

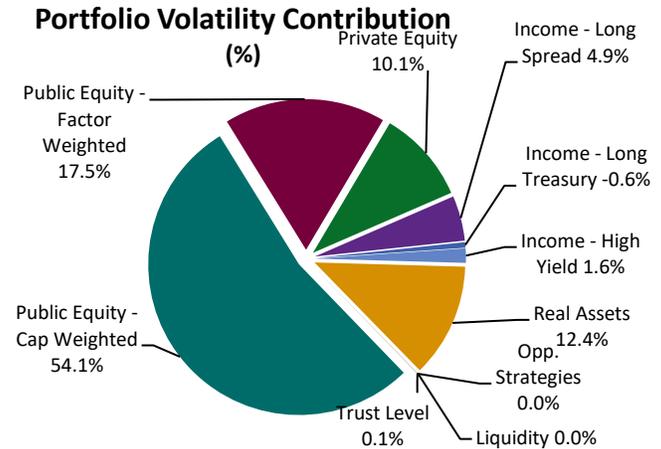
CalPERS Trust Level Review Risk Management Summary



As of July 1, 2020

Investment Belief 9: Risk to CalPERS is multi-faceted and not fully captured through measures such as volatility or tracking error. CalPERS shall develop a broad set of investment and actuarial risk measures and clear processes for managing risk. The path of returns matters, because highly volatile returns can have unexpected impacts on contribution rates and funding status.

Total Fund Forecast Volatility Trends (%)				
	Policy Limit	Current 7/1/2020	Last Qtr 3/31/2020	Last Year ¹ 6/30/2019
Total	n/a	11.5	11.1	9.7
Benchmark	n/a	11.1	10.9	9.7
Tracking Error	< 1.5	1.0	1.1	0.8
Allocation	< 0.75	0.0	0.0	0.1
Selection	n/a	1.0	1.1	0.7



Comments:

Forecast Total Volatility of the PERF increased by 183 bps over the last year. This increase is primarily a reflection of recent high market volatility.

Rapid shifts in volatility regime can occur and would not be predicted by this model. The best interpretation of this estimate is as an indicator of the plan's volatility given the current market environment.

The pie chart above gives a visual representation of portfolio volatility contribution by asset classes (in percent).

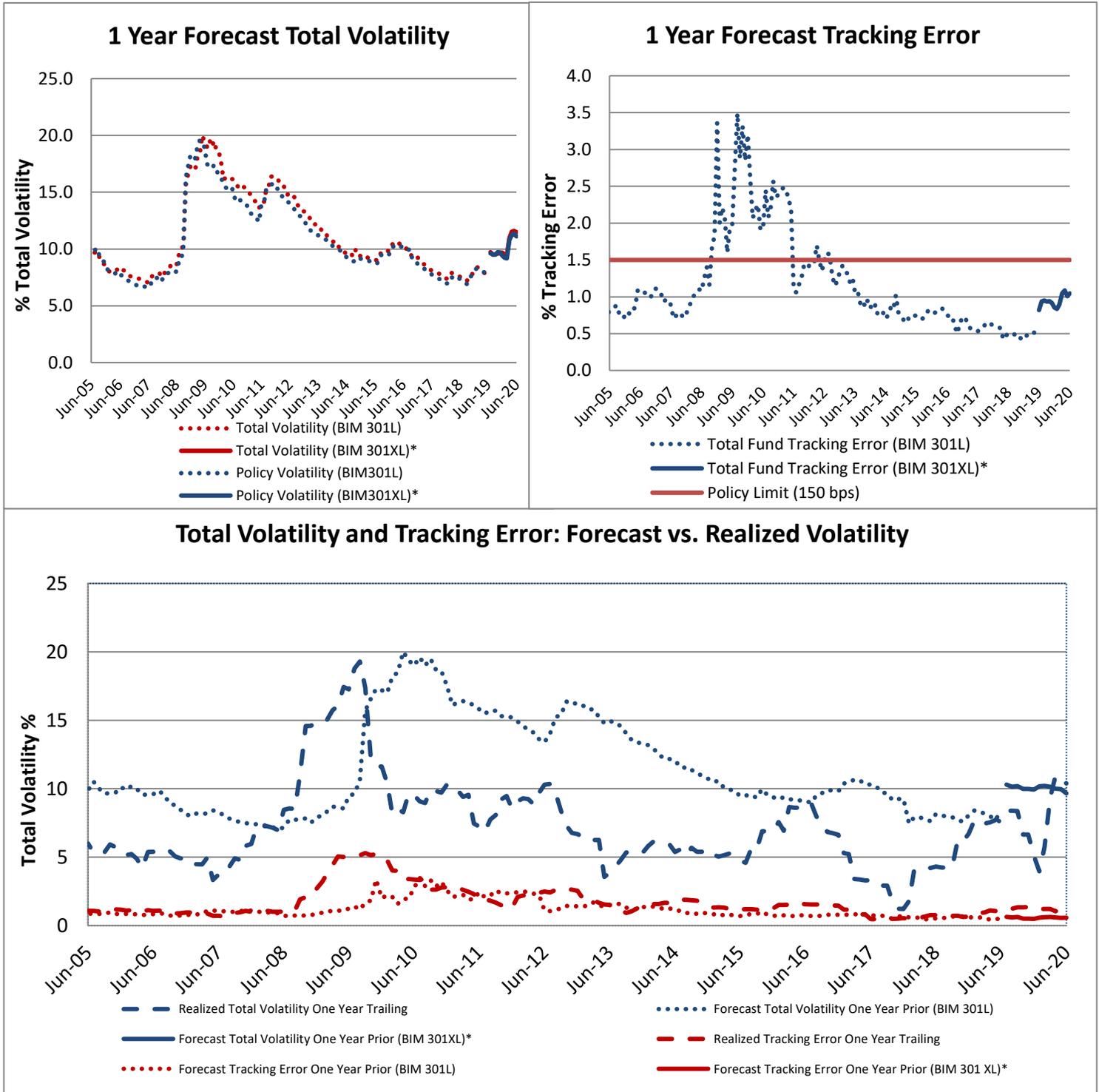
Asset Class	Market Value (\$millions)	Total Forecast Volatility (%)	% Contribution to Total Volatility	Tracking Error (%)
Public Equity	\$ 205,706	16.1	71.6	0.1
Cap Weighted	\$ 146,984	17.2	54.1	0.2
Factor Weighted	\$ 58,722	13.8	17.5	0.2
Private Equity	\$ 24,745	22.5	10.1	13.6
Income	\$ 111,616	7.2	5.8	0.7
Long Spread	\$ 64,139	6.7	4.9	0.6
Long Treasury	\$ 35,975	12.1	-0.6	0.3
High Yield	\$ 11,501	8.4	1.6	0.3
Real Assets	\$ 43,909	15.8	12.4	4.3
Liquidity	\$ 3,919	0.2	0.0	0.2
Opportunistic Strategies	\$ 99	10.0	0.0	10.0
Trust Level²	\$ 907	N/A	0.1	N/A
TOTAL FUND	\$ 390,900	11.5	100.0	1.0

