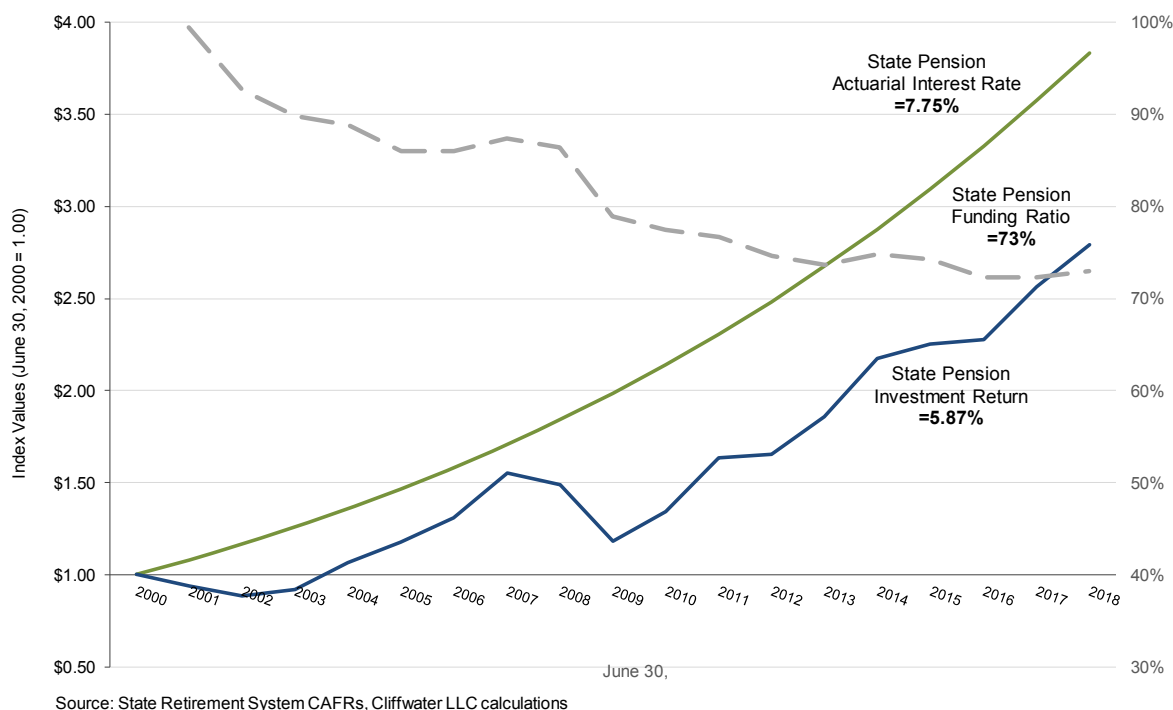


An Examination of State Pension Performance, 2000 to 2018

March 2019

This annual study tracks the financial condition of state pension plans over time. Its purpose is to provide feedback that potentially better informs investment policy. Of course, each state pension has its own set of unique circumstances but understanding the experiences and actions of state pensions collectively should prove valuable to decision makers in executing their fiduciary responsibility.

Exhibit 1: Pension Performance, Actuarial Rates, and Funding Ratios
18 Fiscal Years ending June 30, 2018



The three lines in Exhibit 1 capture the progression of state pensions for the June 30 fiscal years from 2000 to 2018.¹ The 2000 start date was selected because (1) state pensions were largely fully funded then, a byproduct of a long and strong bull market of the prior decade and (2) the period includes two significant bear markets and two bull markets, a seemingly fair representation of full market cycles. Since that time, state pensions have collectively earned an asset-weighted annual return equal to 5.87%, badly trailing their 7.75% collective asset-weighted actuarial interest rate assumption. The almost two percentage point

¹ See Definitions and Methodologies for description of the data.

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performance shortfall contributed greatly to a decline in pension funding ratios (assets divided by liabilities) from close to unity in 2000 to 73% (0.73) in 2018. The ratio of cumulative state pension investment return (\$2.79) to cumulative actuarial interest return (\$3.87) equals 0.72, roughly equal to the 0.73 collective funded ratio provided in fiscal 2018 state pension financial reports. While other events undoubtedly have impacted pension funding, among them the failure of some states to make required contributions², outdated mortality tables, and unfunded benefit improvements, the failure of actuaries to properly assess long term asset return is clearly the primary factor in pension underfunding today.

