

CalPERS Trust Level Review Risk Management Summary

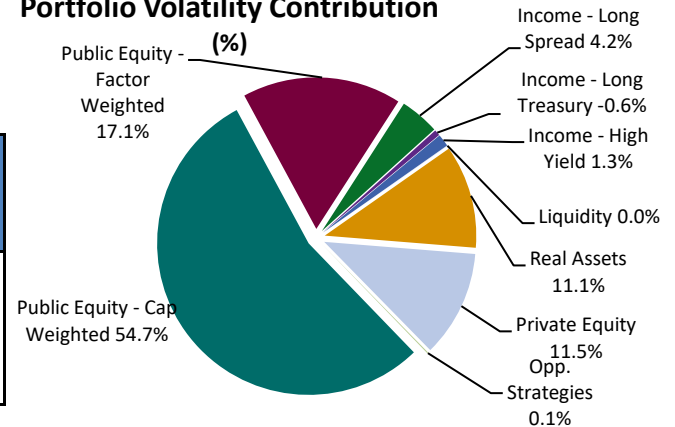


As of January 4, 2021

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 |

Portfolio Volatility Contribution



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.

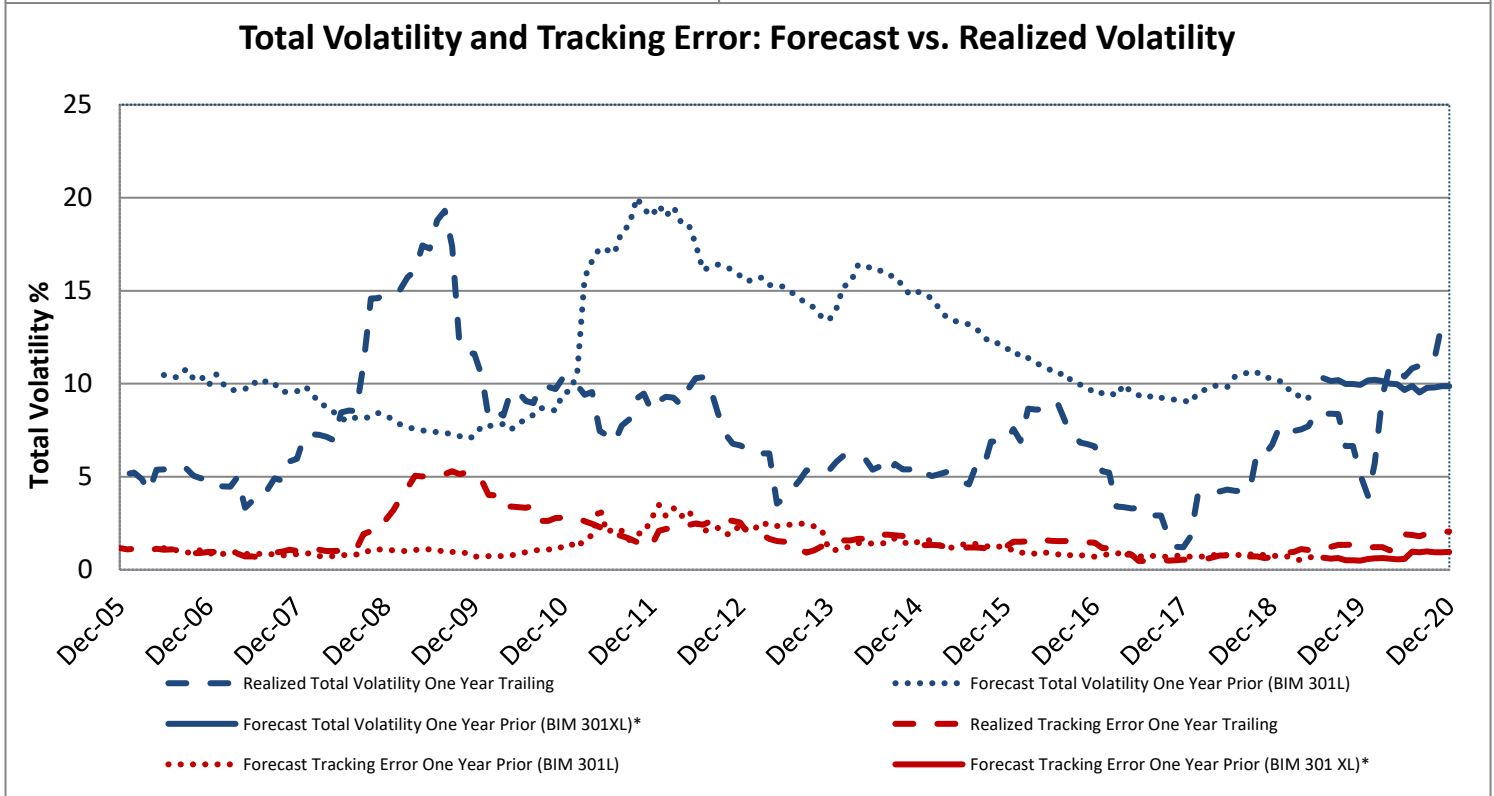
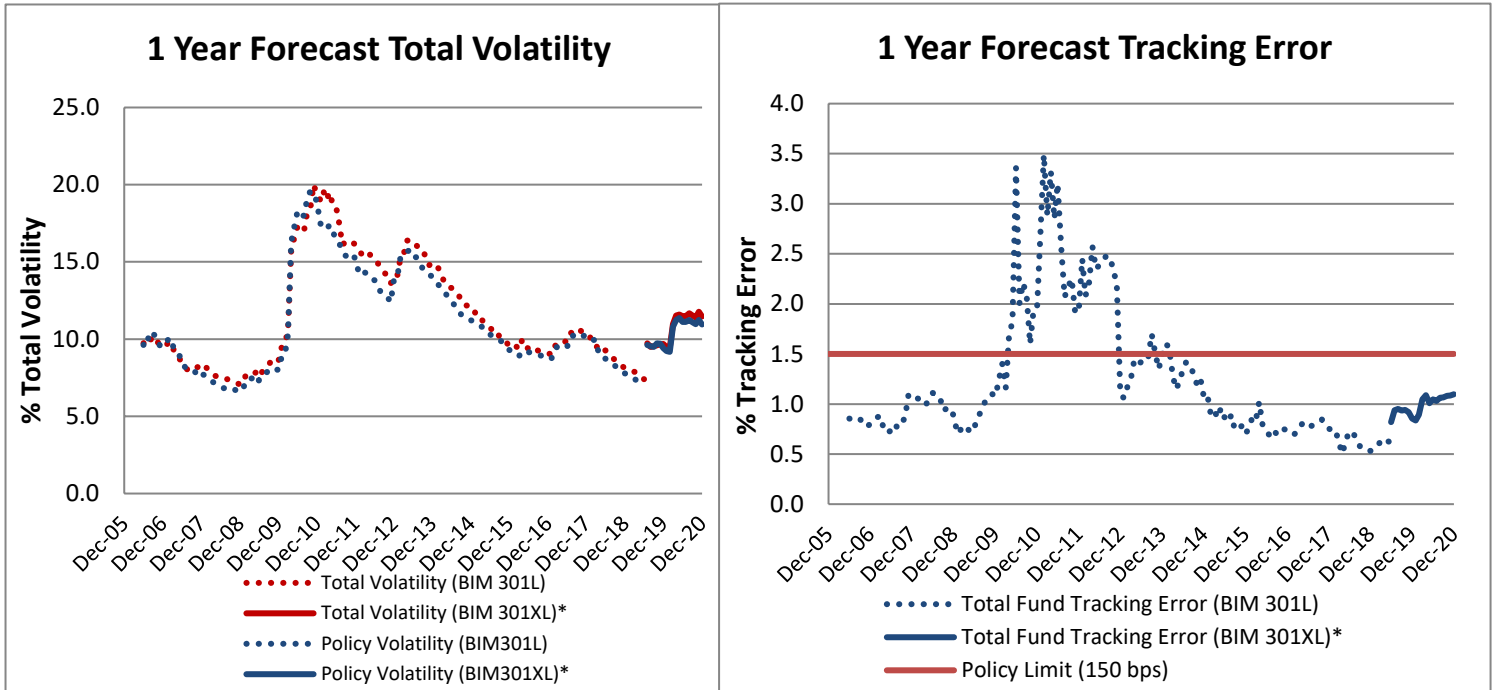
Rapid shifts in volatility regime can occur and would not be predicted by this model. The best interpretation of this estimate is as an indicator of the plan's volatility given the current market environment.

