Verus

PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS

AUGUST 2021

Asset-Liability Study

Fresno County Employees' Retirement Association

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Introduction

Session objectives

- Confirm/adjust the Board's enterprise risk tolerance
- Develop an intuitive sense of how different investment strategies lead to different ranges of outcomes for the System.
- Confirm the merits of the current approach, or alternatively, adjust course if warranted.
  - If a course-adjustment is necessary, Verus can refine the asset allocation mixes under consideration based on Board feedback.

Asset / liability analysis is best used to evaluate the impact of broad strategic shifts, rather than small asset allocation adjustments

A complex problem

— Asset allocation is typically the most important decision an investor can make

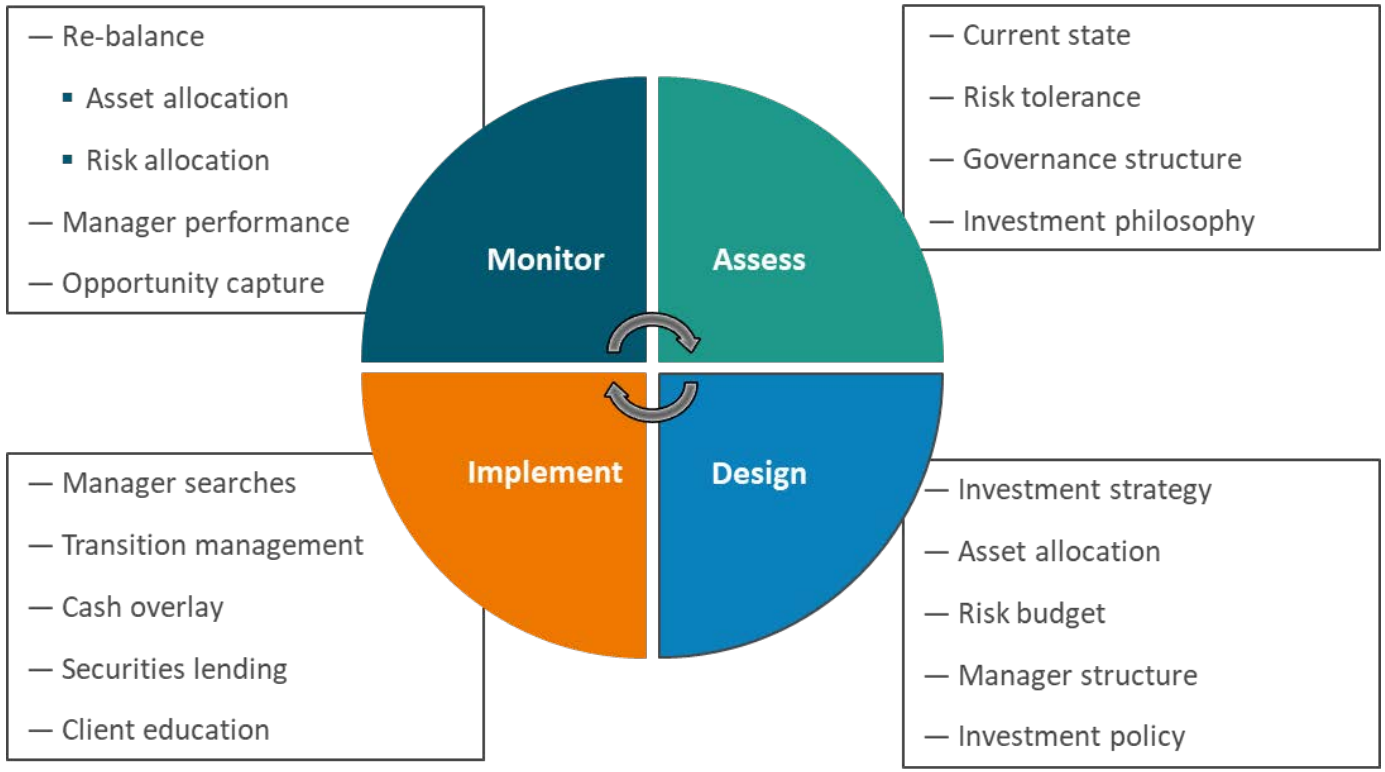
— There is an infinite number of possible asset allocation mixes

How can we address the asset allocation question to ensure we get a solution that fits?

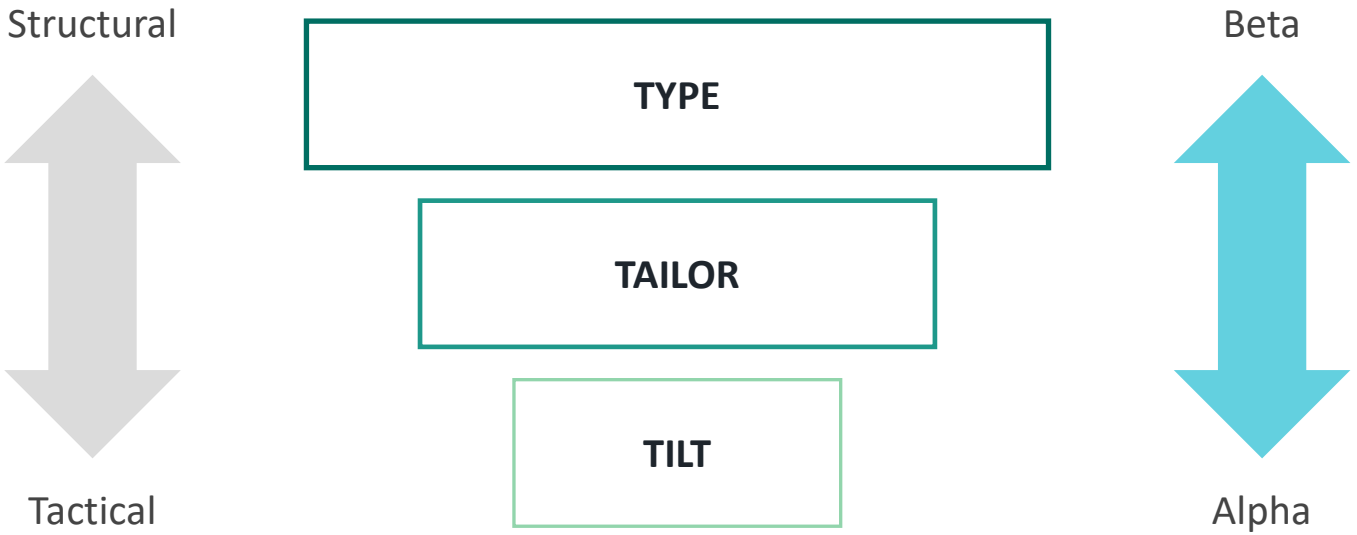
— Disciplined, repeatable process

— Logical, intuitive framework

Process


— Re-balance
▪ Asset allocation
▪ Risk allocation
— Manager performance
— Opportunity capture
Monitor
Assess
— Current state
— Risk tolerance
— Governance structure
— Investment philosophy
Implement
Design
— Manager searches
— Transition management
— Cash overlay
— Securities lending
— Client education
— Investment strategy
— Asset allocation
— Risk budget
— Manager structure
— Investment policy

Framework: type, tailor, tilt



Which conversation are we having today?

Type, Tailor, Tilt

- What is our basic portfolio structure, or 'type'?
- 'Type' of portfolio should have the greatest impact on results.
- 'Type' decisions are made infrequently - *perhaps only once*.
- An institution may not be able to change its 'type' due to peer risk or the expectations of its constituents.

'Type' is a beta decision

Type, *Tailor*, Tilt

- Now that portfolio type is decided, how are unique needs and preferences integrated?
- 'Tailoring' of the portfolio should have material impacts on results, but less of an impact than portfolio type
- 'Tailoring' decisions are also made less frequently – perhaps on an annual basis

'Tailor' is a beta decision, but might also involve alpha

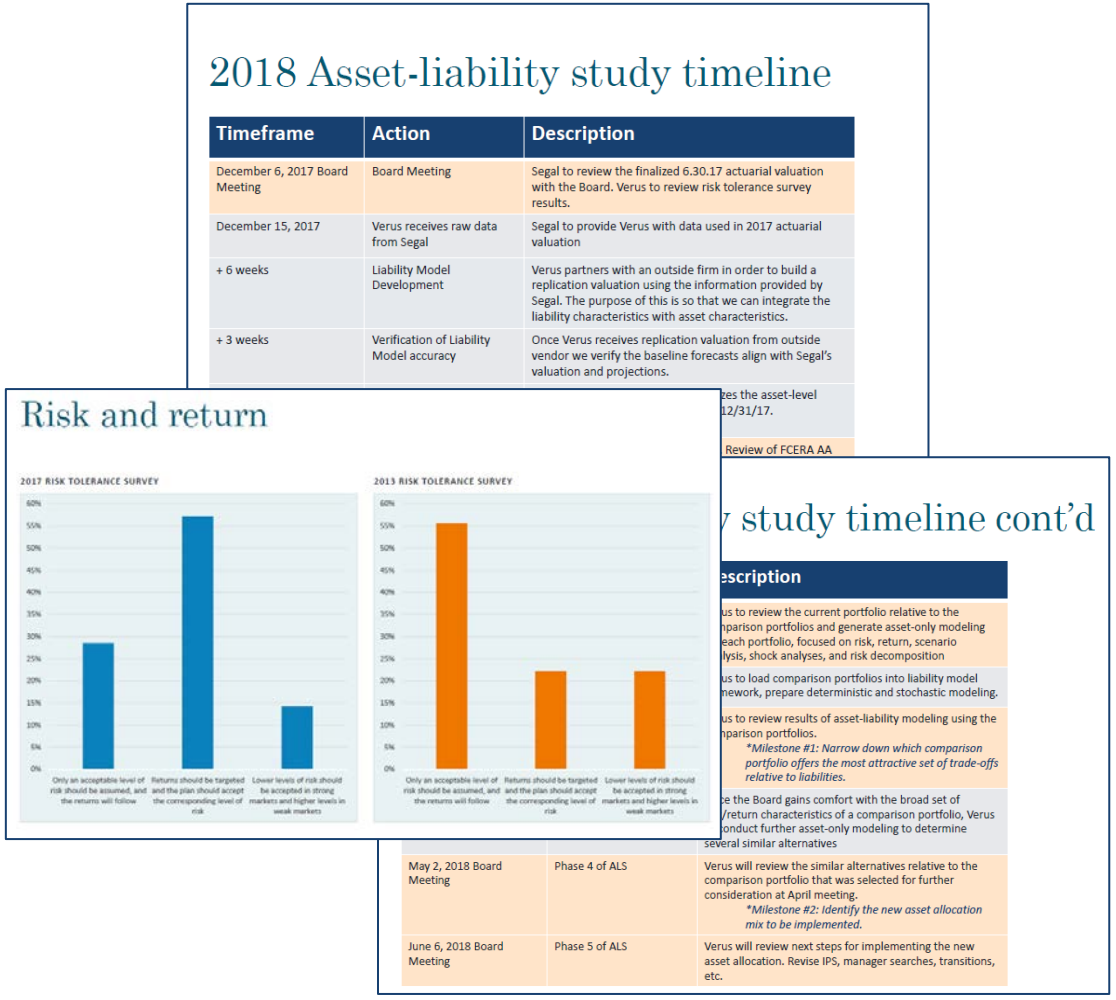
Type, Tailor, *Tilt*

- The portfolio is now complete and the IPS is decided.
- 'Tilt' decisions are typically more tactical in nature.
- ***'Tilts' must be large enough in size to make a difference in performance*, and governance surrounding these decisions is very important.**

'Tilt' decisions are typically focused on alpha

Past & present "type" discussions

- In 2013, as a result of a comprehensive Asset-Liability Study, the Board de-risked the portfolio considerably, going from 53% public equity to 36%.
- In 2018, the Board spent considerable time & energy re-evaluating that decision, and ultimately decided to re-align the portfolio more closely with peers; public equity was increased to the current target of 49%.
- In 2019, the Board sought to improve the tail-risk characteristics of the portfolio by increasing core fixed income and decreasing credit.



2018 Asset-liability study timeline

Timeframe	Action	Description
December 6, 2017 Board Meeting	Board Meeting	Segal to review the finalized 6.30.17 actuarial valuation with the Board. Verus to review risk tolerance survey results.
December 15, 2017	Verus receives raw data from Segal	Segal to provide Verus with data used in 2017 actuarial valuation
+ 6 weeks	Liability Model Development	Verus partners with an outside firm in order to build a replication valuation using the information provided by Segal. The purpose of this is so that we can integrate the liability characteristics with asset characteristics.
+ 3 weeks	Verification of Liability Model accuracy	Once Verus receives replication valuation from outside vendor we verify the baseline forecasts align with Segal's valuation and projections.
		ces the asset-level 12/31/17.
		Review of FCERA AA

Risk and return

2017 RISK TOLERANCE SURVEY

2013 RISK TOLERANCE SURVEY

y study timeline cont'd

escription
us to review the current portfolio relative to the nparison portfolios and generate asset-only modeling each portfolio, focused on risk, return, scenario lysis, shock analyses, and risk decomposition
us to load comparison portfolios into liability model nework, prepare deterministic and stochastic modeling.
us to review results of asset-liability modeling using the nparison portfolios. *Milestone #1: Narrow down which comparison portfolio offers the most attractive set of trade-offs relative to liabilities.*
e the Board gains comfort with the broad set of /return characteristics of a comparison portfolio, Verus onduct further asset-only modeling to determine several similar alternatives
Verus will review the similar alternatives relative to the comparison portfolio that was selected for further consideration at April meeting. *Milestone #2: Identify the new asset allocation mix to be implemented.*
Verus will review next steps for implementing the new asset allocation. Revise IPS, manager searches, transitions, etc.

May 2, 2018 Board Meeting	Phase 4 of ALS	
June 6, 2018 Board Meeting	Phase 5 of ALS	

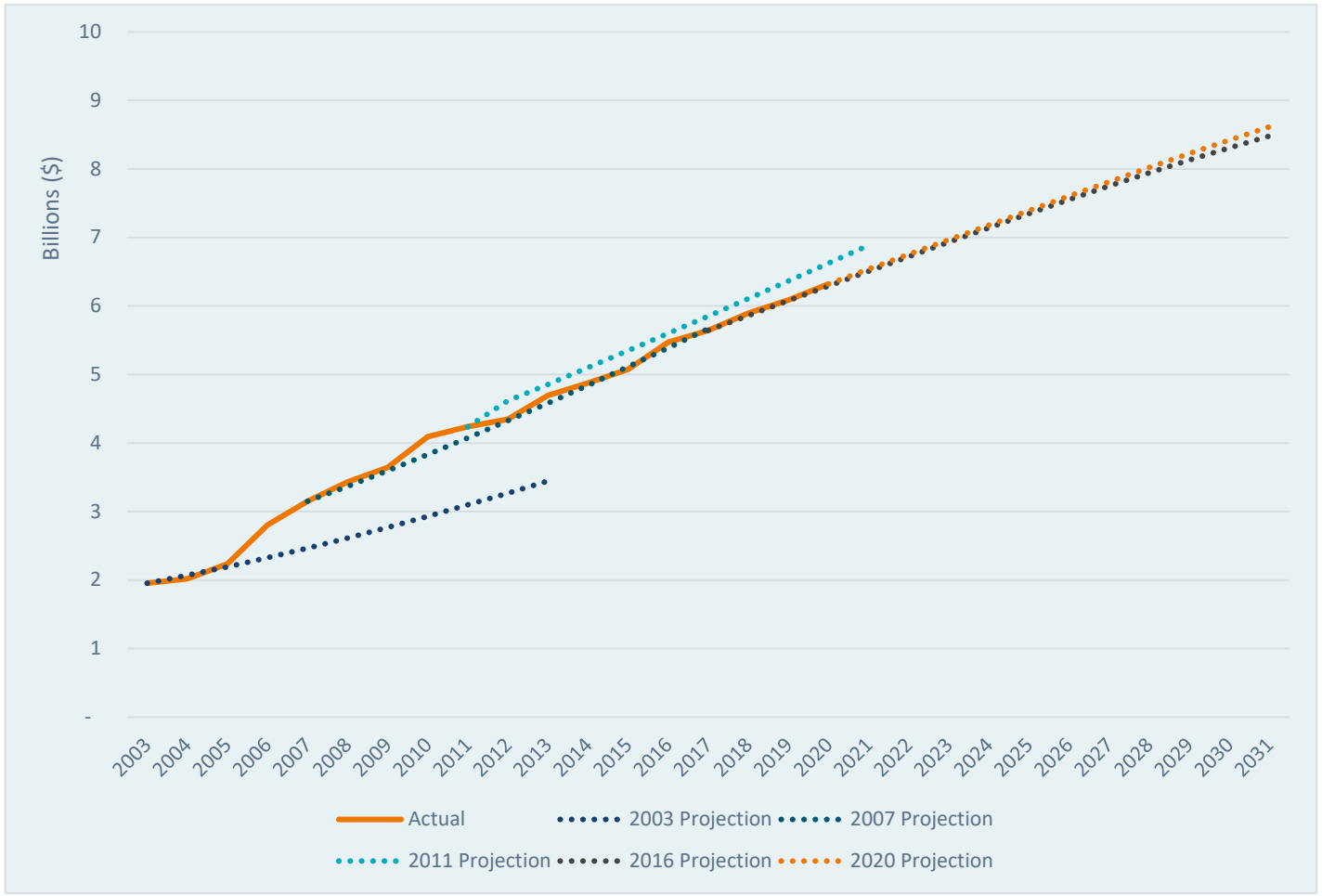
Which overall risks should FCERA accept?

- Accept greater volatility
- Be truly different from peers
- Add portfolio leverage, which can change risk profile
- Accept lower risk, but also weaker performance
- Take on illiquidity risk, which may lead to forced selling
- Tilt into assets with higher expected return, but forecasts may be wrong
- Make portfolio "bets" which might fail to pay off
- Rely on active managers who may fail to produce alpha
- Over-diversify which might reduce return

Historical accuracy of projections

Liability projections

ACTUARIAL LIABILITY: PROJECTIONS VS ACTUAL



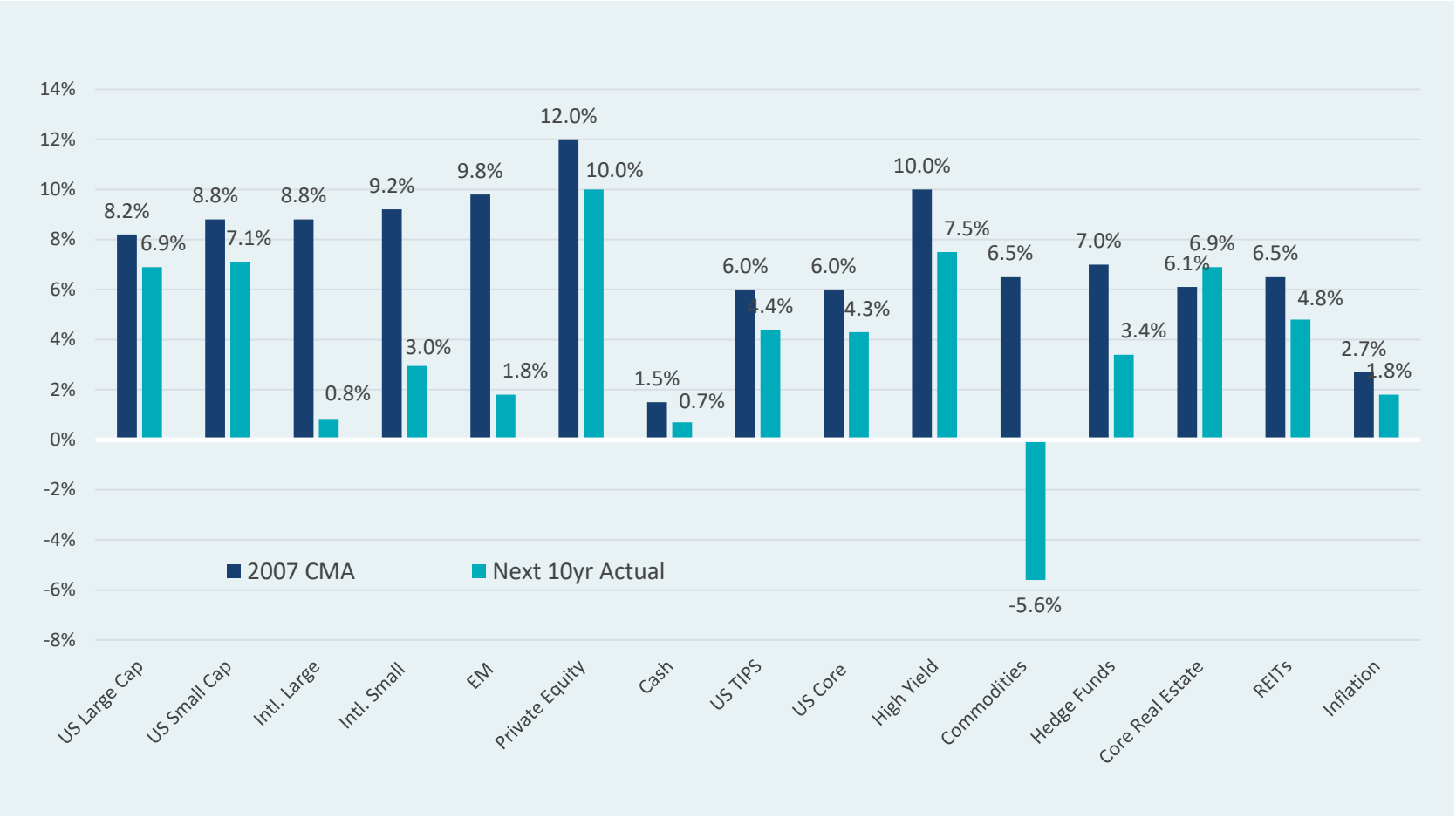
Source: Verus

Excluding discount rate movements in early 2000, Verus liability projections have been accurate and act as a reasonable predictor of future liability within the FCERA plan.

Projected liability growth for FCERA plan ranges from 3%-3.4% in the next 5 years, declining to roughly 1.5% thereafter.

Verus' CMAs vs. subsequent performance

2007 projections vs. actual



Average deviation: 3.5%

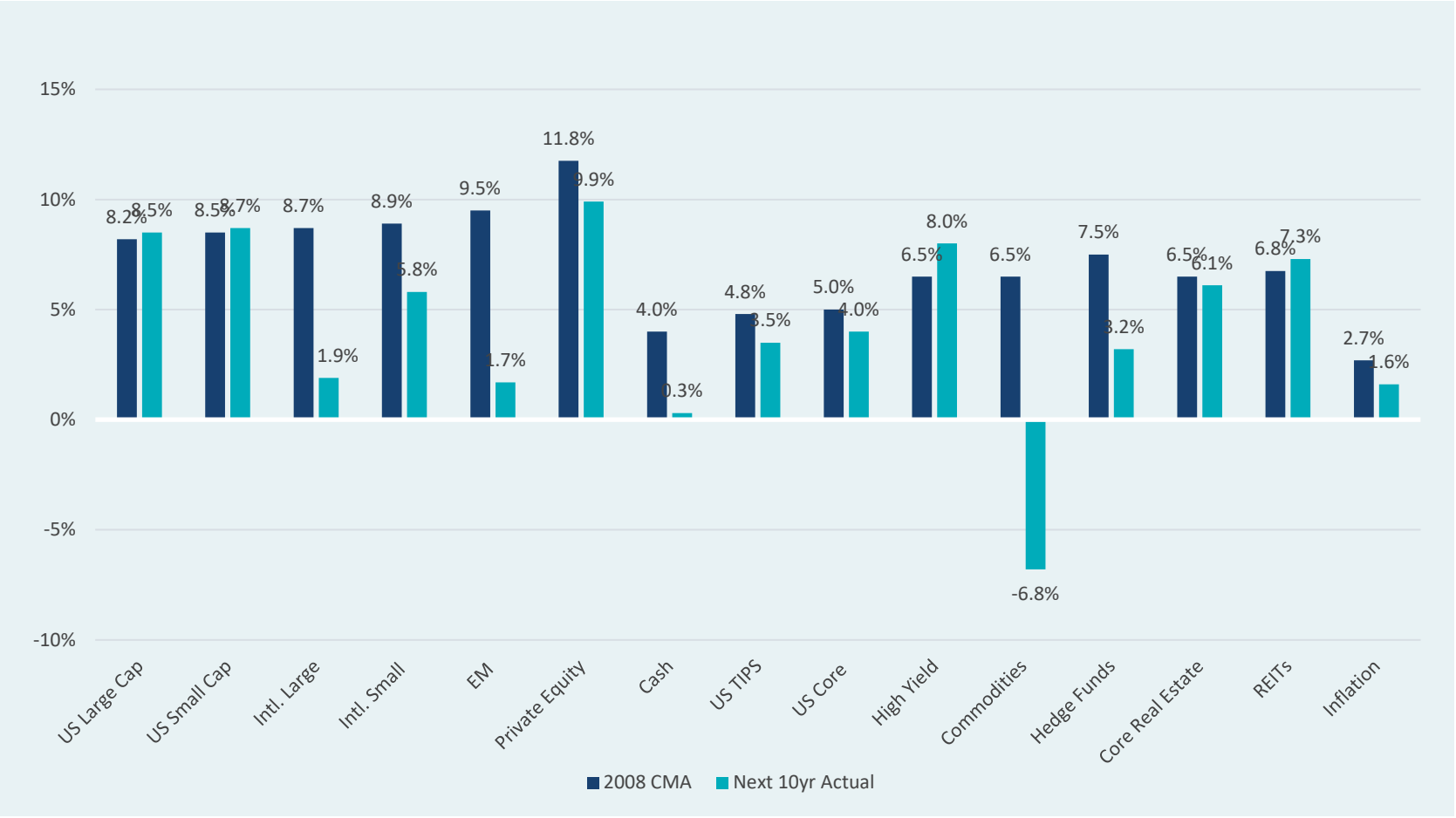
Biggest miss:

Commodities - 12.1%.