Consultant 10-year return forecasts for diversified institutional pension portfolios average 5.95%³, which is slightly above the 5.87% actual state pension return over the past 18 years and well below the current (fiscal 2018) 7.23% asset-weighted actuarial interest rate assumption. Achieving the 7.23% collective asset-weighted actuarial rate will be a challenge and a more likely outcome will be continued budgetary pressures as states find they must make up for shortfalls in asset performance through additional unscheduled pension contributions.

Study Design and Data

We draw our findings entirely from data and descriptive narrative provided in the Comprehensive Annual Financial Reports (“CAFRs”) published by state pension systems, unless otherwise noted. We select this data source because, unlike commonly used commercial universes, it is a closed group absent of selection biases, and represents results for large institutional investors.

Unfortunately, however, state pensions still are not consistent in their reporting of fees. Most of the performance measurement industry still reports returns before investment fees, and consequently some fraction of returns presented in this report is before fees. This is certainly true for public stock and bond asset classes, where approximately one-quarter of states report returns net-of-fees, one-quarter report gross-of-fees, and one-half make no mention of whether returns are net or gross. Our strong suspicion is that where the treatment of fees is not reported, returns are gross-of-fees.

An exception is alternative investments (private real assets, private real estate, private equity, and hedge funds) where returns are almost always reported net-of-fees. This is because either they are based on cash flows where fees are already netted, or in the case of hedge funds, performance is calculated on net asset value (“NAV”) from the fund administrator where fees are always deducted.

Because of the industry’s inconsistency in the netting of fees, our results should be viewed as a mix of net and gross returns where traditional asset classes generally, but not always, will be reported gross-of-fees and alternative asset classes almost always will be reported net-of-fees.

The study covers 66 state pensions that use June 30 as their fiscal year end and report investment and other financial data as of that calendar date. Collectively, the 66 state pensions reported \$2.7 trillion in assets at June 30, 2018. In those cases where multiple in-state pensions are managed under one investment board with a single investment strategy, performance for those multiple in-state pensions is counted once and not duplicated. There are 11 state pensions excluded who use December 31 as their fiscal year end and another 5 state pensions that have fiscal year ends other than June 30 or December 31. While this report details findings only for the 66 fiscal June 30 state pensions, Cliffwater regularly conducts similar analyses on the other 16 state pensions with findings that are consistent with the study group.

The report references two types of averages. When citing industry-wide statistics such as found in Exhibit 1 the “asset-weighted” average is used, which weights individual state pension values by state pension assets. The largest state pension in the data set is Calpers, with a 11% asset weighting over the 18-year

² States contributed an average of 93% of their actuarial recommended contribution (ARC) over the 18-year period, though contribution rates made by some states were far lower, including Illinois, New Jersey and Pennsylvania.

³ “Survey of Capital Market Assumptions: 2018 Edition”, Horizon Actuarial Services, LLC.

time period. When citing statistics for individual asset classes an “average” value is sometimes presented which represents a simple average of individual state pension values.

18-Year Performance across State Pensions

Exhibit 2 plots 66 individual state pension cumulative returns together with the asset weighted investment and actuarial averages from Exhibit 1.

