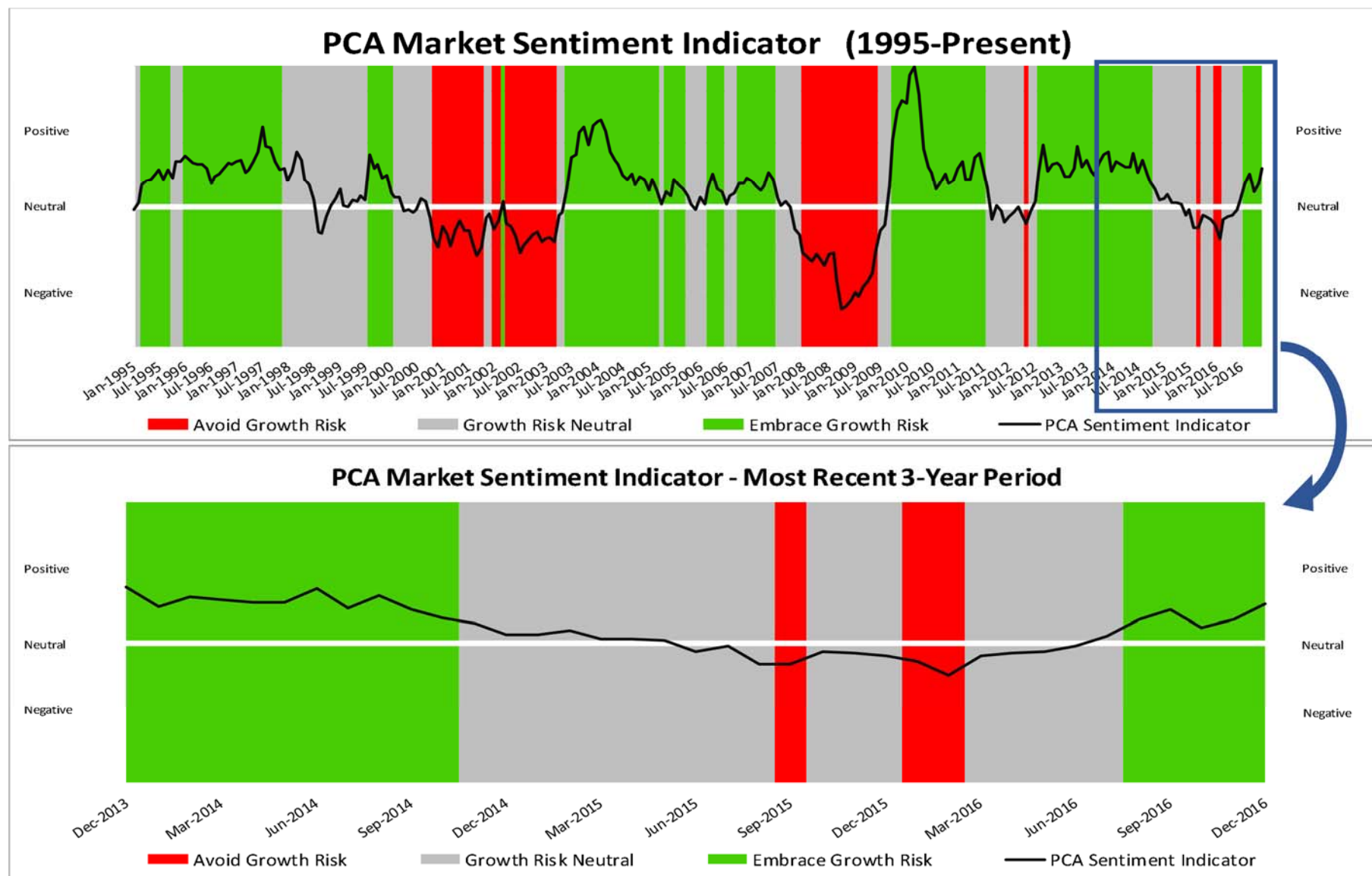
A Measure of Risk



Other Important Metrics within their Historical Ranges

Pay Attention to Extreme Readings





Information Behind Current Sentiment Reading

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

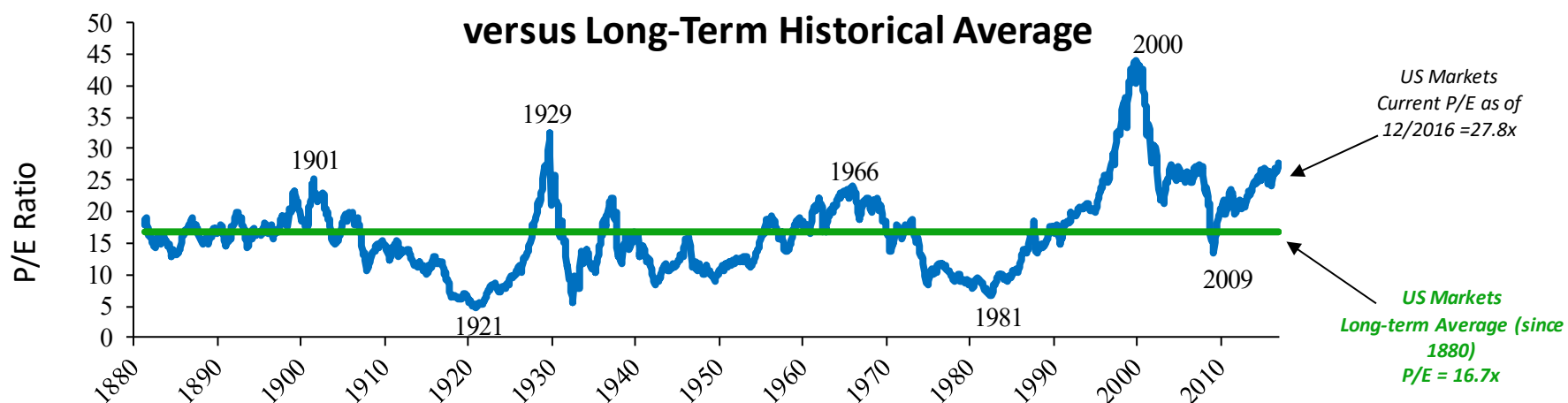
Positive
Positive
Agree



Developed Public Equity Markets

Exhibit 1

U.S. Equity Market P/E Ratio¹ versus Long-Term Historical Average

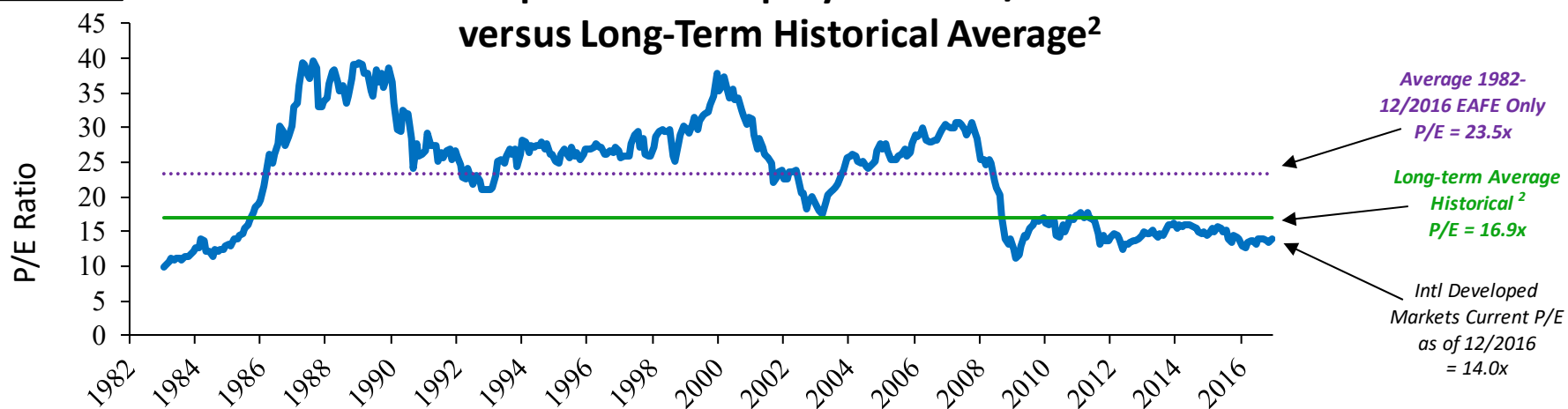


¹ P/E ratio is a Shiller P/E-10 based on 10 year real S&P 500 earnings over S&P 500 index level.

(Please note different time scales)

Exhibit 2

Developed ex-U.S. Equity Market P/E Ratio¹ versus Long-Term Historical Average²



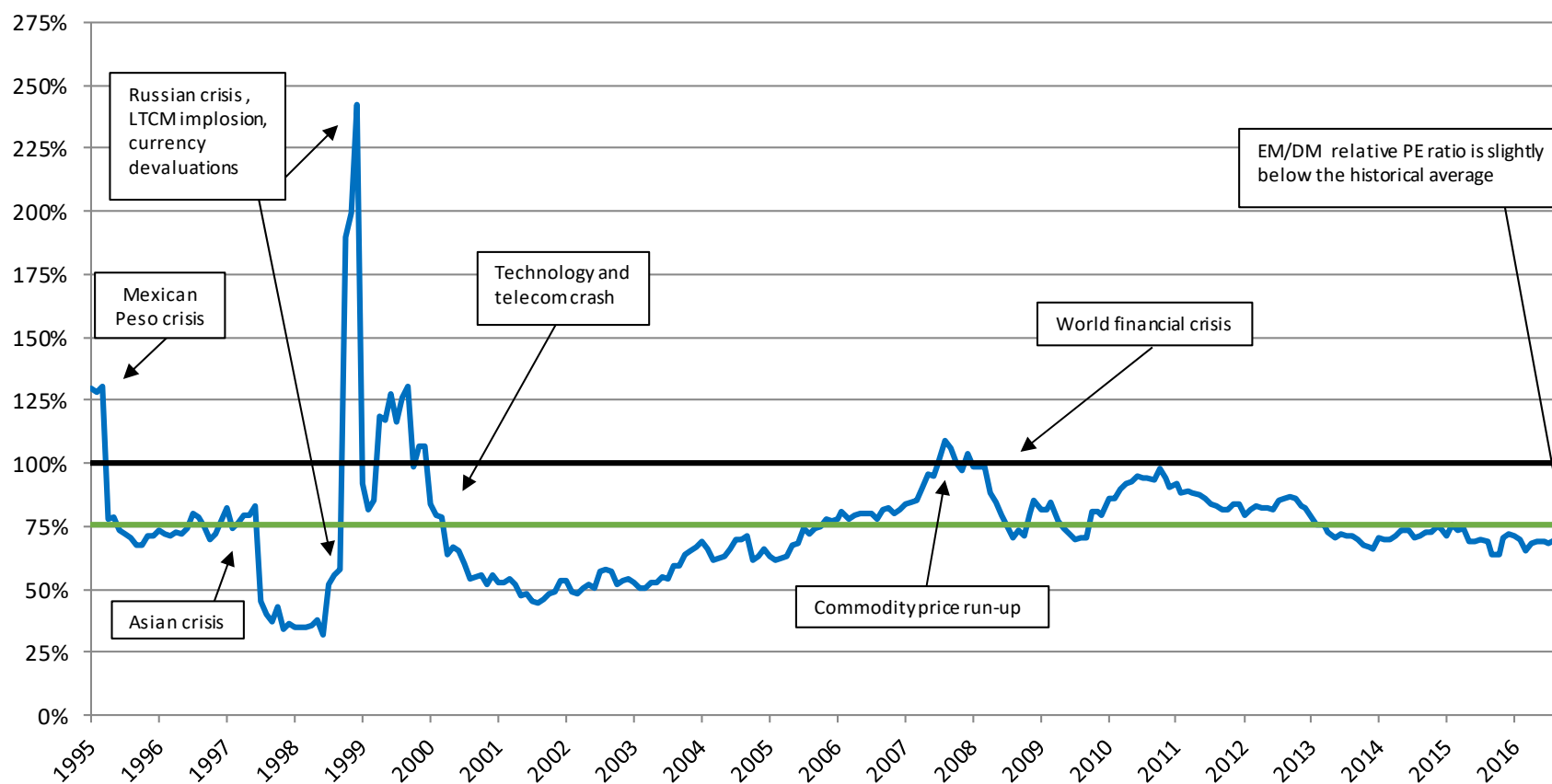
¹ P/E ratio is a Shiller P/E-10 based on 10 year real MSCI EAFE earnings over EAFE index level.

² To calculate the LT historical average, from 1881 to 1982 U.S. data is used as developed market proxy. From 1982 to present, actual developed ex-US market data (MSCI EAFE) is used.

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

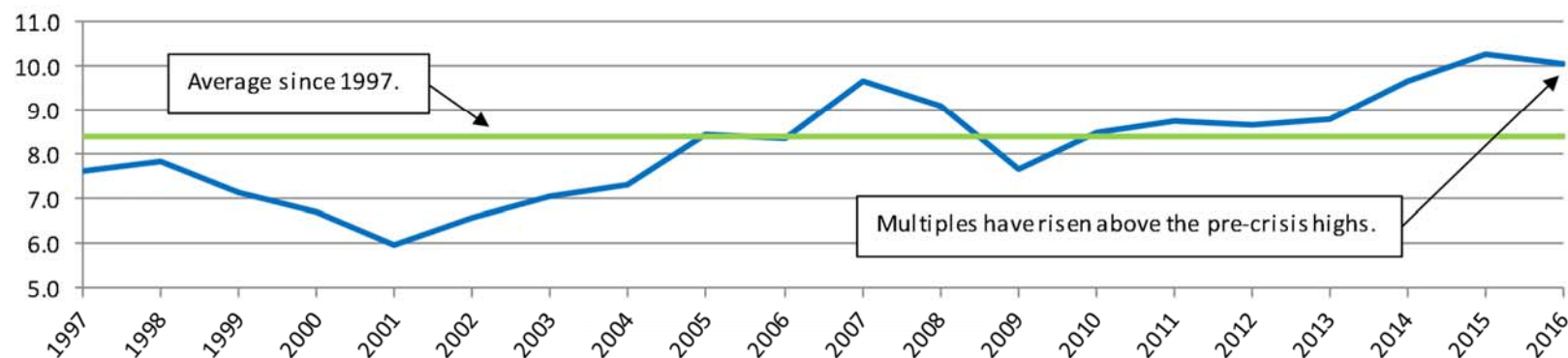
Average EM/DM PE

Parity

U.S. Private Equity Markets

Exhibit 4

Price to EBITDA Multiples Paid in LBOs

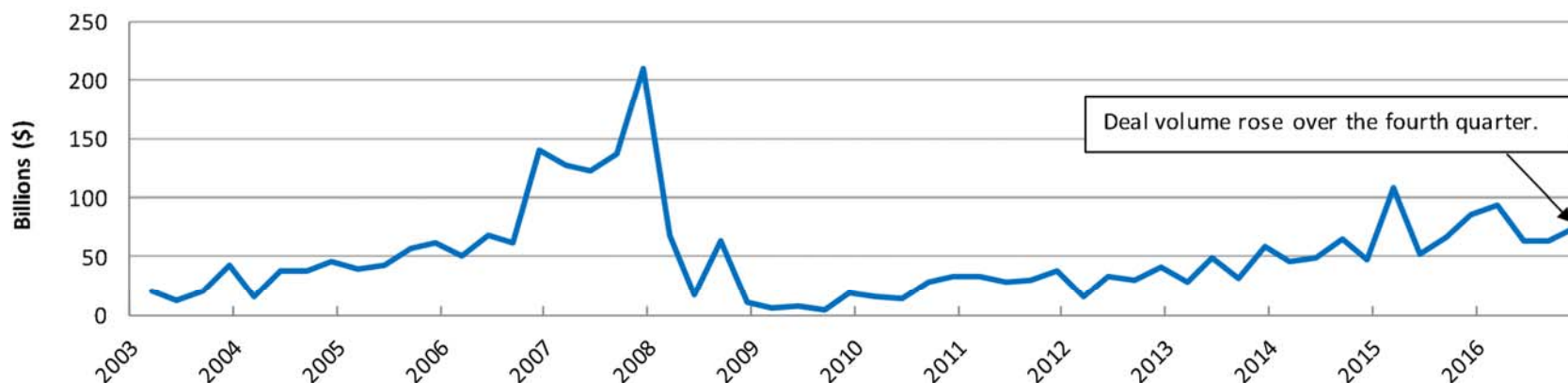


Source: S&P LCD study

(Please note different time scales)

Exhibit 5

Disclosed U.S. Quarterly Deal Volume*



Source: Thomson Reuters Buyouts

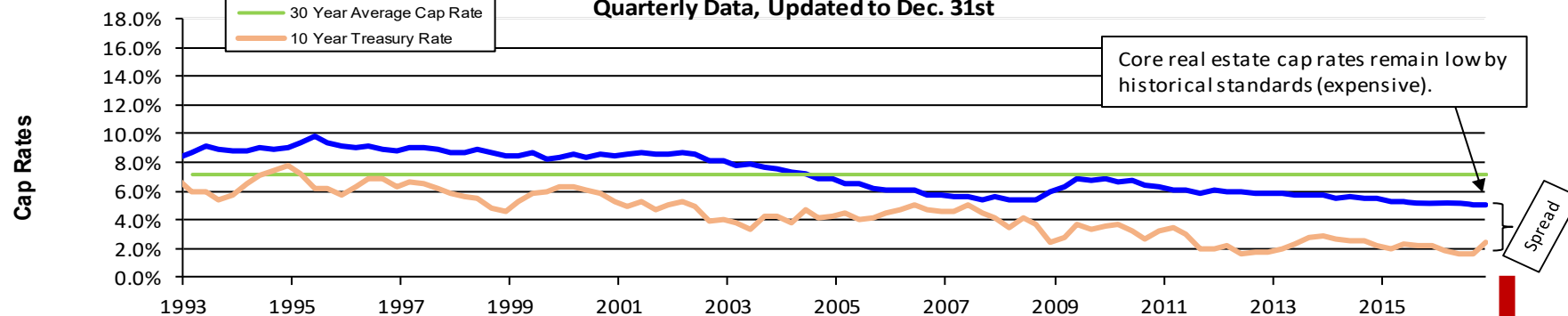
* quarterly total deal size (both equity and debt)

Private Real Estate Markets

Exhibit 6

Current Value Cap Rates¹

Quarterly Data, Updated to Dec. 31st



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

Core Cap Rate Spread over 10-Year Treasury Interest Rate

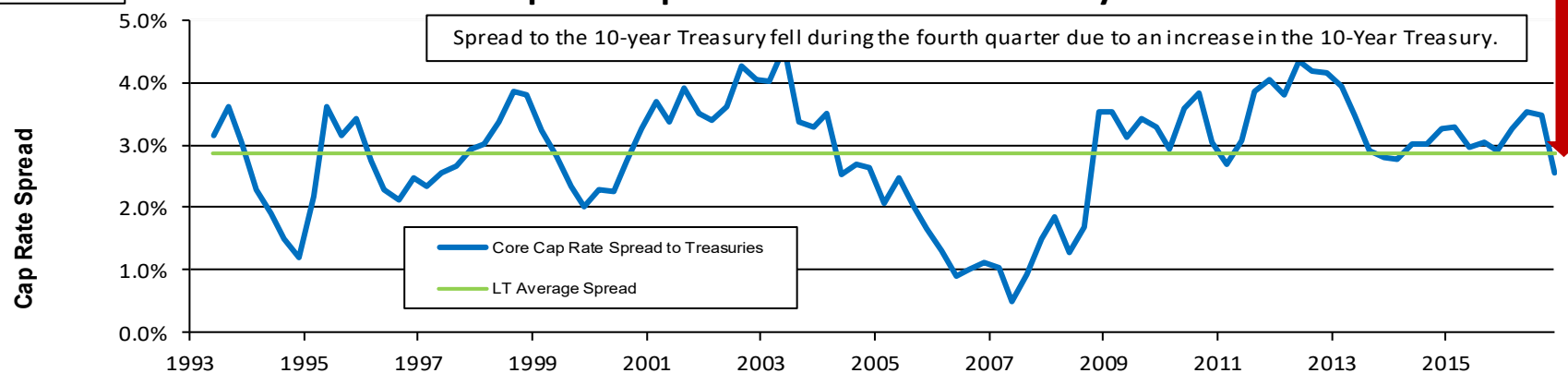
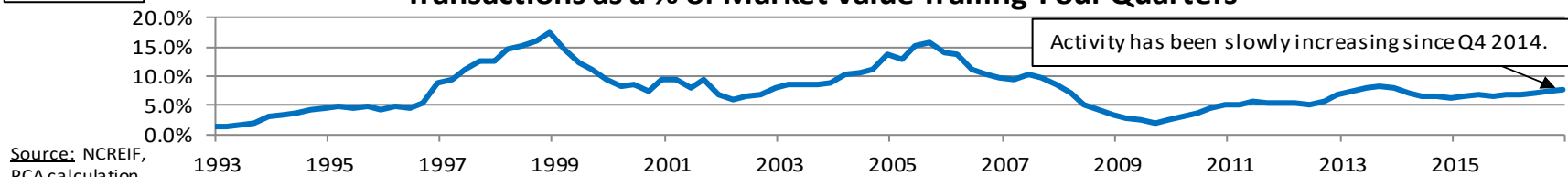


