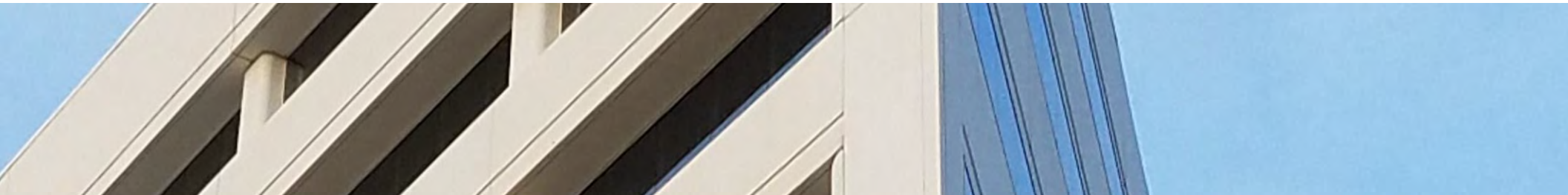




# WILSHIRE ASSOCIATES

Wilshire Consulting



California Public Employees' Retirement System  
Performance Review – December 31, 2018

Wilshire Consulting



# DECEMBER 2018 ASSET CLASS ASSUMPTIONS

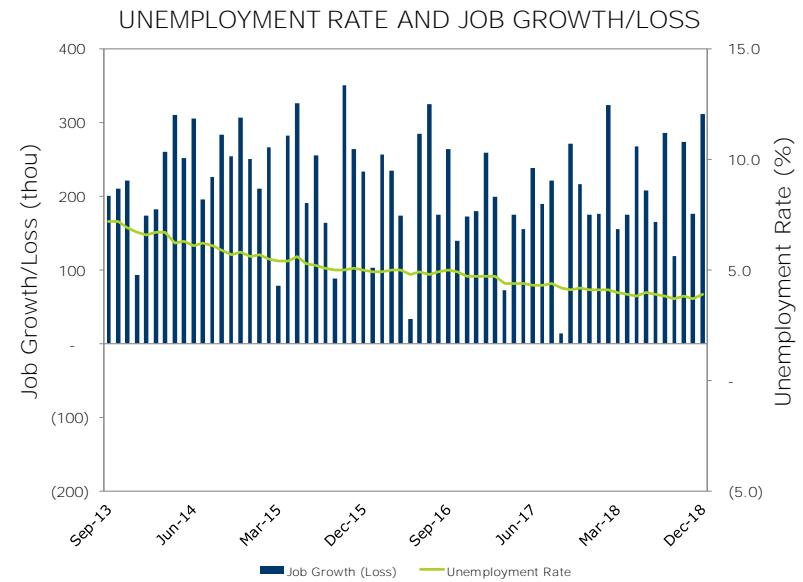
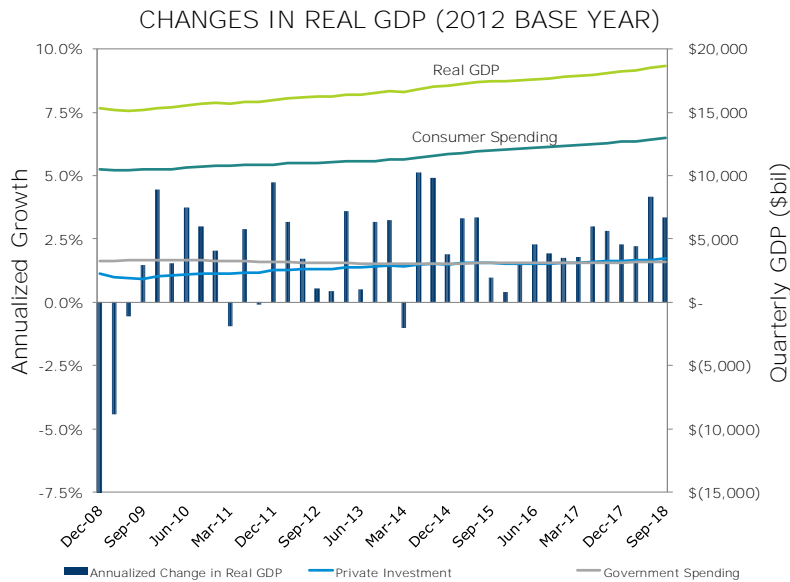
	EQUITY						FIXED INCOME						REAL ASSETS					
	US STOCK	DEV	EMG	GLOBAL		PRIVATE EQUITY	CASH	LT		US TIPS	HIGH YIELD	NON-US BOND (HDG)	REAL ESTATE			CMDTY	REAL ASSETS	US CPI
		EX-US STOCK	MRKT STOCK	EX-US STOCK	GLOBAL STOCK			CORE BOND	CORE BOND				US RES	GLOBAL RES	PRIVATE RE			
EXPECTED COMPOUND RETURN (%)	7.00	7.50	7.50	7.75	7.45	10.05	2.65	3.85	4.25	3.00	5.90	1.25	5.65	5.85	6.65	4.35	6.40	1.70
EXPECTED ARITHMETIC RETURN (%)	8.30	8.95	10.45	9.35	8.75	13.35	2.65	4.00	4.70	3.15	6.35	1.30	7.00	7.00	7.55	5.40	6.75	1.70
EXPECTED RISK (%)	17.00	18.00	26.00	18.80	17.05	28.00	1.25	5.15	9.85	6.00	10.00	3.50	17.00	15.80	14.00	15.00	8.75	1.75
CASH YIELD (%)	2.15	3.50	2.50	3.25	2.65	0.00	2.65	4.05	5.00	3.55	8.95	1.80	4.40	4.40	2.70	2.65	3.00	0.00
<b>CORRELATIONS</b>																		
US STOCK	1.00																	
DEV EX-US STOCK (USD)	0.81	1.00																
EMERGING MARKET STOCK	0.74	0.74	1.00															
GLOBAL EX-US STOCK	0.83	0.96	0.86	1.00														
GLOBAL STOCK	0.94	0.92	0.82	0.94	1.00													
PRIVATE EQUITY	0.74	0.64	0.62	0.67	0.74	1.00												
CASH EQUIVALENTS	-0.05	-0.09	-0.05	-0.08	-0.07	0.00	1.00											
CORE BOND	0.28	0.13	0.00	0.09	0.20	0.31	0.19	1.00										
LT CORE BOND	0.31	0.16	0.01	0.12	0.23	0.32	0.11	0.93	1.00									
US TIPS	-0.05	0.00	0.15	0.05	0.00	-0.03	0.20	0.60	0.47	1.00								
HIGH YIELD BOND	0.54	0.39	0.49	0.45	0.51	0.34	-0.10	0.25	0.32	0.05	1.00							
NON-US BOND (HDG)	0.16	0.25	-0.01	0.18	0.18	0.26	0.10	0.67	0.66	0.39	0.26	1.00						
US RE SECURITIES	0.59	0.47	0.44	0.49	0.56	0.50	-0.05	0.17	0.23	0.10	0.56	0.05	1.00					
GLOBAL RE SECURITIES	0.65	0.59	0.56	0.62	0.66	0.58	-0.05	0.17	0.22	0.11	0.62	0.03	0.94	1.00				
PRIVATE REAL ESTATE	0.54	0.44	0.44	0.47	0.52	0.51	-0.05	0.19	0.25	0.09	0.57	0.05	0.77	0.76	1.00			
COMMODITIES	0.25	0.34	0.39	0.38	0.32	0.27	0.00	-0.02	-0.02	0.25	0.29	-0.10	0.25	0.28	0.25	1.00		
REAL ASSET BASKET	0.42	0.43	0.50	0.48	0.47	0.43	0.01	0.24	0.25	0.41	0.53	0.06	0.65	0.69	0.69	0.59	1.00	
INFLATION (CPI)	-0.10	-0.15	-0.13	-0.15	-0.13	-0.10	0.10	-0.12	-0.12	0.15	-0.08	-0.08	0.05	0.03	0.05	0.44	0.26	1.00

# ECONOMIC REVIEW

AS OF DEC. 31, 2018 KEY ECONOMIC INDICATORS

CPI (ALL ITEMS)	MONTHLY CHANGE		CUMULATIVE CHANGE	
SEASONALLY ADJUSTED	Dec-18	-0.1	3-Mo.	0.3
	Nov-18	0.0	12-Mo.	1.9
	Oct-18	0.3	10-Yr. (Annual)	1.8
	10-Yr.	1.7		
BREAKEVEN INFLATION				
CONSUMER SENTIMENT	Dec-18	98.3		
U. OF MICHIGAN SURVEY	Nov-18	97.5		
	1-Yr. Ago	95.9	10-Yr. Avg	82.5
MANUFACTURING	Dec-18	54.1	CHANGE IN SECTOR	
INST. FOR SUPPLY MGMT	Nov-18	59.3	>50	Expansion
PURCHASING MNGRS' IDX	1-Yr. Avg.	58.8	<50	Contraction

Note: Seasonally adjusted CPI data is utilized to better reflect short-term pricing activity.



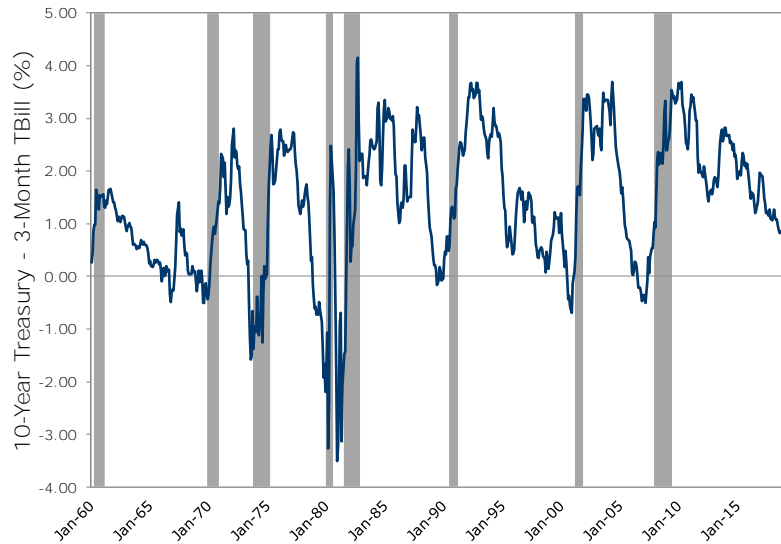
Data sources: Bureau of Labor Statistics, U.S. Treasury, University of Michigan, Institute for Supply Management, Bureau of Economic Analysis

# Wilshire Consulting

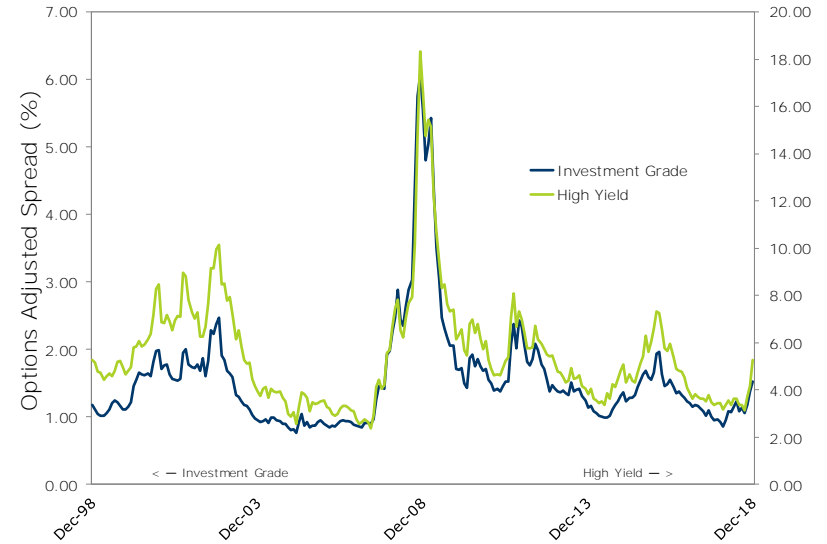
## RISK MONITOR



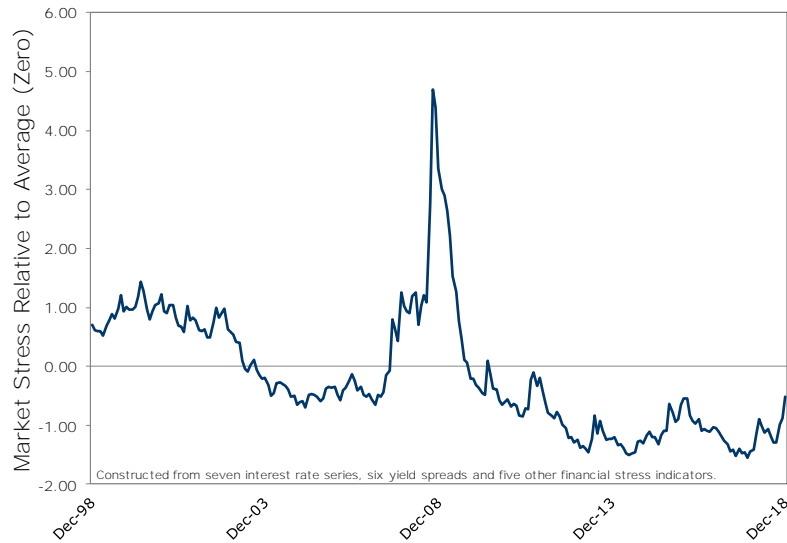
YIELD CURVE SLOPE VS RECESSIONS (IN GRAY)



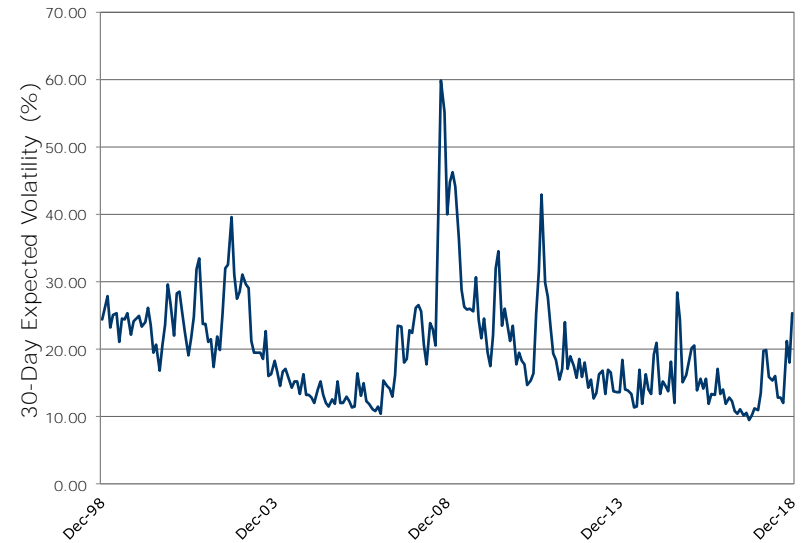
BLOOMBERG BARCLAYS CREDIT INDEXES



ST. LOUIS FED FINANCIAL STRESS INDEX



CBOE VOLATILITY INDEX

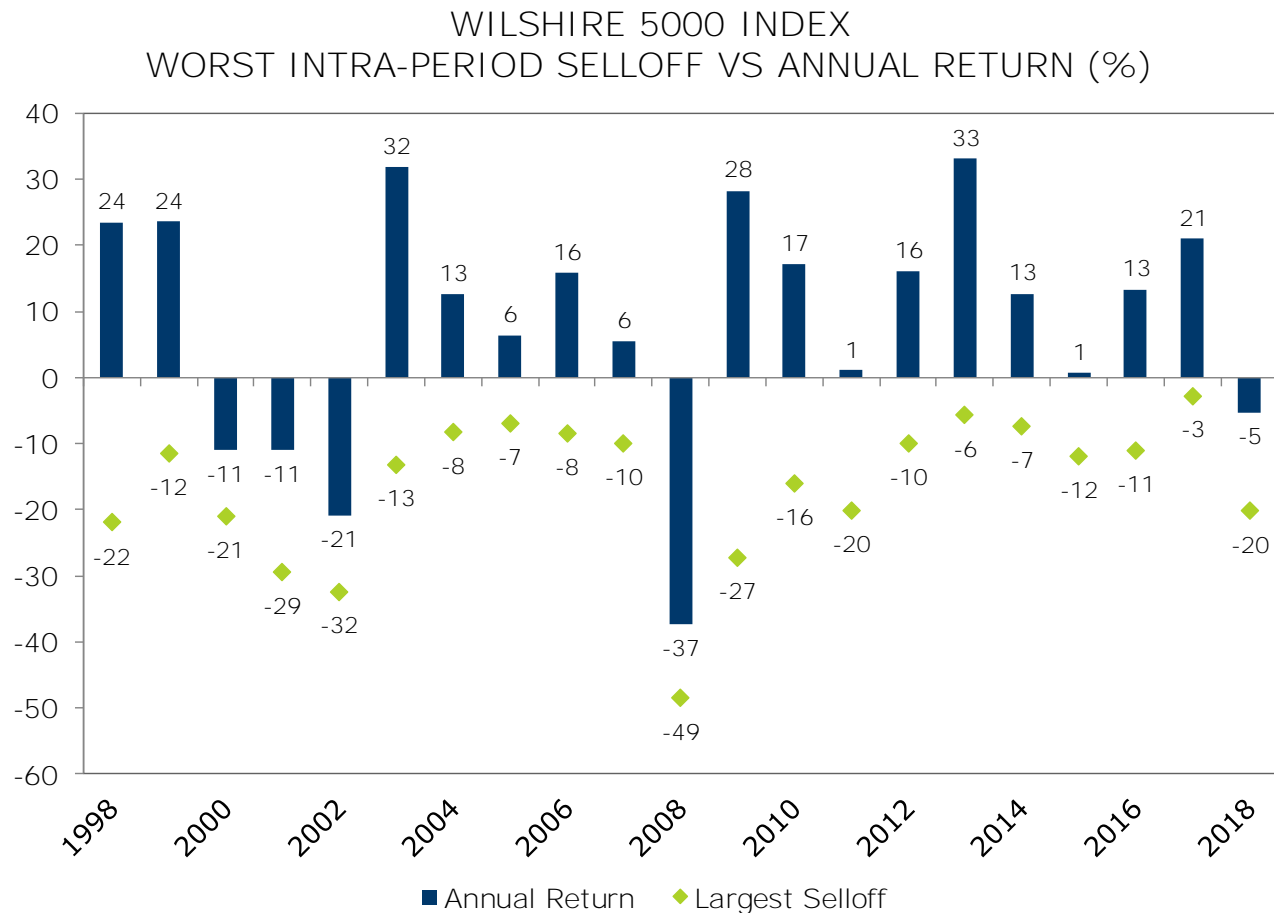


Data sources: Federal Reserve, Bloomberg Barclays

©2019 Wilshire Associates.

# ANNUAL EQUITY RETURNS

- 2018 was the first down year for the Wilshire 5000 Index since the global financial crisis
- While it was the mildest negative return in two decades, the market briefly entered a technical bear market (-20%) in late December





# Wilshire Consulting

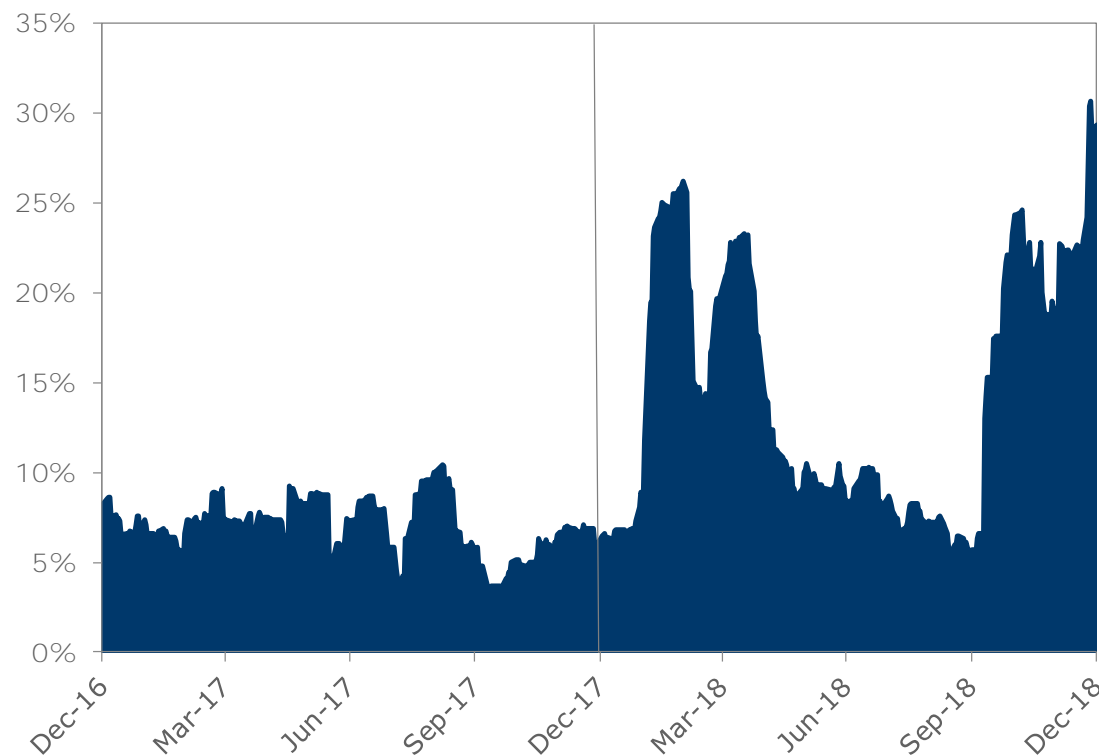
## EQUITY VOLATILITY

- Volatility returned to the equity markets after a tranquil 2017
- Investor concerns included monetary tightening, global trade and future economic growth

Since 1980	Year	Annual Volatility	Largest Drawdown	Number of Days Down:				Worst Down Day
				1%	2%	3%	4%	
Universe Statistics	Max Risk	40.56%	-48.54%	71	42	24	17	-17.23%
	Avg	15.48%	-13.97%	28.2	7.7	2.3	1.0	-4.00%
	Med	13.33%	-9.95%	23.0	4.0	1.0	0.0	-3.34%
	Min Risk	6.96%	-2.74%	3	0	0	0	-1.36%
2017	Level	6.96%	-2.75%	4	0	0	0	-1.85%
	Rank	1	2	2	1	1	1	7
2018	Level	16.86%	-20.18%	32	15	5	1	-4.02%
	Rank	29	31	25	33	32	27	27

The "Rank" statistics reflect ordinal rankings among 39 annual observations (i.e. ranks shown are X of 39)

