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Mendocino County Employees Retirement Association Performance Review

Periods ended June 30, 2019

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Agenda

- Capital Market Overview

- MCERA CY 2Q 2019 Performance

- Asset/Liability Study

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Capital Market Overview

Global Economic Update 2019

The Big Picture

Central bank policy front and center

– The Fed was alone on a path to normalize interest rates, with nine rate hikes in two years; euro zone sat out. U.S. rates have been substantially higher than developed markets globally for an extended period.

– Fed adopted dovish tone in January, a sharp reversal in stance. Rates held constant through Q2; rate cuts now expected in Q3 or Q4 2019.

However, U.S. economy remains strong, labor market very tight, reaching the limits of full employment

– Solid Q1 GDP growth (3.2%) moderated in Q2 (2.1%), will soften further in face of slowing global economy, trade uncertainty

– Slower growth inevitable after impact of 2018 fiscal stimulus fades and full impact of nine rate hikes feeds through the economy.

– Switch to dovish Fed policy boosted consumer and business confidence, and juiced stock market; drop back in borrowing costs expected to sustain growth, or at least soften slowdown

– Policy reversal simultaneously stoked fears of coming slowdown and fed a rally in bonds.

The slowdown in Europe and China weighing on global growth

– Euro zone unemployment has dropped, but economic growth stalled (GDP below 1.5%).

– China suffering dramatic slowdown in growth: industrial output, retail sales, implied GDP

– Resolution of trade uncertainty crucial to resumption of growth, far more important to China than the U.S.

Inflation remains stuck below 2% in U.S., weaker overseas

– Wage pressures building in U.S. have yet to translate into headline inflation.

– Weakening global growth, softer inflation give Fed cover to reverse policy and cut rates

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Does Strong First Half Spell Problems for Second Half of 2019 and 2020?

Did we just "steal" the expected return for the next 18 months?

Strong equity markets continue in Q2, adding to sharp rebound in Q1

– S&P up 18.5%, ACWI ex USA up 13.6% y-t-d

Dovish Fed comments, solid corporate fundamentals, and even lower unemployment propel equity markets in Q2:

– low quality stocks outperform

– growth over value

– small cap lags large cap once again

– Developed non-U.S. equities continue rebound, EM stalls in Q2

Trade uncertainty slowed markets in May, hope of deal rebounded in June

Fixed income markets participate, too

– Investment grade is strongest performer in the U.S.

– Credit spreads continued rally in Q2.

– Yield curve shifts lower across maturities, inverts from 3 months – 10 years; upward sloping from 1 year

*Cambridge PE data are available through December 31, 2018.

Source: Callan

Returns for Periods ended June 30, 2019

	1 Quarter	1 Year	5 Years	10 Years	25 Years
U.S. Equity					
Russell 3000	4.10	8.98	10.19	14.67	9.98
S&P 500	4.30	10.42	10.71	14.70	9.97
Russell 2000	2.10	-3.31	7.06	13.45	9.26
Non-U.S. Equity					
MSCI World ex USA	3.79	1.29	2.04	6.75	5.01
MSCI Emerging Markets	0.61	1.22	2.49	5.81	--
MSCI ACWI ex USA Small Cap	1.21	-5.94	2.77	8.48	5.32
Fixed Income					
Bloomberg Barclays Aggregate	3.08	7.87	2.95	3.90	5.50
3-Month T-Bill	0.64	2.31	0.87	0.49	2.52
Bloomberg Barclays Long Gov/Credit	6.59	13.82	5.68	7.62	7.73
Bloomberg Barclays Global Agg ex-US	3.42	4.10	-0.12	2.10	4.49
Real Estate					
NCREIF Property	1.51	6.51	8.83	9.25	9.36
FTSE NAREIT Equity	1.24	11.21	7.92	15.46	10.25
Alternatives					
CS Hedge Fund	2.35	2.46	2.36	5.03	7.84
Cambridge Private Equity*	4.86	12.71	12.30	14.83	15.32
Bloomberg Commodity	-1.19	-6.75	-9.15	-3.74	1.69
Gold Spot Price	8.87	12.69	1.35	4.31	5.32
Inflation - CPI-U	0.76	1.65	1.45	1.73	2.22

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What Are We Talking About with Investors?

Common themes emerging in second half of 2019

Dominant fear: inevitable equity market downturn

– Fear of missing out (FOMO!) fades the longer the current expansion continues.

– Lower equity exposures are a serious consideration across all investor types.

– Re-evaluation of the purpose and implementation of asset classes:

  – *Real assets*

  – *Hedge funds and liquid alternatives*

  – *Fixed income*

  – *Equity*

– Tail risk hedging returns

– Leverage to manage liquidity needs

Litany of macro investing concerns raising anxiety:

– How long can the current expansion continue?

– Is value dead?

– Is there any hope for active management?

– How does the reversal in Fed policy change the landscape?

  – *Equity markets cheered, but doesn't accommodation imply leaner times ahead?*

  – *LDI pays off when rates fall, but lower rates can wreak havoc with liability-driven investing glidepaths.*

Market volatility has subsided once again despite sentiment of uncertainty

When Will Inflation Catch Fire? The Job Market Squeeze on Policy

10 years of persistent monetary and fiscal stimulus has caught up to global growth
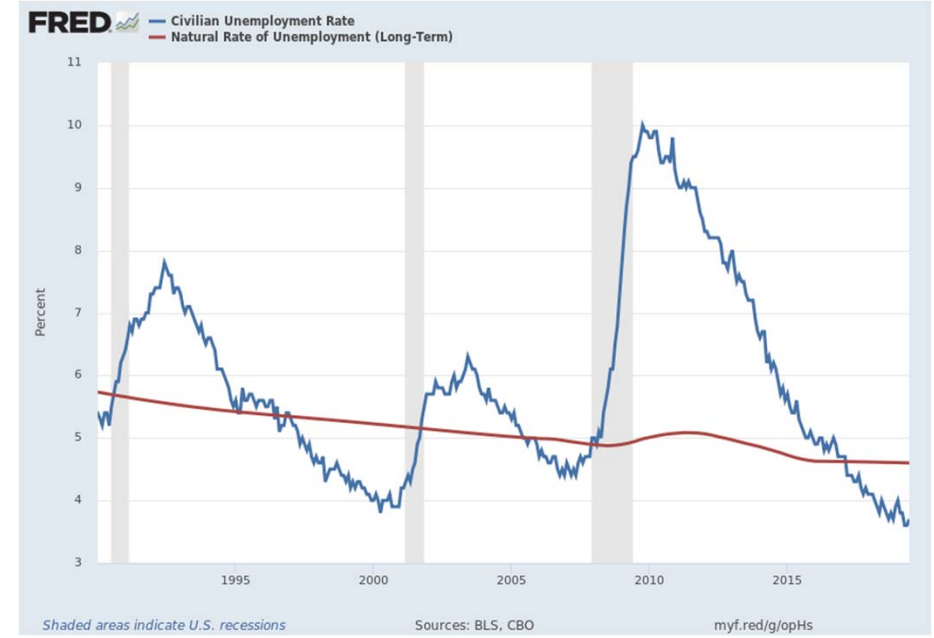
Discouraged Workers—Not in Labor Force

Discouraged worker effect has been pervasive since the Global Financial Crisis

– Gradual, persistent growth has finally coaxed workers back from the sidelines, erasing the slack in the job market.

Actual and Natural Rates of Unemployment (%)

The U.S. unemployment rate has reached a generational low:

– Hit a new low at 3.6% in May 2019

– Well below the long-term natural rate of unemployment

Sources: Federal Reserve, U.S. Department of Labor

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Labor Force Participation Finally Rising, Driven by Women

Labor Force Participation Rates (%) Prime Working Age (25-54)

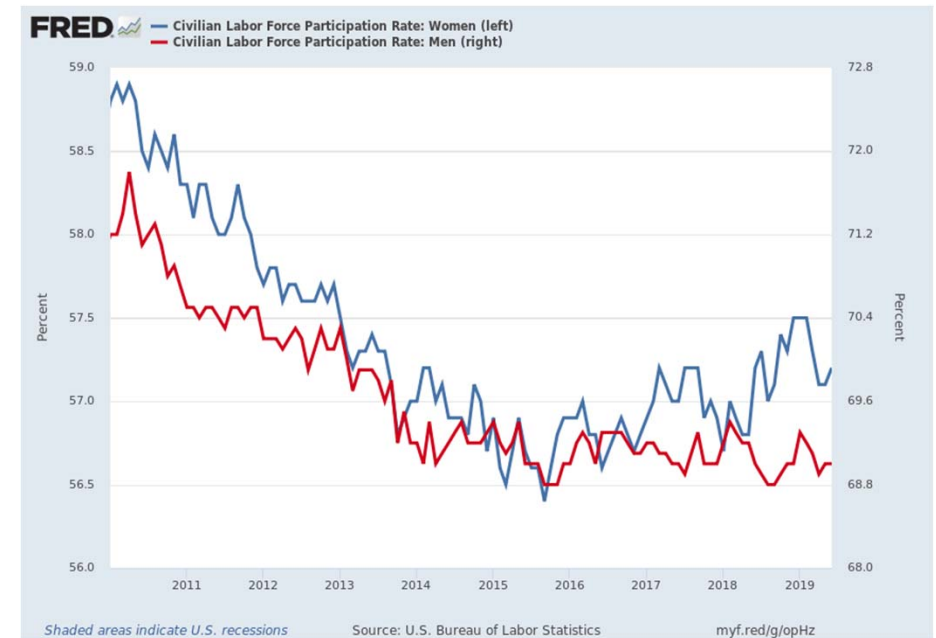**Labor Force Participation Rates (%) Men vs. Women**
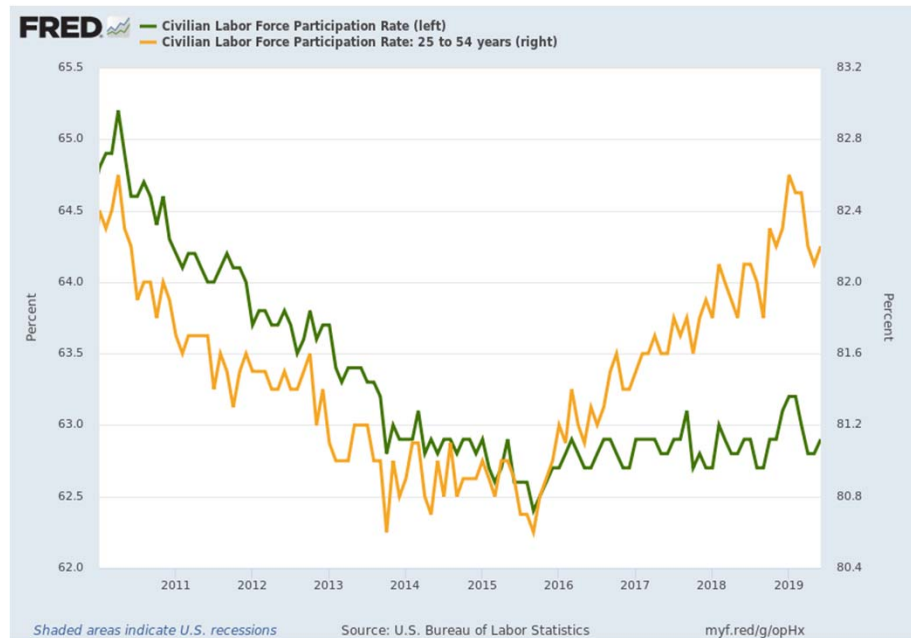
Participation rate steady in Q1 and Q2 after finally rising in second half of 2018

– Unemployment rate fell to a new low in Q2 2019, while labor force participation stabilized, suggesting still more room to run in a tight labor market.

– Participation has risen strongly in the last several years in prime working age segment (25-54 years).

Women are driving the increase in participation rates

– But even participation for 55 and over rose during 2018

Sources: Federal Reserve, U.S. Department of Labor

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Demographics Will Be a Drag on Labor Force Participation as Population Ages

Longer term, demographics are not positive for labor force growth

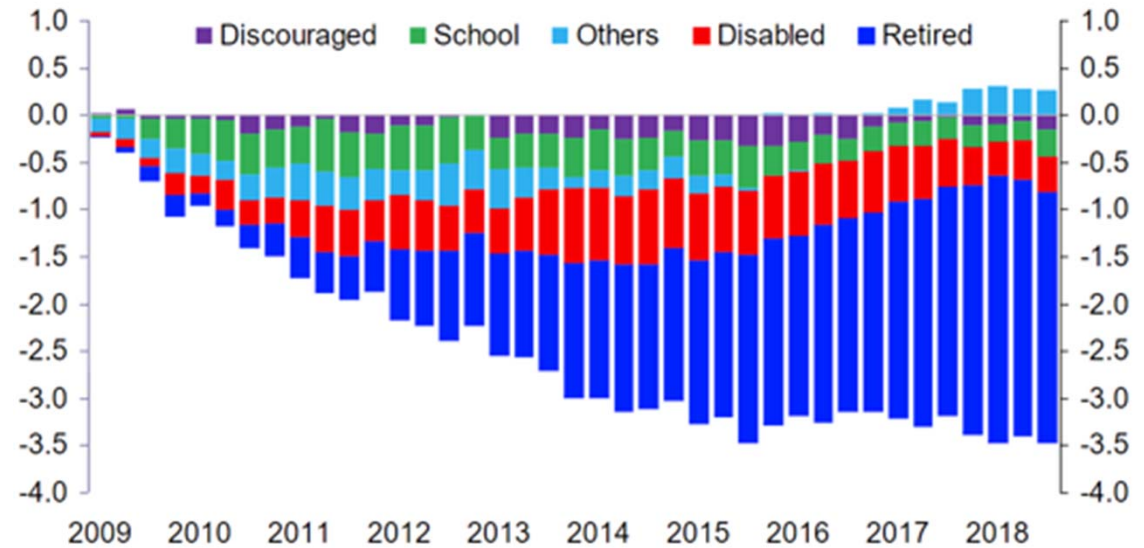– Aging of the workforce has been a prevalent force since the GFC.

Challenge for labor force to keep up with future employer demands:

– Skills

– Training

– Experience

– Industry

Decline in labor force participation since the crisis driven by demographics

Decomposition of labor force participation rate in U.S.
Cumulative differences relative to Q4 2008 (% pts)

Source: Shigeru Fujita, FRB Philadelphia, DB Global Research

Sources: Deutsche Bank Research, Federal Reserve

Broad-Based Inflation Measures Still Benign in the U.S.

Expectations have fallen again and are low relative to long-term history

10-Year Breakeven Inflation Rate

U.S. Average Hourly Earnings, %Year over Year

U.S. breakeven rate recovered somewhat in Q1 2019, only to plunge again in Q2

– Breakeven rate (TIPS vs nominal Treasury yields) had recovered with oil prices, but expectations weakened as the Fed changed its policy stance.
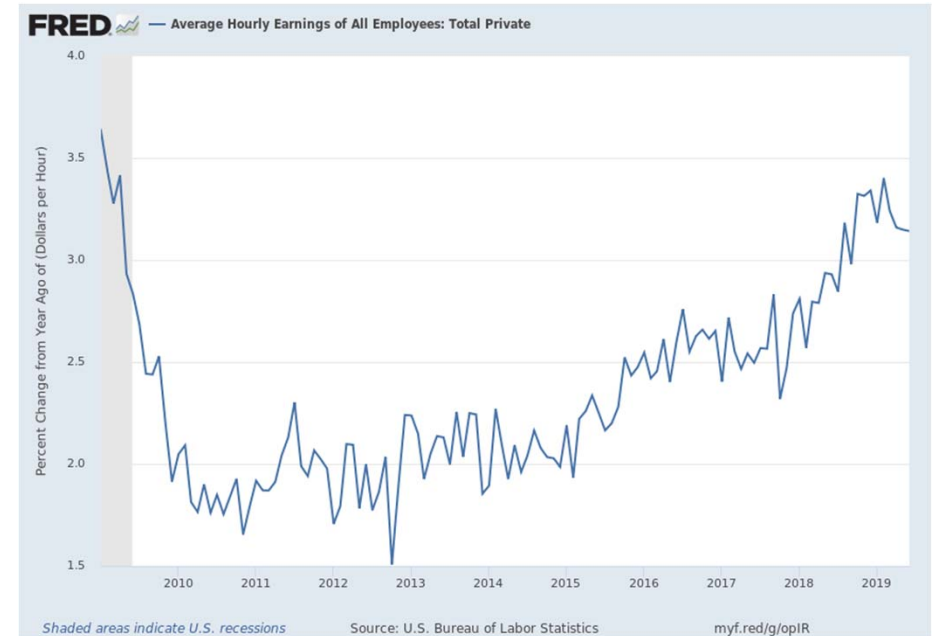
**Wage growth topped 3% annually in the second half of 2018, continued into Q1 and Q2 2019**

– Steady rise of 2017 has been shrugged off.

– Tight labor markets finally pushing up wages; good news for workers and consumer spending

However, wage pressure yet to show as headline inflation

Sources: Federal Reserve, U.S. Department of Labor

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Inflation Diverges for Goods vs. Services

Services inflation much steadier than goods
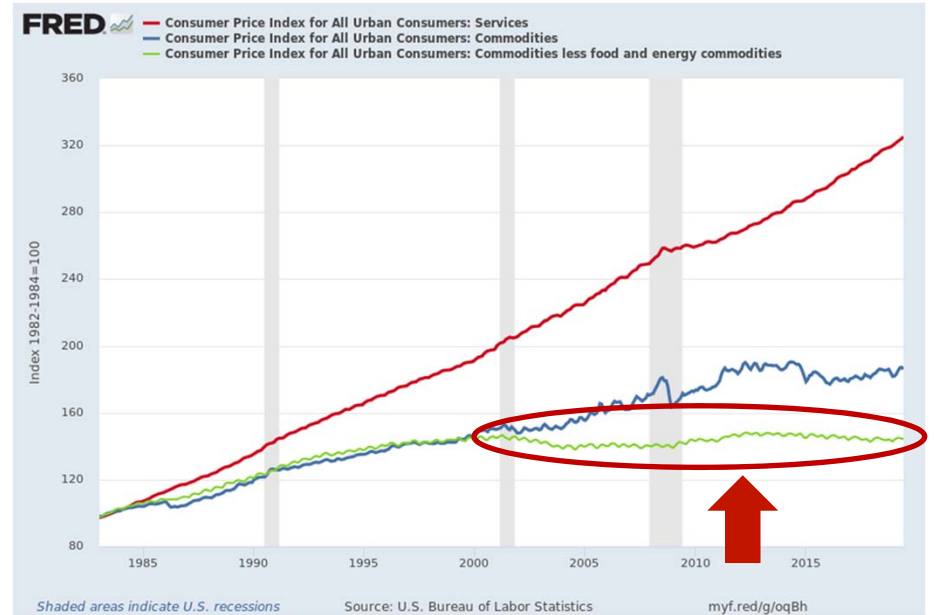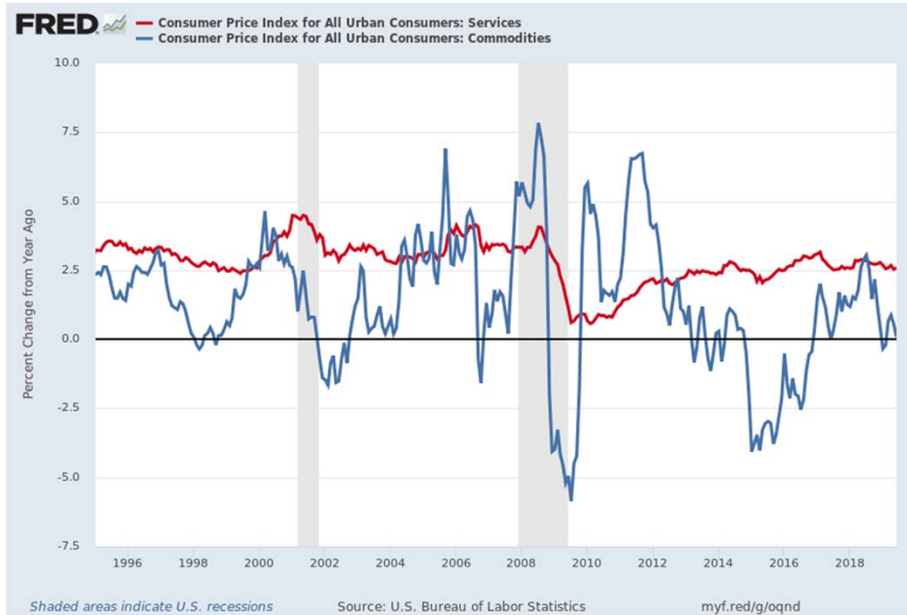
- Services now make up about 2/3 of consumption spending, and consumption accounts for 70% of GDP.

- Services inflation rate has been much more steady than goods inflation and consistently positive.

- Goods or "commodity" inflation captures the headlines because of its volatility and ties to trade, currency, supply and demand of raw materials, and geopolitics.

- Services prices have risen substantially more than goods over the past 35 years.

- The impact of steady services inflation translates into steadier overall inflation over time.

- Consumers have benefited greatly from weak goods price inflation—essentially NO price inflation for goods ex-food and energy since 2000.

Sources: Federal Reserve, U.S. Department of Labor

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Consumer Borrowing Reaching New Heights

Leverage has fueled consumption growth to a new historical peak
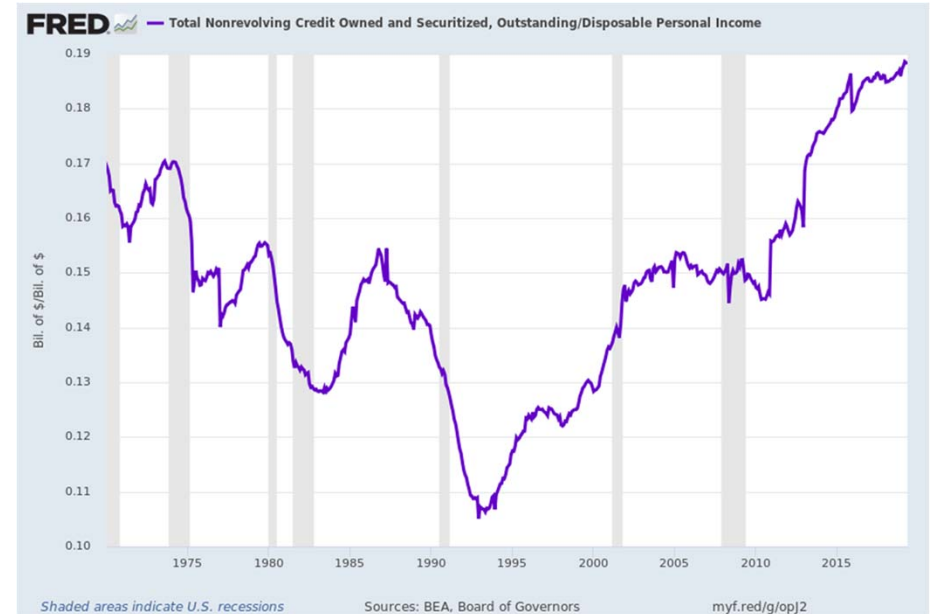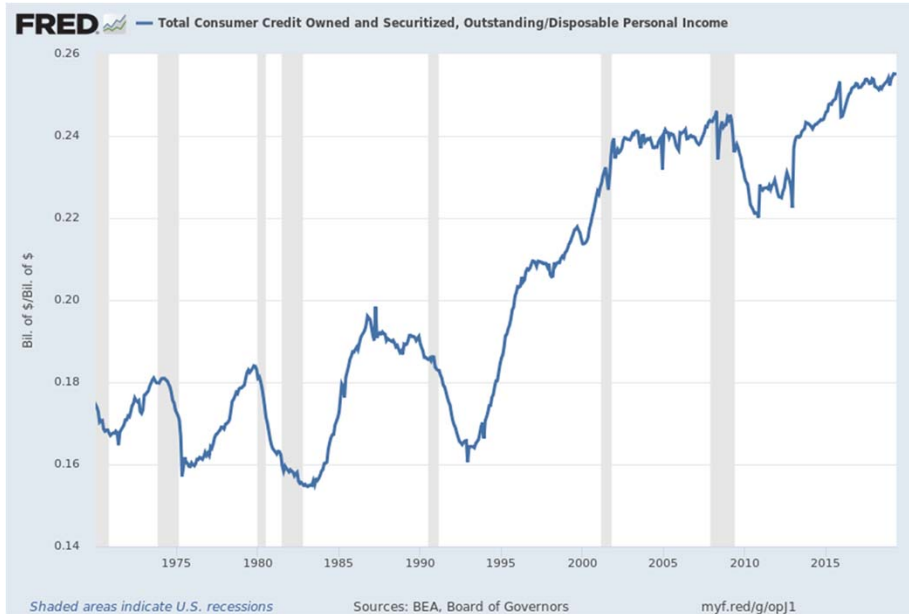
Consumer credit (ex-mortgages) as a percentage of disposable income has leveled off, after climbing sharply during the last five years

– Credit exposures well above the pre-GFC peak, at an all-time high

– Suggests vulnerability to deleveraging

The increase stems from non-revolving debt, mostly student and auto loans

– The ratio of non-revolving debt to disposable income reached a new peak in Q2 2019.

– Another sign of potential vulnerability to deleveraging

Source: Federal Reserve

Trade Matters, but More to U.S. Trading Partners

Exports, imports, and trade-to-GDP ratio in 2017

Trade and trade policy dominate headlines in 2019, but impact of trade in the U.S. is far lower than in Europe and many other developed markets

– Trade-to-GDP ratio is the sum of exports and imports as a % of GDP. Exports and imports include both goods and services.

– Trade has become a larger component of U.S. GDP over time.

– U.S. exports have gradually risen from 7% in 1985 to 11.9% in 2017, while imports rose from 9% to 14.7%.

– Trade activity now involves 26.6% of U.S. GDP.

– By comparison, trade accounts for 37.8% of China GDP, and well over half of GDP in Europe and Mexico.

	Exports (% of GDP)	Imports (% of GDP)	Trade-to-GDP Ratio
Germany	47.2%	39.7%	86.9%
Mexico	37.9%	39.7%	77.6%
Canada	30.9%	33.2%	64.1%
France	30.9%	32.0%	62.9%
U.K.	30.5%	31.9%	62.4%
Italy	31.3%	28.2%	59.5%
Russia	26.0%	20.7%	46.7%
China	19.8%	18.0%	37.8%
Japan	16.1%	15.1%	31.2%
U.S.	11.9%	14.7%	26.6%

Source: World Bank

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Trade War With China

Substantial impact on trade, but small impact on U.S. GDP

Exports to China have fallen by 20%, imports are down by more than 10% (top chart)

– However, decline in exports subtracted less than 0.1% from U.S. GDP in Q1 2019.

U.S. Bilateral Trade With China (3 month average, % change y/y)
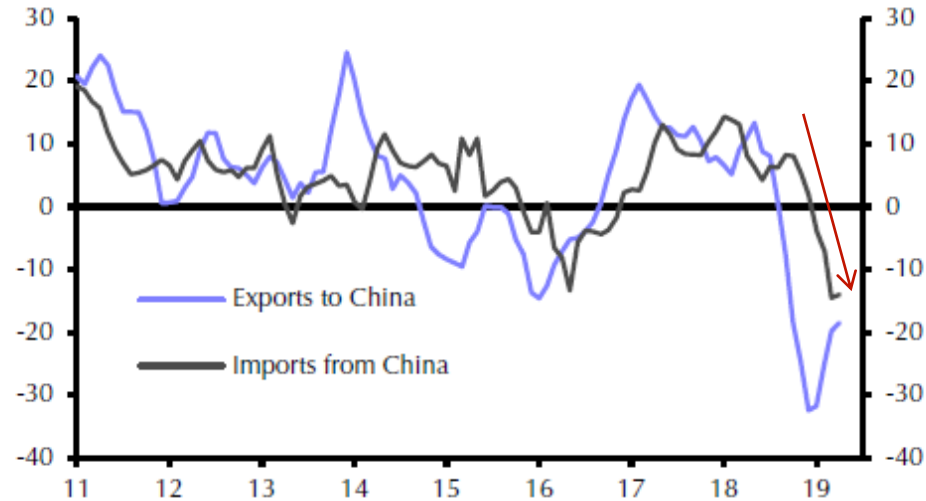
Threatened tariffs could reduce GDP by 0.2% in second half of 2019 and another 0.2% in first half of 2020

– Analysis assumes 10% tariff in 2019, rising to 25% in 2020.

– Chart depicts cumulative impact on GDP growth through Q2 2020 is less than 1%.

– Larger impact is on business confidence and investor sentiment.