Exhibit 8

Transactions as a % of Market Value Trailing-Four Quarters

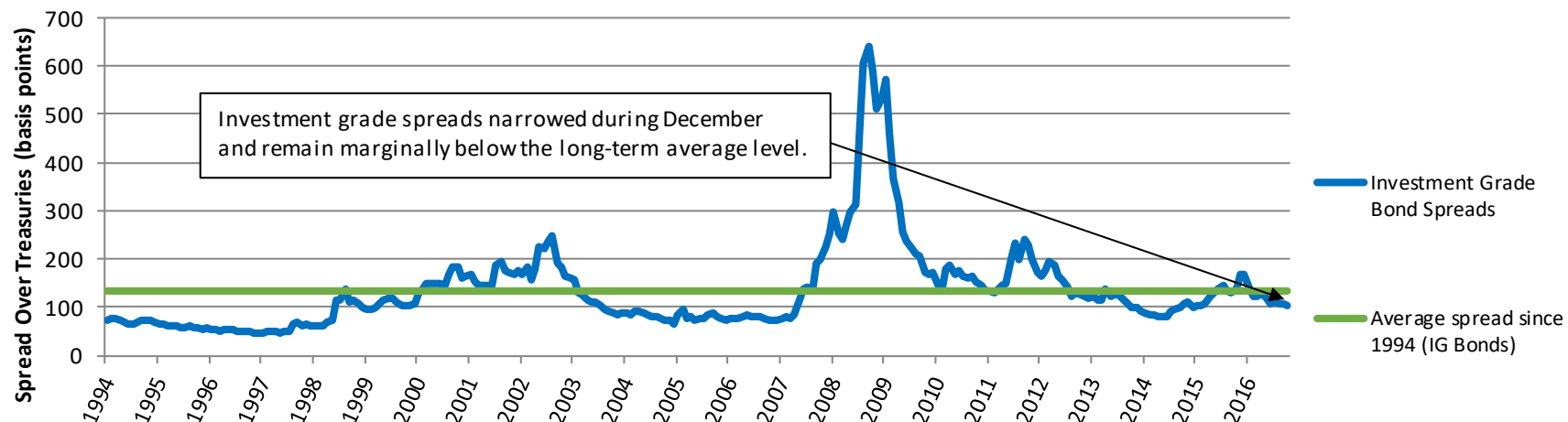


Source: NCREIF, PCA calculation

Credit Markets U.S. Fixed Income

Exhibit 9

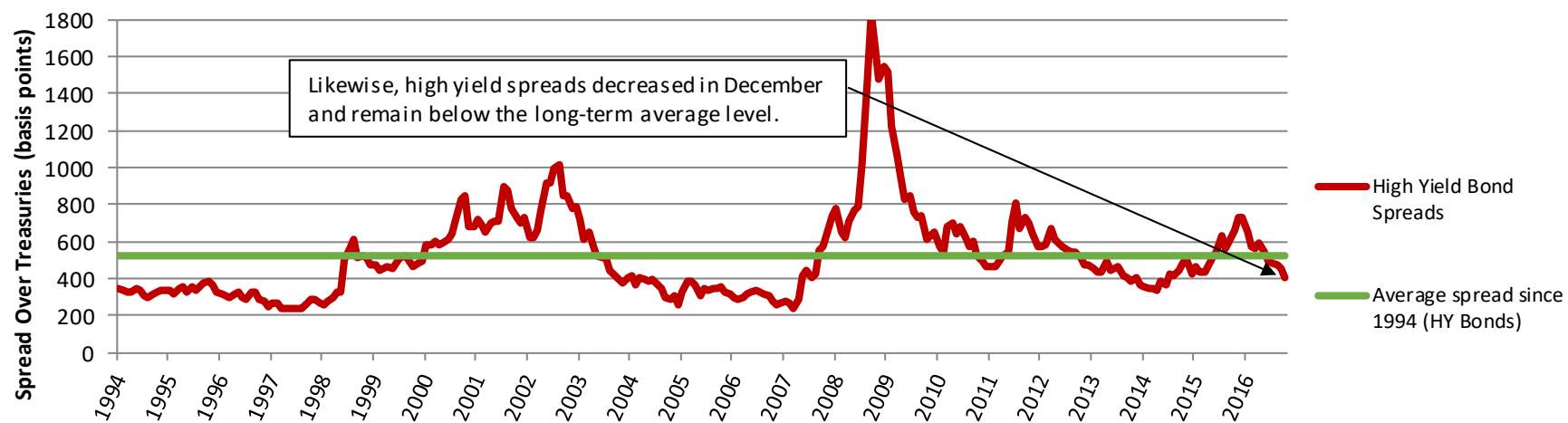
Investment Grade Corporate Bond Spreads



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

Exhibit 10

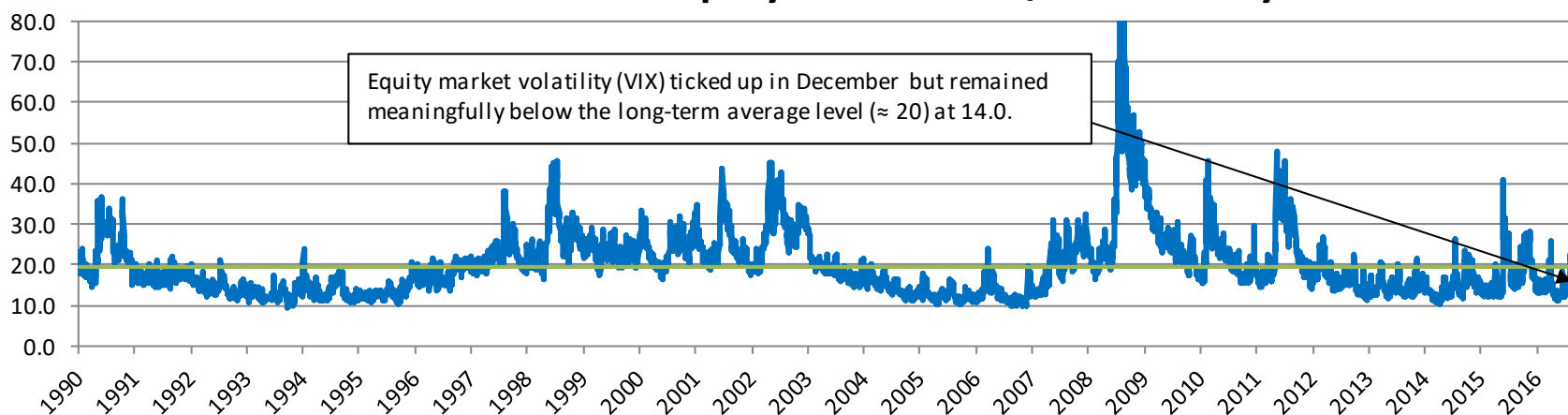
High Yield Corporate Bond Spreads



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

Other Market Metrics

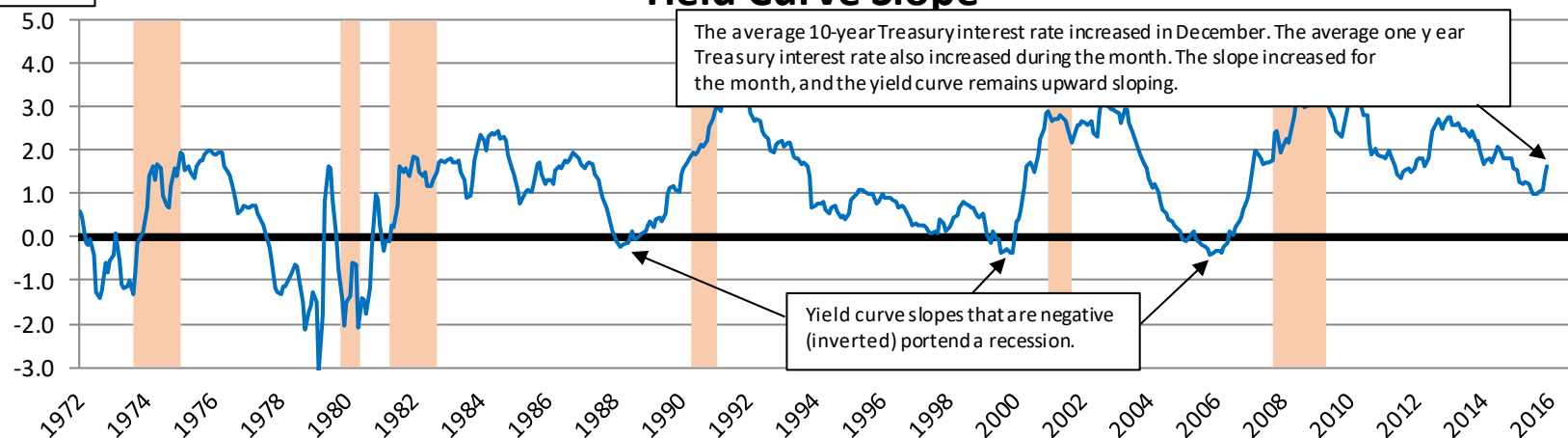
Exhibit 11

VIX - a measure of equity market fear / uncertainty

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

(Please note different time scales)

Exhibit 12

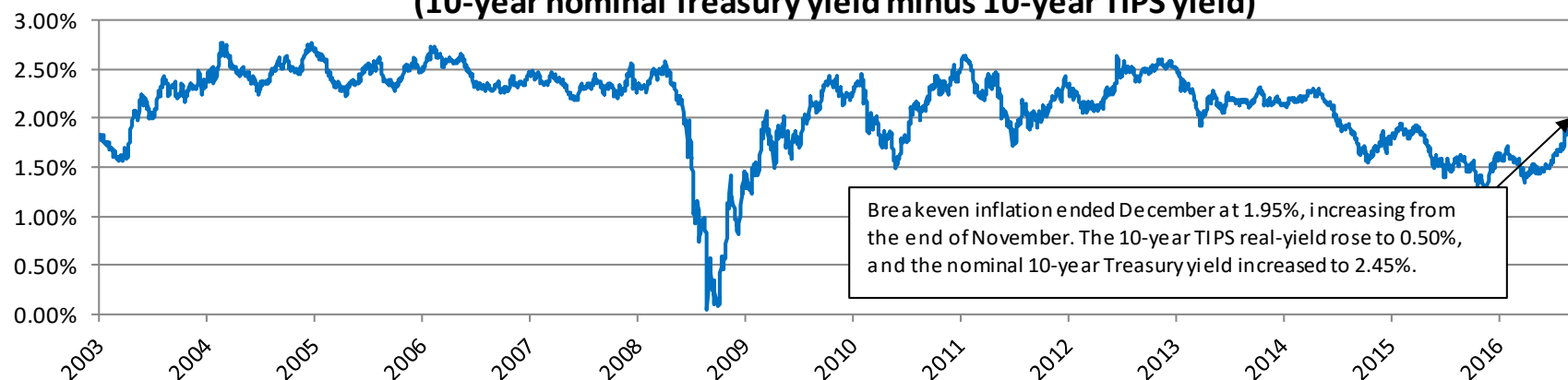
Yield Curve Slope

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

Measures of Inflation Expectations

Exhibit 13

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



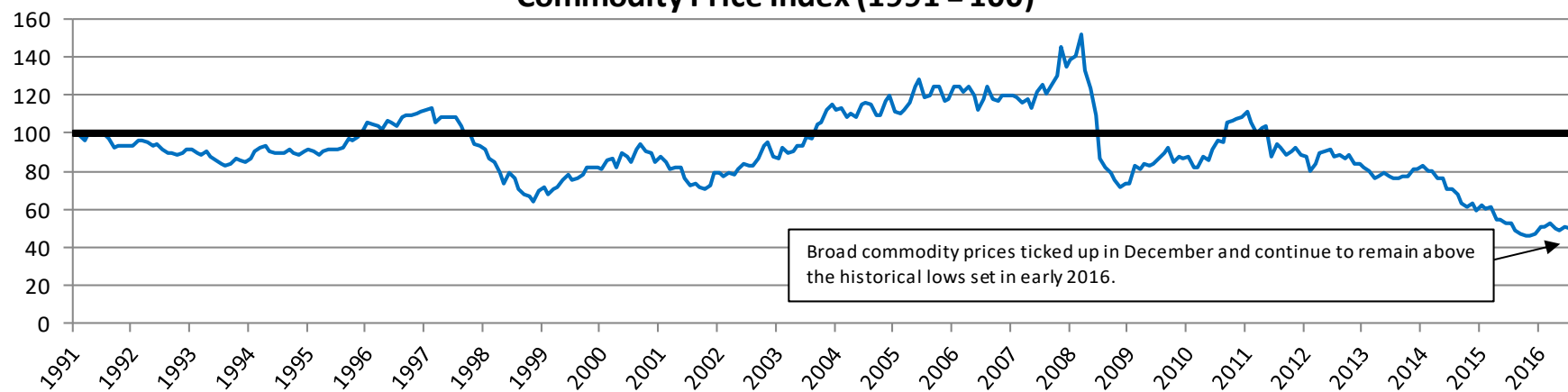
Source: www.ustreas.gov

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)

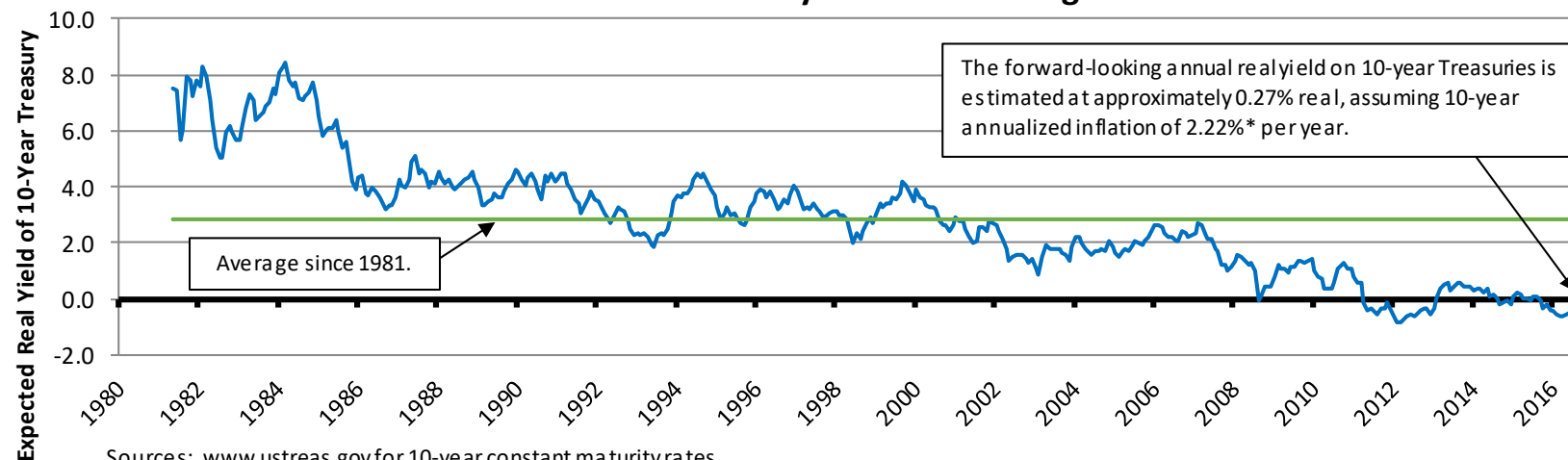


Source: Bloomberg Commodity Index, St. Louis Fed for US CPI all urban consumers.

Measures of U.S. Treasury Interest Rate Risk

Exhibit 15

Estimate of 10-Year Treasury Forward-Looking Real Yield

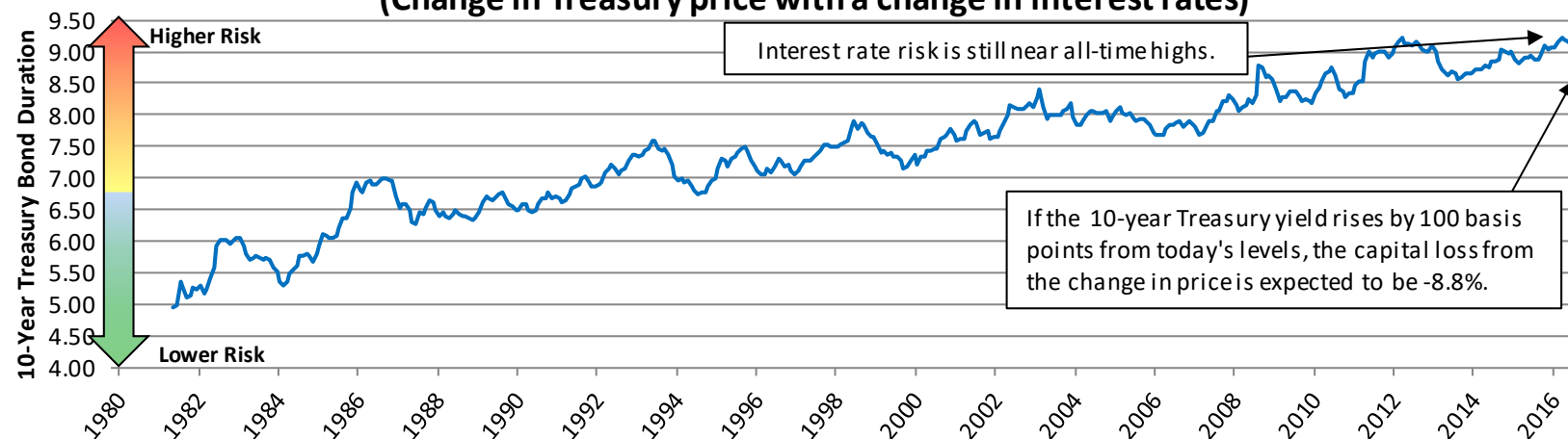


Sources: www.ustreas.gov for 10-year constant maturity rates

*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

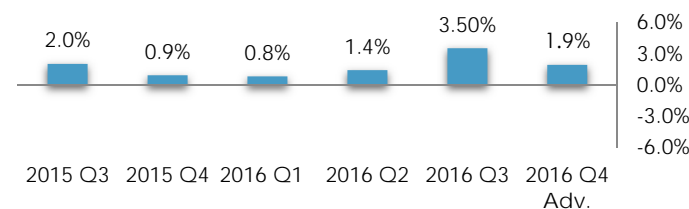
Economic & Market Overview

Overview: US GDP growth increased by 1.9% in the fourth quarter. GDP growth during the quarter was driven mostly by consumer spending, private inventory investment, and state and local government spending. The unemployment rate decreased during the fourth quarter to 4.7%. The seasonally adjusted Consumer Price Index for All Urban Consumers increased by 3.4% on an annualized basis during the quarter. Commodities increased during the fourth quarter, and are now up 11.7% over the trailing 1-year period. Global equities were positive for the quarter, 1.3% (MSCI ACWI). The US dollar appreciated against the Euro, Pound, and the Yen. Bond markets produced a negative return over the quarter as the BC Universal decreased by (2.6%).

Economic Growth

- Real GDP increased at an annualized rate of 1.9 percent in the fourth quarter of 2016.
- Real GDP growth was driven by increases in consumer spending, private inventory investment, and state and local government spending.
- GDP growth gains were partially offset during the quarter by declines in exports and federal government spending. Imports, which detract from GDP, increased.

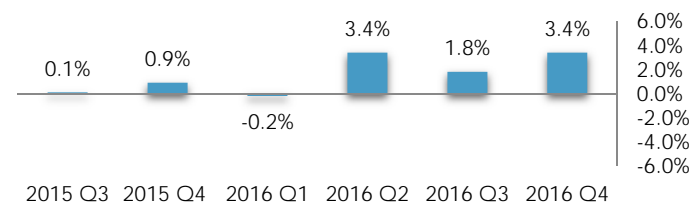
Annualized Quarterly GDP Growth



Inflation

- The Consumer Price Index for All Urban Consumers (CPI-U) increased 3.4 percent in the 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 2.1 percent for the quarter on an annualized basis after seasonal adjustment.
- Over the last 12 months, core CPI-U increased 2.2 percent after seasonal adjustment.

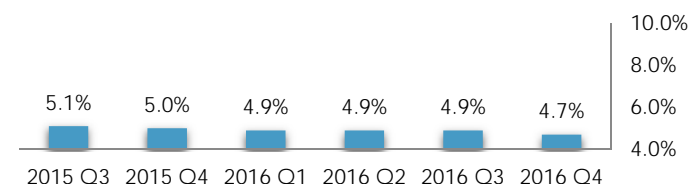
CPI-U After Seasonal Adjustment



Unemployment

- The US economy gained approximately 495,000 jobs in the quarter.
- The unemployment rate decreased to 4.7% at quarter end.
- The majority of jobs gained occurred in education and health services, professional and business services, and health care and social assistance. The majority of jobs lost occurred mining and logging, nondurable goods, and information.

