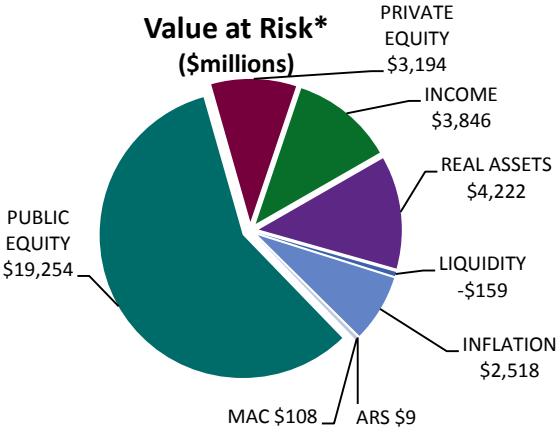
CalPERS Trust Level Review
Risk Management Summary

Period Ending May 31, 2017

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 5/31/2017	Last Qtr 3/31/2017	Last Year 5/31/2016
Total	n/a	8.3	8.6	10.4
Benchmark	n/a	7.9	8.2	10.2
Tracking Error	< 1.5%	0.5	0.6	0.8
Allocation	< .75%	0.1	0.1	0.0
Selection	n/a	0.5	0.5	0.7



Comments:

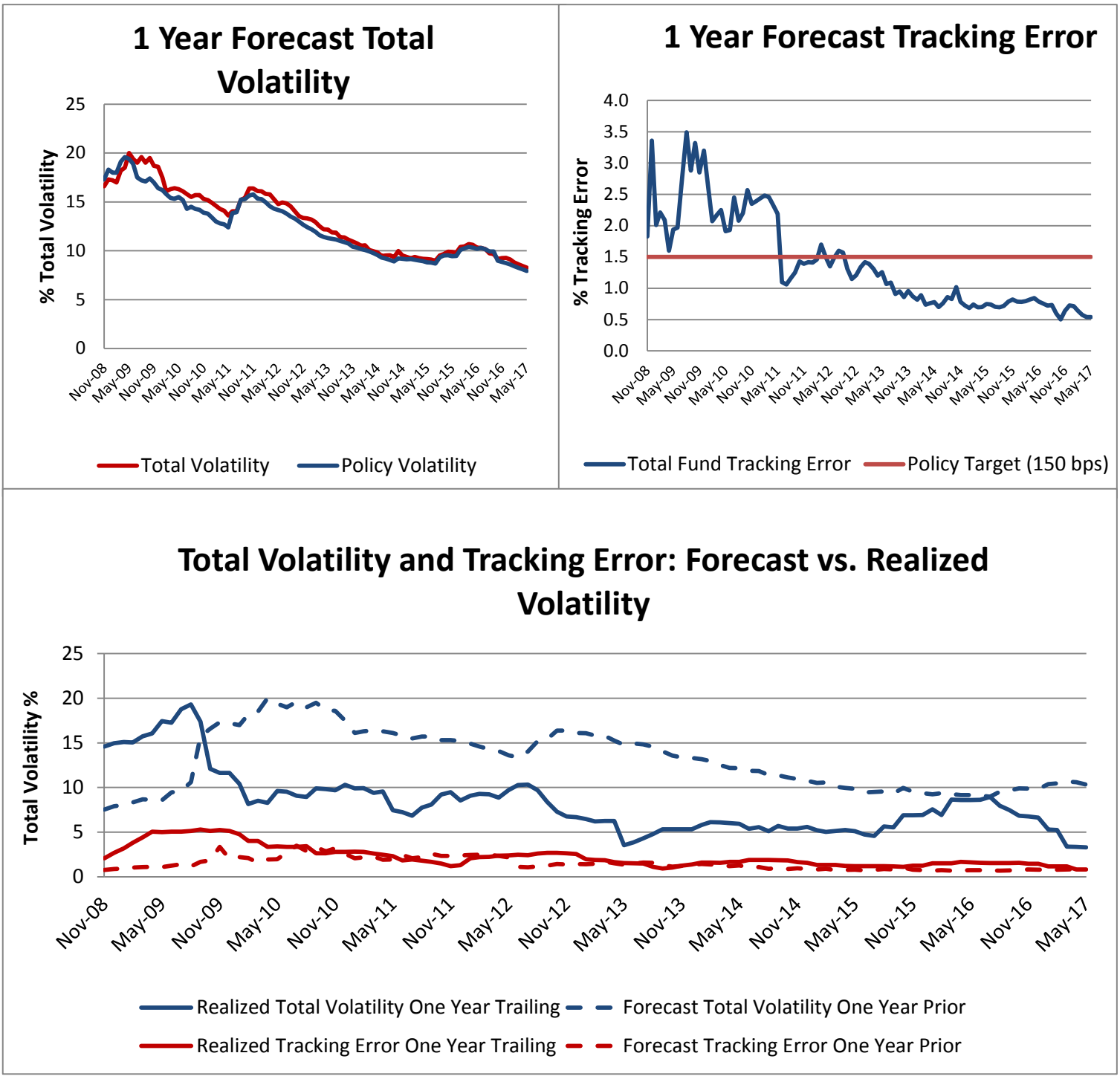
Forecast Total Volatility of the PERF decreased by 213 bps over the last year. Approximately 75% of the decrease is due to recent low market volatility and about 25% of the decrease is due to positioning changes.

