CLIFFWATER LLC

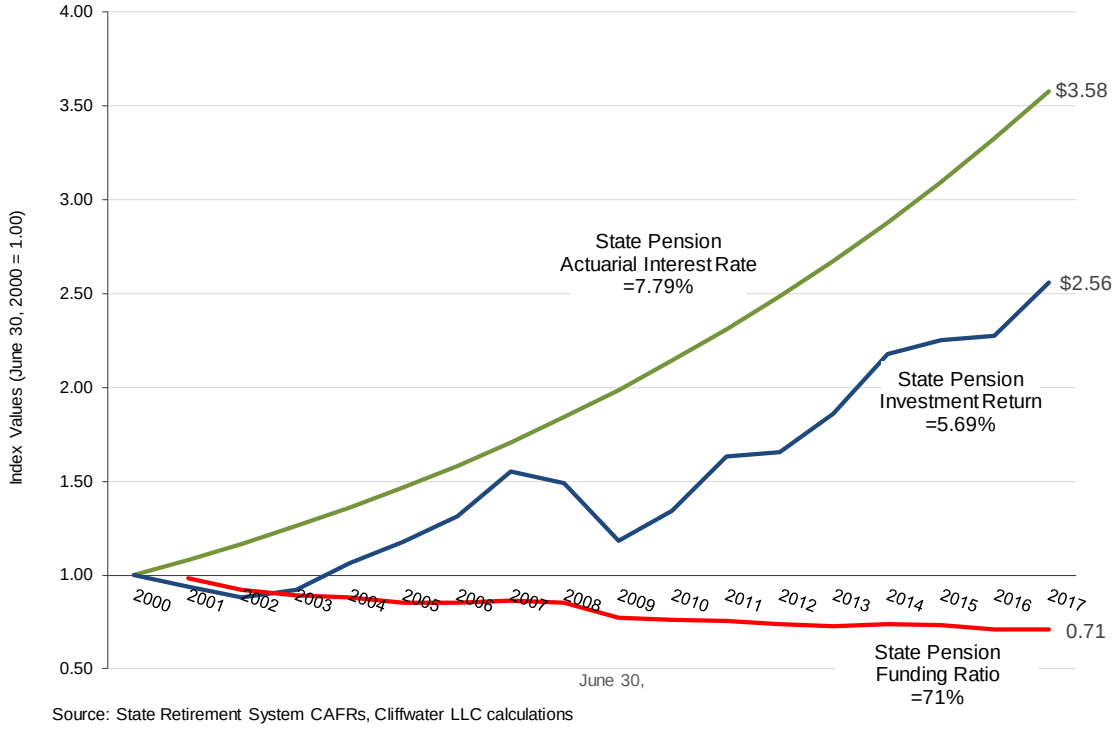
An Examination of State Pension Performance, 2000 to 2017

September 12, 2018

An Inconvenient Truth

The passing of Jeremy Gold this summer received significant industry and press attention. Jeremy was a noted actuary who I met only once 20 years ago at a pension conference in Washington, D.C. where we both questioned how actuarial interest rates are set and shared concerns for potential future underfunding. Jeremy was an actuarial insider and former head of pensions at Morgan Stanley, making his views weighty, if inconvenient. Shortly thereafter private pensions moved to corporate bond rates to value liabilities, resulting in higher pension contributions[1], a change that Jeremy also wanted for public pensions. An unintended consequence has been the further demise of the corporate defined benefit plan. Public pensions successfully fought back change, preserving the traditional defined benefit plan but, as Exhibit 1 shows, at the cost of a continuous state of severe underfunding that Jeremy predicted.

Exhibit 1: Pension Performance, Actuarial Rates, and Funding Ratios
17 Fiscal Years ending June 30, 2017



Source: State Retirement System CAFRs, Cliffwater LLC calculations

[1] Pension Protection Act of 2006.

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The three lines in Exhibit 1 capture the progression of state pensions for the June 30 fiscal years from 2000 to 2017.[2] 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 a compound asset-weighted annual return equal to 5.69%, badly trailing their 7.79% collective asset-weighted actuarial interest rate assumption. The almost two percentage point performance shortfall has resulted in a decline in pension funding ratios (assets divided by liabilities) from close to unity in 2000 to 71% (0.71) in 2017. The ratio of cumulative state pension investment return ($2.56) to cumulative actuarial interest return ($3.58) equals 0.72, roughly equal to the 0.71 collective funded ratio provided in fiscal 2017 state pension financial reports. While other events undoubtedly have impacted pension funding, among them the failure of some states to make required contributions, outdated mortality tables, and unfunded benefit improvements, the failure of actuaries to properly assess long term asset return is clearly the dominant factor in pension underfunding today.