Wilshire 5000 Index: 20-Day Rolling Risk





Wilshire Consulting

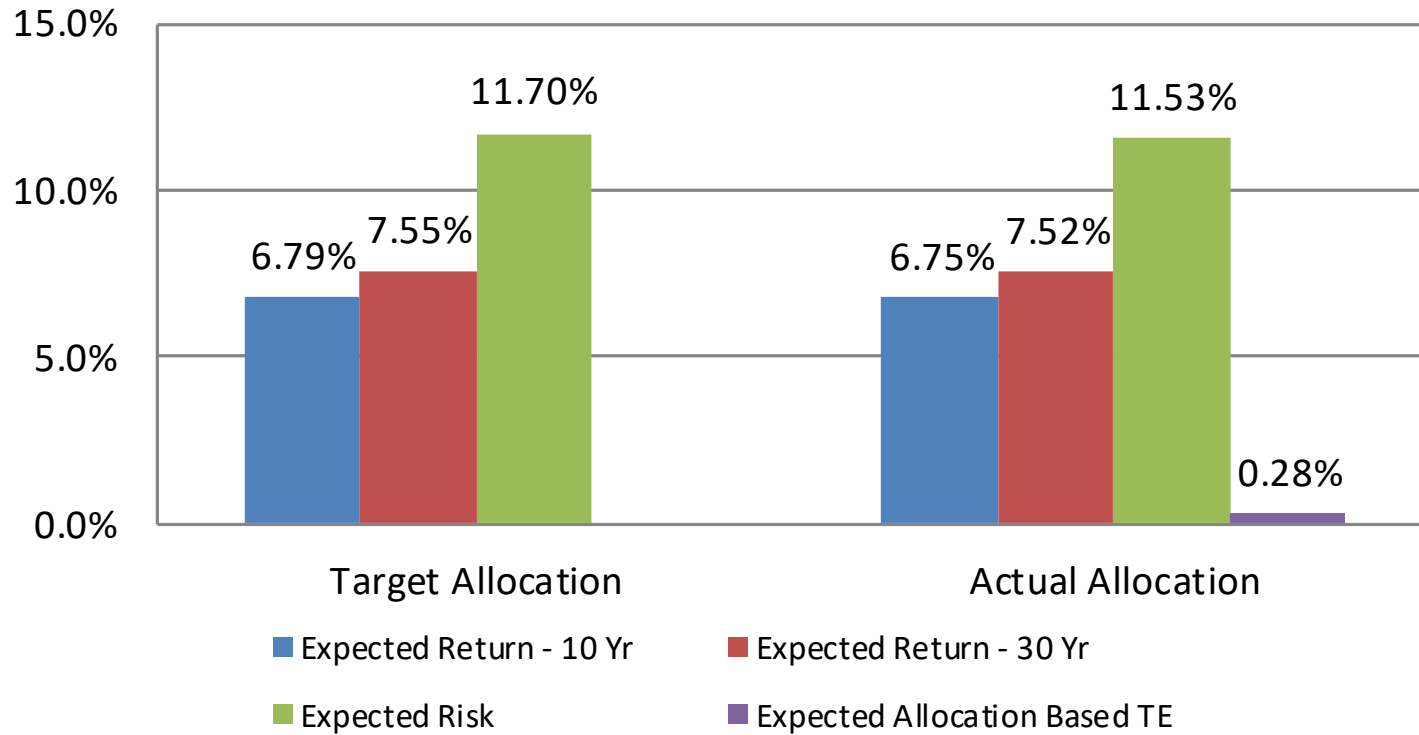
# ASSET CLASS PERFORMANCE

ASSET CLASS RETURNS - BEST TO WORST						ANNUALIZED 5-YEAR AS OF 12/2018
2013	2014	2015	2016	2017	2018 YTD	
U.S. Equity 33.1%	REITs 31.8%	REITs 4.2%	MLPs 18.3%	Emrg Mrkts 37.7%	T-Bills 1.9%	U.S. Equity 8.1%
MLPs 27.6%	U.S. Equity 12.7%	U.S. Equity 0.7%	High Yield 17.1%	Developed 25.6%	Core Bond 0.0%	REITs 7.9%
Developed 23.3%	Core Bond 6.0%	Core Bond 0.6%	U.S. Equity 13.4%	U.S. Equity 21.0%	U.S. TIPS -1.3%	High Yield 3.8%
High Yield 7.4%	MLPs 4.8%	T-Bills 0.1%	Commodities 11.8%	High Yield 7.5%	High Yield -2.1%	Core Bond 2.5%
REITs 1.9%	U.S. TIPS 3.6%	Developed -0.4%	Emrg Mrkts 11.6%	REITs 4.2%	REITs -4.8%	Emrg Mrkts 2.0%
T-Bills 0.1%	High Yield 2.5%	U.S. TIPS -1.4%	REITs 7.2%	Core Bond 3.6%	U.S. Equity -5.3%	U.S. TIPS 1.7%
Core Bond -2.0%	T-Bills 0.0%	High Yield -4.5%	U.S. TIPS 4.7%	U.S. TIPS 3.0%	Commodities -11.2%	Developed 1.0%
Emrg Mrkts -2.3%	Emrg Mrkts -1.8%	Emrg Mrkts -14.6%	Core Bond 2.6%	Commodities 1.7%	MLPs -12.4%	T-Bills 0.6%
U.S. TIPS -8.6%	Developed -4.5%	Commodities -24.7%	Developed 1.5%	T-Bills 0.8%	Developed -13.4%	MLPs -7.3%
Commodities -9.5%	Commodities -17.0%	MLPs -32.6%	T-Bills 0.3%	MLPs -6.5%	Emrg Mrkts -14.2%	Commodities -8.8%

Data sources: Wilshire Compass

Note: Developed asset class is developed equity markets ex-U.S., ex-Canada

# CalPERS Expected Return and Risk Estimates



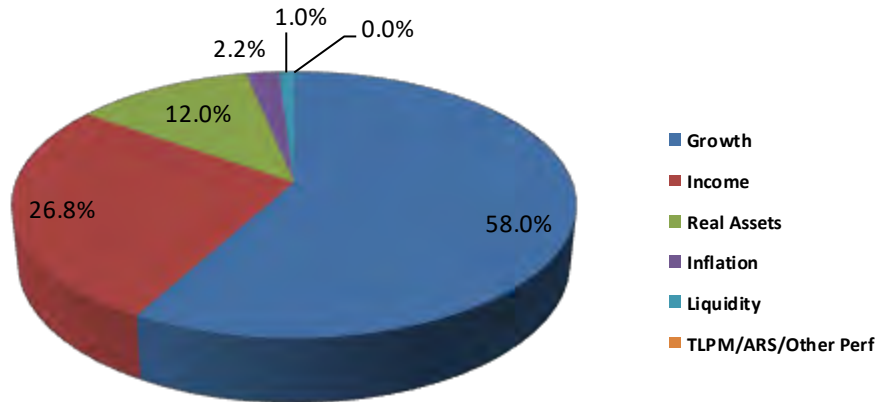




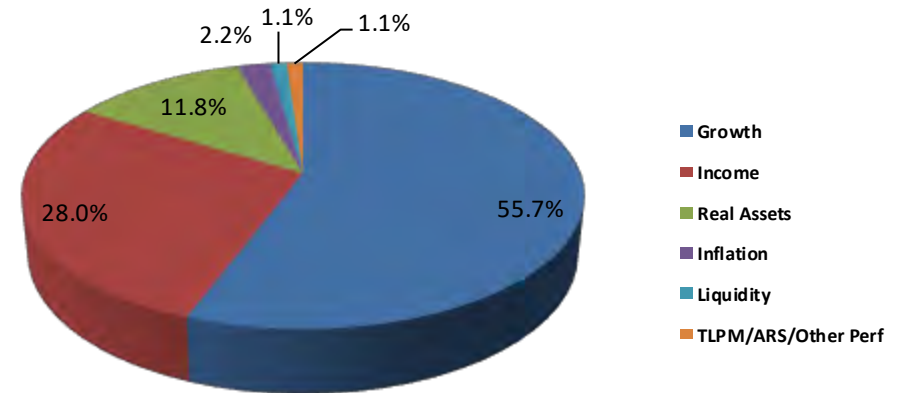
# Wilshire Consulting

## Asset and Risk Allocation

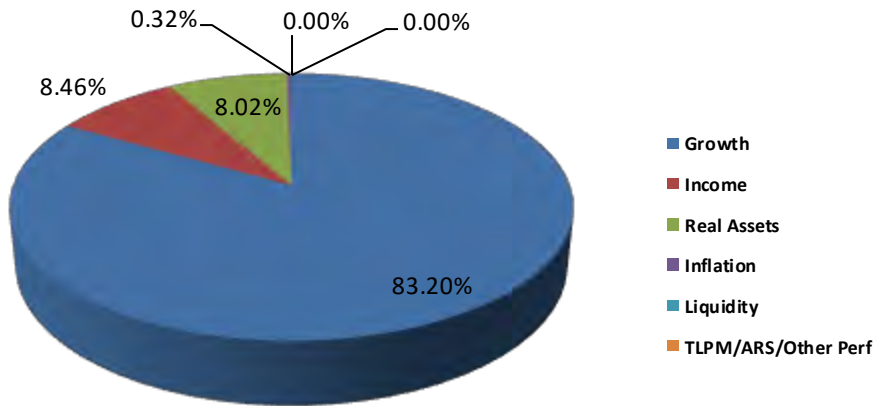
### Target Asset Allocation



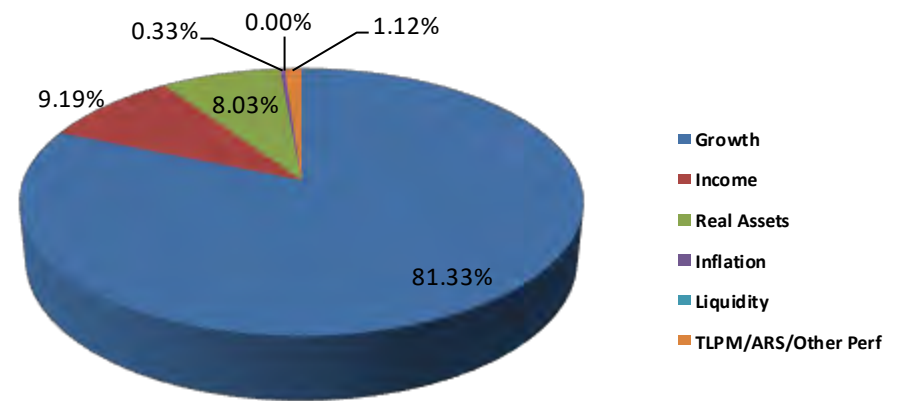
### Actual Asset Allocation



### Contribution to Total Risk - Target Allocation

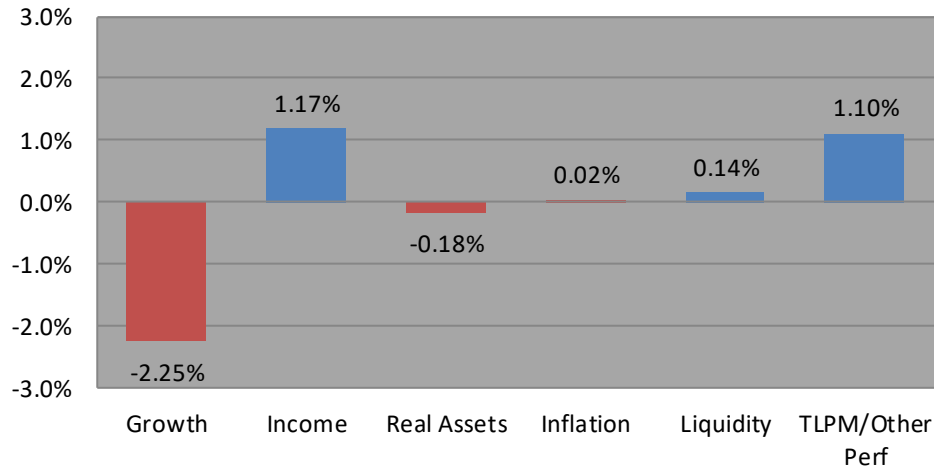


### Contribution to Total Risk - Actual Allocation

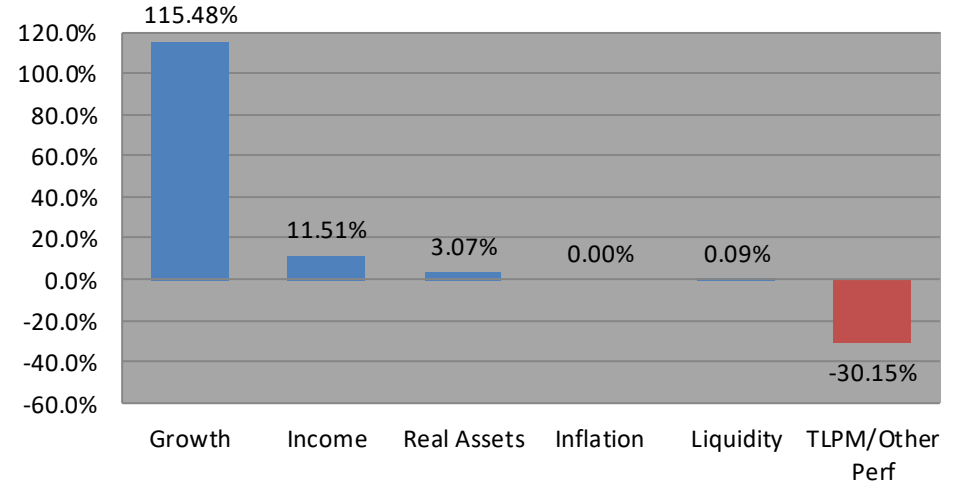


# Drivers of Expected Excess Risk

**CalPERS Asset Allocation Variance**



**Contribution to TF Tracking Error**



- This excess risk forecast is based on asset allocation variance only
- Other sources of risk (structural within asset classes, manager/program specific source of tracking error, covariance) are not considered here

Wilshire Consulting



# Total Fund – Performance

	Market Value	5-Year Ratios							
		Qtr	1-Year	3-Year	5-Year	10-Year	VaR	Sharpe	Info
<b>TOTAL FUND</b>	\$337.2 bil	-6.2%	-3.5%	6.3%	5.1%	7.9%	\$42.0 bil	0.8	-0.2
<i>Total Fund Policy Benchmark</i>		-5.7%	-2.7%	6.8%	5.3%	8.7%		0.8	0.0
<i>Actuarial Rate</i>		1.8%	7.3%	7.4%	7.5%	7.6%			
<b>GROWTH</b>	188.0	-10.6%	-6.1%	8.1%	5.8%	10.3%	\$38.3 bil	0.6	-0.3
<i>Growth Policy Benchmark</i>		-10.2%	-5.6%	9.0%	6.3%	11.1%		0.6	0.0
<b>PUBLIC EQUITY</b>	160.1	-12.5%	-8.9%	7.4%	4.8%	10.4%	\$31.2 bil	0.4	-0.1
<i>Public Equity Policy Benchmark</i>		-12.5%	-8.6%	7.4%	4.9%	10.4%		0.4	0.0
<b>PRIVATE EQUITY</b>	27.8	2.1%	12.5%	12.3%	11.3%	11.4%	\$10.7 bil	3.2	-0.2
<i>Private Equity Policy Benchmark</i>		4.5%	13.0%	17.5%	13.2%	14.5%		1.3	0.0
<b>INCOME</b>	94.3	0.9%	-1.8%	3.5%	3.7%	6.2%	\$7.2 bil	0.7	1.0
<i>Income Policy Benchmark</i>		0.9%	-2.2%	2.8%	3.2%	4.5%		0.6	0.0
<b>REAL ASSETS</b>	39.9	0.1%	4.2%	6.1%	9.0%	1.4%	\$5.7 bil	1.5	0.0
<i>Real Assets Policy Benchmark</i>		1.9%	7.5%	7.4%	9.1%	6.7%		2.3	0.0
<b>INFLATION</b>	7.5	-6.4%	-5.3%	2.3%	-2.1%	2.0%	\$0.5 bil	-0.5	0.8
<i>Inflation Policy Benchmark</i>		-6.6%	-5.4%	2.2%	-2.6%	1.3%		-0.5	0.0
<b>LIQUIDITY</b>	3.8	0.6%	2.2%	1.3%	1.2%	1.0%	\$0.0 bil	0.7	-0.1
<i>Liquidity Policy Benchmark</i>		0.5%	1.7%	1.0%	1.2%	1.1%		0.5	0.0
<b>ABSOLUTE RETURN STRATEGIES</b>	0.2	-.%	-.%	-.%	-.%	-.%		N/A	N/A
<i>Absolute Return Strategies Policy Benchmark</i>		-.%	-.%	-.%	-.%	-.%		N/A	N/A
<b>EXTERNAL MULTI-ASSET CLASS COMPOSITE</b>	2.4	-6.5%	-10.5%	1.7%	3.1%	-.%		N/A	N/A
<i>Total MAC Custom Benchmark</i>		-8.4%	-6.3%	5.2%	4.2%	-.%		N/A	N/A
<b>TRUST LEVEL PORTFOLIO MANAGEMENT / OTHER</b>	1.1	-.%	-.%	-.%	-.%	-.%		N/A	N/A
<b>TERMINATED AGENCY POOL</b>	0.1	0.4%	-1.6%	2.8%	3.8%	-.%		N/A	N/A
<b>TOTAL FUND PLUS TAP</b>	337.3	-6.2%	-3.5%	6.3%	5.1%	7.9%		N/A	N/A

Wilshire Consulting



# Total Fund – Attribution (Quarter)

**California Public Employees' Retirement System**  
**Total Fund Attribution - Quarter**  
**As of 12/31/2018**

Asset Class	Actual (%)		Policy (%)		Difference (%)		Total Fund Return Contribution (%)			
	Weight	Return	Weight	Return	Weight	Return	Actual Allocation	Interaction	Active Management	Total
<b>Growth</b>	55.65	-10.57	57.33	-10.20	-1.69	-0.37	0.09	0.01	-0.20	-0.10
Public Equity	47.73	-12.50	49.33	-12.47	-1.60	-0.03	0.11	0.00	-0.02	0.10
Private Equity	7.92	2.08	8.00	4.47	-0.08	-2.39	-0.02	0.01	-0.18	-0.20
<b>Income</b>	25.66	0.88	25.73	0.87	-0.07	0.01	-0.01	0.00	0.00	-0.01
<b>Real Assets</b>	11.24	0.09	12.00	1.86	-0.76	-1.77	-0.07	0.01	-0.20	-0.26
<b>Inflation</b>	3.23	-6.44	3.30	-6.61	-0.07	0.17	0.00	0.00	0.01	0.00
<b>Ext. MAC/ARS/TLPM/Other</b>	2.63	-8.16	0.00	-8.44	2.63	0.28	-0.08	0.01	0.00	-0.07
<b>Liquidity</b>	1.59	0.63	1.63	0.51	-0.04	0.11	0.00	0.00	0.00	0.01
<b>Monthly Linked Return</b>	<b>100.00</b>	<b>-6.13</b>	<b>100.00</b>	<b>-5.67</b>		<b>-0.45</b>	<b>-0.07</b>	<b>0.03</b>	<b>-0.39</b>	<b>-0.45</b>
<b>Trading/Hedging/Other</b>		-0.03		0.00		-0.03				<b>-0.03</b>
<b>Total</b>		<b>-6.15</b>		<b>-5.67</b>		<b>-0.48</b>				<b>-0.48</b>

Wilshire Consulting



# Total Fund – Attribution (Calendar YTD)

**California Public Employees' Retirement System  
Total Fund Attribution - Calendar Year-to-Date  
As of 12/31/2018**

Asset Class	Actual (%)		Policy (%)		Difference (%)		Total Fund Return Contribution (%)			
	Weight	Return	Weight	Return	Weight	Return	Actual Allocation	Interaction	Active Management	Total
<b>Growth</b>	56.64	-6.15	56.35	-5.60	0.29	-0.55	0.03	0.01	-0.27	-0.23
Public Equity	48.93	-8.90	48.35	-8.55	0.58	-0.34	0.09	0.00	-0.18	-0.09
Private Equity	7.71	12.47	8.00	13.04	-0.29	-0.58	-0.05	0.00	-0.07	-0.12
<b>Income</b>	22.05	-1.82	22.63	-2.17	-0.59	0.35	0.05	0.00	0.07	0.12
<b>Real Assets</b>	10.77	4.21	12.25	7.53	-1.48	-3.32	-0.12	0.02	-0.37	-0.47
<b>Inflation</b>	5.85	-5.28	5.98	-5.41	-0.13	0.13	-0.02	0.00	0.00	-0.01
<b>Ext. MAC/ARS/TLPM/Other</b>	1.45	-11.97	0.00	-2.85	1.45	-9.12	-0.06	-0.08	0.00	-0.14
<b>Liquidity</b>	3.24	2.21	2.78	1.74	0.46	0.47	0.00	0.00	0.01	0.01
<b>Monthly Linked Return</b>	<b>100.00</b>	<b>-3.45</b>	<b>100.00</b>	<b>-2.73</b>		<b>-0.72</b>	<b>-0.12</b>	<b>-0.05</b>	<b>-0.56</b>	<b>-0.72</b>
<b>Trading/Hedging/Other</b>		-0.05		0.00		-0.05				<b>-0.05</b>
<b>Total</b>		<b>-3.51</b>		<b>-2.73</b>		<b>-0.77</b>				<b>-0.77</b>