Asset Class	Market Value ($millions)	Total Forecast Volatility (%)	% Contribution to Total Vol	Tracking Error (%)	Value at Risk* ($millions)	Conditional VaR* ($millions)
PUBLIC EQUITY	$ 155,093	12.3%	69.1%	0.2%	$ 19,254	$ 27,204
PRIVATE EQUITY	$ 26,180	14.8%	12.7%	3.7%	$ 3,194	$ 4,811
INCOME	$ 59,613	6.0%	1.9%	0.3%	$ 3,846	$ 5,340
REAL ASSETS	$ 35,815	11.2%	11.7%	2.5%	$ 4,222	$ 5,921
LIQUIDITY	$ 15,111	0.1%	0.0%	0.1%	$ (159)	$ (155)
INFLATION	$ 25,571	7.8%	4.1%	0.8%	$ 2,518	$ 3,354
ARS	$ 288	5.9%	0.0%	5.9%	$ 9	$ 17
MAC	$ 1,278	9.0%	0.4%	9.0%	$ 108	$ 156
TOTAL FUND	**$ 322,202**	**8.3%**	**100.0%**	**0.5%**	**$ 23,143**	**$ 34,306**

*1-year, 95% confidence Value at Risk. Conditional Value at Risk measures the mean of the tail distribution beyond the 95% confidence level. Both are adjusted to account for 1 year of expected returns of each asset class and the PERF using Wilshire June 2016 expected return assumptions.

Due to reporting constraints, all risk statistics are as of May 31, 2017 unless otherwise stated.

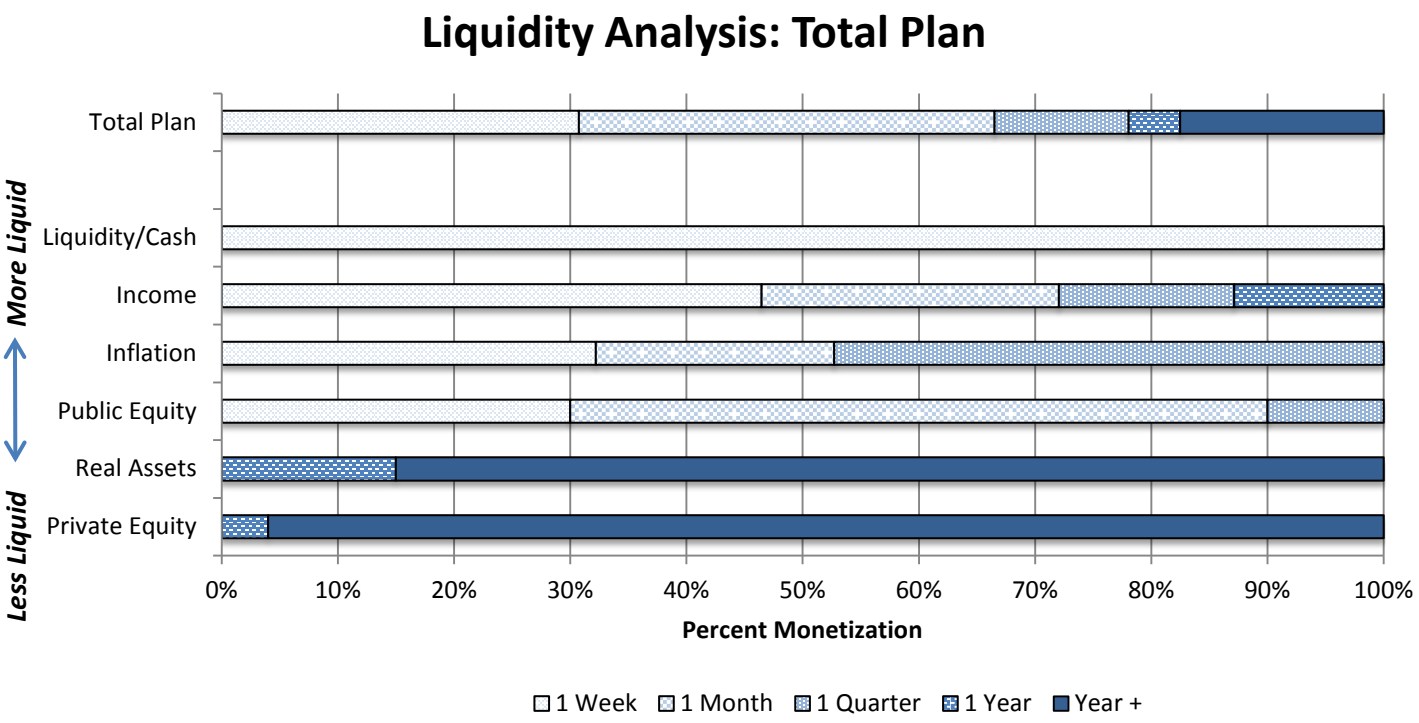
Source: BarraOne / CalPERS



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 shows the lagged nature of long term risk models that incorporate a larger backward estimation window which you can see from the realized volatility leading the forecast from the model and highlights the importance of looking at changes in realized volatility that may indicate a deviation from capital markets assumptions.