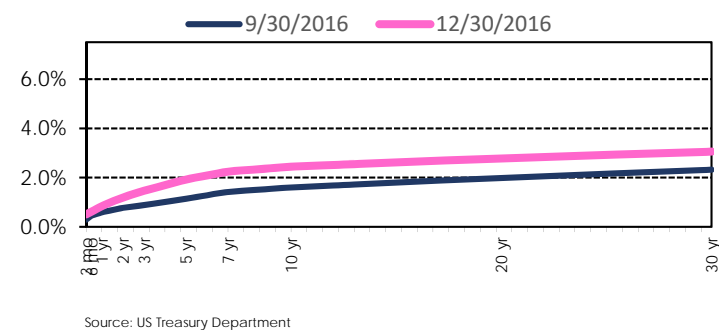
Unemployment Rate



Interest Rates & US Dollar

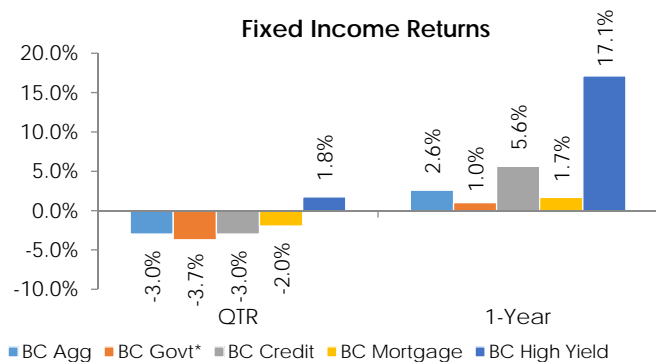
- US Treasury yields rose on average over the quarter.
- The Federal Reserve has increased the federal funds rate to between 0.50 percent and 0.75 percent.
- The US dollar appreciated against the Euro, Pound and the Yen by 6.4%, 4.9%, and 15.4%, respectively.

Treasury Yield Curve Changes



Fixed Income

- US bonds delivered mostly negative returns for the quarter, with high yield performing the best, returning 1.8%, while government performed the worst at (3.7%).
- Over the trailing 1-year period, high yield materially outperformed all other sectors producing a 17.1% return. Credit also performed favorably with an annual return of 5.6%.



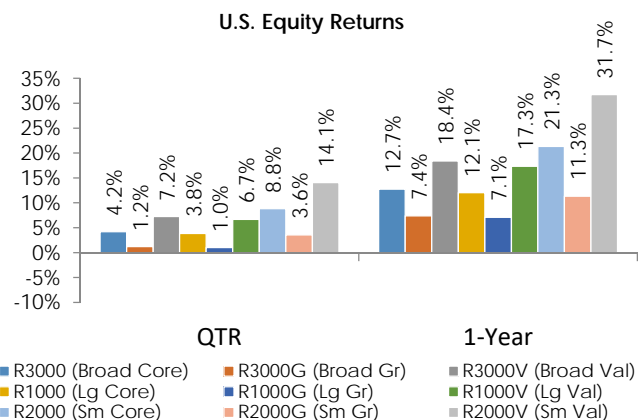
*US Treasuries and Agencies

US Fixed Income Sector Performance (BC Aggregate Index)			
Sector	Weight	QTR	1 Year
Governments*	40.0%	-3.7%	1.3%
Agencies	3.9%	-2.1%	2.3%
Inv. Grade Credit	25.7%	-2.8%	6.1%
MBS	28.1%	-2.0%	1.7%
ABS	0.5%	-0.7%	2.0%
CMBS	1.7%	-3.0%	3.3%

*US Treasuries and Government Related

US Equities

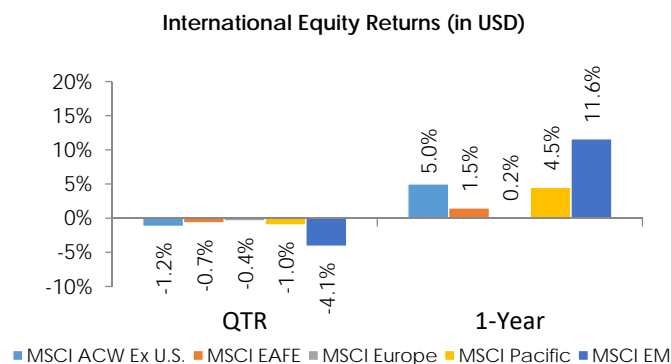
- During the quarter, value stocks dominated growth stocks across the market capitalization spectrum. In terms of market capitalization, small cap stocks provided the strongest returns across styles. Large cap growth stocks returned this quarter's weakest return at 1.0%, and small cap value provided the best results (+14.1%).
- During the 1-year period, US equities provided positive double digit returns, with the top performer, small cap value, returning 31.7%. Conversely, large cap growth trailed all other market caps and styles with a return of 7.1%.



US Equity Sector Performance (Russell 3000 Index)			
Sector	Weight	QTR	1 Year
Information Tech.	19.9%	2.2%	16.4%
Financials	15.5%	22.3%	23.2%
Health Care	13.0%	-2.9%	1.4%
Consumer Disc.	12.5%	4.1%	8.9%
Industrials	10.9%	9.2%	22.6%
Consumer Staples	8.3%	-1.0%	6.3%
Energy	7.0%	8.4%	33.8%
Real Estate	4.0%	-1.9%	9.7%
Utilities	3.1%	1.0%	17.6%
Materials	3.4%	7.5%	31.0%
Telecomm. Serv.	2.4%	5.7%	24.1%

International Equities

- International equities performed poorly over the quarter as each region provided negative returns. The best performer was Europe, with a return of minus (0.4%). Emerging markets trailed all other regions with a return of minus (4.1%).
- Over the trailing 1-year period, international equities were positive across the board. Emerging markets provided a double digit return of 11.6%, while Europe underperformed all other regions with a 0.2% 1-year return.



International Equity Region Performance (in USD) (MSCI ACW Index ex US)			
Sector	Weight	QTR	1 Year
Europe Ex. UK	31.6%	-0.2%	0.3%
Emerging Markets	22.8%	-4.1%	11.6%
Japan	17.0%	-0.1%	2.7%
United Kingdom	13.0%	-0.9%	-0.0%
Pacific Ex. Japan	8.6%	-2.7%	8.0%
Canada	7.1%	3.4%	25.5%

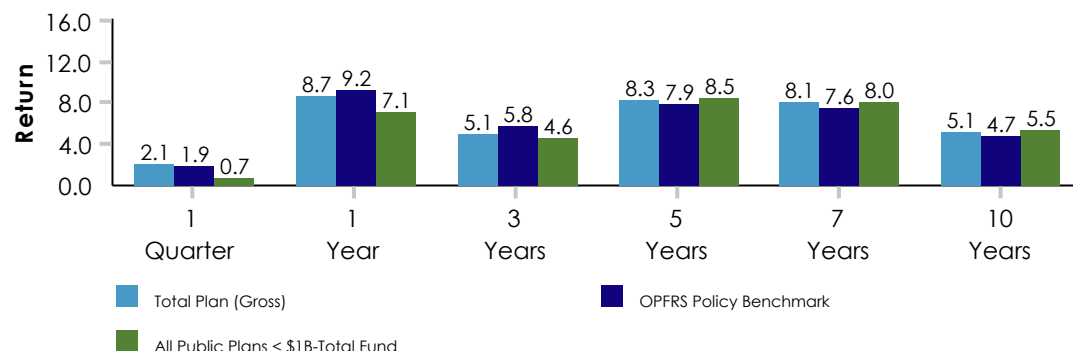
Market Summary – Long-term Performance*

Indexes	Month	Quarter	1 Year	3 Years	5 Years	10 Years	20 Years
Global Equity							
MSCI AC World Index	2.2%	1.3%	8.5%	3.7%	10.0%	4.1%	6.1%
Domestic Equity							
S&P 500	2.0%	3.8%	12.0%	8.9%	14.7%	6.9%	7.7%
Russell 3000	2.0%	4.2%	12.7%	8.4%	14.7%	7.1%	7.9%
Russell 3000 Growth	1.2%	1.2%	7.4%	8.3%	14.4%	8.3%	6.8%
Russell 3000 Value	2.6%	7.2%	18.4%	8.6%	14.8%	5.8%	8.4%
Russell 1000	1.9%	3.8%	12.1%	8.6%	14.7%	7.1%	7.9%
Russell 1000 Growth	1.2%	1.0%	7.1%	8.6%	14.5%	8.3%	6.9%
Russell 1000 Value	2.5%	6.7%	17.3%	8.6%	14.8%	5.7%	8.3%
Russell 2000	2.8%	8.8%	21.3%	6.7%	14.5%	7.1%	8.2%
Russell 2000 Growth	1.4%	3.6%	11.3%	5.1%	13.7%	7.8%	6.3%
Russell 2000 Value	4.1%	14.1%	31.7%	8.3%	15.1%	6.3%	9.7%
Russell Microcap	4.6%	10.0%	20.4%	5.8%	15.6%	5.5%	---
CBOE BXM Index	0.1%	2.6%	7.1%	6.0%	7.2%	4.3%	6.8%
International Equity							
MSCI AC World Index ex USA	2.6%	-1.2%	5.0%	-1.3%	5.5%	1.4%	5.0%
MSCI EAFE	3.4%	-0.7%	1.5%	-1.2%	7.0%	1.2%	4.6%
MSCI Pacific	5.3%	-0.4%	0.2%	-2.6%	6.9%	1.0%	5.8%
MSCI Europe	0.5%	-1.0%	4.5%	1.7%	7.4%	1.8%	2.6%
MSCI EM (Emerging Markets)	0.3%	-4.1%	11.6%	-2.2%	1.6%	2.2%	5.7%
Fixed Income							
BC Universal	0.3%	-2.6%	3.9%	3.3%	2.8%	4.6%	5.5%
Global Agg. - Hedged	0.3%	-2.3%	3.9%	4.1%	3.6%	4.4%	5.3%
BC Aggregate Bond	0.1%	-3.0%	2.6%	3.0%	2.2%	4.3%	5.3%
BC Government	-0.1%	-3.7%	1.0%	2.3%	1.2%	3.9%	4.9%
BC Credit Bond	0.6%	-3.0%	5.6%	4.1%	3.8%	5.3%	5.9%
BC Mortgage Backed Securities	0.0%	-2.0%	1.7%	3.1%	2.1%	4.3%	5.2%
BC High Yield	1.8%	1.8%	17.1%	4.7%	7.4%	7.5%	7.0%
BC WGIL All Maturities - Hedged	1.4%	-2.1%	10.2%	5.9%	3.5%	5.1%	---
Emerging Markets Debt	1.1%	-2.6%	9.9%	5.3%	5.7%	6.7%	8.8%
Real Estate							
NCREIF	0.7%	2.1%	8.8%	12.1%	12.2%	5.8%	9.3%
FTSE NAREIT All Equity Index	4.2%	-2.9%	9.3%	12.4%	12.0%	4.7%	9.1%
Commodity Index							
Bloomberg Commodity Index	1.8%	2.7%	11.7%	-11.3%	-9.0%	-5.6%	0.5%

* Performance is annualized for periods greater than one year.

Performance and Market Values As of December 31, 2016

Investment Performance



Portfolio Valuation (000's)

	1 Quarter	1 Year
OPFRS Total Plan		
Beginning Market Value	363,169	384,001
Net Contributions	-15,000	-60,497
Gain/Loss	7,404	32,068
Ending Market Value	355,573	355,573

Asset Class Performance (gross of fees)

	1 Quarter	1 Year	3 Years	5 Years	7 Years	10 Years
OPFRS Total Plan	2.1	8.7	5.1	8.3	8.1	5.1
OPFRS Policy Benchmark*	1.9	9.2	5.8	7.9	7.6	4.7
Domestic Equity	4.4	12.8	8.2	14.5	13.2	7.3
Russell 3000 (Blend)**	4.2	12.7	8.4	14.7	12.9	7.1
International Equity	-2.2	2.1	-0.9	6.5	3.7	1.4
MSCI ACWI Ex US (Blend)^	-1.2	5.0	-1.3	5.5	3.4	1.4
Fixed Income	-2.1	4.9	3.5	3.0	4.2	4.9
Bloomberg Barclays Universal (Blend)^^	-2.6	3.9	3.3	2.8	4.0	4.6
Covered Calls	3.0	10.1	-	-	-	-
CBOE BXM	2.6	7.1	-	-	-	-
Cash	0.2	0.6	0.2	0.1	-	-
Citigroup 3 Month T-Bill Index	0.1	0.3	0.1	0.1	-	-

* 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

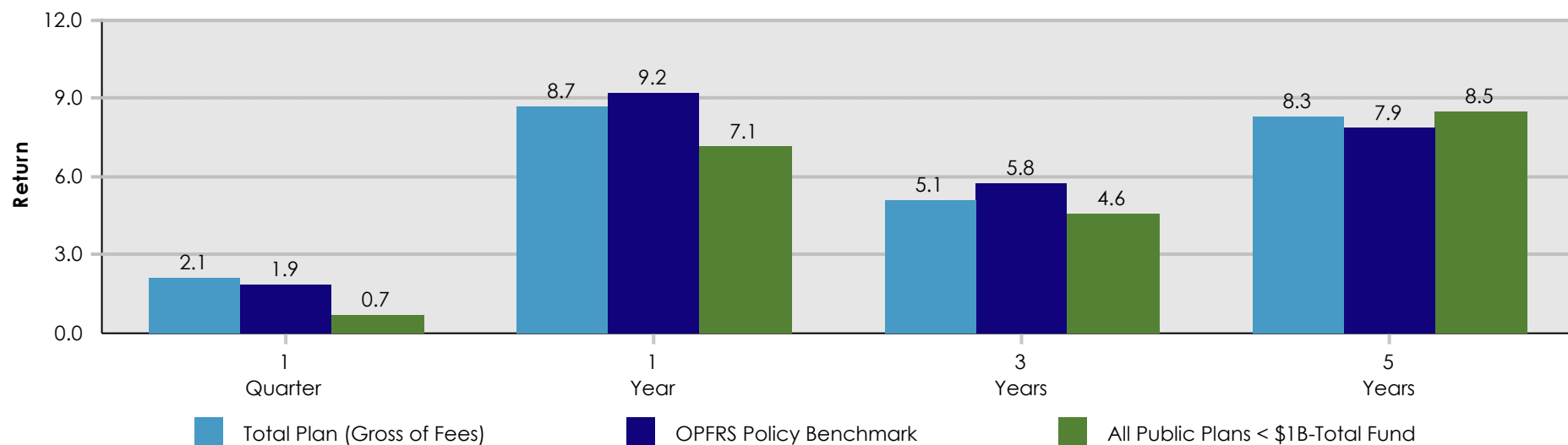
^ International Equity Benchmark consists of MSCI EAFE thru 12/31/04, and MSCI ACWI x US thereafter.

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

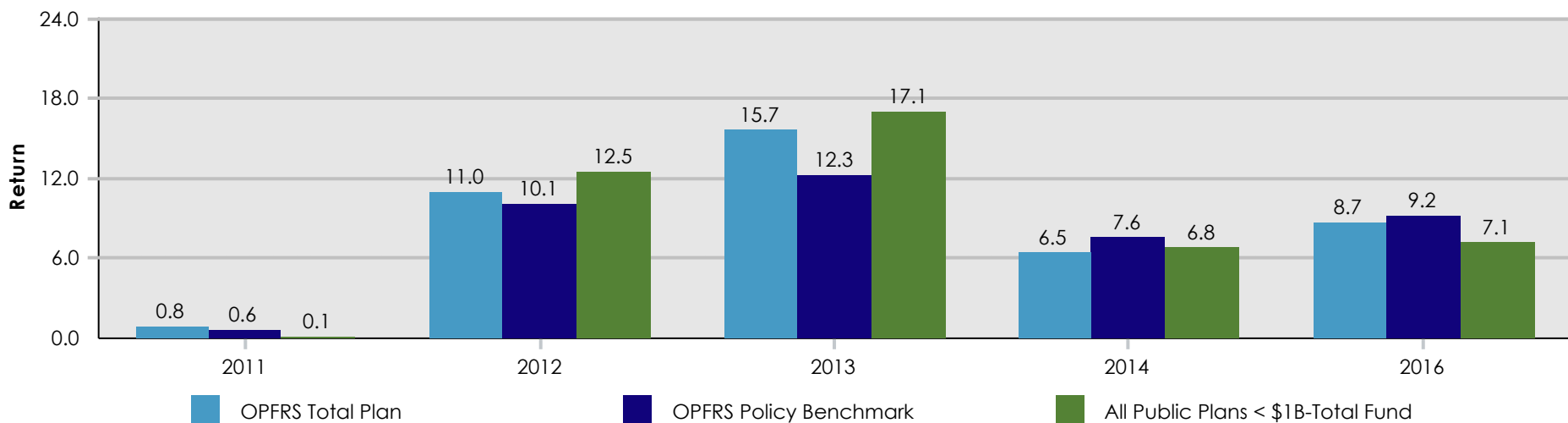
OPFRS Portfolio Relative Performance Results

As of December 31, 2016

Trailing Period Performance (annualized)



12-month Performance- As of December 31, 2016



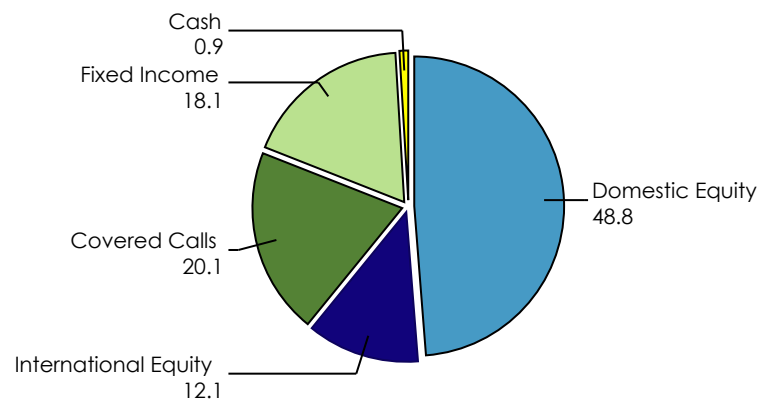
Actual vs. Target Allocation
As of December 31, 2016

	Asset Allocation (\$000)	Asset Allocation (%)	Target Allocation* (%)	Variance (%)
OPFRS Total Plan	355,573	100.0	100.0	0.0
Domestic Equity	173,333	48.7	48.0	0.7
International Equity	43,102	12.1	12.0	0.1
Total Fixed Income	64,289	18.1	20.0	-1.9
Covered Calls	71,496	20.1	20.0	0.1
Cash	3,352	0.9	0.0	0.9

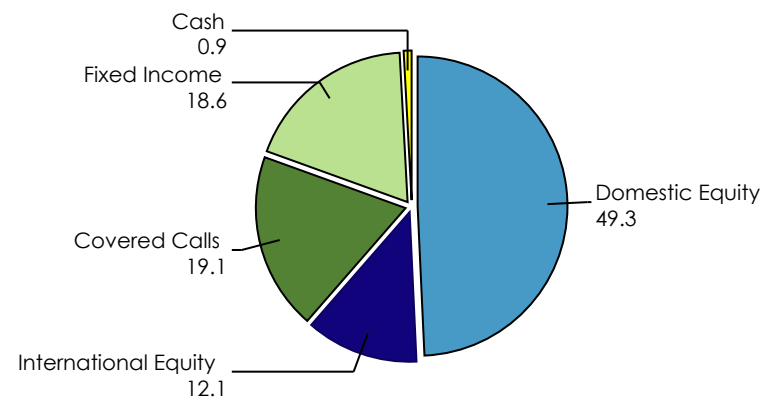
*Target weightings reflect the Plan's evolving asset allocation (effective 3/31/2014).

