# CalPERS Trust Level Review
# Risk Management Summary

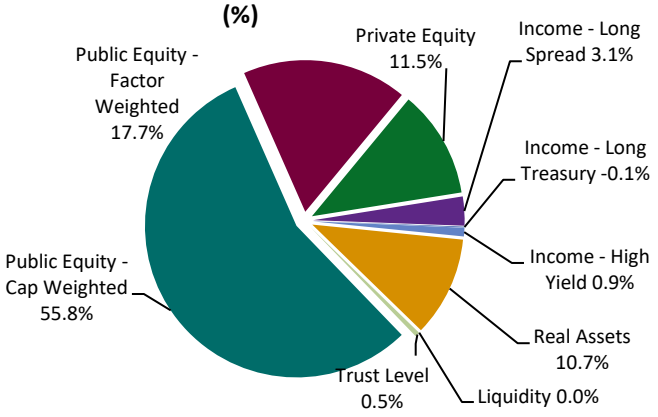
Period Ending December 31, 2019

***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 12/31/2019 | Last Qtr[1] 9/30/2019 | Last Year[1] 12/31/2018 |
|---|---|---|---|---|
| Total | n/a | 9.7 | 9.5 | 9.9 |
| Benchmark | n/a | 9.4 | 9.5 | 9.9 |
| Tracking Error | < 1.5 | 0.9 | 0.9 | 0.9 |
| Allocation | < 0.75 | 0.0 | 0.1 | 0.0 |
| Selection | n/a | 0.8 | 0.8 | 0.9 |

**Portfolio Volatility Contribution (%)**




**Comments:**

Forecast Total Volatility of the PERF decreased by 26 bps over the last year. This decrease is primarily a reflection of recent low 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).

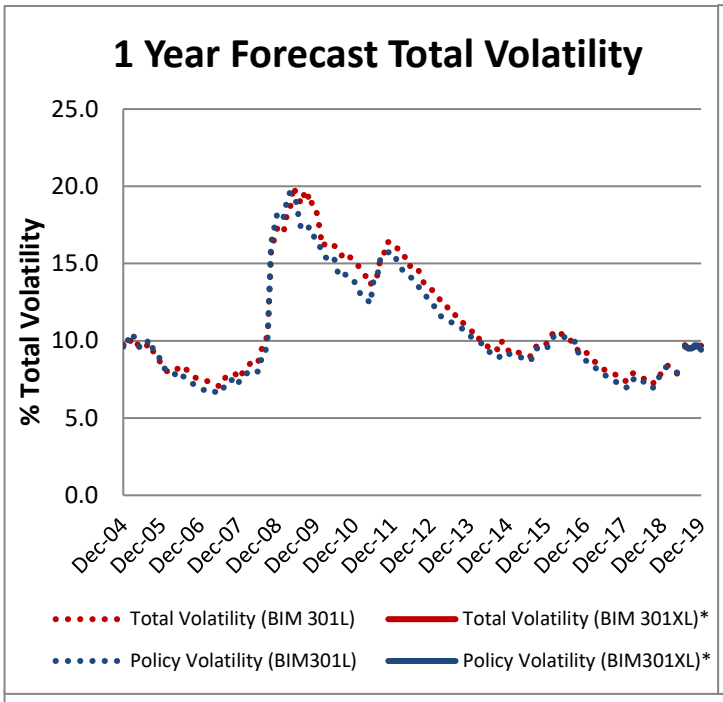
| Asset Class | | Market Value ($millions) | Total Forecast Volatility (%) | % Contribution to Total Volatility | Tracking Error (%) |
|---|---|---|---|---|---|
| **Public Equity** | **$** | **205,891** | **14.0** | **73.4** | **0.1** |
| Cap Weighted | $ | 143,758 | 15.0 | 55.8 | 0.1 |
| Factor Weighted | $ | 62,133 | 11.8 | 17.7 | 0.1 |
| **Private Equity** | **$** | **26,104** | **20.3** | **11.5** | **11.8** |
| **Income** | **$** | **113,384** | **6.7** | **3.9** | **0.3** |
| Long Spread | $ | 58,374 | 5.7 | 3.1 | 0.3 |
| Long Treasury | $ | 43,219 | 11.0 | -0.1 | 0.4 |
| High Yield | $ | 11,790 | 4.7 | 0.9 | 0.3 |
| **Real Assets** | **$** | **43,513** | **12.5** | **10.7** | **2.3** |
| **Liquidity** | **$** | **3,882** | **0.1** | **0.0** | **0.1** |
| **Trust Level[2]** | **$** | **2,070** | **9.4** | **0.5** | **6.1** |
| **TOTAL FUND** | **$** | **394,844** | **9.7** | **100.0** | **0.9** |