Source: BarraOne, SSB, CalPERS

LIQUIDITY

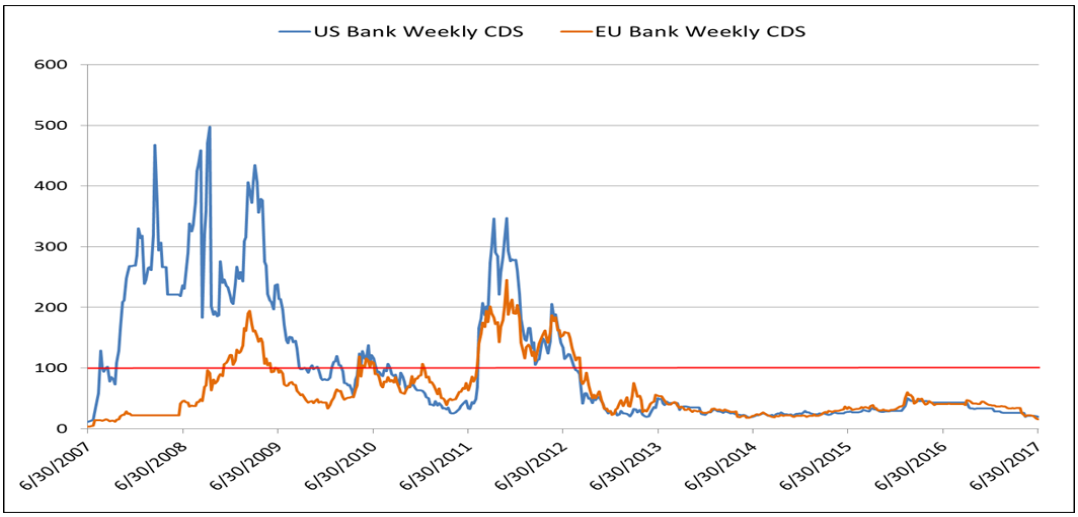


Transactional liquidity is estimated for each asset class /strategy based on the current market environment while also accounting for legal structures or other factors that may impact liquidity. *Source: SSB, CalPERS*

	PERF LIQUIDITY SNAPSHOT As of July 1, 2017			
		Expected Cash Flows for 1 Month		
		Normal Conditions	Stress Scenario	
a	Cash Equivalents in Liquidity Portfolio (< 30 days)*	$9,294,625,244	$9,285,116,332	
b	Sources Total (cash flow in)	$3,290,124,224	$2,774,541,764	
c	Uses Total (cash flow out)	($2,649,106,298)	($2,649,106,298)	
d	Contingency Use**		($3,286,417,553)	
	Expected Cash Equivalents (Period End)	$9,935,643,170	$6,124,134,245	
	Liquidity Coverage Ratio	475%	203%	= (a+b)/-(c+d)
	* Excludes borrowed liquidity i.e. cash available in asset classes and cash collateral from sec lending ** Contingency Use accounts for potential cash demands from derivatives positions, sec lending, and fund level contingent liabilities			

Liquidity Coverage is computed from estimates of future cash inflows and outflows up to a 1 year horizon. In this table, the 1 month forward period is shown with Liquidity Coverage ratios for a normal environment and for a selected stress period (Sept 2008). The Liquidity Coverage ratios could be interpreted as how many times (4.75 times in normal market conditions) available liquid cash /cash equivalents could cover projected cash needs over a 1 month forward period. *Source: BarraOne, SSB, CalPERS*

COUNTERPARTY RISK



CDS spreads 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	226,922				226,922	226,922	(230,000)	(3,078)
Bank of Montreal	(1,866,504)			(1,866,528)	24	(1,866,504)	1,900,000	33,496
Bank of America	(18,181,349)	(190,206)	17,127,052	(22,134,587)	20,890,084	(1,244,503)	1,250,000	5,497
BNP Paribas	1,302,097		13,124,848	(5,812,780)	20,239,725	14,426,945	(14,450,000)	(23,055)
Barclays	(1,018,597)			(1,957,199)	938,602	(1,018,597)	1,100,000	81,403
Citigroup	(4,088,477)		438,618	(5,852,674)	2,202,815	(3,649,859)	3,650,000	141
Canadian Imperial Bank of Commerce	(2,254)		2,069,340	(2,254)	2,069,340	2,067,086	(2,070,000)	(2,914)
Credit Suisse International	(56,323)		(12,698)	(100,617)	31,596	(69,021)	0	(69,021)
Deutsche Bank	(5,270,802)			(7,967,737)	2,696,935	(5,270,802)	5,280,000	9,198
Goldman Sachs Intl.	311,469	1,521,373	29,066,996	(105,707,385)	136,607,223	30,899,838	(30,900,000)	(162)
HSBC	(2,362,093)		(5,426)	(21,418,244)	19,050,725	(2,367,519)	2,400,000	32,481
JPMorgan Chase Bank	(23,529,685)	(10,450,600)	15,697,912	(41,158,360)	22,875,987	(18,282,373)	18,290,000	7,627
Morgan Stanley Capital Group			2,169,798		2,169,798	2,169,798	(2,200,000)	(30,202)
Morgan Stanley Capital Service	74,636	(796,572)	(565,278)	(12,741,634)	11,454,420	(1,287,214)	1,300,000	12,786
RBC Capital Markets	(1,272,959)			(1,272,959)		(1,272,959)	1,280,000	7,041
Standard Chartered Bank	(10,994,026)			(11,111,852)	117,826	(10,994,026)	11,000,000	5,974
Societe Generale	(21,590,125)	271,531	3,347,812	(30,070,375)	12,099,593	(17,970,782)	17,980,000	9,218
State Street	468,841			(142,129)	610,970	468,841	(440,000)	28,841
Toronto Dominion	(18,133,456)			(18,683,436)	549,980	(18,133,456)	18,140,000	6,544
UBS AGG	(8,021,006)	111		(8,835,616)	814,721	(8,020,895)	8,050,000	29,105
Wells Fargo			11,140,251		11,140,251	11,140,251	(11,150,000)	(9,749)
Grand Total	(114,003,691)	(9,644,363)	93,599,225	(296,836,366)	266,787,537	(30,048,829)	30,180,000	131,171

