

House Views and Portfolio Positioning

Arizona State Retirement System

June 22, 2018

Outline

- 1 Summary View and Positioning
- 2 Macro Environment
- 3 Equities
 - Commentary
 - Trends
 - Valuation
 - Private Equity
- 4 Fixed Income
 - Commentary
 - Interest Rate Sensitive Fixed Income
 - High Yield and Private Debt
- 5 Real Estate
 - Commentary
 - Trends
 - Supply and Demand
 - Capital Markets Dynamics
- 6 Commodities
- 7 Historic Data

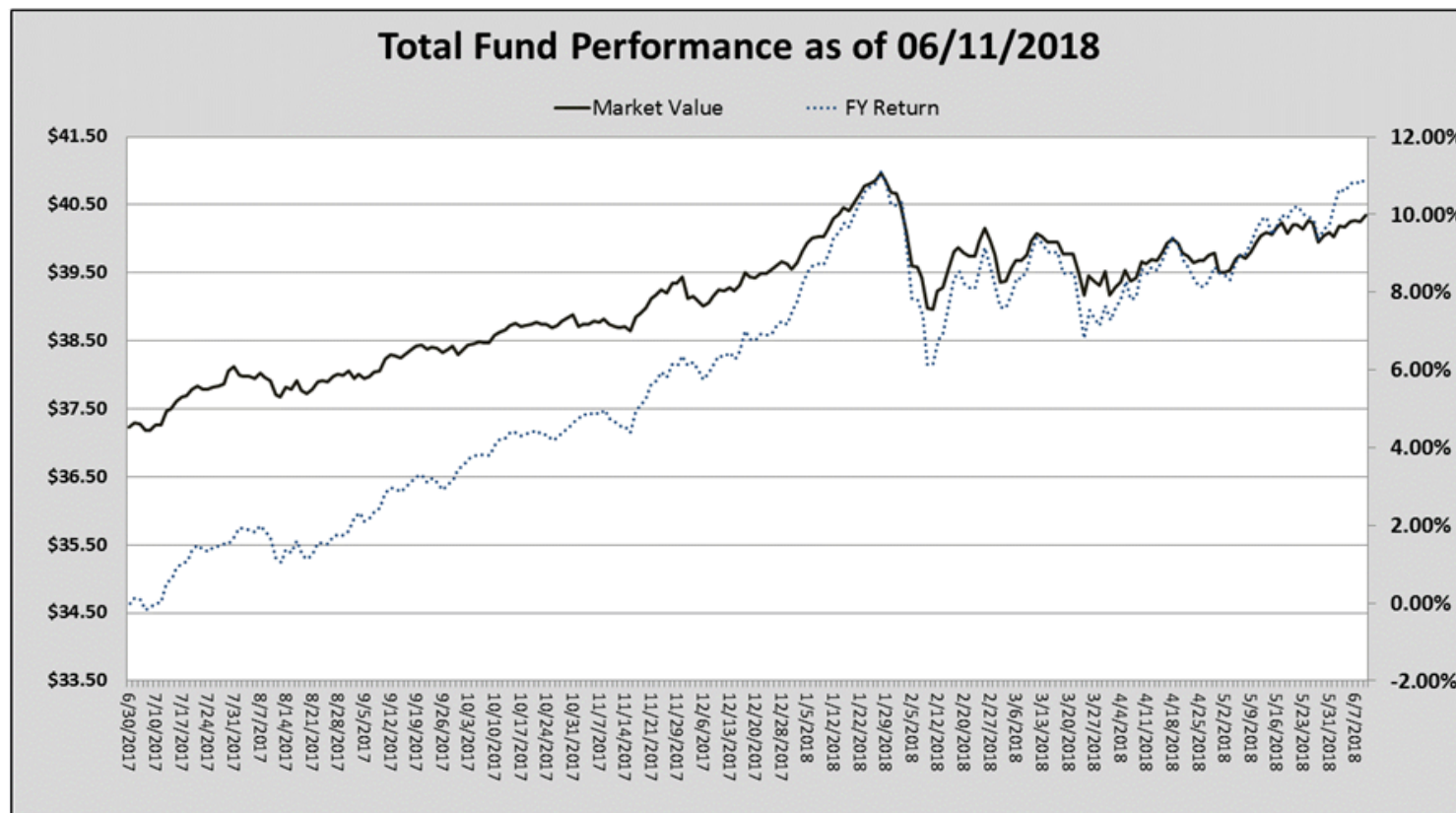
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Summary View

- We are close to policy weights throughout the portfolio
 - We moved to slight underweight in equities earlier this year with increased volatility
 - We are underweight core bonds expecting a continued upward trend in rates
 - We are slightly overweight credit expecting private credit to outperform in current conditions
- In general, markets are priced richly
 - Equity are slightly below their January peak, but are not cheap
 - After a period of some weakness, dollar is showing some strength due at least in part to higher U.S. rates
 - Political uncertainty is affecting markets
 - Prospect of isolationism/trade wars is troubling to the market
 - Unconventional fiscal policy has little precedent
 - Late cycle dynamics create asymmetric risk

Fiscal Year Performance



Total Fund Positioning

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Commentary

- Moderate growth globally
 - Accelerating growth in US and Europe
 - Decelerating growth in UK and Japan
 - US, UK and Japan at or near full employment
 - Europe employment improving, but room to run with nearly 8% unemployment
 - China growth a concern as lending levels are managed and normalized
- Inflation generally low but accelerating in US

Macro Indicators

Slow to moderate growth, strong employment, inflation generally low¹

6/11/2018

Economy		Moving Average		
			2 Yr.	1 Yr.
EHUPUS Index	US Unemp	4.1	4.8	4.7
EHUPEUN Index	EUR Unemp	7.4	8.6	8.4
EHUPGB Index	UK Unemp	4.2	4.9	4.7
EHUPJP Index	Japan Unemp	2.5	3.1	3.0
GDP CYOY Index	US GDP	2.8	1.8	1.9
EHGDEUR Index	EUR GDP	2.0	1.8	1.8
EHGDGB Index	UK GDP	1.2	1.8	2.0
EHGDJP Index	Japan GDP	-0.6	1.0	1.1
EHGDCN Index	China GDP	6.8	6.8	6.8
CPI YOY Index	US CPI	2.5	1.3	2.0
CPI XYOY Index	US CPI X fd nrg	2.1	2.1	2.0
CPEXEUY Index	EU CPI X fd nrg	0.9	0.9	1.0
JCPNEFEY Index	Jpn CPI X fd nrg	0.1	0.3	-0.1
CNCPIYOY Index	China CPI	1.8	1.7	1.6

¹ Note on data sources: Unless otherwise noted, all market and economic data in this report are from Bloomberg either in the form of screen shots or automatically retrieved using an API and formatted with ASRS software.

Global Interest Rates

Rates moving up in US, but soft elsewhere.

June 11, 2018

		Price	100 day moving average	50 day moving average	relative strength index	Hurst Exponent
Global Interest Rates						
USGG3M Index	US 3 Month	1.90	1.73	1.84	60	68
USGG10YR Index	US 10 Year	2.95	2.87	2.93	52	84
GETB1 Index	German 3 Month	-0.59	-0.66	-0.63	55	34
GDBR10 Index	German 10 Year	0.49	0.58	0.52	49	88
GUKG3M Index	UK 3 Month	0.50	0.45	0.50	51	91
GUKG10 Index	UK 10 Year	1.41	1.46	1.42	50	77
GJTB3MO Index	Japan 3 Month	-0.13	-0.16	-0.15	58	124
JGBS10 Index	Japan 10 Year	0.05	0.05	0.05	51	90

Currency

June 11, 2018

		Price	200 day moving average	100 day moving average	50 day moving average	relative strength index	Hurst Exponent	6 month price change	6 month volatility annualized	Momentum Index
Currency										
EURUSD Curncy	Euro/USD	1.18	1.20	1.22	1.20	43	80	0.10	6.97	0.01
GBPUSD Curncy	GBP/USD	1.34	1.36	1.38	1.37	40	73	0.10	7.66	0.01
JPYUSD Curncy	Yen/USD	0.0091	0.0091	0.0093	0.0092	45	47	2.63	6.79	0.39
CNY BGN Curncy	CNY/USD	0.1562	0.1545	0.1576	0.1576	54	66	3.34	4.07	0.82

Consensus Economic Forecasts

Economic Forecasts

Contributor

Composite

☐ See Previous forecasts

Period

Yearly

☐ See Last Actuals

	Real GDP (yoy %)			CPI (yoy %)			Unemployment (%)			Curr Acct (% of GDP)			Budget (% of GDP)		
	18	19	20	18	19	20	18	19	20	18	19	20	18	19	20
LatAm	2.48	2.92	3.04	337.9	246.97	6.79	10.06	9.38		-1.83	-2.26	-2.59	-5.93	-5.16	-4.92
E. Europe & Africa	3.09	2.88	2.86	5.13	5.2	4.9	7.73	7.66	7.79	-0.1	-0.34	-0.25	-1.68	-1.8	-1.73
Middle East	2.58	2.98	3.41	3.9	3.44	3.25	10.04			1.28	1.22	1.9	-5.53	-4.92	
Asia	5.92	5.87	5.82	2.23	2.58	2.68	3.91	3.9	4.01	1.7	1.47	1.23	-2.9	-2.92	-2.55
China	6.5	6.3	6.2	2.2	2.2	2.3	4	4	4	1.15	1.05	1.1	-3.5	-3.5	-2.9
G-10	2.35	2.05	1.7	1.97	1.88	1.95	5.2	4.98	5.02	0.14	0.09	-0.06	-2.55	-2.88	-2.85
USA	2.8	2.45	1.9	2.5	2.26	2.2	3.86	3.64	3.73	-2.7	-2.81	-2.84	-4	-4.89	-4.88
Japan	1.2	1	0.4	1	1	1.45	2.5	2.5	2.56	3.75	3.7	3.75	-4.2	-4	-3.4
Euro	2.3	1.9	1.7	1.5	1.6	1.75	8.3	7.9	7.8	3.3	3.25	3.1	-1	-1	-0.95
United Kingdom	1.4	1.5	1.8	2.5	2.1	2	4.3	4.4	4.4	-3.7	-3.4	-2.45	-2	-1.7	-1.4
Canada	2.1	1.9	1.8	2.3	2.1	2	5.8	5.7	6.05	-2.86	-2.6	-2.2	-0.8	-0.9	-1.25
Australia	2.7	2.8	2.8	2.2	2.3	2.5	5.5	5.3	5.1	-2.3	-2.3	-2.3	-1	-0.75	-0.1
Sweden	2.55	2.1	2	1.85	1.9	2	6.3	6.15		4	3.9		0.7	0.65	0.6
New Zealand	2.9	2.95	2.85	1.75	2	1.95	4.4	4.3	4.4	-2.8	-2.88	-2.8	0.95	0.9	1.6
Switzerland	2.1	1.8	1.7	0.8	1	1	2.93	2.8	2.7	9.9	9.85	9.2	0.4	0.3	0.3
Denmark	2	1.9	1.8	1	1.5	1.6	4.05	3.9		7.7	7.3		-0.3	-0.3	
Norway	2.3	2.2	1.8	2	1.8	2	3.75	3.5	3.3	6	5.8	6.4	4.65	4.9	5
Germany	2.3	2	1.5	1.7	1.8	1.8	5.2	4.95	4.95	7.8	7.4	7.1	0.9	0.6	0.4
France	2	1.8	1.6	1.6	1.5	1.7	8.8	8.4	8.2	-1	-0.9	-0.7	-2.6	-2.8	-2.4
Italy	1.4	1.2	1	1.2	1.3	1.6	10.7	10.3	10.1	2.7	2.45	2.3	-1.8	-1.8	-1.6
Europe	2.12	1.87	1.63	1.67	1.68	1.74	7.17	6.84	6.75	2.82	2.74	2.85	-0.81	-0.8	-0.87

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Positioning

- We are 0.7% underweight US public equities in aggregate
 - 0.7% underweight LC, neutral in MC & SC largely reflecting performance difference since March 1
- 0.7% in private opportunistic equity, which is predominantly US equity exposure
- We are 1.8% underweight in international equities in aggregate
 - 1.4% underweight EAFE LC, 0.2% underweight EAFE SC, and 0.2% underweight emerging markets
 - Transition to fund international factor portfolios is complete

Commentary

- On a valuation basis, US looks expensive vs ROW
- However. . .
 - Economic fundamentals of US and Europe are good
 - Low but modestly rising inflation, stable GDP growth, and high profitability
 - Easy monetary policy in US has ended while it persists in Europe
 - Fiscal stimulus via tax reform likely to bolster confidence in the short term albeit while unemployment is low
 - Dollar has strengthened recently
 - Fund flows have recently favored US versus ROW
 - EM has underperformed since mid-April
 - Recent tariff announcements also increase volatility and uncertainty
- Comparatively strong economic fundamentals justify, to some extent, the differential valuation between US and international equities
 - Consumer confidence in the US remains strong but several risk indicators are trending up after being on a downward trend from early 2016 to the end of 2017

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Equity Price Trends

Generally favorable price trends. International stocks impacted by currency.

June 11, 2018

		Price	200 day moving average	100 day moving average	50 day moving average	relative strength index	Hurst Exponent	6 month price change	6 month volatility annualized	Momentum Index
Stocks										
SPX Index	S&P 500	2782	2647	2710	2687	57	77	4.47	14.20	0.31
MID Index	S&P Mid	2001	1872	1913	1917	61	39	6.32	13.33	0.47
SML Index	S&P Small	1039	933	962	977	65	50	12.27	14.85	0.83
MXEA Index	EAFE	2010	2029	2045	2030	46	127	-0.23	9.54	-0.02
MSDLEAFE Index	EAFE Local	1148	1145	1140	1145	50	98	-1.07	9.24	-0.12
MXEASC Index	EAFE Small	271	265	271	270	51	109	4.19	9.94	0.42
NCLDEAFE Index	EAFE Small Local	402	386	391	396	57	107	4.44	9.20	0.48
MXEF Index	EM	1135	1154	1178	1152	46	74	1.54	12.91	0.12
NDLEEGF Index	EM Local	597	590	602	595	50	92	4.01	11.13	0.36
VIX Index	S&P 500 Volatility	12	14	17	16	45	69	25.13	157.64	0.16
RVX Index	Russell 2000 Volatility	13	16	18	17	46	52	-7.72	126.71	-0.06
VXEFA Index	EAFE Volatility	11	12	14	12	54	15	36.35	159.29	0.23
VXEEM Index	EM Volatility	18	19	22	20	47	69	14.61	107.25	0.14