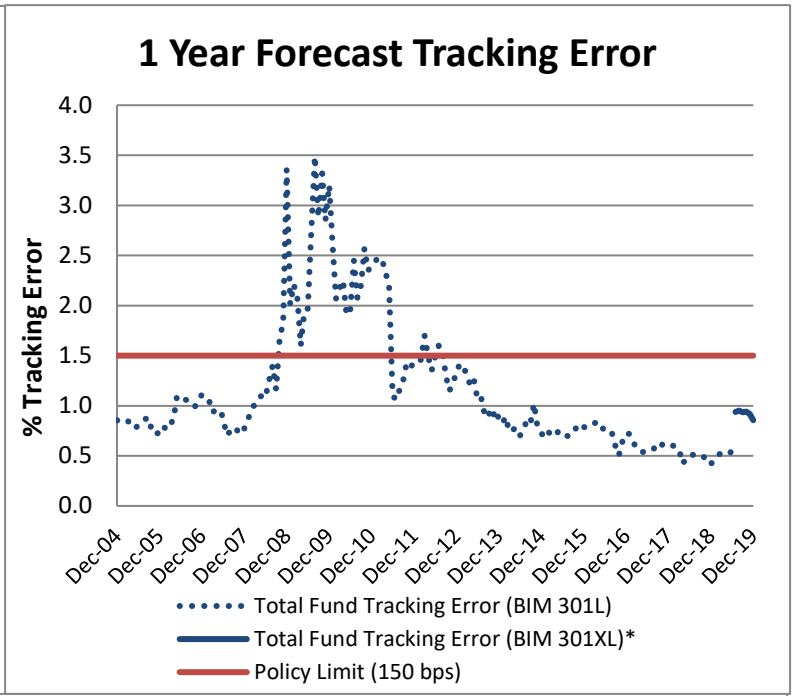
[1]PERF Risk model changed to a longer horizon model (from Barra 301L to 301XL). 12/31/2018 and 9/30/2019 risk values have been restated.

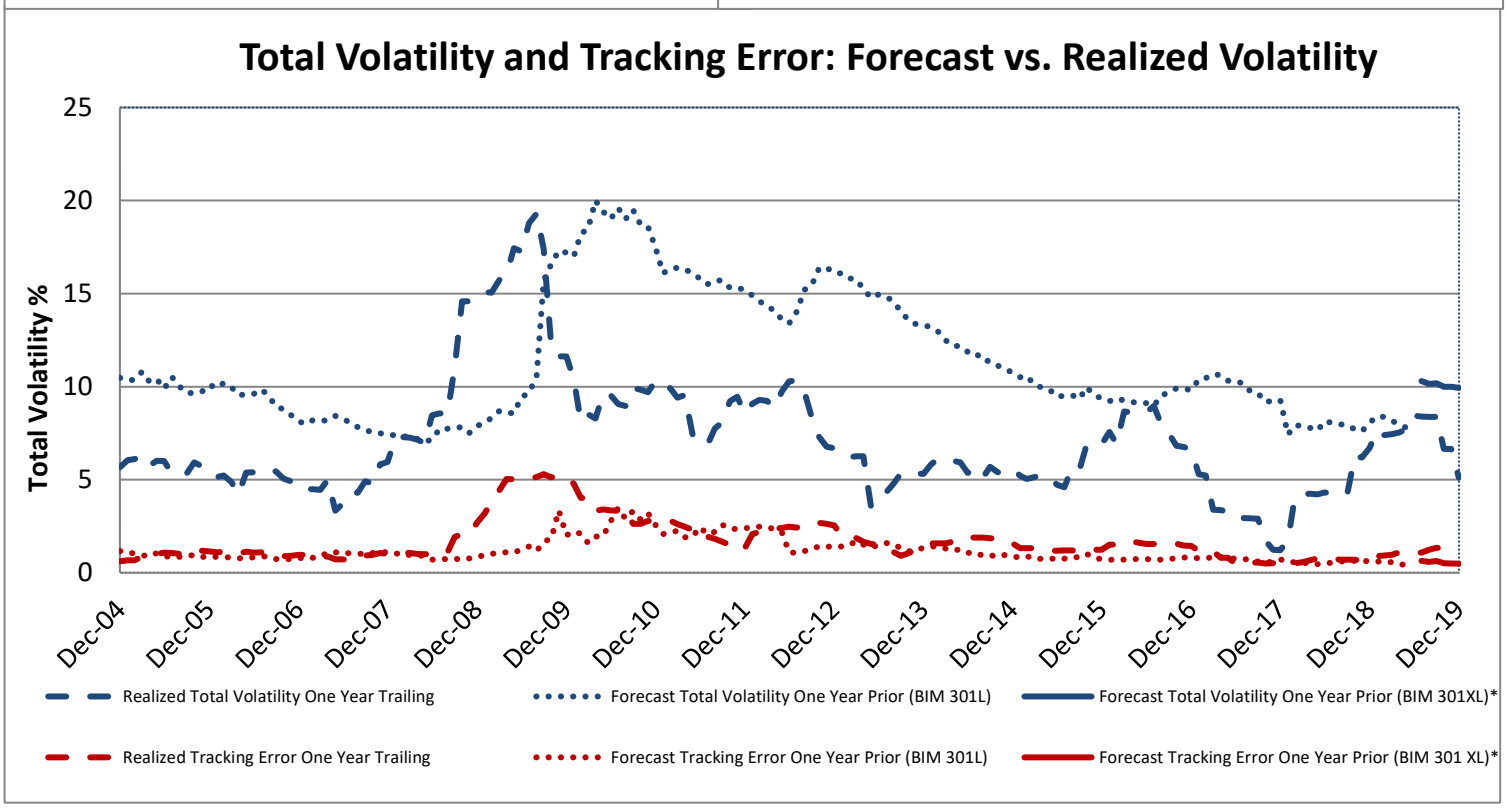
[2]Trust Level includes Multi Asset Class, Absolute Return Strategies, and other Total Fund level portfolios.

*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.

