CalPERS Trust Level Review

Period Ending June 30, 2017

Ted Eliopoulos, Chief Investment Officer
Wylie Tollette, Chief Operating Investment Officer
Eric Baggesen, Managing Investment Director
John Rothfield, Investment Director

Investment Committee
August 2017

CalPERS | Investment Office

Review Outline

I. Economic and Market Overview

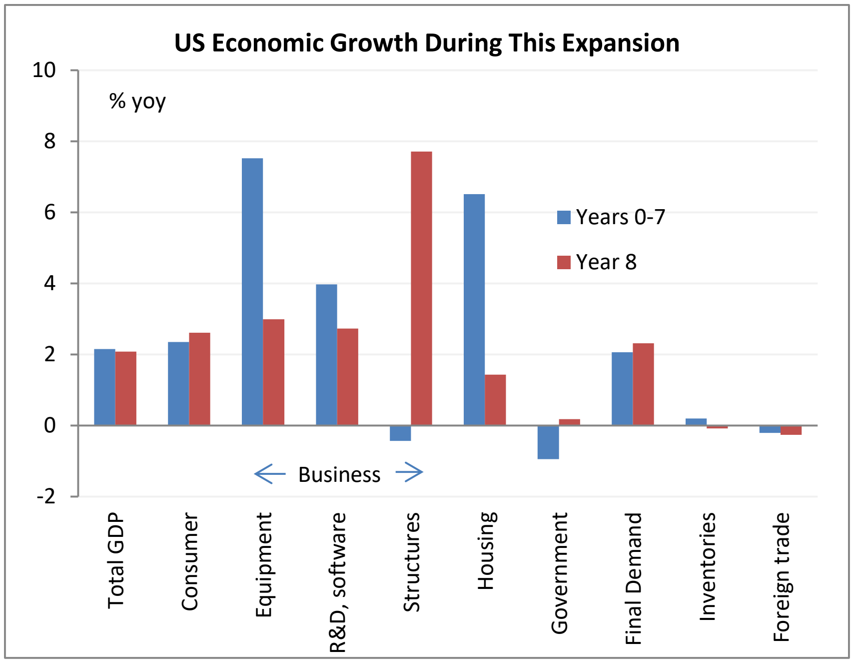
II. Investment Review
   i. Performance
   ii. Risk

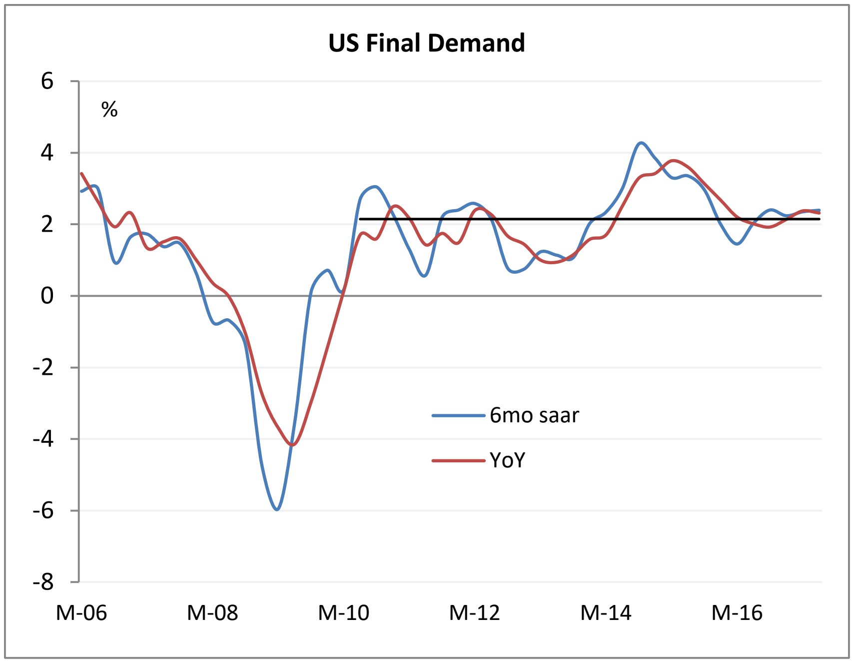
I. Economics and Market Overview

Economic trends since last review

Positive	Same Trend	Negative
- Confidence surge sustains Consumer and business confidence indicators remains very strong. **- Improved relative position of low income earners** Showing up somewhat in wages and confidence data. Could boost housing and spending in aggregate. **- Housing** Strength across starts, sales and sentiment. Comfortable valuations vs last cycle and vs abroad. **- Mining drag dissipates** Significant rebound in drilling and extraction could add about 0.3% to US GDP this year. **-Benign US Inflation** Likely to remain (well) below the 2% target this year, affording flexibility to the Fed. **- Stable China** Solid growth and slower capital outflows have reduced tail risk pressure from this source. **- Less nationalist outcomes in Europe** Recent elections partly reversed shift to nationalism seen in the 1st Brexit vote and US election.	**- US economic growth** The less volatile 'final demand' measure remains steady in the low to mid 2s. **- US labor market** Jobs growth 180K per month this year vs 187K per month in '16. Fed's "LMCI" remains slightly positive. **- Leverage in the US economy** There have been some compositional changes but leverage as a multiple of GDP remains steady **- US external balance** US current account deficit remains at around 2.5%/GDP	**- Soft personal income reduces 'cushion'** Revised US GDP data shows less income growth and savings than previously thought. **- Weak corporate investment** In low growth world with scarce labor, borrowing deployed to buybacks rather than investment. **- Consumer credit** Auto, student loan and credit card debt has risen strongly as GDP multiple. **- Auto sector** Production appears to have topped out. Also,a lot of leased cars coming into used market. **- Weak tax revenues** Due in part to low wages plus shifting income out of 2016 … has compromised federal and S&L budgets. **- QE taper/ trim** Not necessarily a negative unless it reflects fatigue. However it can be correlated with equity prices. **- Eight years and counting** US business cycle is into its ninth year, so investors start looking for 'late-cycle' signs

Economic growth has another steady year





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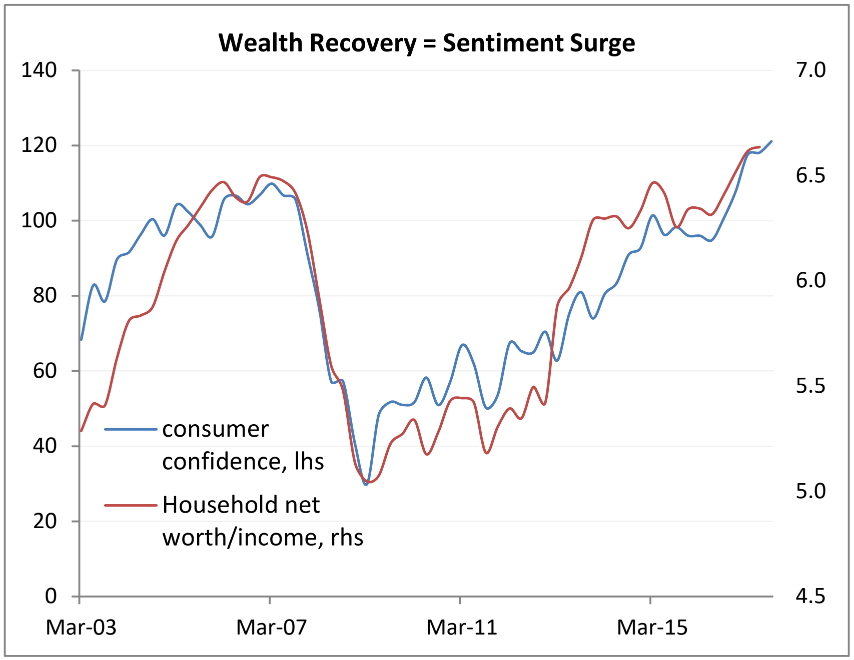
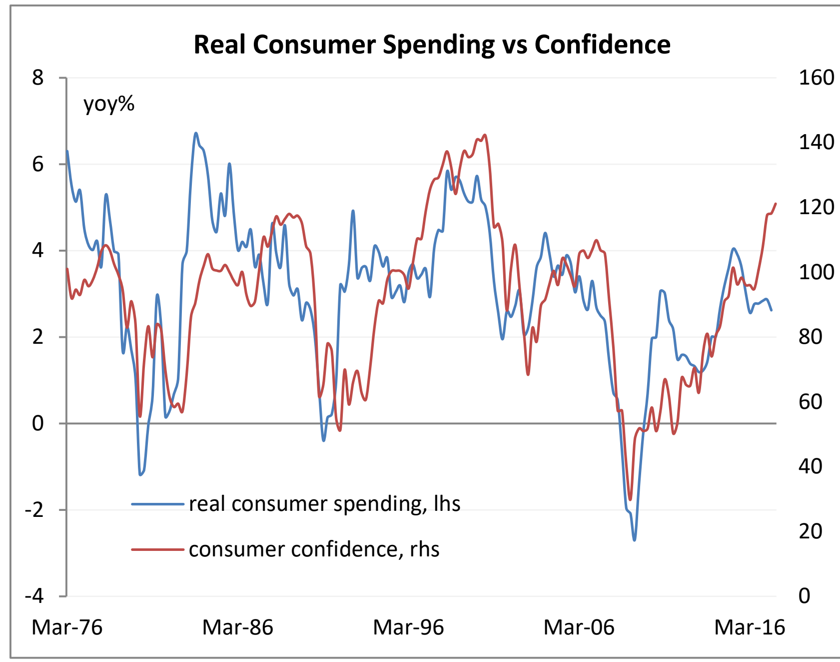
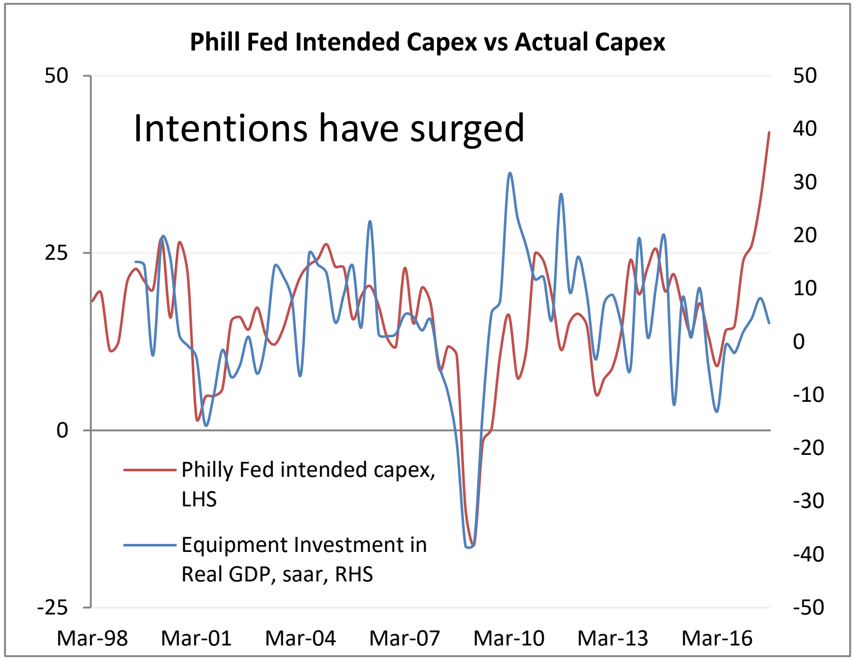
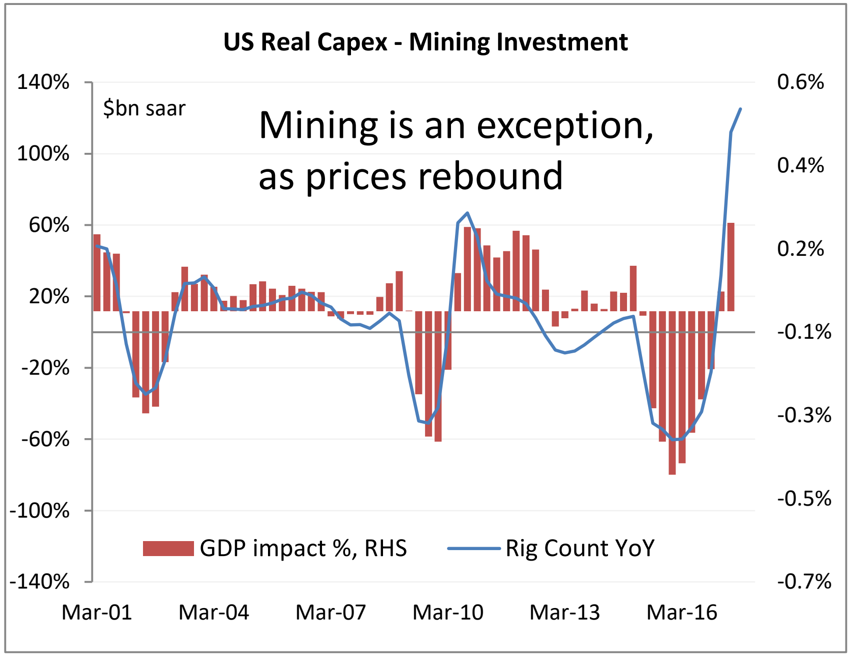




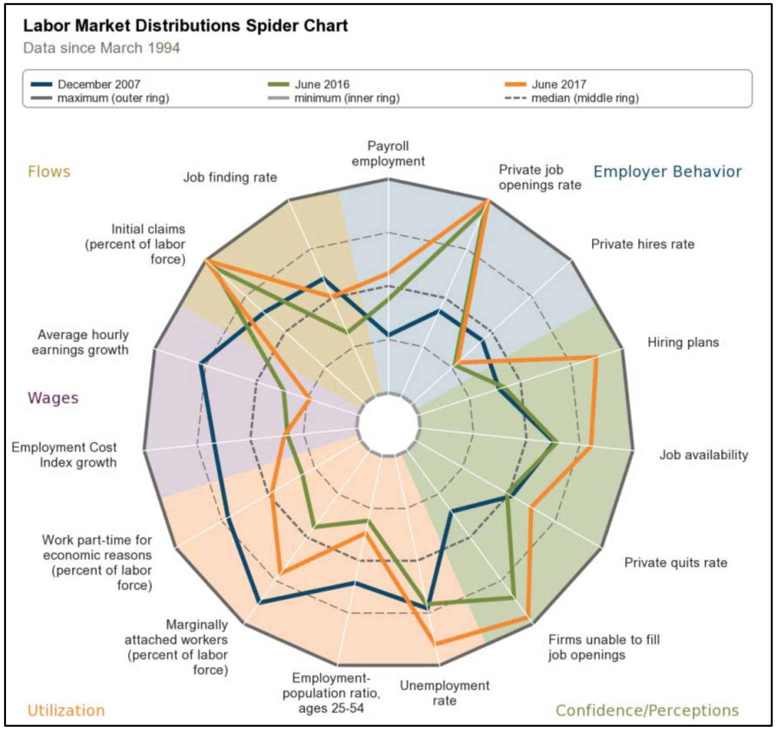
Why the gap? Slower real income growth and balance sheet restoration.

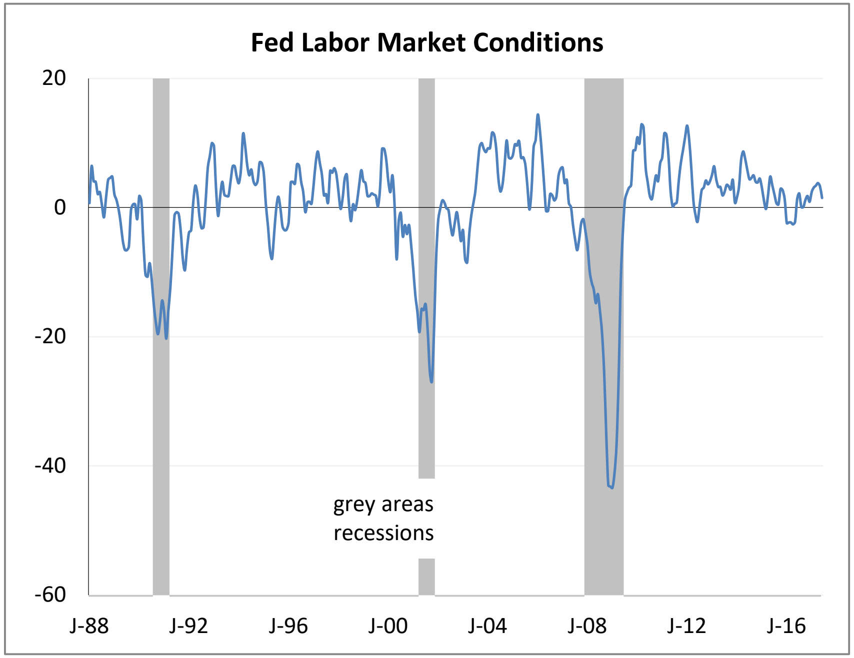
Business capex hasn't yet reflected intentions





Gradual improvement continues in US labor market





Steady leverage is a plus … if sustained

Household Net Worth and Growth of Domestic Nonfinancial Debt

Year		Household net worth[1]	Growth of domestic nonfinancial debt[2] Total	Households	Businesses	Federal government	State and local gov'ts
2007		66,505	8.1	7.1	12.4	4.7	6.2
2008		56,205	5.8	0.1	5.9	21.4	1.3
2009		57,969	3.6	0.4	-4.0	20.4	4.5
2010		62,026	4.4	-0.5	-0.7	18.5	2.4
2011		63,280	3.5	-0.4	2.7	10.8	-1.4
2012		69,118	5.0	2.0	4.6	10.1	-0.2
2013		78,818	3.8	1.8	4.6	6.7	-1.8
2014		84,014	4.3	3.0	6.1	5.4	-1.2
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2015:	Q1	85,824	2.8	2.2	7.5	-0.3	1.6
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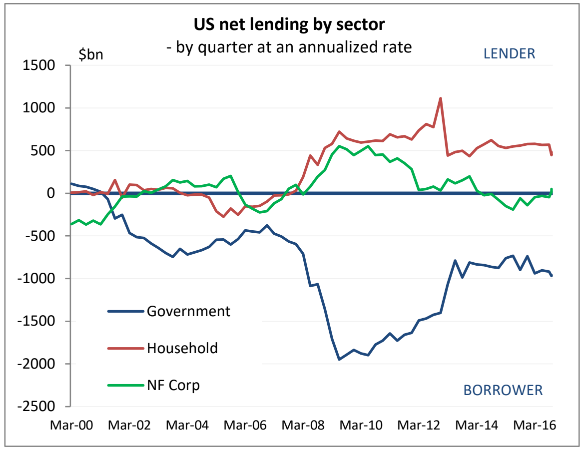
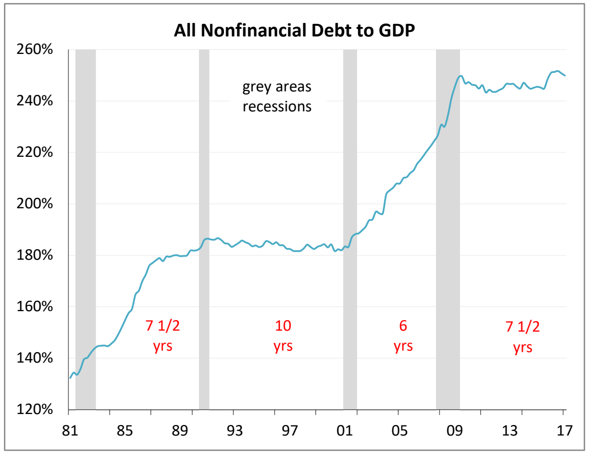




Many business cycle indicators still have runway

Labor Market	Early	Late	%
Want A Job per Job Offer			97%
Unemployment Rate			90%
Jobs Growth 12mo			38%
Labor Market Conditions Index			42%
Emp/Pop 16-24			37%
Emp/Pop 25-54			52%
Emp/Pop 55+			100%
Activity	**Early**	**Late**	**%**
National Activity Index			36%
Private Savings Ratio			76%
Consumer confidence			77%
Real Personal Disp. Income			59%
10yr UST vs 3mo LIBOR			52%
Quarterly	**Early**	**Late**	**%**
Profit share			27%
Current Account/GDP			40%
Leverage YoY			10%
Net Worth/DI			100%
Housing affordability			46%

Scenarios for Market Returns

DOWNSIDE (25%)	CENTRAL (50%)	UPSIDE (25%)
"Late cycle risks"	"Challenging Returns"	"Headwinds Recede"
Waning central bank support undermines asset markets.	US GDP growth remains in the low 2s', constrained by secular factors	Sudden pick up in legislative progress by the GoP, unlocking spending
Late cycle US stimulus increases stagflation risk.	Labor force, household formation and deregulation modestly feed productivity and growth.	Productivity at least temporarily improves from current 1%.
US pivots toward protectionist measures.	Gradual roll out of GoP policies but on a smaller scale.	Recent signs of bottoming in emerging markets morph into a virtuous cycle
Fed (and Bank of Japan) decisions become more politicized.	Inflation tepid in spite of late cycle labor market.	Clearer European political picture supports upward growth momentum
Unpredictable US responses to global geopolitical events.	Gradual removal of stimulus in the US, China, Europe and Japan	