¹PERF Risk model changed to a longer horizon model (from Barra 301L to 301XL). 6/30/2019 risk values have been restated.

²Trust Level includes Multi Asset Class, Absolute Return Strategies, and other Total Fund level portfolios.

Source: BarraOne, SSB, CalPERS

RISK MANAGEMENT TIME SERIES



*PERF Risk model changed to a longer horizon model (from Barra 301L to 301XL). Risk values from 7/31/19 onward are reported under 301XL.

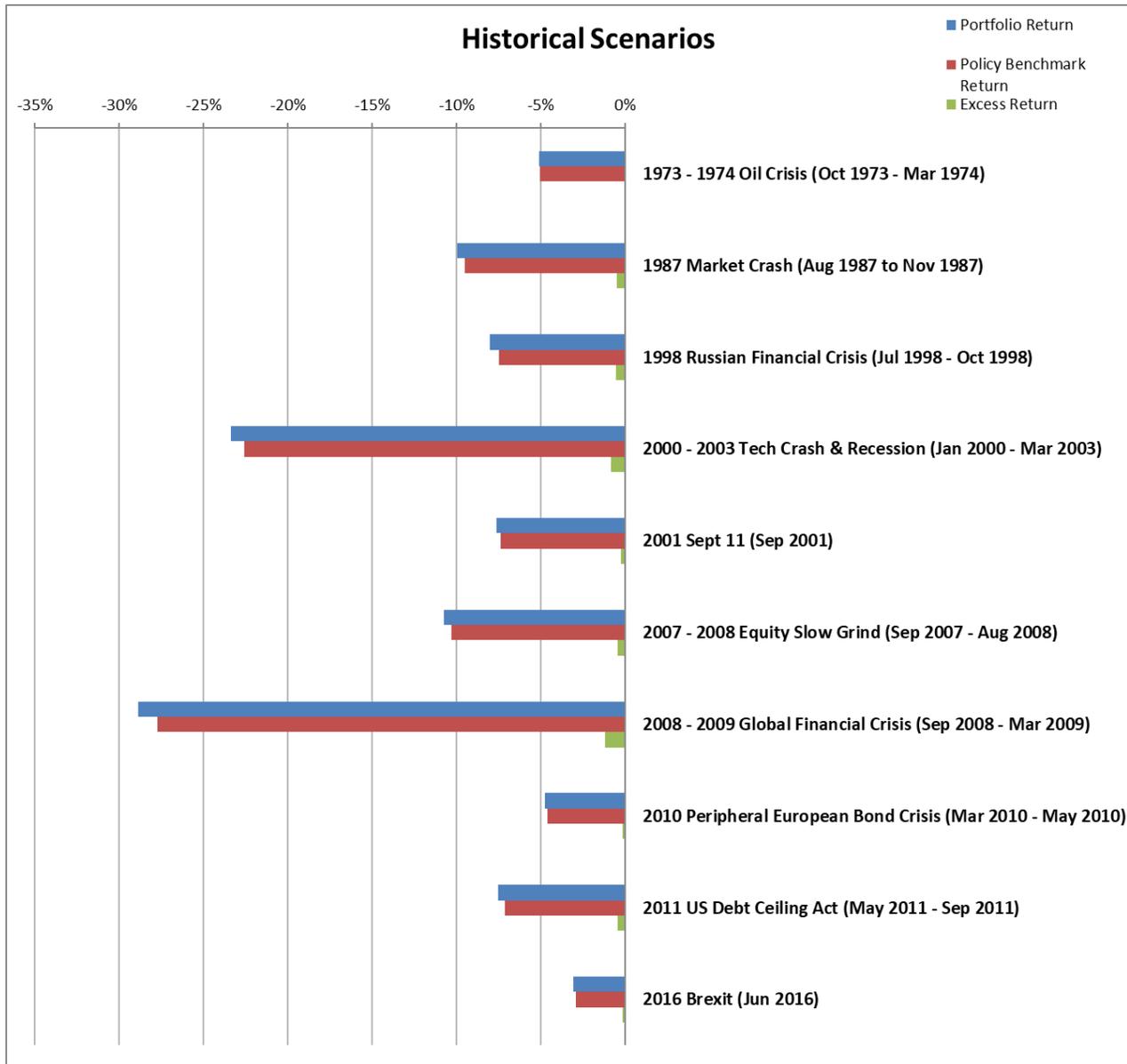
The bottom chart plots the Forecast Total Volatility and Tracking Error for the Total Fund one year prior to each date vs. the Total Volatility and Tracking Error realized for that date. The graph highlights potential deviations between risk model estimates and subsequent realized volatility, due to the lagged and smoothed nature of risk models. In particular, modeled volatility forecasts tend to lag changes in regimes, for example the rapid increase in volatility during the period of the global financial crisis, and similarly the persistent decline in market volatility in the last few years.