U.S. Tariffs on China ($B and % of GDP)
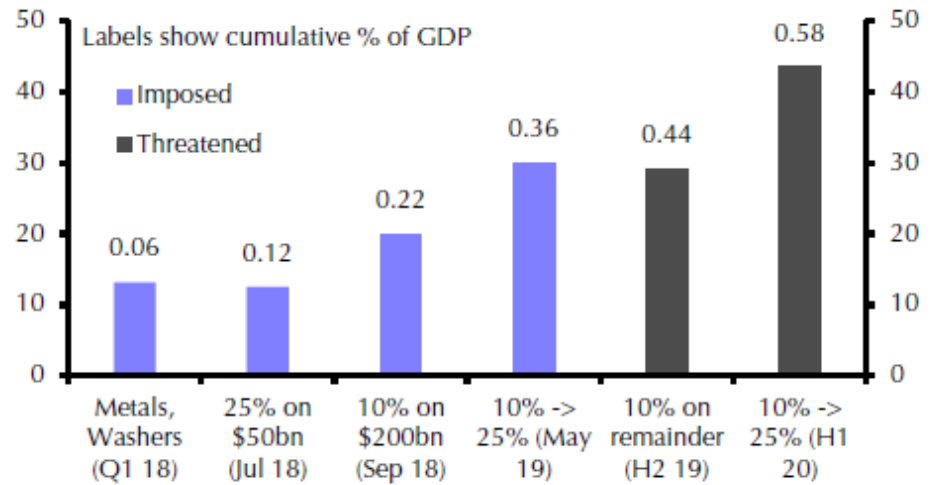
Yield Curve Flattens While Global Rates Diverge

U.S. Treasury Yield Curves

● June 30, 2019 ● March 31, 2019 ● June 30, 2018
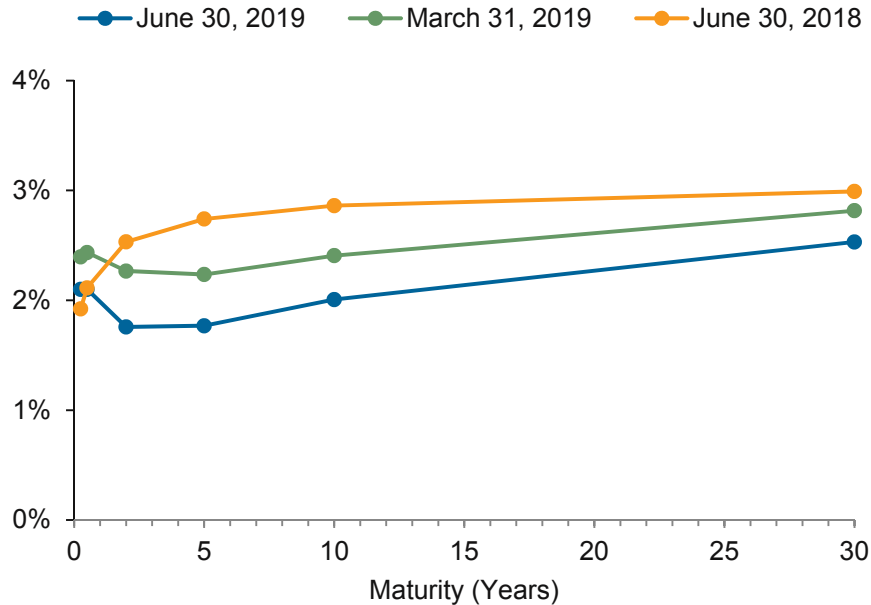
10-Year Global Government Bond Yields

— U.S. Treasury — Germany — U.K.
— Canada — Japan
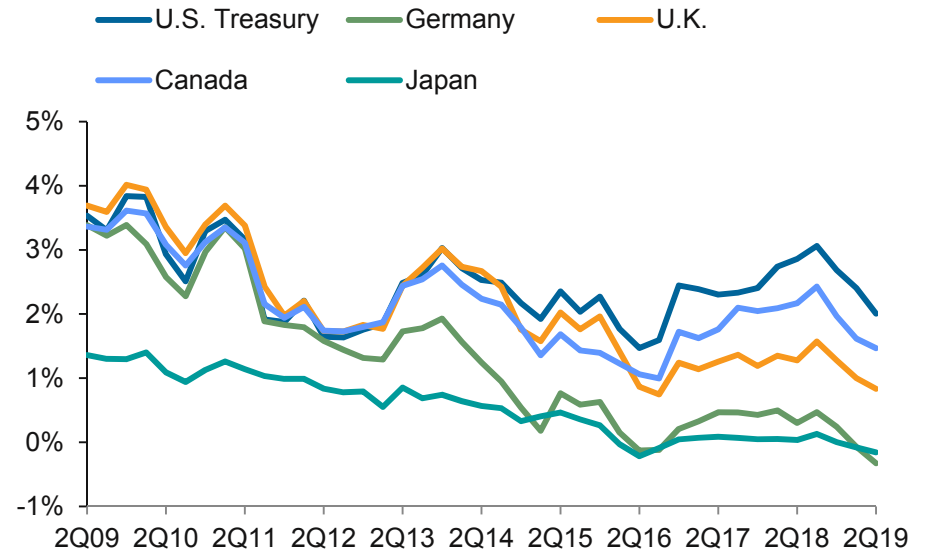
Treasury yield curve has inverted from 90-day T-bill through the 10-year T-note

– Yields have fallen almost 50 bps on the long end from one year ago.

– Inverted yield curve has presaged most recessions in past 70 years.

– Yields are still upward sloping from 2- to 10-year notes.

U.S. yields diverged further in 2017 as monetary policies fell out of sync

– U.S. tightened for two years while euro zone waited.

– U.S. has now paused and is expected to reverse course.

– Euro zone will skip tightening entirely in this cycle; U.S. spread remains very wide.

Source: Bloomberg

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Q2 Rebound Continues, Global Stock Markets Surge Through First Half of 2019

New record for the S&P 500 reached in Q2 2019

– 4.3% gain in Q2, on top of strongest first quarter (13.7%) since 2009

Forward valuation rose back to 17.1 in Q2, above its 25-year average (16.2)

– Still nowhere near the peak set in 2000

Yield on 10-year Treasury fell back to the level of the dividend yield on stocks

– Prior to GFC, Treasury yield typically exceeded that of the stock dividend; two yields were very close for eight years following GFC.

– Gap began to widen with Fed tightening in 2017, but narrowed again in Q2 with reversal of Fed policy.

– Vastly different relationship between stock and bond yields in 2000 and 2007

S&P 500 Price Index

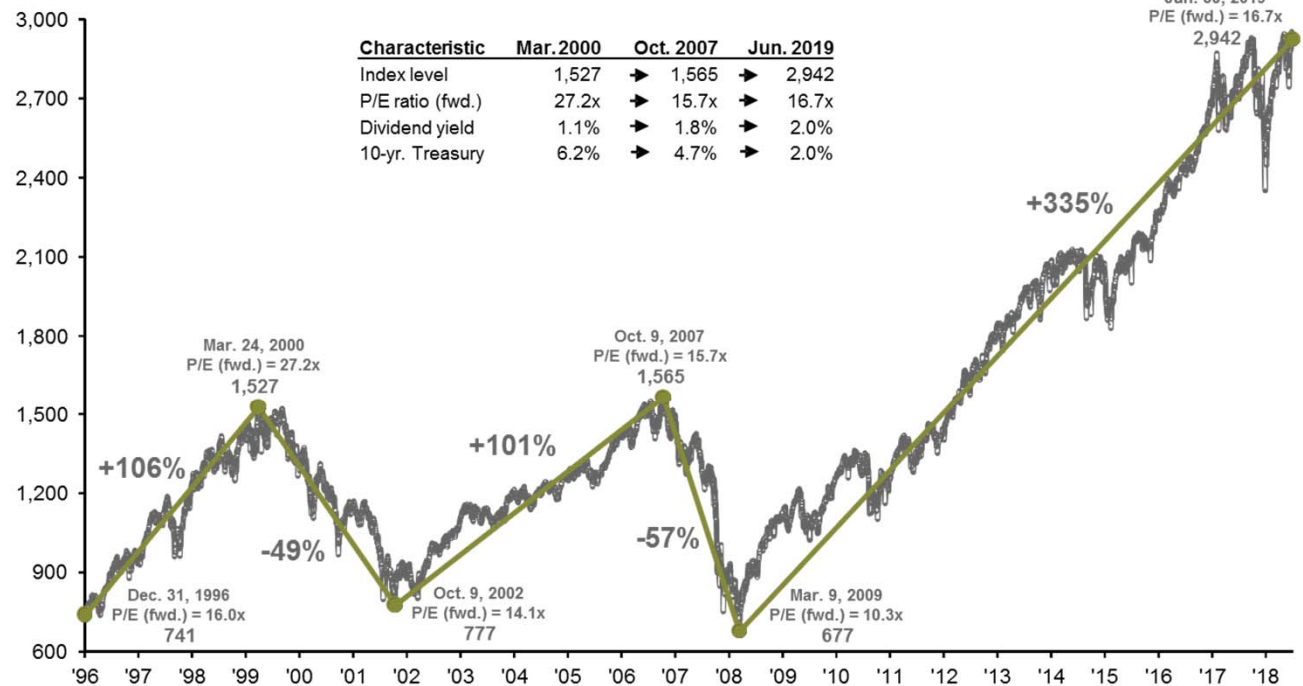| Characteristic	Mar. 2000		Oct. 2007		Jun. 2019
Index level	1,527	→	1,565	→	2,942
P/E ratio (fwd.)	27.2x	→	15.7x	→	16.7x
Dividend yield	1.1%	→	1.8%	→	2.0%
10-yr. Treasury	6.2%	→	4.7%	→	2.0%

Jun. 30, 2019
P/E (fwd.) = 16.7x
2,942

Mar. 24, 2000
P/E (fwd.) = 27.2x
1,527

Oct. 9, 2007
P/E (fwd.) = 15.7x
1,565

+106%

+101%

+335%

-49%

-57%

Dec. 31, 1996
P/E (fwd.) = 16.0x
741

Oct. 9, 2002
P/E (fwd.) = 14.1x
777

Mar. 9, 2009
P/E (fwd.) = 10.3x
677

Source: Compustat, FactSet, Federal Reserve, Standard & Poor's, J.P. Morgan Asset Management.
Dividend yield is calculated as consensus estimates of dividends for the next 12 months, divided by most recent price, as provided by Compustat.
Forward price to earnings ratio is a bottom-up calculation based on the most recent S&P 500 Index price, divided by consensus estimates for earnings in the next 12 months (NTM), and is provided by FactSet Market Aggregates. Returns are cumulative and based on S&P 500 Index price movement only, and do not include the reinvestment of dividends. Past performance is not indicative of future returns.
Guide to the Markets – U.S. Data are as of June 30, 2019.

Long Period of Zero Interest Rate Policy Skews Memories of 'Normal Markets'

Yields on 2- and 10-year Treasury notes now back at level of the S&P dividend
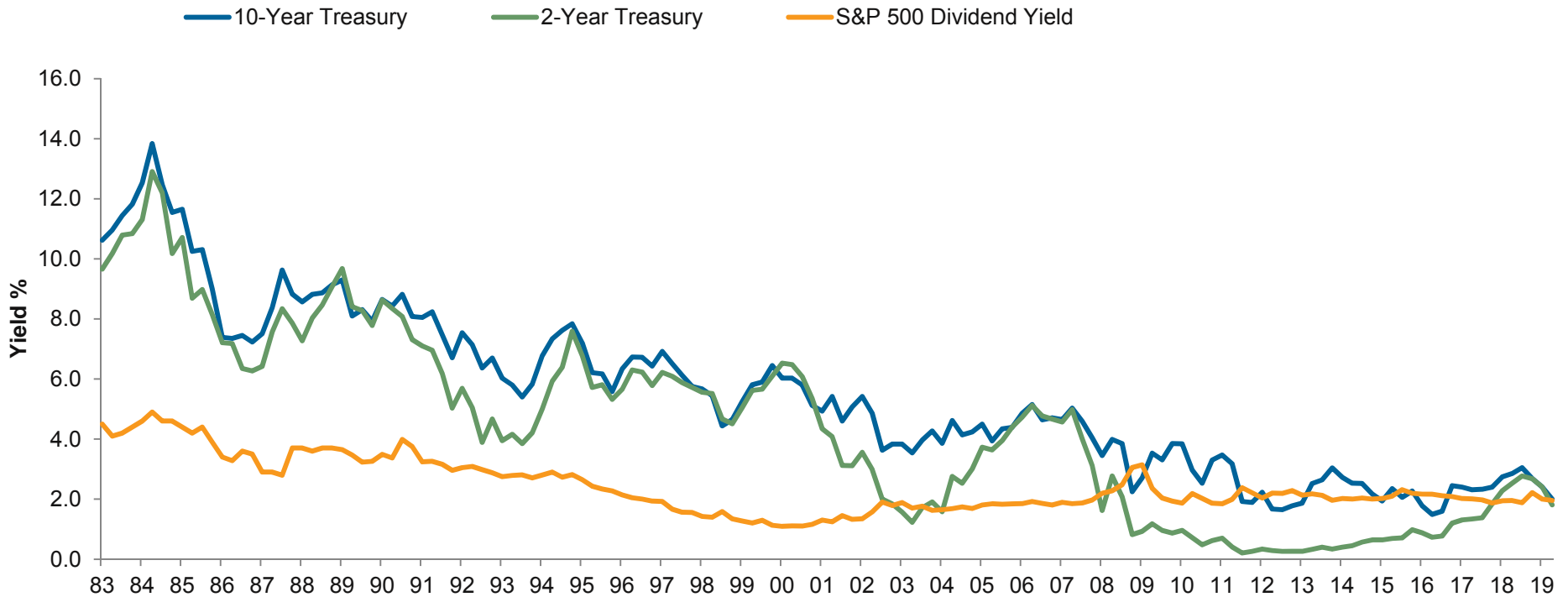
Long-term historical relationship between bond yields and dividends has been distorted by 10 years of extreme policy intervention

After Fed rate hikes starting in 2017, 2-year Treasury yields rose above dividends. Both 2- and 10-year Treasury yields fell back to the level of stock dividends in Q2 2019

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Inverted Yield Curve Points to Recession, a Normal Part of the Economic Cycle

Built into the 10-year forecast

Timing of recession following yield curve inversion is long and variable—6 to 18 months

Consensus expectation for U.S. recession in 2020; may avoid true recession with slowdown in GDP growth to 1%

Typical economic impact:
- Slowing job growth, layoffs
- Wages and income
- Consumer confidence
- Housing market
- Capital spending

Thus far, only housing market and business investment are showing incipient signs of slowdown.

Stock market reaction is usually sharp and early.
- Recession fears spurred Q4 2018 market decline; snap back in Q1 and Q2 2019 a response to Fed policy shift, which ultimately signals fear of recession.

Bond market will benefit from falling rates, but:
- Sharp rise in government debt from 2018 tax cut; impact exacerbated by recession (hits tax receipts)
- Ballooning share of BBB corporate debt: increases risk of downgrade and upheaval in the credit markets

Treasury Yield Curve Inverts

Source: Bloomberg

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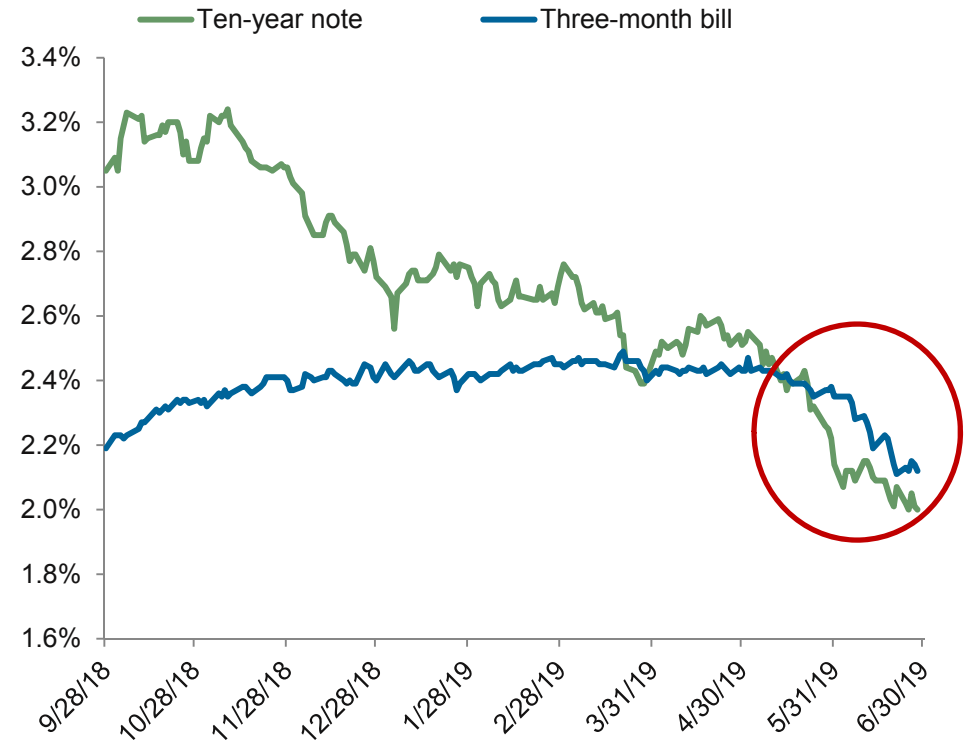
Federal Reserve Is Now Reducing Its Balance Sheet

Effect is known as "Quantitative Tightening"
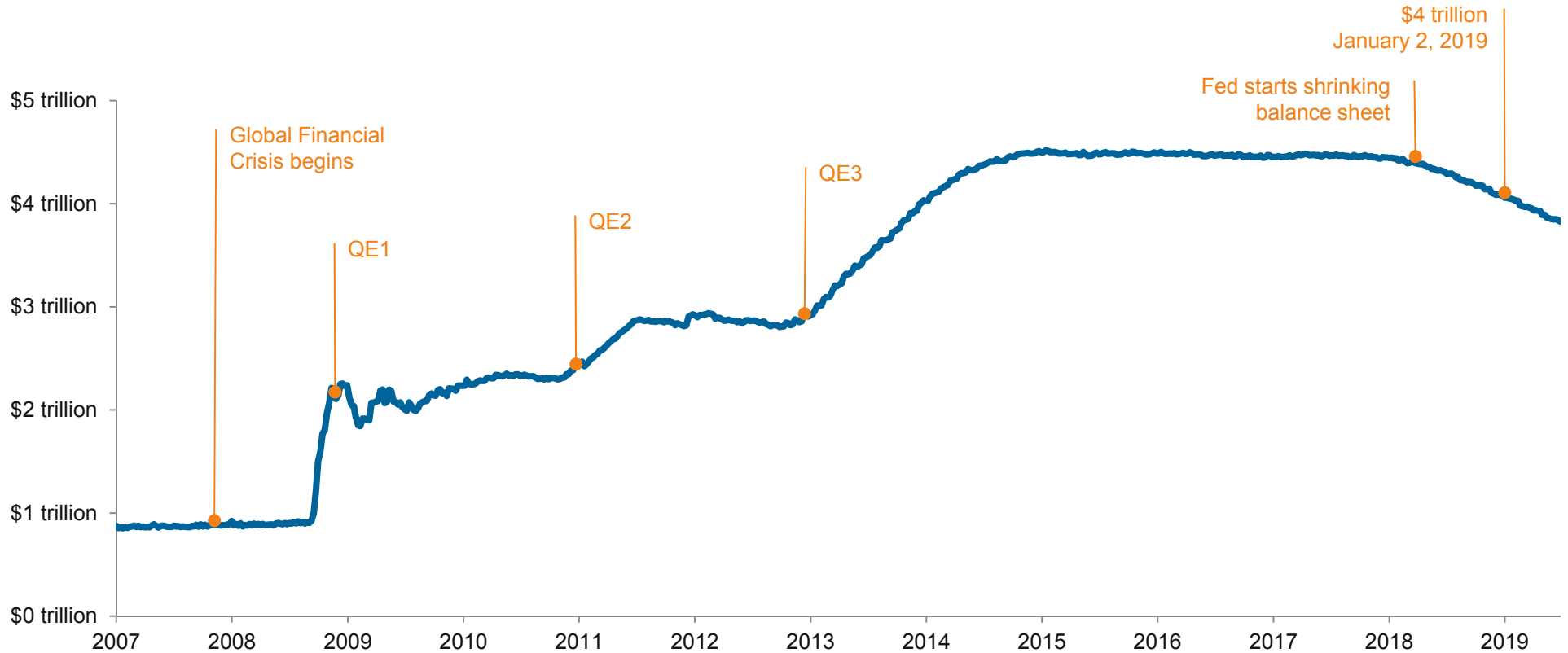
Reversal of successive rounds of Quantitative Easing will take years to accomplish

– Began with the taper in bond purchases, continues as bonds in the Fed portfolio mature and are not replaced

– Effective monetary tightening—lessens demand, potential upward pressure on yields

– U.S. is years ahead of euro zone monetary policy.

Source: Federal Reserve

Fixed Income Valuations Back Below Historical Median Levels

	Aggregate	Agency	MBS	ABS	CMBS	Corporate	Preferred	Floating-Rate Loans	Emerging Markets (USD)	High Yield
Max Spread Date	12/3/2008	11/20/2008	12/3/2008	1/6/2009	11/21/2008	12/3/2008	3/9/2009	12/19/2008	10/24/2008	12/15/2008
Min Spread Date	2/23/2005	3/12/2013	7/27/2010	10/1/2009	12/8/2004	3/11/2005	12/6/2017	3/31/2006	6/1/2007	6/1/2007
Spread on 12/31/18	54	16	35	53	86	153	242	551	415	533
Spread on 12/31/17	36	14	25	36	62	93	-30	405	285	358
Spread on 12/31/16	43	21	15	59	75	123	211	465	342	421

Source: Eaton Vance

Spreads widened during 2018 relative to Treasuries on a 15-year basis

However, spreads narrowed again in Q1 2019, and held steady through Q2 2019. Spreads are below median for all sectors except EMD

– Below-investment grade sectors such as high yield and bank loans still maintain a yield advantage over other spread sectors.

Global Equity Valuations—Historical Data

Price/Earnings Ratio (exc neg) for 15 Years ended June 30, 2019

Chart legend:
- 20.5 - S&P 500
- 17.7 - S&P 500 Average
- 15.4 - MSCI EAFE Average
- 14.9 - MSCI EAFE
- 13.4 - MSCI Emerging Markets
- 13.4 - MSCI Emerging Markets Average
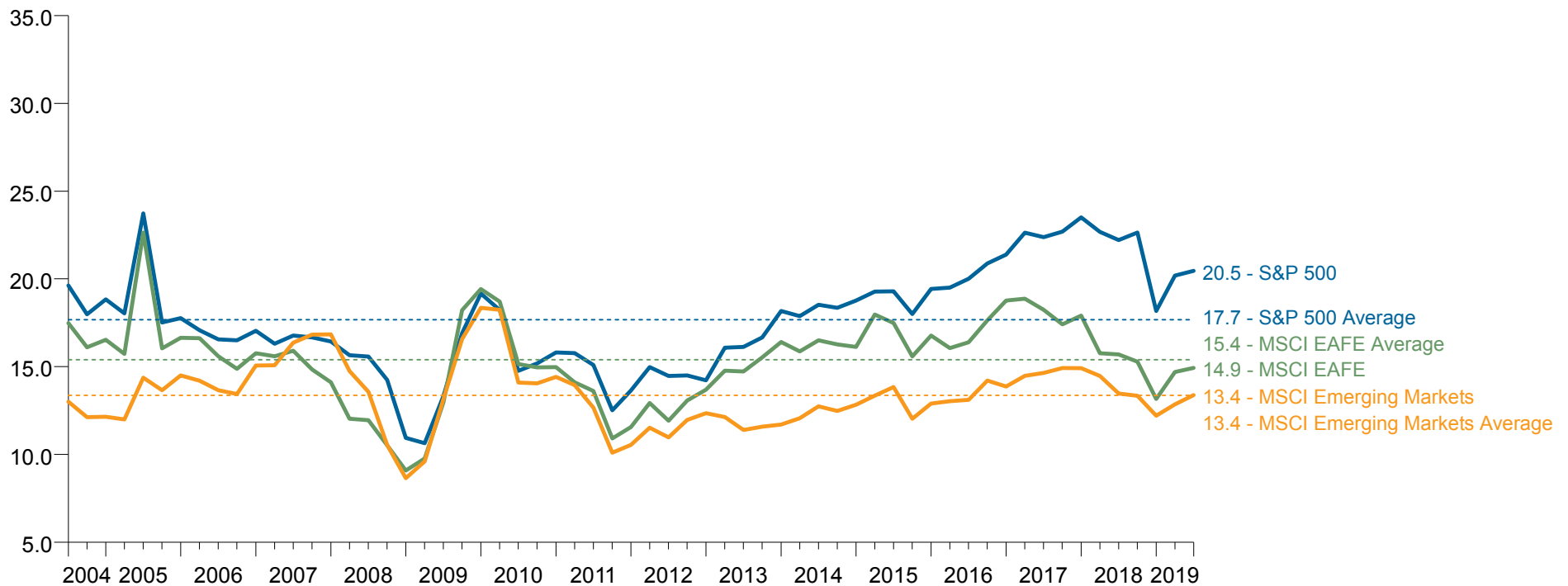
U.S. equity valuations plummeted in Q4 to their historical average, but popped back up in Q1 and Q2 2019

– U.S. remains higher than non-U.S. developed and emerging market equity valuations relative to the 15-year average for each index.

– Despite reasonable relative valuations, both political and economic risks remain in non-U.S. markets.

