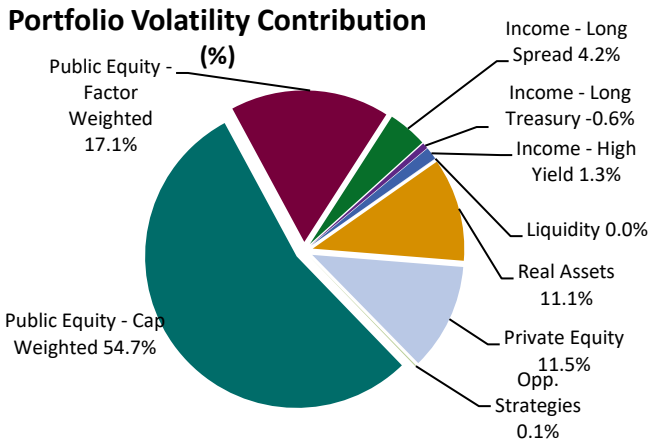
CalPERS Trust Level Review
Risk Management Summary

As of January 4, 2021

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 1/4/2021	Last Qtr 9/29/2020	Last Year 12/31/2019
Total	n/a	11.5	11.5	9.7
Benchmark	n/a	11.0	11.1	9.4
Tracking Error (TE)	< 1.5	1.10	1.07	0.86
Actionable TE	n/a	0.26	0.27	
Allocation TE	< 0.75	0.03	0.03	0.03



Comments:

Forecast Total Volatility of the PERF increased by 180 bps over the last year. This increase is primarily a reflection of higher market volatility in 2020 relative to prior years.

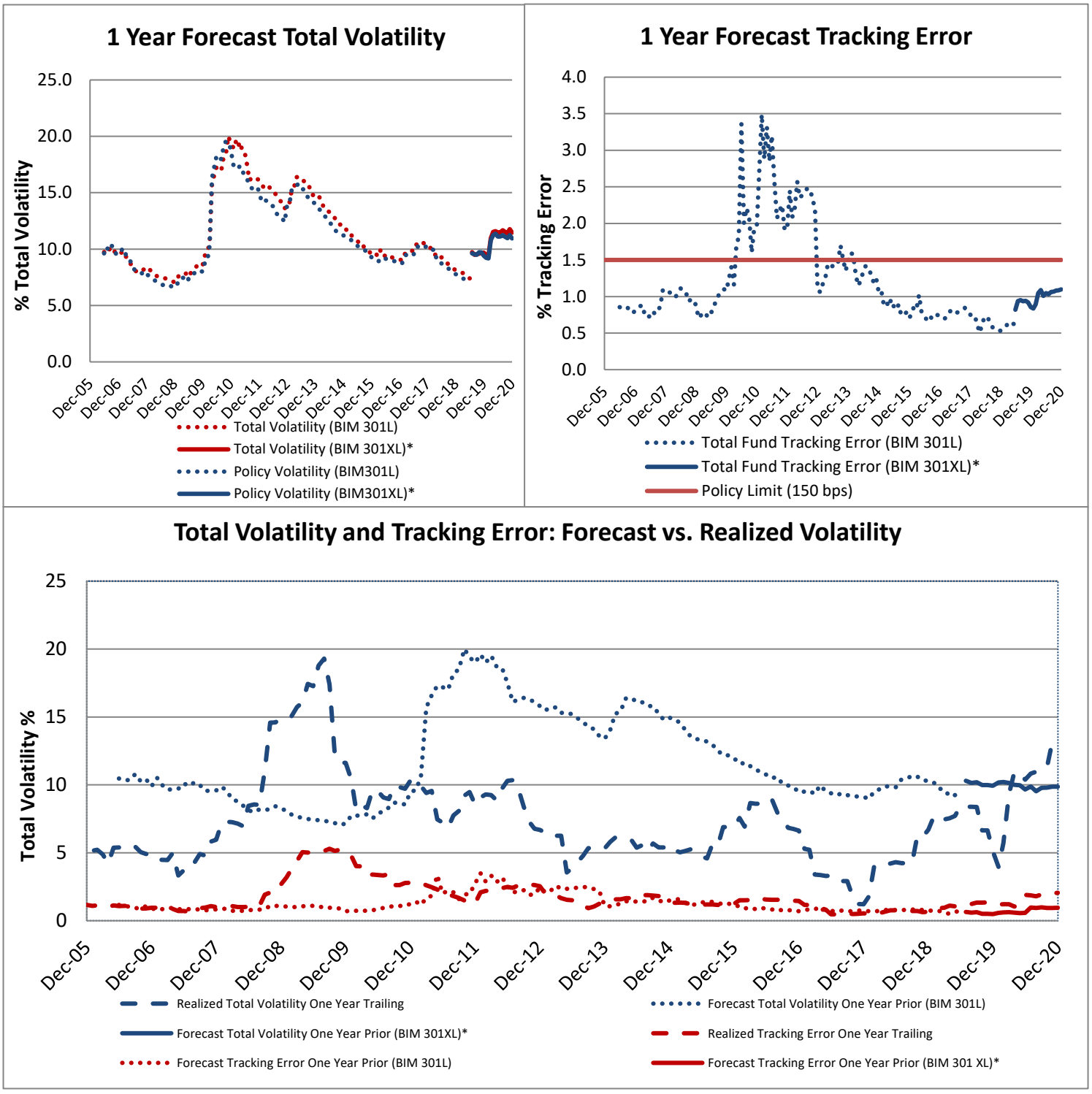
Rapid shifts in volatility regime can occur and would not be predicted by this model. The best interpretation of this estimate is as an indicator of the plan's volatility given the current market environment.

