



# Quarterly Investment Performance Analysis

Commonwealth of Pennsylvania  
State Employees' Retirement System

Period Ended: December 31, 2017

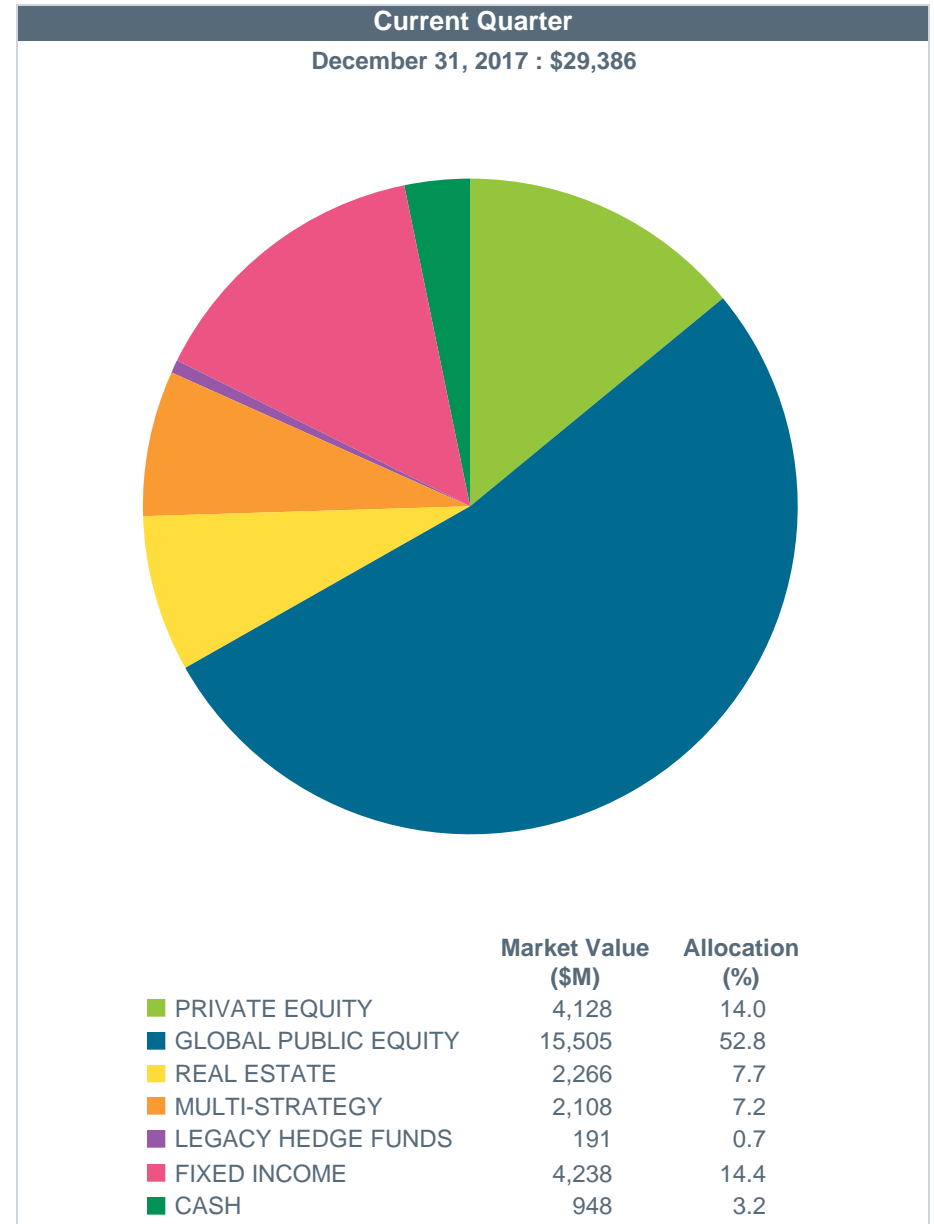
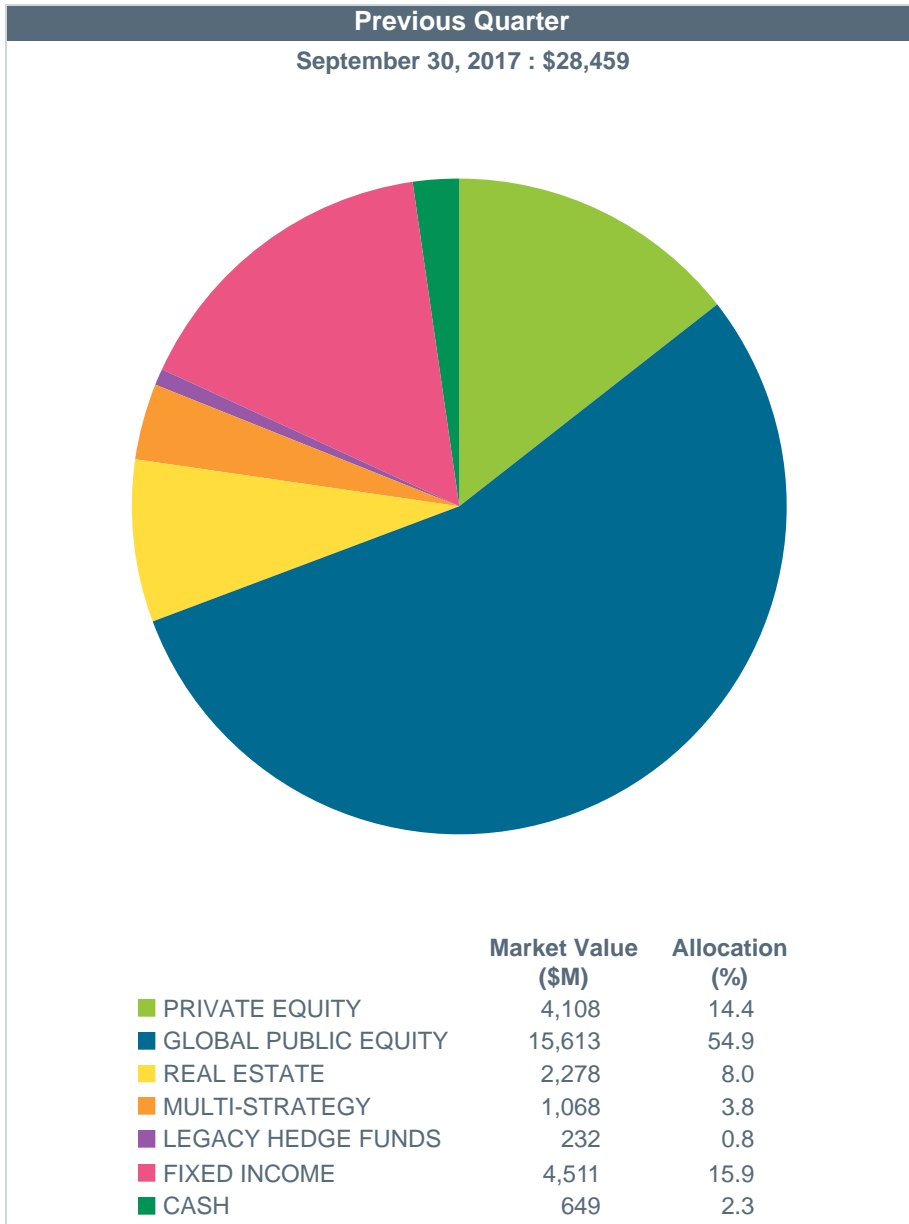


**Commonwealth of Pennsylvania State Employees' Retirement System**  
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**As of December 31, 2017**

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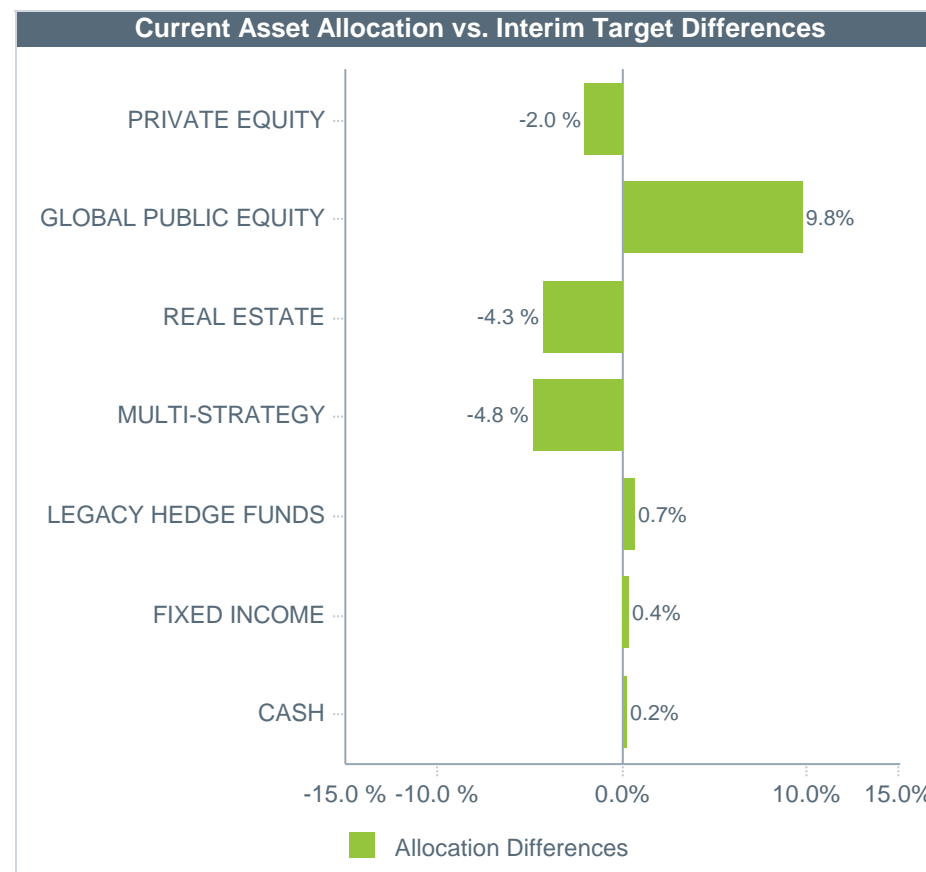
# Total Fund Composite





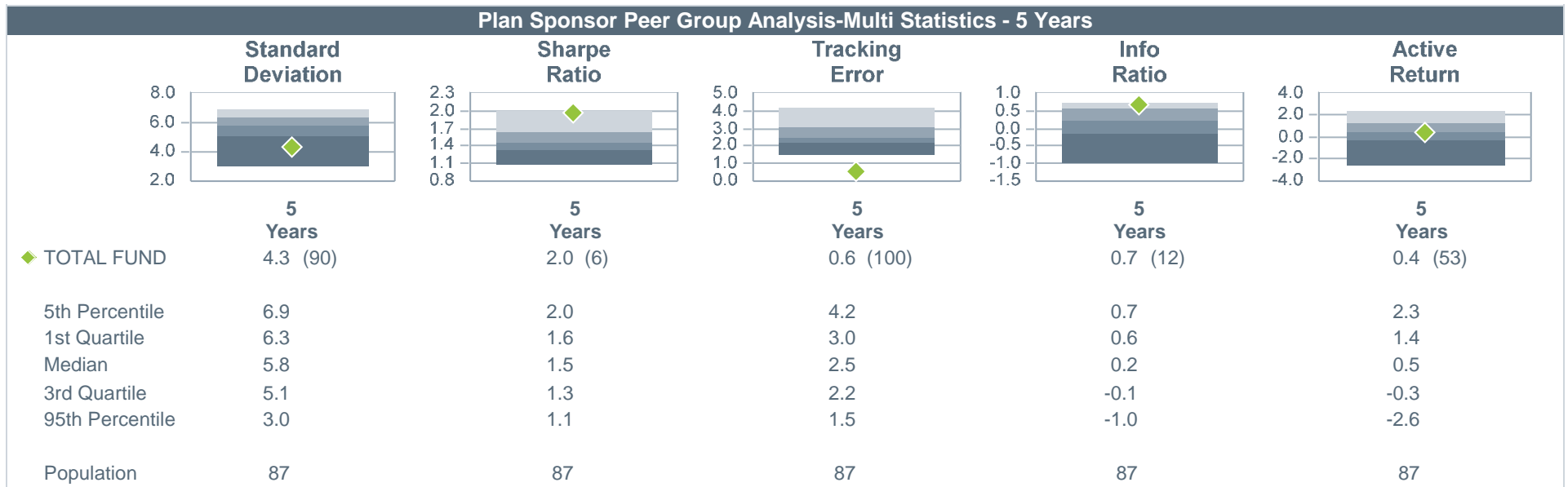
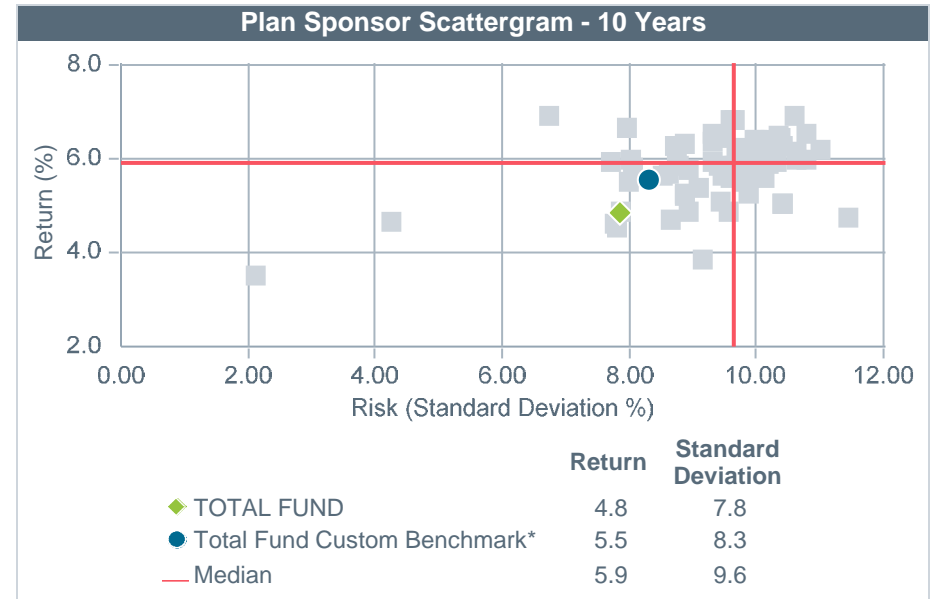
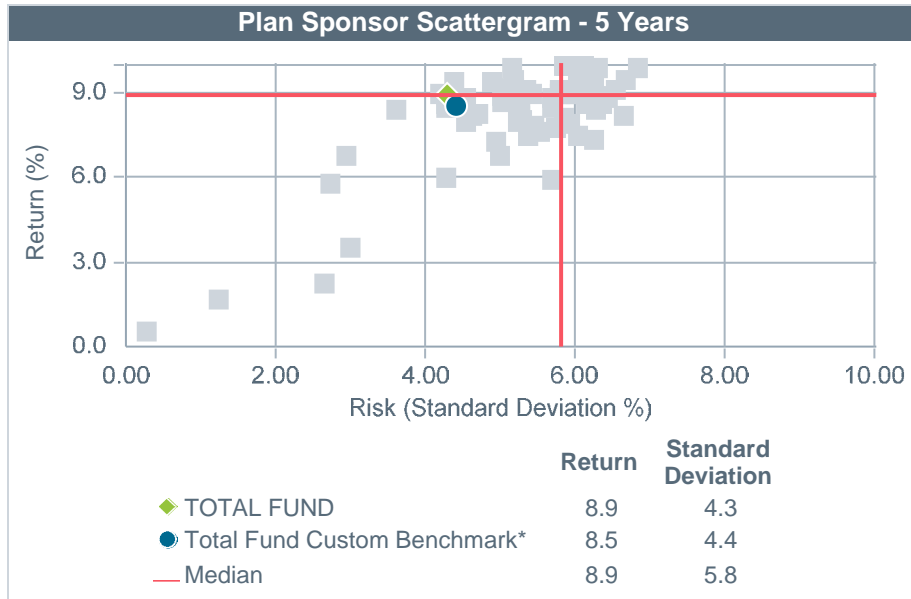
Allocations shown may not sum up to 100% exactly due to rounding.

Current Asset Allocation vs. Interim Target			
	Market Value (\$M)	Allocation (%)	Target (%)
PRIVATE EQUITY	4,128	14.0	16.0
GLOBAL PUBLIC EQUITY	15,505	52.8	43.0
REAL ESTATE	2,266	7.7	12.0
MULTI-STRATEGY	2,108	7.2	12.0
LEGACY HEDGE FUNDS	191	0.7	0.0
FIXED INCOME	4,238	14.4	14.0
CASH	948	3.2	3.0
Total Fund	29,386	100.0	100.0



Schedule of Investable Assets						
Periods Ending	Beginning Market Value (\$M)	Net Cash Flow (\$M)	Gain/Loss (\$M)	Ending Market Value (\$M)	% Return	Unit Value
CYTD	26,656	-1,194	3,924	29,386	15.1	115.1

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding. Target allocations represent interim targets. The Legacy Hedge Funds composite is in liquidation.

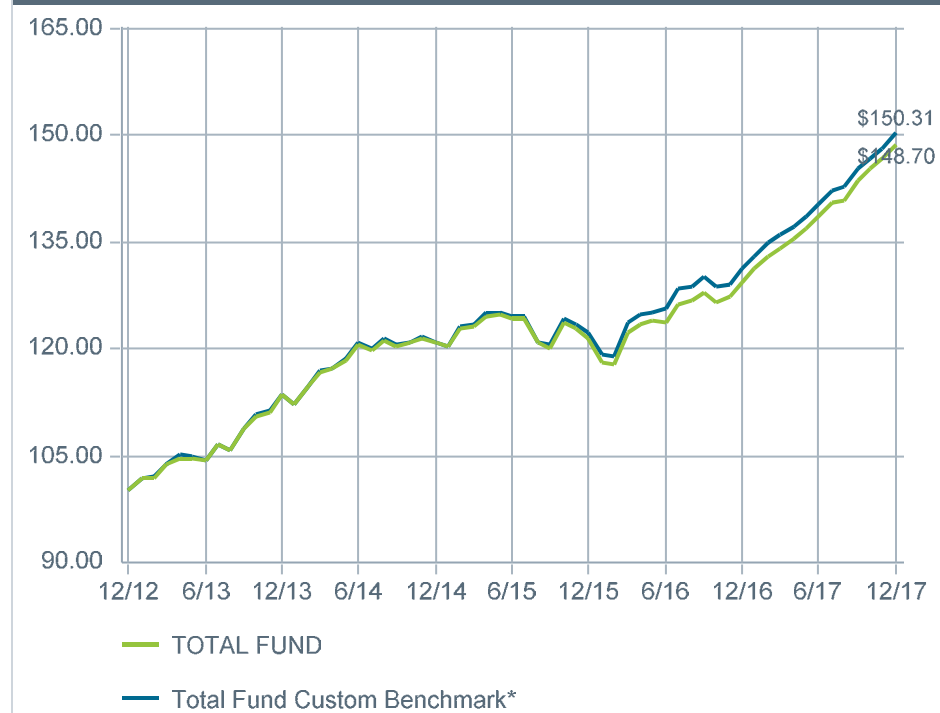


Performance shown is gross of fees. Calculation is based on monthly periodicity. Parentheses contain percentile ranks. \*Please see Addendum for the complete history of the benchmark.

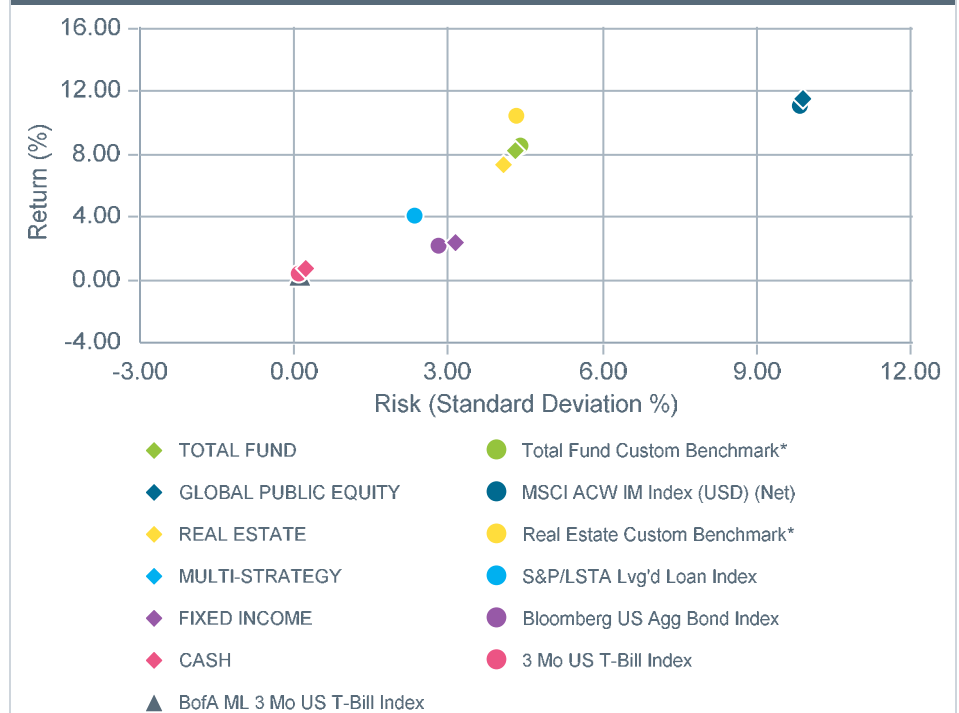
Plan Sponsor Peer Group Analysis - All Public Plans > \$1B-Total Fund

	QTD	CYTD	1 Year	3 Years	5 Years	6 Years	7 Years	10 Years
◆ TOTAL FUND (Gross)	3.7 (62)	15.8 (59)	15.8 (59)	7.8 (53)	8.9 (52)	9.6 (51)	8.7 (33)	4.8 (90)
5th Percentile	4.4	18.4	18.4	9.0	10.9	11.2	9.7	6.9
1st Quartile	4.0	17.1	17.1	8.3	9.9	10.5	9.0	6.4
Median	3.8	16.1	16.1	7.9	8.9	9.6	8.2	5.9
3rd Quartile	3.5	14.7	14.7	7.2	8.1	8.8	7.7	5.5
95th Percentile	1.7	8.1	8.1	4.3	5.8	6.7	6.1	4.6
Population	97	94	94	89	87	85	84	77

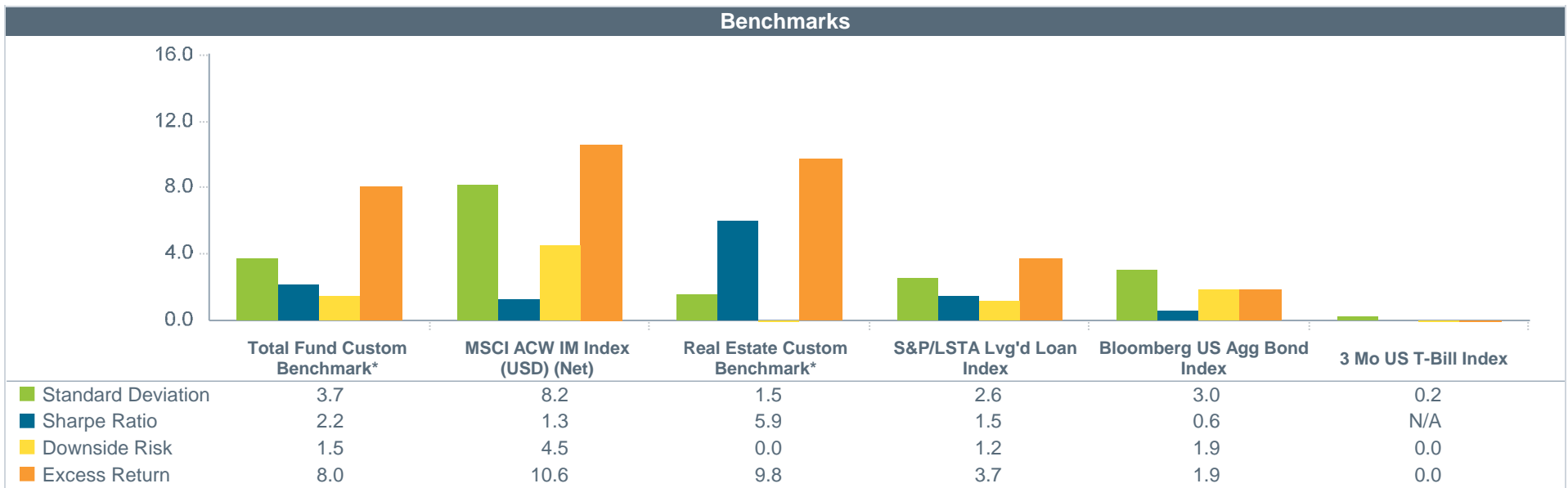
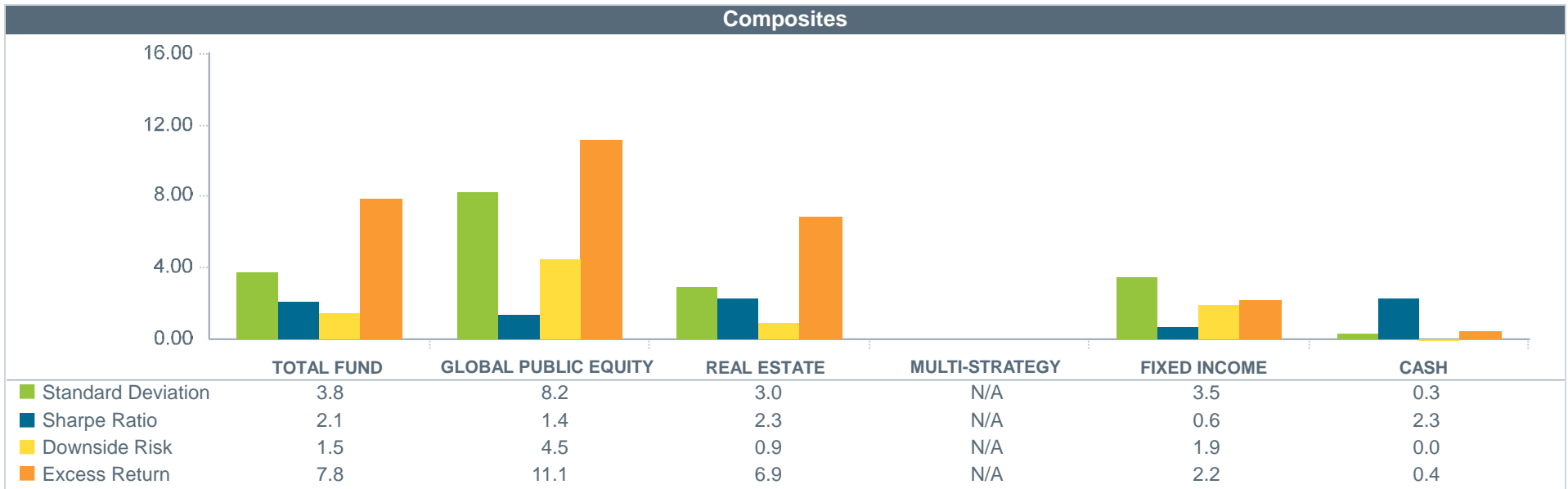
Growth of \$100 - 5 Years



Risk and Return - 5 Years

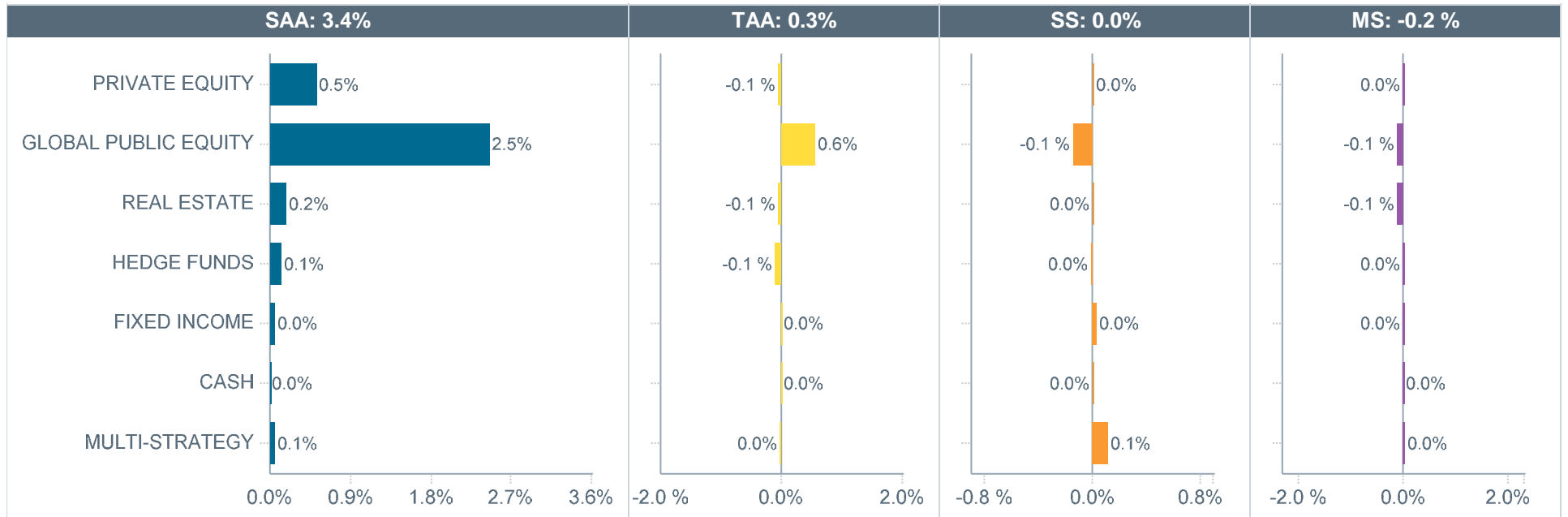
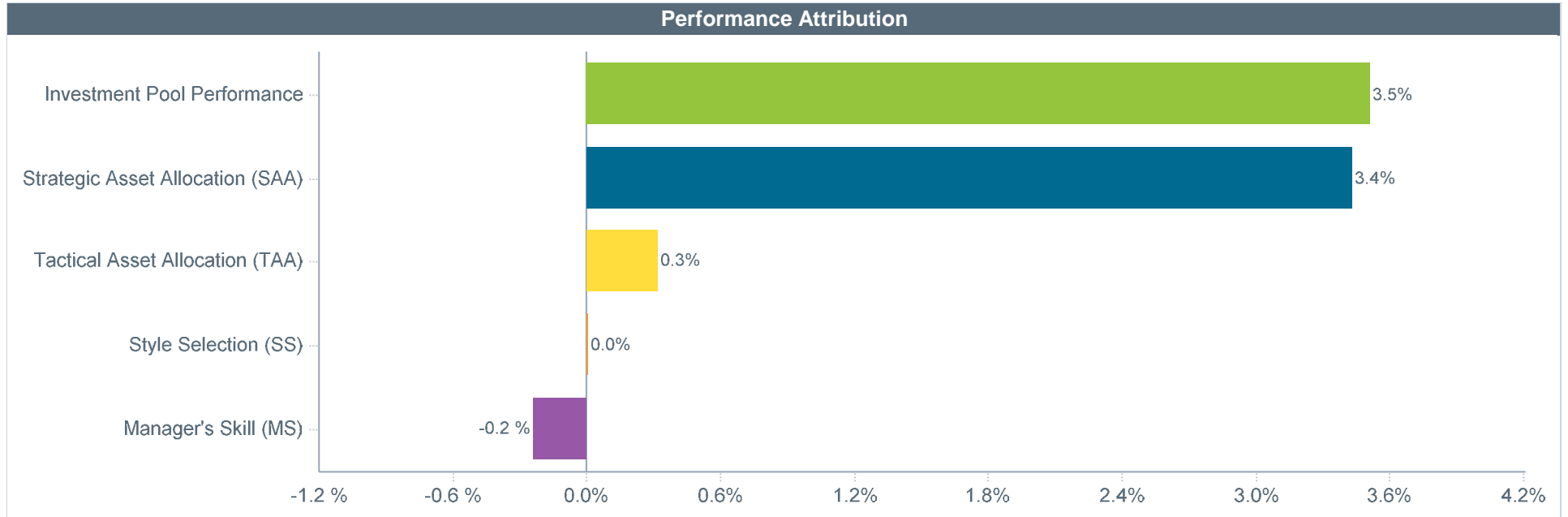


Performance shown is net of fees unless otherwise noted. Calculation is based on monthly periodicity. Parentheses contain percentile ranks. \*Please see Addendum for the complete history of the benchmark. Composites with less history than the specified time period will not appear in the chart. Quarter lagged composites are not shown in risk and return chart.