Avg. deviation ex-Commodities: 2.9%

Verus' CMAs vs. subsequent performance

2008 projections vs. actual



Average deviation: 3.1%

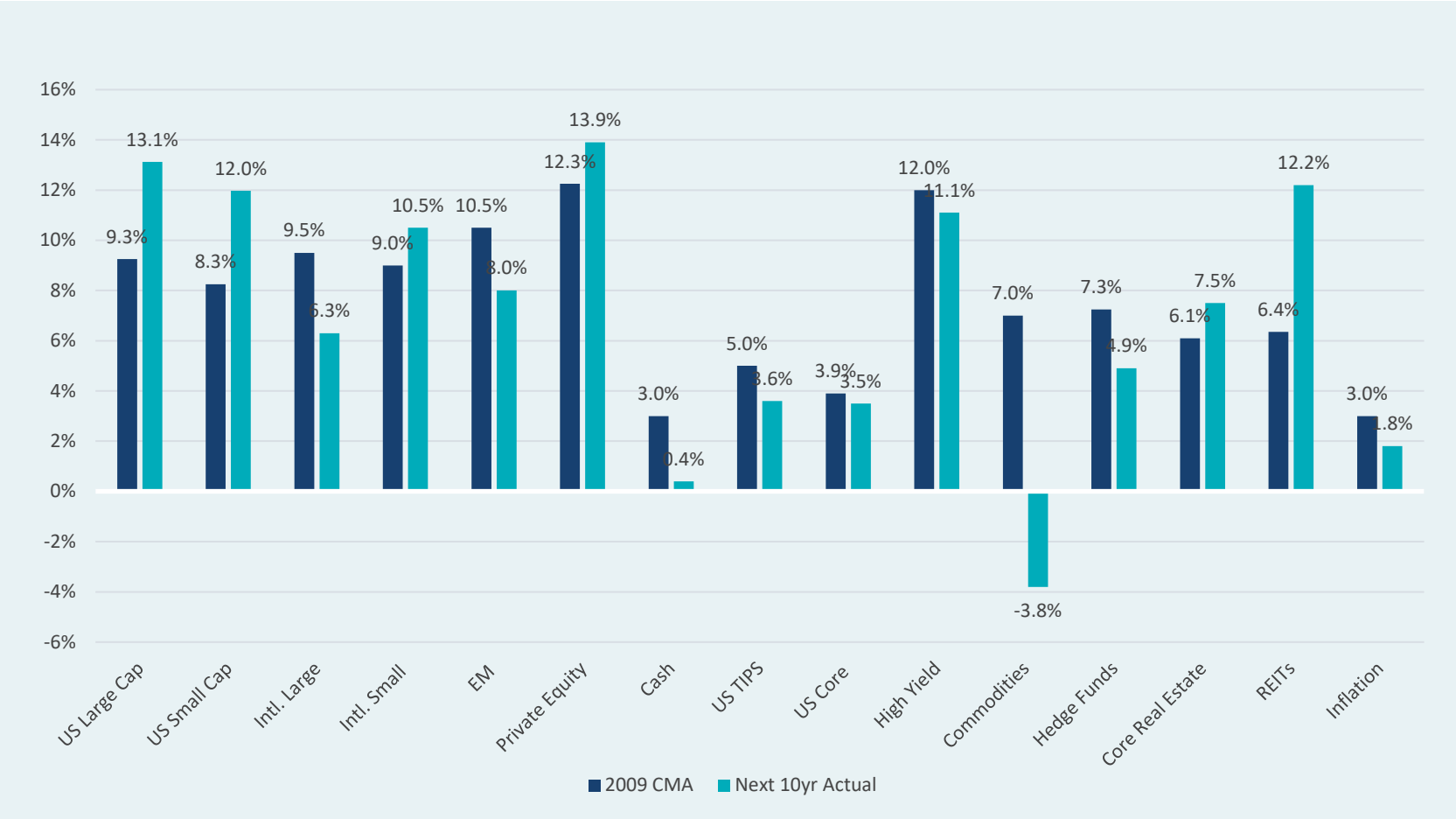
Biggest miss:

Commodities - 13.3%.

Avg. deviation ex-Commodities: 2.4%

Verus' CMAs vs. subsequent performance

2009 projections vs. actual



Average deviation: 2.9%

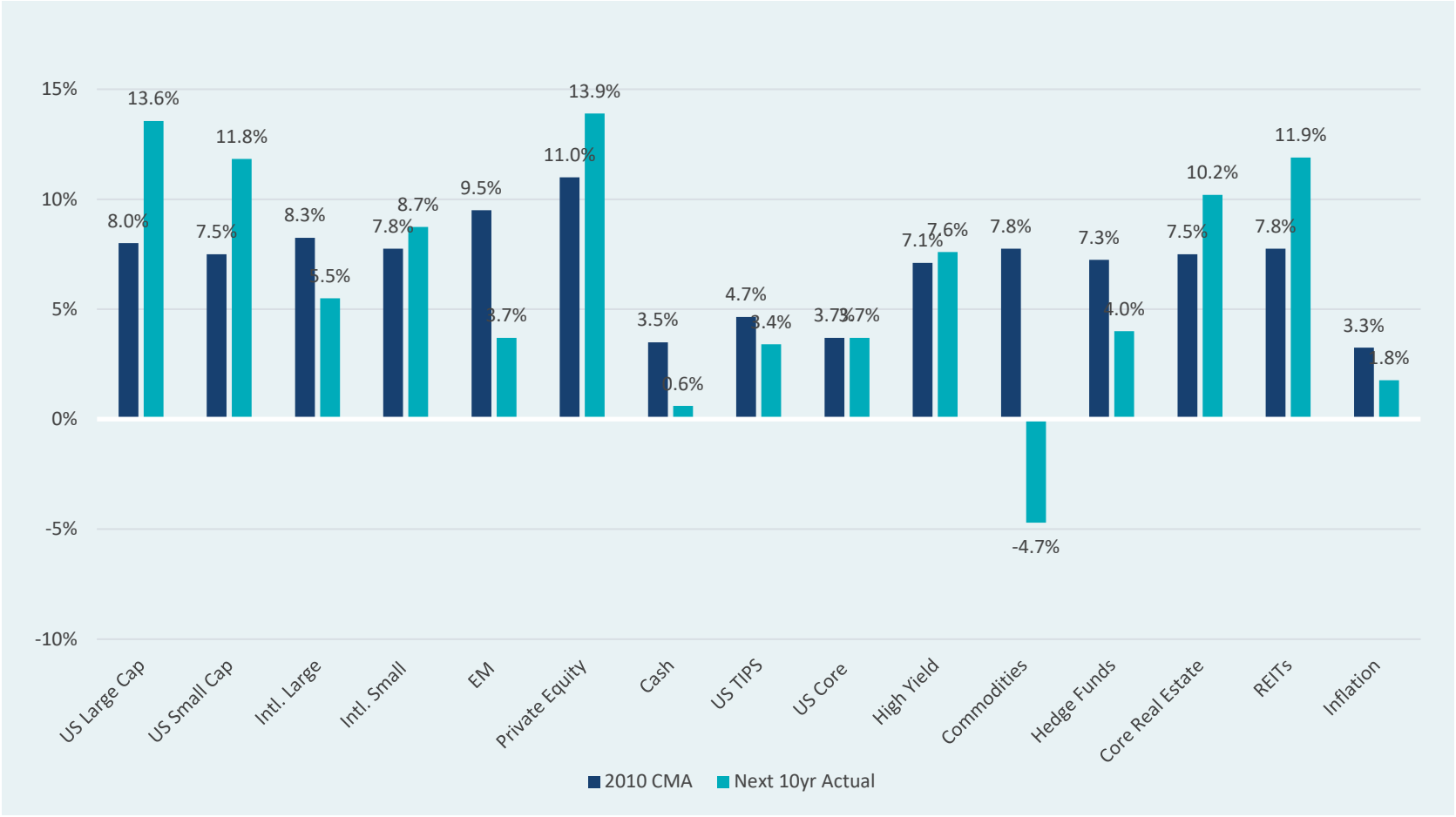
Biggest miss:

Commodities - 10.8%

Avg. deviation ex-Commodities: 2.3%

Verus' CMAs vs. subsequent performance

2010 projections vs. actual



Average deviation: 3.4%

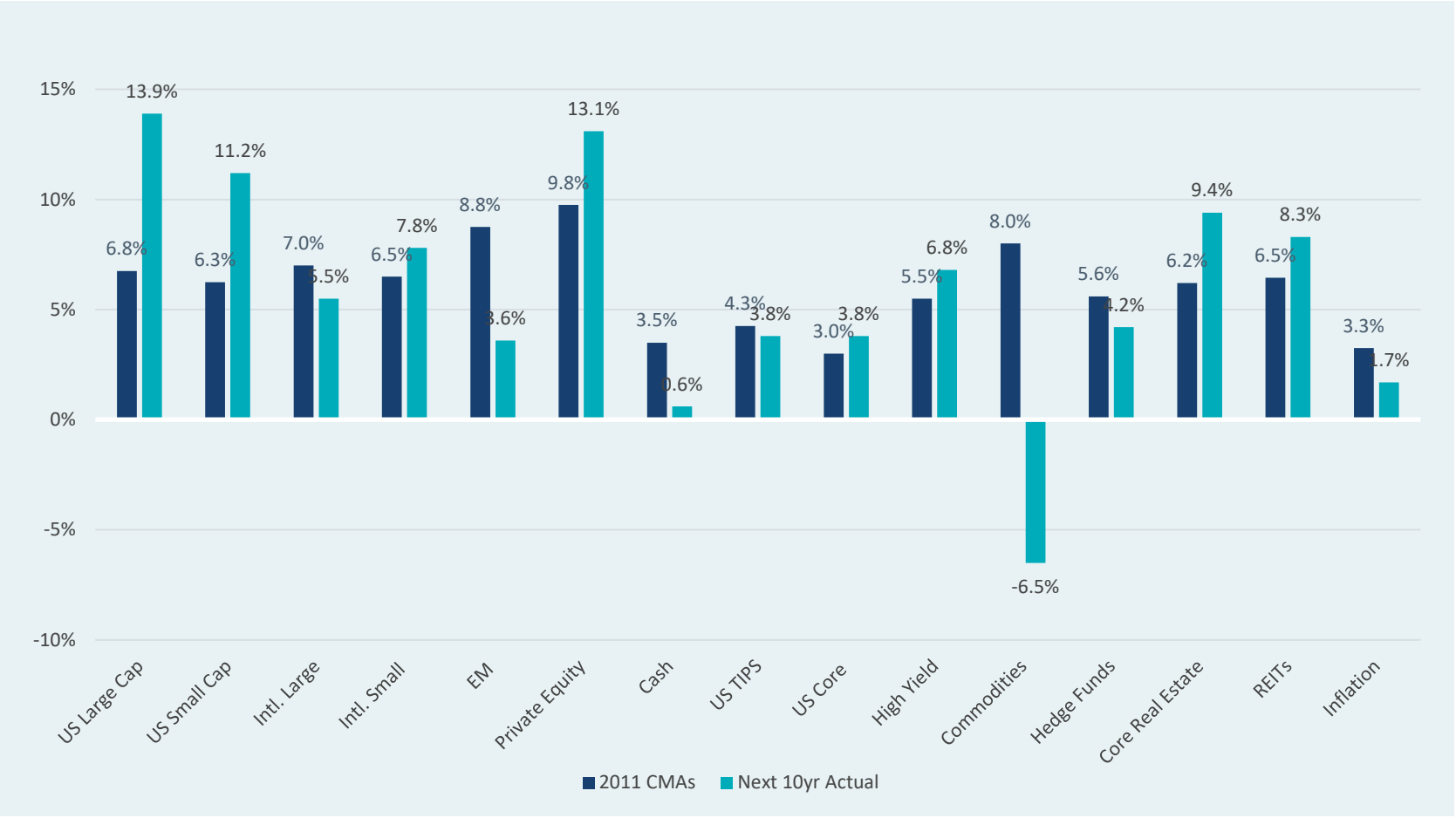
Biggest miss:

Commodities - 12.5%

Avg. deviation ex-Commodities: 2.8%

Verus CMAs vs. subsequent performance

2011 projections vs. actual



Average deviation: 3.4%

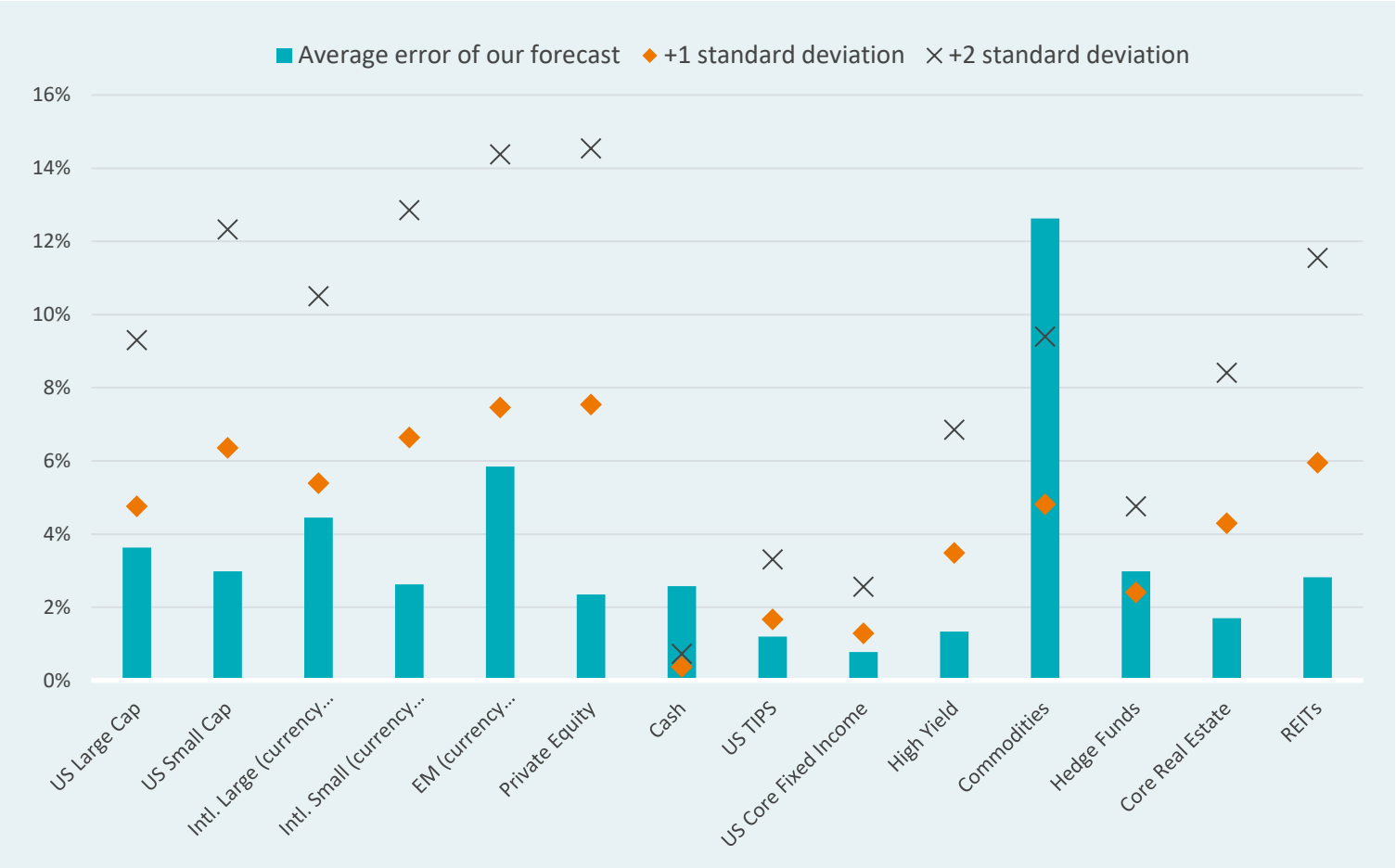
Biggest miss:

Commodities - 14.5%

Avg. deviation ex-Commodities: 2.6%

Summarizing the data

How accurate have our CMAs been?



Other than forecasting cash rates going to zero for much of the decade, and commodities underperformance, the projections were statically accurate.

2021 capital market assumptions

Methodology

CORE INPUTS

— We use a fundamental building block approach based on several inputs, including historical data and academic research to create asset class return forecasts.
— For most asset classes, we use the long-term historical volatility after adjusting for autocorrelation.
— Correlations between asset classes are calculated based on the last 10 years. For illiquid assets, such as private equity and private real estate, we use BarraOne correlation estimates.

Asset	Return Methodology	Volatility Methodology*
Inflation	25% weight to the University of Michigan Survey 5-10 year ahead inflation expectation and the Survey of Professional Forecasters (Fed Survey), and the remaining 50% to the market's expectation for inflation as observed through the 10-year TIPS breakeven rate	-
Cash	75% * current federal funds rate + 25% * U.S. 10-year Treasury yield	Long-term volatility
Bonds	Nominal bonds: current yield; Real bonds: real yield + inflation forecast	Long-term volatility
International Bonds	Current yield	Long-term volatility
Credit	Current option-adjusted spread + U.S. 10-year Treasury – effective default rate	Long-term volatility
International Credit	Current option-adjusted spread + foreign 10-year Treasury – effective default rate	Long-term volatility
Private Credit	Bank loan forecast + 1.75% private credit premium**	Long-term volatility
Equity	Current yield + real earnings growth (historical average) + inflation on earnings (inflation forecast) + expected P/E change	Long-term volatility
Intl Developed Equity	Current yield + real earnings growth (historical average) + inflation on earnings (intl. inflation forecast) + expected P/E change	Long-term volatility
Private Equity	US large cap domestic equity forecast * 1.85 beta adjustment	1.2 * Long-term volatility of U.S. small cap
Commodities	Collateral return (cash) + spot return (inflation forecast) + roll return (assumed to be zero)	Long-term volatility
Hedge Funds	Return coming from traditional betas + 15-year historical idiosyncratic return	Long-term volatility
Core Real Estate	Cap rate + real income growth – capex + inflation forecast	65% of REIT volatility
REITs	Core real estate	Long-term volatility
Value-Add Real Estate	Core real estate + 2%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Opportunistic Real Estate	Core real estate + 4%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Infrastructure	Current yield + real income growth + inflation on earnings (inflation forecast)	Long-term volatility
Risk Parity	Expected Sharpe Ratio * target volatility + cash rate	Target volatility

**Long-term historical volatility data is adjusted for autocorrelation (see Appendix)*
***The private credit premium is generated by illiquidity, issuer size, and lack of credit rating*

10-year return & risk assumptions

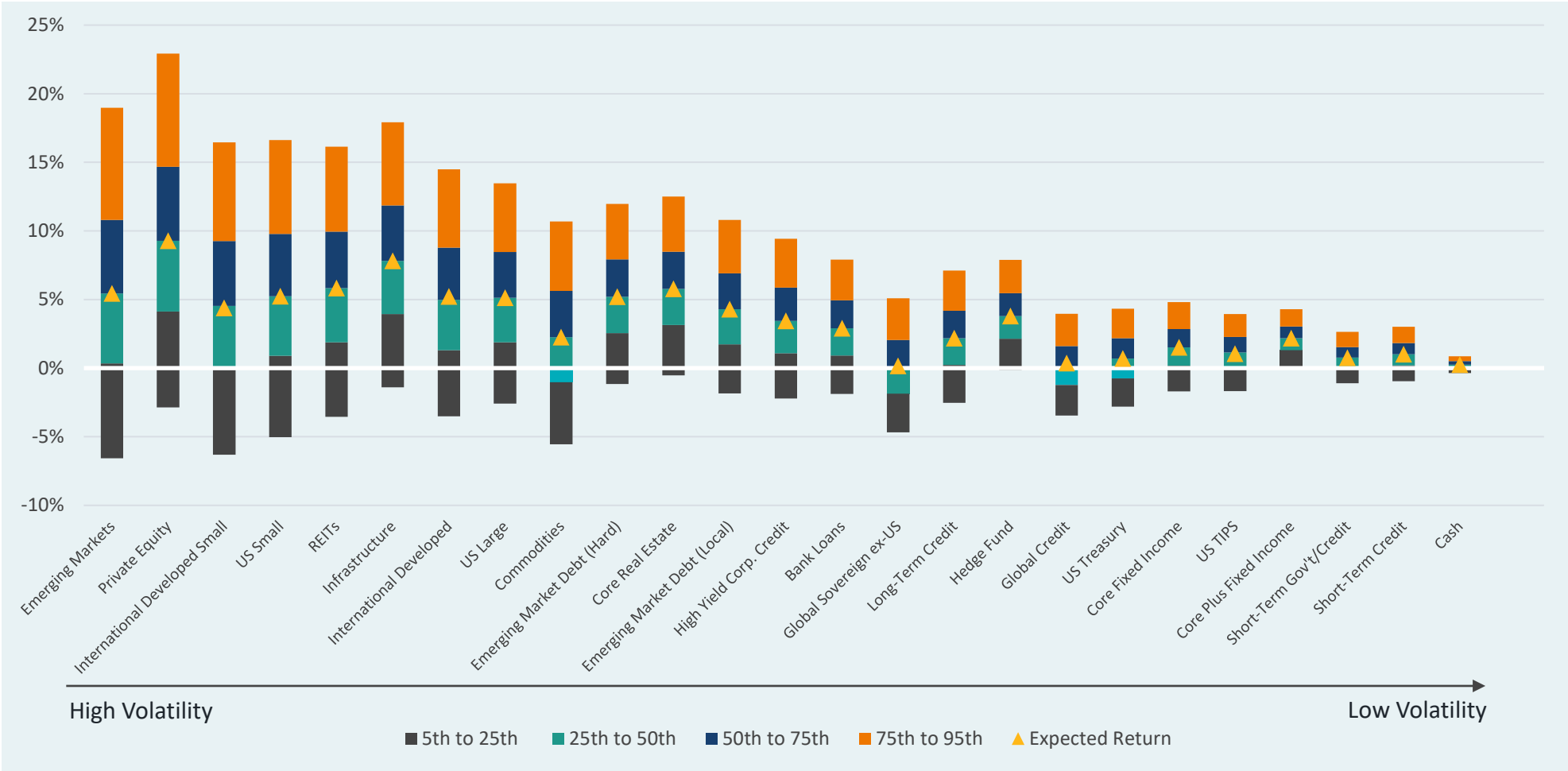
Asset Class	Index Proxy	Ten Year Return Forecast Geometric	Ten Year Return Forecast Arithmetic	Standard Deviation Forecast	Sharpe Ratio Forecast (g)	Sharpe Ratio Forecast (a)	10-Year Historical Sharpe Ratio (g)	10-Year Historical Sharpe Ratio (a)
Equities								
U.S. Large	S&P 500	5.1%	6.3%	15.7%	0.31	0.38	0.99	0.99
U.S. Small	Russell 2000	5.2%	7.3%	21.4%	0.23	0.33	0.51	0.58
International Developed	MSCI EAFE	5.2%	6.7%	17.9%	0.28	0.36	0.27	0.34
International Small	MSCI EAFE Small Cap	4.4%	6.7%	22.4%	0.19	0.29	0.43	0.49
Emerging Markets	MSCI EM	5.4%	8.3%	25.5%	0.20	0.32	0.11	0.19
Global Equity	MSCI ACWI	5.2%	6.6%	17.3%	0.29	0.37	0.58	0.62
Private Equity*	Cambridge Private Equity	9.3%	12.1%	25.7%	0.35	0.46	-	-
Fixed Income								
Cash	30 Day T-Bills	0.2%	0.2%	1.2%	-	-	-	-
U.S. TIPS	BBgBarc U.S. TIPS 5-10	1.1%	1.2%	5.3%	0.15	0.18	0.66	0.67
U.S. Treasury	BBgBarc Treasury 7-10 Year	0.7%	0.9%	6.7%	0.07	0.10	0.67	0.68
Global Sovereign ex U.S.	BBgBarc Global Treasury ex U.S.	0.2%	0.6%	9.6%	-0.01	0.04	0.09	0.12
Global Aggregate	BBgBarc Global Aggregate	1.1%	1.3%	6.1%	0.14	0.17	0.38	0.39
Core Fixed Income	BBgBarc U.S. Aggregate Bond	1.5%	1.6%	4.0%	0.31	0.36	1.02	1.01
Core Plus Fixed Income	BBgBarc U.S. Universal	2.2%	2.3%	4.0%	0.49	0.50	1.13	1.12
Short-Term Gov't/Credit	BBgBarc U.S. Gov't/Credit 1-3 Year	0.7%	0.8%	3.6%	0.14	0.16	1.23	1.22
Short-Term Credit	BBgBarc Credit 1-3 Year	1.0%	1.1%	3.6%	0.21	0.23	1.23	1.22
Long-Term Credit	BBgBarc Long U.S. Corporate	2.2%	2.6%	9.3%	0.21	0.25	0.76	0.77
High Yield Corp. Credit	BBgBarc U.S. Corporate High Yield	3.4%	4.0%	11.3%	0.28	0.34	0.82	0.83
Bank Loans	S&P/LSTA Leveraged Loan	2.9%	3.2%	9.5%	0.28	0.32	0.66	0.67
Global Credit	BBgBarc Global Credit	0.3%	0.6%	7.4%	0.01	0.05	0.63	0.64
Emerging Markets Debt (Hard)	JPM EMBI Global Diversified	5.2%	6.0%	12.7%	0.39	0.45	0.60	0.63
Emerging Markets Debt (Local)	JPM GBI-EM Global Diversified	4.3%	5.0%	12.2%	0.33	0.39	-0.01	0.05
Private Credit	Bank Loans + 175bps	4.6%	5.2%	11.2%	0.39	0.45	-	-
Other								
Commodities	Bloomberg Commodity	2.2%	3.4%	15.9%	0.13	0.20	-0.47	-0.41
Hedge Funds*	HFRI Fund Weighted Composite	3.8%	4.1%	7.8%	0.46	0.49	0.47	0.49
Real Estate Debt	BBgBarc CMBS IG	2.2%	2.5%	7.5%	0.26	0.30	1.18	1.17
Core Real Estate	NCREIF Property	5.8%	6.5%	12.6%	0.44	0.50	2.06	1.99
Value-Add Real Estate	NCREIF Property + 200bps	7.8%	9.1%	17.1%	0.44	0.52	-	-
Opportunistic Real Estate	NCREIF Property + 400bps	9.8%	11.8%	21.6%	0.44	0.54	-	-
REITs	Wilshire REIT	5.8%	7.5%	19.3%	0.29	0.38	0.46	0.52
Global Infrastructure	S&P Global Infrastructure	7.8%	9.4%	18.8%	0.40	0.49	0.28	0.35
Risk Parity	Risk Parity	5.2%	5.9%	10.0%	0.50	0.56	-	-
Currency Beta	MSCI Currency Factor Index	1.2%	1.3%	3.5%	0.28	0.30	0.15	0.16
Inflation		2.0%	-	-	-	-	-	-

