"MVO (Mean Variance Optimization) Shortcomings...

- *Models are sometimes highly sensitive to small changes to input values ("robustness").*
- *Unconstrained output yields highly concentrated portfolios rather than the expected diversification."* [lxvi]

As a result of these shortcomings, the mean variance optimization model must be constrained because the model combined with the assumptions used would suggest allocations that consultants would not recommend. In other words, consultants believe that there are flaws with the model, with the assumptions, or with both.

The implication is that there is significant uncertainty in a portfolio's expected returns and in which portfolio allocation is optimal, even though this may be obscured in the analysis. There is generally no statistical significance to small model-based basis point improvements in expected return between portfolio allocations. In general, a board should not choose an allocation with too much reliance on a particular model or set of assumptions.

Risk parity.[18] "Risk Parity" is an asset allocation model promoted by the hedge fund Bridgewater Associates and others. Recognizing how hard it is to forecast future returns and correlations, some risk parity advocates suggest balancing a portfolio's risk exposure to 4 potential scenarios driven by whether economic growth exceeds or falls short of expectations and whether inflation exceeds or falls short of expectations. More generally, a risk parity approach to asset allocation uses leverage to approximately equalize a portfolio's "risk exposure" to different asset types and macro-economic scenarios without lowering expected returns. Assets, such as bonds and commodities, that have expected risk and returns that are lower than equities can be levered in order to achieve "parity." For example, without a constraint on the use of direct or indirect borrowing (leverage), and with favorable assumptions about the expected future return and correlation of stocks and bonds, a portfolio with 65% stocks, 35% bonds, plus another 20% of a leveraged position in bonds (65%/55%), may be forecasted to outperform a 70%/30% allocation. Of course, as leverage is added into the portfolio allocation, errors in forecasts of future returns and correlations have a more meaningful impact.

PSERS' portfolio allocation reflects a risk parity model. As of June 2018, PSERS reported 16.8% portfolio level financing.[lxvii] At the same time, PSERS also has a separate allocation to a Risk Parity category. This makes interpreting or comparing their exposures very difficult as the 10% allocation (as of June 2018) to the "Risk Parity" category has within it leveraged exposure to a mixture of equity, fixed income, commodities, inflation-protected securities, and other traditionally defined asset classes. By using a separate "risk parity" category, PSERS total exposures to traditional asset classes and portfolio risks cannot be calculated.

A NOTE ON LEVERAGE AT PSERS

The use of leverage at PSERS, while consistent with a risk parity model, adds complexity to risk reporting. When leverage is used, allocations need to reflect total exposure – cash exposures plus notional exposures – and risk metrics need to account for the levered exposure. Calculations need to be clear and consistent and well defined. Direct borrowing and indirect financing through derivative securities must be calculated and disclosed.

Current reports produced by PSERS are difficult to understand regarding the use and level of leverage, as well as what total exposures or risks relative to traditional asset classes are. It is unclear which types of leverage are and are not included in the reported financing. For example, consider the PSERS Commodity Beta investment which was shown on the Moneyline Report for June 2018 at $1.748 billion. The footnote labels this a notional exposure with $584 million of cash and $301 million of the PIMCO Commodity Alpha Fund as collateral. Under financing, there is a line for PSERS Commodity Beta for $863 million. The PIMCO Commodity Alpha Fund is not listed elsewhere, although there is a line for "PIMCO PARS/GCOF/MAV" under absolute return for $793 million. It is unclear if the $584 million of cash is counted in the line for cash management or in the allocated cash. When a borrower takes out a mortgage on a house, the size of the mortgage does not decline just because the house is collateral or if the lender requires the borrower to maintain a checking account at their bank. This would not seem to be different. A derivative with a notional exposure of $1.748 billion is synthetically the same as a loan (financing) for $1.748 billion and a purchase of $1.748 of the commodity index that the derivative is based on. That would suggest a financing of $1.748 billion should be recorded. Yet, the financing line is less than half of that at $863 million which is the difference between the notional value and the value of the collateral. From these materials, it is difficult to know if PSERS' limits on leverage have been exceeded or not. The reported leverage will change by as much as 1.6% of the value of PSERS' assets by how one calculates the leverage of this one line item.

There are further complications from leverage related to performance evaluation (discussed in a different chapter) and for the management of liquidity (discussed below).

[18] *Some suggest that risk parity models require less assumptions about expected returns. However, a model, for example, where asset class sharpe ratios are equal and future volatilities are the same as historical is assuming such about future return distributions.*

A fourth consideration for the investment allocation decision is idiosyncratic risk. Seeking "alpha" is by definition deviating from the benchmark – accepting idiosyncratic risk – hoping to produce excess returns. A key observation that led to the development of modern portfolio theory was that idiosyncratic risk is diversifiable and therefore should not be systematically rewarded. Therefore, allocation models should not assume any returns from idiosyncratic risk, including returns to active management styles, as doing so conflates illiquidity, manager skill, and manager selection skill with the returns and risk from systematic risk exposures.

Whatever approach is taken to diversifying across more systematic risk exposures and creating a more refined investment allocation, the result is for the board to establish a second policy benchmark portfolio with the same risk level as the simple portfolio benchmark, but with a more diversified allocation to market indices. The performance of this diversified benchmark portfolio is compared over time to the performance of the simple portfolio benchmark to evaluate whether the asset allocation models and assumptions used have performed as expected or whether there needs to be a re-evaluation.

The choice of the diversified policy benchmark described above constitutes the allocation decision. There has been significant academic research that shows that over 90% of the returns of a portfolio can be explained by the allocation. As SERS' consultant RVK writes:

> **Asset Allocation Explains:**
>
> **100%** *of Return Amount Over Time*
>
> - *Studies consistently find that funds making timing and selection bets against their long-term policy mix are unsuccessful in adding significant value by engaging in timing and/or manager selection.*
>
> **90%** *of Return Variability Over Time*
>
> - *Studies consistently conclude that roughly 90% of the movement of a fund's total return is explained by target policy fluctuation.*[lxviii]

Respecting this data, many institutional investment managers simply choose to invest in the diversified benchmark portfolio. In fact, David Swensen, the acclaimed chief investment officer for Yale University's endowment, in his book *Pioneering Portfolio Management*, recommends investing in a diversified benchmark portfolio. Georgia, Idaho, and Nevada and others have essentially utilized this practice to great success. These portfolios are well-diversified, have low external and internal costs, are easily understood, and are highly liquid.

Portfolio Execution

Costs, and Why They Matter.

> ***All other things being equal, the smaller a fund's expense ratio, the better the results obtained by its stockholders. - William F. Sharpe, Nobel Laureate***

Once investors turn from establishing an asset allocation to implementing that asset allocation, they face the issue of costs. An abstract reference portfolio on paper is cost free; a portfolio in the real world will incur investing costs, whether large or small. Since by simple math, any investors' actual return will be the return of the underlying assets minus the cost to obtain that return, clearly understanding and minimizing costs matters – and can matter considerably – to maximizing returns. This was the central insight behind the creation of this Commission by Act 5, and its mandate to identify savings.

The diversified benchmark portfolio described above is simple to manage, simple to monitor, and simple to understand. It does not require complex compliance systems or risk measurement or monitoring. Even a risk

parity strategy, such as PSERS', can be implemented using public markets indices at low cost. The leverage of the risk parity model makes the strategy a bit more complex for reporting and monitoring, but not significantly so, when it is employed with liquid public markets indices.

Some investment owners, believing that they can "beat" indices, choose to implement the portfolio using other types of investment strategies instead of investing directly in liquid public markets indices as defined by the diversified benchmark portfolio. This is a more expensive implementation. It adds direct and indirect costs and it adds risks. Since the asset allocation decision accounts for so much of the return, doing so, and thereby adding complexity through manager or security selection, should be done cautiously and must factor in the costs of doing so.

There are two types of costs associated with manager and/or security selection. First is the cost of monitoring and managing the risks – systematic and idiosyncratic – that are thereby introduced. An active management strategy may have different systematic risk than the index it replaces in the benchmark. For example, active fixed income managers often invest with more credit risk than the index. An active management strategy also introduces idiosyncratic risk, in two ways. One, from the risk of an adverse event in the (internal or external) manager's operations – either unintentional or intentional (fraud or rogue trader). Two, an active management strategy's securities differ from the index with the goal of outperforming an index. Those risks need to be measured, monitored, and managed. Doing all of this well in today's financial market environment requires sophisticated risk measurement tools and equally sophisticated investment expertise (staff and board) to understand and use them. This is neither simple nor cheap. Wall Street and institutional investment management operations like Blackstone and Apollo have enormous numbers of people and resources dedicated to this task alone. This issue is described in more detail in Chapter VII: Cost-saving Options.

The second cost associated with manager and/or security selection is the direct cost of the investment management. When an external manager is hired to implement an investment strategy, they do not do it for free. Some of the costs are direct fees and easy to measure, such as an asset management fee. Some of the costs are indirect, such as commissions on

CATEGORIES OF FEES AND COSTS

Transparency to the actual fees and costs of every individual investment is critical to good decision making and performance evaluation. Terms of contracts that dictate what fees and costs can and will be charged to the pension fund are enormously varied and they directly impact the risk of an investment by altering the incentives of an investment manager. Outlined here are general categories of fees and costs. It is important to note that tradeoffs between different types of fees are complex. Reducing base management fees in exchange for increases in performance-based fees will only deliver the full savings associated with the reduction of the base management fees when performance is so poor that no performance-based fees are earned.

Base management fees. Also known as asset management fees, these fees are charged as a percentage of assets under management. There is a financial incentive for an investment manager to gather assets to increase their total fee income. Offsetting the risk associated with this behavior is the understanding that longer term, if performance is poor, the investment manager will lose assets and thus fees.

Performance-based fees. Performance-based fees, also called incentive fees or carried interest, are usually a share of profits that accrue to the investment manager, often – although not always – above a threshold return to the asset owner. Important terms include whether the threshold return is a hurdle or a preferred return, what the threshold return is, what the catch up is, and what percentage of the returns over the hurdle or threshold the general partner earns. A common oversimplification is that these fees serve to align interests between asset managers and asset owners. The truth is significantly more nuanced. While it is true that the asset manager earns more in performance-based fees when performance is higher, the asset manager does not generally suffer losses when returns are negative. This creates an asymmetry between investor and manager: the manager wins when the investor wins . . . but does not lose when the investor loses. Moreover, there are very few contracts where the performance is adjusted for the use of leverage or other risk-increasing techniques, including the use of subscription lines of credit.

Other fees and costs. Transparency into other fees and costs are also critical to ensuring that the asset owner understands the incentives of the investment manager. There are numerous ways in which investment managers earn money at the expense of the asset owner. A few examples include commissions, soft dollar commissions, partnership expenses, portfolio company monitoring expenses, directors' fees, advisory fees, and travel expenses. Transparency is critical for controlling these costs and ensuring proper alignment of interests. As an example, historically, soft dollar transactions were not tracked or monitored,[lxix] but transparency and regulations uncovered and then controlled abuse. Some costs are justifiable and appropriate, and others are not. Without transparency, it is impossible to form an accurate view on how the pension's assets are being treated.