Fiscal 2018 returns are just being reported and early releases suggest they will modestly beat actuarial interest rates, thanks to a strong US stock market. The celebrations should be brief. Consultant 10-year return forecasts for diversified institutional pension portfolios average 6.18%[3], which is slightly above the 5.69% actual state pension return over the past 17 years and well below the current (fiscal 2017) 7.45% asset-weighted actuarial interest rate assumption. Achieving the 7.45% 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.

Our annual state pension performance report focuses on investment strategy and not pension funding, but with Jeremy's passing we wanted to at least pay tribute to his work. We begin with a description of the data upon which our findings are based.

Study Design and Data

We draw our findings from data and descriptive narrative provided in the Comprehensive Annual Financial Reports ("CAFRs") published by state pension systems. 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. 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

[2] See Definitions and Methodologies for description of the data.
[3] "Survey of Capital Market Assumptions: 2017 Edition", Horizon Actuarial Services, LLC.

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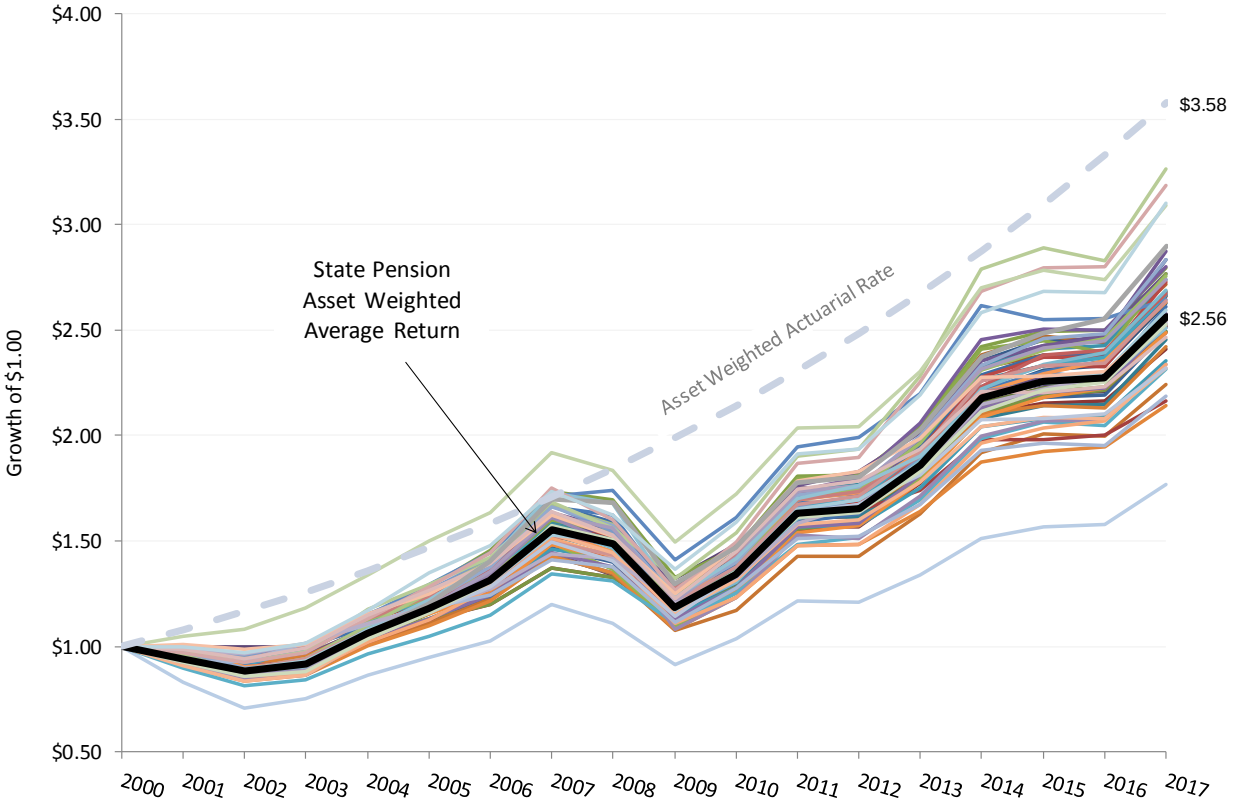
pensions is counted once and not duplicated. There are 11 state pensions excluded who use December 31 as their fiscal year end and another 5 state pensions that have fiscal year ends other than June 30 or December 31. While this report details findings only for the 66 fiscal June 30 state pensions, Cliffwater has conducted similar analyses on the other 16 state pensions with findings that are consistent with the study group.