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



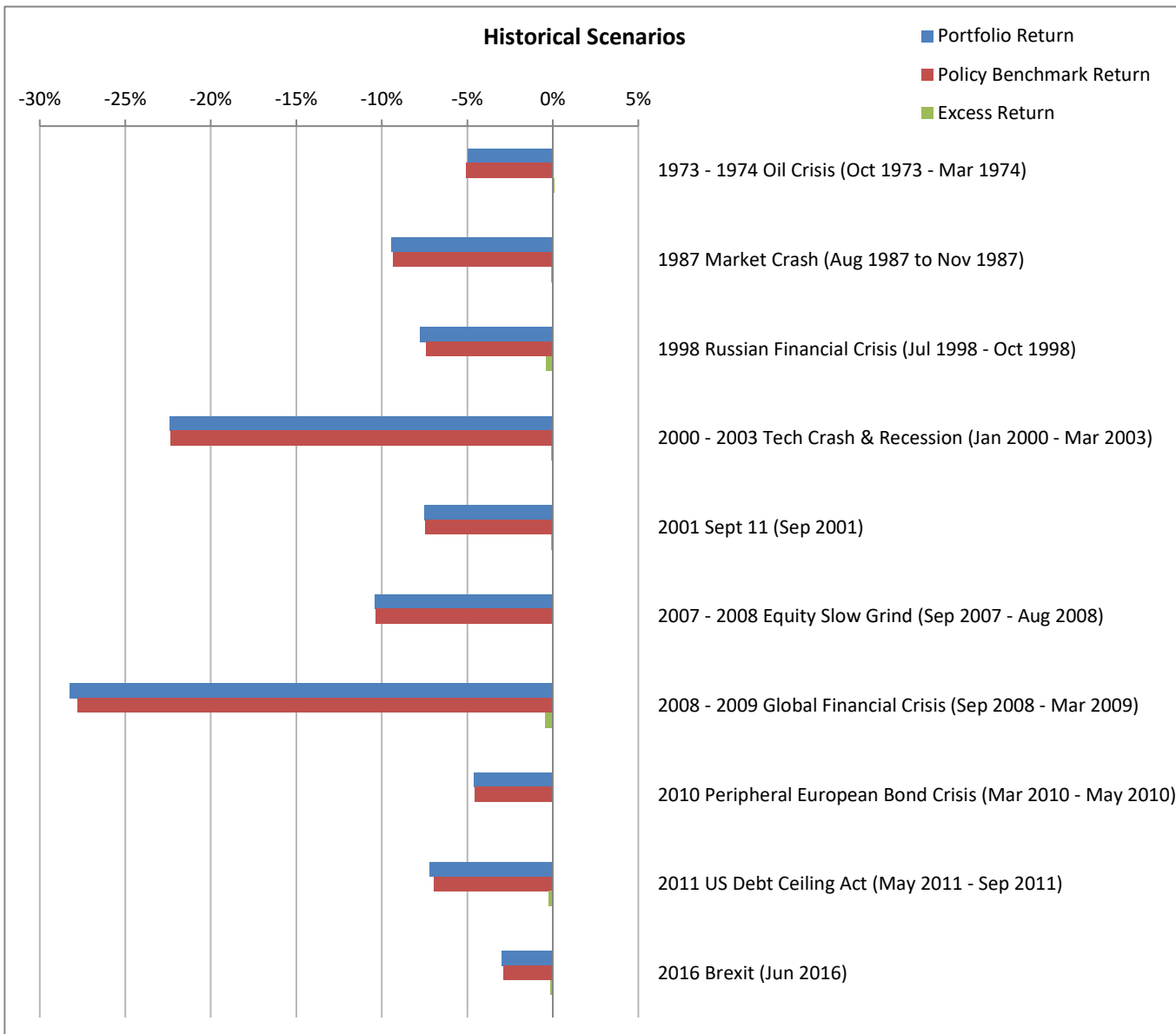
*PERF Risk model changed to a longer horizon model (from Barra 301L to 301XL). Risk values from 7/31/19 onward are reported under 301XL.