Forward valuations dropped during 2018, but June 2019 reading of 17.1 for S&P 500 is back above the 25-year average

Sources: MSCI, Standard & Poor's, Callan

Callan Periodic Table of Investment Returns

As of June 30, 2019

	Annual Returns					Monthly Returns						
2013	**2014**	**2015**	**2016**	**2017**	**2018**	**Jan 2019**	**Feb 2019**	**Mar 2019**	**Apr 2019**	**May 2019**	**Jun 2019**	**YTD 2019**
Small Cap Equity 38.82%	Real Estate 15.02%	Large Cap Equity 1.38%	Small Cap Equity 21.31%	Emerging Market Equity 37.28%	U.S. Fixed Income 0.01%	Small Cap Equity 11.25%	Small Cap Equity 5.20%	Real Estate 3.51%	Large Cap Equity 4.05%	U.S. Fixed Income 1.78%	Small Cap Equity 7.07%	Large Cap Equity 18.54%
Large Cap Equity 32.39%	Large Cap Equity 13.69%	U.S. Fixed Income 0.55%	High Yield 17.13%	Non-U.S. Equity 24.21%	High Yield -2.08%	Real Estate 10.87%	Large Cap Equity 3.21%	Large Cap Equity 1.94%	Small Cap Equity 3.40%	Non-U.S. Fixed Income 1.04%	Large Cap Equity 7.05%	Small Cap Equity 16.98%
Non-U.S. Equity 21.02%	U.S. Fixed Income 5.97%	Real Estate -0.79%	Large Cap Equity 11.96%	Large Cap Equity 21.83%	Non-U.S. Fixed Income -2.15%	Emerging Market Equity 8.77%	Non-U.S. Equity 2.57%	U.S. Fixed Income 1.92%	Non-U.S. Equity 2.83%	Real Estate -0.29%	Emerging Market Equity 6.24%	Non-U.S. Equity 14.64%
High Yield 7.44%	Small Cap Equity 4.89%	Non-U.S. Equity -3.04%	Emerging Market Equity 11.19%	Small Cap Equity 14.65%	Large Cap Equity -4.38%	Large Cap Equity 8.01%	High Yield 1.66%	High Yield 0.94%	Emerging Market Equity 2.11%	High Yield -1.19%	Non-U.S. Equity 5.94%	Real Estate 14.51%
Real Estate 3.67%	High Yield 2.45%	Small Cap Equity -4.41%	Real Estate 4.06%	Non-U.S. Fixed Income 10.51%	Real Estate -5.63%	Non-U.S. Equity 7.14%	Emerging Market Equity 0.22%	Emerging Market Equity 0.84%	High Yield 1.42%	Non-U.S. Equity -4.73%	Non-U.S. Fixed Income 2.98%	Emerging Market Equity 10.59%
U.S. Fixed Income -2.02%	Emerging Market Equity -2.19%	High Yield -4.47%	Non-U.S. Equity 2.75%	Real Estate 10.36%	Small Cap Equity -11.01%	High Yield 4.52%	U.S. Fixed Income -0.06%	Non-U.S. Fixed Income 0.71%	U.S. Fixed Income 0.03%	Large Cap Equity -6.35%	High Yield 2.28%	High Yield 9.94%
Emerging Market Equity -2.60%	Non-U.S. Fixed Income -3.08%	Non-U.S. Fixed Income -6.02%	U.S. Fixed Income 2.65%	High Yield 7.50%	Non-U.S. Equity -14.09%	Non-U.S. Fixed Income 1.86%	Real Estate -0.15%	Non-U.S. Equity 0.51%	Non-U.S. Fixed Income -0.61%	Emerging Market Equity -7.26%	Real Estate 1.56%	U.S. Fixed Income 6.11%
Non-U.S. Fixed Income -3.08%	Non-U.S. Equity -4.32%	Emerging Market Equity -14.92%	Non-U.S. Fixed Income 1.49%	U.S. Fixed Income 3.54%	Emerging Market Equity -14.57%	U.S. Fixed Income 1.06%	Non-U.S. Fixed Income -1.04%	Small Cap Equity -2.09%	Real Estate -1.32%	Small Cap Equity -7.78%	U.S. Fixed Income 1.26%	Non-U.S. Fixed Income 4.99%

Sources: ● Bloomberg Barclays Aggregate ● Bloomberg Barclays Corp High Yield ● Bloomberg Barclays Global Aggregate ex US
● EPRA/NAREIT Developed ● MSCI World ex USA ● MSCI Emerging Markets ● Russell 2000 ● S&P 500

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MCERA Plan Performance

MCERA Actual vs Target Asset Allocation as of June 30, 2019

Actual Asset Allocation

Domestic Equity
40%

Cash
0%

Domestic Real Estate
11%

Domestic Fixed Income
21%

International Equity
27%

Target Asset Allocation

Domestic Equity
38%

Domestic Real Estate
11%

Domestic Fixed Income
22%
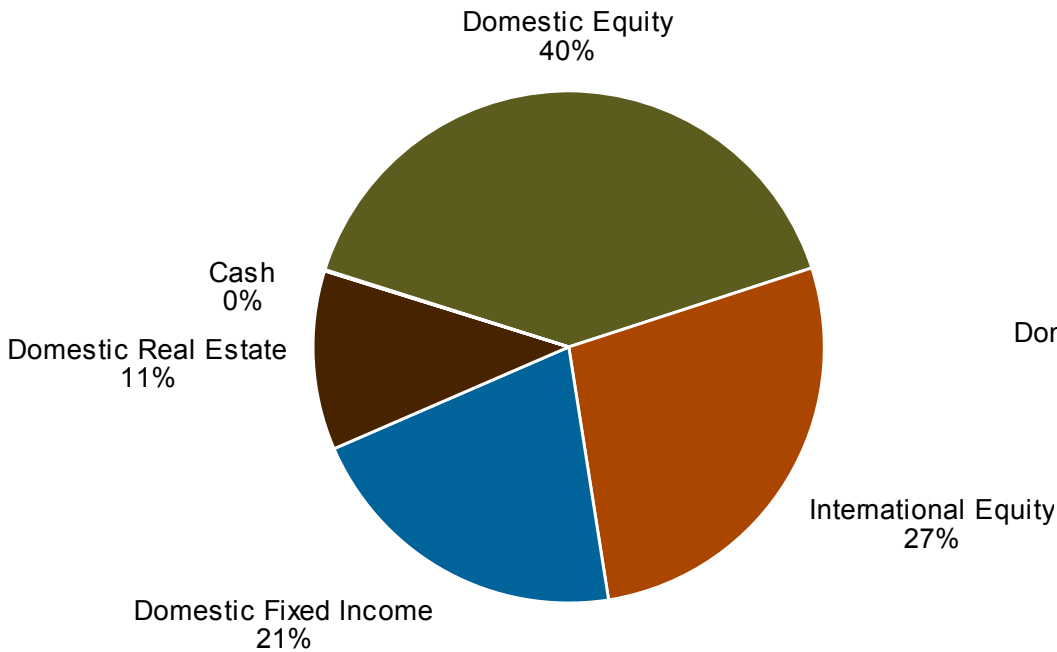
International Equity
29%
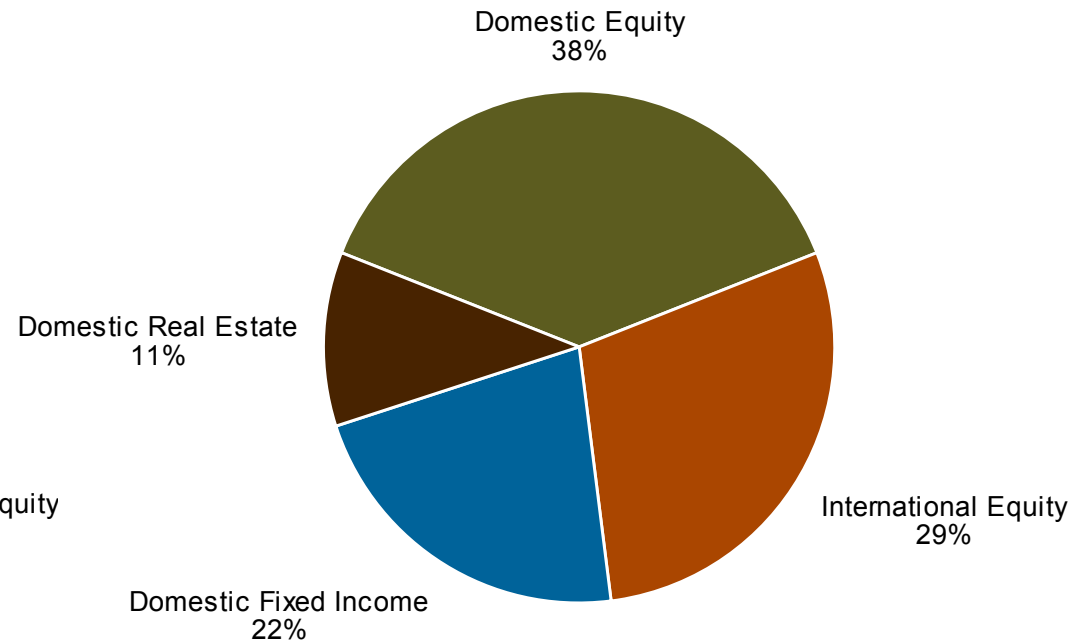
Asset Class	$000s Actual	Weight Actual	Target	Percent Difference	$000s Difference
Domestic Equity	214,241	40.2%	38.0%	2.2%	11,917
International Equity	146,238	27.5%	29.0%	(1.5%)	(8,166)
Domestic Fixed Income	111,669	21.0%	22.0%	(1.0%)	(5,466)
Domestic Real Estate	59,991	11.3%	11.0%	0.3%	1,424
Cash	291	0.1%	0.0%	0.1%	291
Total	532,429	100.0%	100.0%		

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MCERA Actual vs Target Historical Asset Allocation

Actual Historical Asset Allocation
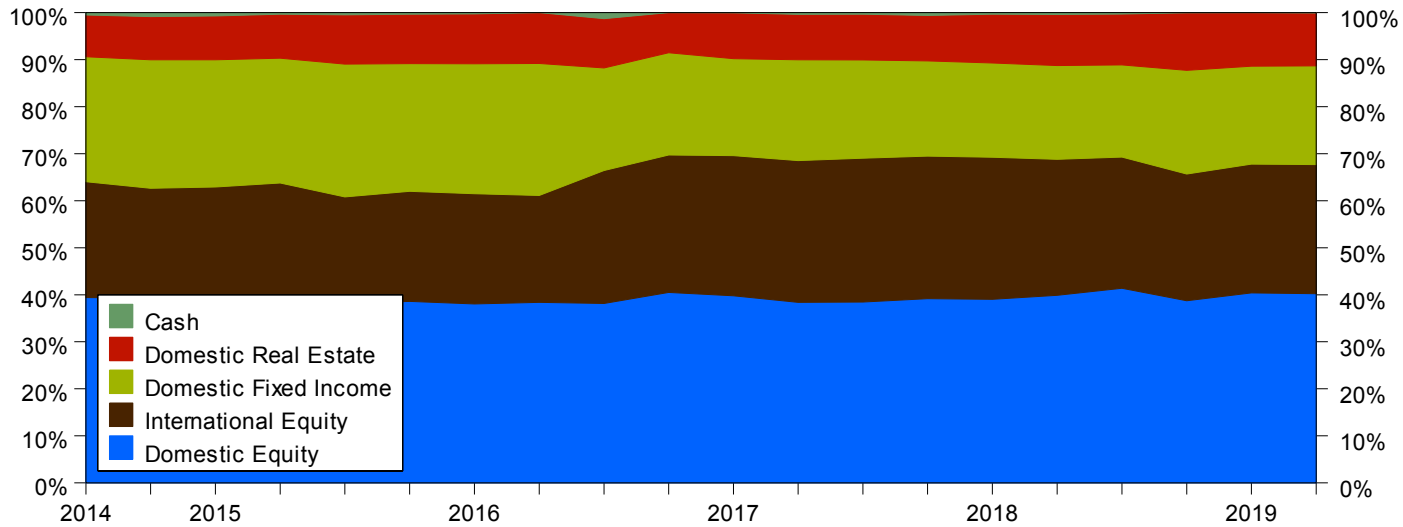
Target Historical Asset Allocation
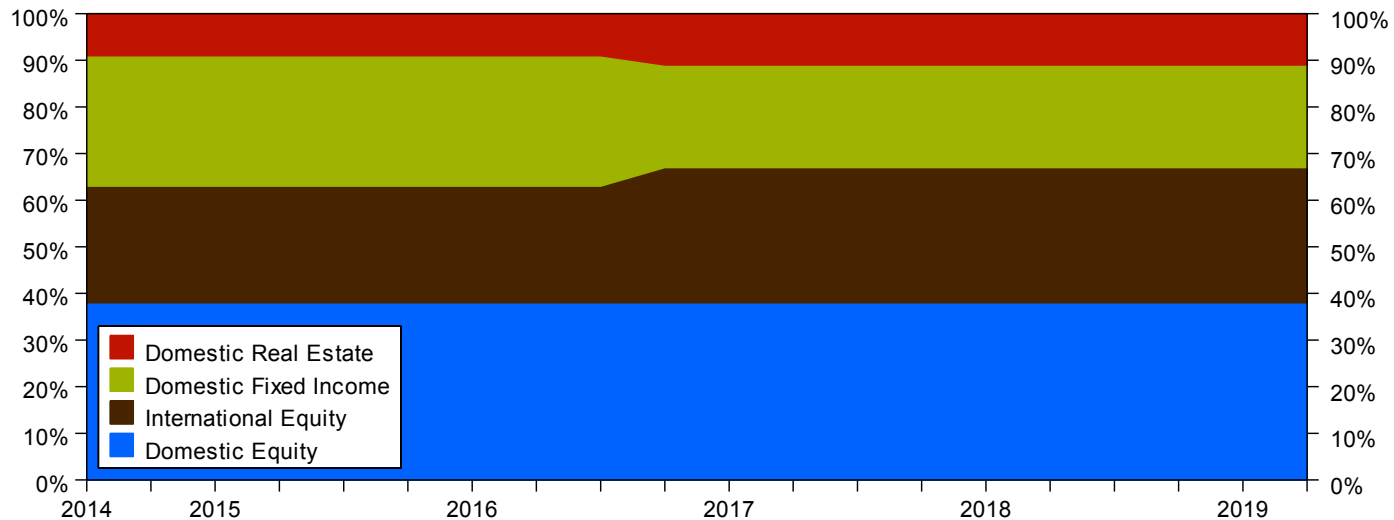
MCERA Asset Class Weights vs Callan Public Fund Sponsor Database

Asset Class Weights vs Callan Public Fund Sponsor Database

	Domestic Equity	Domestic Fixed Income	Cash	Domestic Real Estate	International Equity	Intl Fixed-Inc	Alternative	Global Balanced	Global Equity Broad	Private Equity	Real Assets
10th Percentile	50.92	37.99	4.68	13.90	26.17	19.40	31.67	13.72	43.35	11.41	10.81
25th Percentile	40.68	33.23	2.11	11.50	23.40	6.36	17.58	9.69	24.15	8.52	8.48
Median	34.23	26.55	0.91	10.03	19.71	3.88	10.07	5.08	16.00	5.35	5.10
75th Percentile	26.52	19.85	0.37	7.48	16.02	0.84	5.13	4.93	8.40	3.50	3.17
90th Percentile	21.12	14.70	0.05	4.54	12.73	0.09	2.06	2.82	0.62	1.37	1.93
Fund ●	40.24	20.97	0.05	11.27	27.47	-	-	-	-	-	-
Target ▲	38.00	22.00	0.00	11.00	29.00	-	-	-	-	-	-
% Group Invested	98.56%	97.12%	78.42%	76.98%	96.40%	16.55%	40.56%	16.55%	12.23%	30.22%	24.46%

- The chart above ranks MCERA's asset allocation and the target allocation versus the Callan Public Fund Sponsor Database

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Asset Allocation as of June 30, 2019

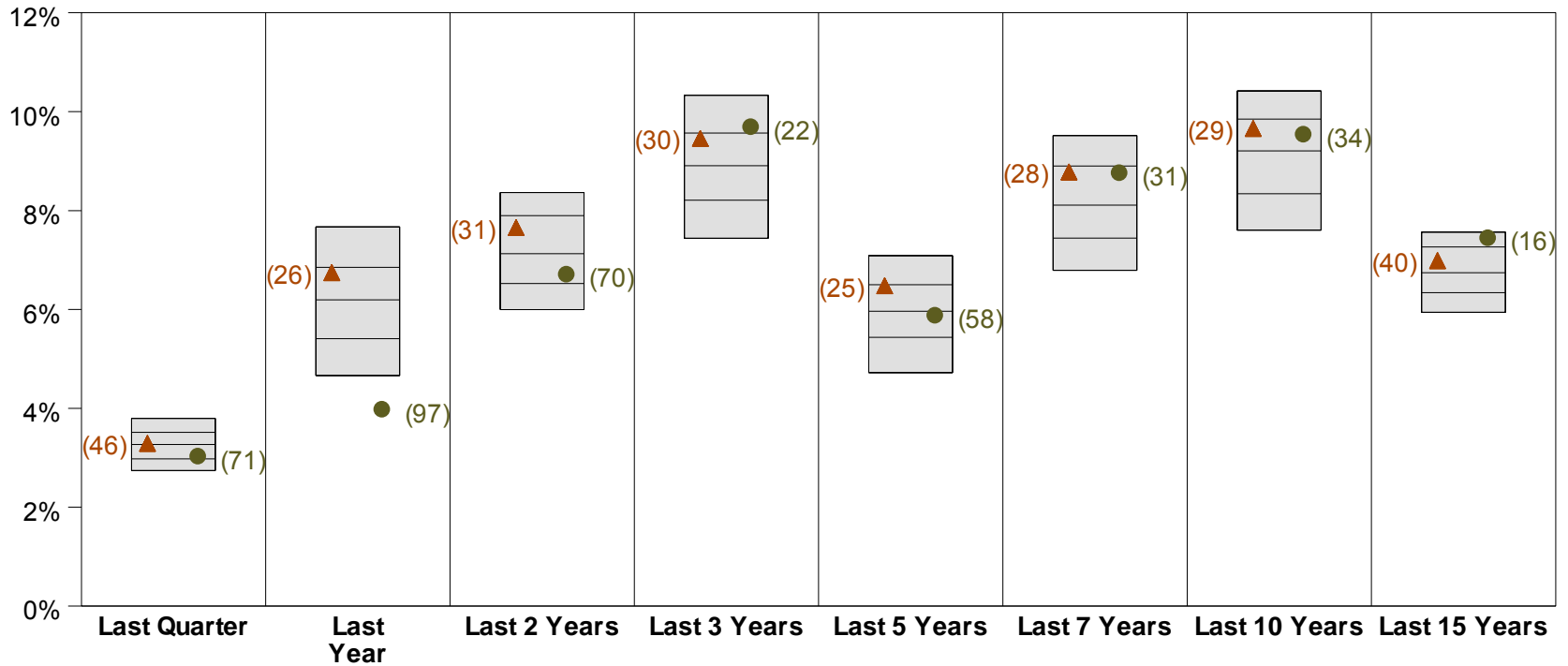|	June 30, 2019				March 31, 2019	
	Market Value	Weight	Net New Inv.	Inv. Return	Market Value	Weight
Domestic Equities	**$214,240,603**	**40.24%**	**$(3,304,502)**	**$7,511,389**	**$210,033,715**	**40.44%**
Large Cap Equities	**$150,690,205**	**28.30%**	**$(1,104,502)**	**$5,166,275**	**$146,628,432**	**28.23%**
Vanguard S&P 500 Index	37,847,213	7.11%	(400,000)	1,572,038	36,675,176	7.06%
SSGA S&P Equal Weighted NL CTF	38,238,231	7.18%	(4,502)	1,433,433	36,809,300	7.09%
Boston Partners	36,633,102	6.88%	0	1,040,571	35,592,531	6.85%
Harbor Cap Appreciation	37,971,659	7.13%	(700,000)	1,120,233	37,551,426	7.23%
Mid Cap Equities	**$33,304,116**	**6.26%**	**$(600,000)**	**$1,429,859**	**$32,474,257**	**6.25%**
Fidelity Low Priced Stock	15,331,413	2.88%	0	214,558	15,116,855	2.91%
Janus Enterprise	17,972,703	3.38%	(600,000)	1,215,301	17,357,403	3.34%
Small Cap Equities	**$30,246,282**	**5.68%**	**$(1,600,000)**	**$915,256**	**$30,931,026**	**5.95%**
Prudential Small Cap Value	12,392,575	2.33%	0	(274,713)	12,667,287	2.44%
AB US Small Growth	17,853,707	3.35%	(1,600,000)	1,189,969	18,263,738	3.52%
International Equities	**$146,238,126**	**27.47%**	**$0**	**$3,971,438**	**$142,266,688**	**27.39%**
EuroPacific	27,006,170	5.07%	0	1,006,994	25,999,176	5.01%
Harbor International	28,766,947	5.40%	0	803,505	27,963,442	5.38%
Oakmark International	27,135,640	5.10%	0	1,001,315	26,134,324	5.03%
Mondrian International	26,510,253	4.98%	0	348,697	26,161,556	5.04%
T. Rowe Price Intl Small Cap	21,787,330	4.09%	0	641,516	21,145,814	4.07%
Investec	15,031,787	2.82%	0	169,412	14,862,374	2.86%
Domestic Fixed Income	**$111,668,789**	**20.97%**	**$0**	**$3,249,350**	**$108,419,439**	**20.87%**
Dodge & Cox Income	56,045,124	10.53%	0	1,519,669	54,525,456	10.50%
PIMCO	55,623,665	10.45%	0	1,729,681	53,893,983	10.38%
Real Estate	**$59,991,416**	**11.27%**	**$(17,341)**	**$918,046**	**$59,090,710**	**11.38%**
RREEF Private	30,787,441	5.78%	0	471,036	30,316,406	5.84%
Barings Core Property Fund	28,053,974	5.27%	0	429,670	27,624,305	5.32%
625 Kings Court	1,150,000	0.22%	(17,341)	17,341	1,150,000	0.22%
Cash	**$290,566**	**0.05%**	**$680,355**	**$(0)**	**$-389,789**	**(0.08%)**
Total Fund	**$532,429,500**	**100.0%**	**$(2,641,488)**	**$15,650,224**	**$519,420,764**	**100.0%**

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MCERA Total Fund Performance as of June 30, 2019

Performance vs Callan Public Fund Sponsor Database (Gross)

	Last Quarter	Last Year	Last 2 Years	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years	Last 15 Years
10th Percentile	3.79	7.67	8.36	10.33	7.09	9.52	10.42	7.56
25th Percentile	3.51	6.85	7.90	9.57	6.50	8.90	9.85	7.26
Median	3.27	6.19	7.13	8.91	5.96	8.11	9.20	6.74
75th Percentile	2.98	5.41	6.52	8.21	5.44	7.44	8.34	6.34
90th Percentile	2.74	4.66	6.00	7.44	4.72	6.79	7.60	5.94
Total Fund ●	2.99	3.94	6.68	9.65	5.85	8.73	9.51	7.41
Total Fund Benchmark ▲	3.29	6.75	7.66	9.46	6.48	8.78	9.66	6.99

- The Callan Public Fund Sponsor Database consists of public employee pension total funds including both Callan LLC client and surveyed non-client funds.

- Returns greater than one year are annualized

MCERA Total Fund Fiscal Year Performance
June 30, 2019
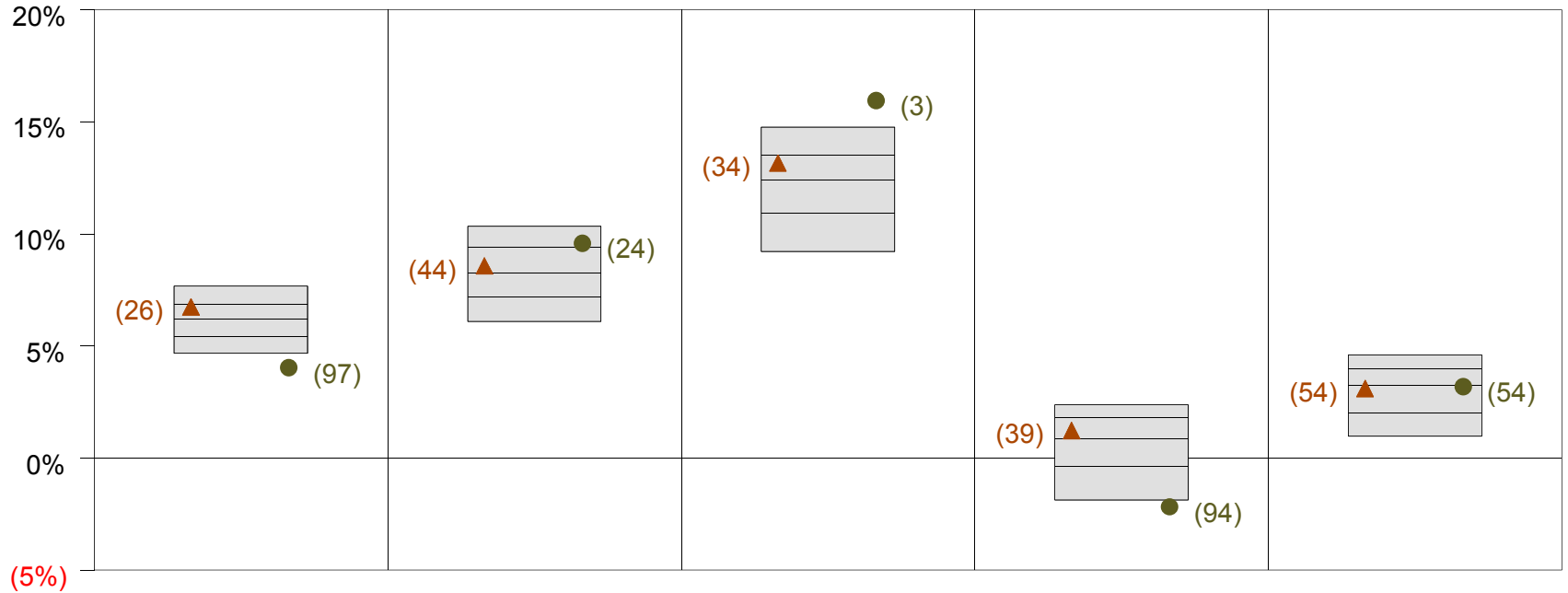
	FY 2019	FY 2018	FY 2017	FY 2016	FY 2015
10th Percentile	7.67	10.34	14.76	2.37	4.61
25th Percentile	6.85	9.40	13.53	1.80	3.98
Median	6.19	8.24	12.43	0.86	3.23
75th Percentile	5.41	7.18	10.92	(0.38)	2.04
90th Percentile	4.66	6.09	9.22	(1.87)	0.98
Total Fund ●	3.94	9.48	15.86	(2.26)	3.09
Total Fund Benchmark ▲	6.75	8.57	13.16	1.23	3.10

MCERA Total Fund Fiscal Year Performance (continued)
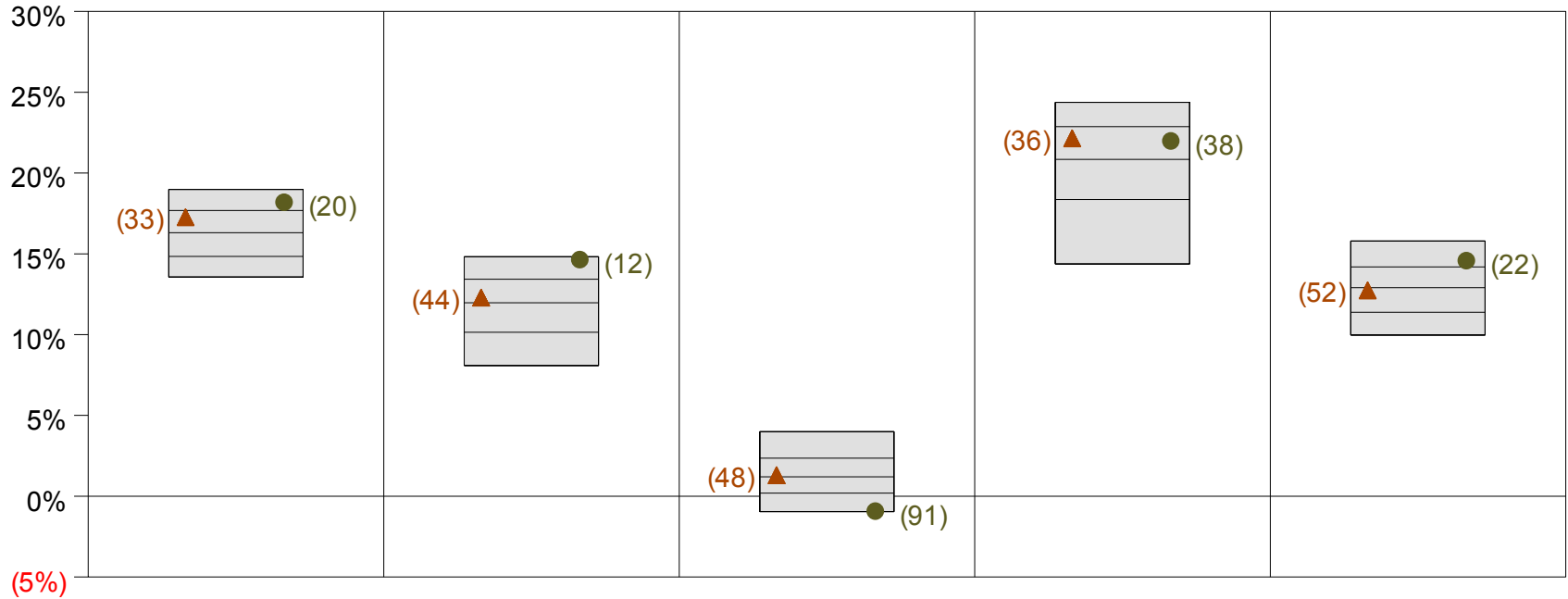
		FY 2014	FY 2013	FY 2012	FY 2011	FY 2010
10th Percentile		18.99	14.82	3.99	24.38	15.80
25th Percentile		17.69	13.43	2.36	22.87	14.20
Median		16.31	11.98	1.20	20.86	12.90
75th Percentile		14.83	10.14	0.20	18.36	11.38
90th Percentile		13.56	8.08	(0.96)	14.38	9.98
Total Fund	●	18.08	14.52	(1.04)	21.87	14.47
Total Fund Benchmark	▲	17.27	12.29	1.30	22.15	12.74

MCERA Cumulative Total Fund Performance
For 15 Years Ended June 30, 2019

Fifteen Year Cumulative Returns
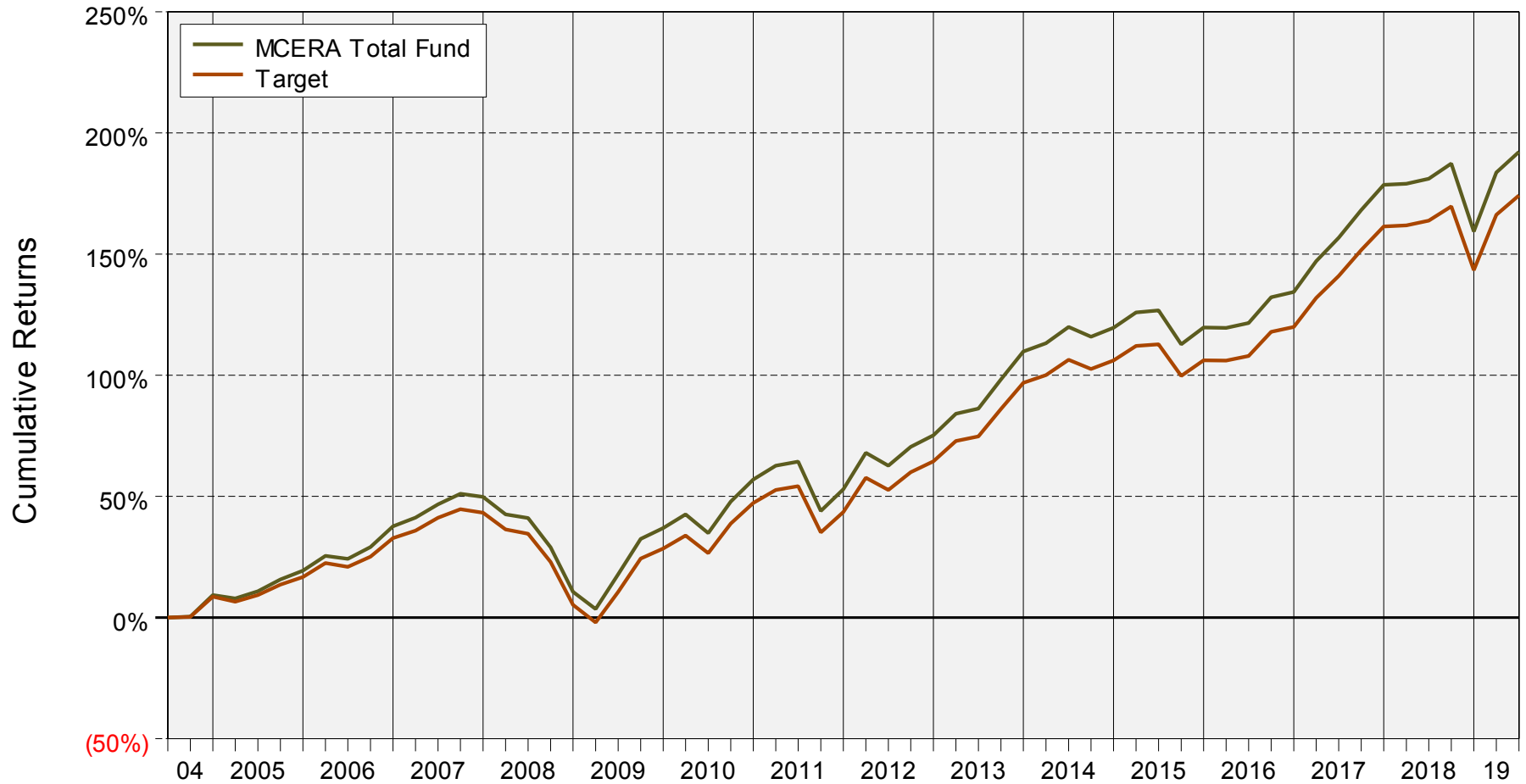
MCERA Annualized Return vs Risk

15 Years Ended June 30, 2019
Group: Callan Public Fund Sponsor Database

- The chart above plots 15 year annualized return vs standard deviation of the MCERA Total Fund and the Total Fund Target. Over the trailing 15 year period the MCERA Total Fund has achieved an annualized return higher than the Total Fund Target with moderately higher volatility.