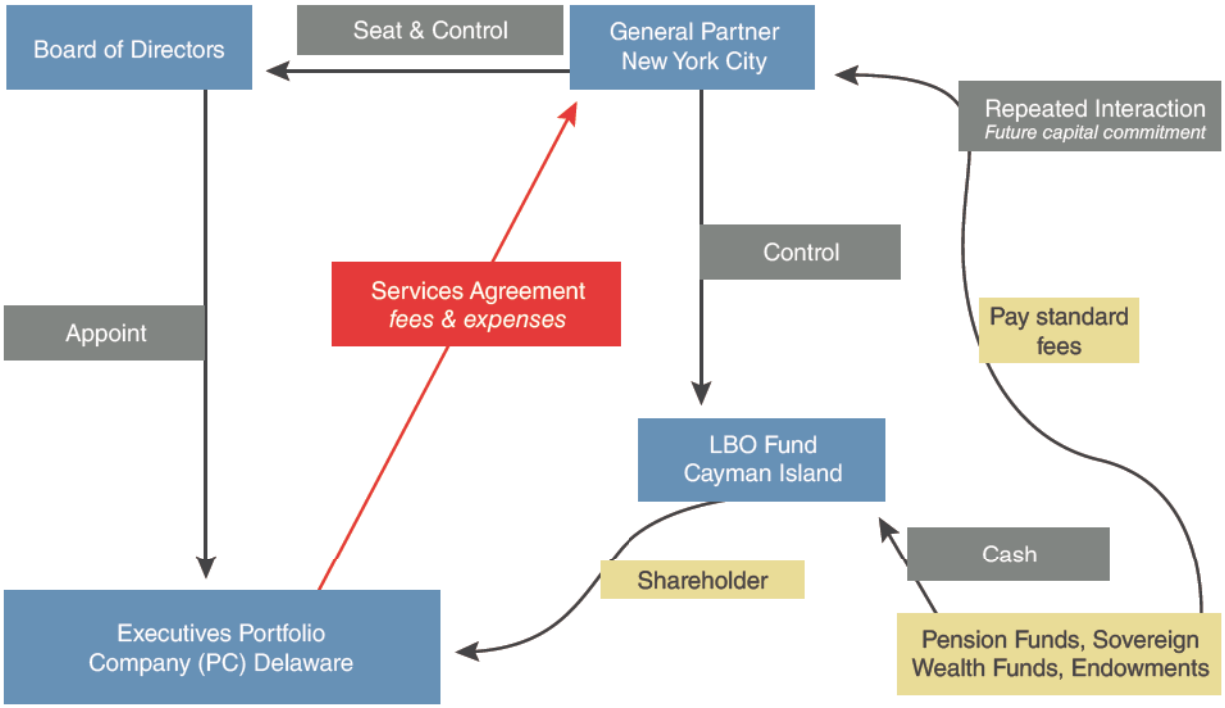
trades, purchases, or sales. Some of the costs are a function of the realized performance of the investment strategy. While there is debate about what legally constitutes a "fee", the Commission's purpose has been to consider the costs associated with achieving returns, so all costs paid or assumed related to the service of an investment have been considered regardless of nomenclature. Internal management may not always be as low cost as indexing. Internal investment management has all of the costs associated with risk and compliance management as described above, plus the costs of internal staff, office space and the like, the costs of additional risk and analytic systems, and the costs associated with increased board supervision needed.

As a board evaluates different types of portfolio implementation, these costs must be considered. Why should fees and costs matter if we are happy with what net-of-fee returns have been? There are several reasons. First, higher fees require a higher level of confidence in the manager's skill. Second, fees and costs influence the alignment of interests. Finally, the board and staff make decisions about the future and not about the past. Historical performance is only useful to the extent that it informs expectations about future returns. Future net-of-fee returns are not known, but fees and how they relate to gross-of-fee returns and the risks that will be taken to generate them can be understood.

Risk. To achieve the same net-of-fee return,[20] when fees and costs are higher, the gross-of-fee return needs to be higher. If, as is reasonable to assume, these higher gross-of-fee returns are associated with higher idiosyncratic risk, then the higher fees also imply higher risk for the same amount of net-of-fee return. In other words, the only way to justify a higher fee manager on a risk adjusted basis is to have more confidence in the consistent success of the strategy.

Alignment of Interests. Fees and other costs of active investment management have the potential to introduce conflicts of interest. For example, conflicts associated with bundled brokerage are discussed in Chapter VIII: Cost-savings Analysis. Investment managers who earn fees as a percentage of assets managed have incentives to gather assets which may not be aligned with optimizing performance. Performance fees do not share downside risk. Few benchmarks, hurdle rates, or performance fees are truly risk-matched to the strategy. The following image provides an illustration of areas for potential conflicts of interest in private equity.

Figure 32: Potential for conflicts of interest in Private Equity



Source: Ludovic Phalippou[lxx]

[20] *This refers to returns in excess of what can be earned by a similar risk liquid markets index portfolio.*

Fee Negotiations. Even when an active management strategy is deemed to be worth the risk it entails, maximizing returns (relative to risk) requires skillful and knowledgeable negotiation of fee structures. Fee structures vary enormously, particularly in private markets investments. As Steve Nesbitt, Chief Executive Officer of Cliffwater, LLC testified to the Commission at the October 2018 hearing:

> ***Fee components and levels are spelled out in a private equity partnership agreement. These are negotiated between managers and investors before the partnership is activated. So again, there is an active negotiation of fees, it happens when the partnership is originated. Large state pensions have historically played an active role in negotiating private equity partnership fees and terms and are not simply price-takers** [emphasis added].*[lxxi]

In choosing a fee structure, the total costs of an investment strategy under different performance scenarios must be evaluated, as well as how the terms impact incentives and/or create conflicts of interest. For example, lowering an asset management fee rate in exchange for a higher performance fee may or may not be wise. It will depend on the expected return of the strategy, the hurdle rate and catch up terms, the level of performance fees and asset management fees, amongst other considerations. To illustrate, consider a 10bps reduction in an asset management fee in exchange for a 10% performance fee (with no hurdle rate). When gross returns are just 1% or more, the savings on the investment management fee is swamped by the increased cost from the performance fee. This example also shows that even "agreements with zero base management fees, and the investment manager only gets his share of the profits generated"[lxxii] may or may not be good as a 10bps asset management fee with no carry is preferable to zero asset management fee and 10% carry for any manager worthy of being hired.

PSERS FEE RENEGOTIATION EXAMPLE

In its response to a Board resolution on management fees, PSERS asserts it will save costs by decreasing "the guaranteed fees, or base fees, in exchange for a profit-sharing arrangement on returns above a negotiated benchmark."[lxxiii] While details of the fee terms were generally not disclosed, there was one example given for a commodity manager: (page 19).

> *We also renegotiated the alpha investment manager's contract to reduce the base management fee from 95 bps to 65 bps. In exchange, we increased the profit share from 22.25% of profits above the base management fee to the higher of 29% of the profits or 65 bps (the base management fee)*[lxxiv]

Using this information, the breakeven between the fee structures is calculated to occur at a gross return of 10.94%. Assuming the alpha manager's expected gross return is less than 10.94%, this would be a true cost-savings. However, the cost-savings are not likely to be the entire 30 bps.. The manager must generate more than a 10.2% gross return to produce a net return equal to the actuarial expected rate of return for the portfolio (7.25%). At that 10.2% gross return, the fee savings from this fee changewould actually be 5bps, not 30bps. In general, any estimated savings that ignore the increased costs associated with performance fees, likely significantly overstate cost-savings.

Overview of Investment Costs at SERS and PSERS

Reported costs for the $29.3 billion SERS portfolio in calendar year 2017 mainly consisted of $135 million of investment expenses and $26 million of administrative expenses, as detailed below. Reported costs for the $52.4 billion PSERS portfolio in fiscal year 2016-2017 consisted of $475 million of investment expenses and $45 million of administrative expenses. When including an estimated $577 million of carried interest for fiscal year 2016-17,[21] estimated total investment expenses for PSERS – or the amount ultimately retained by investment managers – exceed $1.03 billion – an amount greater than the $1.01 billion in all employee contributions for the same period.

[21] *Carried interest reported by calendar year; therefore, an average was calculated.*

Figure 33: SERS Expense Overview, 2017

PENSION ADMINISTRATIVE & INVESTMENT EXPENSES	
	TOTAL REPORTED EXPENSES
Private Equity	$63,144
Global Public Equity	21,552
Real Assets	20,392
Multi-Strategy	9,433
Fixed Income	9,176
Hedge Funds	2,844
TOTAL MANAGER INVESTMENT EXPENSES	**$126,541**
Investment Consultants	3,597
Investment Professional Personnel	2,864
Custodian	1,302
Legal	369
Subscriptions and Memberships	296
Operational	110
TOTAL INVESTMENT EXPENSES	**$135,079**
Administrative Expenses	26,122
TOTAL ADMINISTRATIVE & INVESTMENT EXPENSES	**$161,201**
Note: Refunds of $15,820 not included	*All amounts in thousands*

ASSET ALLOCATION & APPROX. EXPENSE RATIO		
	VALUE	EXPENSE RATIO
Private Equity	$4,044,500	1.55%
Global Public Equity	15,505,300	0.14%
Real Assets	2,207,400	0.92%
Multi-Strategy	2,121,400	0.44%
Fixed Income	4,238,200	0.22%
Hedge Funds	191,000	1.49%
Cash	948,400	
TOTAL	**$29,289,200**	

Source: SERS 2017 CAFR

Figure 34: PSERS Expense Overview FY 2016-2017

PENSION ADMINISTRATIVE & INVESTMENT EXPENSES				CARRIED INTEREST	
	BASE	PERFORMANCE	TOTAL	16-17 AVERAGE	TOTAL W/ CARRIED
Domestic Equity	$1,494	$1,490	$2,984		$2,984
International Equity	19,771	5,392	25,163		25,163
Fixed Income	87,464	21,061	108,525	81,000	189,525
Real Estate	50,609		50,609	160,000	210,609
Alternative Investments	102,714		102,714	336,000	438,714
Absolute Return	78,202	50,784	128,986		128,986
Commodities	4,132		4,132		4,132
Master Limited Partnership	8,295	238	8,533		8,533
Risk Parity	19,632	3,466	23,098		23,098
TOTAL EXTERNAL MANAGEMENT			**454,744**	**577,000**	**1,031,744**
TOTAL INTERNAL MANAGEMENT			**12,787**		
Custodian Fees			2,476		
Consultant and Legal Fees			4,484		
Total Investment Expenses			**474,491**		
Pension Administration Expenses			45,127		
Total Pension Administrative & Investment Expenses			**$519,618**		
Note: Post-employment healthcare of $39,310 not included				*All amounts in thousands*	

ASSET ALLOCATION & APPROX. EXPENSE RATIO		
	VALUE	EXPENSE RATIO
Domestic Equity	6,910,141	0.04%
International Equity	4,243,439	0.59%
Fixed Income	18,660,470	1.02%
Real Estate	6,146,728	3.43%
Alternative Investments	7,909,926	5.55%
Absolute Return	5,082,149	2.54%
Commodities	4,052,402	0.10%
Master Limited Partnership	2,369,627	0.36%
Risk Parity	1,055,092	2.19%
Infrastructure	5,038,035	
Financing	(9,070,910)	
TOTAL	**52,397,099**	

Source: PSERS 2016-2017 CAFR, PSERS Carried Interest Presentation, October 2018.