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

**Return expectations differ depending on method of implementation*

Range of likely 10-year outcomes

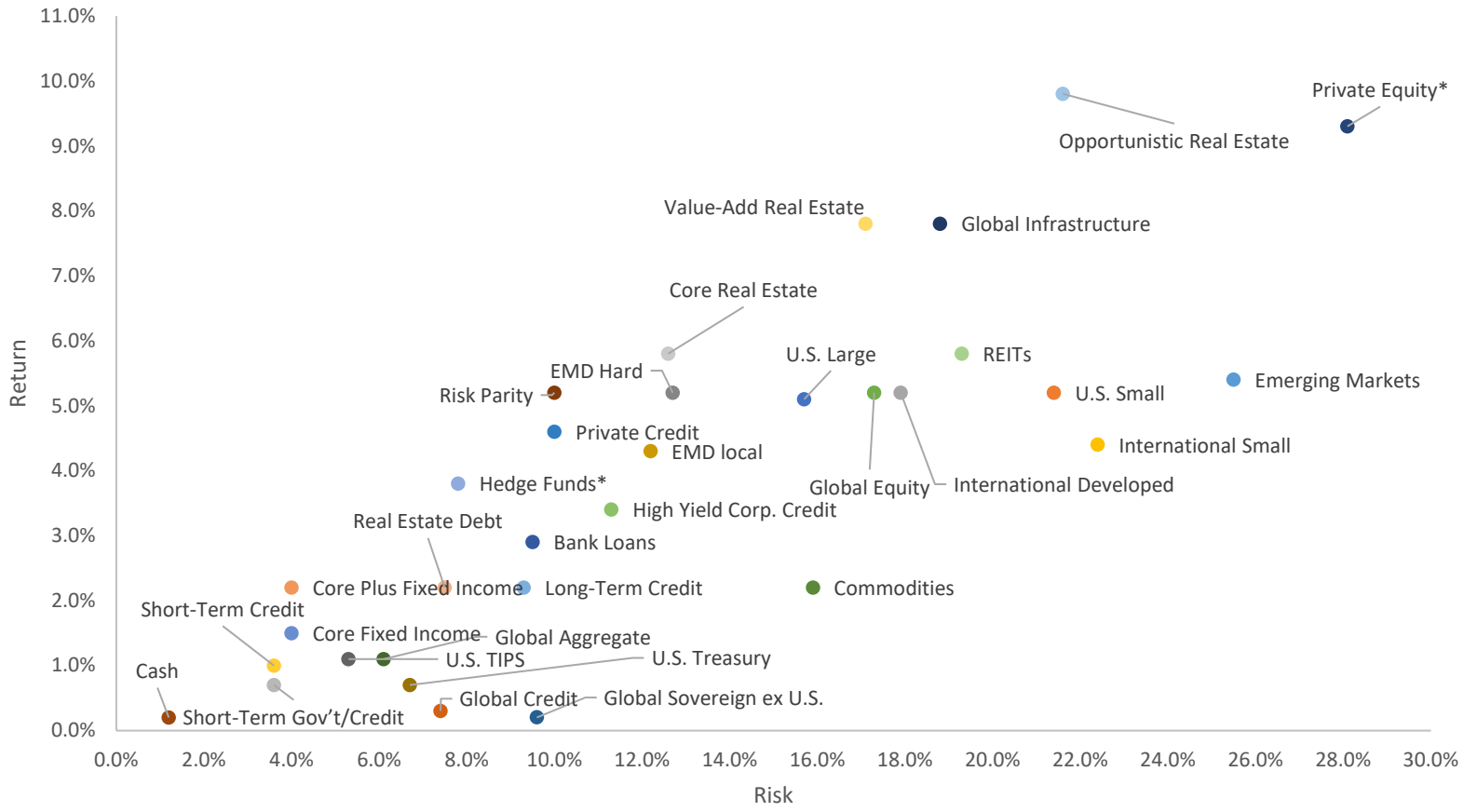
10-YEAR RETURN 90% CONFIDENCE INTERVAL



Source: Verus, MPI

Risk & return

Increasing risk does not guarantee higher returns… but it's a starting point

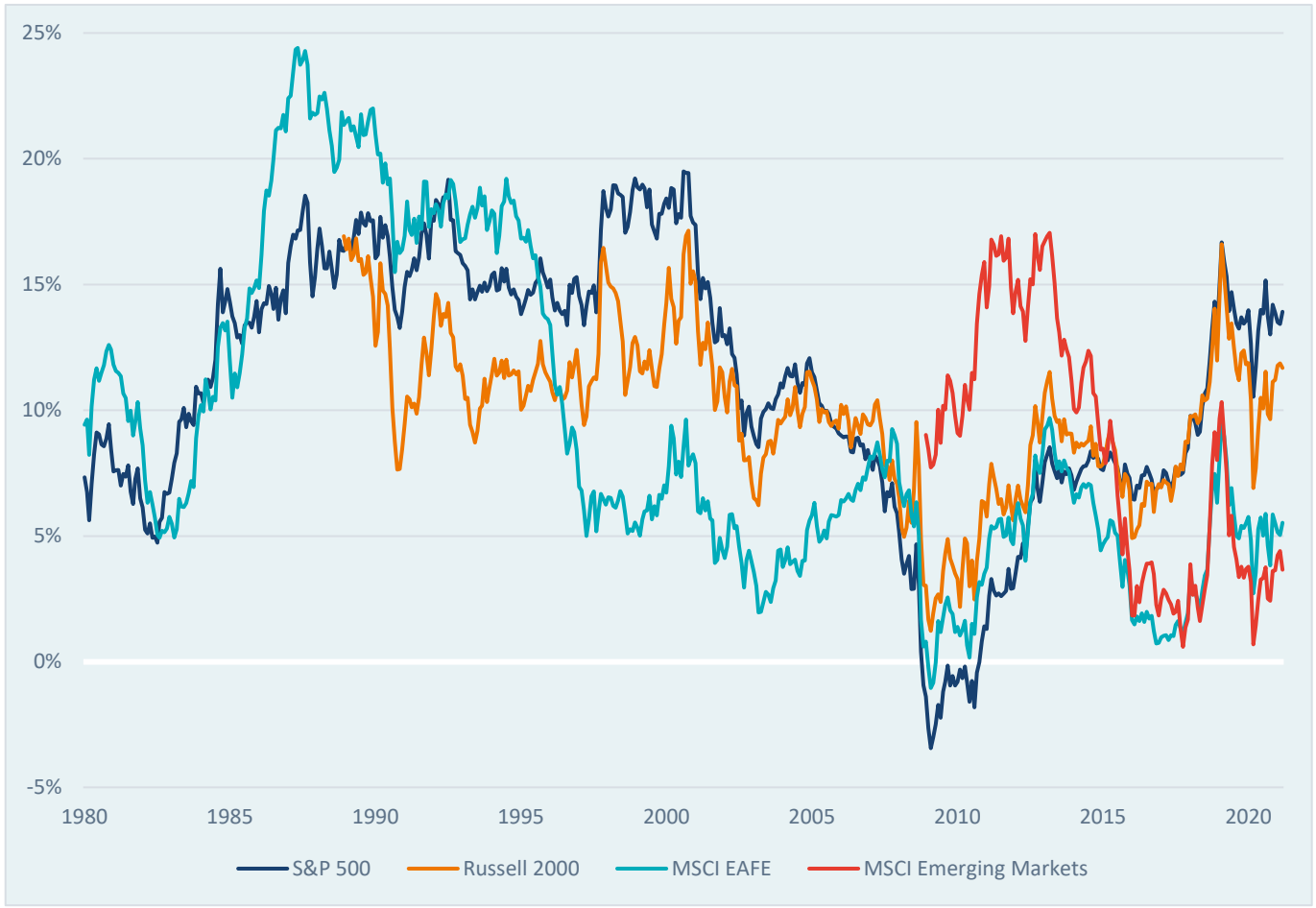


Currently, the asset classes with the highest projected returns are illiquid strategies.

Based on the Verus 2021 Capital Market Assumptions (10 year, returns are geometric)

Public equity: a historical perspective

ROLLING 10-YEAR RETURNS



Source: eVestment. Monthly rolling 10-year intervals.
Note: Returns as of 3/31/2021

Past performance is not indicative of future returns….

We need to balance humility in forecasting with trying to mitigate natural behavioral biases

Percent of 10-year periods with returns below 5%	
S&P 500	11.1%
Russell 2000	7.2%
MSCI EAFE	24.0%
MSCI EM	37.8%

Correlation assumptions

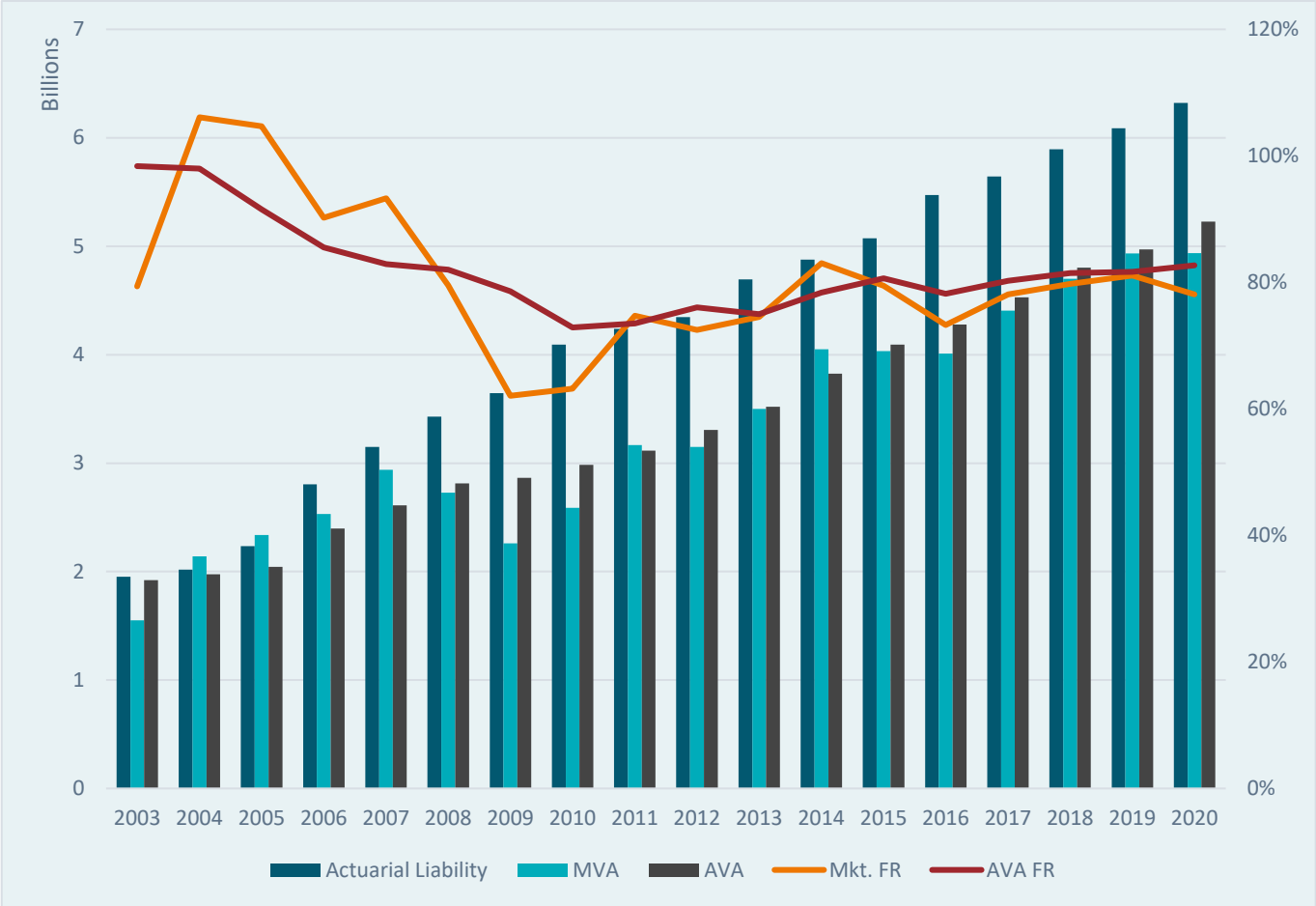
	Cash	US Large	US Small	Intl Large	Intl Small	EM	Global Equity	PE	US TIPS	US Treasury	Global Sovereign ex-US	US Core	Core Plus	Short-Term Gov't/Credit	Short-Term Credit	Long-Term Credit	US HY	Bank Loans	Global Credit	EMD USD	EMD Local	Commodities	Hedge Funds	Real Estate	REITs	Infrastructure	Risk Parity	Currency Beta
Cash	1.0																											
US Large	-0.2	1.0																										
US Small	-0.2	0.9	1.0																									
Intl Large	-0.1	0.9	0.8	1.0																								
Intl Small	-0.2	0.9	0.8	1.0	1.0																							
EM	-0.1	0.7	0.7	0.8	0.8	1.0																						
Global Equity	-0.2	1.0	0.9	1.0	0.9	0.9	1.0																					
PE	-0.2	0.6	0.6	0.6	0.6	0.5	0.7	1.0																				
US TIPS	0.0	0.1	0.1	0.2	0.2	0.3	0.2	0.1	1.0																			
US Treasury	0.2	-0.4	-0.5	-0.4	-0.4	-0.3	-0.4	-0.2	0.7	1.0																		
Global Sovereign ex-US	0.1	0.2	0.1	0.3	0.3	0.5	0.3	0.0	0.6	0.3	1.0																	
US Core	0.1	-0.1	-0.2	-0.1	-0.1	0.1	-0.1	0.0	0.8	0.9	0.5	1.0																
Core Plus	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.0	0.8	0.7	0.6	0.9	1.0															
Short-Term Gov't/Credit	0.4	-0.1	-0.2	0.0	-0.1	0.1	0.0	-0.2	0.6	0.7	0.5	0.8	0.8	1.0														
Short-Term Credit	0.0	0.4	0.4	0.4	0.4	0.5	0.4	0.0	0.5	0.2	0.5	0.5	0.8	0.7	1.0													
Long-Term Credit	0.0	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.7	0.5	0.5	0.8	0.9	0.5	0.6	1.0												
US HY	-0.2	0.8	0.7	0.8	0.8	0.8	0.8	0.5	0.4	-0.2	0.4	0.2	0.4	0.1	0.7	0.5	1.0											
Bank Loans	-0.3	0.7	0.7	0.6	0.7	0.6	0.7	0.4	0.2	-0.3	0.2	0.0	0.2	0.0	0.6	0.4	0.9	1.0										
Global Credit	-0.1	0.6	0.5	0.7	0.7	0.7	0.7	0.4	0.6	0.1	0.7	0.5	0.6	0.4	0.8	0.7	0.8	0.6	1.0									
EMD USD	-0.2	0.5	0.5	0.6	0.6	0.7	0.6	0.4	0.6	0.1	0.5	0.5	0.6	0.3	0.7	0.6	0.8	0.7	0.9	1.0								
EMD Local	0.0	0.5	0.4	0.7	0.7	0.8	0.7	0.4	0.4	0.0	0.6	0.3	0.4	0.3	0.5	0.4	0.7	0.5	0.8	0.8	1.0							
Commodities	-0.1	0.5	0.5	0.6	0.6	0.6	0.6	0.3	0.2	-0.3	0.4	-0.1	0.0	0.0	0.3	0.1	0.6	0.5	0.5	0.5	0.6	1.0						
Hedge Funds	-0.2	0.8	0.8	0.8	0.9	0.7	0.9	0.6	0.2	-0.4	0.2	0.0	0.2	0.0	0.5	0.3	0.8	0.8	0.7	0.6	0.5	0.5	1.0					
Real Estate	-0.1	0.5	0.5	0.4	0.5	0.4	0.5	0.4	0.1	-0.1	0.1	0.0	-0.1	0.0	0.1	0.0	0.3	0.3	0.4	0.3	0.3	0.3	0.4	1.0				
REITs	-0.2	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.4	0.1	0.3	0.4	0.4	0.2	0.5	0.5	0.6	0.6	0.7	0.6	0.5	0.4	0.5	0.8	1.0			
Infrastructure	-0.2	0.8	0.7	0.8	0.8	0.7	0.8	0.7	0.4	-0.2	0.5	0.2	0.4	0.2	0.6	0.5	0.8	0.7	0.8	0.8	0.7	0.5	0.7	0.3	0.7	1.0		
Risk Parity	-0.1	0.6	0.6	0.7	0.6	0.6	0.7	0.3	0.4	0.0	0.4	0.2	0.5	0.3	0.6	0.5	0.8	0.6	0.7	0.7	0.6	0.6	0.7	0.0	0.5	0.7	1.0	
Currency Beta	0.0	0.2	0.2	0.1	0.1	0.1	0.2	0.0	0.0	-0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	1.0

Note: Correlation assumptions are based on the last ten years. Private Equity and Real Estate correlations are especially difficult to model – we have therefore used BarraOne correlation data to strengthen these correlation estimates.

Historical plan experience

Historical funded status

FCERA HISTORICAL FUNDED STATUS



Actuarial funded status incorporates asset-smoothing.

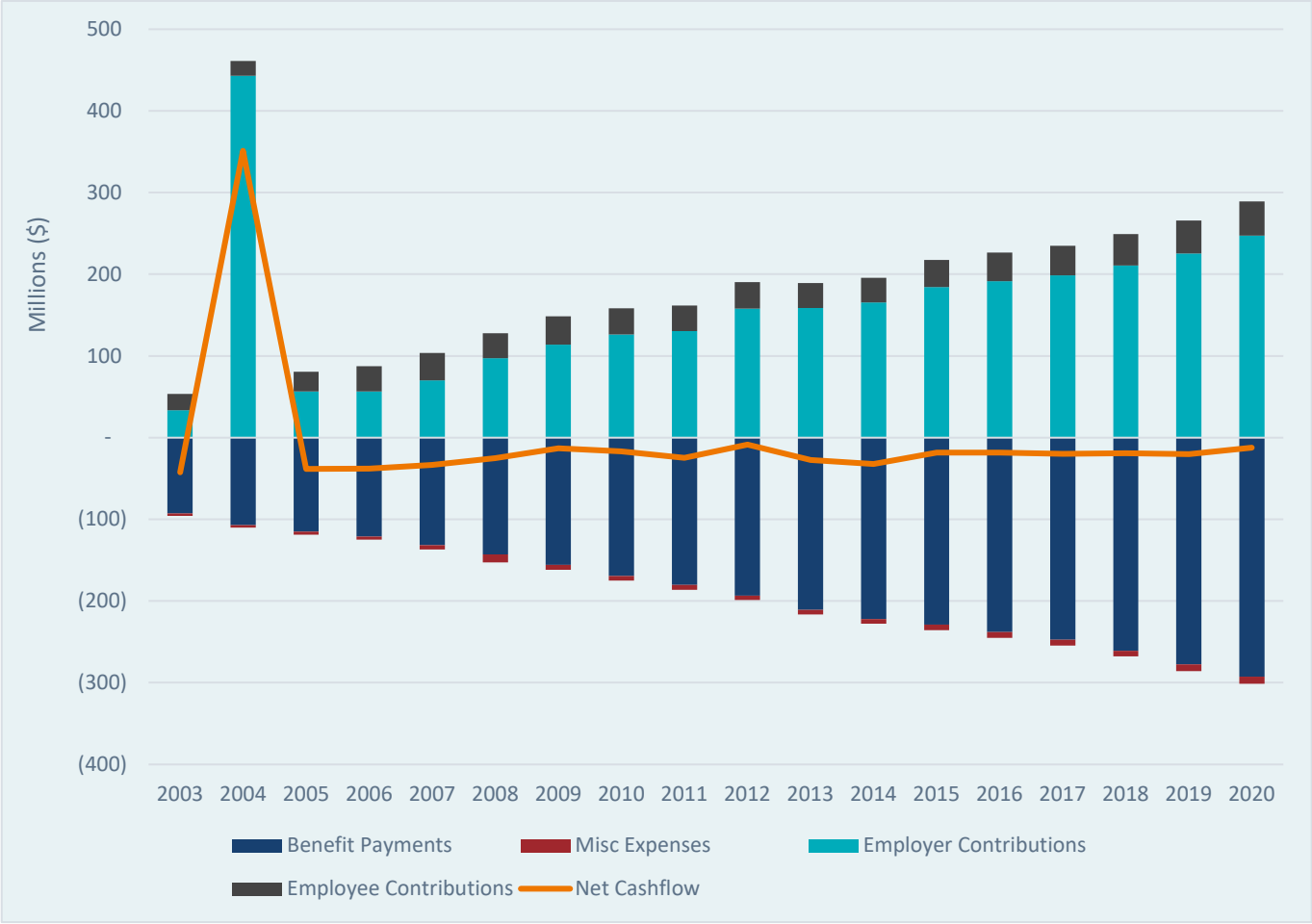
Market-value funded status is more volatile.

Current funded status is approximately 80%.