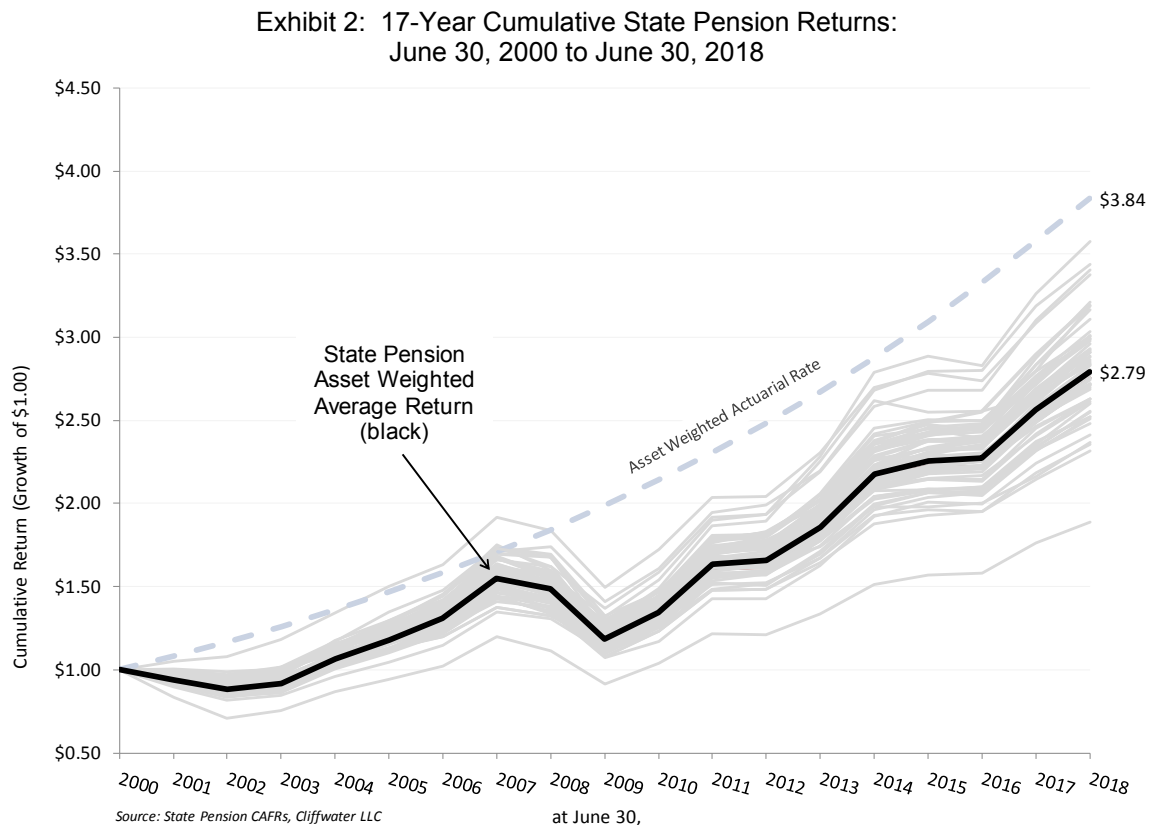


Exhibit 2 shows that none of the 66 individual state pensions exceeded the asset weighted actuarial rate of growth. Our study also finds that no state pension investment return exceeded its unique actuarial rate over the same period. The average asset/actuarial return deficit was -1.92%, annualized, and the smallest deficit was -0.42%.

Exhibit 2 also reflects a meaningful dispersion in individual state pension returns over the 18-year study period, which is captured also in Exhibit 3. Comparisons across state pensions is often discouraged. The argument is that each state pension has its own unique objectives and risk tolerance which is reflected in policy portfolios that are a byproduct of asset allocation studies. However, policy benchmarks measure only the implementation of policy and not the policy itself, which studies show have an outsized impact on return. This is also becoming important as asset allocation studies have migrated from standard models using standard asset classes to more complex risk-based models with non-standard asset classes. Comparing state pension performance may be a useful way to benchmark the asset allocation and governance processes used by state pensions.

Exhibit 3: State Pension Return Dispersion, Fiscal Years 2001 to 2018

	Return	Growth of \$1.00
Highest	7.34%	\$3.58
25th Percentile	6.24%	\$2.97
Median Return	5.88%	\$2.80
75th Percentile	5.65%	\$2.69
Lowest	3.60%	\$1.89

The 18-year returns for the 66 state pensions reflect the characteristics of a normal distribution. The difference between a first and third quartile return equals a modest 59 basis points (6.24% minus 5.65%) but that difference compounded over 18 years produces a 28-percentage point difference in cumulative return (197% minus 169%). There are 6 state pensions whose 18-year returns differ from the 5.88% asset weighted average return at a statistically significant level (t-statistic greater than 2.0 or less than -2.0). There are 3 states that outperform the group average at a level considered statistically significant and 3 states that underperformed at a statistically significant level. It is likely worth studying all 6 state pensions to understand both best practices and lessons learned.

Return and Risk

General stock and bond movements, measured by the MSCI ACWI and Bloomberg Barclays Aggregate Bond Indices, drive state pension performance for any individual fiscal year, as illustrated in Exhibit 4.

Exhibit 4: State Pension Return Distributions for Fiscal Years 2001 to 2018,
And 18-Year Annualized Returns