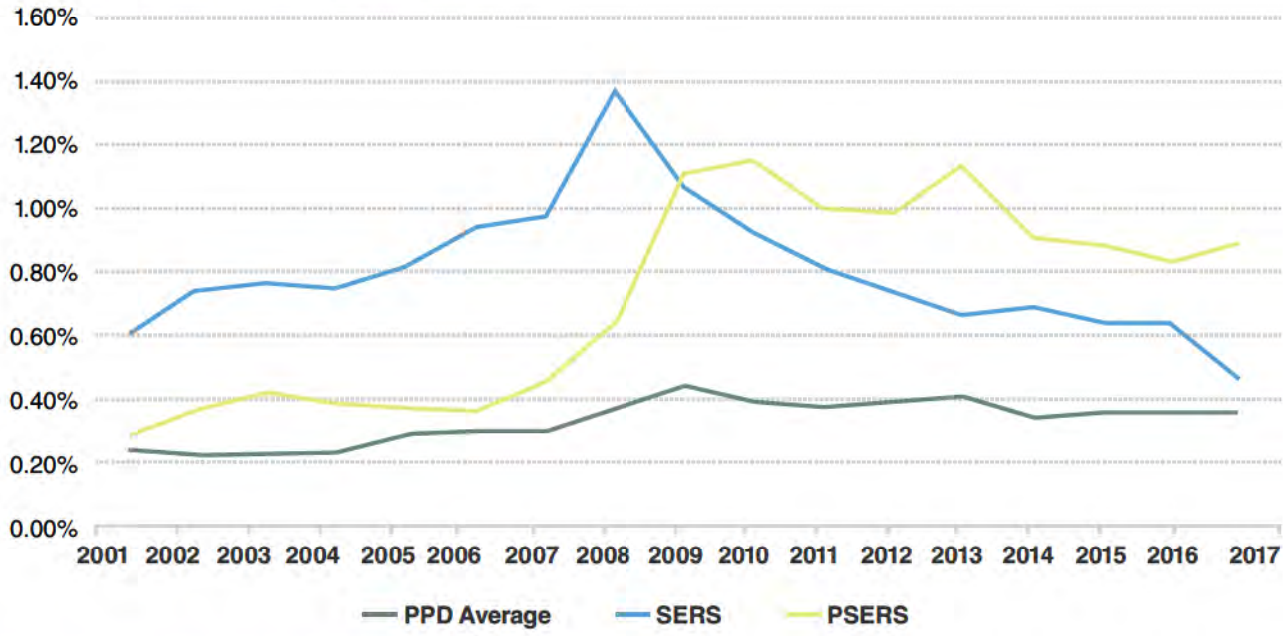
Investment Expenses

Concerns about the increasing expenses for managing public pension plan investments were elevated to Pennsylvania's elected leaders in an April 2017 report that showed PSERS had the 6th highest investment expenses in the nation and SERS had the 9th highest out of the 73 largest plans (based on 2015 data).[lxxv] A year later, PSERS was reported at 8th highest and SERS at the 16th highest (based on 2016 data).[lxxvi] While it is difficult to precisely compare reported expenses among differing public funds, the simple underlying fact remains: SERS and PSERS have higher investment expense levels than most comparable funds, and the difference is especially stark at PSERS. As JP Aubrey of Boston College, during his presentation in front of the Commission in July, stated: "Our estimates for Pennsylvania were closer to 70 to 80 basis points, so they were at the very high, very high end of the average fee paid over the whole period."[lxxvii]

The following chart shows how the investment expense ratios for SERS and PSERS have changed over time, compared to the average expense ratio of all plans on the Boston College Public Plan Database. Notably, **SERS has made significant and commendable progress in reducing investment expenses**.

Investment expenses at SERS decreased over 50% from $310 million in 2008 to $135 million in 2017. At first glance, the savings could be attributed to a nearly 50% reduction in the allocation to alternative investments – saving nearly $60 million in investment expenses alone. What is both notable and commendable is that public equity investment expenses decreased 75% while the allocation to public equity more than doubled. The total dollars saved in public equity markets totaled $67 million and exceeded those saved in alternative investments. This was accomplished through the increased indexing of public equity investments. Please see Chapter VIII: Cost-saving Analysis for additional information on how these investments performed.

Figure 35: Estimated Investment Expense Ratio



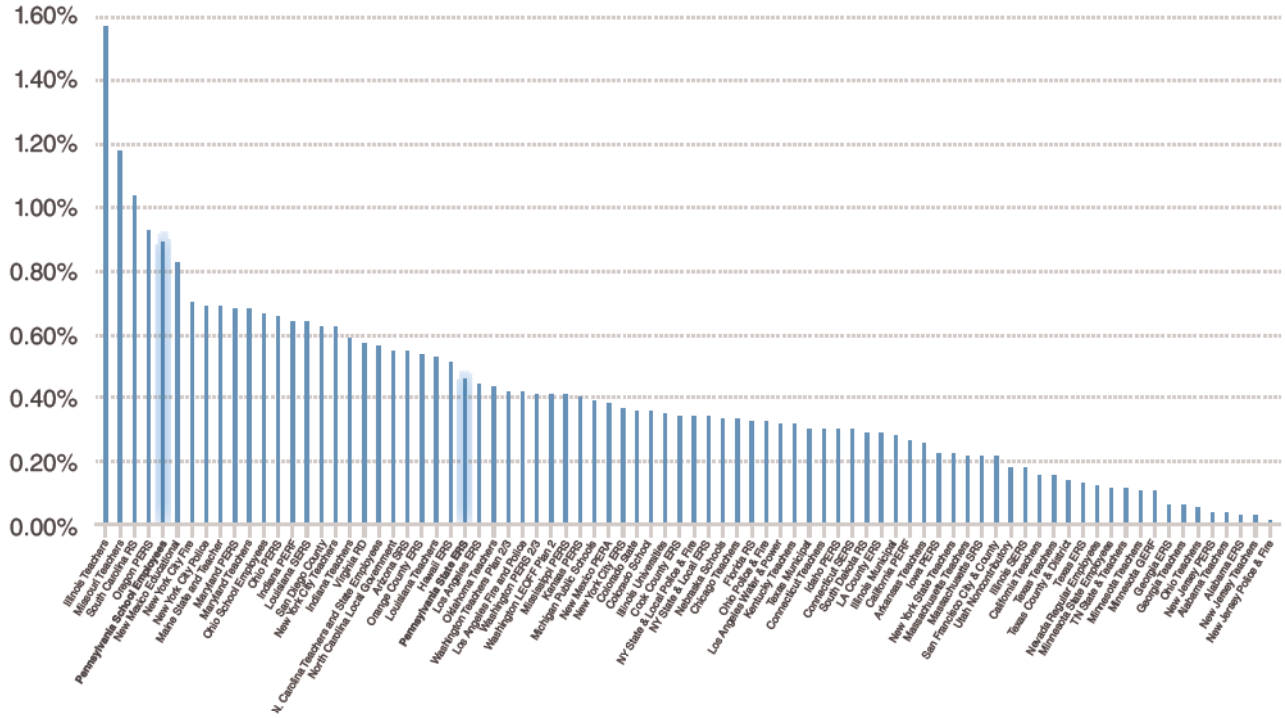
Source: Analysis of Boston College Public Plans Data, 2001-2017.

Costs Compared to Peers

An analysis of peer public pension plans with assets greater than $10 billion from the Boston College Public Plans database supports the findings of the April 2017 report and subsequent update (which used 2015 and 2016 data, respectively). Additionally, as of the 2017 fiscal year SERS ranked 27th most expensive out of a peer group of 82 funds in investment expenses expressed as a ratio of total investment expenses to net market

assets. PSERS ranked 5th most expensive – a concerning placement among peers that has remained relatively consistent over the past three years and between the different peer groups.[lxxviii]

Figure 36: Estimated Investment Expense Ratio, Plans above $10 billion in assets.



Source: Analysis of Boston College Public Plans Data, 2017 data.

Inconsistency in Reporting of Investment Expenses

Certain funds cite inconsistencies in the reporting of investment expenses as an explanation of their reported high cost among peers (please see Chapter II: Transparency). In a November 2018 guest piece for investment industry website top1000funds.com, PSERS staff wrote: "PennPSERS is one of the most transparent pension funds in the US regarding disclosure of management fees. For example, certain pension funds report little to nothing in management fees for alternative investments because they are considered part of the cost of the investment and are netted against performance rather than shown separately."[lxxix] However, if PSERS were to report zero management expenses for fixed income, alternative investments, and real estate, total investment expenses would still total $234 million for fiscal year 2016-17 and PSERS' rank would change from 5th most expensive to 27th most expensive, slightly less expensive than SERS at 25th. In other words, PSERS could hypothetically reduce total investment expenses 50% and still remain amongst the top third most expensive plans. The transparency of PSERS' management expenses for fixed income (High Yield), alternative investments, and real estate is not the sole cause of its appearing as high cost.

Please see the Chapter VIII: Cost-saving Analysis of this report for a deeper and targeted analysis of investment management costs for managers and asset classes at SERS and PSERS.

Administrative Expenses

Administrative expenses include the personnel and operating costs of running the pension system, such as office space, legal fees, postage, phone systems, and technology. On an absolute dollar basis, SERS and PSERS appear to have high administrative expenses. Of 73 plans on the Public Plans Database with assets greater than $10 billion where data were available, SERS' $26 million ranks it 16th most expensive and PSERS' $45 million

of administrative expenses ranks it as the 7th most expensive. When based on cost per member – a commonly-used, yet not all-inclusive way to normalize costs – SERS' per member costs of $109.18 ranks as 27th most expensive and PSERS' per-member cost of $88.40 ranks as 36th most expensive. Again, while the actual ranking may be reasonably disputed, the underlying premise remains valid – that SERS' and PSERS' administrative expenses are higher than most comparable plans.

As is the case with investment expenses, there is potential that some administrative costs are reported differently between plans. The Commission's primary focus was on investment performance and costs; the administrative costs of SERS and PSERS as it relates to peers on an absolute basis suggests that further analysis is warranted. Please see the Chapter IX: Consolidation of Investment Operations for specific analysis and recommendations for SERS and PSERS to reduce investment and administrative expenses.

Managing Liquidity

As a board assesses different portfolio implementations, in addition to costs, liquidity must be evaluated, monitored, and managed. While pension funds are long-term assets, liquidity still matters. There are several reasons that liquidity is valuable. First, liquid assets are needed to pay expenses, including benefits. Second, one of the payoffs to diversification is achieved by being able to rebalance a portfolio's allocations back to the desired targets. When stock market returns are poor and values are depressed, for example, other liquid investments can be sold to fund purchases of these now-cheaper assets.

This is not just an academic matter. Institutional investors that have ignored liquidity have suffered. As Steve Nesbitt of Cliffwater testified to the Commission:

> ***If I may briefly go back to the subject of asset allocation and speak to the issue of private equity and liquidity management, which has generally been overlooked in asset allocation. Trustees learn from the Global Financial Crisis that asset allocation targets to private equity and private assets more generally need to take account of cash flow needs of the pension system and the potential for large variances in actual versus target allocations during downturns. Prior to the Global Financial Crisis, many endowments, including large endowments like Princeton and Stanford, had outsized allocations and unfunded commitments to private assets well exceeding 50 percent of their total assets. The crisis forced these and other endowments into potential distress sales of their illiquid assets and unfunded commitments to meet then current spending needs. Fortunately, distressed sales were largely averted as capital markets rebounded and private asset managers delayed calling on committed capital. But the experience was a lesson learned . . .*** [lxxx]

To the best of our knowledge, PSERS' current allocations and unfunded commitments to private assets are over the levels that caused Stanford University and Princeton University trouble. Based on the footnote to the June 30, 2018, Moneyline Report, PSERS has 18.1% in unfunded capital commitments and 43.1% in private investment structures giving a 61.2% exposure.[lxxxi] The liquidity problem Nesbitt describes is worse for underfunded pension funds such as Pennsylvania's than for endowments. Pension funds' benefit payments do not decrease when pension assets decrease. In fact, as a percentage of the assets, they increase. Moreover, history indicates that contributions from the employer become less certain in financial crisis. As a PSERS official testified to the Commission:

> ***At the bottom, towards the bottom of the market, what we were facing was an uncertain funding future, right? We knew at the time we were being severely underfunded, the ARC. Obviously [...] we've gone through three years in a row, but to this point [...] I guess I'm not going to be comfortable until I see it through a recession, whether the contribution rate will be maintained, right? So, we're at the best of times from an economic standpoint, and we're meeting the ARC. I'm more interested in what's going to happen in the worst of times when the, you know, need for government spending will increase, the tax revenue will fall, and then you're going to have to figure out how to balance that budget. I'm not 100 percent convinced what that's going to look like.*** [lxxxii]

Endowments, by contrast, generally only need to distribute 5% of their assets – an amount that decreases when their assets decrease.