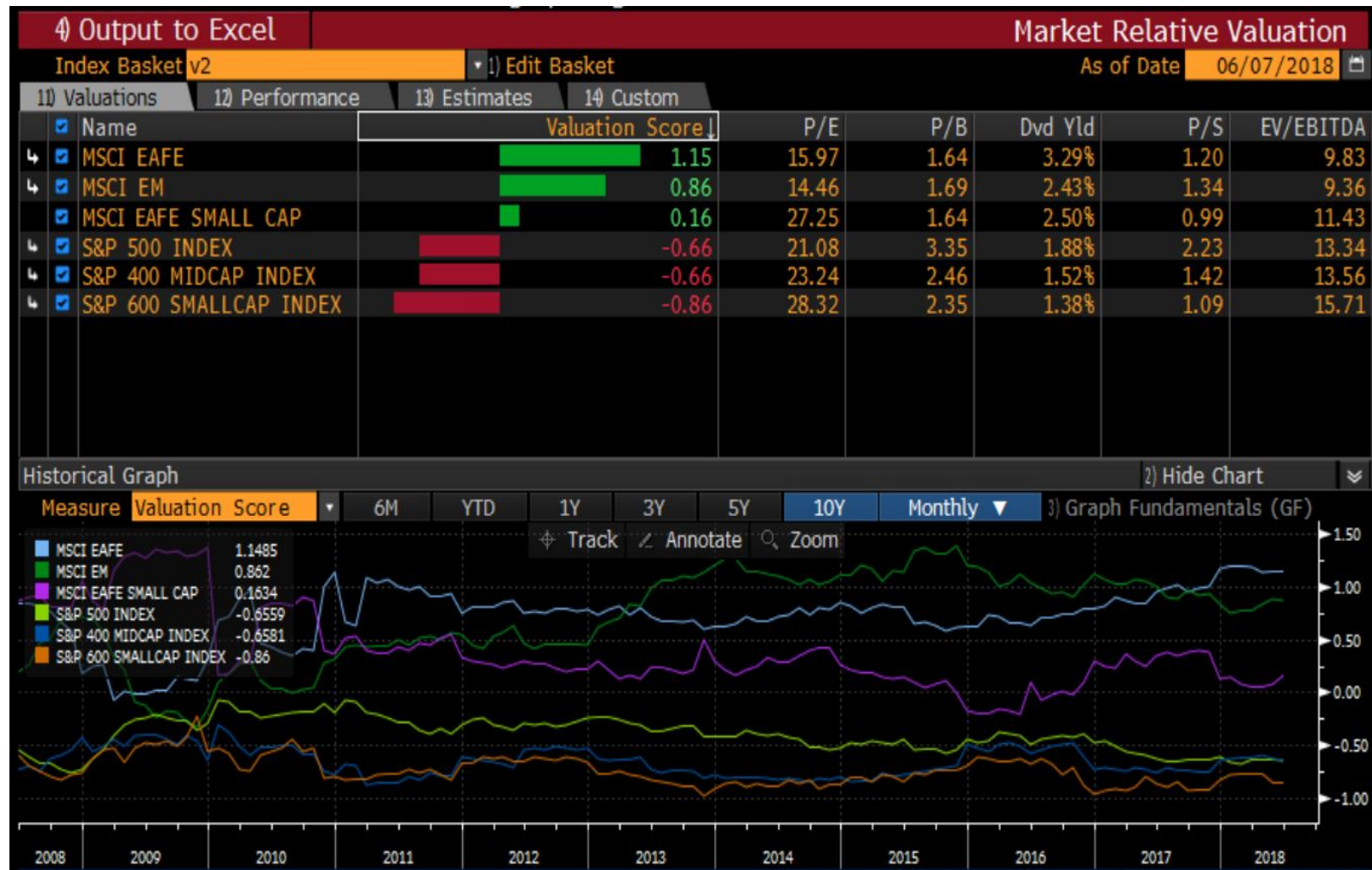
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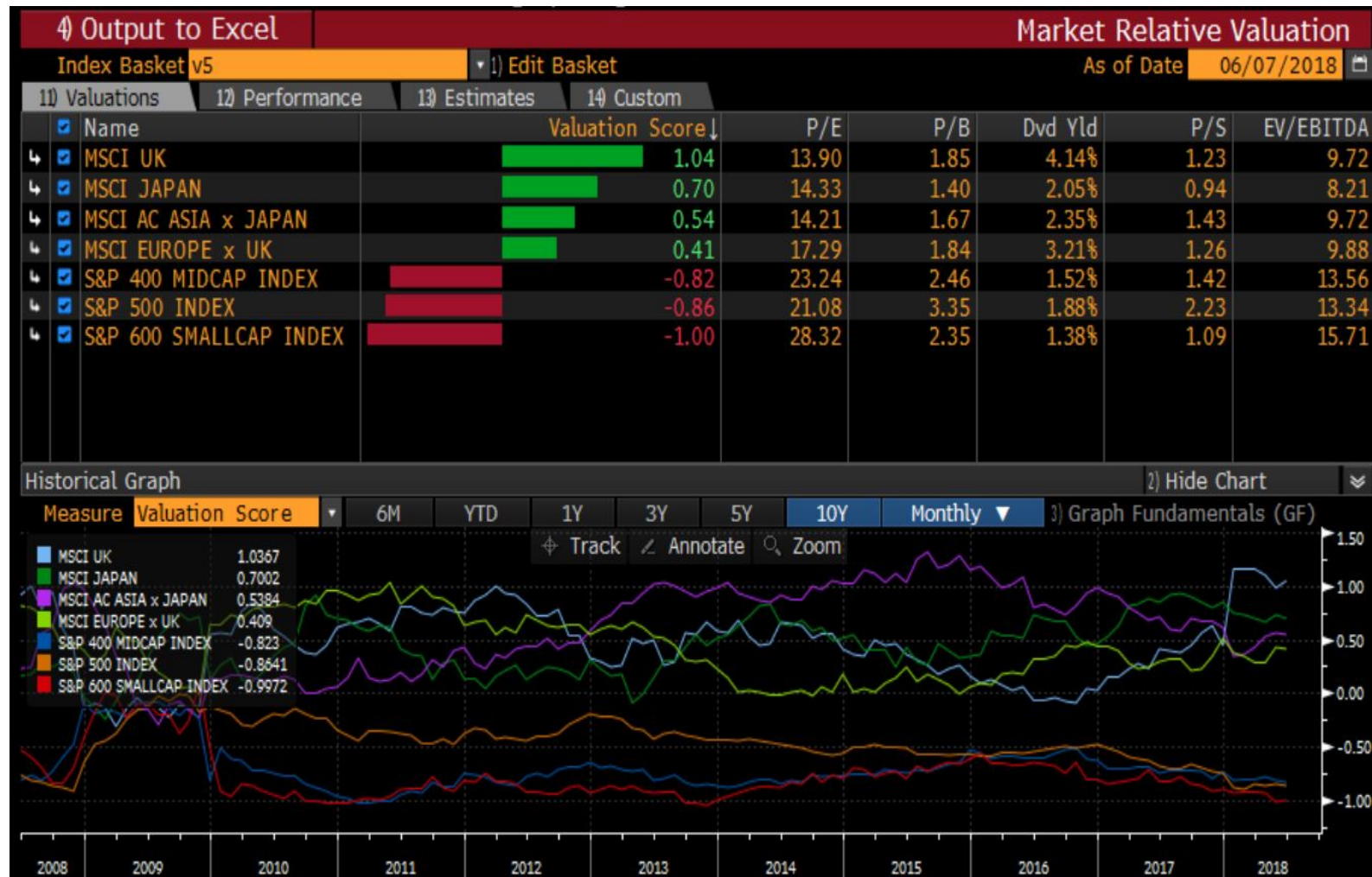
Relative Valuation of Global Indices



Relative Valuation of Global Indices (Continued)



Relative Valuation of Global Indices (Continued)



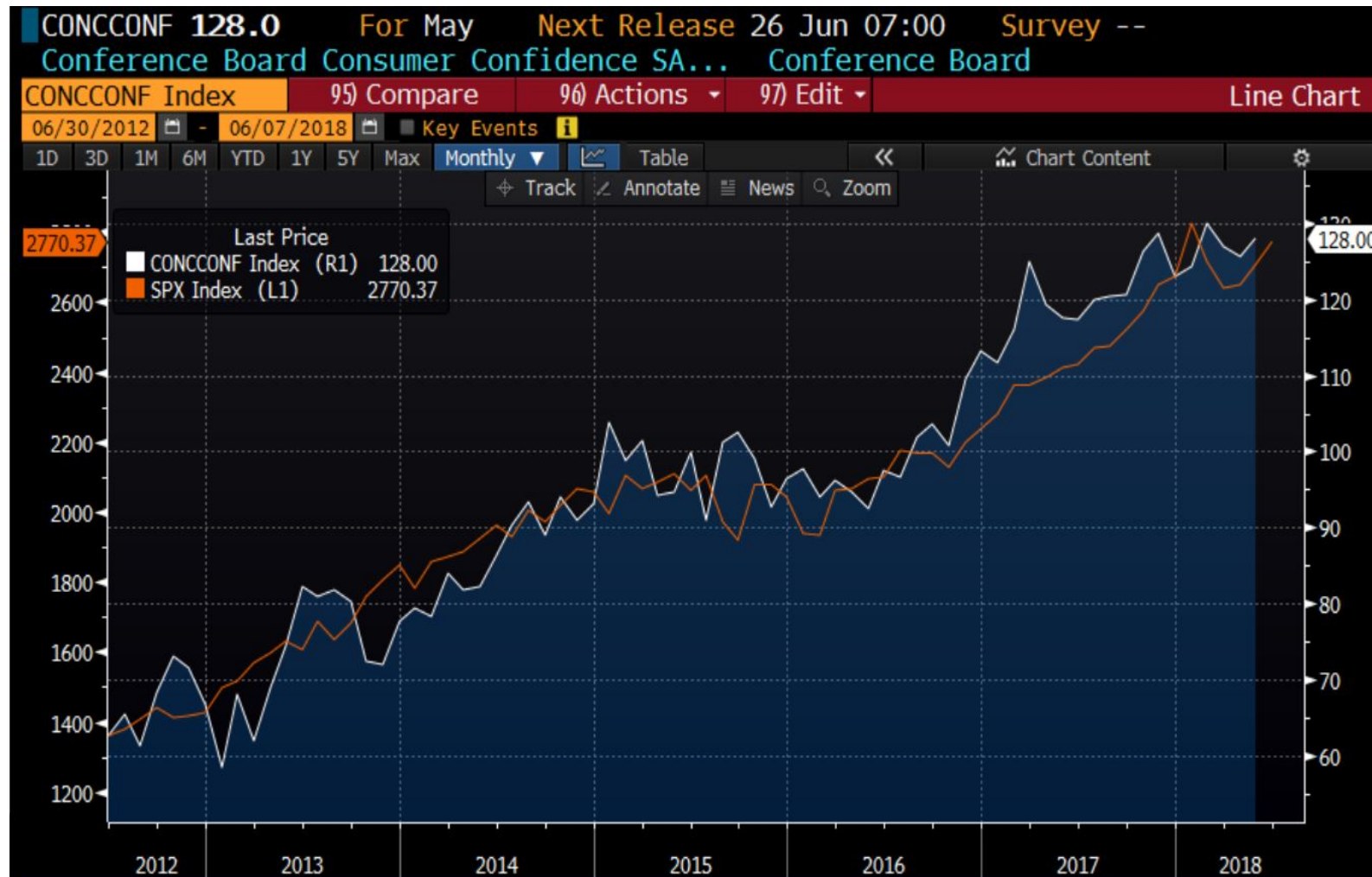
US Dollar











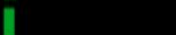

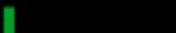

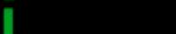

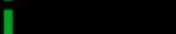

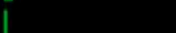

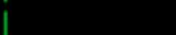

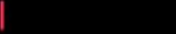

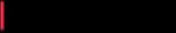

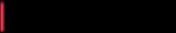

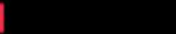

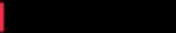

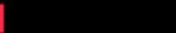

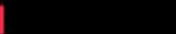

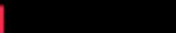

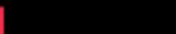

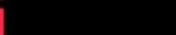

Currency Forecasts



Consumer Confidence



Fund Flows

Settings		ETF Flows							
View	Highest/Lowest	Show	Netflow	Market	All	Period	3M	In Millions of USD	
Map View	Details	Historical							
Country	Netflow	Netflow	Flow%	Assets	#Funds	Inflow	In/Out	Outflow	
Highest									
10) United States		+65,962	+2.3	2,887,150	1,814	336,257		-270,296	
11) Japan		+10,054	+2.7	377,519	282	57,137		-47,083	
12) China		+9,078	+7.5	120,334	328	26,393		-17,315	
13) United Kingdom		+1,057	+2.8	37,850	105	3,191		-2,134	
14) Canada		+1,016	+1.4	70,606	240	8,529		-7,513	
15) Mexico		+993	+23.0	4,325	25	1,804		-811	
16) Hong Kong		+757	+2.8	27,032	45	1,574		-817	
17) Brazil		+711	+6.9	10,357	30	1,341		-630	
18) South Korea		+371	+1.1	32,470	192	10,373		-10,002	
19) Singapore		+245	+10.2	2,390	10	383		-138	
Lowest									
20) Greater China*		-331	-2.5	13,083	43	2,302		-2,633	
21) Spain		-343	-9.4	3,631	12	559		-902	
22) Taiwan		-348	-3.7	9,331	37	819		-1,167	
23) India		-650	-2.7	24,121	107	528		-1,177	
24) Switzerland		-751	-4.7	15,889	48	1,176		-1,928	
25) Russia		-818	-21.7	3,772	19	529		-1,347	
26) Italy		-1,047	-21.6	4,848	43	1,059		-2,106	
27) Germany		-2,499	-6.0	41,782	140	3,356		-5,855	
28) European Region*		-4,801	-4.0	119,623	332	8,338		-13,139	
29) Eurozone*		-10,153	-6.5	155,985	266	10,671		-20,824	

Outline

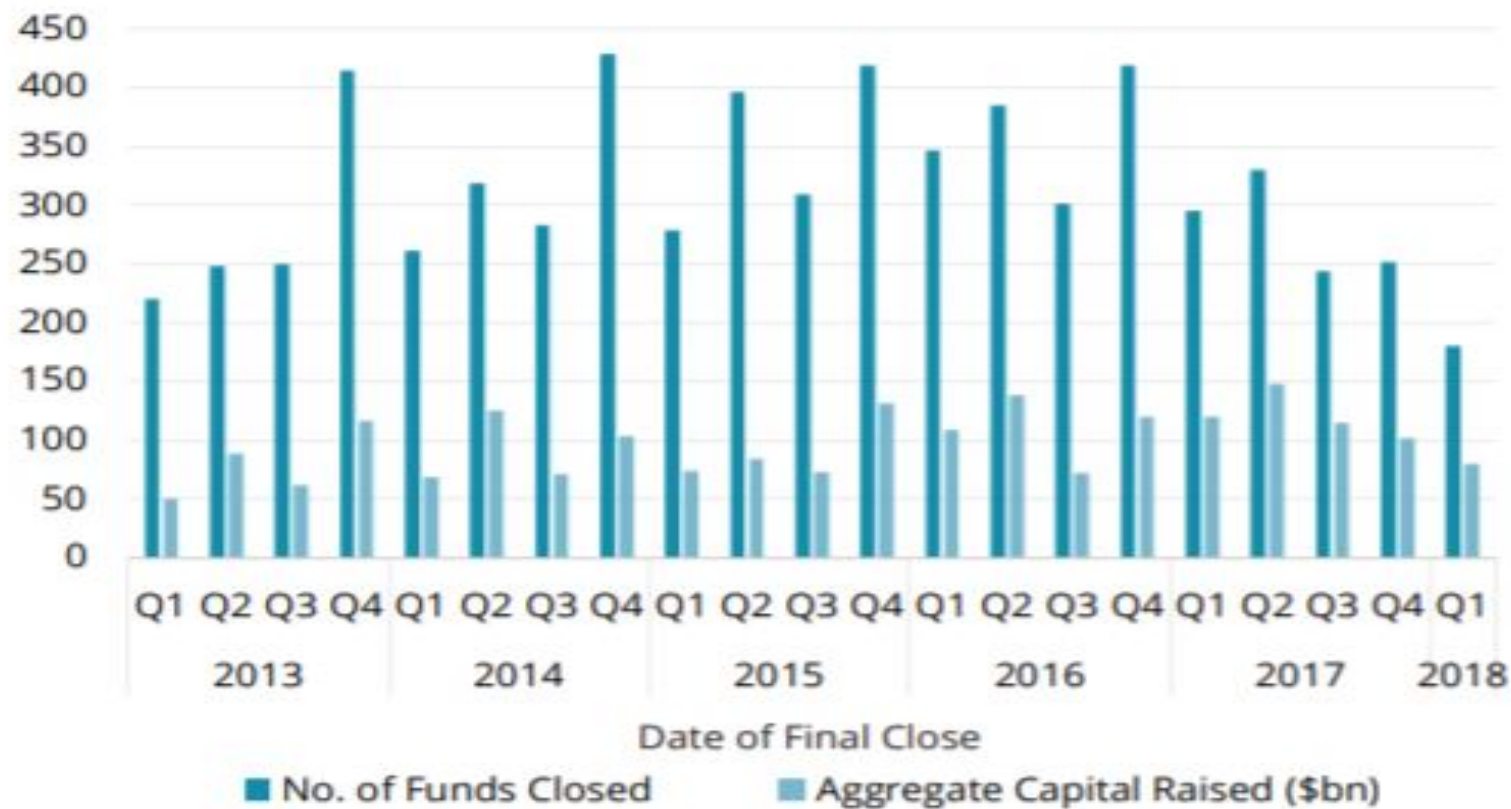
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Private Equity Environment