Wilshire Consulting

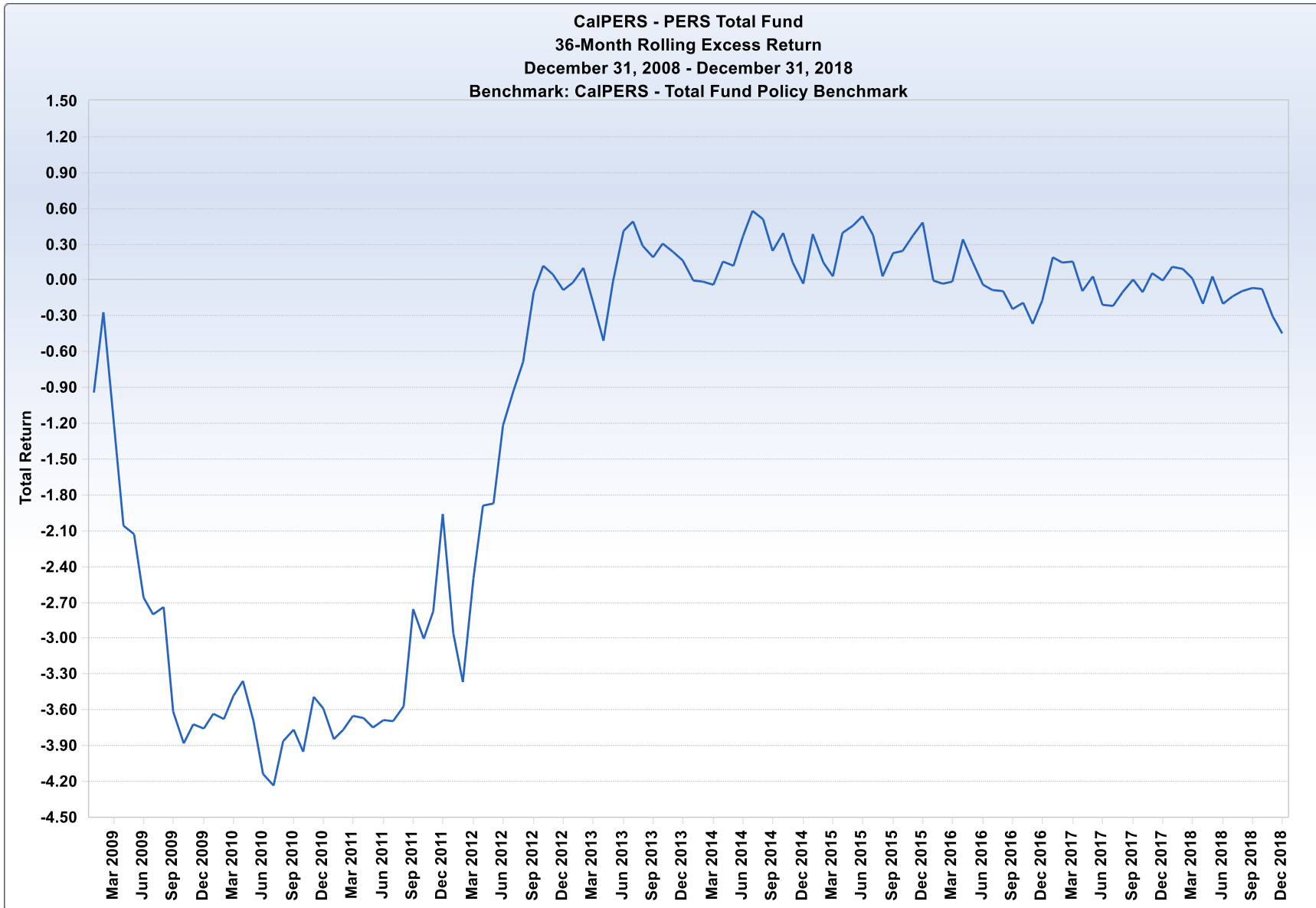


# Total Fund – Attribution (Fiscal YTD)

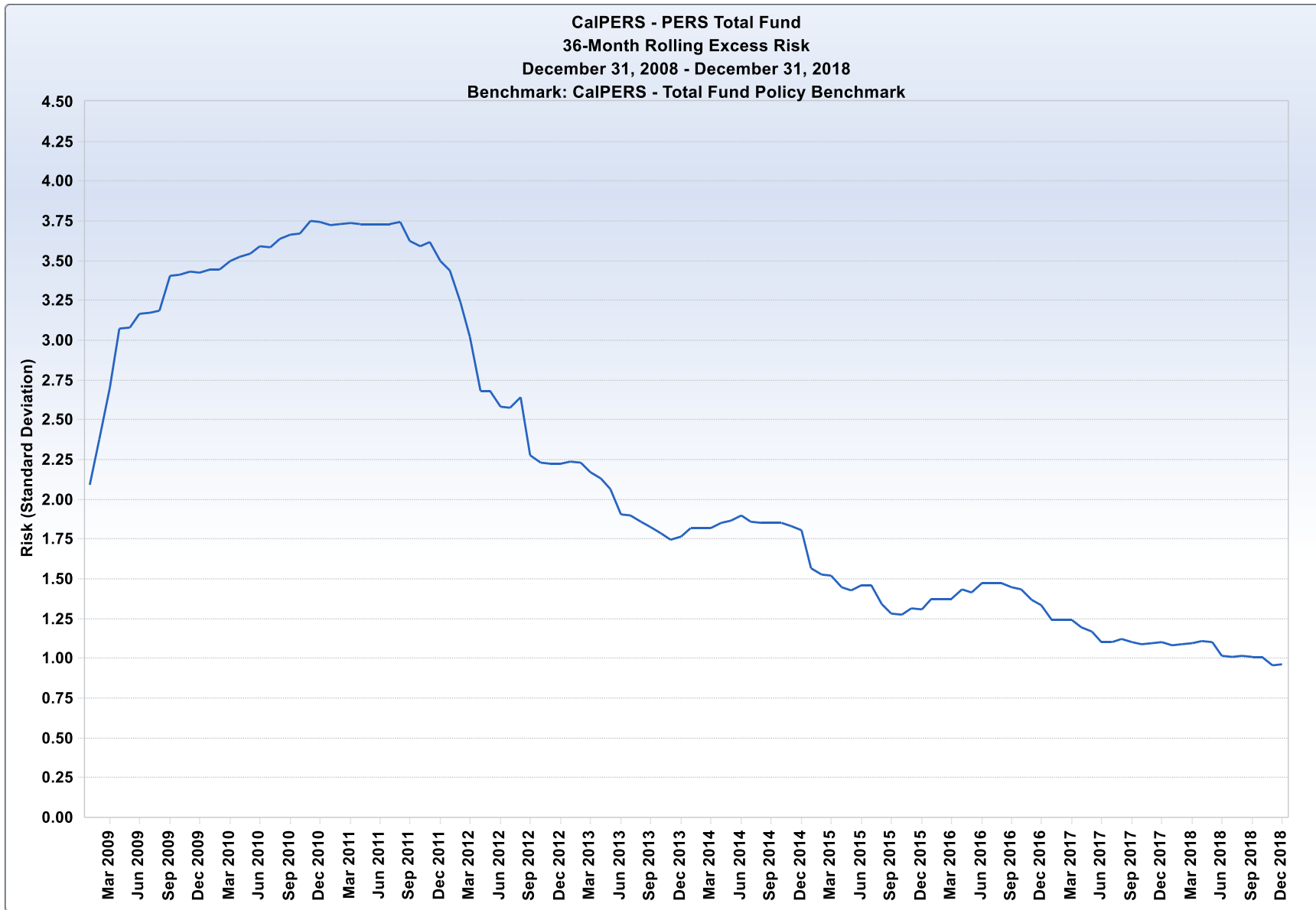
**California Public Employees' Retirement System  
Total Fund Attribution - Fiscal Year-to-Date  
As of 12/31/2018**

Asset Class	Actual (%)		Policy (%)		Difference (%)		Total Fund Return Contribution (%)			
	Weight	Return	Weight	Return	Weight	Return	Actual Allocation	Interaction	Active Management	Total
<b>Growth</b>	56.08	-6.78	57.20	-6.77	-1.12	-0.01	0.09	0.00	0.02	0.11
Public Equity	48.29	-8.78	49.20	-8.78	-0.91	0.00	0.11	0.00	0.00	0.11
Private Equity	7.79	6.31	8.00	5.91	-0.21	0.40	-0.02	0.00	0.02	0.00
<b>Income</b>	24.25	0.49	24.27	0.40	-0.02	0.09	-0.02	0.00	0.02	0.00
<b>Real Assets</b>	10.99	0.85	12.00	3.71	-1.01	-2.85	-0.06	0.02	-0.33	-0.37
<b>Inflation</b>	4.37	-6.91	4.47	-7.07	-0.09	0.17	0.00	0.00	0.01	0.01
<b>Ext. MAC/ARS/TLPM/Other</b>	2.01	-6.30	0.00	-6.30	2.01	0.00	-0.09	0.01	0.00	-0.07
<b>Liquidity</b>	2.30	1.22	2.07	0.98	0.23	0.24	-0.01	0.00	0.00	0.00
<b>Monthly Linked Return</b>	<b>100.00</b>	<b>-3.90</b>	<b>100.00</b>	<b>-3.54</b>		<b>-0.35</b>	<b>-0.08</b>	<b>0.03</b>	<b>-0.28</b>	<b>-0.35</b>
<b>Trading/Hedging/Other</b>		-0.04		0.00		-0.04				<b>-0.04</b>
<b>Total</b>		<b>-3.94</b>		<b>-3.54</b>		<b>-0.40</b>				<b>-0.40</b>

# Total Fund – Rolling Excess Returns



# Total Fund – Rolling Tracking Error



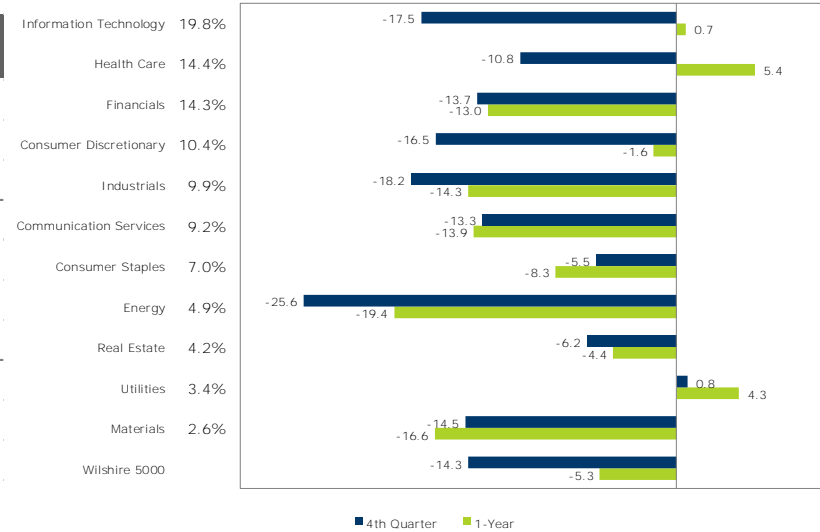


# Wilshire Consulting U.S. EQUITY MARKET

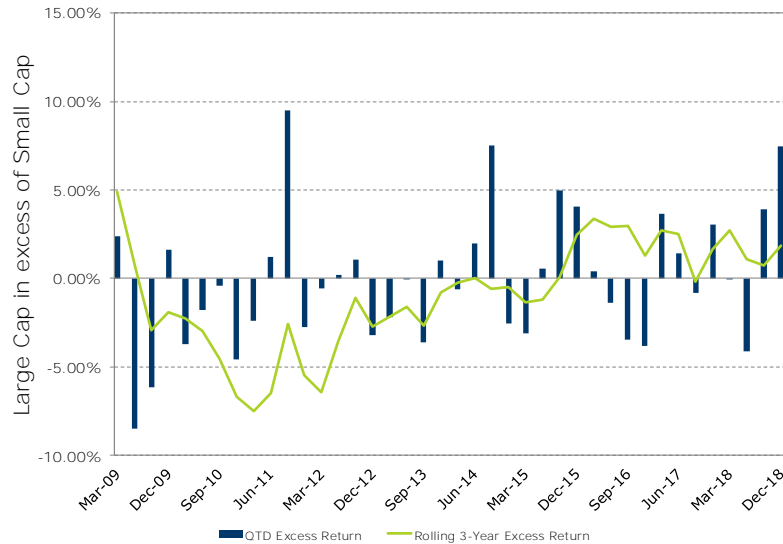


AS OF DECEMBER 31, 2018	QTR	YTD	1 YR	3 YR	5 YR	10 YR
WILSHIRE 5000 INDEX	-14.3	-5.3	-5.3	9.1	8.1	13.2
WILSHIRE U.S. LARGE CAP	-13.7	-4.6	-4.6	9.3	8.5	13.1
WILSHIRE U.S. SMALL CAP	-19.7	-10.8	-10.8	7.4	4.7	13.9
WILSHIRE U.S. LARGE GROWTH	-16.8	-3.6	-3.6	10.3	9.6	14.6
WILSHIRE U.S. LARGE VALUE	-10.8	-5.9	-5.9	8.1	7.2	11.6
WILSHIRE U.S. SMALL GROWTH	-20.6	-9.7	-9.7	8.1	4.5	14.7
WILSHIRE U.S. SMALL VALUE	-18.7	-12.0	-12.0	6.5	4.7	12.9
WILSHIRE REIT INDEX	-6.9	-4.8	-4.8	2.1	7.9	12.2
MSCI USA MIN. VOL. INDEX	-7.7	0.9	0.9	9.5	9.8	12.6
FTSE RAFI U.S. 1000 INDEX	-13.8	-8.3	-8.3	7.9	6.6	14.1

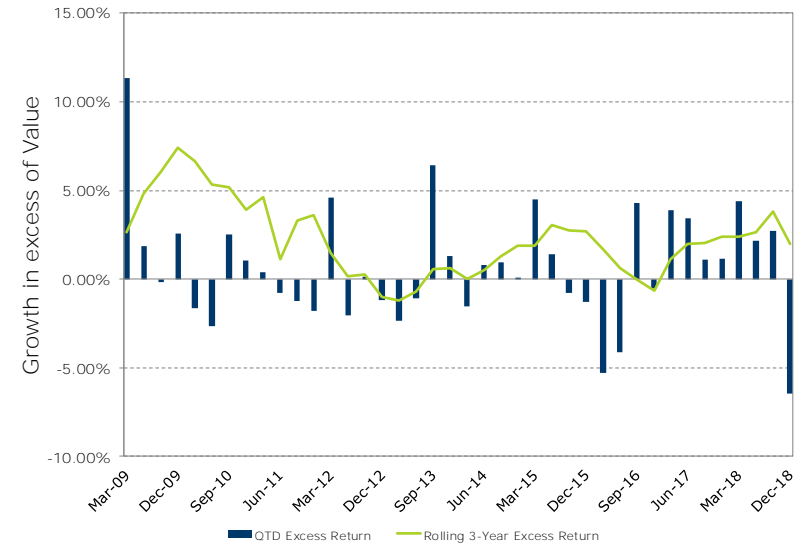
WILSHIRE 5000 SECTOR WEIGHT & RETURN (%)



LARGE CAP VS SMALL CAP



GROWTH VS VALUE



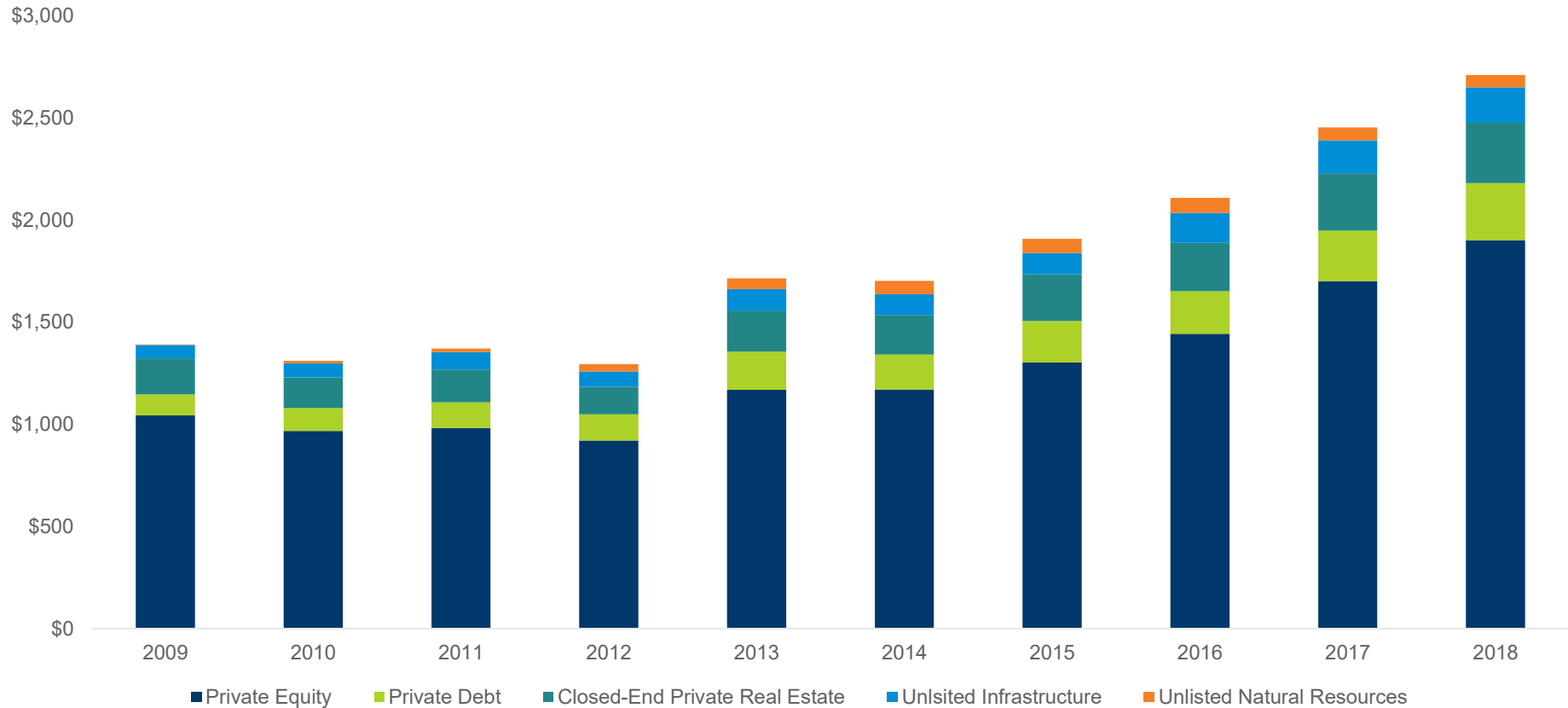
Data sources: Wilshire Compass, Wilshire Atlas



Wilshire Private Markets

# PRIVATE CAPITAL DRY POWDER

Private Capital Dry Powder by Fund Type (2009 - Q4 2018)

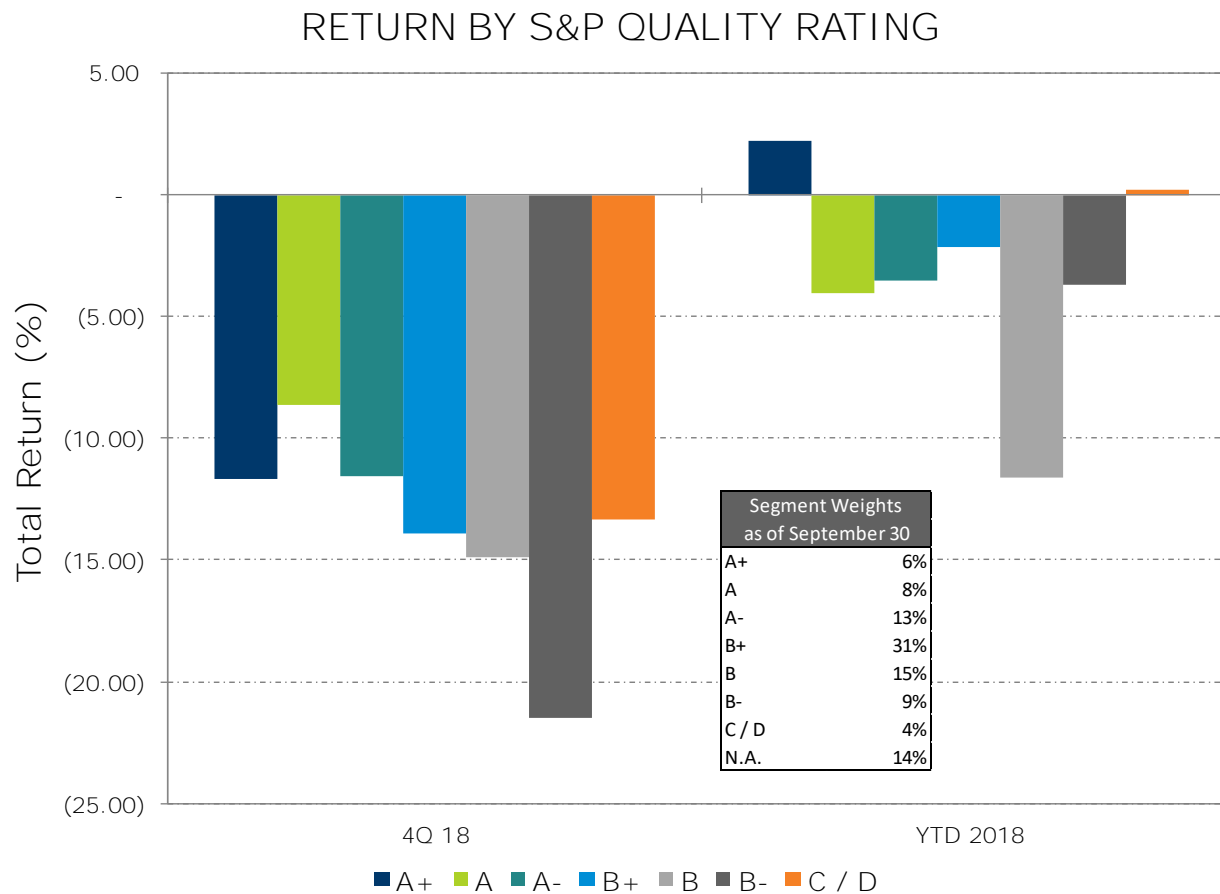


- Global private capital dry powder continues to increase, topping \$2 trillion across all fund types
- Private equity comprises just under 70% of total dry powder in the market as of Q4 2018

Source: Preqin, as of December 31, 2018.