Illiquidity comes from many sources. First, even when the underlying securities are themselves liquid, the pension fund may only have access to the strategy by committing to a legal structure that limits their rights to withdraw assets quickly. Hedge funds are examples of such structures, and often the general partner is legally permitted to restrict withdrawals (impose gates) when too many investors want to redeem at once – an event that happens when liquidity is most valuable.

Second, private investments – for example, private buyout equity, private equity in venture capital, private debt investments, private real estate equity and debt – share a common feature – illiquidity. The investments are typically made through a partnership structure where the pension fund is a limited partner, with limited rights and limited liquidity.

Finally, these structures typically involve commitments of capital that can be requested by the general partner at any time during the investment period. Amounts committed but not yet funded (unfunded capital commitments or unfunded commitments) represent a significant liability that must be included in calculations of required liquidity. While institutional investors attempt to model expected cash flows from private markets investing, the pacing of capital calls and distributions is far from predictable. The recent rise of the use of subscription lines of credit by general partners makes this risk worse. These are loans by a bank to the partnership that are collateralized by the partner commitments. In a financial crisis, banks may withdraw[22] those loans, forcing general partners to call capital quickly to fund investments already made. Monitoring the use of these lines of credit is important for understanding liquidity as well as understanding performance as discussed in a separate chapter. Internally managed direct investments or co-investments in debt or equity securities that are not traded on a public market are also illiquid.

While secondary markets for private investments and limited partnership interests have been developing, a pension fund will typically only be able to sell their illiquid investments at very substantial discounts from current valuations, particularly when global liquidity is most valuable.

The use of leverage also affects required liquidity. First, leverage may introduce cash flow needs. When a pension invests in a total return swap on the S&P 500, for example, while there is little or no money allocated at the outset, the fund is obligated to produce cash to fund losses as they occur. Futures contracts are similar, with mark-to-market happening daily. Second, all else equal, leverage causes the volatility of the liquid assets to increase. Can that volatility be tolerated when the liquid assets are needed to fund cash flows and to rebalance the portfolio?

PSERS' CIO testified to the Commission about PSERS' liquidity problems during the Great Financial Crisis of 2008:

[22] *Some general partners negotiate term subscription lines of credit, where the bank does not have the right to call the loan. The size of this issue is not known.*

> ***When you look back, you know, through our history, coming into the Great Recession, we probably looked similar to a lot of other pension plans, very heavy in equities, say about 70 percent, 30 percent in fixed income. When we entered the crisis, assets fell significantly. You know, we probably top ticked assets around $70 billion and we fell down to about $40 billion. And that was just an indication of the risk profile that the fund was taking. We had 70 percent in equities. Equities were cut in half...***
>
> ***Our cash flow went to about negative eight percent of assets... So if the fund grew zero in that next year, we would have eight percent less in assets. And if you went through a period, a long protracted period of sort of no returns, or God forbid, you had another drawdown after that, we ran into issues where solvency could become an issue.***
>
> ***So we stepped back and we said that we really couldn't accept that 70/30 type risk profile anymore. It was way too risky.***[lxxxiii]

As noted above, PSERS risk reports are difficult to interpret, as it is difficult to know whether the risk from leverage and risk parity is fully reflected. judging solely on the basis of the ratio of return-seeking to risk-protecting liquid assets, and without having access to all the necessary data to evaluate, stakeholders should consider whether the risk profile of PSERS' liquid portfolio today may be, in fact, riskier than before the 2008 financial crisis:

Figure 37: PSERS Liquidity

PRIVATE/ILLIQUID ASSETS		**61.2%**
	Private Equity	14.1%
	High Yield/LP Structure	9.0%
	Real Estate	9.7%
	Absolute Return	10.3%
	Unfunded Commitments	18.1%
LIQUID ASSETS EXPOSURE		**69.3%**
	Public Equity	21.0%
	Investment Grade Fixed Income	8.6%
	Emerging Markets Fixed Income	0.6%
	Inflation-Linked Fixed Income	14.5%
	Commodities and Infrastructure (some is illiquid)	14.7%
	Risk Parity	9.9%
NET LEVERAGE		**(12.4%)**
Liquid Assets	Not including Unfunded Commitments	56.9%
Liquid Assets	Deducting Unfunded Commitments	38.8%

Source: Analysis based on data from Moneyline.[lxxxiv]

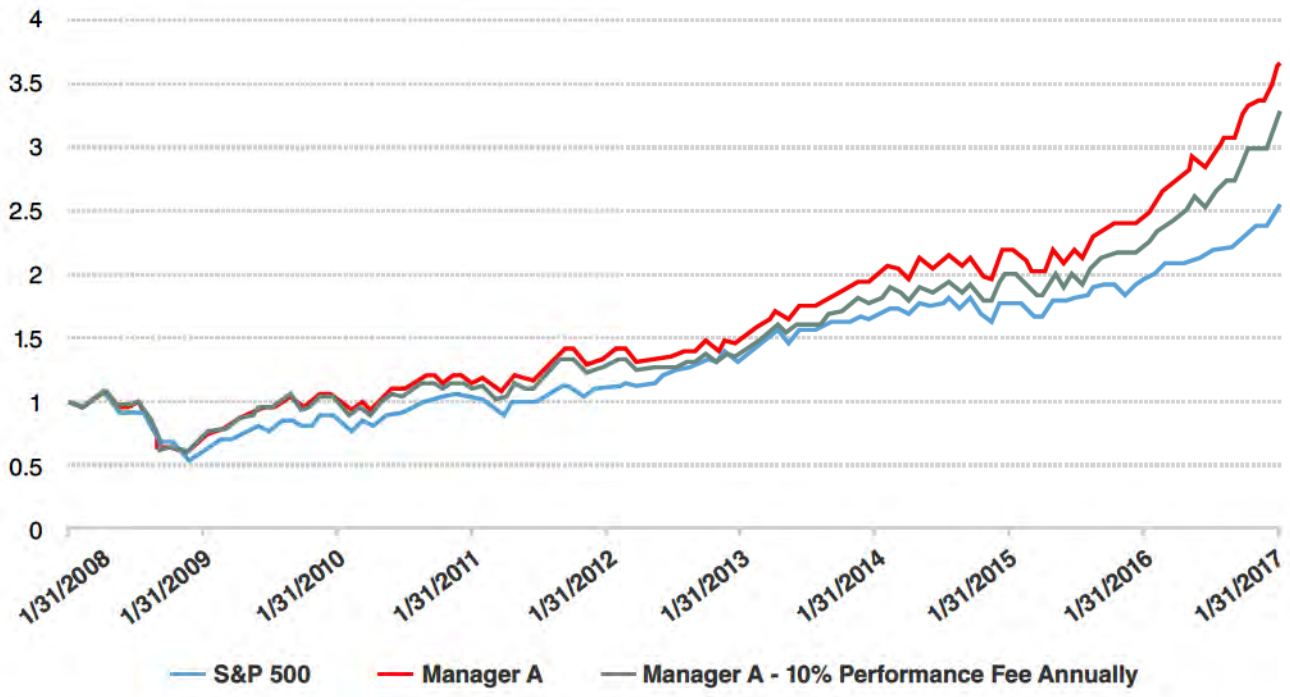
Its only possible to pay benefits and operating costs, fund commitments, pay financing, fund losses on financed positions, and rebalance a portfolio with liquid assets. Therefore, the riskiness of the liquid assets is an important number to monitor. As such, public equities plus the public equity exposure of risk parity, last reported at the full 9.9%, would be 30.9%.[lxxxv] As a ratio of just the net liquid assets, PSERS has between 54% and 79.6% in equities, depending on how the unfunded commitments are treated. The size of the negative cash flow in a crisis (the benefit payments described by PSERS CIO in testimony) is closer to 10% as a percentage of these liquid assets. If accurate, such a combination of illiquidity and leverage is concerning and warrants attention.

Manager Selection. If active management is used, it should only be employed if there is great confidence that it is "worth it". There is always the option to invest in low fee, highly liquid market indices. As Craig Lazzara, Managing Director and Global Head of Index Investment Strategy at Standard & Poors Dow Jones Indices testified to the Commission in September 2018, there are low cost indices for many styles of investing to allow a pension fund to have the risk profile that they desire.[lxxxvi] It is not just the S&P 500. An active management strategy must be evaluated relative to its alternatives, taking into account costs and liquidity and additional risk.

PSERS writes that their "first job is to hire the best institutional managers we can find."[lxxxvii] Identifying managers is not the "first" task of implementing a portfolio according to best practice. Investment staff should never hire an investment manager unless there is great confidence that they are worth their fees – that they will earn returns net of all costs that exceed those available from risk equivalent public markets index exposures. Without being explicit about the systematic risk exposures of the manager's investment strategy, and the other risks and costs associated with managing it, it is impossible to judge how worthy the manager is. The view that in investment management, "you get what you pay for," is unsupported and risky, and could easily lead to high fees and low performance.[lxxxviii] Higher fees do not guarantee higher performance and evidence and logic indicates it is more often the reverse. In fact, as is shown in Chapter VIII: Cost-savings Analysis of this report, in one category, PSERS' least expensive manager is its best performing.

A manager and the associated investment strategy must be evaluated on (1) what portion of the diversified portfolio benchmark is replaced, (2) what additional risk the strategy introduces, (3) the expected excess return net-of-fees that is earned relative to a public markets index exposure to the same systematic risks, and (4) the costs associated with those excess returns. There are many investment strategies, available at high fees, that appear to "outperform" simply because they take on different risk. Investors who wish to take on different risk profiles should do so explicitly, and the default option should always be to do so at low cost.

Figure 38: Manager Selection



Source: Analysis using data from S&P Dow Jones Indices and Bloomberg.

The previous chart is the wealth index generated by Manager A. The orange line is the gross-of-fee wealth index and the grey line is after deducting the 10% annual performance fee. Manager A outperformed the S&P 500 by 3.8% per year for the last 10 years gross-of-fees and by a still "respectable" 2.4% per year net-of-fees. Without further analysis, Manager A might be considered "clearly worth their fees" exceptManager A is simply the index returns of the S&P 500 IT Sector so paying any fees for those returns, if manager A was investing in the IT sector, would in fact be poor execution.Choosing active management requires several assumptions. (1) That alpha exists: that it is possible to create true persistent returns above those of an investable index, adjusted for systematic risks and illiquidity – true "alpha." (2) That the pension fund has processes to capture that alpha without taking on too much additional risk – either through internal management or through selecting external managers who can do it and negotiating a fee structure with them such that enough of the alpha is earned by the pension, compared to the risk taken. (3) That the board has sufficient skills, risk controls and compliance procedures to manage the increased complexity and risk that this activity entails.

David Swensen, the Chief Investment Officer of Yale University's endowment, has written and spoken on many occasions about the challenges of doing this well.

> ***At the active end of the spectrum, you've got institutions like Yale and Harvard and Princeton and Stanford and others, who've really built high-quality investment teams that have a shot at making consistently good active management decisions. But there's a vanishingly small number of such investors. Those on the passive end of the spectrum have figured out that they don't know enough to be active. The passive group is not nearly as big as it should be. Almost everybody should be there.***[lxxxix]

As discussed in the next chapter, data and logic show that active management generally underperforms indexing in public markets. It warrants repeating here, that foregoing active management is not the same as investing in the simple portfolio benchmark that is merely a stock index and a bond index. Some sophisticated asset allocation approaches, even including versions of risk parity, can be implemented with low cost, highly liquid, diversified investable indices.[xc]

Private Markets. While there is momentum towards indexing for large capitalization equities, there is still resistance to apply the logic and data to markets that are considered less efficient, particularly private markets. While a complete review of private markets investing could not be completed by this Commission, we note here that private asset investing involves the highest levels of costs – both the direct costs from the investment manager and the costs to properly understand and manage the risks associated with them.[23] Moreover, they are illiquid for long periods of time, so decisions made today often cannot be undone – or even fully evaluated – for 10-15 years. As discussed in the performance evaluation chapter, proper rigorous analysis of private investment performance is extraordinarily difficult but at the same time critical to success.