Source: FCERA 2020 CAFR and Actuarial Valuations

Historical cashflow

FCERA HISTORICAL CASHFLOW



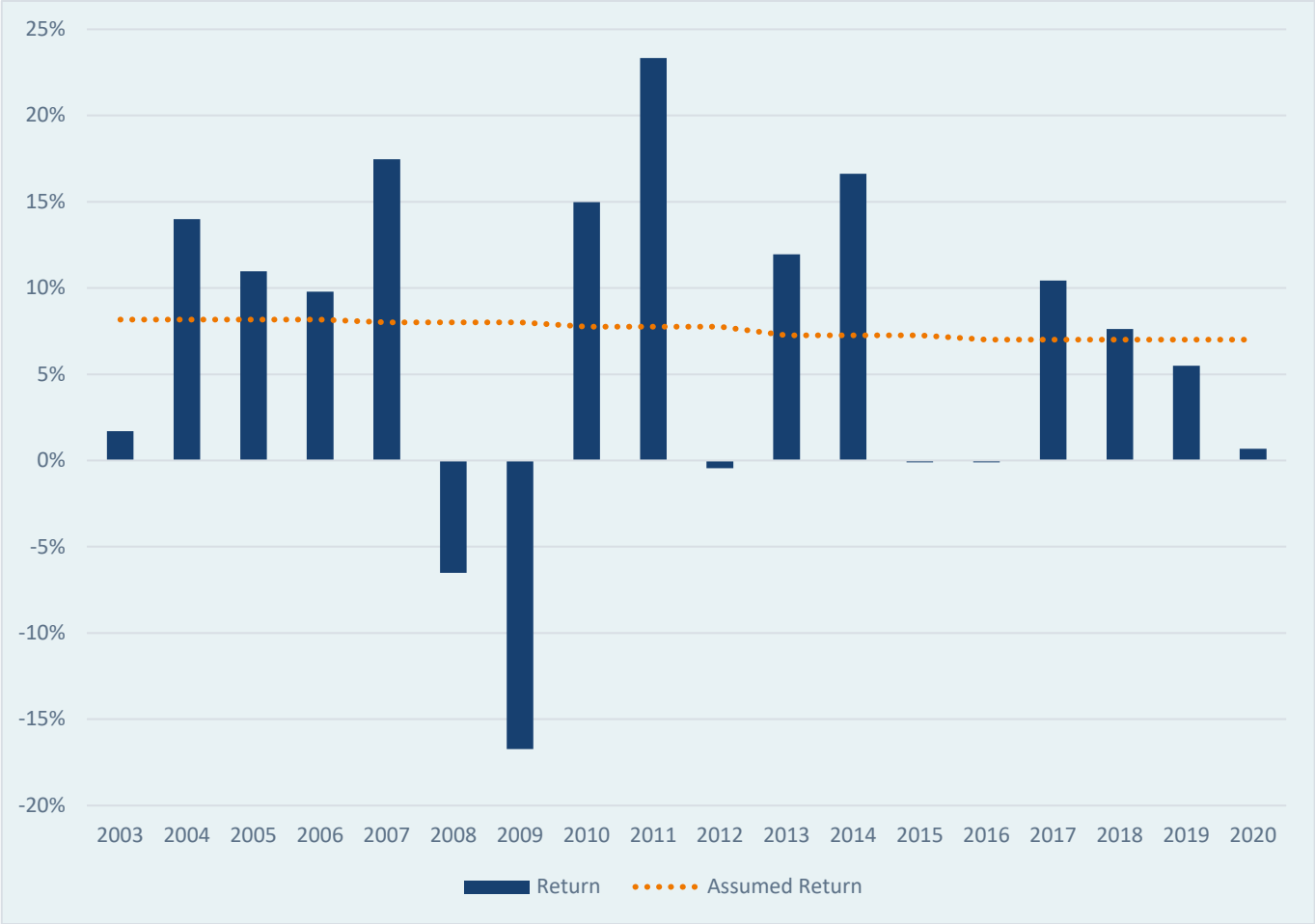
Source: FCERA 2020 CAFR

Net cash outflows have averaged ~$20 million a year over the recent past.

The extent of cash outflows impact tolerance for illiquidity, and overall risk tolerance.

Historical return

FCERA HISTORICAL RETURN



FCERA has exceeded the assumed rate in 10 of the last 18 years.

On an annualized basis, as of 3/31/21, the Fund has returned:

	FCERA
5 years	8.8%
10 years	7.1%
15 years	6.5%
20 years	7.2%

Source: FCERA 2020 CAFR and Historical Actuarial Valuation. Annualized returns are net of fees, other than the 20-year time frame, for which only gross data is available.

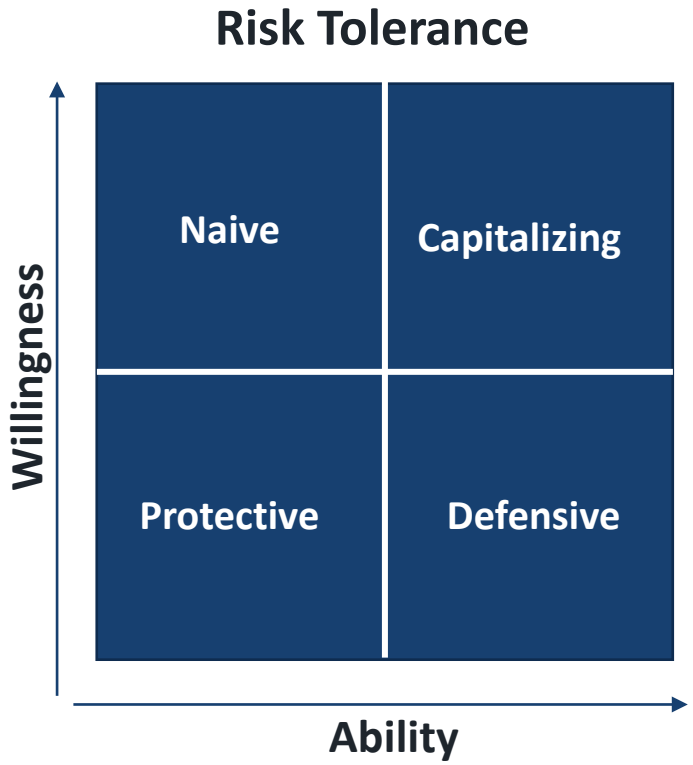
Enterprise risk tolerance

Enterprise risk tolerance in context

— Properly assessing Enterprise Risk Tolerance has important and practical implications for investment strategy development.

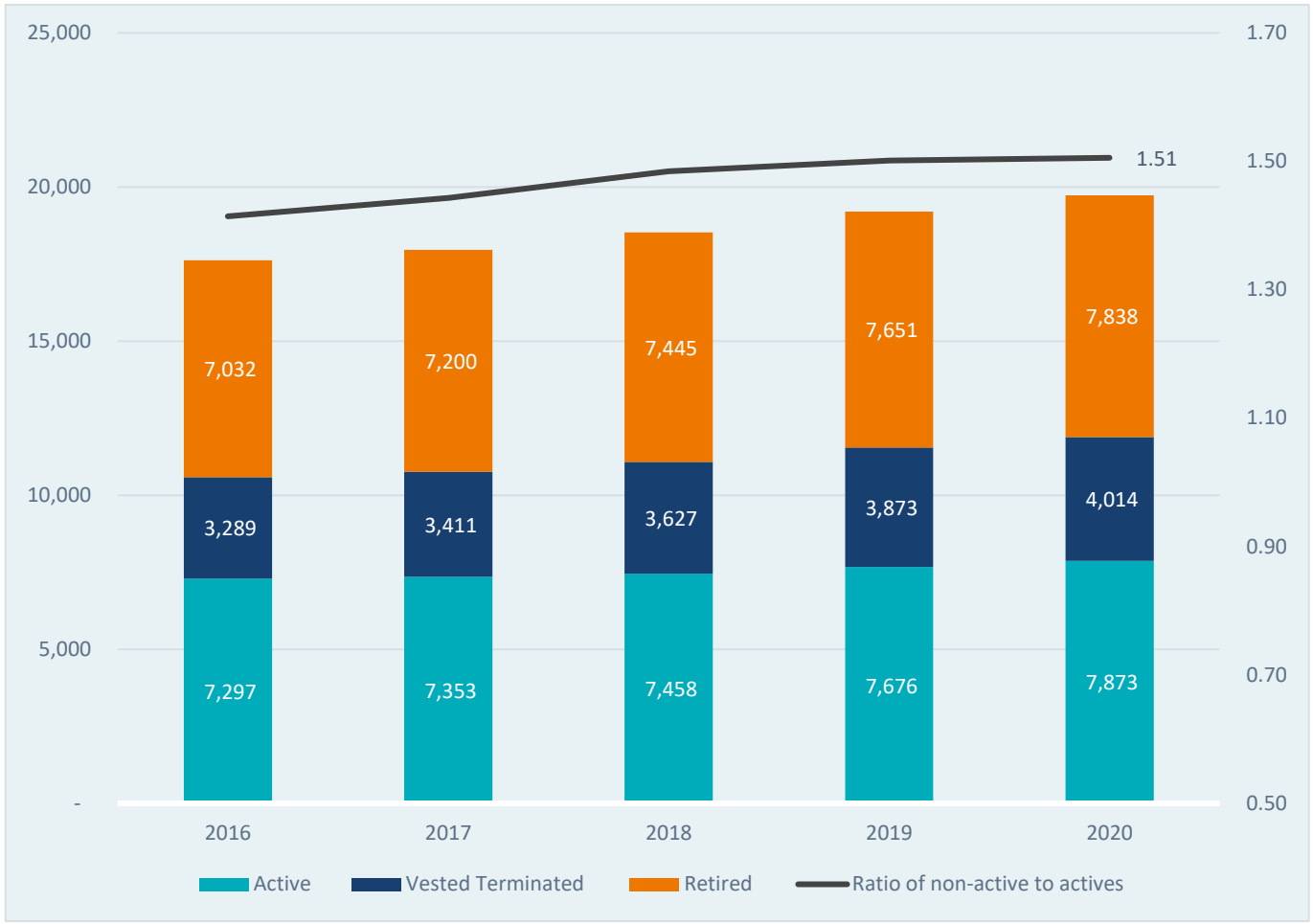
— It involves assessing the Plan's ability and the Board's willingness to accept risk.

— Although the Board's fiduciary duty is to the Members, understanding how the County's financial situation impacts its ability to make contributions cannot be overlooked.



Plan demographics

FCERA MEMBER POPULATION



Source: Segal - FCERA Actuarial Valuation Report as of June 30, 2020

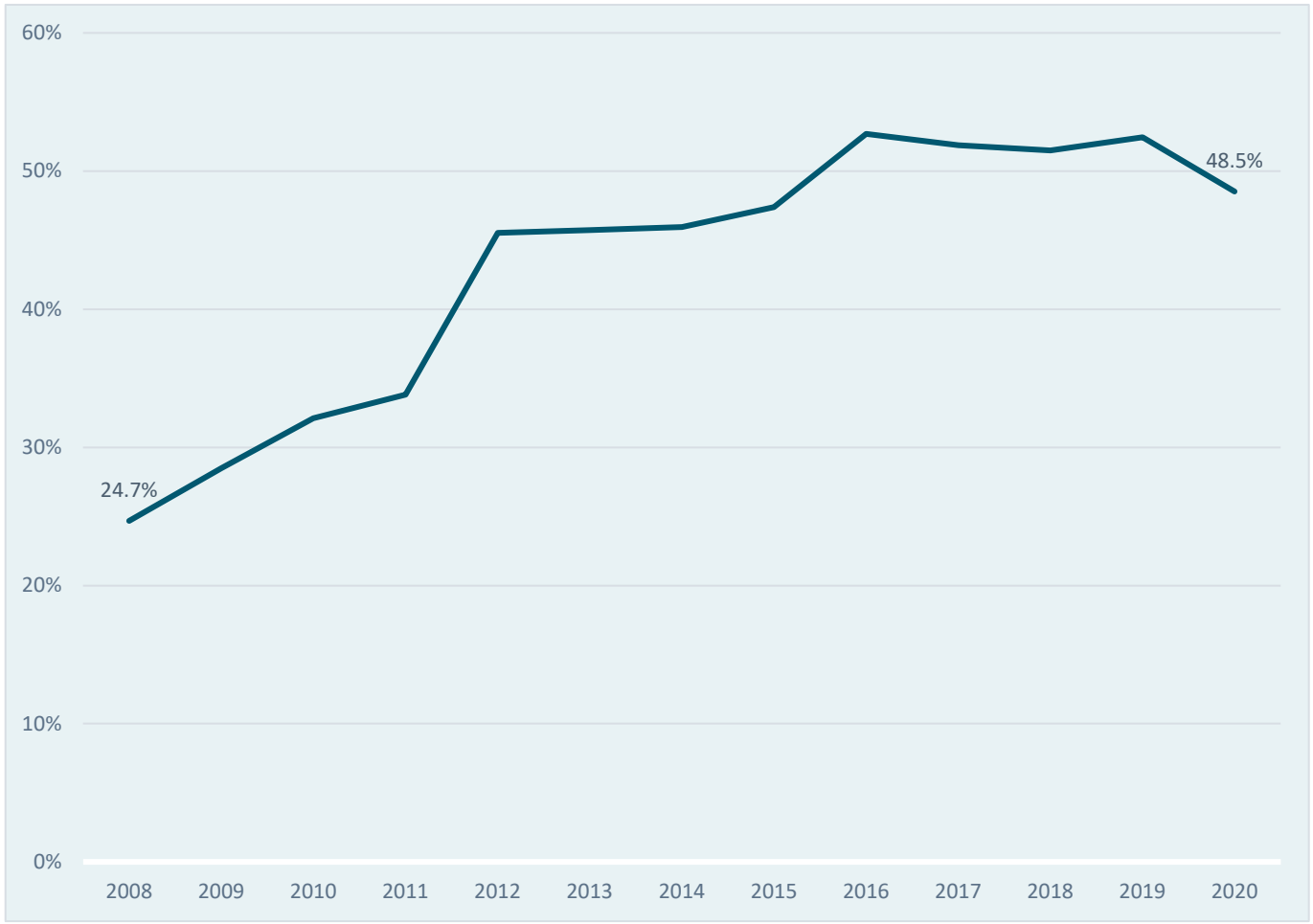
As of June 30, 2020, there were 7,873 active members, 7,838 inactive members, and 4,014 vested terminated members.

For every 1 active employee there are 1.51 inactive employees.

Since 2016, the active population has grown by 7.8% while in-actives have grown by 14.8%.

Historical employer contributions

HISTORICAL CONTRIBUTIONS AS A % OF COVERED PAYROLL



Source: Brown Armstrong – 2020 Fresno County CAFR as of June 30, 2020

Losses from the 2008 Great Financial Crisis resulted in subsequently higher contributions.

Over the last 5 years, the ratio has moved closer to its 2015 level.

Peer group

1937 Act Systems	Population		Median Household Income
Los Angeles	10,039,107	$	68,044
San Diego	3,338,330	$	78,980
Orange	3,175,692	$	90,234
San Bernadino	2,180,085	$	63,362
Alameda	1,671,329	$	99,406
Sacramento	1,552,058	$	67,151
Contra Costa	1,153,526	$	99,716
Fresno	**999,101**	**$**	**53,969**
Kern	900,202	$	53,350
Ventura	846,006	$	88,131
San Mateo	766,573	$	122,641
San Joaquin	762,148	$	64,432
Stanislaus	550,660	$	60,704
Sonoma	494,336	$	81,018
Tulare	479,997	$	49,687
Santa Barbara	446,499	$	74,624
Merced	277,680	$	53,672
Marin	258,826	$	115,246
Imperial	181,215	$	47,622
Mendocino	86,749	$	51,416

Source: U.S. Consensus Bureau as of 2019

For the purposes of this study, a peer group was created by identifying four counties within the SACRS county system that are similar in population, geographic location, household income, and sources of economic revenue. Fresno county's peer group includes:

- **Sacramento County**
- **Contra Costa County**
- **Kern County**
- **Ventura County**

To ensure 'fair' comparisons, financial data was collected and reviewed from each county's most recent CAFR. With that said, we also recognize that each county has unique characteristics that make perfect comparisons impossible.

Credit ratings

Fresno's credit ratings are similar its peer counties

- Fresno County has been assigned high general credit ratings from 2 of the 3 national rating agencies:
  - Moody's Baa2
  - S&P AA
- Credit ratings are generally specific to certain types of debt issued by municipality.
  - Fresno's largest outstanding debts consists of pension obligation bonds, tobacco tax bonds, and revenue bonds.
  - Higher credit ratings lead to a lower cost of borrowing for the plan sponsor.

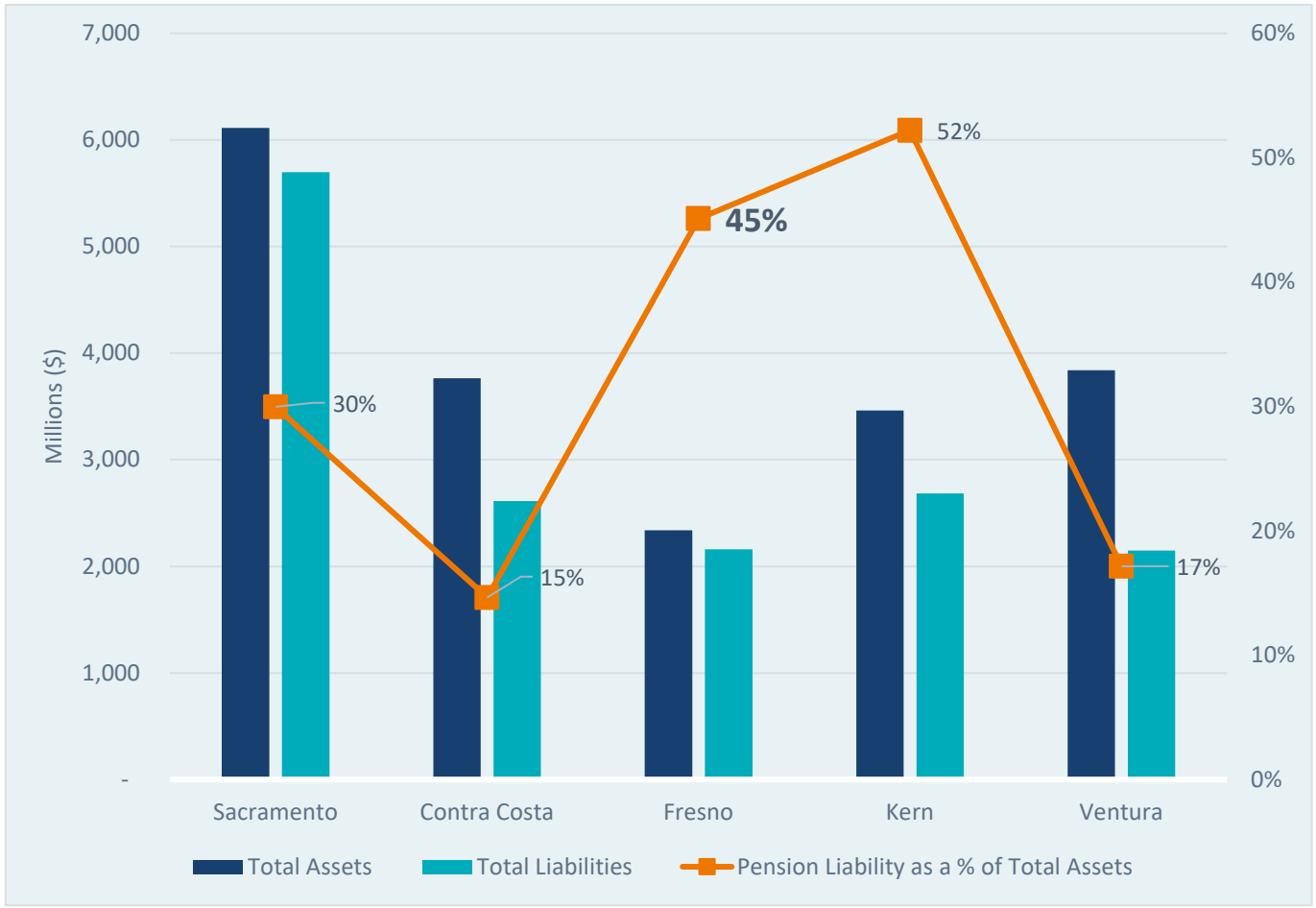
County	Moody's	S&P	Market Value Funded Status	Actuarial Value of Assets (000s)	Total County Revenue (000s)	Population	Per Capita Income	Average Unemployment Rate (FY2019)	CAFR As of Date
Fresno	Baa2	AA	82.7%	$ 5,226,009	$ 1,757,231	999,101	$ 43,084	8.8%	6/30/2020
Sacramento	Aa3	A+	80.6%	$ 10,074,345	$ 3,562,287	1,552,058	$ 55,266	6.8%	6/30/2020
Contra Costa	Aa2	AA+	90.6%	$ 9,128,669	$ 3,738,705	1,153,526	$ 82,506	6.3%	6/30/2020
Kern	Aa3	AA	64.4%	$ 4,508,458	$ 1,848,241	900,202	$ 38,592	10.1%	6/30/2020
Ventura	Aa1	AA+	89.6%	$ 6,044,036	$ 2,147,905	846,006	$ 62,343	5.8%	6/30/2020

Sources: Each County's respective CAFR, BLS.GOV; Respective credit ratings sourced from Western Asset Management Company.

Note: Contra Costa County per capita income as of June 2018.

Balance sheet by county

ASSETS AND LIABILITIES



Source: County CAFR's as of 6/30/20. Includes both governmental and business-type activities.

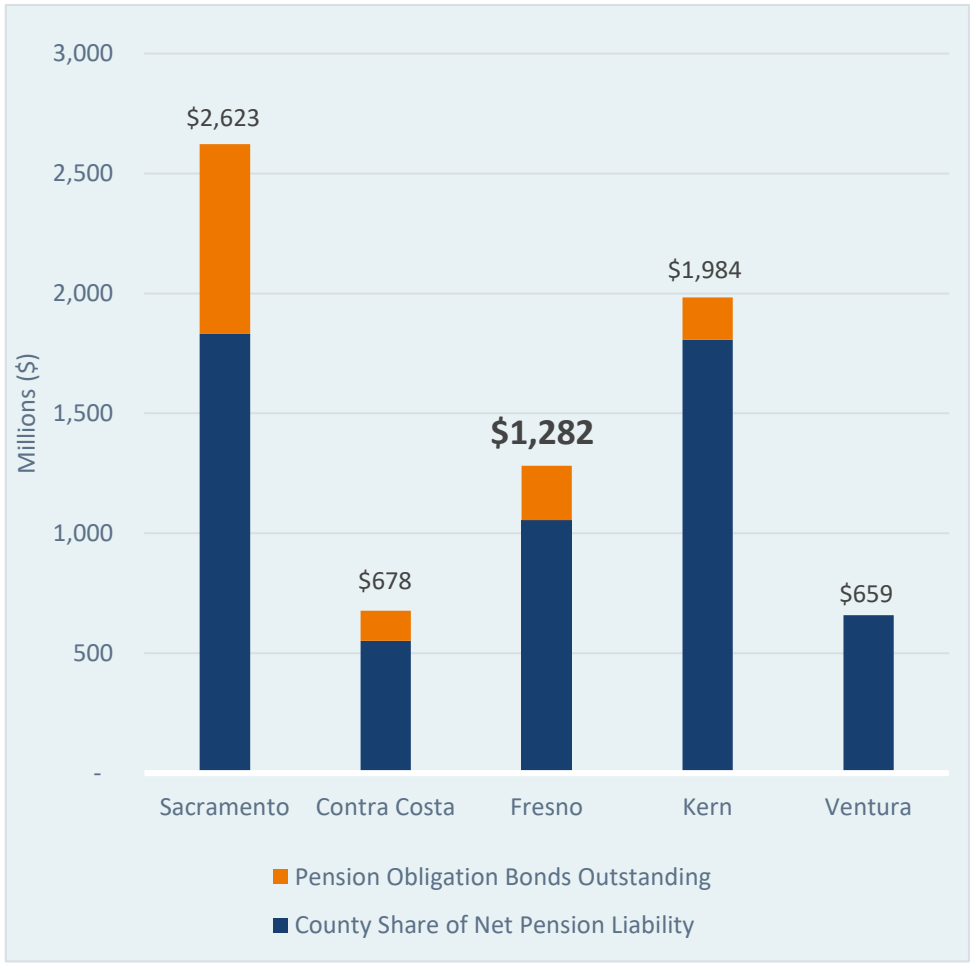
Note: Proportionate share of the pension liability excludes pension obligation bonds

Fresno County's operations are generally smaller relative to the peer counties.