**As of 6/30 Counterparties posted 61mm to Counterparties which includes Internal and External Collateral*

Above: Total market value exposure and net credit exposures are monitored for all of our OTC (over-the-counter) positions. The green check box in the OTC exposure table indicates that the total market value exposure is within our procedural tolerances.
Source: Blackrock, CalPERS

Below: FCM (Futures Commission Merchant) exposures are monitored for how much initial margin we have posted with our FCM in addition to reviewing key metrics that provide some insight on the FCM's risk profile such as Excess Net Capital (amount of additional capital the FCM has to support the business) and customer assets. Large changes in these metrics could be an indicator of potential credit or operational issues with the FCM and would trigger an internal review. *Source: CalPERS, CFTC*

FUTURES CLEARING MERCHANT EXPOSURE

Futures Commission Merchant	Collateral Posted	Procedure Check	Excess Net Capital	Procedure Check	Customers' Assets	Procedure Check
CITIGROUP GLOBAL MARKETS INC	269,673,620	✓	8,087,250,523	✓	8,282,621,651	✓
MERRILL LYNCH PIERCE FENNER & SMITH INCORPORATED	80,136,723	✓	10,759,033,596	✓	14,256,144,706	✓

**As of May 31, 2017*

Total Fund Leverage Report

as of 06/30/17

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:

"L1" captures exposures with full recourse to the total plan, and is most relevant from an immediate liquidity perspective. "L2" includes non-recourse borrowing, which can amplify risk and returns for a given $ invested.

Company Embedded Leverage:

Some Fund assets embed leverage by their nature (i.e., private and public companies). In this case, leverage is not a result of 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

		L1: Portfolio Leverage - Full Recourse						*L2: Portfolio Leverage w/Non-Recourse*		
Asset Class/ Program	**Net Market Value ($Billions) (A)**	**+ Sources of Leverage[1]**			**Cash[2]**	**Gross Risk Exposure (B)**	**Portfolio Leverage (B/A)**	**Additional + Sources of Leverage[1]**	**Gross Risk Exposure (C)**	**Portfolio Leverage (C/A)**
		Derivatives	**Recourse Debt[3]**	**Other**				**Non Recourse Debt**		
Public Equity	156.2	11.3			6.7	160.7	1.03		160.7	1.03
Private Equity	25.9				0.0	25.9	1.00	1.7	27.6	1.07
Income	62.9	6.5			4.5	64.8	1.03		64.8	1.03
Liquidity	15.5				15.5	0.0	0.00		0.0	0.00
Real Assets	36.3		0.005		0.0	36.3	1.00	17.6	53.9	1.49[4]
Inflation	25.3	7.3			6.5	26.1	1.03		26.1	1.03
Securities Lending[5]	0.0			4.4	4.4	0.0	N/M		0.0	N/M
Credit Enhancement	0.0			0.3		0.3	N/M		0.3	N/M
Other Trust Level[6]	1.6					1.6	1.00		1.6	N/M
Total Fund	$323.5	$25.1	$0.0	$4.7	$37.6	$315.7	**0.98**	$19.3	$335.0	**1.04**

Company Embedded Leverage

	Net Market Value ($B)	Estimated Enterprise Value ($B)	Implied Leverage
Public Equity[7]	156.2	213.9	1.37
Private Equity[8]	25.9	43.7	1.69