17-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: 17-Year Cumulative State Pension Returns:
June 30, 2000 to June 30, 2017



Source: State Pension CAFRs, Cliffwater LLC

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 -2.11%, annualized, and the smallest deficit was -0.53%.

Exhibit 2 also reflects a meaningful dispersion in individual state pension returns over the 17-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.

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Exhibit 3: State Pension Return Dispersion, Fiscal Years 2001 to 2017

	Return	Growth of $1.00	Ratio to Median Return
Highest	7.20%	$3.26	127%
25th Percentile	6.04%	$2.72	106%
Median Return	5.71%	$2.56	100%
75th Percentile	5.51%	$2.49	97%
Lowest	3.40%	$1.77	69%

The 17-year returns for the 66 state pensions reflect all the characteristics of a normal distribution. The difference between a first and third quartile return equals a modest 53 basis points (6.04% minus 5.51%) but that difference compounded over 17 years produces a 9-percentage point difference in cumulative return (106% minus 97%). There are 6 state pensions whose 17-year returns differ from the 5.69% 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 2017,
And 17-Year Annualized Returns

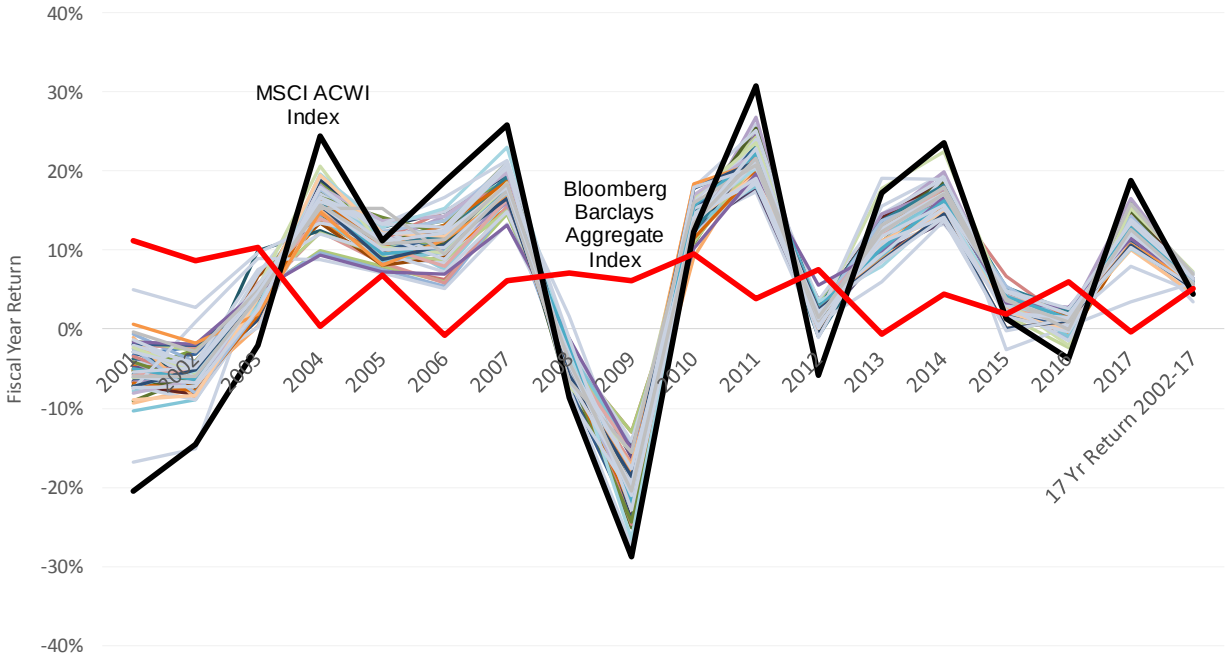

Exhibit 4 plots fiscal year-to-year returns for each of the 66 state pensions, ending with 17-year annualized return. Each line represents one state pension. Also shown are fiscal year returns for global stocks (MSCI ACWI Index) and U.S. bonds (Bloomberg Barclays Aggregate Bond Index).