Cumulative Total Fund Relative Attribution

June 30, 2019

One Year Relative Attribution Effects

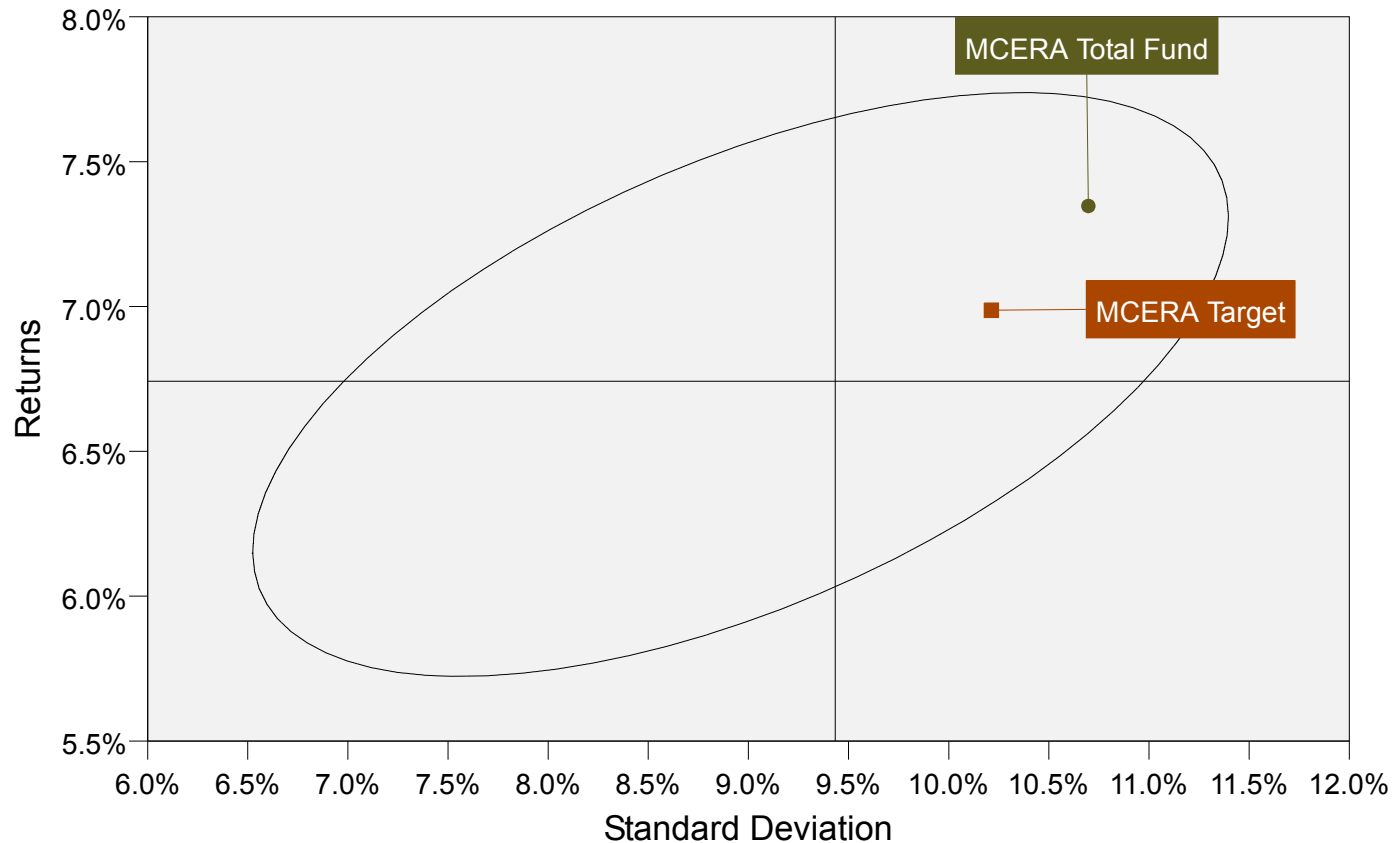| Asset Class	Effective Actual Weight	Effective Target Weight	Actual Return	Target Return	Manager Effect	Asset Allocation	Total Relative Return
Domestic Equity	40%	38%	6.66%	8.98%	(0.91%)	(0.12%)	(1.02%)
Domestic Fixed Income	21%	22%	7.61%	7.87%	(0.07%)	(0.20%)	(0.27%)
Domestic Real Estate	11%	11%	6.39%	5.99%	0.04%	(0.12%)	(0.08%)
International Equity	28%	29%	(3.16%)	1.80%	(1.45%)	0.02%	(1.44%)
Cash	0%	0%	0.00%	0.00%	0.00%	0.00%	0.00%
Total			**3.94%** =	**6.75%** +	**(2.38%)** +	**(0.42%)**	**(2.80%)**

Ten Year Annualized Relative Attribution Effects

Asset Class	Effective Actual Weight	Effective Target Weight	Actual Return	Target Return	Manager Effect	Asset Allocation	Total Relative Return
Domestic Equity	39%	38%	14.66%	14.67%	0.01%	(0.05%)	(0.04%)
Domestic Fixed Income	27%	27%	4.65%	3.90%	0.20%	(0.11%)	0.09%
Domestic Real Estate	9%	10%	11.33%	12.10%	(0.06%)	(0.02%)	(0.08%)
International Equity	25%	25%	6.76%	6.46%	0.02%	(0.01%)	0.00%
Cash	1%	0%	0.04%	0.04%	0.00%	(0.11%)	(0.11%)
Total			**9.51%** =	**9.66%** +	**0.15%** +	**(0.30%)**	**(0.15%)**

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Investment Manager Returns for Periods Ended June 30, 2019

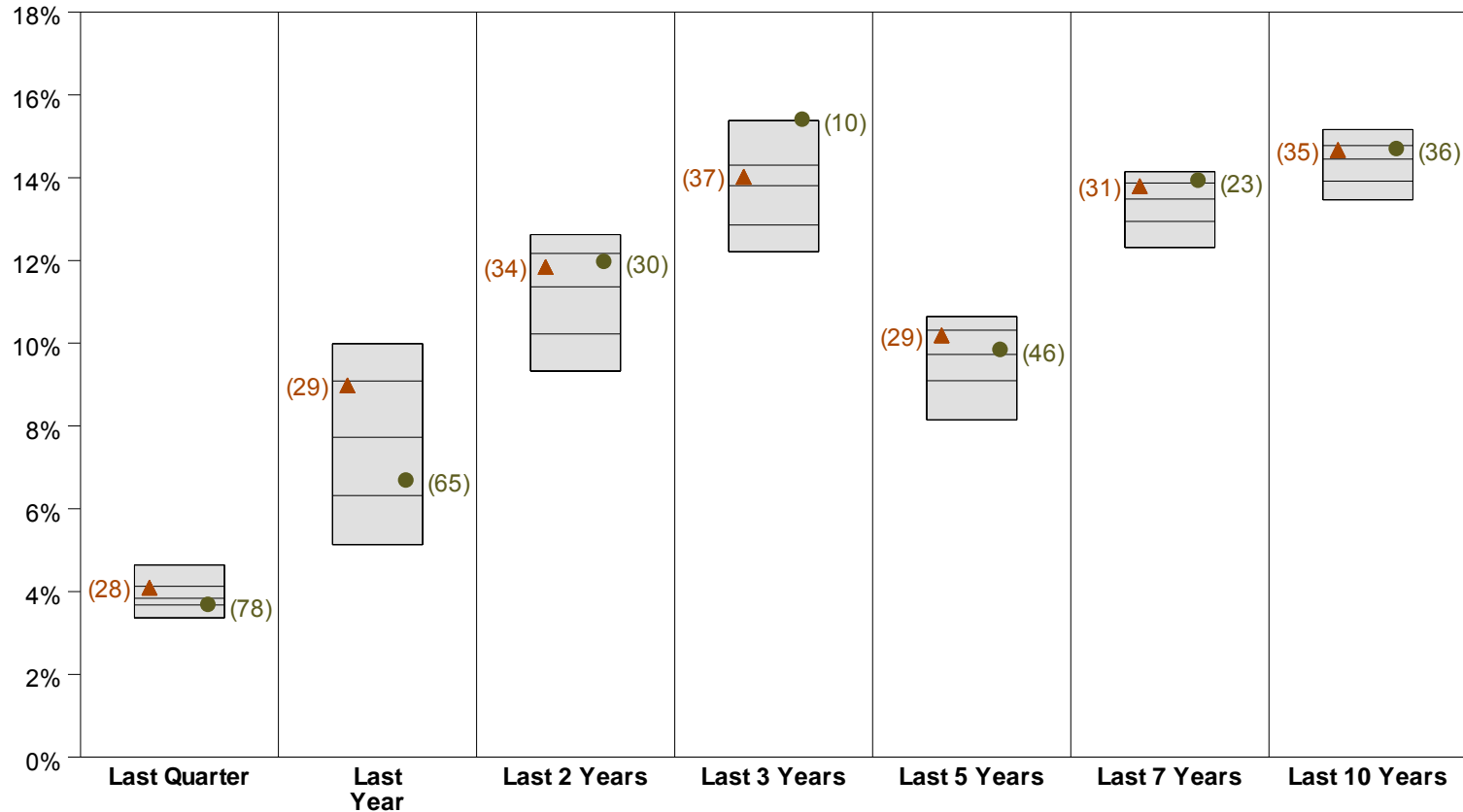|	Last Quarter	Last Year	Last 3 Years	Last 5 Years	Last 10 Years
Domestic Equties	**3.65%**	**6.66%**	**15.37%**	**9.81%**	**14.66%**
Russell 3000 Index	4.10%	8.98%	14.02%	10.19%	14.67%
Large Cap Equities					
Vanguard S&P 500 Index	4.30%	10.39%	14.15%	10.68%	-
S&P 500 Index	4.30%	10.42%	14.19%	10.71%	14.70%
SSGA S&P Eq Weighted NL CTF	3.87%	8.14%	-	-	-
S&P 500 Eq Weighted	3.72%	8.18%	12.41%	9.14%	15.56%
Boston Partners	2.92%	4.48%	11.26%	6.86%	-
S&P 500 Index	4.30%	10.42%	14.19%	10.71%	14.70%
Russell 1000 Value Index	3.84%	8.46%	10.19%	7.46%	13.19%
Harbor Cap Appreciation (1)	3.05%	8.12%	20.28%	13.65%	15.93%
S&P 500 Index	4.30%	10.42%	14.19%	10.71%	14.70%
Russell 1000 Growth Index	4.64%	11.56%	18.07%	13.39%	16.28%
Mid Cap Equities					
Fidelity Low Priced Stock	1.42%	(0.93%)	9.34%	6.01%	12.84%
Russell MidCap Value Idx	3.19%	3.68%	8.95%	6.72%	14.56%
Janus Enterprise (2)	7.23%	16.92%	19.02%	14.48%	17.36%
Russell MidCap Growth Idx	5.40%	13.94%	16.49%	11.10%	16.02%
Small Cap Equities					
Prudential Small Cap Value (3)	(2.17%)	(13.06%)	6.48%	3.54%	-
US Small Cap Value Idx	0.86%	(4.69%)	8.89%	5.71%	13.19%
Russell 2000 Value Index	1.38%	(6.24%)	9.81%	5.39%	12.40%
AB US Small Growth (4)	7.13%	10.70%	24.66%	12.43%	18.76%
Russell 2000 Growth Index	2.75%	(0.49%)	14.69%	8.63%	14.41%

Investment Manager Returns for Periods Ended June 30, 2019 (continued)

	Last Quarter	Last Year	Last 3 Years	Last 5 Years	Last 10 Years
International Equities	**2.69%**	**(3.16%)**	**8.33%**	**1.09%**	**6.76%**
MSCI ACWI ex-US Index	3.22%	1.80%	9.91%	2.65%	7.03%
EuroPacific	3.87%	1.91%	10.84%	4.45%	8.16%
Harbor International (1)	2.87%	(6.05%)	4.97%	(0.37%)	6.37%
Oakmark International (2)	3.83%	(6.81%)	11.07%	1.67%	9.13%
Mondrian International	1.13%	1.70%	6.57%	0.70%	-
MSCI EAFE Index	3.68%	1.08%	9.11%	2.25%	6.90%
MSCI ACWI ex-US Index	3.22%	1.80%	9.91%	2.65%	7.03%
T. Rowe Price Intl Small Cap	2.77%	(8.04%)	-	-	-
MSCI ACWI ex US Small Cap	1.21%	(5.94%)	7.76%	2.77%	8.48%
Investec	0.94%	0.10%	-	-	-
MSCI Emerging Markets Index	0.61%	1.22%	10.66%	2.49%	5.81%
Domestic Fixed Income	**3.00%**	**7.61%**	**3.43%**	**3.14%**	**4.65%**
Blmbg Aggregate Index	3.08%	7.87%	2.31%	2.95%	3.90%
Dodge & Cox Income	2.79%	7.58%	3.69%	3.27%	5.05%
PIMCO	3.21%	7.64%	3.17%	3.02%	4.69%
Blmbg Aggregate Index	3.08%	7.87%	2.31%	2.95%	3.90%
Real Estate	**1.55%**	**6.39%**	**6.36%**	**8.68%**	**11.33%**
Real Estate Custom Benchmark (3)	1.12%	5.99%	6.42%	8.86%	12.10%
RREEF Private	1.55%	6.48%	7.08%	9.43%	10.01%
Barings Core Property Fund	1.56%	6.24%	6.91%	8.53%	-
NFI-ODCE Equal Weight Net	1.12%	5.99%	6.97%	9.12%	8.80%
625 Kings Court	1.51%	7.52%	13.75%	12.18%	9.22%
Total Fund	**2.99%**	**3.94%**	**9.65%**	**5.85%**	**9.51%**
Total Fund Benchmark*	3.29%	6.75%	9.46%	6.48%	9.66%

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MCERA Domestic Equity Composite Performance
For Periods Ended June 30, 2019

Performance vs Public Fund - Domestic Equity (Gross)

	Last Quarter	Last Year	Last 2 Years	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years
10th Percentile	4.64	9.99	12.62	15.38	10.64	14.15	15.16
25th Percentile	4.13	9.09	12.17	14.30	10.32	13.87	14.78
Median	3.84	7.73	11.36	13.81	9.73	13.48	14.45
75th Percentile	3.68	6.32	10.23	12.86	9.09	12.94	13.91
90th Percentile	3.37	5.14	9.33	12.21	8.15	12.31	13.47
Domestic Equity Composite ●	3.65	6.66	11.93	15.37	9.81	13.89	14.66
Russell 3000 Index ▲	4.10	8.98	11.84	14.02	10.19	13.79	14.67

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MCERA International Equity Composite Performance
For Periods Ended June 30, 2019

Performance vs Public Fund - International Equity (Gross)
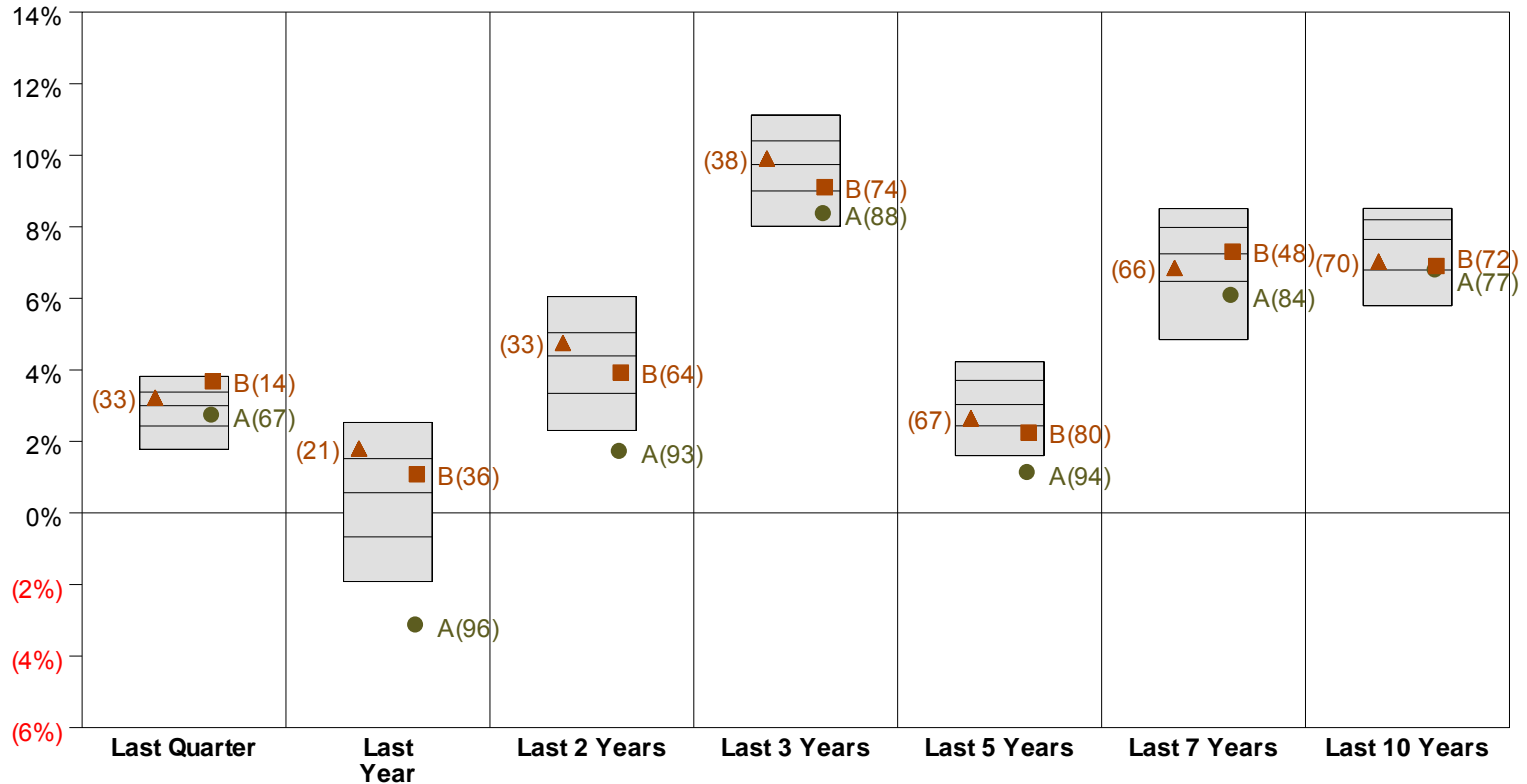
	Last Quarter	Last Year	Last 2 Years	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years
10th Percentile	3.82	2.53	6.05	11.12	4.23	8.51	8.51
25th Percentile	3.38	1.52	5.04	10.40	3.70	7.98	8.20
Median	3.00	0.57	4.39	9.74	3.03	7.24	7.64
75th Percentile	2.43	(0.67)	3.35	9.00	2.44	6.47	6.79
90th Percentile	1.78	(1.92)	2.31	8.01	1.61	4.85	5.79
International Equity Composite ● A	2.69	(3.16)	1.69	8.33	1.09	6.04	6.76
MSCI EAFE Index ■ B	3.68	1.08	3.92	9.11	2.25	7.31	6.90
MSCI ACWIxUS Gross ▲	3.22	1.80	4.75	9.91	2.65	6.85	7.03

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MCERA Fixed Income Composite Performance
For Periods Ended June 30, 2019

Performance vs Public Fund - Domestic Fixed (Gross)
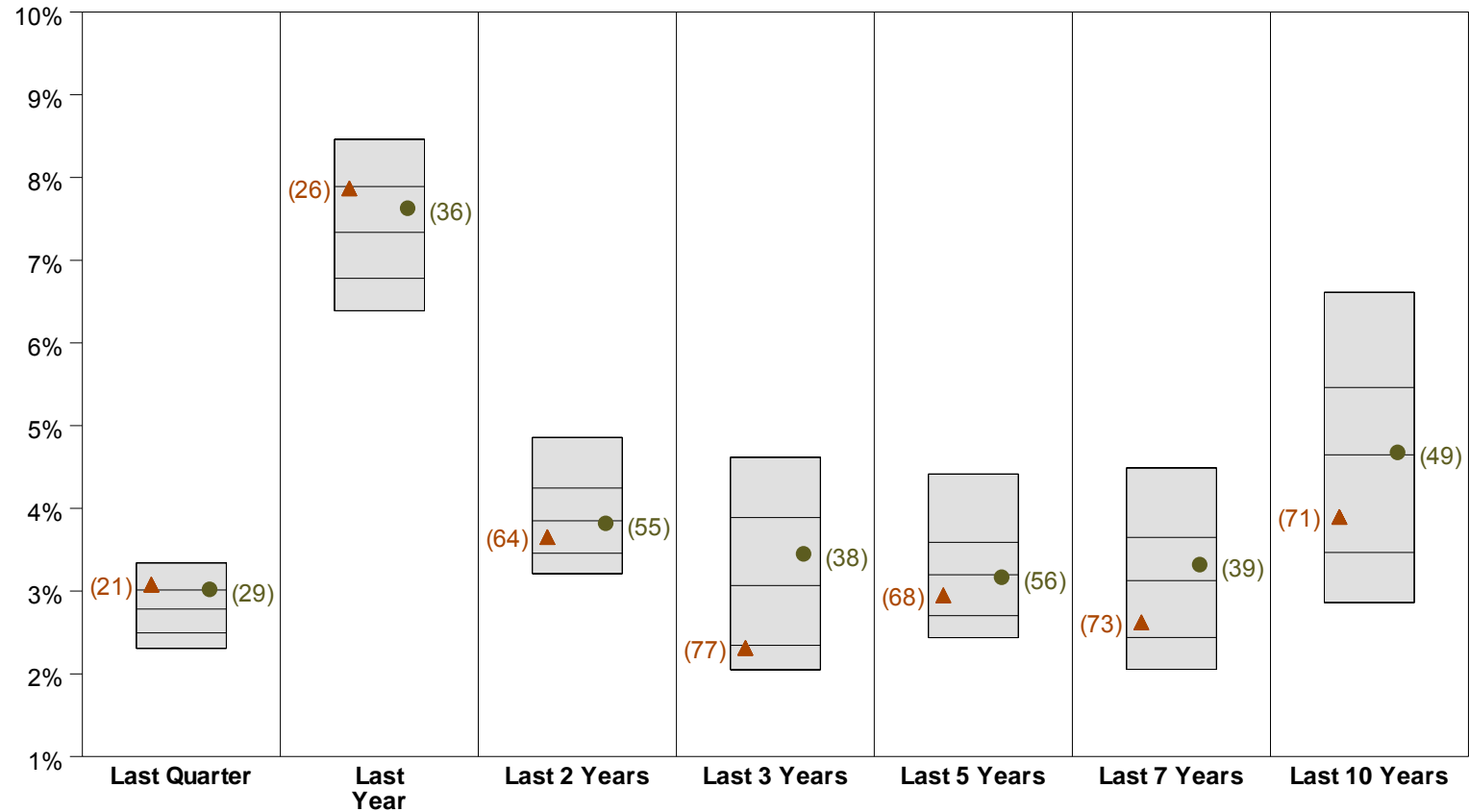
	Last Quarter	Last Year	Last 2 Years	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years
10th Percentile	3.34	8.46	4.86	4.62	4.42	4.49	6.61
25th Percentile	3.01	7.89	4.25	3.89	3.59	3.65	5.46
Median	2.78	7.34	3.85	3.07	3.20	3.13	4.65
75th Percentile	2.49	6.78	3.46	2.34	2.70	2.44	3.47
90th Percentile	2.31	6.39	3.21	2.05	2.44	2.05	2.86
Domestic Fixed Income Composite ●	3.00	7.61	3.80	3.43	3.14	3.30	4.65
Blmbg Aggregate ▲	3.08	7.87	3.65	2.31	2.95	2.62	3.90

MCERA Real Estate Composite Performance
For Periods Ended June 30, 2019

Performance vs Callan Open End Core Cmmingled Real Est (Net)
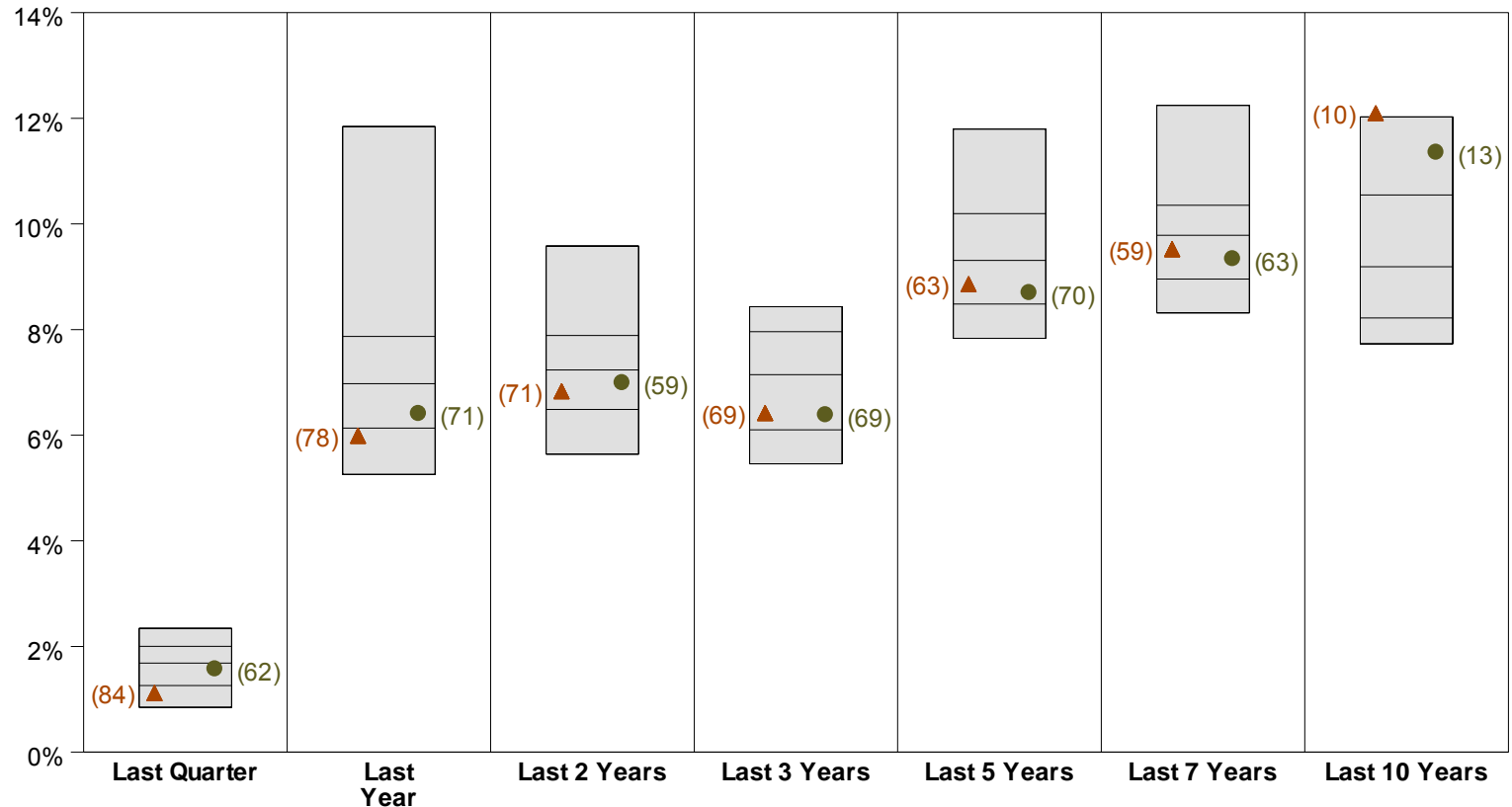
	Last Quarter	Last Year	Last 2 Years	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years
10th Percentile	2.34	11.84	9.58	8.44	11.80	12.25	12.03
25th Percentile	2.00	7.87	7.89	7.96	10.20	10.36	10.55
Median	1.69	6.98	7.24	7.15	9.31	9.79	9.19
75th Percentile	1.26	6.14	6.49	6.10	8.49	8.96	8.22
90th Percentile	0.85	5.26	5.64	5.46	7.83	8.31	7.73
Real Estate Composite ●	1.55	6.39	6.97	6.36	8.68	9.32	11.33
Real Estate Custom Benchmark ▲	1.12	5.99	6.83	6.42	8.86	9.52	12.10