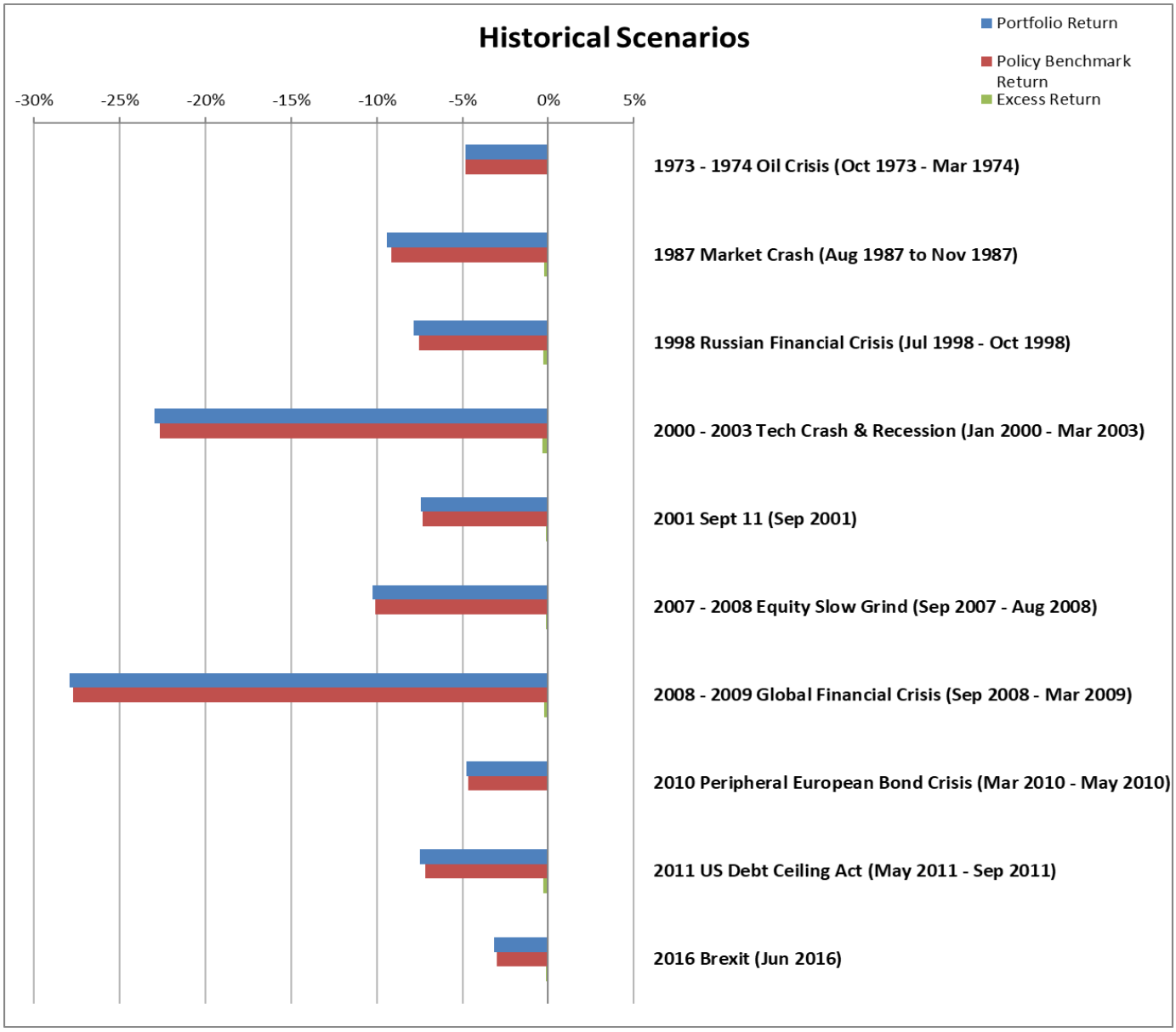
The bottom chart plots the Forecast Total Volatility and Tracking Error for the Total Fund one year prior to each date vs. the Total Volatility and Tracking Error realized for that date. The graph highlights potential deviations between risk model estimates and subsequent realized volatility, due to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