The pie chart above gives a visual representation of portfolio volatility contribution by asset classes (in percent). Growth sensitive assets dominate, so PERF returns will be driven by performance of those assets.

Asset Class		Market Value ($millions)	Total Forecast Volatility (%)	% Contribution to Total Volatility	Tracking Error (%)
Public Equity	**$**	**231,490**	**16.2**	**71.8**	**0.2**
Cap Weighted	$	165,744	17.3	54.7	0.1
Factor Weighted	$	65,746	13.4	17.1	0.0
Income	**$**	**116,359**	**8.4**	**5.0**	**1.2**
Long Spread	$	65,672	6.5	4.2	0.5
Long Treasury	$	31,017	12.0	-0.6	0.2
Total Fund Income	$	6,432	11.8	0.0	1.7
High Yield	$	13,238	7.1	1.3	0.2
Total Fund	**$**	**18,612**	**N/A**	**0.7**	**N/A**
Opportunistic	$	939	9.6	0.1	9.6
LLER	$	10,940	4.3	0.6	4.3
Liquidity	$	6,443	0.3	0.0	0.2
Other	$	291	N/A	0.0	N/A
TOTAL PERF Actionable					**0.26**
Private Equity	**$**	**30,928**	**22.4**	**11.5**	**13.1**
Real Assets	**$**	**44,357**	**15.8**	**11.1**	**3.4**
TOTAL PERF	**$**	**441,746**	**11.5**	**100.0**	**1.10**

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.

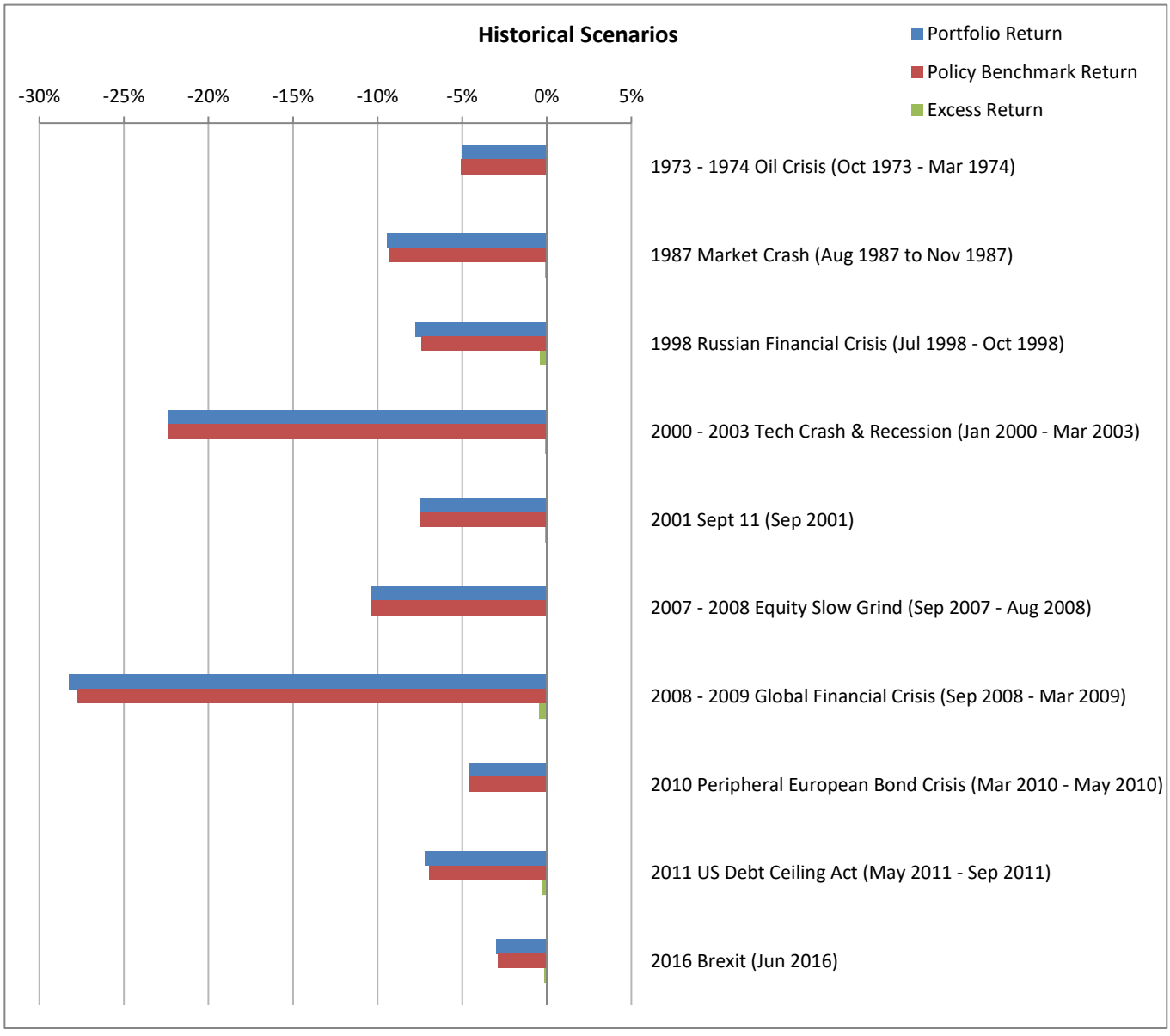
The bottom chart plots the Forecast Total Volatility and Tracking Error for the Total Fund one year prior to each date vs. the Total Volatility and Tracking Error realized for that date. The graph highlights potential deviations between risk model estimates and subsequent realized volatility, due to 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