Cumulative, annualized 17-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

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and bond returns, over a longer 10-year period 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 0.83 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 11.02% over the 17-year study period versus 17.75% for the MSCI ACWI Index. The average state pension equity beta equals 0.49. 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 0.87. Collectively, these statistics suggest that the future health of public pension systems is intertwined with the performance of the global stock markets.

10-Year Asset Class Performance

Exhibit 5 plots individual state pension returns by major asset class. The returns cover a shorter 10-year period ending June 30, 2017 because a larger sample set of asset class returns is available compared to the 17-year sample set, particularly for private equity, real estate, and hedge funds. Despite the shorter 10-year period, our asset class findings described below are consistent with those for the entire 17-year period. 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, 2017

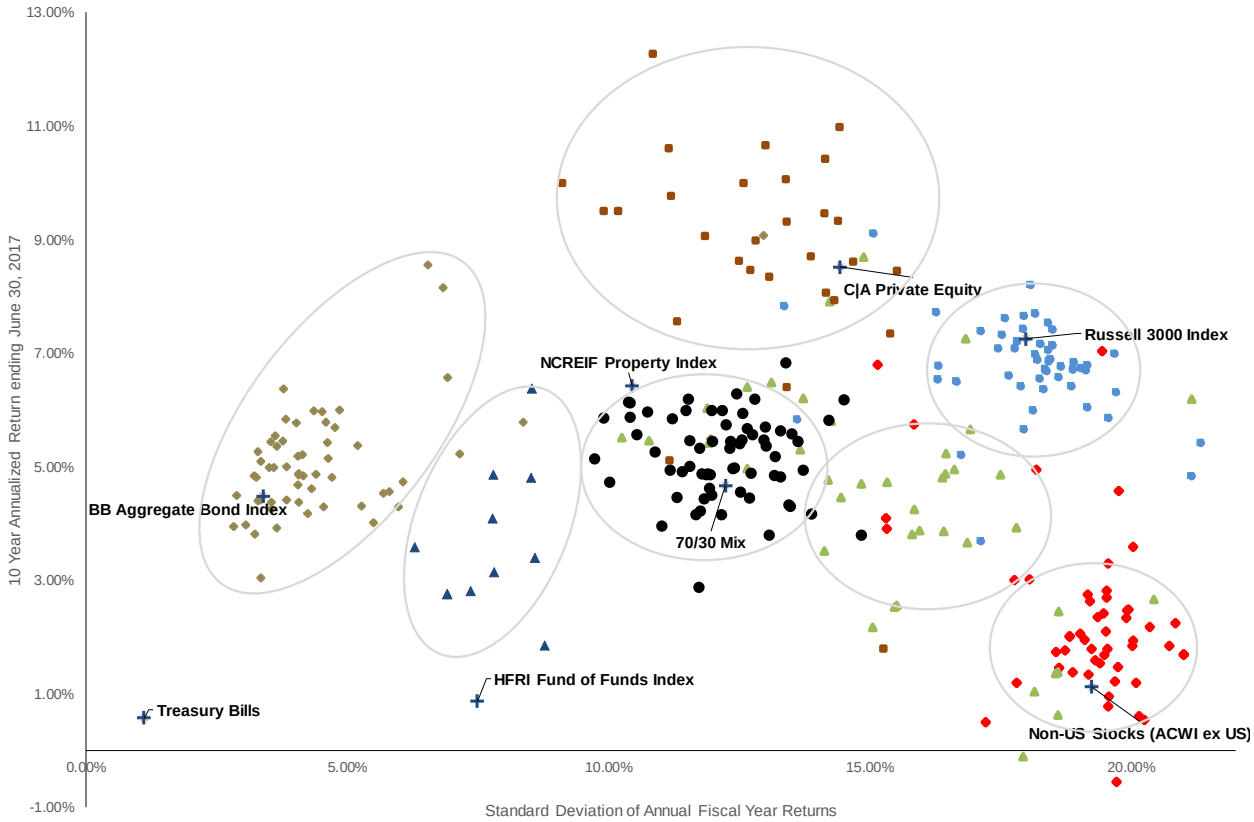

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Exhibit 6: State Pension 10-Year Returns by Major Asset Class