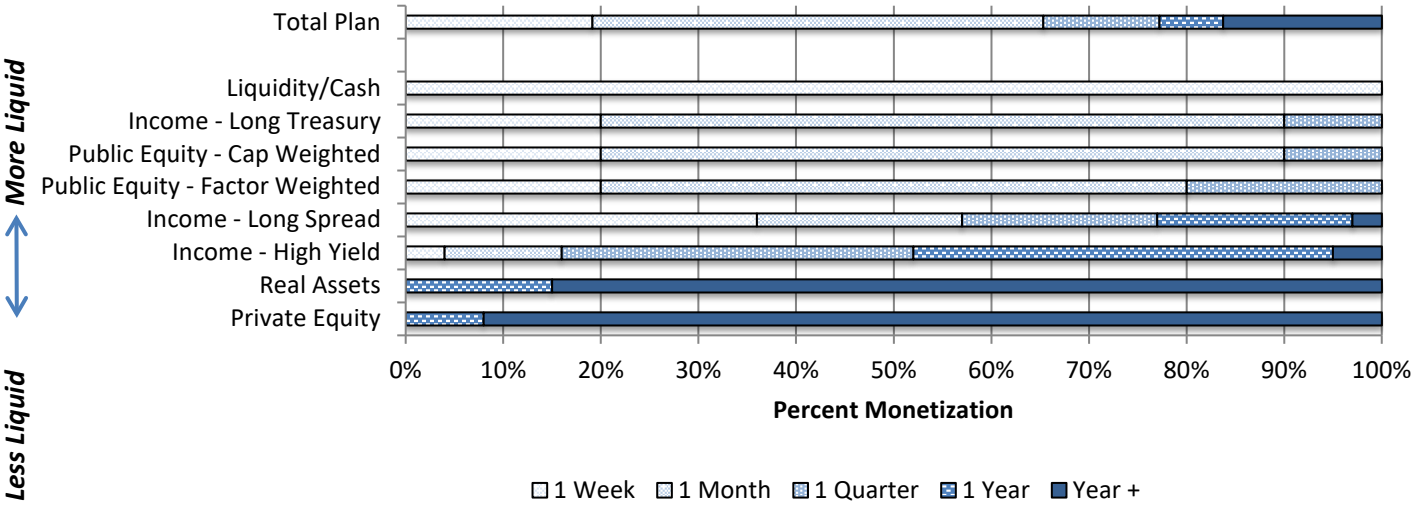
| Scenario | Portfolio Return | Policy Benchmark Return | Excess Return |
|---|---|---|---|
| 2016 Brexit (Jun 2016) | -3.2% | -3.0% | -0.1% |
| 2010 Peripheral European Bond Crisis (Mar 2010 - May 2010) | -4.8% | -4.7% | -0.1% |
| 1973 - 1974 Oil Crisis (Oct 1973 - Mar 1974) | -4.8% | -4.8% | 0.0% |
| 2001 Sept 11 (Sep 2001) | -7.4% | -7.3% | -0.1% |
| 2011 US Debt Ceiling Act (May 2011 - Sep 2011) | -7.5% | -7.2% | -0.3% |
| 1998 Russian Financial Crisis (Jul 1998 - Oct 1998) | -7.8% | -7.5% | -0.3% |
| 1987 Market Crash (Aug 1987 to Nov 1987) | -9.4% | -9.2% | -0.2% |
| 2007 - 2008 Equity Slow Grind (Sep 2007 - Aug 2008) | -10.2% | -10.1% | -0.1% |
| 2000 - 2003 Tech Crash & Recession (Jan 2000 - Mar 2003) | -23.0% | -22.7% | -0.3% |
| 2008 - 2009 Global Financial Crisis (Sep 2008 - Mar 2009) | -27.9% | -27.7% | -0.2% |




*Source: BarraOne, CalPERS*

## LIQUIDITY

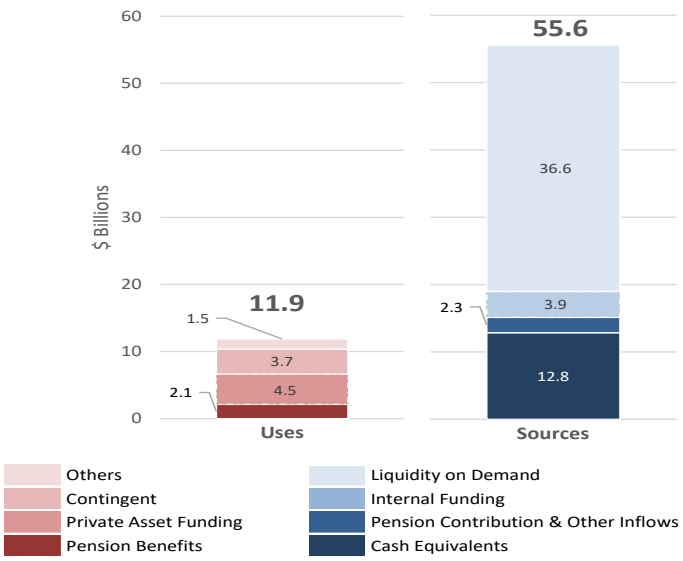
# Liquidity Analysis: Total Plan




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*

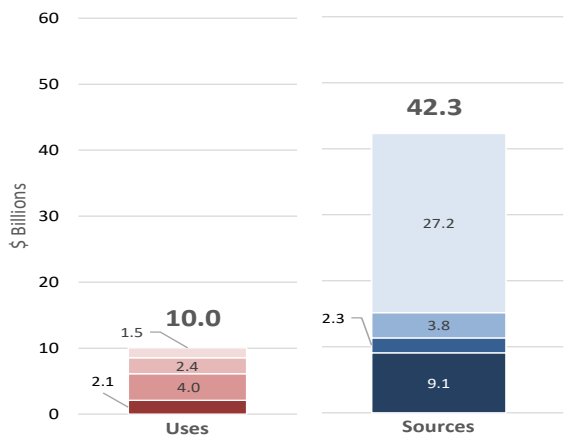
## Stress (Current Regime)[1]

**Tier 1 30 Day Liquidity Coverage Ratio = 4.7x**




## Historical Worst[2]

**Tier 1 30 Day Liquidity Coverage Ratio = 4.2x**




[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 stres scenario and for a historical worst experience. The Liquidity Coverage ratios could be interpreted as how many times available cash / cash equivalents 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: BarraOne, SSB, CalPERS*

**LEVERAGE**

# Total Fund Leverage Report

as of 12/31/19

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 | 143.8 | 3.3 | | | 3.9 | 143.2 | 36.3% | 35.0% | |
| Public Equity - Factor Weighted | 62.1 | 0.5 | | | 0.4 | 62.2 | 15.8% | 15.0% | |
| Private Equity | 26.1 | | 1.7[4] | | 0.0 | 27.8 | 7.1% | 8.0% | |
| Income - Long Spread | 58.4 | 0.0 | | | 0.5 | 57.9 | 14.7% | 15.0% | |
| Income - Long Treasury | 43.2 | 13.6 | 2.1 | | 1.9 | 57.0 | 14.4% | 10.0% | |
| Income - High Yield | 11.8 | | | | 0.0 | 11.8 | 3.0% | 3.0% | |
| Real Assets | 43.5 | | 0.0[5] | 19.8 | 0.7 | 62.7 | 15.9% | 16.6% | |
| Liquidity | 3.9 | | | | 3.9 | 0.0 | | | |
| Trust Level | 2.1 | | | | 0.1 | 1.9 | 0.5% | | |
| Securities Lending[6] | 0.0 | | 3.3 | | 3.3 | 0.0 | | | |
| **Total Fund** | **394.8** | **$17.4** | **$1.7** | **$19.8** | **$14.7** | **$424.5** | **107.5%** | **102.6%** | **4.9%** |