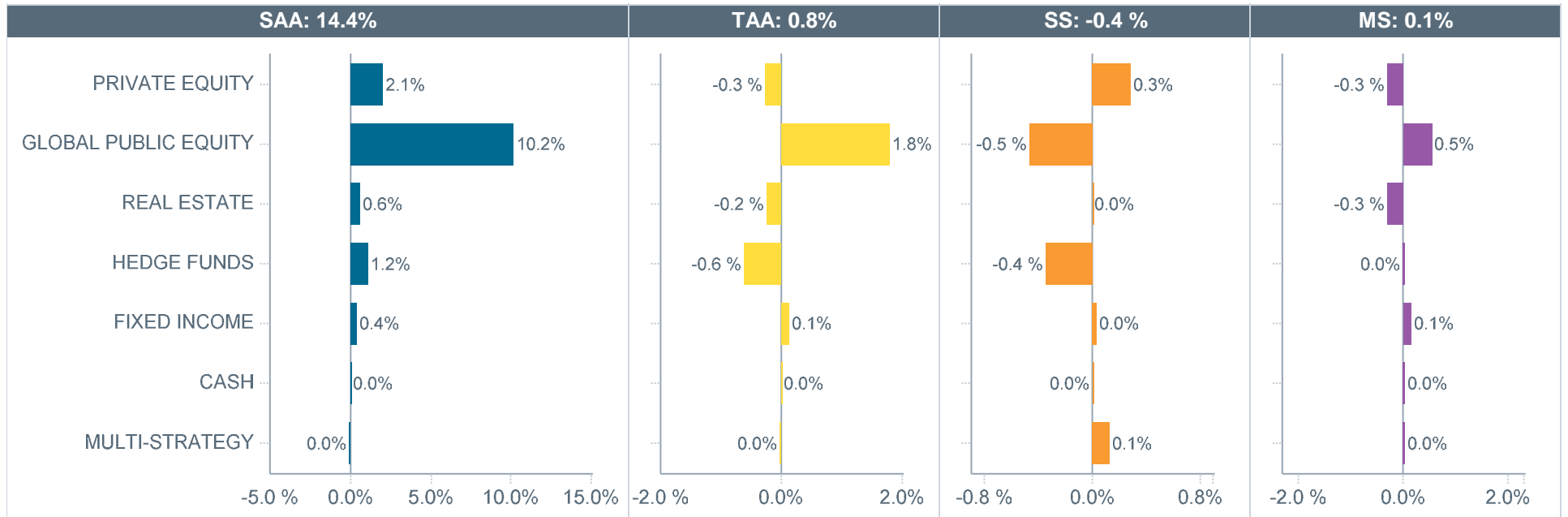
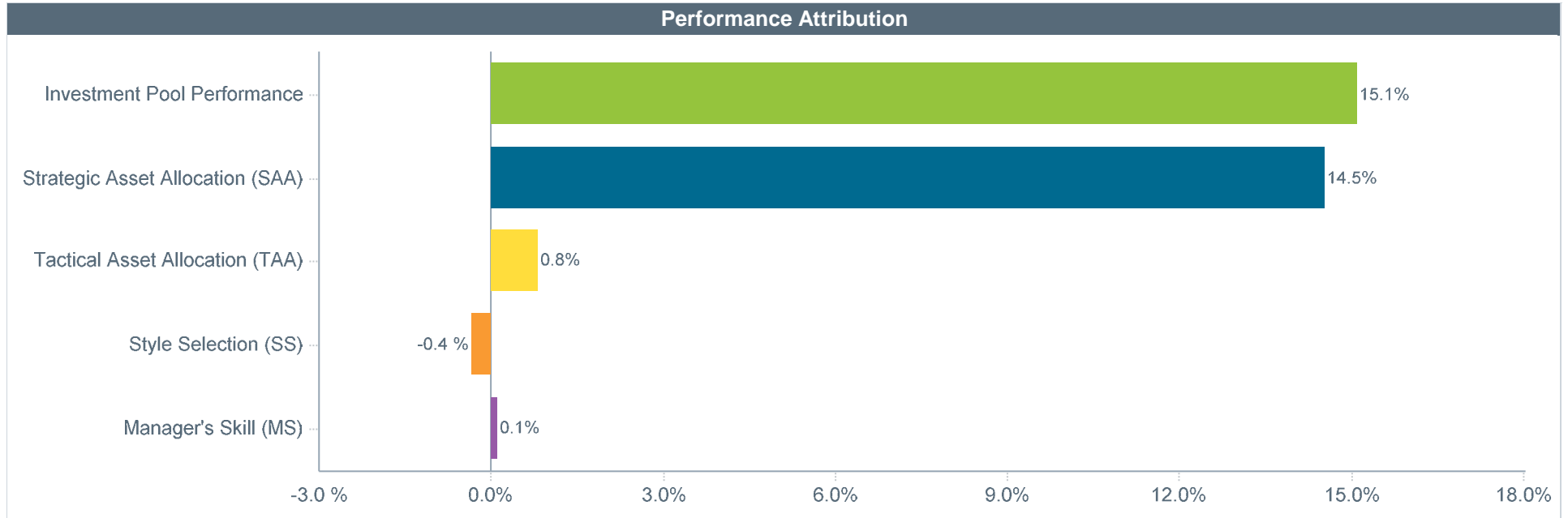


Statistics shown are based on net of fees returns. Calculation is based on quarterly periodicity. \*Please see Addendum for the complete history of the benchmark. Excess Return statistic is calculated against the BofA ML 3 Mo US T-Bill Index. Quarter lagged composites are not shown in historical statistic charts.





Performance shown is net of fees. Calculation is based on monthly periodicity. See Glossary for additional information regarding the Total Fund Attribution - IDP calculation.



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Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 Composites - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)								
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	Since Incep.	Inception Date
<b>TOTAL FUND</b>	<b>29,386</b>	<b>100.0</b>	<b>3.5</b>	<b>15.1</b>	<b>15.1</b>	<b>7.2</b>	<b>8.3</b>	<b>8.0</b>	<b>4.1</b>	<b>9.7</b>	<b>01/01/1981</b>
<i>Total Fund Custom Benchmark*</i>			3.4	14.5	14.5	7.6	8.5	8.2	5.5	N/A	
<i>Total Fund Public Mkt Equiv Benchmark*</i>			3.6	15.9	15.9	8.1	9.5	9.1	6.1	N/A	
<b>PRIVATE EQUITY</b>	<b>4,128</b>	<b>14.0</b>	<b>3.3</b>	<b>12.8</b>	<b>12.8</b>	<b>8.6</b>	<b>10.3</b>	<b>10.8</b>	<b>7.5</b>	<b>10.9</b>	<b>01/01/1986</b>
<i>Burgiss All Private Equity Custom Index (Qtr Lag)</i>			3.3	14.9	14.9	11.1	13.0	12.9	8.5	16.6	
<i>Russell 3000 Index+3% (Qtr Lag)</i>			5.3	22.3	22.3	14.1	17.7	17.7	10.8	14.3	
<b>GLOBAL PUBLIC EQUITY</b>	<b>15,505</b>	<b>52.8</b>	<b>5.2</b>	<b>24.1</b>	<b>24.1</b>	<b>9.7</b>	<b>11.5</b>	<b>9.5</b>	<b>4.3</b>	<b>7.1</b>	<b>01/01/2002</b>
<i>MSCI ACW IM Index (USD) (Net)</i>			5.7	23.9	23.9	9.5	11.0	8.8	5.0	7.5	
<b>REAL ESTATE</b>	<b>2,266</b>	<b>7.7</b>	<b>0.0</b>	<b>2.0</b>	<b>2.0</b>	<b>5.0</b>	<b>7.9</b>	<b>8.5</b>	<b>1.3</b>	<b>8.6</b>	<b>03/01/1984</b>
<i>Real Estate Custom Benchmark*</i>			1.6	5.6	5.6	9.4	10.4	11.2	4.1	N/A	
<i>Consumer Price Index+3% (Qtr Lag)*</i>			1.5	5.3	5.3	4.3	4.3	4.8	4.8	5.7	
<b>MULTI-STRATEGY</b>	<b>2,108</b>	<b>7.2</b>	<b>3.7</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>3.7</b>	<b>10/01/2017</b>
<i>S&amp;P/LSTA Lvg'd Loan Index</i>			1.1	4.1	4.1	4.4	4.0	4.5	4.9	1.1	
<i>Russell 3000 Index</i>			6.3	21.1	21.1	11.1	15.6	13.5	8.6	6.3	
<b>LEGACY HEDGE FUNDS</b>	<b>191</b>	<b>0.7</b>	<b>0.9</b>	<b>4.9</b>	<b>4.9</b>	<b>0.9</b>	<b>2.2</b>	<b>2.1</b>	<b>1.9</b>	<b>2.3</b>	<b>05/01/2007</b>
<i>HF Custom Index*</i>			2.5	11.3	11.3	3.4	7.1	6.5	5.6	5.6	
<i>HFRI FOF: Strategic Index</i>			2.5	11.3	11.3	3.4	4.7	3.1	1.1	1.7	
<b>FIXED INCOME</b>	<b>4,238</b>	<b>14.4</b>	<b>0.5</b>	<b>4.7</b>	<b>4.7</b>	<b>2.5</b>	<b>2.4</b>	<b>4.0</b>	<b>4.8</b>	<b>8.6</b>	<b>01/01/1981</b>
<i>Bloomberg US Agg Bond Index</i>			0.4	3.5	3.5	2.2	2.1	3.2	4.0	7.8	
<b>CASH</b>	<b>948</b>	<b>3.2</b>	<b>0.3</b>	<b>1.5</b>	<b>1.5</b>	<b>0.9</b>	<b>0.7</b>	<b>0.6</b>	<b>0.8</b>	<b>3.7</b>	<b>01/01/1987</b>
<i>BofA ML 3 Mo US T-Bill Index</i>			0.3	0.9	0.9	0.4	0.3	0.2	0.4	3.4	

Performance shown is net of fees. Performance is annualized for periods greater than one year. Allocations shown may not sum to 100% exactly due to rounding. \*Please see Addendum for the complete history of the benchmark. Burgiss index data has been provided by StepStone.

**Commonwealth of Pennsylvania State Employees' Retirement System**  
**Calendar Years**  
**Composites - NET OF FEES**

**As of December 31, 2017**

	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
<b>TOTAL FUND</b>	<b>6.5</b>	<b>0.4</b>	<b>6.4</b>	<b>13.6</b>	<b>12.0</b>	<b>2.7</b>	<b>11.9</b>	<b>9.2</b>	<b>-28.7</b>	<b>17.2</b>
<i>Total Fund Custom Benchmark*</i>	7.3	1.2	6.3	13.7	11.4	3.6	11.3	18.7	-25.4	14.3
<i>Total Fund Public Mkt Equiv Benchmark*</i>	8.4	0.6	7.6	15.5	15.7	0.9	11.3	18.7	-25.4	14.3
<b>PRIVATE EQUITY</b>	<b>6.8</b>	<b>6.4</b>	<b>13.1</b>	<b>12.6</b>	<b>11.4</b>	<b>12.7</b>	<b>16.5</b>	<b>-7.8</b>	<b>-6.8</b>	<b>35.8</b>
<i>Burgiss All Private Equity Custom Index (Qtr Lag)</i>	9.0	9.6	16.3	15.7	12.3	12.8	15.6	-9.8	-7.0	33.3
<i>Russell 3000 Index+3% (Qtr Lag)</i>	18.4	2.5	21.3	25.2	34.1	3.6	14.3	-3.6	-19.2	20.0
<b>GLOBAL PUBLIC EQUITY</b>	<b>8.4</b>	<b>-1.8</b>	<b>3.3</b>	<b>26.3</b>	<b>17.6</b>	<b>-7.0</b>	<b>15.4</b>	<b>35.8</b>	<b>-48.6</b>	<b>12.8</b>
<i>MSCI ACW IM Index (USD) (Net)</i>	8.4	-2.2	3.8	23.6	16.4	-7.9	14.3	36.4	-42.3	11.2
<b>REAL ESTATE</b>	<b>3.2</b>	<b>9.9</b>	<b>10.9</b>	<b>13.7</b>	<b>9.9</b>	<b>10.5</b>	<b>2.3</b>	<b>-29.3</b>	<b>-10.9</b>	<b>22.4</b>
<i>Real Estate Custom Benchmark*</i>	9.9	12.9	11.4	12.4	12.8	13.7	6.7	-31.7	-2.5	17.4
<i>Consumer Price Index+3% (Qtr Lag)*</i>	4.5	3.0	4.7	4.2	5.1	7.0	4.2	1.7	8.1	5.8
<b>MULTI-STRATEGY</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
<i>S&amp;P/LSTA Lvg'd Loan Index</i>	10.2	-0.7	1.6	5.3	9.7	1.5	10.2	51.6	-29.1	2.0
<i>Russell 3000 Index</i>	12.7	0.5	12.6	33.6	16.4	1.0	16.9	28.3	-37.3	5.1
<b>LEGACY HEDGE FUNDS</b>	<b>4.2</b>	<b>-6.0</b>	<b>2.5</b>	<b>6.0</b>	<b>7.0</b>	<b>-3.0</b>	<b>7.4</b>	<b>14.7</b>	<b>-15.6</b>	<b>N/A</b>
<i>HF Custom Index*</i>	-0.1	-0.5	4.1	22.2	6.7	3.3	3.3	4.0	3.8	5.6
<i>HFRI FOF: Strategic Index</i>	-0.1	-0.5	3.1	10.5	5.8	-7.3	6.3	13.2	-25.2	12.8
<b>FIXED INCOME</b>	<b>5.6</b>	<b>-2.7</b>	<b>6.2</b>	<b>-1.4</b>	<b>10.0</b>	<b>6.2</b>	<b>11.7</b>	<b>31.9</b>	<b>-17.4</b>	<b>6.1</b>
<i>Bloomberg US Agg Bond Index</i>	2.6	0.5	6.0	-2.0	4.2	7.8	6.5	5.9	5.2	7.0
<b>CASH</b>	<b>0.6</b>	<b>0.7</b>	<b>0.4</b>	<b>0.2</b>	<b>0.4</b>	<b>0.2</b>	<b>0.3</b>	<b>0.5</b>	<b>3.4</b>	<b>5.1</b>
<i>BofA ML 3 Mo US T-Bill Index</i>	0.3	0.1	0.0	0.1	0.1	0.1	0.1	0.2	2.1	5.0

Performance shown is net of fees. \*Please see Addendum for the complete history of the benchmark. Burgiss index data has been provided by StepStone.

Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 PRIVATE EQUITY - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>PRIVATE EQUITY</b>	<b>4,128</b>	<b>14.0</b>	<b>3.3</b>	<b>12.8</b>	<b>12.8</b>	<b>8.6</b>	<b>10.3</b>	<b>10.8</b>	<b>7.5</b>	<b>6.8</b>	<b>6.4</b>	<b>10.9</b>	<b>01/01/1986</b>
<i>Burgiss All Private Equity Custom Index (Qtr Lag)</i>			3.3	14.9	14.9	11.1	13.0	12.9	8.5	9.0	9.6	16.6	
<i>Russell 3000 Index+3% (Qtr Lag)</i>			5.3	22.3	22.3	14.1	17.7	17.7	10.8	18.4	2.5	14.3	
<b>Buyouts</b>	<b>2,474</b>	<b>8.4</b>	<b>4.0</b>	<b>15.3</b>	<b>15.3</b>	<b>11.3</b>	<b>12.6</b>	<b>13.5</b>	<b>9.4</b>	<b>10.8</b>	<b>7.8</b>	<b>13.3</b>	<b>04/01/1986</b>
<i>Burgiss Buyout Custom Index (Qtr Lag)</i>			3.5	17.9	17.9	12.0	13.5	13.3	8.7	11.6	6.9	24.8	
<b>Special Situations</b>	<b>654</b>	<b>2.2</b>	<b>2.5</b>	<b>17.5</b>	<b>17.5</b>	<b>6.5</b>	<b>9.0</b>	<b>9.5</b>	<b>7.3</b>	<b>1.1</b>	<b>1.7</b>	<b>12.4</b>	<b>01/01/1995</b>
<i>Burgiss Special Situations Custom Index (Qtr Lag)</i>			2.7	10.8	10.8	6.6	9.1	9.3	6.5	6.1	2.9	11.2	
<b>Venture Capital</b>	<b>1,000</b>	<b>3.4</b>	<b>2.1</b>	<b>4.4</b>	<b>4.4</b>	<b>3.9</b>	<b>5.5</b>	<b>7.3</b>	<b>4.1</b>	<b>1.2</b>	<b>6.1</b>	<b>6.2</b>	<b>01/01/1986</b>
<i>Burgiss Venture Capital Custom Index (Qtr Lag)</i>			3.5	9.1	9.1	10.9	14.0	13.7	9.1	3.3	21.1	14.2	

Performance shown is net of fees. Performance is annualized for periods greater than one year. Allocations shown may not sum up to 100% exactly due to rounding. Burgiss index data has been provided by StepStone.

Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 GLOBAL PUBLIC EQUITY - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>GLOBAL PUBLIC EQUITY</b>	<b>15,505</b>	<b>52.8</b>	<b>5.2</b>	<b>24.1</b>	<b>24.1</b>	<b>9.7</b>	<b>11.5</b>	<b>9.5</b>	<b>4.3</b>	<b>8.4</b>	<b>-1.8</b>	<b>7.1</b>	<b>01/01/2002</b>
MSCI ACW IM Index (USD) (Net)			5.7	23.9	23.9	9.5	11.0	8.8	5.0	8.4	-2.2	7.5	
<b>Global Mandates</b>	<b>871</b>	<b>3.0</b>	<b>6.2</b>	<b>27.0</b>	<b>27.0</b>	<b>11.4</b>	<b>11.9</b>	<b>10.2</b>	<b>7.3</b>	<b>6.4</b>	<b>2.4</b>	<b>8.1</b>	<b>11/01/2006</b>
MSCI World Index (Net)			5.5	22.4	22.4	9.3	11.6	9.6	5.0	7.5	-0.9	5.7	
Walter Scott & Ptnrs Glbl Gr Eq (SA) MSCI World Index (Net)	871	3.0	6.2	27.0	27.0	11.4	11.9	10.6	8.0	6.4	2.4	8.7	10/01/2006
			5.5	22.4	22.4	9.3	11.6	9.6	5.0	7.5	-0.9	6.0	
<b>U.S. Equity</b>	<b>7,820</b>	<b>26.6</b>	<b>5.9</b>	<b>20.5</b>	<b>20.5</b>	<b>10.1</b>	<b>14.7</b>	<b>13.2</b>	<b>6.4</b>	<b>11.2</b>	<b>-0.5</b>	<b>10.8</b>	<b>01/01/1981</b>
Russell 3000 Index*			6.3	21.1	21.1	11.1	15.6	13.5	8.6	12.7	0.5	11.0	
<b>U.S. Mid/Large Cap Equity</b>	<b>6,290</b>	<b>21.4</b>	<b>6.2</b>	<b>21.8</b>	<b>21.8</b>	<b>10.7</b>	<b>15.4</b>	<b>13.9</b>	<b>6.7</b>	<b>11.0</b>	<b>0.3</b>	<b>9.6</b>	<b>01/01/1994</b>
Russell 1000 Index			6.6	21.7	21.7	11.2	15.7	13.7	8.6	12.1	0.9	9.8	
Iridian Asset Mgmt MCV (SA) Russell Mid Cap Index	485	1.7	2.3	23.4	23.4	7.4	15.1	14.2	10.9	4.1	-3.6	13.9	03/01/1995
			6.1	18.5	18.5	9.6	15.0	12.8	9.1	13.8	-2.4	11.4	
MCM Russell 1000 Index (SA) Russell 1000 Index	5,805	19.8	6.6	21.6	21.6	11.2	15.7	N/A	N/A	12.2	0.9	15.8	01/01/2012
			6.6	21.7	21.7	11.2	15.7	13.7	8.6	12.1	0.9	15.8	
<b>U.S. Small Cap Equity</b>	<b>1,530</b>	<b>5.2</b>	<b>4.4</b>	<b>16.2</b>	<b>16.2</b>	<b>6.6</b>	<b>11.1</b>	<b>10.0</b>	<b>7.1</b>	<b>10.6</b>	<b>-5.8</b>	<b>9.5</b>	<b>01/01/1994</b>
Russell 2000 Index*			3.3	14.6	14.6	9.7	14.1	12.1	9.1	18.6	-2.9	10.8	
S&P Sm Cap 600 Index (Cap Wtd)			4.0	13.2	13.2	12.0	16.0	13.8	10.4	26.6	-2.0	10.9	
Emerald Adv Div Sm Cap Grth (SA) Russell 2000 Grth Index	635	2.2	7.3	26.1	26.1	N/A	N/A	N/A	N/A	N/A	N/A	25.4	12/01/2016
			4.6	22.2	22.2	10.3	15.2	12.3	9.2	11.3	-1.4	21.8	
MCM Russell 2000 Core Index (SA) Russell 2000 Index	312	1.1	3.3	14.6	14.6	N/A	N/A	N/A	N/A	N/A	N/A	16.4	12/01/2016
			3.3	14.6	14.6	10.0	14.1	11.6	8.7	21.3	-4.4	16.4	
MCM Russell 2000 Val Index (SA) Russell 2000 Val Index	583	2.0	2.0	7.8	7.8	N/A	N/A	N/A	N/A	N/A	N/A	11.2	12/01/2016
			2.0	7.8	7.8	9.5	13.0	10.8	8.2	31.7	-7.5	11.3	

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding. \*Please see Addendum for the complete history of the benchmark.



Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 GLOBAL PUBLIC EQUITY - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>Non-U.S. Equity</b>	<b>6,807</b>	<b>23.2</b>	<b>4.3</b>	<b>30.3</b>	<b>30.3</b>	<b>9.0</b>	<b>7.8</b>	<b>5.9</b>	<b>1.2</b>	<b>3.4</b>	<b>-4.0</b>	<b>6.8</b>	<b>11/01/1995</b>
<i>MSCI ACW Ex US IM Index (USD) (Net)*</i>			5.2	27.8	27.8	8.4	7.2	5.2	2.1	4.4	-4.6	6.1	
<b>Non-U.S. Developed Markets Equity</b>	<b>5,686</b>	<b>19.3</b>	<b>4.0</b>	<b>29.1</b>	<b>29.1</b>	<b>8.9</b>	<b>8.8</b>	<b>7.1</b>	<b>1.8</b>	<b>2.0</b>	<b>-1.9</b>	<b>6.9</b>	<b>01/01/2002</b>
<i>MSCI ACW Ex US IM Index (USD) (Net)</i>			5.2	27.8	27.8	8.4	7.2	5.2	2.2	4.4	-4.6	7.6	
<b>Non-U.S. Dev Mid/Large Cap Equity</b>	<b>5,059</b>	<b>17.2</b>	<b>4.3</b>	<b>31.7</b>	<b>31.7</b>	<b>9.2</b>	<b>8.8</b>	<b>7.4</b>	<b>1.1</b>	<b>1.3</b>	<b>-2.4</b>	<b>6.2</b>	<b>01/01/2002</b>
<i>MSCI World Ex US Index (Net)</i>			4.2	24.2	24.2	7.4	7.5	5.6	1.9	2.7	-3.0	6.5	
BlackRock MSCI World ex US Index (CF)	5,048	17.2	4.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.6	06/01/2017
<i>MSCI Wrld Ex US Index (USD) (Net)</i>			4.2	24.2	24.2	7.4	7.5	5.6	1.9	2.7	-3.0	10.2	
Artisan Int'l Growth Eq (SA)	1	0.0	0.6	-13.5	-13.5	-8.7	-0.6	1.9	-0.7	-9.0	-3.2	6.8	04/01/2003
<i>MSCI ACW Ex US Index (Net)*</i>			5.0	27.2	27.2	7.8	6.8	4.9	1.5	4.5	-5.7	9.2	
MCM MSCI World Ex US Index (SA)	7	0.0	0.0	0.4	0.4	0.3	3.3	N/A	N/A	3.3	-2.8	5.4	01/01/2012
<i>MSCI World Ex US Index (Net)</i>			4.2	24.2	24.2	7.4	7.5	5.6	1.9	2.7	-3.0	8.9	
Morgan Stanley Inv Mgmt Int'l Eq (SA)	2	0.0	0.3	7.9	7.9	2.4	4.2	4.6	2.0	-1.7	1.1	6.1	12/01/1999
<i>MSCI EAFE Index (Net)*</i>			4.2	25.0	25.0	7.8	7.9	6.0	1.9	1.0	-0.8	4.1	
Templeton Int'l Eq (SA)	1	0.0	-9.3	-18.6	-18.6	-7.2	-2.0	-0.4	-2.4	1.1	-2.8	5.5	01/01/1995
<i>MSCI ACW Ex US Index (Net)*</i>			5.0	27.2	27.2	7.8	6.8	4.9	1.5	4.5	-5.7	5.5	
<b>Non-U.S. Dev Small Cap Equity</b>	<b>627</b>	<b>2.1</b>	<b>2.0</b>	<b>27.5</b>	<b>27.5</b>	<b>11.4</b>	<b>11.1</b>	<b>7.4</b>	<b>5.4</b>	<b>7.3</b>	<b>1.0</b>	<b>7.7</b>	<b>10/01/1993</b>
<i>MSCI Wrld Ex US Sm Cap Index (Net)</i>			5.8	31.0	31.0	13.0	11.4	7.8	5.2	4.3	5.5	N/A	
Harris Assoc Int'l SCV (SA)	627	2.1	2.0	27.5	27.5	11.4	11.1	7.9	7.5	7.3	1.0	12.5	07/01/2003
<i>MSCI Wrld Ex US Sm Cap Index (Net)</i>			5.8	31.0	31.0	13.0	11.4	7.8	5.2	4.3	5.5	10.7	

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding. \*Please see Addendum for the complete history of the benchmark.



Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 GLOBAL PUBLIC EQUITY - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>Emerging Markets Equity</b>	<b>1,121</b>	<b>3.8</b>	<b>6.2</b>	<b>41.4</b>	<b>41.4</b>	<b>11.0</b>	<b>4.9</b>	<b>2.2</b>	<b>-0.3</b>	<b>10.3</b>	<b>-12.4</b>	<b>8.4</b>	<b>01/01/2002</b>
<i>MSCI Emg Mkts Index (Net)</i>			7.4	37.3	37.3	9.1	4.3	2.6	1.7	11.2	-14.9	11.1	
BlackRock Emg Mkts Index (CF)	331	1.1	7.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15.8	07/01/2017
<i>MSCI Emg Mkts Index (USD) (Net)</i>			7.4	37.3	37.3	9.1	4.3	2.6	1.7	11.2	-14.9	15.9	
Macquarie Emerging Markets Equity (SA)	343	1.2	4.3	42.1	42.1	10.8	N/A	N/A	N/A	10.7	-13.5	6.4	05/01/2013
<i>MSCI Emg Mkts Index (Net)</i>			7.4	37.3	37.3	9.1	4.3	2.6	1.7	11.2	-14.9	4.9	
GlobeFlex Emerging Small Cap (SA)	103	0.3	4.2	38.5	38.5	8.4	N/A	N/A	N/A	4.8	-12.2	7.8	08/01/2013
<i>MSCI Emg Mkts Sm Cap Index (Net)</i>			9.2	33.8	33.8	8.4	5.4	2.1	2.8	2.3	-6.8	6.9	
Martin Currie Emerging Markets Equity (SA)	343	1.2	7.5	50.0	50.0	13.6	N/A	N/A	N/A	12.6	-13.2	8.1	01/01/2014
<i>MSCI Emg Mkts Index (Net)</i>			7.4	37.3	37.3	9.1	4.3	2.6	1.7	11.2	-14.9	6.2	
Northern Trust Equity Transition (SA)	7	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	01/01/2012

Artisan Int'l Growth Eq (SA), MCM MSCI World Ex US Index (SA), Morgan Stanley Inv Mgmt Int'l Eq (SA), and Templeton Int'l Eq (SA) are currently undergoing liquidation.