Actual Asset Allocation Comparison

December 31, 2016 : \$355,525,830



September 30, 2016 : \$363,123,202



Manager Performance - Gross of Fees

As of December 31, 2016

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	71,112	3.8	11.8	8.6	14.7	13.1	05/2010
<i>Russell 1000 Index</i>		3.8	12.1	8.6	14.7	12.3	
Excess Return		0.0	-0.3	0.0	0.0	0.8	
Large Cap Value							
SSgA Russell 1000 Value Index	26,076	6.6	17.3	---	---	7.1	11/2014
<i>Russell 1000 Value Index</i>		6.7	17.3	---	---	7.0	
Excess Return		-0.1	0.0	---	---	0.1	
Large Cap Growth							
SSgA Russell 1000 Growth Index	24,579	1.1	7.2	---	---	6.9	11/2014
<i>Russell 1000 Growth Index</i>		1.0	7.1	---	---	6.9	
Excess Return		0.1	0.1	---	---	0.0	
Mid Cap Core							
EARNST Partners - Active	30,391	5.2	16.4	9.2	14.7	8.5	03/2006
<i>Russell Midcap Index</i>		3.2	13.8	7.9	14.7	8.2	
Excess Return		2.0	2.6	1.3	0.0	0.3	
Small Cap Value							
NWQ - Active	11,708	10.3	21.7	8.9	16.8	7.9	02/2006
<i>Russell 2000 Value Index</i>		14.1	31.7	8.3	15.1	7.0	
Excess Return		-3.8	-10.0	0.6	1.7	0.9	
Small Cap Growth							
Russell 2000 Growth ETF	9,467	3.7	---	---	---	6.4	08/2016
<i>Russell 2000 Growth Index</i>		3.6	---	---	---	6.2	
Excess Return		0.1	---	---	---	0.2	

During the latest three-month period ending December 31, 2016, one of OPFRS's two active Domestic Equity managers outperformed its respective benchmark.

All of OPFRS's passive Domestic Equity mandates performed 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.

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

Manager Performance - Gross of Fees

As of December 31, 2016

Domestic Equity

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, completed the quarter with an 5.2% return, outperforming the Russell Midcap Index by 2.0%. Over the latest 1- and 3-year periods, Earnest outperformed its benchmark by 2.6% and 1.3%, respectively, while matching the benchmark over the 5-year period.

NWQ, the Plan's small cap value manager, underperformed the Russell 2000 Value Index by (3.8%) over the latest quarter. Over the 1-year period, NWQ underperformed its benchmark by (10.0%), but has outperformed over the 3- and 5-year periods by 0.6% and 1.7%, respectively.

Russell 2000 Growth ETF, the Russell 2000 Growth ETF continues to be used as a stand-in until OPFRS's new small cap growth manager, Rice Hall James, is funded sometime during the 1Q2017.

Manager Performance - Gross of Fees

As of December 31, 2016

International Equity

Manager - Style	Mkt Value (\$000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Active International							
Fisher Investments	15,127	-1.6	2.3	-0.4	6.2	2.2	03/2011
<i>MSCI AC World ex USA</i>		-1.2	5.0	-1.3	5.5	1.5	
Excess Return		-0.4	-2.7	0.9	0.7	0.7	
Hansberger	15,572	-4.0	2.5	-1.1	6.6	2.9	01/2006
<i>MSCI AC World ex USA</i>		-1.2	5.0	-1.3	5.5	3.5	
Excess Return		-2.8	-2.5	0.2	1.1	-0.6	
Passive International							
SSgA	12,402	-0.7	1.4	-1.3	6.9	6.8	07/2002
<i>MSCI EAFE Index</i>		-0.7	1.5	-1.2	7.0	6.1	
Excess Return		0.0	-0.1	-0.1	-0.1	0.7	

During the latest three-month period ending December 31, 2016, both of OPFRS's active International Equity managers underperformed their respective benchmarks.

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 (2.8%). The portfolio also underperformed the benchmark by (2.5%) over the 1-year period, but has outperformed over the 3-, and 5-year periods by 0.2% and 1.1%, respectively.

Fisher, one of OPFRS' active international equity managers, underperformed the MSCI ACWI x US Index by (40) basis points during the quarter. Over the latest 1-year period, Fisher trailed its benchmark target by (2.7%), but outperformed over the 3- and 5-year periods by 90 and 70 basis points, respectively.

Manager Performance - Gross of Fees

As of December 31, 2016

Fixed Income

Manager - Style	Mkt Value (\$000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Core Fixed Income							
T. Rowe Price	33,637	-2.9	3.2	3.5	2.8	3.3	04/2011
<i>Bloomberg Barclays U.S. Aggregate Index</i>		-3.0	2.6	3.0	2.2	3.2	
Excess Return		0.1	0.6	0.5	0.6	0.1	
Core-Plus Fixed Income							
Reams	21,904	-2.8	4.0	3.1	3.4	5.8	01/1998
<i>Bbg Barclays Universal (Blend)</i>		-2.6	3.9	3.3	2.8	5.2	
Excess Return		-0.2	0.1	-0.2	0.6	0.6	
High Yield / Bank Loans							
DDJ Capital	8,703	3.4	16.0	---	---	5.3	01/2015
<i>BofA Merrill Lynch High Yield Master II</i>		1.9	17.5	---	---	5.8	
Excess Return		1.5	-1.5	---	---	-0.5	

During the latest three-month period, ending December 31, 2016, two of OPFRS' three active Fixed Income managers outperformed their respective benchmarks.

T. Rowe Price, the Plan's core fixed income manager, produced a quarterly loss of (2.9%), but outperformed the Bbg BC Aggregate Index by 10 basis points. The portfolio outperformed its benchmark over the 1-year period by 60 basis points, while beating the benchmark over the 3- and 5-year periods by 50 and 60 basis points, respectively.

Reams, the Plan's core plus fixed income manager, produced a quarterly loss of (2.8%), underperforming the Bbg BC Universal (Blend) Index by (20) basis points. During the latest 1-year period, the portfolio slightly outperformed its benchmark by 10 basis points while underperforming its benchmark by (20) basis points over the 3-year period. Reams outperformed its benchmark over the 5-year period by 60 basis points.

DDJ, the Plan's High Yield & Bank Loan manager, outperformed its benchmark, the BofAML US High Yield Master II index, by 1.5% over the most recent quarter, but has underperformed over the latest 1-year period by (1.5%).

Manager Performance - Gross of Fees

As of December 31, 2016

Covered Calls

Manager - Style	Mkt Value (\$000)	1 Quarter	1 Year	3 Years	5 Years	Since Inception	Inception Date
Covered Calls Composite							
Covered Calls	71,496	3.0	10.1	---	---	7.2	04/2014
CBOE BXM		2.6	7.1	---	---	5.6	
Excess Return		0.4	3.0	---	---	1.6	
CC - Passive Allocation							
Parametric BXM	35,327	2.5	8.6	---	---	6.4	04/2014
CBOE BXM		2.6	7.1	---	---	5.6	
Excess Return		-0.1	1.5	---	---	0.8	
CC - Active Allocation							
Parametric DeltaShift	36,169	3.5	11.5	---	---	9.0	04/2014
CBOE BXM		2.6	7.1	---	---	5.6	
Excess Return		0.9	4.4	---	---	3.4	

During the latest three-month period ending December 31, 2016, OPFRS' aggregate Covered Calls portfolio has outperformed its benchmark over all time periods measured.

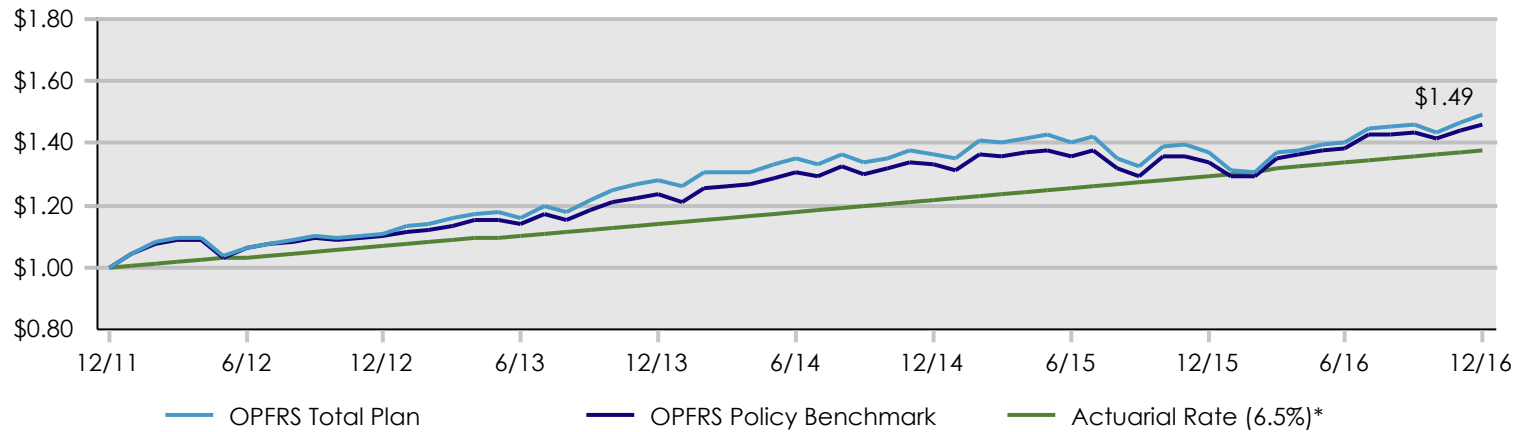
Parametric BXM Portfolio, the Plan's passive covered calls allocation slightly underperformed its CBOE BXM index by (10) basis points over the most recent quarter. Over the most recent 1-year period, the passive replication strategy has outperformed the index by 1.5%.

Parametric Delta Shift Portfolio, the Plan's active covered calls allocation has outperformed the CBOE BXM benchmark by 0.9% over the most recent quarter, and has outperformed the benchmark by 4.4% over the most recent 1-year period.

OPFRS Total Portfolio 5-Year Performance

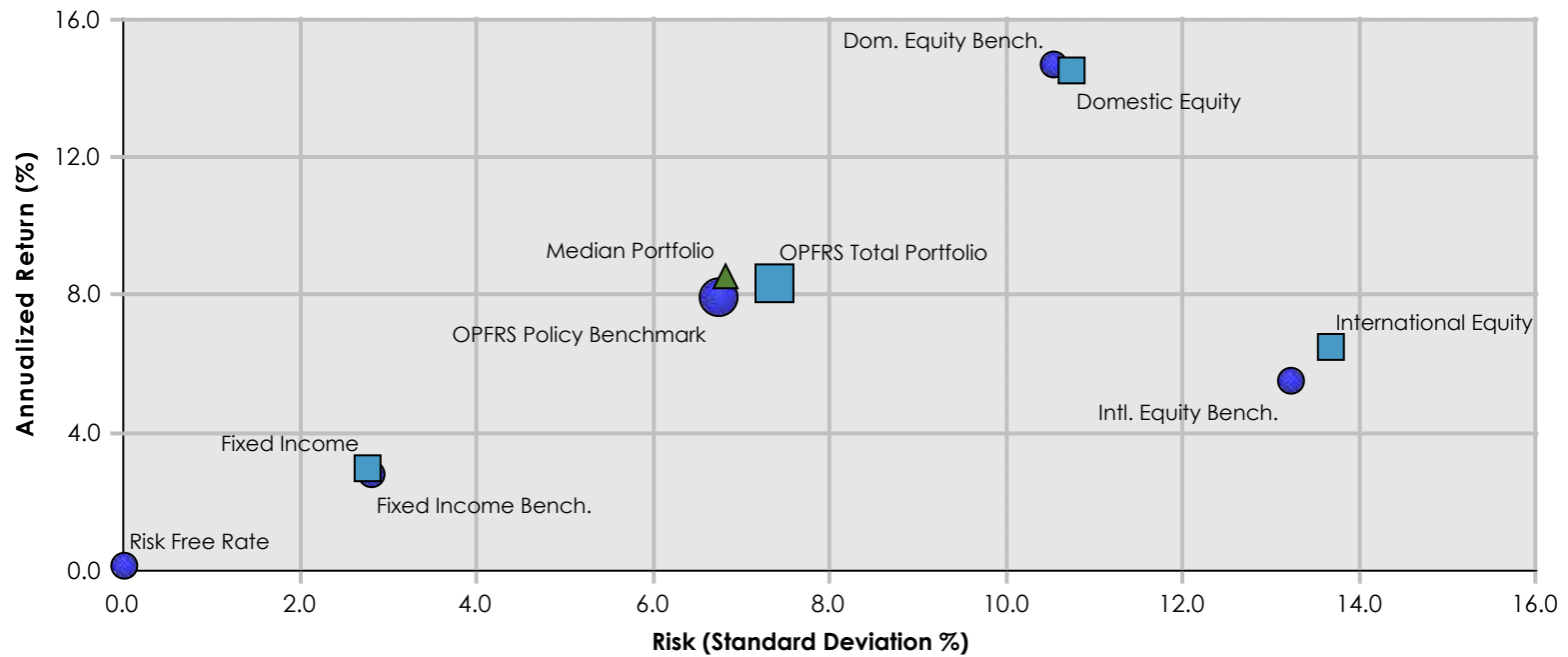
As of December 31, 2016

Growth of \$1 (5-year)

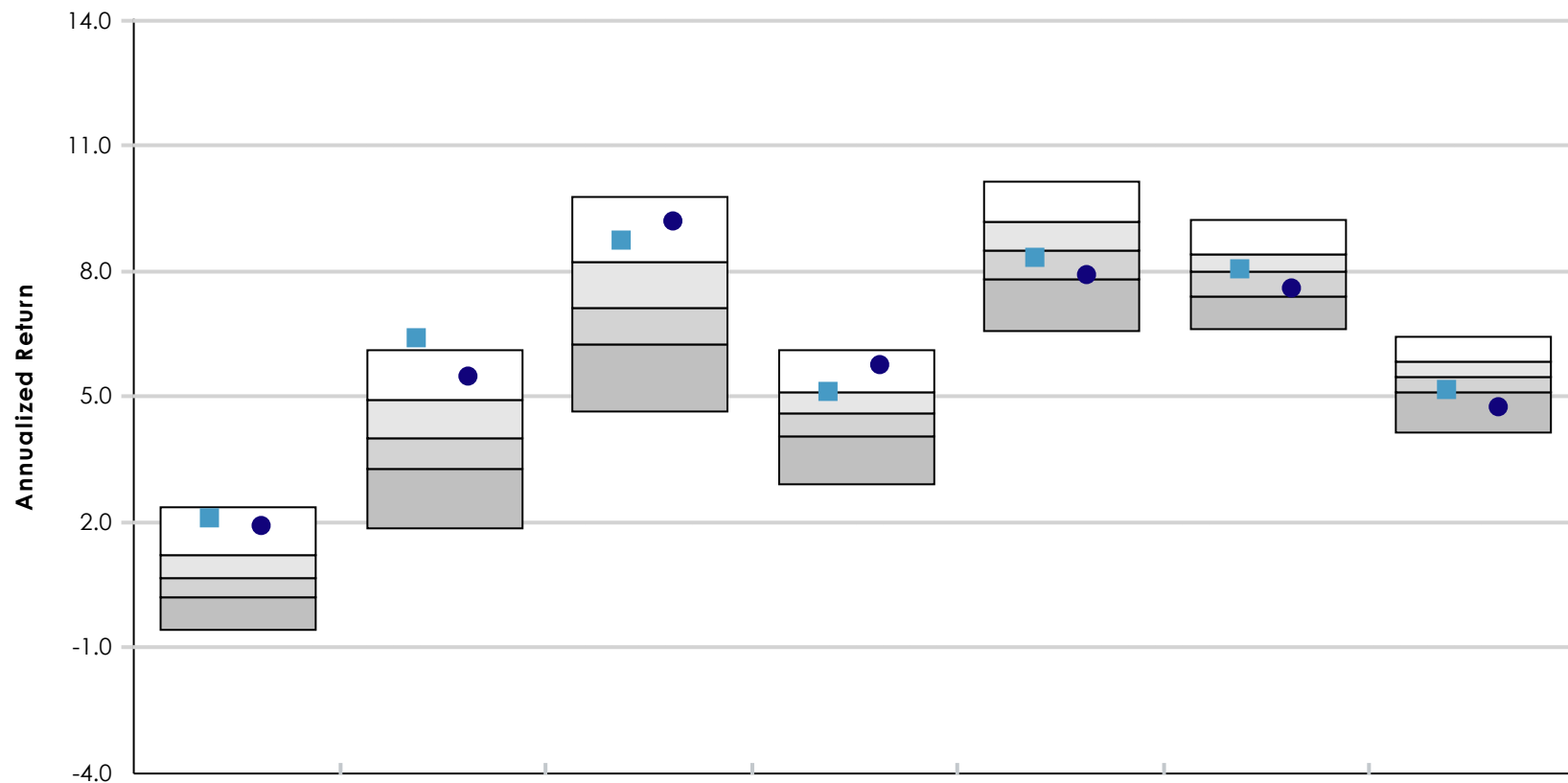


* The actuarial expected rate of return was 8% through 6/30/2009, 7.5% through 6/30/2010, 7% through 6/30/2011, 6.75% through 6/30/2014, and 6.5% currently

Risk/Return Performance (5-year)



Plan Sponsor Peer Group Analysis
As of December 31, 2016



	1 Quarter	Fiscal YTD	1 Year	3 Years	5 Years	7 Years	10 Years
OPFRS Total Plan	2.1 (7)	6.4 (4)	8.7 (15)	5.1 (27)	8.3 (63)	8.1 (47)	5.1 (74)
OPFRS Policy Benchmark	1.9 (10)	5.5 (13)	9.2 (11)	5.8 (9)	7.9 (74)	7.6 (68)	4.7 (84)
5th Percentile	2.4	6.1	9.8	6.1	10.1	9.2	6.4
1st Quartile	1.2	4.9	8.2	5.1	9.2	8.4	5.8
Median	0.7	4.0	7.1	4.6	8.5	8.0	5.5
3rd Quartile	0.2	3.3	6.3	4.0	7.8	7.4	5.1
95th Percentile	-0.6	1.9	4.6	2.9	6.6	6.6	4.2
Population	446	446	440	426	418	400	347

Parenteses contain percentile rankings.
Calculation based on monthly periodicity.

Monitoring/Probation Status

As of December 31, 2016
Return vs. Benchmark since Corrective Action

Portfolio	Status	Concern	Months Since Corrective Action	Performance [^] Since Corrective Action	Date of Corrective Action*
DDJ Capital	On Watch	Organizational	7	10.4%	5/25/2016
BofAML US High Yield M2	---	---	7	8.6%	---

[^] 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

All critelized basis.

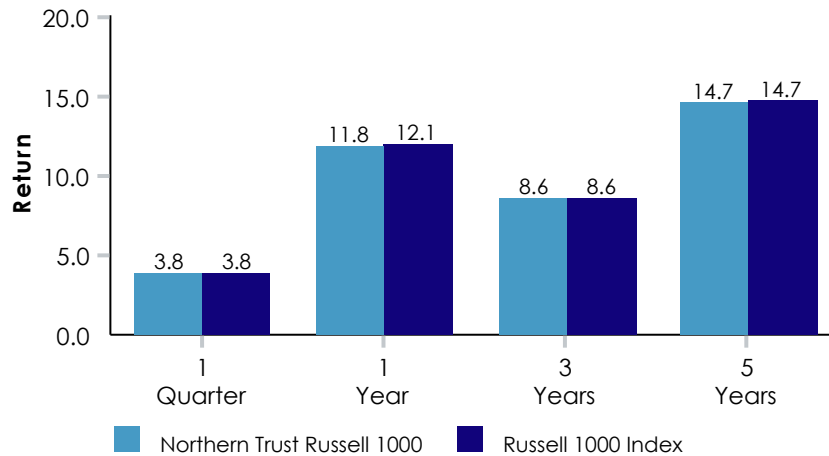
VRR – Value Relative Ratio – is calculated as: manager cumulative return / benchmark cumulative return.