This is particularly true in Pennsylvania, whose two state-run plans have higher than average allocations to alternatives, according to a recent analysis of statewide pension plans. In 2016, PSERS had the highest allocation to alternatives in the nation at 56% and SERS ranked #22 at 32% – both above the national average of 26%.[xci] In the discussion that follows, we outline important concerns that warrant further study and analysis before the pension funds continue adding commitments to these types of investments.

Private investment opportunities exist in all types of markets: equity, debt, real estate, commodity, infrastructure, etc. The common feature of most of these investments is the limited partnership structure,

[23] Some suggest that the only method to achieve the desired actuarial rate of return is to invest in private markets securities. Leaving aside whether the actuarial rate of return should drive investment decisions, there are other means for increasing the expected return of a portfolio. As discussed in the section about risk parity, leverage can be used, even with liquid securities, to increase the level of expected rates of return. SERS and PSERS have very similar expected rates of return, as reported by their consultants, but very dissilimar asset allocations. Moreover, as discussed in this section, it is unclear whether prospective private markets net-of-fee returns are going to be attractive relative to public markets, particularly risk-adjusted.

whereby the pension fund (the limited partner) commits capital to a partnership that the general partner controls and on which the general partner collects asset-based and performance-based fees, amongst other compensation. Investments are illiquid for multi-year periods. In addition, the general partner has the right to call the capital that has been committed at any time and distributes the capital as investments are realized, introducing significant cash flow uncertainty.

Within private equity, much like public equity, there are many different categories with different risk profiles. Private equity includes investments in startups and early stage companies through venture and growth capital, and buyouts of more mature and/or larger capitalization companies. Some private equity managers have a specific industry or geographic focus to their investments. These risk profiles must be understood and evaluated. Hamilton Lane produces a "Periodic Table of Returns" which show how style drives return differences within a vintage year.[xcii] To compare (without risk adjusting) returns of a private equity manager that has invested in, for example, technology and software companies over the last 10 years to the average private equity manager will almost always cause that particular private equity manager to appear attractive.

An allocation bucket for any type of private markets has inherent dangers. With an allocation bucket, investment staff are implicitly directed to source and invest with the "best" private managers currently raising a fund in order to maintain the allocation, rather than only investing in a private investment vehicle when there is compelling evidence that its manager will, cost and liquidity risk adjusted, outperform appropriately chosen public market index exposures. As PSERS writes in its response to the management fee resolution:

> ***Non-traditional asset classes are those that only offer active management to implement, such as private equity and absolute return. The decisions to invest in these asset classes are made by the Board when the asset allocation is set. PSERS Investment Professionals then find appropriate investment manager(s) to implement this portion of the asset allocation.*** [xciii]

Private markets investing is reminiscent of some aspects of active public markets investing in the 1960s – a lack of well understood, risk-adjusted performance measurement, a lack of disclosures on fees and costs, a lack of a commonly accepted low-cost liquid alternative, and incentives for fee earning investment managers and consultants to produce data professing "alpha." Given this, it is not surprising that there is conflicting evidence on what level of alpha exists in private markets.

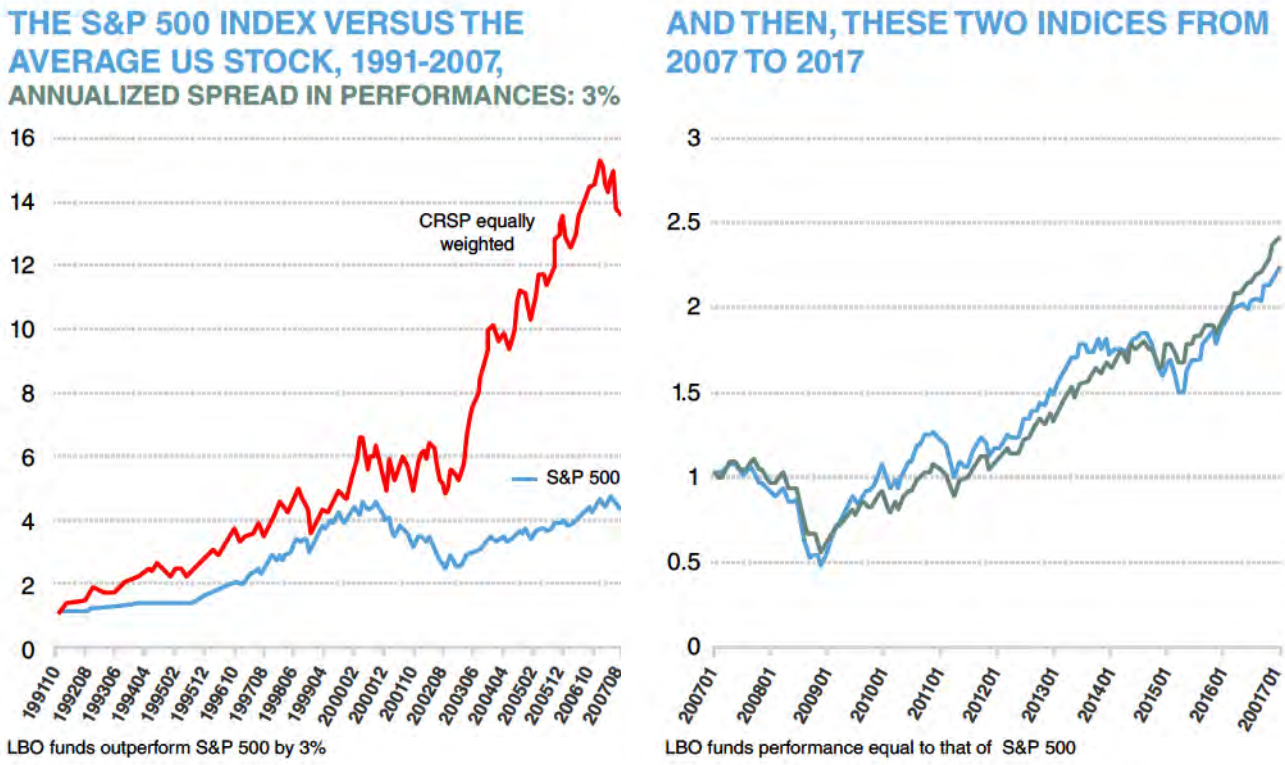
The legal structure itself does not magically endow investments inside it with risk premia. A public company that is taken private does not magically have more value. The legal structure does create more risk for the limited partner – illiquidity, lack of transparency and control – but it does not guarantee or create excess returns.

As Professor of Finance at Said Business School, Oxford University, Tim Jenkinson testified to the Commission in September, private equity is "really just an alternative way to get equity returns and should be judged against equity returns."[xciv] The question is whether there is some unique information or operating advantage that should enable the average private company to outperform the average public company. Jenkinson testified on the increased proportion of equity assets that are in private markets.[xcv] It is unclear what this means for investors. An owner of a company (consider Uber) chooses whether to raise needed/desired capital from public markets or from private markets. Among other factors, if private markets will value the company as highly or higher than public markets, then owners may choose to raise money privately. Therefore, it is unclear if the increased size of private markets reflects value for investors, or if it in fact reflects the opposite.

Research by Ludovic Phalippou suggests that, historically, outperformance of the average private company has largely accrued to the investment manager or operator and not to the asset owner. The average net returns of

private equity have essentially matched the return of the average stock.

Figure 39: Average PE Returns Now Match Average Stock



Source: Ludovic Phalippou, September 2018.[xcvi]

Prospectively, it is even less clear whether private equity returns net-of-fees will deliver the returns investors are forecasting. Hedge funds in the 80s and 90s were able to take advantage of the lack of capital that would permit the use of leverage and short securities. As a result of this lack of capital, there were arbitrage strategies that offered high returns for the level of risk taken. Returns to hedge funds during those decades were very attractive. As a result, institutional investors relaxed their constraints and started to invest in these strategies. With the added capital, the expected return per unit of risk declined. Returns to the average arbitrage strategies have been risk appropriate, at best, since then. It is possible that a similar trend is occurring in private equity – institutional investment in private equity has increased over the last 30 years, and there is a much smaller difference today between private markets purchase price multiples of earnings compared to those in public markets. As Jenkinson testified to the Commission:

> ***…anybody looking at those charts will see that that premium has been falling over time and has been getting, you know, closer to one. So, it's, you know – there's no doubt that I think that as competition and growth in the sector has happened, people have been attracted to this sector. The returns have come down. And that's what we expect. That's what you expect in any asset class. That's what we've seen in hedge fund, some real estate funds, and others. The competition and growth tends to limit returns.***[xcvii]

He continued later, "There's no doubt the private equity premium has been falling over the years."[xcviii] Thus the future median return in private equity gross-of-fees may be much closer to public markets. As a result, net-of-fees returns could be extremely disappointing given the level of fees charged, and certainly not worthy of all of the additional monitoring costs and illiquidity.

Much like the proponents of active management in public markets, proponents of private equity point to the large dispersion of returns realized as evidence that it should be easy to outperform the median. However, the large dispersion is likely more reflective of the differences in the risk profiles of the investment strategies considered in the bucket – including different levels of manager-employed leverage – and the difficulties of comparing and evaluating private investment returns as will be discussed in the Performance Evaluation chapter. Consistent with the above, McKinsey has found that there is almost no persistence of top quartile funds.[xcix] Moreover, portfolios such as the ones constructed at SERS and PSERS are diversified across so many managers and therefore underlying portfolio companies that they may simply own systematic risk, paying high costs and bearing illiquidity for it.

Co-investing. Co-investments are a special type of private markets investing whereby the pension fund invests in a single security alongside an external investment manager. These investments are often made at lower or no asset management fees and at lower or no performance-based fees. Fees on co-investments are not pooled or netted – when charged, performance fees on successful co-investments are not offset by the poor returns on unsuccessful co-investments.

Again, it is unclear from the data whether co-investments, even considering the lower fees, outperform the net-of-fees returns from the manager's pooled vehicles. There is no fee low enough to offset bad investment returns. And, in this context, a bad investment is simply one that does not earn a return commensurate with what can be earned from a (risk-equivalent) public market index.

In addition, co-investing requires internal investment staff to conduct rigorous evaluation of and to be able to manage an individual investment and for their board to be resourced to supervise it. Co-investing typically involves exposure to a specific investment that is larger (as a percentage of the pension fund's assets) than exposures to other individual investments (greater idiosyncratic risk) and can involve "hands on" expertise, particularly if the investment underperforms and the general partner needs to be removed for any reason.

Figure 40: Performance of PSERS' Internally Managed Private Debt Co-Investment, Calendar Year Performance

	2014	2015	2016
PSERS – Internally Managed Private Debt Co-Investment	15.79	-33.14	-32.79
Benchmark: Blmbg US Corp HY	2.45	-4.47	17.13
Difference – "Value Added"	13.34	-28.67	-49.92

Source: Aon Hewitt, June 2017. (2017 not provided.)[c]

Figure 40 shows the performance of PSERS' internally managed private debt co-investment. PSERS has highlighted that this is not a diversified portfolio, that this was the beginning of a new program, and that other co-investing strategies at PSERS have performed well. However, it underscores the need for fiduciaries to understand the magnitude of financial loss possible with these strategies at the time of investment. Co-investments, even at no-fees, are still risky investments. As David Swensen, Chief Investment Officer of Yale University Endowment said:

> ***You know, I'm not a big fan of co-investments. Josh Lerner did a study – Josh is at Harvard Business School – looked at six very large programs that had been in existence for a long period of time. And the conclusion that he came to was that the co-investments, in spite of the fact that they had lower fees, underperformed the funds in which the investments were located.***[ci]

It is recommended that a new body such as this commission, with appropriate expertise, resources and time, further study data on these and other issues around private market investing more broadly, and that private markets investments be limited until there is better evidence both that private markets investing provides a risk-adjusted return above public markets and that SERS and PSERS have processes that are rigorous enough to ensure selection of above median managers, on a risk-adjusted basis.