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding. \*Please see Addendum for the complete history of the benchmark.





Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 REAL ESTATE - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>REAL ESTATE</b>	<b>2,266</b>	<b>7.7</b>	<b>0.0</b>	<b>2.0</b>	<b>2.0</b>	<b>5.0</b>	<b>7.9</b>	<b>8.5</b>	<b>1.3</b>	<b>3.2</b>	<b>9.9</b>	<b>8.6</b>	<b>03/01/1984</b>
Real Estate Custom Benchmark*			1.6	5.6	5.6	9.4	10.4	11.2	4.1	9.9	12.9	N/A	
Consumer Price Index+3% (Qtr Lag)*			1.5	5.3	5.3	4.3	4.3	4.8	4.8	4.5	3.0	5.7	
<b>Core Real Estate Funds</b>	<b>340</b>	<b>1.2</b>	<b>1.5</b>	<b>5.9</b>	<b>5.9</b>	<b>9.3</b>	<b>10.4</b>	<b>11.6</b>	<b>5.6</b>	<b>9.9</b>	<b>12.2</b>	<b>7.1</b>	<b>09/01/1986</b>
NCREIF ODCE Index (AWA) (Net) (Qtr Lag)*			1.6	6.7	6.7	10.1	11.0	12.0	3.7	9.3	14.5	6.3	
<b>Non-Core Real Estate</b>	<b>1,565</b>	<b>5.3</b>	<b>-0.2</b>	<b>3.4</b>	<b>3.4</b>	<b>4.8</b>	<b>8.1</b>	<b>8.8</b>	<b>0.4</b>	<b>0.3</b>	<b>10.8</b>	<b>7.0</b>	<b>03/01/1984</b>
NCREIF ODCE Index (AWA) (Net) (Qtr Lag)*			1.6	6.7	6.7	10.1	11.0	12.0	3.7	9.3	14.5	6.6	
Non-Core Open-End Funds	71	0.2	1.4	6.0	6.0	5.8	8.0	9.8	7.4	4.6	6.7	6.6	09/01/2007
NCREIF ODCE Index (AWA) (Net) (Qtr Lag)*			1.6	6.7	6.7	10.1	11.0	12.0	3.7	9.3	14.5	4.5	
Real Estate Separate Accounts	1,081	3.7	-1.3	1.6	1.6	3.4	6.8	7.2	-0.4	-2.3	11.4	5.5	06/01/1988
NCREIF ODCE Index (AWA) (Net) (Qtr Lag)*			1.6	6.7	6.7	10.1	11.0	12.0	3.7	9.3	14.5	6.3	
Non-Core Closed-End Funds	412	1.4	2.5	8.0	8.0	7.8	11.0	11.8	1.0	6.0	9.5	7.9	03/01/1984
NCREIF ODCE Index (AWA) (Net) (Qtr Lag)*			1.6	6.7	6.7	10.1	11.0	12.0	3.7	9.3	14.5	6.6	
<b>REITs</b>	<b>232</b>	<b>0.8</b>	<b>0.6</b>	<b>-4.7</b>	<b>-4.7</b>	<b>4.3</b>	<b>6.6</b>	<b>7.9</b>	<b>3.6</b>	<b>14.0</b>	<b>4.6</b>	<b>9.9</b>	<b>04/01/1996</b>
S&P Developed Global Index (Qtr Lag)*			1.1	0.7	0.7	6.6	7.8	8.7	2.8	16.2	3.5	9.9	
<b>Timberland</b>	<b>129</b>	<b>0.4</b>	<b>-3.4</b>	<b>-6.3</b>	<b>-6.3</b>	<b>-0.9</b>	<b>0.5</b>	<b>0.4</b>	<b>-0.7</b>	<b>-0.2</b>	<b>4.3</b>	<b>4.7</b>	<b>03/01/1993</b>
Consumer Price Index+3% (Qtr Lag)*			1.5	5.3	5.3	6.3	7.8	5.9	5.5	4.5	9.3	9.4	

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding. \*Please see Addendum for the complete history of the benchmark.



Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 MULTI-STRATEGY - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>MULTI-STRATEGY</b>	<b>2,108</b>	<b>7.2</b>	<b>3.7</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>3.7</b>	<b>10/01/2017</b>
<i>S&amp;P/LSTA Lvg'd Loan Index</i>			1.1	4.1	4.1	4.4	4.0	4.5	4.9	10.2	-0.7	1.1	
<i>Russell 3000 Index</i>			6.3	21.1	21.1	11.1	15.6	13.5	8.6	12.7	0.5	6.3	
<b>Credit Focused Strategies</b>	<b>876</b>	<b>3.0</b>	<b>1.4</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>1.4</b>	<b>10/01/2017</b>
Blackstone Keystone Fund <sup>1</sup>	876	3.0	1.4	7.9	7.9	4.4	7.6	N/A	N/A	2.9	2.3	8.5	07/01/2012
<i>HFRI FOF Comp Index</i>			2.0	7.7	7.7	2.6	4.0	2.7	1.1	0.5	-0.3	4.3	
<b>Opportunistic Equity &amp; Fixed Income</b>	<b>1,233</b>	<b>4.2</b>	<b>5.5</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>5.5</b>	<b>10/01/2017</b>
MCM Russell 3000 Index (SA) <sup>2</sup>	925	3.1	6.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.3	06/01/2017
<i>Russell 3000 Index</i>			6.3	21.1	21.1	11.1	15.6	13.5	8.6	12.7	0.5	12.2	
SEI Structured Credit High Yield Bank Loans (CF) <sup>3</sup>	308	1.0	3.2	13.2	13.2	7.9	7.2	10.4	N/A	17.8	-5.9	13.5	05/01/2008
<i>FTSE Hi Yld Mkt Index</i>			0.5	7.0	7.0	6.0	5.4	6.8	7.6	17.8	-5.6	7.7	

1. Since inception returns are included in the Legacy Hedge Fund composite through 9/30/2017. Beginning 10/1/2017, returns are included in the Multi-Strategy composite. Since inception returns are reported in the Total Fund.

2. Since inception returns are included in the Global Public Equity composite through 9/30/2017. Beginning 10/1/2017, returns are included in the Multi-Strategy composite. Since inception returns are reported in the Total Fund.

3. Since inception returns are included in the Fixed Income composite through 9/30/2017. Beginning 10/1/2017, returns are included in the Multi-Strategy composite. Since inception returns are reported in the Total Fund.

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding.

Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 HEDGE FUNDS - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>LEGACY HEDGE FUNDS HISTORY</b>	<b>191</b>	<b>0.7</b>	<b>0.9</b>	<b>4.9</b>	<b>4.9</b>	<b>0.9</b>	<b>2.2</b>	<b>2.1</b>	<b>1.9</b>	<b>4.2</b>	<b>-6.0</b>	<b>3.9</b>	<b>01/01/2002</b>
<b>LEGACY HEDGE FUNDS</b>	<b>191</b>	<b>0.7</b>	<b>0.9</b>	<b>4.9</b>	<b>4.9</b>	<b>0.9</b>	<b>2.2</b>	<b>2.1</b>	<b>1.9</b>	<b>4.2</b>	<b>-6.0</b>	<b>2.3</b>	<b>05/01/2007</b>
<i>HF Custom Index*</i>			2.5	11.3	11.3	3.4	7.1	6.5	5.6	-0.1	-0.5	5.6	
<i>HFRI FOF Strategic Index</i>			2.5	11.3	11.3	3.4	4.7	3.1	1.1	-0.1	-0.5	1.7	
<b>Direct Hedge Funds</b>	<b>18</b>	<b>0.1</b>	<b>1.7</b>	<b>8.4</b>	<b>8.4</b>	<b>1.6</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>1.9</b>	<b>-5.0</b>	<b>2.3</b>	<b>10/01/2013</b>
Hoplite Partners, L.P.	1	0.0	0.0	1.6	1.6	-0.5	N/A	N/A	N/A	-6.0	3.2	1.7	10/01/2013
<i>HFRI Eq Hedge (Tot) Index</i>			3.4	13.3	13.3	5.8	6.6	4.4	3.2	5.5	-1.0	5.6	
Luxor Capital Partners LP	12	0.0	3.2	22.7	22.7	2.3	N/A	N/A	N/A	7.9	-19.1	-0.9	01/01/2014
<i>HFRI ED: (Tot) Index</i>			2.0	7.6	7.6	4.7	5.5	4.6	4.2	10.6	-3.6	3.8	
Pine River Fund Ltd.	3	0.0	0.3	-1.3	-1.3	-0.7	N/A	N/A	N/A	1.7	-2.5	0.7	10/01/2013
<i>HFRI Rel Value (Tot) Index</i>			1.1	5.2	5.2	4.1	4.7	4.9	4.8	7.7	-0.3	4.4	
Samlyn Onshore Fund LP	2	0.0	0.0	6.5	6.5	2.1	N/A	N/A	N/A	1.2	-1.1	3.6	07/01/2014
<i>HFRI Eq Hedge (Tot) Index</i>			3.4	13.3	13.3	5.8	6.6	4.4	3.2	5.5	-1.0	4.5	
Stelliam Fund LP	1	0.0	0.0	0.8	0.8	-1.6	N/A	N/A	N/A	7.3	-11.9	2.1	02/01/2014
<i>HFRI Eq Hedge (Tot) Index</i>			3.4	13.3	13.3	5.8	6.6	4.4	3.2	5.5	-1.0	5.1	

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding. \*Please see Addendum for the complete history of the benchmark. Performance for LEGACY HEDGE FUNDS HISTORY is for reference purposes only.

Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 HEDGE FUNDS - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>Absolute Return</b>	<b>59</b>	<b>0.2</b>	<b>0.5</b>	<b>-1.6</b>	<b>-1.6</b>	<b>-1.0</b>	<b>-0.2</b>	<b>0.6</b>	<b>0.6</b>	<b>-3.1</b>	<b>1.9</b>	<b>0.7</b>	<b>07/01/2007</b>
<i>3 Mo LIBOR Index+3%*</i>			1.0	4.1	4.1	3.7	3.5	3.5	3.6	3.7	3.2	3.7	
Arden Inst'l LP	16	0.1	2.6	0.1	0.1	2.3	5.1	4.7	2.7	-2.5	9.6	3.3	10/01/2006
<i>3 Mo LIBOR Index+3%*</i>			1.0	4.1	4.1	3.7	3.5	3.5	3.6	3.7	3.2	3.8	
BAAM Custom ARS Fund LP	15	0.1	-1.9	-7.0	-7.0	-7.1	-2.9	-1.1	-0.7	-2.5	-11.7	2.7	01/01/2002
<i>3 Mo LIBOR Index+3%*</i>			1.0	4.1	4.1	3.7	3.5	3.5	3.6	3.7	3.2	3.4	
Mesirow Multi-Manager Fund III LP	10	0.0	4.3	2.3	2.3	4.7	6.4	6.3	4.3	-7.5	21.3	5.9	10/01/2002
<i>3 Mo LIBOR Index+3%*</i>			1.0	4.1	4.1	3.7	3.5	3.5	3.6	3.7	3.2	3.4	
MS Institutional Fund of Hedge Funds SPV LP (CF)	7	0.0	10.0	17.6	17.6	5.4	7.8	6.4	3.7	3.9	-4.3	5.1	07/01/2002
<i>3 Mo LIBOR Index+3%*</i>			1.0	4.1	4.1	3.7	3.5	3.5	3.6	3.7	3.2	3.4	
PAAMCO Newport Sequoia Fund LLC	7	0.0	-9.8	-10.2	-10.2	-2.3	-17.2	-15.1	-11.0	-0.1	4.0	-4.2	07/01/2002
<i>3 Mo LIBOR Index+3%*</i>			1.0	4.1	4.1	3.7	3.5	3.5	3.6	3.7	3.2	3.4	
Rock Creek Penn Quarter LP	3	0.0	-1.5	-3.4	-3.4	-7.9	-3.2	-1.7	-1.6	-12.6	-7.5	-0.6	10/01/2006
<i>3 Mo LIBOR Index+3%*</i>			1.0	4.1	4.1	3.7	3.5	3.5	3.6	3.7	3.2	3.8	
<b>Funds-of-Hedge Funds</b>	<b>114</b>	<b>0.4</b>	<b>1.1</b>	<b>6.9</b>	<b>6.9</b>	<b>3.3</b>	<b>6.2</b>	<b>N/A</b>	<b>N/A</b>	<b>2.7</b>	<b>0.4</b>	<b>6.1</b>	<b>04/01/2012</b>
<i>HFRI FOF Comp Index</i>			2.0	7.7	7.7	2.6	4.0	2.7	1.1	0.5	-0.3	3.7	
Arden Keystone Fund LP	20	0.1	0.1	4.1	4.1	0.3	N/A	N/A	N/A	1.4	-4.4	3.1	05/01/2013
<i>HFRI FOF Comp Index</i>			2.0	7.7	7.7	2.6	4.0	2.7	1.1	0.5	-0.3	3.4	
Entrust Keystone Fund	94	0.3	1.3	4.0	4.0	1.0	4.5	N/A	N/A	2.8	-3.5	4.6	04/01/2012
<i>HFRI FOF Comp Index</i>			2.0	7.7	7.7	2.6	4.0	2.7	1.1	0.5	-0.3	3.7	

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding. \*Please see Addendum for the complete history of the benchmark. Performance for HEDGE FUNDS HISTORY is for reference purposes only.

Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 FIXED INCOME - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>FIXED INCOME</b>	<b>4,238</b>	<b>14.4</b>	<b>0.5</b>	<b>4.7</b>	<b>4.7</b>	<b>2.5</b>	<b>2.4</b>	<b>4.0</b>	<b>4.8</b>	<b>5.6</b>	<b>-2.7</b>	<b>8.6</b>	<b>01/01/1981</b>
<i>Bloomberg US Agg Bond Index</i>			<i>0.4</i>	<i>3.5</i>	<i>3.5</i>	<i>2.2</i>	<i>2.1</i>	<i>3.2</i>	<i>4.0</i>	<i>2.6</i>	<i>0.5</i>	<i>7.8</i>	
<b>Core Plus Fixed Income</b>	<b>840</b>	<b>2.9</b>	<b>0.1</b>	<b>6.5</b>	<b>6.5</b>	<b>2.7</b>	<b>4.2</b>	<b>N/A</b>	<b>N/A</b>	<b>11.1</b>	<b>-8.5</b>	<b>4.7</b>	<b>10/01/2012</b>
Brandywine Global Opp (SA)	197	0.7	-0.2	13.3	13.3	2.9	2.1	N/A	N/A	5.0	-8.4	4.7	02/01/2011
<i>FTSE Wrld Gov't Bond Index</i>			<i>1.0</i>	<i>7.5</i>	<i>7.5</i>	<i>1.7</i>	<i>0.1</i>	<i>1.2</i>	<i>2.7</i>	<i>1.6</i>	<i>-3.6</i>	<i>1.2</i>	
Pyramis Gbl Adv HY CMBS (SA)	305	1.0	0.3	5.7	5.7	4.2	6.7	9.5	7.3	3.1	3.9	8.8	04/01/1997
<i>Bloomberg US CMBS ex AAA Index</i>			<i>1.1</i>	<i>6.0</i>	<i>6.0</i>	<i>3.5</i>	<i>3.2</i>	<i>5.5</i>	<i>-0.1</i>	<i>4.6</i>	<i>0.1</i>	<i>N/A</i>	
Stone Harbor EMD (SA)	160	0.5	0.6	12.1	12.1	8.4	3.1	6.1	7.5	14.0	-0.3	8.3	04/01/2005
<i>JPM Emg Mkt Bond Index</i>			<i>0.5</i>	<i>9.3</i>	<i>9.3</i>	<i>6.8</i>	<i>3.8</i>	<i>6.4</i>	<i>7.1</i>	<i>10.2</i>	<i>1.2</i>	<i>7.8</i>	
Stone Harbor Gbl HY (SA)	177	0.6	0.0	5.6	5.6	4.8	4.8	5.9	6.8	13.7	-4.3	7.8	07/01/2000
<i>FTSE High Yield Market Index</i>			<i>0.5</i>	<i>7.0</i>	<i>7.0</i>	<i>6.0</i>	<i>5.4</i>	<i>6.8</i>	<i>7.6</i>	<i>17.8</i>	<i>-5.6</i>	<i>7.3</i>	

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding. \*Please see Addendum for the complete history of the benchmark.

Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 FIXED INCOME - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>Core Fixed Income</b>	<b>2,033</b>	<b>6.9</b>	<b>0.5</b>	<b>4.3</b>	<b>4.3</b>	<b>2.6</b>	<b>2.3</b>	<b>3.8</b>	<b>4.6</b>	<b>3.5</b>	<b>0.0</b>	<b>4.9</b>	<b>01/01/2002</b>
<i>Bloomberg US Agg Bond Index</i>			0.4	3.5	3.5	2.2	2.1	3.2	4.0	2.6	0.5	4.5	
Mellon Cap Mgmt Bond Index (SA) <i>Bloomberg US Agg Bond Index*</i>	1,232	4.2	0.4	3.5	3.5	2.2	2.1	3.2	3.8	2.5	0.5	7.3	04/01/1984
			0.4	3.5	3.5	2.2	2.1	3.2	4.0	2.6	0.5	7.6	
PIMCO Core Bond Fund (SA) <i>Bloomberg US Agg ex Trsy</i>	616	2.1	0.7	5.0	5.0	2.8	2.3	N/A	N/A	3.5	0.1	2.3	01/01/2013
			0.6	4.3	4.3	2.7	2.6	3.6	4.4	3.6	0.4	2.6	
Taplin, Canida & Habacht Corp FI (SA) <i>Bloomberg US Credit Index</i>	185	0.6	1.1	7.1	7.1	3.7	3.4	5.0	5.7	8.2	-3.8	6.0	12/01/2000
			1.0	6.2	6.2	3.6	3.2	4.8	5.4	5.6	-0.8	5.9	
<b>Global TIPS</b>	<b>820</b>	<b>2.8</b>	<b>1.5</b>	<b>3.9</b>	<b>3.9</b>	<b>2.2</b>	<b>0.4</b>	<b>2.0</b>	<b>2.8</b>	<b>4.6</b>	<b>-1.7</b>	<b>3.3</b>	<b>02/01/2003</b>
<i>Bloomberg US Trsy: US TIPS Index</i>			1.3	3.0	3.0	2.1	0.1	2.9	3.5	4.7	-1.4	4.4	
Brown Brothers TIPS (SA) <i>Bloomberg US Trsy: US TIPS Index</i>	217	0.7	1.2	2.9	2.9	2.2	0.3	N/A	N/A	4.9	-1.1	1.1	02/01/2012
			1.3	3.0	3.0	2.1	0.1	2.9	3.5	4.7	-1.4	0.9	
New Century Global TIPS (SA) <i>Bloomberg Wrld Gov Infl-Lnkd Index (Unhedged)</i>	116	0.4	2.8	9.3	9.3	2.8	1.7	N/A	N/A	3.8	-4.3	2.3	02/01/2012
			2.8	8.5	8.5	2.5	1.3	3.4	3.2	4.0	-4.7	1.8	
NISA Inv Adv TIPS (SA) <i>Bloomberg US Trsy: US TIPS Index*</i>	488	1.7	1.3	3.1	3.1	2.1	0.1	1.7	2.6	4.7	-1.4	3.1	04/01/2007
			1.3	3.0	3.0	2.1	0.1	1.6	2.5	4.7	-1.4	N/A	
<b>Nominal U.S. Treasuries</b>	<b>546</b>	<b>1.9</b>	<b>-0.1</b>	<b>2.4</b>	<b>2.4</b>	<b>1.4</b>	<b>1.2</b>	<b>N/A</b>	<b>N/A</b>	<b>0.5</b>	<b>1.2</b>	<b>2.0</b>	<b>09/01/2011</b>
<i>Bloomberg US Trsy Bellwethers: 10 Yr</i>			-0.3	2.1	2.1	1.0	1.0	3.6	4.1	-0.2	0.9	2.1	
PIMCO US Treasuries (SA) <i>Bloomberg US Trsy Bellwethers: 10 Yr</i>	546	1.9	-0.1	2.9	2.9	1.8	1.5	N/A	N/A	1.1	1.5	2.2	09/01/2011
			-0.3	2.1	2.1	1.0	1.0	3.6	4.1	-0.2	0.9	2.1	

Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding. \*Please see Addendum for the complete history of the benchmark.

Commonwealth of Pennsylvania State Employees' Retirement System  
 Asset Allocation & Performance  
 CASH - NET OF FEES

As of December 31, 2017

	Allocation		Performance (%)										
	Market Value (\$M)	%	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	Since Incep.	Inception Date
<b>CASH</b>	<b>948</b>	<b>3.2</b>	<b>0.3</b>	<b>1.5</b>	<b>1.5</b>	<b>0.9</b>	<b>0.7</b>	<b>0.6</b>	<b>0.8</b>	<b>0.6</b>	<b>0.7</b>	<b>3.7</b>	<b>01/01/1987</b>
<b>Cash Equivalents</b>	<b>948</b>	<b>3.2</b>	<b>0.3</b>	<b>1.5</b>	<b>1.5</b>	<b>0.9</b>	<b>0.7</b>	<b>0.6</b>	<b>0.8</b>	<b>0.6</b>	<b>0.7</b>	<b>3.7</b>	<b>01/01/1987</b>
<i>BofA ML 3 Mo US T-Bill Index</i>			<i>0.3</i>	<i>0.9</i>	<i>0.9</i>	<i>0.4</i>	<i>0.3</i>	<i>0.2</i>	<i>0.4</i>	<i>0.3</i>	<i>0.1</i>	<i>3.4</i>	
Cash Management (SA)	948	3.2	0.3	1.5	1.5	0.9	0.7	0.6	0.8	0.6	0.7	3.7	01/01/1987
<i>BofA ML 3 Mo US T-Bill Index</i>			<i>0.3</i>	<i>0.9</i>	<i>0.9</i>	<i>0.4</i>	<i>0.3</i>	<i>0.2</i>	<i>0.4</i>	<i>0.3</i>	<i>0.1</i>	<i>3.4</i>	

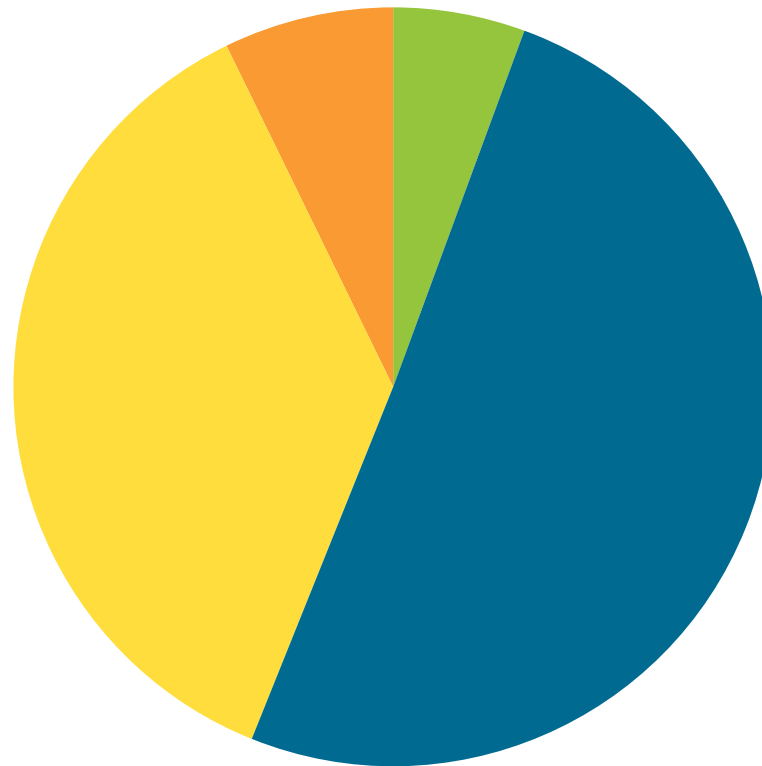
Performance shown is net of fees. Allocations shown may not sum up to 100% exactly due to rounding.

# Sub-Composites





December 31, 2017 : \$15,498



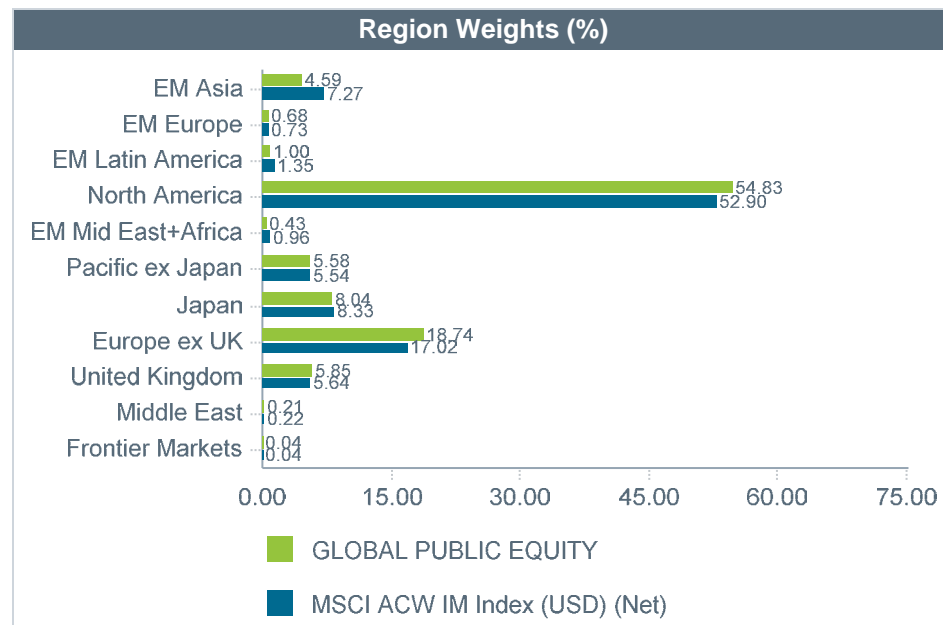
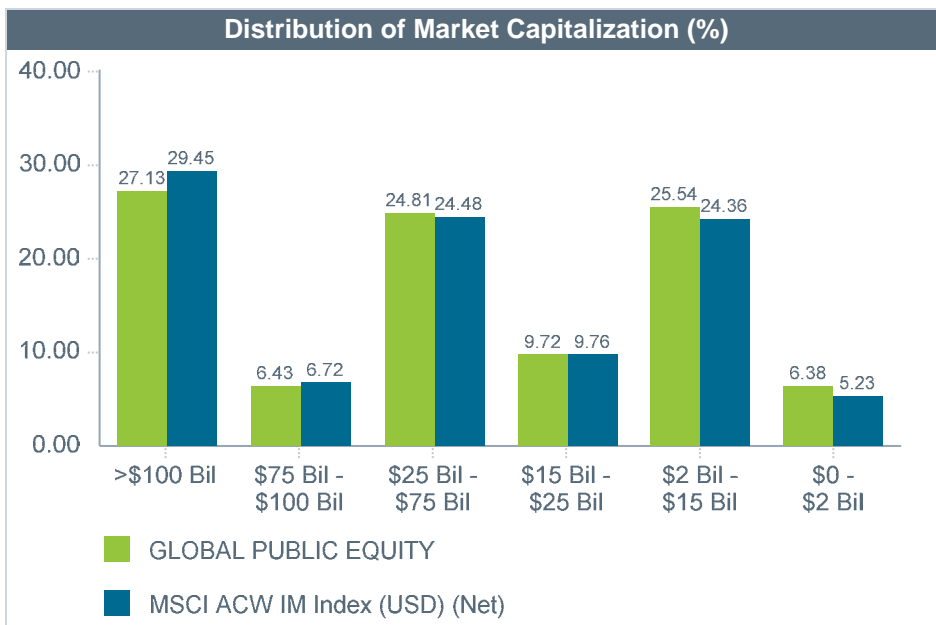
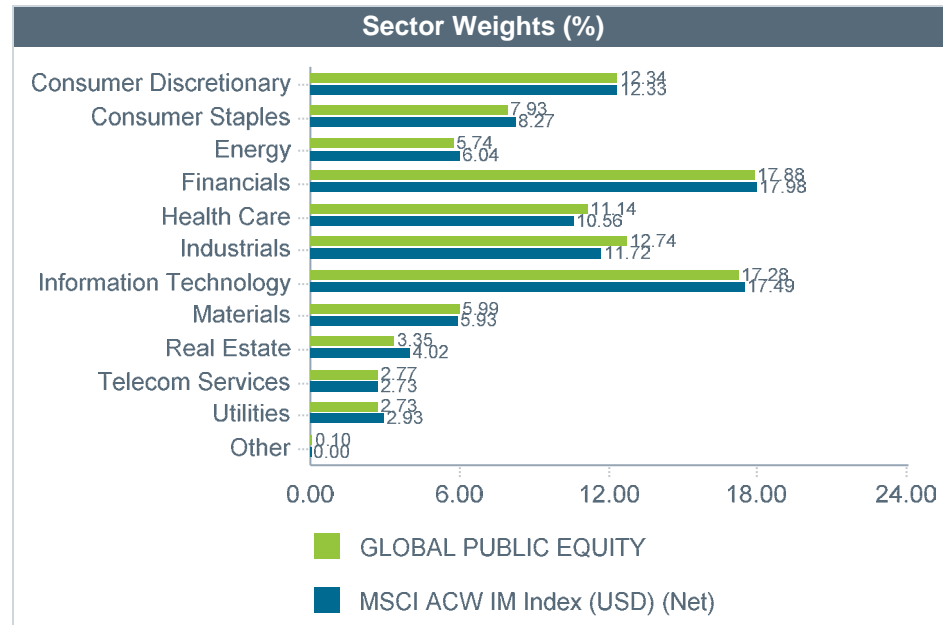
	Market Value (\$M)	Allocation (%)
Global Mandates	871	5.62
U.S. Equity	7,820	50.46
Non-U.S. Developed Markets Equity	5,686	36.69
Emerging Markets Equity	1,121	7.23

Allocations shown may not sum up to 100% exactly due to rounding. The value shown for Global Public Equity excludes Northern Trust's Transition account.