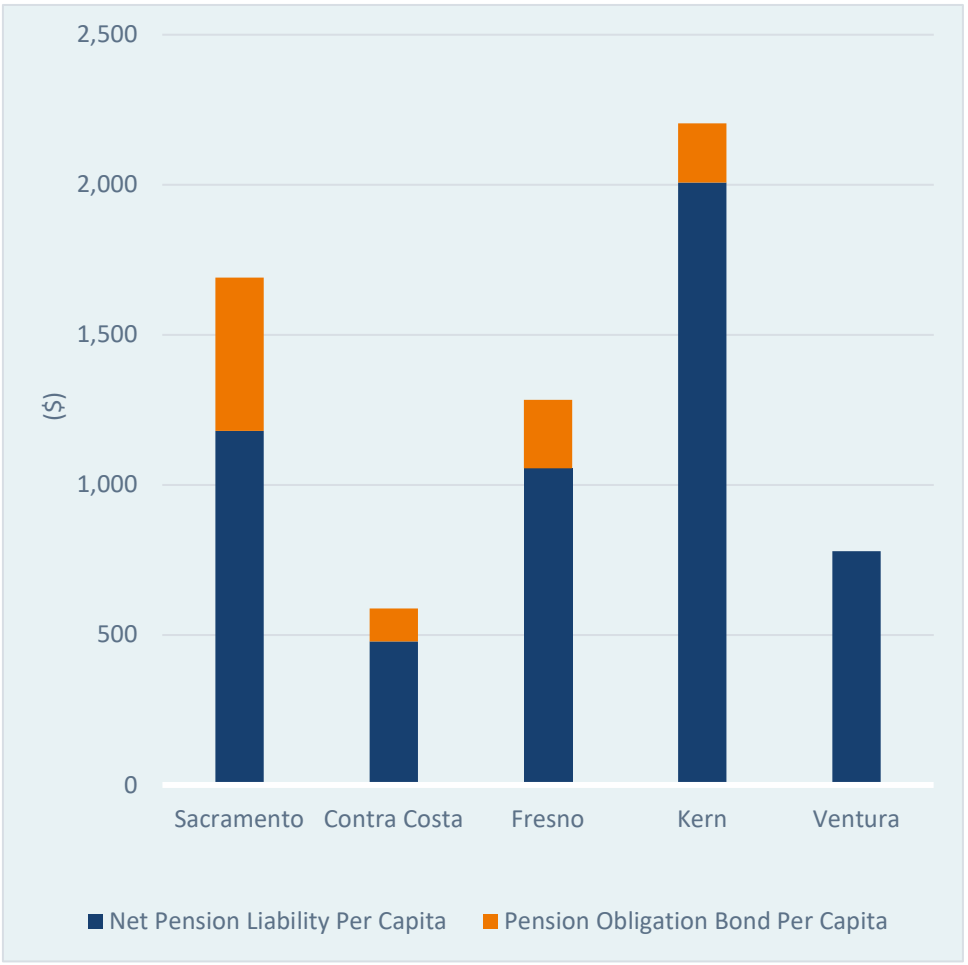
The accrued pension liability is 45% of total assets and 2nd highest amongst its peers.

County's pension liability

"TRUE" COST OF PENSION LIABILITY



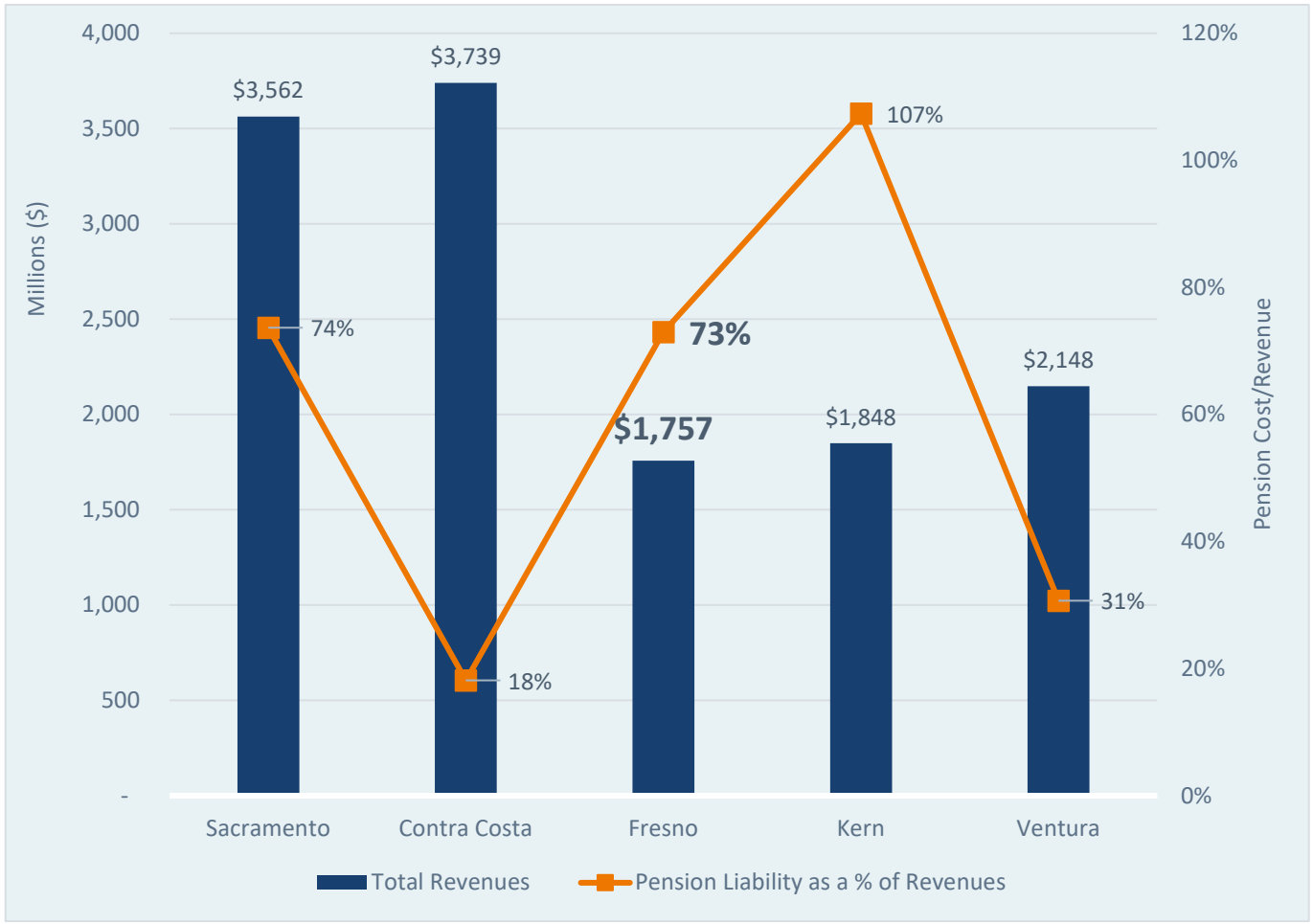
PENSION LIABILITY PER CAPITA



Source: County CAFR's as of 6/30/20

County revenues

REVENUES BY COUNTY



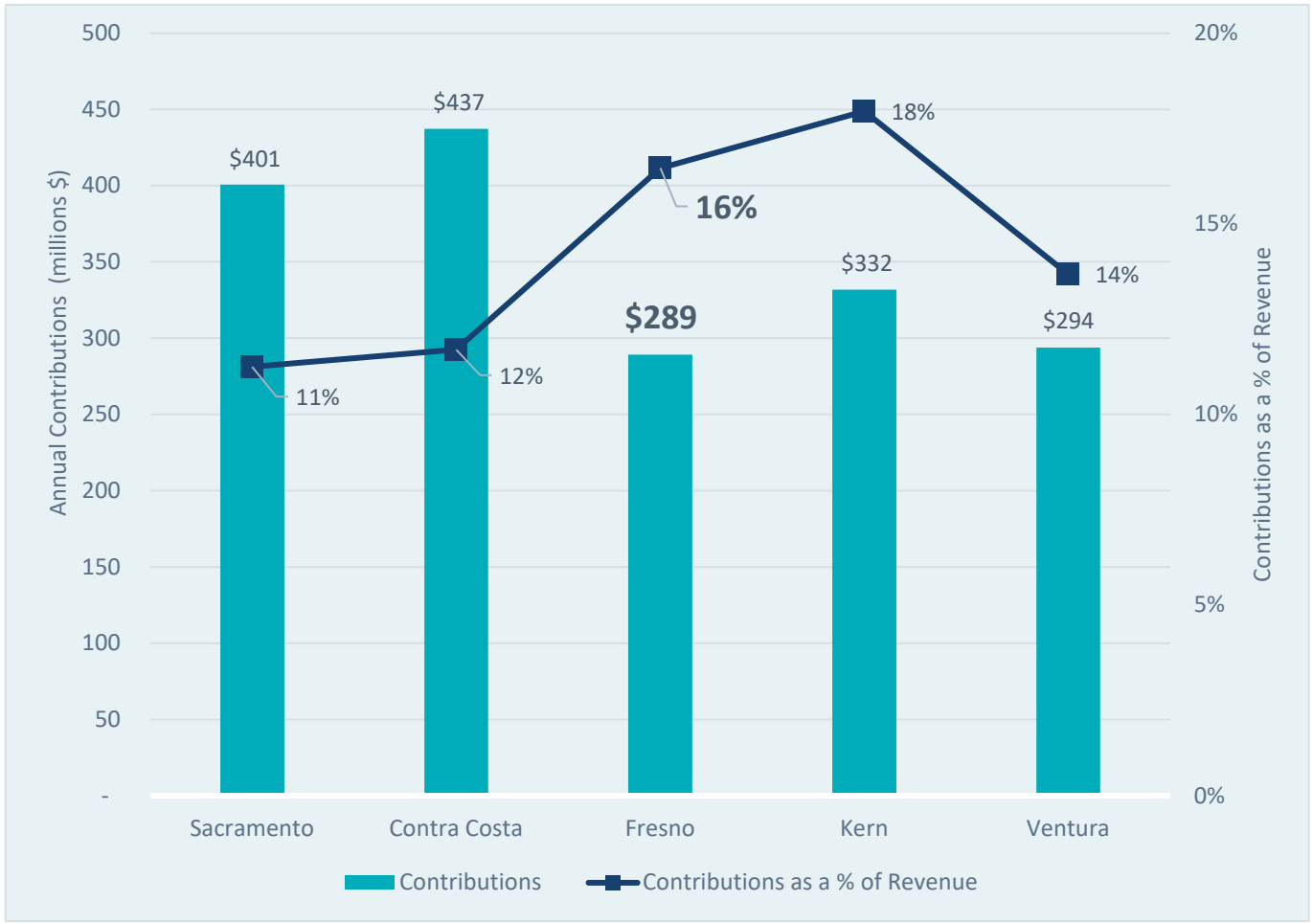
Source: County CAFR's as of 6/30/20

Fresno County's total revenue for fiscal year end 2020 was $1.76 billion.

The "true" pension cost (county's proportionate share of the pension liability + POBs outstanding) was $1.28 billion.

County contributions

CONTRIBUTIONS BY COUNTY

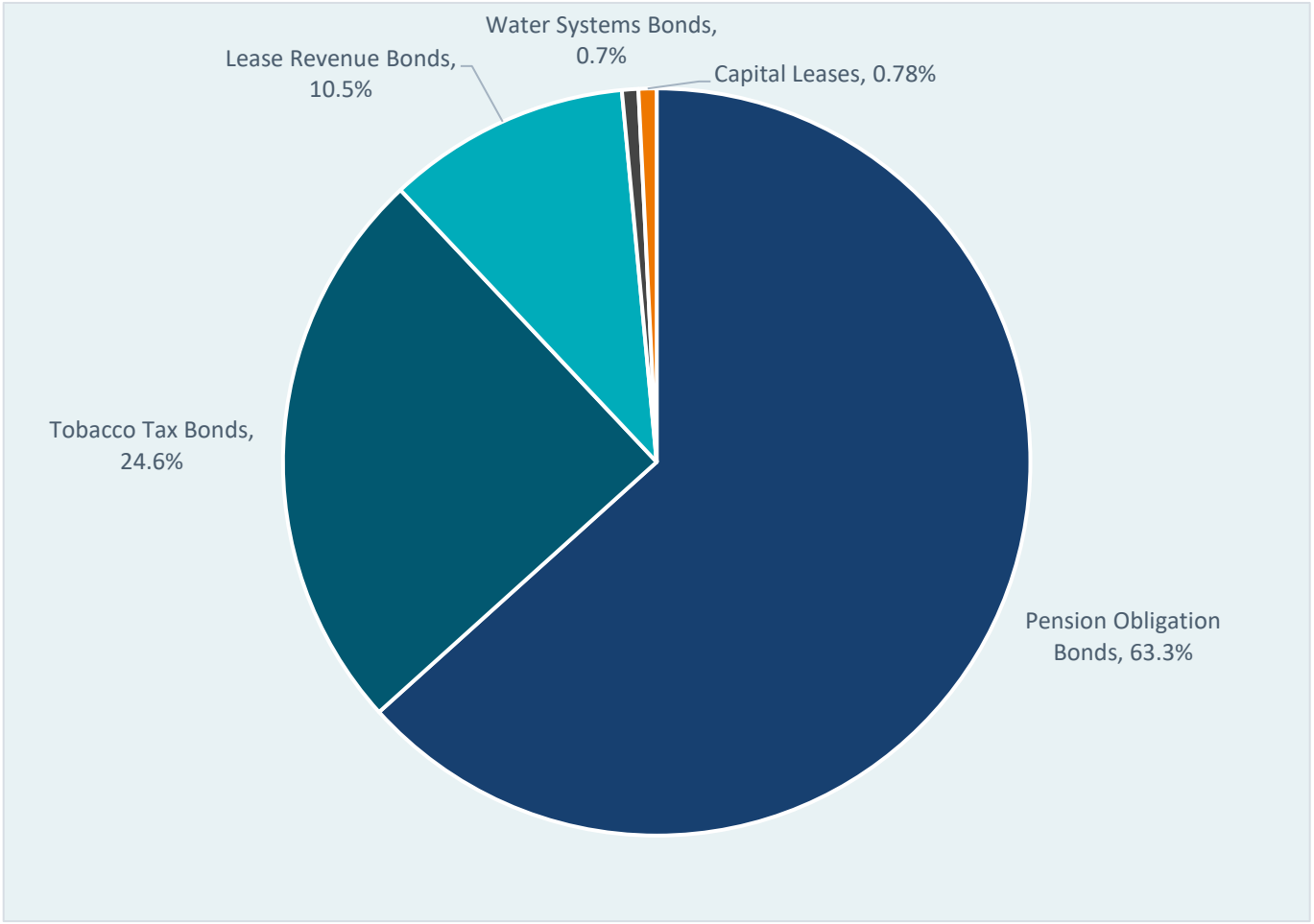


Source: Actuarial Valuation Reports 2020. CCERA Actuarial Valuation report as of 2019

Relative to county revenue, FCERA had the second highest contributions but still inline with its peer group.

Debt structure

LONG-TERM OUTSTANDING DEBT BY TYPE



Source: County CAFR's as of 6/30/20

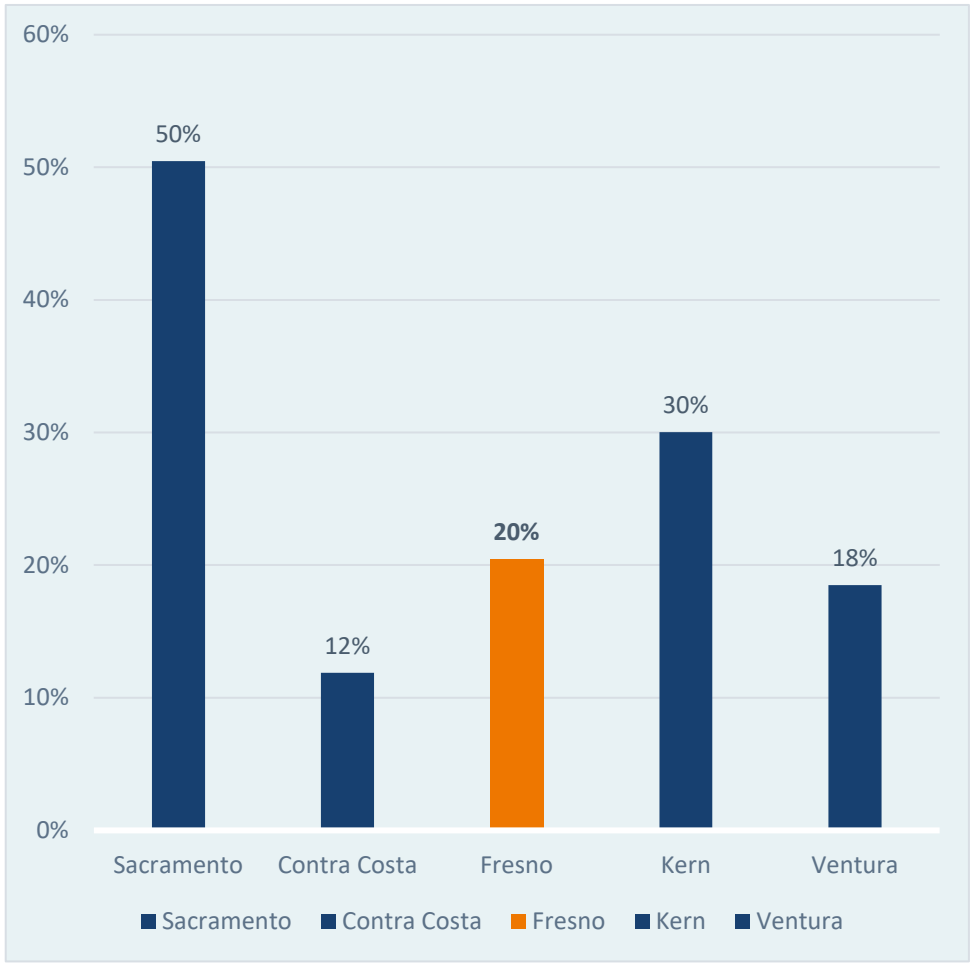
Fresno County has ~63% of its total outstanding debt in pension obligation (PO) bonds. Compared to its peers:

- Sacramento: 28%
- Contra Costa: 29%
- Kern: 32%
- Ventura: 0%

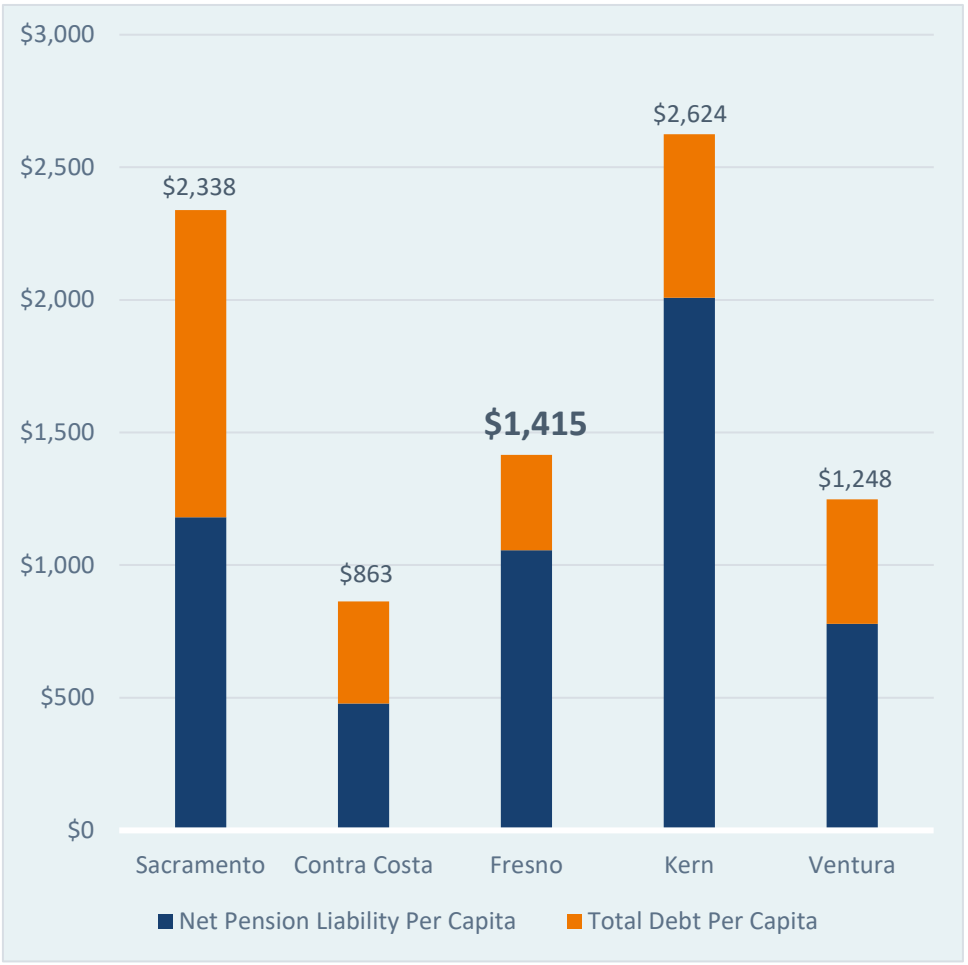
Fresno has ~$227 million in PO bonds outstanding; this amount is 10% of total assets.

Debt vs. revenue, population

TOTAL LONG-TERM DEBT AS A PERCENTAGE OF REVENUE



TOTAL DEBT PER CAPITA



Source: County CAFR's as of 6/30/20

Debt vs assessed property values

TOTAL LONG-TERM DEBT TO ASSESSED VALUE OF PROPERTY

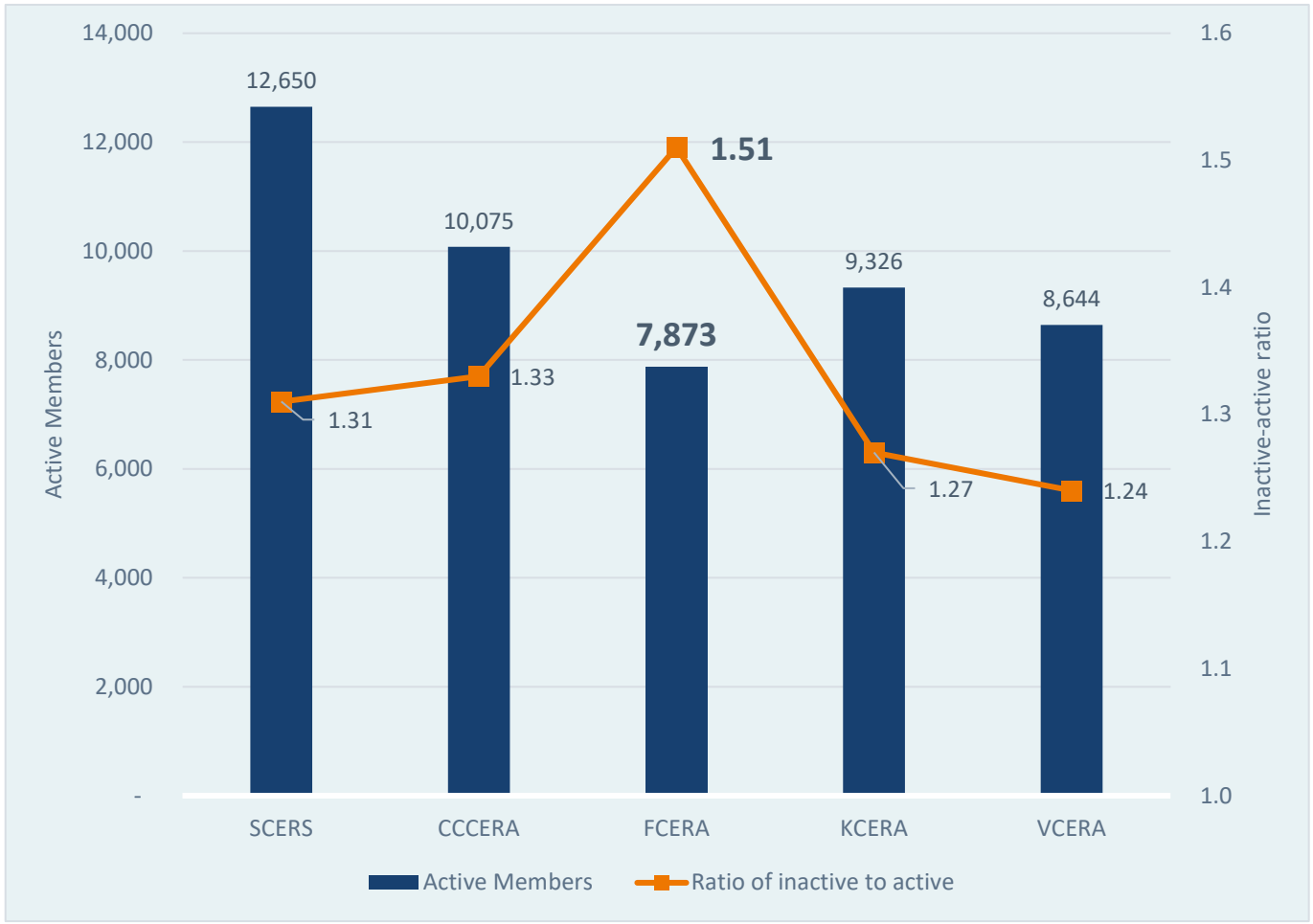
Source: County CAFR's as of 6/30/20

Debt, relative to assessed value of property is in the middle amongst its peers.