Northern Trust Russell 1000 - gross of fees

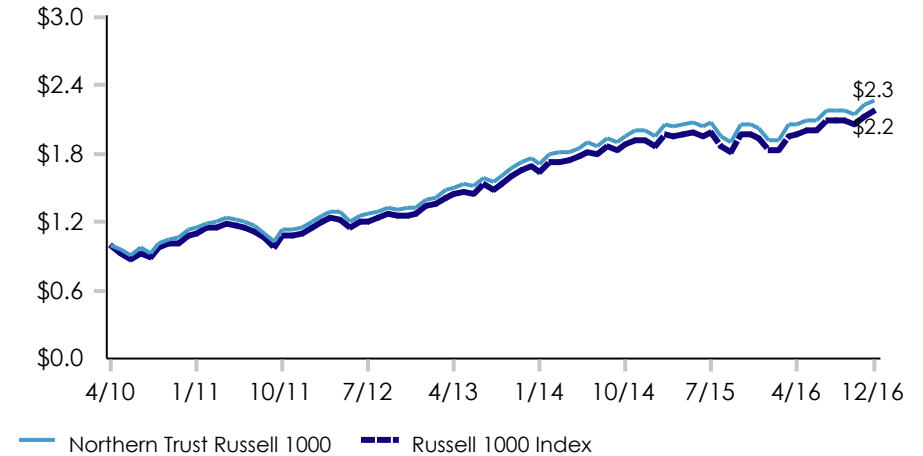
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Northern Trust Russell 1000	1.08	0.96	0.38	1.05	1.54	0.99	99.45	93.97	05/01/2010
Russell 1000 Index	0.00	1.00	-	0.97	0.00	1.00	100.00	100.00	05/01/2010

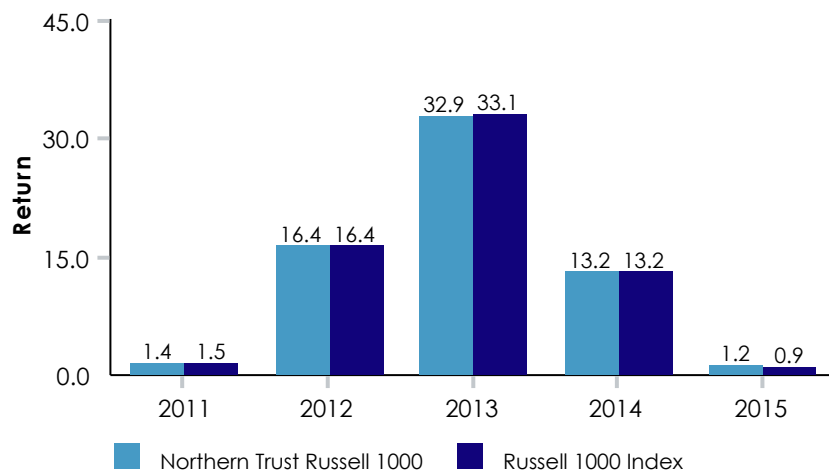
Trailing Period Performance



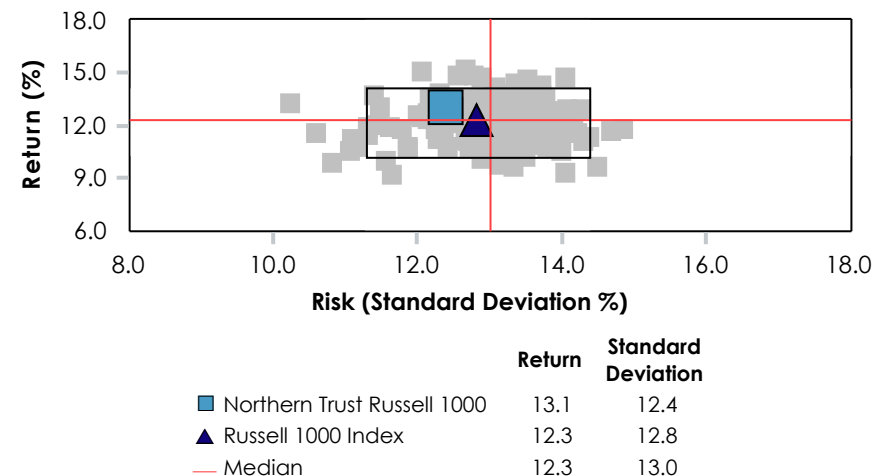
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

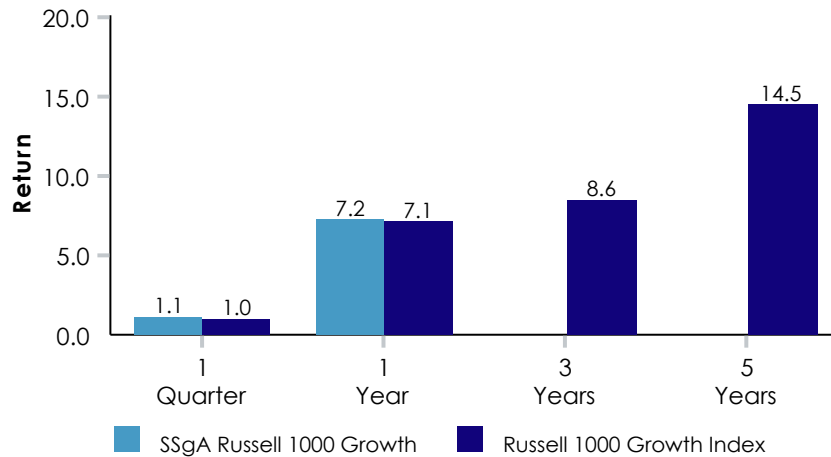


SSgA Russell 1000 Growth - gross of fees

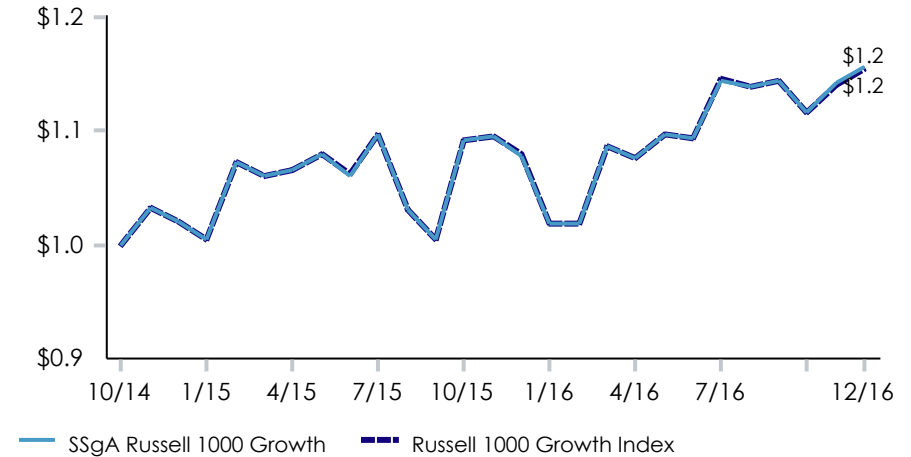
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
SSgA Russell 1000 Growth	0.03	1.00	0.89	0.62	0.04	1.00	100.17	99.96	11/01/2014
Russell 1000 Growth Index	0.00	1.00	-	0.61	0.00	1.00	100.00	100.00	11/01/2014

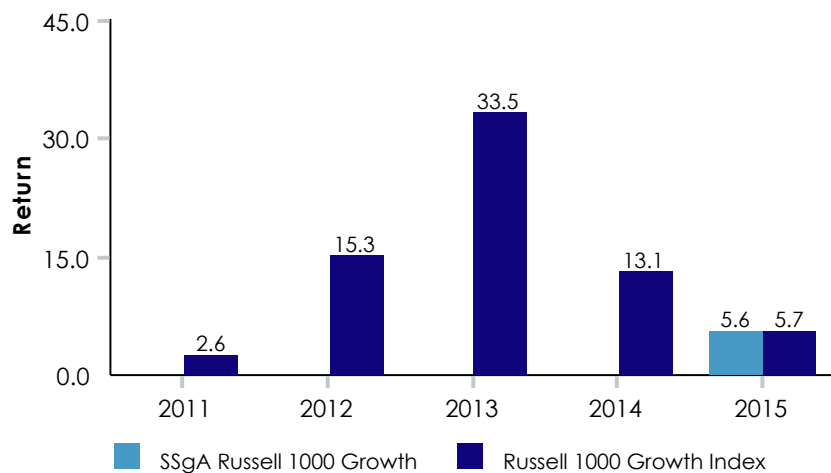
Trailing Period Performance



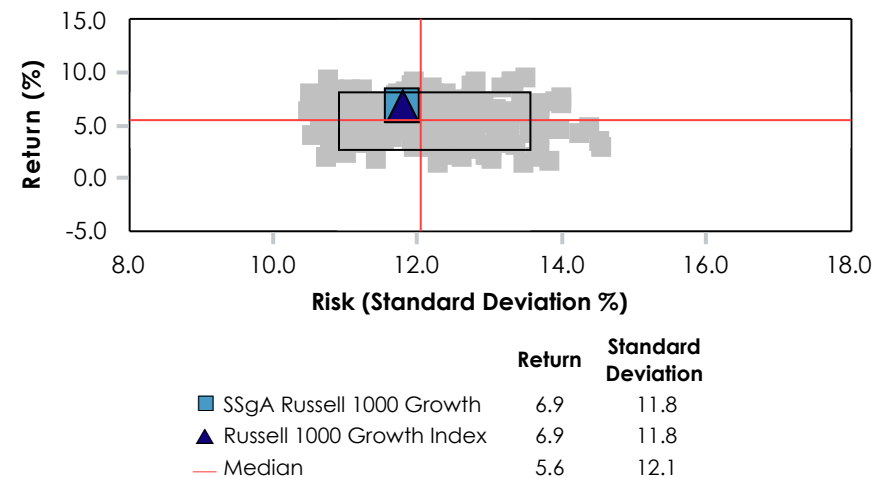
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

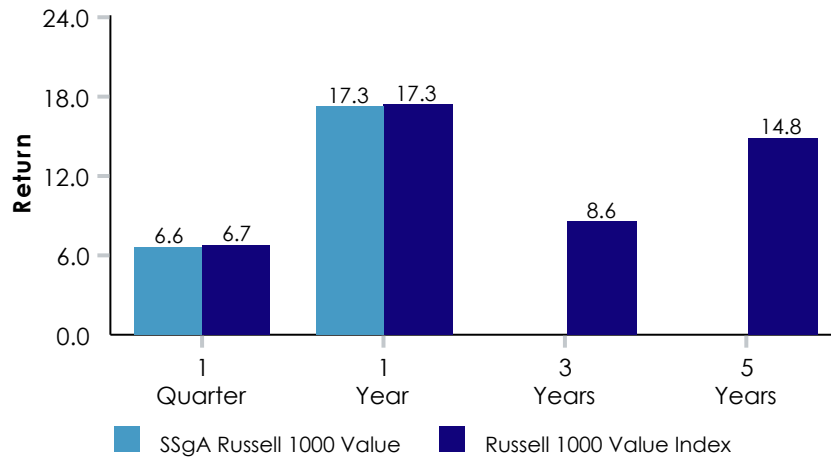


SSgA Russell 1000 Value - gross of fees

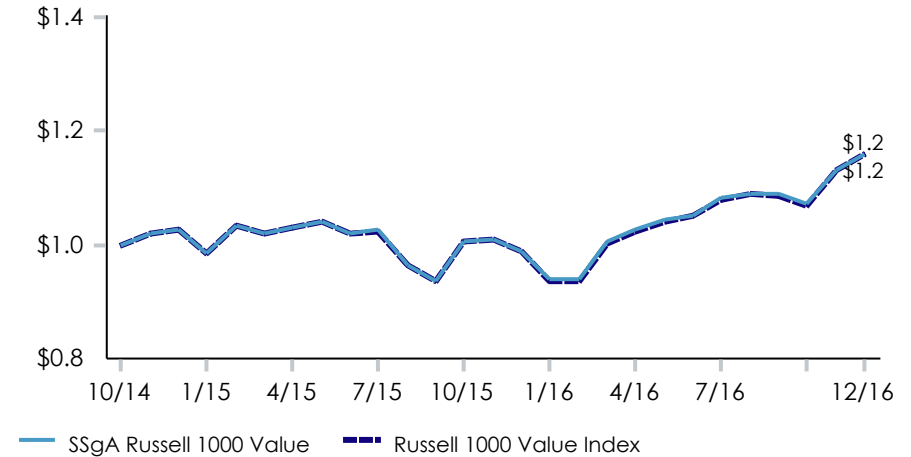
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
SSgA Russell 1000 Value	0.09	1.00	1.07	0.65	0.08	1.00	100.21	99.64	11/01/2014
Russell 1000 Value Index	0.00	1.00	-	0.64	0.00	1.00	100.00	100.00	11/01/2014

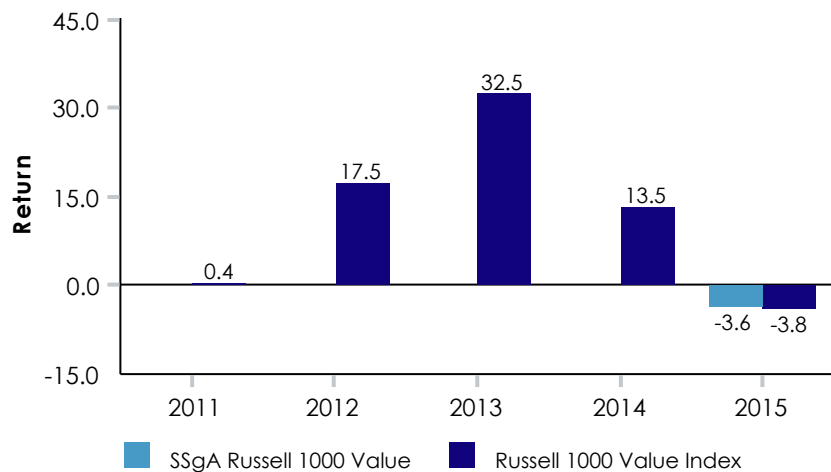
Trailing Period Performance



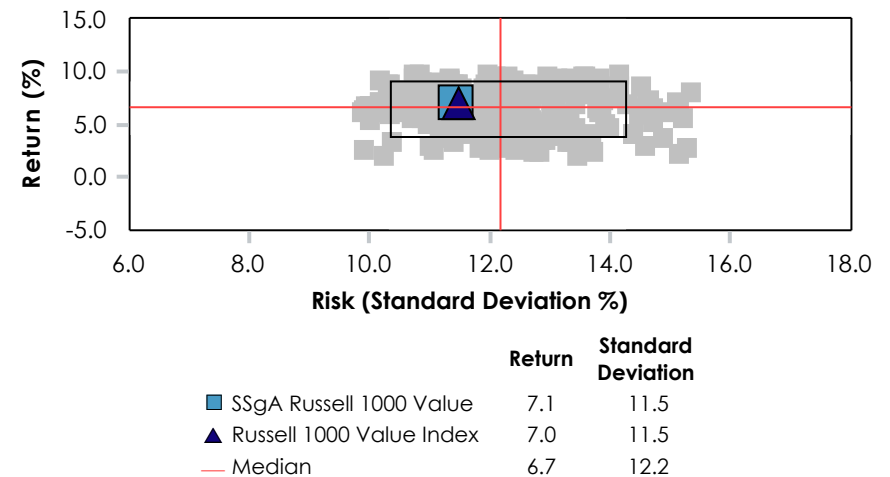
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

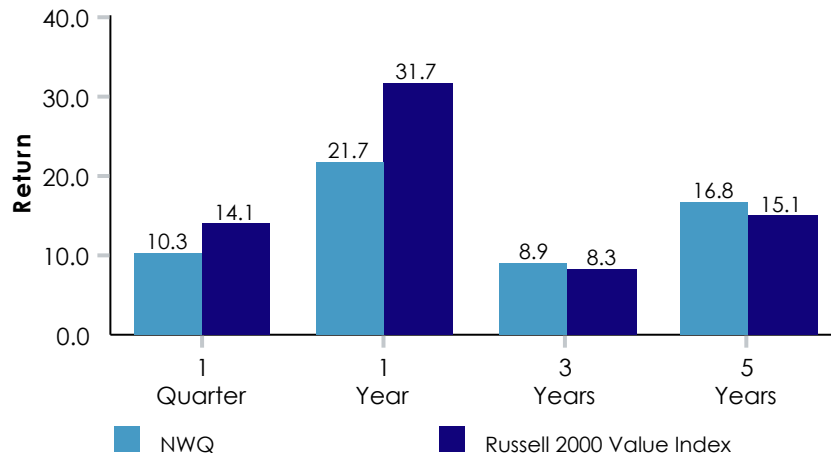


NWQ - gross of fees

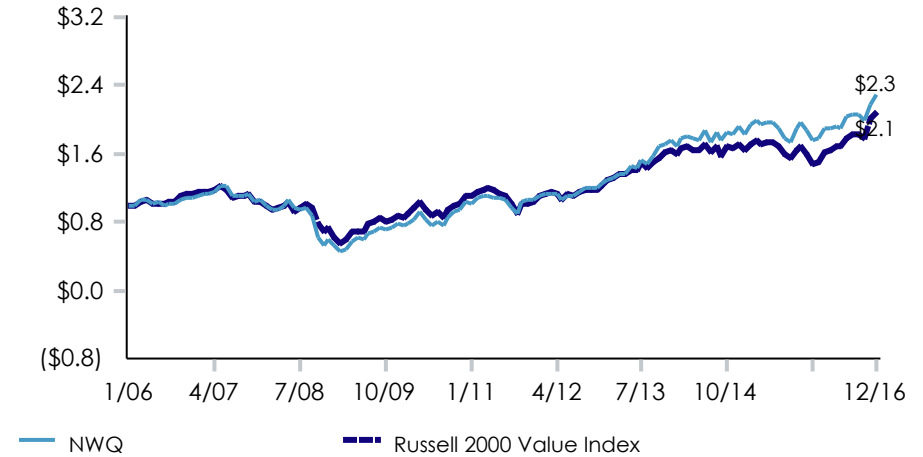
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
NWQ	0.97	1.02	0.18	0.42	6.70	0.90	103.61	99.64	02/01/2006
Russell 2000 Value Index	0.00	1.00	-	0.39	0.00	1.00	100.00	100.00	02/01/2006

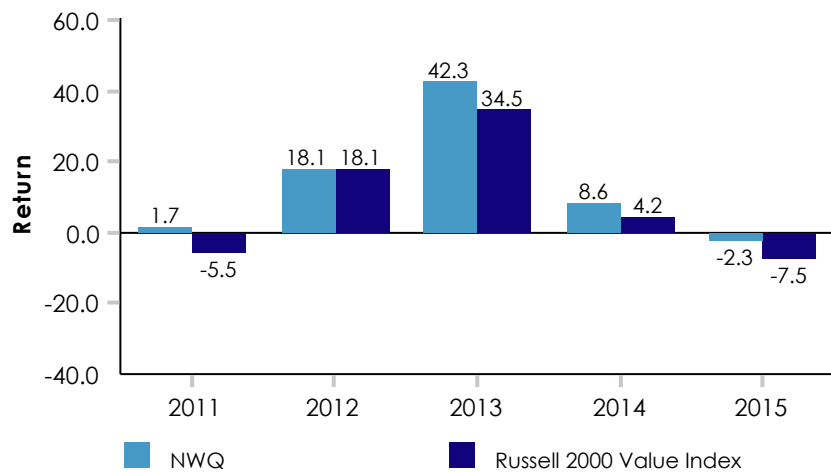
Trailing Period Performance



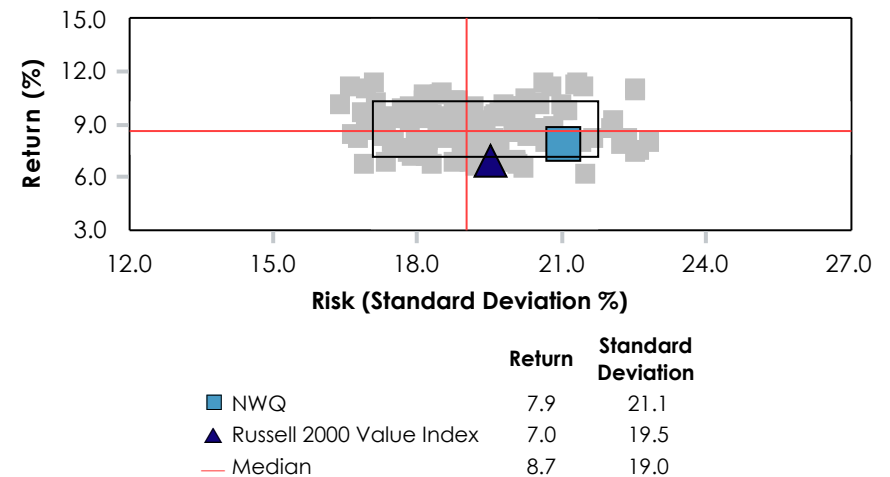
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

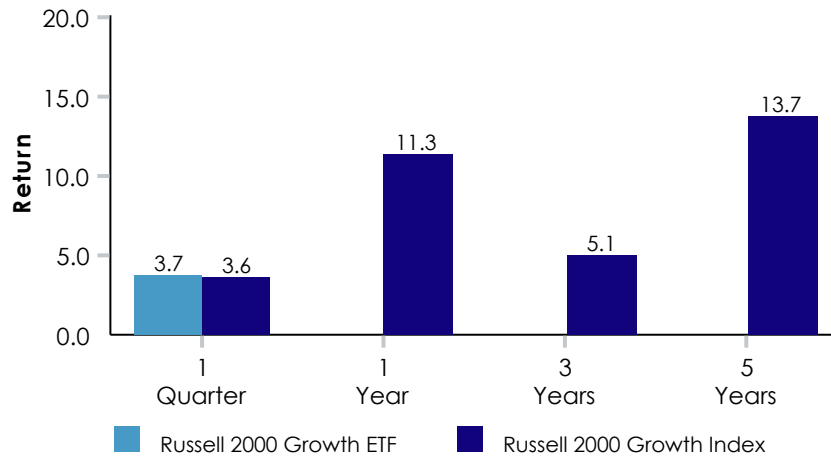


Russell 2000 Growth ETF - gross of fees

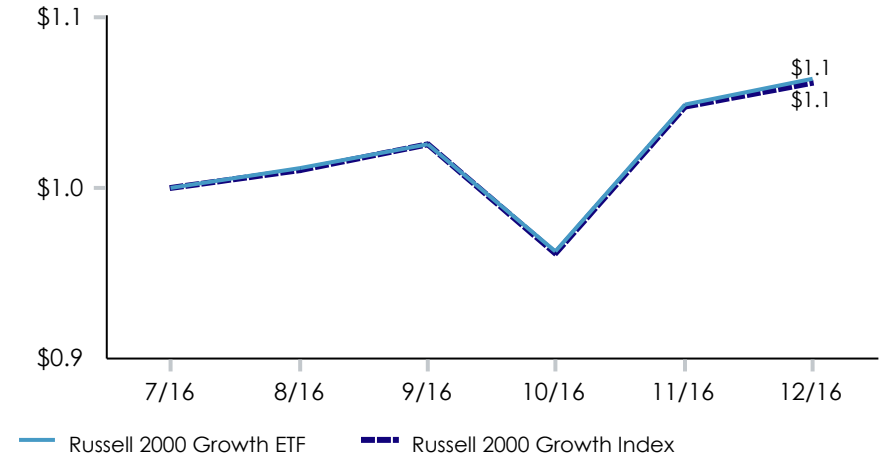
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Russell 2000 Growth ETF	0.05	0.98	0.36	0.28	0.08	1.00	99.95	97.41	08/01/2016
Russell 2000 Growth Index	0.00	1.00	-	0.27	0.00	1.00	100.00	100.00	08/01/2016