- Pace of fundraising has moderated a bit
- Deal volume and aggregate deal value are relatively steady
- Exit volume and values are showing a moderate downward trend
- Dry powder has steadily risen as the asset class has grown
- Deal multiples are flat while debt levels are up
- Given the long-dated nature of funds we do not attempt to time cycles but are paying close attention to the partners we select and their capabilities

Private Equity Fund Raising

Fig. 1: Global Quarterly Private Equity Fundraising, Q1 2013 - Q1 2018



Source: Preqin

Private Equity M&A Deal Volume

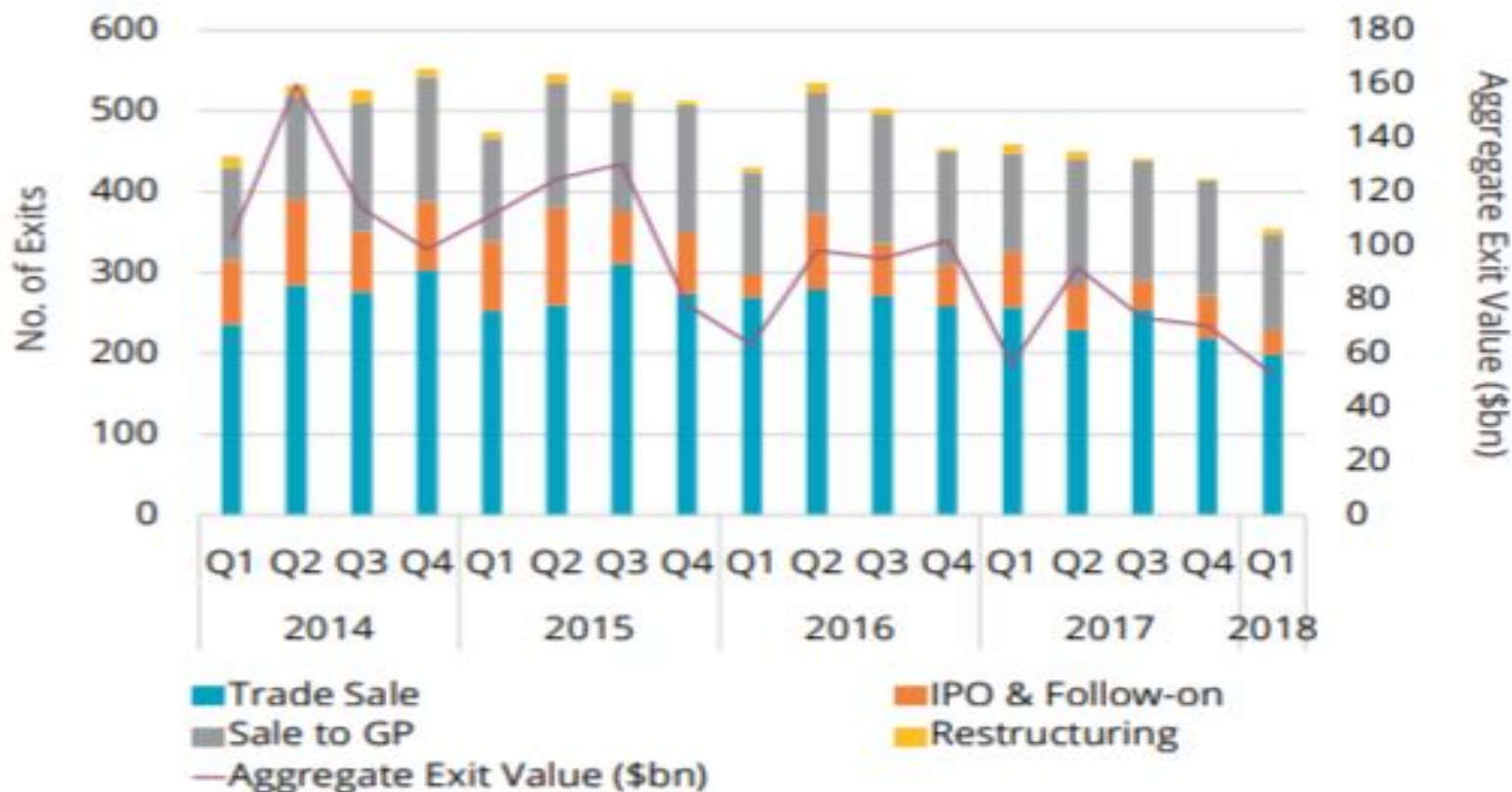
Fig. 17: Private Equity-Backed Buyout Deals, Q1 2014 - Q1 2018



Source: Preqin

Private Equity Exits

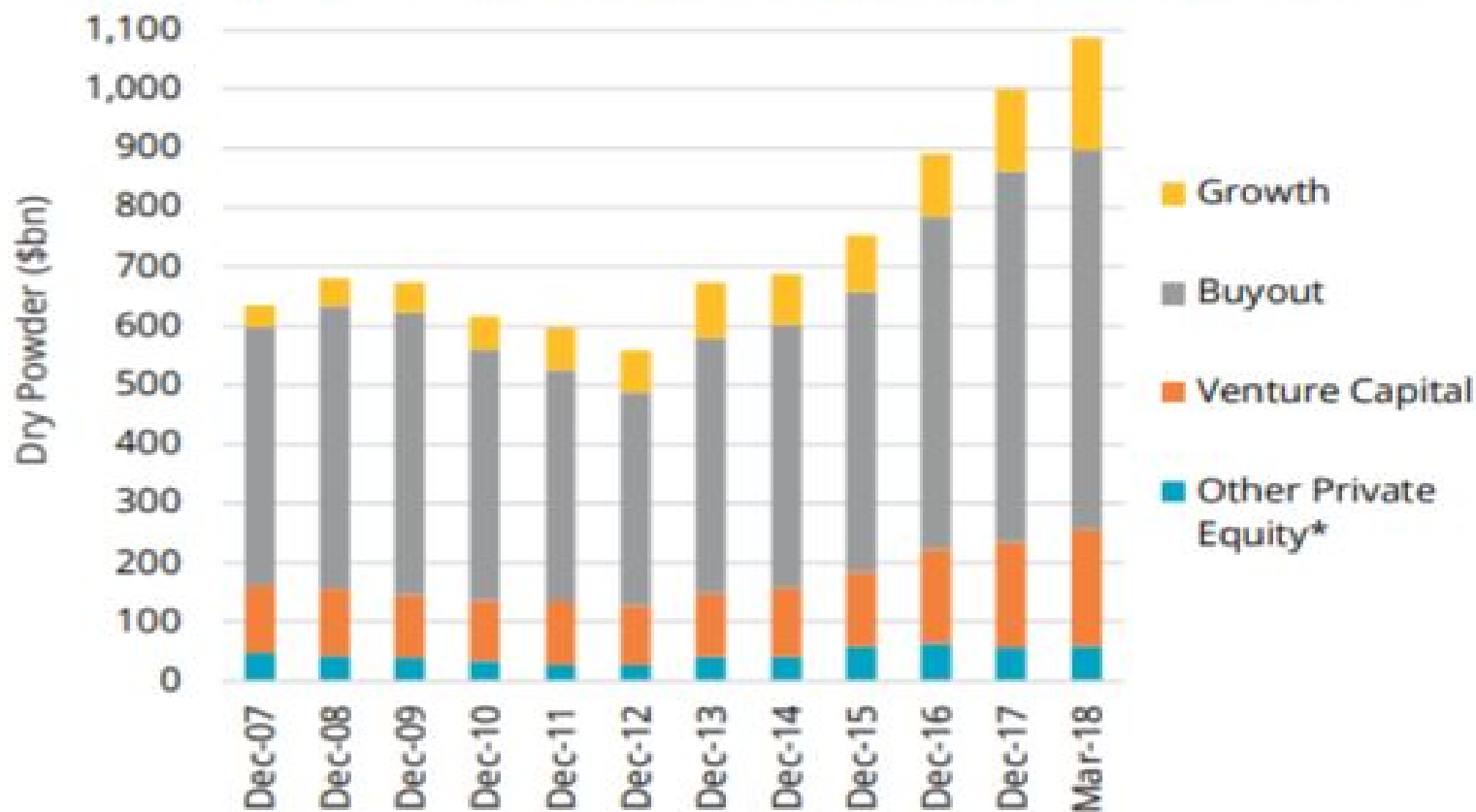
Fig. 19: Private Equity-Backed Buyout Exits by Type and Aggregate Exit Value, Q1 2014 - Q1 2018



Source: Preqin

Private Equity Dry Powder

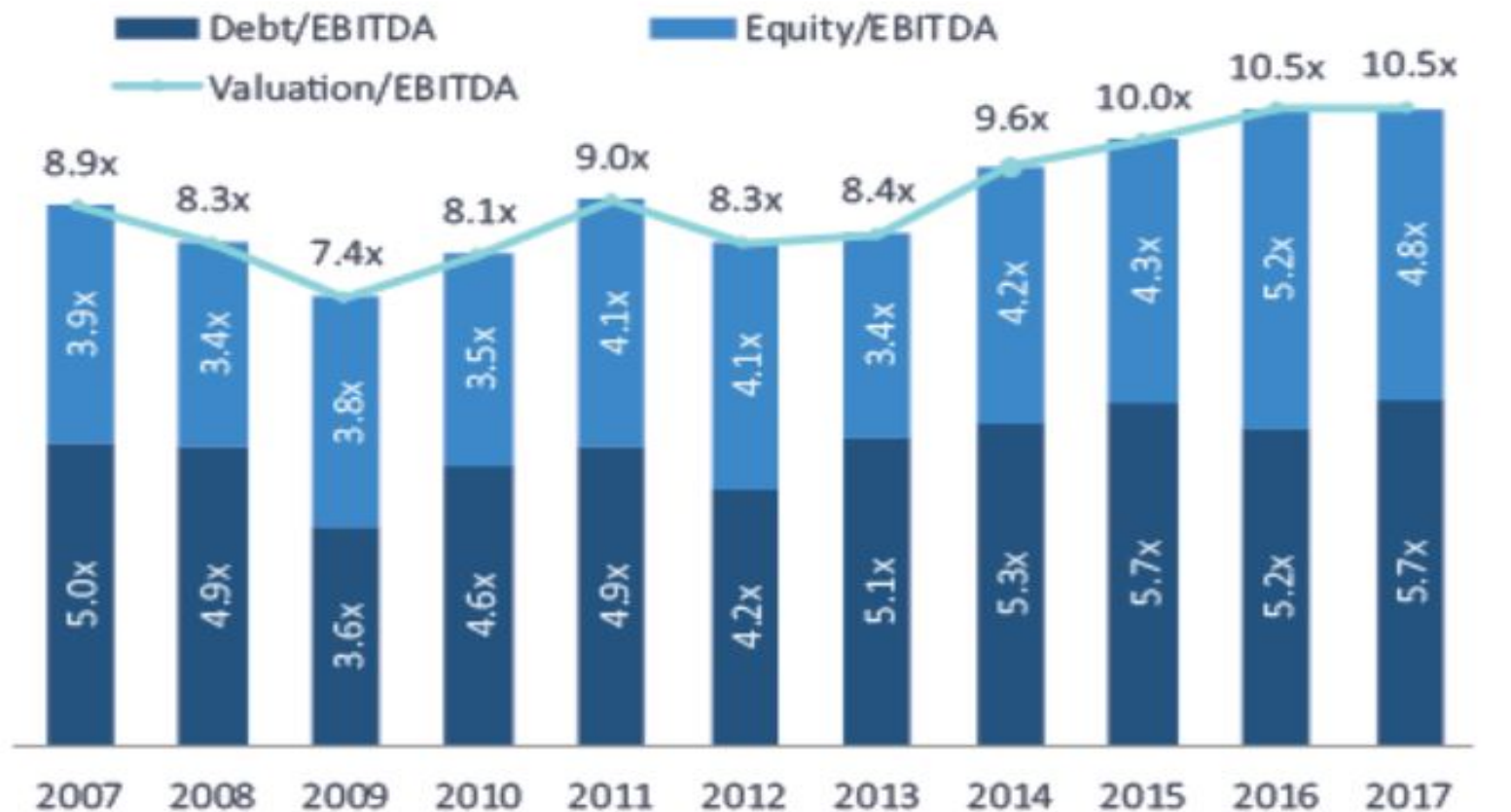
Fig. 28: Private Equity Dry Powder by Fund Type, 2007 - 2018



Source: Preqin

Private Equity Buyout Multiples

US M&A (including PE buyouts) multiples



Source: PitchBook

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Commentary

Fixed Income

- We have an overweight allocation to Fixed Income with a recent weighting of 25.7% vs. the SAA target of 25.0%.
- The overweight in Fixed Income is entirely due to our allocation to Opportunistic Debt (4.1% vs. a 0.0% target). This reflects our view that select areas of the debt markets which are not encompassed in the SAA, such as distressed debt in the U.S. and Europe, offer attractive return opportunities over the long-term.
- We are underweight Interest Rate Sensitive Fixed Income (9.5% vs. a 11.5% target) and High Yield Fixed Income (0.8% vs. a 2.1% target).
- We continue to believe that the Private Debt asset class offers the most attractive opportunity in Fixed Income with double-digit yields and relatively stable investment performance available for investors willing to accept illiquidity. Investments in Private Debt represent approximately 11.4% of the total fund (vs. a target of 12% and a potential range of 8-16%).
- In order to take advantage of the attractive opportunity in Private Debt, over the past year, we increased our commitments to our Private Debt managers with current partnership commitments (adjusted for partnerships in liquidation) now representing approximately 15.5% of the total fund.