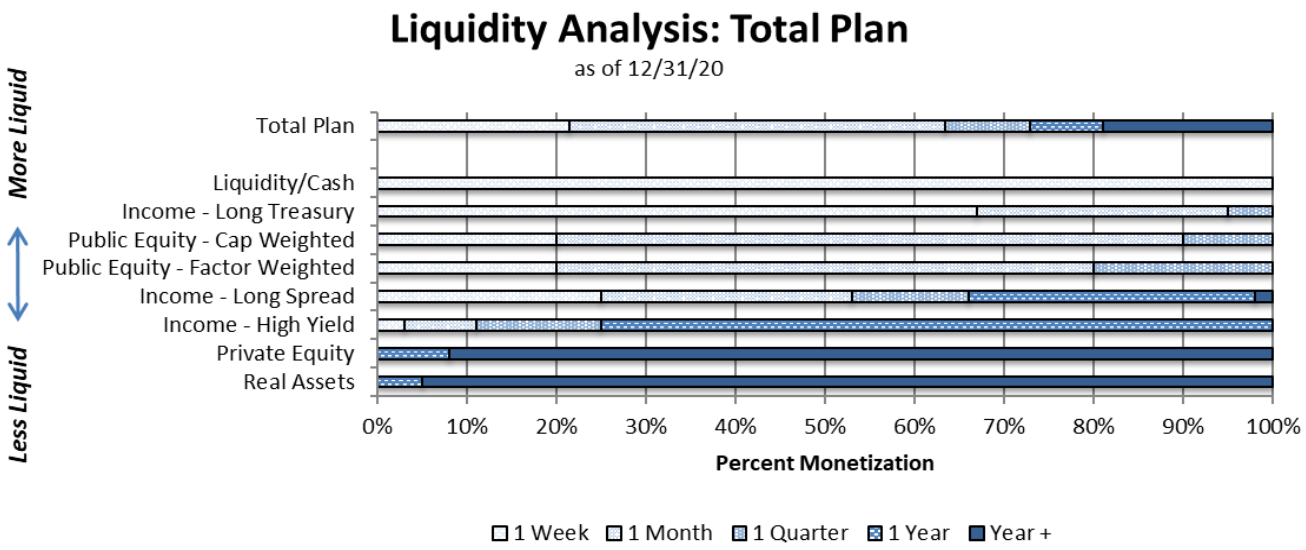
Historical scenarios highlight the sensitivity of the portfolio to past economic regimes or specific events. The scenarios can be used as a "what if" gauge of current portfolio positioning to understand the potential impact if a similar event or regime were to repeat.