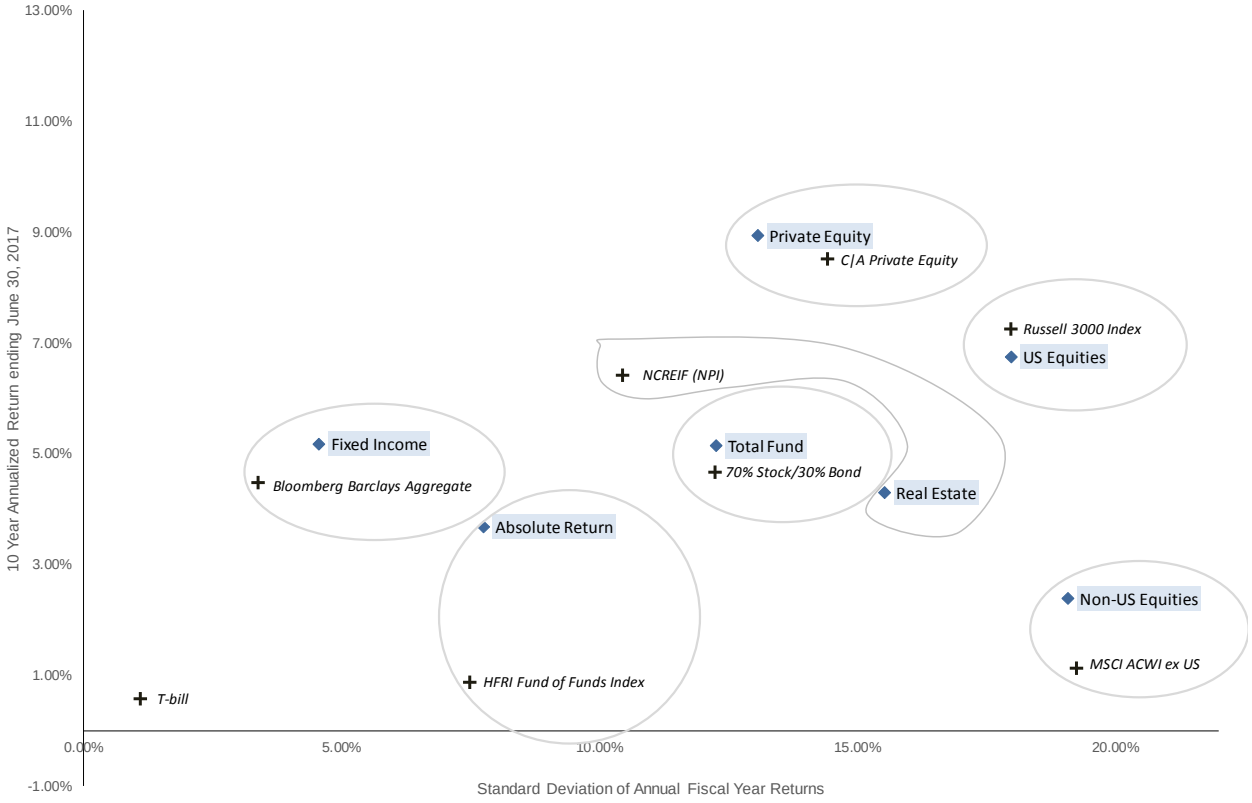
	Total Fund	US Stocks	Non-US Stocks	Fixed Income	Real Estate	Private Equity	Absolute Return
Highest Return	6.84%	9.10%	7.04%	9.07%	8.70%	13.19%	6.38%
25th Percentile	5.74%	7.16%	2.75%	5.55%	5.48%	10.00%	4.45%
Median Return	5.29%	6.79%	2.01%	4.98%	4.75%	9.29%	3.40%
75th Percentile	4.76%	6.42%	1.55%	4.42%	3.30%	8.38%	2.79%
Lowest Return	2.89%	3.69%	-0.54%	3.04%	-2.33%	1.80%	1.85%
Average Return	5.14%	6.75%	2.39%	5.18%	4.30%	9.19%	3.68%
Benchmark Return	4.67%	7.26%	1.13%	4.48%	6.42%	8.52%	0.87%
Benchmark Percentile	76%	22%	89%	74%	10%	69%	0%
25th - 75th Mid Range	0.98%	0.74%	1.20%	1.13%	2.17%	1.63%	1.66%
Count	66	49	53	57	40	34	11

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

Exhibit 7 simplifies individual asset class returns from Exhibit 5, presenting one asset class return that is a 10-year overage of all the available individual state pension returns for each asset class.