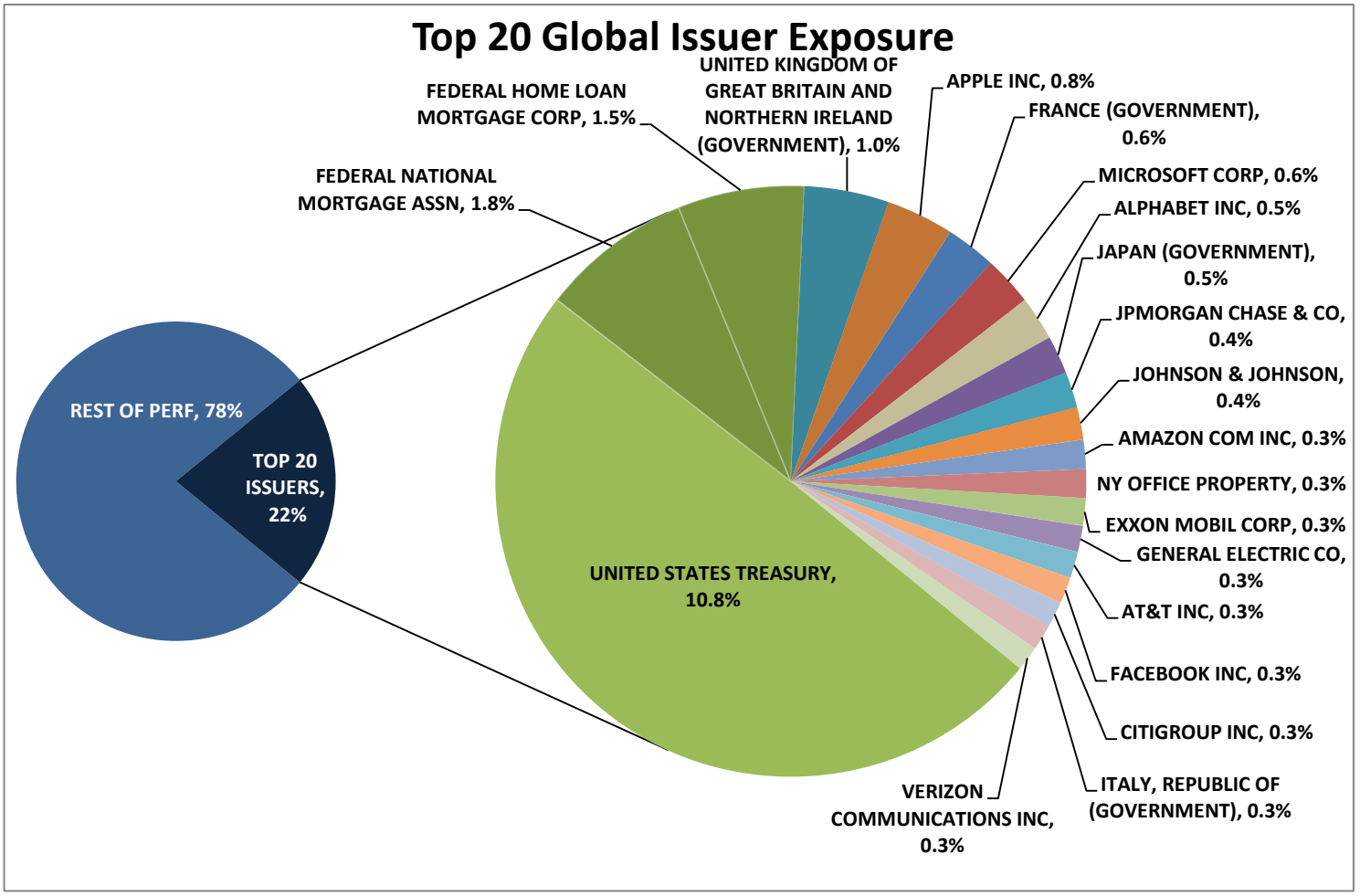
Unfunded Commitments

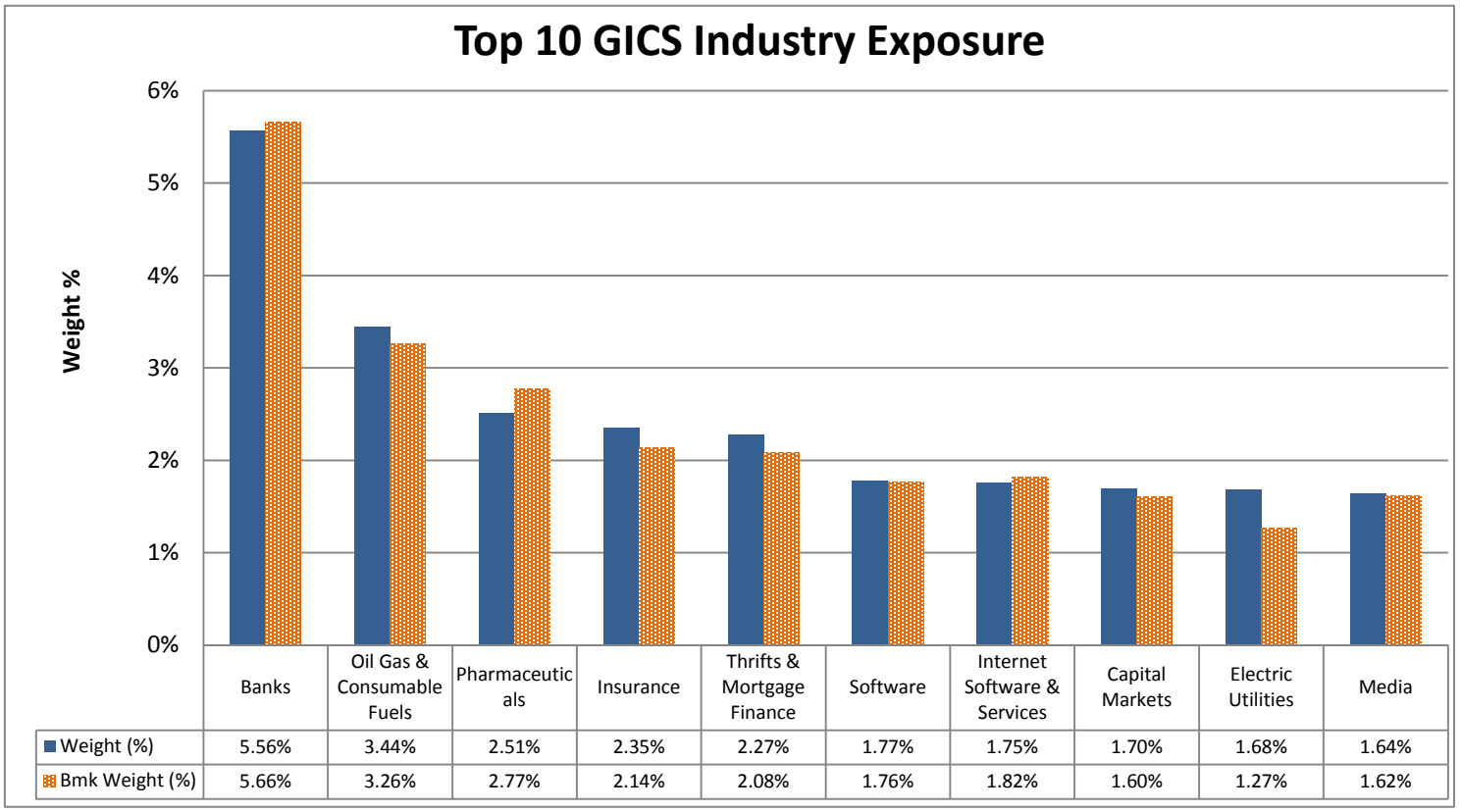
	Net Market Value ($B)	Unfunded Commitments ($B)[9]	% of Total Fund
Private Equity	25.9	14.2	4.4%
Real Assets	36.3	9.1	2.8%

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, and include cash holdings in the Fund except frictional balances with external managers.
3. Recourse Debt in Real Estate has not changed from the prior period.
4. Policy leverage for Real Assets is measured as a Loan-to-Value ratio and will differ from figure shown in table. LTV leverage as of 3/31/17 for Real Estate, Infrastructure and Forestland are: 31%, 46%, and 22%, respectively.
5. Securities lending includes only securities lent for cash collateral (which creates a source of financing).
6. Other Trust Level includes: Absolute Return Strategies, Multi-Asset Class Composite, Transition, and Plan Level Portfolios.
7. Embedded leverage for Public Equity is estimated using the Enteprise Value/Capital ratio for Public Equity. Source: Factset.
8. Embedded leverage for Private Equity represents debt exposure at the portfolio company level, and is estimated using the Enteprise Value/Equity ratio as of 12/31/15. Source: Private Equity program.
9. Unfunded commitments are as of 12/31/16.