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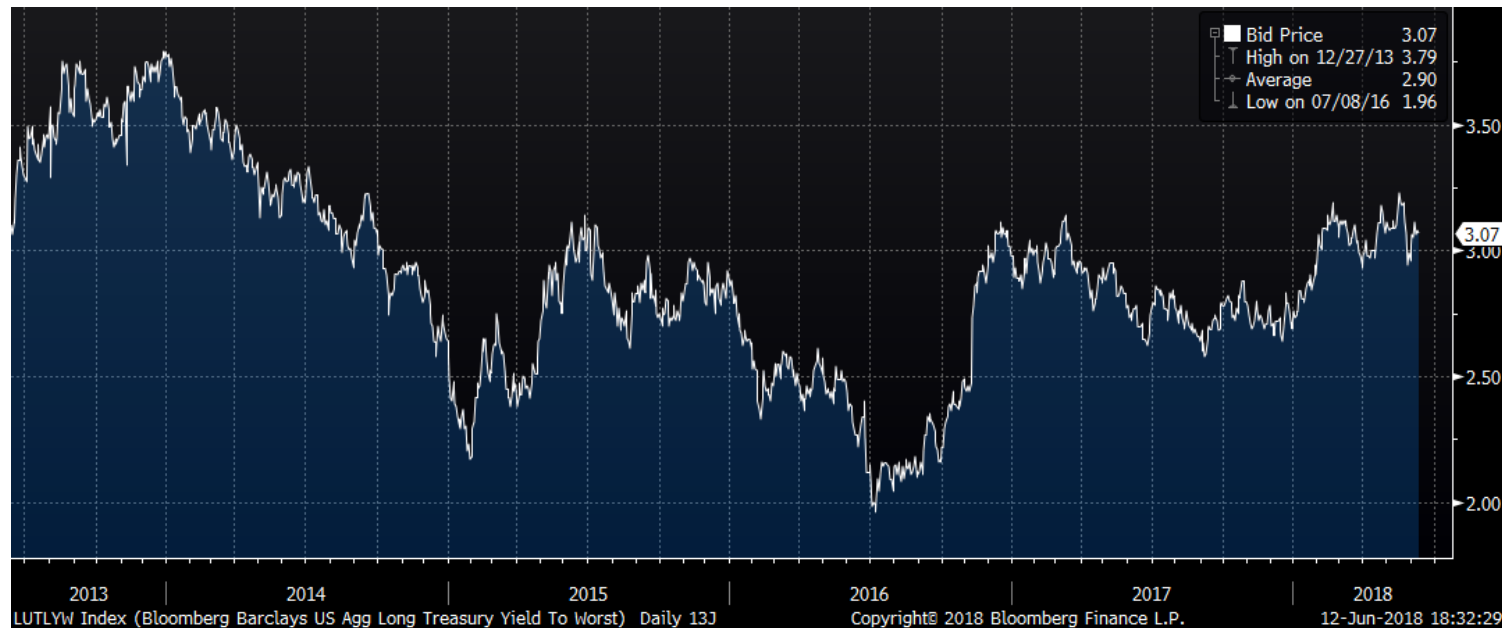
Rates

Interest Rate Sensitive Fixed Income

- We are underweight Interest Rate Sensitive Fixed Income (9.5% vs. a 11.5% target). Interest Rate Sensitive Fixed Income is likely to generate low returns as Treasury yields are at relatively low levels both on the short-end and long-end of the yield curve. Competing long-term interest rates in major developed countries such as Germany and Japan are very low.
- In addition, over the intermediate term, we see a heightened risk that rates may rise as global growth expectations are generally improving and central banks such as the Federal Reserve and the ECB are pulling back from unusually aggressive monetary policies that have pushed down interest rates in major developed countries.
- That being said, Interest Rate Sensitive Fixed Income remains a safe haven in times of market turbulence or uncertainty and tends to perform well when risky assets such as equities sell off.

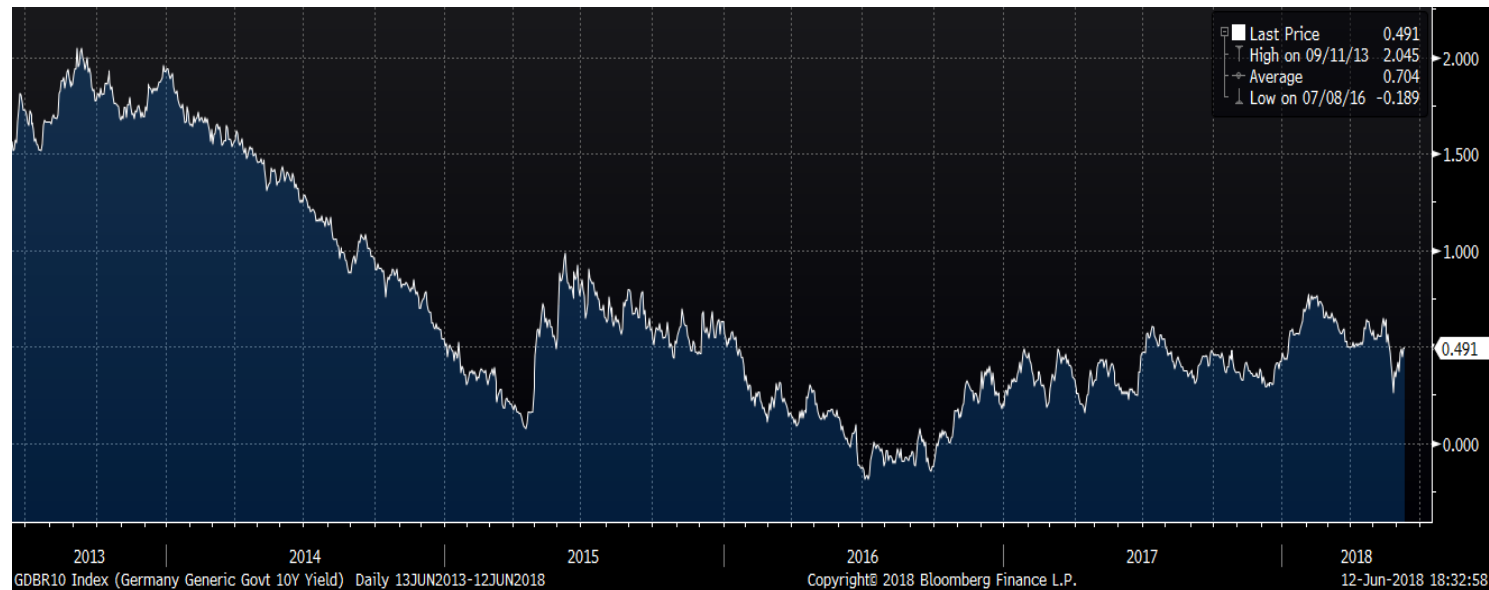
Long Treasury

Bloomberg Barclays U.S. Long Treasury Index Yield 2013 – 2018



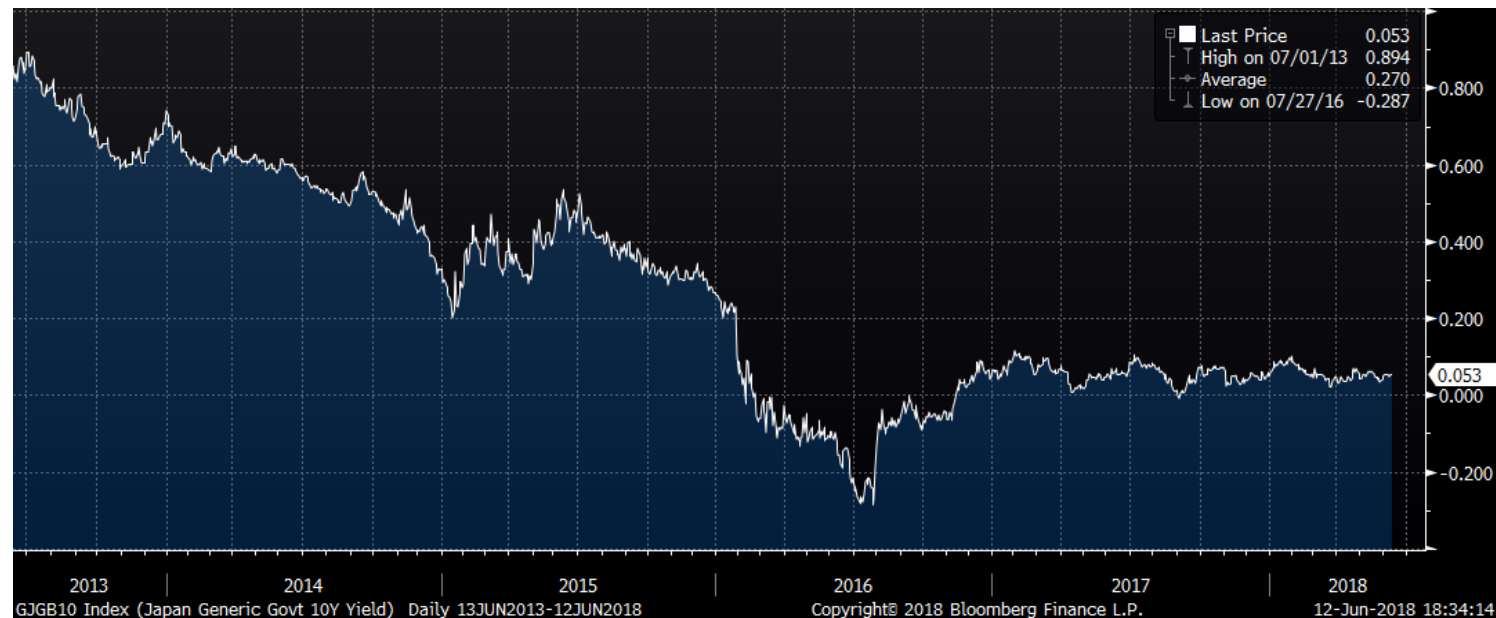
German Bund

10 Year German Bund Yield 2013 - 2018



Japanese Bonds

10 Year Japanese Government Bond Yield 2013 - 2018



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High Yield

High Yield

- We have an underweight in High Yield Fixed Income (0.8% vs. a 2.1% target). In 2017, we reduced our weighting in the High Yield asset class to fund the expansion of our investments in Private Debt, an asset class which offers significantly higher expected returns with lower volatility.
- We have had an unusually long credit cycle, which began with an upturn in 2009. With corporate credits having a generally healthy outlook and strong global demand for yield buoying the high yield market, we believe that defaults will likely remain low over the intermediate term and the credit cycle will be elongated.
- Spreads and yields in the high yield market are generally at much lower levels than in the past. As a consequence, we do not view this asset class as being particularly attractive.

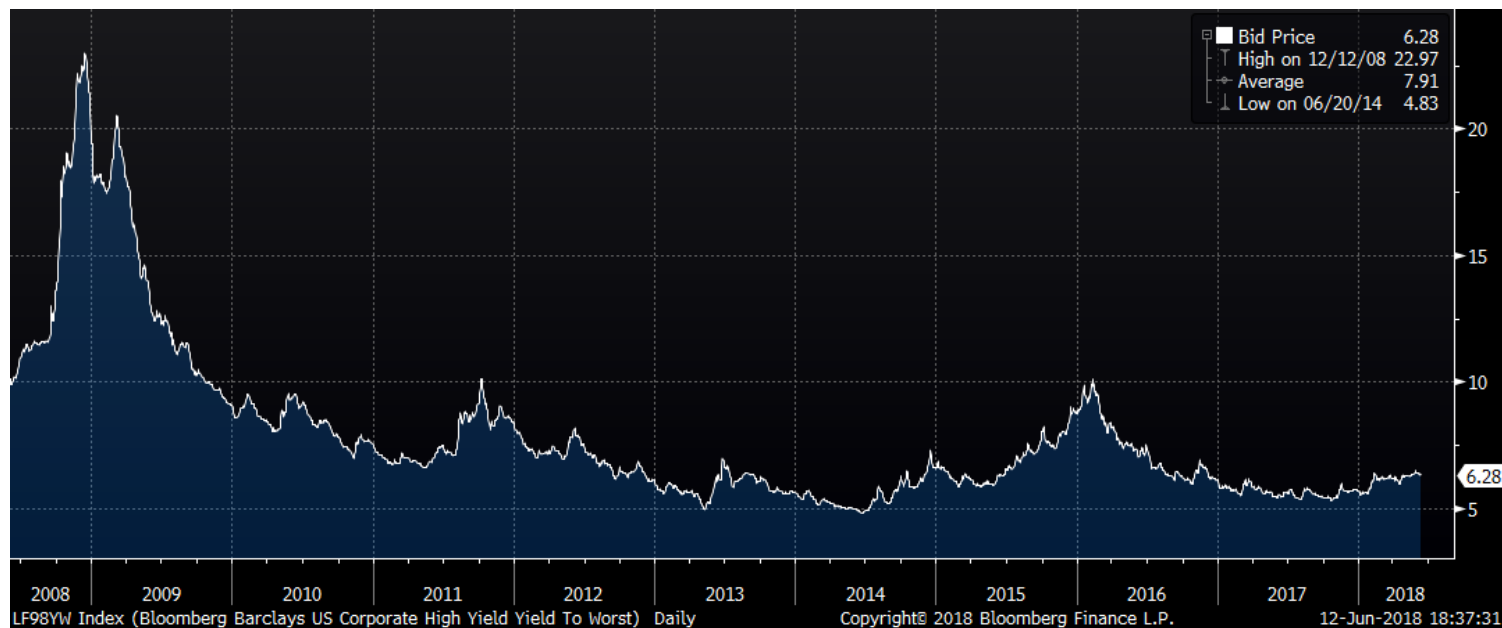
High Yield Credit Spread

Bloomberg Barclays US Corporate High Yield Index Option Adjusted Spread (OAS) 2008 – 2018



High Yield Yield-to-Worst

Bloomberg Barclays US Corporate High Yield Index Yield-to-Worst 2008 – 2018



Private Debt

Private Debt

- We believe the Private Debt asset class offers the most attractive opportunity in the fixed income markets with double-digit yields available for investors willing to accept illiquidity. The market opportunity is principally driven by regulatory constraints that make it unattractive for banks to hold illiquid loans or other debt of below investment-grade credit quality.
- In the past several years, regulatory constraints limiting the ability of banks to make below investment-grade, illiquid loans (typically to middle market companies) have become more severe due to a number of policies: the adoption of Basel III, Dodd-Frank financial regulation and “Leveraged Lending Guidelines” of US bank regulators.
- Over time, it is likely that the new Trump administration may ease some regulatory burdens on banks that could result in fewer opportunities for private lenders in some situations. However, we believe that the primary regulatory constraints on banks, which are driven by international banking requirements, will remain intact.
- In the past few years, additional capital flowing into the Private Debt markets has increased competition for the funding of private lending transactions; this has generally resulted in lower spreads. To some extent, the lower spreads have been offset by higher LIBOR levels which increase the yields on floating rate loans. Despite some compression in overall yields, the Private Debt market offers significantly higher expected returns than the public credit markets.