Scenario	Portfolio Return	Policy Benchmark Return	Excess Return
2016 Brexit (Jun 2016)	-3.0%	-2.9%	-0.1%
2010 Peripheral European Bond Crisis (Mar 2010 - May 2010)	-4.6%	-4.5%	0.0%
1973 - 1974 Oil Crisis (Oct 1973 - Mar 1974)	-5.0%	-5.1%	0.1%
2011 US Debt Ceiling Act (May 2011 - Sep 2011)	-7.2%	-7.0%	-0.2%
2001 Sept 11 (Sep 2001)	-7.5%	-7.4%	-0.1%
1998 Russian Financial Crisis (Jul 1998 - Oct 1998)	-7.8%	-7.4%	-0.4%
1987 Market Crash (Aug 1987 to Nov 1987)	-9.4%	-9.4%	-0.1%
2007 - 2008 Equity Slow Grind (Sep 2007 - Aug 2008)	-10.4%	-10.4%	0.0%
2000 - 2003 Tech Crash & Recession (Jan 2000 - Mar 2003)	-22.4%	-22.4%	-0.1%
2008 - 2009 Global Financial Crisis (Sep 2008 - Mar 2009)	-28.2%	-27.8%	-0.4%



Source: BarraOne, CalPERS

LIQUIDITY



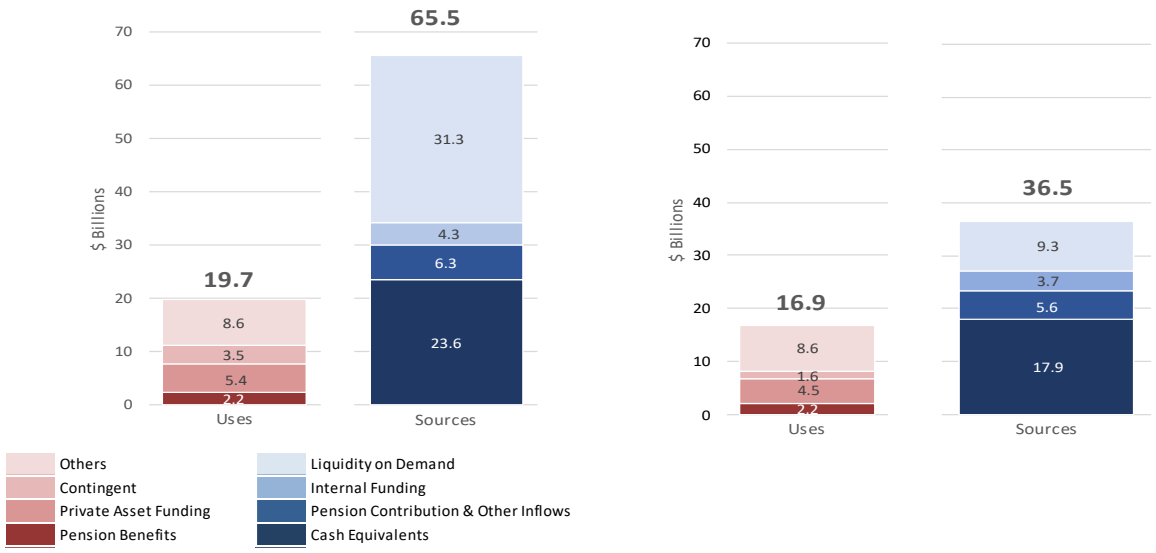
Transactional liquidity is estimated for each asset class/strategy based on the current market environment while also accounting for legal structures or other factors that may impact liquidity. *Source: SSB, CalPERS*

Stress (Current Regime)[1]

Tier 1 30 Day Liquidity Coverage Ratio = 3.3x

Historical Worst[2]

Tier 1 30 Day Liquidity Coverage Ratio = 2.2x



[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

Total Fund Leverage Report

as of 12/31/20

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.

Total Fund Leverage Breakdown:
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.

Total Fund Leverage Breakdown

Total Fund Leverage Breakdown[1]	Asset Value ($ Mill)	Share of Plan NAV
Total Fund Financing and Liquidity	7,089	1.6%
Total Financing (Derivatives & Repos)	17,422	
- Liquidity Segment	(10,333)	
Real Asset Financing[2]	21,432	4.8%
Non-recourse Debt	22,016	
- Cash	(584)	
PE Subscription Financing	1,745	0.4%
Program Level Financing	1,446	0.3%
Public Equity	75	
Income	564	
Total Fund Income	811	
Other[3]	(4)	
Total Fund Leverage	31,713	7.2%
Leverage in Strategic Asset Allocation		2.8%
Policy Leverage		4.4%