Source: BarraOne, SSB, CalPERS

STRESS TESTING

Historical scenarios highlight the sensitivity of the portfolio to past economic regimes or specific events. The scenarios can be used as a "what if" gauge of current portfolio positioning to understand the potential impact if a similar event or regime were to repeat.

Scenario	Portfolio Return	Policy Benchmark Return	Excess Return
2016 Brexit (Jun 2016)	-3.1%	-2.9%	-0.2%
2010 Peripheral European Bond Crisis (Mar 2010 - May 2010)	-4.7%	-4.6%	-0.1%
1973 - 1974 Oil Crisis (Oct 1973 - Mar 1974)	-5.1%	-5.0%	-0.1%
2011 US Debt Ceiling Act (May 2011 - Sep 2011)	-7.5%	-7.1%	-0.4%
2001 Sept 11 (Sep 2001)	-7.6%	-7.4%	-0.2%
1998 Russian Financial Crisis (Jul 1998 - Oct 1998)	-8.0%	-7.4%	-0.5%
1987 Market Crash (Aug 1987 to Nov 1987)	-9.9%	-9.5%	-0.5%
2007 - 2008 Equity Slow Grind (Sep 2007 - Aug 2008)	-10.7%	-10.3%	-0.4%
2000 - 2003 Tech Crash & Recession (Jan 2000 - Mar 2003)	-23.4%	-22.5%	-0.8%
2008 - 2009 Global Financial Crisis (Sep 2008 - Mar 2009)	-28.9%	-27.7%	-1.2%

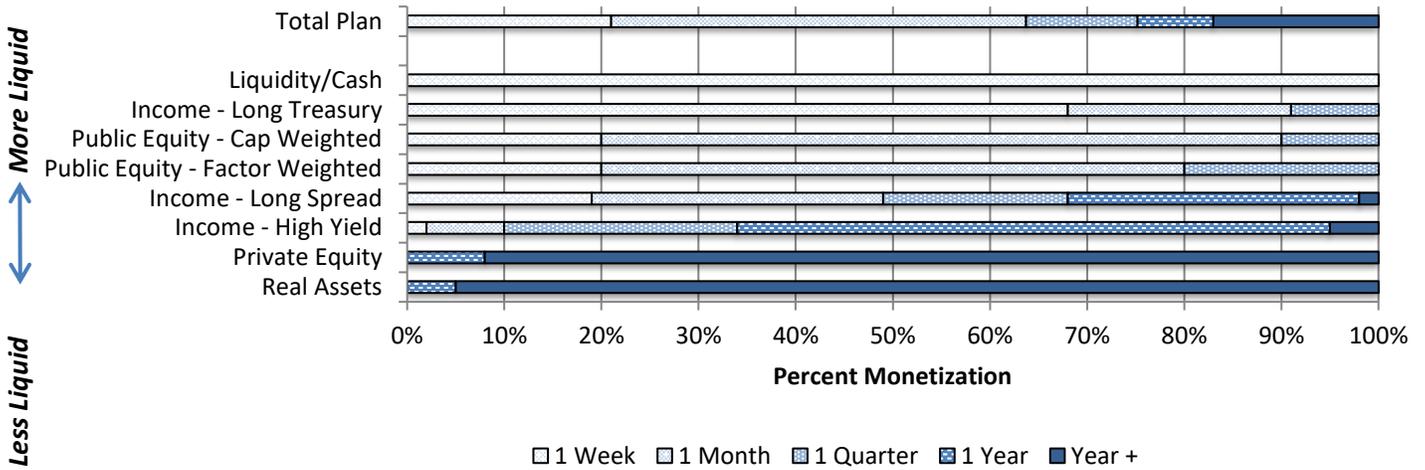


Source: BarraOne, CalPERS

LIQUIDITY

Liquidity Analysis: Total Plan

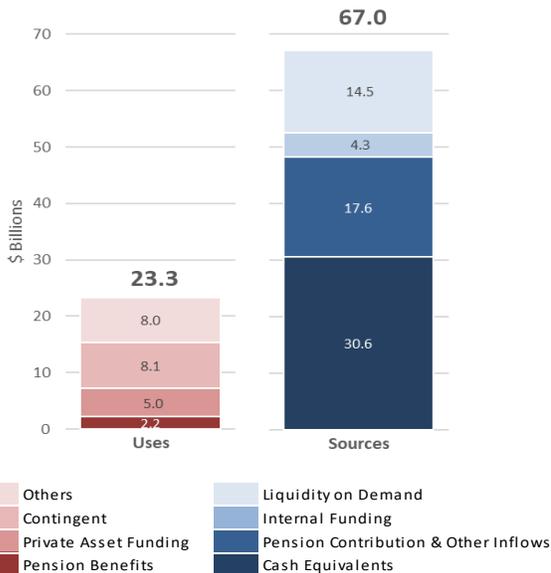
as of 7/1/20



Transactional liquidity is estimated for each asset class/strategy based on the current market environment while also accounting for legal structures or other factors that may impact liquidity. *Source: SSB, CalPERS*