Exhibit 7: State Pension Asset Class Average Return and Risk for 10 Years ending June 30, 2017



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Key Findings from Exhibits 5-7:

1. State pensions collectively earned a **5.1% asset weighted annualized return** and **5.3% median return** over the **10 years ended June 30, 2017**, badly trailing their **7.7% asset weighted actuarial interest rate assumption** for the same period.
2. Roughly three-quarters (76%) of state pensions outperformed a passive 70%/30% stock/bond benchmark over the 10-year period.
3. State pension returns were volatile year to year, with **an asset weighted standard deviation of return equal to 12.3%**. Standard deviations for individual state pensions ranged from a low of 9.9% to a high of 14.8%, suggesting some meaningful differences in risk-taking among state pensions. By comparison, standard deviations for global equities and U.S. bonds were 18.1% and 3.4%, respectively.
4. The 5.1% asset weighted state pension return fell within a **wide 2.9% to 6.8% range** for individual state returns, with the **top performing state plan outperforming the bottom performing state plan by a cumulative 61% over 10 years**, demonstrating the potential for significant financial consequences (positive and negative) underlying investment policy and implementation decisions.
5. **We find that differences in 10-year state pension returns appear unrelated to risk taking**, as measured by standard deviation, with a -0.09 correlation. This may be attributable to the time period examined wherein lower risk fixed income enjoyed returns consistent with the total fund returns.
6. The average state pension **fixed income** returned 5.18%, exceeding the Bloomberg Barclays Aggregate Bond Index return by 0.70% but incurred higher risk as well. State pensions generally take more credit exposure compared to the benchmark which likely explains both the higher return and higher risk.
7. Average **US equity** returns for state pensions continue to trail the benchmark index, which will likely continue the reallocation of assets from active to passive management.
8. On the other hand, **non-US equity** returns among state pensions exceed the benchmark index, as value driven active management has worked outside the US.
9. **Private equity** continues its history of providing state pensions the highest asset class returns, with an 9.19% average return over the 10-year study period. However, outcomes vary widely across state pensions suggesting that implementation is a critical factor in outcomes.
10. Individual state pension **real estate** returns varied the most of any asset class over the 10-year study period with a 4.75% median return but a wide range from -0.1% to 8.9%. There is equally a very wide range in measured volatility. Differences in how state pensions allocate within real estate explain the wide range in individual state pension real estate outcomes over the 10-year study period and should be an area of greater attention by allocators. 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 10-year outcomes because the 10-year annualized return for the NAREIT Index equaled 5.97%. However, public REIT returns were very volatile and the amount and timing of allocations could explain some of the disparity in real estate returns.
11. **Hedge fund** returns far exceeded benchmark returns but their absolute level, averaging 3.68%, fell below “equity-like” expected long term returns.
12. 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 no evidence of smoothing in private equity returns. The serial correlation of private equity returns over the longer 17-year period measures 0.19, roughly equal to the 0.15 serial correlation found in the

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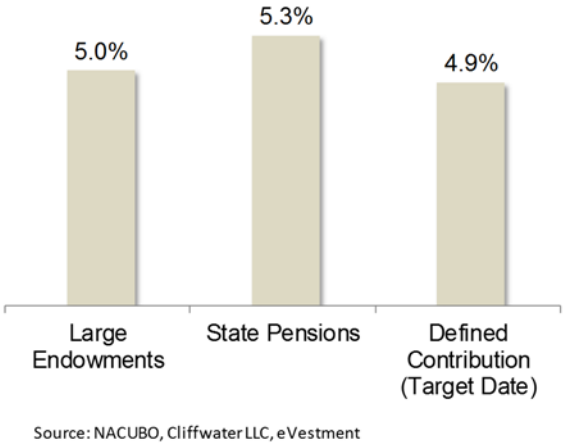
Russell 3000 index. The average serial correlation for state pension real estate returns equals a higher 0.33, suggesting slightly higher risk levels than those calculated.

Performance Comparison Across Fund Type

Exhibit 8 compares state pension returns over the last 10 years with two other types of long-term capital: large endowments[4] and large professionally managed defined contribution plans (e.g. target date funds[5]).