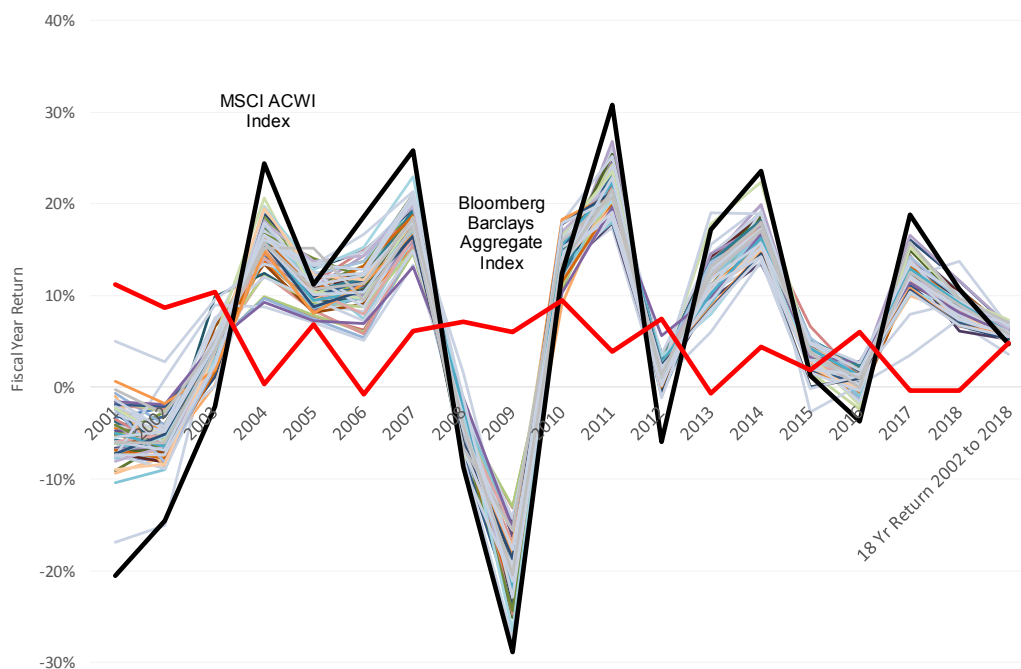


Exhibit 4 plots fiscal year-to-year returns for each of the 66 state pensions, ending with 18-year annualized return. Each line represents one state pension. Also shown are fiscal year returns for global stocks (MSCI ACWI Index) and U.S. bonds (Bloomberg Barclays Aggregate Bond Index).

Cumulative, annualized 18-year returns are plotted at the far right in Exhibit 4. The ups and downs of individual years are offset to achieve longer term returns more in line with expectations. Notice also that while state pension returns for individual years appear well bounded and largely explained by general stock

and bond returns. Over longer 10-year periods, differences in state pension returns are less impacted by differences in overall risk-taking.

Exhibit 4 illustrates the importance of stock price movements on individual fiscal year state pension returns and suggests that volatility in state pension assets is largely equity related. Our study finds a high but not unexpected 0.92 R-squared between individual state pension fiscal year returns and the MSCI ACWI Index. While global stock movements explain most of state pension asset volatility, the average state pension risk, measured by standard deviation of fiscal year returns, equals 10.59% over the 18-year study period versus 17.26% for the MSCI ACWI Index. The average state pension equity beta equals 0.59. Together, these risk measures demonstrate that state pension return and risk are driven by stock markets. Impressive also is the high correlation among individual state pension returns. The average state fund has a 0.97 R-squared with the asset weighted state pension composite return, with the lowest value equaling 0.88. Collectively, these statistics suggest that the future health of public pension systems is intertwined with the performance of the global stock markets.

10-Year and 18-Year State Pension Asset Class Performance

Exhibit 5 plots individual state pension returns and risk by major asset class. The returns cover the shorter 10-year period ending June 30, 2018 where a larger sample set of asset class returns is available compared to the 18-year sample set, particularly for private equity, real estate, and absolute return. Exhibit 6 provides statistics summarizing the asset class return data displayed in Exhibit 5.

Exhibit 5: State Pension Asset Class Return and Risk for 10 Years ending June 30, 2018