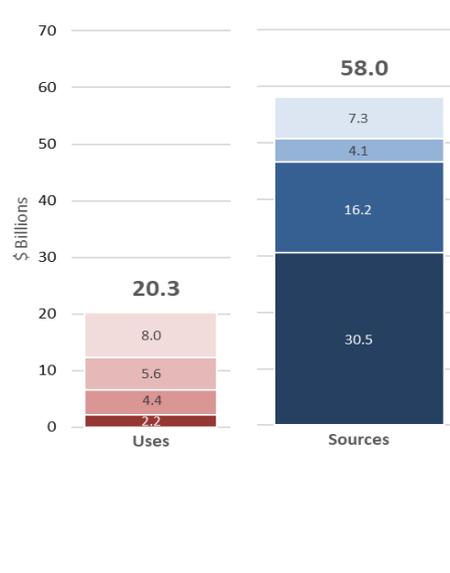
Stress (Current Regime)¹

Tier 1 30 Day Liquidity Coverage Ratio = 2.9x



Historical Worst²

Tier 1 30 Day Liquidity Coverage Ratio = 2.9x



¹ **Stress (Current Regime)** - Regime-dependent scenario to capture a "worst contemplated" outcome across liquidity uses and sources given current market conditions.

² **Historical Worst** - Historical experience for the 30 day period: 9/28/08-10/27/08 (the worst equity drawdown in the past 20 years) applied to current portfolio.

Liquidity Coverage is computed from estimates of future cash inflows and outflows. In this table, the 1-month forward period is shown with Liquidity Coverage ratios for a stress scenario and for a historical worst experience. The Liquidity Coverage ratios could be interpreted as how many times available sources could cover projected cash needs over a 1-month forward period. A ratio of less than one implies the Fund could be forced to sell assets to meet liquidity needs in the given scenario.

Source: Aladdin, SSB, CalPERS

LEVERAGE

Total Fund Leverage Report

as of 7/1/20

Leverage changes a portfolio's risk profile through both impact on liquidity and amplification of returns volatility. As a metric, leverage has the benefit of being relatively straightforward to calculate, making it a good backstop to more nuanced but complex perspectives on risk that could suffer from model errors or flawed assumptions. However, since the leverage metric implicitly treats all assets as equally risky, and because it does not capture the interrelationships between assets (diversification), leverage should always be viewed in conjunction with other perspectives. For example, a low leverage portfolio could easily be more risky than a better-diversified moderate leverage portfolio.

Portfolio View of Plan Leverage:

Total portfolio leverage as defined in the Total Fund Investment Policy.

Company Embedded Leverage:

Some Fund assets embed leverage by their nature (i.e., private and public companies). In this case, leverage is not a portfolio management decision, but does contribute to the assets' inherent riskiness.

Unfunded Commitments:

Represent potential draws on Fund liquidity, but are contingent in nature.

Portfolio View of Plan Leverage

Asset Class/ Program	Net Asset Value (\$Billions)	Sources of Leverage ¹			Cash ²	Gross Asset Exposure	Gross Asset Exposure % of NAV	Benchmark Asset Exposure % of NAV	Exposure over Benchmark ³
		Derivatives	Recourse Debt including Repos	Non-Recourse Debt					
Public Equity - Cap Weighted	147.0	18.2			9.1	156.1	39.9%	35.0%	
Public Equity - Factor Weighted	58.7	0.2			0.8	58.1	14.9%	15.0%	
Private Equity ⁴	24.7		1.5		0.0	26.3	6.7%	8.0%	
Income - Long Spread	64.1	5.2			5.0	64.4	16.5%	15.0%	
Income - Long Treasury	36.0	12.6	0.9		11.2	38.3	9.8%	10.0%	
Income - High Yield	11.5				0.0	11.5	2.9%	3.0%	
Real Assets ⁵	43.9			21.7	0.6	65.0	16.6%	16.7%	
Liquidity	3.9				4.1	(0.2)	0.0%	0.0%	
Opportunistic Strategies	0.1				0.0	0.1	0.0%	0.0%	
Trust Level	0.9	2.6			0.3	3.2	0.8%	0.0%	
Securities Lending ⁶	0.0		1.3		1.3	0.0			
Total Fund	390.9	\$38.8	\$3.8	\$21.7	\$32.4	\$422.7	108.1%	102.7%	5.5%