Source: BarraOne, SSB, Factset, CalPERS

CONCENTRATION REPORT

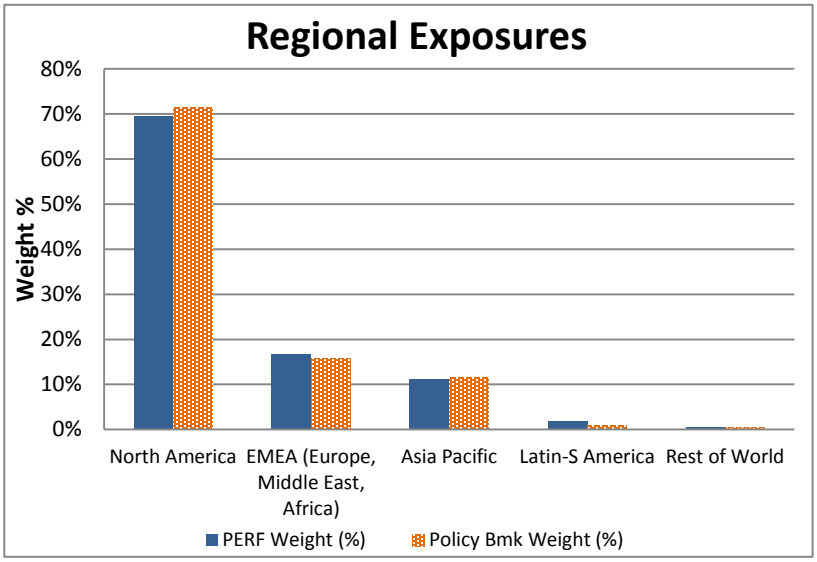




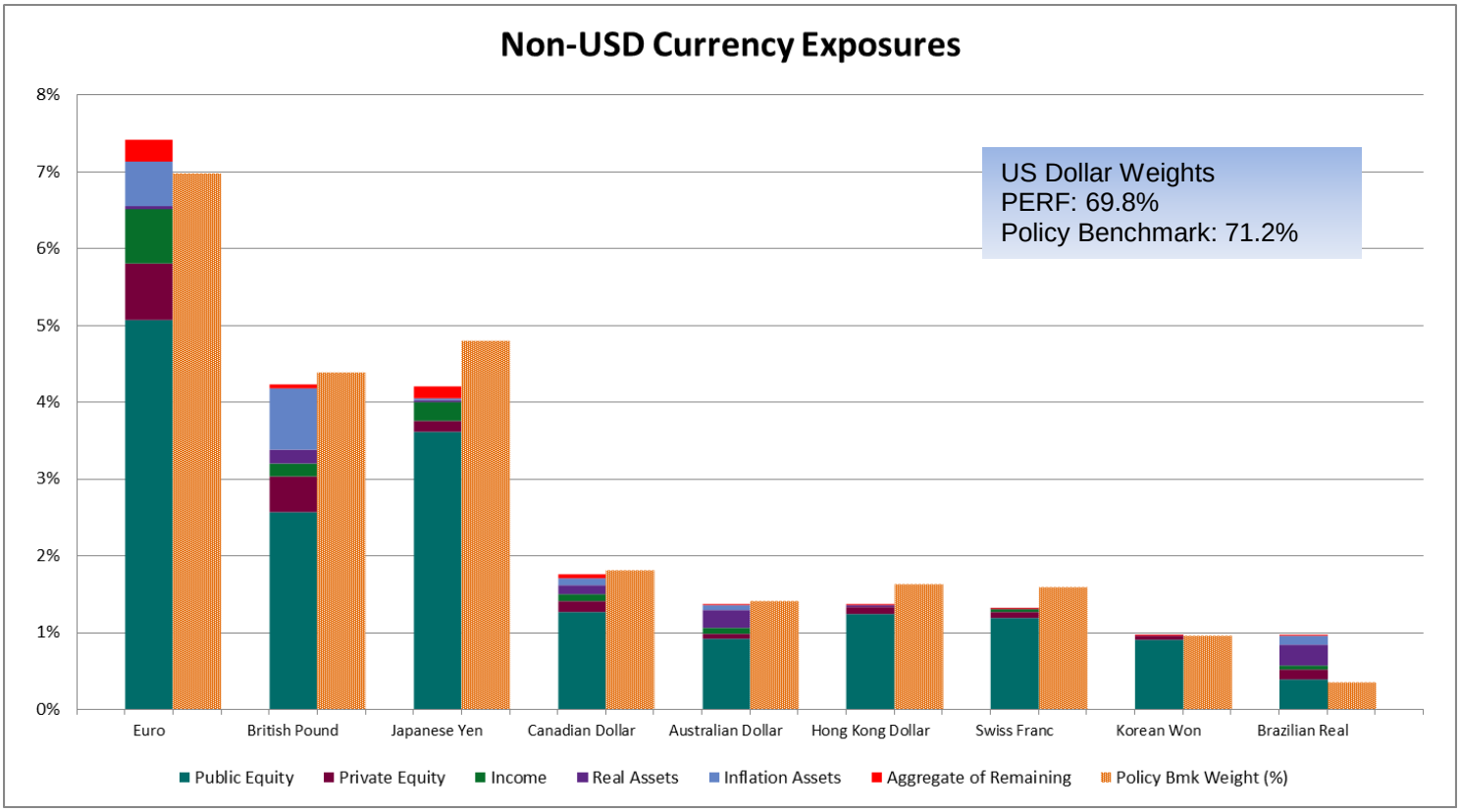
	Banks	Oil Gas & Consumable Fuels	Pharmaceuticals	Insurance	Thrifts & Mortgage Finance	Software	Internet Software & Services	Capital Markets	Electric Utilities	Media
Weight (%)	5.56%	3.44%	2.51%	2.35%	2.27%	1.77%	1.75%	1.70%	1.68%	1.64%
Bmk Weight (%)	5.66%	3.26%	2.77%	2.14%	2.08%	1.76%	1.82%	1.60%	1.27%	1.62%