**Embedded Leverage in Asset Classes**

| | Implied Leverage[7] |
|---|---|
| Public Equity | 1.56 |
| Private Equity | 2.22 |
| Real Estate | 1.28 |

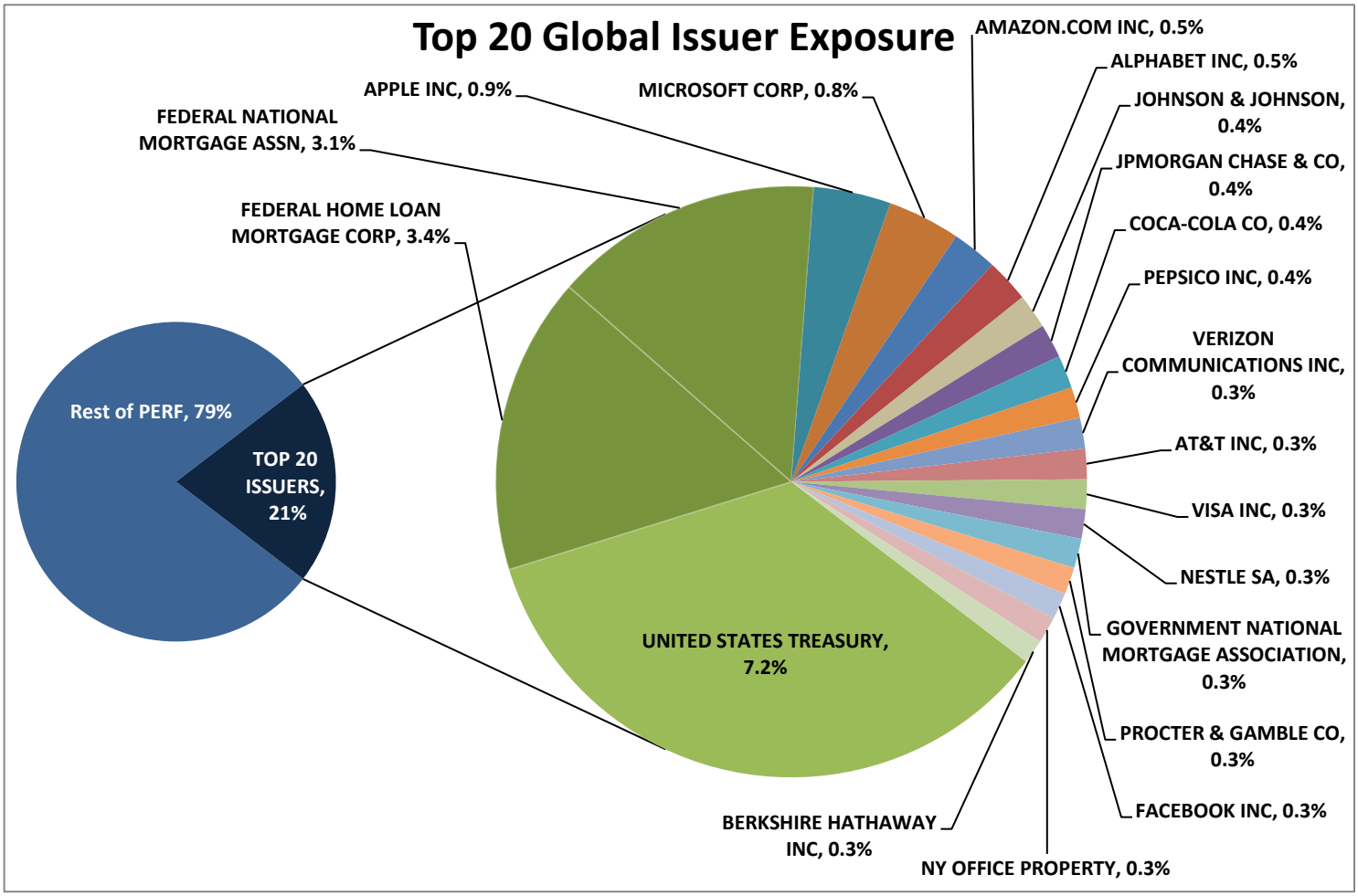
**Unfunded Commitments**

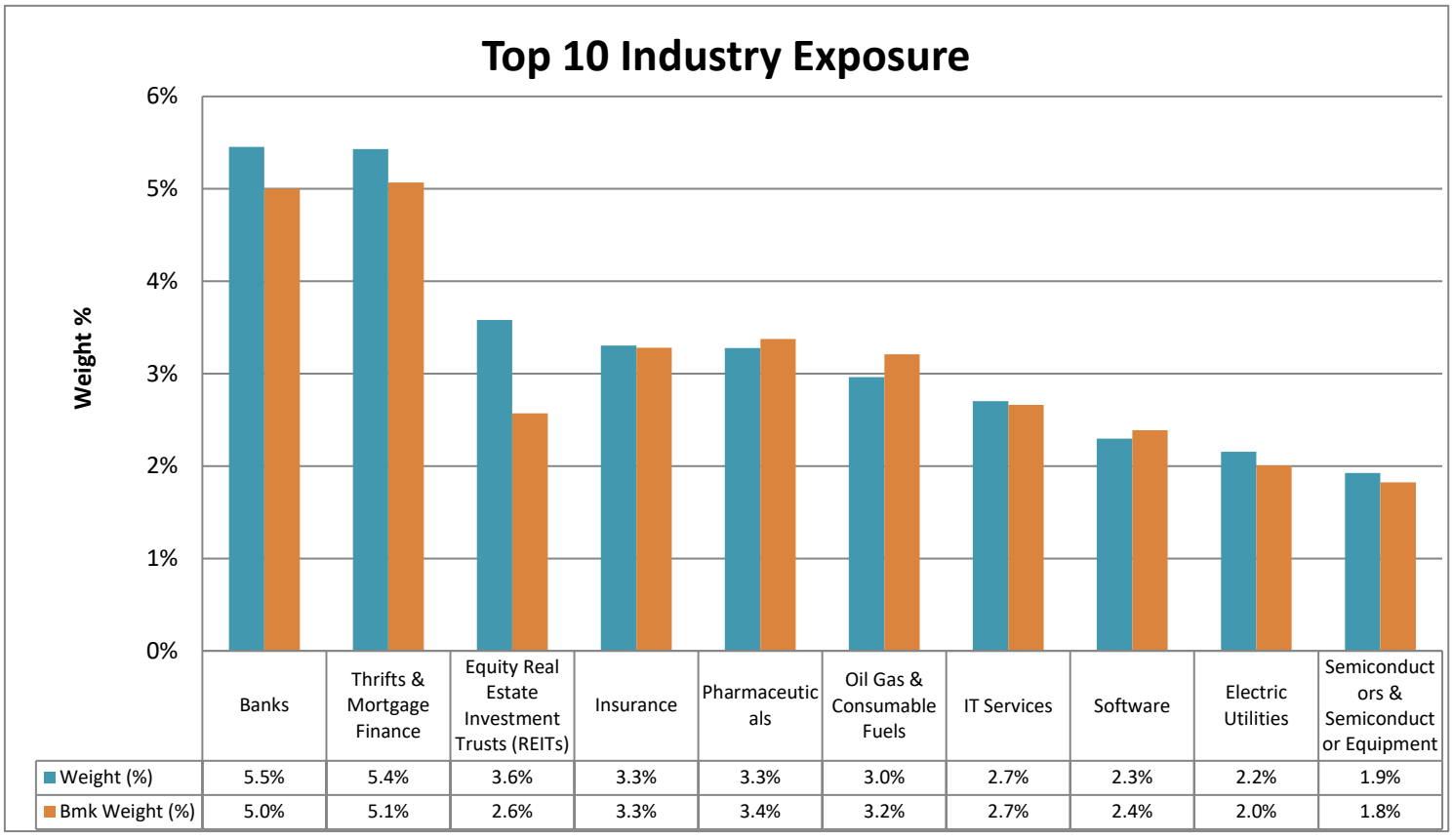
| | Net Market Value ($B) | Unfunded Commitments ($B)[8] | % of Total Fund |
|---|---|---|---|
| Private Equity | 26.1 | 18.6 | 4.7% |
| Real Assets | 43.5 | 10.8 | 2.7% |

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.
2. Cash is defined as assets meeting Liquidity program guidelines.
3. Asset class contribution to total plan leverage includes program-level leverage and the difference between actual and target SAA allocation adjusted for benchmark leverage.
4. Subscription financing and other liabilities at the fund level (as of 6/30/2019) are shown as recourse, while defined non-recourse for policy definition.
5. As of 9/30/19 there is no Recourse Debt in Real Estate. There has been no change from the last reported date of 3/31/19.
6. Securities lending includes only securities lent for cash collateral (which creates a source of financing).
7. Implied leverage is estimated from either asset class benchmark data or industry research. It represents the Enterprise Value to Equity ratio.
8. Unfunded commitments are as of 12/31/2019 for Private Equity and 9/30/2019 for Real Assets. 77% of Real Asset unfunded commitments are revocable at CalPERS' discretion.