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.

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% |

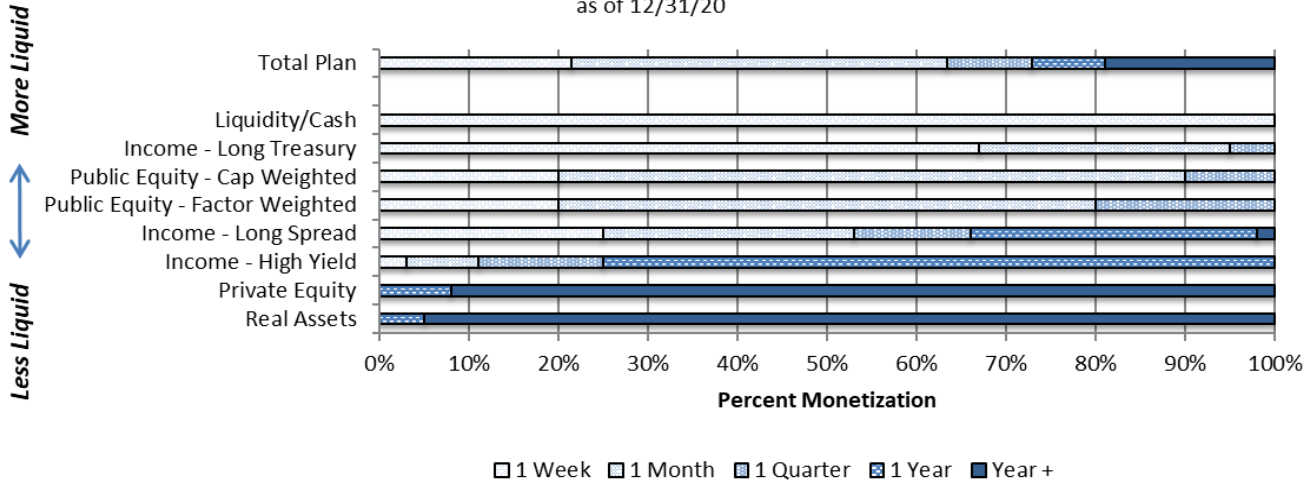


Source: BarraOne, CalPERS

LIQUIDITY

Liquidity Analysis: Total Plan

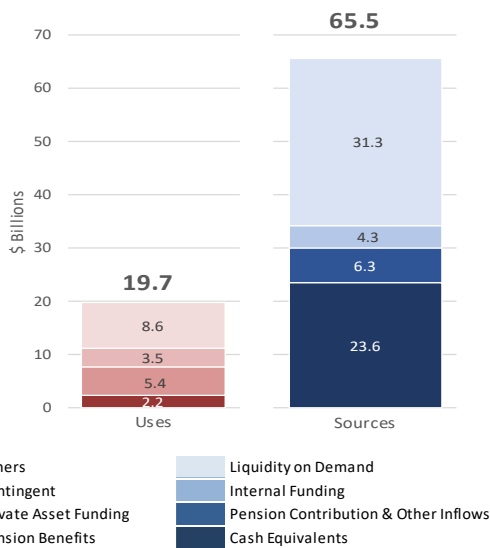
as of 12/31/20



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*

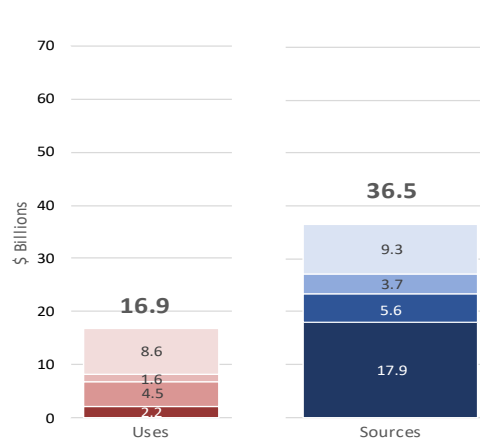
Stress (Current Regime)¹

Tier 1 30 Day Liquidity Coverage Ratio = 3.3x



Historical Worst²

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

LEVERAGE

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.