Internal Investing. A board can delegate authority to internal investment staff to manage investments directly rather than through an index fund or an external active investment manager. Authority can be granted for public markets index investing, public markets active investing, or direct investments in private investments including the co-investments described above.

Internal investment management represents its own set of risks. Just like any other investment manager, there is risk of an adverse event within management's processes. No amount of risk control completely eliminates the possibility that something significant will go wrong. As a result, the oversight burden on the board for risk monitoring and management increases since internal staff cannot effectively monitor themselves.

While internal investing is usually lower direct cost than external management, often dramatically, it is important to recognize that some external managers have resources, networks, and expertise for sourcing, due diligence, selecting, operating and managing portfolio investments that far exceed that of the internal staff. As with any other investment strategy, and as PSERSand others have noted, lower costs are not a justification for selecting a portfolio implementation. Any implementation style must always be evaluated relative to other options, including indexing.

A special type of internal investment management is tactical asset allocation. Tactical asset allocation is temporary changes in the systematic risk exposures of the pension portfolio based on a view of current expected returns and risks. It is notoriously difficult to predict returns, and consistent with that there is strong evidence that tactical asset allocation adds risk without adding return. Examples of tactical asset allocation includes the purchase or sale of options, foreign exchange exposures, and other derivative contracts that impact the systematic risk exposures. Tactical asset allocation can also be achieved by intentionally allowing investment allocations to deviate from targets. The board should understand what tactical asset allocation decisions the investment staff makes, track how these decisions have performed, and establish clear limits to deviations from the strategic asset allocation.

Risk Monitoring, Reporting, and Compliance. An Investment Policy Statement (IPS) documents for the public and for the investment staff what the board-approved portfolio risk budget is: the volatility target, the limit on illiquidity, and downside risk limit. The IPS shows, directly or by reference, the approved allocations to liquid markets indices as well as the simple portfolio benchmark. If allocations are established as "economic exposur," then the calculations for those economic exposures must be clearly defined. What is the economic exposure of a small cap value fund compared to the S&P 500? What is the economic exposure of a small cap value fund hedged with a short position in the S&P 500? These questions also illustrate the need for there to be limits on gross long and gross short positions or exposures, particularly when leverage and/or shorting is permitted. The IPS also codifies limits on other idiosyncratic risks in the portfolio such as limits on a particular manager, industry, or company. These benchmarks and risk limits function as the basis for future performance evaluations and for risk controls and compliance checks.

Relative to the diversified benchmark portfolio, a board that authorizes any type of active management (including selecting external active managers) takes on a greater burden of risk management. The board must monitor compliance with their established risk parameters. They need to understand and control liquidity and leverage and the interaction of the two with cash flow needs. Authorizing staff to directly invest in securities increases the responsibility of the board for expert oversight. They need risk systems and reports to quickly identify and respond to problems and to monitor whether the risk borne internally stays within the limits set.

As discussed below, the audit committee of the board is responsible for verifying processes and reports.

The use of performance evaluation will be discussed in its own chapter, but decisions that cannot be changed for an extended period of time, such as making private markets investments, should receive careful consideration and be taken with considerable caution. Investment staff cannot be held accountable for decisions made by prior investment teams, but they and the board must be held accountable for the processes and decisions they do make and how those decisions will impact future investment teams.

AUDIT COMMITTEES

The duties and responsibilities of Audit Committees, public, nonprofit and governmental, in both fiscal and in other compliance matter,s have become broader in scope in the last decade.

In the PSERS' bylaws, PSERS has the duties and responsibilities of the Audit/Compliance Committee written into the Committee's description. SERS has an Audit Committee Charter. Below are some, not all, of best practices outlined by the Association of Public Pension Fund Auditors, Inc. and the Government Finance Officers Association. Many of the "best practices" below are in the PSERS' duties and responsibilities of their Audit/Compliance Committee. The SERS' charter also includes many of the "best practices" listed below.

The following notes are from the Model Audit Committee Charter endorsed by the Association of Public Pension Fund Auditors, Inc.:

The Committee has the authority to direct the Chief Audit Executive (CAE), external auditors, or consultants to conduct an audit, review, and/or investigation into any matters within the Committee's scope of responsibility. It is empowered to:

- *Seek any information it requires from employees – all of whom are directed by the Board to cooperate with the Committee's requests – external auditors, consultants, and external parties.*
- *Appoint, compensate, and oversee the work of all public accounting firms employed by the organization.*
- *Resolve any disagreements between management and the external auditors regarding financial reporting.*
- *Retain independent counsel, accountants, or others to advise or assist the Committee in the performance of its responsibilities.*
- *Approve the consultants, or others retained by the organization to assist in the conduct of an audit, review, and/or a special investigation.*
- *Meet with management, external and internal auditors, or outside counsel as necessary.*
- *Obtain information and/or training to enhance the Committee's understanding of the organization's financial reports and the related financial reporting processes.*
- *Review significant accounting and reporting issues, including complex or unusual transactions, and recent professional and regulatory pronouncements, and understand their impact on the financial statements.*
- *Hire outside experts and consultants in risk management as necessary.*
- *Approve the appointment, retention, or discharge of the external auditors. Obtain input from the CAE, management, and other parties as appropriate.*
- *On a regular basis, meet separately with the external auditors to discuss any matters that the Committee or auditors believe should be discussed privately. {Note: Subject to open meeting laws.}*
- *Review the effectiveness of the organization's system for monitoring compliance with laws, regulations, contracts, and policies and the results of management's investigation and follow-up (including disciplinary action) of any instances of noncompliance.*

Institute and oversee special investigations, as needed.

- *Ensure the creation and maintenance of an appropriate whistleblower mechanism for reporting any fraud, noncompliance, and/or inappropriate activities.*
- *Provide an open avenue of communication between the internal auditors, external auditors, management, and the Board.*

The following notes are from the Government Finance Officers Association Audit Committee Best Practices:

- *The audit committee should be formally established by charter, enabling resolution or other appropriate legal means and made directly responsible for the appointment, compensation, retention, and oversight of the work of any independent accountants engaged for the purpose of preparing or issuing an independent audit report or performing other independent audit, review, or attest services. Likewise, the audit committee should be established in such a manner that all accountants thus engaged report directly to the audit committee. The written documentation establishing the audit committee should prescribe the scope of the committee's responsibilities, as well as its structure, processes, and membership requirements. The audit committee should itself periodically review such documentation, no less than once every five years, to assess its continued adequacy.*

CONTINUED ON NEXT PAGE

AUDIT COMMITTEES (CONTINUED FROM PREVIOUS PAGE)

- *Ideally, all members of the audit committee should possess or obtain a basic understanding of governmental financial reporting and auditing. The audit committee also should have access to the services of at least one financial expert, either a committee member or an outside party engaged by the committee for this purpose.*
- *All members of the audit committee should be members of the governing body.*
- *Members of the audit committee should be educated regarding both the role of the audit committee and their personal responsibility as members, including their duty to exercise an appropriate degree of professional skepticism.*[cii]

The role and responsibilities of the Audit/Compliance Committee at PSERS and the Audit Committee at SERS (the Committees) must be independent, have an understanding of their roles and the scope of their responsibilities. Audit Committees, in addition to their financial and fiduciary responsibilities, also monitor risk, financial and otherwise, and ensure the creation and maintenance of an appropriate whistleblower mechanism for reporting any fraud noncompliance, and/or inappropriate activities. A conflict of interest policy, document retention and destruction, cyber and other security matters, disaster and recovery planning, the Board's adherence to its by-laws and internal control oversight are some of the responsibilities of a robust Audit Committee.

The Committees, consulting with management, including Internal Auditing, are solely responsible for hiring the external auditors. The external auditors – albeit, they should have a good working relationship with the system's management and staff – report solely to the Committees.

The Committees report findings to the Board; they do not report to the Board. The Committees should have independent authority. There may be times when the Committees need to direct the Board on matters of risk, compliance, by law adherence or other matters. The Committees should have "*an appropriate degree of professional skepticism.*"

The Committees "*also should have access to the services of at least one financial expert, either a committee member or an outside party engaged by the committee for this purpose.*"

The best practices listed above in the *Model Audit Committee Charter and the Government Finance Officers Association* is an abbreviated version. The Boards of PSERS and SERS and the Audit/Compliance Committee at PSERS and the Audit Committee of SERS should review these and other documents to add an independent layer of protection for the members and annuitants of the Systems.

Recommendations

- We recommend that the Boards of SERS and PSERS review their Investment Policy Statements and ensure that:
  - o There is a risk budget that specifies the tolerable volatility, downside risk, and illiquidity and the associated simple benchmark portfolio
  - o There is a diversified policy benchmark that is composed of investable index funds
  - o Systematic risk calculations are defined and targets established
  - o Idiosyncratic risk limits are defined
  - o There is a specified rebalancing policy.
- We recommend that the level of illiquidity in combination with leverage at PSERS be reviewed and addressed immediately.
- We recommend that the level of illiquidity at SERS be comprehensively reviewed and reevaluated.
- We recommend that both funds report the levels of return-seeking and risk-mitigating assets, as well as those levels for just liquid assets.
- We recommend that new risk reports be developed so that the amount of liquidity and leverage is transparent, and the allocations and systematic risks of the portfolio on a look-through basis is clear. Risk reports should identify how risk is allocated across the portfolio, specify the risks (by investment

or asset class) that are not captured in the standard deviation metric, and provide appropriate ways to measure or monitor those risks. Identifying sources of risk mitigation within the portfolio is also relevant, while quantifying how much of the risk is hedged.

- We recommend that internal investment management be limited to index investments until risk controls and compliance procedures can be verified or established that are consistent with more complex strategies. At a minimum, we recommend no expansion of internal strategies beyond indexing until this step is taken.
- We recommend both funds limit new commitments in private markets until risk controls, liquidity management and evaluations are fixed.
- We recommend that the fiduciary Boards should oversee and explicitly authorize any tactical asset allocation decisions the investment staff makes, track how these decisions have performed, and establish clear limits to deviations from the strategic asset allocation.
- We recommend that a new body such as this Commission, with appropriate expertise, resources and time, further study issues around private market investing more broadly, and that private markets investments be limited until there is better evidence both that private markets investing provides a risk-adjusted return above public markets and that SERS and PSERS have processes that are rigorous enough to ensure selection of above median managers, on a risk-adjusted basis.
- We recommend that SERS and PSERS collaborate on a detailed CEM administrative and investment cost benchmarking analysis, and make the detailed report(s) available to the public (not only the Executive Summary).
- We recommend that the Boards see an annual report on manager contracts, which identifies changing terms.
- We recommend that costs be linked to performance in a report similar to the Novarca study that identifies whether managers outperform and how much of the value they capture.
- We recommend that the General Assembly investigate the feasibility of establishing a common investment performance reporting period for both retirement systems that complements existing employer budgeting periods.

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

ACITVE AND INDEXING

IV. Active and Indexing

Active and Index Investing

> ***"When trillions of dollars are managed by Wall Streeters charging high fees, it will usually be the managers who reap outsized profits, not the clients. Both large and small investors should stick with low-cost index funds."*** - Warren Buffett, Letter to Shareholders, 2016

> ***"I am going to…go over a decision you've already made and just encourage you to keep on going until you've got it completed. And that is the movement to indexing and away from active management."*** [ciii] - Charley Ellis, PPMAIRC Testimony, October 25, 2018

The Origins of Index Investing

This chapter discusses active management and index (sometimes referred to as "passive")[24] investing in the context of public securities markets. By definition, most private market investments do not have a precise index equivalent, although this is a subject of both debate and innovation. Private markets are discussed in the "Portfolio Implementation" and "Performance Evaluation" chapters of this report.