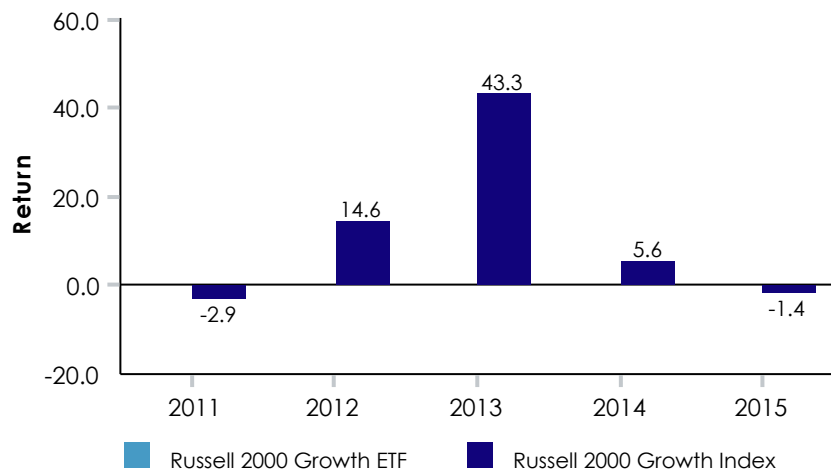
Trailing Period Performance



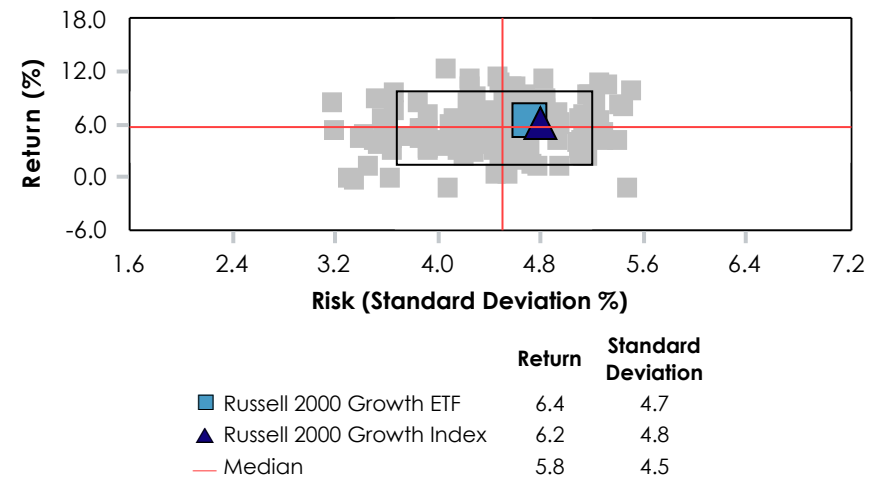
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

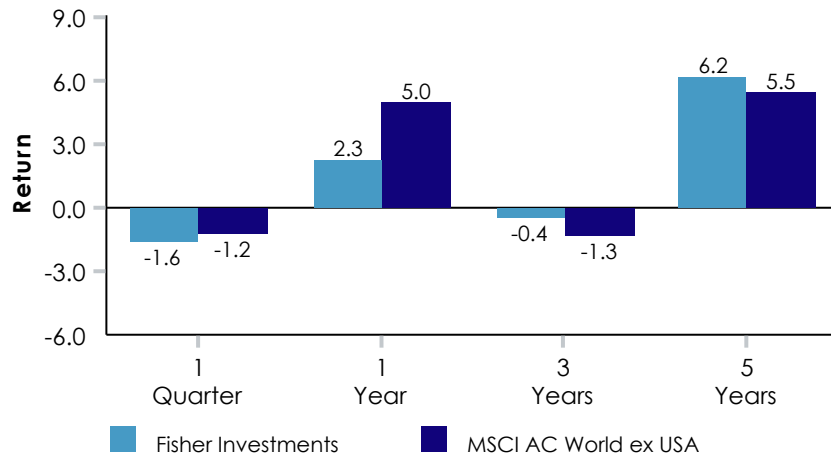


Fisher Investments - gross of fees

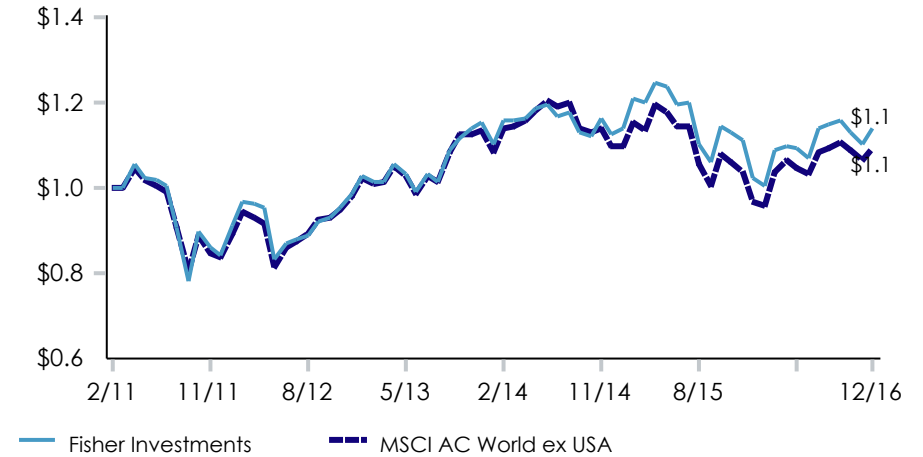
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Fisher Investments	0.74	1.09	0.26	0.21	3.70	0.96	106.62	102.24	03/01/2011
MSCI AC World ex USA	0.00	1.00	-	0.17	0.00	1.00	100.00	100.00	03/01/2011

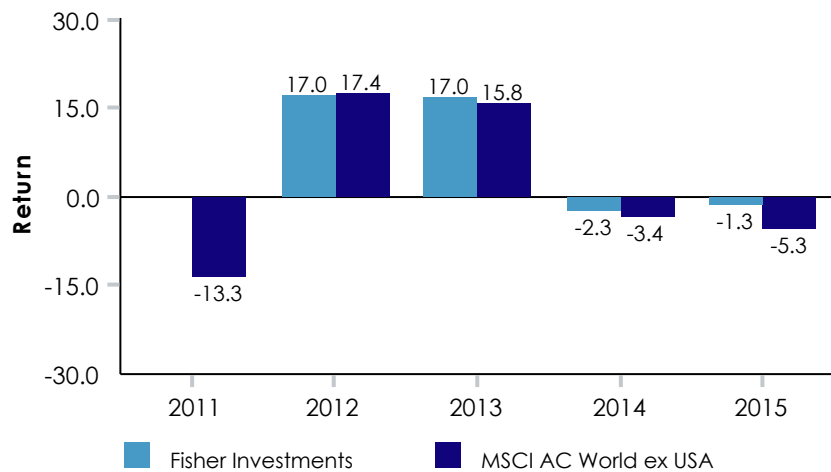
Trailing Period Performance



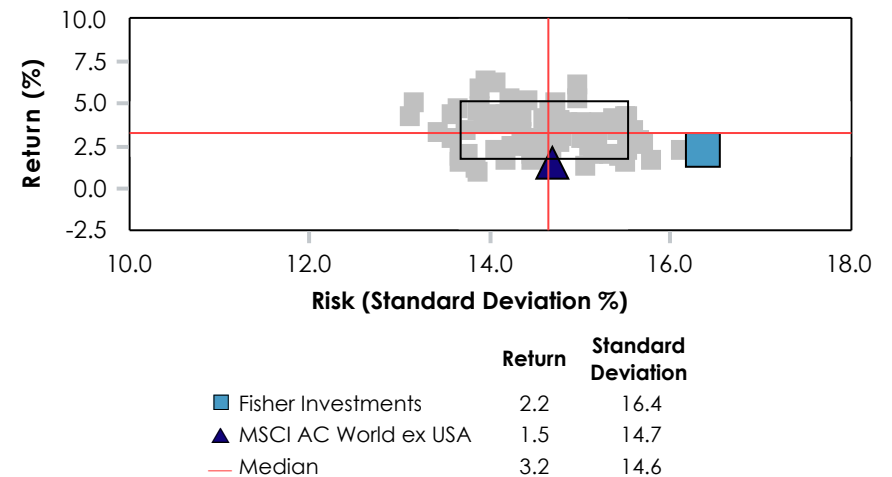
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

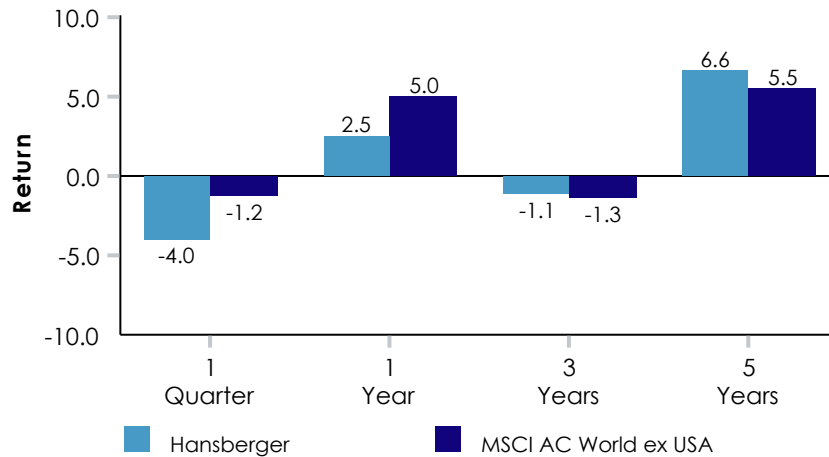


Hansberger - gross of fees

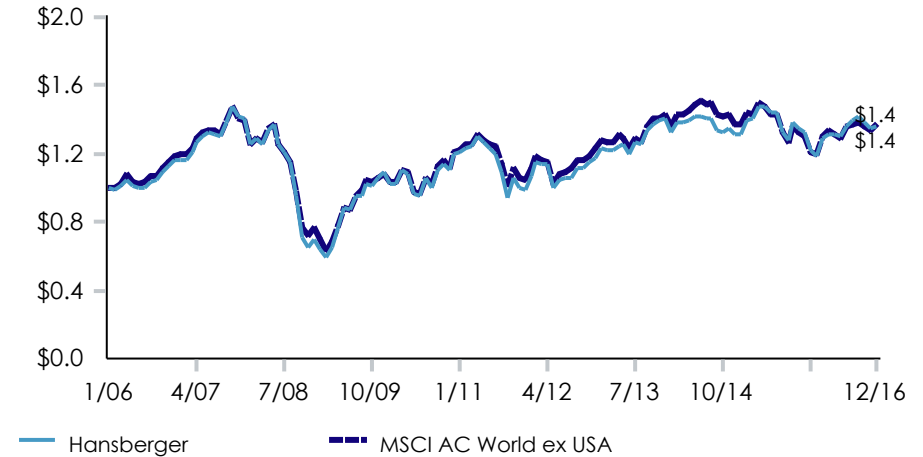
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Hansberger	-0.04	1.09	0.09	0.19	4.03	0.97	105.36	104.83	02/01/2006
MSCI AC World ex USA	0.00	1.00	-	0.19	0.00	1.00	100.00	100.00	02/01/2006

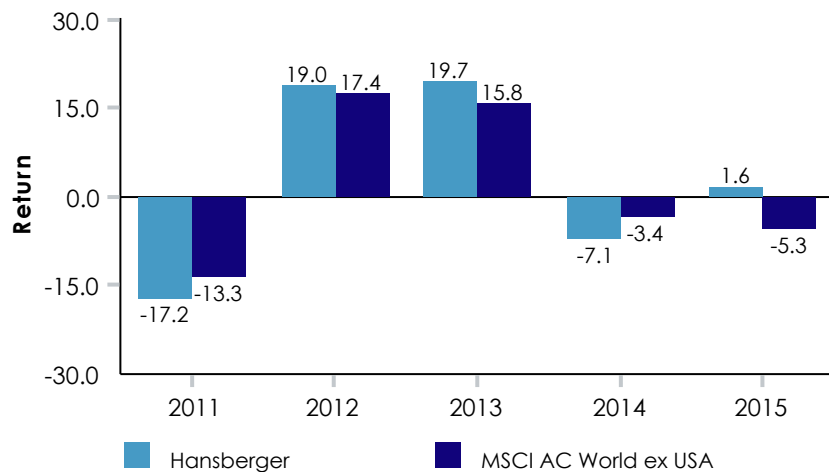
Trailing Period Performance



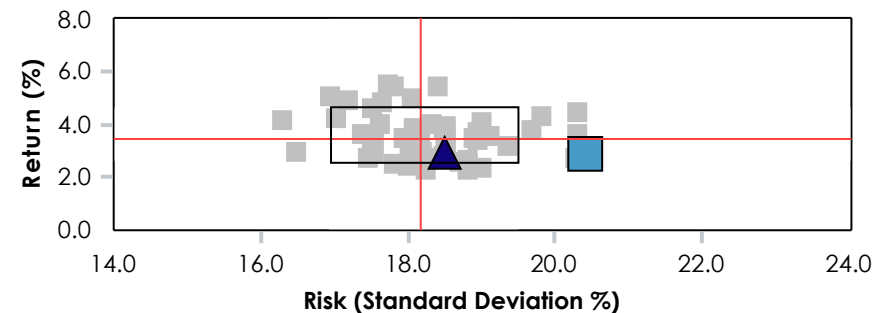
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception



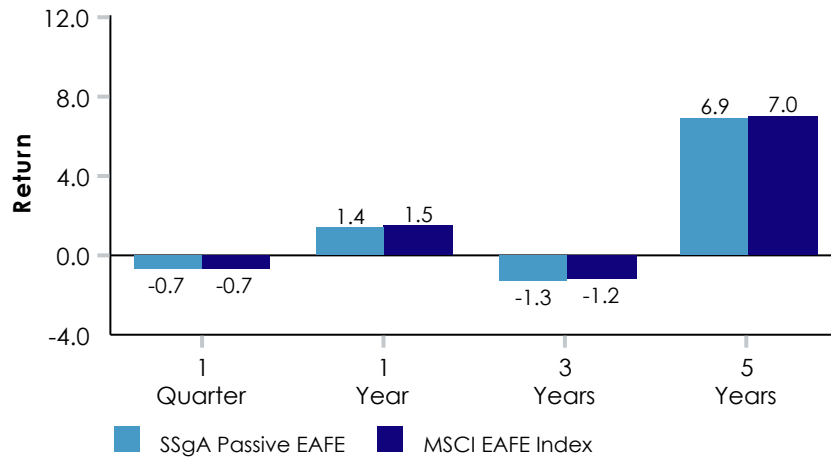
	Return	Standard Deviation
Hansberger	2.9	20.4
MSCI AC World ex USA	2.9	18.5
Median	3.5	18.2

SSgA Passive EAFE - gross of fees

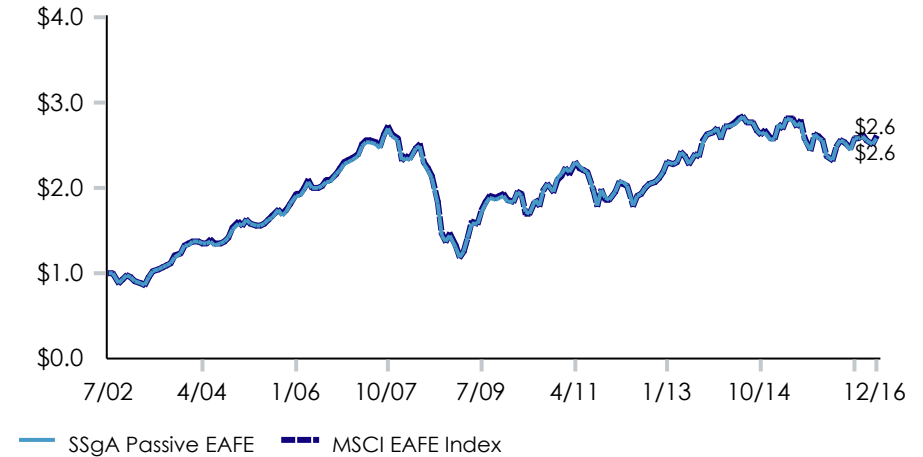
As of December 31, 2016

	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	-0.12	0.40	0.46	1.00	99.25	99.23	08/01/2002
MSCI EAFE Index	0.00	1.00	-	0.40	0.00	1.00	100.00	100.00	08/01/2002

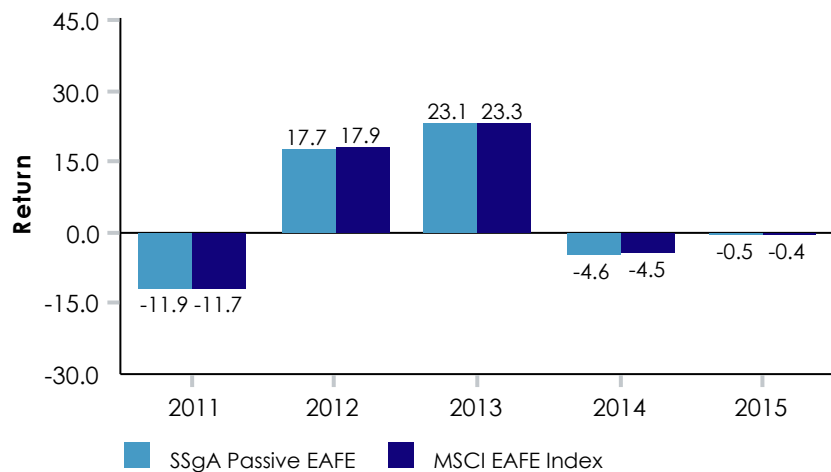
Trailing Period Performance



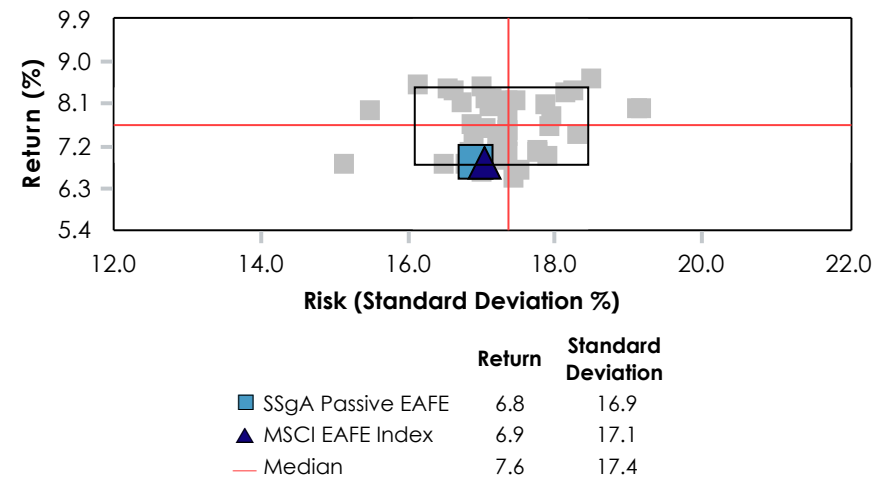
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