II. Investment Review

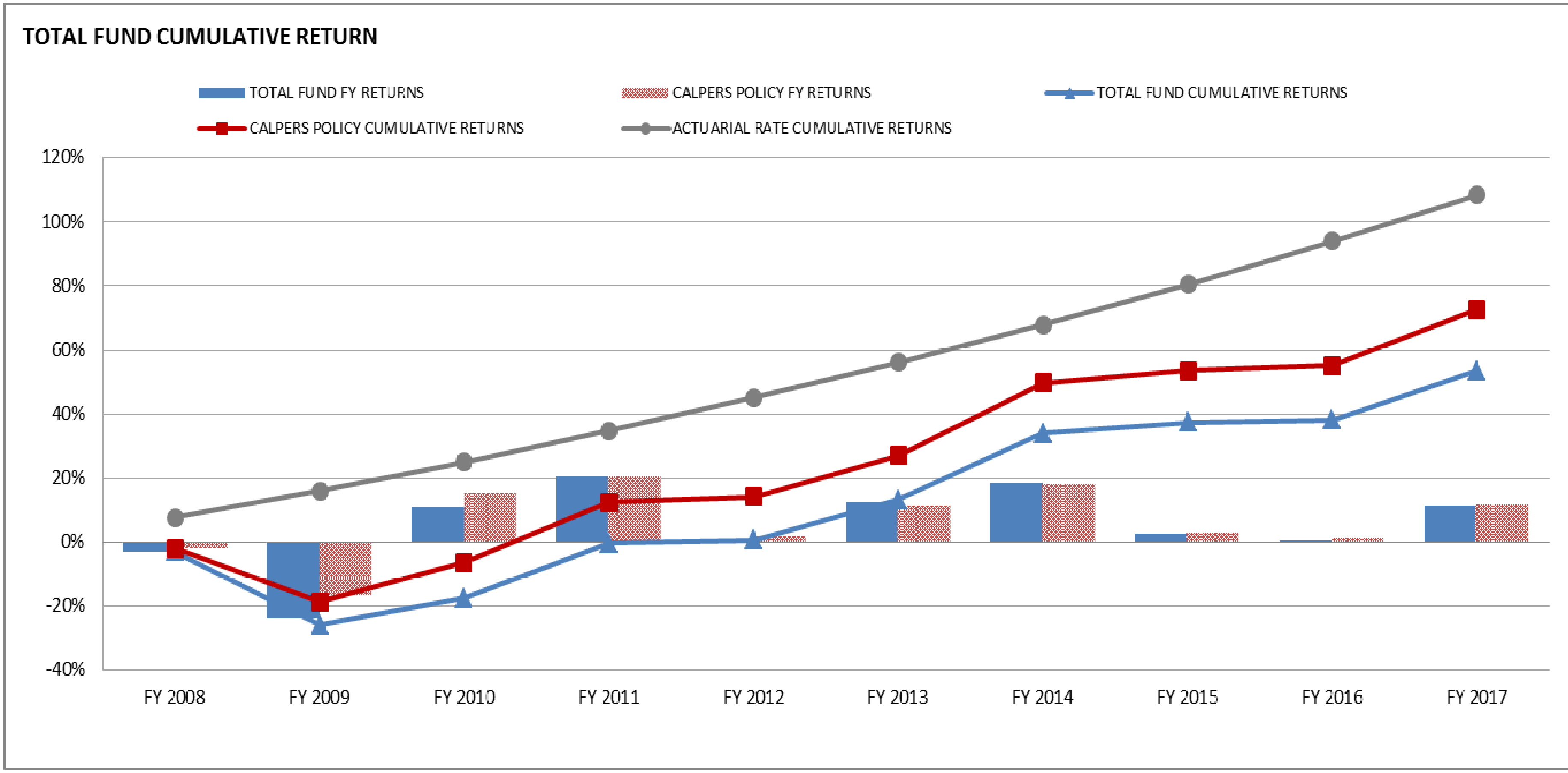
Executive Summary

- Public Employees' Retirement Fund (PERF) returned 11.2% for the fiscal year bringing Total Fund performance to 8.8%, 4.4%, and 6.6% over the 5, 10, and 20 year time periods
- Global Equity was the strongest contributor, with 19.6% FY return contributing approximately 9% to the plan total return
- PERF underperformed the benchmark by 15 bps for the fiscal year
    - Private Equity explains -43 bps of plan excess return. The Program returned 13.9% for the year relative to a benchmark return of 20.3%
    - Fixed Income contributed +23 bps. The program returned 0.3% relative to a benchmark return of -0.9%
- Affiliate Investment Programs returns were in line with their respective asset allocations, largely positive for both the fiscal year and over longer time periods
- Current Barra volatility estimate for PERF is 8.3%, 2.1% lower than prior
    - 75% of the decline is due to low recent market volatility feeding into model forecasts
    - 25% of the decline is due to asset mix changes
- Current active tracking error of 0.5%, within policy of 1.5%

Performance Summary

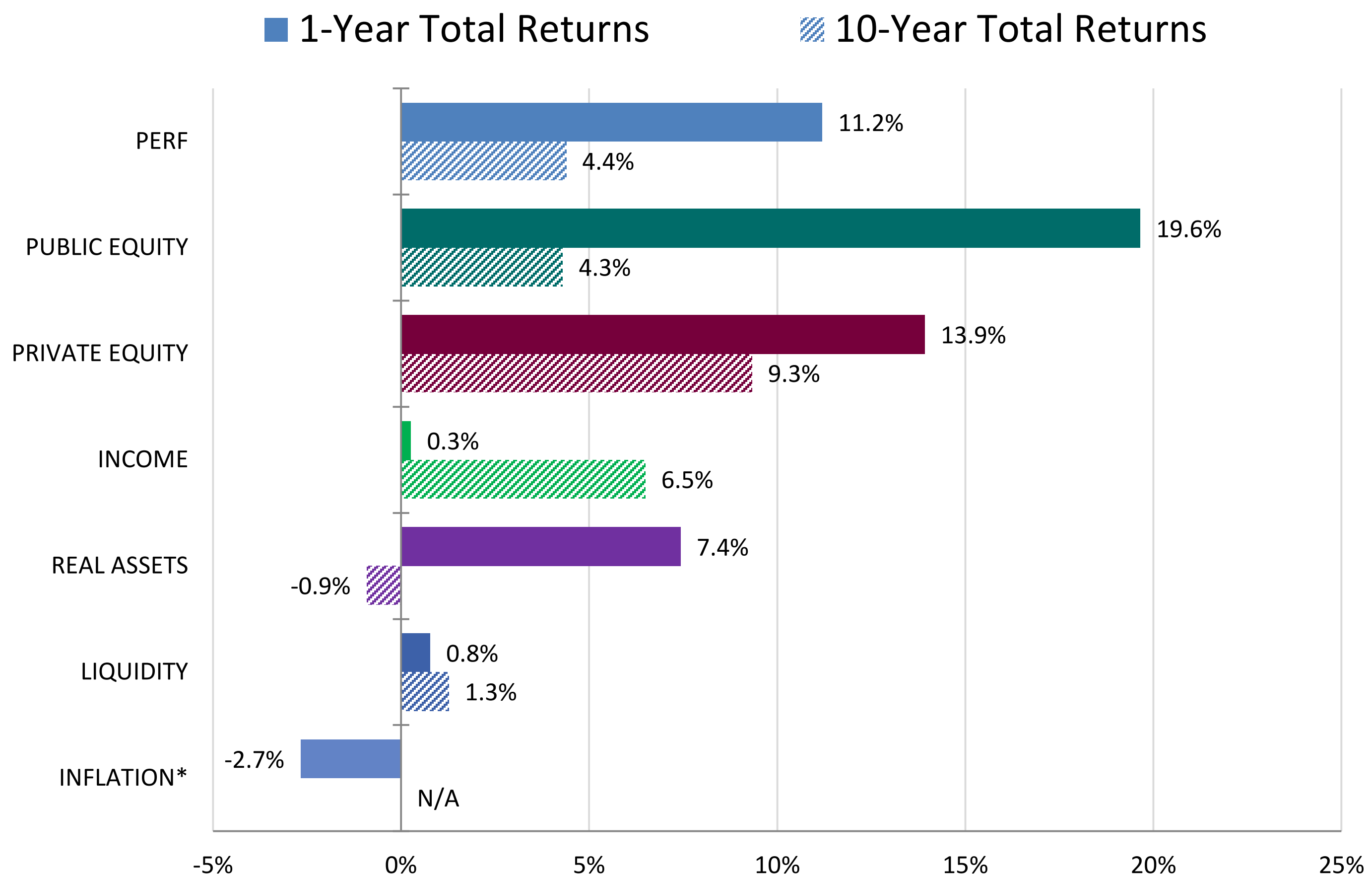
As of June 30, 2017		1-YR		3-YR		5-YR		10-YR	
Trust Assets Managed	Ending Market Value (MM)	Net Return	Excess BPS	Net Return	Excess BPS	Net Return	Excess BPS	Net Return	Excess BPS
PUBLIC EMPLOYEES' RETIREMENT FUND	323,660	11.2%	(15)	4.6%	(22)	8.8%	23	4.4%	(123)
JUDGES' RETIREMENT FUND	44	0.7%	25	0.4%	16	0.3%	8	0.7%	16
JUDGES' RETIREMENT SYSTEM II FUND	1,341	9.6%	62	3.6%	25	8.2%	30	5.1%	6
LEGISLATORS' RETIREMENT SYSTEM FUND	117	4.4%	58	2.8%	28	5.4%	42	5.3%	25
CERBT STRATEGY 1	5,655	10.6%	71	3.7%	48	8.1%	41	4.6%	38
CERBT STRATEGY 2	880	7.2%	71	3.2%	42	6.7%	40	-	-
CERBT STRATEGY 3	261	4.1%	64	2.7%	42	5.2%	46	-	-
CALPERS HEALTH CARE BOND FUND	445	-0.3%	4	2.7%	24	2.8%	55	4.7%	23
LONG-TERM CARE FUND	4,376	1.6%	4	2.0%	19	3.9%	27	3.6%	13

PERF 10 Year Cumulative Returns



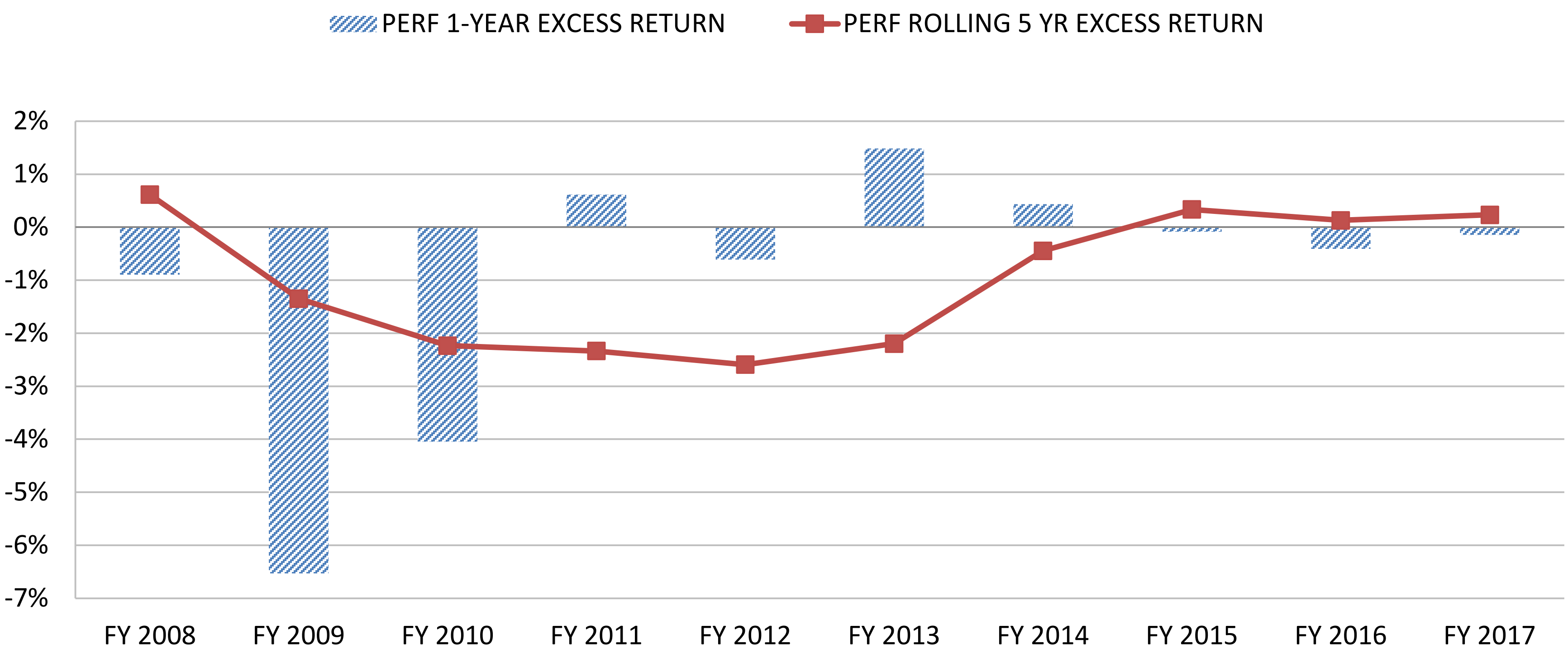
Note: Actuarial Rate of Return FY 2007-12 was 7.75%. FY 2013-17 rate is 7.5%.

PERF Short-Term vs. Long-Term Performance

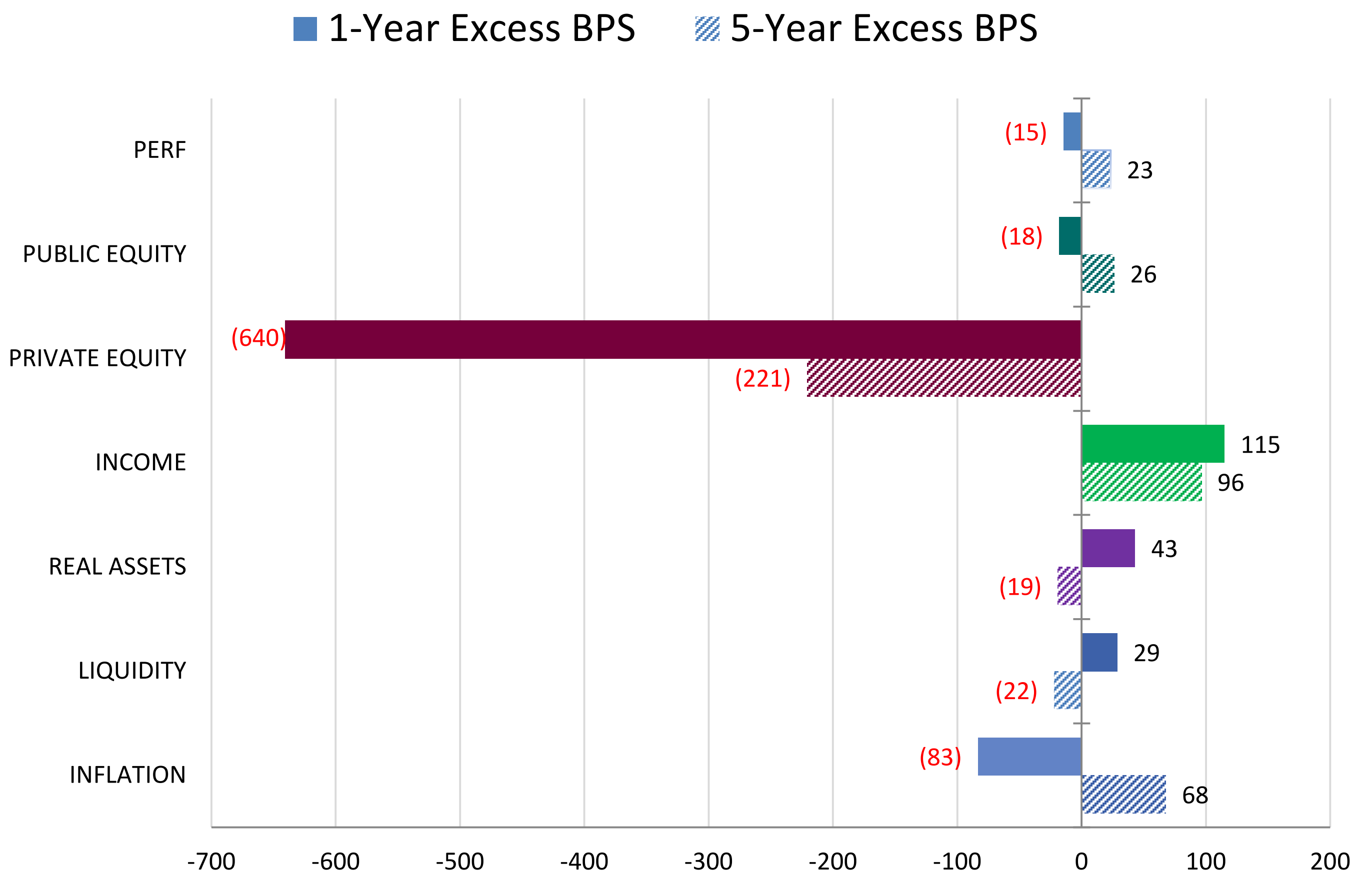


*Inflation has an inception date of October 2007, therefore 10-year returns and excess BPS are unavailable

PERF Rolling 5-Year Excess Returns



PERF 1-Year and 5-Year Excess Returns



- Private Equity one year excess of -640 bps
  - Excess returns are volatile over shorter periods due to valuation-based pricing relative to a public market benchmark
- Income one year excess of +115 bps
  - Driven in part by strong excess returns in credit and mortgage portfolios
- Inflation program one year excess of -83 bps
  - Driven mostly by an underweight to commodities in Q1 during a period of rising prices

Excess Returns Attribution

Total Fund Attribution

As of : June 30, 2017 (Annualized)

	Average Weight in Plan	Program Excess Return (bps)			Contribution to Plan Excess (bps) [1]		
	5 Year	1 Year	3 Year	5 Year	1 Year	3 Year	5 Year
Total Excess Return (bps)					**(15)**	**(22)**	**23**
Public Program Contributions					**12**	**22**	**34**
PUBLIC EQUITY	52%	(18)	5	26	(7)	2	13
INCOME	18%	115	70	96	23	13	17
INFLATION	5%	(83)	70	68	(5)	3	3
OTHER					1	2	2
Private Program Contributions					**(39)**	**(30)**	**(25)**
PRIVATE EQUITY	10%	(640)	(180)	(221)	(43)	(16)	(21)
REAL ASSETS	10%	43	(130)	(19)	4	(15)	(5)
Allocation Management[2]					**4**	**(1)**	**6**
Public Proxy Performance [3]					**10**	**(10)**	**(10)**
Other/Residual [4]					**(1)**	**(2)**	**18**

[1] Contribution figures are calculated on monthly basis and aggregated over the respective period.

[2] Contribution from MAC and ARS Programs are inlcuded in Allocation Impact.

[3] Impact of not obtaining full desired interim policy exposure to private asset classes and proxying these with public assets.
Includes the impact of lagged reporting of private asset benchmarks relative to current month reporting of public proxies.

[4] Includes impact of 2009-2013 benchmark currency hedge calculation and compounding residual.