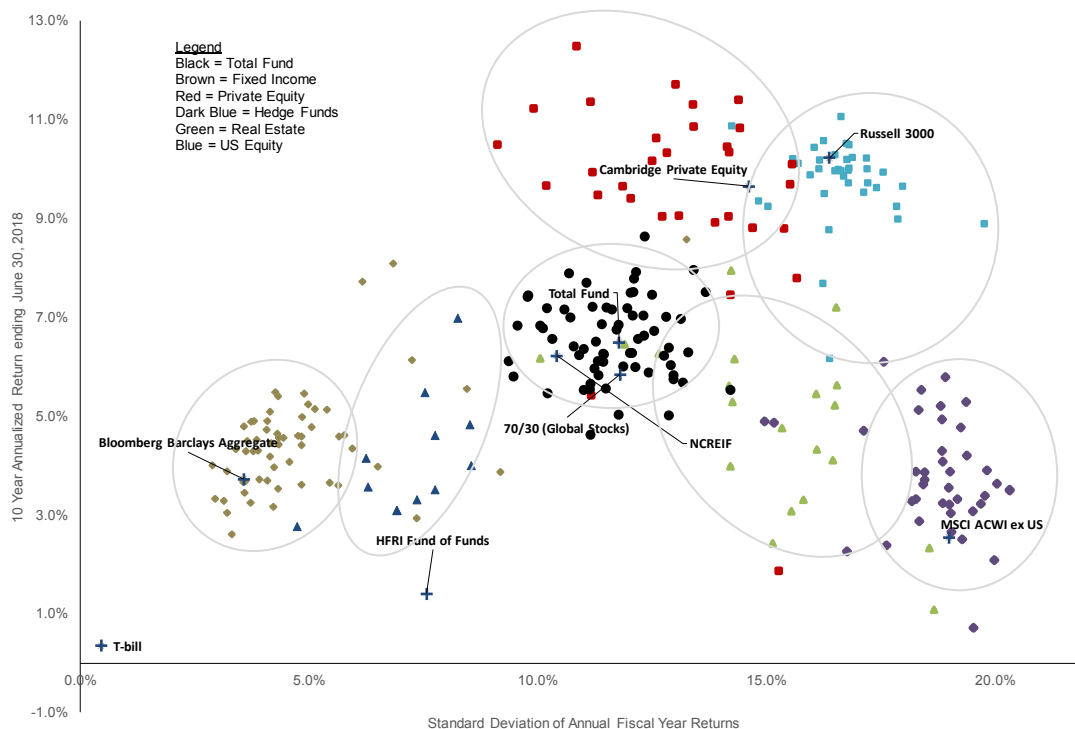


Exhibit 6: State Pension 10-Year Returns by Major Asset Class

	Total Fund	US Stocks	Non-US Stocks	Fixed Income	Real Estate	Private Equity	Absolute Return
Highest Return	8.64%	11.06%	6.10%	8.58%	7.94%	13.44%	6.98%
25th Percentile	7.17%	10.19%	4.72%	4.89%	6.17%	11.24%	4.66%
Median Return	6.54%	9.95%	3.62%	4.43%	5.27%	10.10%	3.78%
75th Percentile	6.00%	9.50%	3.22%	3.71%	4.01%	9.06%	3.25%
Lowest Return	4.63%	2.64%	0.71%	2.60%	-0.54%	1.87%	2.76%
Average Return	6.49%	9.85%	3.78%	4.64%	4.32%	10.05%	3.87%
Benchmark Return	5.84%	10.23%	2.54%	3.72%	6.22%	9.65%	1.41%
Benchmark Percentile	80%	18%	89%	74%	23%	64%	100%
25th - 75th Mid Range	1.16%	0.69%	1.50%	1.18%	2.16%	2.18%	1.41%
Count	66	38	40	59	34	37	12

Benchmarks:

Total Fund	70% Global Stocks (MSCI ACWI), 30% Fixed Income
US Stocks	Russell 3000 Index
Non-US Stocks	MSCI ACWI ex US Index
Fixed Income	Bloomberg Barclays Aggregate Bond Index
Real Estate	NCREIF Index (NPI)
Private Equity	Cambridge Associates Private Equity Index
Absolute Return	HFRI Fund of Funds Index

Exhibits 7 plots the longer 18-year return and risk for individual state pension asset classes with the return statistics provided in Exhibit 8. The sample set gets smaller than the 10-year sample but large enough to draw meaningful observations. Absolute return figures are not shown as those asset class returns do not extend back to June 30, 2000.

Exhibit 7: State Pension Asset Class Average Return and Risk for 18 Years ending June 30, 2018



Exhibit 8: State Pension 18-Year Returns by Major Asset Class

	Total Fund	US Stocks	Non-US Stocks	Fixed Income	Real Estate	Private Equity
Highest Return	7.34%	6.77%	6.30%	7.72%	10.73%	13.01%
25th Percentile	6.24%	6.45%	5.05%	5.84%	9.90%	9.89%
Median Return	5.88%	5.95%	4.34%	5.43%	8.88%	9.19%
75th Percentile	5.65%	5.61%	3.99%	5.09%	6.78%	8.68%
Lowest Return	3.60%	5.07%	2.24%	4.44%	4.99%	7.52%
Average Return	5.87%	6.29%	4.64%	5.46%	8.28%	9.31%
Benchmark Return	5.15%	5.98%	4.03%	4.80%	8.85%	9.12%
Benchmark Percentile	93%	49%	71%	92%	51%	54%
25th - 75th Mid Range	0.59%	0.84%	1.06%	0.75%	3.12%	1.21%
Count	66	25	22	34	14	19
Benchmarks:						
Total Fund	70% Global Stocks (MSCI ACWI), 30% Fixed Income					
US Stocks	Russell 3000 Index					
Non-US Stocks	MSCI ACWI ex US Index					
Fixed Income	Bloomberg Barclays Aggregate Bond Index					
Real Estate	NCREIF Index (NPI)					
Private Equity	Cambridge Associates Private Equity Index					