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Asset/Liability Study

Agenda

Overview of Presentation

- Asset/Liability Study Overview

- MCERA Current Conditions

- Deterministic Forecasts

- Simulated Forecasts
  – Capital Market Projections
  – Asset Mix Alternatives
  – Simulated Financial Conditions

- Conclusion

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Asset/Liability Study Overview

Motivation

- An Asset/Liability Study Provides the Basis for Selecting a Long-Term Strategic Asset Allocation

- The Cornerstone of a Prudent Process
  - Careful and thorough examination of the long-term strategic plan
  - Explicitly acknowledge change and uncertainty in the capital markets

- Establish Reasonable Rate-of-Return and Risk Expectations

- Incorporate Material Changes in Strategic Policies or Regulations
  - Funding
  - Benefits
  - Investments

- Results of an Asset and Liability Study
  - Evaluates the ability of the current investment policy to meet return and risk objectives in relation to funding, accounting and policy goals
  - Projects the impact of changes in asset allocation on the assets, liabilities and funded status

- Frequency
  - If no material changes have occurred, an asset/liability study should still be conducted approximately every 3 to 5 years
  - Last study for MCERA was conducted in 2016

Asset/Liability Study Overview

Study Process

- **Deterministic and Stochastic Process Used**
  - Deterministic analysis forecasts future plan conditions assuming that all of the actuarial assumptions are realized
    - *Provides a broad characterization of projected plan conditions*
  - Stochastic analysis forecasts future plan conditions under a range of assumptions
    - *Asset mixes*
    - *Inflation scenarios*
    - *Asset class returns*

- **The Appropriate Asset Allocation Depends on the Tradeoff Between Returns and Return Volatility**
  - Higher (lower) long-term returns reduce (increase) the need for contributions over time
  - Higher (lower) long-term returns increase (decrease) short-term return volatility which in turn increases the volatility of contributions and funded status
  - The appropriate asset allocation provides the highest acceptable level of projected contribution and funded status risk
  - The expected return follows from the asset allocation which meets this risk level

- **Asset Allocation is a Subjective Decision**
  - Two different sets of fiduciaries faced with identical pension characteristics could choose two different asset allocations
  - Board risk tolerance
  - Funding flexibility
  - Plan visibility
  - Staff support
  - No "one-size-fits-all" solution exists

Asset/Liability Study Overview

Policy Considerations

*Evaluate the interaction of the three key policies that govern a pension fund
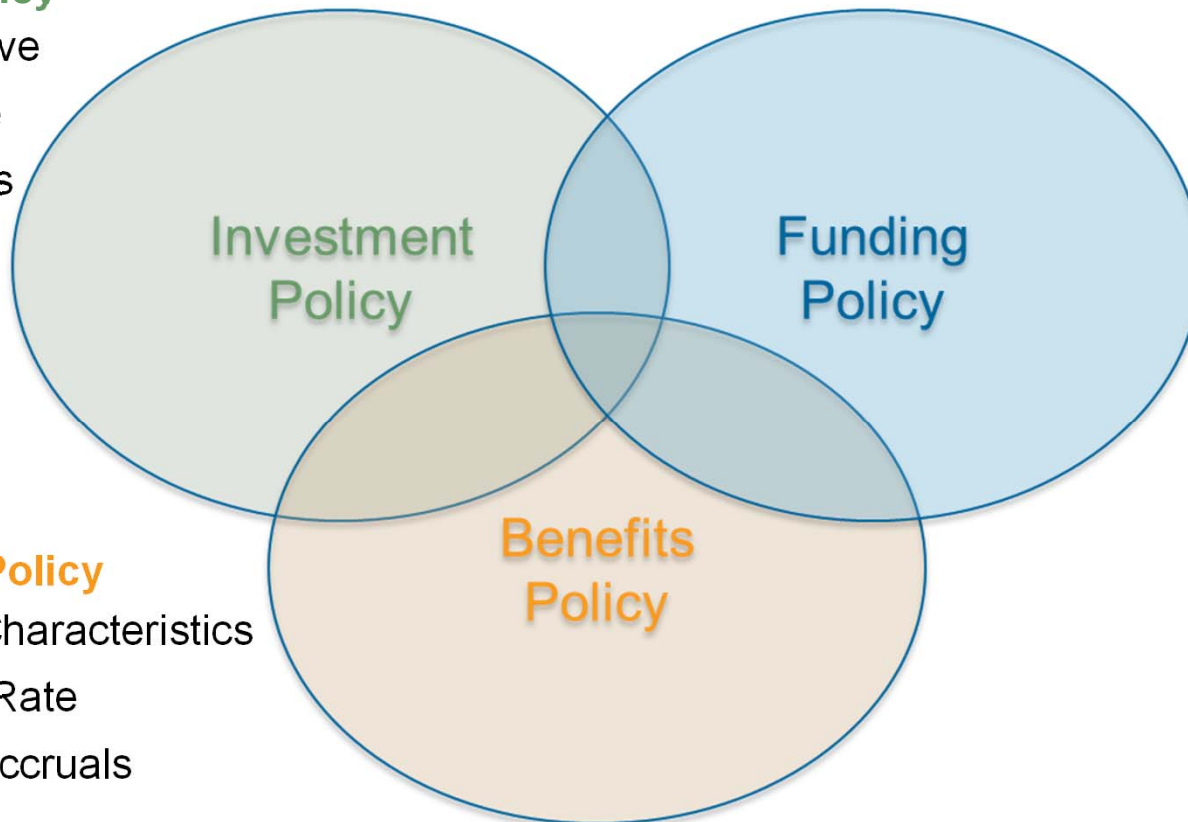with the goal of establishing the optimal investment policy*

Investment Policy
- Return Objective
- Risk Tolerance
- Liquidity Needs
- Time Horizon

Funding Policy
- Discount Rate
- Funding Policy
- Actuarial Methodology

Benefits Policy
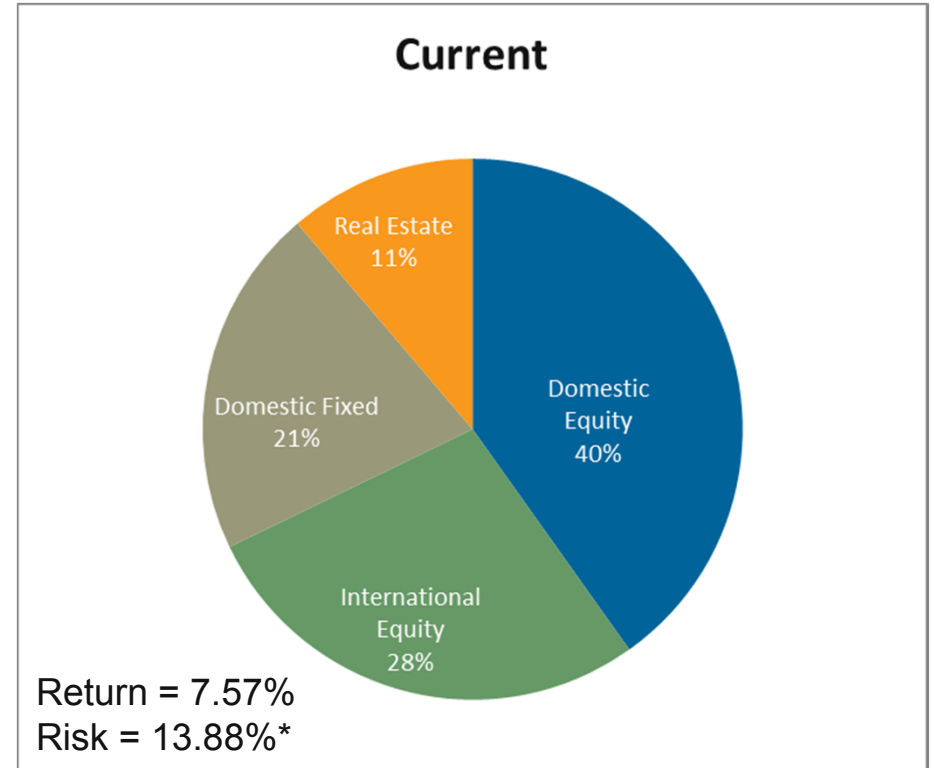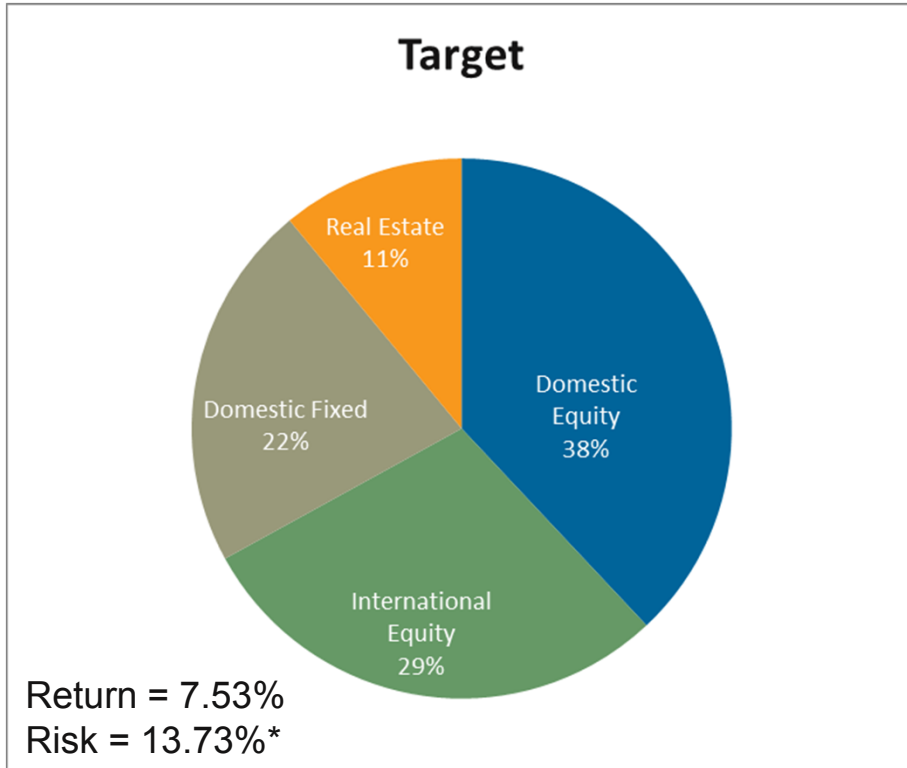- Benefit Characteristics
- Inflation Rate
- Benefit Accruals

Investment Policy — Funding Policy — Benefits Policy

Asset/Liability Study Overview

MCERA Current Conditions

Factor	Description*
Return Objective	• Assumed net investment return is 7.0% including a 3% inflation assumption
Time Horizon	• Long (plan is open)
Liquidity Needs	• Liquidity needs are gradually rising as benefits are likely to exceed contributions • Portfolio currently has a moderate allocation to illiquid investments (11% private real estate) • Illiquidity could increase with the introduction of private infrastructure and private equity
Actuarial Methodology	• The actuarial value of assets is smoothed over rolling five-year periods • The actuarial value of assets is limited to a corridor between 75% and 125% of market value
Contributions	• Policy is normal cost plus supplemental cost based on entry age normal cost method targeting a constant percentage of salary • Amortization of 2012 unfunded liability (21 years remaining as of the 2018 valuation) • Amortization of additional annual gains and losses going forward
Liability Growth	• Liability return is estimated at 6.25% per year • Fraction of liability attributable to active population is expected to decline only modestly reflecting the maturity of the plan • Retirees with annuity payments can stretch for many years
Funded Status	• Plan is underfunded • Actuarial Value of Assets / Actuarial Liability = 70.4% • Market Assets / Actuarial Liability = 72.5%

*Based on June 30, 2018 actuarial valuation

MCERA Current Conditions

Current Asset Allocations

Target

- Real Estate 11%
- Domestic Equity 38%
- Domestic Fixed 22%
- International Equity 29%

Return = 7.53%
Risk = 13.73%*

Current

- Real Estate 11%
- Domestic Equity 40%
- Domestic Fixed 21%
- International Equity 28%

Return = 7.57%
Risk = 13.88%*

- Plan Assets Were $532.4 Million as of June 30, 2019
- Current Mix Close to Target
  - All asset classes within policy rebalancing ranges
  - Domestic equity 2% over target
  - International equity and domestic fixed income both 1% under target

* Return is 10-year compound return. Risk is measured by standard deviation.

MCERA Current Conditions

Build Actuarial Liability Model

- Callan Built Liability Model Based on Segal 2018 Actuarial Valuation
  - Callan's model matches Segal's 2018 actuarial accrued liability within +/-3%
  - The close match indicates that the model is built correctly

- Model Used to Forecast Future Liabilities
  - 2018 values are starting point
  - Reflects all of Segal's actuarial assumptions
  - Uses MCERA's benefits and funding policies

- Assets rolled forward to June 30, 2019 to reflect actual asset values

- Additional Forecast Assumptions
  - Open to new entrants
    - *Composition reflects recent new entrants*
  - 0% workforce growth

June 30, 2018 Actuarial Valuation	All Plans
Actuarial Accrued Liability	$717.5 mm
Market Value of Assets	$520.4 mm
Actuarial Value of Assets	$504.8 mm
Market Funded Status (MVA/AL)	72.5%
Actuarial Funded Status (AVA/AL)	70.4%
Employer Contribution ($)	$23.3 mm
Employer Contribution (% of payroll)	34.27%

Key Assumptions	Actuarial Assumption	Callan 10-year Expectation
Investment Return	7.00%	6.79%*
Price Inflation	3.00%	2.25%

*Based on Callan's capital market assumptions applied to MCERA's target asset allocation

Deterministic Forecasts

Member Numbers
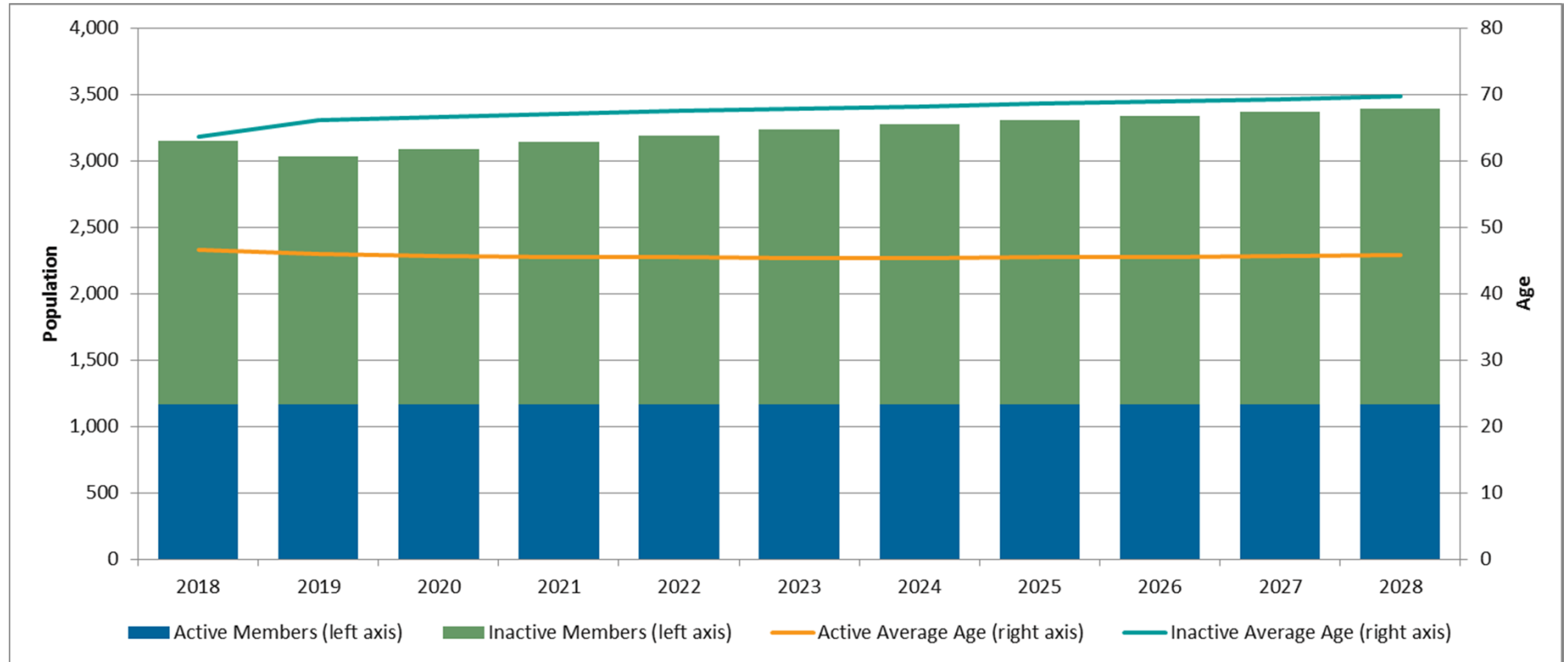
- Number of Active Members Assumed Constant
  - New members replace members expected to terminate, retire or die
  - New members added based on recent hire demographics
  - Stable active age reflects plan maturity

- Inactive Members Increase
  - Number of inactive members falls initially as actuarial assumptions are applied
  - In subsequent years inactive members increase reflecting demographic assumptions

Deterministic Forecasts

Member Percentages
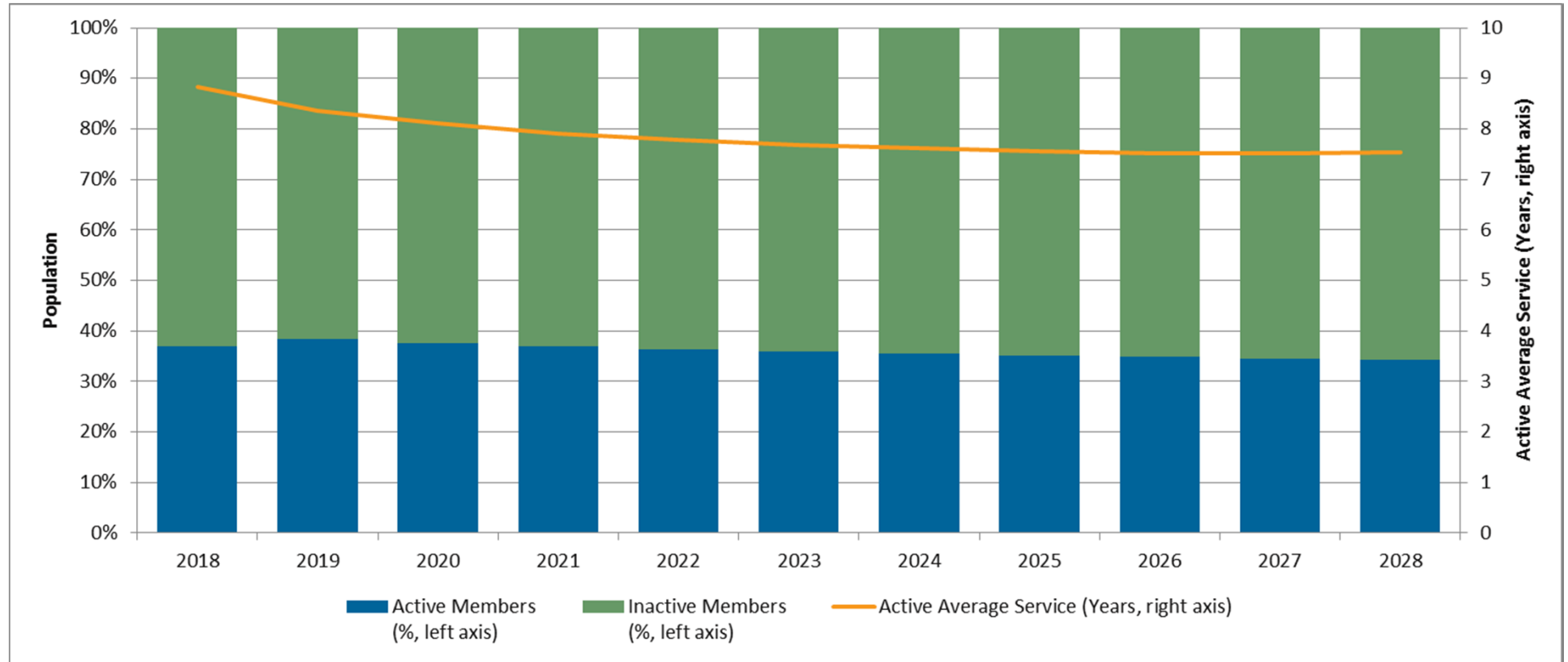
- Active Fraction of Total Population Declines Slightly Over Projection Period
  - Number of inactive members increases slightly while active population remains constant
  - Relatively stable proportions reflect mature plan

- Active Average Service Falls in Early Years
  - Longer-tenured members retire in line with actuarial assumptions
  - Retired members are replaced by younger employees

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Deterministic Forecasts

Cash Flows and Liquidity
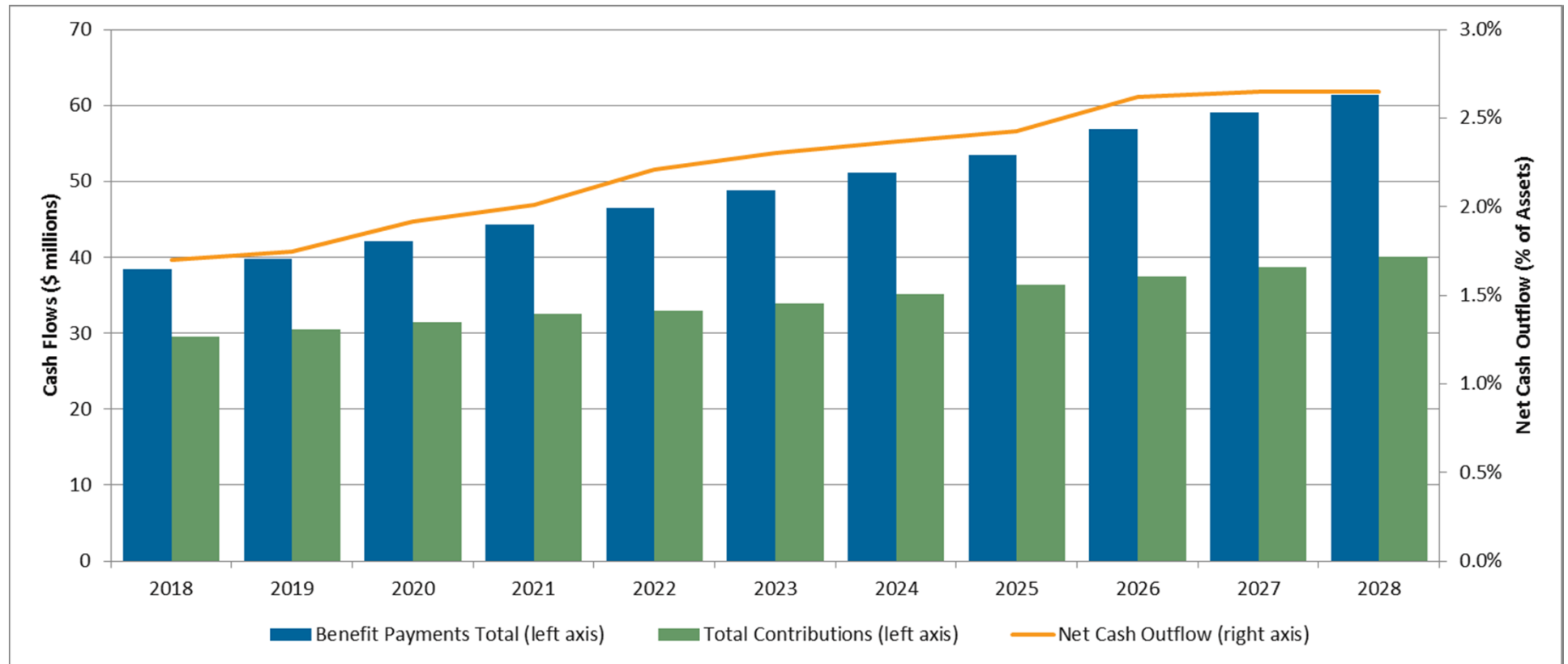
- Nominal Benefit Payments Increase with Increasing Levels of Compensation

- Contributions are Governed by Policy

- Benefits Exceed Contributions Resulting in Net Cash Outflows
  - Net cash flow is a factor used to determine a cap on the level of private investments
  - MCERA net cash outflows as a percentage of assets are relatively small in this scenario so should not limit private investments

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Deterministic Forecasts

Funding
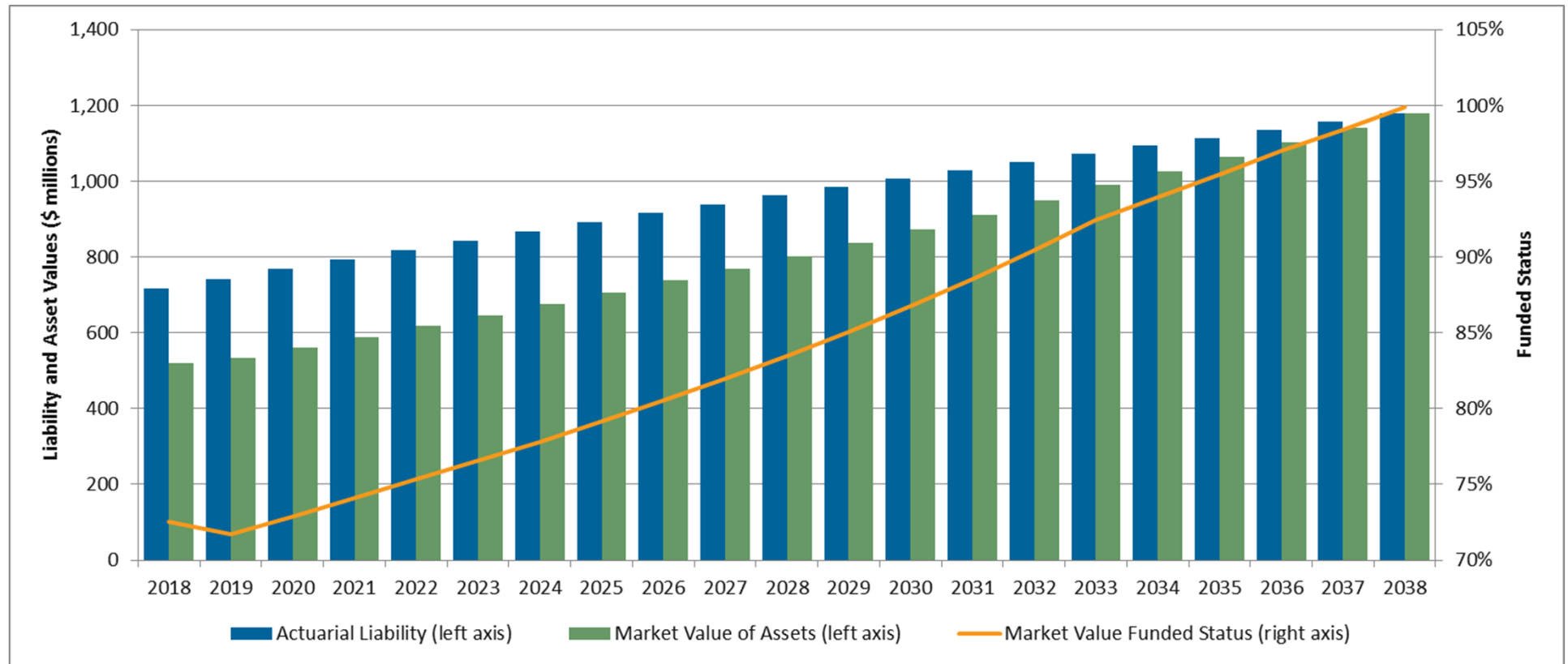
- Market Value of Assets Increases Faster than Liabilities Closing Funding Gap
  - Change in assets due to both investment returns and net cash flows (contributions net of benefit payments and expenses)
  - Contributions reflect amortization payments designed to fully fund benefits in 2038