**Commonwealth of Pennsylvania State Employees' Retirement System**  
**GLOBAL PUBLIC EQUITY vs. MSCI ACW IM Index (USD) (Net)**  
**Portfolio Characteristics**

As of December 31, 2017

Portfolio Characteristics		
	Portfolio	Benchmark
Wtd. Avg. Mkt. Cap (\$M)	100,899	111,750
Median Mkt. Cap (\$M)	4,029	1,792
Price/Earnings Ratio	19.84	19.42
Price/Book Ratio	2.76	2.74
5 Yr. EPS Growth Rate (%)	10.52	11.40
Current Yield (%)	2.18	2.27
Beta (5 Years, Monthly)	1.00	1.00
Number of Securities	5,034	8,653



Sector allocation to "Other" consists of ETF holdings.



December 31, 2017 : \$871



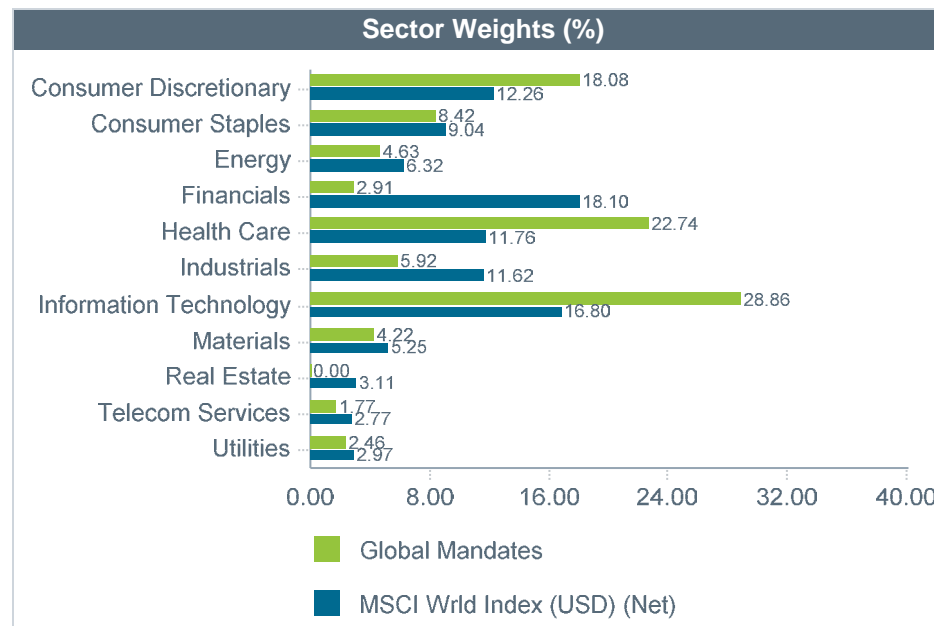
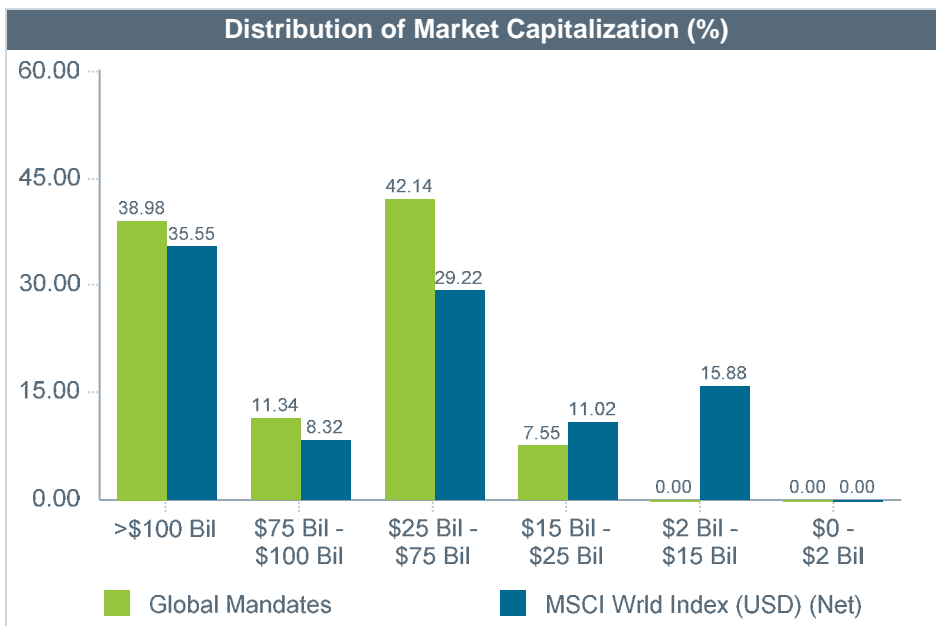
	Market Value (\$M)	Allocation (%)
■ Walter Scott & Ptnrs Gbl Gr Eq (SA)	871	100.00

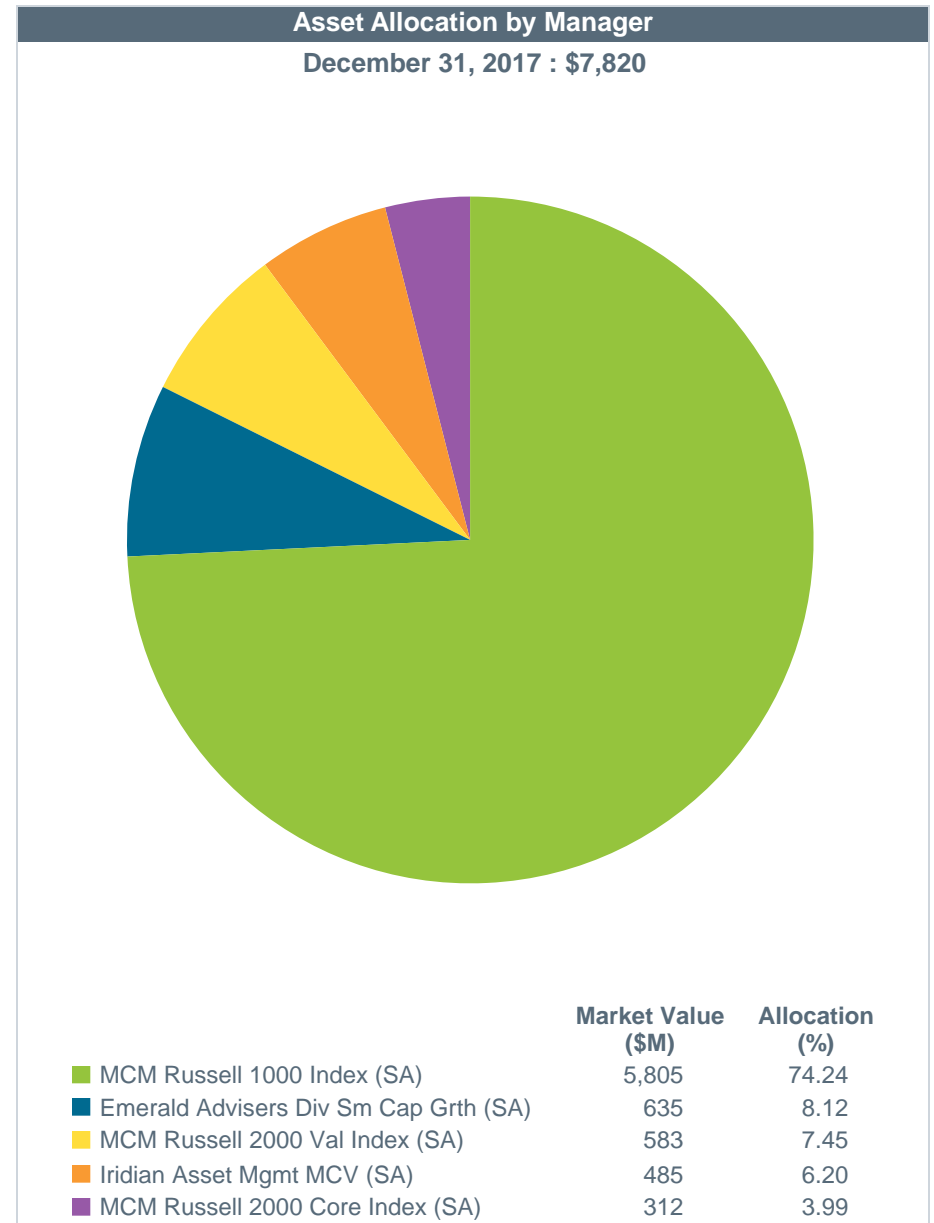
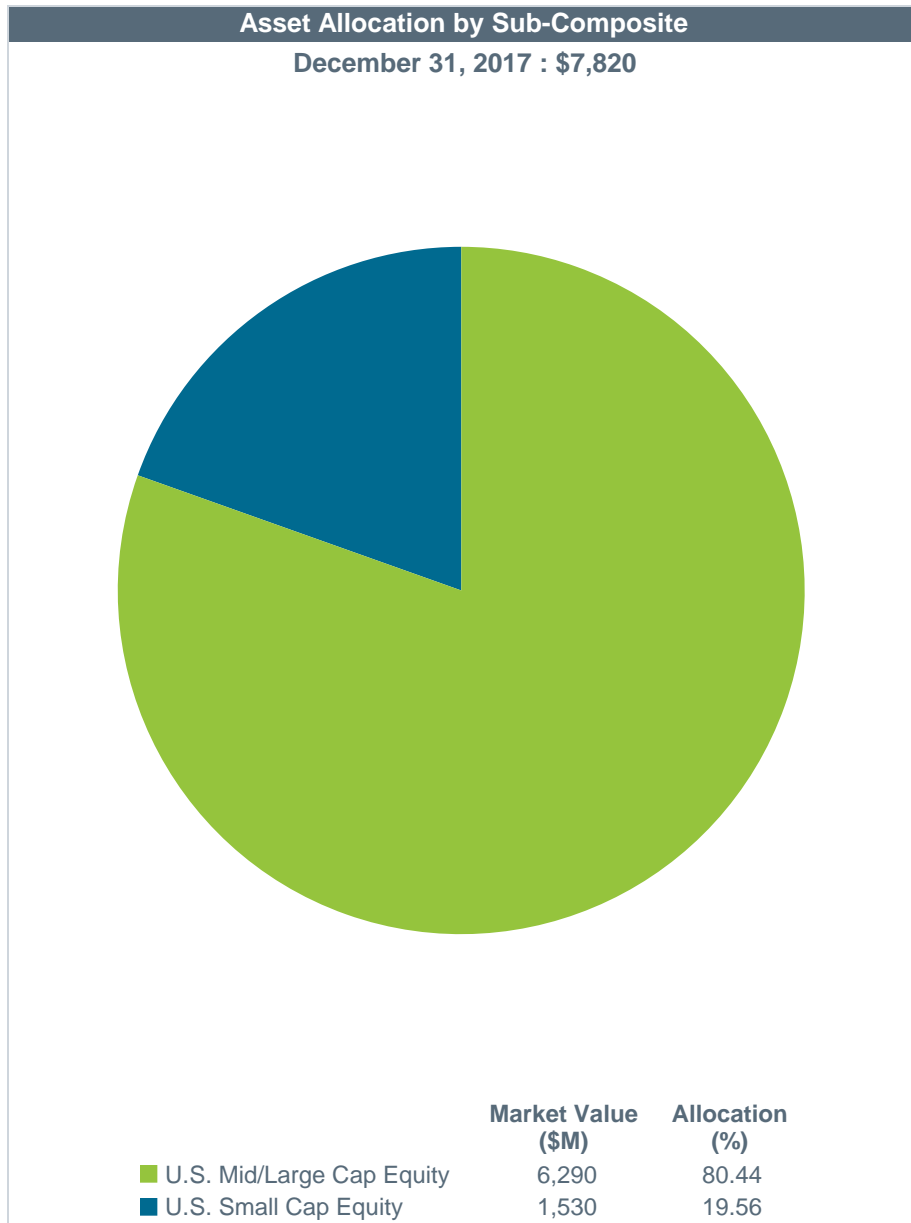
Commonwealth of Pennsylvania State Employees' Retirement System  
Global Mandates vs. MSCI Wrld Index (USD) (Net)  
Portfolio Characteristics

As of December 31, 2017

Top Ten Equity Holdings				
	Portfolio Weight (%)	Benchmark Weight (%)	Active Weight (%)	Quarterly Return (%)
Mastercard Inc	3.89	0.35	3.54	7.36
Adobe Systems Inc	3.68	0.21	3.47	17.47
AIA Group Ltd	2.91	0.25	2.66	15.62
Keyence Corp	2.84	0.13	2.71	5.58
Taiwan Semiconductor Mfg (ADR)	2.71	0.00	2.71	5.59
Intuitive Surgical Inc	2.71	0.10	2.61	4.68
TJX Companies Inc (The)	2.66	0.12	2.54	4.18
Lvmh Moet Hennessy Louis Vuitton	2.60	0.20	2.40	7.45
Fanuc Corp	2.58	0.12	2.46	18.67
Novo Nordisk A/S	2.56	0.25	2.31	12.84
% of Portfolio	29.14	1.73	27.41	

Portfolio Characteristics		
	Portfolio	Benchmark
Wtd. Avg. Mkt. Cap (\$M)	123,203	133,922
Median Mkt. Cap (\$M)	66,060	13,689
Price/Earnings Ratio	25.75	20.46
Price/Book Ratio	4.63	2.84
5 Yr. EPS Growth Rate (%)	7.20	11.31
Current Yield (%)	1.80	2.34
Beta (5 Years, Monthly)	0.87	1.00
Number of Securities	55	1,653

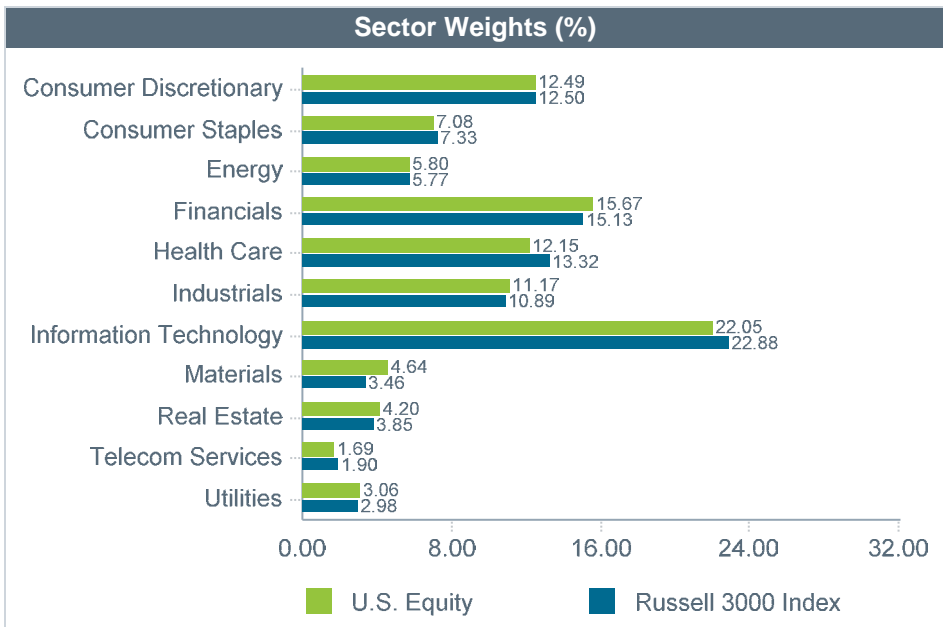
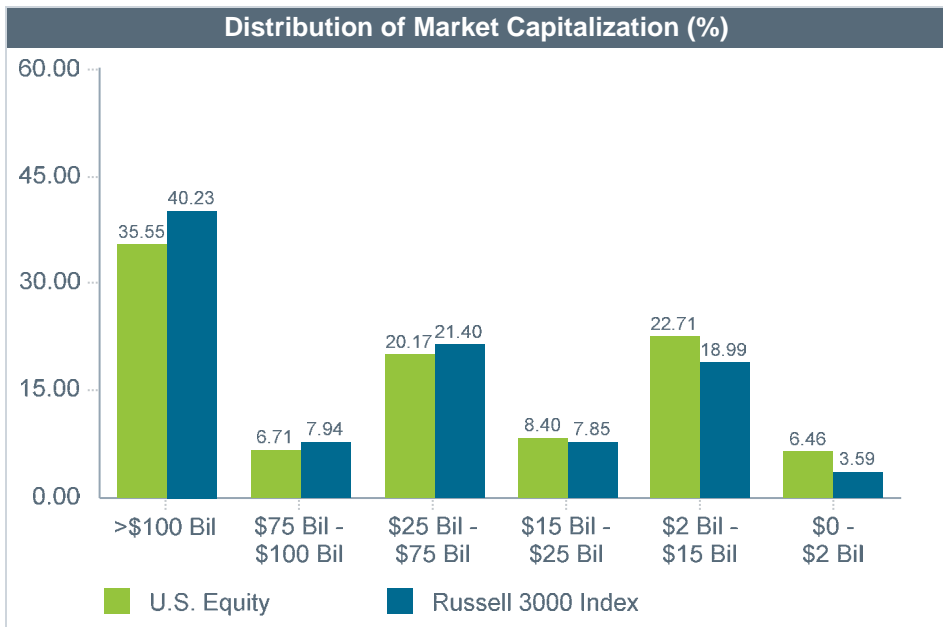


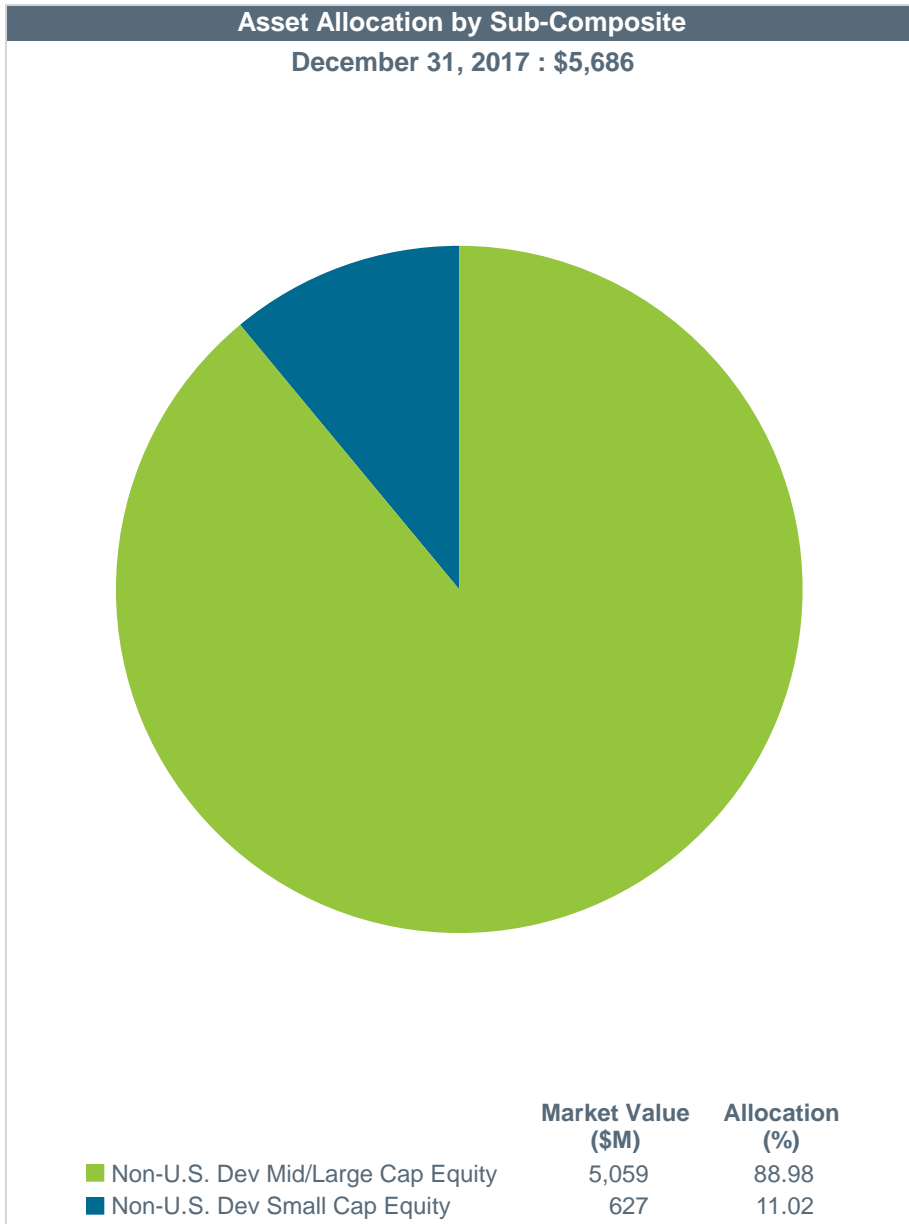


Allocations shown may not sum up to 100% exactly due to rounding. Asset Allocation by Manager excludes liquidating accounts.

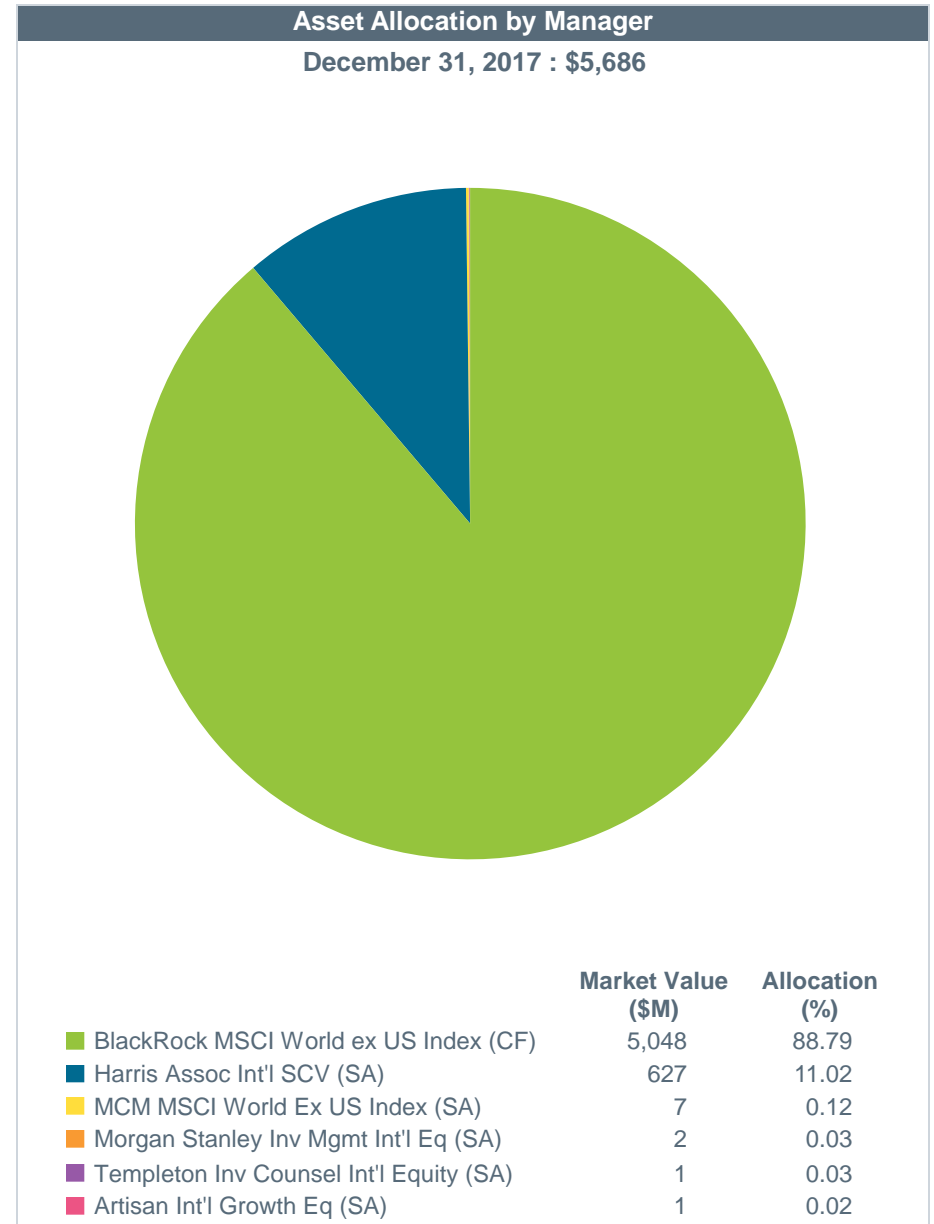
Top Ten Equity Holdings				
	Portfolio Weight (%)	Benchmark Weight (%)	Active Weight (%)	Quarterly Return (%)
Apple Inc	2.80	3.17	-0.37	10.20
Microsoft Corp	2.07	2.34	-0.27	15.42
Amazon.com Inc	1.50	1.69	-0.19	21.65
Facebook Inc	1.33	1.50	-0.17	3.27
Berkshire Hathaway Inc	1.23	1.39	-0.16	8.13
Johnson & Johnson	1.21	1.37	-0.16	8.12
JPMorgan Chase & Co	1.19	1.35	-0.16	12.61
Exxon Mobil Corp	1.14	1.29	-0.15	2.97
Alphabet Inc	1.02	1.15	-0.13	9.10
Alphabet Inc	1.01	1.14	-0.13	8.18
% of Portfolio	14.50	16.39	-1.89	

Portfolio Characteristics		
	Portfolio	Benchmark
Wtd. Avg. Mkt. Cap (\$M)	143,921	161,776
Median Mkt. Cap (\$M)	1,772	1,759
Price/Earnings Ratio	22.85	23.24
Price/Book Ratio	3.12	3.28
5 Yr. EPS Growth Rate (%)	12.61	13.21
Current Yield (%)	1.76	1.79
Beta (5 Years, Monthly)	1.02	1.00
Number of Securities	2,925	2,961





Allocations shown may not sum up to 100% exactly due to rounding.

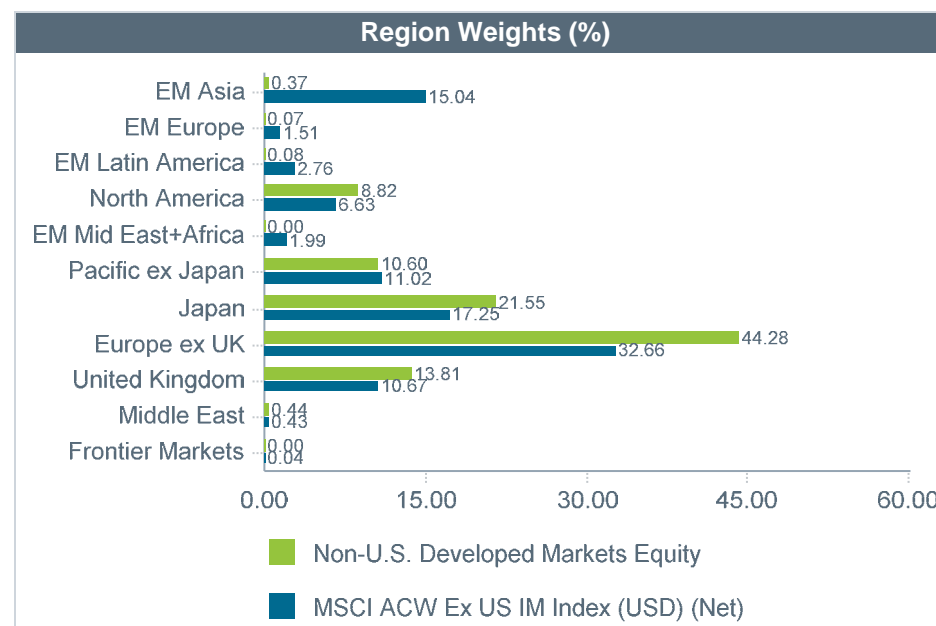
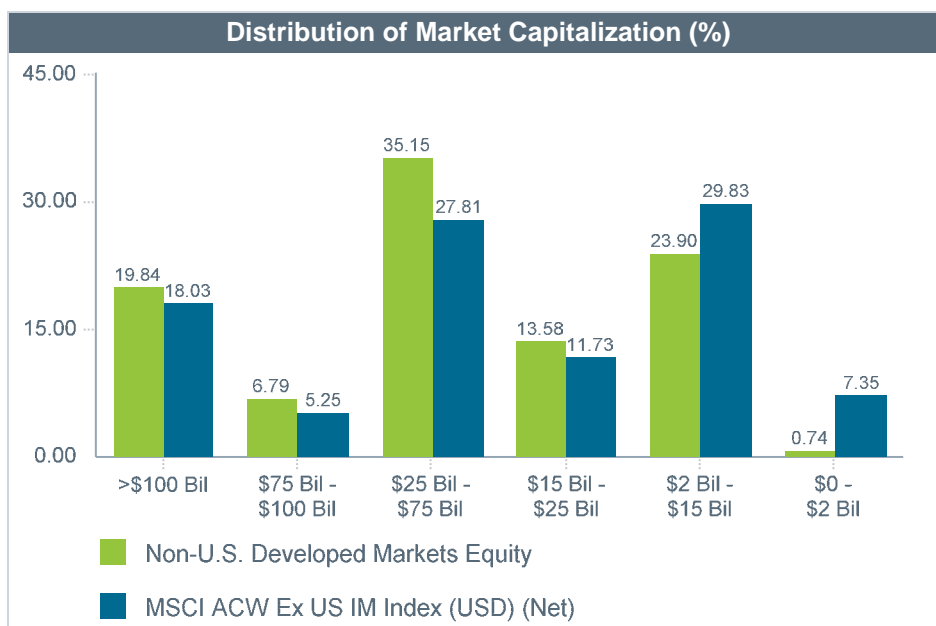


Commonwealth of Pennsylvania State Employees' Retirement System  
 Non-U.S. Developed Markets Equity vs. MSCI ACW Ex US IM Index (USD) (Net)  
 Portfolio Characteristics