An active investment strategy, or active management, refers to selecting and managing a portfolio's securities – actively – with the aim of producing returns that outperform those of a given market index. Index investing, or indexing, by contrast, involves investing in a set of securities to replicate as closely as possible the entire market for such securities, typically as reflected in a published market index. In this chapter, "indexing" refers to this strategy, which can be executed in several ways, whether through purchase of an index fund, creation of a separately managed account that tracks an index, purchase of an exchange-traded fund (ETF), or similar means.

Active management had its heyday in the 1950s and 1960s, when a more limited number of professional fund managers were largely competing against amateur investors, and there were not yet regulations insuring fair disclosure[25] of information. Moreover, at that time, indexing was not well understood as a strategy or as a performance evaluation tool because the seminal work of Markowitz, Sharpe[civ] and others on modern portfolio theory was just being developed and disseminated. Active asset management fees were considerable, but were generally not questioned, in part because of poor transparency to costs and the lack of good tools to evaluate performance.[cv]

[24] This terminology is controversial because while indexing is passive in that it follows the same rules as those used to construct the index, some argue that the construction of any index, or decision to invest in it, inherently have some "active" components. The important point is that indexing follows a set of rules to invest in an asset or sub-asset class as a whole that are independent of market conditions or value judgments of a manager.

[25] Regulation Fair Disclosure, also known as Reg FD, was promulgated by the SEC in August 2000. The regulation is codified as 17 C.F.R. 243. The regulation aims to level the playing field between investors and prohibits public companies from disclosing previously nonpublic, material information to certain parties unless the information is distributed to the public first or simultaneously. Reg FD eliminated one information "edge" that certain institutional investors had utilized.

"ALPHA"

Investors often refer to the "alpha" of an active management strategy. Positive alpha is considered to be good and negative alpha to be bad. Unfortunately, modern use of the term "alpha" has distorted its original intent. Alpha is often taken to mean the simple difference between the returns of a given active investment strategy and some market index, but the term originated in a much more rigorous regression analysis that accounted for the relative risk of the two strategies. Specifically, a regression of the strategy's returns (over a risk-free rate) on those of an appropriate market index can be described by the equation $r_{strategy} = \alpha + \beta\, r_{index} + \varepsilon$ and the estimated intercept, α, is the "alpha." Even more rigorously, the regression can be completed with multiple indices representing different systematic risks to account for more complex strategies. For example, a strategy that invests in corporate bonds hedged with Treasury futures should be regressed against both Treasury futures returns and the appropriate credit quality corporate bond index. When a strategy is measured against such a risk-weighted basket of systematic exposures, the alpha can then be viewed as skill. Unfortunately, the mathematics and statistics of the concept has been largely lost and without an appropriate choice and weighting of market indices, the benchmark, so-called "alpha," often does not actually reflect true value added. See the chart in Chapter III: Portfolio Implementation on Manager A.

Even though Dow had published market indices since as early as the late 1800s, and the S&P started publishing an index in 1923,[cvi] these indices had not been investable. As Burton Malkiel wrote in A Random Walk Down Wall Street in 1973:

> ***What we need is a no-load, minimum management-fee mutual fund that simply buys the hundreds of stocks making up the broad stock-market averages and does no trading from security to security in an attempt to catch the winners. Whenever below-average performance on the part of any mutual fund is noticed, fund spokesmen are quick to point out "You can't buy the averages." It's time the public could.*** [cvii]

This described the investing application of modern portfolio theory, capital asset pricing theory and the efficient market hypothesis. That academic work established the intellectual and investing significance of market indices. A key observation made was that idiosyncratic or stock specific risk could be diversified away and therefore should not be rewarded with a risk premium. Systematic or market risk, by contrast, was and should be rewarded. In other words, a share of the Exxon Mobil Corporation stock will fluctuate with what happens at Exxon in particular. However, a diversified basket of energy stocks will fluctuate with energy prices and economic growth; however, they will not be affected much by what happens at any one company – bad news for one company is offset by good news at another.

Modern portfolio theory implied, and studies have borne out, that the bulk of investors' returns would come from asset allocation rather than security selection: that is, from market (systematic) returns, rather than from individual security excess returns (the idiosyncratic risk). Early studies of determinants of portfolio performance found that over 90 percent of performance was due to investment policy (including asset allocation) as opposed to investment strategy (including securities selection).[cviii] While different scholars may differ on the precise attributions to the allocation effect, there is wide agreement that it accounts for the vast majority of a given portfolio's return. SERS' consultant, RVK, for example, writes that asset allocation explains 100 percent of the return amount over time, and 90 percent of the return variability over time.[cix]

In 1971, the first index funds began to emerge.[cx] By 1976, John C. Bogle opened what is now the Vanguard 500 Index mutual fund, and indexing as we know it today was launched. Investors finally had access to an investment which earned the return for market risk without high fees. Investors could now buy the average. There was an alternative to the high fee active management strategies proffered. Importantly, these investment vehicles also represented an important performance evaluation tool.

Today, there are investable market indices for all types of systematic risk exposures, financial markets and segments. The S&P 500, for example, includes stock from the 500 leading companies in the U.S, which are weighted according to market capitalization. As such, it tracks the performance of the largest U.S. company stocks. The Russell 2000, on the other hand, includes stock from 2,000 small-capitalization companies. There are indices for various foreign stock markets, Treasury bonds, corporate bonds of a particular credit quality, or even specific industries such as technology. By the end of 2017, about $6.7 trillion was invested in index funds, and around $3 billion a day was flowing into index funds.[cxi]

John Bogle's advocacy of index funds received much criticism and doubt.[cxii] Nobel Laureate Daniel Kahneman, who studies behavioral economics, would attribute the criticism to people's biases about data, particularly when they threaten their livelihood: "When people believe a conclusion is true, they are also very likely to believe arguments that appear to support it, **even when these arguments are unsound**."[cxiii] Investing in indexing strategies has boomed despite criticisms, because both theory and experience support it.

Performance of Indexing

After fees, it is not just the average active manager that fails to beat index returns, the majority of them fail. Nobel prize-winning economist William Sharpe gave the following simple mathematical proof for the superior value of indexing:

> *(1) before costs, the return on the average actively managed dollar will equal the return on the average passively managed dollar and*
>
> *(2) after costs, the return on the average actively managed dollar will be less than the return on the average passively managed dollar.*[cxiv]

In other words, if the total return of a market is x%, and the market is divided into active strategies and index strategies, then since index strategies return x%, mathematically the average active strategy before fees must also return x%. After fees, they must return less.

S&P Managing Director of Index Investment Strategy Craig Lazzara told the Commission in his September testimony with Aye Soe: "There is no natural source of alpha."[cxv] That is, in order to outperform a market index, someone else must underperform. Adding in fees, not only will the average active manager underperform, but the majority will.

This is the theoretical case for why indexing is a better choice. But there is now considerable data and real-world experience, and it supports the theory: Most active managers indeed underperform their equivalent index fund across all markets and investing styles.

The Standard and Poor Indices Versus Active, or SPIVA®, is the single most comprehensive body of research[26] that "compares actively managed funds against their appropriate benchmarks on a semiannual basis."[cxvi] It is now in its 18th year. The consistent evidence from SPIVA® is that most active managers underperform their index most of the time. This result is not dependent on the efficiency of a market or the size of the fees. Plain and simple, index investing outperforms.

SPIVA® is based on data that has eliminated data quality issues previously identified by experts (see below). It addresses issues related to measurement techniques, universe composition, and fund survivorship. It eliminates "survivorship bias," by including the entire opportunity set and not just funds that have survived. It draws comparisons to appropriate benchmarks, taking into account size or style classification. SPIVA® uses asset-weighted averages to draw accurate results, because a $10 million fund should not count the same as a $10 billion fund. In addition, it avoids double-counting by using only share classes with the greater assets. SPIVA® also analyzes performance gross-of-fees and net-of-fees. The size, scope, and rigorous construction of the SPIVA® study make it the gold standard in evaluating active and passive performance.

[26] While SPIVA® is associated with S&P which is a provider of indices, all other research that was reviewed or presented either corroborated the findings discussed herein or was subject to biases that are discussed herein and make the results suspect.

At the September Commission hearing, Aye Soe, head of Research Design at Standard and Poor's Dow Jones Indices, shared the results of analysis of 17 years' worth of SPIVA® data, a period that covered several market cycles, both bull and bear markets.

- The equity annual league table below shows that across all domestic equity funds, regardless of style or capitalization size, most active funds failed to beat their benchmark in most years.

Figure 41: Equity Annual League Table

EQUITY ANNUAL LEAGUE TABLE

FUND CATEGORY	BENCHMARK INDEX	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
All Domestic Funds	S&P 1500	54.87	58.34	48.01	51.43	42.26	68.02	48.90	64.91	40.68	48.28	84.65	64.91	43.26	86.89	74.03	60.49	63.43
All Large-Cap Funds	S&P 500	65.16	67.73	75.44	68.79	48.81	68.38	44.63	55.95	48.40	65.88	82.24	62.66	54.56	86.73	65.39	66.00	63.08
All Mid-Cap Funds	S&P Midcap 400	67.64	74.43	51.70	64.56	73.63	44.77	45.77	75.73	55.69	73.29	68.59	79.85	37.11	66.05	57.18	89.37	44.41
All Small-Cap Funds	S&P SmallCap 600	53.97	67.54	34.63	83.84	60.95	62.53	45.98	83.30	30.69	53.95	85.81	66.28	67.77	71.96	71.79	85.54	47.70
All Multi-Cap Growth Funds	S&P 1500	54.73	54.02	49.21	49.38	37.14	68.77	45.97	70.14	39.30	60.39	83.88	65.22	46.84	81.62	70.10	74.88	56.46
Large-Cap Core Funds	S&P 500 Growth	94.80	83.13	48.36	44.08	37.96	93.93	27.14	90.67	36.81	50.98	95.90	45.62	41.08	95.61	47.55	89.79	32.92
Mid-Cap Growth Funds	S&P 500	77.03	66.55	85.29	82.91	56.16	81.09	43.50	52.26	50.55	76.61	83.21	66.59	57.65	80.38	73.75	74.56	68.98
Mid-Cap Core Funds	S&P 500 Value	30.77	34.63	85.98	86.47	54.11	80.28	45.79	24.45	45.71	70.55	54.28	85.05	64.86	77.78	61.52	77.99	46.88
Mid-Cap Value Funds	S&P MidCap 400 Growth	87.96	86.24	35.75	64.16	79.67	27.96	41.97	90.95	54.01	84.11	76.53	86.81	34.48	55.37	79.68	94.58	18.05
Mid-Cap Growth Funds	S&P MidCap 400	80.00	70.42	54.74	57.27	66.34	32.04	60.78	60.18	70.75	86.54	65.66	78.57	42.96	58.65	68.18	90.65	61.67
Mid-Cap Value Funds	S&P MidCap 400 Value	47.42	63.64	68.42	53.09	69.14	36.90	57.83	68.00	47.33	57.14	67.61	73.47	40.85	71.43	34.38	96.77	43.14
Small-Cap Growth Funds	S&P SmallCap 600 Growth	76.64	97.14	26.88	94.71	78.06	50.75	40.80	94.84	31.34	62.25	94.12	62.91	55.25	63.98	87.50	95.96	15.08
Small-Cap Core Funds	S&P SmallCap 600	57.78	67.27	34.88	79.47	58.33	56.34	55.51	82.07	33.22	58.63	86.01	68.68	77.74	66.92	77.46	89.47	58.59
Small-Cap Value Funds	S&P SmallCap 600 Value	39.07	29.93	48.08	71.76	45.24	71.26	39.36	72.07	25.17	41.98	81.82	61.54	78.81	94.07	45.04	88.89	74.07

Source: S&P Dow Jones Indices LLC. Data as of Dec. 29, 2017. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

Source: S&P Dow Jones Indices.