Key Observations

- \+ Consistent positive contribution from public programs
- +/- Neutral impact from allocation management
- \- Private Equity was biggest negative contributor
- \- The need to use public assets to proxy underweights vs. targets in privates detracted over 3 & 5 year periods

- Over 5-year period Other/Residual added +18 bps

PERF Risk Highlights (as of 05/31/2017)

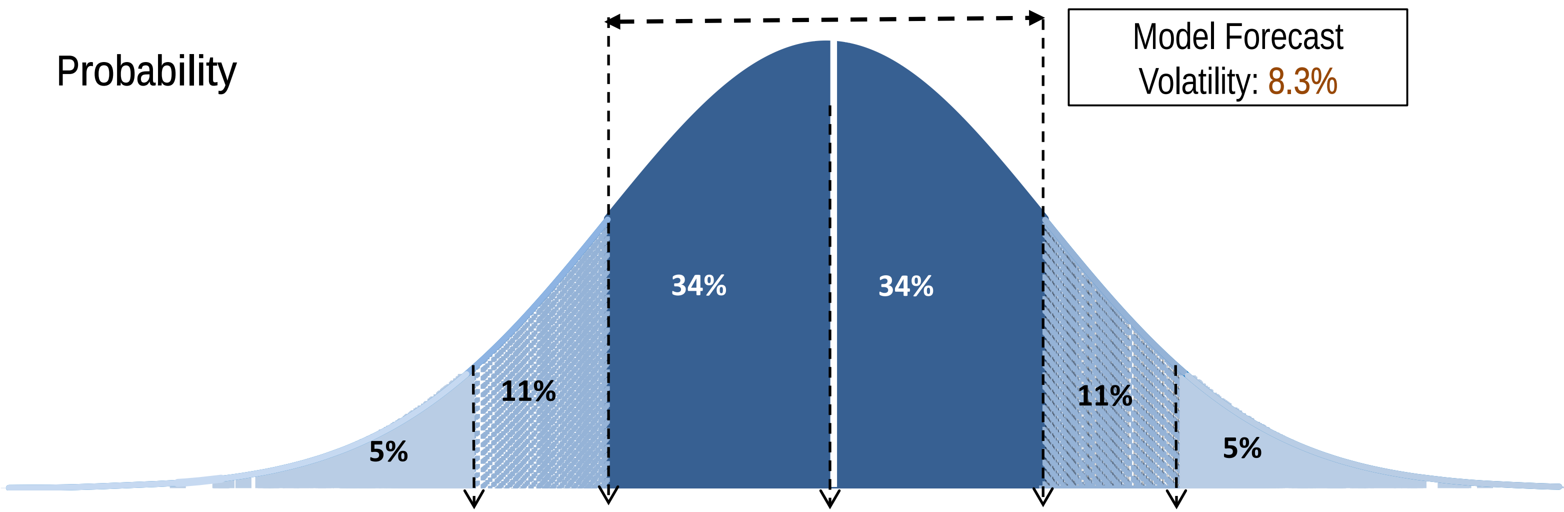
<u>One Year Volatility Estimates</u>

- Current forecast volatility of 8.3% vs. 10.4% in prior year
  - 0.5% risk reduction from asset allocation changes
  - Recent low-volatility market conditions explain remainder of reduction in forecast
  - Implies 24% chance of negative returns in a given year
- Growth assets, especially public equities, remain the primary drivers of total volatility
- Forecast active tracking error of 0.5% is within guidelines of 1.5%

<u>Fundamental</u>

- Well diversified across individual issuers/companies
- Geographically weighted to US
- Adequate liquidity coverage and modest leverage level
- Counterparty risk remains modest

One Year Outcomes Implied by Risk Model



Return	-7.1%	-1.7%	6.5%	14.8%	20.1%
	1-in-20 year minimum loss		Expected return using June 2017 Capital Market Assumptions with current interim asset allocation (*arithmetic* returns)		1-in-20 year minimum gain
Gain/Loss $B	-23	-6	+21	+48	+65
Estimated Funding Ratio*	61%	64%	70%	75%	78%

CalPERS Investment Office

* Estimated starting Funding Ratio of 68%, 1 yr growth in liabilities and cash flow projections provided by CalPERS Actuarial Office. Forecast volatility of 8.3% from Barra as of 05/31/2017. PERF's NAV as of Jun 30, 2017 = $323.5B.

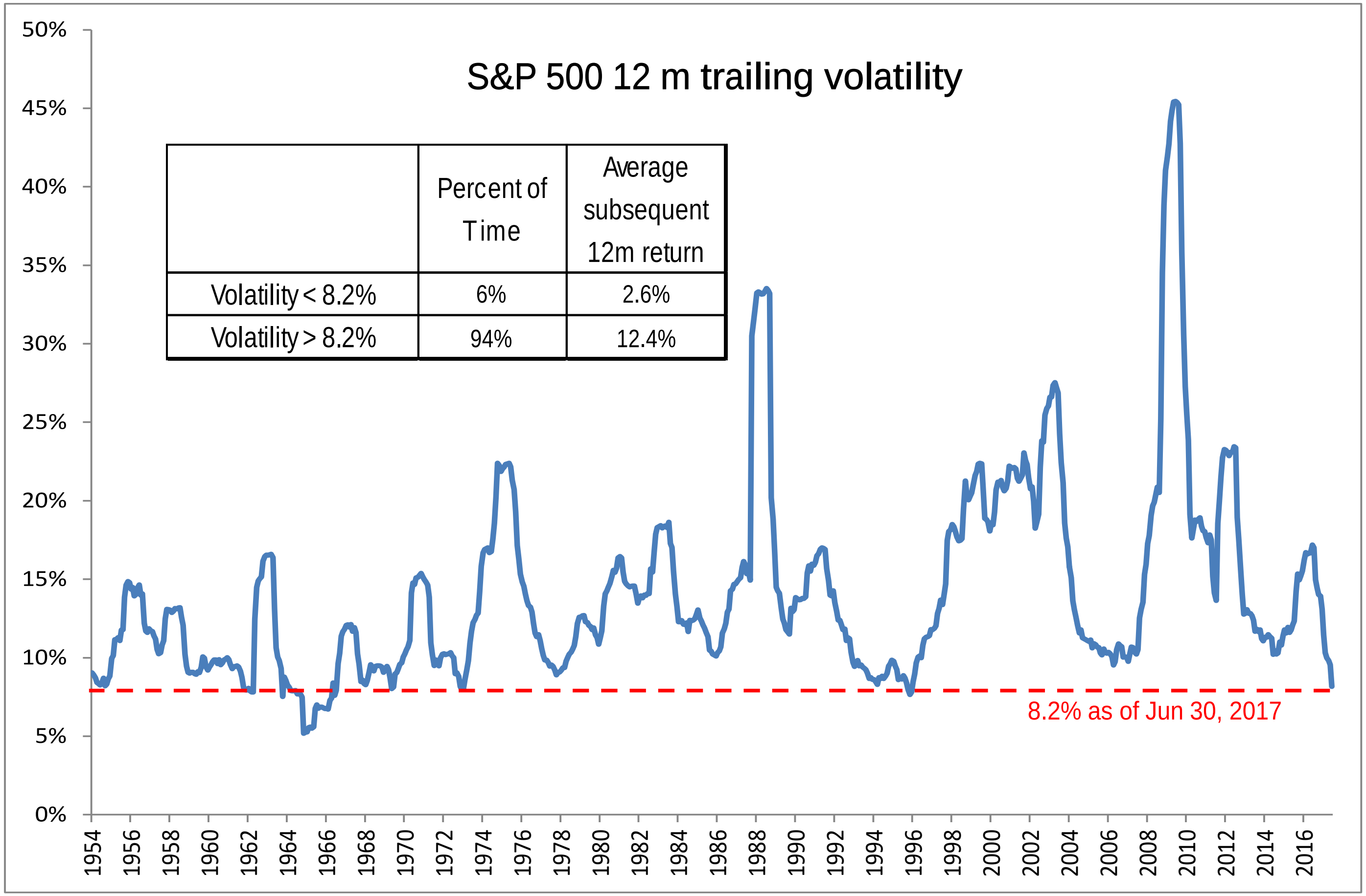
Risk Forecasts Vary with Time Period

	Barra Model Used for Risk Reporting	Barra Model Used as Input to ALM Process	Wilshire*
Historical period for model estimation	~1 Year	~8 Years	long (20+ yrs)
Forecast Volatility	8.3%	10.6%	11.6%

All numbers are as of May 31, 2017, except otherwise noted
*From Performance Review Dec 31, 2016 for Actual Allocation

- Risk models use historical data to build forecasts
- For shorter periods, more recent data is emphasized
- Current market environment is unusually calm, leading to lower short-term forecast

Markets Have Been Unusually Calm

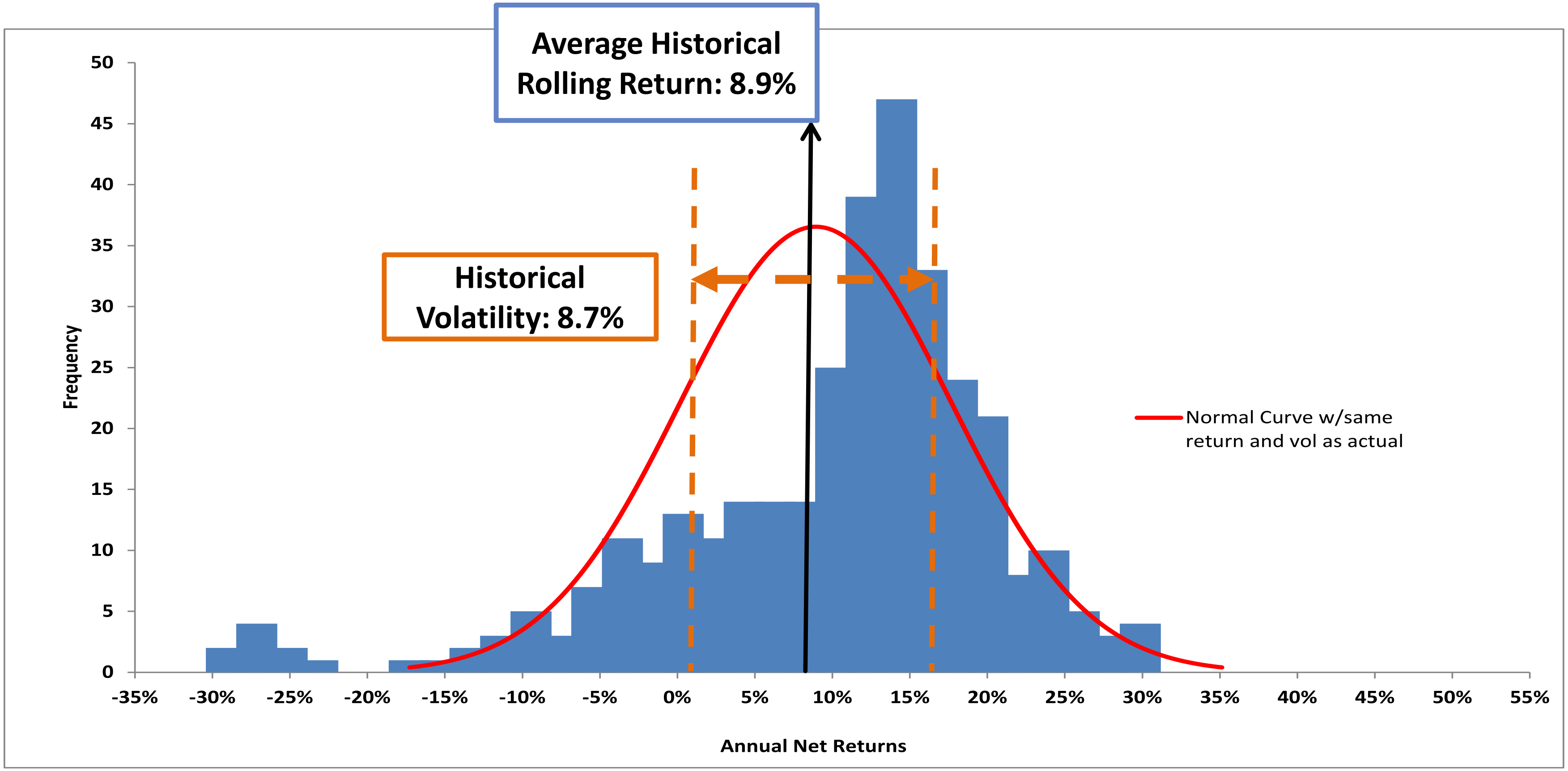


	Percent of Time	Average subsequent 12m return
Volatility < 8.2%	6%	2.6%
Volatility > 8.2%	94%	12.4%

Source: Global Financial Data

Historical Returns Are Not Normally Distributed

PERF's Rolling Annual Returns: Jun 89-May 17



Drawdown Risk

Scenario	Simulated Impact on Current Portfolio				PERF Actual Historical Experience 1989-2017
	Simulated Return	Gain/Loss	Estimated Funding Ratio*		Historical PERF Return
Subprime and Credit Crisis (Oct 07 – Mar 09)	-37%	-$119B	41%		-32.6%
Tech Crash and Recession (Jan 00-Mar 03)	-16%	-$51B	55%		-17.5%

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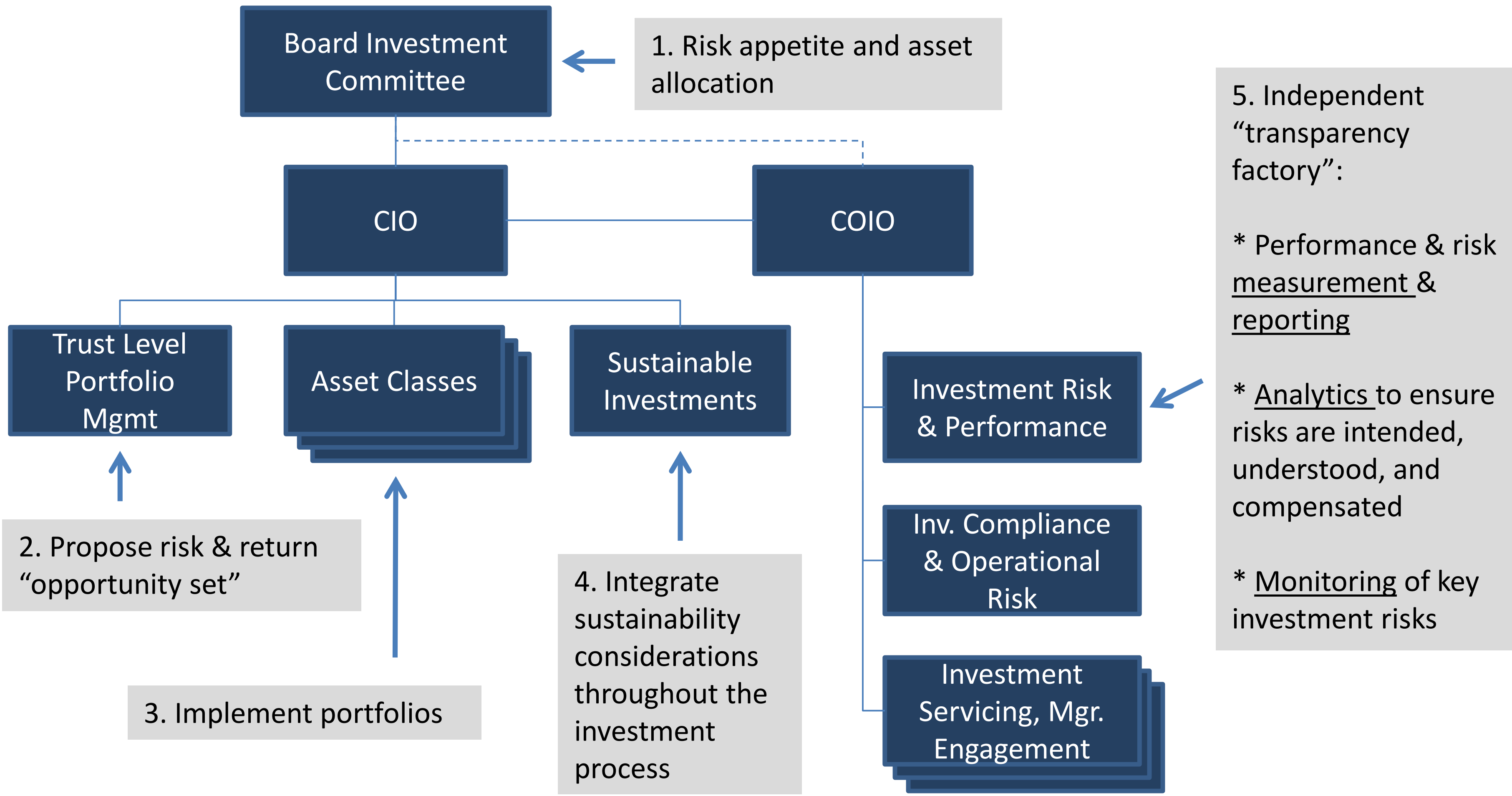
Investment Risk Responsibilities in Context



Appendix

Steady leverage and household savings is a plus

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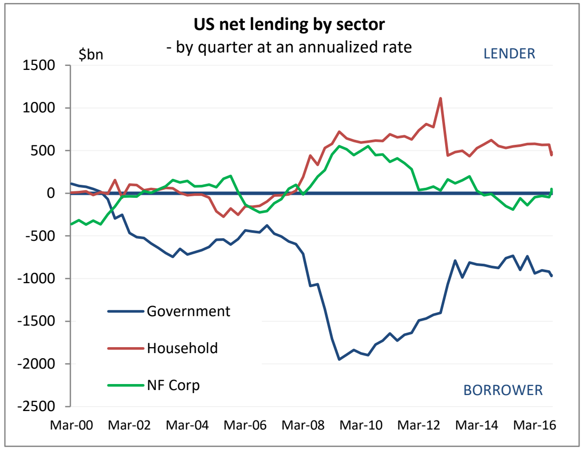
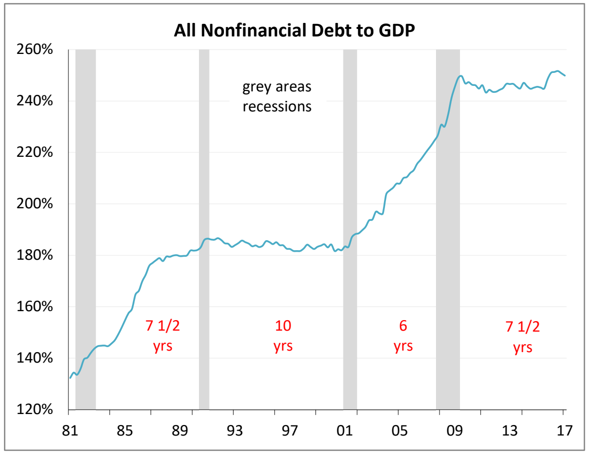
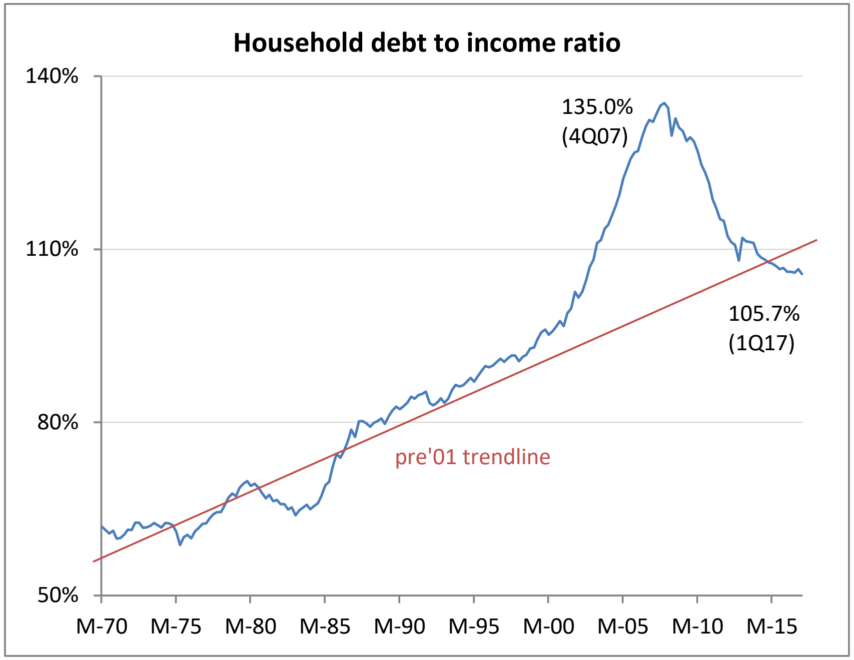
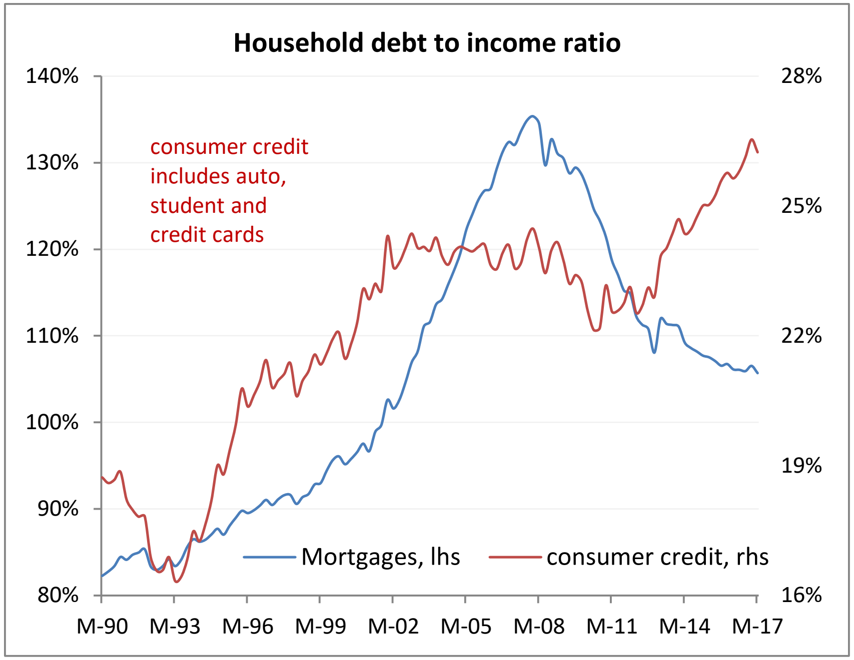