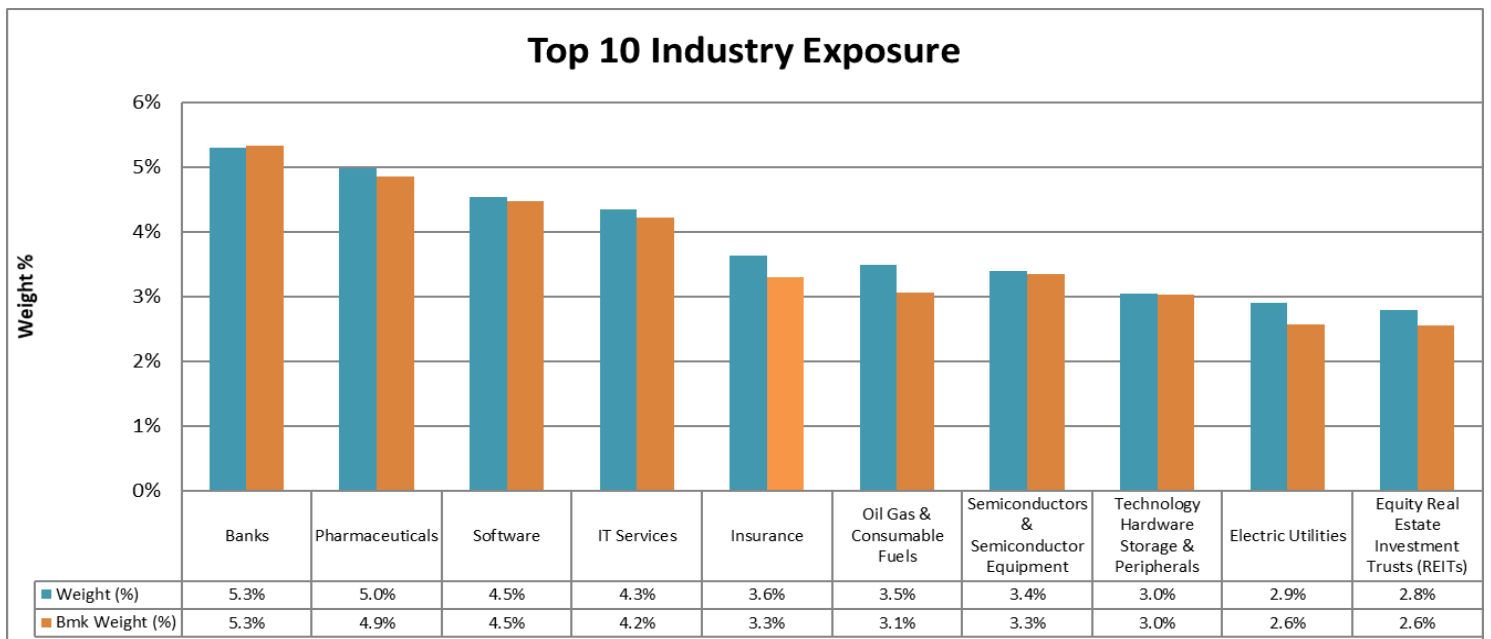
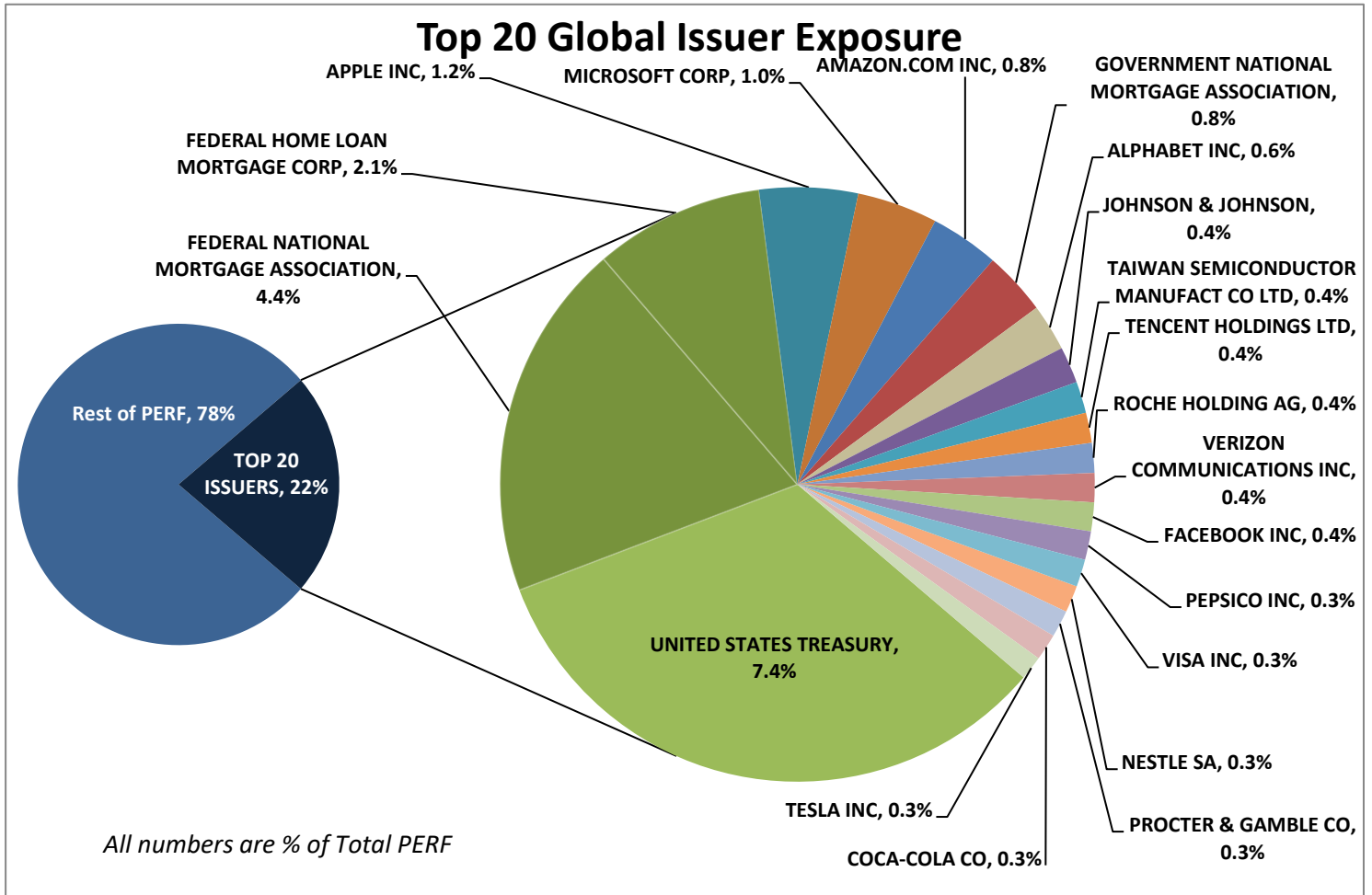
5. Unfunded commitments are as of 12/31/20 for Opportunistic and Private Equity and 9/30/20 for Real Assets.