As of December 31, 2017

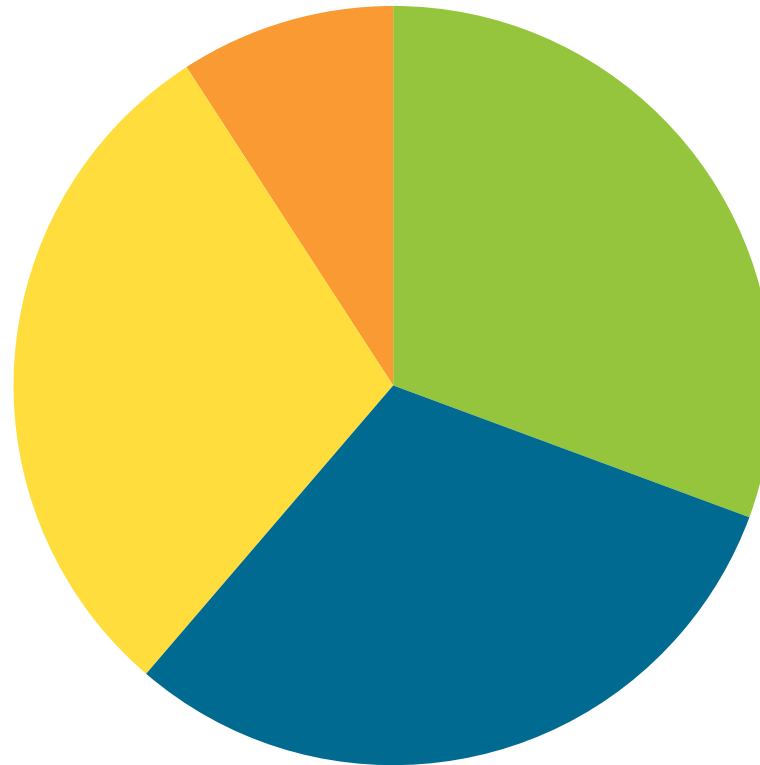
Top Ten Equity Holdings				
	Portfolio Weight (%)	Benchmark Weight (%)	Active Weight (%)	Quarterly Return (%)
Nestle SA, Cham Und Vevey	1.56	1.04	0.52	2.60
HSBC Holdings PLC	1.22	0.81	0.41	5.99
Novartis AG	1.10	0.73	0.37	-1.30
Roche Holding AG	1.04	0.69	0.35	-0.98
Toyota Motor Corp	0.98	0.65	0.33	7.43
British American Tobacco PLC	0.91	0.61	0.30	9.27
Royal Dutch Shell PLC	0.89	0.59	0.30	12.93
BP PLC	0.82	0.55	0.27	12.08
Total SA	0.77	0.51	0.26	4.28
Royal Dutch Shell PLC	0.75	0.50	0.25	11.91
% of Portfolio	10.04	6.68	3.36	

Portfolio Characteristics		
	Portfolio	Benchmark
Wtd. Avg. Mkt. Cap (\$M)	60,230	59,298
Median Mkt. Cap (\$M)	11,267	1,560
Price/Earnings Ratio	17.06	16.28
Price/Book Ratio	2.21	2.26
5 Yr. EPS Growth Rate (%)	7.89	9.23
Current Yield (%)	3.04	2.77
Beta (5 Years, Monthly)	0.98	1.00
Number of Securities	1,077	6,221





December 31, 2017 : \$1,121



	Market Value (\$M)	Allocation (%)
■ Martin Currie Emerging Markets Equity (SA)	343	30.65
■ Macquarie Emerging Markets Equity (SA)	343	30.63
■ BlackRock Emg Mkts Index (CF)	331	29.56
■ GlobeFlex Emerging Small Cap (SA)	103	9.16

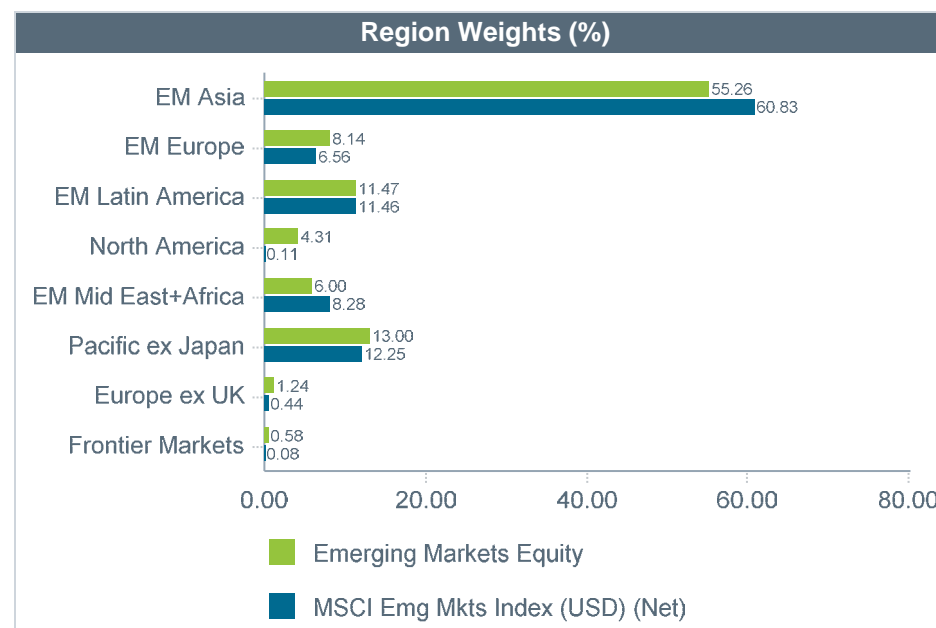
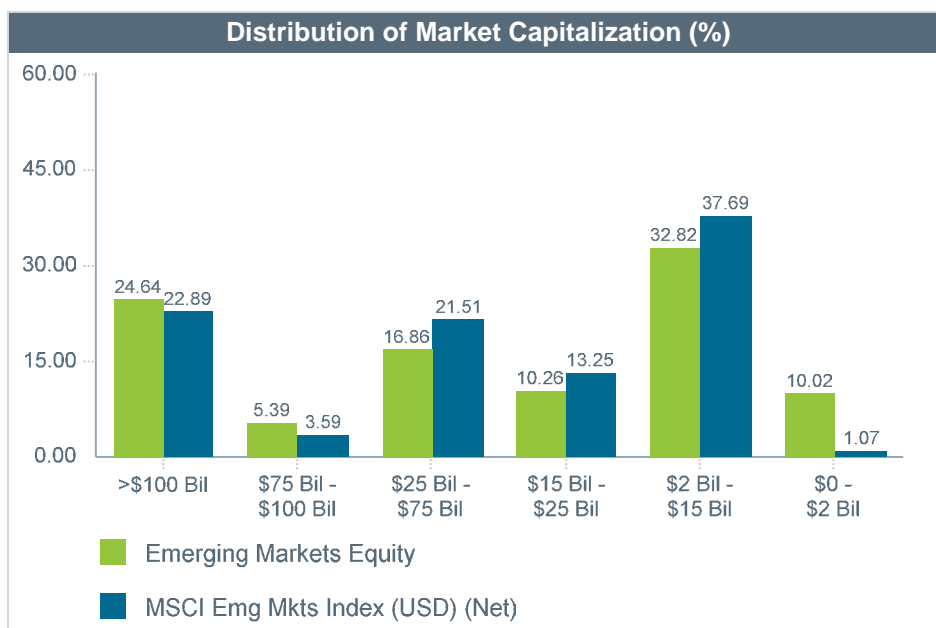
Allocations shown may not sum up to 100% exactly due to rounding. Liquidated managers with residual assets of less than \$1 million are not shown.

Commonwealth of Pennsylvania State Employees' Retirement System  
 Emerging Markets Equity vs. MSCI Emg Mkts Index (USD) (Net)  
 Portfolio Characteristics

As of December 31, 2017

Top Ten Equity Holdings				
	Portfolio Weight (%)	Benchmark Weight (%)	Active Weight (%)	Quarterly Return (%)
Samsung Electronics Co Ltd	5.82	4.27	1.55	6.35
Tencent Holdings LTD	5.54	5.45	0.09	20.67
Alibaba Group Holding Ltd	4.22	3.66	0.56	-0.16
Naspers Ltd	2.24	2.25	-0.01	28.90
Taiwan Semiconductor Mfg (ADR)	2.07	3.50	-1.43	5.59
Taiwan Semiconductor Mfg	2.06	3.50	-1.44	8.11
Ind. & Com. Bank of China Ltd	1.96	1.09	0.87	8.37
Reliance Industries Ltd	1.83	0.69	1.14	19.71
iShares MSCI India ETF	1.83	0.00	1.83	10.63
WisdomTree India Earnings Fund ETF	1.44	0.00	1.44	10.71
% of Portfolio	29.01	24.41	4.60	

Portfolio Characteristics		
	Portfolio	Benchmark
Wtd. Avg. Mkt. Cap (\$M)	93,617	89,981
Median Mkt. Cap (\$M)	5,343	6,078
Price/Earnings Ratio	14.09	14.41
Price/Book Ratio	2.42	2.46
5 Yr. EPS Growth Rate (%)	12.32	11.34
Current Yield (%)	1.97	2.27
Beta (5 Years, Monthly)	0.99	1.00
Number of Securities	1,044	846



December 31, 2017 : \$2,266



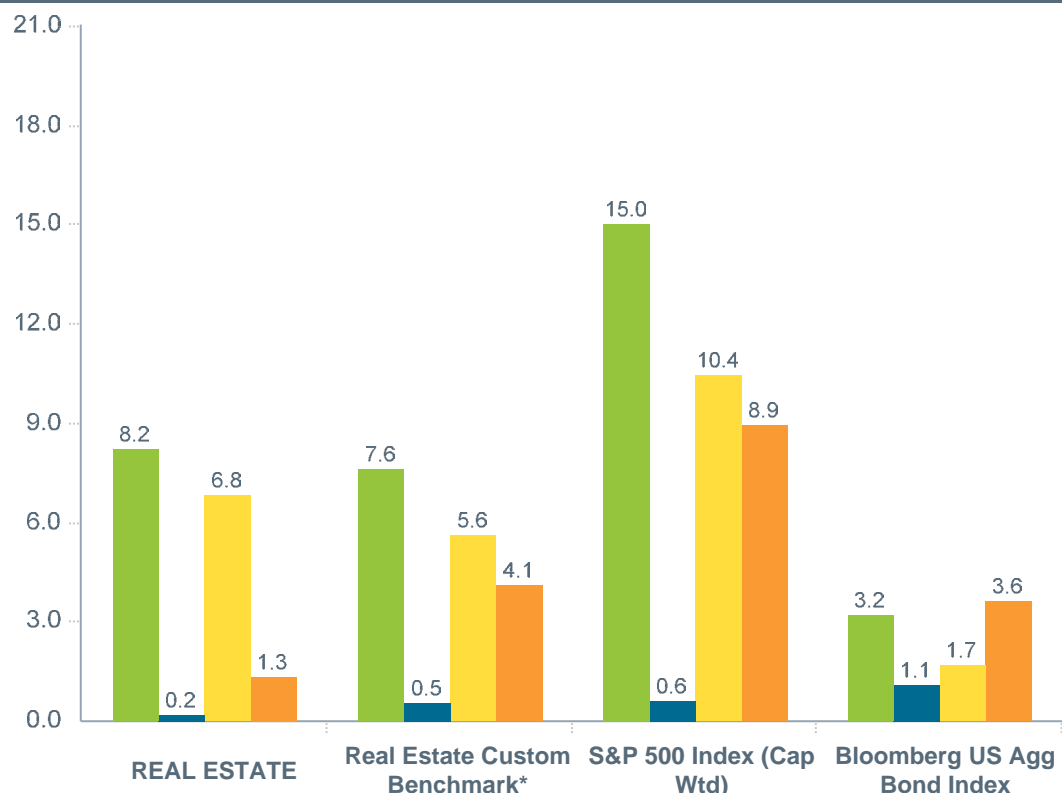
	Market Value (\$M)	Allocation (%)
Real Estate Separate Accounts	1,081	47.71
Non-Core Closed-End Funds	412	18.19
Core Real Estate Funds	340	15.01
REITs	232	10.23
Timberland	129	5.71
Non-Core Open-End Funds	71	3.14

Allocations shown may not sum up to 100% exactly due to rounding.

Comparative Performance

	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	2014	Since Incep.	Inception Date
<b>REAL ESTATE</b>	<b>0.0</b>	<b>2.0</b>	<b>2.0</b>	<b>5.0</b>	<b>7.9</b>	<b>8.5</b>	<b>1.3</b>	<b>3.2</b>	<b>9.9</b>	<b>10.9</b>	<b>8.6</b>	<b>03/01/1984</b>
Real Estate Custom Benchmark*	1.6	5.6	5.6	9.4	10.4	11.2	4.1	9.9	12.9	11.4	N/A	
Difference	-1.6	-3.6	-3.6	-4.4	-2.5	-2.7	-2.8	-6.7	-3.0	-0.5	N/A	

Historical Statistics - 10 Years

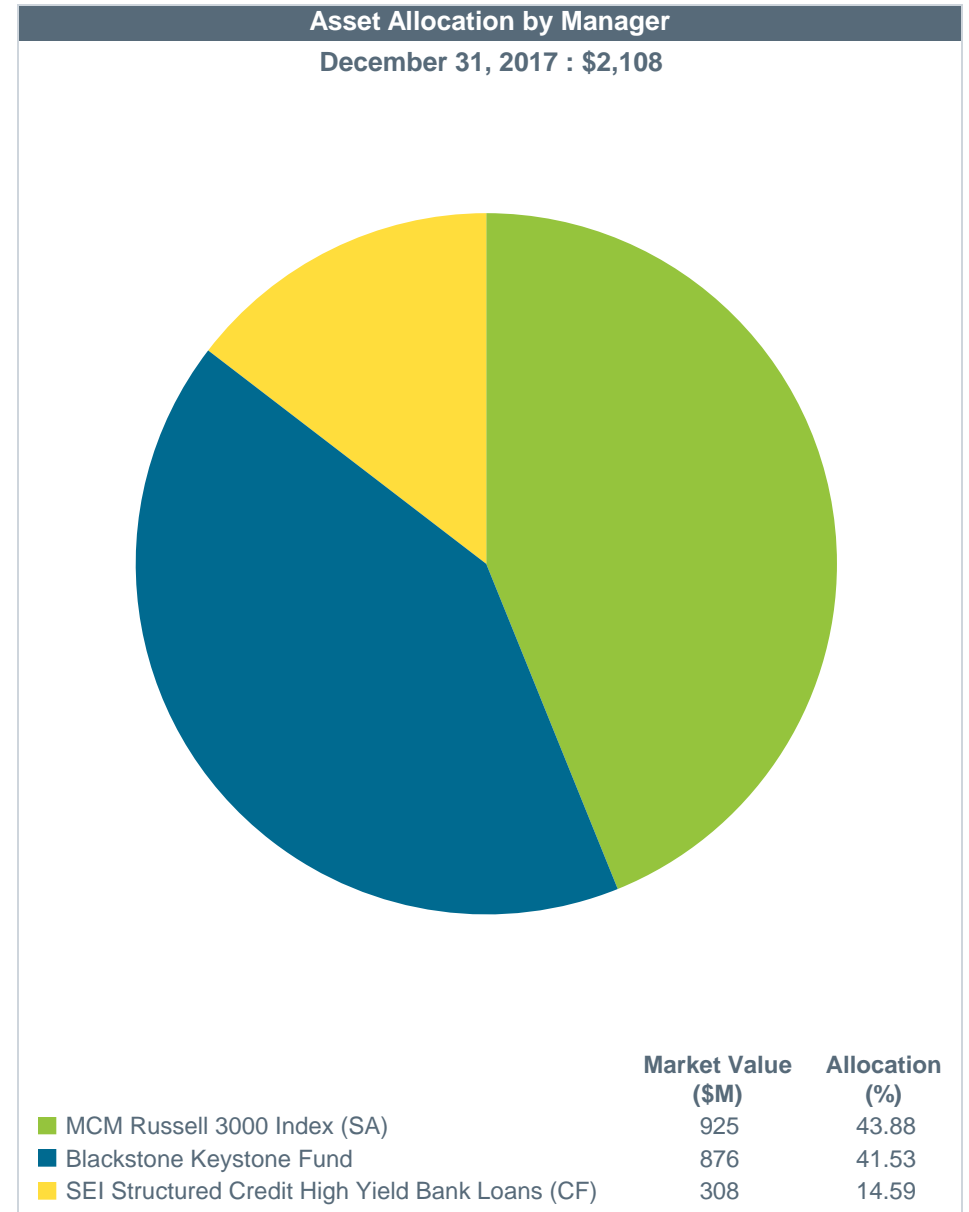
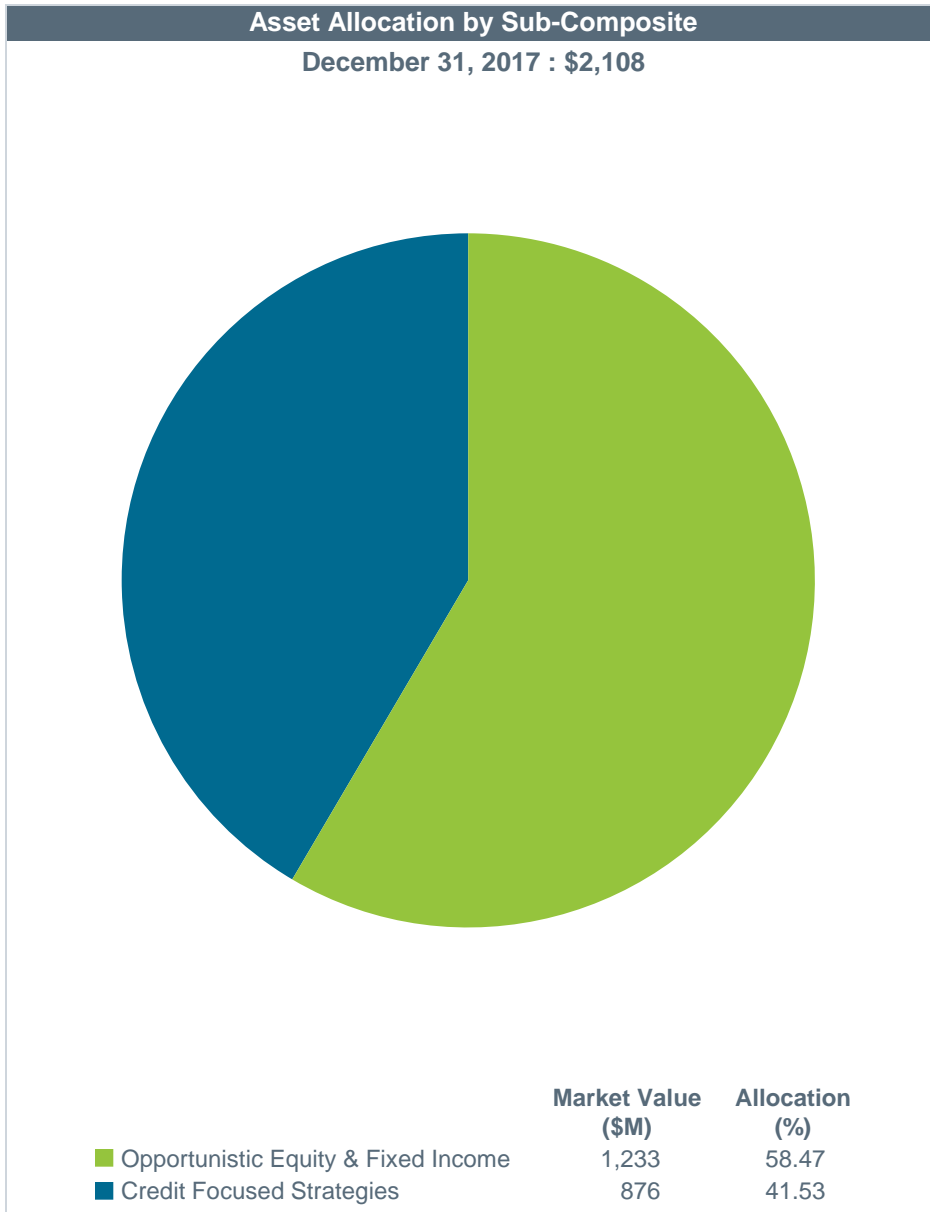


Standard Deviation	8.2	7.6	15.0	3.2
Sharpe Ratio	0.2	0.5	0.6	1.1
Downside Risk	6.8	5.6	10.4	1.7
Excess Return	1.3	4.1	8.9	3.6

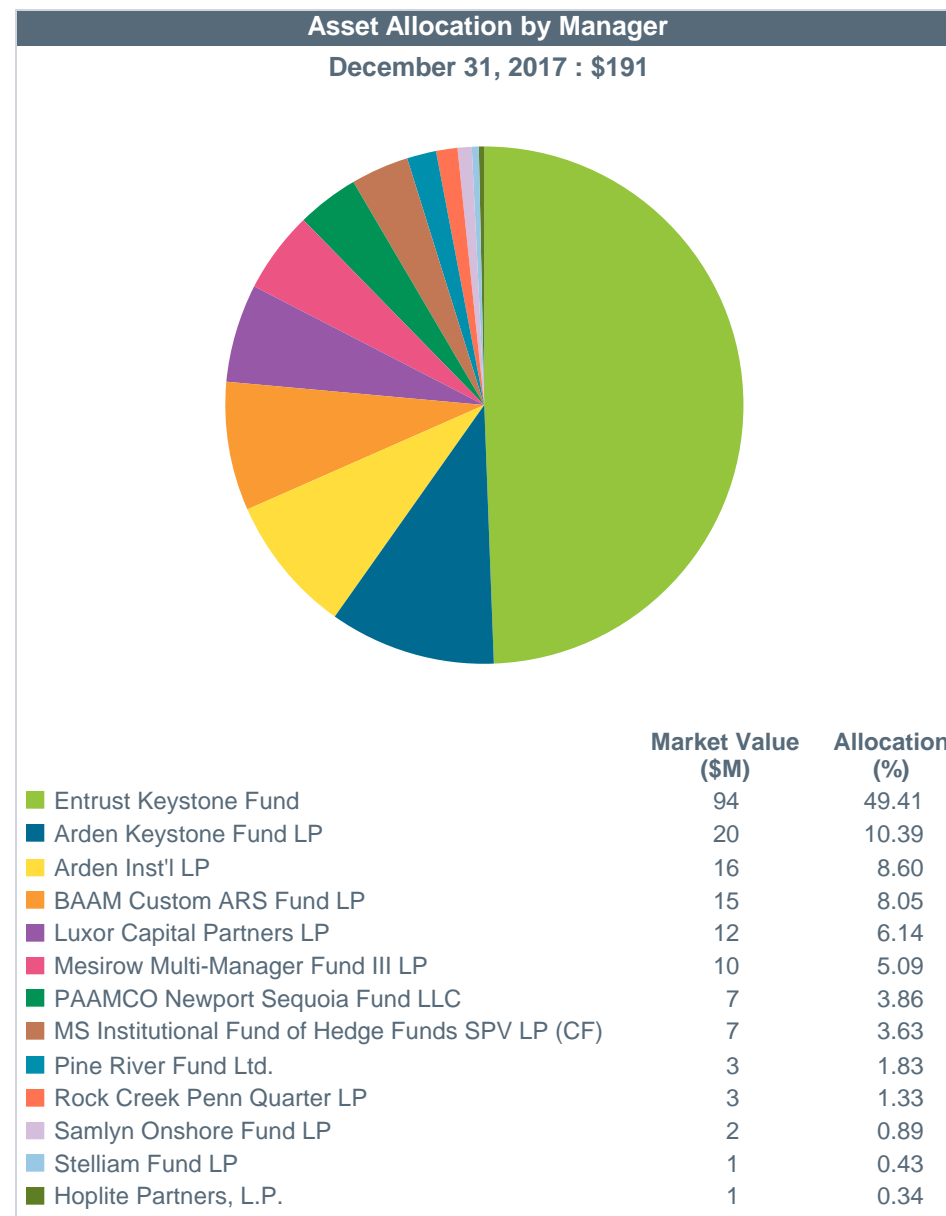
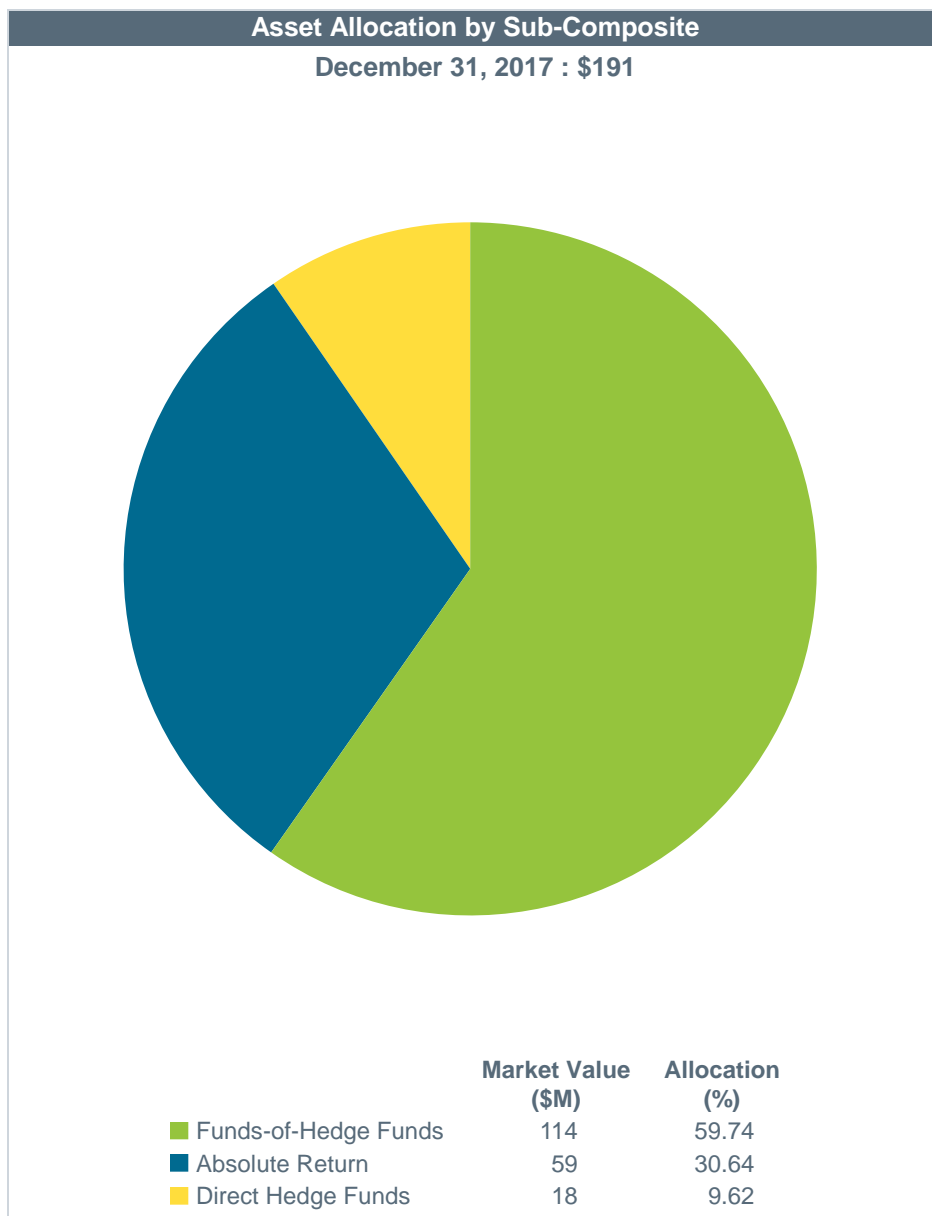
Actual Correlation - 10 Years

	Actual Correlation
Real Estate Custom Benchmark*	0.52
S&P 500 Index (Cap Wtd)	-0.02
Russell 2000 Index	-0.01
MSCI EAFE Index (USD) (Net)	-0.02
MSCI Emg Mkts Index (USD) (Net)	-0.06
Bloomberg US Agg Bond Index	-0.30
Bloomberg US Trsy US TIPS Index	-0.28
Wilshire US REIT Index	-0.13
HFRI FOF Comp Index	0.19
Bloomberg Cmdty Index (TR)	0.17
3 Mo US T-Bill Index	-0.10
Cons Price Index (Unadjusted)	0.23

Performance shown is net of fees. Calculation is based on monthly periodicity. \*Please see Addendum for the complete history of the benchmark. Excess Return statistic is calculated against the BofA ML 3 Mo US T-Bill Index.



Allocations shown may not sum up to 100% exactly due to rounding.

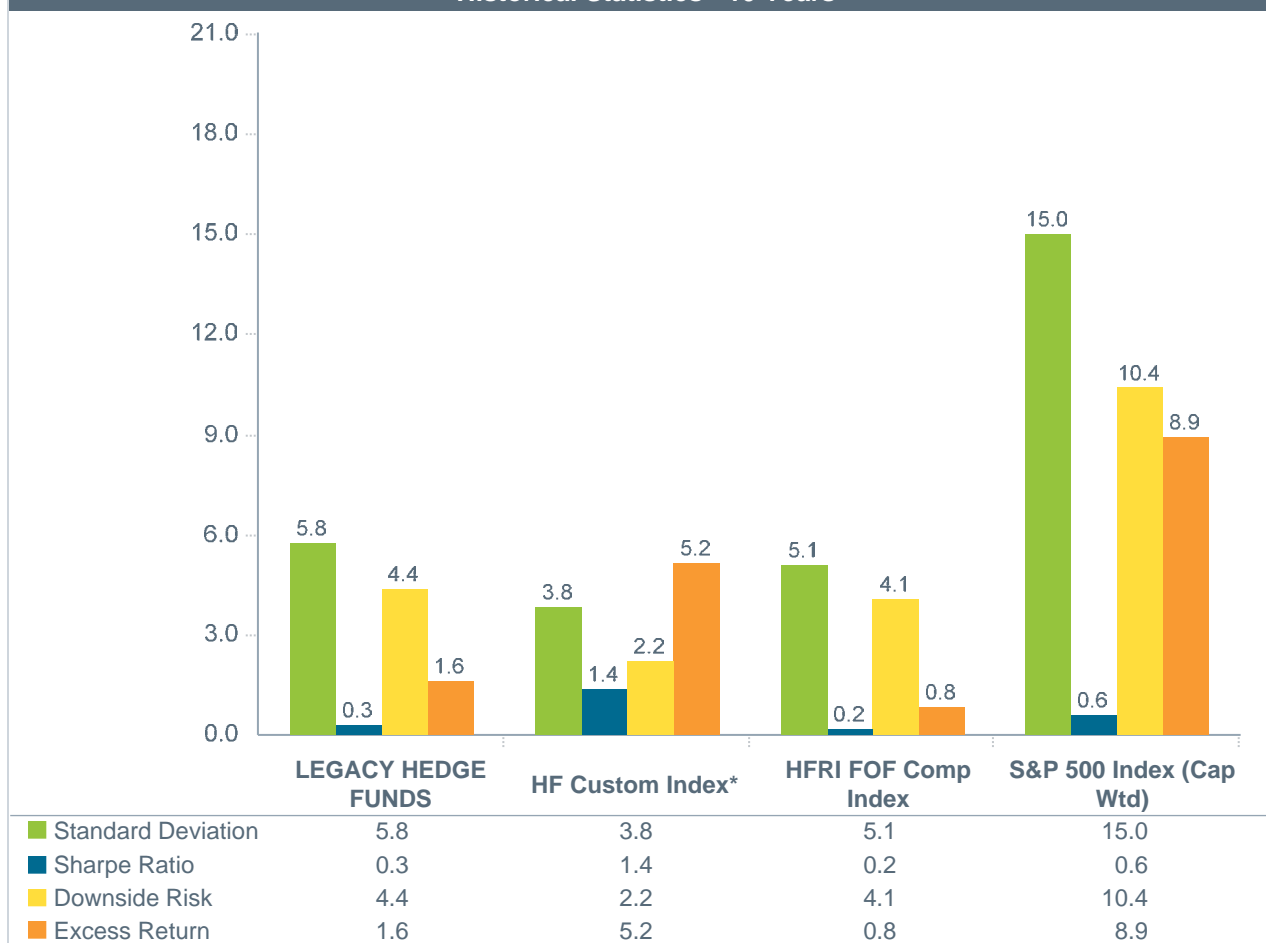


Allocations shown may not sum up to 100% exactly due to rounding. Asset Allocation by Manager doesn't include liquidated managers with residual assets of less than \$1 million.