Embedded Leverage in Asset Classes

	Implied Leverage[4]
Public Equity	1.59
Private Equity	2.22
Real Estate	1.30

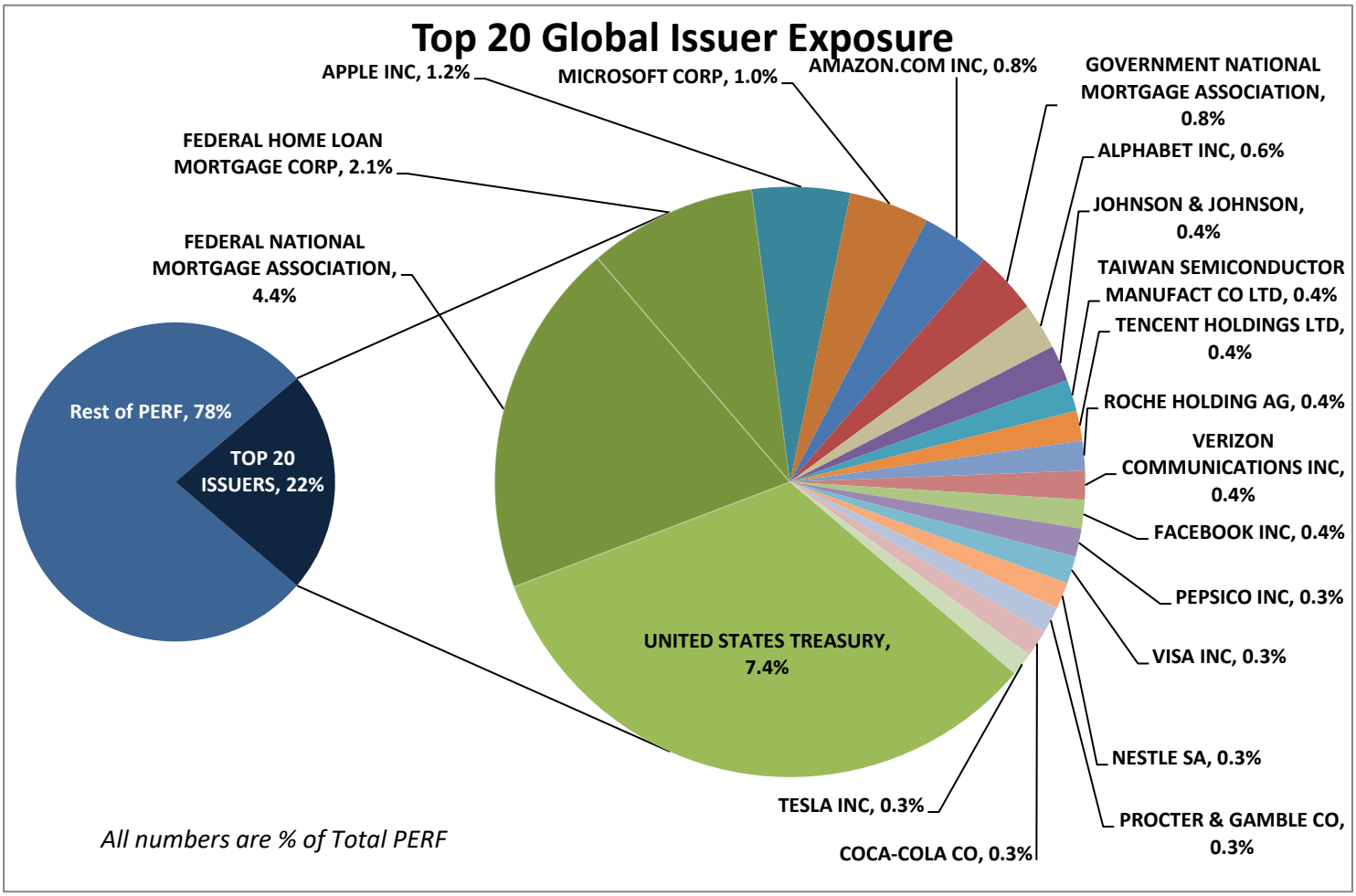
Unfunded Commitments

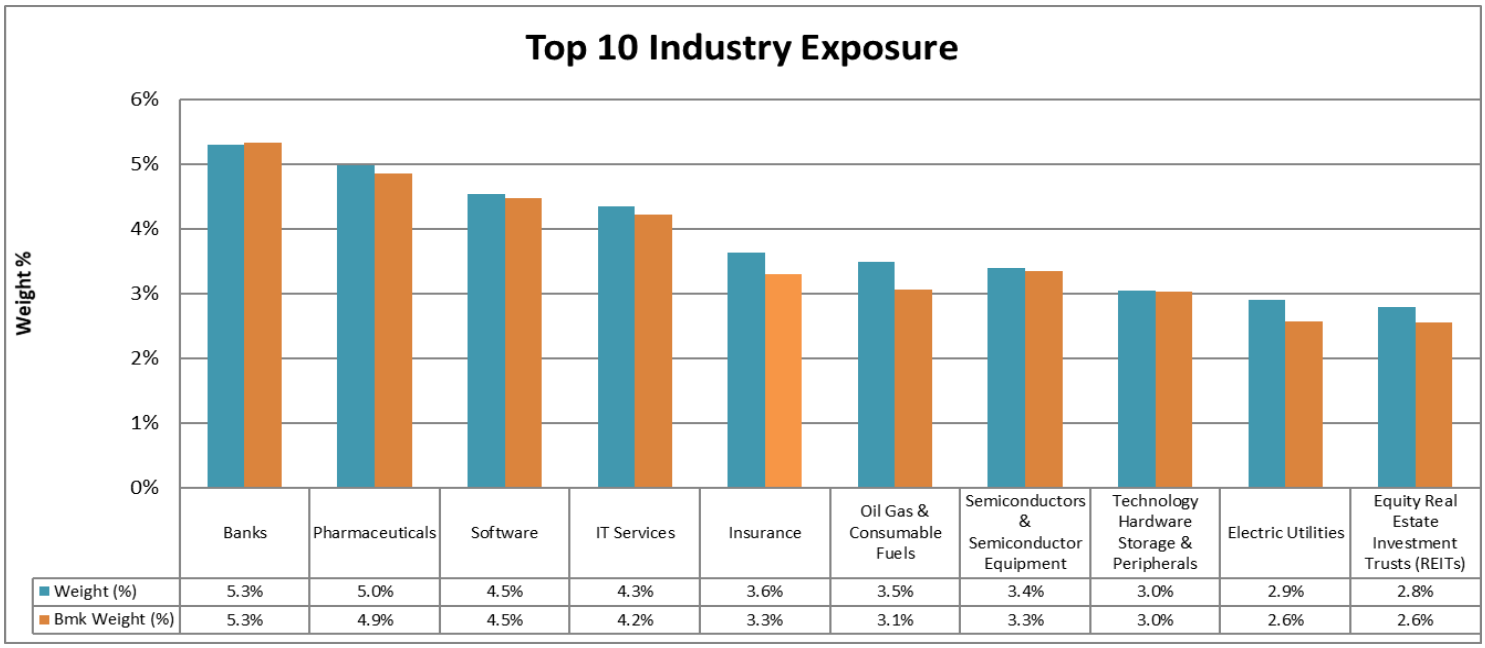
	Net Market Value ($B)	Unfunded Commitments ($B)[5]	% of Total Fund
Opportunistic Strategies[6]	11.9	8.1	1.8%
Private Equity	30.9	29.6	6.7%
Real Assets	44.4	11.8	2.7%

1. 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.
   All debt is recourse except for Real Assets as listed.
2. Real Asset 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 RMS reported date.
3. Other in Program Level Financing includes Opportunistic, LLER and Trust Level.
4. Implied leverage is estimated from either asset class benchmark data or industry research. It represents the Enterprise Value to Equity ratio.
5. Unfunded commitments are as of 12/31/20 for Opportunistic and Private Equity and 9/30/20 for Real Assets.
   67% of Real Assets unfunded commitments are revocable at CalPERS' discretion.
6. Opportunistic Strategies includes both Opportunistic and LLER.