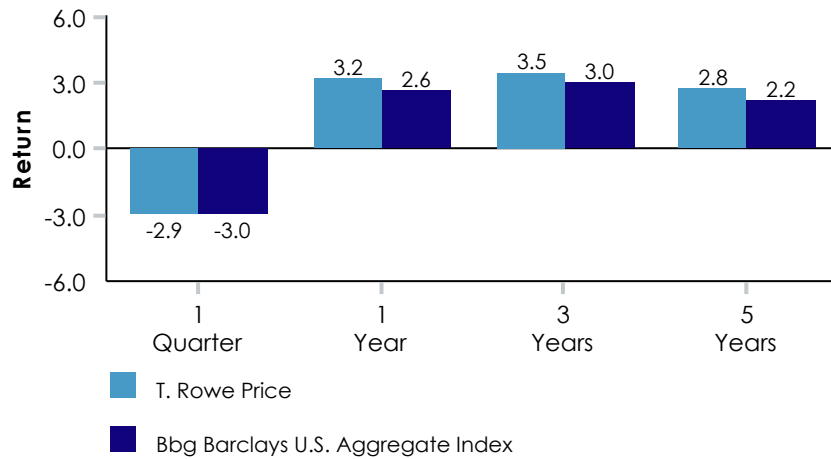


T. Rowe Price - gross of fees

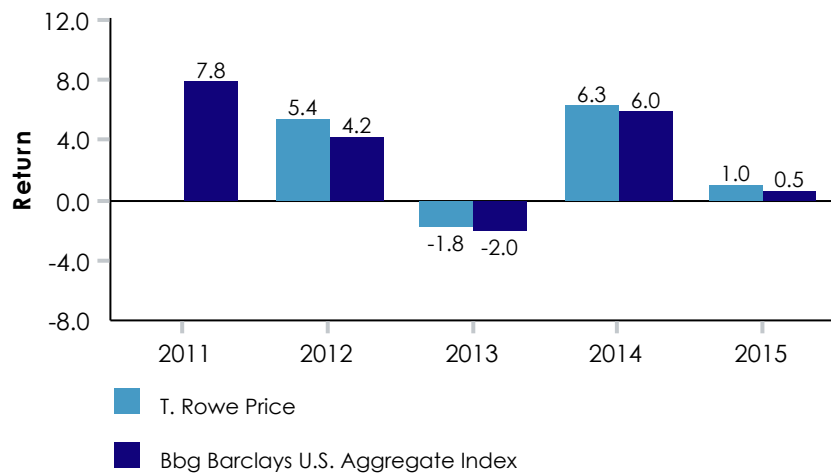
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
T. Rowe Price	0.44	0.95	0.49	1.15	0.58	0.96	100.81	90.59	05/01/2011
Bbg Barclays U.S. Aggregate Index	0.00	1.00	-	1.01	0.00	1.00	100.00	100.00	05/01/2011

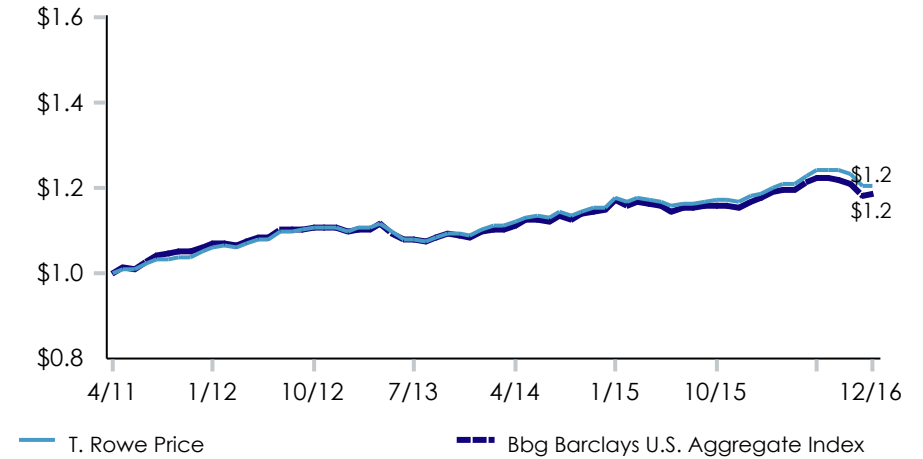
Trailing Period Performance



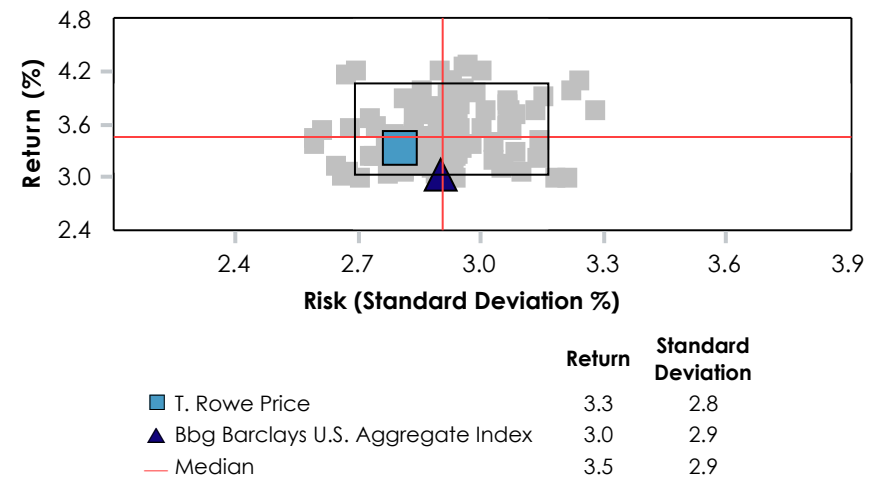
Calendar Year Performance



Growth of \$1 - Since Inception



Risk/Return - Since Inception

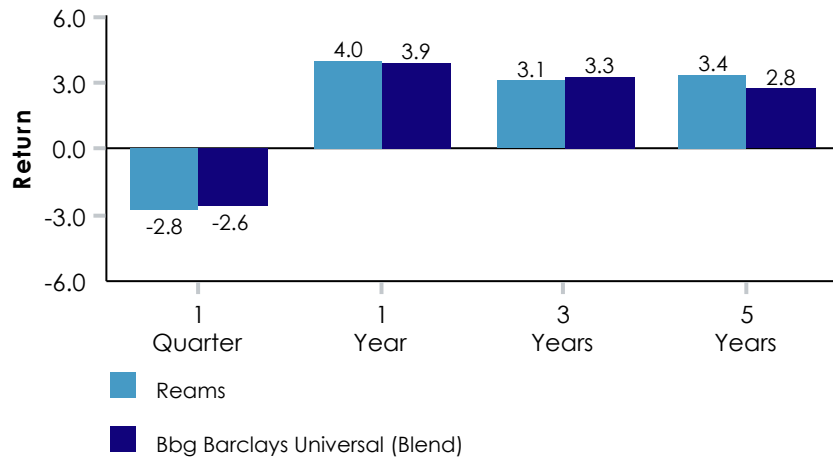


Reams - gross of fees

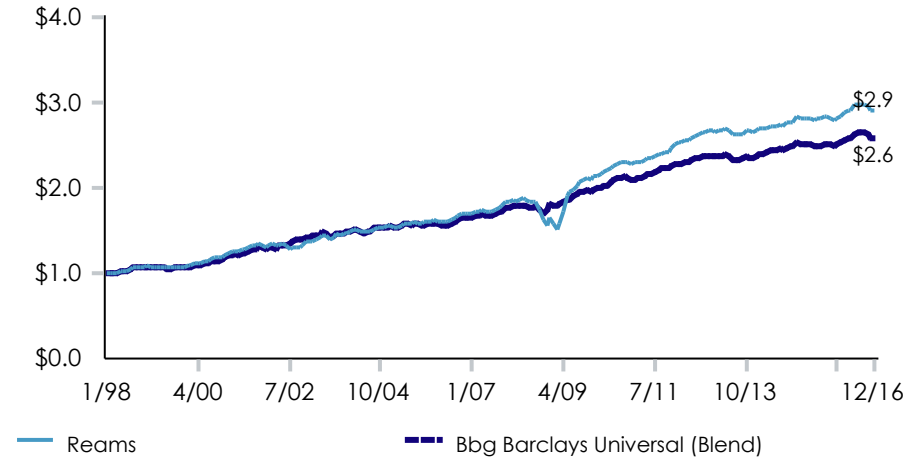
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Reams	0.38	1.06	0.17	0.68	4.19	0.43	110.50	104.10	02/01/1998
Bbg Barclays Universal (Blend)	0.00	1.00	-	0.89	0.00	1.00	100.00	100.00	02/01/1998

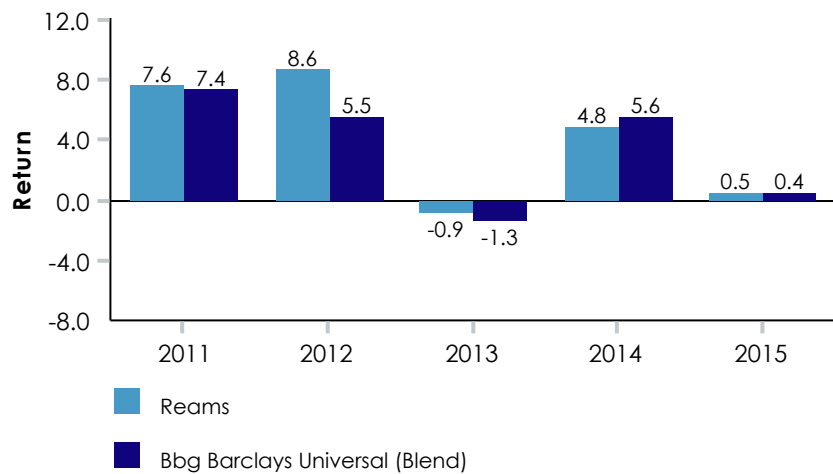
Trailing Period Performance



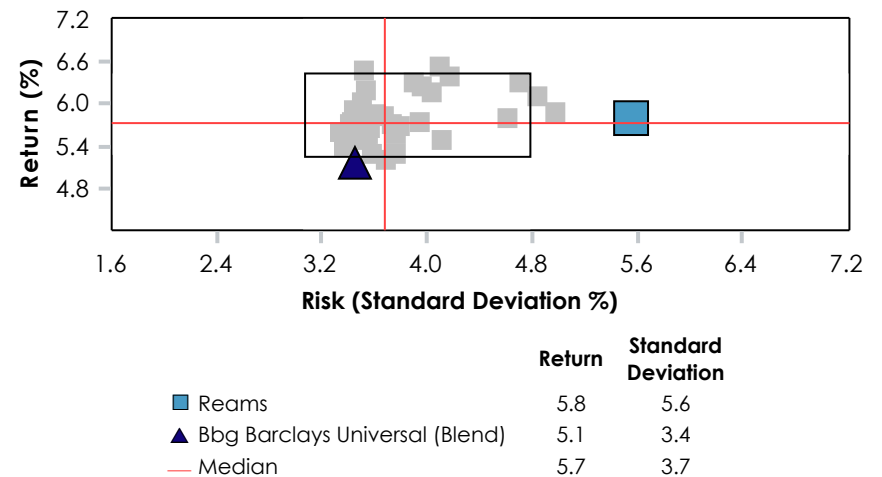
Growth of \$1 - Since Inception



Calendar Year Performance



Risk/Return - Since Inception

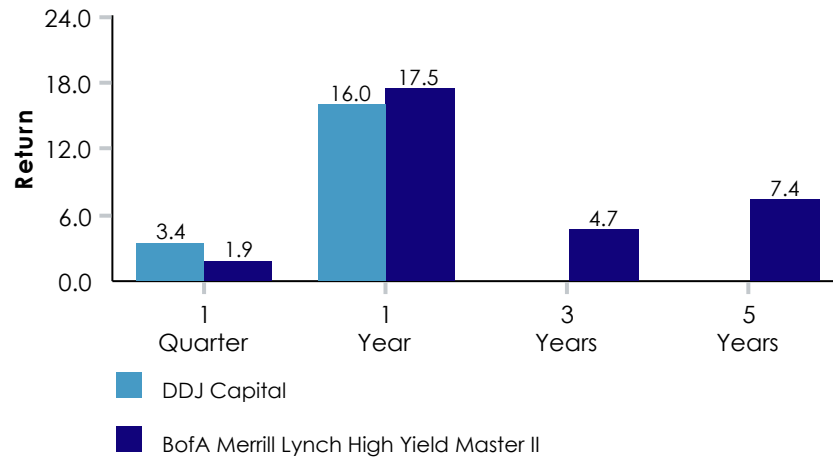


DDJ Capital - gross of fees

As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
DDJ Capital	1.47	0.70	-0.09	0.99	3.32	0.77	82.36	72.49	02/01/2015
BofA Merrill Lynch High Yield Master II	0.00	1.00	-	0.83	0.00	1.00	100.00	100.00	02/01/2015

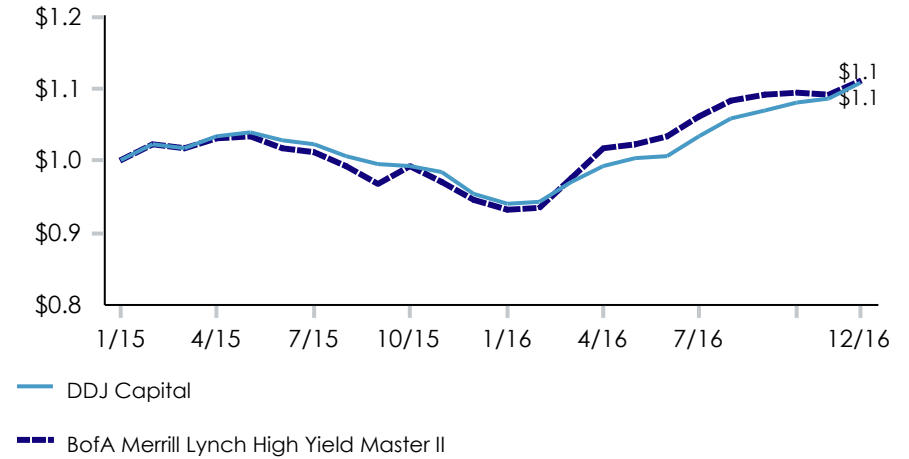
Trailing Period Performance



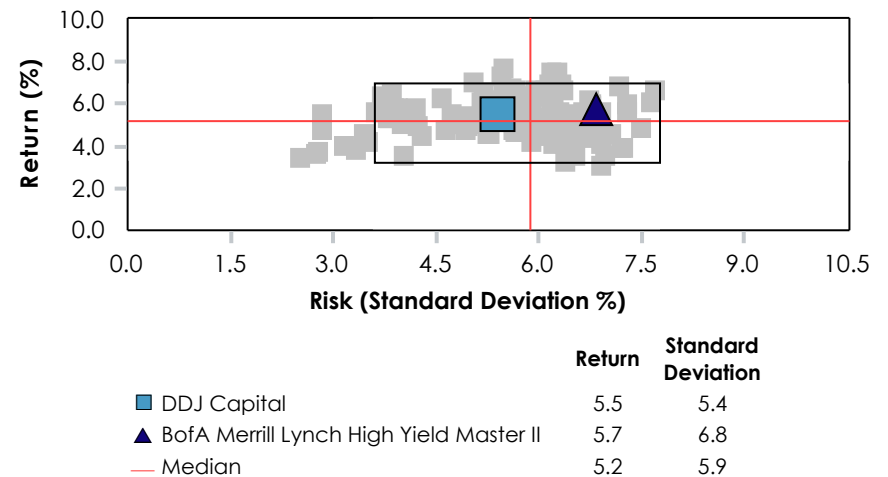
Calendar Year Performance



Growth of \$1 - Since Inception



Risk/Return - Since Inception

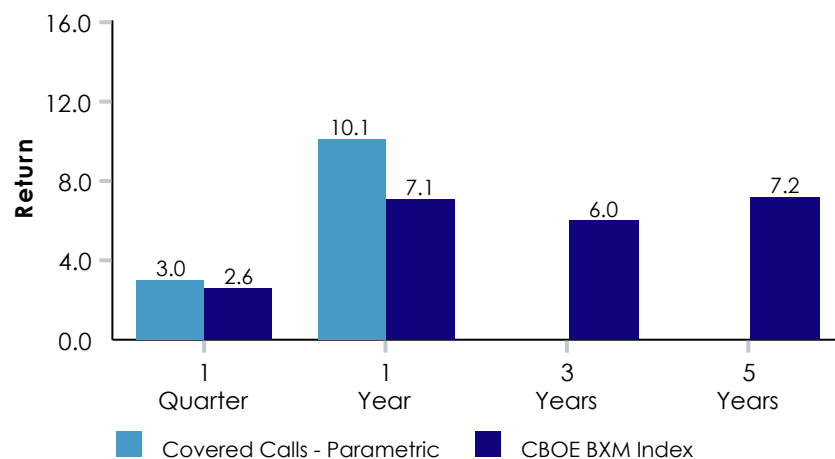


Covered Calls - Parametric - gross of fees

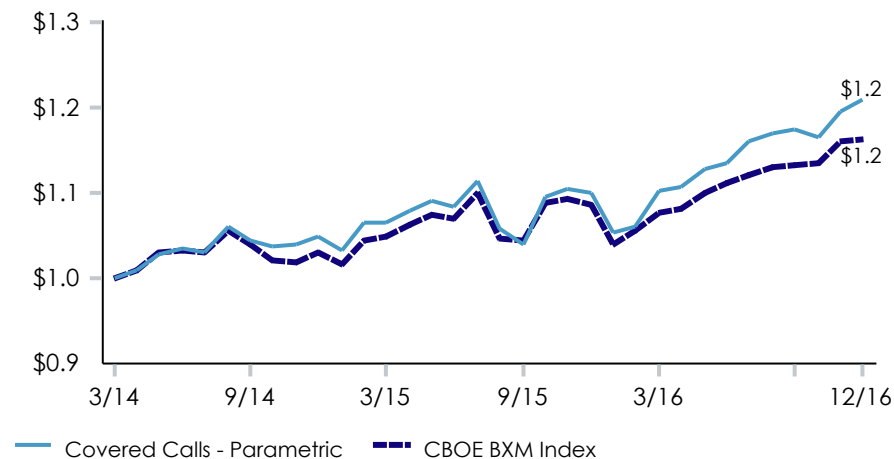
As of December 31, 2016

	Alpha	Beta	Information Ratio	Sharpe Ratio	Tracking Error	R-Squared	Up Market Capture	Down Market Capture	Inception Date
Covered Calls - Parametric	1.18	1.06	0.64	1.00	2.38	0.89	114.33	101.90	04/01/2014
CBOE BXM Index	0.00	1.00	-	0.88	0.00	1.00	100.00	100.00	04/01/2014