*Source: BarraOne, SSB, Factset, CalPERS*

## CONCENTRATION REPORT

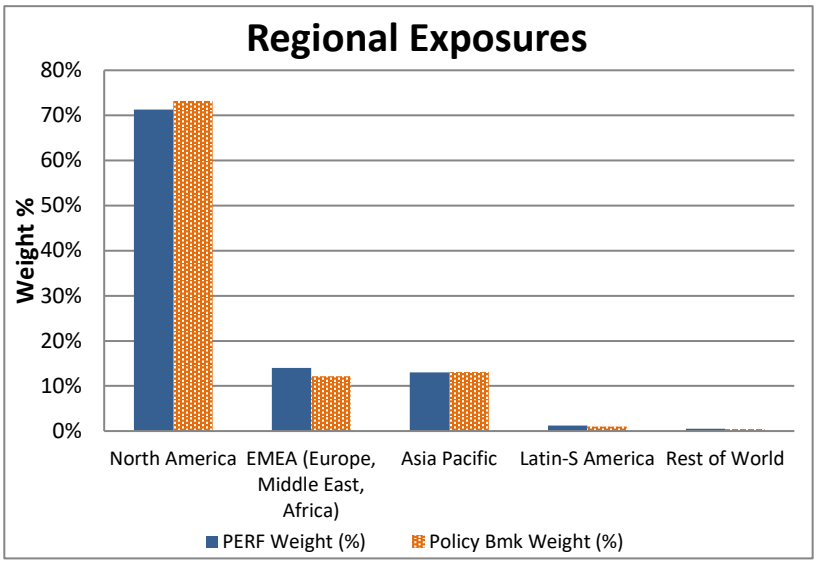


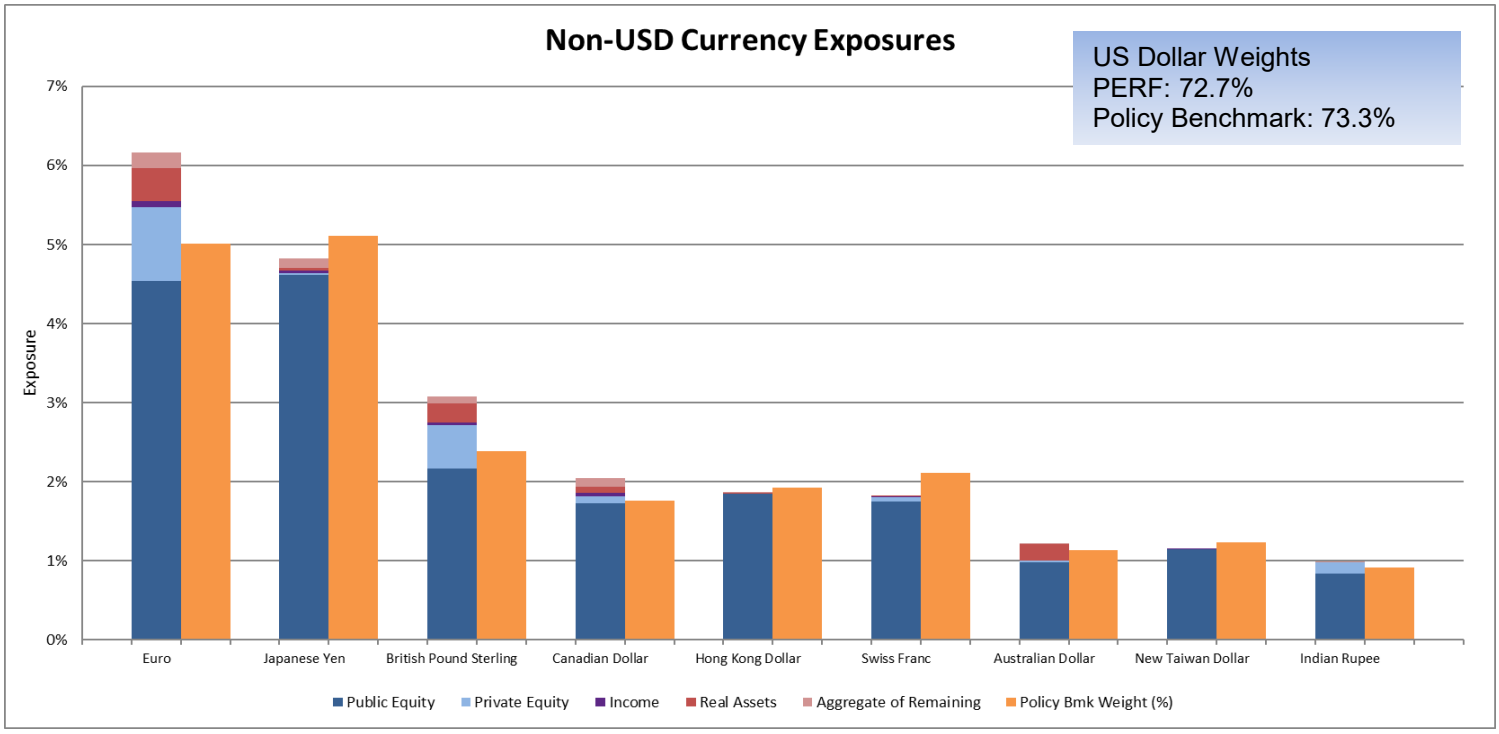

| | Banks | Thrifts & Mortgage Finance | Equity Real Estate Investment Trusts (REITs) | Insurance | Pharmaceuticals | Oil Gas & Consumable Fuels | IT Services | Software | Electric Utilities | Semiconductors & Semiconductor Equipment |
|---|---|---|---|---|---|---|---|---|---|---|
| Weight (%) | 5.5% | 5.4% | 3.6% | 3.3% | 3.3% | 3.0% | 2.7% | 2.3% | 2.2% | 1.9% |
| Bmk Weight (%) | 5.0% | 5.1% | 2.6% | 3.3% | 3.4% | 3.2% | 2.7% | 2.4% | 2.0% | 1.8% |