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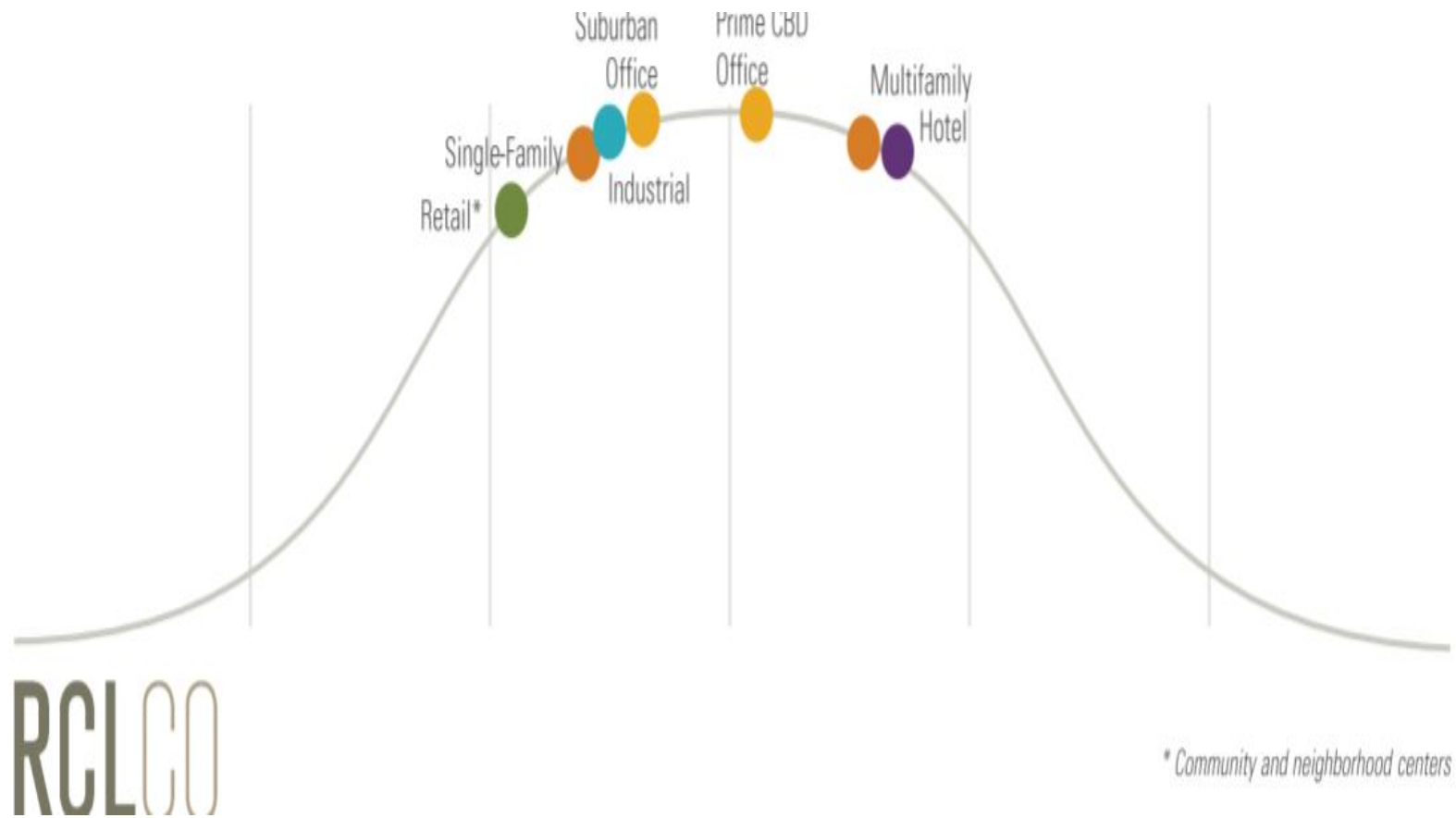
Commentary

- Property markets are generally in the latter stages of the real estate cycle for most property types in most geographies
 - These conditions are anticipated to extend through 2018 due to a continued strong economy and healthy property market fundamentals
- Fundamentals leads us to emphasize apartments, industrial properties, medical office buildings, and senior housing as well as specific MSA's (e.g. Los Angeles, New York) for demographic and macro policy reasons
 - Certain retail categories require a substantial discount because of weak demand fundamentals and the rapid growth of e-commerce sales
 - For sale housing remains a potential target for opportunistic investing because financing and entitlement constraints have kept the market under-supplied
 - Single-family residential rental market is a target for investing due to new household formations reaching 2001 levels, low availability of mortgage credit, and an under-supplied market
- CMBS spreads have declined and continue to remain at fairly attractive rates as they have not increased commensurate with the 10 year Treasury yield
- Dry powder remains at cyclical highs globally and North America representing more than half of total but fundraising has declined from the 2015 high

Outline

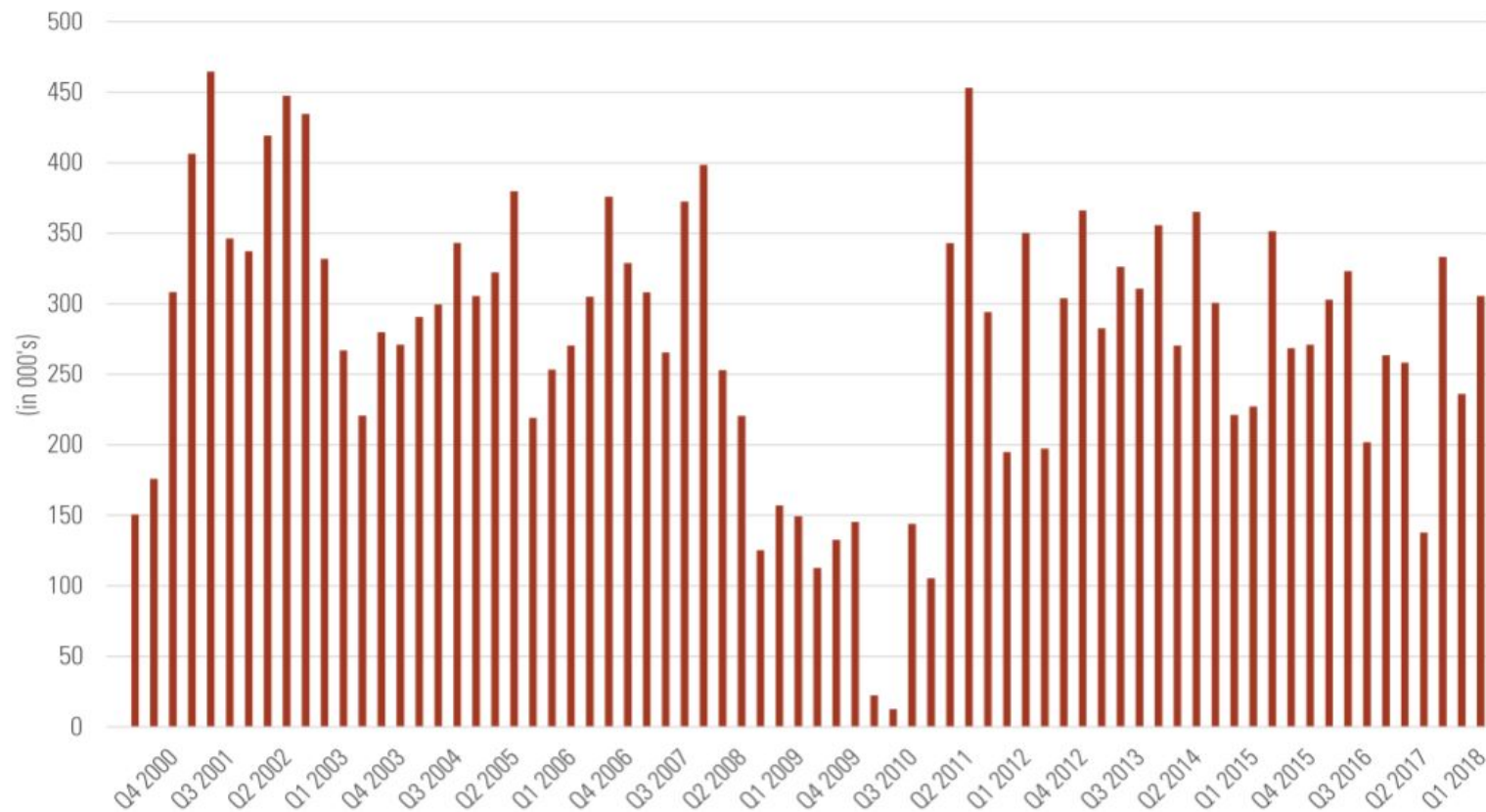
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Real Estate Cycle Overview



New Household Formation

U.S. Household Formation
2000 - Q1 2018



RCLCO

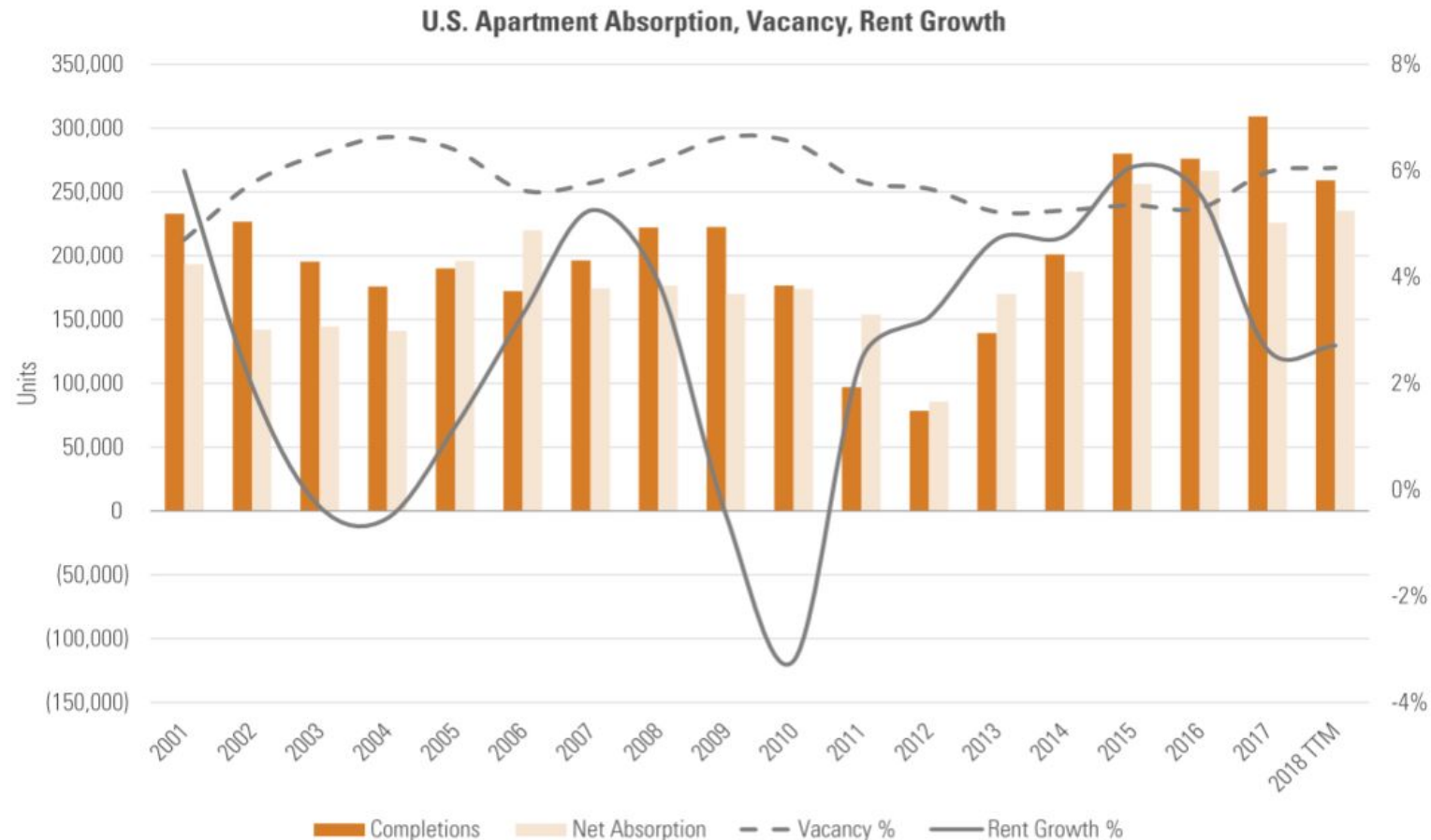
Source: Moody's Economy.com

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Occupancy Trends and New Supply

Multifamily (As of 3/31/18)



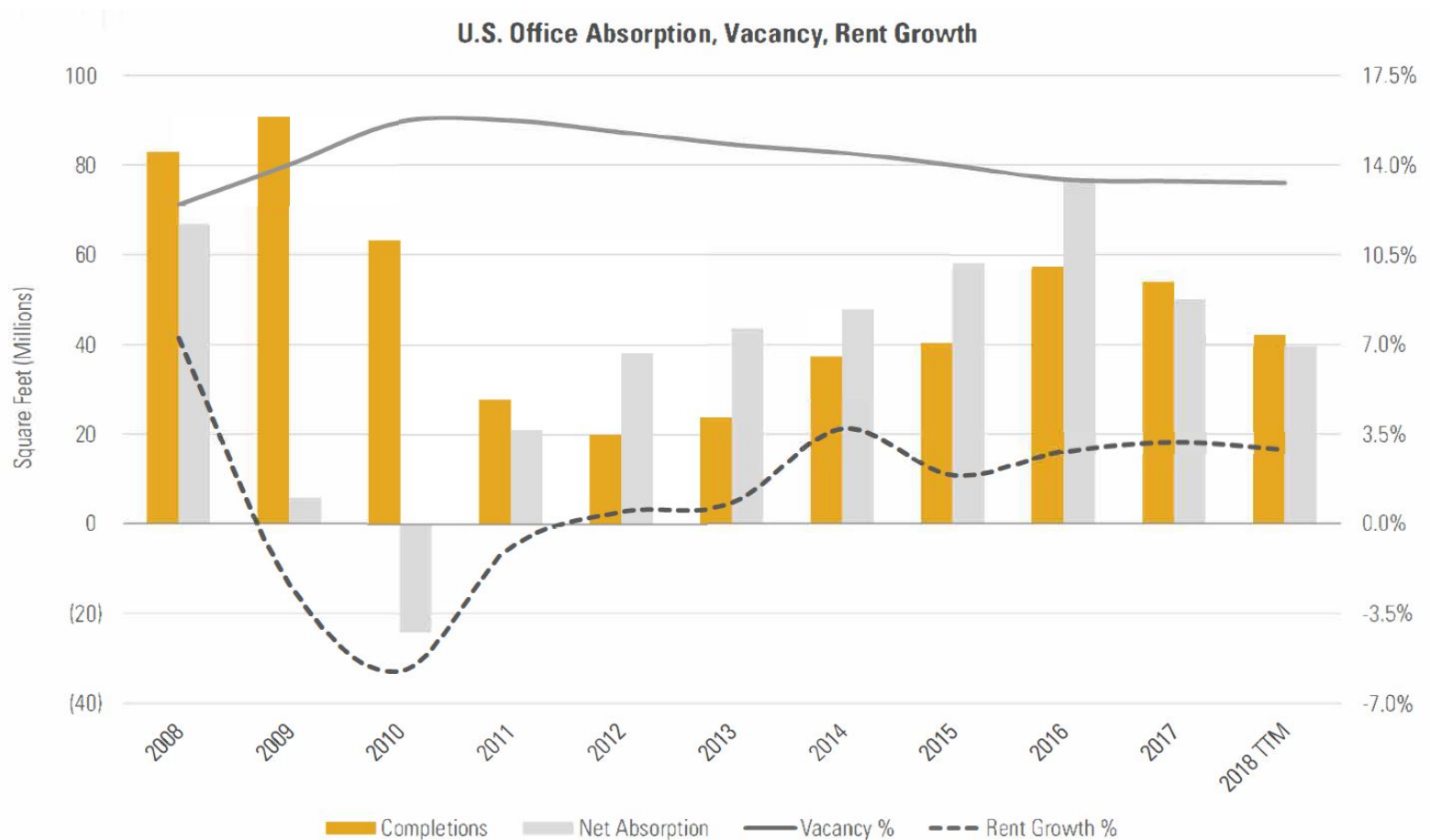
RCLCO

Notes: Apartment criteria filtered as follows: multifamily property (secondary type is apartment), 50+ units, and a 3-star or greater CoStar rating

Source: CoStar; RCLCO

Occupancy Trends and New Supply

Office (As of 3/31/18)