Exhibit 8: Average Ten-Year Returns by Fund Type
(Ended June 30, 2017)



Source: NACUBO, Cliffwater LLC, eVestment

This is the first of our annual studies where state pensions outperform large endowments, with state pensions earning 5.3% over the past 10 years compared to 5.0% for large endowments. This switch in performance leadership is likely due to strong US stock returns over the past 10 years which represents a larger 25% of state pension assets compared to 13% for large endowments.[6]

The 5.3% asset-weighted state pension return also outperformed the 4.9% return for defined contribution plans over the 10-year study period, measured by the median performance of 103 target date funds. This positive difference supports a public policy view that defined benefit plans provide a lower cost (or more benefits) path to retirement security when compared to defined contribution plans. We do not have data on self-directed defined contribution performance, but other studies suggest that average investor returns are lower due to the "buy high, sell low" behavior of retail investors.[7]

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 of allocations to private equity, private debt, private real estate, hedge funds, and private real assets. Exhibit 9 shows average asset allocation among major asset classes for state pensions covering the period 2006 to 2017. [8]

[4] Our sample consists of 100 endowments with assets greater than $1 billion. (Source: NACUBO/Commonfund)
[5] Our sample consists of 103 target date funds with 10-year track records spanning 2020/25/30/35/40/45/50 target retirement dates. (Source: eVestment)
[6] NACUBO.
[7] See, for example, Stephen L. Nesbitt, "Buy High, Sell Low: Timing Errors in Mutual Fund Allocations," in Journal of Portfolio Management, Fall 1995.
[8] Asset allocation data is based upon an expanded list of 90 state pension systems, including those whose fiscal 2017 end is not June 30.

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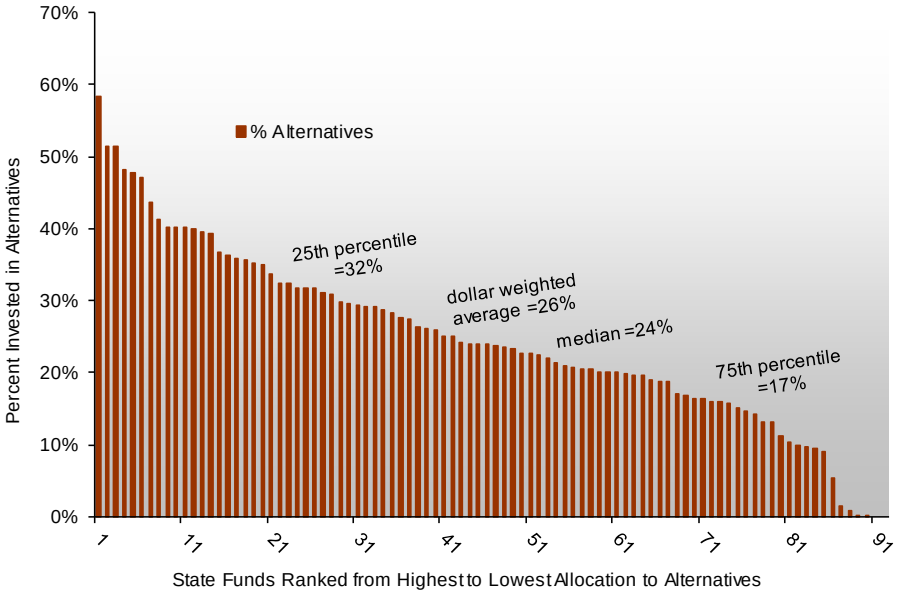
Allocations to alternatives increased dramatically right after the Great Financial Crisis (GFC), rising from 10% of total assets in 2006 to 21% in 2011, and steadily increasing thereafter. Most of the increase in alternatives has come from public equities, which has fallen from 61% in 2006 to 47% in 2017. However, over the last fiscal year ending 2017 the allocation to alternatives by state pensions has remained unchanged at 26% of total assets.

Exhibit 9: Changes to Overall State Pension Asset Allocation (asset-weighted)

	2006	2011	2012	2013	2014	2015	2016	2017	YoY Change
Public Equities	61%	51%	49%	50%	51%	50%	48%	47%	-1%
Fixed Income	26%	25%	25%	22%	23%	23%	24%	23%	-1%
Alternatives	10%	21%	24%	25%	24%	24%	26%	26%	0%
Cash	2%	3%	2%	3%	2%	3%	2%	3%	1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	

Individual state pension allocations to alternatives continue to vary widely, as shown in Exhibit 10, which orders alternatives allocations from highest to lowest across the 90-state pension plan sample, which includes all fiscal year end dates.

Exhibit 10: Distribution of 2017 Alternative Allocations among State Pensions



The median allocation to alternatives equaled 24% as of June 30, 2017. The dollar-weighted average allocation equaled 26% of total assets, as previously reported in Exhibit 9.