# RETURNS BY QUALITY SEGMENT

Highest quality names produced a positive return for the year but are among the lowest weight within the broad market

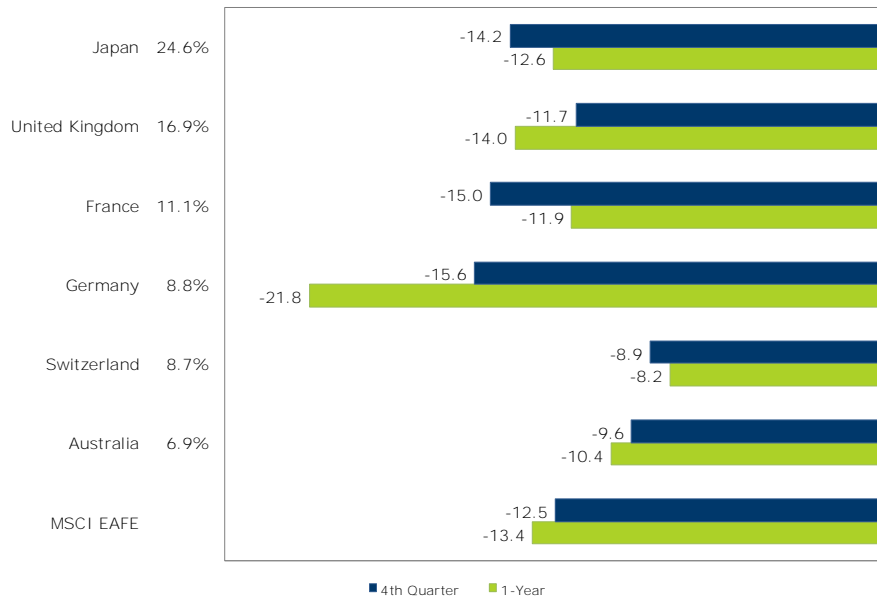


Data sources: Wilshire Atlas

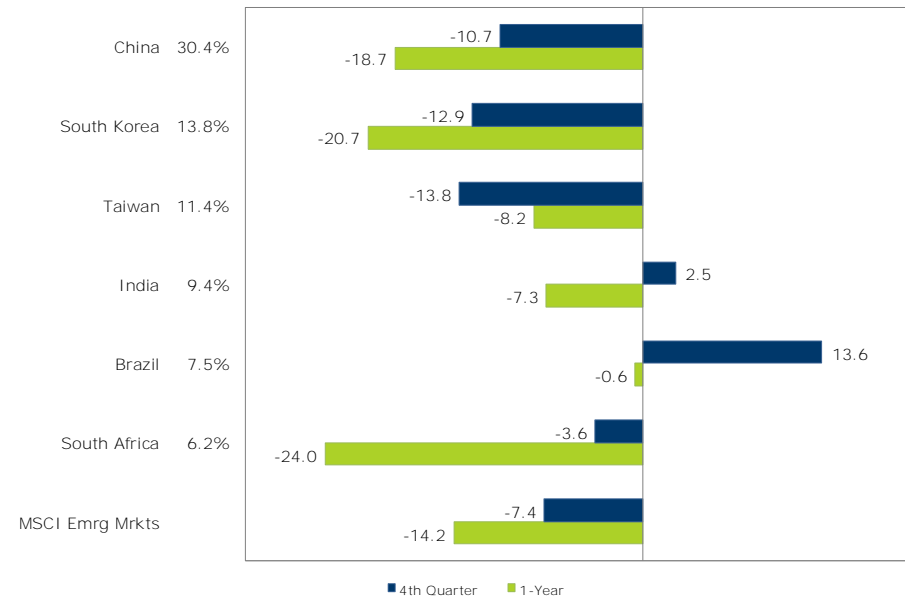
# NON-U.S. EQUITY MARKET

AS OF DECEMBER 31, 2018	QTR	YTD	1 YR	3 YR	5 YR	10 YR
MSCI ACWI EX-US (\$G)	-11.4	-13.8	-13.8	5.0	1.1	7.1
MSCI EAFE (\$G)	-12.5	-13.4	-13.4	3.4	1.0	6.8
MSCI EMERGING MARKETS (\$G)	-7.4	-14.2	-14.2	9.6	2.0	8.4
MSCI FRONTIER MARKETS (\$G)	-4.3	-16.2	-16.2	4.6	1.1	5.4
MSCI ACWI EX-US GROWTH (\$G)	-12.2	-14.1	-14.1	4.6	2.1	7.5
MSCI ACWI EX-US VALUE (\$G)	-10.6	-13.4	-13.4	5.4	0.2	6.6
MSCI ACWI EX-US SMALL (\$G)	-14.4	-17.9	-17.9	4.4	2.4	10.5
MSCI ACWI MINIMUM VOLATILITY	-6.5	-1.0	-1.0	8.3	7.9	10.5
MSCI EAFE MINIMUM VOLATILITY	-7.3	-5.2	-5.2	4.5	5.4	8.1
FTSE RAFI DEVELOPED EX-US	-12.8	-14.5	-14.5	4.9	0.9	7.3
MSCI EAFE LC (G)	-12.2	-10.5	-10.5	3.1	4.3	8.0

MSCI EAFE: LARGEST COUNTRIES & RETURN (USD)



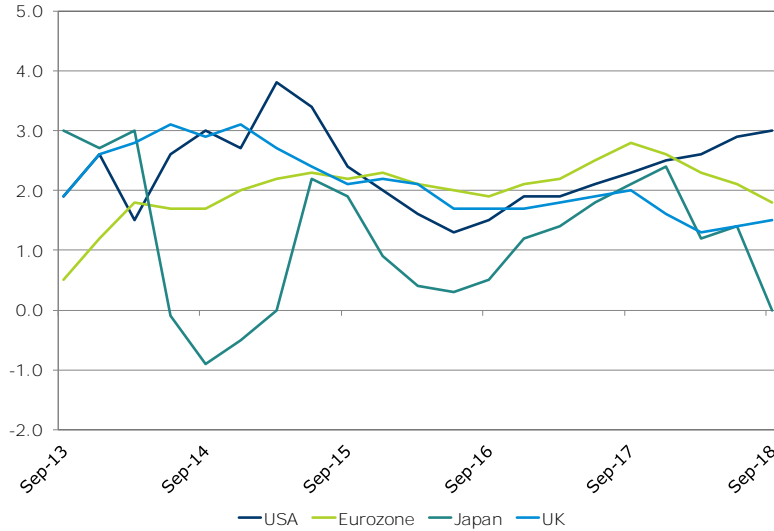
MSCI EM: LARGEST COUNTRIES & RETURN (USD)



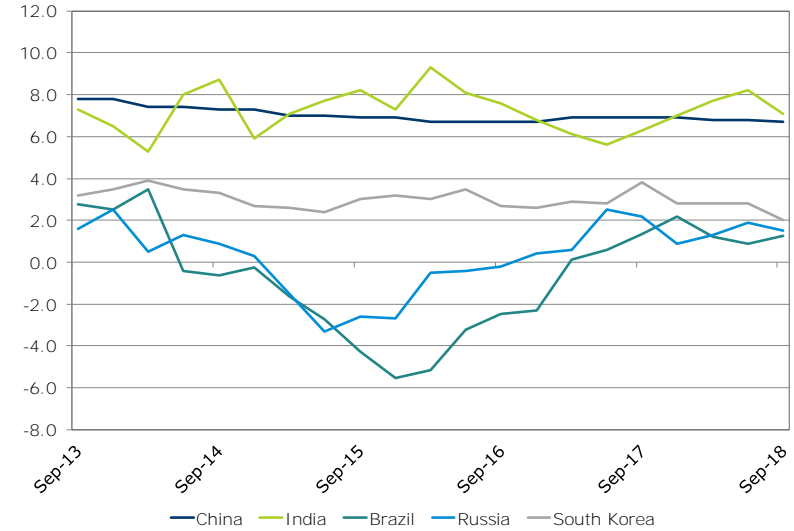
Data sources: Wilshire Compass

# NON-U.S. GROWTH AND INFLATION

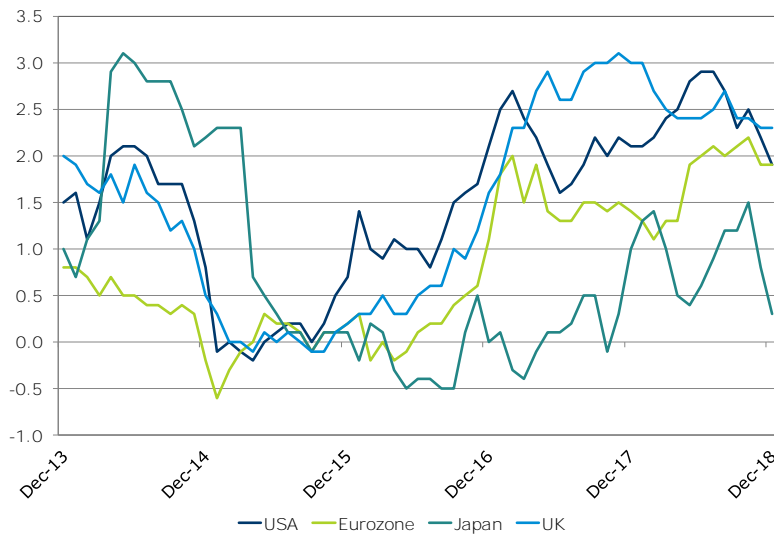
DEVELOPED MARKETS REAL GDP GROWTH YoY (%)



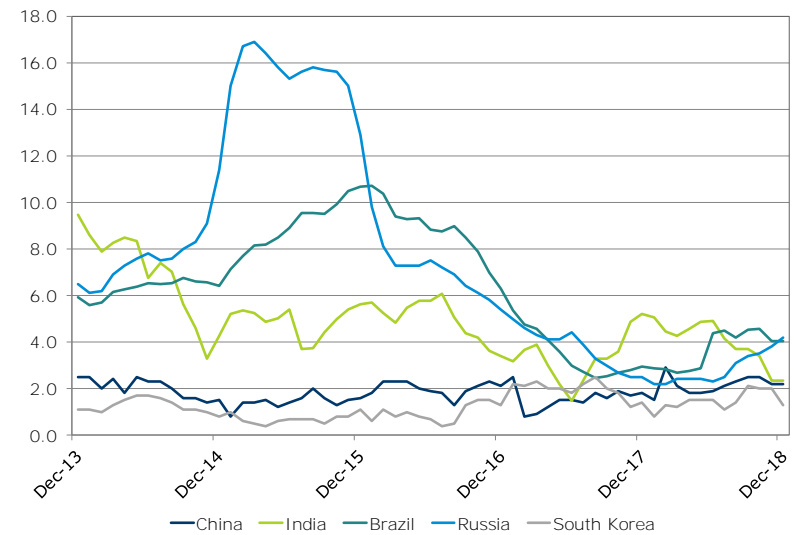
EMERGING MARKETS REAL GDP GROWTH YoY (%)



DEVELOPED MARKETS CPI GROWTH YoY (%)



EMERGING MARKETS CPI GROWTH YoY (%)



Data sources: Bloomberg

©2019 Wilshire Associates.



Wilshire Consulting

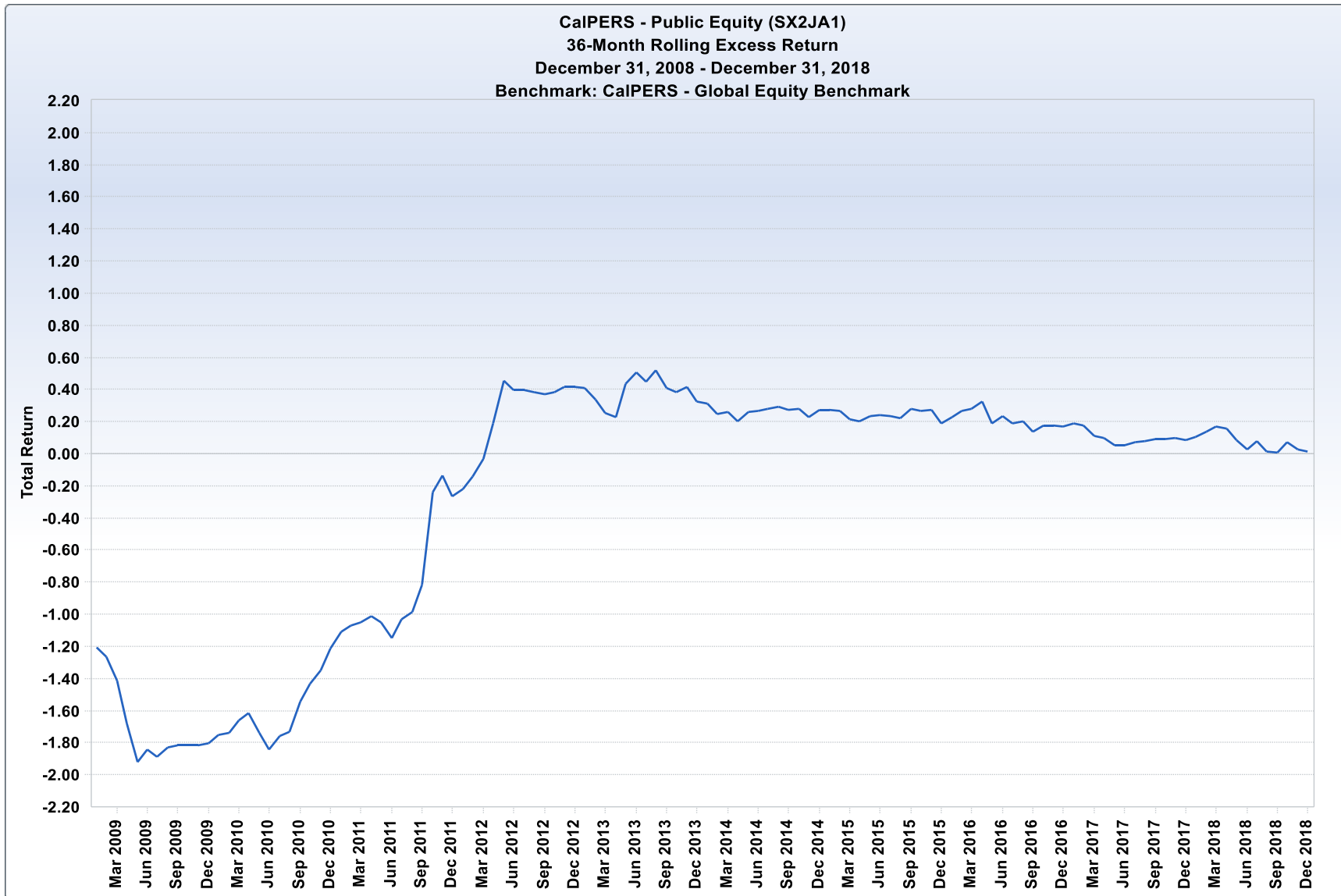
# Growth: Public Equity – Performance

	<b>Market Value</b>	<b>Qtr</b>	<b>1-Year</b>	<b>3-Year</b>	<b>5-Year</b>	<b>10-Year</b>	<b>VaR</b>	<b>5-year Sharpe Ratio</b>	<b>5-year Info Ratio</b>
<b>PUBLIC EQUITY</b>	<b>160.1</b>	<b>-12.5%</b>	<b>-8.9%</b>	<b>7.4%</b>	<b>4.8%</b>	<b>10.4%</b>	<b>\$31.2 bil</b>	<b>0.4</b>	<b>-0.1</b>
<i>Custom Global Public Equity BM</i>		-12.5%	-8.6%	7.4%	4.9%	10.4%		<b>0.4</b>	<b>0.0</b>
<i>Value Added</i>		0.0%	-0.3%	0.0%	-0.1%	0.0%			



Wilshire Consulting

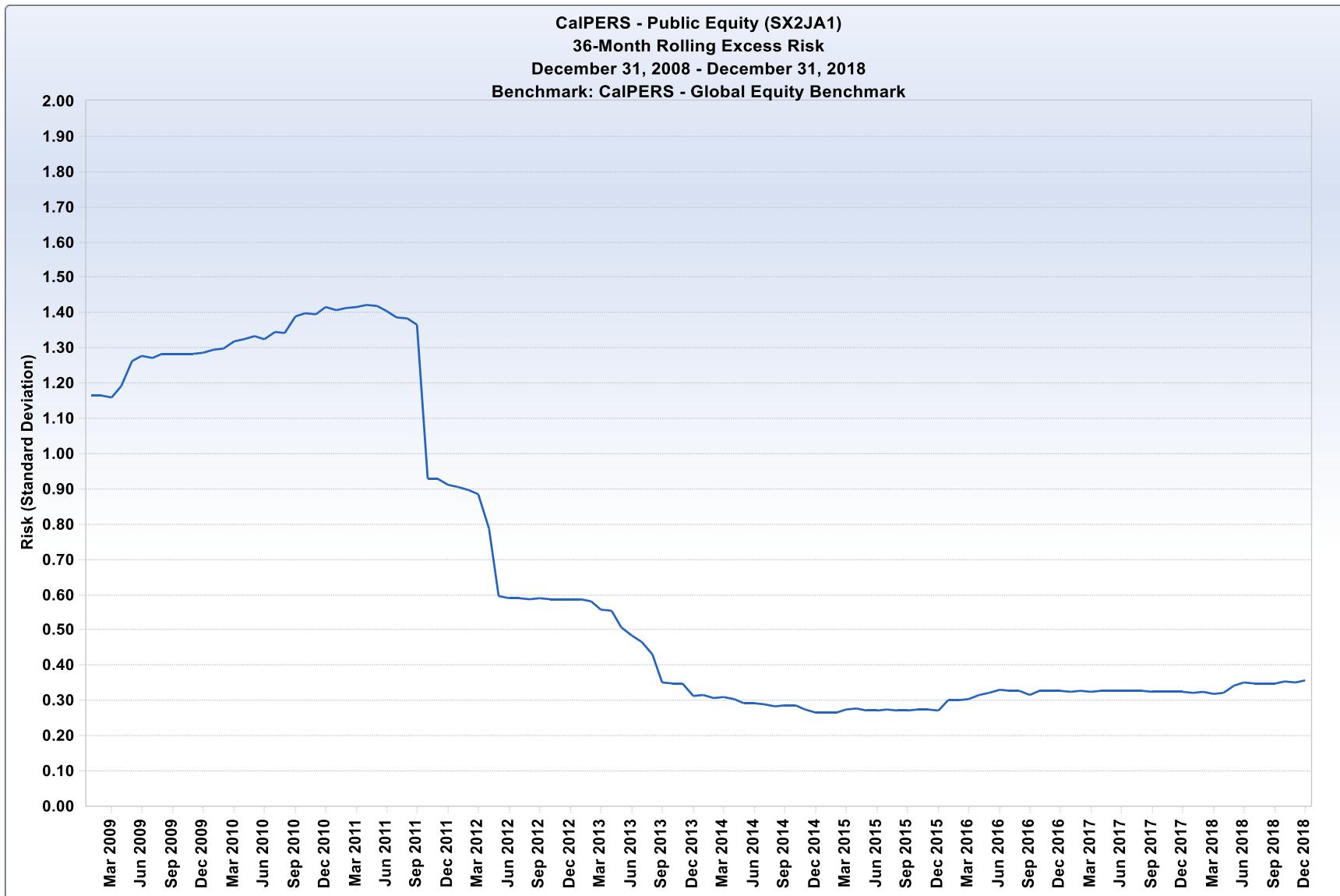
# Growth: Public Equity – Rolling Excess Returns





Wilshire Consulting

# Growth: Public Equity – Rolling Tracking Error



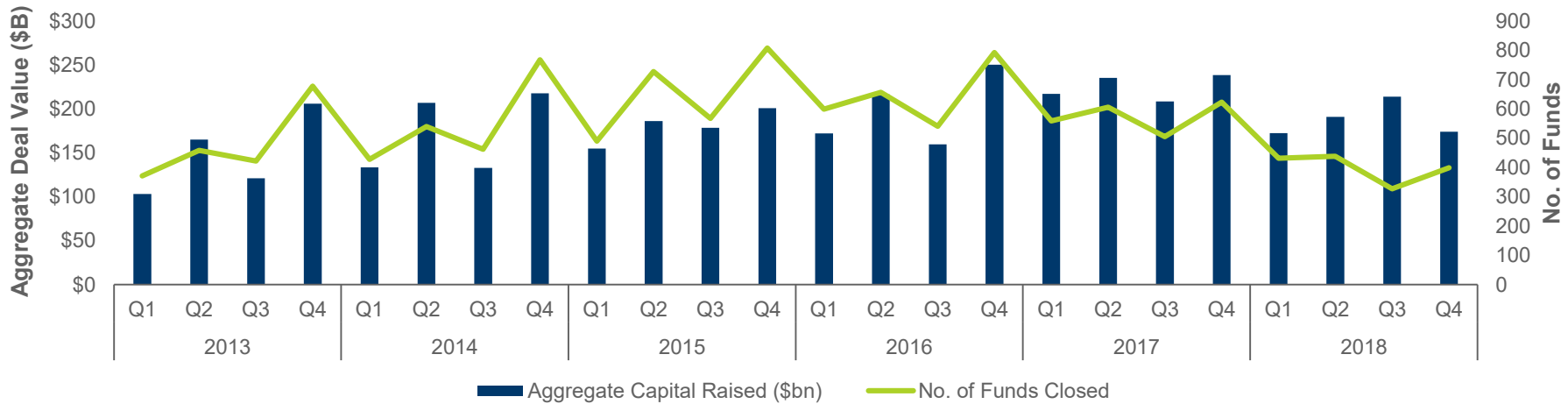




Wilshire Private Markets

# PRIVATE EQUITY – FUNDRAISING & INVESTMENT ACTIVITY

Global Quarterly Private Capital Fundraising (Q1 2013 – Q4 2018)



Global Annual Private Equity-Backed Buyout Activity (Q1 2013 – Q4 2018)

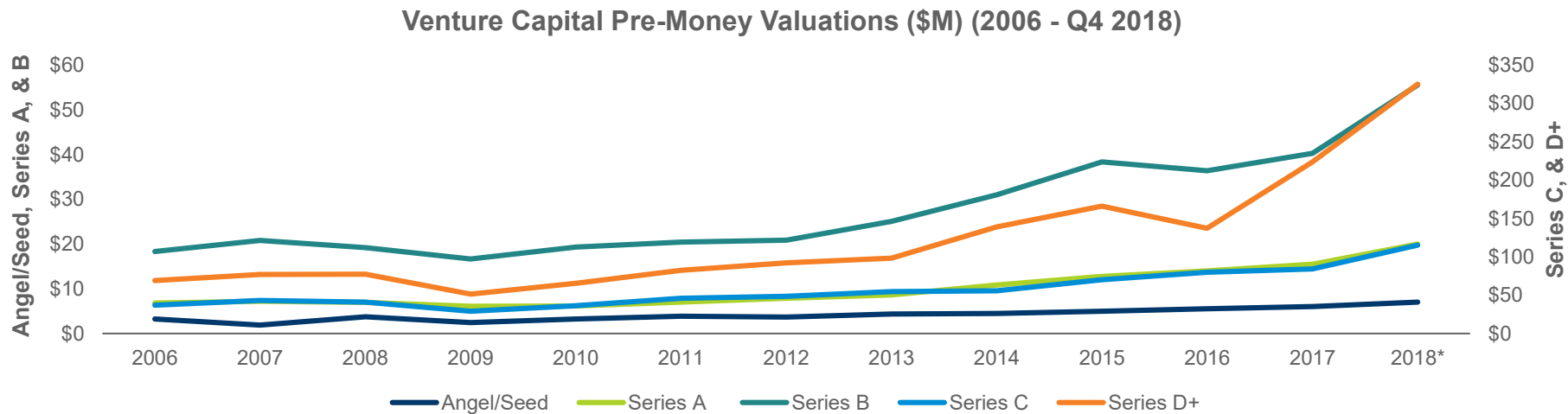
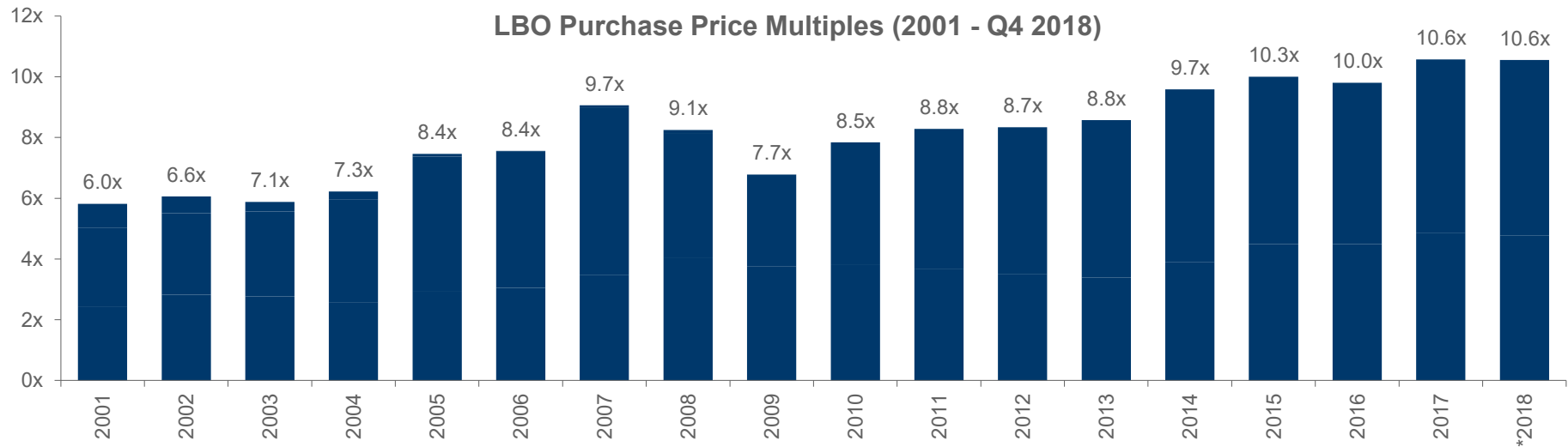


Source: Preqin, as of December 31, 2018.