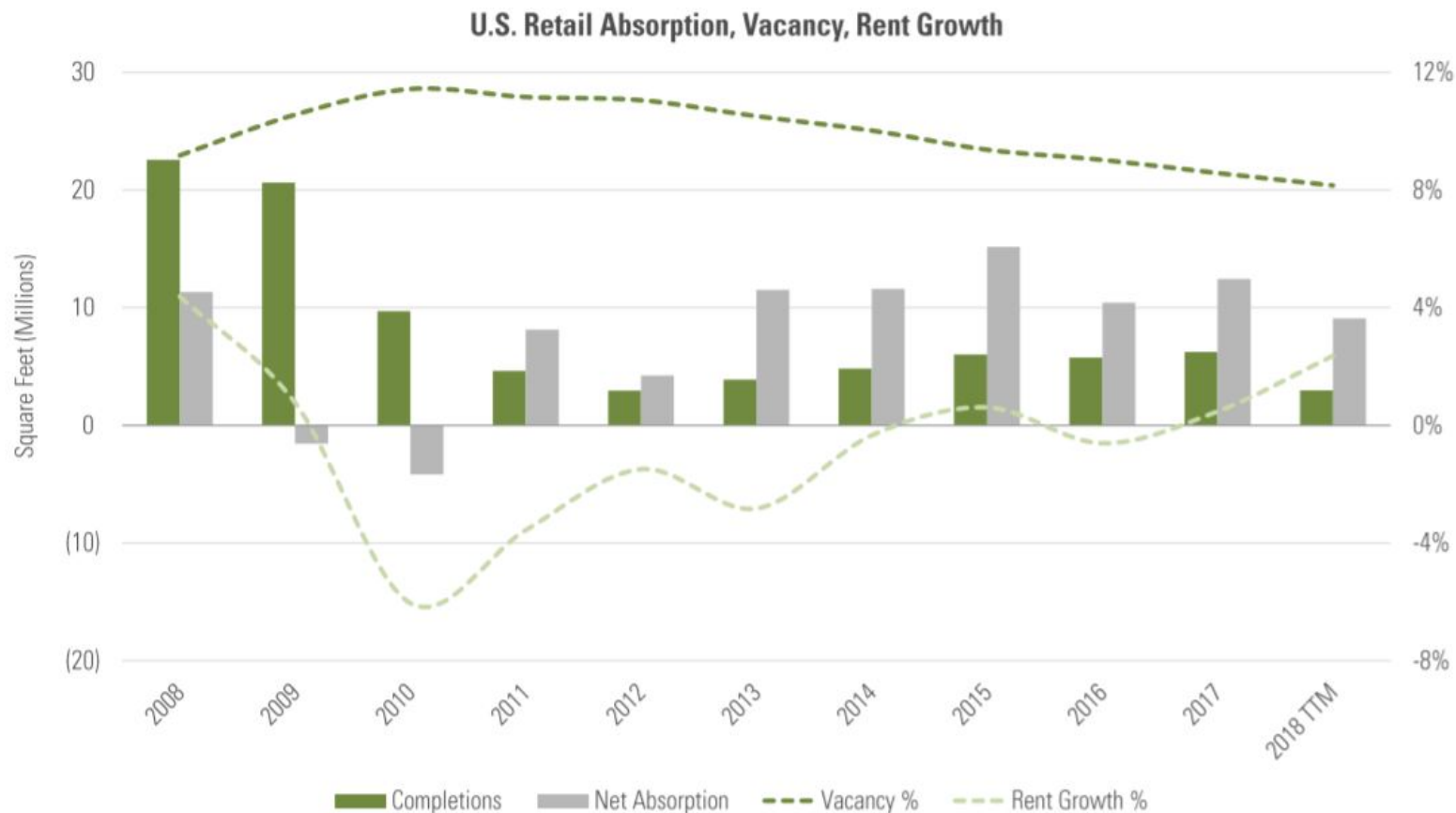
RCLCO

Note: Office criteria filtered as follows: office property, not owner occupied, 30,000+ SF, and a 3-star or greater CoStar rating

Source: CoStar, RCLCO

Occupancy Trends and New Supply

Retail (As of 3/31/18)



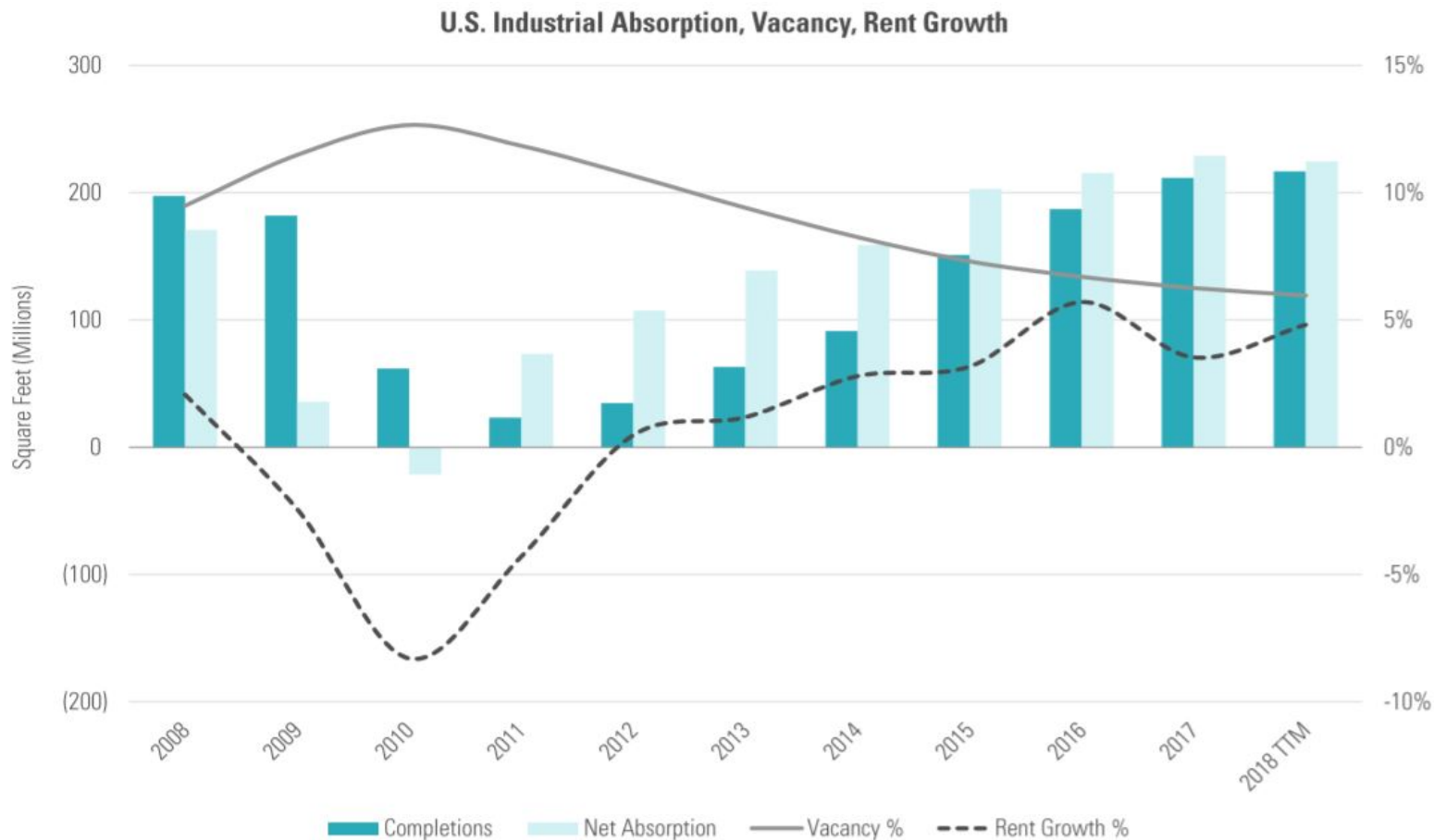
RCLCO

Notes: Above data is for neighborhood and community centers only; Retail criteria filtered as follows: retail property in a shopping center, not owner occupied, 30,000+ SF, multiple tenancy, and a 3-star or greater CoStar rating

Source: CoStar, RCLCO

Occupancy Trends and New Supply

Industrial (As of 3/31/18)



RCLCO

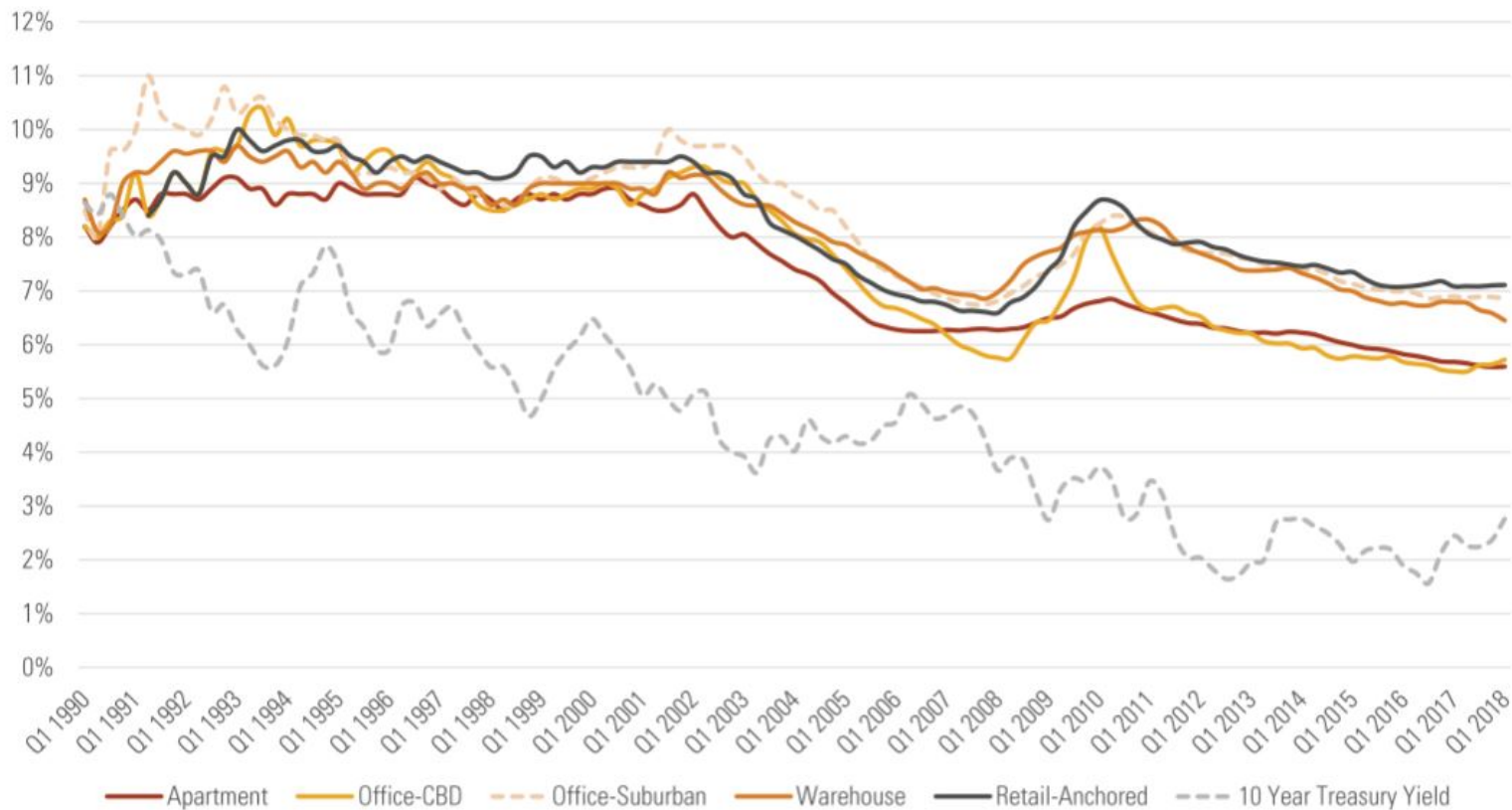
Note: Industrial criteria filtered as follows: industrial property (secondary type is either distribution or warehouse), 30,000+ SF, and a 3-star or greater CoStar rating
Source: CoStar; RCLCO

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Cap Rate Trends

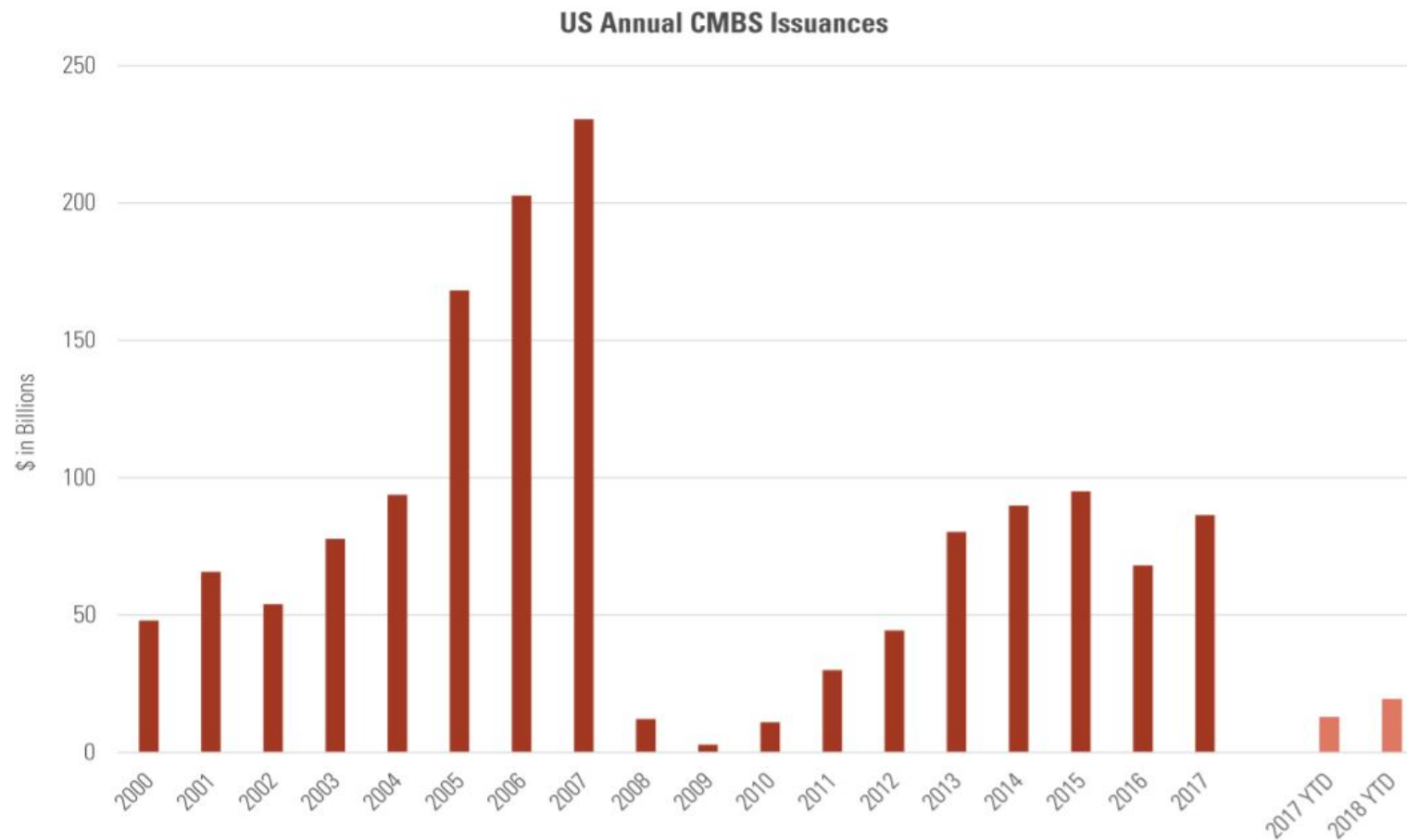
Cap Rates by Property Type
1990 - Q1 2018