Embedded Leverage in Asset Classes

	Implied Leverage ⁷
Public Equity	1.56
Private Equity	2.22
Real Estate	1.28

Unfunded Commitments

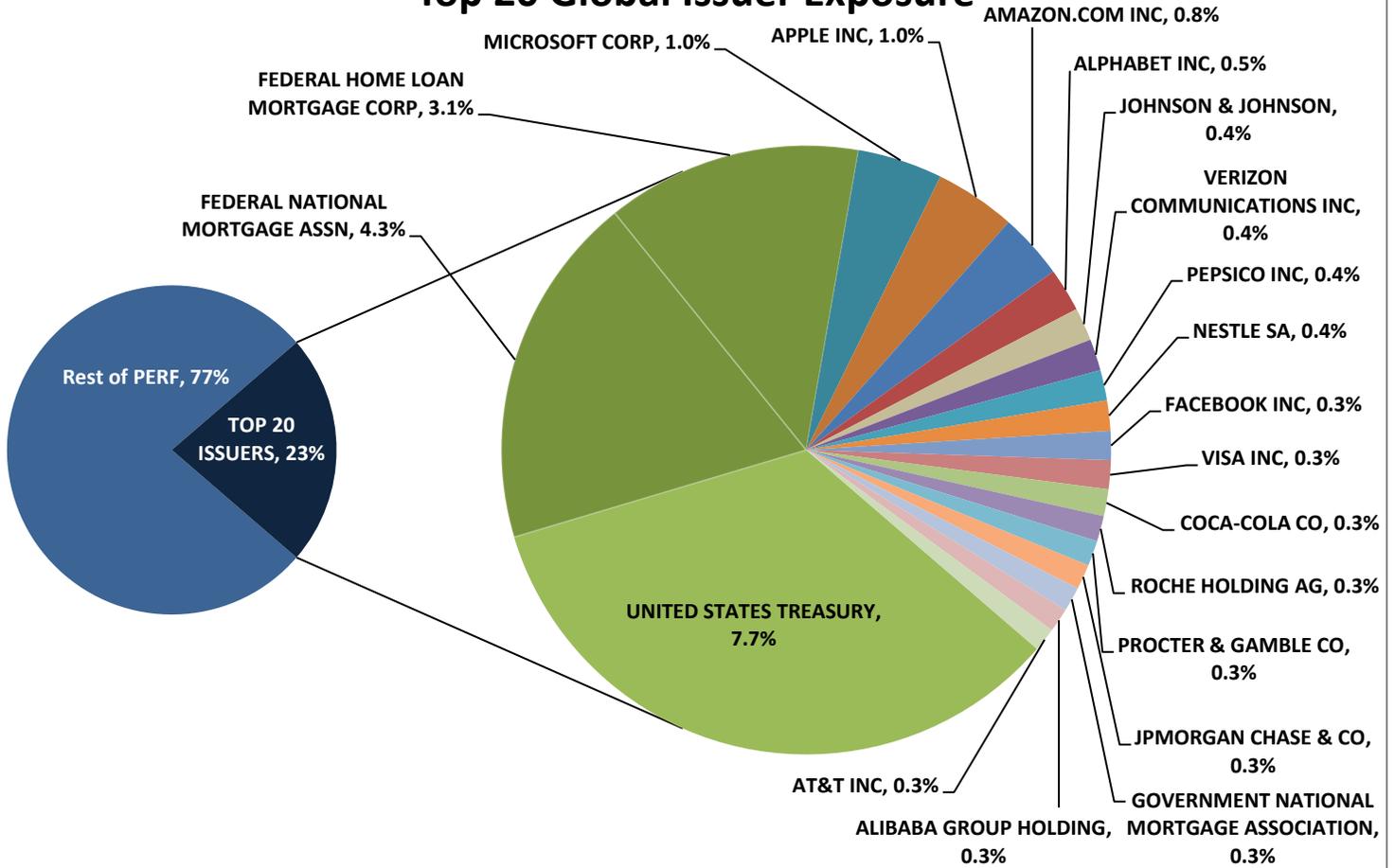
	Net Market Value (\$B)	Unfunded Commitments (\$B) ⁸	% of Total Fund
Private Equity	24.7	25.4	6.5%
Real Assets	43.9	10.7	2.7%

- FX Forwards used for hedging and fixed income duration shifting are not counted as leverage. Options are included based on delta adjusted notional value.
- Cash is defined as assets meeting Liquidity program guidelines.
- Asset class contribution to total plan leverage includes program-level leverage and the difference between actual and target SAA allocation adjusted for benchmark leverage.
- Subscription financing and other liabilities at the fund level (as of 3/31/20) are shown as recourse, while defined non-recourse for policy definition.
- Debt is reported as of 3/31/20. There is no recourse debt as of 3/31/20 and there has been no change to recourse debt from the last reported date of 9/30/19.
- Securities lending includes only securities lent for cash collateral (which creates a source of financing).
- Implied leverage is estimated from either asset class benchmark data or industry research. It represents the Enterprise Value to Equity ratio.
- Unfunded commitments are as of 6/30/20 for Private Equity and 7/1/20 for Real Assets. 75% of Real Assets unfunded commitments are revocable at CalPERS' discretion.