Key performance takeaways from Exhibits 1-7 are:

1. **State Pension Historical Returns.** State pensions collectively and individually struggle to earn their actuarial interest assumptions over longer time periods. Their 5.87% and 6.49% asset-weighted annualized returns over the last 18 and 10 years, respectively, fell well short of 7.75% and 7.61% asset-weighted actuarial interest assumptions for the same time periods.
2. **State Pension Expected Returns.** Shortfalls in state pension returns are most likely to continue. Horizon Actuarial Services finds a 5.95% expected long-term return for institutional portfolios from a survey of investment consultants. Cliffwater forecasts a higher 6.92% expected return for state pensions, but still below the most recent 7.23% asset-weighted fiscal 2018 actuarial interest rate.
3. **State Pension Relative Returns.** The 6.49% asset-weighted state pension return over the last 10 years fell within a wide 4.63% to 8.64% range for individual state returns, with the top performing state pension outperforming the bottom performing state pension by a cumulative 72% over 10 years, demonstrating the potential for significant financial consequences (positive and negative) underlying individual state investment policy and implementation decisions.
4. **Active versus Passive.** State pensions benefited from not embracing a 100% passive strategy. Ninety-three percent (93%) of state pensions outperformed a passive 70%/30% mix of global stocks and US bonds over the 18-year period, and eighty percent (80%) of state pensions outperformed a passive 70%/30% mix of global stocks and US bonds over the recent 10-year period and.
5. **Risk-Taking.** State pension returns are variable year to year, with an average annual standard deviation of return equal to 11.65%, measured over the last 10 fiscal years. Standard deviations for individual state pensions ranged from a low of 9.35% to a high of 14.21%, suggesting some meaningful differences in risk-taking among state pensions. By comparison, standard deviations for global equities and US bonds were 17.37% and 3.6%, respectively, with a 70%/30% portfolio annual standard deviation equal 11.80%. However, contrary to expectations, differences in 10-year state pension returns appear unrelated to standard deviation of return, with a -0.01 cross-sectional correlation between 10-year return and risk and a 0.09 cross-sectional correlation between 18-year return and risk. These statistics suggest that differences in state pension returns

had more to do with differences in asset allocation implementation, rather than asset allocation policy.⁴

6. **US Equity.** Most state pension US equity returns continue to lag the broad Russell 3000 Index return. The Russell 3000 Index ranks in the 49th and 18th percentiles against reported state pension US equity returns for 18-year and 10-year periods, an outcome which will likely continue the reallocation of US equity assets from active to passive management.
7. **Non-US Equity.** Unlike US equities, most state pensions have produced non-US equity returns that exceed the MSCI ACWI ex US Index, the most common non-US benchmark index. Covering the 18-year and 10-year time periods, 70% and 89%, respectively, of state pensions exceeded index returns. Excess returns are not necessarily attributable to emerging markets, which underperformed the non-US developed equity markets over the shorter 10-year period.
8. **Fixed Income.** State pension fixed income returns successfully outperform the Bloomberg Barclays Aggregate Bond Index return, returning 5.46% and 4.64% over the last 18-year and 10-year periods, respectively, compared to index returns of 4.80% and 3.82%, respectively. State pensions generally achieve these above-index returns by taking more credit exposure compared to the index through allocations to non-investment grade bonds and bank loans. For example, the Bloomberg Barclays High Yield Bond Index returned 7.38% and 8.19%, for the same 18-year and 10-year periods, respectively. State pensions that overweight credit within their traditional fixed income portfolios have been rewarded over time, but during market downturns, such as fiscal 2009, the average state pension underperformed the Bloomberg Barclays Aggregate Bond Index by 3.81%.
9. **Private Equity** continues its history of providing state pensions the highest asset class returns, with average returns equal to 9.31% and 10.05%, respectively, over the 18-year and 10-year study periods. These returns outperform public market equivalent (PME) returns by 3.49% and 1.58%, respectively, over the 18-year and 10-year study periods. PME returns reflect a 70% weighting to the US stocks (Russell 3000 Index) and 30% weighting to non-US stocks (MSCI ACWI ex US), weights reflecting Cliffwater qualitative and quantitative assessment of private equity geographic allocations.⁵ The state pension private equity returns are also above the Cambridge Private Equity Benchmark returns of 9.12% and 9.65%, respectively, for the 18-year and 10-year study periods. Finally, private equity returns vary widely across state pensions suggesting that implementation is a critical factor in individual state private equity return outcomes.
10. **Real Estate.** Individual state pension real estate returns varied the most of any asset class over the 18-year and 10-year study periods, likely reflecting different investment approaches to this asset class. There is equally a very wide range in measured return volatility. Real estate returns equaled 8.28% and 4.32%, respectively, over the 18-year and 10-year periods, falling short of the 8.85% and 6.22% returns for the NCREIF Index of private equity over the same time periods. Some state pensions include publicly traded REITs as part of what is an asset class largely comprised of private real estate investments. The presence of public REITs, if held consistently, should have helped both 18-year and 10-year outcomes because the NAREIT Index of equity REITs returned 10.77% and 7.94%, respectively, for those periods equaled.