67% of Real Assets unfunded commitments are revocable at CalPERS' discretion.

6. Opportunistic Strategies includes both Opportunistic and LLER.

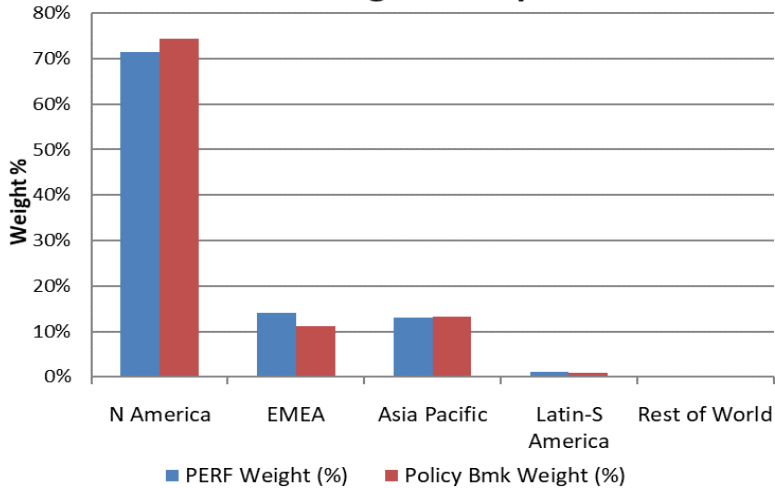
Source: Aladdin, SSB, Factset, CalPERS

CONCENTRATION REPORT



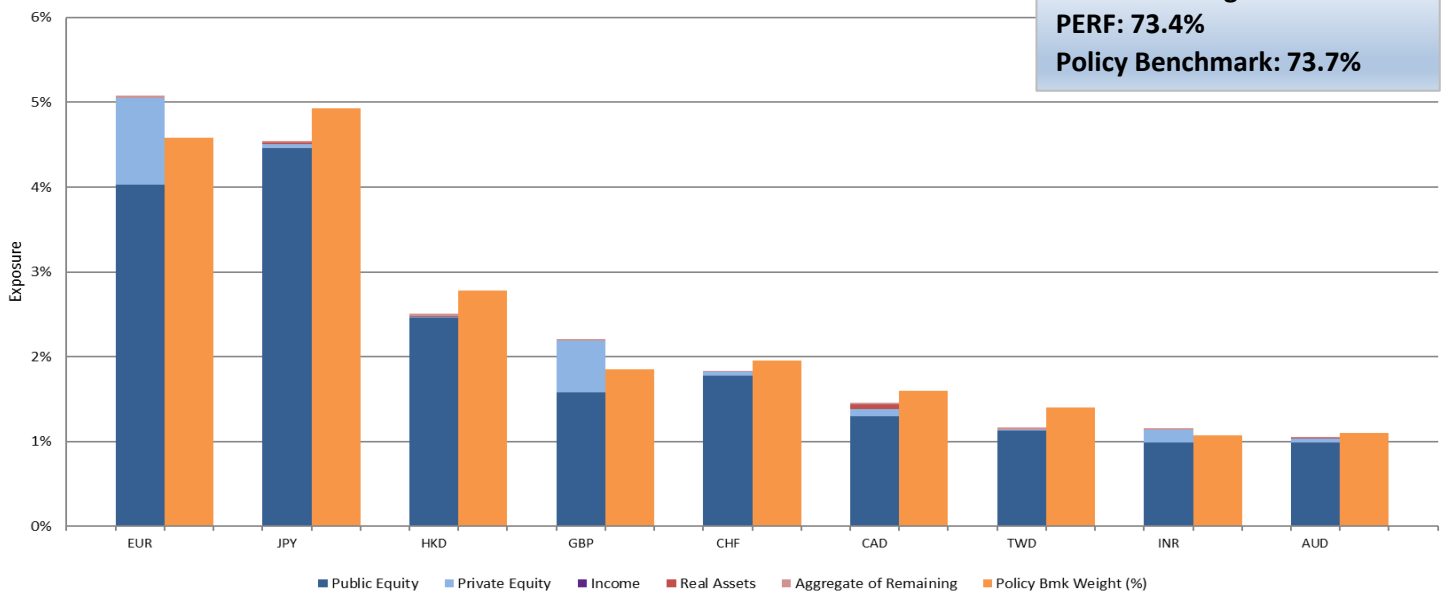
CONCENTRATION REPORT

Regional Exposures



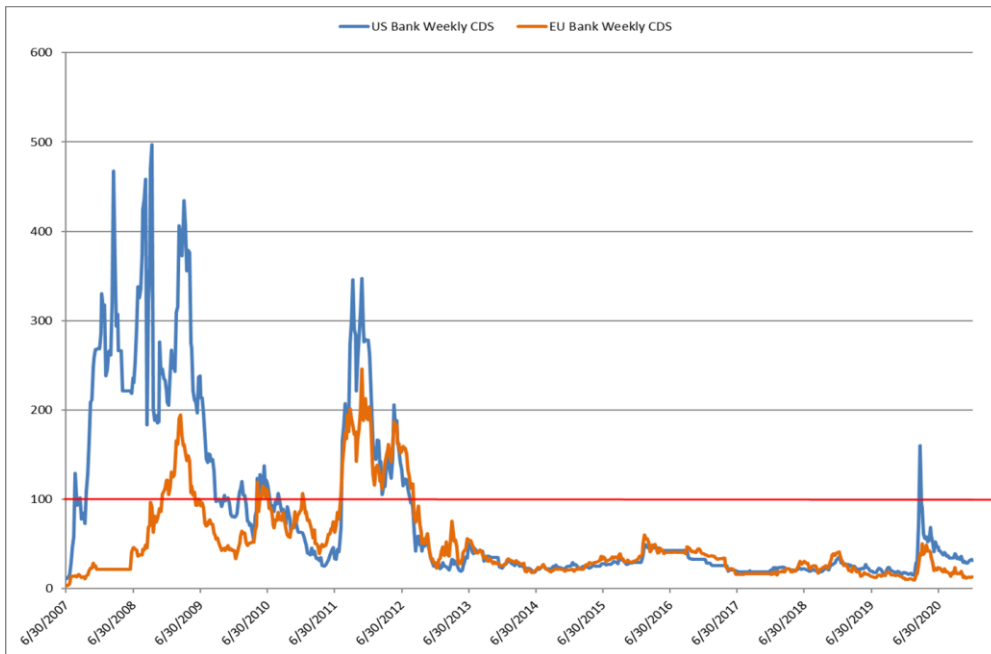
| Country | PERF Weight (%) | Policy Bmk Weight (%) | Active Weight (%) |
|----------------|-----------------|-----------------------|-------------------|
| United States | 68.0% | 71.6% | -3.5% |
| Japan | 4.9% | 5.0% | -0.1% |
| China* | 3.2% | 3.3% | -0.1% |
| United Kingdom | 2.9% | 2.1% | 0.8% |
| 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% |

Non-USD Currency Exposures



*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 | 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) | (1,422,390) | 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

| 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