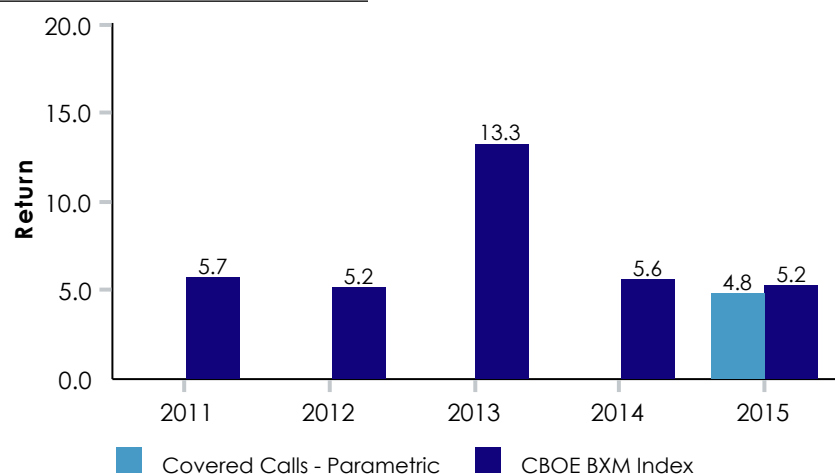
Trailing Period Performance



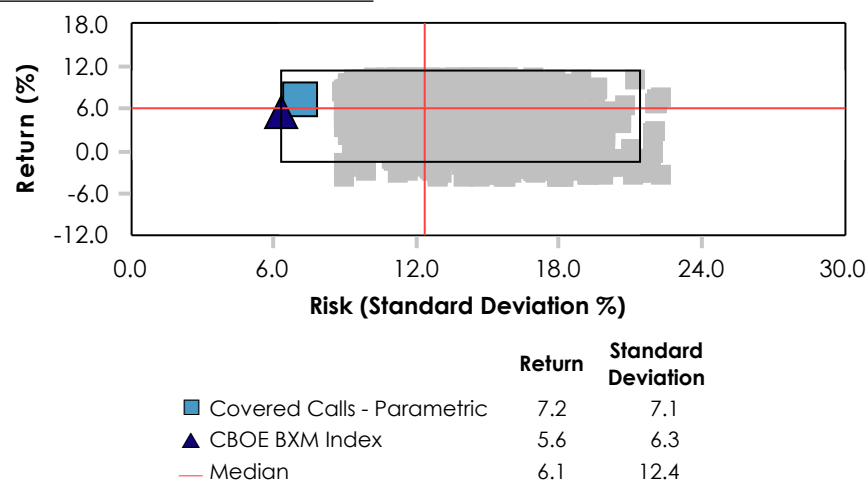
Growth of \$1 - Since Inception



Calendar Year Performance

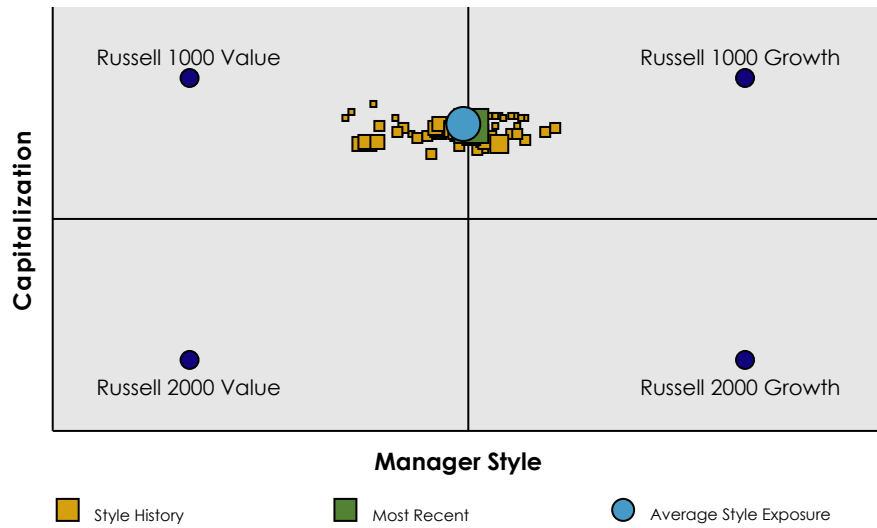


Risk/Return - Since Inception

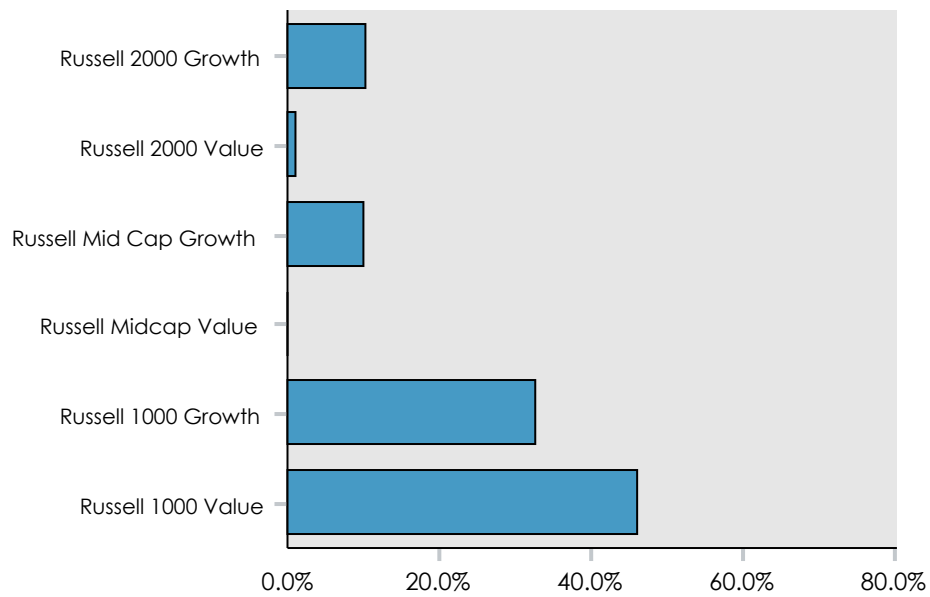


Domestic Equity Analysis As of December 31, 2016

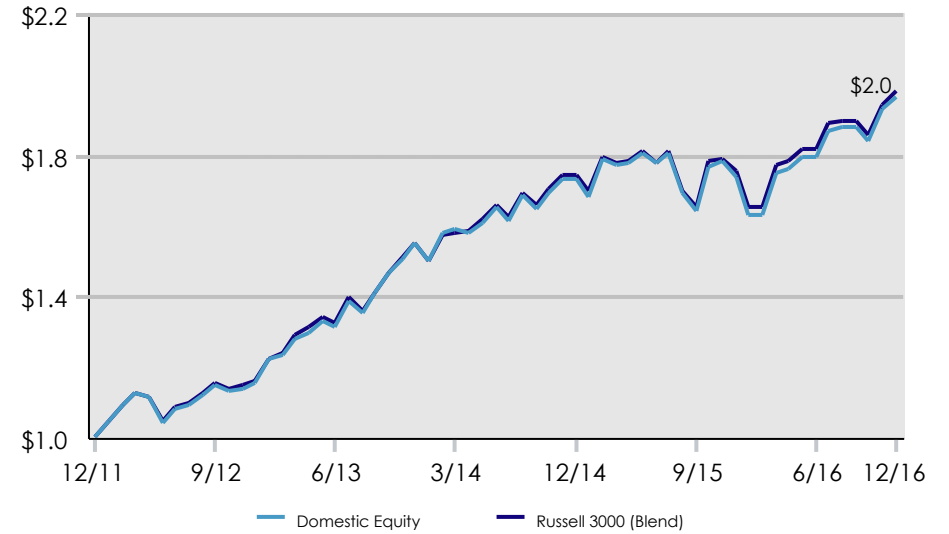
Style Map (5-Year)



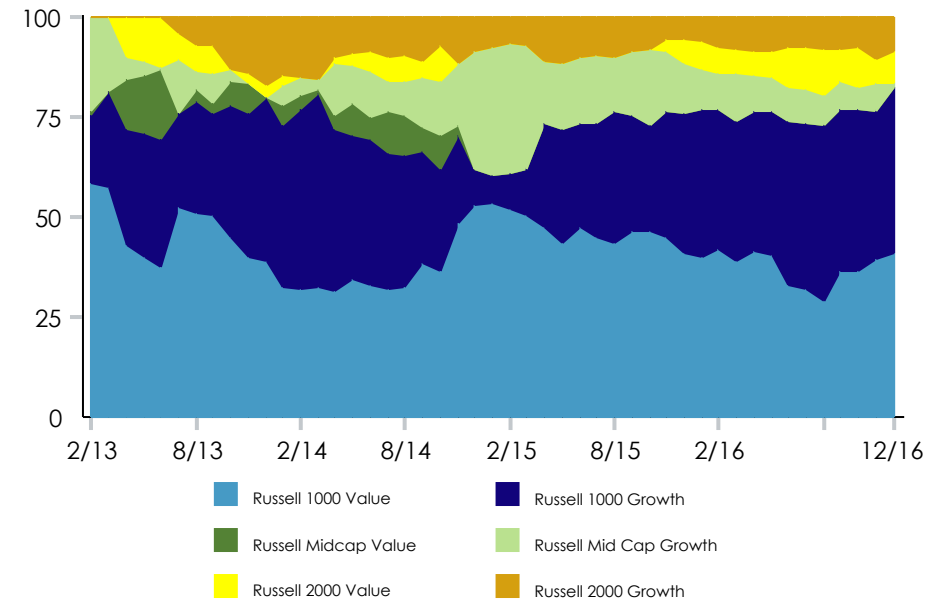
Style Exposure



Growth of \$1 (5-Year)

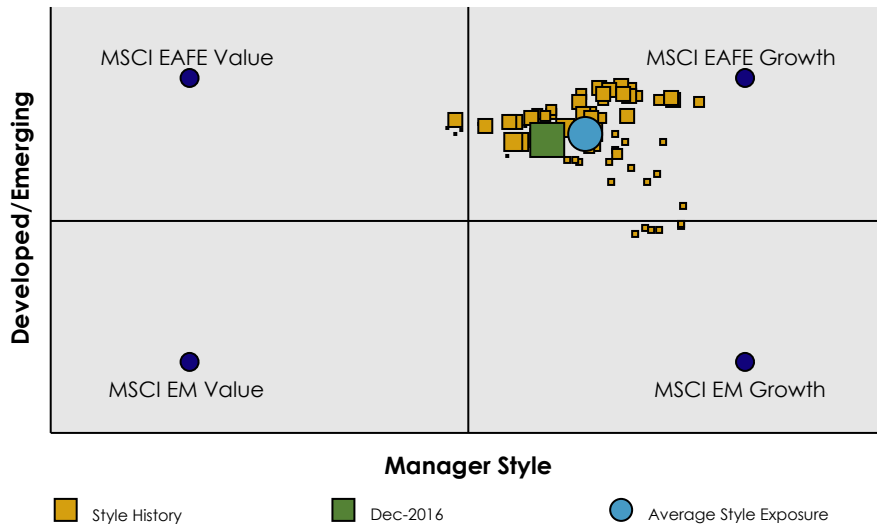


Style History (5-Year)

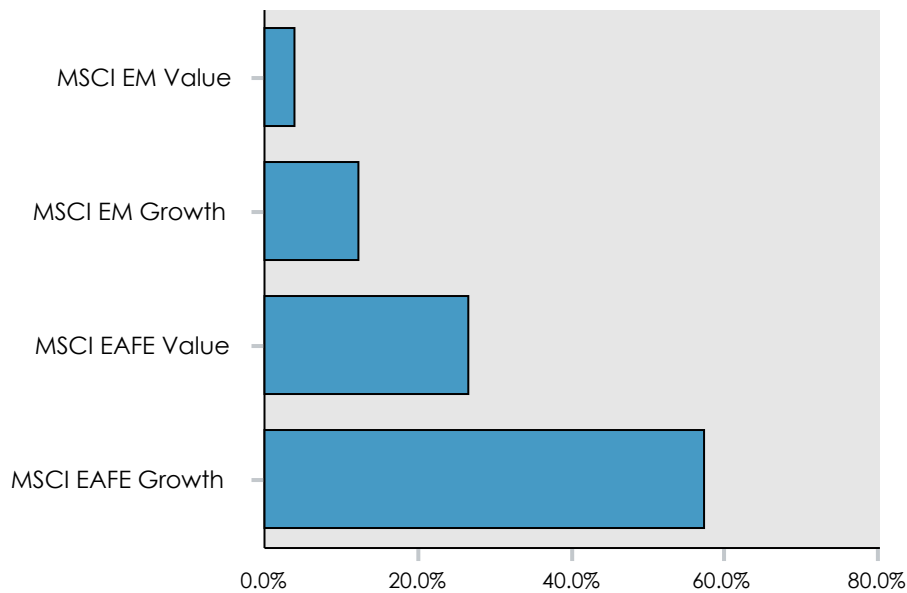


International Equity Analysis As of December 31, 2016

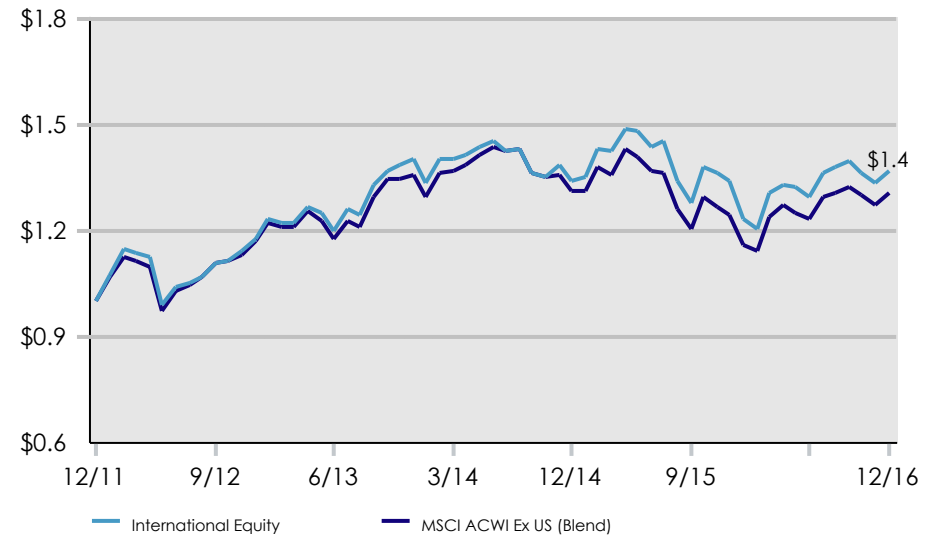
Style Map (5-Year)



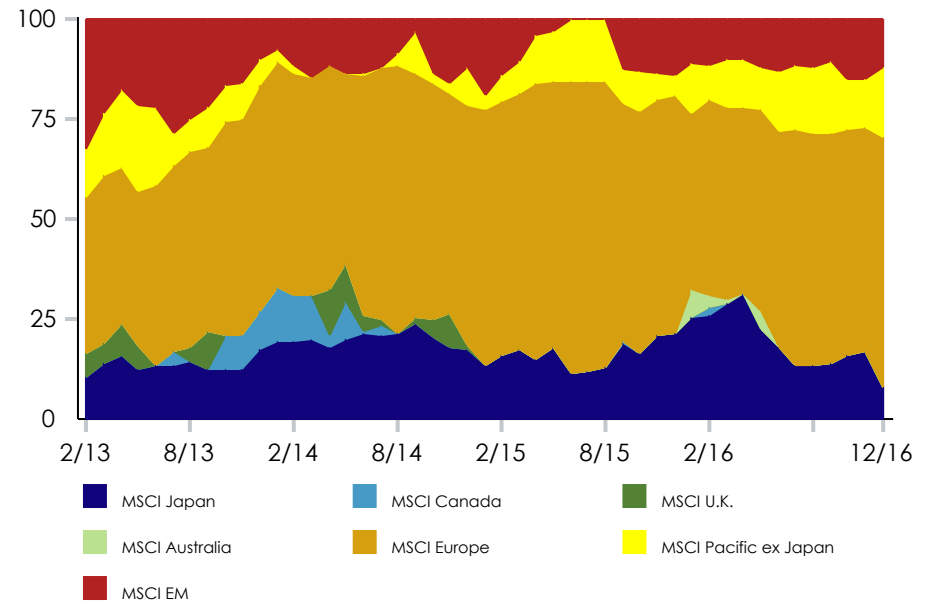
Style Exposure



Growth of \$1 (5-Year)

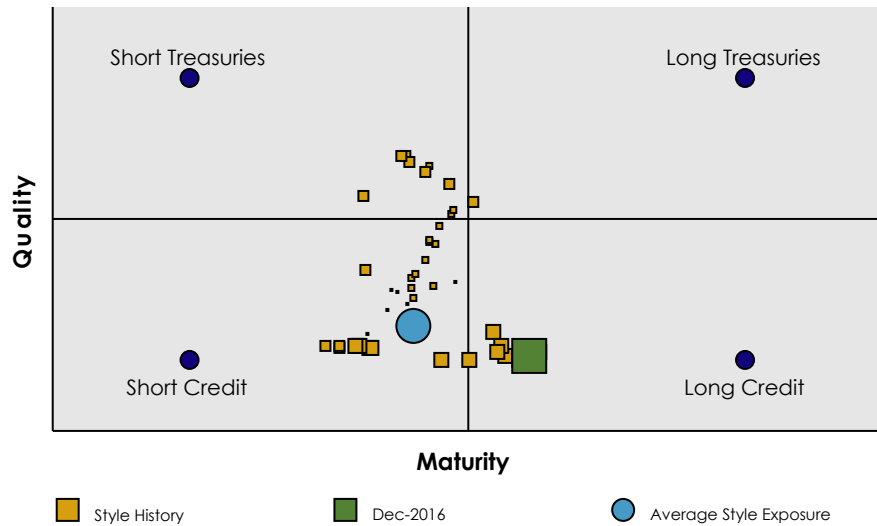


Style History (5-Year)

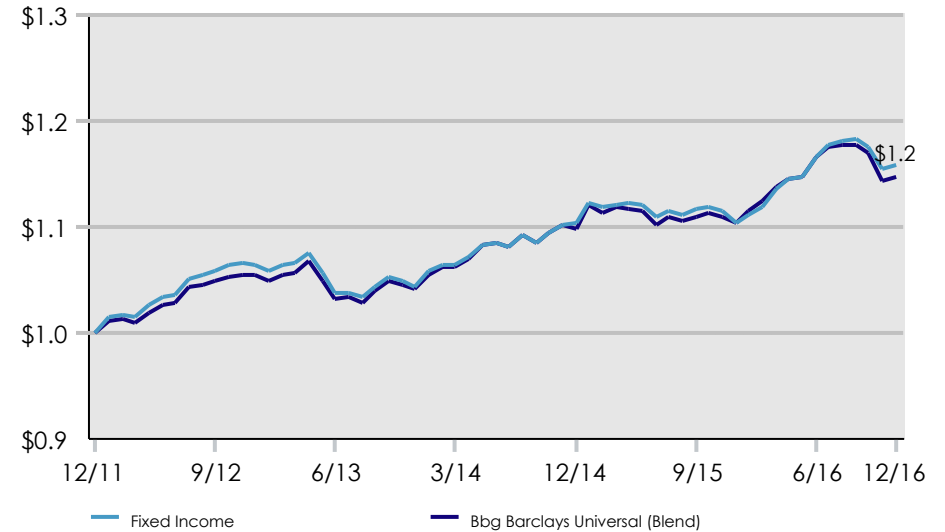


Fixed Income Analysis As of December 31, 2016

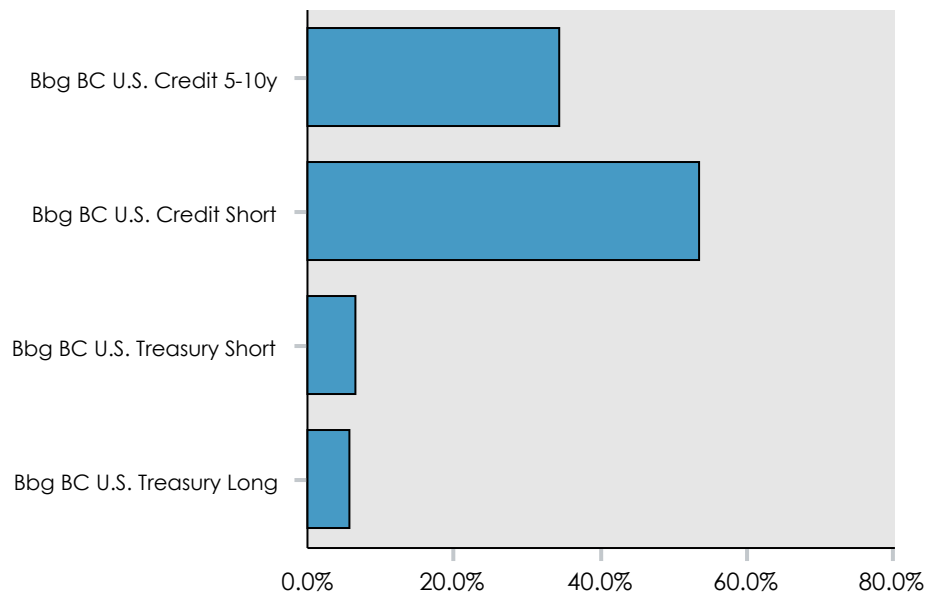
Style Map (5-Year)



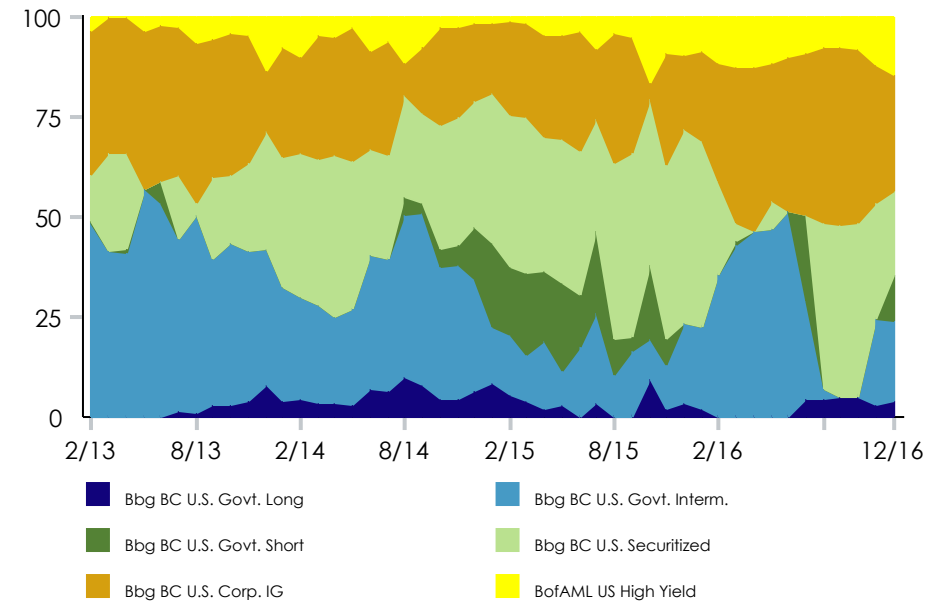
Growth of \$1 (5-Year)



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: $P/E \text{ ratio} = \text{Price} / \text{"Normalized" earnings for the S\&P 500 Index}$

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: $P/E \text{ ratio} = \text{Price} / \text{"Normalized" earnings for the MSCI EAFE Index}$

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: $\text{Ratio of Emerging Market P/E Ratio to Developed Market P/E Ratio}$

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 date 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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