*Source: BarraOne, CalPERS*

## CONCENTRATION REPORT

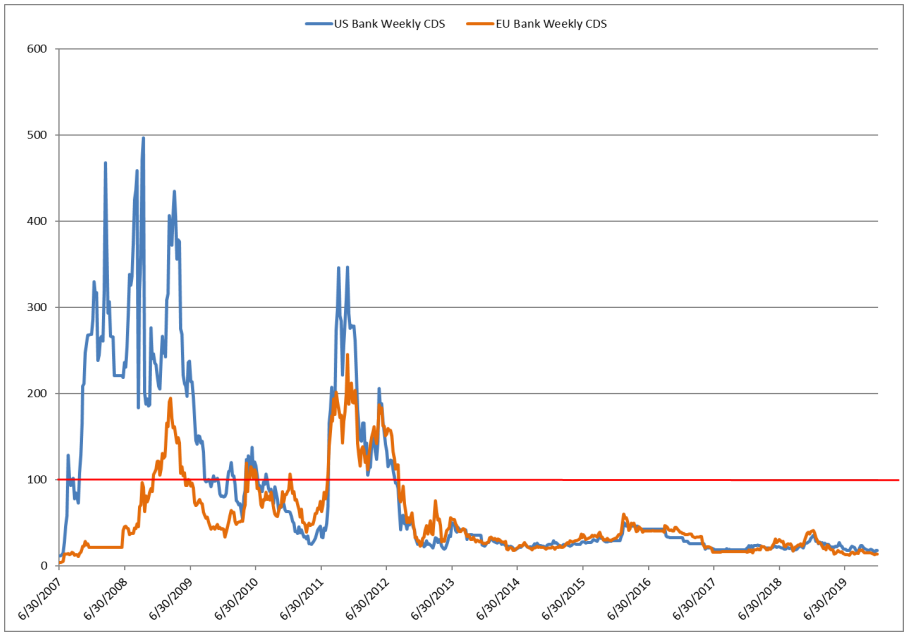



| Country | PERF Weight (%) | Policy Bmk Weight (%) | Active Weight (%) |
|---|---|---|---|
| United States | 68.7% | 71.0% | -2.3% |
| Japan | 4.9% | 5.2% | -0.3% |
| United Kingdom | 3.3% | 2.6% | 0.7% |
| Canada | 2.6% | 2.2% | 0.3% |
| China | 2.0% | 1.8% | 0.1% |
| Switzerland | 1.8% | 2.0% | -0.1% |
| France | 1.8% | 1.6% | 0.2% |
| Germany | 1.6% | 1.5% | 0.2% |
| Australia | 1.3% | 1.2% | 0.2% |
| Taiwan | 1.2% | 1.2% | -0.1% |




*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 ($)* | Net Credit Net Exposure ($) |
|---|---|---|---|---|---|---|---|---|
| Australia and New Zealand Banking | 19,214 | | | 19,214 | | 19,214 | | 19,214 |
| Bank of Montreal | 31,507 | | | 31,507 | | 31,507 | | 31,507 |
| Bank of America | 2,526,463 | | 5,797,420 | 9,160,433 | (836,550) | 8,323,883 | (8,329,604) | (5,721) |
| BNP Paribas | (3,641,154) | | | 2,585,864 | (6,227,018) | (3,641,154) | 3,700,000 | 58,846 |
| Barclays | (595,117) | | | 1,009,025 | (1,604,142) | (595,117) | 600,000 | 4,883 |
| CommonWealth Bank of Australia | 328,334 | | | 328,334 | | 328,334 | (350,000) | (21,666) |
| Citigroup | (22,610,561) | | | 5,799,874 | (28,410,435) | (22,610,561) | 22,620,000 | 9,439 |
| Canadian Imperial Bank of Commerce | 199,509 | | | 199,509 | | 199,509 | (130,000) | 69,509 |
| Credit Suisse International | 36,499 | | 396,720 | 447,956 | (14,737) | 433,219 | (450,000) | (16,781) |
| Deutsche Bank | 3,264,744 | | | 3,264,744 | | 3,264,744 | (3,270,000) | (5,256) |
| Goldman Sachs Intl. | 50,641,443 | | | 117,326,497 | (66,685,054) | 50,641,443 | (50,671,000) | (29,557) |
| HSBC | 10,216,223 | | 24,844,915 | 41,431,764 | (6,370,626) | 35,061,138 | (35,100,000) | (38,862) |
| Morgan Stanley Capital Service | (890,787) | | 1,507,017 | 16,738,228 | (16,121,998) | 616,230 | (650,000) | (33,770) |
| RBC Capital Markets | (171,934) | | | 375,897 | (547,831) | (171,934) | 180,000 | 8,066 |
| Standard Chartered Bank | 19,426,289 | | | 19,426,289 | | 19,426,289 | (19,428,903) | (2,614) |
| Societe Generale | 4,226,100 | | 205,039 | 6,914,615 | (2,483,476) | 4,431,139 | (4,440,000) | (8,861) |
| State Street | 1,952,037 | | | 2,007,478 | (55,441) | 1,952,037 | (1,959,170) | (7,133) |
| Toronto Dominion | (186,112) | | | | (186,112) | (186,112) | 190,000 | 3,888 |
| UBS AGG | (1,830,199) | | 6,217,511 | 6,217,699 | (1,830,387) | 4,387,312 | (4,400,000) | (12,688) |
| WestPac Bank | 545,761 | | | 545,761 | | 545,761 | (650,000) | (104,239) |
| Grand Total | 63,488,259 | | 38,968,622 | 233,830,688 | (131,373,807) | 102,456,881 | (102,538,677) | (81,796) |

**As of 12/31 Counterparties posted 130mm to CalPERS which includes Internal Collateral*

*#Internal Threshold Limit*

**Above:** Total market value exposure and net credit exposures are monitored for all of our OTC (over-the-counter) positions.
*Source: Blackrock, CalPERS*
**Below:** FCM (Futures Commission Merchant) exposures are monitored for how much margin we have posted with our FCM. *Source: CalPERS*

| FUTURES COMMISSION MERCHANT EXPOSURE | |
|---|---|
| **Futures Commission Merchant** | **Collateral Posted*** |
| CITIGROUP GLOBAL MARKETS INC | 341,774,464 |
| MERRILL LYNCH PIERCE FENNER & SMITH INCORPORATED | 25,196,758 |

**As of December 31, 2019*

## Appendix

### 1. How to interpret the OTC Counterparty Risk Exposure section