RCLCO

Source: RERC; RCA

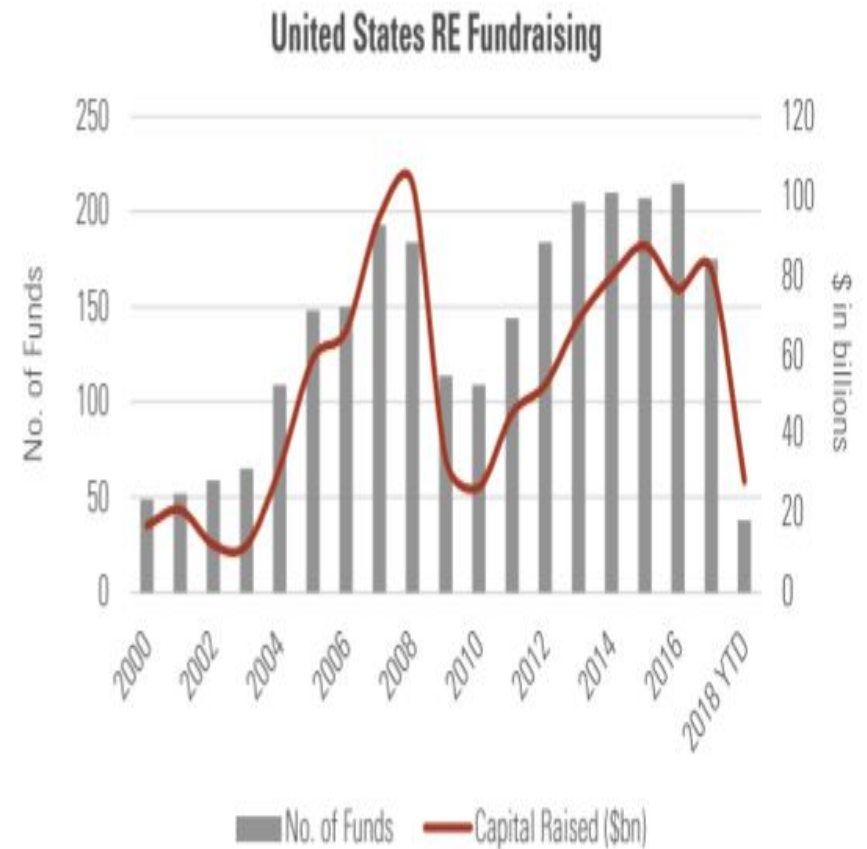
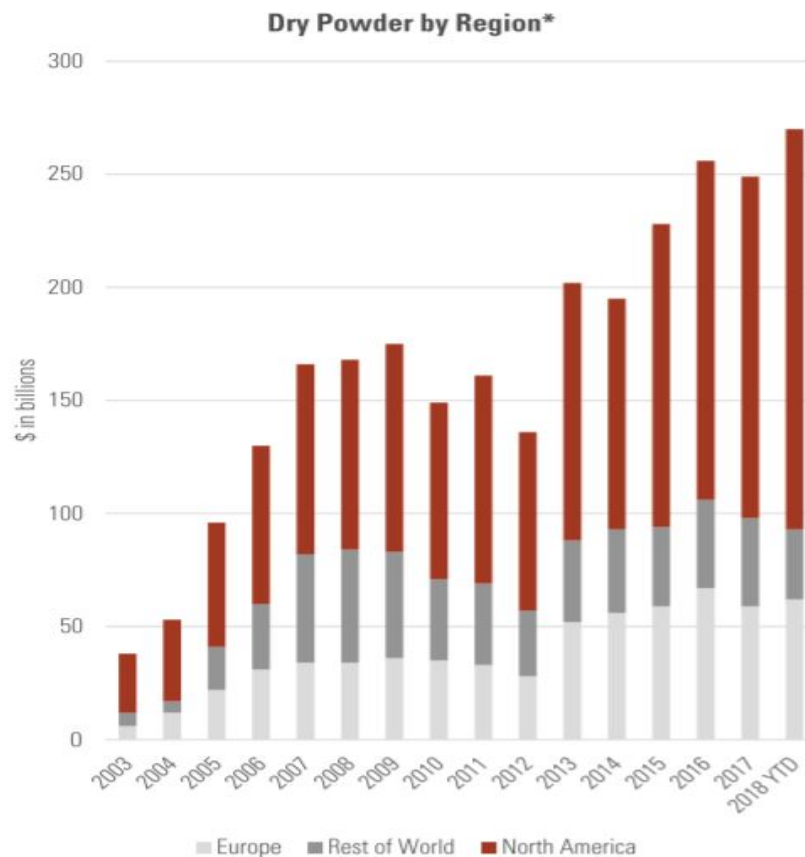
Credit Availability



RCLCO

Source: Commercial Real Estate Finance Council

Real Estate Dry Powder



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Commentary

- Bottoms up model shows modestly down expected performance
 - Small decline in ags
- Top down model shows a moderate expected increase
 - Projected global growth and weak dollar are positive for commodities
- Index has been on a modest upward trend (albeit choppy) since the end of Q2 2017
 - We remain underweight in light of an expected strengthening of the dollar

Bottoms up model

1-3 month horizon as of: 6/11/2018	Index DJUBS	Current price	60 day volatility	-1 st dev	+1 st dev	prob -	prob +	prob price	% ret	wght'd ret	
AGRICULTURE											
Corn	6.7%	367.25	7%	340	395	50%	50%	367	-2%	-0.2%	
Soybeans	5.2%	953.75	7%	884	1,024	50%	50%	954	-1%	0.0%	
Wheat	4.2%	514.60	12%	452	577	50%	50%	515	-3%	-0.1%	
Soybean Meal	2.7%	351.20	9%	320	382	33%	67%	362	3%	0.1%	
Soybean Oil	2.5%	30.58	5%	29	32	50%	50%	31	0%	0.0%	
Group SubTotal	21.4%									-0.3%	
ENERGY											
Crude Oil WTI	7.3%	66.07	10%	59	73	50%	50%	66	0%	0.0%	
Crude Oil Brent	8.5%	76.40	9%	69	84	50%	50%	76	0%	0.0%	
Heating Oil	4.2%	216.06	8%	198	234	50%	50%	216	0%	0.0%	
Natural Gas	6.5%	2.95	8%	2.71	3.19	50%	50%	3	0%	0.0%	
Unleaded Gas (RB)	3.8%	210.48	8%	194	227	50%	50%	210	1%	0.0%	
Group SubTotal	30.4%									0.1%	
INDUSTRIAL METALS											
Aluminum	5.6%	2302.00	14%	1,981	2,623	50%	50%	2,302	-1%	0.0%	
Copper (NY)	9.1%	325.10	7%	302	348	50%	50%	325	0%	0.0%	
Nickel	2.9%	15356.00	11%	13,635	17,077	67%	33%	14,771	-4%	-0.1%	
Zinc	3.2%	3223.50	8%	2,961	3,486	50%	50%	3,224	0%	0.0%	
Group SubTotal	20.9%									-0.2%	
LIVESTOCK											
Live Cattle	3.9%	104.18	9%	95	113	50%	50%	104	0%	0.0%	
Lean Hogs	2.2%	75.55	9%	68	83	50%	50%	76	-5%	-0.1%	
Group SubTotal	6.1%									-0.1%	
PRECIOUS METALS											
Gold	11.6%	1304.40	4%	1,247	1,362	50%	50%	1,304	0%	0.0%	
Silver	4.0%	16.96	7%	16	18	50%	50%	17	0%	0.0%	
Group SubTotal	15.5%									0.1%	
FOODS & FIBERS											
Cotton	1.4%	91.68	7%	85	98	67%	33%	89	-3%	0.0%	
Sugar	2.3%	12.64	11%	11	14	50%	50%	13	0%	0.0%	
Coffee (ICE)	2.0%	119.20	7%	111	127	50%	50%	119	0%	0.0%	
Group SubTotal	5.7%									0.0%	
	100.0%										
Total										-0.5%	
total weighted expected return:											bottoms up

Source: Bloomberg data, ASRS analysis

Top down model

$$\Delta Price = -16.8 + 5.3 * \Delta WorldGDP - 0.9 * \Delta USDollar$$

$$wGDPchg = 0.038$$

$$USDchg = -0.017$$

The expected change in price equals 4.87 percent.

Source: <http://libertystreeteconomics.newyorkfed.org/2016/03/what-tracks-commodity-prices.html> and Bloomberg data, ASRS analysis