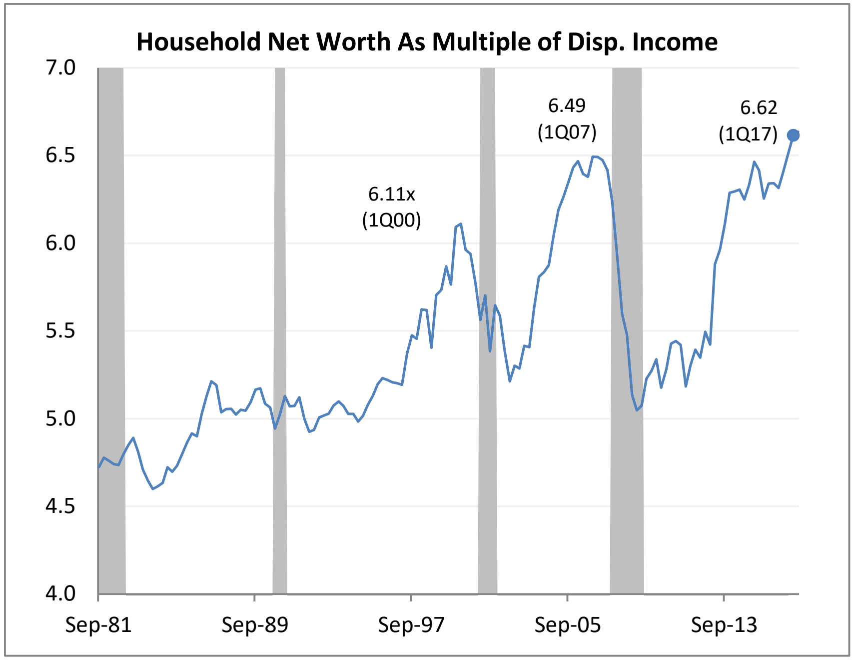


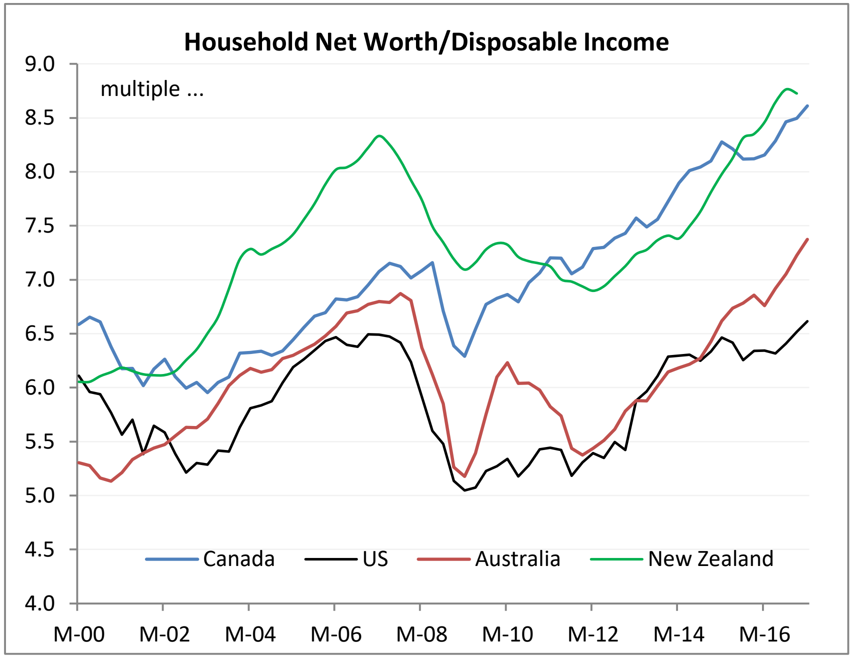
Household debt is higher for consumer credit but stagnant for outstanding mortgages





Household net asset valuations are high relative to history but lower than many peer group countries





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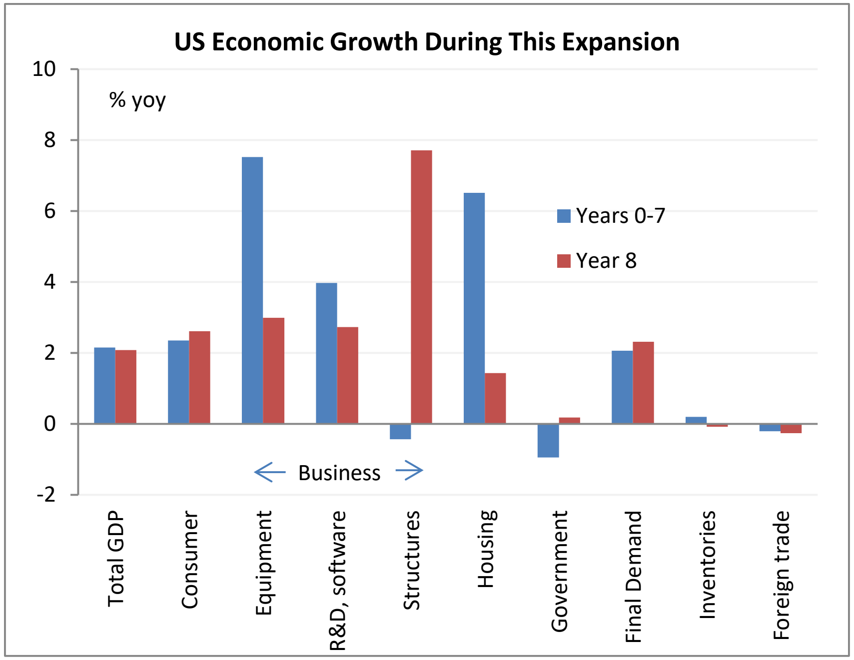
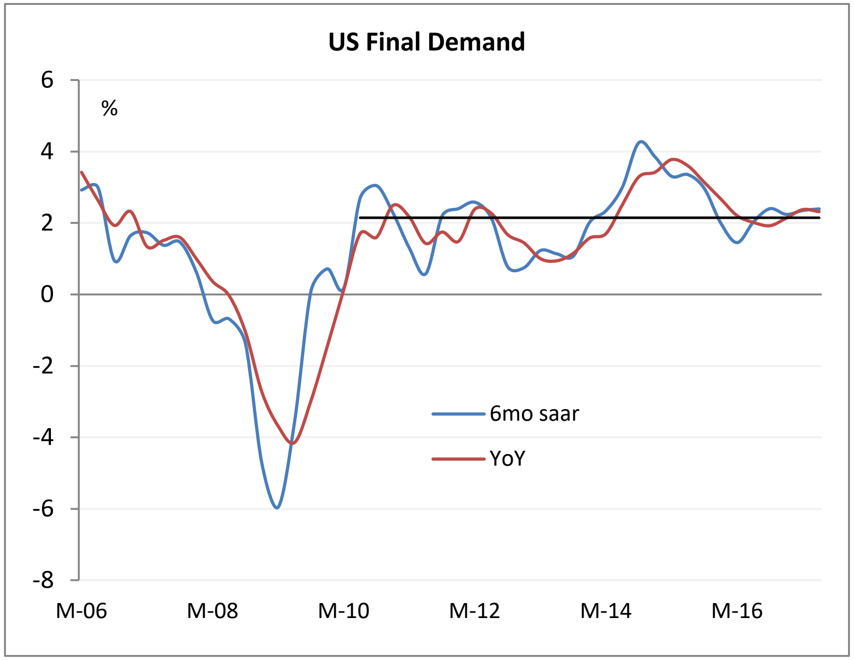
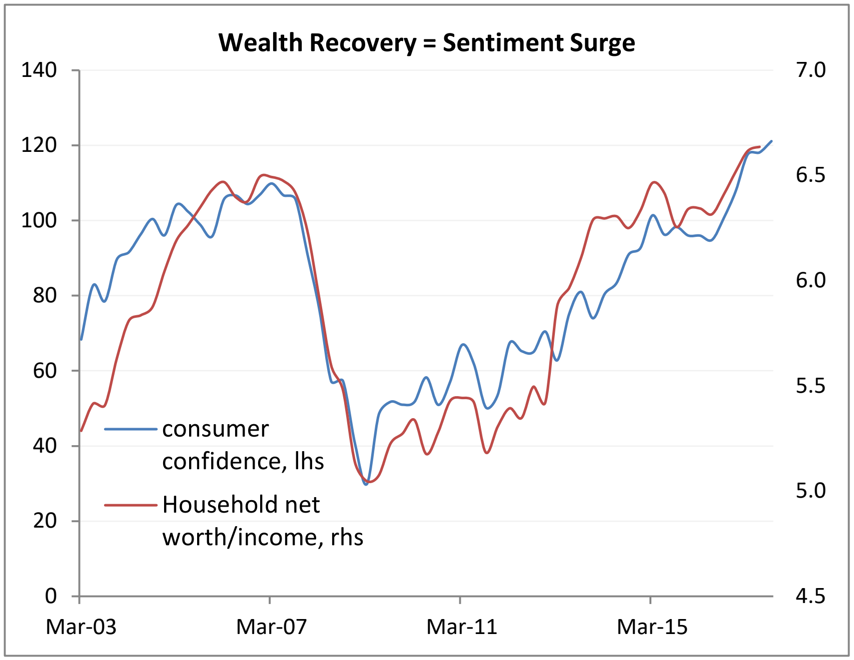
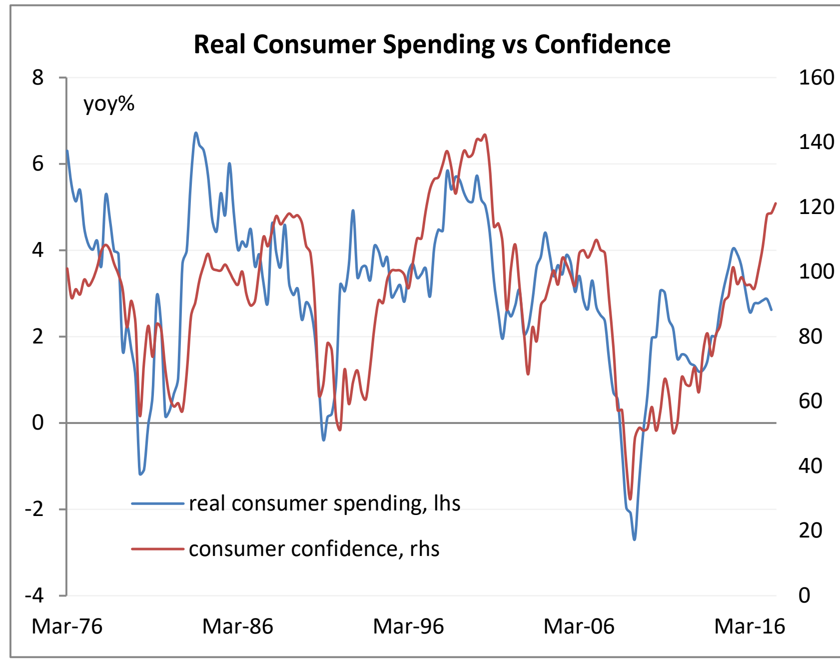




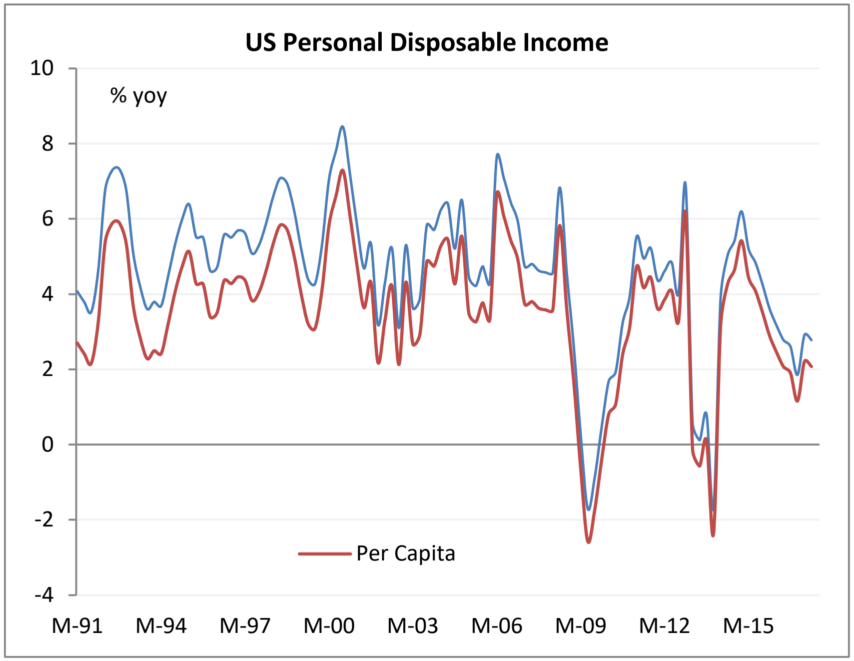
Rising wealth has raised confidence but not spending

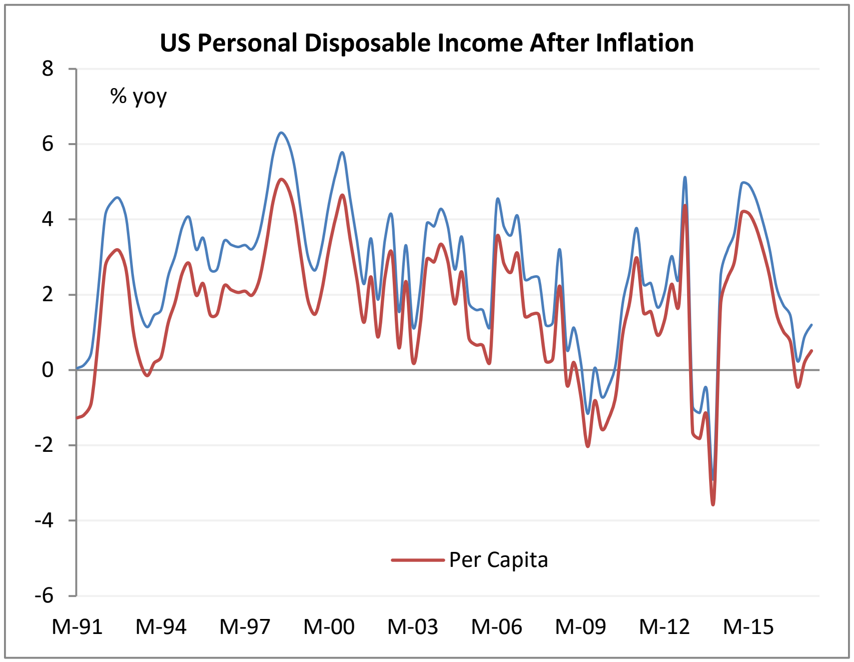




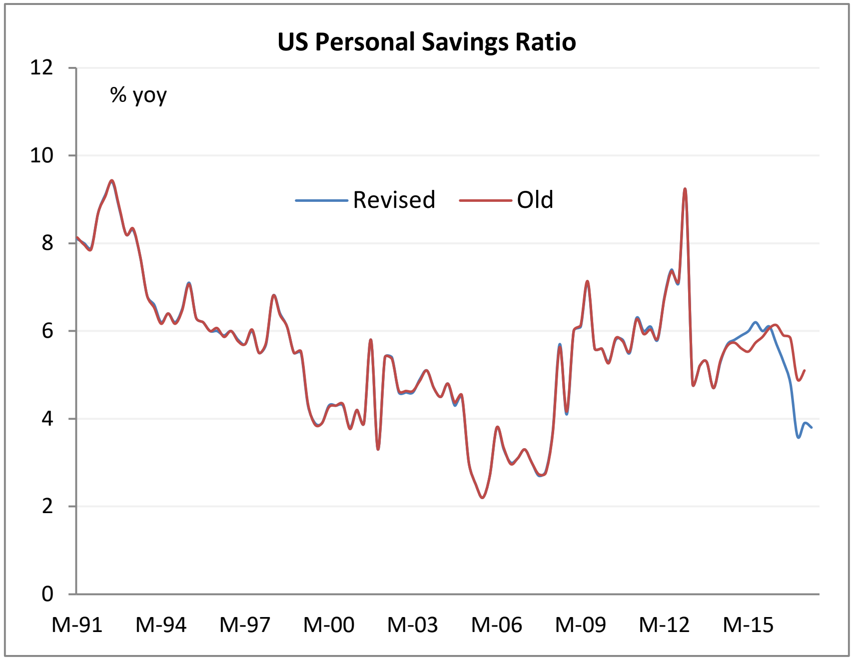
Why the gap? Slower real income growth and balance sheet restoration.

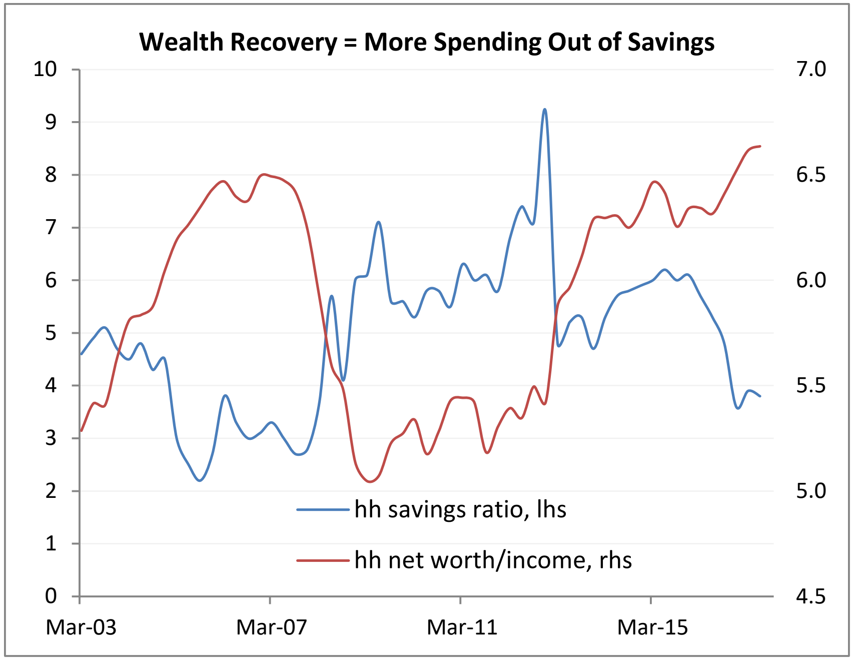
Recent revision down in income growth



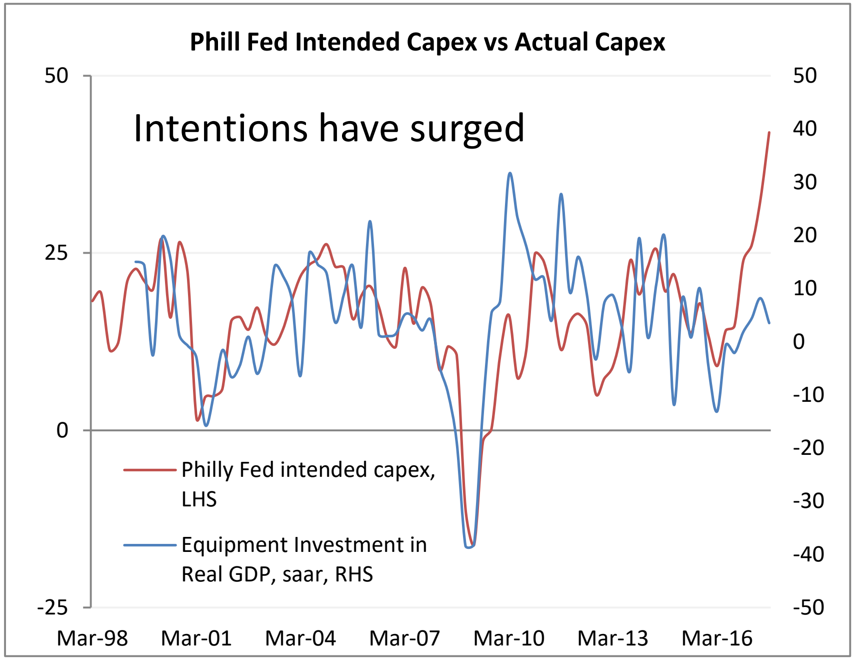


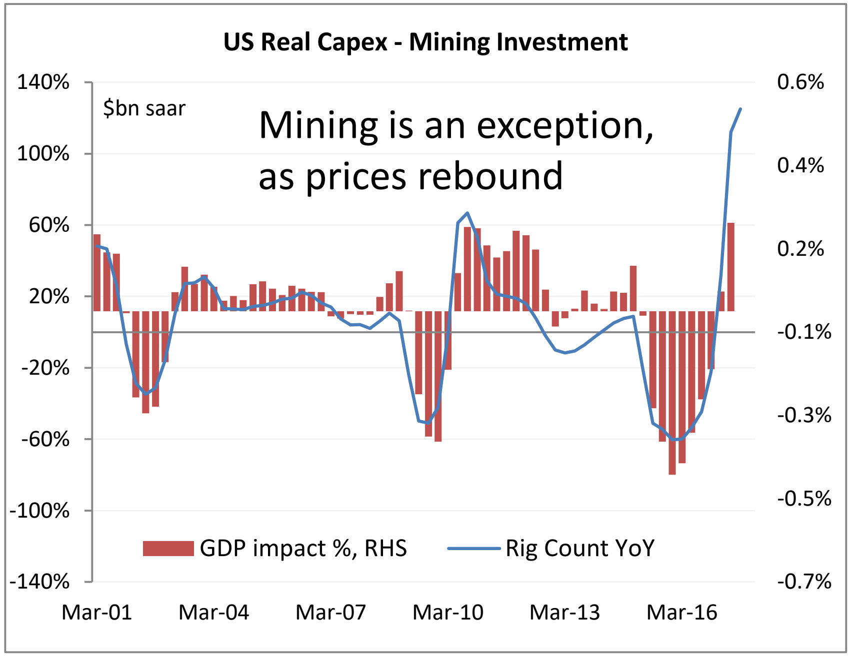
Accompanying downward revision to savings ratio