Source: BarraOne, CalPERS

CONCENTRATION REPORT



Country	PERF Weight (%)	Policy Bmk Weight (%)	Active Weight (%)
United States	67.60%	69.34%	-1.75%
United Kingdom	4.32%	4.53%	-0.21%
Japan	4.23%	4.86%	-0.63%
France	2.28%	2.24%	0.05%
Canada	1.98%	2.07%	-0.08%
Germany	1.86%	2.05%	-0.19%
Australia	1.43%	1.43%	0.01%
Switzerland	1.34%	1.61%	-0.27%
China	0.99%	1.14%	-0.15%
Brazil	0.99%	0.37%	0.62%



Source: BarraOne, CalPERS

HISTORICAL SCENARIOS

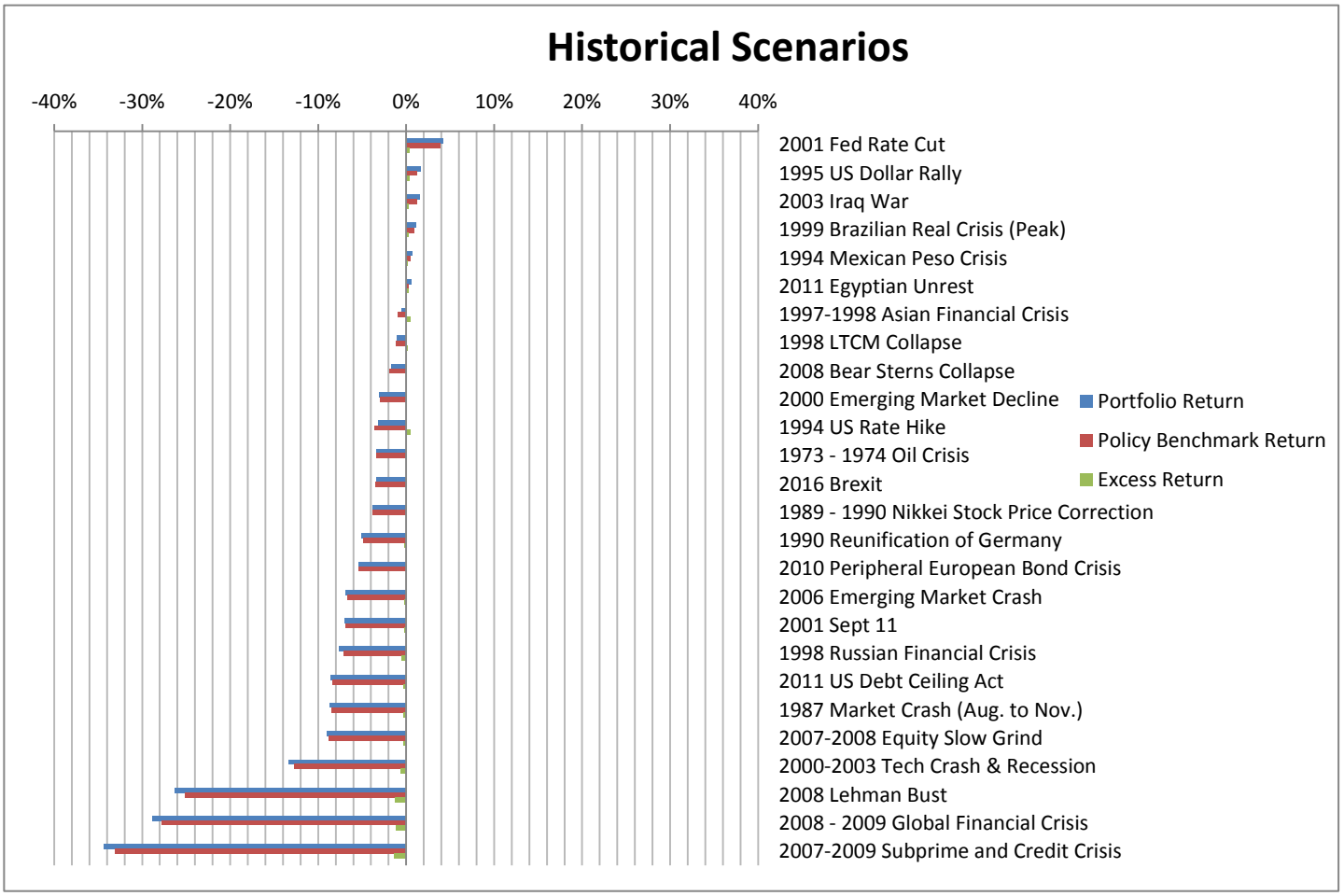
Historical scenarios highlight the sensitivity of the portfolio to past economic regimes or specific events. The scenarios can be used as a "what if" gauge of current portfolio positioning to understand the potential impact if a similar event or regime were to repeat.