Wilshire Private Markets

# PRIVATE EQUITY – PRICING & VALUATIONS



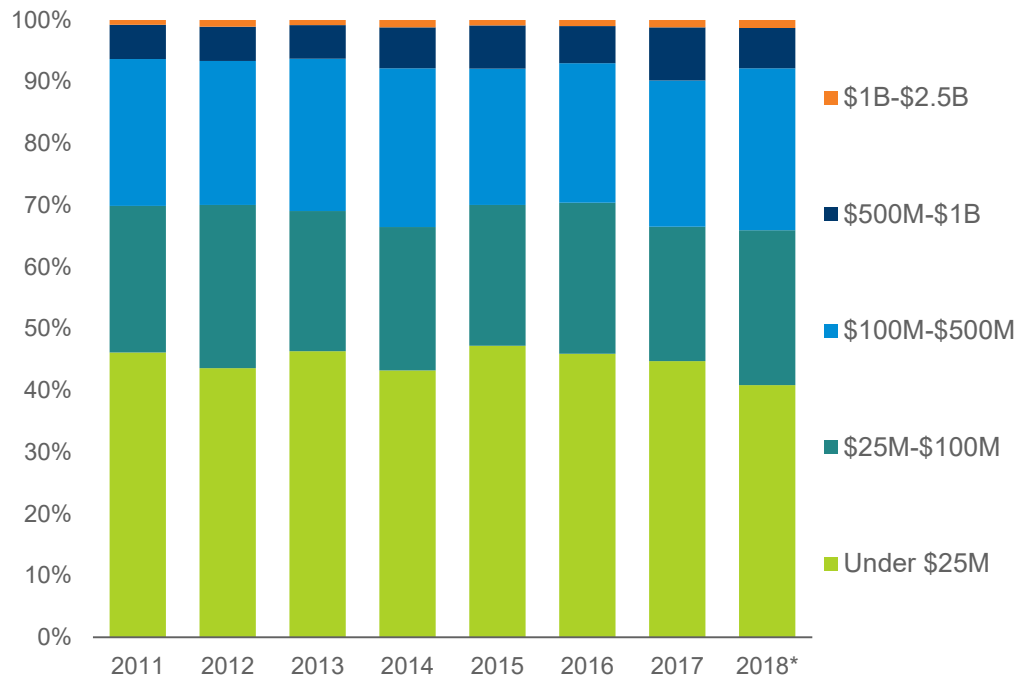
Source: S&P LBO; PitchBook, \*as of December 31, 2018.



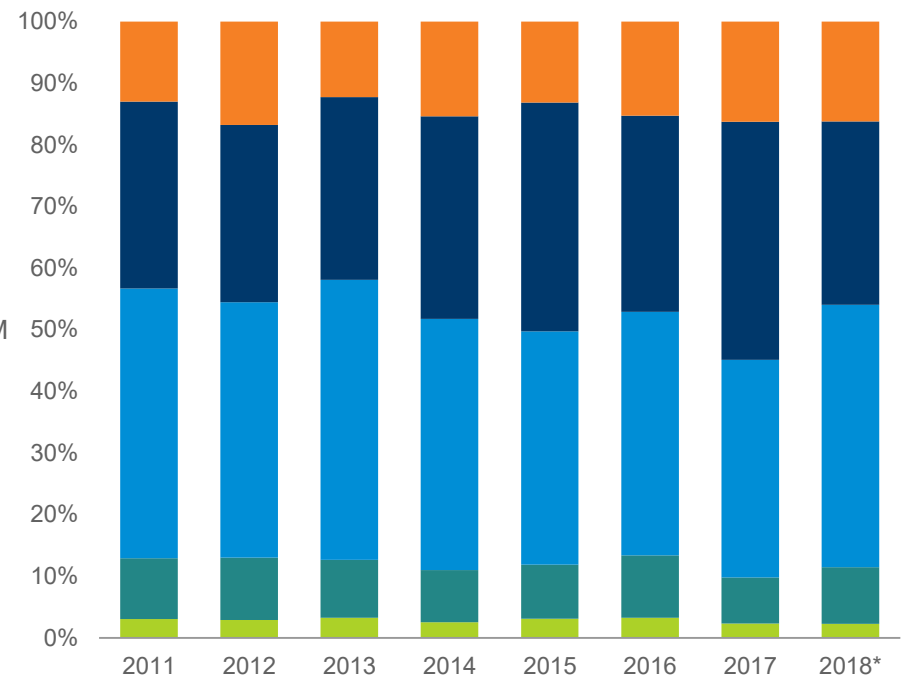
Wilshire Private Markets

# U.S. INVESTMENT ACTIVITY BY DEAL SIZE

Percentage of Deal Volume by Deal Size (by Count)



Percentage of Deal Volume by Deal Size (by Dollars)



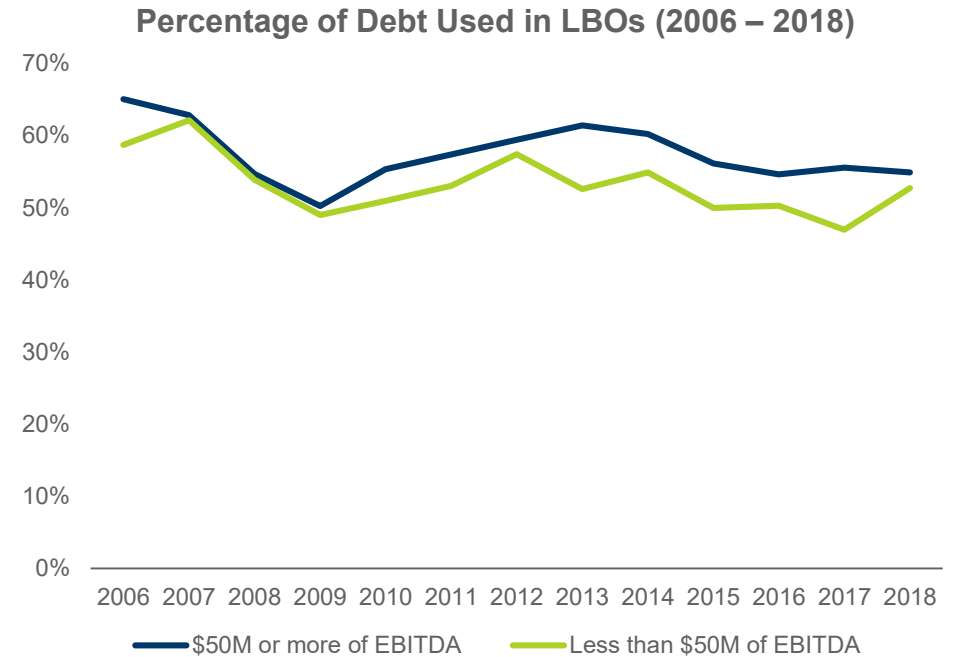
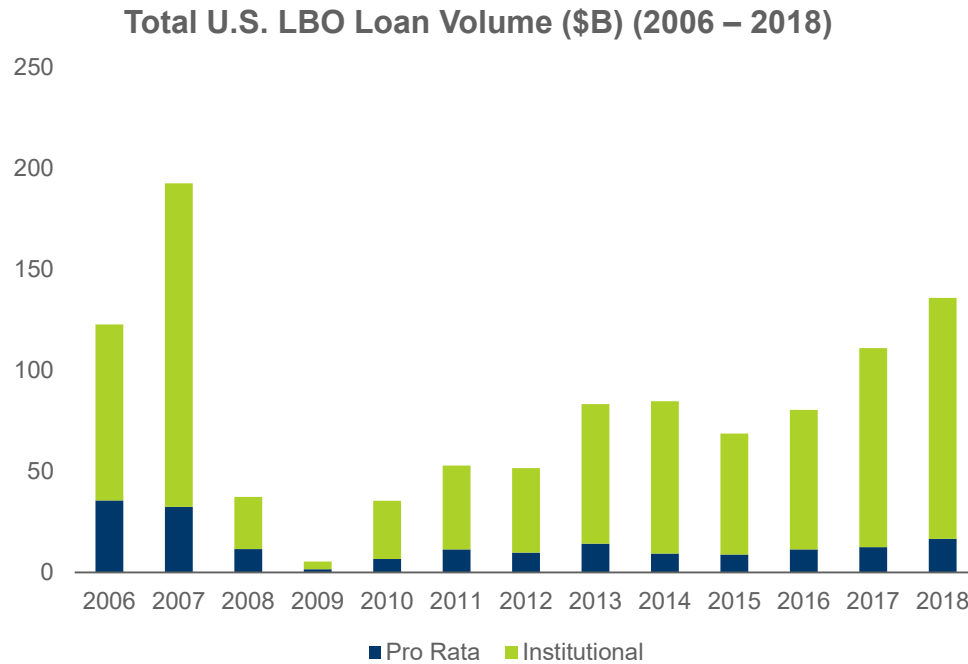
- Deal volume continues to be dominated by lower middle market deals with investment sizes below \$100 million through the fourth quarter of 2018
- However, deals with below \$100 million check sizes comprised only 7% of all deal volume by amount of capital invested in the fourth quarter of 2018

Source: PitchBook, \*as of December 31, 2018.



## Wilshire Private Markets

# PRIVATE EQUITY - U.S. DEBT MARKETS



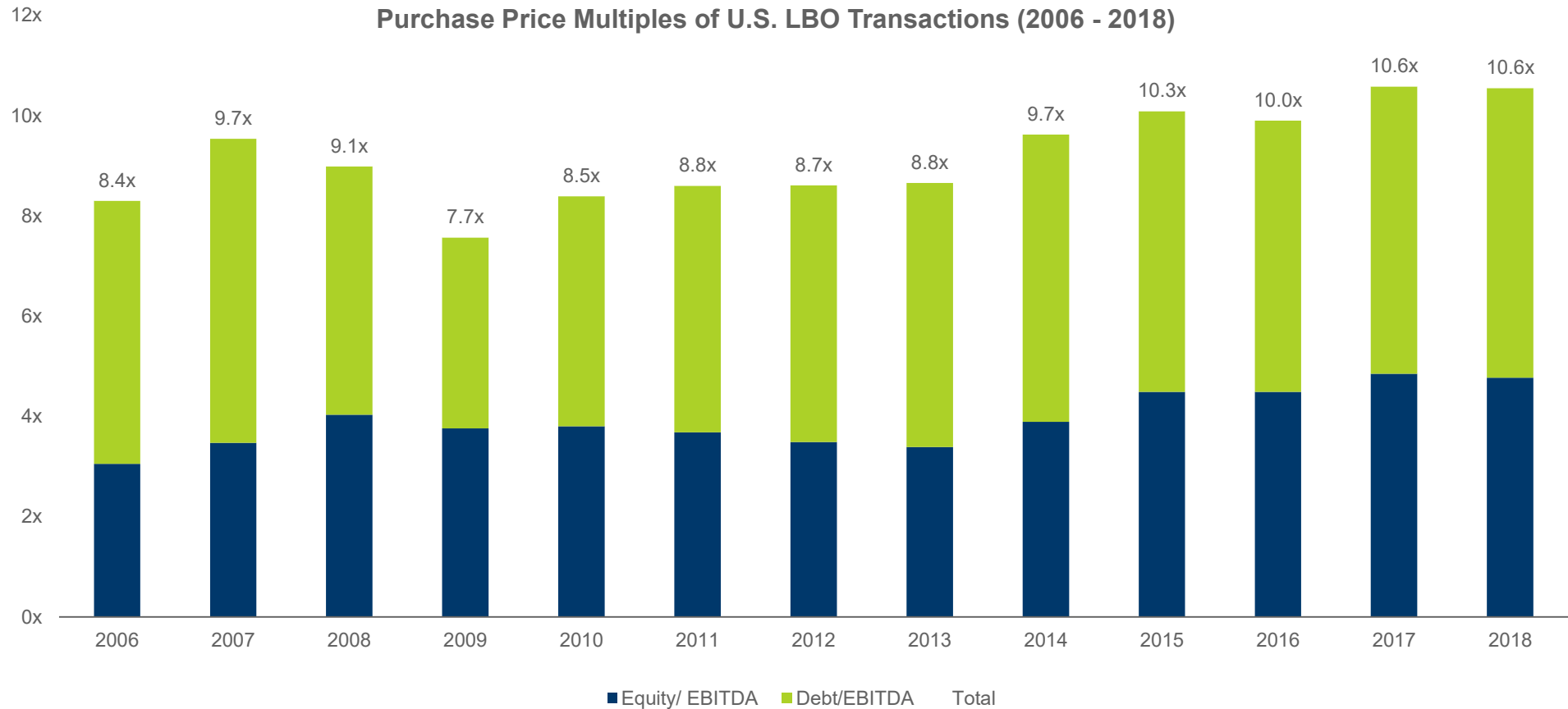
- Loan volume in 2018 increased by approximately \$25 billion from the prior year and is on pace to once again increase year-over-year through the fourth quarter of 2018
- Availability of debt capital has driven up the percentage of debt used to finance leveraged buyouts of less than \$50 million of EBITDA through the fourth quarter of 2018

Source: S&P LBO, as of December 31, 2018.



## Wilshire Private Markets

# PRIVATE EQUITY - U.S. LBO PURCHASE PRICE MULTIPLES



- Due to the amount of debt that is readily available, purchase price multiples for U.S. LBOs have remained consistent through Q4 2018 relative to 2017 levels

Source: S&P LBO, as of December 31, 2018.



Wilshire Consulting

# Growth: Private Equity – Performance

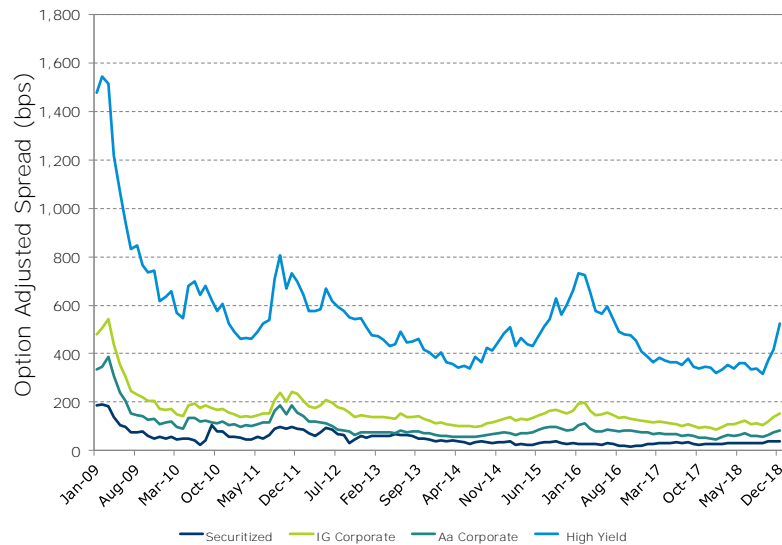
	<u>Market Value</u>	<u>Qtr</u>	<u>1-Year</u>	<u>3-Year</u>	<u>5-Year</u>	<u>10-Year</u>	<u>VaR</u>	<u>5-year Sharpe Ratio</u>	<u>5-year Info Ratio</u>
<b>PRIVATE EQUITY</b>	<b>27.8</b>	<b>2.1%</b>	<b>12.5%</b>	<b>12.3%</b>	<b>11.3%</b>	<b>11.4%</b>	<b>\$10.7 bil</b>	<b>3.2</b>	<b>-0.2</b>
<i>PE Policy Benchmark</i>		4.5%	13.0%	17.5%	13.2%	14.5%		1.3	0.0
<i>Value Added</i>		-2.4%	-0.5%	-5.2%	-1.9%	-3.1%			
Private Equity Partnership Investments	27.8	2.1%	12.6%	12.3%	11.4%	11.4%			
Private Equity Distribution Stock	0.0	-8.8%	11.0%	2.1%	-14.2%	-8.0%			

# U.S. FIXED INCOME

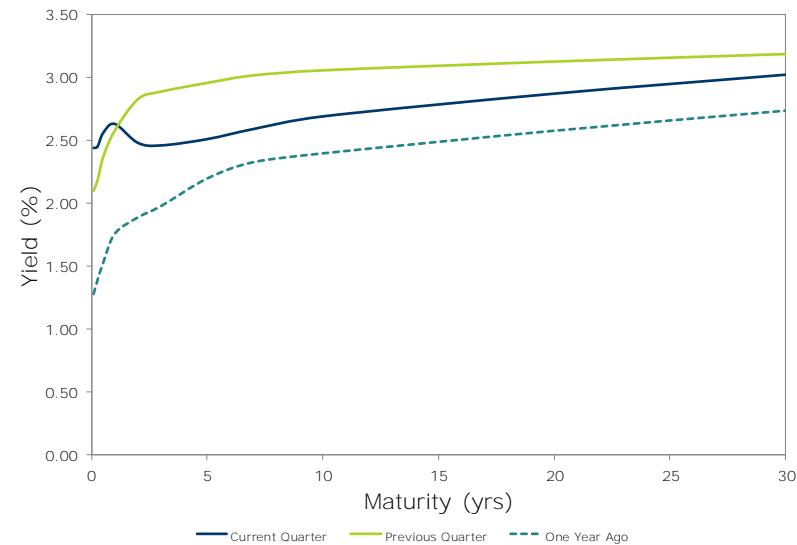
AS OF DECEMBER 31, 2018	YTM	DURATION	QTR	YTD	1 YR	3 YR	5 YR	10 YR
BLOOMBERG BARCLAYS AGGREGATE	3.3	5.9	1.6	0.0	0.0	2.1	2.5	3.5
BLOOMBERG BARCLAYS TREASURY	2.6	6.1	2.6	0.9	0.9	1.4	2.0	2.1
BLOOMBERG BARCLAYS GOV'T-REL.	3.4	5.3	1.2	0.3	0.3	2.4	2.6	2.9
BLOOMBERG BARCLAYS SECURITIZED	3.4	4.7	2.0	1.0	1.0	1.8	2.5	3.4
BLOOMBERG BARCLAYS CORPORATE	4.2	7.1	-0.2	-2.5	-2.5	3.3	3.3	5.9
BLOOMBERG BARCLAYS LT G/C	4.1	15.0	0.8	-4.7	-4.7	4.0	5.4	5.9
BLOOMBERG BARCLAYS LT TREASURY	3.0	17.4	4.2	-1.8	-1.8	2.6	5.9	4.1
BLOOMBERG BARCLAYS LT GOV't-REL.	4.6	11.8	0.0	-3.2	-3.2	4.7	5.6	5.7
BLOOMBERG BARCLAYS LT CORP.	4.9	13.5	-1.8	-7.2	-7.2	4.9	5.0	7.6
BLOOMBERG BARCLAYS U.S. TIPS *	2.7	7.6	-0.4	-1.3	-1.3	2.1	1.7	3.6
BLOOMBERG BARCLAYS HIGH YIELD	8.0	4.0	-4.5	-2.1	-2.1	7.2	3.8	11.1
TREASURY BILLS	2.5	0.25	0.6	1.9	1.9	1.0	0.6	0.4

\* Yield and Duration statistics are for a proxy index based on similar maturity, the Bloomberg Barclays U.S. Treasury 7-10 Year Index

BLOOMBERG BARCLAYS FIXED INCOME INDEXES



TREASURY YIELD CURVE

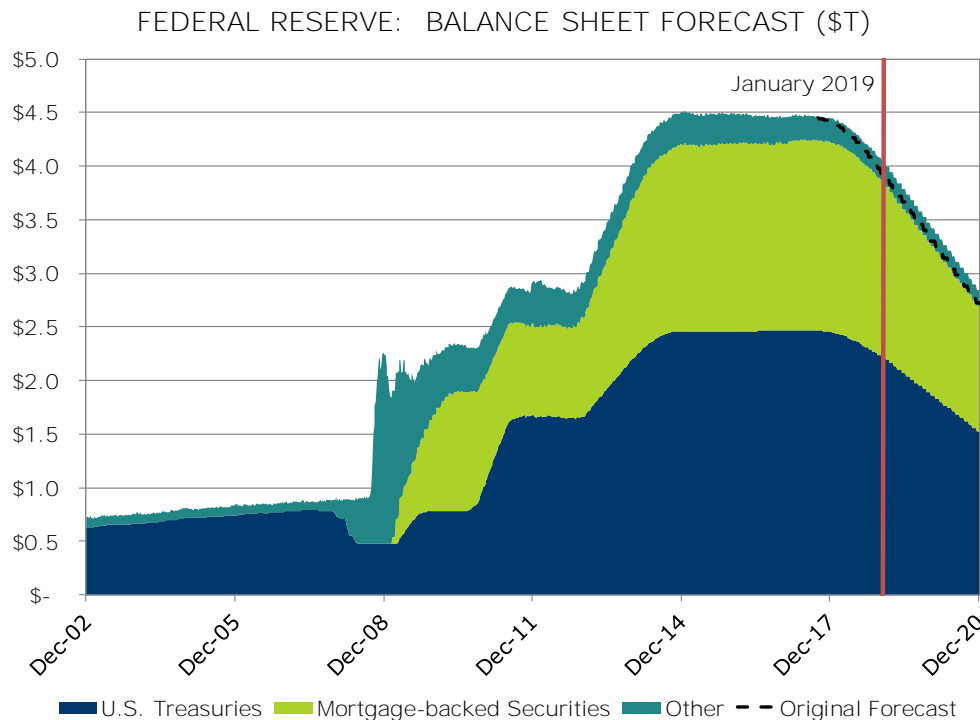
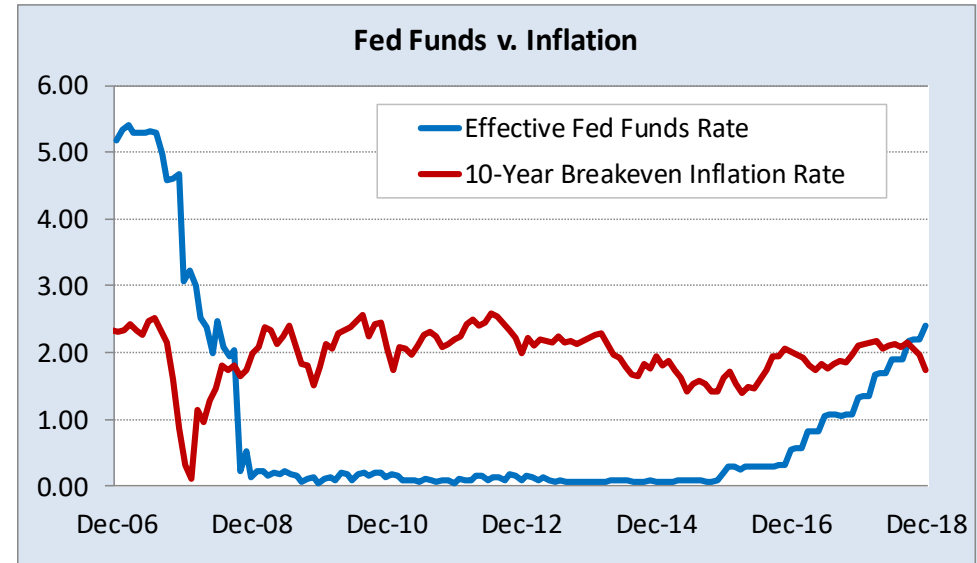


Data sources: Wilshire Compass, Bloomberg Barclays, U.S. Treasury



# Wilshire Consulting FEDERAL RESERVE

- Nominal discount rate moved above expected inflation during 2018 for the first time since the global financial crisis
- Investors can once again earn a positive real return from cash, ending a decade-long period of financial repression



Data sources: Federal Reserve

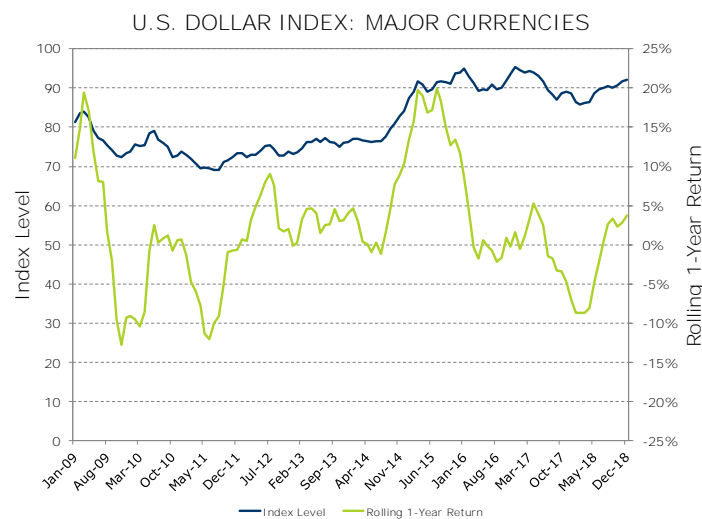
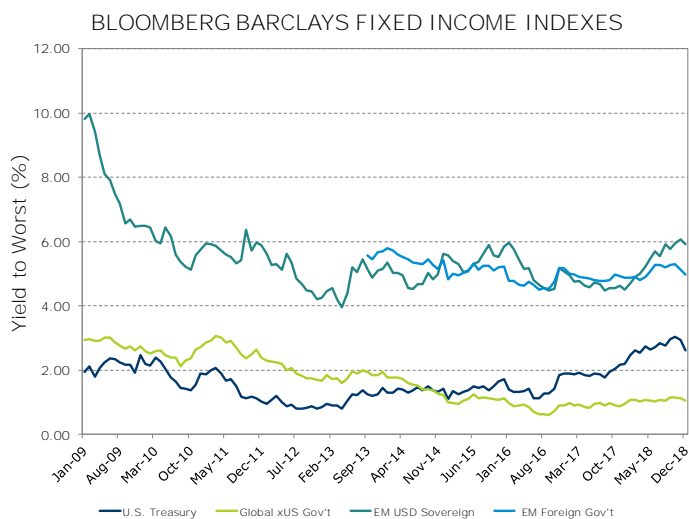
©2019 Wilshire Associates.