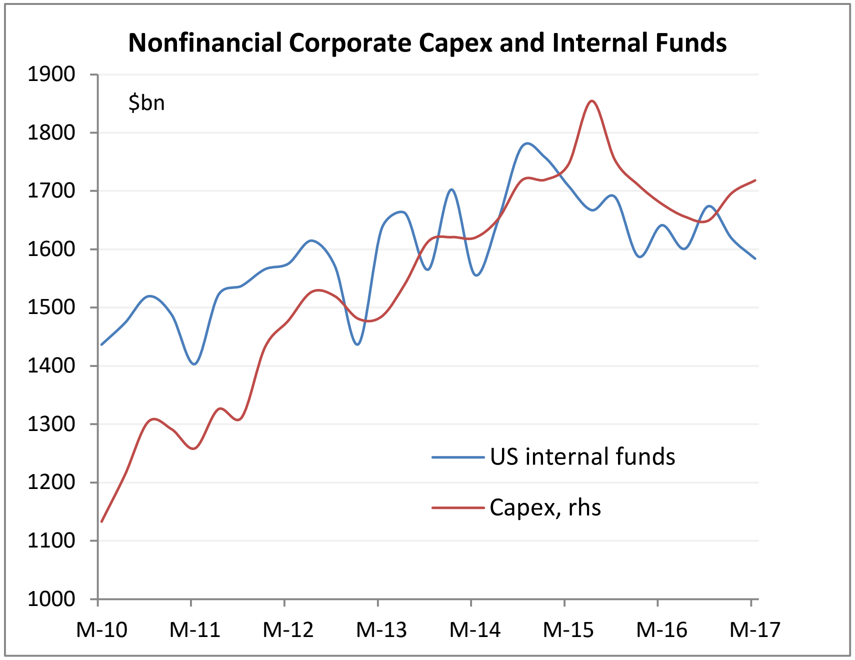


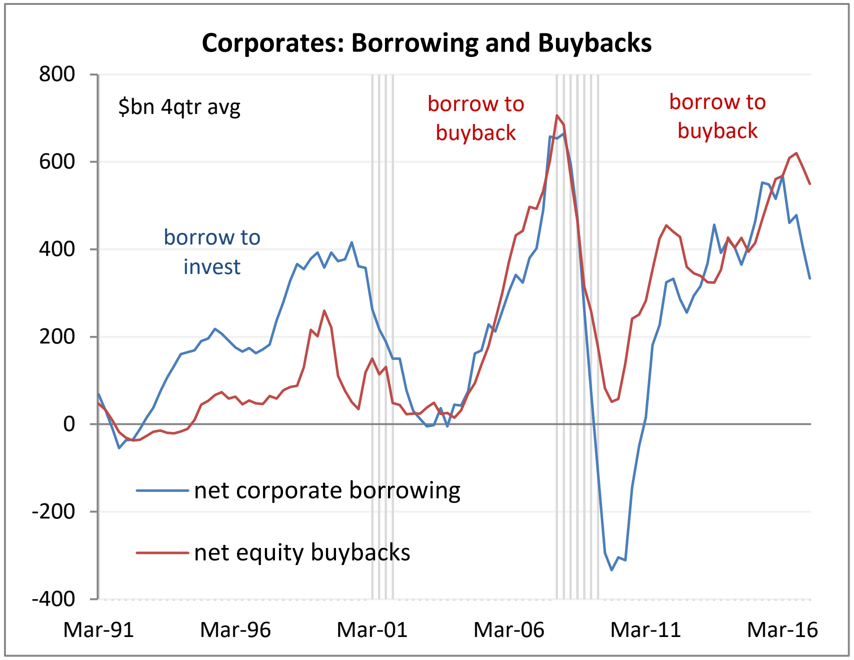
Business capex hasn't yet reflected intentions



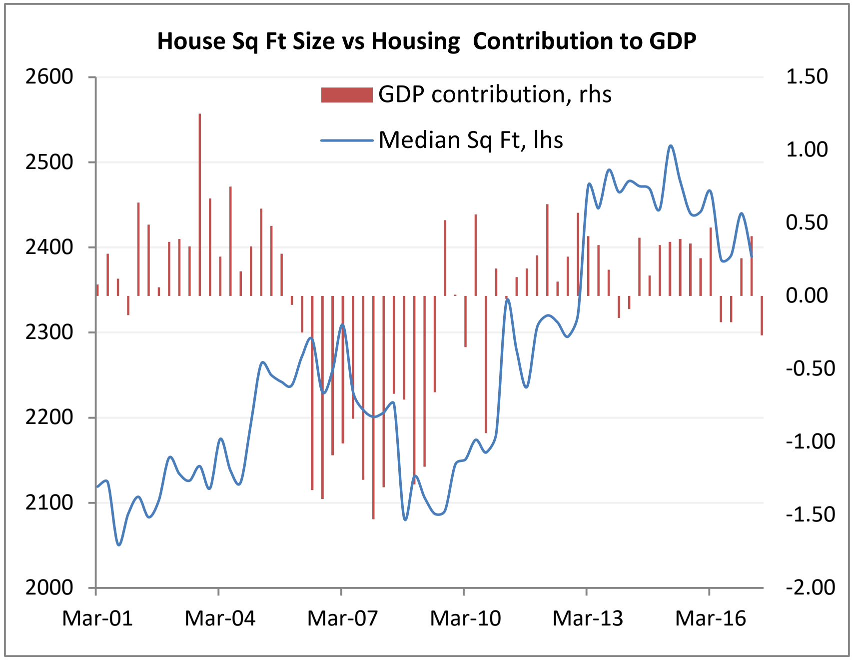


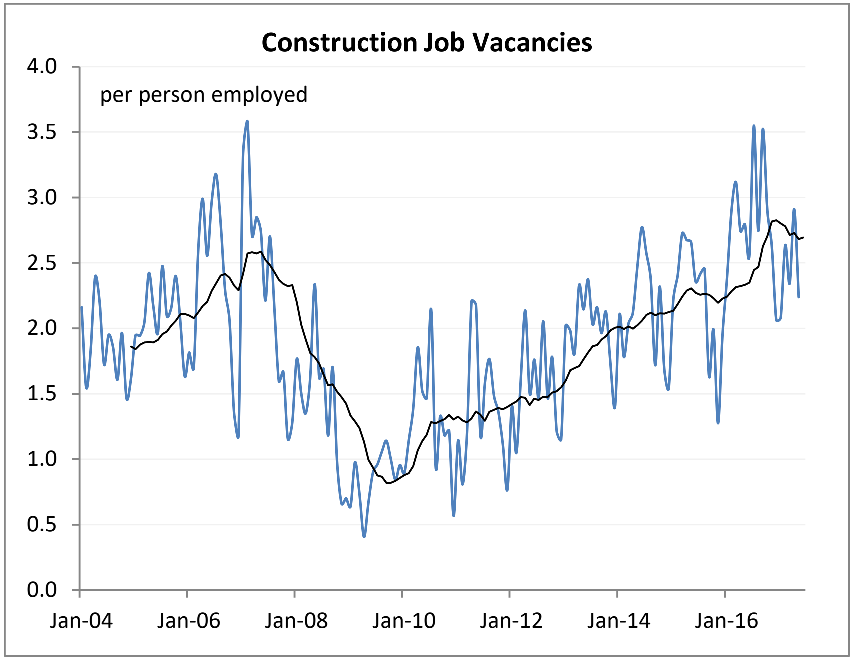
Capex constrained by softer internal fund generation, and by deploying borrowing to buybacks



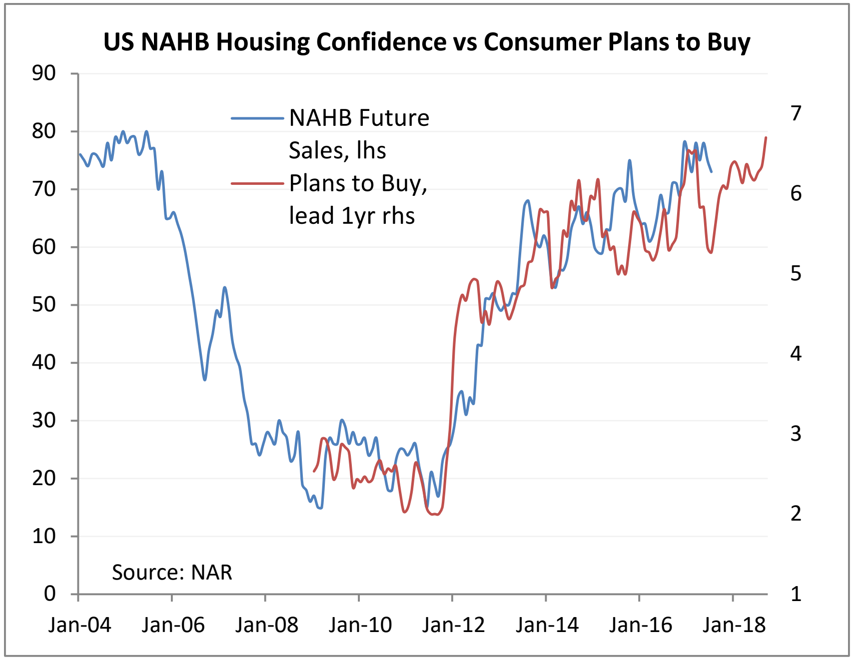


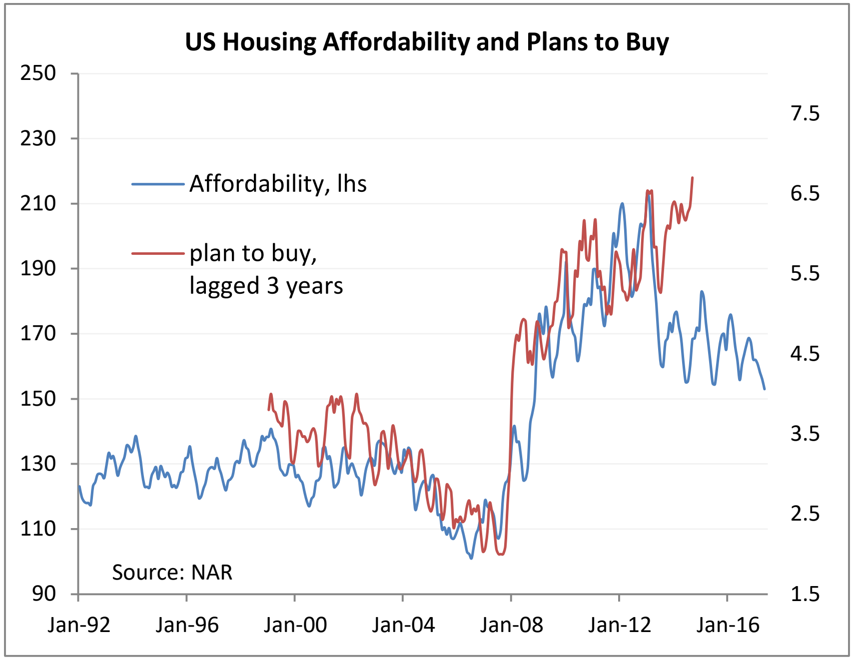
Housing: lower square footage and shortage of workers



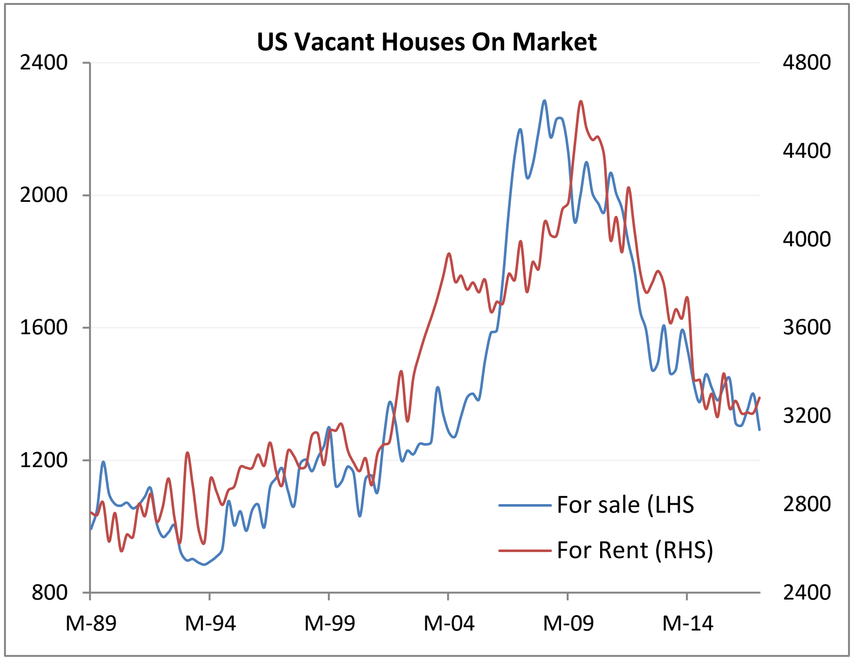


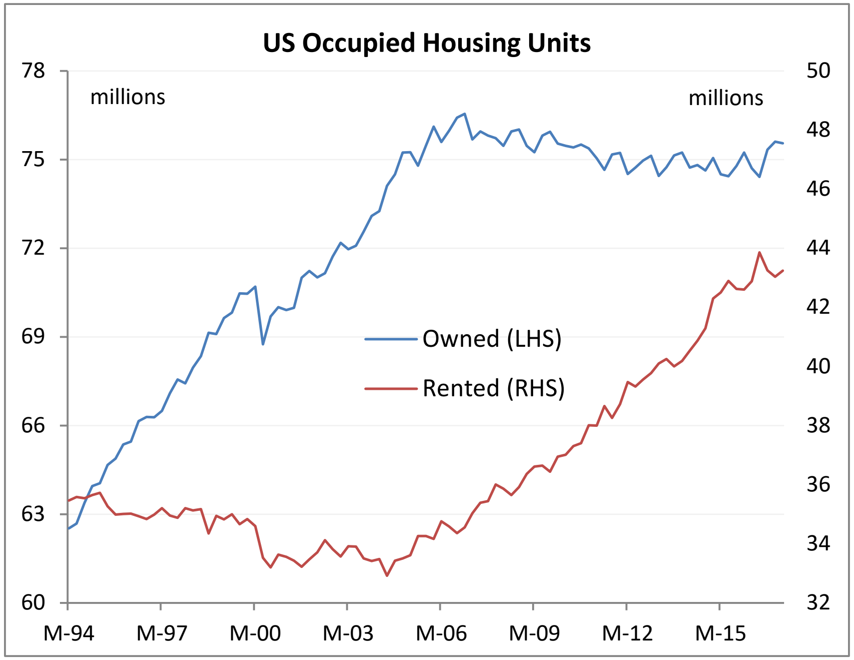
Housing still has upside but closer to inflection point



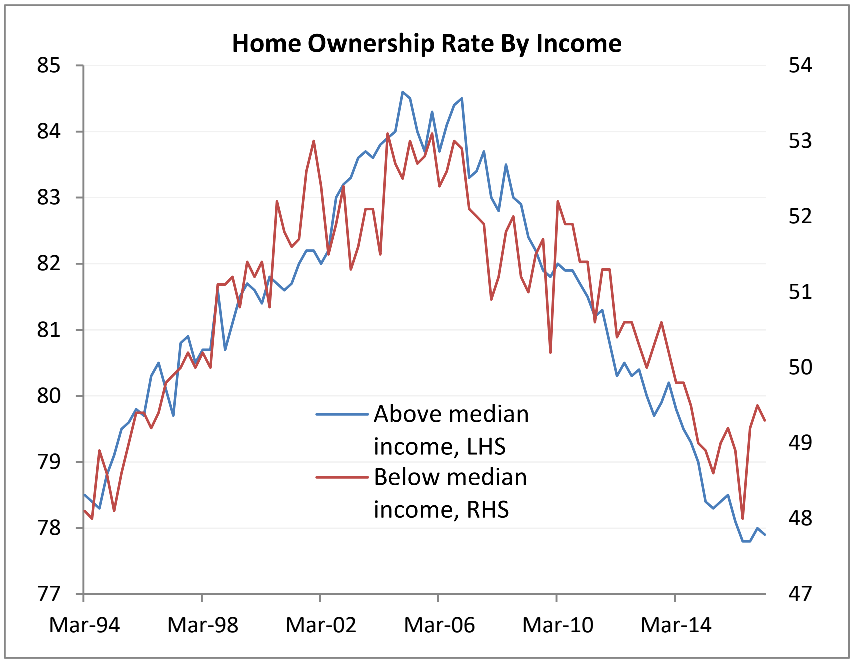


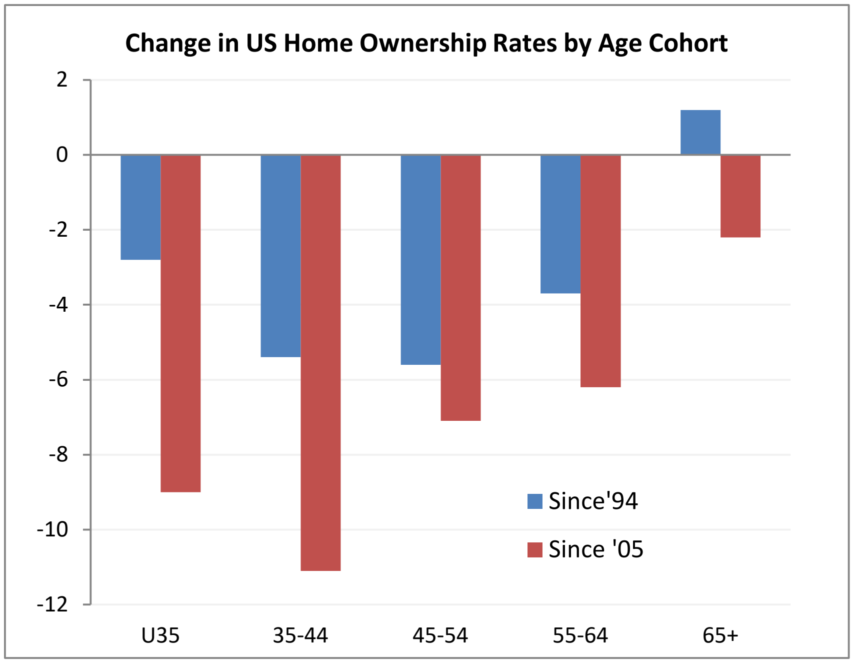
Incentive to build still there, slight jump in owned rate



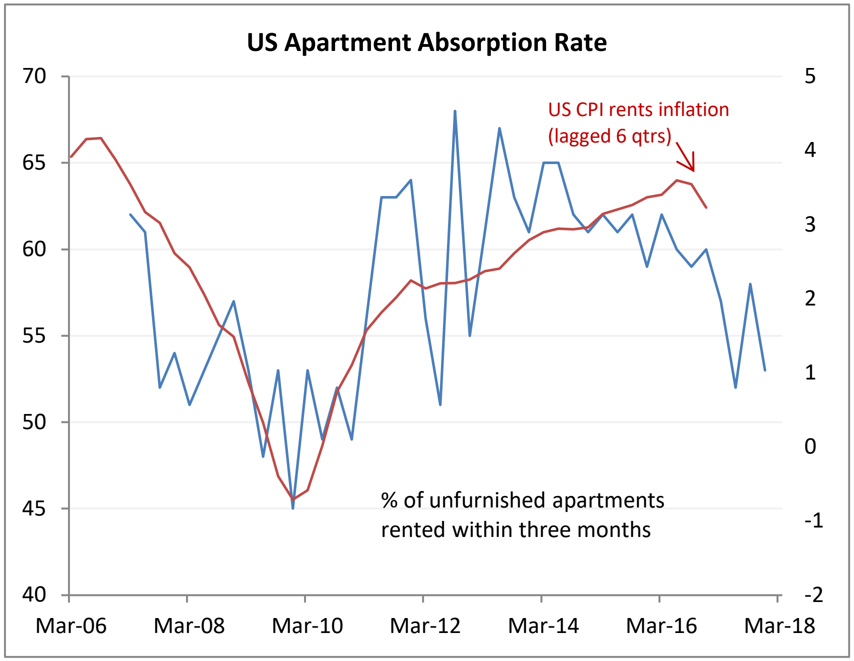


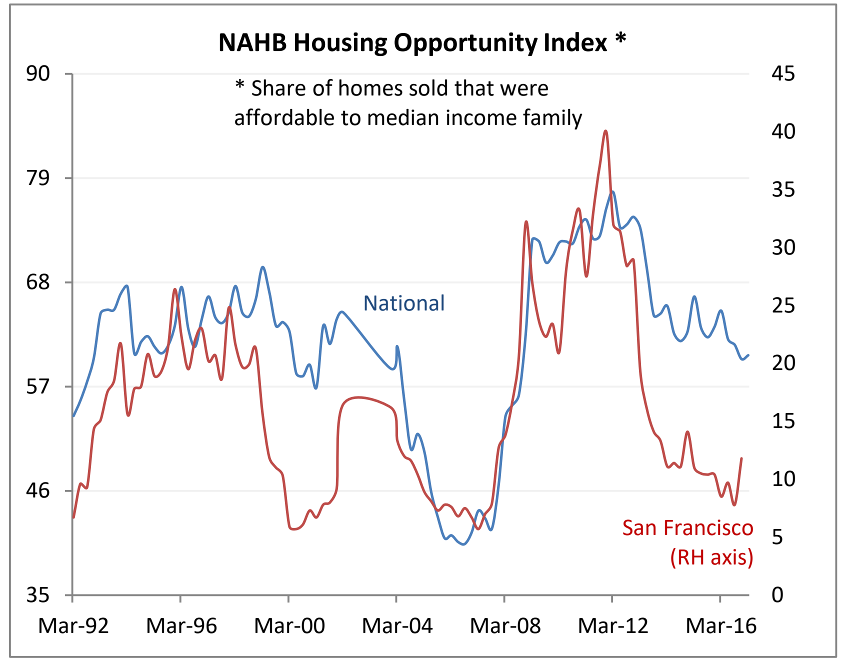
Home ownership drop most evident for young cohorts