- Improved Funding Not Guaranteed
  - Depends on adherence to the contribution policy
  - Assumes assets earn actuarial discount rate

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Stochastic Forecasts

Process

Liability Modeling

Build Liability Model

↓

Deterministic Projections

Asset Projections

Define Capital Market Projections

↓

Create Asset Mix Alternatives

Simulate Financial Condition

↓

Define Risk Tolerance

↓

Select Appropriate Target Mix
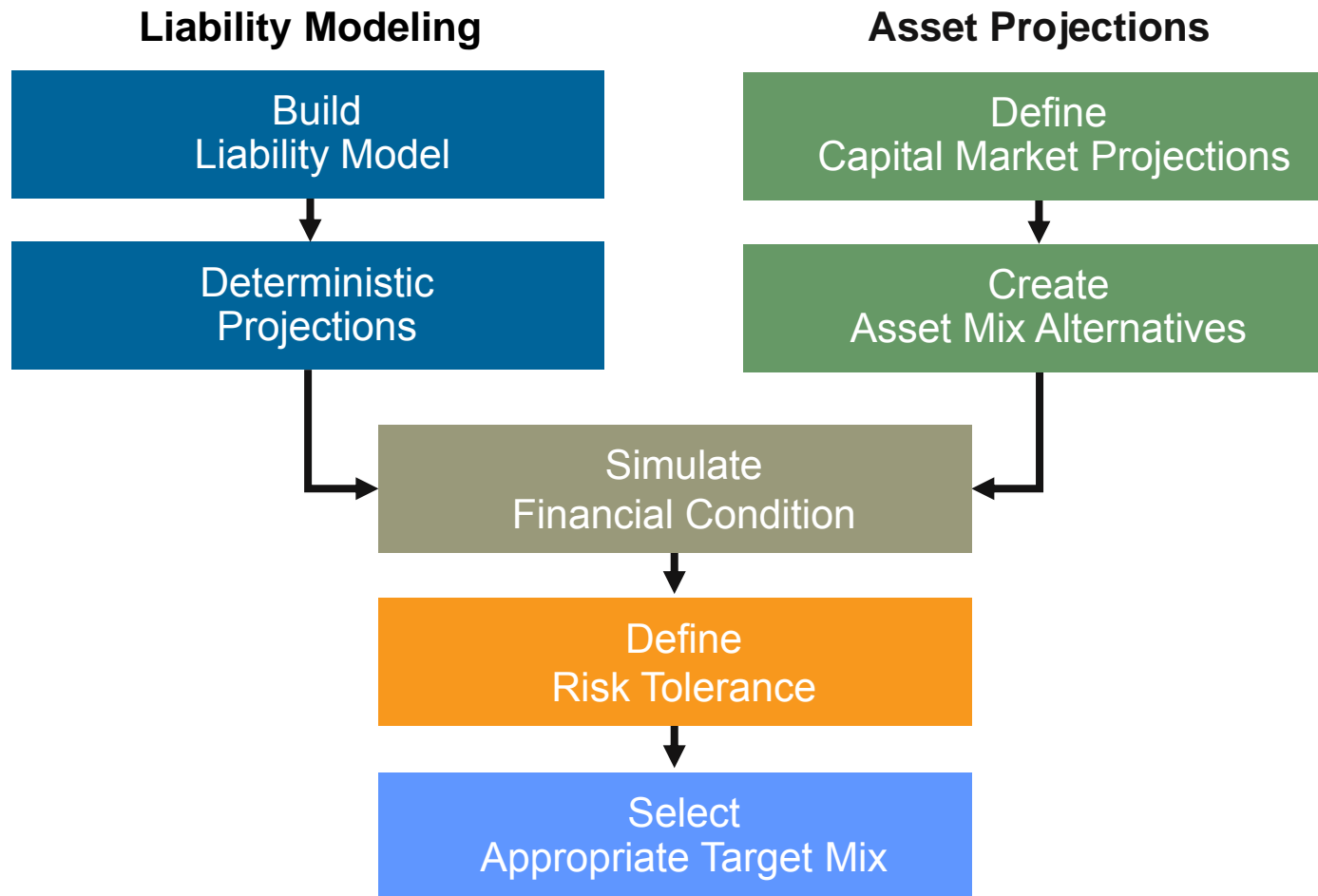
Capital Market Projections

Process and Philosophy

- Underlying beliefs guide the development of the projections
  - An initial bias toward long-run averages
  - A conservative bias
  - An awareness of risk premiums
  - A presumption that markets ultimately clear and are rational

- Reflect our beliefs that long-term equilibrium relationships between the capital markets and lasting trends in global economic growth are key drivers to setting capital market expectations.

- Long-term compensated risk premiums represent "beta"—exposure to each broad market, whether traditional or "exotic," with limited dependence on successful realization of alpha.

- The projection process is built around several key building blocks:
  - Advanced modeling at the individual asset class level (for example, detailed bond and equity models)
  - A path for interest rates and inflation
  - A cohesive economic outlook
  - A framework that encompasses Callan beliefs about the long-term operation and efficiencies of the capital markets

- This analysis uses our most recent (2019) capital market expectations which are incrementally higher than recent years' numbers.

Capital Market Projections

Return and Risk

- Public Market Assumptions are Passive
  - Represent "beta" only
  - Do not include active manager value added ("alpha")

- Private Market Assumptions Include Impact of Active Management
  - Real estate
  - Infrastructure
  - Private equity
  - Hedge funds

- Assumptions are Net of Fees

- Asset Classes Highlighted are Included in this Analysis

Asset Class	Index	Projected Return*	Projected Risk
Equities			
Broad Domestic Equity	Russell 3000	7.15%	17.95%
Large Cap	S&P 500	7.00%	17.10%
Small/Mid Cap	Russell 2500	7.25%	22.65%
International Equity	MSCI ACWI ex USA	7.25%	21.10%
Developed Markets Equity	MSCI World ex USA	7.00%	19.75%
Emerging Markets Equity	MSCI Emerging Markets	7.25%	27.45%
Fixed Income			
Short Duration	Bloomberg Barclays 1-3 Yr G/C	3.40%	2.10%
Domestic Fixed	Bloomberg Barclays Aggregate	3.75%	3.75%
Long Duration	Bloomberg Barclays Long G/C	3.75%	10.65%
TIPS	Bloomberg Barclays TIPS	3.75%	5.05%
High Yield	Bloomberg Barclays High Yield	5.35%	10.35%
Non-US Fixed	Bloomberg Barclays Glbl Agg xUSD	1.40%	9.20%
Emerging Market Debt	EMBI Global Diversified	5.05%	9.50%
Other			
Real Estate	NCREIF ODCE	6.25%	15.70%
Infrastructure	FTSE Global Core Infrastructure	6.80%	17.85%
Private Equity	Cambridge Private Equity	8.50%	29.30%
Hedge Funds	Callan Hedge FoF Database	5.50%	8.85%
Commodities	Bloomberg Commodity	3.20%	18.00%
Cash Equivalents	90-Day T-Bill	2.50%	0.90%
Inflation	CPI-U	2.25%	1.50%

* Geometric returns are derived from arithmetic returns and the associated risk (standard deviation).
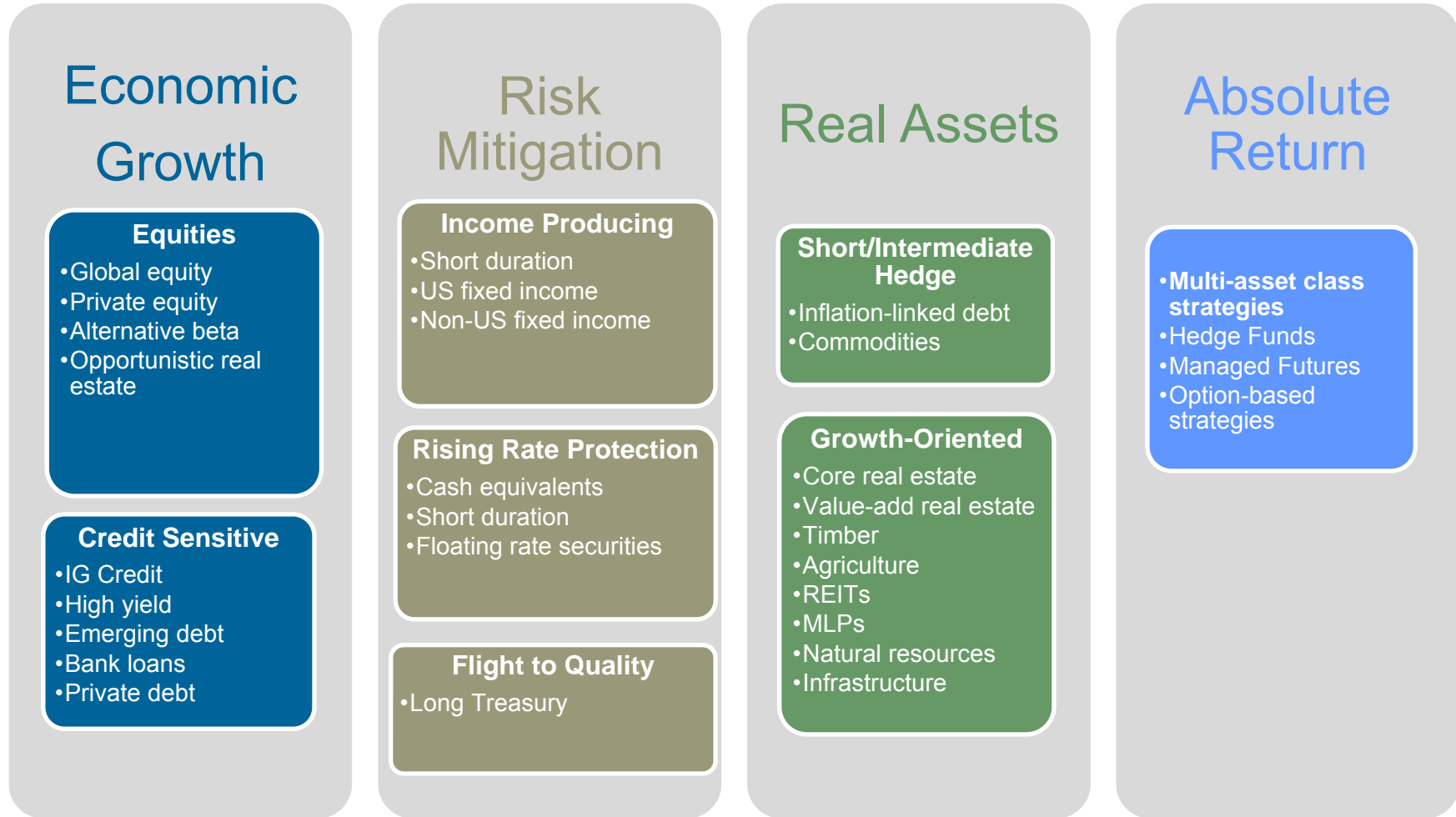
Asset Mix Alternatives

Current Asset Classes Plus Private Infrastructure

Asset Classes	Benchmark Mixes		Constraints		Optimal Mixes				
	Target	Current	Min	Max	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Domestic Equity	38	40	0	100	28	30	34	37	41
International Equity	29	28	0	100	19	21	23	25	28
Domestic Fixed	22	21	0	100	41	35	28	21	12
Real Estate	11	11	0	100	8	9	10	11	13
Private Infrastructure	0	0	0	100	4	5	5	6	6
Totals	100	100			100	100	100	100	100
1-Year Return	7.53	7.57			6.56	6.86	7.19	7.55	7.94
10-Year Compound Return	6.79	6.81			6.20	6.40	6.60	6.80	7.00
Risk (Standard Deviation)	13.73	13.88			10.19	11.29	12.48	13.79	15.26
Public Equity	67	68			47	51	57	62	69
Illiquid	11	11			12	14	15	17	19

- Optimal Mixes Range from More Conservative to More Aggressive Relative to Target
  - The optimal mixes are constructed with increasing returns in 20 bps increments
  - The optimal mixes have decreasing allocations to fixed income (from 41% to 12%)
  - Mix 1 is the most conservative while Mix 5 is the most aggressive
  - As the fixed income allocation decreases the expected portfolio return increases, but so does the expected risk

- Asset Mixes Include Current Asset Classes Plus Private Infrastructure

Asset Mixes

Asset Class Roles

Economic Growth

Equities
- Global equity
- Private equity
- Alternative beta
- Opportunistic real estate

Credit Sensitive
- IG Credit
- High yield
- Emerging debt
- Bank loans
- Private debt

Risk Mitigation

Income Producing
- Short duration
- US fixed income
- Non-US fixed income

Rising Rate Protection
- Cash equivalents
- Short duration
- Floating rate securities

Flight to Quality
- Long Treasury

Real Assets

Short/Intermediate Hedge
- Inflation-linked debt
- Commodities

Growth-Oriented
- Core real estate
- Value-add real estate
- Timber
- Agriculture
- REITs
- MLPs
- Natural resources
- Infrastructure

Absolute Return

- **Multi-asset class strategies**
- Hedge Funds
- Managed Futures
- Option-based strategies

Strategies should not be weighted equally

- Periods of economic growth are longer than periods with market downturns so growth strategies generally form a larger portion of the portfolio than risk mitigation strategies

Asset Mix Alternatives

Current Asset Classes Plus Private Infrastructure and Private Equity

Asset Classes	Benchmark Mixes		Constraints		Optimal Mixes				
	Target	Current	Min	Max	Mix 1P	Mix 2P	Mix 3P	Mix 4P	Mix 5P
Domestic Equity	38	40	0	100	21	23	25	28	30
International Equity	29	28	0	100	14	15	17	19	20
Domestic Fixed	22	21	0	100	49	44	38	32	27
Real Estate	11	11	0	100	5	5	6	6	7
Private Infrastructure	0	0	0	100	2	3	3	3	3
Private Equity	0	0	0	100	9	10	11	12	13
Totals	100	100			100	100	100	100	100
1-Year Return	7.53	7.57			6.51	6.79	7.10	7.43	7.78
10-Year Compound Return	6.79	6.81			6.20	6.40	6.60	6.80	7.00
Risk (Standard Deviation)	13.73	13.88			9.63	10.63	11.70	12.86	14.12
Public Equity	67	68			35	38	42	47	50
Illiquid	11	11			16	18	20	21	23

- Optimal Mixes Constructed with Private Equity
  - Private equity allocations range from 9% to 13%
  - Private equity allocations lead to reductions in allocations to all asset classes except domestic fixed which increases to offset risk
  - Private infrastructure is included in the optimal mixes

- Performance Improves with the Introduction of Private Equity
  - Identical targeted compound returns so performance differences show up as changes in risk
  - Risk is reduced by 56 bps for mix 1 up to 114 bps for mix 5 by the introduction of private equity
  - Mix risk reduction comes from superior return and risk tradeoff for private equity
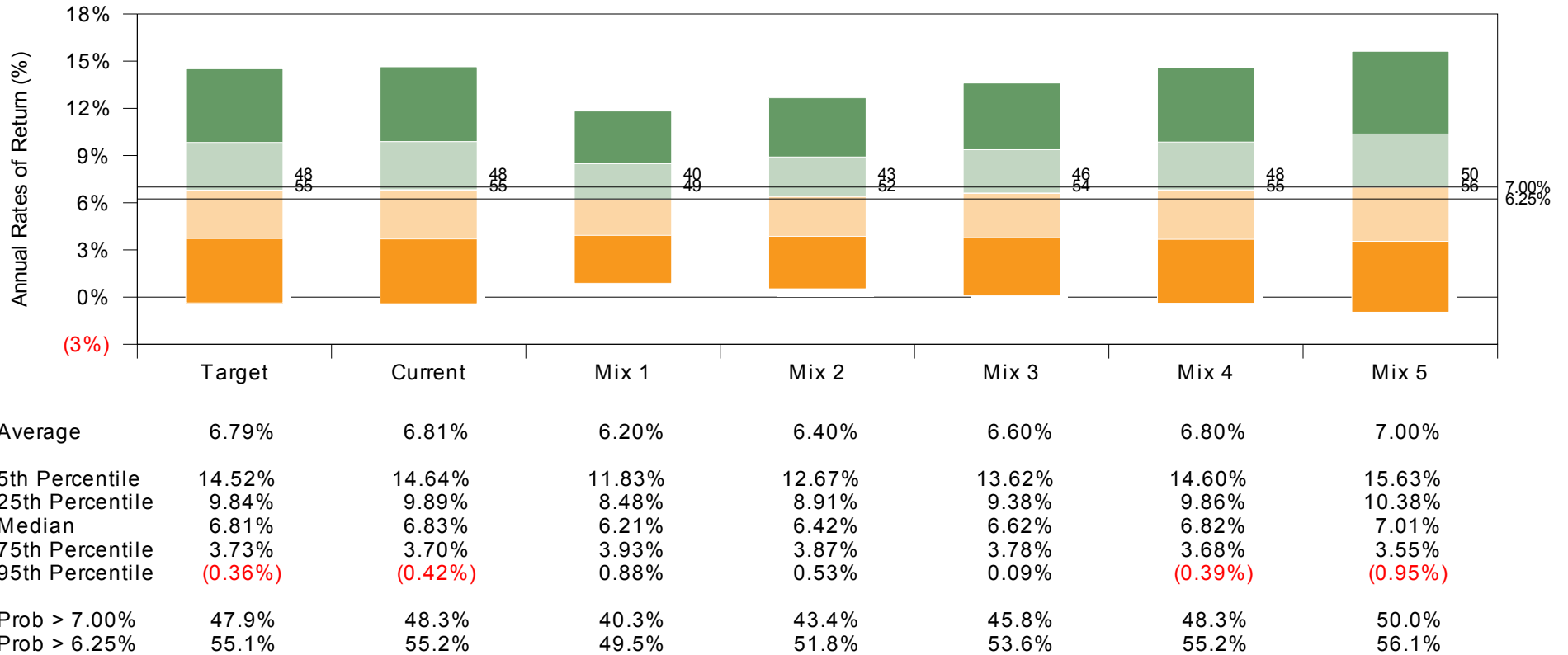
Asset Mix Alternatives

Efficient Frontier
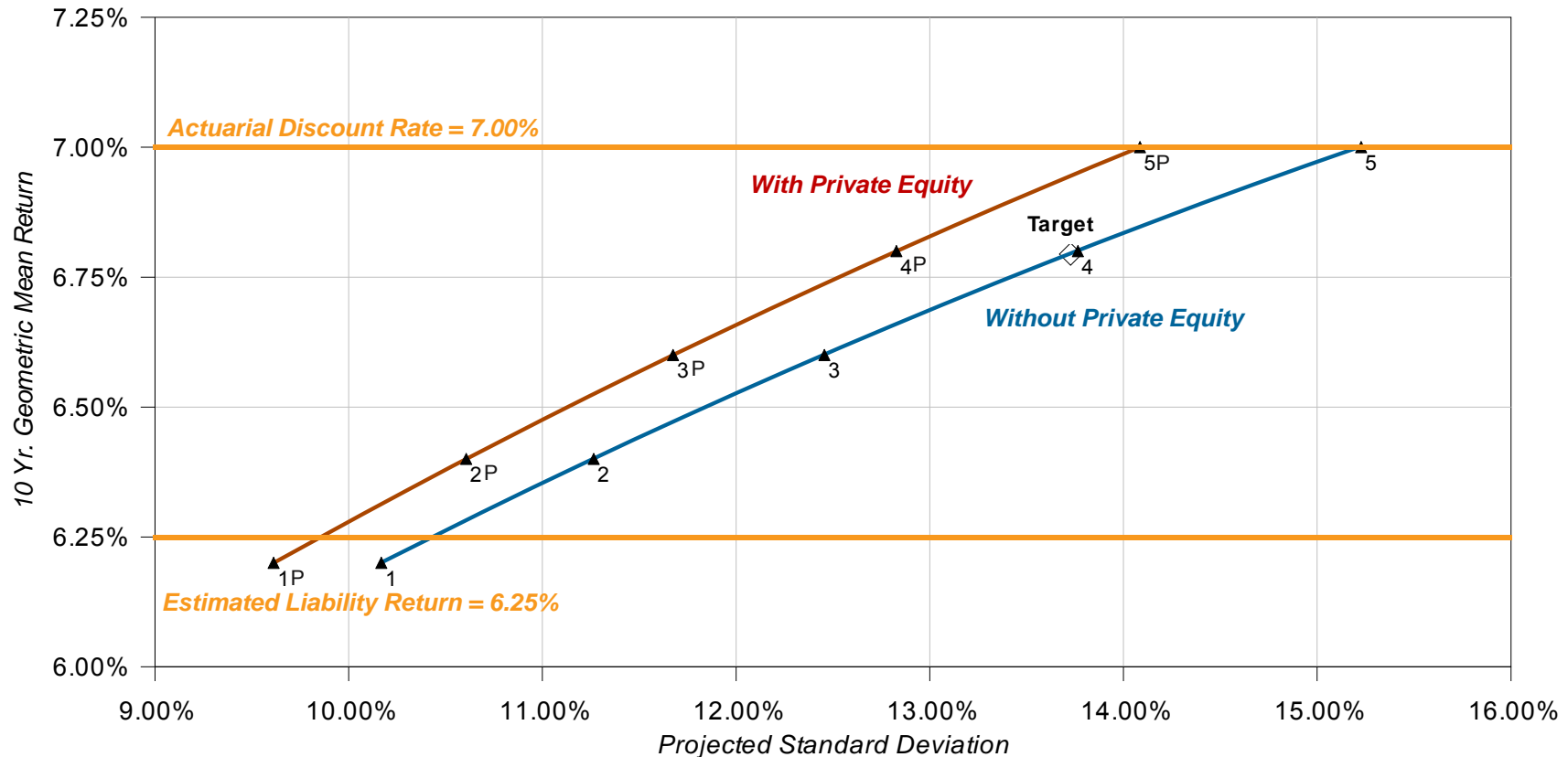
The efficient frontier represents mixes which optimally trade off between expected return and expected risk

Mixes 1-5 represent efficient mixes with Private Infrastructure but without Private Equity, while Mixes 1P-5P represent efficient mixes with both Private Infrastructure and Private Equity

Asset Mix Alternatives

Range of Expected Rates of Return without Private Equity, 10 Years

	Target	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Average	6.79%	6.81%	6.20%	6.40%	6.60%	6.80%	7.00%
5th Percentile	14.52%	14.64%	11.83%	12.67%	13.62%	14.60%	15.63%
25th Percentile	9.84%	9.89%	8.48%	8.91%	9.38%	9.86%	10.38%
Median	6.81%	6.83%	6.21%	6.42%	6.62%	6.82%	7.01%
75th Percentile	3.73%	3.70%	3.93%	3.87%	3.78%	3.68%	3.55%
95th Percentile	(0.36%)	(0.42%)	0.88%	0.53%	0.09%	(0.39%)	(0.95%)
Prob > 7.00%	47.9%	48.3%	40.3%	43.4%	45.8%	48.3%	50.0%
Prob > 6.25%	55.1%	55.2%	49.5%	51.8%	53.6%	55.2%	56.1%

● Bar Sizes Proportional to Return Volatility

− Increases in volatility increase the ranges of returns from mix 1 to mix 5

− Increased volatility leads to lower 95th percentile returns including losses for mixes 4 and 5 as well as target and current

● Higher Returns Associated with Higher Volatilities

− Mixes 4, 5, target and current have the highest probabilities of earning the actuarial discount rate (7%) and the liability return (6.25%)

Asset Mix Alternatives

Range of Expected Rates of Return with Private Equity, 10 Years
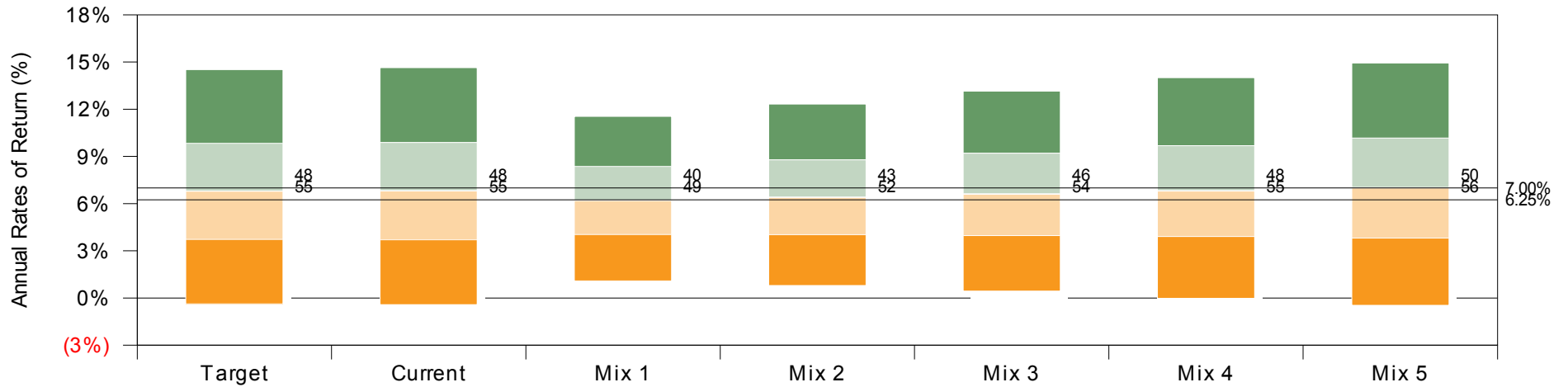
	Target	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Average	6.79%	6.81%	6.20%	6.40%	6.60%	6.80%	7.00%
5th Percentile	14.52%	14.64%	11.55%	12.33%	13.15%	14.01%	14.94%
25th Percentile	9.84%	9.89%	8.37%	8.78%	9.21%	9.69%	10.17%
Median	6.81%	6.83%	6.21%	6.42%	6.63%	6.83%	7.03%
75th Percentile	3.73%	3.70%	4.04%	4.04%	3.97%	3.91%	3.81%
95th Percentile	(0.36%)	(0.42%)	1.09%	0.80%	0.45%	(0.02%)	(0.46%)
Prob > 7.00%	47.9%	48.3%	40.0%	43.3%	45.8%	48.4%	50.2%
Prob > 6.25%	55.1%	55.2%	49.5%	52.1%	53.8%	55.4%	56.5%

- Introduction of Private Equity Reduces Volatility by Construction
  - Targeted returns are the same for mixes with and without private equity

- Reduced Volatility Narrows Range of Return Bars
  - 95th percentile returns are higher than without private equity but 5th percentile returns are lower
  - Improvement in 95th percentile returns ranges from 21 bps for mix 1 up to 49 bps for mix 5
    - *Difference in average return between mixes is 20 bps*

- Improvements in Hurdle Probabilities Less than 0.5%

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Simulated Financial Conditions

Actuarial Liability, 2019 – 2029

Pctl	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
95	746.1	775.0	803.1	830.3	858.4	884.7	911.1	937.2	962.0	986.3	1,010.2
75	742.8	768.9	794.0	817.9	842.0	864.6	884.7	906.7	925.4	942.7	961.1
50	737.1	756.4	775.8	796.0	813.0	830.3	848.4	864.5	880.8	895.2	910.8
25	730.0	743.7	756.8	769.8	785.5	799.5	814.5	828.1	840.2	850.5	862.8
5	719.4	723.4	730.3	739.5	744.3	753.3	761.5	769.5	778.3	785.7	797.2
Range	26.7	51.6	72.8	90.8	114.1	131.4	149.6	167.7	183.7	200.7	213.1

- Liabilities Vary Primarily with Inflation
  - Inflation impacts liabilities directly by changing the sizes of the COLAs
  - Inflation impacts liabilities indirectly by changing member compensation which is a component of the retirement benefit formula
- Inflation Volatility is Low
- Actuarial Discount Rate is Assumed to be Constant