# NON-U.S. FIXED INCOME

AS OF DECEMBER 31, 2018	QTR	YTD	1 YR	3 YR	5 YR	10 YR
<b>DEVELOPED MARKETS</b>						
BLMBRG BRCLYS GBL AGGREGATE xUS	0.9	-2.1	-2.1	3.2	0.0	1.7
BLMBRG BRCLYS GBL AGGREGATE xUS *	1.9	3.2	3.2	3.5	4.1	4.0
BLMBRG BRCLYS GLOBAL INF LNKD xUS	-1.1	-5.9	-5.9	3.1	1.0	3.8
BLMBRG BRCLYS GLOBAL INF LNKD xUS *	1.4	1.3	1.3	6.2	6.3	5.8
<b>EMERGING MARKETS (HARD CURRENCY)</b>						
BLMBRG BRCLYS EM USD AGGREGATE	-0.2	-2.5	-2.5	5.0	4.2	8.5
<b>EMERGING MARKETS (FOREIGN CURRENCY)</b>						
BLMBRG BRCLYS EM LOCAL CURR. GOV'T	2.5	-3.4	-3.4	5.3	0.5	4.1
BLMBRG BRCLYS EM LOCAL CURR. GOV'T *	2.6	2.7	2.7	3.2	2.9	3.2
<b>CURRENCY RETURNS</b>						
EURO vs. DOLLAR	-1.6	-4.8	-4.8	1.7	-3.7	-2.0
YEN vs. DOLLAR	3.5	2.7	2.7	3.1	-0.9	-1.9
POUND vs. DOLLAR	-2.3	-5.9	-5.9	-4.7	-5.1	-1.2

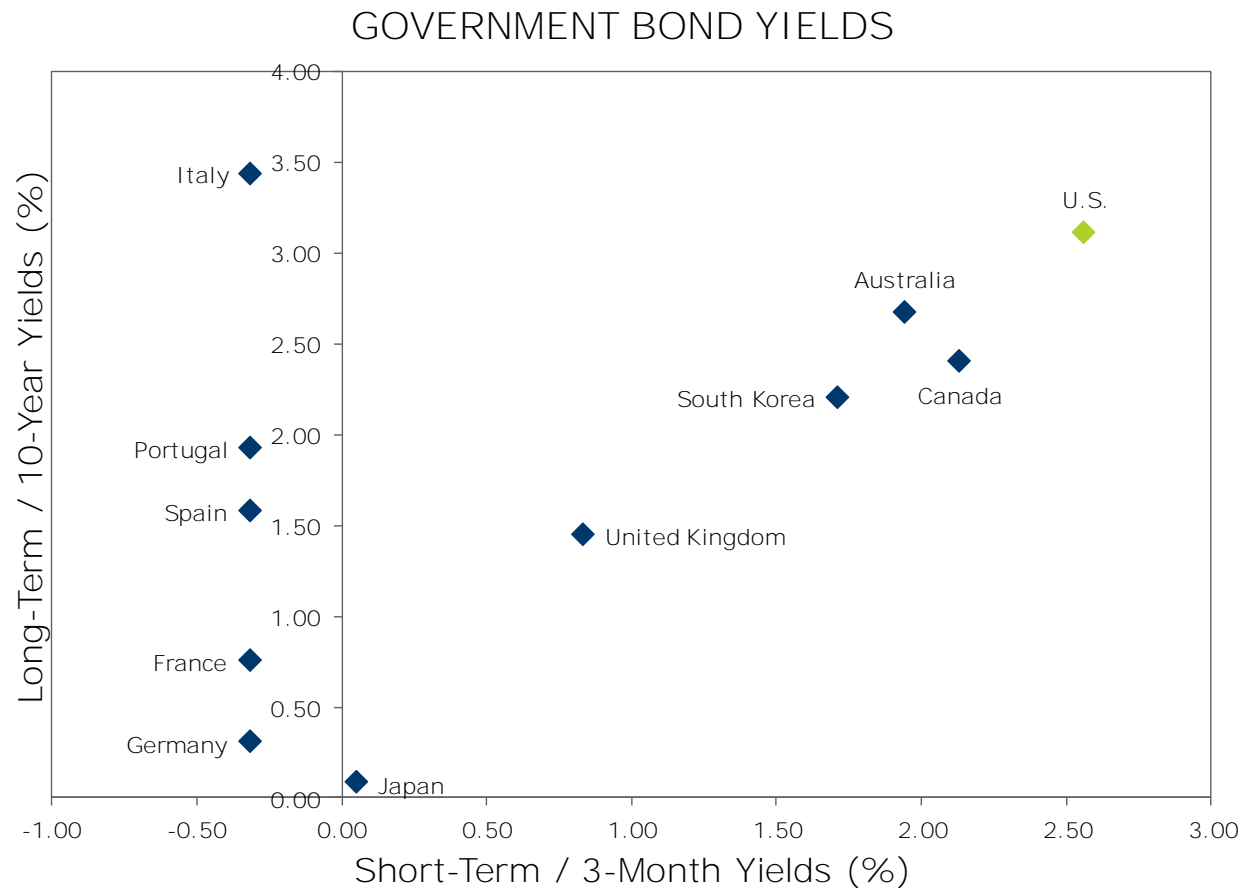
\* Returns are reported in terms of local market investors, which removes currency effects.



Data sources: Wilshire Compass, Bloomberg Barclays, Federal Reserve Bank of St. Louis

# GLOBAL INTEREST RATES

Negative short-term rates remain in Europe; Long rates jumped in Italy during the quarter

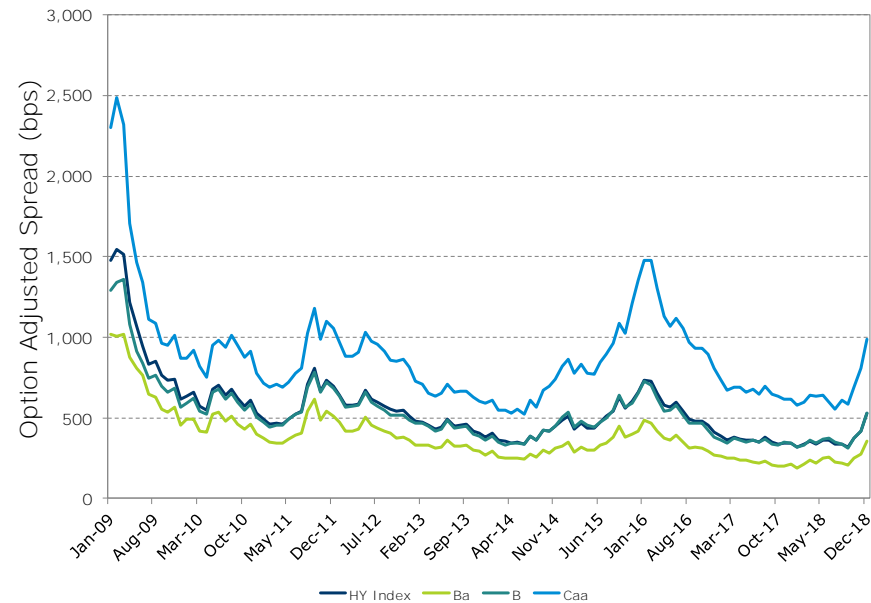


Data sources: Organization for Economic Co-operation and Development

# HIGH YIELD BOND MARKET

AS OF DECEMBER 31, 2018		QTR	YTD	1 YR	3 YR	5 YR	10 YR
BLOOMBERG BARCLAYS HIGH YIELD		-4.5	-2.1	-2.1	7.2	3.8	11.1
CREDIT SUISSE LEVERAGED LOAN		-3.1	1.1	1.1	5.0	3.3	8.3
<b>HIGH YIELD QUALITY DISTRIBUTION</b>	<b>WEIGHT</b>						
Ba U.S. HIGH YIELD	46.1%	-2.9	-2.4	-2.4	5.7	4.3	10.2
B U.S. HIGH YIELD	39.7%	-4.4	-1.3	-1.3	6.8	3.3	9.7
Caa U.S. HIGH YIELD	13.3%	-9.3	-3.8	-3.8	11.7	3.9	13.9
Ca to D U.S. HIGH YIELD	0.6%	-24.1	-1.3	-1.3	27.2	-11.2	7.4
Non-Rated U.S. HIGH YIELD	0.2%	-1.7	1.2	1.2	5.3	-0.5	6.9

BLOOMBERG BARCLAYS HIGH YIELD INDEXES



Data sources: Wilshire Compass, Bloomberg Barclays

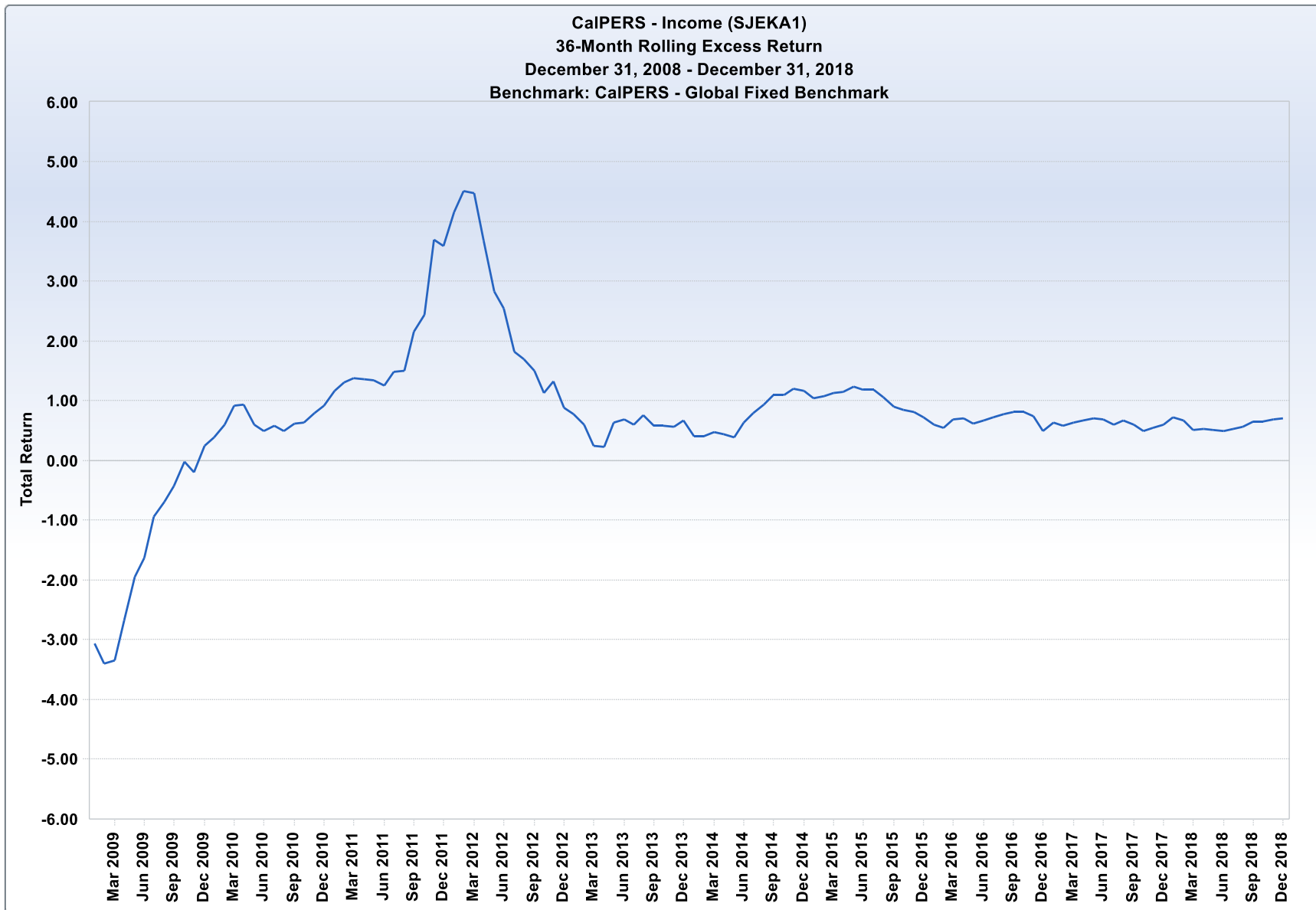


## Wilshire Consulting

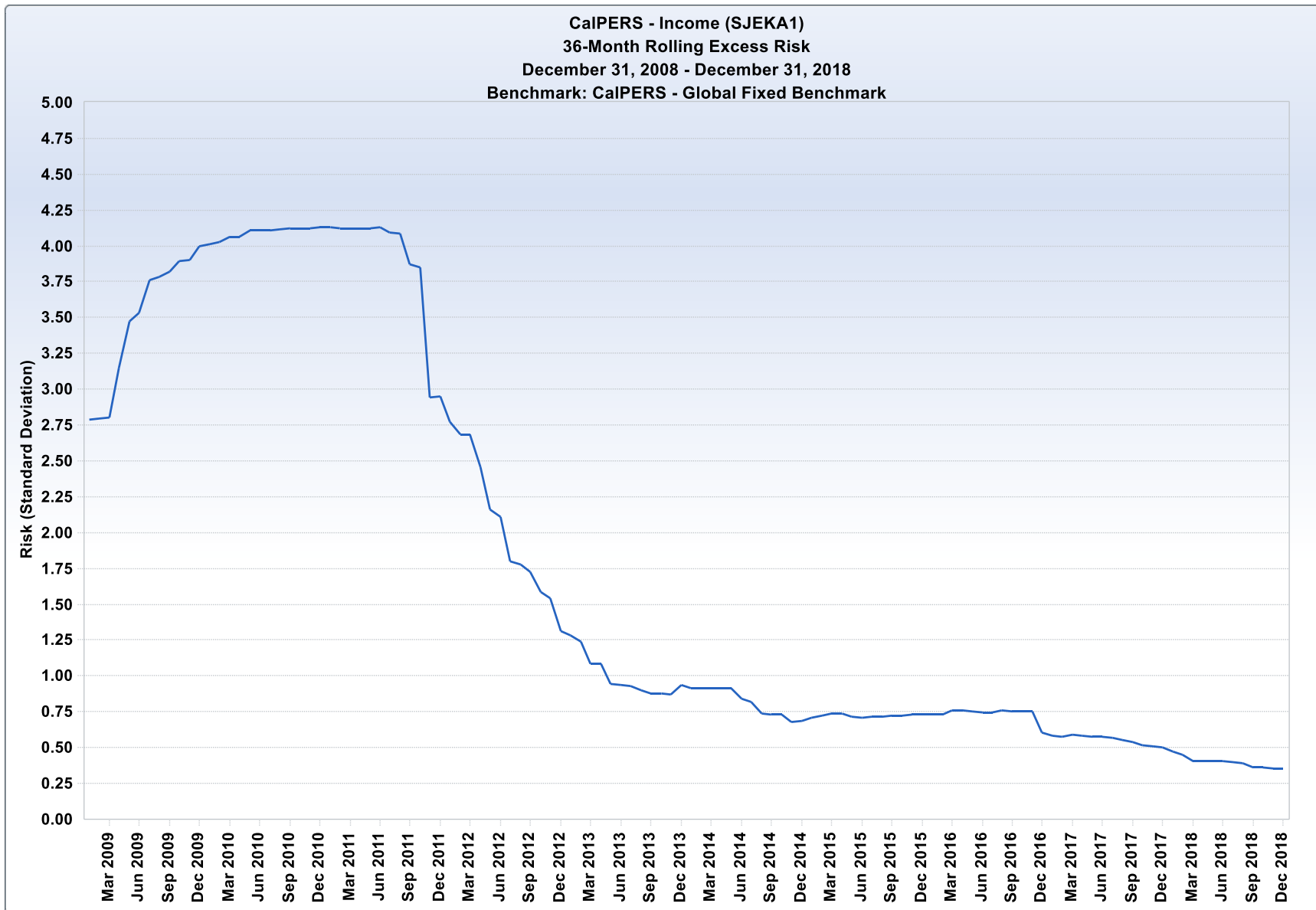
# Income – Performance

	<b>Market Value</b>	<b>Qtr</b>	<b>1-Year</b>	<b>3-Year</b>	<b>5-Year</b>	<b>10-Year</b>	<b>VaR</b>	<b>5-year Sharpe Ratio</b>	<b>5-year Info Ratio</b>
<b>INCOME</b>	<b>94.3</b>	<b>0.9%</b>	<b>-1.8%</b>	<b>3.5%</b>	<b>3.7%</b>	<b>6.2%</b>	<b>\$7.2 bil</b>	<b>0.7</b>	<b>1.0</b>
<i>Income Policy Benchmark</i>		0.9%	-2.2%	2.8%	3.2%	4.5%		<b>0.6</b>	<b>0.0</b>
<i>Value Added</i>		0.0%	0.4%	0.7%	0.5%	1.7%			
<b>U.S. Income</b>	<b>86.6</b>	<b>0.9%</b>	<b>-1.6%</b>	<b>3.6%</b>	<b>4.2%</b>	<b>6.7%</b>		<b>0.8</b>	<b>0.6</b>
<i>U.S. Income Policy Benchmark</i>		1.4%	-1.6%	2.9%	3.8%	4.9%		<b>0.7</b>	<b>0.0</b>
<i>Value Added</i>		-0.5%	0.0%	0.7%	0.4%	1.8%			
<b>Non-U.S. Income</b>	<b>7.7</b>	<b>0.3%</b>	<b>-4.1%</b>	<b>3.6%</b>	<b>-0.3%</b>	<b>2.1%</b>		<b>-0.1</b>	<b>0.8</b>
<i>Non-US Income Policy Benchmark</i>		0.2%	-3.9%	3.2%	-0.8%	0.8%		<b>-0.2</b>	<b>0.0</b>
<i>Value Added</i>		0.1%	-0.2%	0.4%	0.5%	1.3%			