⁴ Allocators worry that risk calculations for private equity and real estate are understated due to a potential for “smoothing” of returns in the valuation process. The presence of smoothing can be discovered by measuring serial correlation among returns. We find little evidence of smoothing in private equity returns. The serial correlation of private equity returns over the longer 18-year period measures 0.20, roughly equal to the 0.17 serial correlation found in the Russell 3000 Index. The average serial correlation for state pension real estate returns equals a higher 0.33, suggesting slightly higher risk levels than those calculated.

⁵ A regression using the average state pension private equity return as the dependent variable and the S&P 500 and the MSCI ACWI ex US indices as independent variables finds a “best-fit” weighting of 60% S&P 500 and 40% MSCI ACWI ex US. Our selection of 70% S&P 500 and 30% MSCI ACWI ex US reflects our preference for an approach that relies on fundamental analysis of company holdings in determining PME index weights.

11. **Absolute Return.** Hedge fund returns have far exceeded benchmark HFRI Fund-of-Funds Index returns but their absolute level, averaging 3.78% over the last 10-year period, fell well short of investor expectations. Returns extending back to 18 years are not available for this asset class.
12. **Real Assets, Private Debt, and Risk Parity.** Return histories among state pensions for other alternative assets consist of only a few years in most instances. Nonetheless, returns have so far been good. Looking just at the most recent June 30, 2018 fiscal year, real assets, private debt, and risk parity earned average returns equal to 8.22% (33), 8.52% (18), and 7.01% (7), respectively, close to the asset-weighted average 8.85% (66) total state pension return for the year.⁶

State Pension Asset Allocation

State pension boards and staffs are fully aware of the investment challenges ahead and began some time ago to gradually shift their asset allocation strategies to include the use of alternative investments. These alternative investments consist primarily of allocations to private equity, private real estate, hedge funds (aka absolute return), private debt and private real assets. Exhibit 9 shows the historical growth in state pension allocations to alternative investments for the time period 2006 to 2018.

Allocations to alternatives increased dramatically soon after the 2008 Financial Crisis, rising from 10% of total assets in 2006 to 21% in 2011, and thereafter steadily increased to 30% of total assets at June 30, 2018. Most of the increase in alternatives had come from public equities, which fell from 61% in 2006 to 47% in 2017. However, over the 2018 fiscal year the increased allocation to alternatives by state pensions has come from reductions in fixed income and cash.

The shift to alternatives over the past decade is a byproduct of lower expected returns from traditional asset classes, especially fixed income, and the desire to avoid potential sharp drawdowns that can come from public equities. Alternatives are perceived as potentially meeting these dual objectives of return and lower volatility. The tradeoff is less liquidity, investment complexity, and higher fees compared to traditional asset classes.

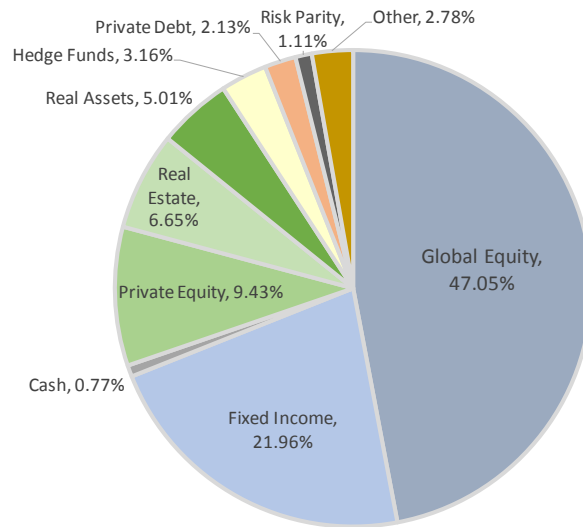
Exhibit 9: Overall State Pension Asset Allocation
(as of fiscal year-end June 30)

	2006	2011	2012	2013	2014	2015	2016	2017	2018	Change from 2006 to 2018
Public Equities	61%	51%	49%	50%	51%	50%	48%	47%	47%	-14%
Fixed Income	26%	25%	25%	22%	23%	23%	24%	23%	22%	-4%
Alternatives	10%	21%	24%	25%	24%	24%	26%	26%	30%	20%
Cash	2%	3%	2%	3%	2%	3%	2%	3%	1%	-1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Exhibit 10 provides a detailed breakdown of the types of alternative investments that comprise the 30% allocation by state pensions.