Simulated Financial Conditions

Market Value of Assets – Target, 2019 – 2029
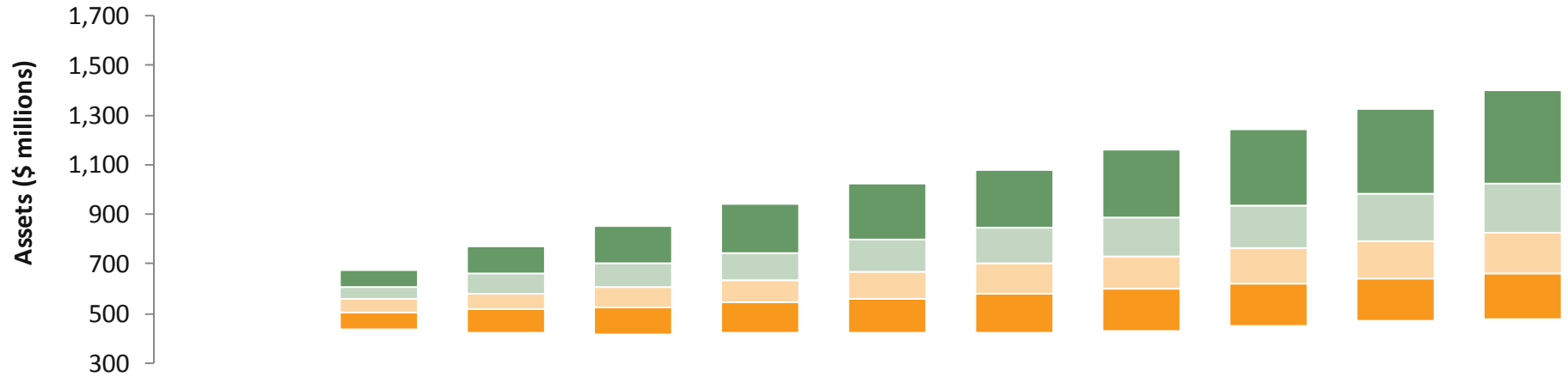
Pctl	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
5	532.1	681.6	774.8	856.5	940.8	1,022.0	1,075.2	1,158.5	1,239.0	1,319.9	1,395.5
25	532.1	611.4	665.4	708.3	749.8	799.5	847.3	887.4	937.7	984.9	1,026.1
50	532.1	564.3	589.5	616.8	638.9	676.7	705.0	736.5	766.8	798.4	826.6
75	532.1	516.4	523.8	535.3	551.2	567.9	584.2	605.3	630.2	650.2	668.0
95	532.1	444.3	434.3	429.6	431.9	432.1	433.2	442.4	459.9	480.4	489.2
Range	0.0	237.3	340.5	426.8	508.9	589.9	642.0	716.2	779.1	839.6	906.3

- Forecast Market Value of Assets Depends on Volatile Variables
  - Investment returns
  - Contributions
- Asset Value Volatility is a Larger Driver of Funded Status Volatility Than Liability Volatility

Simulated Financial Conditions

Funded Ratio (Market) – Target, 2019 – 2029
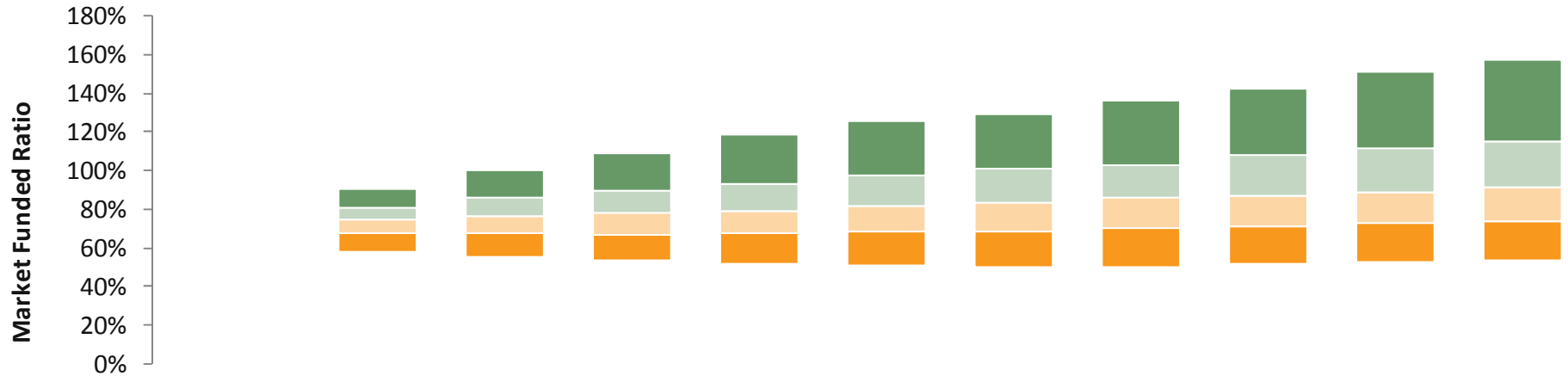
Pctl	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
5	74%	91%	100%	109%	118%	125%	129%	135%	142%	150%	156%
25	73%	81%	86%	90%	93%	98%	101%	103%	108%	111%	114%
50	72%	75%	77%	78%	79%	82%	84%	86%	87%	89%	91%
75	72%	68%	68%	68%	68%	69%	69%	70%	71%	73%	74%
95	71%	59%	56%	54%	53%	52%	51%	51%	52%	53%	54%
Range	3%	32%	44%	54%	65%	73%	78%	84%	89%	96%	102%

- Market Funded Ratio = Market Value of Assets / Liabilities

- Funded Ratio Range Increases with Time as Simulations Applied to Progressively Wider Range of Starting Points

- Median Funded Ratio Increases as Expected Returns and Contributions Realized

- 95th Percentile Funded Ratio Falls as Contributions Don't Compensate for Investment Losses

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Simulated Financial Conditions without Private Equity

Employer Contributions, 2029 (10 years)

- Contributions in 2029 are Driven by Prior Simulations
  - Contributions made in years 1 through 9
  - Investment returns earned in years 1 through 9
  - Benefit expected to be accrued in year 10

- Median Contributions Decrease with Increasing Allocations to Growth Assets
  - Mix 1 median contributions are $29.2 mm
  - Mix 5 median contributions are $25.0 mm

- 95th Percentile Contributions Increase with Increasing Allocations to Growth Assets
  - Mix 1 95th percentile contributions are $50.5 mm
 - Mix 5 95th percentile contributions are $55.7 mm
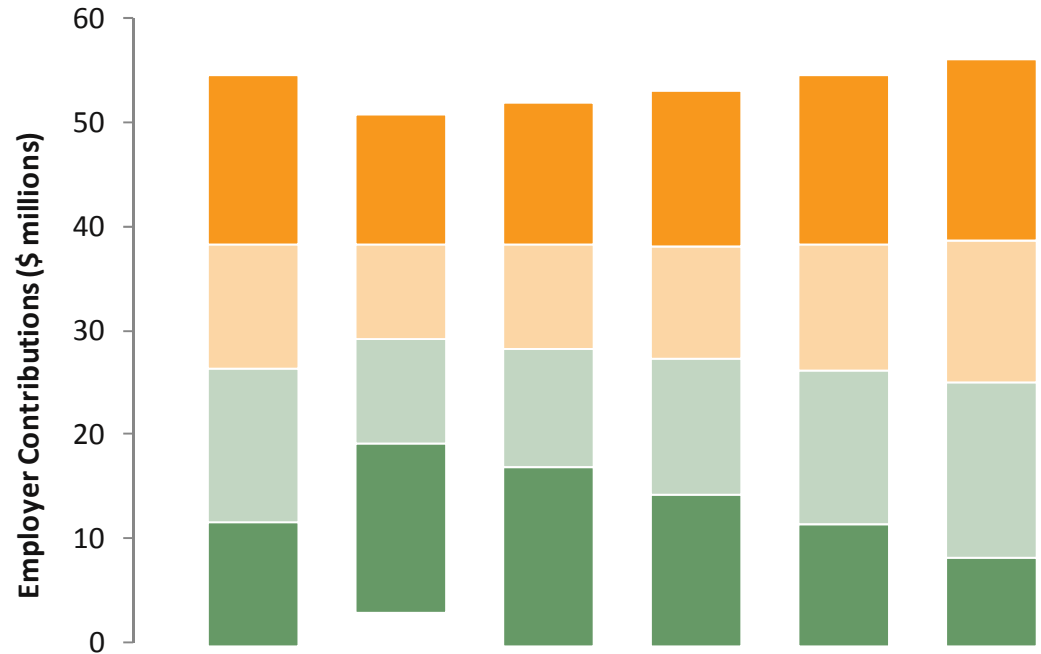
Pctl	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
95	54.2	50.5	51.6	52.7	54.2	55.7
75	38.2	38.2	38.1	37.9	38.1	38.5
50	26.4	29.2	28.2	27.2	26.1	25.0
25	11.8	19.2	17.0	14.5	11.6	8.4
5	0.0	3.1	0.0	0.0	0.0	0.0
Range	54.2	47.3	51.6	52.7	54.2	55.7

Simulated Financial Conditions without Private Equity

Present Value of Cumulative Contributions, 2029 (10 years)

- ● Present Value of Cumulative Contributions (PVCC) is the Total Employer Cost to Year 10
  - – Sum of all contributions made in years 1 through 10
  - – The present value process adjusts for inflation that is expected in each year of the projection

- ● Median PVCCs Decrease with Increasing Allocations to Growth Assets
  - – Same pattern as in any single year of contributions
  - – Mix 1 median PVCC is $268 mm
  - – Mix 5 median PVCC is $254 mm

- ● 95th Percentile Contributions Increase with Increasing Allocations to Growth Assets
  - – Same pattern as in any single year of contributions
  - – Mix 1 95th percentile PVCC is $355 mm
 - – Mix 5 95th percentile PVCC is $379 mm
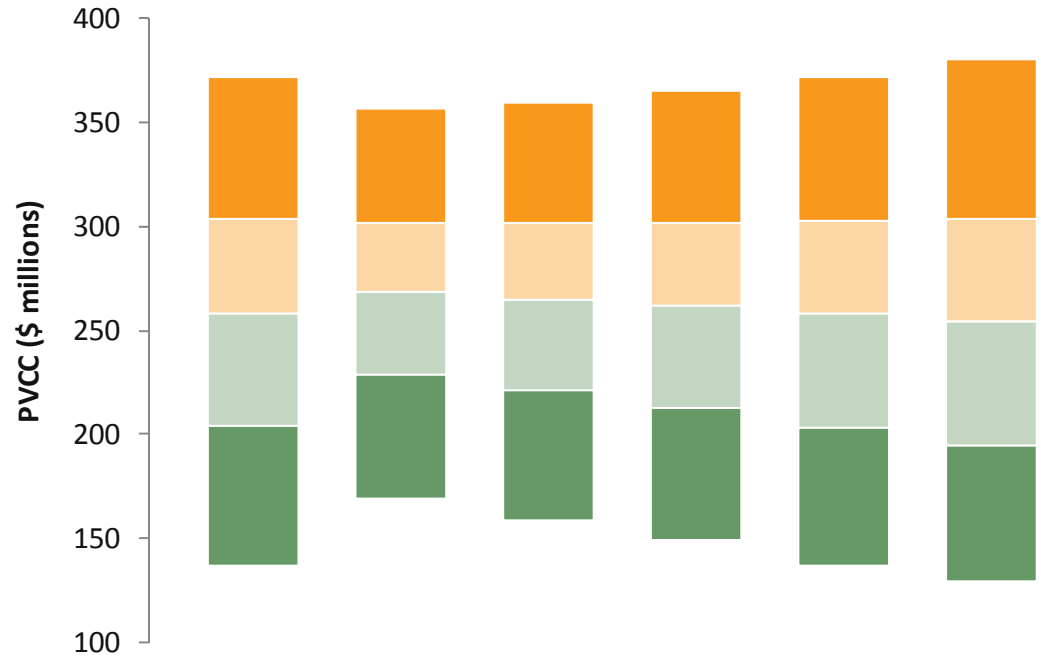
Pctl	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
95	370	355	358	364	370	379
75	303	301	301	301	302	303
50	258	268	265	262	258	254
25	204	229	221	213	204	195
5	138	170	160	150	138	131
Range	232	185	198	214	232	248

Simulated Financial Conditions without Private Equity

Market Value of Assets, 2029 (10 years)

- Year 10 Market Value of Assets Reflects Starting Value + Cash Flows
  - All simulations begin with $532.4 million on July 1, 2019
  - Assets are increased due to simulated contributions and investment returns
  - Assets are decreased due to expenses and simulated benefits payments

- Median Assets Increase with Increasing Allocations to Growth Assets
  - Mix 1 median assets are $781 mm
  - Mix 5 median assets are $849 mm

- 95th Percentile Assets Decrease with Increasing Allocations to Growth Assets
  - Mix 1 95th percentile assets are $527 mm
  - Mix 5 95th percentile assets are $474 mm

- Returns Impact Assets Both Directly and Through Contributions
  - Higher returns reduce contributions and vice versa
 - For example median mix 5 assets reflect lower contributions than median mix 1 assets
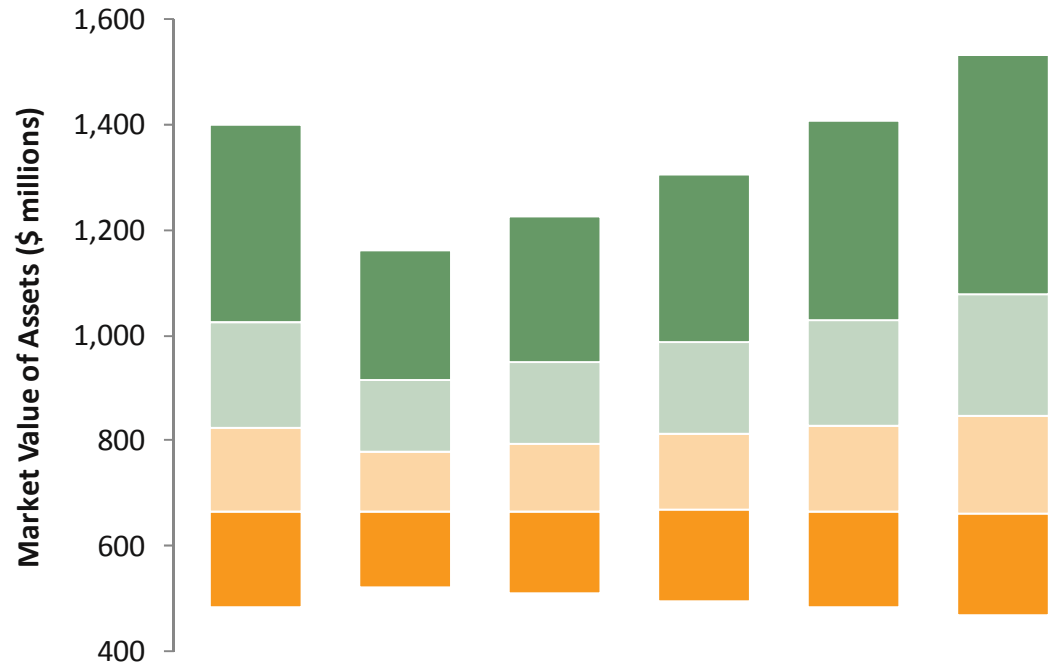
Pctl	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
5	1,395	1,158	1,222	1,303	1,402	1,526
25	1,026	916	950	987	1,029	1,076
50	827	781	797	813	829	849
75	668	667	669	671	669	666
95	489	527	515	501	489	474
Range	906	630	706	802	912	1,052

Simulated Financial Conditions without Private Equity

Unfunded Liability, Market Value of Assets, 2029 (10 years)

- Ideally, Yearly Contributions Should Pay for Benefits Earned in that Year

- Practically, Contributions Vary from Benefit Accruals
  - Experience differs from assumptions
  - Benefits could be granted retroactively
  - Full contributions not budgeted

- Unfunded Liabilities Result from Shortfalls
  - Unfunded liabilities need to be amortized Future contributions that fall short of funding policy will result in higher ranges of unfunded liabilities than those at right
  - Investment returns generally have smaller impacts on funding than contributions

- Median Unfunded Decreases with Higher Allocations to Growth Assets
  - Mix 1 median unfunded is $121 mm
  - Mix 5 median unfunded is $59 mm

- 95th Percentile Unfunded Increases with Higher Levels of Growth Assets
  - Mix 1 95th percentile unfunded is $391 mm
 - Mix 5 95th percentile unfunded is $451 mm
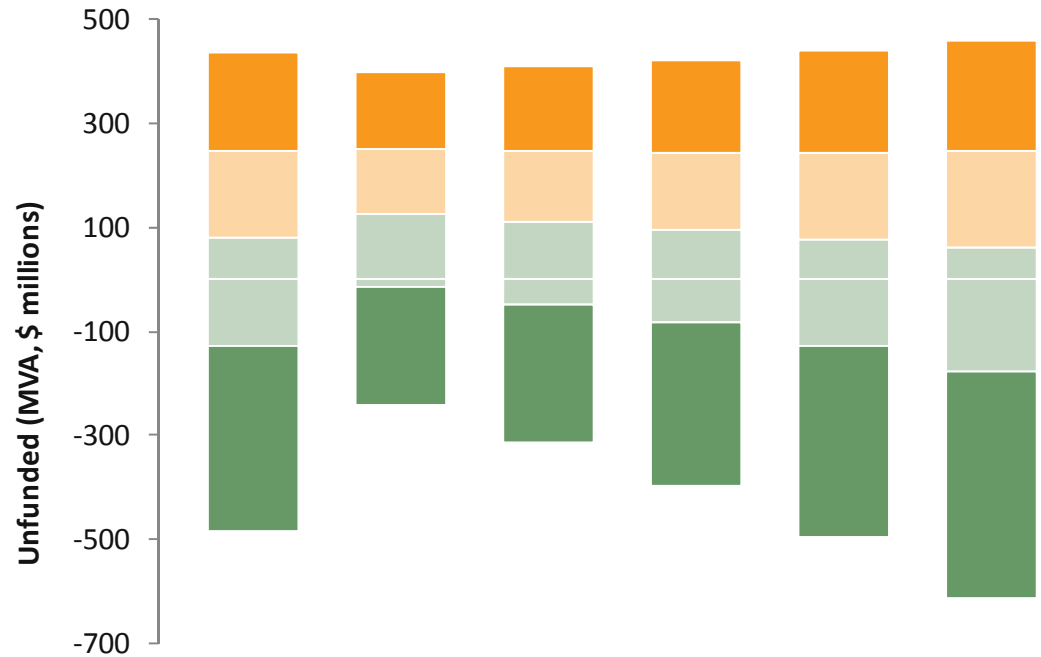
Pctl	Targe	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
95	431	391	402	415	433	451
75	241	245	242	241	239	242
50	78	121	107	92	75	59
25	-126	-14	-50	-85	-127	-175
5	-480	-240	-313	-393	-490	-606
Range	911	631	715	808	923	1,056

Simulated Financial Conditions without Private Equity

Ultimate Net Cost, 2029 (10 years)

- Ultimate Net Cost (UNC) is the Total Employer Cost of the Plan
  - UNC = PVCC + Unfunded Liability
  - Includes costs already paid
    - *Contributions*
    - *Expenses*
  - Includes future costs
    - *Unfunded liability*
  - Calculated at the end of the 10-year horizon
  - All costs are in today's dollars for an "apples to apples" comparison

- Median UNC Decreases with Higher Allocations to Growth Assets
  - Mix 1 median UNC is $358 mm
  - Mix 5 median UNC is $290 mm

- 95th Percentile Unfunded Increases with Higher Levels of Growth Assets
  - Mix 1 95th percentile UNC is $630 mm
 - Mix 5 95th percentile UNC is $687 mm
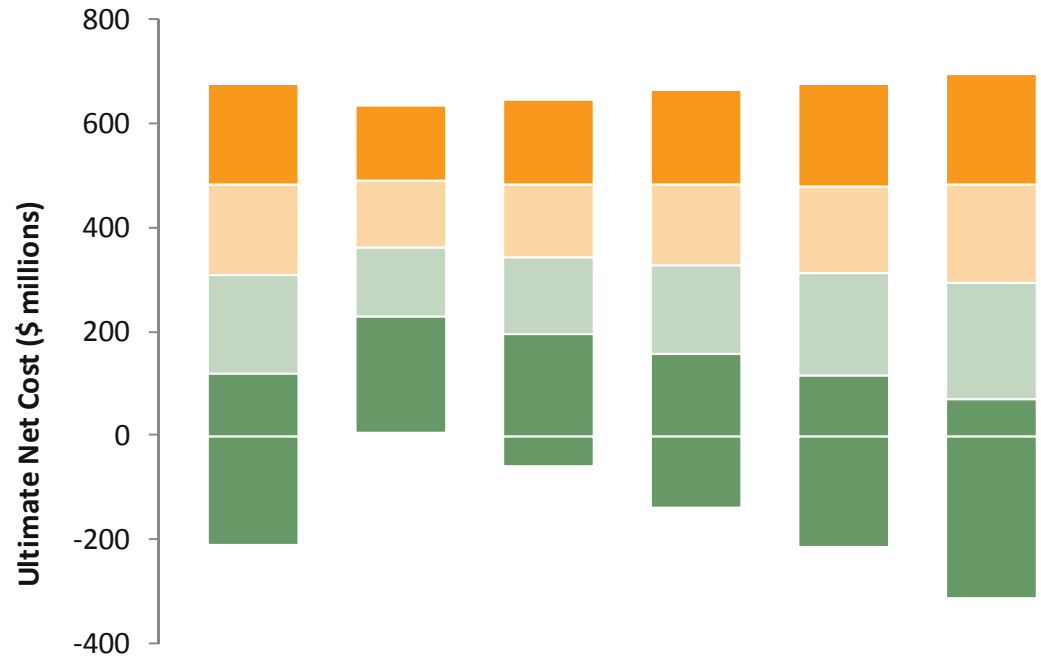
Pctl	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
95	668	630	640	657	671	687
75	478	485	481	477	475	477
50	308	358	341	325	311	290
25	119	229	195	157	115	71
5	-204	6	-56	-135	-209	-309
Range	872	624	696	792	880	996

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Simulated Financial Conditions with Private Equity

Employer Contributions, 2029 (10 years)

- **Median Contributions Decrease with Increasing Allocations to Growth Assets**
  - Mix 1P median contributions are $29.4 mm
  - Mix 5P median contributions are $25.3 mm
  - Median contributions with and without private equity don't change significantly because corresponding asset mixes have the same expected rates of return

- **95th Percentile Contributions Increase with Increasing Allocations to Growth Assets**
  - Mix 1P 95th percentile contributions are $50.0 mm
  - Mix 5P 95th percentile contributions are $54.4 mm
  - The benefits of investing in private equity are reflected in the 95th percentile results
  - The benefits are smaller for lower allocations to private equity
    - *$500k for 9% in mix 1*
  - Higher allocations bring greater rewards
   - *$1.3 million for mix 5*
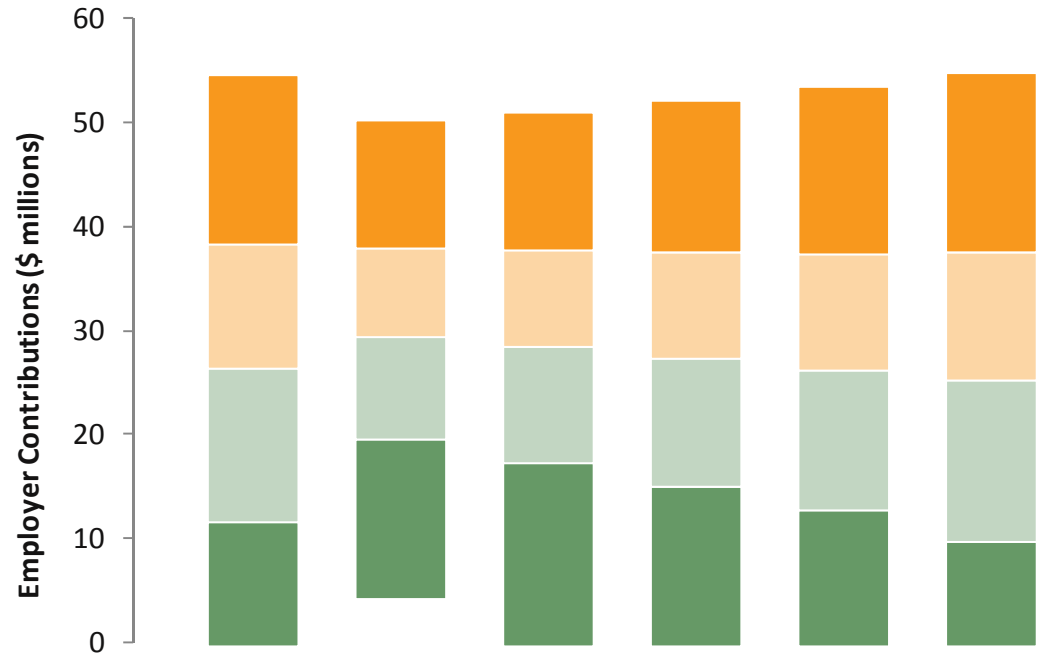
Pctl	Target	Mix 1P	Mix 2P	Mix 3P	Mix 4P	Mix 5P
95	54.2	50.0	50.7	51.9	53.2	54.4
75	38.2	37.8	37.6	37.4	37.2	37.4
50	26.4	29.4	28.4	27.3	26.2	25.3
25	11.8	19.7	17.4	15.2	12.8	10.0
5	0.0	4.5	0.0	0.0	0.0	0.0
Range	54.2	45.5	50.7	51.9	53.2	54.4

Simulated Financial Conditions with Private Equity

Present Value of Cumulative Contributions, 2029 (10 years)

- Median PVCCs Decrease with Increasing Allocations to Growth Assets
  - Same pattern as in any single year of contributions
  - Mix 1 median PVCC is $268 mm
  - Mix 5 median PVCC is $254 mm

- 95th Percentile Contributions Increase with Increasing Allocations to Growth Assets
  - Same pattern as in any single year of contributions
  - Mix 1 95th percentile PVCC is $351 mm
  - Mix 5 95th percentile PVCC is $369 mm

- The Benefits of Private Equity Magnified by 10 Years of Contributions
  - 95th percentile PVCC is reduced by $4 mm for mix 1 and $10 mm for mix 5 relative to the mixes without private equity
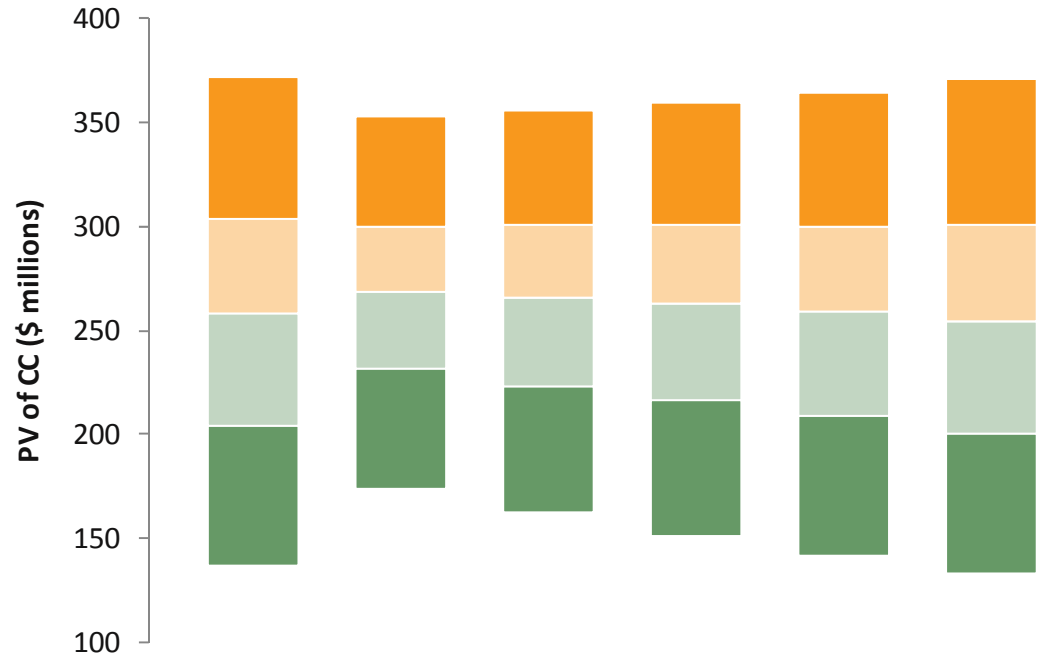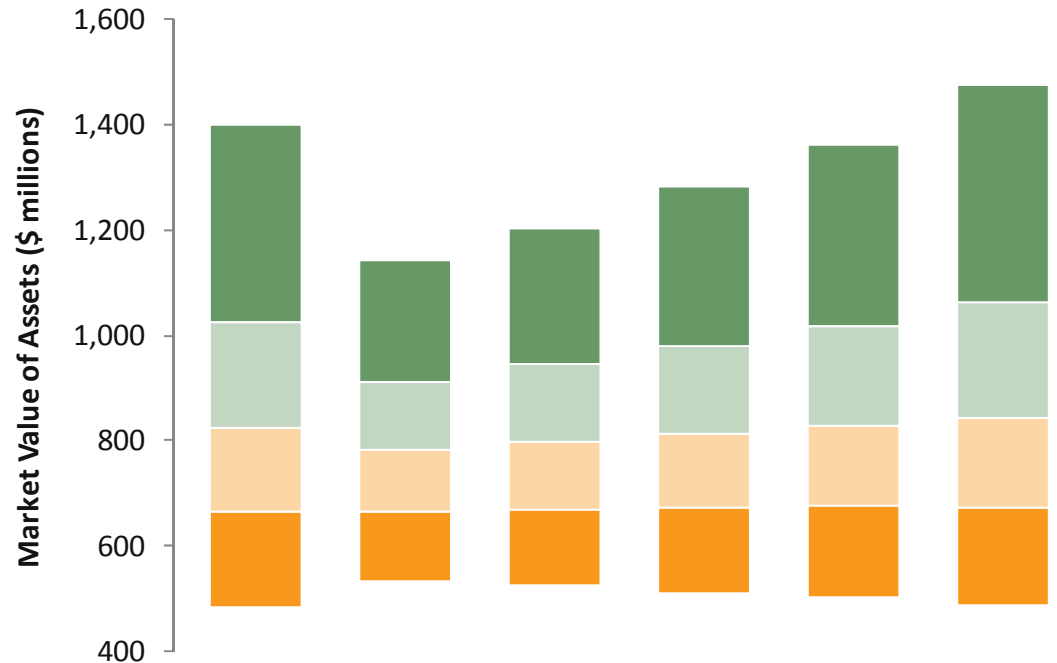