This indicates a reasonable level of leverage.

Member population

ACTIVE MEMBER POPULATION BY PLAN



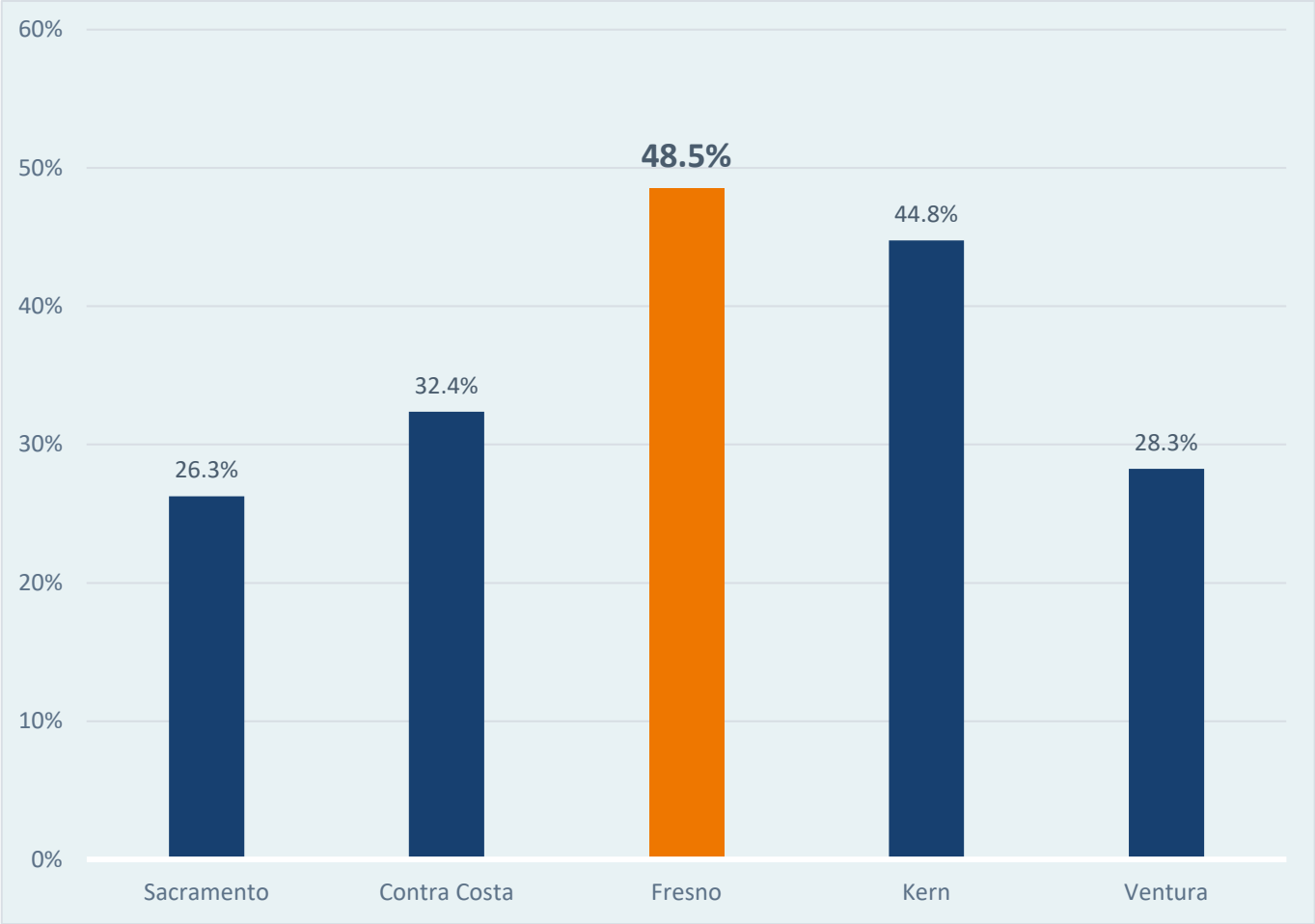
Source: County CAFR's as of 6/30/20

FCERA has the lowest number of active members and the highest ratio of inactive-to-active members.

Since contributions are driven by the active population, this suggests a lower risk tolerance relative to peers.

Contributions

EMPLOYER CONTRIBUTIONS AS A % OF PAYROLL



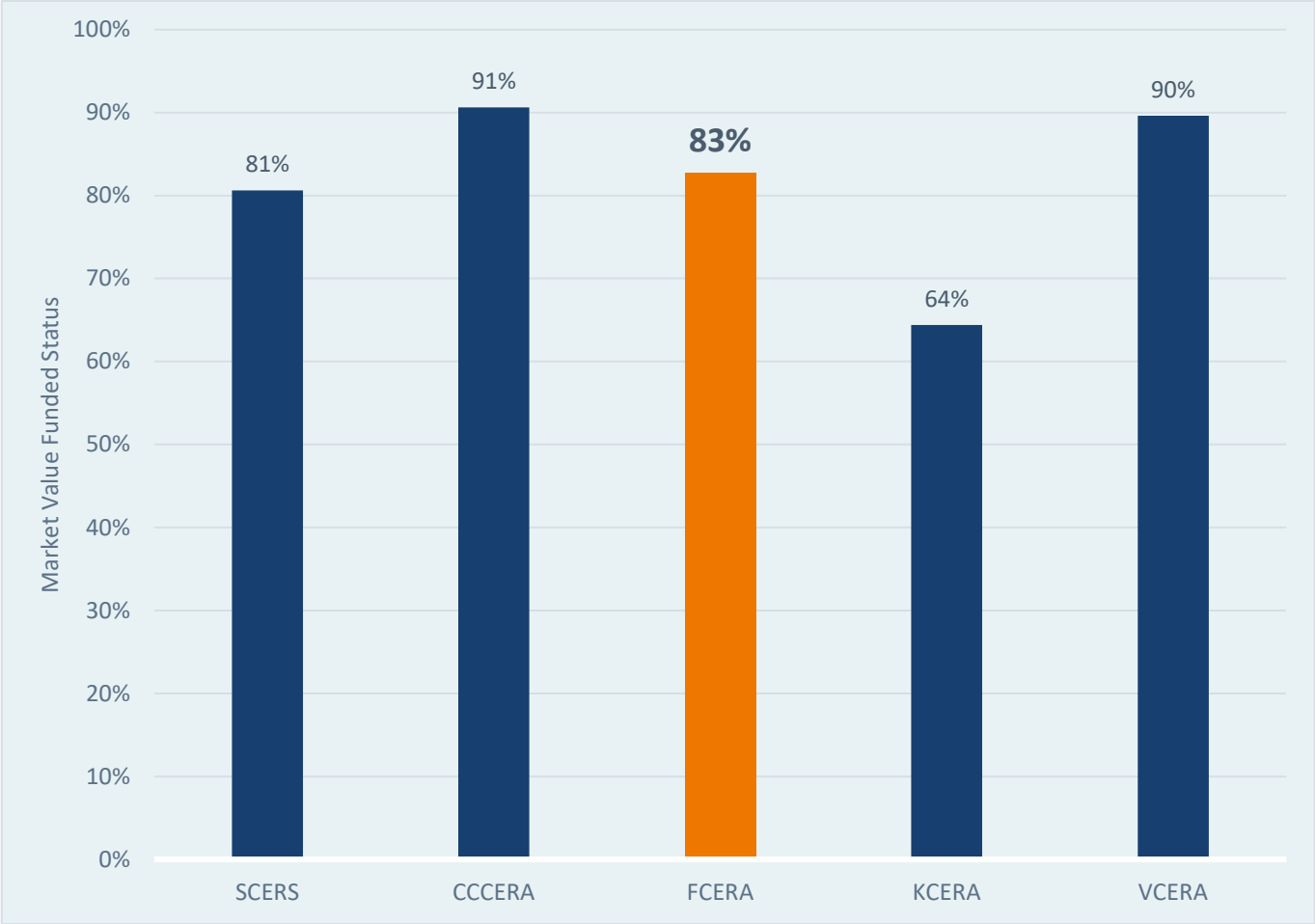
Source: County CAFR's as of 6/30/20

Fresno had the highest number of contributions as a percentage of payroll.

This potentially gives the county relatively less flexibility to increase future contribution amounts.

Funded status

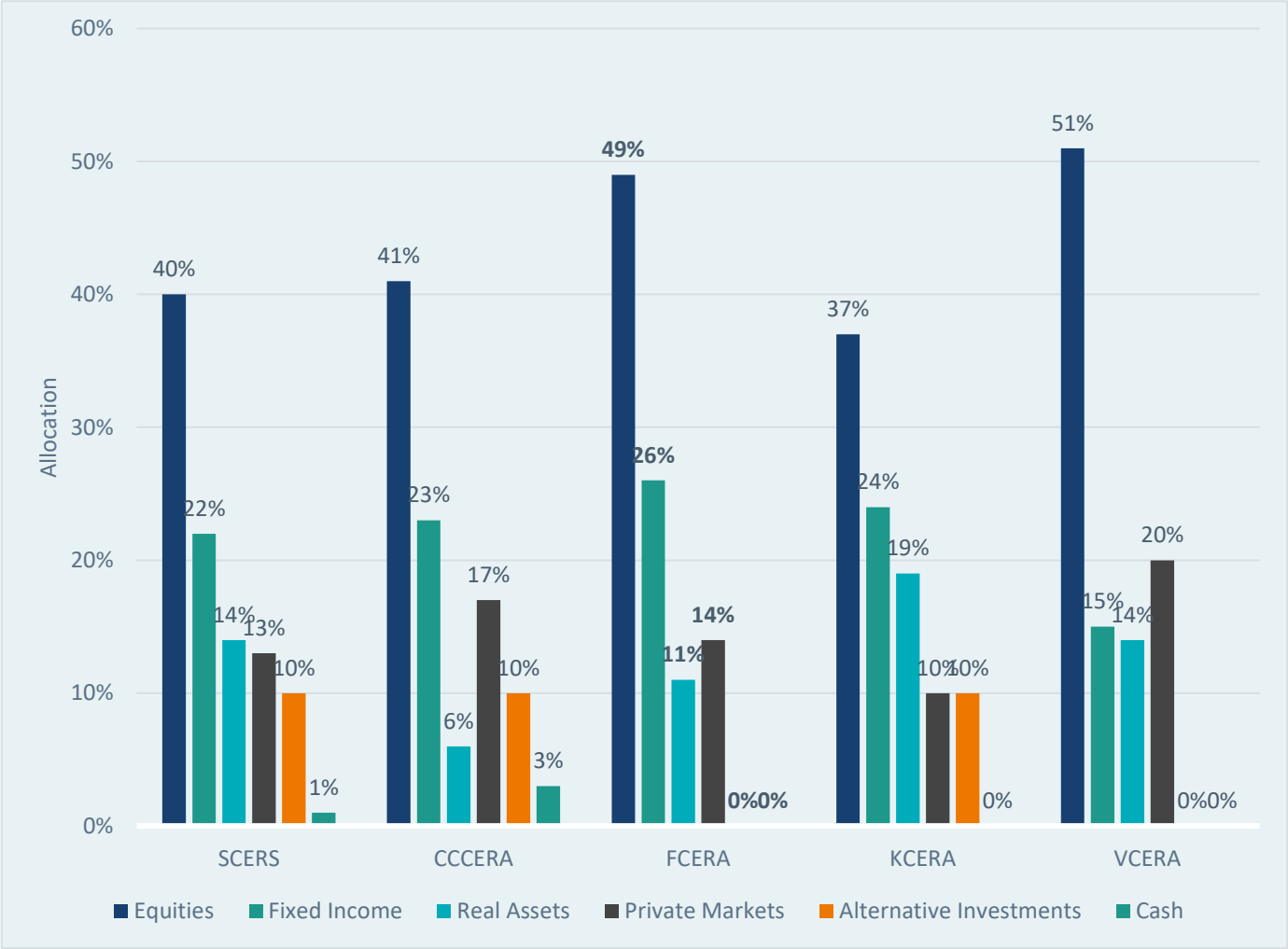
MARKET VALUE FUNDED STATUS



Source: County Actuarial Valuation Reports 2020. CCERA Actuarial Valuation report as of 2019

FCERA's actuarial funded status is in the middle of its peers.

Strategic asset allocation vs. peers



FCERA has the highest relative allocation to public markets which includes a 49% allocation to public equities and 26% to fixed income.

Source: FCERA, SCERS, KCERA, and VCERA CAFR as of June 30, 2020; CCCERA CAFR as of December 31, 2020

Note: CCCERA 's fixed income allocation is in high quality, short duration securities used to produce monthly cash flows.

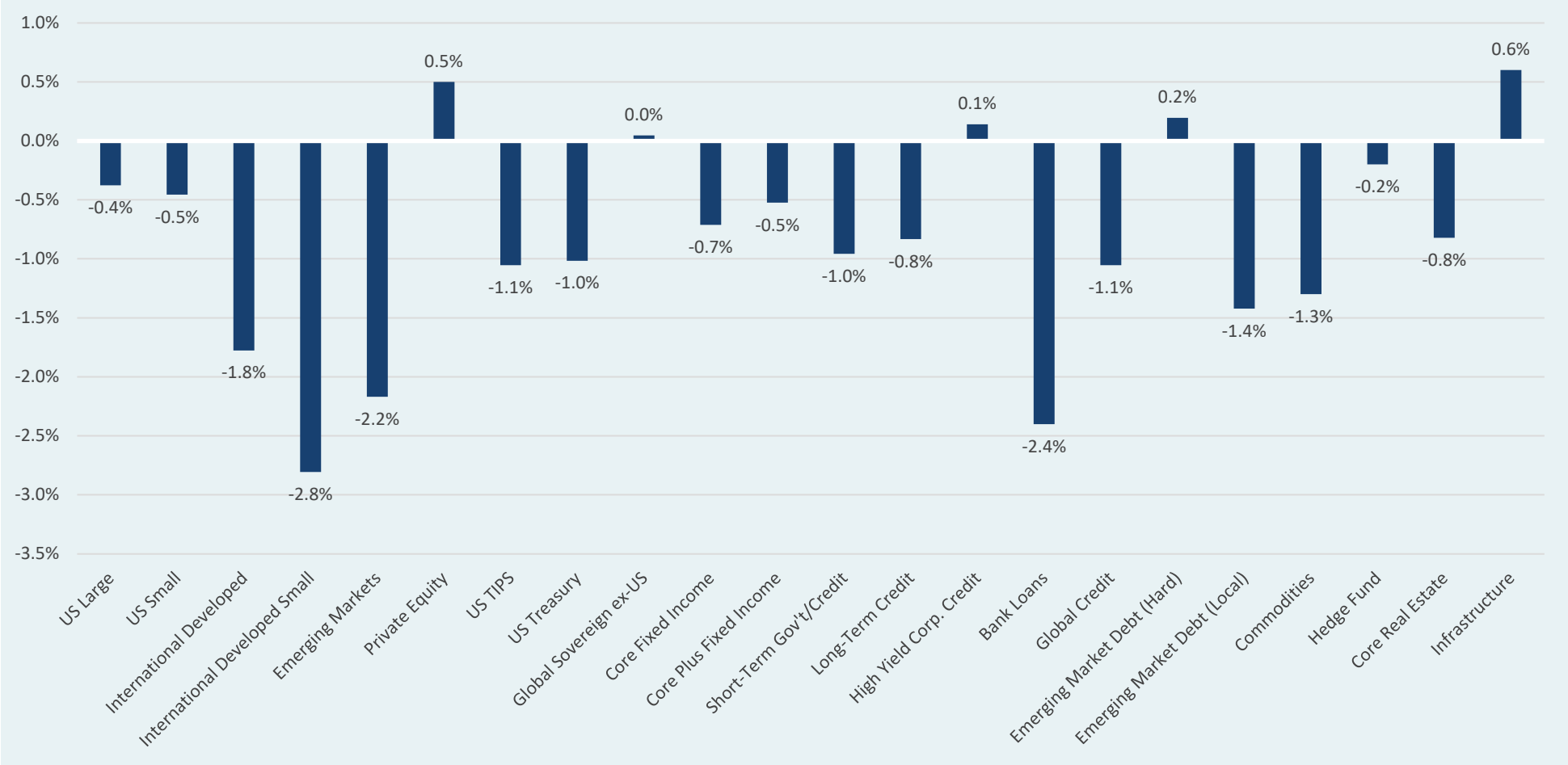
Summary - ERT

- Overall, Fresno county enjoys favorable financial conditions thanks in part to its agriculturally driven economy which is the largest in terms of total value in California.
- The county's credit rating on its long-term debt from national rating agencies Moody's and S&P are of high quality.
- Long-term debt obligations are reasonable. Total debt to assessed value of property is 0.4% indicating a solid tax base relative to debt burden.
- The county's pension plan is a relatively low burden as per capita indicators are favorable. Although the pension plan is relatively less favorable from an income and balance sheet perspective, this is primarily attributable to Fresno's relatively smaller economy.
- The ratio of inactive-to-active members has been trending higher and is highest relative to its peers.
  - This suggests that the plan should assume a lower risk tolerance compared to peers.
- The pension plan's actuarial funded status has steadily increased over the past ten years in part to the county's ability to consistently increase contributions.
- The financial health of the sponsor gauges the *Ability* to accept risk. *Willingness* is determined by the Board.

Asset mixes & monte carlo analysis

Setting expectations

2021 return projections vs. 2020 return projections



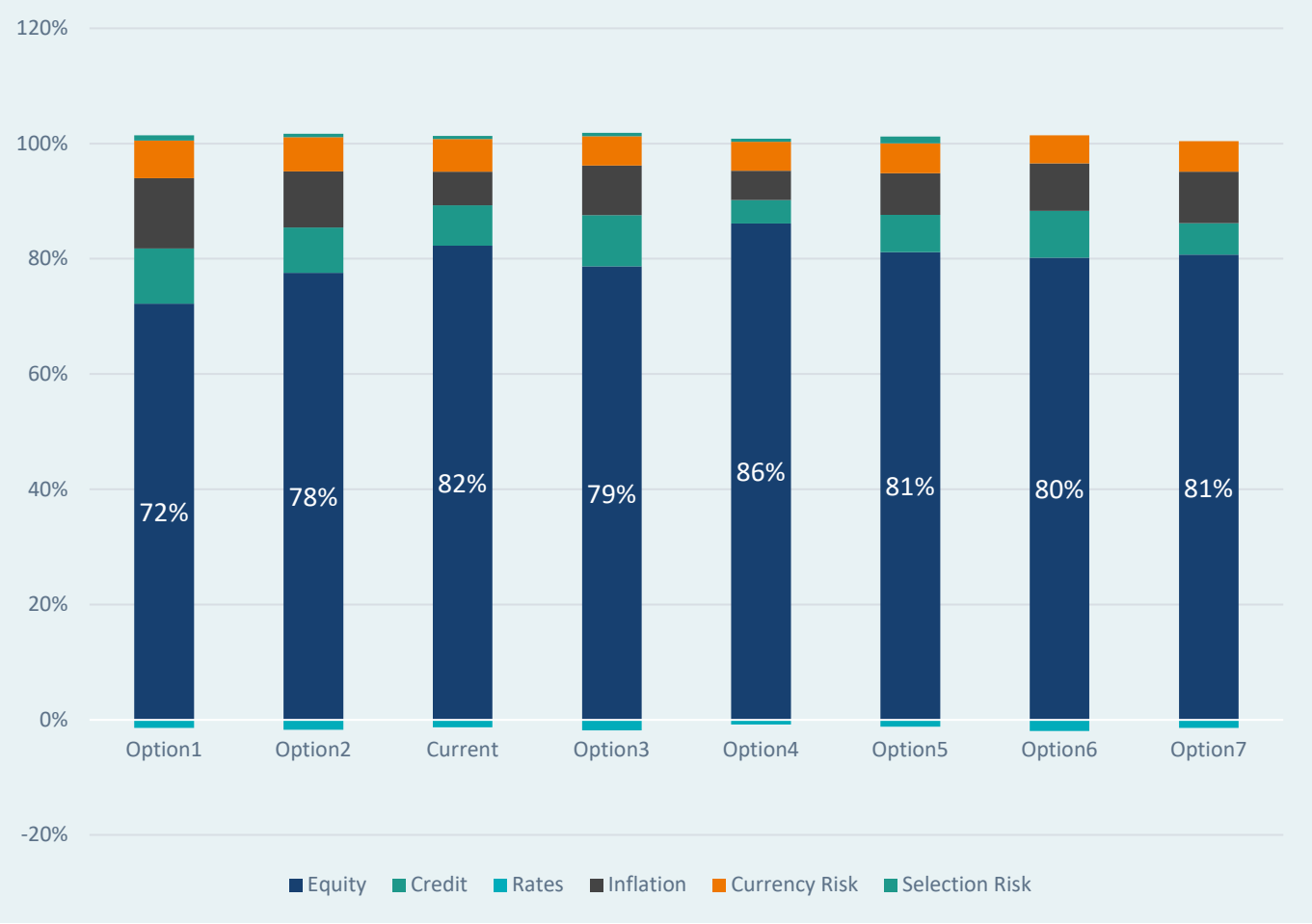
Note: year-over-year change of the select group of asset classes above is based on the 2020 CMA methodology

Asset allocation mixes

Intended to demonstrate:	"30% equity" portfolio	"40% equity" portfolio	"Peer" mix	More diversification, similar risk	"60% equity" portfolio	Heavy private markets/real assets	Leverage Strategy	Private markets + more inflation protection
	Option 1	Option 2	Current	Option 3	Option 4	Option 5	Option 6	Option 7
Domestic Equity								
US Large	15	18	22.5	21	28	20	25	20
US Small	3	4	5.5	4	7	4	5	4
	18	**22**	**28**	**25**	**35**	**24**	**30**	**24**
International Equity								
International Developed	8	11	12.5	12	15	12	12	12
International Developed Small	2	3	3	2	3	3	3	3
Emerging Markets	2	4	5.5	4	7	5	5	5
	12	**18**	**21**	**18**	**25**	**20**	**20**	**20**
Total Equity	**30**	**40**	**49**	**43**	**60**	**44**	**50**	**44**
Core Fixed Income	23	17	15	13	12	16	20	12
Global Sovereign	3	3	4					
US TIPS	5	5		4			5	7
High Yield Corp. Credit	2	2	2	2			1	0
Bank Loans	2	2	2	2			1	
Emerging Market Debt (Local)	5	3	3	3	3	3	3	3
Total Fixed Income	**40**	**32**	**26**	**24**	**15**	**19**	**30**	**22**
Real Assets								
Core Real Estate	7	6	4	4	4	5	4	5
Value Add Real Estate	1.5	1.5	1.5	1.5	1.5	2	1.5	2
Opportunistic Real Estate	1.5	1.5	1.5	1.5	1.5	2	1.5	2
Infrastructure	5	5	4	4	4	5	4	5
	15	**14**	**11**	**11**	**11**	**14**	**11**	**14**
Alternatives								
Risk Parity				8			10	
Private Equity	7	6	6	6	6	11	6	10
Private Credit	8	8	8	8	8	12	8	10
	15	**14**	**14**	**22**	**14**	**23**	**24**	**20**
Total	100	100	100	100	100	100	115	100
Forecast 10 Year Return (%)	**4.9**	**5.1**	**5.3**	**5.4**	**5.6**	**5.8**	**5.8**	**5.6**
Standard Deviation (%)	**9.7**	**11.0**	**12.1**	**11.5**	**13.5**	**12.5**	**12.8**	**12.2**
Return/Std. Deviation	*0.50*	*0.46*	*0.43*	*0.47*	*0.42*	*0.46*	*0.46*	*0.46*
Sharpe Ratio	0.51	0.48	0.46	0.49	0.45	0.49	0.49	0.49
1th percentile ret. 1 year	*-15.3*	-17.4	-19.3	-18.1	-21.3	-19.4	-19.9	-19.1