Alternatives allocations ranged from 0% for one of the 90 state pension systems reporting, to a high of 58%. There is also considerable difference in allocations among systems ranking in the middle 50%. The 75th percentile allocation to alternatives equaled 17% of assets, down from 18% last year. The 25th percentile allocation equaled 32% of assets, down from 33% last year.

In a few instances the difference in allocations is due to statutory restrictions. Some state pensions only recently were given the latitude to invest in alternatives (Georgia). Those state pensions with higher alternative allocations can also differ in how they invest. Some, like Michigan, Oregon, and Washington, invest primarily in private equity and real estate. Others, like Missouri, Utah, and South Carolina, tilt their alternatives allocations toward hedge funds. These differences in the composition of alternatives could be

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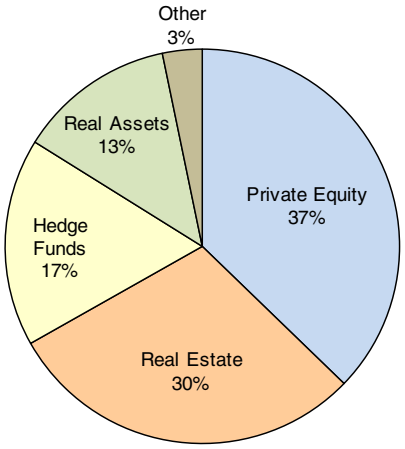
caused by a number of factors, including the intended role of alternatives within the overall asset allocation plan or staff/consultant preferences.

Exhibit 11 shows the average composition of alternatives for state pensions across private equity, real estate, hedge funds, real assets, and other alternatives for the fiscal year 2017. Private equity is the largest alternative asset class, representing 37% of total alternatives. Real estate is second at 30% of alternatives. Hedge funds and real assets follow, equaling 17% and 13%, respectively, of the alternatives pie. Private debt represents a newer allocation among state pensions but is still generally considered a part of private equity allocations.

Exhibit 11: State Pension Allocations to Alternative Assets, Fiscal 2017



	Assets ($ bil)	% of Total Assets	% of Alternative Assets
Private Equity	$291	9%	37%
Real Estate	$231	7%	30%
Hedge Funds	$133	4%	17%
Real Assets	$101	3%	13%
Other Alts	$25	1%	3%
	$782	24%	100%

Comparison to Endowments

State pensions have been shifting their asset allocation slowly toward what is referred to as the "endowment model." Endowments have historically had higher allocations to alternatives. In contrast to the 26% average state pension allocation to alternatives, endowments reported an average alternatives allocation equal to 53% of assets on June 30, 2017.[9] It is very unlikely that state pension alternative allocations will reach endowment levels but further increases are very possible.

The composition of alternatives within state pensions also differs from endowments, as shown in Exhibit 12. Hedge funds represent a much larger 35% fraction of the endowment alternative asset pie compared to 16% for state pensions. Offsetting the lower allocation to hedge funds for state pensions is a much higher allocation to real estate. Real estate represents 28% of alternative allocations for state pensions versus 11% for large endowments.

[9] Source: NACUBO/Commonfund.

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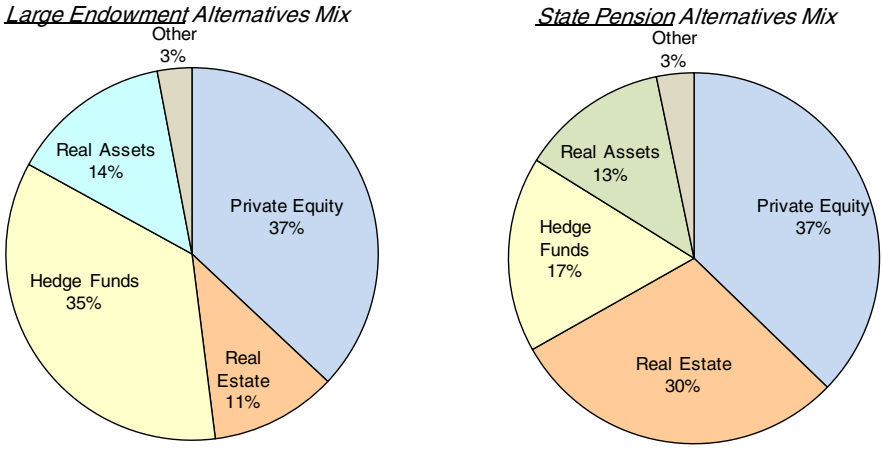
Exhibit 12: Composition of Alternative Investments for Fiscal 2017



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 pension assets over our 17-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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