Pctl	Target	Mix 1P	Mix 2P	Mix 3P	Mix 4P	Mix 5P
95	370	351	355	358	363	369
75	303	300	300	300	300	300
50	258	268	265	262	259	254
25	204	231	224	217	209	201
5	138	175	163	152	143	134
Range	232	177	191	206	220	235

Simulated Financial Conditions with Private Equity

Market Value of Assets, 2029 (10 years)

- Median Assets Increase with Increasing Allocations to Growth Assets
  - Mix 1 median assets are $783 mm
  - Mix 5 median assets are $846 mm

- 95th Percentile Assets Decrease with Increasing Allocations to Growth Assets
  - Mix 1 95th percentile assets are $538 mm
  - Mix 5 95th percentile assets are $492 mm

- Even with Smaller Contributions Market Values Can Be Increased by Private Equity Investments
  - Medians are comparable
  - Mix 1 95th percentile increases by $11 mm relative to the mixes without private equity
 - Mix 5 95th percentile increases by $18 mm relative to the mixes without private equity

Pctl	Target	Mix 1P	Mix 2P	Mix 3P	Mix 4P	Mix 5P
5	1,395	1,140	1,201	1,279	1,359	1,469
25	1,026	911	944	979	1,018	1,062
50	827	783	798	813	830	846
75	668	669	672	675	678	676
95	489	538	529	516	507	492
Range	906	602	672	763	852	977

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Simulated Financial Conditions with Private Equity

Unfunded Liability, Market Value of Assets, 2029 (10 years)

- Median Unfunded Decreases with Higher Allocations to Growth Assets
  - Mix 1 median unfunded is $124 mm
  - Mix 5 median unfunded is $62 mm

- 95th Percentile Unfunded Increases with Higher Levels of Growth Assets
  - Mix 1 95th percentile unfunded is $379 mm
  - Mix 5 95th percentile unfunded is $434 mm

- Private Equity Lowers Unfunded Liability in 95th Percentile
  - Reduction corresponds to the higher market value of assets
  - Mix 1 decreases by $12 mm relative to the mixes without private equity
 - Mix 5 decreases by $17 mm relative to the mixes without private equity
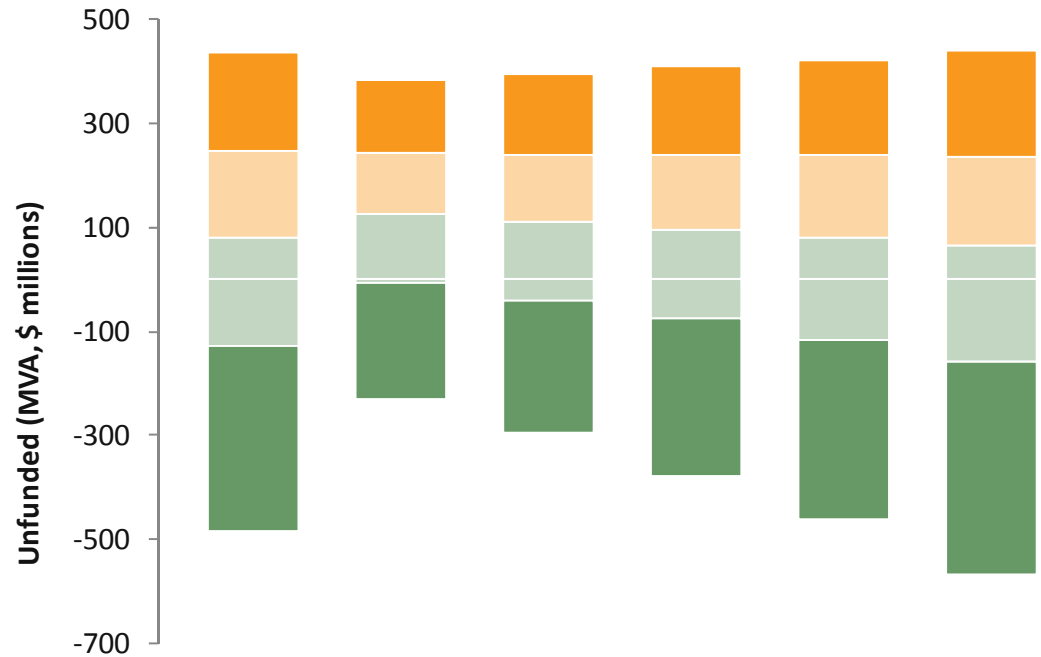
Pctl	Target	Mix 1P	Mix 2P	Mix 3P	Mix 4P	Mix 5P
95	431	379	390	402	415	434
75	241	239	237	235	234	233
50	78	124	109	93	78	62
25	-126	-9	-41	-76	-116	-159
5	-480	-230	-294	-373	-458	-564
Range	911	609	684	776	873	997

Simulated Financial Conditions with Private Equity

Ultimate Net Cost, 2029 (10 years)

- Median UNC Decreases with Higher Allocations to Growth Assets
  - Mix 1 median UNC is $360 mm
  - Mix 5 median UNC is $292 mm

- 95th Percentile Unfunded Increases with Higher Levels of Growth Assets
  - Mix 1 95th percentile UNC is $624 mm
  - Mix 5 95th percentile UNC is $669 mm

- Private Equity Lowers Unfunded Liability in 95th Percentile
  - Reduction corresponds to the higher market value of assets
  - Mix 1 decreases by $6 mm relative to the mixes without private equity
  - Mix 5 decreases by $18 mm relative to the mixes without private equity
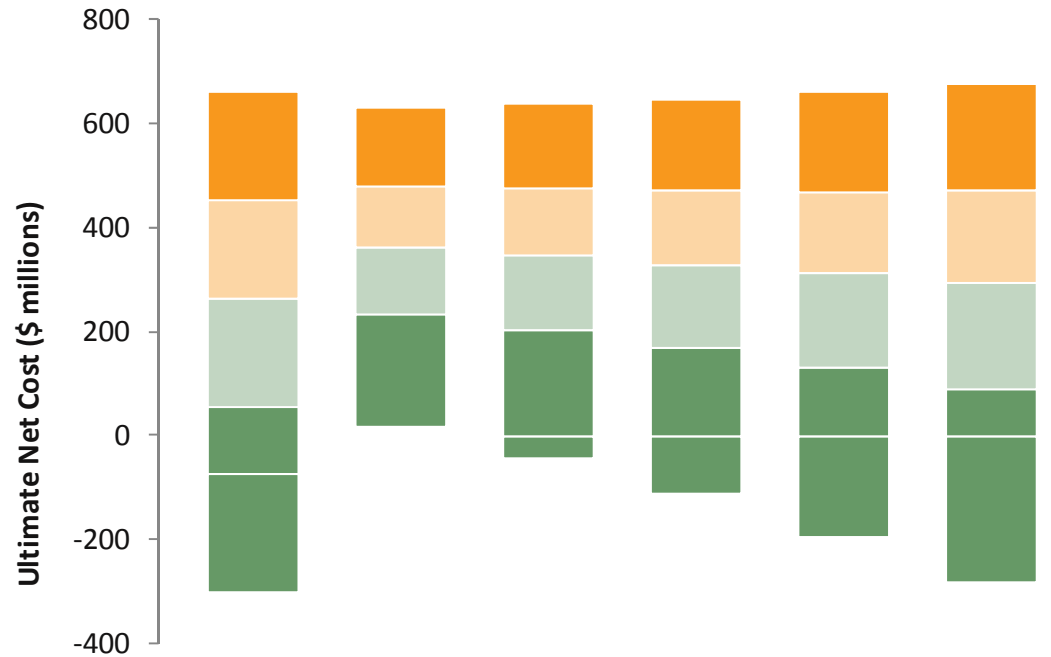
Pctl	Target	Mix 1P	Mix 2P	Mix 3P	Mix 4P	Mix 5P
95	668	624	632	639	653	669
75	478	475	471	468	465	467
50	308	360	344	326	310	292
25	119	232	202	168	131	90
5	-204	19	-43	-110	-192	-276
Range	872	604	674	750	845	944

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Simulated Financial Conditions

Ultimate Net Cost, 2029 (10 years)

Pctl	Target	Mix 1	Mix 1P	Mix 2	Mix 2P	Mix 3	Mix 3P	Mix 4	Mix 4P	Mix 5	Mix 5P
95	668	630	624	640	632	657	639	671	653	687	669
75	478	485	475	481	471	477	468	475	465	477	467
50	308	358	360	341	344	325	326	311	310	290	292
25	119	229	232	195	202	157	168	115	131	71	90
5	-204	6	19	-56	-43	-135	-110	-209	-192	-309	-276
Range	872	624	604	696	674	792	750	880	845	996	944

- Consolidation of Prior UNC Exhibits with and without Private Equity

- UNC for Mixes with Identical Return Targets
  - Differences between 50th percentile of comparable mixes is not statistically meaningful

- UNC for 95th Percentiles Across Mixes with Identical Return Targets Displays Benefit of Private Equity
  - Mix 1 decreases by $6 mm
  - Mix 5 decreases by $18 mm

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Simulated Financial Conditions

Ultimate Net Cost – Expected vs Worst Case (95%), 2029 (10 years)
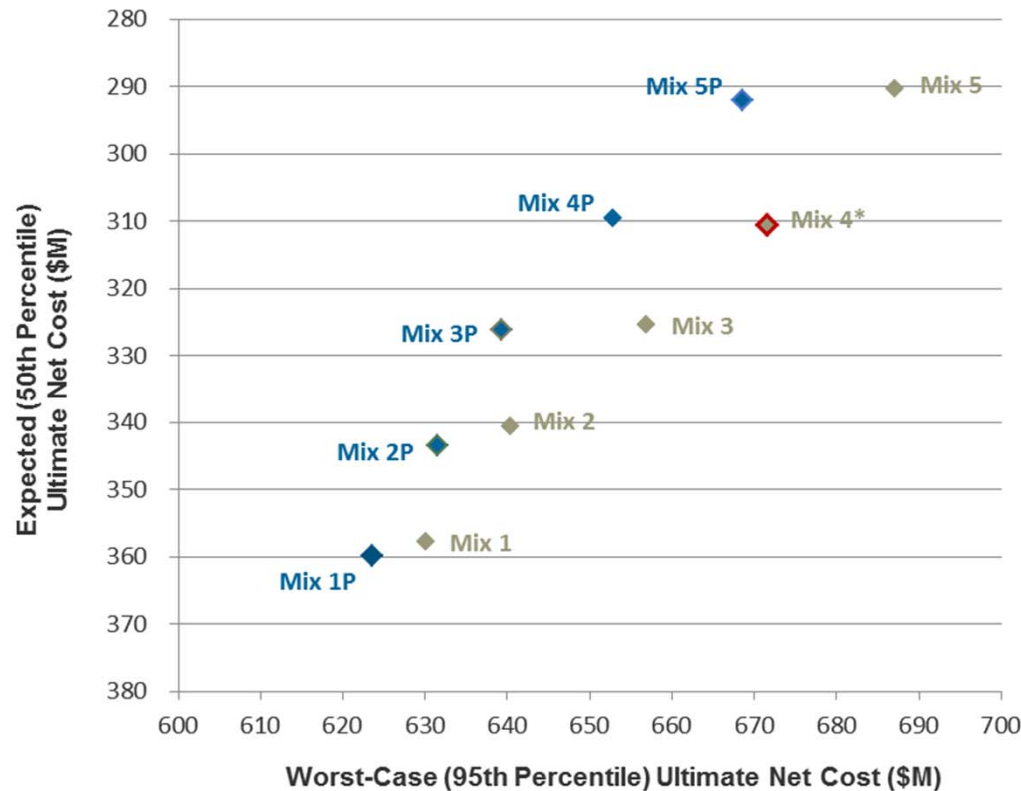
- Private Equity Improves Performance
  - Mixes with a "P" notation have essentially the same expected ultimate net cost but measurably better worst-case outcomes
  - The greater the private equity allocation, the greater the improvement in performance

- Potential Improvement in Expected Performance Depends on Priorities
  - Moving from the current target/mix 4 to mix 4P improves the worst-case outcome while maintaining the expected outcome
  - Moving from the current target/mix 4 to mix 5P improves the expected outcome while maintaining the worst-case outcome

* Target Mix is represented here by Mix 4, due to how similar the two mixes are.

Conclusion

Summary and Observations

- Mendocino County Employees Retirement Association is Moving Toward Full Funding
  - The realization of full funding is most dependent on adherence to the existing funding policy

- The Existing Target Asset Mix is Expected to Slightly Underperform the Actuarial Discount Rate
  - The actuarial discount rate is 7% vs. an expected return of 6.8% for the existing target mix
  - The underlying projections for the asset classes in the target mix have a 10-year time horizon
  - The amortization period for the unfunded liability is almost 20 years
  - The retirement program has a perpetual time horizon
  - There is ample opportunity for returns to improve over longer time horizons indicating no requirement to change existing target mix

- Introduction of Private Infrastructure Could Improve the Investment Program
  - Impact on theoretical return and risk is minor
  - In practice private infrastructure adds a diversified source of returns with the potential for improved performance in inflationary environments

- Inclusion of Private Equity in the Investment Program Offers the Greatest Opportunities for Improved Performance
  - Measurably increases the projected return at a given volatility level or reduces volatility for a given return target
  - For asset mixes with comparable projected returns private equity could reduce costs if investment markets perform poorly
    - *Cost reduction is about $15 million over 10 years relative to target and similar optimal portfolio without private equity (mix 4)*
    - *Cost reductions for mixes with and without private equity range from $6 million for the most conservative mix up to $18 million for the most aggressive*
  - Private equity costs are high
    - *Management fees including fund-of-funds fees*
    - *Administrative costs including Board and staff initiation, maintenance and monitoring time*

Conclusion

Less Disruptive Alternative Mixes

Asset Classes	Benchmark Mixes		Constraints		Optimal Mixes					
	Target	Current	Min	Max	Mix 1LP	Mix 2LP	Mix 3LP	Mix 4LP	Low Dis	Mix 5LP
Domestic Equity	38	40	0	100	23	26	28	31	31	32
International Equity	29	28	0	100	16	17	19	21	21	22
Domestic Fixed	22	21	0	100	47	42	36	29	25	26
Real Estate	11	11	0	100	6	7	7	8	11	9
Private Infrastructure	0	0	0	100	2	2	3	3	4	3
Private Equity	0	0	0	100	6	6	7	8	8	8
Totals	100	100			100	100	100	100	100	100
1-Year Return	7.53	7.57			6.52	6.81	7.12	7.46	7.63	7.62
10-Year Compound Return	6.79	6.81			6.20	6.40	6.60	6.80	6.89	6.89
Risk (Standard Deviation)	13.73	13.88			9.79	10.81	11.91	13.11	13.72	13.69
Public Equity	67	68			39	43	47	52	52	54
Illiquid	11	11			14	15	17	19	23	20

- Optimal Mixes Above Constructed with Private Equity Implemented with 15% of Total Public Equity
  - Original mixes held private equity at 25% of total public equity
  - Private equity allocations range from 6% to 8%

- Mix 4LP Has the Same Return with Lower Risk Than Target (-62 bps)
  - 15% from Public Equity and 3% from Real Estate to Private Equity (8%), Private Infrastructure (3%), Fixed Income (7%)

- Low Disruption Mix Has Roughly the Same Risk as Target with a Higher Return (+10 bps)
  - 15% from Public Equity to Private Equity (8%), Private Infrastructure (4%), and Fixed Income (3%)

Liquidity Analysis

Simulated Financial Conditions

Liquidity – Net Outflows (% of Liquid Assets), 2019 – 2028 (Target, 11% Illiquid)

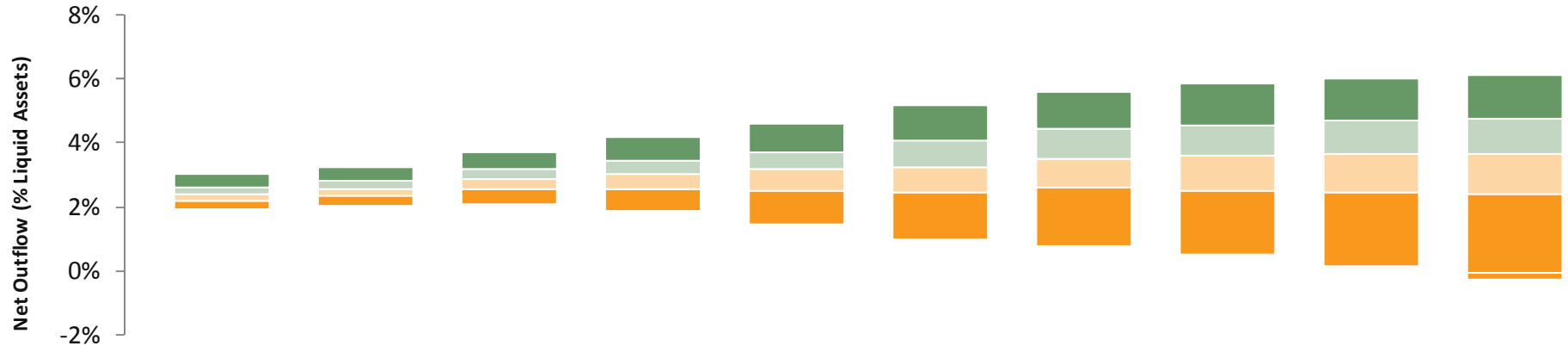| Pctl	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
95	2.7%	2.9%	3.4%	3.8%	4.1%	4.7%	5.1%	5.2%	5.4%	5.5%
75	2.3%	2.5%	2.8%	3.1%	3.3%	3.6%	4.0%	4.0%	4.2%	4.2%
50	2.1%	2.3%	2.5%	2.7%	2.8%	2.9%	3.1%	3.2%	3.3%	3.3%
25	1.9%	2.1%	2.3%	2.3%	2.2%	2.1%	2.3%	2.2%	2.1%	2.0%
5	1.7%	1.8%	1.8%	1.6%	1.2%	0.7%	0.5%	0.2%	-0.1%	-0.4%
Range	1.0%	1.1%	1.5%	2.2%	3.0%	4.0%	4.6%	5.0%	5.5%	5.9%

- Expected Net Outflow = Benefit Payments – Contributions
  - A useful indicator of ongoing liquidity needs.
  - Median ratio < 7.0% typically manageable; >10% presents high liquidity pressure and illiquid investments may need to be reduced
  - Based on our experience, most public funds have net outflow of 4-7% depending on funded status, funding policy and plan maturity
- For the current target, liquidity needs are manageable: even in the worst-case scenario net outflows are below 6%
- The liquidity analysis is sensitive to the funding policy which drives the amount of future contributions

Simulated Financial Conditions

Liquidity – Net Outflows (% of Liquid Assets), 2019 – 2028 (Mix 4P, 21% Illiquid)

Pctl	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
95	3.0%	3.2%	3.7%	4.2%	4.5%	5.1%	5.5%	5.8%	6.0%	6.1%
75	2.6%	2.8%	3.2%	3.4%	3.7%	4.0%	4.4%	4.5%	4.7%	4.7%
50	2.4%	2.6%	2.9%	3.0%	3.2%	3.3%	3.5%	3.6%	3.7%	3.7%
25	2.2%	2.3%	2.6%	2.6%	2.5%	2.5%	2.6%	2.5%	2.5%	2.4%
5	2.0%	2.0%	2.1%	1.9%	1.5%	1.0%	0.8%	0.6%	0.2%	-0.2%
Range	1.1%	1.2%	1.6%	2.3%	3.1%	4.1%	4.7%	5.2%	5.8%	6.3%

- For Mix 4P, with allocations to Private Equity, Private Infrastructure, and Private Real Estate totaling ~21% of plan assets, net outflows are 3-4% of in the expected case, and slightly over 6% in the worst-case

- Moving from Target to Mix 4P increases the worst case net outflow by ~0.6%

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Glossary of Terms

Glossary of Terms

Actuary

A specialist in the application of mathematics, probability, statistics and risk theory to financial problems involving future uncertainty. These uncertainties are usually associated with life insurance, property and casualty insurance, annuities, pension or other employee benefit plans and investments.

Actuarial (Accrued) Liability (AL)

The actuarial present value of all benefits accrued or earned under the Plan as of the beginning of the year, based on the anticipated salary increases for pay-related plans. Under the entry age normal cost method, the actuarial liability is the difference between the actuarial present value of future benefits and the actuarial present value of future normal cost.

Actuarial Value of Assets (AVA)

The value of cash, investments and other property belonging to a pension plan, as used by the actuary for the purpose of an actuarial valuation.

Alternative Investments

Refers broadly to non-traditional investment strategies such as hedge funds, private equity, distressed debt, commodities and futures.

Glossary of Terms (Continued)

Bond

A bond is a debt instrument issued by entities such as corporations, municipalities, federal, state and local government agencies for the purpose of raising capital through borrowing. Bonds typically pay interest periodically while repaying the principal, or par value, at maturity. Bonds with maturities of five years or less are often called notes.

Cost-of-Living Adjustment (COLA)

An increase (or decrease) in pension benefits according to the rise (or fall) in the cost of living as measured by an index, often the Consumer Price Index (CPI).

Deterministic Forecast

An outcome that is precisely determined in advance, using single estimates and without variation.

Diversification

The allocation of funds across different asset classes or securities within a portfolio.

Equity

The ownership interest of common and preferred stockholders in a company.

Glossary of Terms (Continued)

Funded Status

The status of a pension plan that has accumulated and set aside assets for the payment of retirement benefits to employees. Funded status is measured as the ratio of the Actuarial Value of Assets / Actuarial Liability.

Government Accounting Standards Board (GASB)

The designated organization for establishing standards of financial accounting and reporting in the public sector.

Inflation

A period in which the general level of prices for goods and services is increasing, and, thus, purchasing power is decreasing.

Liquidity

In general, liquidity refers to the ease by which a financial asset can be converted into cash. Liquidity is often more narrowly defined as the ability to sell an asset quickly without having to make a substantial price concession.

Liquidity Risk

Liquidity risk is the risk stemming from a lack of marketability of an investment, which makes it difficult to sell when desired.

Glossary of Terms (Continued)

Market Value of Assets (MVA)

An asset valuation that is based on the price for which an asset could be sold on the valuation date (also known as fair market or actual value).

Normal Cost (NC)

The annual accrual cost attributable to the upcoming plan year.

Present Value

Present value is the value on a given date of a future payment/receipt or series of future payments/receipts, discounted to reflect the time value of money, usually by the current relevant market interest rate.

Present Value of Benefits (PVB)

The actuarial present value all benefits (accrued service plus future service) under the Plan as of the beginning of the year, based on the anticipated salary increases for pay-related plans.

Purchasing Power Risk

Purchasing power risk is the risk that a portfolio or investment will earn a return less than the rate of inflation.

Glossary of Terms (Continued)

Sharpe Ratio

The Sharpe ratio is a commonly used measure of risk-adjusted return. It is calculated by subtracting the risk-free return (usually the 3 month Treasury bill) from a portfolio's return and then dividing this excess return by the portfolio's total standard deviation (a measure of portfolio volatility, or risk). The ratio thus represents the return gained per unit of risk taken.

Standard Deviation

Standard deviation is a statistical measure of portfolio risk. It reflects the average deviation of returns from their mean. Standard deviation is used as an estimate of risk since it measures how wide the range of returns has been.

Stochastic Forecast

An outcome based on variability or a range of values, and expressed in the form of a probability distribution.

Strategic Asset Allocation

Strategic asset allocation requires rebalancing back to a pre-determined policy allocation at specified time intervals or when established tolerance bands are violated.

Glossary of Terms (Continued)

Tactical Asset Allocation

Tactical Asset Allocation involves actively altering allocation among broad asset classes in an attempt to capture the highest returns. It is also referred to as "market timing."

Unfunded Liability

The difference between the actuarial (accrued) liability and the actuarial value of assets. A surplus exists if assets exceed liabilities.

VAR (Value at Risk)

The difference between the Downside Scenario (97.5th) and the Expected Case (50th): How much could be lost in a downside scenario relative to where you expected to be.

Volatility

The degree to which an investment's market value goes up and down over time.

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Callan Update

Published Research Highlights from 2Q19

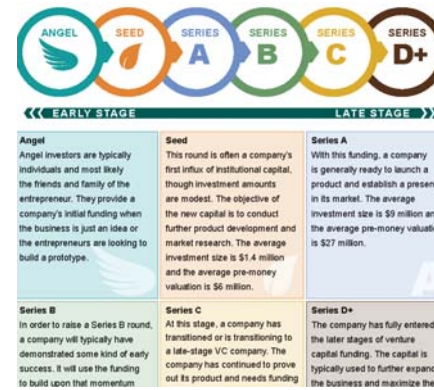**The Cobbler's Shoes: How Asset Managers Run Their Own 401(k) Plans**
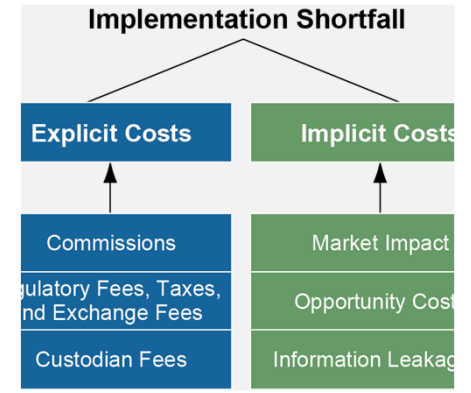
Callan's Periodic Table Explained

How to Distinguish Between Growth Equity and Late-Stage VC

Two Questions to Help DC Plans Save on Litigation Costs

Recent Blog Posts

How STRIPS Can Help Corporate DB Plans

Sweta Vaidya

A Primer on Interval Funds

Kristin Bradbury and David Welsch

Legislative Fixes for the Student Debt Tsunami

Jana Steele

Additional Reading

Private Equity Trends quarterly newsletter

Active vs. Passive quarterly charts

Capital Market Review quarterly newsletter

Monthly Updates to the Periodic Table

Market Pulse Flipbook quarterly markets update

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Callan Institute Events

Upcoming Conferences, Workshops, and Webinars

"Callan College" on Alternative Investments
October 29-30, 2019 in Chicago

Dive into Alternatives!

Alternative investments like private equity, hedge funds, and real estate can play a key role in any portfolio. In this one-and-a-half-day session, learn about the importance of allocations to alternatives, and how to consider integrating, evaluating, and monitoring them.

3 Reasons You Should Attend

1 **Enhance** your knowledge to maximize your plan's long term returns

2 **Learn** about new opportunities for greater diversification

3 **Prepare** your plan's portfolio for market ups and downs

"This is a great opportunity for investors of all types to get a thorough introduction to alternative investments and meet the Callan team."

— Pete Keliuotis, Executive Vice President

Upcoming Webinar

ESG

Webinars: On-Demand now available at
https://www.callan.com/ondemandwebinar/

Regional Workshops

Denver, October 22, 2019
Chicago, October 24, 2019

40th National Conference

January 27–29, 2020
The Palace Hotel
San Francisco, CA

"Callan College" Introduction to Investments

Atlanta, October 8–9, 2019
Chicago, October 29-30, 2019

Callan Updates

Firm updates by the numbers, as of June 30, 2019

Total Associates: 194

Ownership

– 100% employees

– Broadly distributed across more than 95 shareholders

Leadership Changes

– No executive additions or departures

– No leadership changes this quarter

Total General and Fund Sponsor Consultants: more than 45

Total Specialty and Research Consultants: more than 60

Total CFA/CAIA/FRMs: more than 50

Total Fund Sponsor Clients: more than 400

AUA: more than $2.4 trillion

"The Callan culture that we have all built together over the years is the reason we like coming to work each day ... Our culture of supporting and caring about each other, of appreciating and respecting each other while still having some fun and good humor has been the key to our longevity and success. We never want to diminish it."

— *Ron Peyton, Executive Chairman*

2019 Content Calendar

Callan Institute

4Q19 Webinar Topics:
- ESG Survey
- Vendor Due Diligence
- Callan's Database Update

1Q19 Webinar Topics:
- Capital Market Projections

3Q19 Webinar Topics:
- Age of Illiquidity
- DC Index Deep Dive

2Q19 Webinar Topics:
- DC Survey
- Cobbler's Shoes: Asset Manager 401(k)s

2019

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institute@callan.com
for more information about our
events and research

National Conference
DC Survey
Cap Mkt Projections
Investment Manager Session
Intro to Investments
June Workshops
Intro to Investments
ESG Survey
Fee Survey
Investment Manager Session
October Workshops
Alternatives
Intro to Investments

Jan · Feb · March · April · May · June · July · Aug · Sept · Oct · Nov · Dec

"Callan College" Conference / Workshop Publication Webinar

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