Source: Aladdin, SSB, Factset, CalPERS

CONCENTRATION REPORT

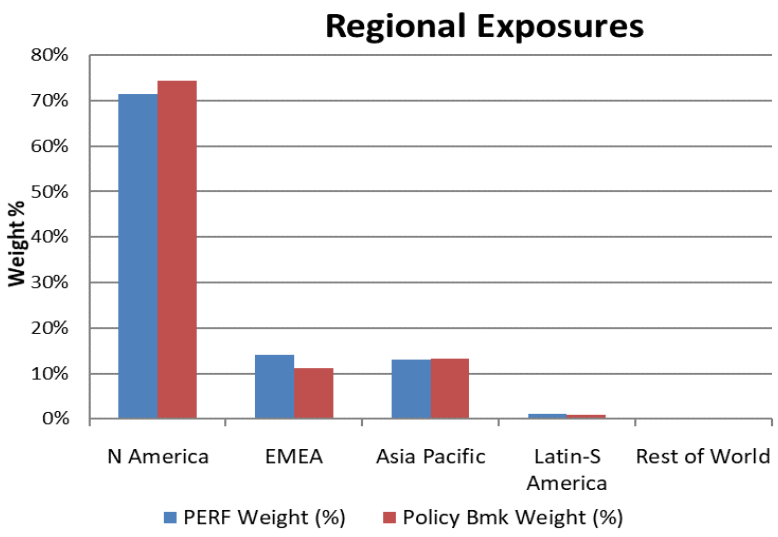




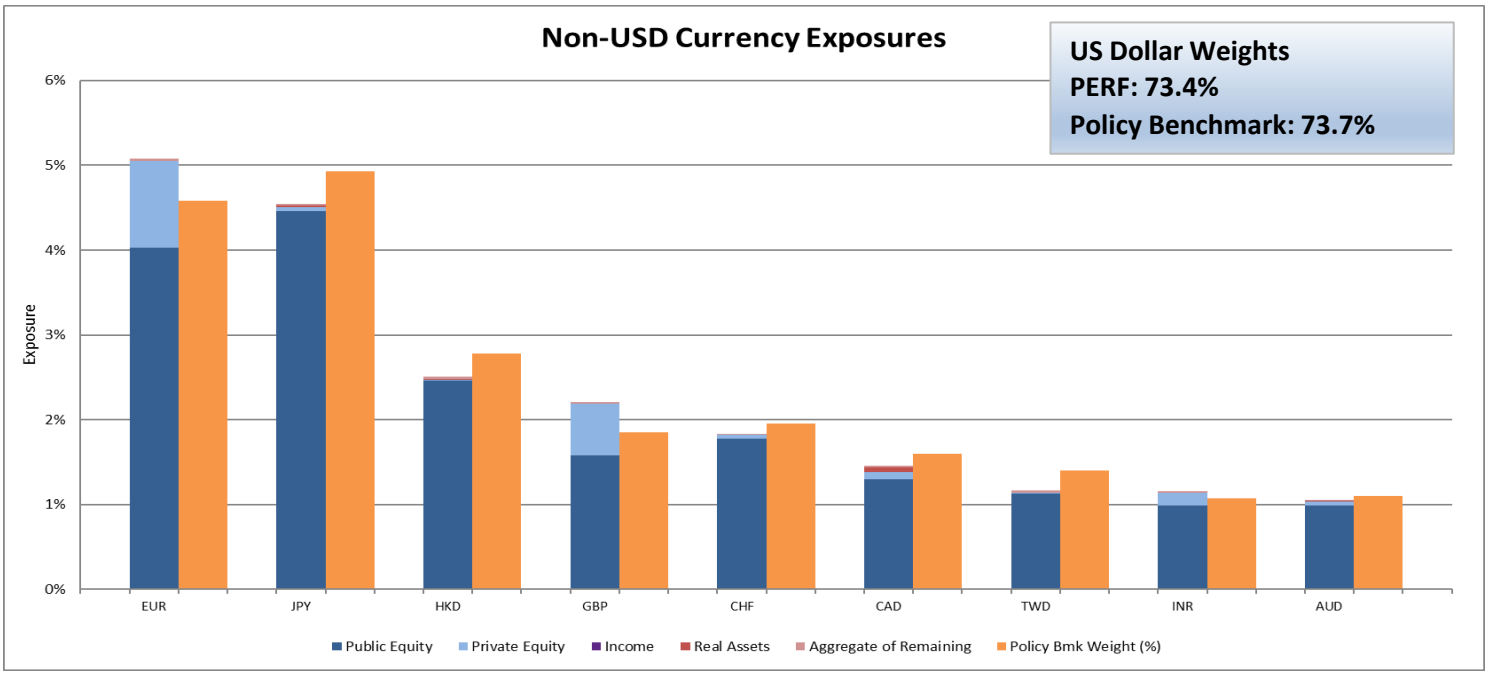
	Banks	Pharmaceuticals	Software	IT Services	Insurance	Oil Gas & Consumable Fuels	Semiconductors & Semiconductor Equipment	Technology Hardware Storage & Peripherals	Electric Utilities	Equity Real Estate Investment Trusts (REITs)
Weight (%)	5.3%	5.0%	4.5%	4.3%	3.6%	3.5%	3.4%	3.0%	2.9%	2.8%
Bmk Weight (%)	5.3%	4.9%	4.5%	4.2%	3.3%	3.1%	3.3%	3.0%	2.6%	2.6%