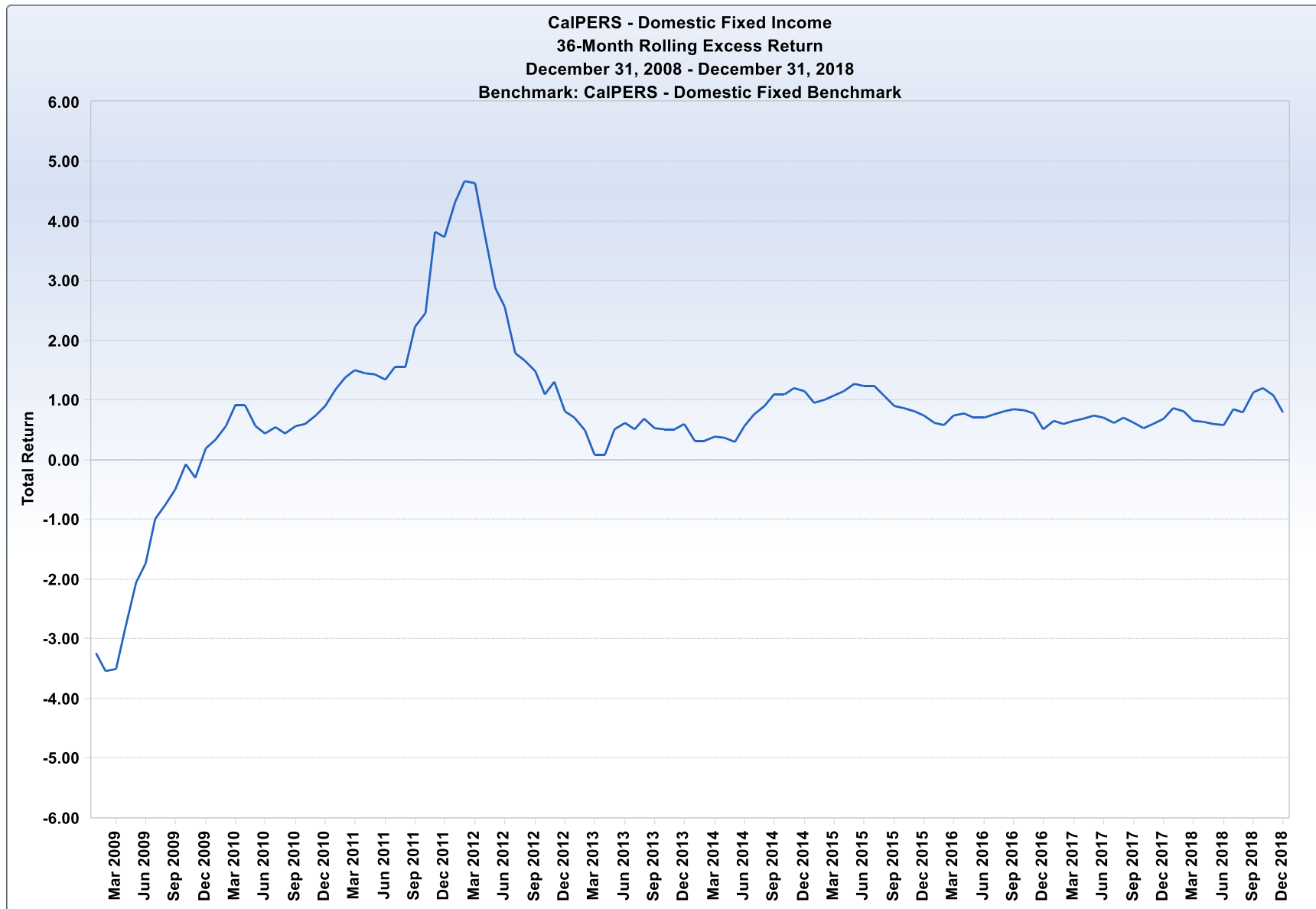
# Income – Rolling Excess Returns



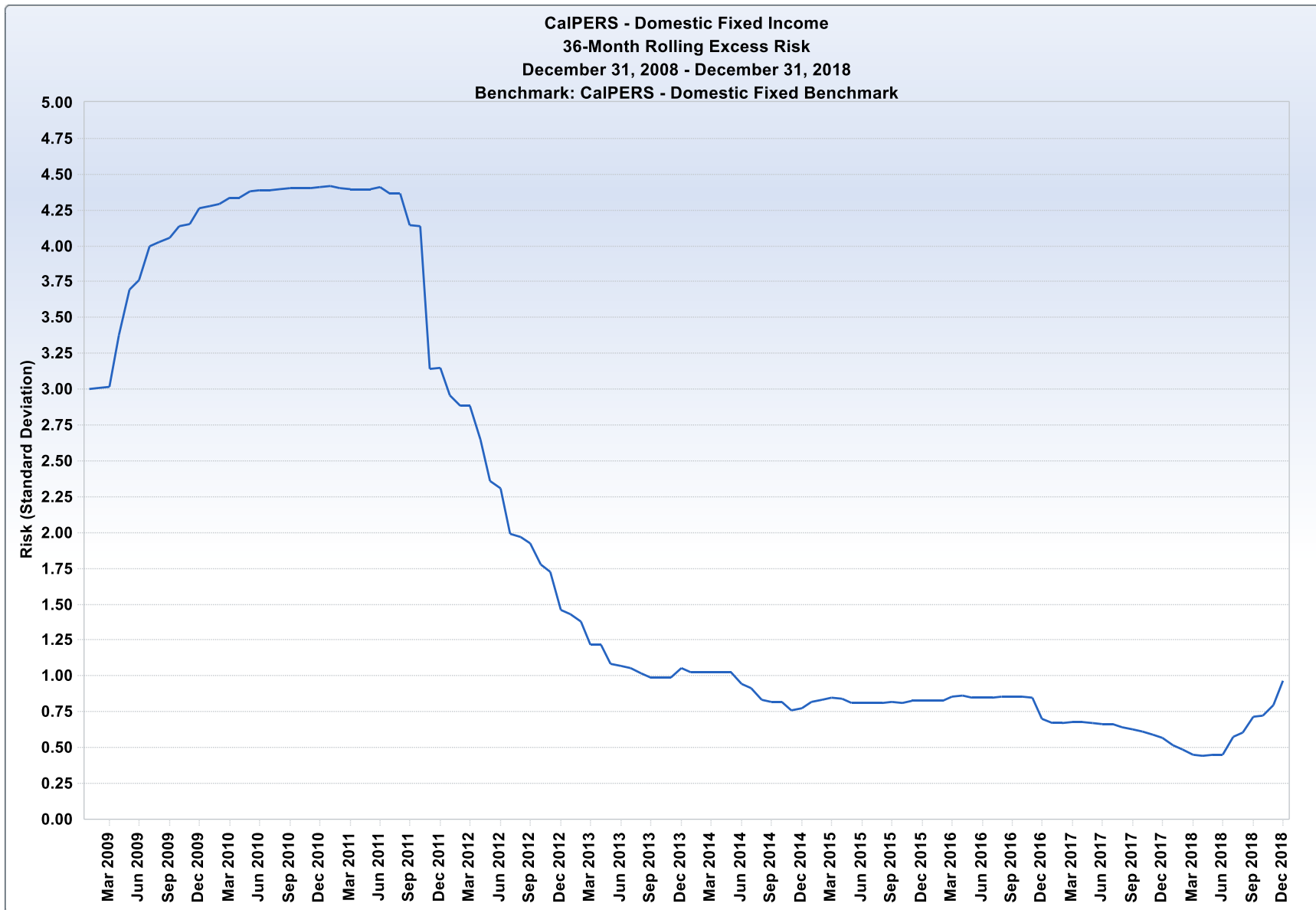
# Income – Rolling Tracking Error



# U.S. Income – Rolling Excess Returns



# U.S. Income – Rolling Tracking Error



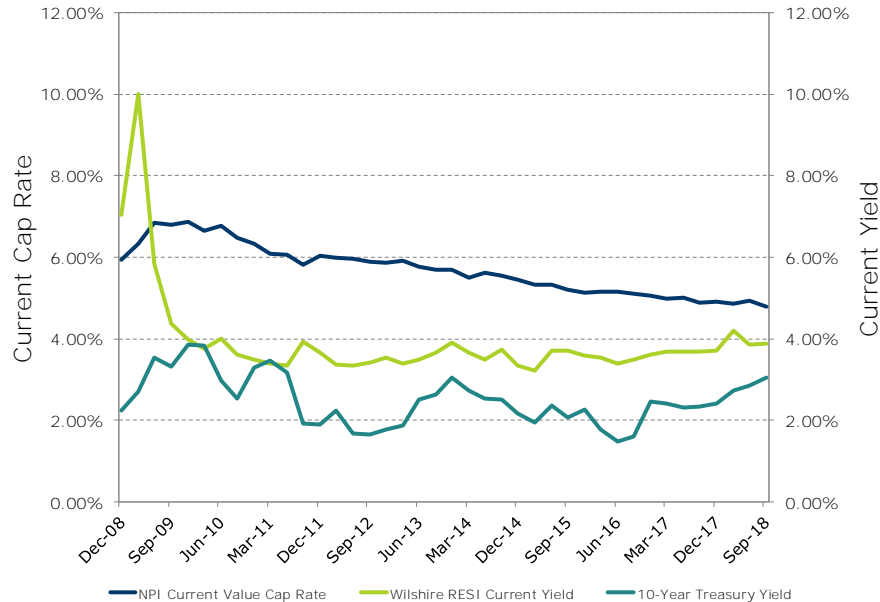


# Wilshire Consulting REAL ASSETS

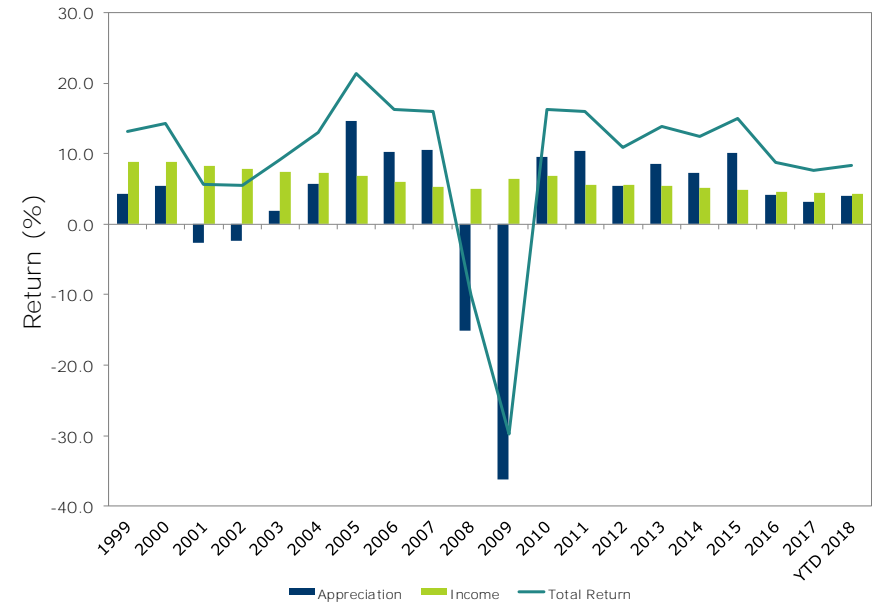


AS OF DECEMBER 31, 2018	QTR	YTD	1 YR	3 YR	5 YR	10 YR
BLOOMBERG BARCLAYS U.S. TIPS	-0.4	-1.3	-1.3	2.1	1.7	3.6
BLOOMBERG COMMODITY INDEX	-9.4	-11.2	-11.2	0.3	-8.8	-3.8
WILSHIRE GLOBAL RESI INDEX	-6.1	-5.4	-5.4	3.3	6.1	11.6
NCREIF ODCE FUND INDEX	1.8	8.3	8.3	8.2	10.4	7.0
NCREIF TIMBERLAND INDEX	1.0	3.4	3.4	3.2	5.0	3.8
ALERIAN MLP INDEX (OIL & GAS)	-17.3	-12.4	-12.4	-1.1	-7.3	9.6

REAL ESTATE VALUATION



NCREIF ODCE FUND INDEX RETURN



Data sources: Wilshire Compass, National Council of Real Estate Investment Fiduciaries

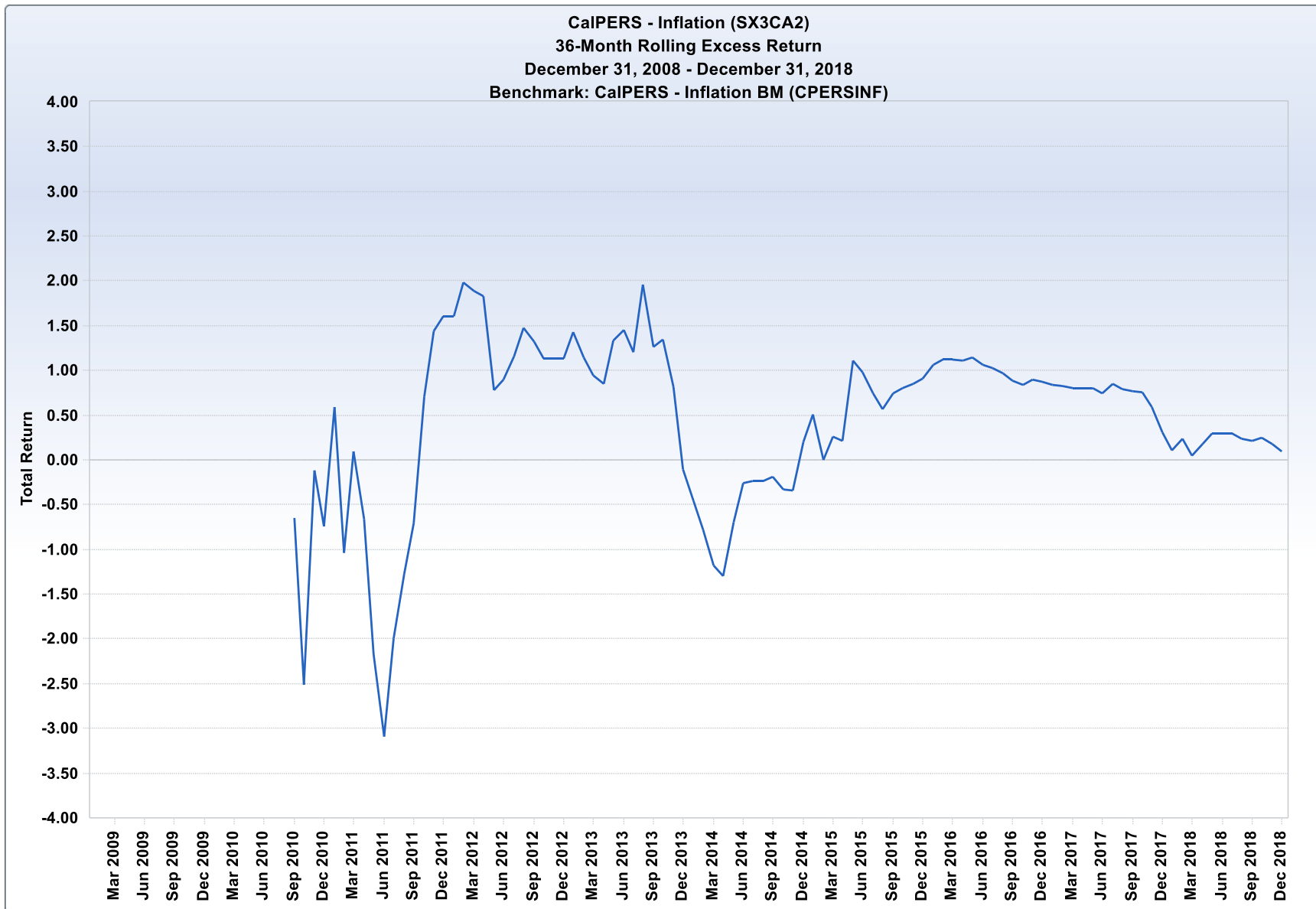


Wilshire Consulting

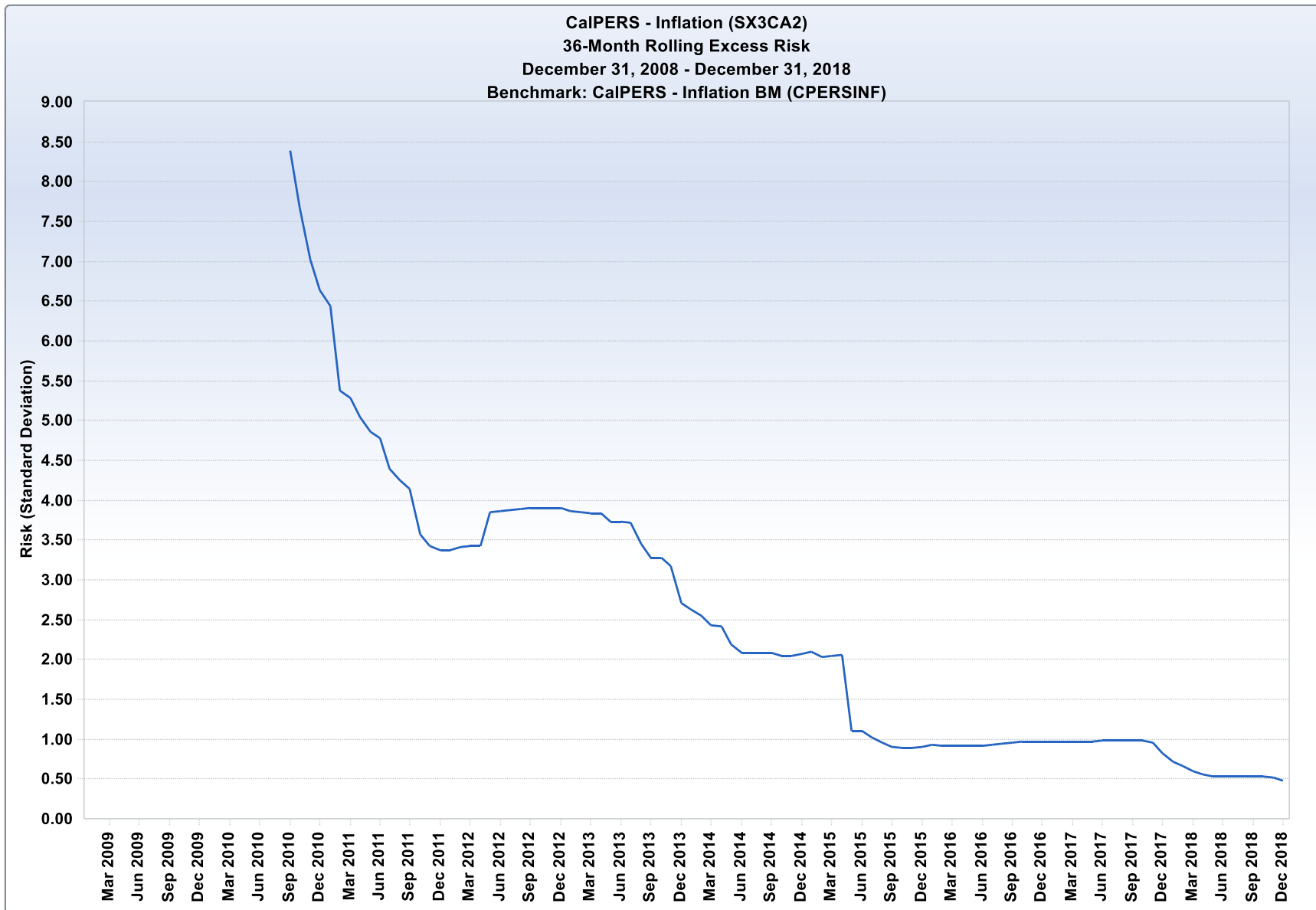
# Inflation – Performance

	<b>Market Value</b>	<b>Qtr</b>	<b>1-Year</b>	<b>3-Year</b>	<b>5-Year</b>	<b>10-Year</b>	<b>VaR</b>	<b>5-year Sharpe Ratio</b>	<b>5-year Info Ratio</b>
<b>INFLATION</b>	<b>7.5</b>	<b>-6.4%</b>	<b>-5.3%</b>	<b>2.3%</b>	<b>-2.1%</b>	<b>2.0%</b>	<b>\$0.5 bil</b>	<b>-0.5</b>	<b>0.8</b>
<i>Inflation Policy Benchmark</i>		-6.6%	-5.4%	2.2%	-2.6%	1.3%		-0.5	0.0
<i>Value Added</i>		0.2%	0.1%	0.1%	0.5%	0.7%			
<b>Commodities Passive</b>	<b>0.1</b>	<b>-24.2%</b>	<b>-14.9%</b>	<b>0.0%</b>	<b>-.-%</b>	<b>-.-%</b>			
<i>GSCI Total Return Index</i>		-22.9%	-13.8%	0.5%	-.-%	-.-%			
<i>Value Added</i>		-1.3%	-1.1%	-0.5%	-.-%	-.-%			
<b>Commodities Active</b>	<b>1.0</b>	<b>-23.1%</b>	<b>-14.0%</b>	<b>0.5%</b>	<b>-14.3%</b>	<b>-5.7%</b>			
<i>GSCI Total Return Index</i>		-22.9%	-13.8%	0.5%	-14.5%	-5.8%			
<i>Value Added</i>		-0.2%	-0.2%	0.0%	0.2%	0.1%			
<b>Core Inflation Linked Bonds</b>	<b>5.2</b>	<b>-0.4%</b>	<b>-2.6%</b>	<b>2.6%</b>	<b>1.5%</b>	<b>3.8%</b>			
<i>Custom Benchmark</i>		-0.8%	-3.0%	2.5%	1.2%	3.6%			
<i>Value Added</i>		0.4%	0.4%	0.1%	0.3%	0.2%			
<b>Tactical Commodities</b>	<b>0.5</b>	<b>-23.2%</b>	<b>-15.5%</b>	<b>-0.3%</b>	<b>-14.9%</b>	<b>-.-%</b>			
<i>GSCI Total Return Index</i>		-22.9%	-13.8%	0.5%	-14.5%	-.-%			
<i>Value Added</i>		-0.3%	-1.7%	-0.8%	-0.4%	-.-%			
<b>Tactical TIPS</b>	<b>0.6</b>	<b>-0.5%</b>	<b>-1.3%</b>	<b>2.0%</b>	<b>1.6%</b>	<b>-.-%</b>			
<i>CalPERS TIPS</i>		-0.4%	-1.3%	2.1%	1.7%	-.-%			
<i>Value Added</i>		-0.1%	0.0%	-0.1%	-0.1%	-.-%			