⁶ Number of state pensions reporting returns in parenthesis.

Exhibit 10: Actual State Pension Allocations, June 30, 2018



All categories of alternative investments have grown since 2006, when they equaled 10% of total assets. Private equity allocations have more than doubled, from 4.1% in 2006 to 9.4%, a 4.7% increase. Real estate grew more modestly, from 4.4% in 2006 to 6.7% in 2018, a 2.3% increase. The remaining 14% additional allocation to alternatives, outside private equity and real estate, has been directed to alternatives that had little or no representation in state pensions in 2006.

The largest single beneficiary of increased alternative allocations is real assets, which includes a range of substrategies such as commodities, energy & mining, infrastructure, and agriculture. Infrastructure and energy represent the largest sub-strategies within real assets. Real assets are expected to provide a high single digit return that is positively correlated with unexpected inflation. Their 5.0% June 30, 2018 allocation is further described in Exhibit 11, which shows for each alternative investment not only their percentage of total state assets, repeated from Exhibit 10, but also allocations for only those state pensions making allocations, and the highest allocation among the state pensions. For example, real assets represent 5.0% of total state pension assets, a higher 7.6% of state pension assets when only state pensions with real asset allocations are counted, and a 25% allocation for the state with the greatest percentage allocation to real assets.

Exhibit 11: State Pension Alternative Allocations
at June 30, 2018

	Private Equity	Real Estate	Real Assets	Hedge Funds	Private Debt	Risk Parity	Other
All States, Asset-Weighted	9.4%	6.7%	5.0%	3.2%	2.1%	1.1%	2.8%
Average of States with Allocations	9.9%	7.9%	7.6%	7.5%	6.5%	7.0%	5.8%
Highest State Allocation	24.4%	17.2%	25.0%	25.8%	18.7%	12.1%	12.9%

Hedge funds grew from 0.3% in 2006 to 3.2% at June 30, 2018, but most of the growth occurred immediately after 2008 and allocations have remained roughly unchanged over the past several years. Still, of those states investing in hedge funds, their average allocation equals 7.5% and some states allocate much higher amounts.

Private debt is the newest and fastest growing alternative investment, representing 2.1% of total state pension assets, and averaging 6.5% of total assets among state pensions with dedicated allocations. Actual allocations to private debt are higher, as most assets within the "Other" category represent opportunistic credit investments. The interest in private debt stems from the desire for high and immediate cash flow with low volatility, potentially filling the void in the northwest corner of Exhibits 5 and 7 above.

Risk parity is an allocation strategy that can combine both traditional asset classes and alternatives, and where asset classes contribute equally to total portfolio risk. Risk Parity portfolios become optimal mean-variance portfolios when leverage is unrestricted and asset classes have identical Sharpe Ratios⁷, allowing correlations to drive optimal asset weights. Allocations to risk parity remain small at 1.1% of total assets and largely unchanged in recent years.⁸

Finally, many state pensions designate an “Other”, “Opportunistic”, or “Innovation” asset class that is dedicated to investment strategies that can’t be classified as part of their traditional or designated alternative investments. These other alternatives have been income in nature with the intent to achieve high cash flow but low correlation to equities. Re-insurance, life settlements, and credit opportunities are examples.

Conclusion

The purpose for our annual state pension study has been to aid in the understanding of the asset performance achieved by state pensions. State pensions overall have been successful stewards of assets over our 18-year study period, achieving returns that captured the opportunities presented by global markets, and then some.

However, we find significant differences among individual state pension 10-year returns, mostly unexplained by simple differences in asset allocation or risk-taking. Some state pensions just appear more effective in implementing asset allocation compared to others.

We recommend that fiduciaries overseeing state pensions continue to allocate resources towards maximizing the return potential from its asset classes, paying attention to differences in how state pensions implement within asset classes.

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⁷ Sharpe Ratio equals excess return, defined as total return minus risk-free rate, divided by risk.

⁸ See Cliffwater Research, “Risk Parity” (January 2018) for a detailed description.