Risk decomposition

BARRAONE RISK DECOMPOSITION: 1-YEAR PROJECTED VOLATILITY & BREAKOUT



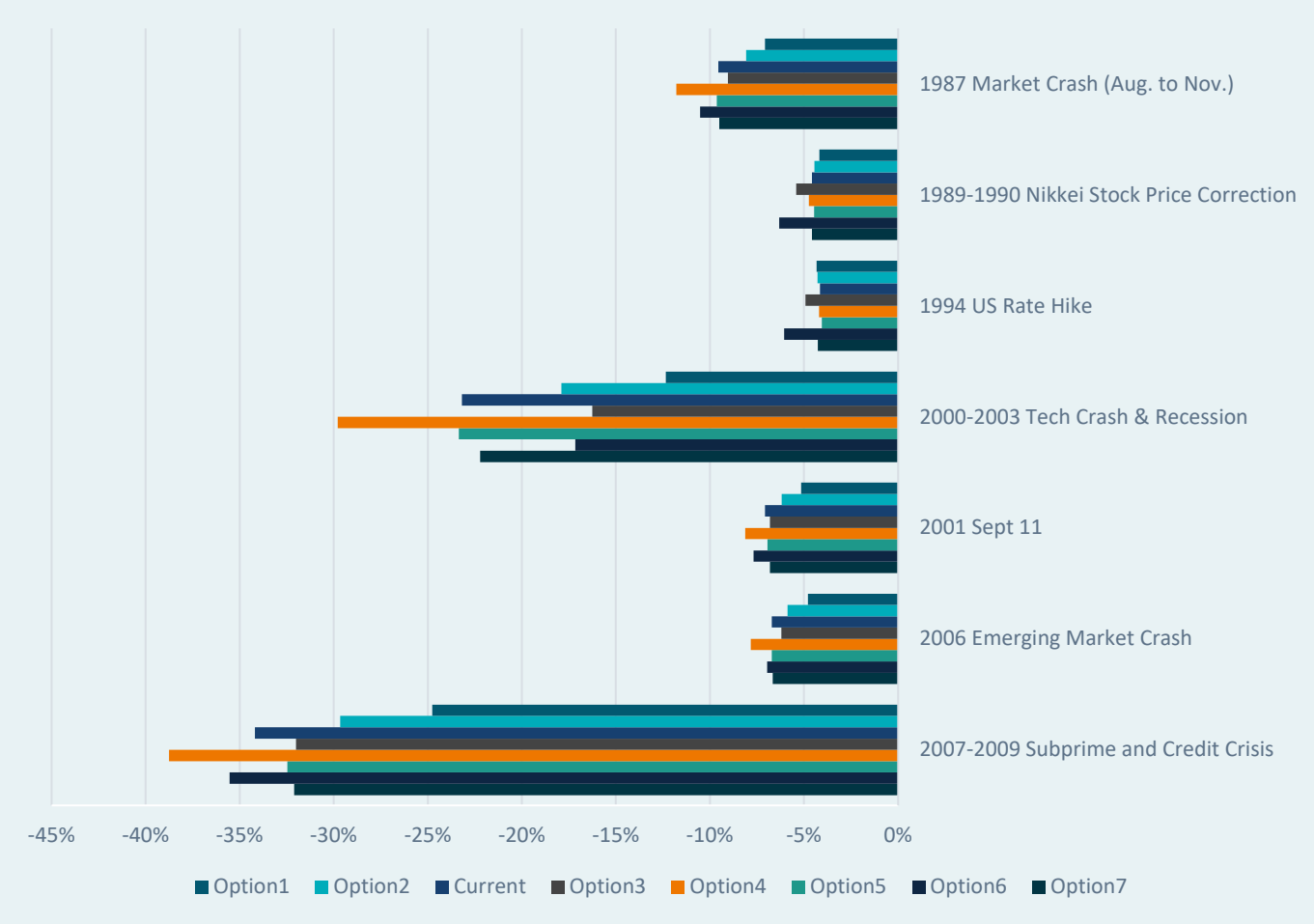
Source: MSCI BarraOne

Option 4 is less diversified by risk factor given the 60% allocation to public equity.

Option 6 has slightly more diversification relative to other options, due to leverage.

Scenario analysis

SCENARIO ANALYSIS

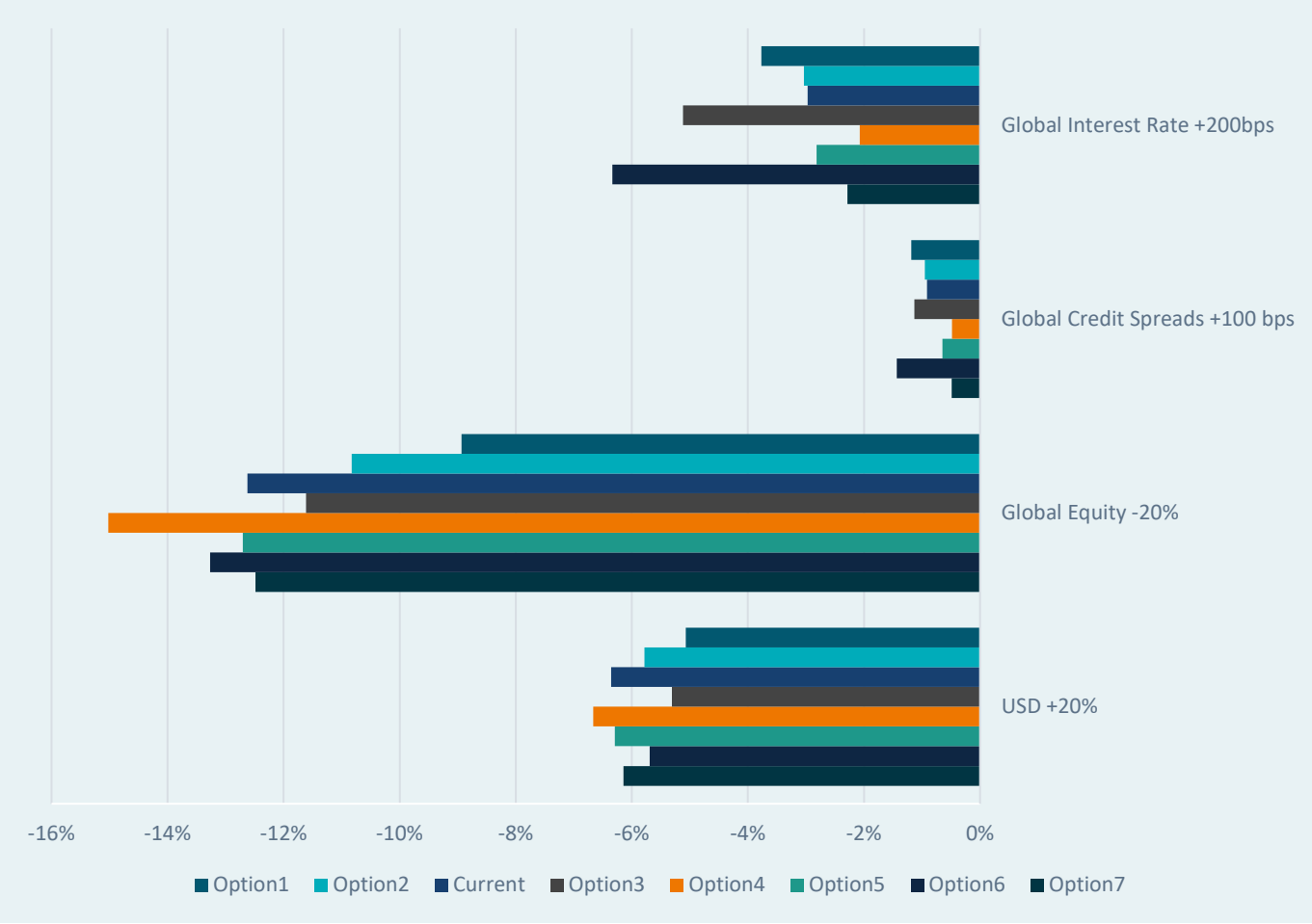


Source: MSCI BarraOne

Option 4 exhibits more tail risk, due to the 60% allocation to public equity.

Stress test

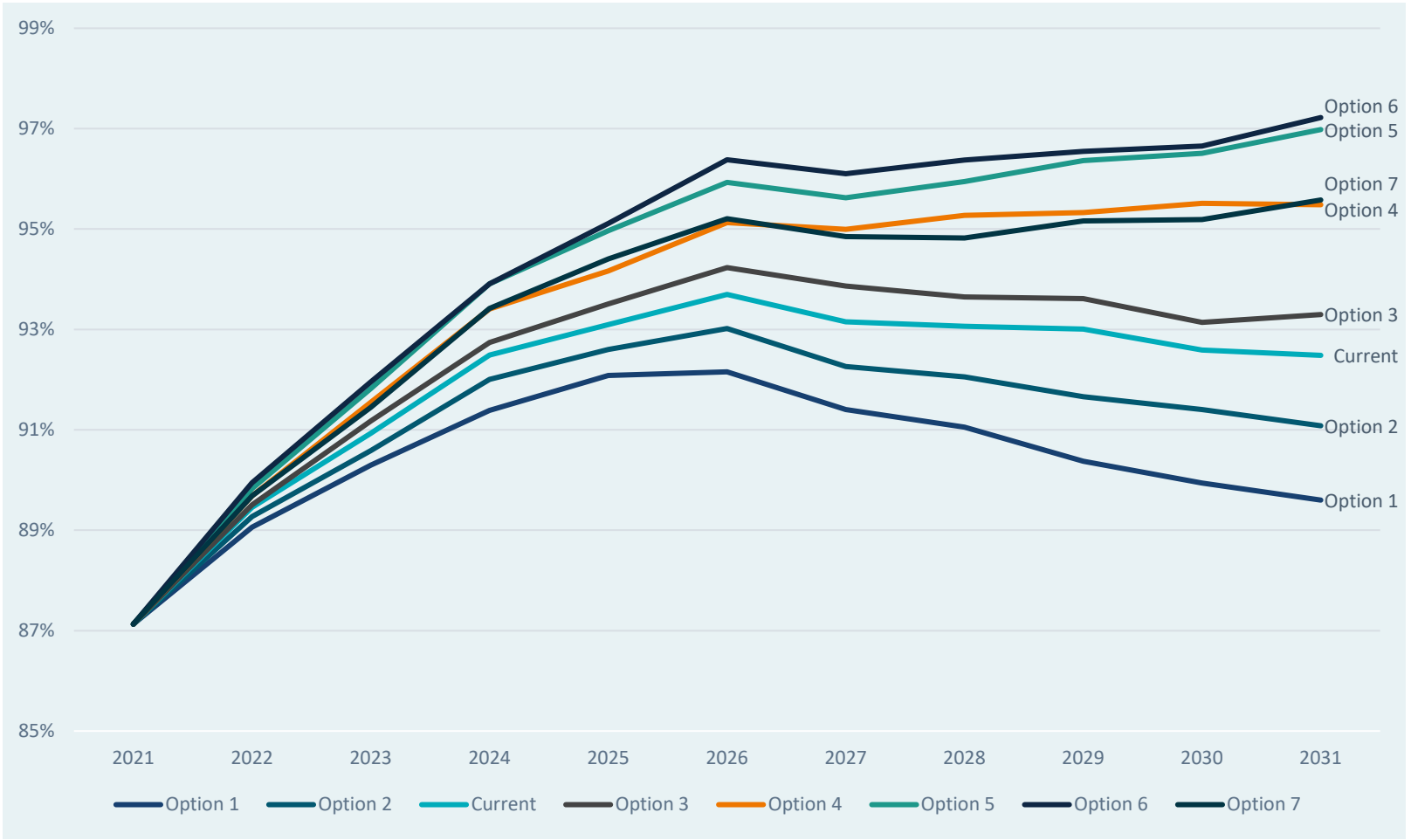
STRESS TEST



Option 6 has more interest rate exposure relative to other options.

Median funded status projections

50TH PERCENTILE OUTCOME: MARKET VALUE ASSETS FUNDED RATIO BY MIX

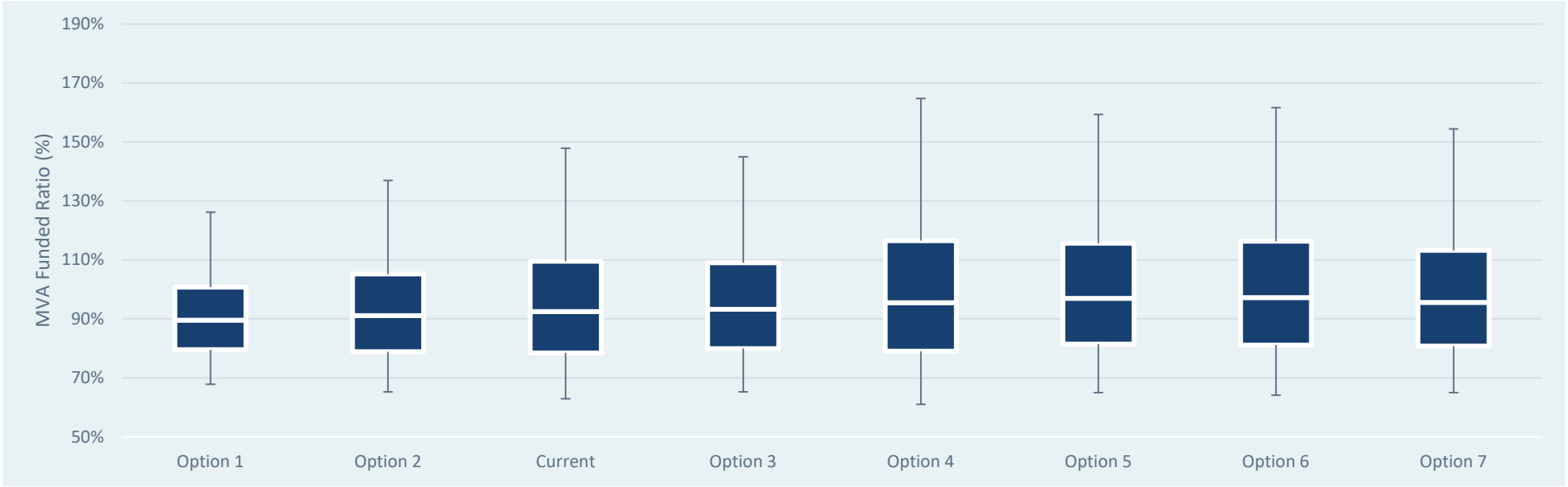


The options with the highest return projection result in the best median outcomes.

FCERA AL Study is synchronized to the 2020 Actuarial Valuation but then adjusted to include a 6.5% discount rate, 2.5% inflation assumption, and the most recent market value of assets effective 2021.

Range of funded ratio outcomes

MARKET VALUE OF ASSETS FUNDED RATIO: END OF YEAR 10

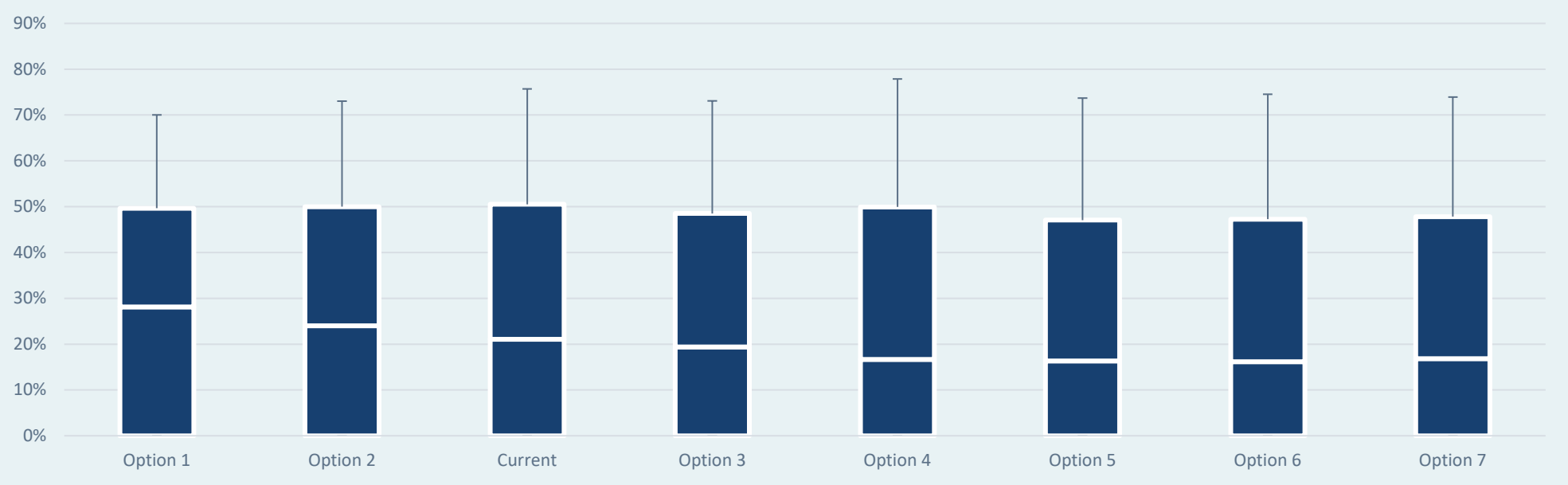


	Option 1	Option 2	Current	Option 3	Option 4	Option 5	Option 6	Option 7
Best Case (95%)	126.2%	137.0%	147.9%	145.0%	164.7%	159.3%	161.6%	154.5%
Upper Quartile (75%)	100.8%	105.2%	109.6%	109.0%	116.5%	115.6%	116.3%	113.2%
Median Outcome (50%)	89.6%	91.1%	92.5%	93.3%	95.5%	97.0%	97.2%	95.6%
Lower Quartile (25%)	79.6%	78.9%	78.5%	80.0%	79.1%	81.5%	81.1%	80.8%
Worst Case (5%)	67.8%	65.2%	62.9%	65.2%	61.0%	65.0%	64.1%	65.0%

FCERA AL Study is synchronized to the 2020 Actuarial Valuation but then adjusted to include a 6.5% discount rate, 2.5% inflation assumption, and the most recent market value of assets effective 2021.

Range of employer contribution outcomes

EMPLOYER CONTRIBUTION: END OF YEAR 10 (% OF PAY)



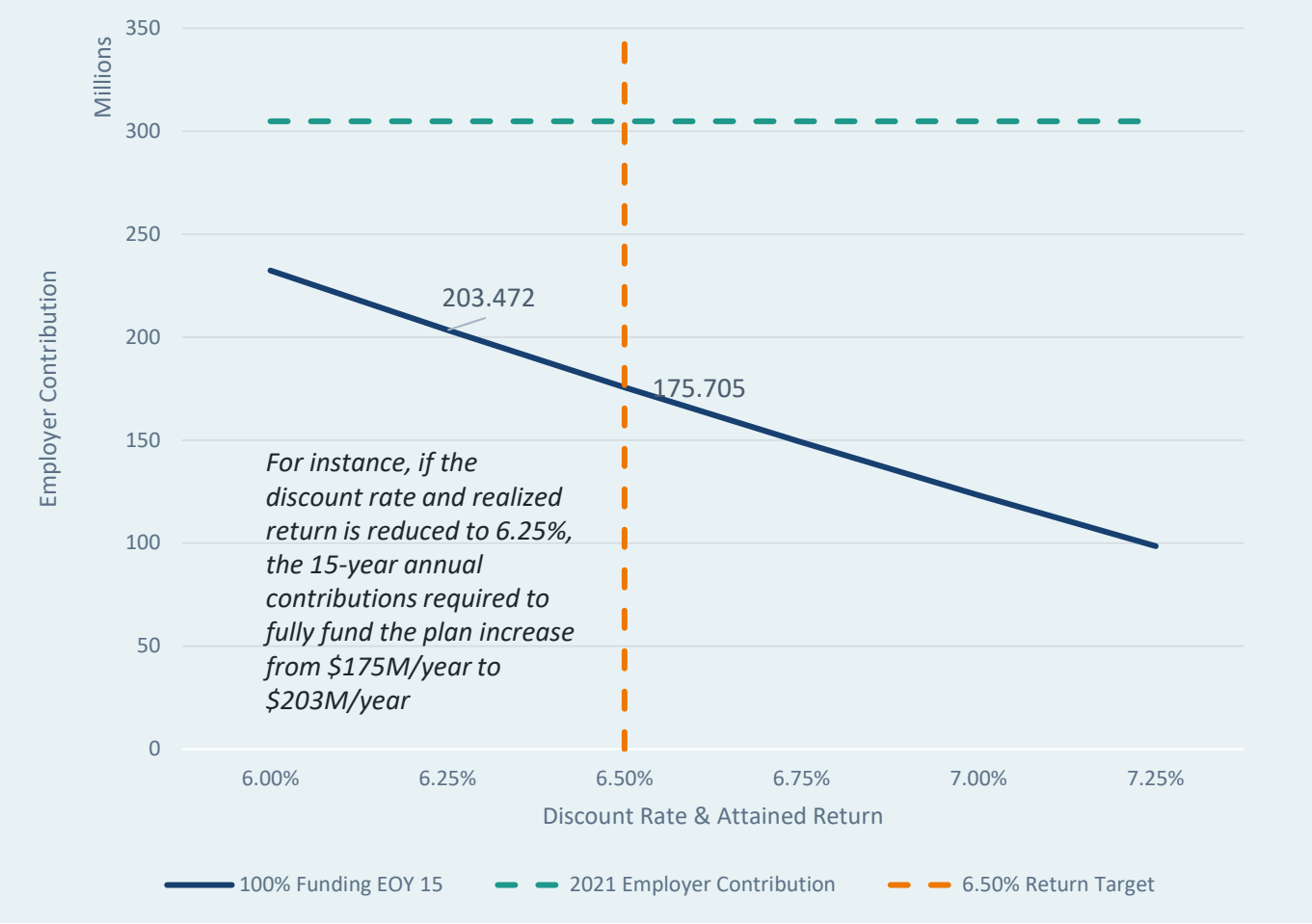
	Option 1	Option 2	Current	Option 3	Option 4	Option 5	Option 6	Option 7
Worst Case (95%)	70.1%	73.0%	75.7%	73.1%	77.9%	73.7%	74.5%	73.9%
Upper Quartile (75%)	49.7%	50.0%	50.5%	48.5%	49.9%	47.1%	47.3%	47.8%
Median Outcome (50%)	28.1%	24.0%	21.1%	19.4%	16.7%	16.4%	16.2%	16.8%
Lower Quartile (25%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Best Case (5%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

FCERA AL Study is synchronized to the 2020 Actuarial Valuation but then adjusted to include a 6.5% discount rate, 2.5% inflation assumption, and the most recent market value of assets effective 2021.

Deterministic modeling

Required return framework

CONTRIBUTIONS AND RETURN NECESSARY FOR FULL FUNDING IN 15 YEARS

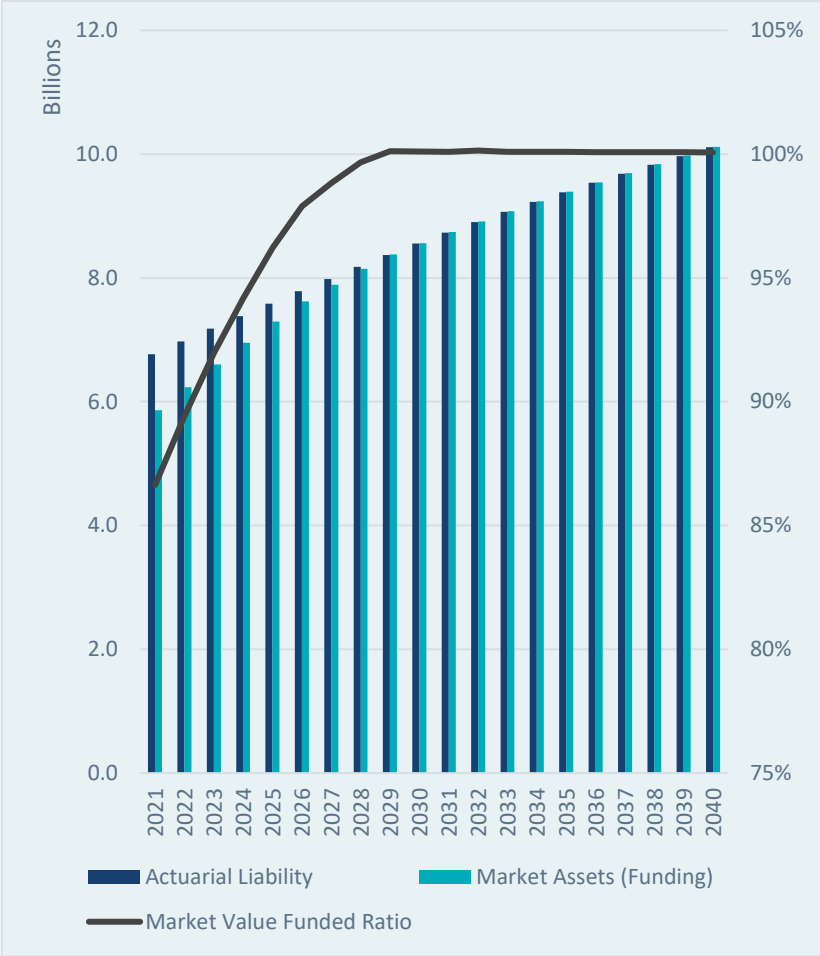


The blue line represents the combination of contributions & returns that result in achieving a 100% funded status, assuming the same annual contribution amount each year.