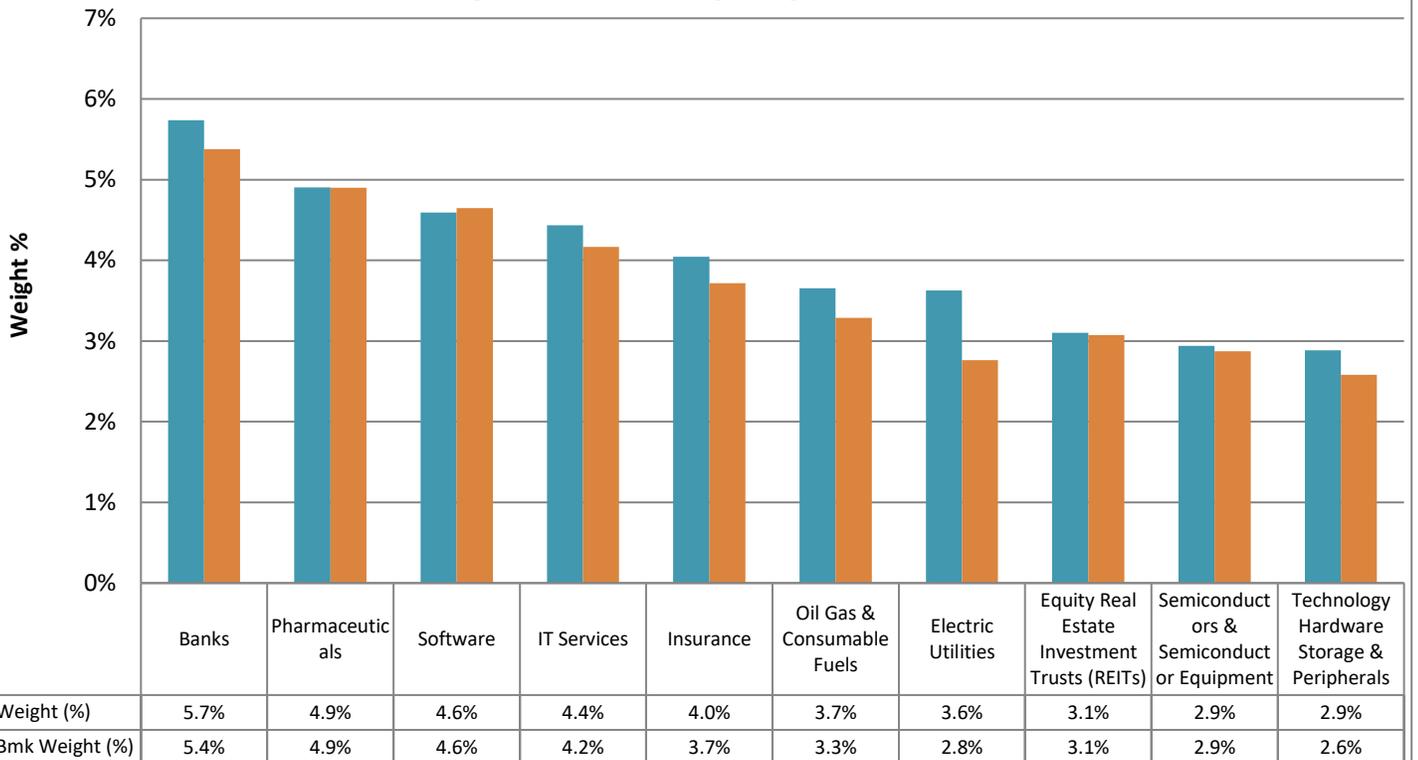
Source: Aladdin, SSB, Factset, CalPERS

CONCENTRATION REPORT

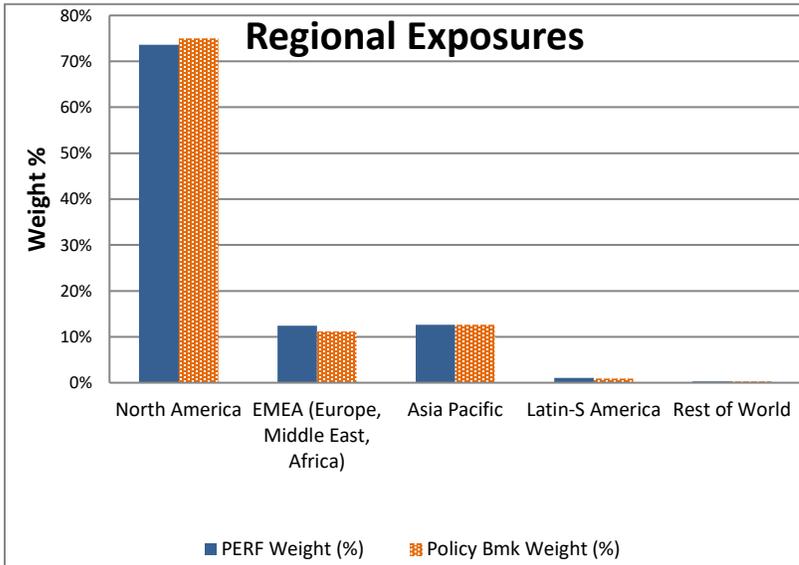
Top 20 Global Issuer Exposure



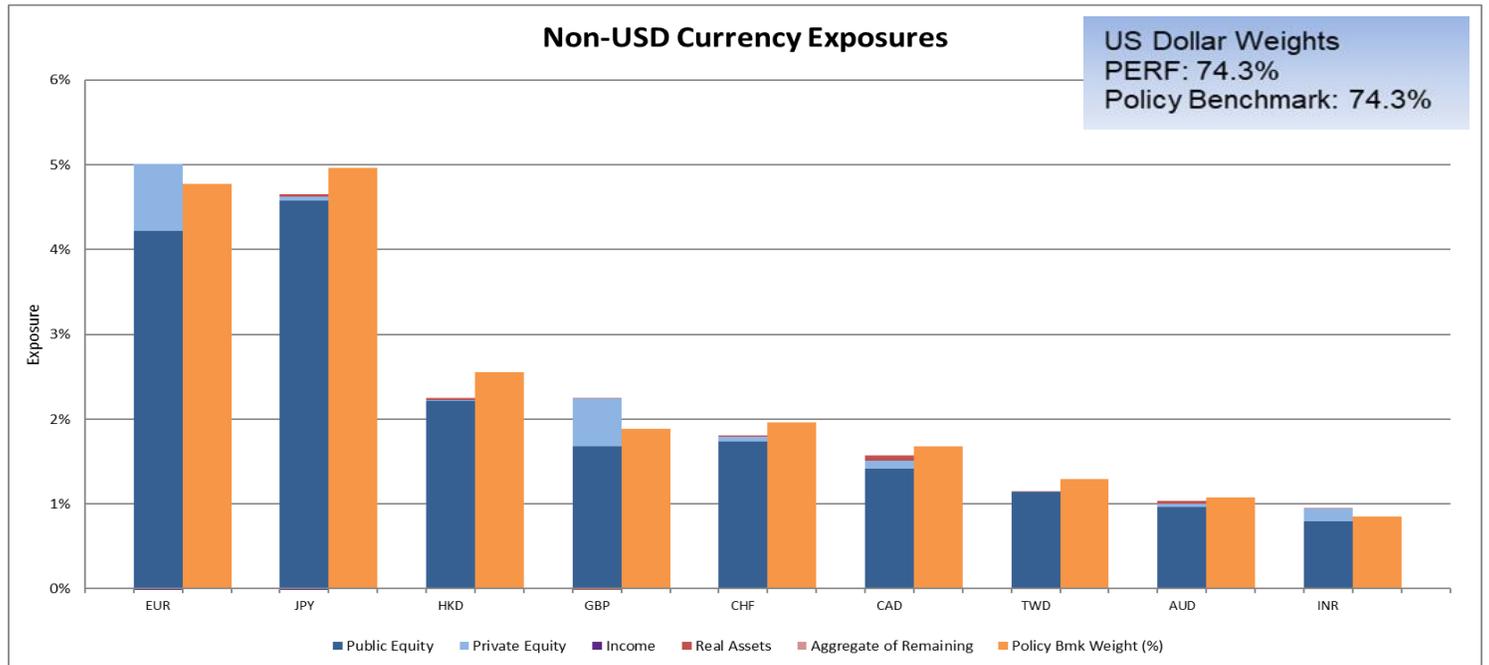
Top 10 Industry Exposure



CONCENTRATION REPORT

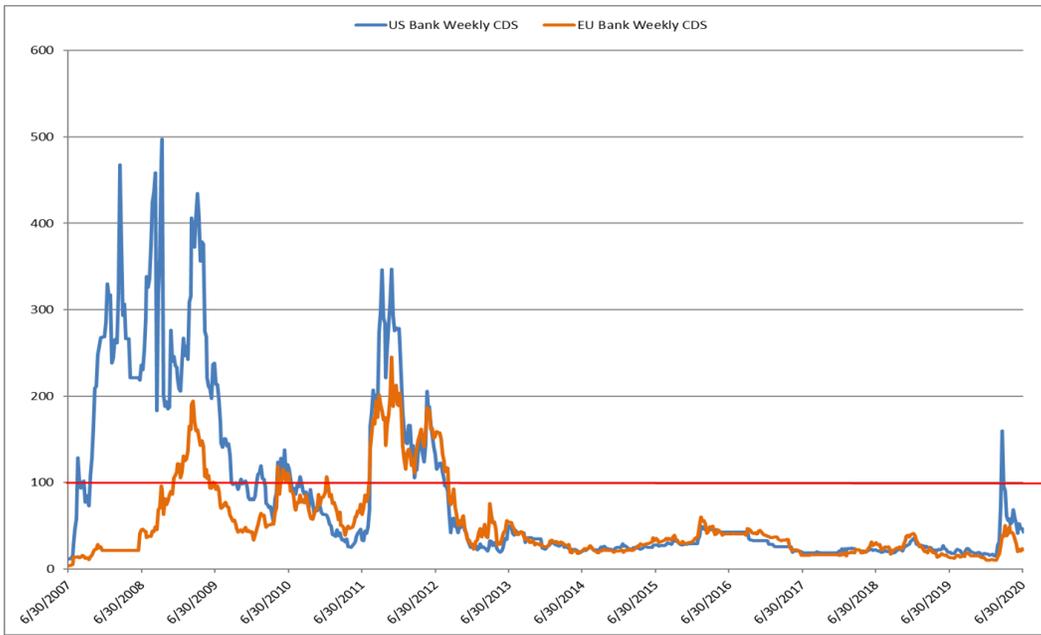


Country	PERF Weight (%)	Policy Bmk Weight (%)	Active Weight (%)
United States	70.4%	72.1%	-1.8%
Japan	4.7%	5.1%	-0.4%
China*	3.0%	3.0%	0.0%
Canada	2.7%	2.1%	0.6%
United Kingdom	2.6%	2.1%	0.5%
France	1.9%	1.5%	0.4%
Germany	1.8%	1.5%	0.4%
Switzerland	1.8%	2.0%	-0.2%
Taiwan	1.2%	1.3%	-0.1%
Australia	1.1%	1.1%	0.0%



*Includes Hong Kong

COUNTERPARTY RISK



CDS spreads and other metrics are regularly monitored for individual CalPERS counterparties. In addition, when aggregate spreads rise above 100 bps additional oversight measures are taken.