Comparative Performance

	QTD	CYTD	1 Year	3 Years	5 Years	7 Years	10 Years	2016	2015	2014	Since Incep.	Inception Date
<b>LEGACY HEDGE FUNDS</b>	<b>0.9</b>	<b>4.9</b>	<b>4.9</b>	<b>0.9</b>	<b>2.2</b>	<b>2.1</b>	<b>1.9</b>	<b>4.2</b>	<b>-6.0</b>	<b>2.5</b>	<b>3.9</b>	<b>01/01/2002</b>
HF Custom Index*	2.5	11.3	11.3	3.4	7.1	6.5	5.6	-0.1	-0.5	4.1	4.7	
Difference	-1.6	-6.4	-6.4	-2.5	-4.9	-4.4	-3.7	4.3	-5.5	-1.6	-0.8	

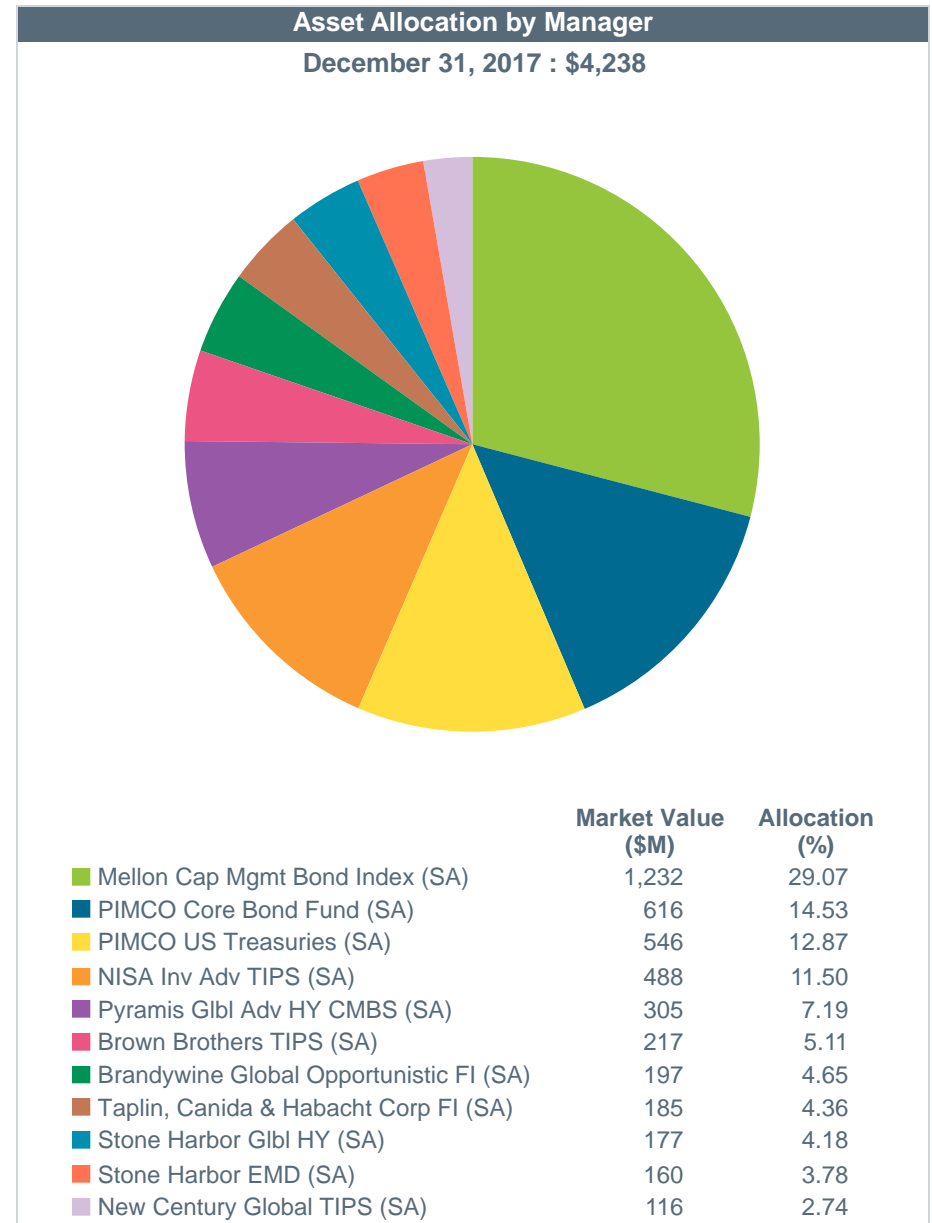
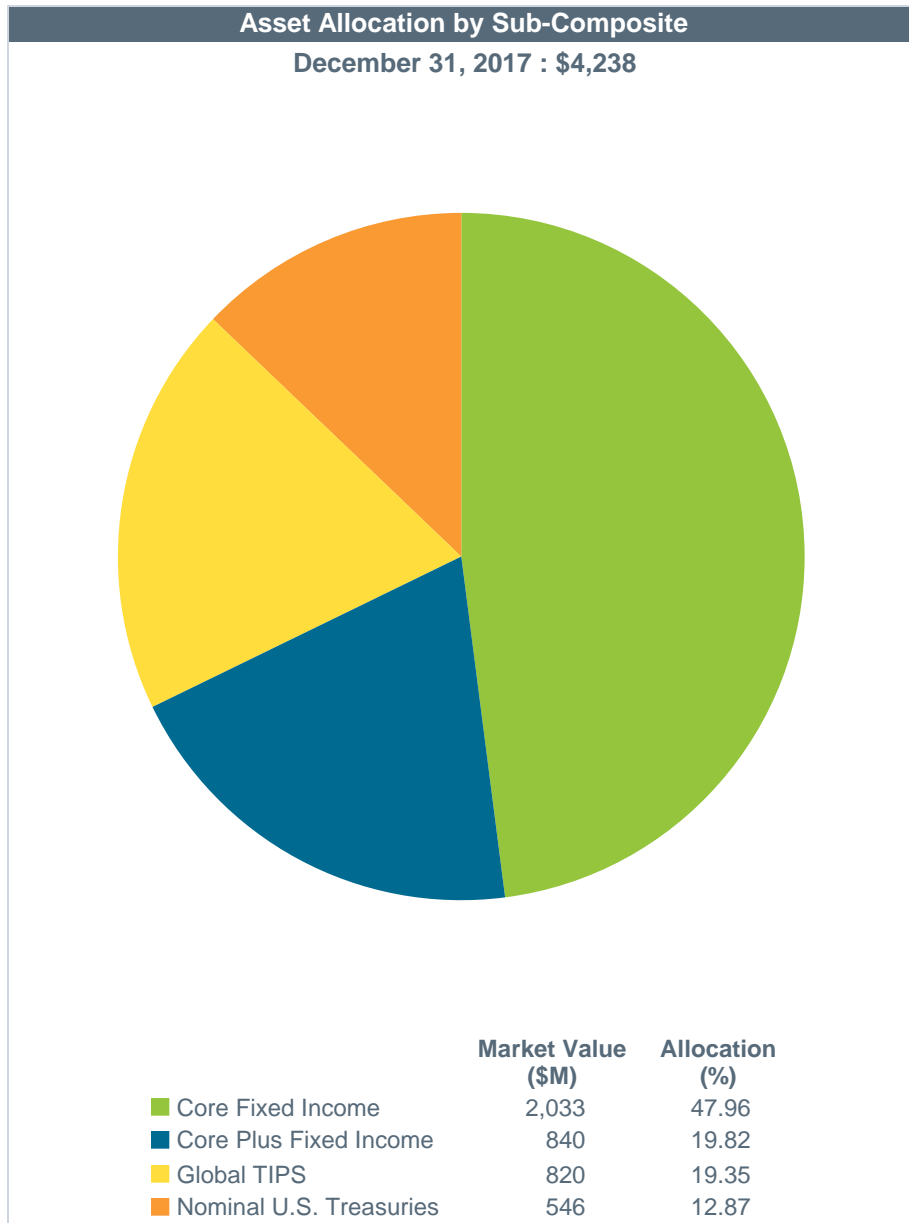
Historical Statistics - 10 Years



Actual Correlation - 10 Years

	Actual Correlation
HF Custom Index*	0.36
S&P 500 Index (Cap Wtd)	0.61
Russell 2000 Index	0.55
MSCI EAFE Index (USD) (Net)	0.67
MSCI Emg Mkts Index (USD) (Net)	0.66
Bloomberg US Agg Bond Index	-0.07
Bloomberg US Trsy US TIPS Index	0.25
Wilshire US REIT Index	0.29
HFRI FOF Comp Index	0.87
Bloomberg Cmdty Index (TR)	0.82
3 Mo US T-Bill Index	-0.26
Cons Price Index (Unadjusted)	0.37

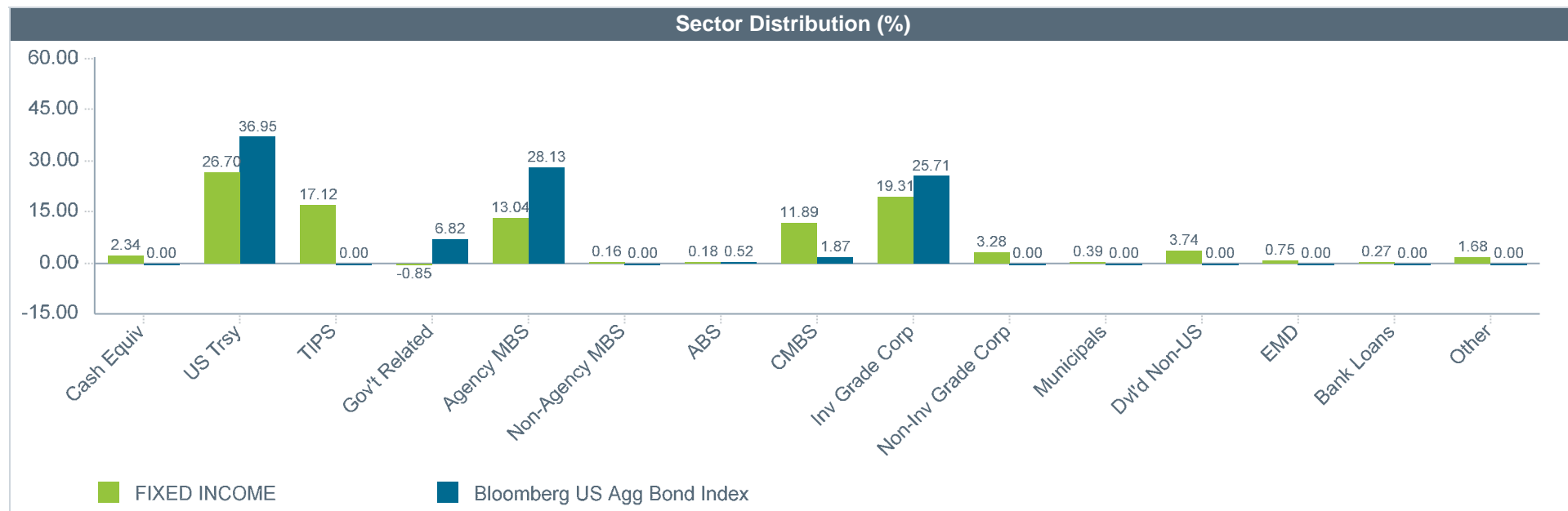
Performance shown is net of fees. Calculation is based on monthly periodicity. \*Please see Addendum for the complete history of the benchmark. Excess Return statistic is calculated against the BofA ML 3 Mo US T-Bill Index. Performance for HEDGE FUNDS HISTORY is for reference purposes only.



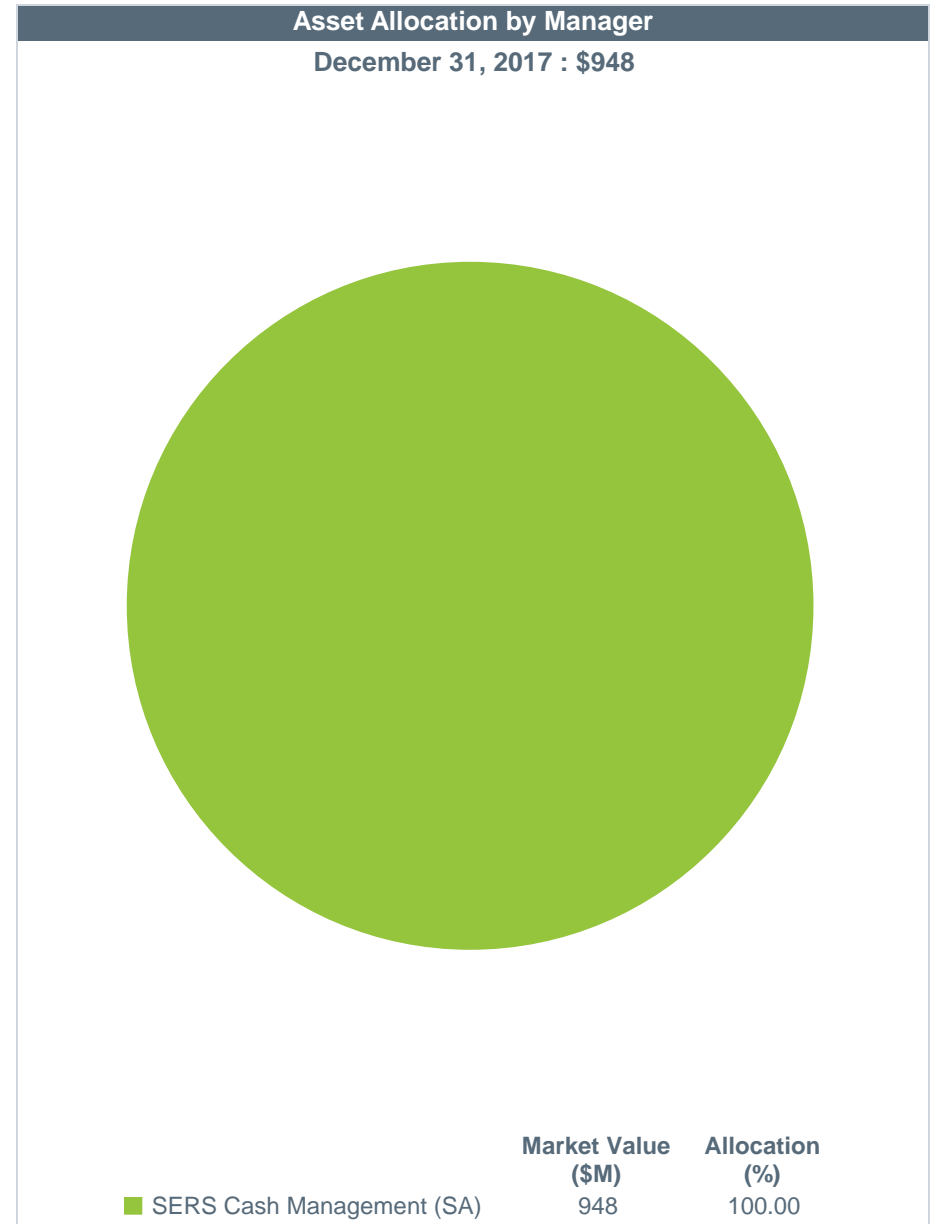
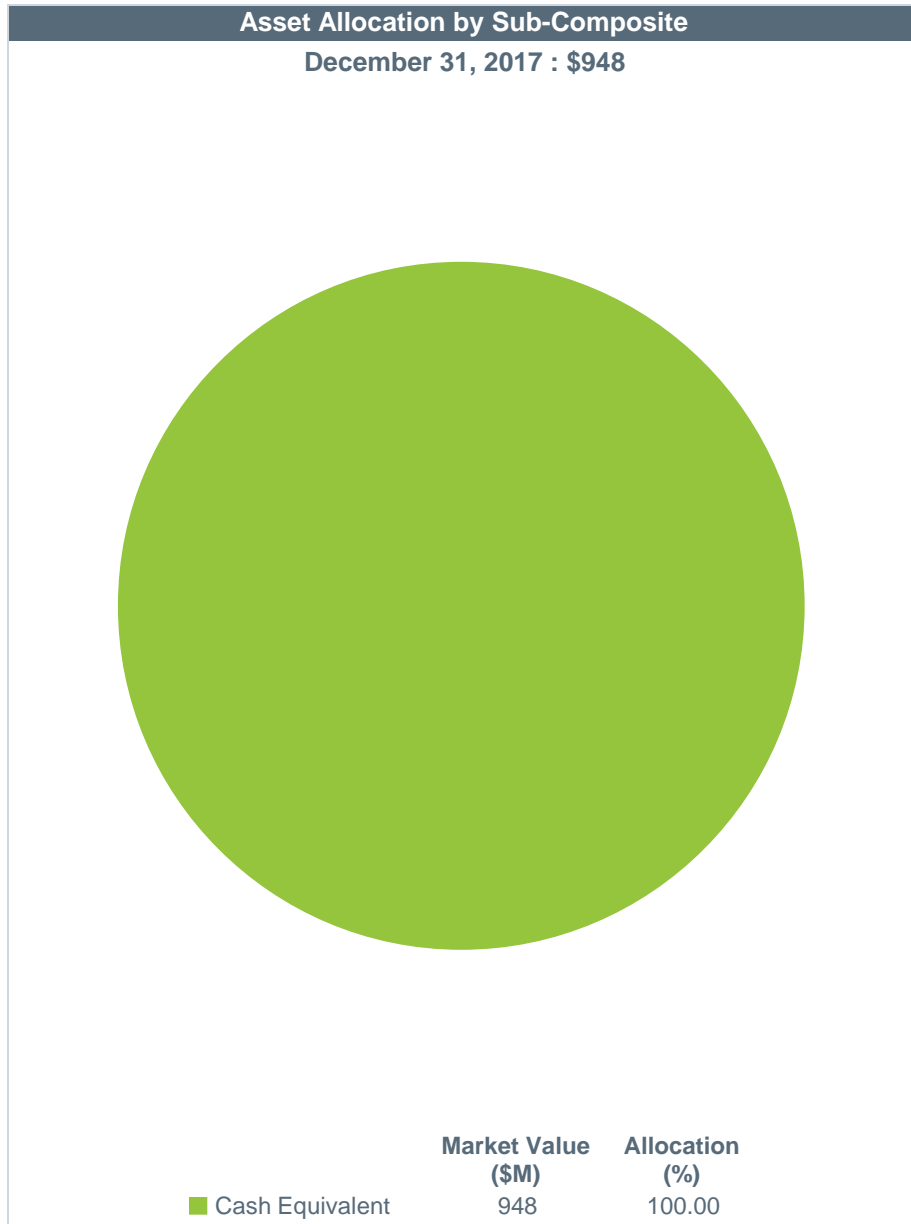
Allocations shown may not sum up to 100% exactly due to rounding. Asset Allocation by Manager doesn't include liquidated managers with residual assets of less than \$1 million.



Portfolio Characteristics		
	Portfolio	Benchmark
Effective Duration	6.43	5.98
Avg. Maturity	7.84	8.27
Avg. Quality	A1	Aa1/Aa2
Yield To Maturity (%)	3.30	2.72
Coupon Rate (%)	2.78	3.06



Allocation to "Other" consists of equity, warrants, accrued interest, unrealized G/L on forwards, high yield and other securitized products. Data shown does not include liquidating accounts and fixed income transition accounts. Effective Duration, Average Quality, and Yield to Maturity statistics have been estimated using the manager's benchmark when statistics are not provided by the manager.



# Capital Markets Review

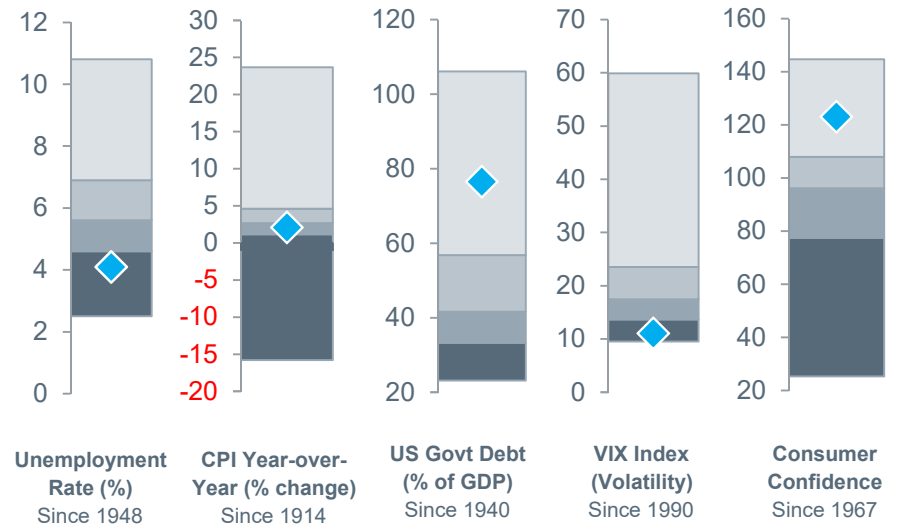


**Fourth Quarter Economic Environment**

**Key Economic Indicators**

Price action across global financial markets continued to be driven by expectations of ongoing economic growth and generally accommodative central bank policies, with equity markets trading to record levels and global sovereign debt yields continuing to trade within recent ranges. The nominal Treasury curve continued to flatten over the quarter. Market participants suggest that recent and expected monetary policy actions, as well as expectations for increased Treasury issuance amidst fiscal stimulus policies, are driving short-maturity and mid-maturity yields higher. Comparatively, longer-dated yields proved stable, and reportedly continue to be heavily influenced by relatively modest expectations for sustained US economic growth and building inflation expectations. Finally, the US dollar continued to depreciate over the quarter, weakening by 1% against major currencies amidst continued economic improvements across developed international and emerging markets. The depreciation over the quarter contributed to a total dollar depreciation of nearly 10% for the year.

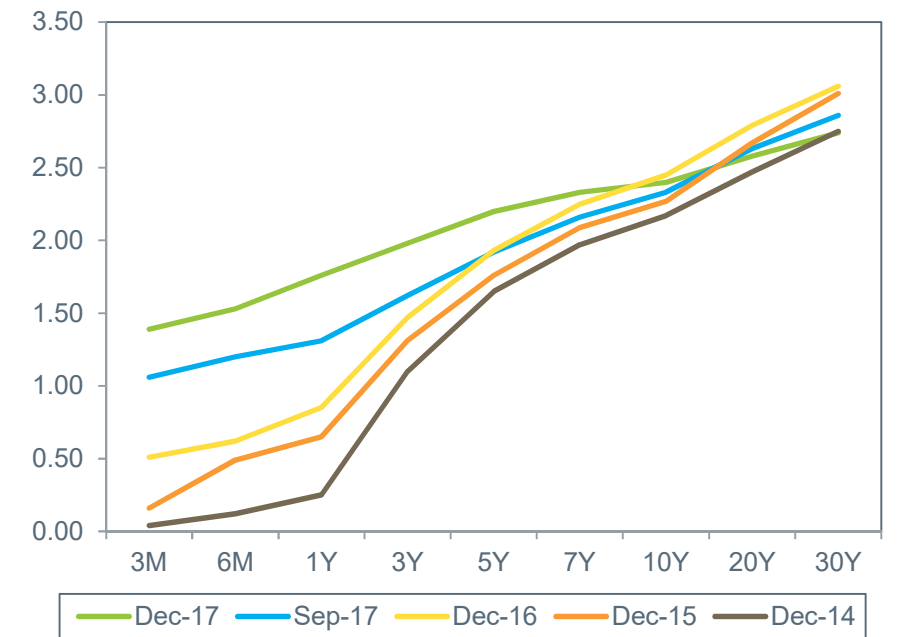
**Key Economic Indicators**



**Economic Indicators**

	Dec-17	Sep-17	Dec-16	Dec-14	20 Yr
Federal Funds Rate (%)	1.33 ▲	1.06	0.55	0.06	2.12
Breakeven Infl. - 1 Yr (%)	0.85 ▼	1.24	1.27	-0.21	N/A
Breakeven Infl. - 10 Yr (%)	1.98 ▲	1.85	1.97	1.68	N/A
CPI YoY (Headline) (%)	2.1 ▼	2.2	2.1	0.8	2.1
Unemployment Rate (%)	4.1 ▼	4.2	4.7	5.6	5.9
Real GDP YoY (%)	2.5 ▲	2.3	1.8	2.7	2.3
PMI - Manufacturing	59.3 ▼	60.2	54.3	54.7	52.4
USD Total Wtd Idx	87.47 ▼	88.10	95.72	85.07	86.73
WTI Crude Oil per Barrel (\$)	60.4 ▲	51.7	53.7	53.3	57.5
Gold Spot per Oz (\$)	1,303 ▲	1,280	1,152	1,185	831

**Treasury Yield Curve (%)**



**Market Performance (%)**

	QTD	CYTD	1 Yr	5 Yr	10 Yr
S&P 500 (Cap Wtd)	6.64	21.83	21.83	15.79	8.50
Russell 2000	3.34	14.65	14.65	14.12	8.71
MSCI EAFE (Net)	4.23	25.03	25.03	7.90	1.94
MSCI EAFE SC (Net)	6.05	33.01	33.01	12.85	5.77
MSCI Emg Mkts (Net)	7.44	37.28	37.28	4.35	1.68
Bloomberg US Agg Bond	0.39	3.54	3.54	2.10	4.01
BofA ML 3 Mo US T-Bill	0.28	0.86	0.86	0.27	0.39
NCREIF ODCE (Gross)	2.07	7.62	7.62	11.53	5.03
Wilshire US REIT	1.70	4.18	4.18	9.35	7.28
HFRI FOF Comp	1.99	7.69	7.69	3.99	1.08
Bloomberg Cmdty (TR)	4.71	1.70	1.70	-8.45	-6.83

Treasury data courtesy of the US Department of the Treasury. Economic data courtesy of Bloomberg Professional Service. Breakeven Inflation does not have 20 years of history; therefore, its 20-year average is shown as N/A.



Fourth Quarter Review

**Broad Market**

A small subset of companies particularly dominated broad market returns in 2017, with FAANG (Facebook, Amazon, Apple, Netflix, and Google), averaging returns of nearly 50% during 2017. As a result, many active managers with light or absent exposure to this lineup of companies experienced difficulty in keeping pace with their respective benchmarks.

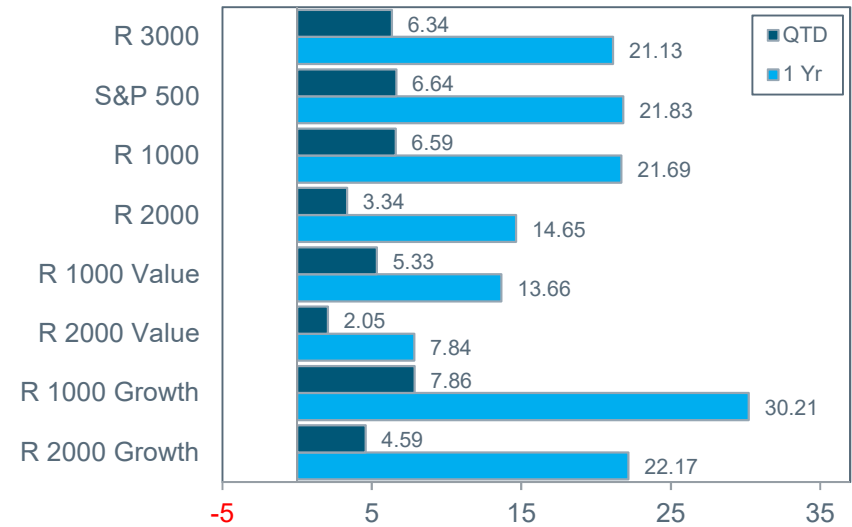
**Market Cap**

Large cap stocks outpaced small cap stocks for the quarter, with the Russell 1000 outperforming the Russell 2000 by 325 basis points.

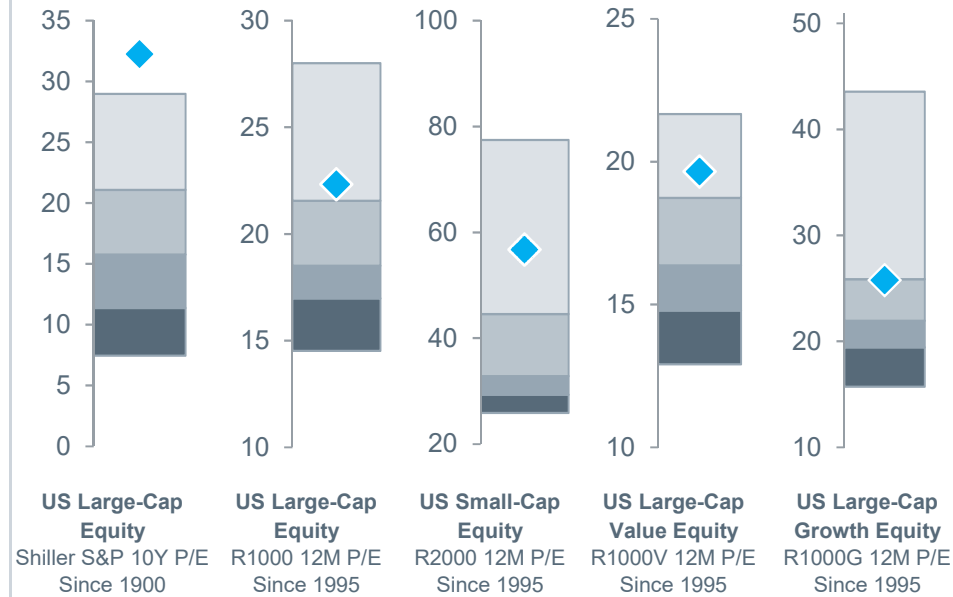
**Style and Sector**

Growth stocks led value stocks for the quarter, and the Russell 1000 Growth Index outperformed its value counterpart by 16.6% for the year. Consumer discretionary and tech stocks posted quarterly returns upwards of 9%, with tech stocks posting a 2017 return of nearly 39%.