Best and Worst Scenarios - Excess Return

Scenario	Portfolio Return	Policy Benchmark Return	Excess Return
1994 US Rate Hike	-3.1%	-3.6%	0.4%
1997-1998 Asian Financial Crisis	-0.5%	-0.9%	0.4%
1995 US Dollar Rally	1.6%	1.2%	0.4%
2008 - 2009 Global Financial Crisis	-28.9%	-27.7%	-1.1%
2008 Lehman Bust	-26.3%	-25.1%	-1.2%
2007-2009 Subprime and Credit Crisis	-34.4%	-33.0%	-1.4%

Best and Worst Scenarios - Portfolio Return

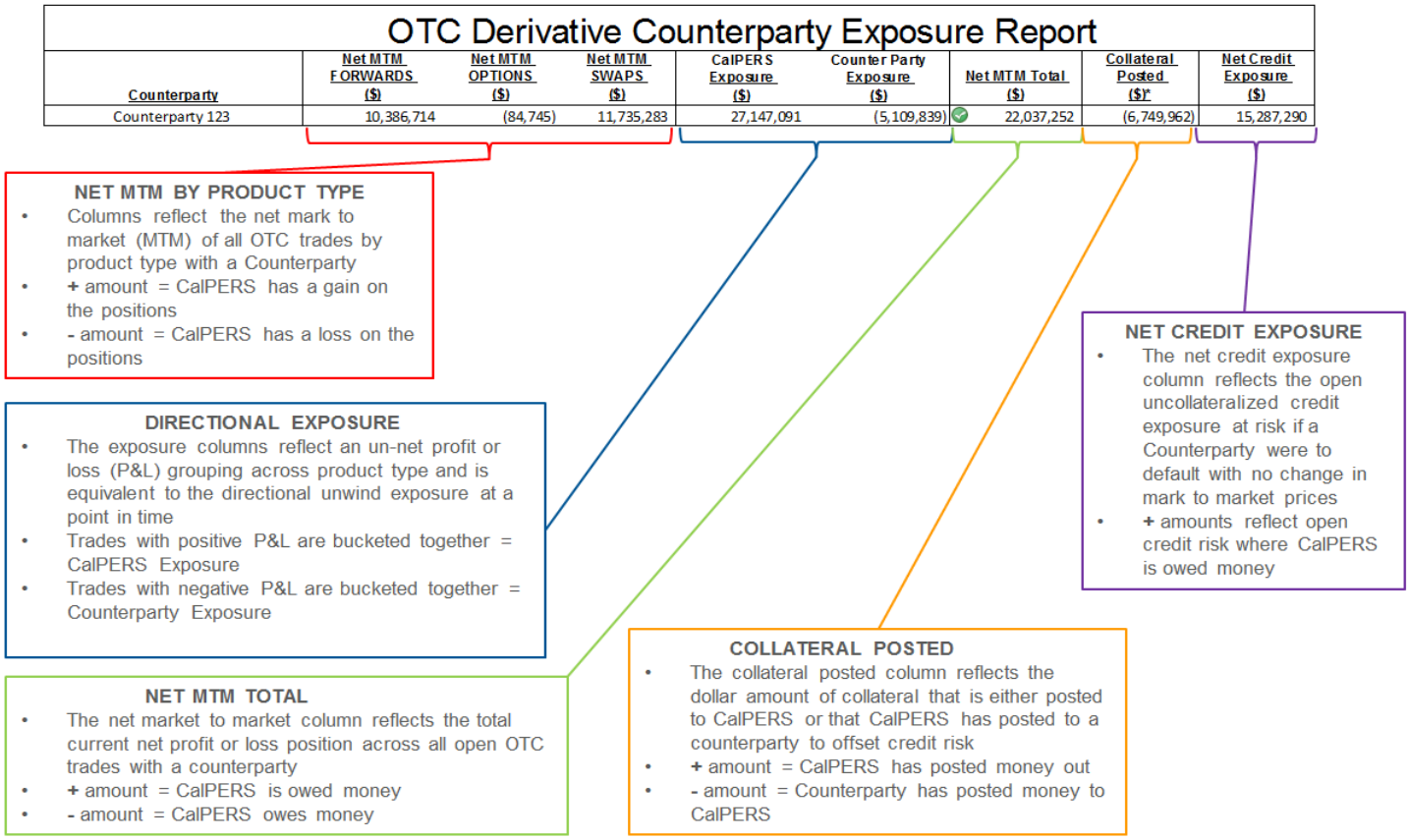
Scenario	Portfolio Return	Policy Benchmark Return	Excess Return
2001 Fed Rate Cut	4.2%	3.8%	0.4%
1995 US Dollar Rally	1.6%	1.2%	0.4%
2003 Iraq War	1.5%	1.2%	0.3%
2008 Lehman Bust	-26.3%	-25.1%	-1.2%
2008 - 2009 Global Financial Crisis	-28.9%	-27.7%	-1.1%
2007-2009 Subprime and Credit Crisis	-34.4%	-33.0%	-1.4%



Source: BarraOne, CalPERS

Appendix

1. How to interpret the OTC Counterparty Risk Exposure section



*Net mark to market (MTM): positions are adjusted to reflect current market values and then summed