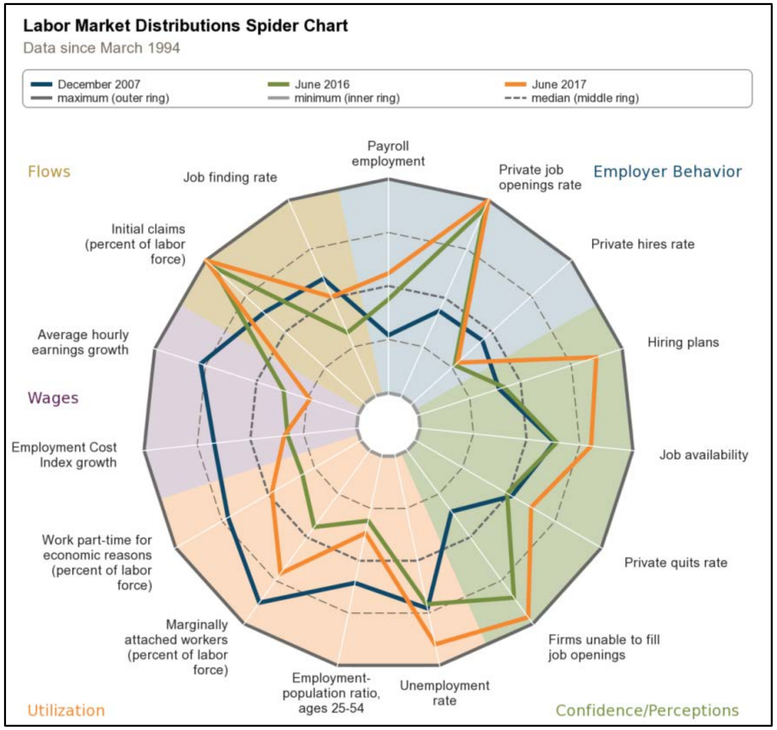


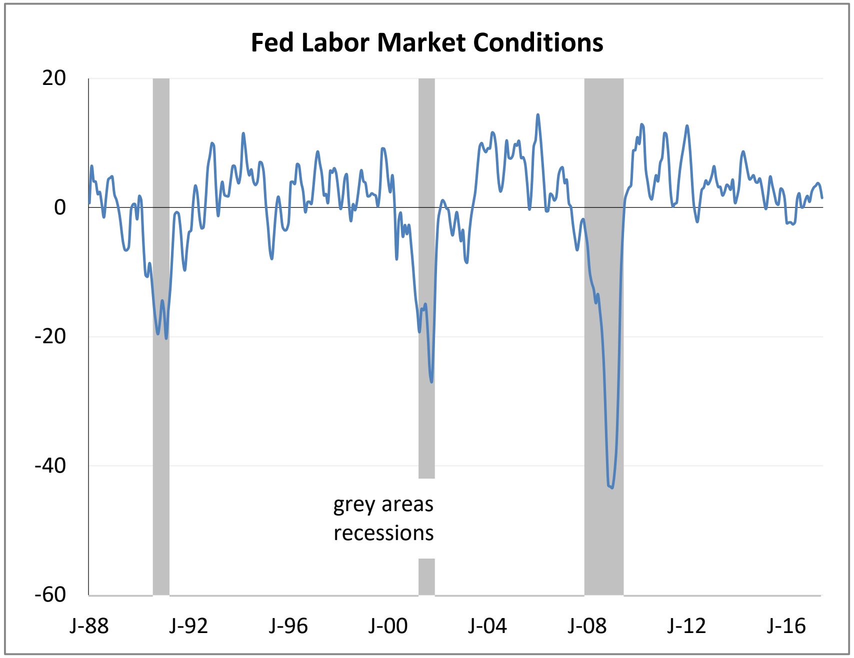
Caveats: multis and west coast getting 'rich'



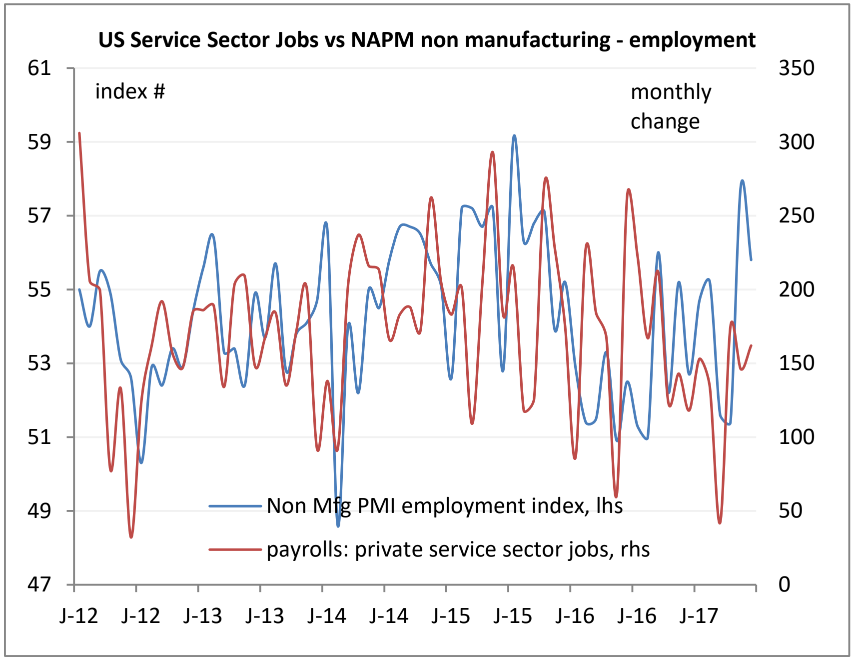


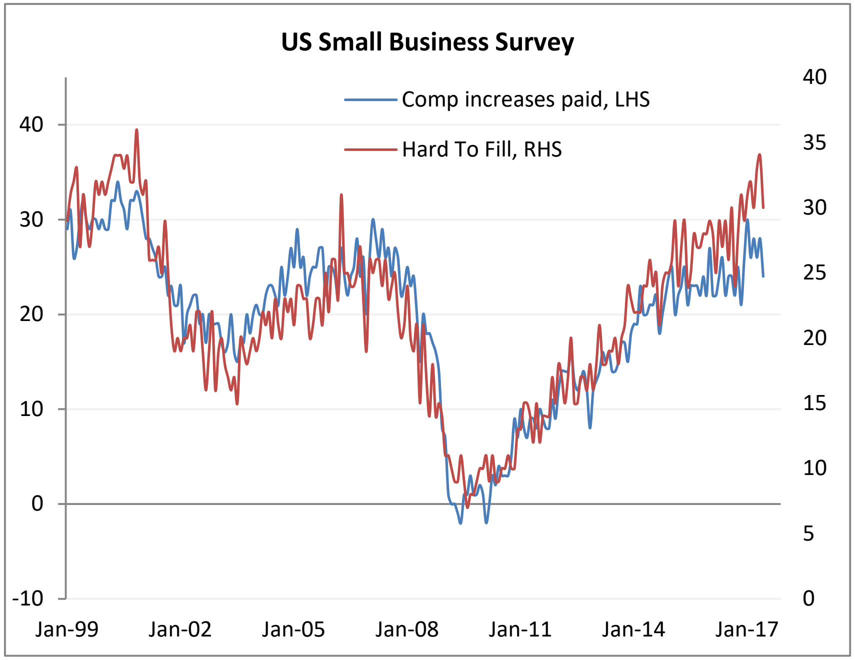
Gradual improvement continues in US labor market



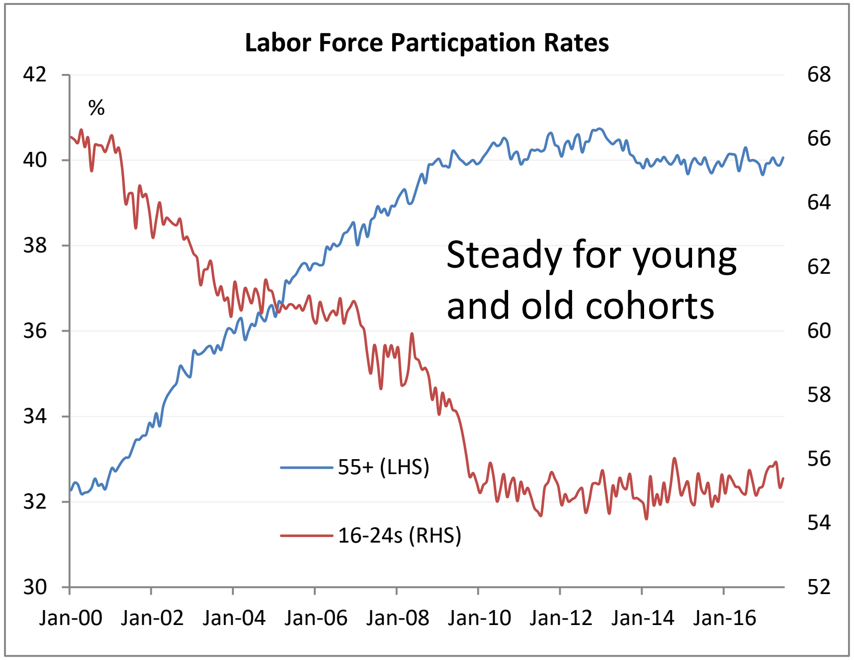


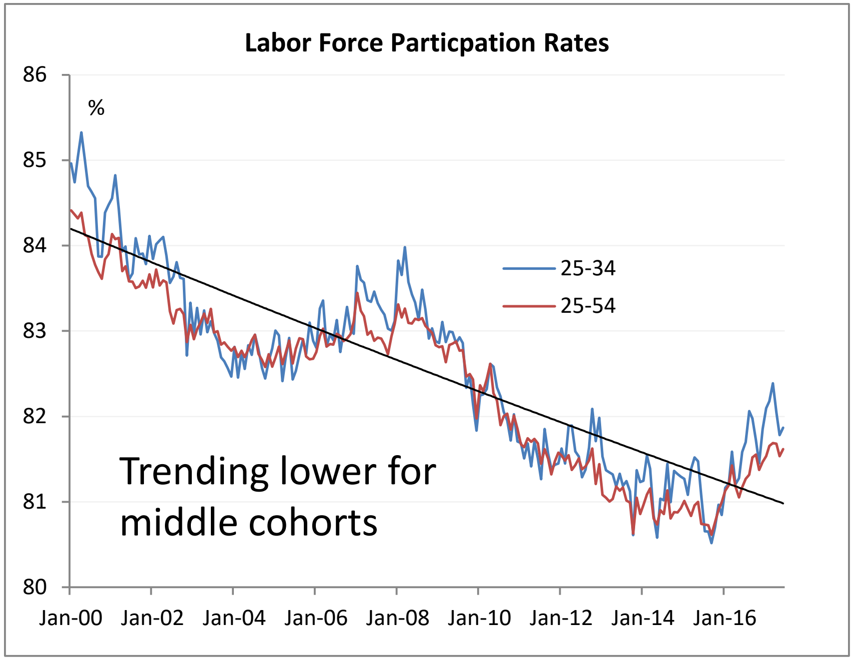
Firms increasingly can't find workers





Getting higher labor force participation in the key 25-34 year old group seems key





Weak participation for *men* in this cohort might be related to trends in disability and chronic pain

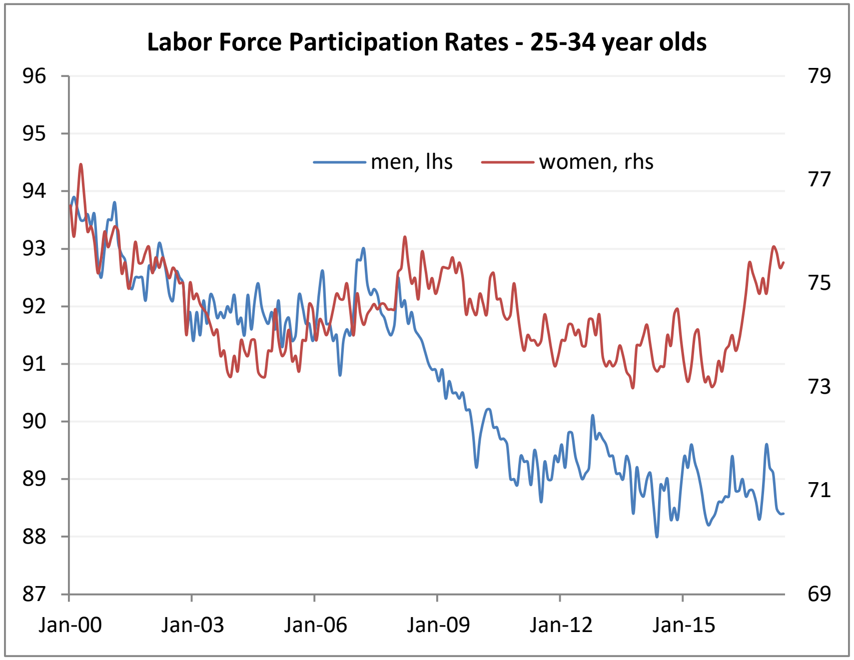


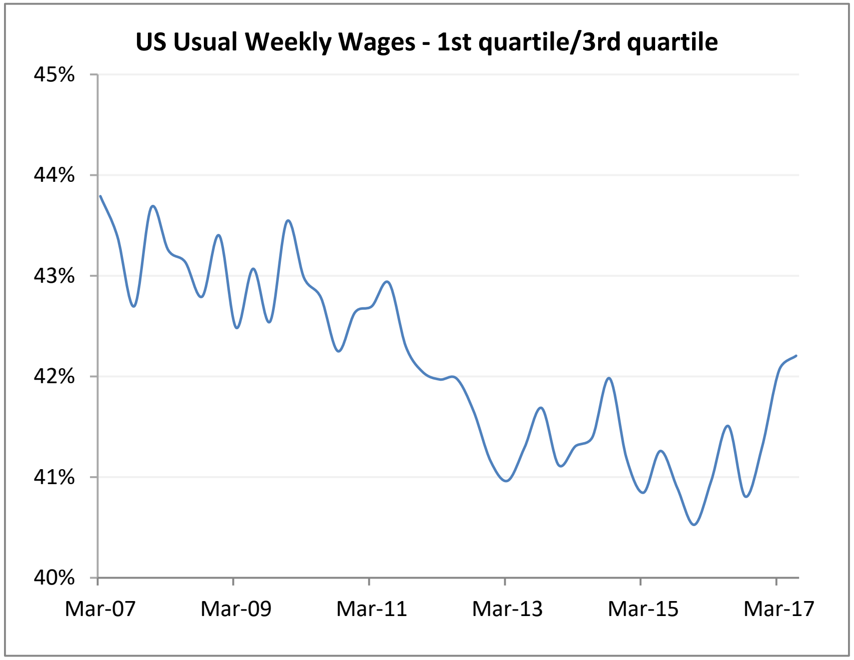
Table 8: Prevalence of Pain and Pain Medication, By Labor Force Status

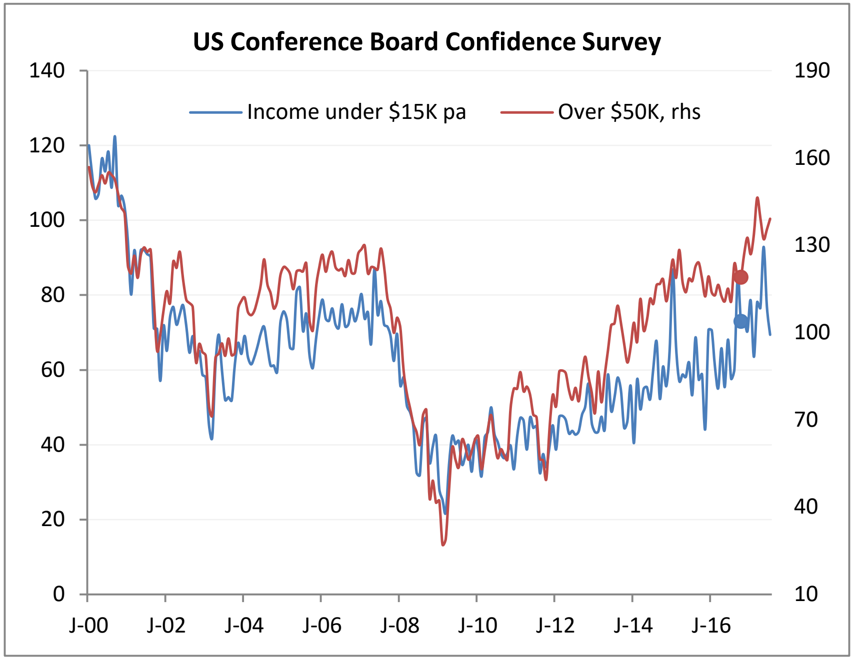
	Employed	*Unemployed*	*Not in LF*
All Prime Age Men			
Average Pain Rating (0-6)	0.76	0.81	1.97
Time Spent with Pain > 0	29.6%	26.3%	51.6%
Took Pain Medication Yesterday	20.2%	18.9%	43.5%
N	*7,277*	*468*	*683*
Disabled Prime Age Men			
Average Pain Rating (0-6)	1.49	1.25	2.81
Time Spent with Pain > 0	52.3%	42.1%	70.9%
Took Pain Medication Yesterday	32.4%	12.4%	57.7%
N	*191*	*25*	*276*

Notes: Sample is ATUS Well-being module respondents, prime age (25-54) men, pooling years 2010, 2012, and 2013. Weighted using the final well being activity weights. N is number of respondents.