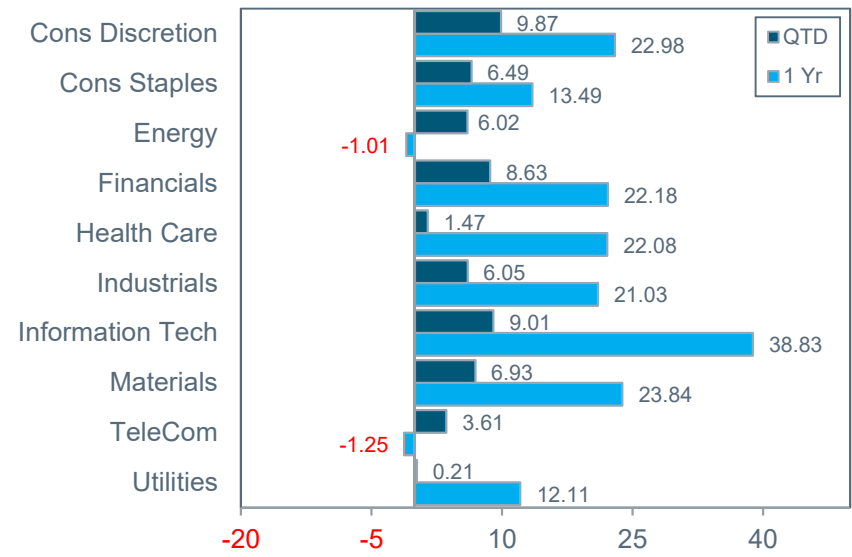
Style and Capitalization Market Performance (%)



Valuations



S&P 500 Index Sector Performance (%)



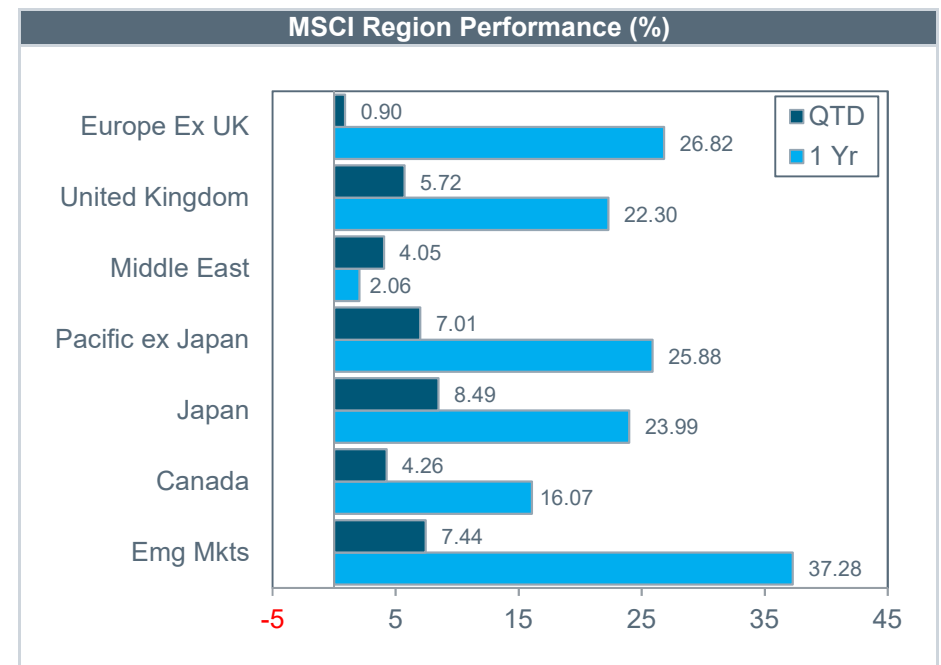
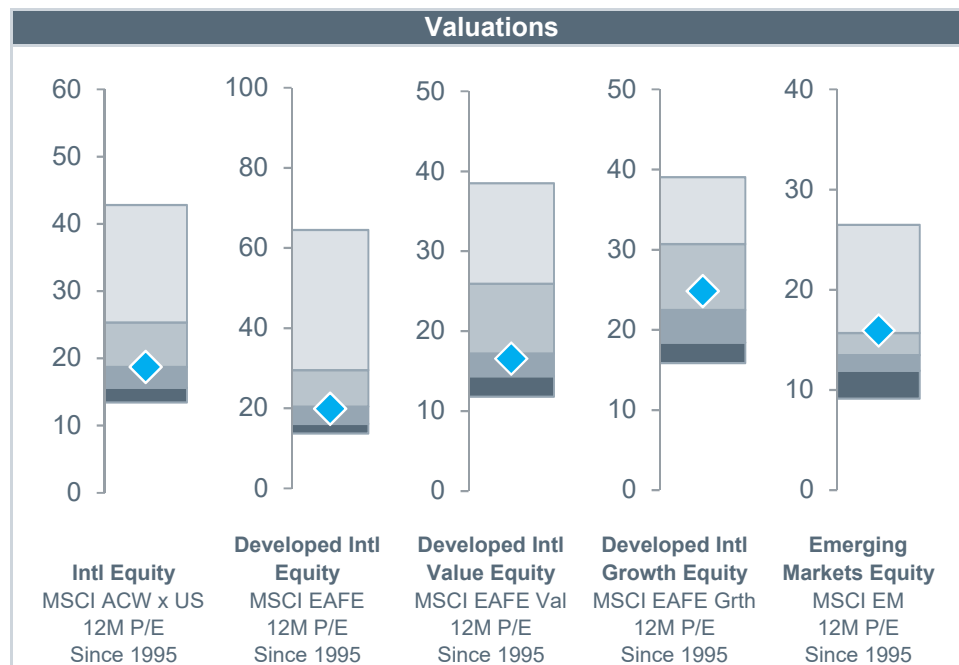
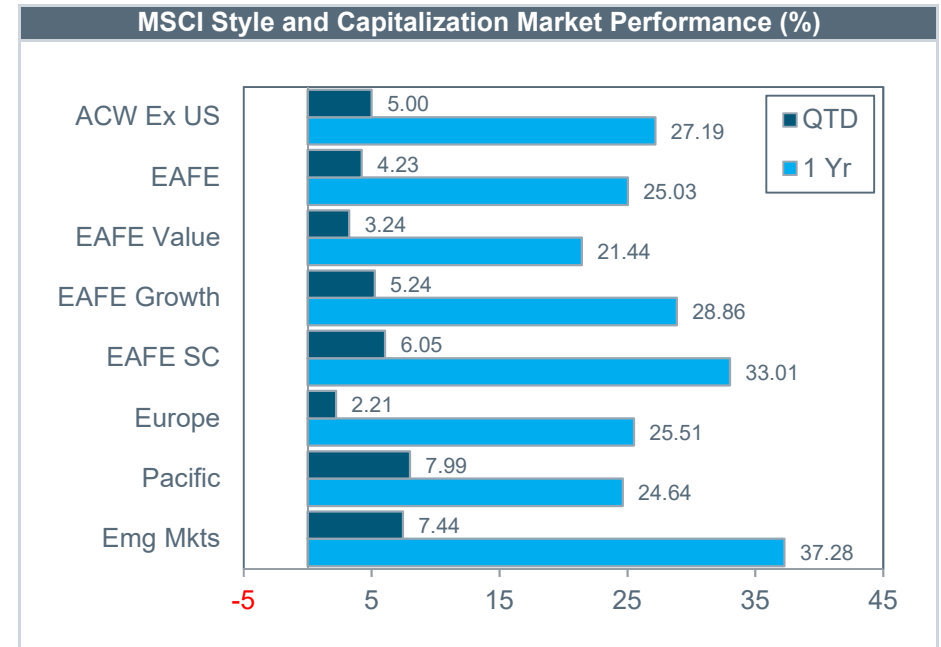
Valuation data courtesy of Bloomberg Professional Service and Robert J. Shiller, Irrational Exuberance, Second Edition. P/E metrics shown represent the 5th through 95th percentiles to minimize the effect of outliers.

### Fourth Quarter Review

**Developed Markets**  
 Developed international markets had a strong quarter, though they lagged the US market. However, they outpaced the domestic market for 2017. In 2017, the EAFE Index returned 25.03% vs. 21.13% for the Russell 3000 Index.

**Emerging Markets**  
 Emerging markets outperformed domestic and developed international markets for both the quarter and year, with the Emerging Markets Index outpacing the EAFE Index by 321 basis points for the quarter, and 1225 basis points for the year.

**Market Cap & Style**  
 The outperformance of value stocks last year did not persist, with growth stocks solidly outperforming for the quarter and year. Small cap also outperformed large cap for both Q4 and 2017.



Valuation data courtesy of Bloomberg Professional Service.  
 P/E metrics shown represent the 5th through 95th percentiles to minimize the effect of outliers.  
 All returns are shown net of foreign taxes on dividends.

**Fourth Quarter Review**

**Broad Market**

The flattening yield curve during the quarter and year detracted from the performance of short duration bonds, while contributing to the performance of long duration bonds. A flatter yield curve has caused some tactical investors and portfolio managers to shorten the duration of their portfolios as the perceived relative value of shorter-dated securities has increased.

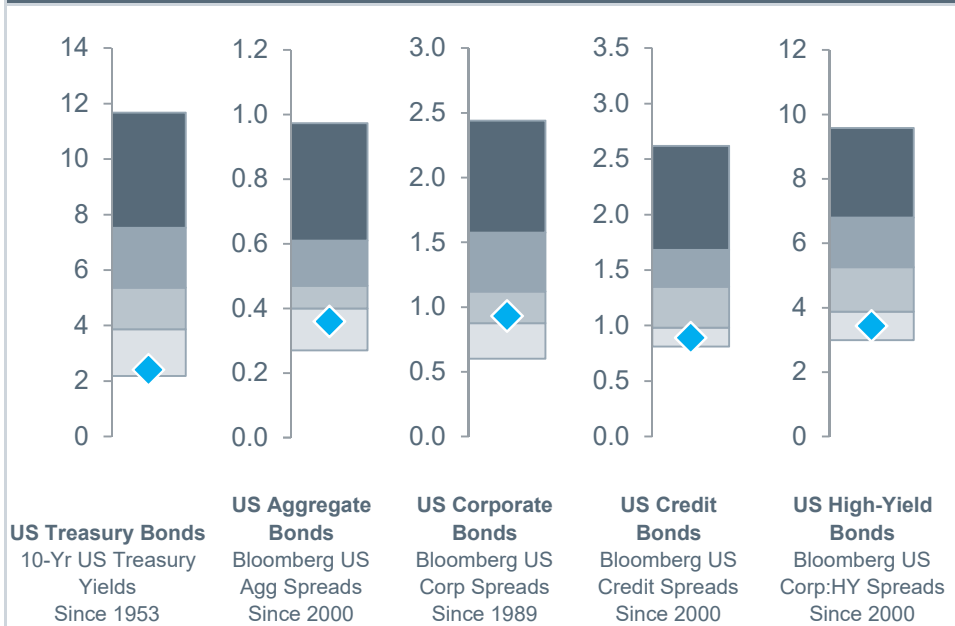
**Credit Market**

Investment grade and high yield credit spreads started the year below long-term averages and continued to grind tighter.

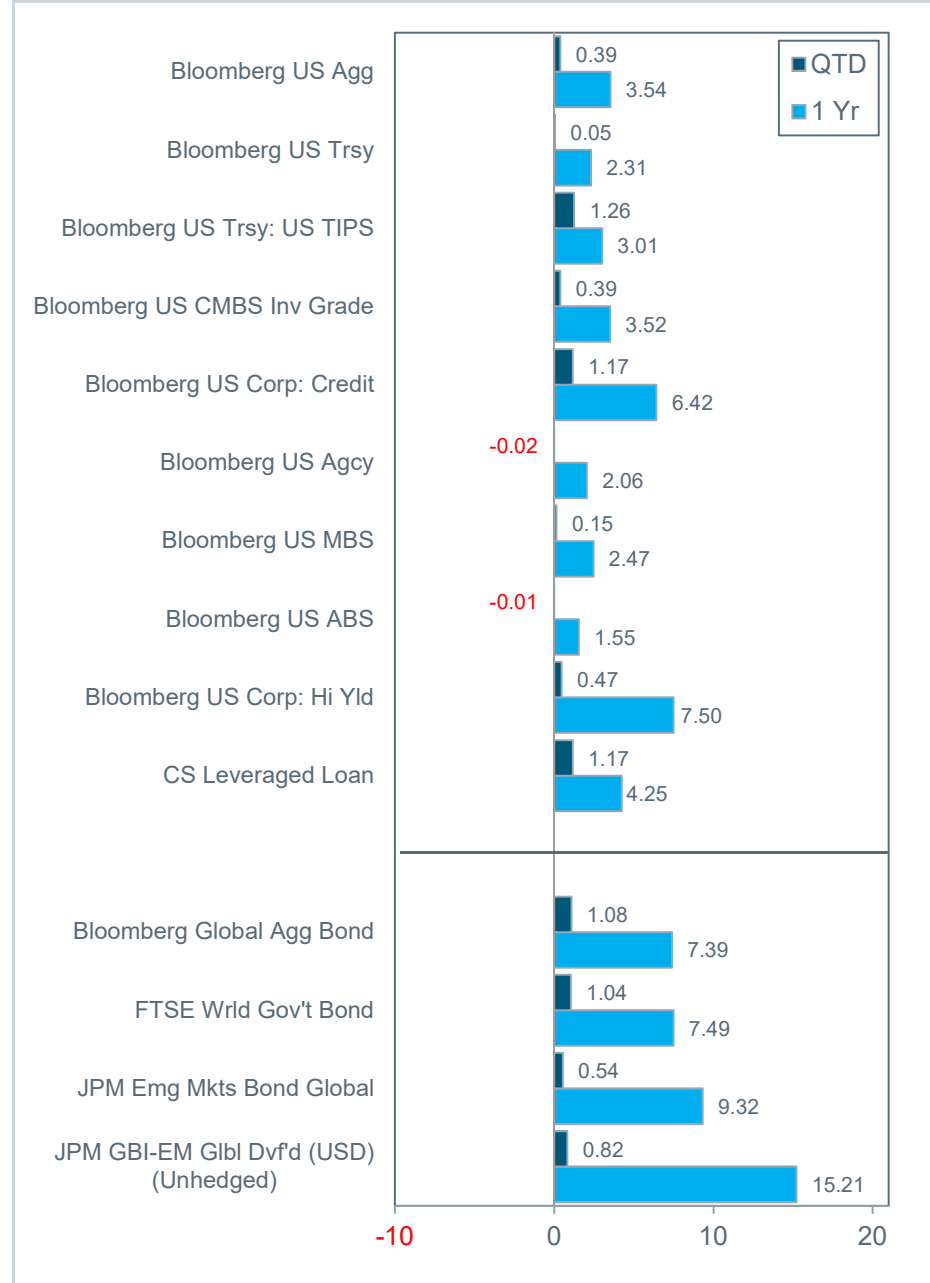
**Emerging Market Debt**

Non-US dollar denominated emerging market debt was the best performing sub-asset class within fixed income over the course of 2017, returning 15.21%. Important drivers of this performance included the improving fundamentals and stabilizing political environments experienced by many countries during the year.

**Valuations**



**Fixed Income Performance (%)**



Valuation data courtesy of Bloomberg Professional Service. Valuations shown represent the 5th through 95th percentiles to minimize the effect of outliers.



**Fourth Quarter Review - Absolute Return**

**General Market - Hedge Funds**

Hedge funds largely provided positive performance, as most fundamentally oriented managers benefited from low inter-stock correlation and a positive return environment across most underlying global risk assets. Multi-Strategy manager returns were generally positive during the quarter, but suffered in November due to corporate merger scrutiny by the DoJ. The best performing broad hedge fund category for the year has been traditional Equity Long-Short (ELS).

**General Market - Global Tactical Asset Allocation (GTAA)**

GTAA managers provided strong performance in Q4 to finish an already successful 2017. Global equity and global fixed income markets were broadly supportive during the quarter, providing a welcome backdrop for most multi-asset strategies. Although GTAA managers performed well in absolute terms, most modestly underperformed relative to a static, undiversified blend of US 60/40. The modest underperformance of tactical managers relative to this static benchmark was generally pronounced for managers who adhere to value-oriented investment processes.

**Fourth Quarter Review - Real Assets**

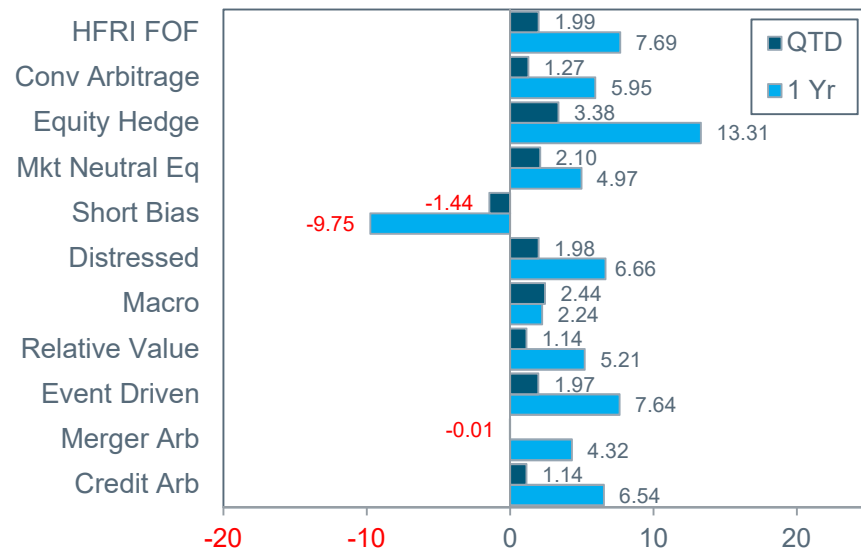
**General Market - Diversified Inflation Strategies (DIS)**

Performance for Diversified Inflation Strategies (“DIS”) in Q4 ranged widely, with managers providing positive performance in a quarter where market-based measures of future expected inflation increased. Market expectations increased from 1.85% to 1.98% based on the 10 year Treasury break-evens.

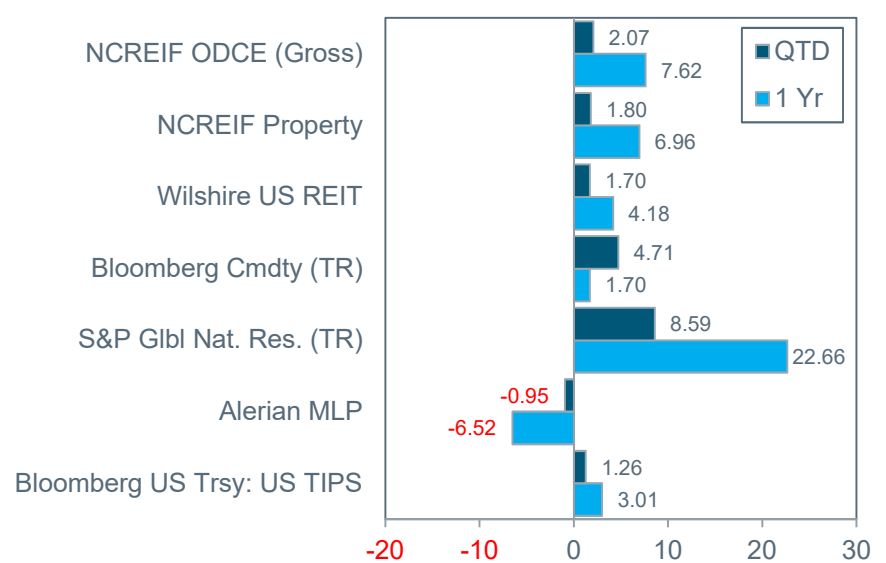
**General Market - Real Estate**

Real estate valuations remain healthy, supported by continuing strength in the overall economy. The core private real estate index, NCREIF-ODCE returned 2.1% during Q4, comprised of 1.1% income and 1.0% appreciation. Market participants characterized this as another quarter of normalizing returns reinforcing investor expectations of lower returns going forward as the market enters the later stages of the recovery. Investors in publicly traded real estate outperformed their private market counterparts during the quarter as measured by FTSE/NAREIT All REIT’s index return of 2.4%.

**HFRI Hedge Fund Performance (%)**



**Real Asset Performance (%)**





Annual Asset Class Performance

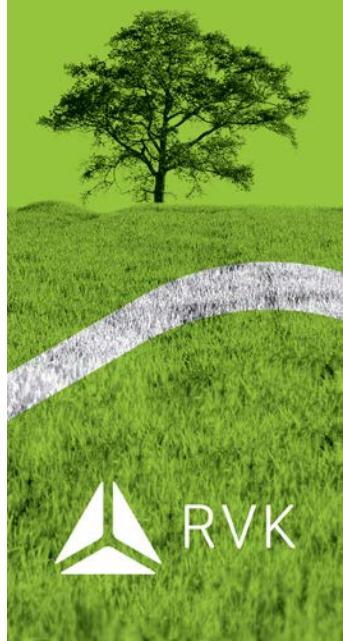
As of December 31, 2017

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Best	61.34	33.16	34.00	35.97	39.38	8.44	78.51	28.60	22.49	20.00	38.82	31.78	15.02	21.31	37.28
	55.81	31.45	26.19	32.18	16.23	5.24	58.21	26.85	15.99	18.23	32.39	19.31	9.59	17.13	33.01
	47.25	25.55	21.39	26.34	15.97	2.06	46.78	22.04	13.56	17.59	29.30	13.69	4.23	11.96	25.03
	38.59	20.25	21.36	19.31	11.63	-2.35	31.78	18.88	9.24	17.32	22.78	12.50	1.38	11.77	21.83
	36.18	18.33	13.82	18.37	11.17	-10.01	28.60	16.83	7.84	16.35	13.94	5.97	0.55	11.19	14.65
	28.96	13.06	13.54	16.32	10.25	-21.37	27.17	16.36	4.98	16.00	8.96	4.89	0.05	8.77	10.71
	28.68	11.14	7.49	15.79	6.97	-26.16	26.46	15.12	2.11	15.81	7.44	3.64	-0.27	7.24	7.69
	23.93	10.88	5.34	11.86	6.60	-33.79	18.91	15.06	0.10	10.94	1.86	3.37	-0.31	6.67	7.62
	11.61	9.15	4.91	10.39	5.49	-35.65	11.47	10.16	-4.18	8.78	0.07	2.45	-1.44	4.68	7.50
	9.28	8.56	4.55	4.85	5.00	-37.00	11.41	7.75	-5.72	6.98	-2.02	0.04	-3.30	2.65	4.18
	8.39	8.46	3.07	4.34	1.87	-39.20	5.93	6.54	-12.14	4.79	-2.60	-2.19	-4.41	2.18	3.54
	5.88	6.86	2.84	2.72	1.45	-43.38	1.92	6.31	-13.32	4.21	-8.61	-4.90	-4.47	1.00	3.01
	4.11	4.34	2.74	2.07	-1.57	-47.01	0.21	5.70	-15.94	0.11	-8.83	-4.95	-14.92	0.51	1.70
Worst	1.15	1.33	2.43	0.49	-17.55	-53.33	-29.76	0.13	-18.42	-1.06	-9.52	-17.01	-24.66	0.33	0.86
	S&P 500 - US Large Cap	R 2000 - US Small Cap	MSCI EAFE (Net) - Int'l Dev.	MSCI EAFE SC (Net) - Int'l SC	MSCI EM (Net) - Int'l Emg Mkts	Bloomberg US Agg Bond - FI	Bloomberg US Corp: Hi Yield - FI	Bloomberg US Trsy: US TIPS - FI	Bloomberg US Gov/Credit: Lng - FI	NCREIF ODCE (Gross) - Real Estate	Wilshire US REIT - REITs	HFRI FOF Comp Index - ARS	Bloomberg Cmdty (TR) - Commod.	BofA ML 3 Mo T-Bill - Cash Equiv	

NCREIF ODCE (Gross) performance is reported quarterly; performance is shown N/A in interim-quarter months.



# Addendum & Glossary



**Performance Related Comments**

- Performance shown is net of fees except where noted.
- Allocations shown may not sum up to 100% exactly due to rounding.
- RVK, Inc. began monitoring the assets of the Commonwealth of Pennsylvania State Employees' Retirement System as of 10/01/2011. Prior historical data was provided by BNY Mellon and Rocaton. Subsequent restructuring of composites during Q4 2012 caused staff to direct BNY to recalculate select composites. This updated history was provided to RVK from inception through 12/31/2012 and cannot be independently verified by RVK due to the absence of accounting history related to newly created historical composites.
- Gross performance shown for the Total Fund Composite is calculated by BNY Mellon by adding the estimated annual expense ratio to the net return stream.
- Manager-reported performance may differ from custodian-reported performance for Hedge Fund managers due to cash flows and valuation revisions.
- Due to the nature of the fund, the market value and performance for SEI Structured Credit High Yield Bank Loans (CF) is lagged by one month. However, the manager page uses product specific performance that is not lagged.
- Beginning in Q2 2012, PAAMCO Newport Sequoia Fund LLC reports performance on a two month lag.
- Due to the nature of the asset classes, performance for Buyouts, Special Situations, Venture Capital, Core Real Estate, Non Core Real Estate, Real Estate Separate Accounts, Timberland and REITs are lagged by one quarter.
- RVK calculates performance beginning with the first full month following inception.
- Total Fund Composite performance shown for calendar years 1981-1984 was updated to be consistent with the 1983-1985 CAFR letters as directed by SERS staff. RVK received the updated calendar year performance for 1981-1984 directly from BNY Mellon. Each calendar year return was converted to twelve equal monthly returns so that the linked performance matches each total calendar year performance. It is important to note that the methodology used to derive these monthly returns may affect the accuracy of risk measures for periods including 1981-1984. The updated calendar year performance and all linked performance shown has not been independently reviewed by RVK.
- Liquidating accounts with market values under \$1 million are not shown in this report, but are included in the composites' market values and performance calculations.
- Fixed Income characteristics and allocations are provided by the managers.
- SERS investments in Absolute Return are in liquidation.
- In Q3 2016, Real Estate was reestablished as a stand-alone asset class.
- In Q3 2016, the following transitions occurred due to the 2016-2017 restructuring: Private Energy was reclassified as a sub-strategy within the Private Equity asset class, Commodities were reclassified as a stand-alone asset class within Hedge Funds, Harvest Fund Advisors MLP and Kayne Anderson MLP were reclassified as Core Plus Fixed Income, and Short-Term Notes were reclassified as a stand-alone strategy within Fixed Income.
- In Q4 2016, MCM Russell 1000 Growth Index (SA), Diamond Hill LC (SA), Epoch LC Value (SA), Emerald Adv PA Sm Cap Core Eq (SA), and Mellon Cap Mgmt PA Quant Eq (SA) were liquidated and Emerald Adv Div Sm Cap Grth (SA), MCM Russell 2000 Core Index (SA), MCM Russell 2000 Val Index (SA) were funded with the proceeds.
- On 03/31/2017, Delaware Investments adopted the name of its parent company, Macquarie Investment Management.
- In Q2 2017, Artisan Int'l Growth Eq (SA), MCM MSCI World Ex US Index (SA), Morgan Stanley Inv Mgmt Int'l Eq (SA), Templeton Int'l Eq (SA), Hoplite Partners, L.P., Stelliam Fund LP, BAAM Custom Commodities Fund LP, MacKay Shields Core Fixed Income (SA), UBS Core Bond (SA), and Wellington US Treasuries (SA) were terminated. Market values shown represent residual assets. MCM Russell 3000 Index (SA) and BlackRock MSCI World ex US Index (CF) were funded with the proceeds.
- In Q3 2017, Samlyn Onshore Fund LP, PNC Short Duration (SA), StoneRidge Short Duration (SA), Waterfall Asset Mgmt ABS (SA), Kayne Anderson MLP, and Harvest Fund Advisors MLP were liquidated. Market values shown represent residual assets.
- In Q4 2017, the following transitions occurred: Multi-Strategy was established as an asset class, Credit-Focused Strategies and Opportunistic Equity & Fixed Income were established as a sub-strategy within the Multi-Strategy asset class, Blackstone Keystone Fund was reclassified as Credit-Focused Strategies, MCM Russell 3000 Index (SA) and SEI Structured Credit HY Bank Loans (CF) were reclassified as Opportunistic Equity & Fixed Income. Legacy Hedge Funds is undergoing liquidation.
- In Q4 2017, Ashmore Emerging Small Cap Equity (SA) was terminated and is undergoing liquidation. Market value shown represents residual assets. BlackRock Emg Mkts Index (CF) was funded with the proceeds.

**Peer Group and Index Comments**

- The All Public Plans > \$1 Billion-Total Fund plan sponsor universe includes public funds with total fund market values over \$1B in the Investment Metrics (IM) and BNY Mellon universe.
- See the following pages for the complete historical composition of indices marked with an asterisk (\*).
- Indices show N/A for since inception returns when the fund contains more history than the corresponding benchmark.

**Plan Sponsor Peer Groups** - RVK utilizes the Mellon Analytical Solutions Trust Universe along with the Investment Metrics Plan Sponsor Universe. The combined Mellon Analytical Solutions Trust Universe and Investment Metrics Plan Sponsor Universe is used for comparison of total fund composite results and utilizes actual client returns compiled from consultant and custodial data. The Plan Sponsor Peer Group database includes performance and other quantitative data for over 1,273 plans which include corporate, endowment, foundation, public, and Taft Hartley plans, across 6 standard peer groups. Plan Sponsor Peer Groups are gross of fees.