Counterparty	NET MTM FORWARDS	Net MTM OPTIONS	Net MTM SWAPS	CalPERS Exposure	Counter Party Exposure	Net MTM Total	Collateral Posted	Net Credit Net Exposure
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)*	(\$)
Bank of Montreal	(1,843,167)				(1,843,167)	(1,843,167)	1,863,564	20,397
Bank of America	(704,634)		28,784,650	33,819,245	(5,739,229)	28,080,016	(28,090,000)	(9,984)
BNP Paribas	15,194,284		446,191,125	469,145,134	(7,759,725)	461,385,409	(461,433,000)	(47,591)
Barclays	(1,126,255)			2,558,006	(3,684,261)	(1,126,255)	1,151,823	25,568
Citigroup	631,366		(197,487)	2,333,250	(1,899,371)	433,879	(439,932)	(6,053)
Canadian Imperial Bank of Commerce	(1,154,158)				(1,154,158)	(1,154,158)	1,157,693	3,535
Credit Suisse International			413,992	413,992		413,992	(250,000)	163,992
Deutsche Bank	(2,575,920)			622	(2,576,542)	(2,575,920)	2,581,584	5,664
Goldman Sachs Intl.	162,980,798		36,610,767	207,545,890	(7,954,325)	199,591,565	(199,623,000)	(31,435)
HSBC	1,271,445		(29,978)	2,303,079	(1,061,612)	1,241,467	(1,352,852)	(111,385)
JPMorgan	(3,549,788)		13,258,714	15,831,918	(6,122,992)	9,708,926	(9,718,000)	(9,074)
Morgan Stanley Capital Service	16,465,997		203,249	48,640,863	(31,971,617)	16,669,246	(17,000,000)	(330,754)
RBC Capital Markets	(5,246,009)			427,378	(5,673,387)	(5,246,009)	5,251,846	5,837
Standard Chartered Bank	28,959,352			30,472,058	(1,512,706)	28,959,352	(28,968,459)	(9,107)
Societe Generale	19,744,837		634,470	20,535,116	(155,809)	20,379,307	(20,380,000)	(693)
State Street	(14,016,049)			8,264,527	(22,280,576)	(14,016,049)	14,017,754	1,705
Toronto Dominion	(635,480)				(635,480)	(635,480)	643,557	8,077
UBS AGG	(6,426,114)		8,405,918	10,328,147	(8,348,343)	1,979,804	(2,300,000)	(320,196)
Wells Fargo			2,373,176	4,053,475	(1,680,299)	2,373,176	(2,380,000)	(6,824)
Grand Total	207,970,505		536,648,596	856,672,700	(112,053,599)	744,619,101	(745,267,422)	(648,321)

*As of 7/01 Counterparties posted 772mm to CalPERS which includes Internal Collateral

Above: Total market value exposure and net credit exposures are monitored for all of our OTC (over-the-counter) positions.

Source: Aladdin, CalPERS

Below: FCM (Futures Commission Merchant) exposures are monitored for how much margin we have posted with our FCM. Source: Aladdin, CalPERS

FUTURES COMMISSION MERCHANT EXPOSURE	
Futures Commission Merchant	Collateral Posted*
CITIGROUP GLOBAL MARKETS INC	1,220,730,173
MERRILL LYNCH PIERCE FENNER & SMITH INCORPORATED	262,373,822

*As of July 1, 2020

Appendix

1. How to interpret the OTC Counterparty Risk Exposure section

OTC Derivative Counterparty Exposure Report								
<u>Counterparty</u>	<u>NET MTM FORWARDS</u> (\$)	<u>Net MTM OPTIONS</u> (\$)	<u>Net MTM SWAPS</u> (\$)	<u>CalPERS Exposure</u> (\$)	<u>Counter Party Exposure</u> (\$)	<u>Net MTM Total</u> (\$)	<u>Collateral Posted</u> (\$)	<u>Net Credit Net Exposure</u> (\$)
Counterparty 123	10,386,714.00	(84,745.00)	11,735,283.00	27,147,091.00	(25,475,215.00)	1,671,876.00	(1,525,000.00)	146,876.00

NET MTM BY PRODUCT TYPE

- Columns reflect the net mark to market (MTM) of all OTC trades by product type with a Counterparty
- + amount = CalPERS has a gain on the positions
- amount = CalPERS has a loss on the positions

Directional Exposure

- The exposure columns reflect an un-net profit or loss (P&L) grouping across product type and is equivalent to the directional unwind exposure at a point in time
- Trades with positive P&L are bucketed together = CalPERS Exposure
- Trades with negative P&L are bucketed together = Counterparty Exposure

NET MTM TOTAL

- The net market to market column reflects the total current net profit or loss position across all open OTC trades with a Counterparty
- + amount = CalPERS is owed money
- amount = CalPERS owes money

COLLATERAL POSTED

- The collateral posted column reflects the dollar amount of collateral that is either posted to CalPERS or that CalPERS has posted to a Counterparty to offset credit risk
- + amount = CalPERS has posted money out
- amount = Counterparty has posted money to CalPERS

NET CREDIT EXPOSURE

- The net credit exposure column reflects the open uncollateralized credit exposure risk if a Counterparty were to default with no change in mark to market prices
- + amounts reflect open credit risk where CalPERS is owed money