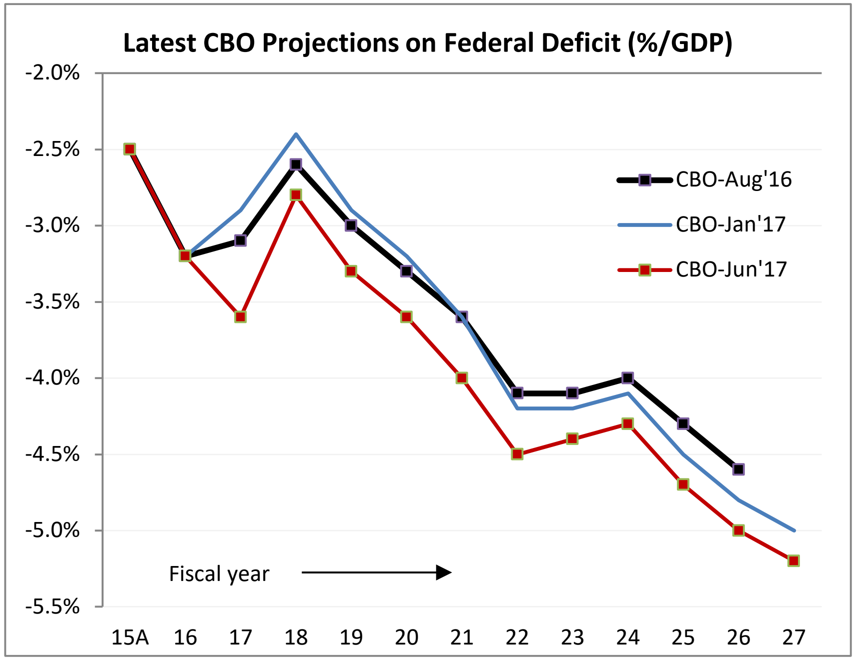
Source: Where Have All the Workers Gone?
Alan B. Krueger, Princeton University and NBER, October 2016

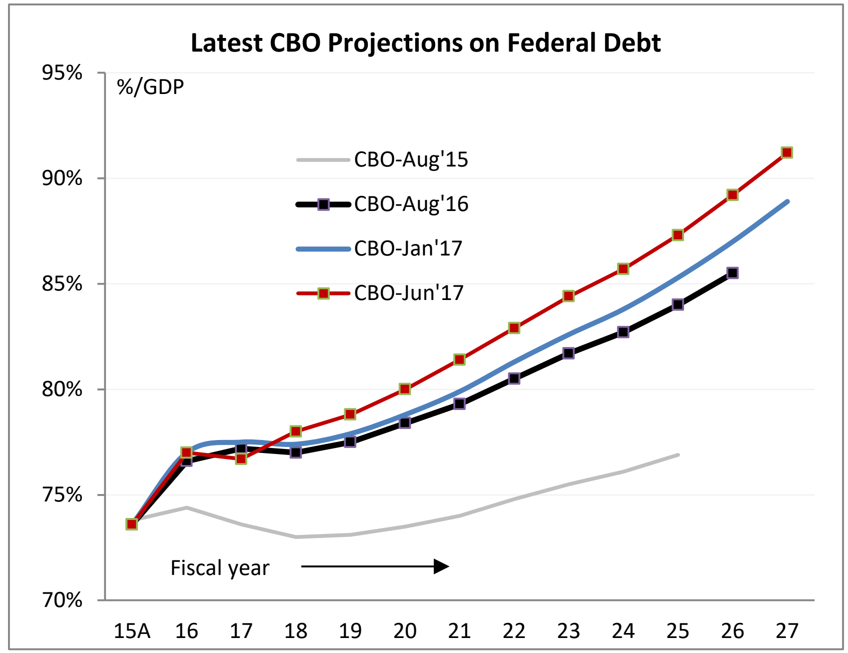
Relative wage growth for lower income earners has improved … but not sentiment



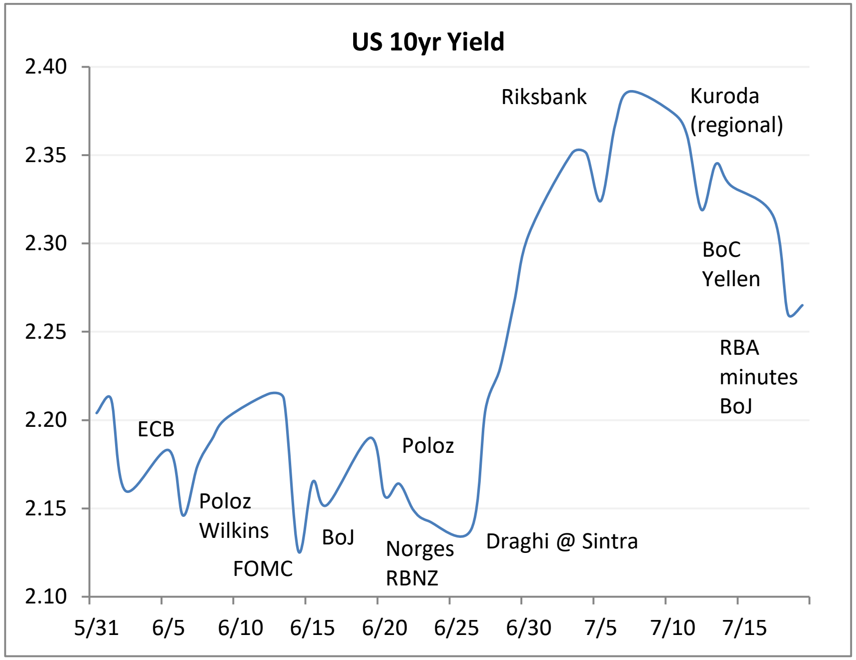


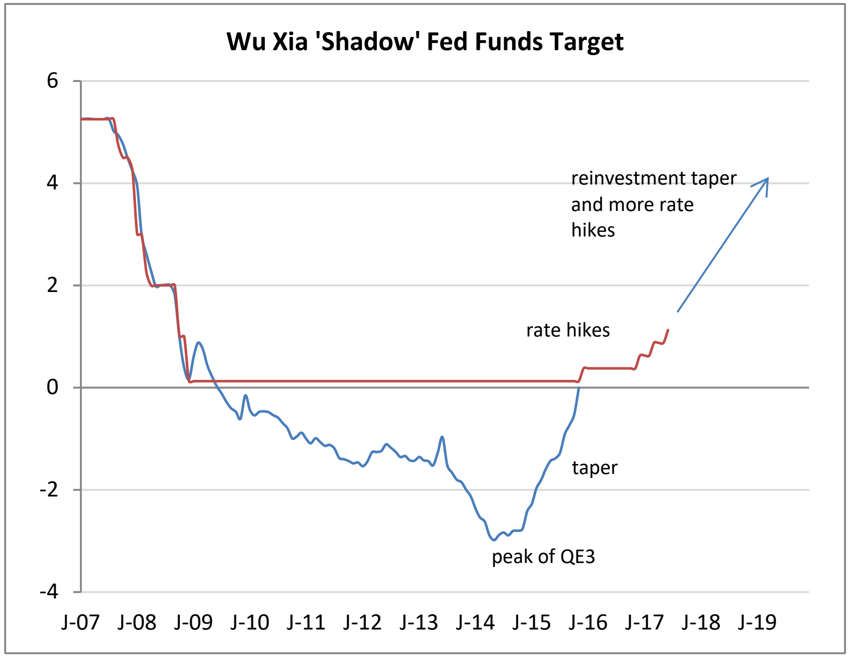
Deteriorating debt and deficit position will limit the US' capacity to effect fiscal stimulus



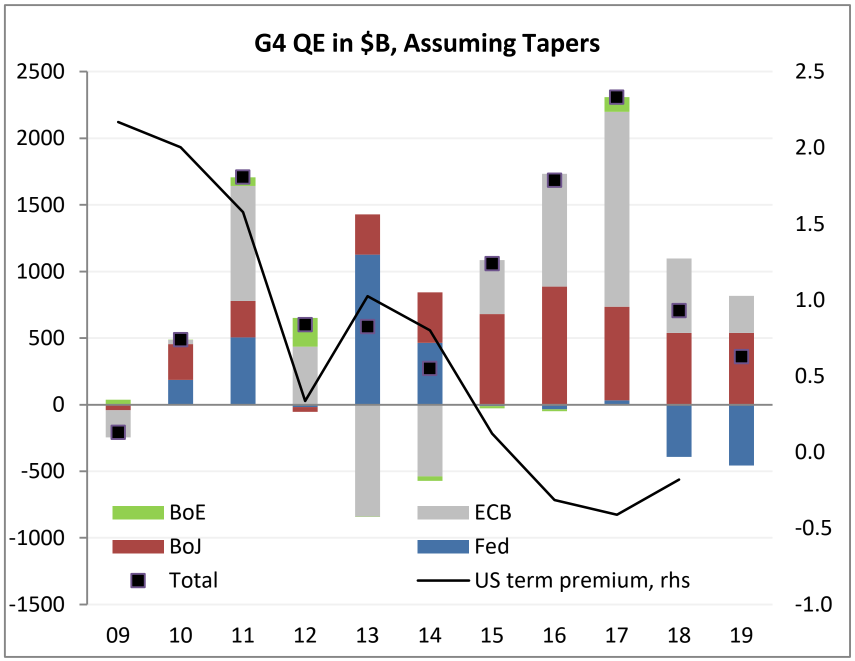


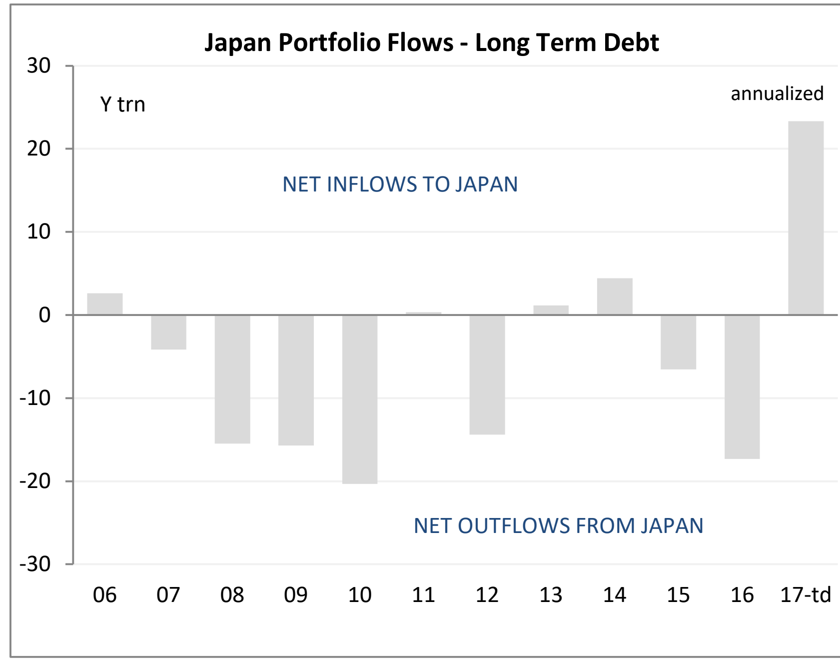
Central banks here and abroad are hinting at pivots toward less accommodative policy



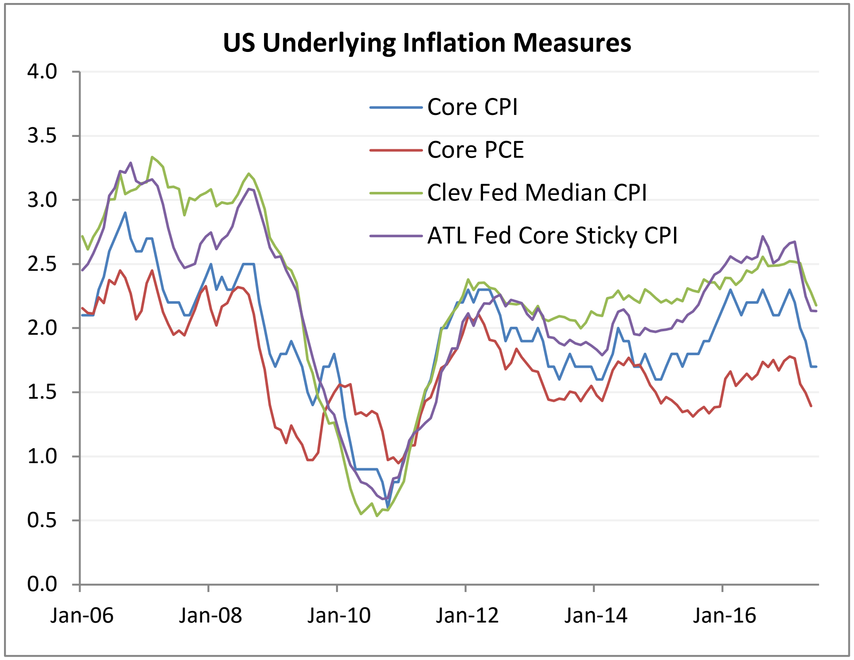


2017 likely to be peak of global QE
Flows to foreign markets from Japan QE has stalled

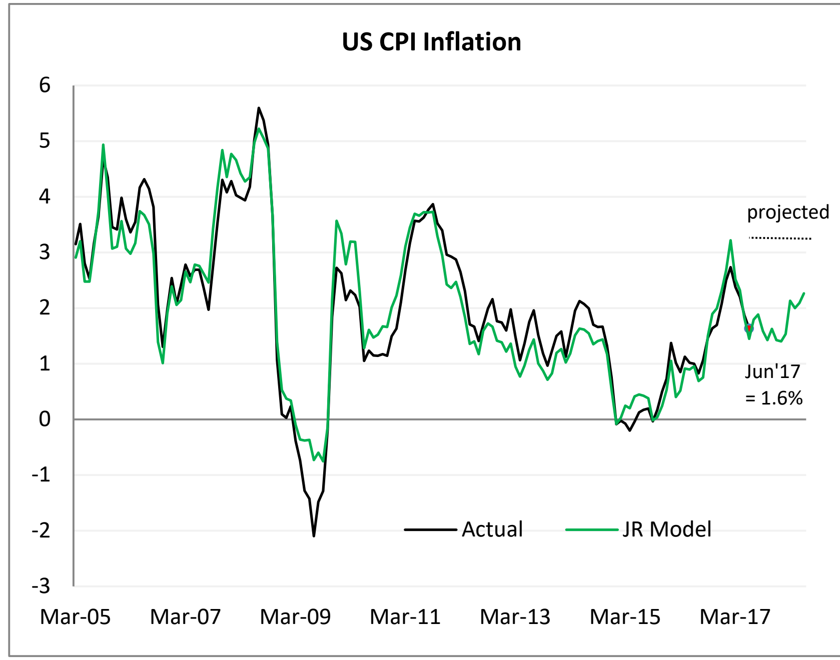




Benign inflation outlook keeps the Fed cautious



US inflation has fallen even after idiosyncratic factors



US inflation could stay in mid-1s all this year

IMF Update projects continued mild upward momentum

IMF - Overview of the World Economic Outlook Projections - July 2017						
	Estimates		Projections		Diff vs April	
	2015	2016	2017	2018	2017	2018
World Output	**3.4**	**3.2**	**3.5**	**3.6**	**0.0**	**0.0**
Advanced Economies	2.1	1.7	2.0	1.9	0.0	–0.1
United States	2.6	1.6	2.1	2.1	–0.2	–0.4
Euro Area	2.0	1.8	1.9	1.7	0.2	0.1
Germany	1.5	1.8	1.8	1.6	0.2	0.1
France	1.1	1.2	1.5	1.7	0.1	0.1
Italy	0.8	0.9	1.3	1.0	0.5	0.2
Spain	3.2	3.2	3.1	2.4	0.5	0.3
Japan	1.1	1.0	1.3	0.6	0.1	0.0
United Kingdom	2.2	1.8	1.7	1.5	–0.3	0.0
Canada	0.9	1.5	2.5	1.9	0.6	–0.1
Other Advanced	2.0	2.2	2.3	2.4	0.0	0.0
Emerging Market	**4.3**	**4.3**	**4.6**	**4.8**	**0.1**	**0.0**
Russia	–2.8	–0.2	1.4	1.4	0.0	0.0
China	6.9	6.7	6.7	6.4	0.1	0.2
India	8.0	7.1	7.2	7.7	0.0	0.0
ASEAN-5	4.9	4.9	5.1	5.2	0.1	0.0
EMEA	4.7	3.0	3.5	3.2	0.5	–0.1
Brazil	–3.8	–3.6	0.3	1.3	0.1	–0.4
Mexico	2.6	2.3	1.9	2.0	0.2	0.0
World Trade Volume	2.6	2.3	4.0	3.9	0.2	0.0
Consumer Prices						
Advanced Economies	0.3	0.8	1.9	1.8	–0.1	–0.1
Emerging Market	4.7	4.3	4.5	4.6	–0.2	0.2

IMF comments

The pickup in global growth anticipated in the April Outlook remains on track.

The unchanged global growth projections mask *somewhat different contributions at the country level.*

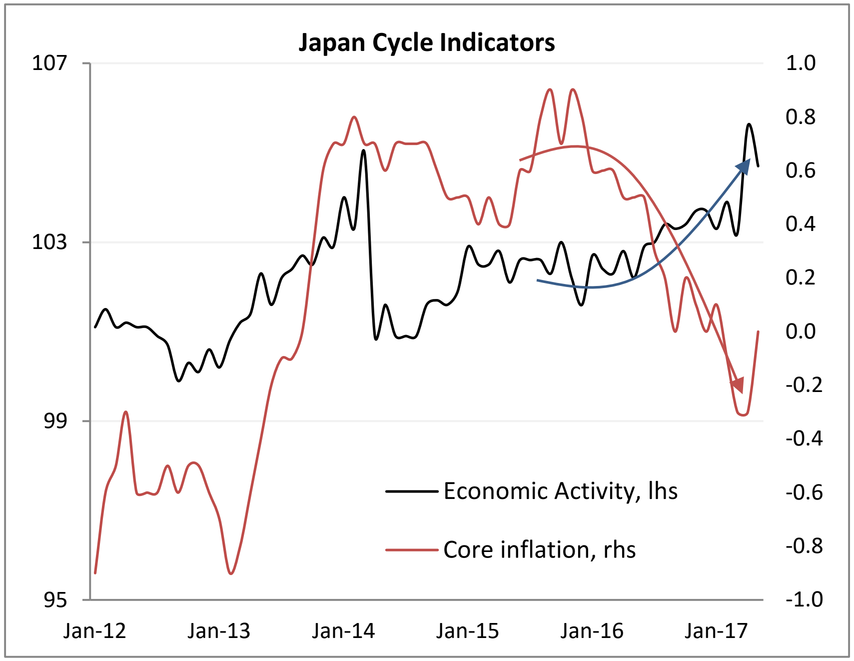
While risks around the global growth forecast appear broadly balanced in the near term, they remain skewed to the downside over the medium term.

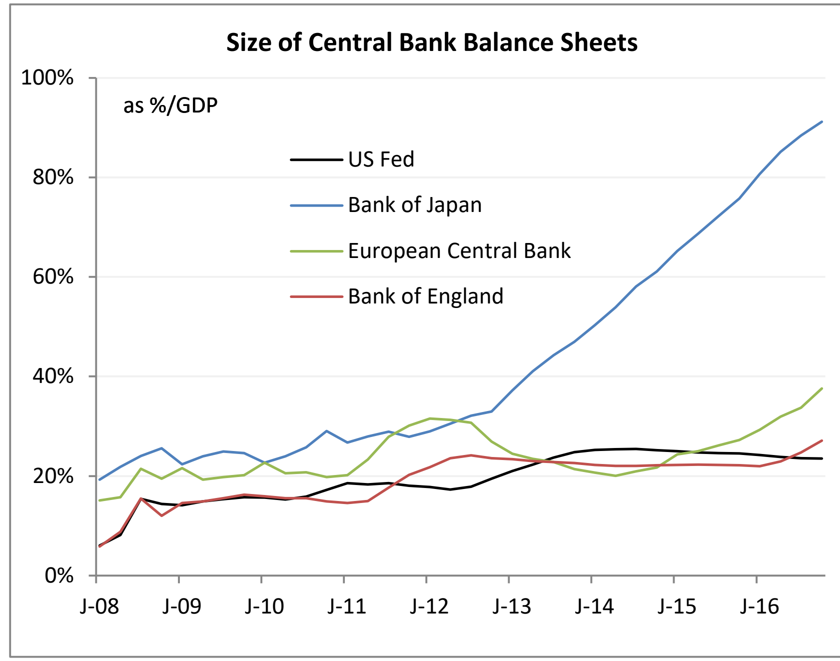
Projected global growth rates for 2017–18 remain below pre-crisis averages.

Many advanced economies face excess capacity as well as headwinds to potential growth from aging populations, weak investment, and slowly advancing productivity.

Financial stability risks need close monitoring in many emerging economies.