**Indices** - All indices and related information are considered intellectual property and are licensed by each index provider. The indices may not be copied, used or distributed without the index provider's prior written approval. Index providers make no warranties and bear no liability with respect to the indices, any related data, their quality, accuracy, suitability and/or completeness.

**Manager/Composite/Benchmark Name**

Total Fund Custom Benchmark\*  
 (Historical performance through 9/30/2011 was provided  
 by Rocaton)

**Benchmark Composition**

The custom index is calculated monthly using January 1st and December 31st actual plan weights of the  
 asset allocation structure.

**Since**

Inception

The custom index is calculated using the Strategic Target Weights.

8/1/2007

The custom index is calculated using 12/31/2009 actual plan weights and the 2010 target weights.

1/1/2010

The custom index is calculated using 2011 target weights, and consists of:

10/1/2011

24.5% SERS - Private Equity Composite Returns  
 3.9% MSCI World Index (Net)  
 9.6% Russell 3000 Index  
 16.5% MSCI ACW Ex US IM Index (USD) (Net)  
 15.5% 3 Mo LIBOR Index+3%  
 9.5% Townsend Stylized Benchmark  
 3% Commodities & Infrastructure Custom Benchmark  
 17.5% Fixed Income Custom Index\*

7/1/2012

21% SERS - Private Equity Composite Returns  
 32% MSCI ACW IM Index (USD) (Net)  
 15% Real Estate Custom Benchmark\*  
 12% Hedge Funds Custom Benchmark\*  
 17% Bloomberg US Agg Bond Index  
 3% BofA Merrill Lynch 3 Month US Treasury Bill Index

4/1/2014

20% SERS - Private Equity Composite Returns  
 37% MSCI ACW IM Index (USD) (Net)  
 17% Real Estate Custom Benchmark\*  
 8% HF Custom Index\*  
 15% Bloomberg US Agg Bond Index  
 3% BofA Merrill Lynch 3 Month US Treasury Bill Index

16% SERS - Private Equity Composite Returns  
 43% MSCI ACW IM Index (USD) (Net)  
 12% Real Estate Custom Benchmark\*  
 12% HF Custom Index\*  
 14% Bloomberg US Agg Bond Index  
 3% BofA Merrill Lynch 3 Month US Treasury Bill Index

7/1/2016

**The custom index is calculated using interim target weights, and currently consists of:**

**10/1/2017**

16% SERS - Private Equity Composite Returns  
 43% MSCI ACW IM (USD) (Net)

<u>Manager/Composite/Benchmark Name</u>	<u>Benchmark Composition</u>	<u>Since</u>
Total Fund Public Mkt Equiv Benchmark* (Historical performance through 9/30/2011 was provided by Rocaton)	12% Real Estate Custom Benchmark*	Inception
	12% S&P/LSTA Leveraged Loan Index	
	14% Bloomberg US Agg Bond Index	
	3% BofA Merrill Lynch 3 Month US Treasury Bill Index	
	The custom index is calculated monthly using January 1st and December 31st actual plan weights of the asset allocation structure.	
	The custom index is calculated using the Strategic Target Weights.	8/1/2007
	The custom index is calculated using 12/31/2009 actual plan weights and the 2010 target weights.	1/1/2010
	The custom index is calculated using 2011 target weights, and consists of:	10/1/2011
	24.5% Russell 3000 Index+3% (Qtr Lag)	7/1/2012
	3.9% MSCI World Index (Net)	
	9.6% Russell 3000 Index	
	16.5% MSCI ACW Ex US IM Index (USD) (Net)	
	15.5% 3 Mo LIBOR Index+3%	
	9.5% Consumer Price Index+3%	
	3% Consumer Price Index+3%	
	17.5% Fixed Income Custom Index*	
	21% Russell 3000 Index+3% (Qtr Lag)	
	32% MSCI ACW IM Index (USD) (Net)	
	15% Consumer Price Index+3%	4/1/2014
	12% Hedge Funds Custom Benchmark*	
	17% Bloomberg US Agg Bond Index	
	3% BofA Merrill Lynch 3 Month US Treasury Bill Index	
	20% Russell 3000 Index+3% (Qtr Lag)	
	37% MSCI ACW IM Index (USD) (Net)	7/1/2016
	17% Consumer Price Index+3%	
	8% HF Custom Index*	
	15% Bloomberg US Agg Bond Index	
	3% BofA Merrill Lynch 3 Month US Treasury Bill Index	
	16% Russell 3000 Index+3% (Qtr Lag)	7/1/2016
	43% MSCI ACW IM Index (USD) (Net)	
	12% Consumer Price Index+3%	
	12% HF Custom Index*	
	14% Bloomberg US Agg Bond Index	
	3% BofA Merrill Lynch 3 Month US Treasury Bill Index	

<u>Manager/Composite/Benchmark Name</u>	<u>Benchmark Composition</u>	<u>Since</u>
	The custom index is calculated using interim target weights, and currently consists of:	10/1/2017
	16% Russell 3000 Index+3% (Qtr Lag) 43% MSCI ACW IM Index (USD) (Net) 12% Consumer Price Index+3% 12% S&P/LSTA Leveraged Loan Index 14% Bloomberg US Agg Bond Index 3% BofA Merrill Lynch 3 Month US Treasury Bill Index	
Burgiss Custom Indices	The custom indices utilize the Burgiss private equity database and are provided by StepStone. They are calculated using the time-weighted returns for a composite of funds based on their specified strategies and with the same vintage dates as SERS's funds. For all Burgiss benchmarks, Geographic Focus, Industry Focus, Fund Size, and Currency are all inclusive across countries, industries, funds, and currencies, respectively. Asset Class compositions are listed below for each index.	
Burgiss All Private Equity Custom Index (Qtr Lag)	<b>Asset Class: Corporate Finance, Generalist, Venture Capital</b>	
Burgiss Buyout Custom Index (Qtr Lag)	<b>Asset Class: Corporate Finance/Buyout</b>	
Burgiss Special Situations Custom Index (Qtr Lag)	<b>Asset Class: Corporate Finance/Distressed Securities, Corporate Finance/Mezzanine, Corporate Finance/Special Situations</b>	
Burgiss Venture Capital Custom Index (Qtr Lag)	<b>Asset Class: Venture Capital</b>	
US Equity	100% Wilshire 5000 Value Wtd Total Index <b>100% Russell 3000 Index</b>	Inception <b>1/1/1999</b>
US Small Cap Equity	100% Wilshire 4500 Completion Index 100% Russell 2500 Index  <b>100% Russell 2000 Index</b>	Inception 1/1/1999  <b>12/1/2016</b>
Non-US Equity (Historical performance through 9/30/2008 was provided by Rocaton)	80% SERS Custom Core International Index 20% FTSE Europe & Pacific Medium/Small Cap Index	Inception
	80% MSCI EAFE Index (Free) 20% FTSE Europe & Pacific Medium/Small Cap Index	2/1/2000
	80% MSCI EAFE Index (Free) 20% S&P World Equity EMI EPAC	7/1/2000
	68.56% MSCI EAFE Index (Free) 17.15% S&P World Equity EMI EPAC 14.29% MSCI EMF Index (Net) (Effective 1/1/2001)	11/1/2000

<u>Manager/Composite/Benchmark Name</u>	<u>Benchmark Composition</u>	<u>Since</u>
	85.71% S&P World Equity EMI EPAC 14.29% MSCI EMF Index (Net) (Effective 1/1/2001)	5/1/2001
	Month-End% S&P World Equity EMI EPAC Month-End% MSCI EMF Index (Net) (Effective 1/1/2001)	1/1/2002
	62.98% MSCI EAFE Index (Net) 15.74% S&P EMI EPAC (Gross)	10/1/2006
	21.28% MSCI Emerging Markets Index (Net) 64.8% MSCI EAFE Index (Net) 16.2% S&P EMI EPAC (Gross) 19.0% MSCI Emerging Markets Index (Net) 100% MSCI ACW Ex US IM Index (Net)	7/1/2007 10/1/2008
	65.5% MSCI EAFE IM Index (Net) 34.5% MSCI Emerging Markets Index (Net)	1/1/2010
	<b>100% MSCI ACW Ex US IM Index (USD) (Net)</b>	<b>1/1/2011</b>
Morgan Stanley Inv Mgmt Int'l Eq (SA)	100% MSCI EAFE Free Index (Net) 100% S&P Developed Ex US Large/Mid Cap TR Index (Gross) <b>100% MSCI EAFE Index (Net)</b>	Inception 5/1/2001 <b>10/1/2006</b>
Templeton Int'l Eq (SA)	100% SERS Custom Core International Index 100% MSCI ACW Ex US Free Index (Gross) 100% S&P Global Ex US BM TR Index (Gross) 100% S&P Global Ex US Lg Mid Cap Index (Gross) 100% MSCI EAFE Index (Net) <b>100% MSCI ACW Ex US Index (USD) (Net)</b>	Inception 2/1/2000 5/1/2001 1/1/2004 10/1/2006 <b>1/1/2010</b>
Artisan Int'l Growth Eq (SA)	100% S&P Global Ex US BM TR Index (Gross) 100% MSCI EAFE Index (Net) <b>100% MSCI ACW Ex US Index (Net)</b>	Inception 10/1/2006 <b>1/1/2010</b>
Real Estate Custom Benchmark*	The custom index is calculated using target weights, and consists of: 62% Non-Core Open-End Funds 20% Core Real Estate Funds 13% REITS 5% Timberland	Inception
	<b>The custom index is calculated monthly using beginning of the month asset class weights applied to each corresponding primary benchmark return.</b>	<b>1/1/2013</b>





## Glossary

**Active Share** - Measures the degree to which the holdings of a fund differ from the holdings of the benchmark. Active share is calculated by taking the sum of the absolute value of the differences of the weight of each holding in the fund versus the weight of each holding in the benchmark and dividing by two.

**Alpha** - A measure of the difference between a portfolio's actual returns and its expected performance, given its level of risk as measured by beta. It is a measure of the portfolio's historical performance not explained by movements of the market or a portfolio's non-systematic return.

**Alpha Ratio** - A measure of a portfolio's non-systematic return per unit of downside risk. It is measured by dividing the alpha of a portfolio by the downside risk. The non-systematic return is a measure of a portfolio's historical performance not explained by movements of the market.

**Average Quality** - Bond quality ratings are reported using the investment managers' and the index providers' preferred rating agency. *Average Quality for managers unable to provide this statistic is instead provided by Morningstar; if unavailable on Morningstar, it has been estimated using a credit quality distribution provided by the manager.* There are two primary rating agencies in the US. *Moody's* assigns ratings on a system that employs up to four symbols (consisting of letters and numbers) such as, Aaa, Aa2, etc., with Aaa being the highest or safest rating. *Standard & Poor's (S&P)* employs a system that uses + and - along with letters such as AAA, AA+, etc. The two rating agencies' systems are summarized below:

<u>S&amp;P</u>	<u>Moody's</u>	<u>Explanation</u>	<u>S&amp;P</u>	<u>Moody's</u>	<u>Explanation</u>
<b>Higher Credit Quality – Investment Grade</b>			<b>Lower Credit Quality – Below Investment Grade</b>		
AAA	Aaa	Prime/Highest credit quality	BB+	Ba1	Speculative/Low credit quality
AA+	Aa1	High credit quality	BB	Ba2	
AA	Aa2		BB-	Ba3	
AA-	Aa3		B+	B1	Highly speculative
A+	A1	Upper-medium credit quality	B	B2	
A	A2		B-	B3	
A-	A3		CCC+	Caa1	Substantial credit/default risk
BBB+	Baa1	Lower-medium credit quality	CCC	Caa2	Extremely speculative
BBB	Baa2		CCC-	Caa3	
BBB-	Baa3		CC	Ca	Vulnerable to default
			C	Ca	
			D	C	In default

**Benchmark Effect** – The difference between the composite's benchmark return and the blended return of each respective managers' benchmark within the composite.

**Beta** - A measure of the sensitivity of a portfolio to the movements in the market. It is a measure of a portfolio's non-diversifiable or systematic risk.

**Box Plots** - A graphical representation of the distribution of observations. From top to bottom, the four boxes represent the spread between the maximum value and the minimum value in each quartile. A quartile represents the values that divide the observations into four quarters (i.e., 1<sup>st</sup> quartile, 2<sup>nd</sup> quartile, 3<sup>rd</sup> quartile, and 4<sup>th</sup> quartile). The median observation is where the 2<sup>nd</sup> quartile and 3<sup>rd</sup> quartile meet.

**Buy and Hold Attribution** - At the beginning of the time period under analysis, the manager and benchmark portfolios are broken down into segments (i.e., styles, sectors, countries, and regions) based on the desired type of attribution. The formula assumes zero turn-over to the manager and benchmark portfolios throughout the period and calculates the segment returns ("buy and hold returns") to arrive at performance attribution. Due to portfolio turnover, buy and hold attribution may not accurately represent quarterly performance relative to the benchmark. Country, region, sector, and style allocations are as of the date one quarter prior to the reporting date, and the returns shown are for those segments throughout the quarter reported. Due to disclosure guidelines set by each investment manager, equity characteristics shown are as of the most recent date available. The following is the methodology for segment classification:

**Sector** - Attribution is calculated using the Global Industry Classification Standard (GICS) which is a detailed and comprehensive structure for sector and industry analysis. Stocks are classified by their primary sector, as defined by S&P Capital IQ data.

**Country/Region** - Attribution is calculated using the Morgan Stanley Capital International (MSCI) region standards. Stocks are classified by their domicile country/region, as defined by S&P Capital IQ data.

**Style** - Stocks are classified into the following style boxes: large/mid/small vs. growth/neutral/value. Stocks are classified along large/mid/small categories at the time of the Russell index rebalancing, using the index market cap boundaries as cutoff points. Stocks are classified along growth/neutral/value categories at the time of the Russell index rebalancing, using the price/book ratio as supplied by S&P Capital IQ. Stocks in the Russell 3000 Index portfolio are sorted by price/book ratio; names with the highest price/book ratio that make up 1/3 of the total market capitalization are assigned to the growth category, names that make up the subsequent 1/3 of the total market capitalization are assigned to the neutral category, while the balance of the names are assigned to the value category.

Portfolio Characteristics and Buy and Hold Attribution reports utilize product-specific data for all mutual funds and commingled funds.

### Capital Markets Review -

**Breakeven Inflation** - Measures the expected inflation rate at each stated maturity by taking the difference between the real yield of the inflation-linked maturity curve and the yield of the closest nominal Treasury maturity.

**Consumer Confidence** - Measures domestic consumer confidence as defined by the degree of optimism on the state of the economy that consumers express through saving and spending.

**Consumer Price Index (CPI)** - Measures the change in the price level of consumer goods and services.

**Federal Funds Rate** - The interest rate at which a depository institution lends funds maintained at the Federal Reserve to another depository institution overnight. It is one of the most influential interest rates in the US economy, since it affects monetary and financial conditions, which in turn have a bearing on key aspects of the broad economy including employment, growth and inflation.

**Option-Adjusted Spread** - Measures the flat spread of an index or bond to the Treasury yield curve after removing the effect of any embedded options.

**Purchasing Managers Index (PMI)** - Measures economic activity by surveying purchasing managers on a monthly basis as to whether business conditions have improved, worsened, or stayed the same.



## Glossary

**Real Gross Domestic Product (Real GDP)** - An inflation-adjusted measure that reflects the value of all goods and services produced by an economy in a given year.

**US Dollar Total Weighted Index** - Measures the value of the US Dollar relative to a basket of other world currencies. It is calculated as the weighted geometric mean of the dollar's value versus the EUR, GBP, CAD, SEK, CHF, and JPY.

**Unemployment Rate** - The percentage of the total labor force that is unemployed but actively seeking employment.

**VIX** - Measures the implied volatility of S&P 500 Index options by looking at the market's expectation of the S&P 500 Index volatility over the next 30 day period. Commonly referred to as the "fear index" or the "fear gauge."

**Cash Flow Effect** – The composite's active return minus the sum of each managers' active return minus the benchmark effect.

**Consistency** - The percentage of quarters that a product achieved a rate of return higher than that of its benchmark. The higher the consistency figure, the more value a manager has contributed to the product's performance.

**Convexity** - A measure of the shape of the curve that describes the relationship between bond prices and bond yields.

**Correlation** - A statistical measure of the relationship between asset class returns. A value of 1.00 is a perfect correlation; that is, the asset classes always move in the same direction. A value of -1.00 indicates a perfect negative correlation, in which the asset classes always move in opposite directions of each other. A value of 0 indicates there is no relationship between the direction of returns of the two asset classes. Correlation calculations only consider the direction of changes relative to two variables and not the magnitude of those changes.

**Coupon Rate** - The percentage rate of interest paid on a bond or fixed income security; it is typically paid twice per year.

**Current Yield** - The annual income of a security divided by the security's current price.

**Down Market Capture** - Down market by definition is negative benchmark return and down market capture represents the ratio in % terms of the average portfolios return over the benchmark during the down market period. The lower the value of the down market capture the better the product's performance.

**Downside Risk** - A measure similar to standard deviation, but focuses only on the negative movements of the return series. It is calculated by taking the standard deviation of the negative monthly returns. The higher the factor, the riskier the product.

**Earnings Per Share** - It is backward looking, calculated using the one year current EPS divided by the one year EPS five years ago.

**Effective Duration** - The approximate percentage change in a bond's price for a 100 basis point change in yield.

**Excess Return vs. Market** - Average of the monthly arithmetic difference between the manager's return and the benchmark return over a specified time period, shown on an annualized basis.

**Excess Return vs. Risk Free** - Average of the monthly arithmetic difference between the manager's return and the risk-free return (i.e., BofA ML 3 Mo US T-Bill Index unless specified otherwise) over a specified time period, shown on an annualized basis.

**Excess Risk** - A measure of the standard deviation of a portfolio's performance relative to the risk free return.

**Expense Ratios** - Morningstar is the source for mutual fund expense ratios.

**Gain/Loss** - The net increase or decrease in the market value of a portfolio excluding its Net Cash Flow for a given period.

**Indices** - All indices and related information are considered intellectual property and are licensed by each index provider. The indices may not be copied, used or distributed without the index provider's prior written approval. Index providers make no warranties and bear no liability with respect to the indices, any related data, their quality, accuracy, suitability and/or completeness.

**Information Ratio** - Measured by dividing the active rate of return by the tracking error. The higher the information ratio, the more value-added contribution by the manager.

**Liability Driven Investing (LDI)** - A method to optimally structure asset investments relative to liabilities. The change in liabilities is estimated by the Ryan Labs Generic PPA Index of appropriate duration for that Plan. This benchmark is based on generic data and is therefore an approximation. RVK is not an actuarial firm, and does not have actuarial expertise.

**Estimated Funded Status** - The estimated ratio of a Plan's assets relative to its future liabilities. This is calculated by dividing the Plan's asset market value by the estimated present value of its liabilities. The higher the estimated funded status, the better the Plan's ability to cover its projected benefit obligations. An estimated funded status of 100% indicates a Plan that is fully funded.

**Estimated PV of Liabilities** - An estimate of a Plan's future liabilities in present value terms. The beginning of the period liability is provided by the Plan's actuary. The period-end present value liability estimate provided in this report is derived by applying the estimated percentage change generated using the Ryan Labs Generic PPA Index with duration similar to that reported on the most recent actuarial valuation report.

**Duration of Liabilities** - The sensitivity of the value of a Plan's liabilities to changes in interest rates, as calculated by the Plan's actuary.

**Duration of Assets** - The dollar-weighted average duration of all the individual Plan assets.

**Estimated Plan Hedge Ratio** - The estimate of how well a Plan's investment portfolio is hedged against changes in interest rates - a primary driver of funded status movements. This is calculated by dividing the dollar-weighted values of both the Plan asset duration by the liability duration and multiplying by the estimated funded status. An estimated plan hedge ratio of zero indicates that the Plan's liabilities have not been hedged, whereas a value of one indicates fully hedged.

**Modified Duration** - The approximate percentage change in a bond's price for a 100 basis point change in yield, assuming the bonds' expected cash flows do not change.

## Glossary

**Mutual Fund Performance** - Whenever possible, manager performance is extended for any share class that does not have 10 years of history. Using Morningstar's methodology, a single ticker within the same fund family (often the oldest share class) is chosen to append historical performance.

**Net Cash Flow** - The sum, in dollars, of a portfolio's contributions and withdrawals. This includes all management fees and expenses only when performance shown is gross of fees.

### Peer Groups -

**Plan Sponsor Peer Groups** - RVK utilizes the Mellon Analytical Solutions Trust Universe along with the Investment Metrics Plan Sponsor Universe. The combined Mellon Analytical Solutions Trust Universe and Investment Metrics Plan Sponsor Universe is used for comparison of total fund composite results and utilizes actual client returns compiled from consultant and custodial data. The Plan Sponsor Peer Group database includes performance and other quantitative data for over 2,100 plans which include corporate, endowment, foundation, public, and Taft Hartley plans. Plan Sponsor Peer Groups are gross of fees.

**Institutional Peer Groups (Separate Account and Commingled Fund)** - RVK utilizes the Investment Metrics Separate Account and Commingled Fund Manager Peer Groups for peer comparison and rankings. The Separate Account and Commingled Fund Peer Group database includes performance and other quantitative data for over 1,000 investment management firms, 6,400 investment products, across 100 standard peer groups. Separate Account and Commingled Fund Peer Groups are gross of fees.

**Mutual Fund (MF) Peer Groups** - RVK utilizes the Lipper Mutual Fund Manager Peer Groups for peer comparison and rankings. The Lipper Manager Peer Group database includes performance and other quantitative data for over 700 investment management firms and 24,500 investment products, across more than 140 standard peer groups. Mutual Fund Peer Groups are net of fees.

For more information on Peer Groups, visit <https://www.invmetrics.com/style-peer-groups>.

**Percentile Rankings** - Percentile rank compares an individual fund's performance with those of other funds within a defined peer group of managers possessing a similar investment style. Percentile rank identifies the percentage of a fund's peer group that has a higher return (or other comparative measurement) than the fund being ranked. Conversely, 100 minus the individual fund's ranking will identify the percentage of funds within the peer group that have a lower return than the fund being ranked.

1 - Highest Statistical Value

100 - Lowest Statistical Value

*Example: American Funds AMCP;R-4 (RAFEX) is ranked in the 4<sup>th</sup> percentile within the IM US Equity Large-Cap Growth Funds (MF) Peer Group for the Sharpe Ratio. Within the IM US Equity Large-Cap Growth Funds peer group, 4% of the other funds performed better than American Funds AMCP;R-4 (RAFEX), while 96% of the funds performed worse.*

**Performance Methodology** - RVK calculates performance for investment managers and composites using different methodologies.

**Investment Managers** - Performance is calculated for interim periods between all large external cash flows for a given month and geometrically linked to calculate period returns. An external cash flow is defined as cash, securities, or assets that enter or exit a portfolio. RVK defines a "large cash flow" as a net aggregate cash flow of  $\geq 10\%$  of the beginning-period portfolio market value or any cash flow that causes RVK calculated performance to deviate from manager/custodian reported performance in excess of 5 basis points for a given month.

**Composites** - The Modified Dietz methodology is utilized to calculate asset class, sub-asset class, and total fund composite performance. The Modified Dietz method calculates a time-weighted total rate of return that considers the timing of external cash flows; however, it does not utilize interim period performance to mitigate the impact of significant cash in- and outflows to the composite.

RVK calculates performance beginning with the first full month following inception. Since inception performance may vary from manager reported performance due to RVK using the first full month of returns as the inception date. Performance for both managers and composites is annualized for periods greater than one year.

**Portfolio Characteristics** - Due to disclosure guidelines set by each investment manager, portfolio characteristics shown are as of the most recent date available.

**Price to Earnings Ratio** - The ratio of a company's share price to its per-share earnings

**Private Equity Quartile Ranks** - Private Equity quartile ranks are generated using vintage year peer group data provided by Thomson Reuters, and are based on each fund's annualized, since inception internal rate of return (IRR). Three Private Equity peer groups are available via Thomson Reuters: Buyout, Venture, and All Private Equity. Ranks are available quarterly, at a one-quarter lag.

**Return** - Compounded rate of return for the period.

**% Return** - The time-weighted rate of return of a portfolio for a given period.

**R-Squared** - The percentage of a portfolio's performance explained by the behavior of the appropriate benchmark. High R-Squared means a higher correlation of the portfolio's performance to the appropriate benchmark.

**Risk Free Benchmark** - BofA ML 3 Mo US T-Bill Index unless specified otherwise.

## Glossary

**RVK Liquidity Rating** - A qualitative method for determining the relative amount of liquidity in a portfolio. The characteristics considered when determining relative liquidity include trading volume, gates for redemption, leverage, nature of transactions, and pricing mechanisms. The RVK Liquidity Rating is calculated using beginning of month investment weights applied to each corresponding asset class liquidity rating.

<u>Asset Class</u>	<u>RVK Liquidity Rating</u>	<u>Asset Class</u>	<u>RVK Liquidity Rating</u>
<u>Liquid Investments</u>		<u>Less Liquid Investments</u>	
T-Bills and Treasuries	100	Fixed Income Plus Sector	50
Cash Equivalents	98	Bank Loans	50
TIPS	95	Stable Value (Plan Sponsor Directed)	50
US Large Cap Equity	95	Absolute Return Strategies	35
Diversified Real Return	93		
Stable Value (Participant Directed)	91		
Non-US Large Cap Equity	90	<u>Not Liquid Investments</u>	
Global Tactical Asset Allocation	88	Core Real Estate	25
US Small Cap Equity	85	Core Plus Real Estate	15
REITS	85	Non-Core Real Estate	5
Non-US Small Cap Equity	85	Private Equity Funds of Funds	5
Emerging Markets Equity	85		
Core Fixed Income	85		
Core Plus Fixed Income	80		

**Sector Allocation** - Negative fixed income sector allocation reflects manager's use of derivatives, short selling, or interest rate swaps.

**Sharpe Ratio** - Represents the excess rate of return over the risk-free return (i.e., BofA ML 3 Mo US T-Bill Index unless specified otherwise), divided by the standard deviation of the excess return to the risk free asset. The result is the absolute rate of return per unit of risk. The higher the value, the better the product's historical risk-adjusted performance.

**Simple Alpha** - The difference between the manager's return and the benchmark's return.

**Spread Duration** - The approximate percentage change in a bond's price for a 100 basis point change in its spread over a Treasury of the same maturity.

**Standard Deviation** - A statistical measure of the range of a portfolio's performance. The variability of a return around its average return over a specified time period.

**Time Period Abbreviations** - **QTD** - Quarter-to-Date. **CYTD** - Calendar Year-to-Date. **FYTD** - Fiscal Year-to-Date. **YOY** - Year Over Year.

**Thematic Classification** - Represents dedicated manager allocations; as such, thematic allocations are approximations. RVK categorizes the following asset classes as Alpha, Capital Appreciation, Capital Preservation, and Inflation:

<u>Alpha</u>	<u>Capital Appreciation</u>	<u>Capital Preservation</u>	<u>Inflation</u>
Absolute Return Strategies	Public Equity	Core Fixed Income	TIPS
Currency Overlay	Private Equity	CMBS Fixed Income	Bank Loans
	Preferred Securities	Asset Backed Fixed Income	Core Real Estate
	High Yield	Domestic Core Plus Fixed Income	Real Return
	Convertible Fixed Income	Mortgage Backed Fixed Income	Inflation Hedges
	TALF Funds	International Developed Fixed Income	REITS
	Distressed Debt	Cash Equivalents	Commodities
	Emerging Market Fixed Income	Stable Value	
	Value Added Real Estate		
	Opportunistic Real Estate		

**Total Fund Attribution** – The Investment Decision Process (IDP) model provides an approach to evaluating investment performance that applies to all asset classes and investment styles. The IDP model is based on a top-down hierarchy framework of investment decisions, with each decision contributing to the overall profit or loss. The IDP approach starts from the strategic asset allocation and follows the flow of the investments down to the manager's skill.

**Strategic Asset Allocation (SAA)** – The percentage return gained or lost from the long-term strategic asset allocation decision, the most significant determinant of long-term performance. SAA is the product of the target asset allocation multiplied by the corresponding benchmark returns.

**Tactical Asset Allocation (TAA)** – The percentage return gained or lost from not having been precisely allocated at the target asset allocation mix, whether by deviations that are tactical in nature or a by-product of moving towards the target mix. TAA is the product of the actual asset allocation multiplied by the broad asset class benchmarks, less the SAA.

**Style Selection (SS)** – The percentage return gained or lost from intentional style biases within each asset class (e.g. value rather than core or overweight to emerging markets relative to benchmark). SS is the product of the actual manager allocation within each asset class multiplied by their specific benchmark, less TAA.

**Manager's Skill (MS)** – The percentage return gained or lost from manager value added relative to their specific benchmark. MS is the product of the actual manager allocation multiplied by their achieved excess return.

**Total Fund Beta** - Total Fund Beta is calculated using the S&P 500 as the benchmark. It represents a measure of the sensitivity of the total fund to movements in the S&P 500 and is a measure of the Total Fund's non-diversifiable or systematic risk.

**Tracking Error** - A measure of the standard deviation of a portfolio's performance relative to the performance of an appropriate market benchmark.



## Glossary

**Treynor Ratio** - Similar to Sharpe ratio, but focuses on beta rather than excess risk (standard deviation). Treynor ratio represents the excess rate of return over the risk-free rate (i.e., BofA ML 3 Mo US T-Bill Index unless specified otherwise) divided by the beta. The result is the absolute rate of return per unit of risk. The higher the value, the better historical risk-adjusted performance.

**Unit Value** - The dollar value of a portfolio, assuming an initial nominal investment of \$100, growing at the compounded rate of %Return for a given period.

**Up Market Capture** - Up market by definition is positive benchmark return and up market capture represents the ratio in % terms of the average portfolios return over the benchmark during the up market period. The higher the value of the up market capture the better the product's performance.

**Yield to Maturity** - The rate of return achieved on a bond or other fixed income security assuming the security is bought and held to maturity and that the coupon interest paid over the life of the bond will be reinvested at the same rate of return. The 30-Day SEC Yield is similar to the Yield to Maturity and is reported for mutual funds.

**Yield to Worst** - The bond yield calculated by using the worst possible yield taking into consideration all call, put, and optional sink dates.



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