Source: BarraOne, CalPERS

CONCENTRATION REPORT



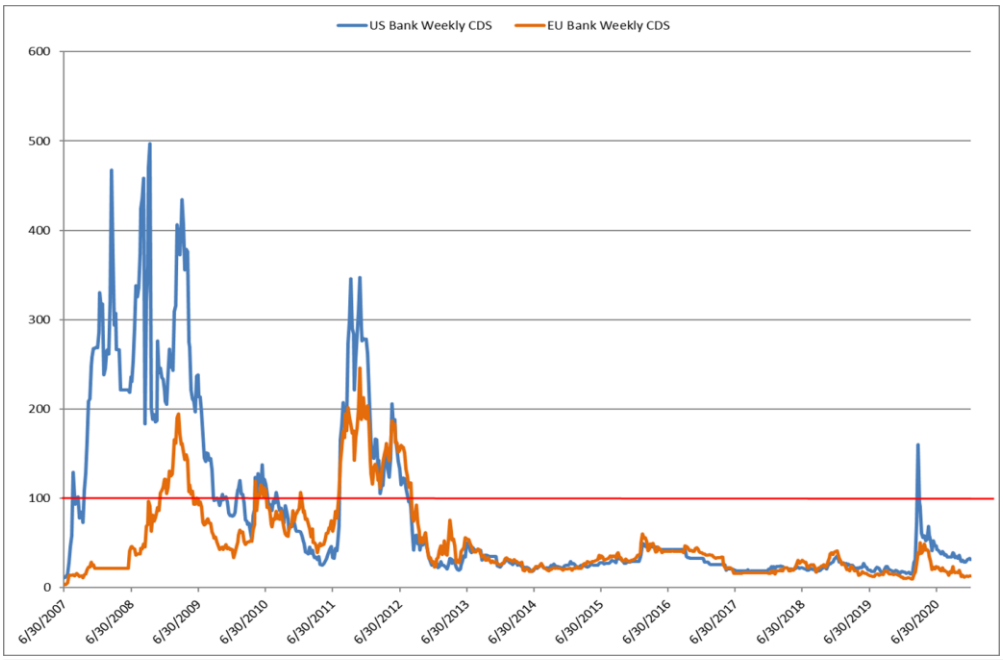
Country	PERF Weight (%)	Policy Bmk Weight (%)	Active Weight (%)
United States	68.0%	71.6%	-3.5%
Japan	4.9%	5.0%	-0.1%
China*	3.2%	3.3%	-0.1%
United Kingdom	2.9%	2.1%	0.8%
Canada	2.4%	2.0%	0.4%
France	1.9%	1.4%	0.4%
Germany	1.8%	1.4%	0.4%
Switzerland	1.8%	2.0%	-0.2%
Taiwan	1.3%	1.4%	-0.1%
Australia	1.3%	1.1%	0.1%



*Includes Hong Kong

Source: BarraOne, CalPERS

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	296,300			296,300		296,300	(101,767)	194,533
Bank of America	(61,870,324)		(36,885,738)	22,402,840	(121,158,902)	(98,756,062)	98,758,033	1,971
BNP Paribas	(4,158,850)		309,162,782	330,752,612	(25,748,680)	305,003,932	(305,006,817)	(2,885)
Barclays	3,543,044		(11,118,550)	4,893,684	(12,469,190)	(7,575,506)	7,599,094	23,588
Citigroup	(9,306,289)		(25,901,482)	521,902	(35,729,673)	(35,207,771)	35,210,556	2,785
Canadian Imperial Bank of Commerce	(1,040,861)				(1,040,861)	(1,040,861)	976,169	(64,692)
Credit Suisse International			7,163,905	15,812,066	(8,648,161)	7,163,905	(7,200,000)	(36,095)
Deutsche Bank	(34,819,180)			1,356,576	(36,175,756)	(34,819,180)	34,828,782	9,602
Goldman Sachs Intl.	30,632,512		36,691,160	93,763,660	(26,439,988)	67,323,672	(67,332,000)	(8,328)
HSBC	(18,576,828)		15,418	1,337,499	(19,898,909)	(18,561,410)	18,581,227	19,817
JPMorgan Chase Bank	(7,600,094)		7,133,839	9,592,182	(10,058,437)	(466,255)	469,198	2,943
Morgan Stanley Capital Service	(62,940,393)		245,948	3,391,387	(66,085,832)	(62,694,445)	62,741,169	46,724
RBC Capital Markets	729,132			1,336,164	(607,032)	729,132	(731,000)	(1,868)
Standard Chartered Bank	2,972,173			16,751,366	(13,779,193)	2,972,173	(2,973,000)	(827)
Societe Generale	(8,458,600)			4,913,940	(13,372,540)	(8,458,600)	8,461,666	3,066
State Street	(70,673,361)			34,026	(70,707,387)	(70,673,361)	70,681,978	8,617
Toronto Dominion	(1,422,390)				(1,422,390)	(1,422,390)	1,431,395	9,005
UBS AGG	(2,890,741)		7,392,295	7,509,173	(3,007,619)	4,501,554	(4,550,000)	(48,446)
Wells Fargo			15,142,438	15,142,438		15,142,438	(15,148,356)	(5,918)
WestPac Bank	(1,343,327)				(1,343,327)	(1,343,327)	1,365,947	22,620
Grand Total	(246,928,077)		309,042,015	529,807,815	(467,693,877)	62,113,938	(61,937,726)	176,212

**As of 1/1 Counterparties posted 403mm 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	474,893,643
MERRILL LYNCH PIERCE FENNER & SMITH INCORPORATED	457,816,567

**As of January 1, 2021*

Appendix

1. How to interpret the OTC Counterparty Risk Exposure section