Some risk that Japan changes from its QQE policy

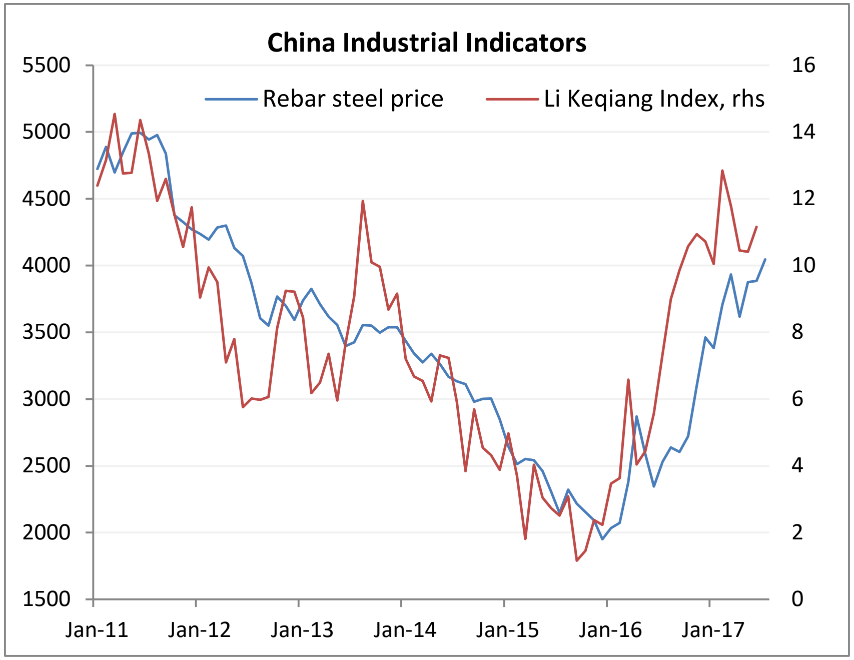


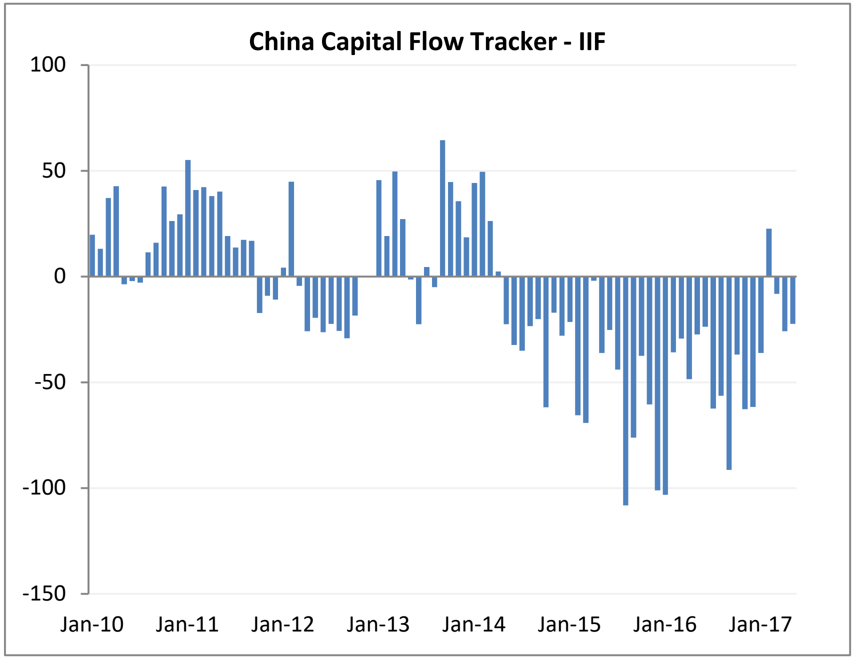


So far, stronger activity hasn't result in higher inflation

But government is less popular and the central bank balance sheet is getting very large

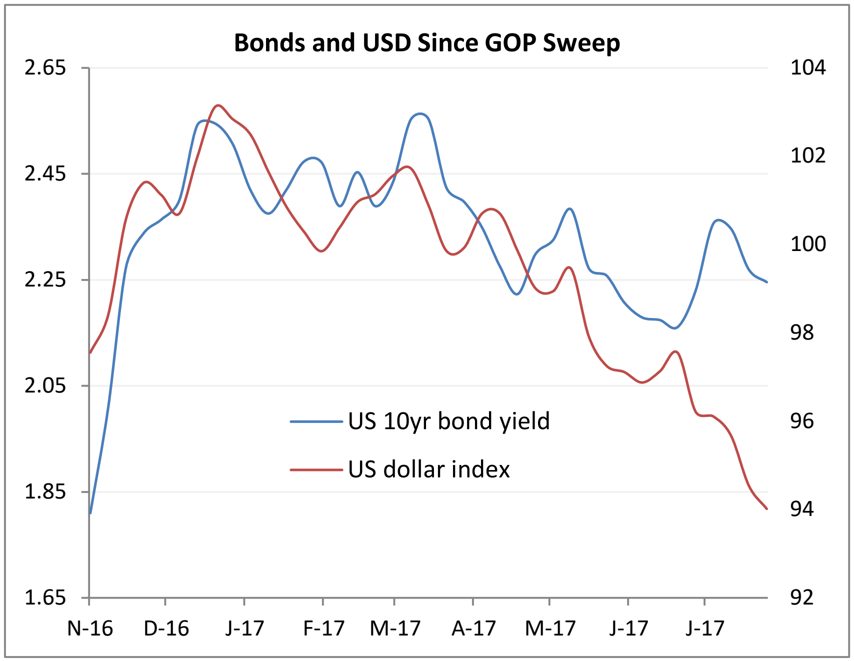
China's stabilization ahead of 19th Party Congress has helped risk markets this year

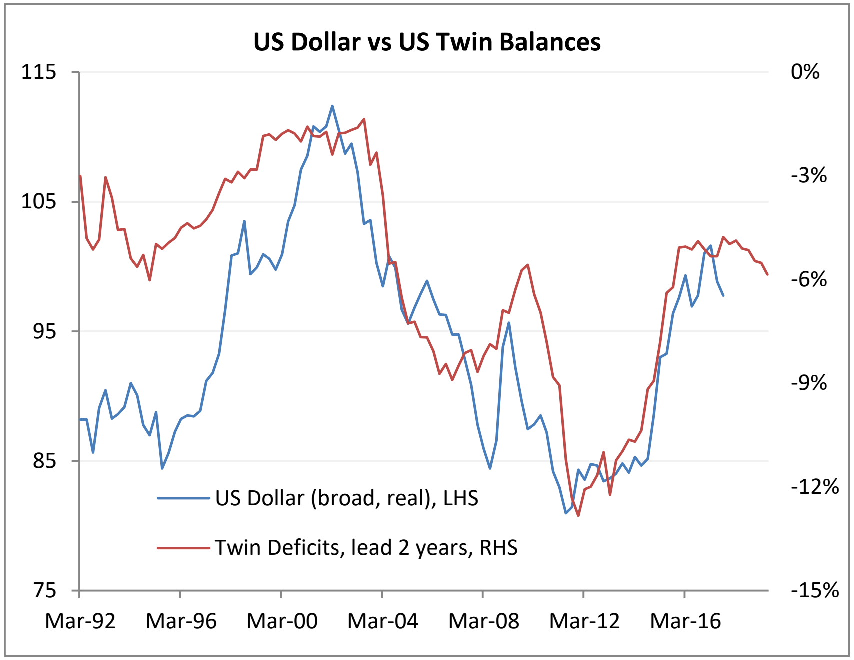




Controls and better economy have - for now - stemmed capital outflow

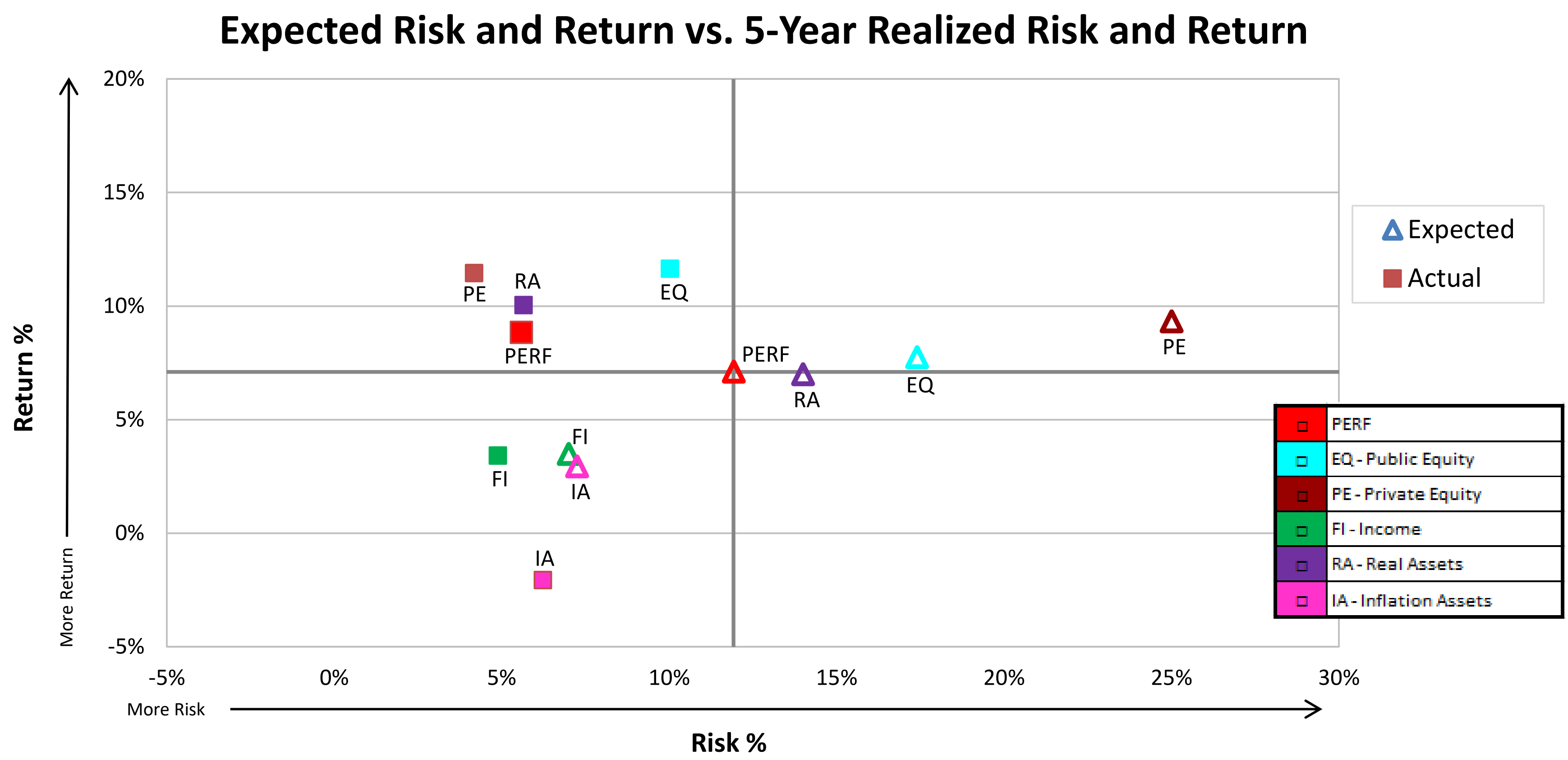
US policy paralysis and stalled improvement in US 'twin deficits" have hurt US dollar





Twin Deficits = budget and external

PERF Asset Liability Management Assumptions



*Expected risk and return is based on the 2013 ALM Workshop and uses the short-term (1-10year) expected return from capital market assumptions; actual risk and return figures are 5 year figures

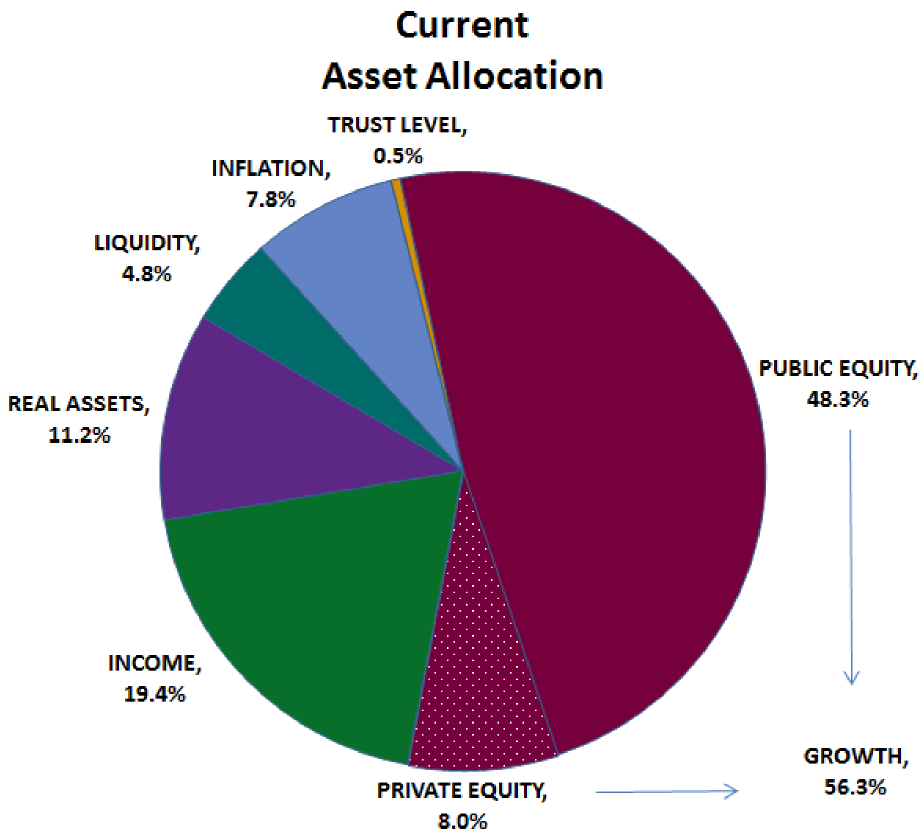
PERF Contribution to Return

Asset Class	Average Weight (%)	1-Year Return (%)	Year Ended Contribution to Return (%)
GROWTH	56.8	18.8	10.4
PUBLIC EQUITY	*48.4*	*19.6*	*9.2*
PRIVATE EQUITY	*8.3*	*13.9*	*1.1*
INCOME	18.9	0.3	0.1
REAL ASSETS	10.9	7.4	0.8
REAL ESTATE	*9.2*	*7.6*	*0.7*
FORESTLAND	*0.6*	*1.0*	*0.0*
INFRASTRUCTURE	*1.0*	*9.9*	*0.1*
LIQUIDITY	4.4	0.8	0.0
INFLATION	8.1	-2.7	-0.2
TRUST LEVEL	1.0		0.1
TOTAL FUND	100	11.2	11.2

Public equity was largest contributor as a function of its weight in the plan + very strong returns (9.2%)

PERF Asset Allocation

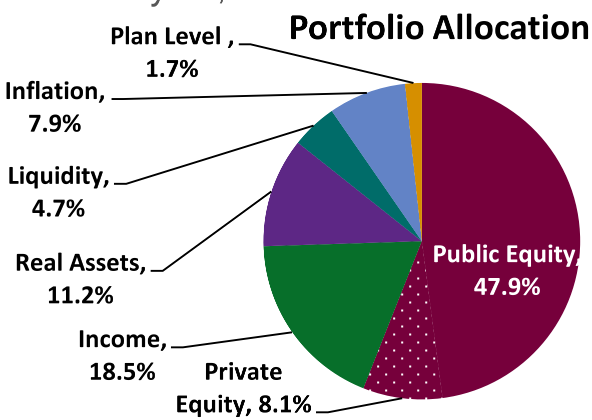
ASSET CLASS AS OF: June 30, 2017	Current Allocation(%)	Interim Strategic Target (%)*
GROWTH	56.3%	54%
PUBLIC EQUITY	48.3%	*46%*
PRIVATE EQUITY	8.0%	*8%*
INCOME	19.4%	20%
REAL ASSETS	11.2%	13%
REAL ESTATE	9.4%	*11%*
FORESTLAND	0.6%	*1%*
INFRASTRUCTURE	1.2%	*1%*
LIQUIDITY	4.8%	4%
INFLATION	7.8%	9%
TRUST LEVEL	0.5%	-
ARS	0.1%	-
MULTI-ASSET CLASS (MAC)	0.4%	-
OVERLAY+TRANS+PLAN	0.0%	-
TOTAL FUND	100.0%	100.0%

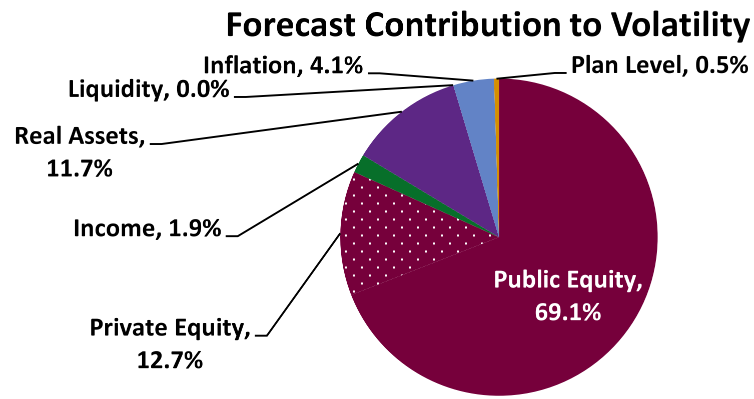


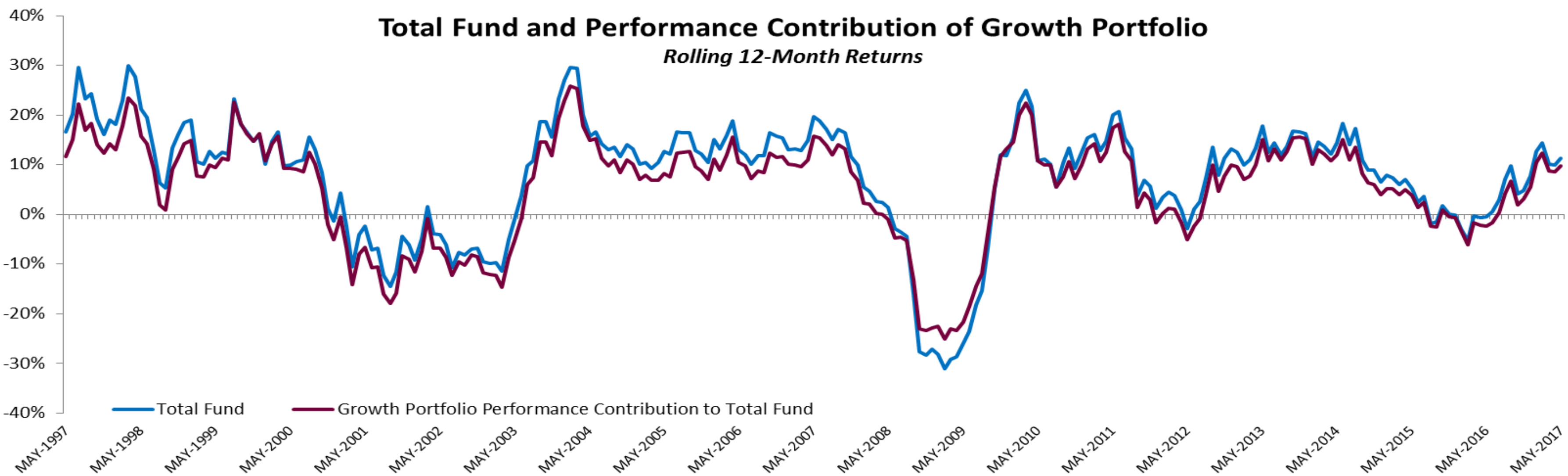
*Interim strategic targets were adopted by the Board and effective October 1, 2016.

Growth Assets Dominate Volatility

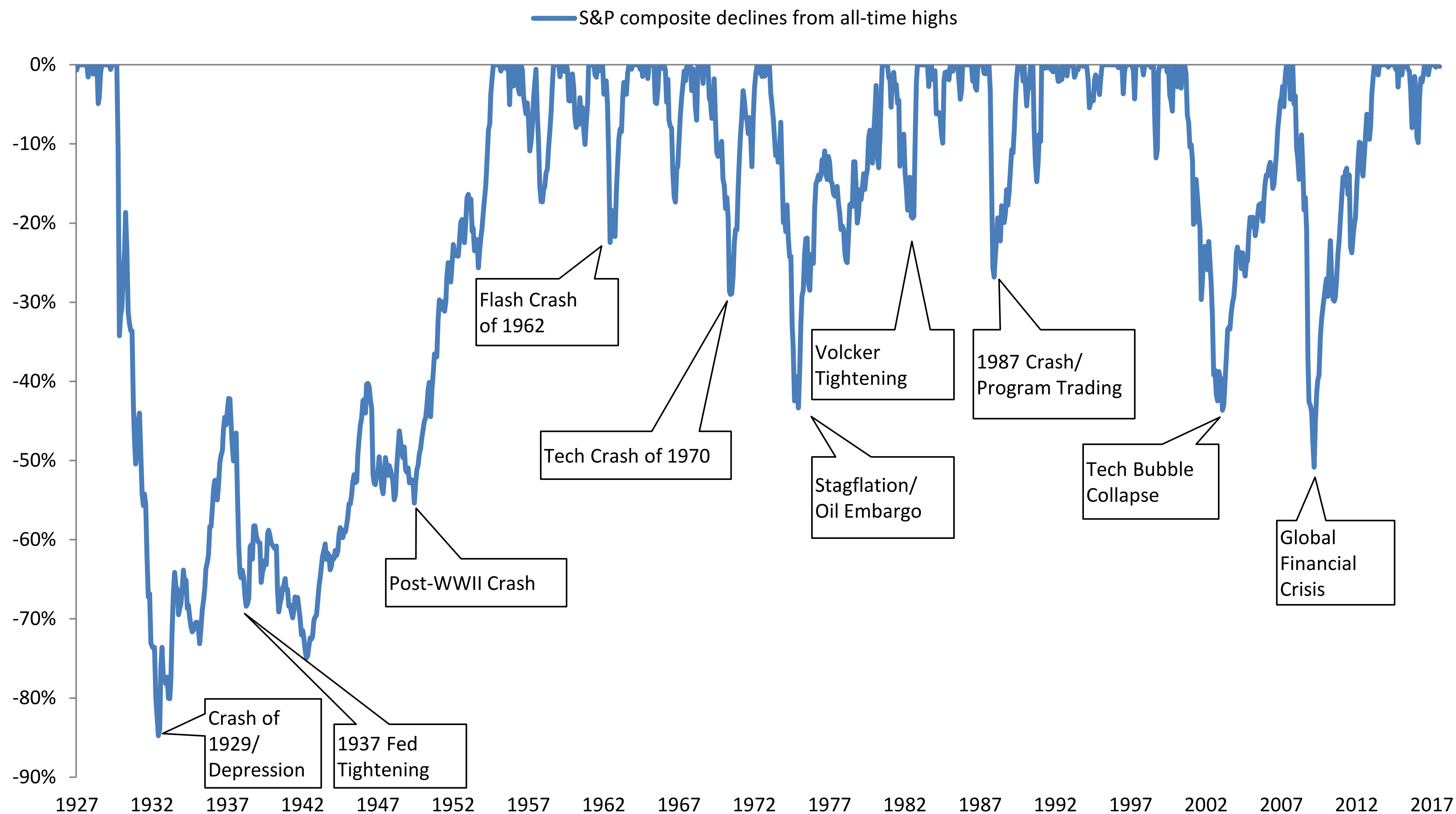
As of May 31, 2017







Historical Equity Market Drawdowns



Source: Robert Shiller, Bloomberg, J.P. Morgan Asset Management, BarraOne