1 Year History



5 Year History



10 Year History



25 Year History

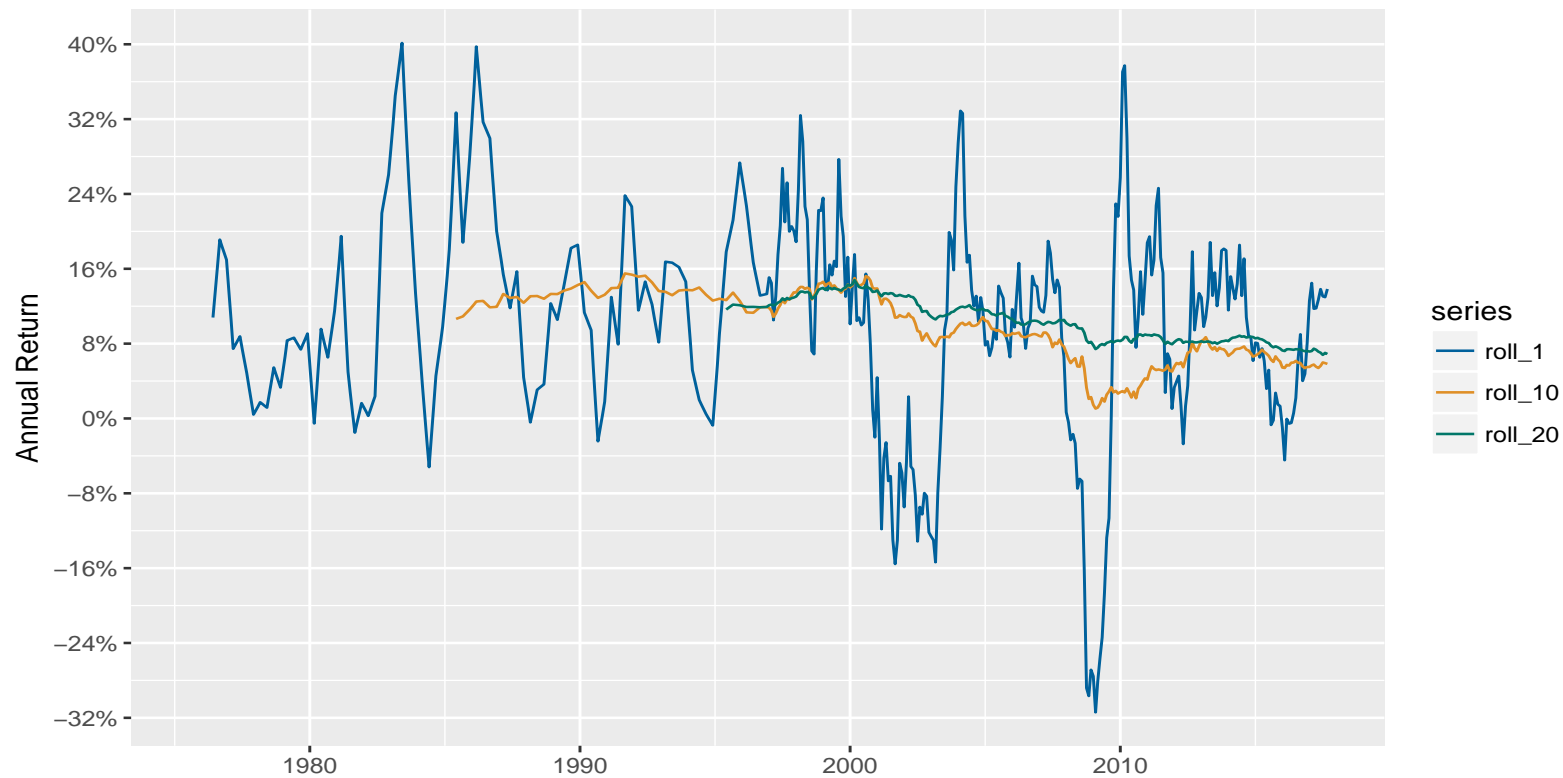


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ASRS Returns

ASRS Total Fund One Ten and Twenty Year Rolling Returns

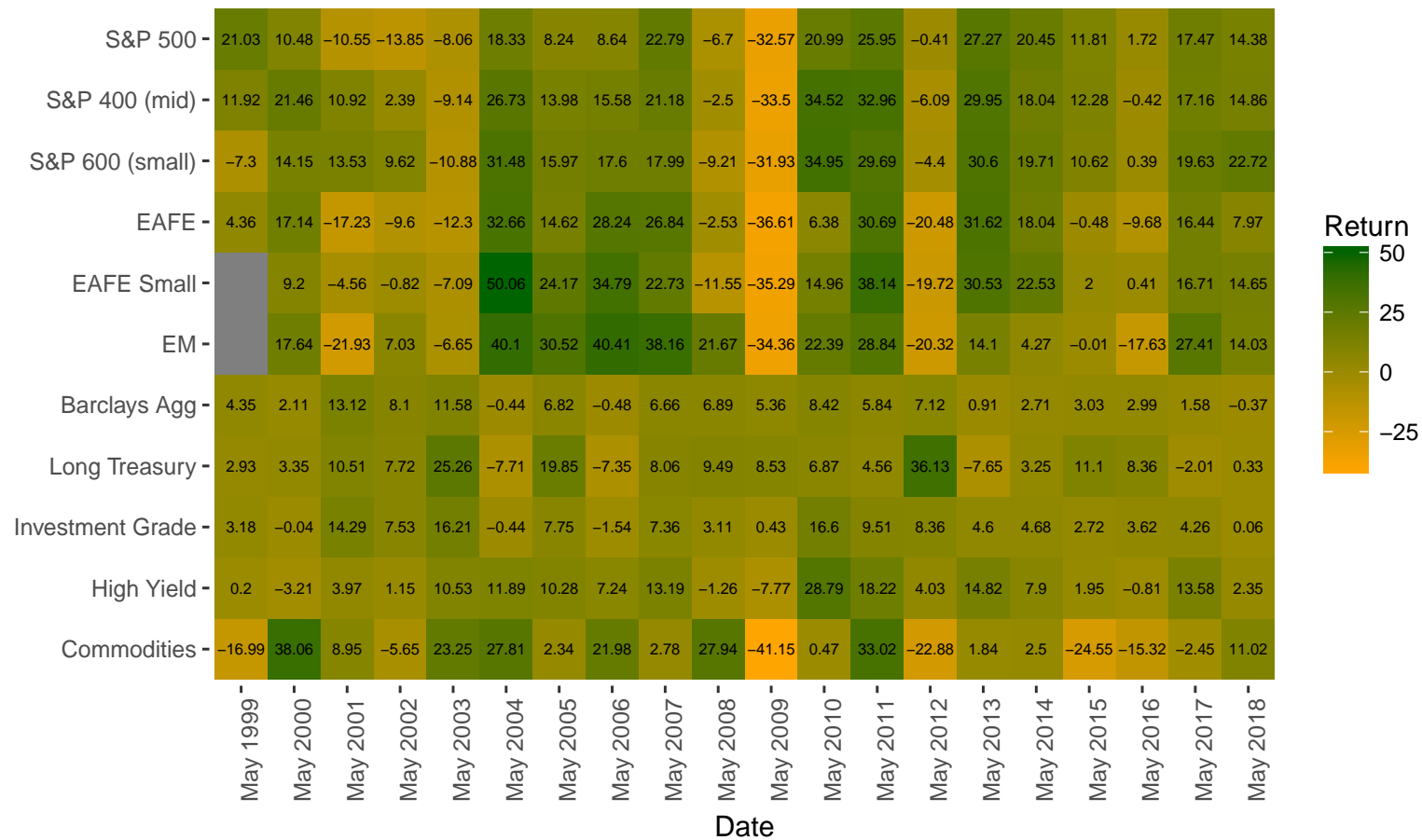


2

²Source: NEPC data, ASRS graphics

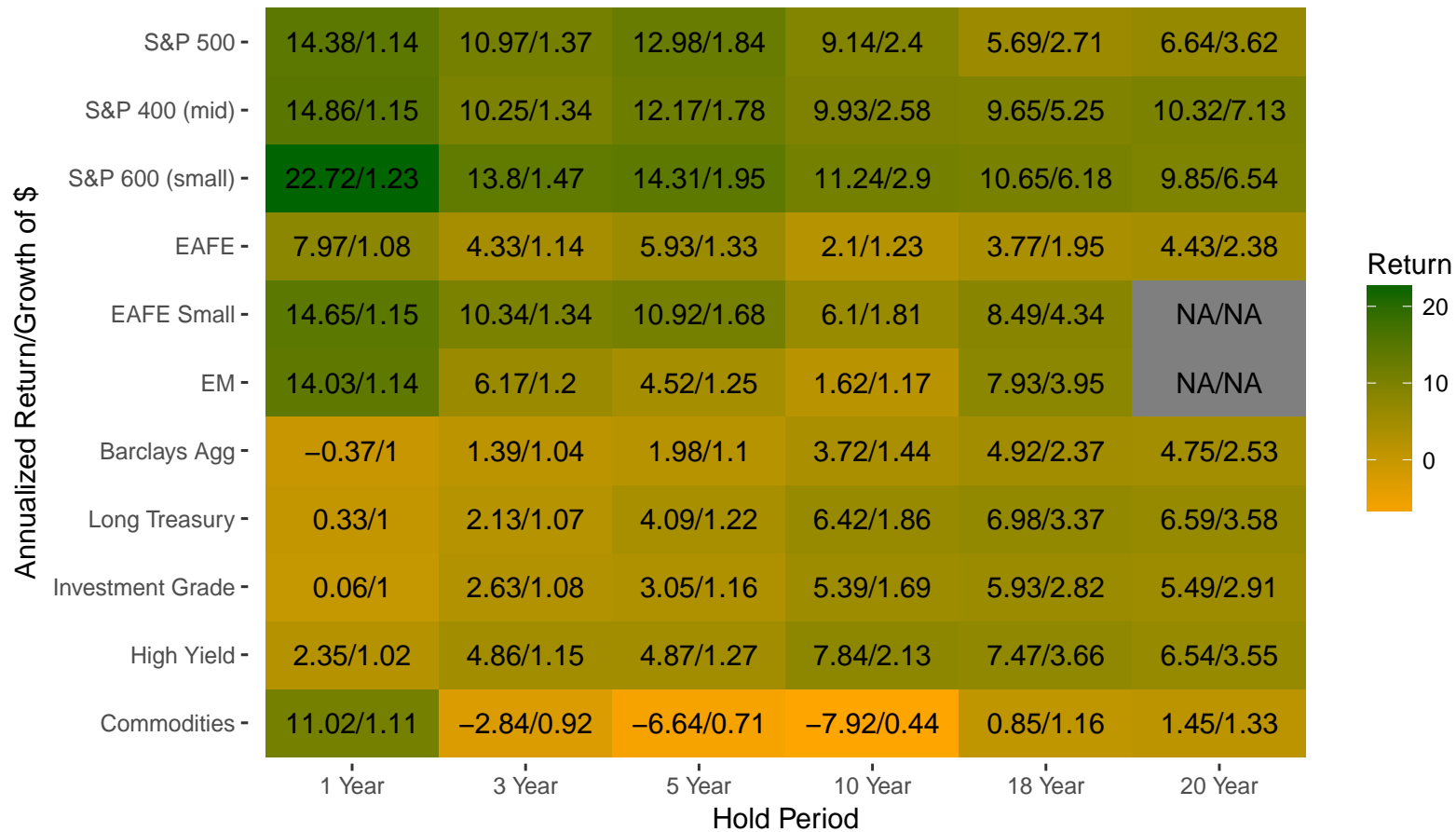
Asset Class One Year Returns

One Year Returns
for indicated end dates



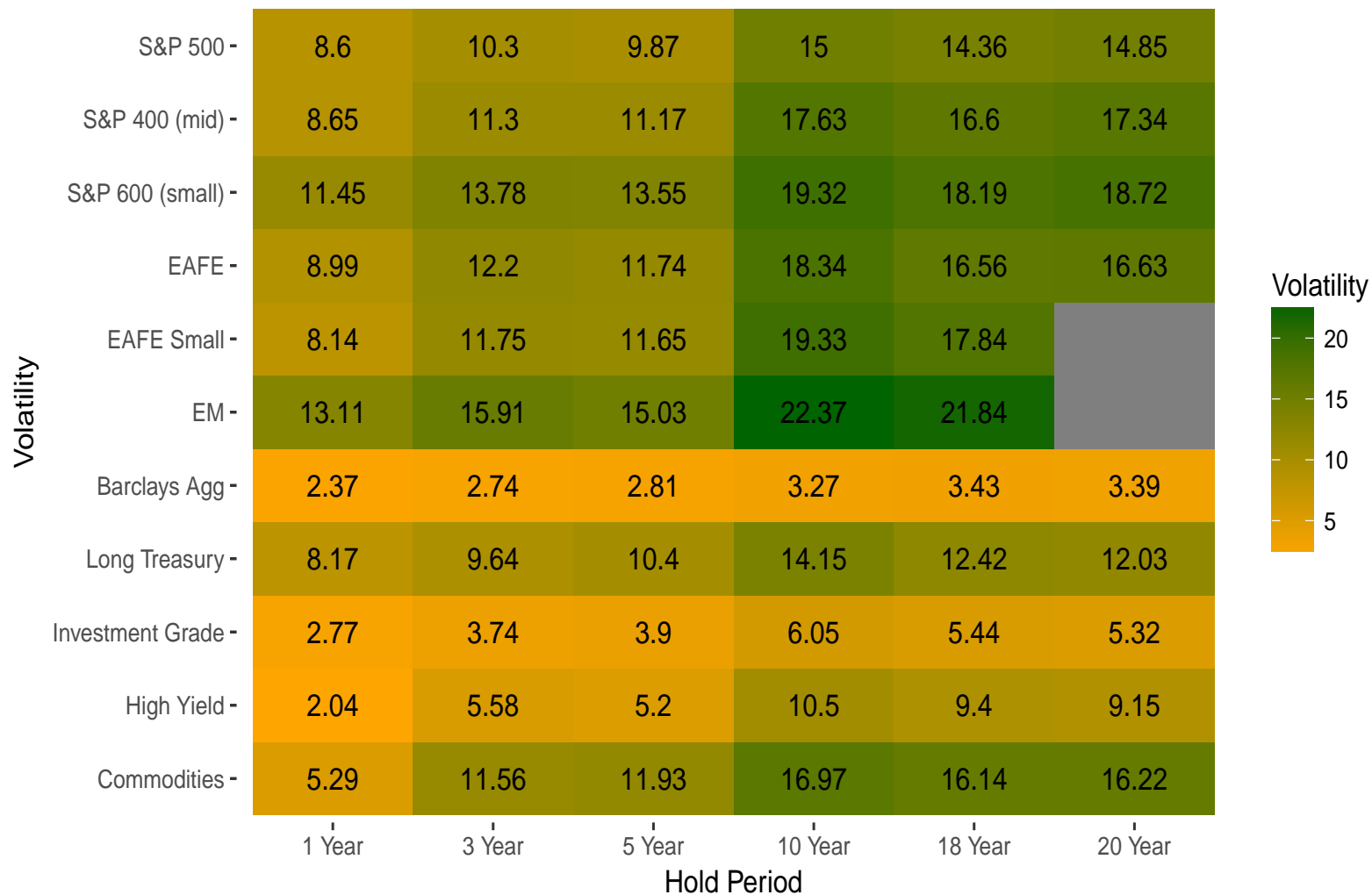
Asset Class Hold Period Returns

Annualized Returns and Growth of a Dollar
for hold periods ending May 2018



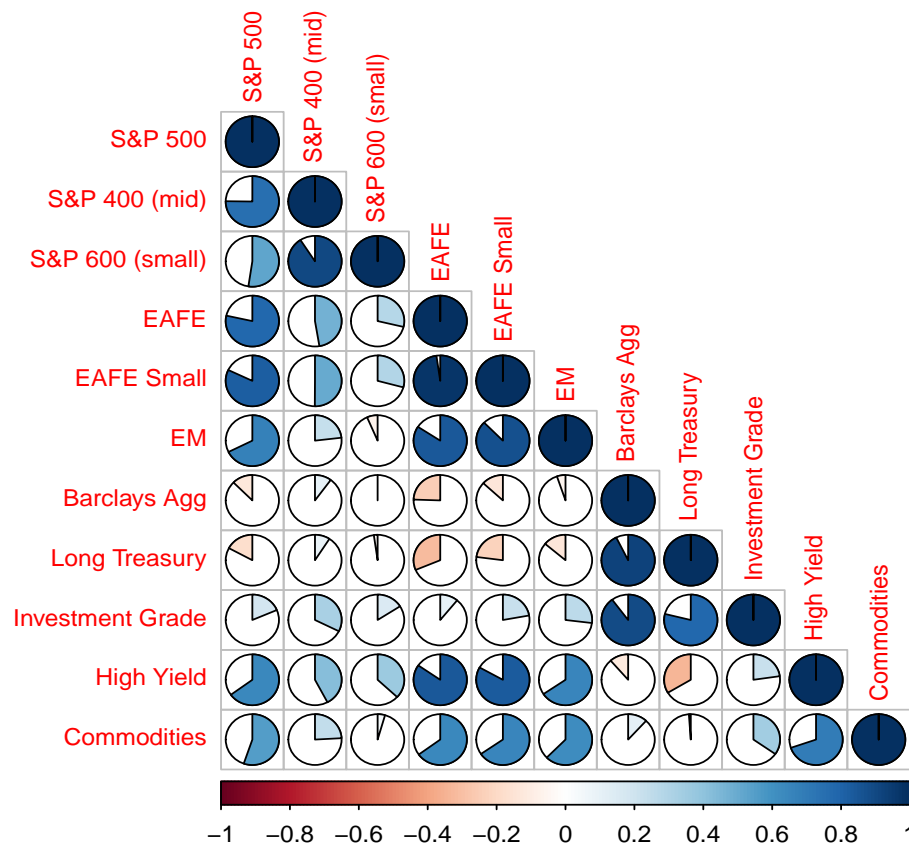
Asset Class Volatility

Volatility
for hold periods ending May 2018



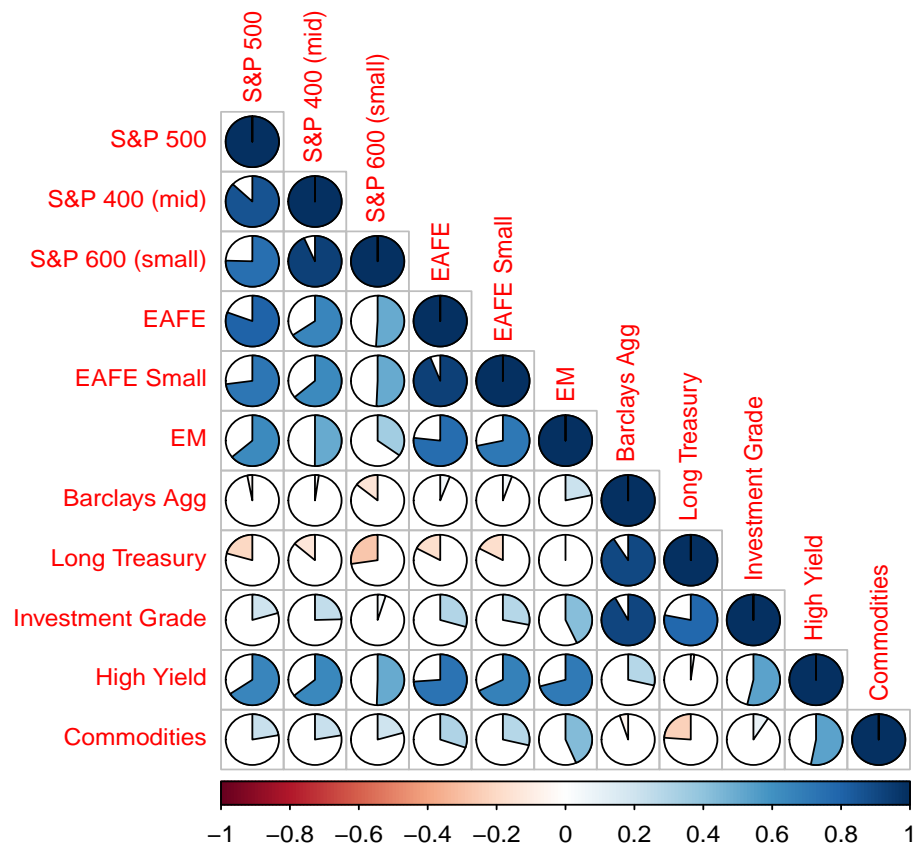
One Year Correlation

1 Year Correlation Matrix



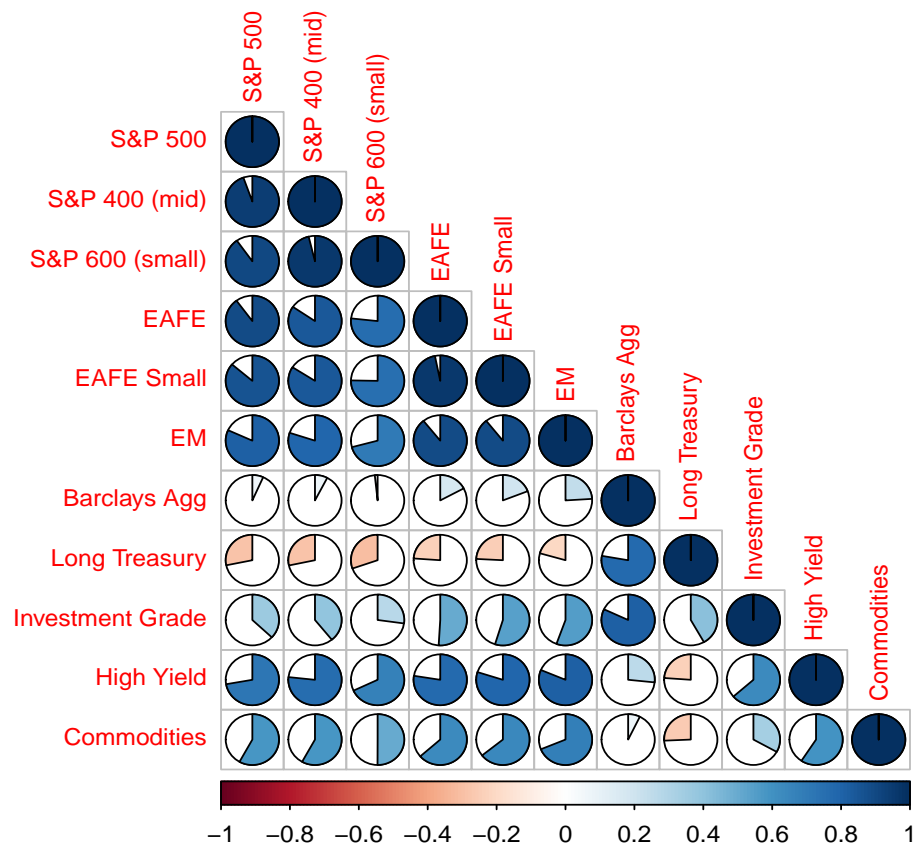
Five Year Correlation

5 Year Correlation Matrix



Ten Year Correlation

10 Year Correlation Matrix



Twenty Year Correlation

20 Year Correlation Matrix