# Inflation – Rolling Excess Returns



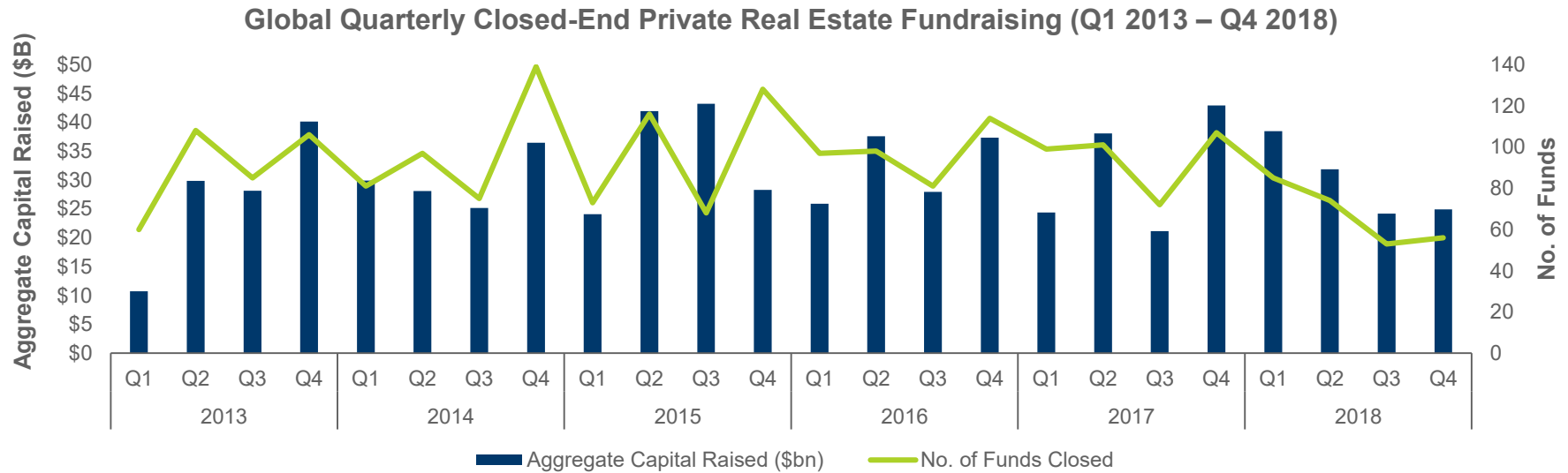
# Inflation – Rolling Tracking Error



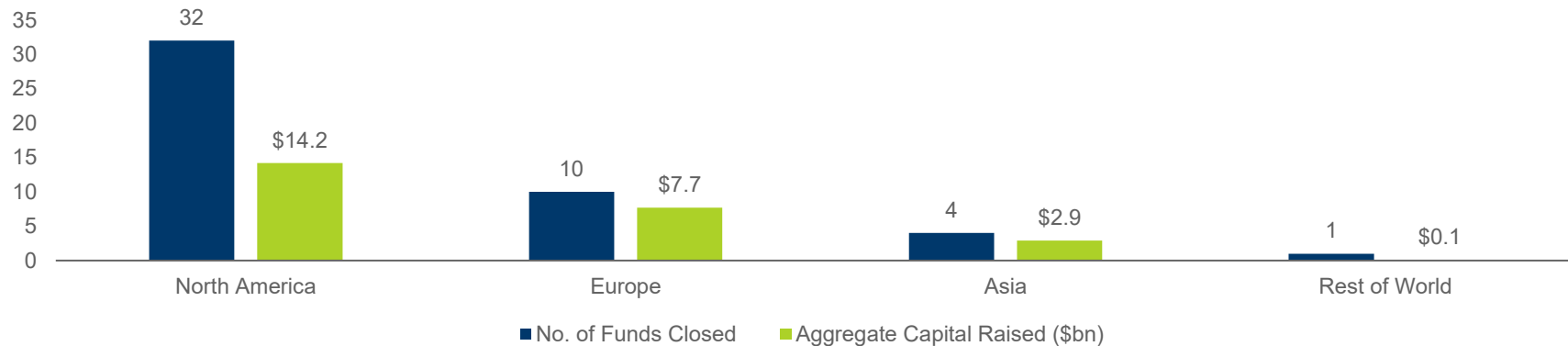


Wilshire Private Markets

# PRIVATE REAL ESTATE – FUNDRAISING ACTIVITY



**Closed-End Private Real Estate Fundraising in Q4 2018 by Primary Geographic Focus**

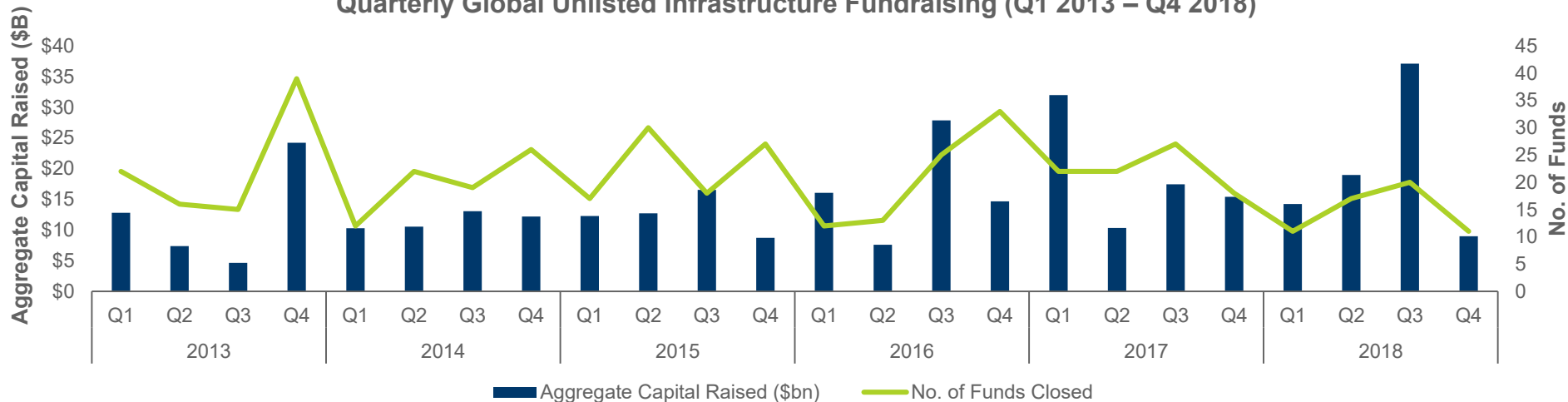


Source: Preqin, as of December 31, 2018.



# UNLISTED INFRASTRUCTURE – FUNDRAISING & INVESTMENT ACTIVITY

Quarterly Global Unlisted Infrastructure Fundraising (Q1 2013 – Q4 2018)



Unlisted Infrastructure Funds in Market over Time (January 2011 - January 2019)

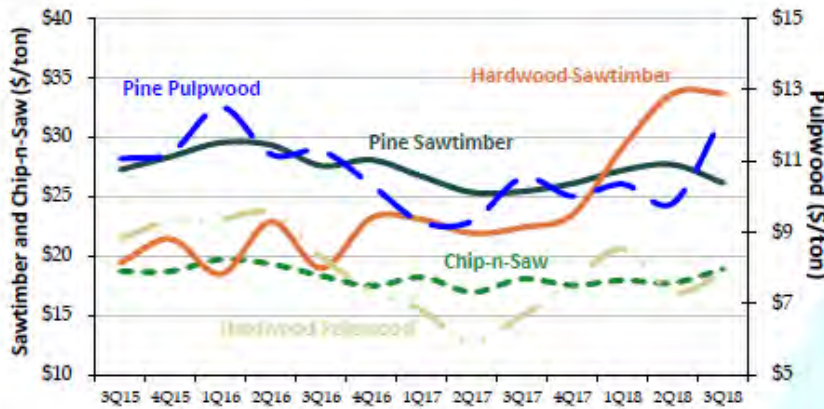


Source: Preqin, as of January 16, 2019.

# Wilshire Consulting TIMBER

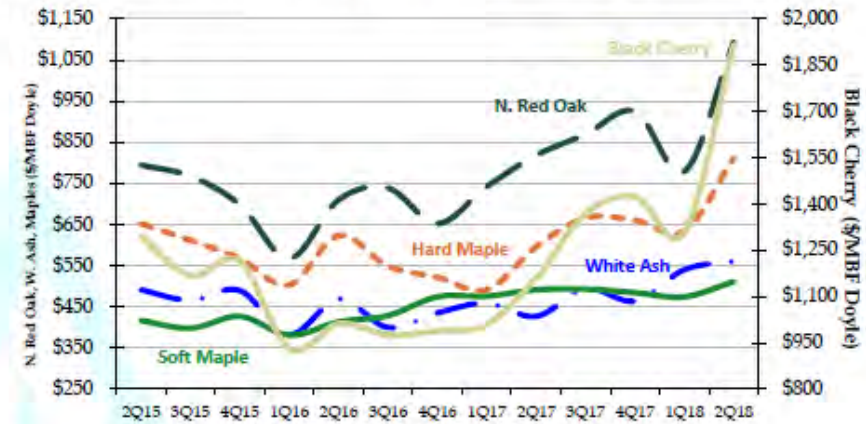


## Southeastern Timber Prices



Source: Forest2Market®

## Northeastern Hardwood Timber Prices



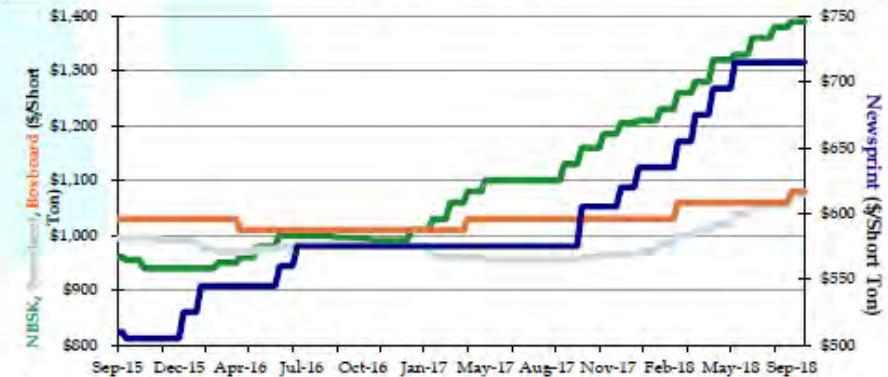
Source: Pennsylvania Woodlands Timber Market Report - Northwest Region

## Pacific Northwest Timber Prices



Source: Log Lines®

## Pulp and Paper



Source: FOEX Indexes, Ltd., RISI Pulp & Paper Week

Data sources: Forest Investment Associates

©2019 Wilshire Associates.

Wilshire Consulting

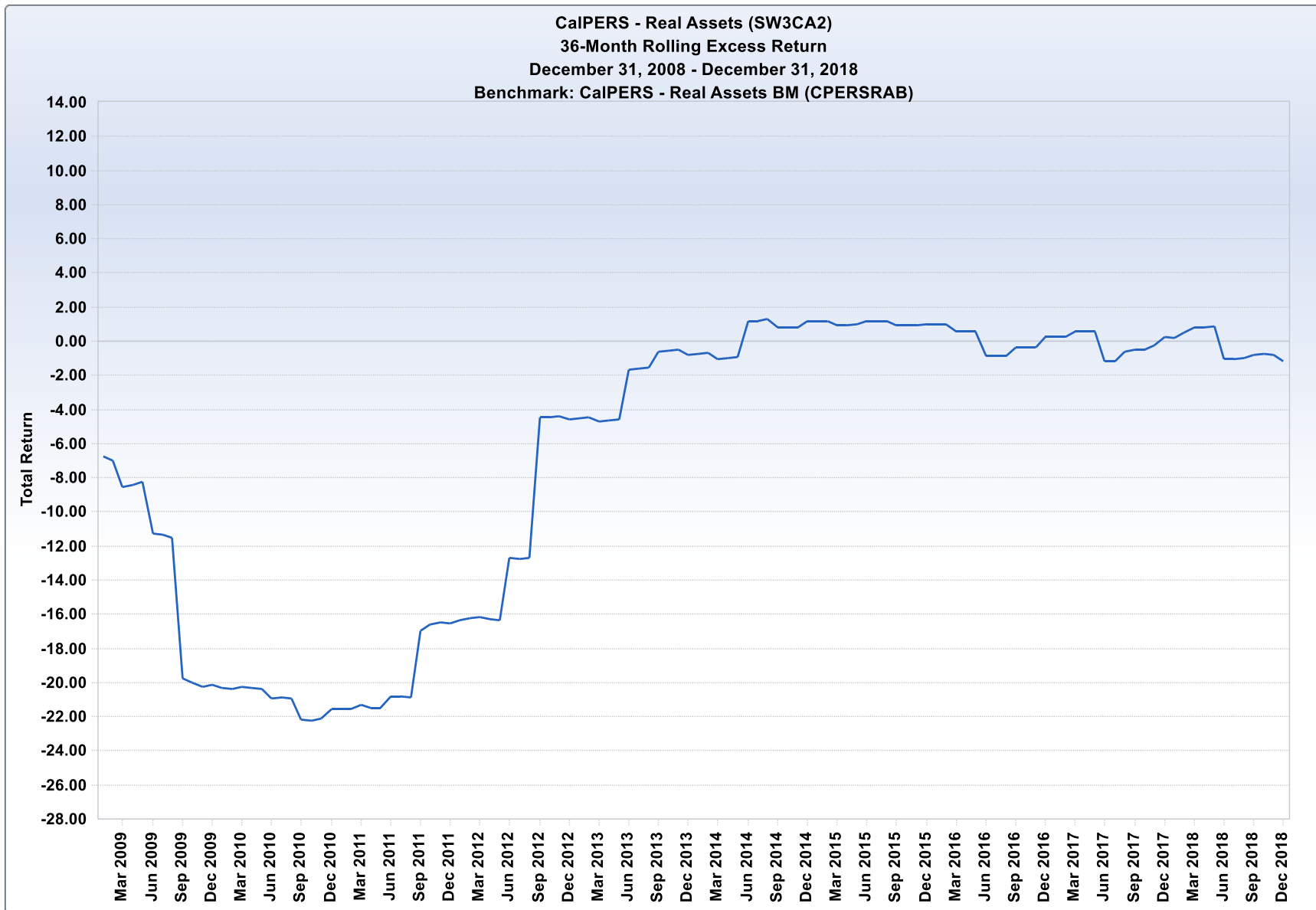


## Real Assets – Performance

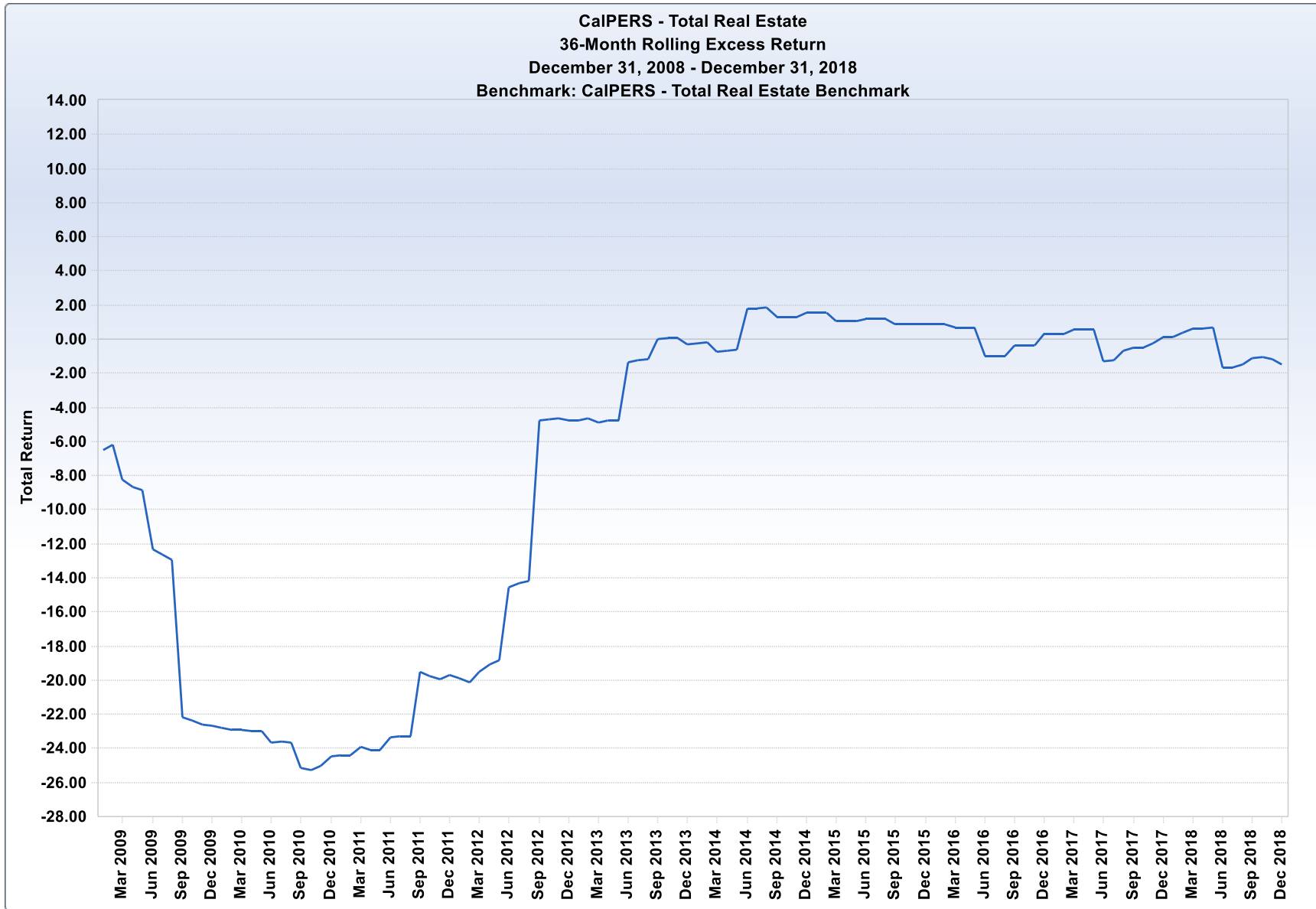
	<b>Market Value</b>	<b>Qtr</b>	<b>1-Year</b>	<b>3-Year</b>	<b>5-Year</b>	<b>10-Year</b>	<b>VaR</b>	<b>5-year Sharpe Ratio</b>	<b>5-year Info Ratio</b>
<b>REAL ASSETS</b>	<b>39.9</b>	<b>0.1%</b>	<b>4.2%</b>	<b>6.1%</b>	<b>9.0%</b>	<b>1.4%</b>	<b>\$5.7 bil</b>	<b>1.5</b>	<b>0.0</b>
<i>Real Assets Policy Benchmark</i>		1.9%	7.5%	7.4%	9.1%	6.7%		<b>2.3</b>	<b>0.0</b>
<i>Value Added</i>		-1.8%	-3.3%	-1.3%	-0.1%	-5.3%			
<b>Real Estate</b>	<b>33.9</b>	<b>-0.3%</b>	<b>4.0%</b>	<b>6.2%</b>	<b>9.4%</b>	<b>1.2%</b>	<b>\$4.9 bil</b>	<b>1.5</b>	<b>-0.1</b>
<i>Real Estate Policy Benchmark</i>		1.9%	7.7%	7.8%	9.7%	7.9%		<b>2.2</b>	<b>0.0</b>
<i>Value Added</i>		-2.2%	-3.7%	-1.6%	-0.3%	-6.7%			
<b>Forestland</b>	<b>1.3</b>	<b>-1.1%</b>	<b>-11.1%</b>	<b>-6.7%</b>	<b>-3.4%</b>	<b>-2.4%</b>			
<i>Forestland Policy Benchmark</i>		1.9%	6.3%	4.3%	6.5%	4.2%			
<i>Value Added</i>		-3.0%	-17.4%	-11.0%	-9.9%	-6.6%			
<b>Infrastructure</b>	<b>4.6</b>	<b>3.2%</b>	<b>11.3%</b>	<b>12.6%</b>	<b>14.3%</b>	<b>15.2%</b>			
<i>Infrastructure Policy Benchmark</i>		1.9%	6.9%	6.3%	5.7%	6.2%			
<i>Value Added</i>		1.3%	4.4%	6.3%	8.6%	9.0%			



# Real Assets – Rolling Excess Returns



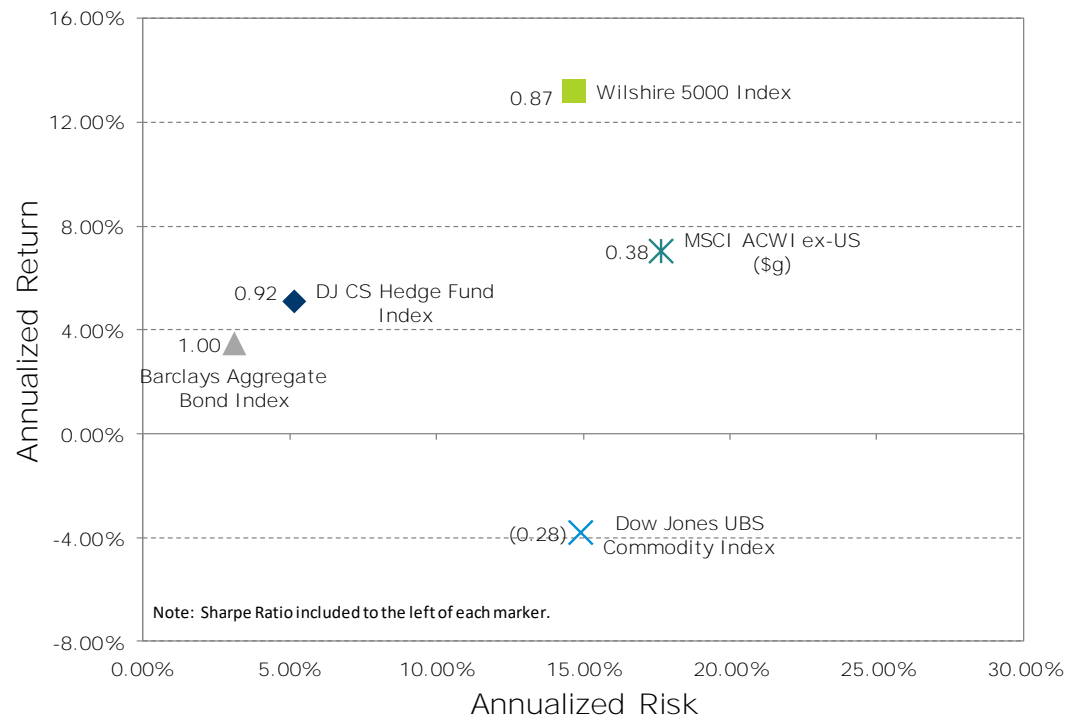
# Real Estate – Rolling Excess Returns



# HEDGE FUND PERFORMANCE

AS OF DECEMBER 31, 2018	QTR	YTD	1 YR	3 YR	5 YR	10 YR
DJ CS HEDGE FUND INDEX	-4.3	-3.2	-3.2	1.6	1.7	5.1
EVENT DRIVEN	-6.2	-3.9	-3.9	1.6	0.0	4.6
GLOBAL MACRO	-1.7	-0.1	-0.1	1.9	1.8	4.8
LONG/SHORT EQUITY	-6.7	-4.6	-4.6	1.5	2.7	5.8
MULTI-STRATEGY	-3.7	-1.0	-1.0	3.3	4.0	7.6
WILSHIRE 5000	-14.3	-5.3	-5.3	9.1	8.1	13.2
MSCI ACWI EX-US (\$G)	-11.4	-13.8	-13.8	5.0	1.1	7.1
BLOOMBERG BARCLAYS AGGREGATE	1.6	0.0	0.0	2.1	2.5	3.5
DOW JONES UBS COMMODITY	-9.4	-11.2	-11.2	0.3	-8.8	-3.8

HEDGE FUND 10-YEAR RISK/RETURN



Data sources: Wilshire Compass

©2019 Wilshire Associates.



# Appendix: ARS Performance

Wilshire Consulting



## ARS – Distribution of Performance

	<u>Market</u> <u>Value</u>	<u>Qtr</u>	<u>1-Year</u>	<u>3-Year</u>	<u>5-Year</u>	<u>10-Year</u>	<u>5-Year</u> <u>Info</u> <u>Ratio</u>	<u>5-Year Up</u> <u>Capture</u> <u>Ratio</u>	<u>5-Year</u> <u>Sharpe</u> <u>Ratio</u>	<u>5-Year</u> <u>Sortino</u> <u>Ratio</u>
<b>Absolute Return Strategies</b>	<b>0.2</b>	<b>4.9%</b>	<b>-4.0%</b>	<b>-1.5%</b>	<b>0.4%</b>	<b>3.3%</b>	<b>-1.1</b>	<b>0.1</b>	<b>0.0</b>	<b>-0.1</b>
<i>ARS Policy Benchmark</i>		2.0%	6.9%	6.1%	5.7%	5.6%				
<i>Value Added</i>		2.9%	-10.9%	-7.6%	-5.3%	-2.3%				
<b>Total Direct Investments</b>	<b>0.2</b>	<b>4.8%</b>	<b>-4.3%</b>	<b>-1.6%</b>	<b>0.3%</b>	<b>3.8%</b>				
HFRI Fund of Funds Index		-4.4%	-3.3%	1.6%	1.5%	3.2%				