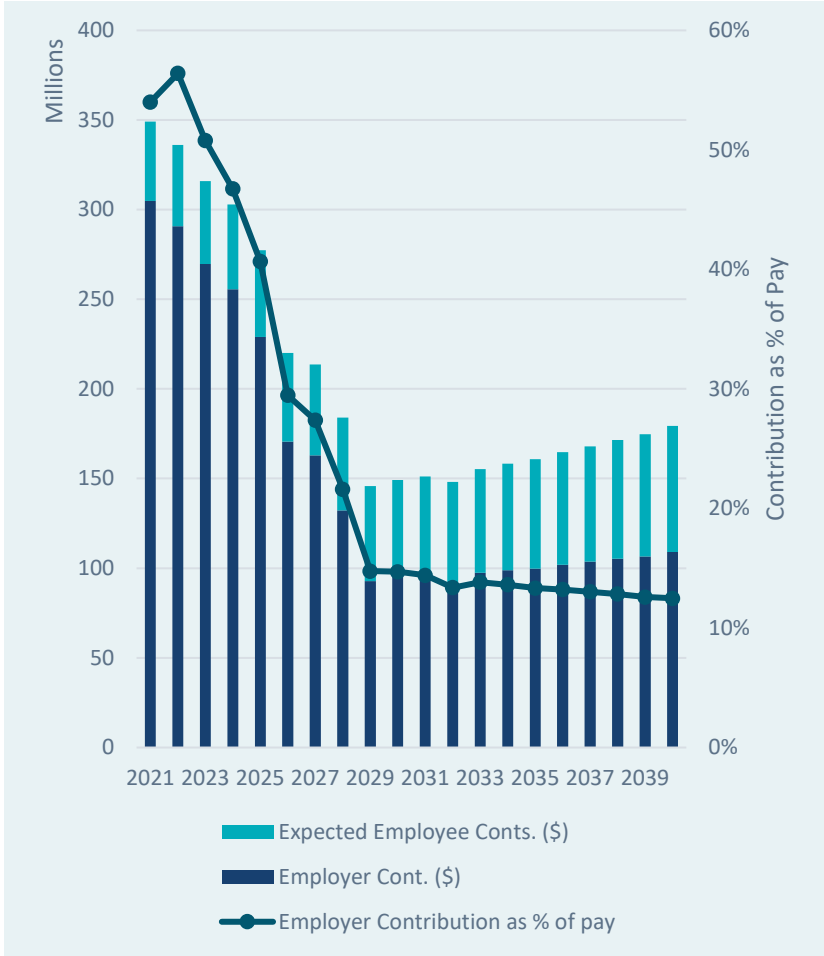
Estimated figures calculated by Verus.

Baseline Projection: 6.5% Return

FUNDED STATUS PROJECTION: 6.5% RETURN



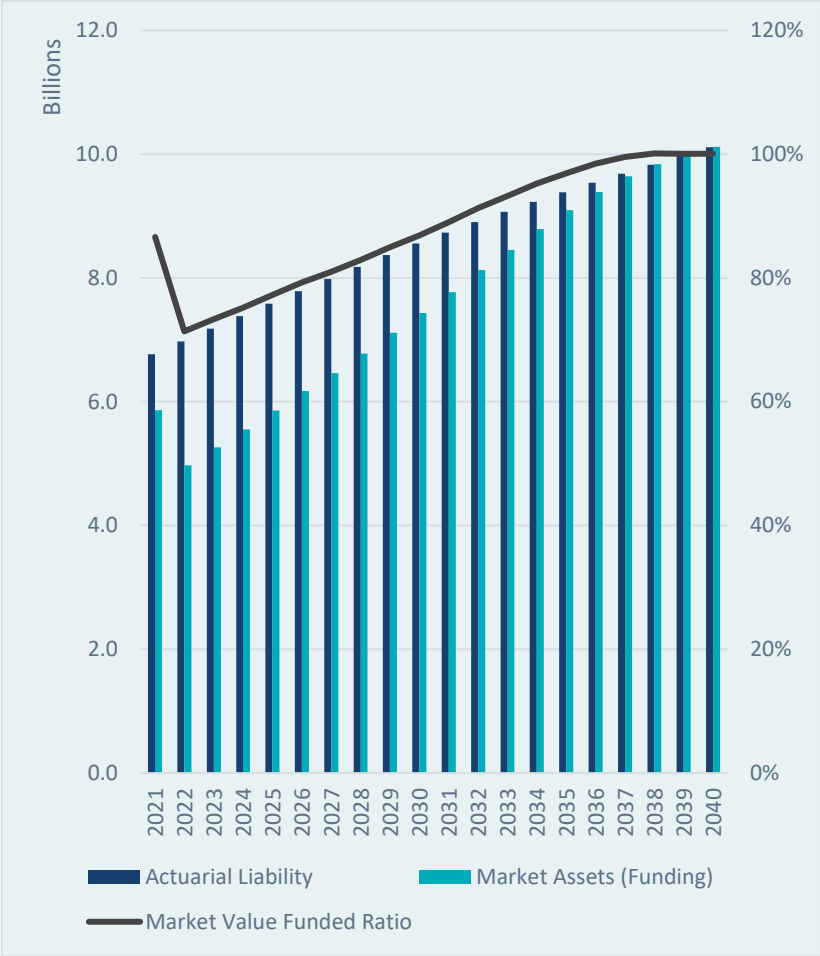
CASHFLOW PROJECTION: 6.5% RETURN



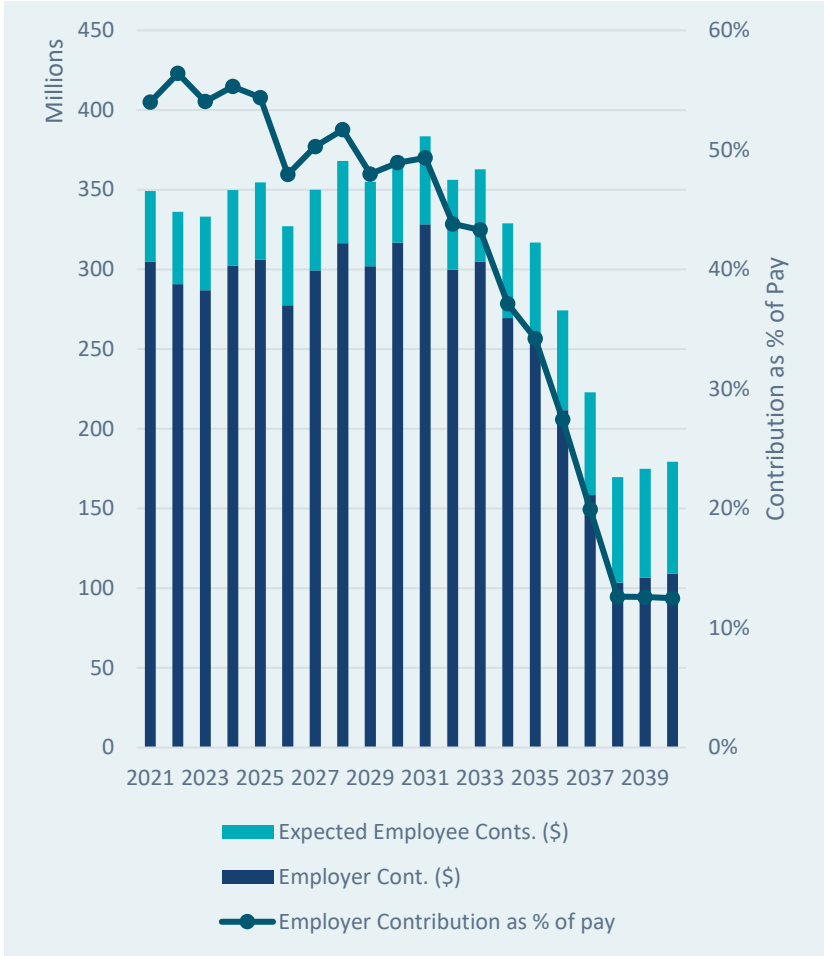
FCERA AL Study is synchronized to the 2020 Actuarial Valuation but then adjusted to include a 6.5% discount rate, 2.5% inflation assumption, and the most recent market value of assets effective 2021.

Drawdown Projection: -15% Year 1

FUNDED STATUS PROJECTION: -15% YR1 6.5% THEREAFTER



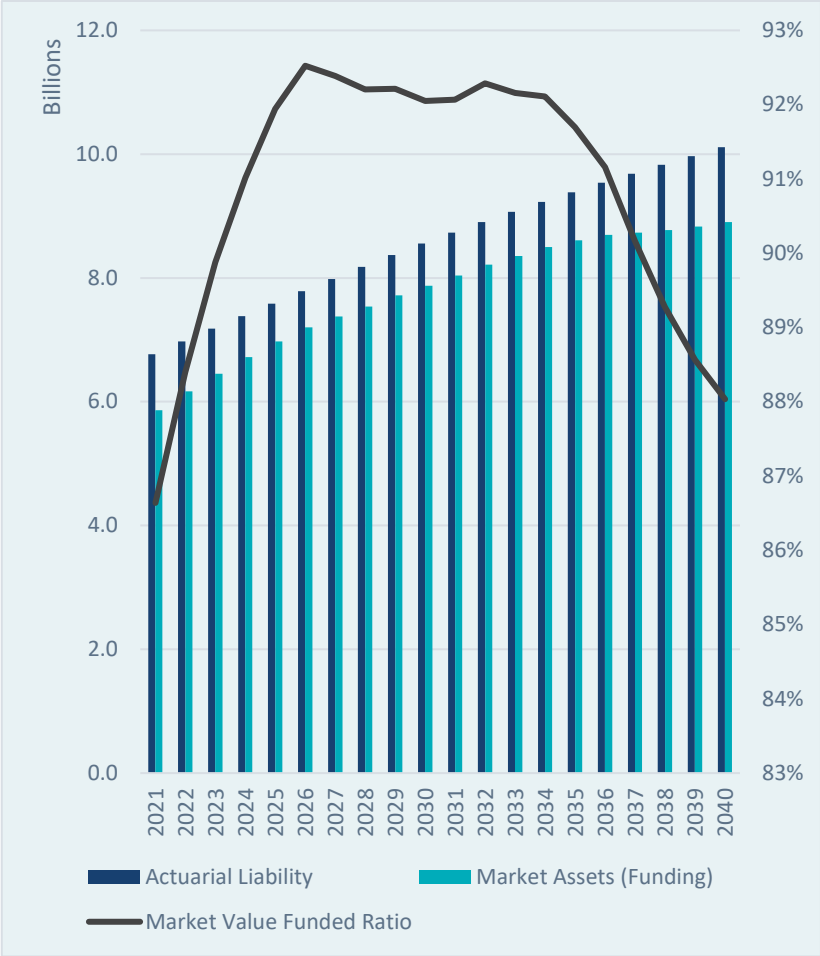
CASHFLOW PROJECTION: -15% YR1 6.5% THEREAFTER



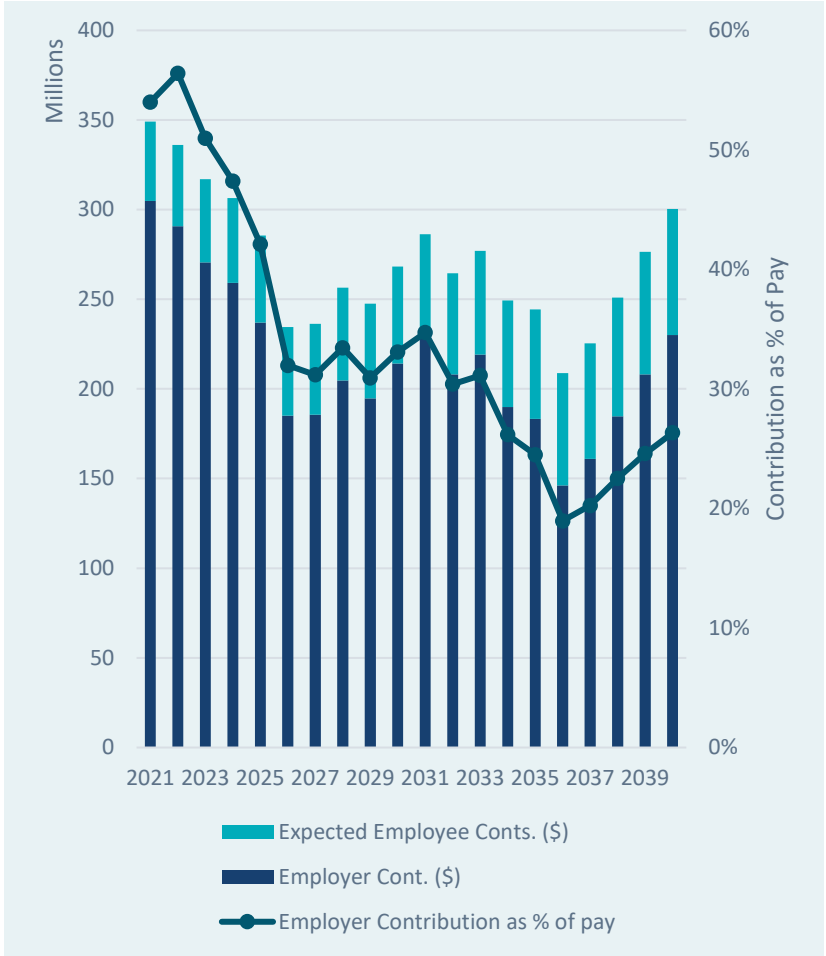
FCERA AL Study is synchronized to the 2020 Actuarial Valuation but then adjusted to include a 6.5% discount rate, 2.5% inflation assumption, and the most recent market value of assets effective 2021.

5.3% Return Projection

FUNDED STATUS PROJECTION: 5.30% RETURN



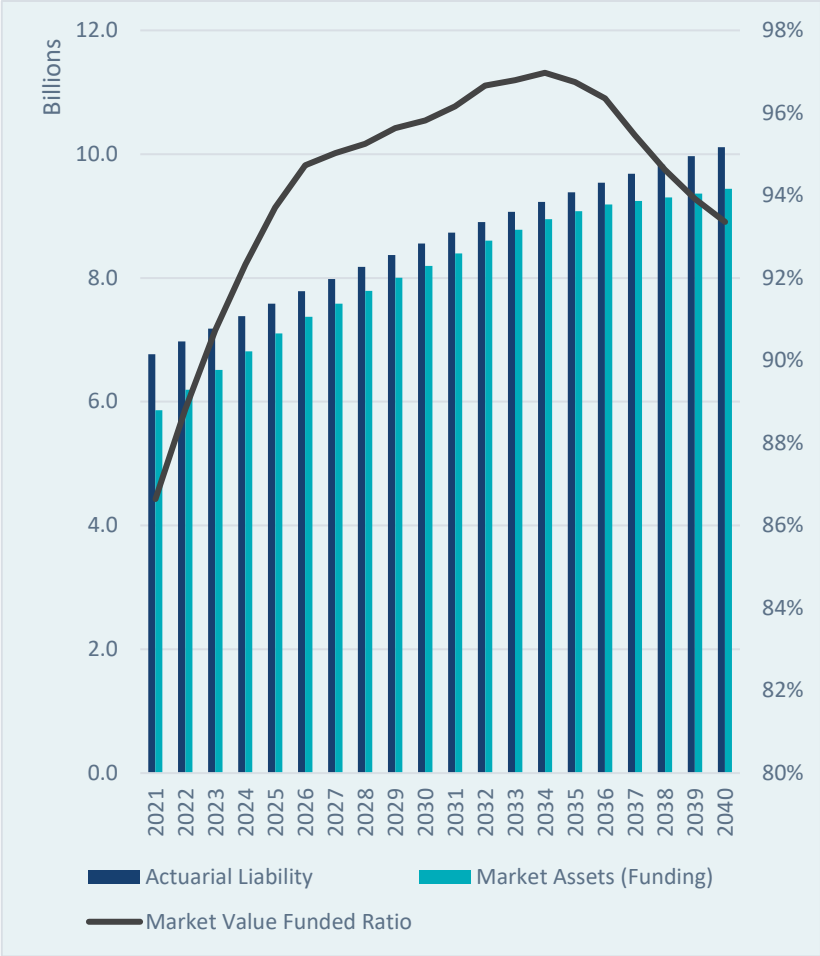
CASHFLOW PROJECTION: 5.30% RETURN



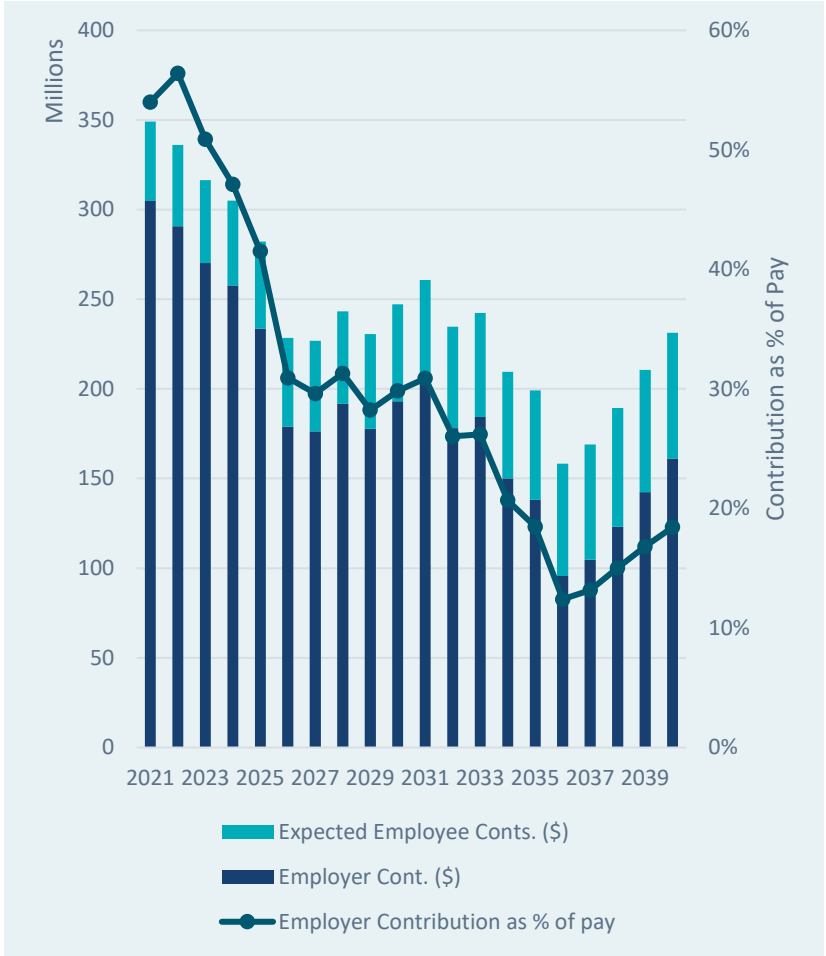
FCERA AL Study is synchronized to the 2020 Actuarial Valuation but then adjusted to include a 6.5% discount rate, 2.5% inflation assumption, and the most recent market value of assets effective 2021.

5.8% Return Projection

FUNDED STATUS PROJECTION: 5.80% RETURN



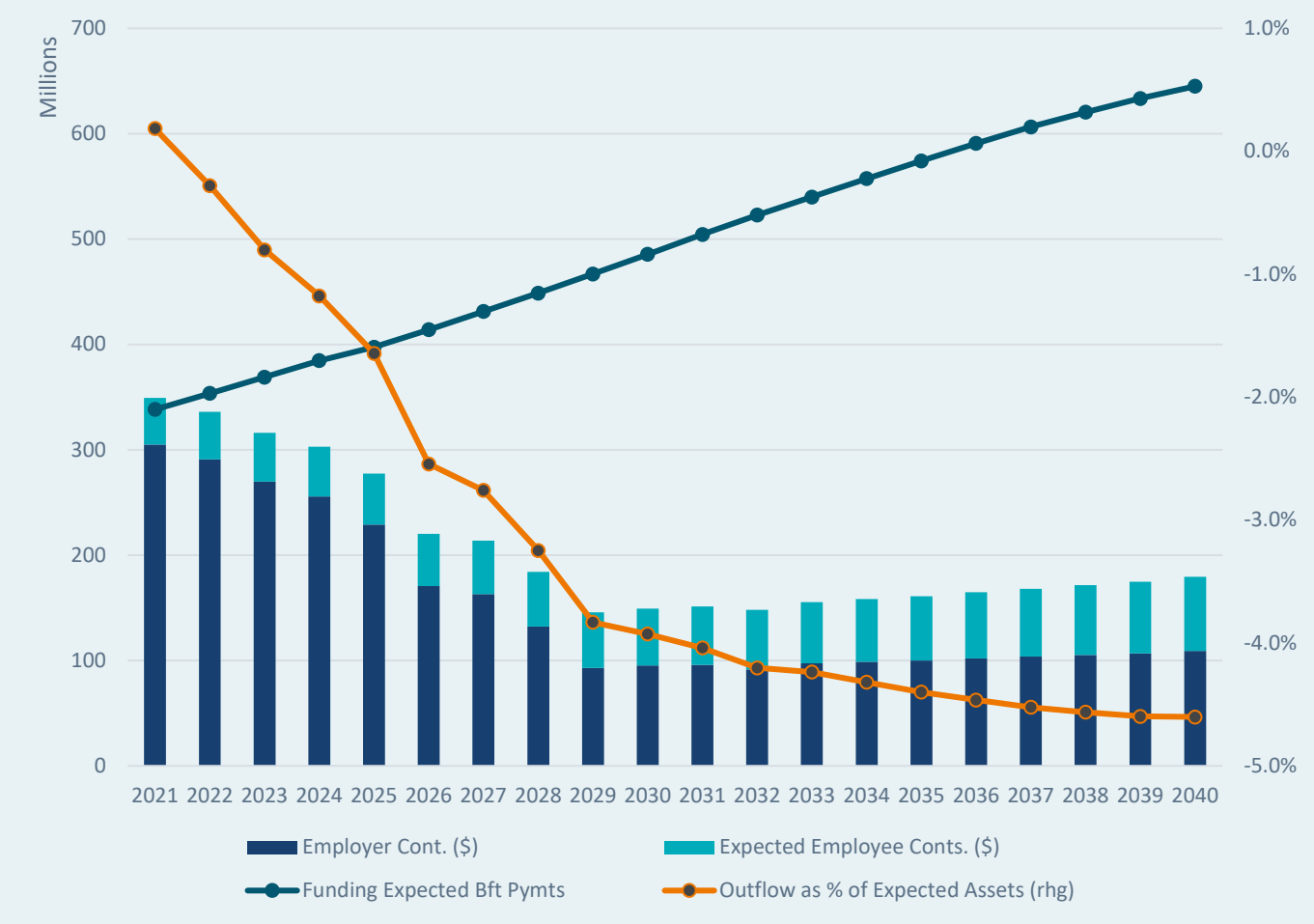
CASHFLOW PROJECTION: 5.80% RETURN



FCERA AL Study is synchronized to the 2020 Actuarial Valuation but then adjusted to include a 6.5% discount rate, 2.5% inflation assumption, and the most recent market value of assets effective 2021.

Baseline projection – cash flows

BASELINE PROJECTION: CASHFLOW AT A 6.5% RETURN



As the plan matures, benefit payments will exceed contributions and the plan will become more cash-flow negative.

FCERA AL Study is synchronized to the 2020 Actuarial Valuation but then adjusted to include a 6.5% discount rate, 2.5% inflation assumption, and the most recent market value of assets effective 2021.

Conclusion

Summary observations

— Capital market assumptions continue to be affected by expectations of a low-return environment, with global equity and core fixed income expected to return just 5.2% and 1.5%, respectively, per year over the next 10 years

— Based on this, we observe the following:

- Of 7 asset mixes modeled, expected returns range from 4.9% - 5.8% with expected volatility (risk) ranging from 9.7% - 13.5%
- If current actuarial assumptions hold and a 6.5% return is realized, the Plan will become fully funded in roughly 10 years.
- The current allocation mix is expected to generate a 5.3% return over the next 10 years. If the 5.3% return projection is realized, the Plan will achieve a peak funded status of 93% and then decline to 88%.
- Mixes that increase expected return generally rely on leverage (risk parity, or explicit leverage), or larger allocations to private markets strategies (illiquidity).