- Over a 15-year horizon, more than 80% of active management funds underperform in every equity category.

Figure 42: Percentage of U.S. Equity Funds Outperformed by Benchmarks

PERCENTAGE OF U.S. EQUITY FUNDS OUTPERFORMED BY BENCHMARKS

FUND CATEGORY	COMPARISON INDEX	1-YEAR (%)	3-YEAR (%)	5-YEAR (%)	10-YEAR (%)	15-YEAR (%)
All Domestic Funds	S&P Composite 1500	63.43	83.40	86.72	86.65	83 .74
All Large-Cap Funds	S&P 500	63.08	80.56	84.23	89.51	92.33
All Mid.Cap Funds	S&P MidCap 400	44.41	86.34	85.06	96.48	94.81
AH Small-Cap Fmds	S&P SmallCap 600	47.70	88.83	91.17	95.71	95.73
All Multi-Cap Funds	S&P Composite 1500	56.46	83.64	84.91	90.70	87.67
Large-Cap Growth Funds	S&P 500 Growth	32.92	67.58	80.92	93.65	93.49
Large-Cap Core Foods	S&P 500	68.98	88.45	90.99	94.95	94.67
Large-Cap Value Funds	S&P 500 Value	46.88	80.37	85.07	70.44	85.71
Mid-Cap Growth Foods	S&P MidCap 400 Growth	18 .05	91.46	81.13	97.69	95.32
Mid-Cap Core Funds	S&P MidCap 400	61.67	88.24	87.90	96.15	96.51
Mid-Cap Value Funds	S&P MidCap 400 Value	43.14	75.41	81.54	88.04	88.89
Small-Cap Growth Funds	S&P SmallCap 600 Growth	15.08	86.53	86.67	95.56	98.73
Small-Cap Core Funds	S&P SmallCap 600	58.59	93.78	95.59	96.23	96.55
Small-Cap Value Funds	S&P SmallCap 600 Value	74.07	82.14	95.45	92.78	89.47
Multi-Cap Growth Funds	S&P SmallCap 1500 Growth	46.32	33.24	85.11	94.77	86.21
Multi-Cap Core Funds	S&P Composite 1500	68.78	92.78	90.13	90.14	90.82
Multi-Cap Value Funds	S&P Composite 1500 Value	49.57	76.47	76.24	84.21	85.96
Real Estate Funds	S&P United States REIT	36.80	59.76	73.68	84.54	81.13

Source: S&P Dow Jones Indices UC. Data as of Dee 29. 2017 Returns shown are annualized. Past performane is no guarantee of future results. Table is provided for illustrative purposes.

Source: S&P Dow Jones Indices.

- The fixed income annual league table shows the same result for fixed income funds. In almost every year, across every style, most active managers underperform their benchmark.

Figure 43: Fixed Income Annual League Table

FIXED INCOME ANNUAL LEAGUE TABLE

Exhibit 2: Fixed Income Annual League Table

FUND CATEGORY	COMPARISON INDEX	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Government Long Funds	Barclays US Government Long	28.95	98.44	85.45	98.25	96.49	20.00	89.36	95.74	8.33	95.29	96.55	71.43	10.94	96.83	20.34	87.93	96.43
Government Intermediate Funds	Barclays US Government Intermediate	91.40	66.67	77.03	62.86	65.08	57.63	92.59	90.00	9.09	73.81	60.53	33.33	76.67	44.44	88.89	74.07	57.89
Government Short Funds	Barclays US Government/ (1-3 Year)	94.74	72.00	82.98	62.22	65.91	71.43	90.70	86.05	23.81	59.52	60.98	42.50	95.12	60.00	89.97	63.16	47.83
Investment-Grade Long Funds	Barclays US Government/ Credit (1-3 Year)	38.27	99.36	68.18	95.95	99.26	9.24	84.26	95.24	7.38	78.01	99.27	62.02	7.32	98.02	12.15	75.00	96.74
Investment-Grade Intermediate Funds	Barclays US Government/ Credit Intermediate	87.14	85.58	55.35	36.24	37.73	49.07	93.02	89.87	14.09	31.43	49.65	20.70	63.54	33.07	93.25	19.75	31.37
Investment-Grade Short Funds	Barclays US Government/ Credit (1-3 Year)	100.00	87.27	67.21	37.50	53.42	46.91	96.34	98.84	16.67	25.00	56.58	11.11	52.56	50.00	70.87	26.61	22.22
High Yield Funds	Barclays US Corpororate High Yeild	74.32	41.50	83.21	80.14	54.61	83.92	44.22	39.19	90.69	75.25	80.00	72.86	68.35	74.09	34.75	94.17	80.95
Mortgage-Backed Securities Funds	Barclays US Aggregate Securitized - MBS	84.21	64.29	83.33	95.00	67.24	92.86	87.50	94.34	36.51	25.00	53.13	24.62	71.21	75.81	72.88	60.00	67.92
Global Income Funds	Barclays Global Aggregate	61.54	64.41	35.85	41.18	55.56	69.23	69.35	77.03	30.00	39.64	77.68	18.49	48.92	37.78	61.54	33.08	64.86
Emerging Markets Debt Funds	Barclays Emerging Markets	9.09	60.00	21.74	28.57	50.00	30.00	42.86	65.38	48.28	34.48	91.43	50.85	74.00	77.78	89.33	39.19	22.58
General Municipal Debt Funds	S&P National AMT-Free Municipal Bond	78.99	67.24	47.75	79.63	79.25	73.12	84.09	81.48	25.00	57.32	77.22	20.78	68.67	31.33	59.30	71.91	42.86
California Municipal Debt Funds	S&P California AMT-Free Municipal Bond	75.51	57.78	15.22	85.11	75.56	72.09	95.24	94.87	10.53	77.78	75.00	6.06	91.43	13.89	38.89	61.11	25.71
New York Municipal Debt Funds	S&P New York AMT-Free Municipal Bond	89.13	73.81	79.49	76.92	76.92	76.32	91.18	88.24	27.27	58.06	75.00	17.24	100.00	7.14	53.57	74.07	33.33
Loan Participation Funds	S&P/ LSTA U.S. Leveraged Loan 100	-	-	-	-	-	-	-	-	-	55.00	14.81	77.50	36.84	56.86	13.46	81.82	52.08

Source: S&P Dow Jones Indices.

- Over the 15-year horizon, more than 80% of active fixed income management funds underperform their index in every category except in investment-grade short funds, global income funds, and emerging markets debt funds, where more than 65% of funds still underperform.

Figure 44: Percentage of Fixed Income Funds Outperformed by Benchmarks

REPORT 11: PERCENTAGE OF FIXED INCOME FUNDS OUTPERFORMED BY BENCHMARKS

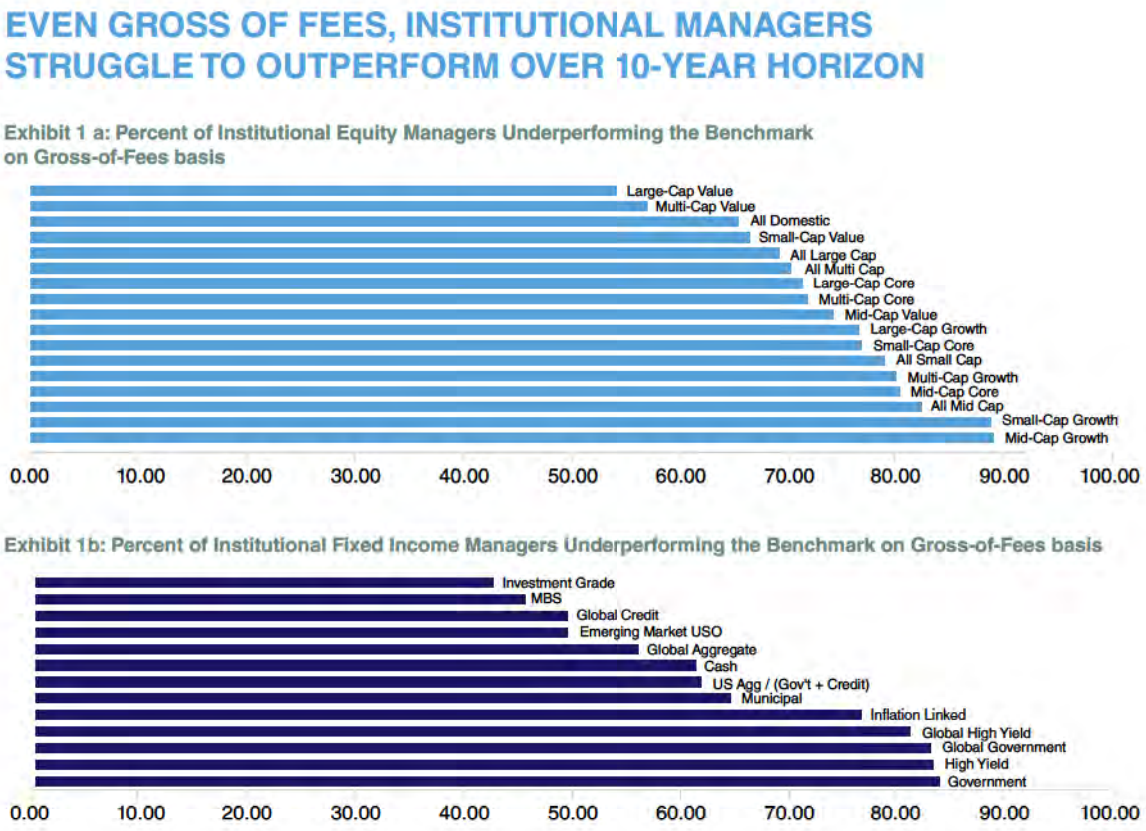
FUND CATEGORY	COMPARISON INDEX	1-YEAR (%)	3-YEAR (%)	5-YEAR (%)	10-YEAR (%)	15-YEAR (%)
Government Long Funds	Barclays US Government Long	96.43	100.00	98.31	95.24	98.00
Government Intermediate Funds	Barclays US Government Intermediate	57.89	90.91	80.00	78.05	90.48
Government Short Funds	Barclays US Government (1-3 Year)	47.83	69.23	79.31	76.47	88.24
Investment-Grade Long Funds	Barclays US Government/Credit Long	96.74	94.68	95.45	95.40	97.73
Investment-Grade Intermediate Funds	Barclays US Government/Credit Intermediate	31.37	35.53	40.94	51.06	73.53
Investment-Grade Short Funds	Barclays US Government/Credit (1-3 Year)	22.22	41.67	43.33	57.81	68.89
High Yield Funds	Barclays US Corporate High Yield	80.95	90.87	93.81	98.37	98.23
Mortgage-Backed Securities Funds	Barclays US Aggregate Securitized MBS	67.92	73.08	79.31	81.40	93.88
Global Income Funds	Barclays Global Aggregate	64.86	60.55	52.59	58.33	69.44
Emerging Markets Debt Funds	Barclays Emerging Markets	22.58	70.69	85.71	73.68	66.67
General Muni cipal Debt Funds	S&P National AMT-Free Municipal Bond	42.86	58.75	47.50	63.29	82.88
California Municipal Debt Funds	S&P California AMT-Free Municipal Bond	25.71	30.56	37.14	66.67	84.44
New York Municipal Debt Funds	S&P New York AMT-Free Municipal Bond	33.33	57.14	73.33	85.29	89.47
Loan Participation Funds	S&P/LSTA U.S. Leveraged Loan 100	52.08	56.25	52.78	100.00	-

Source: S&P Dow Jones Indices LLC. Data as of Dec. 29, 2017. Returns shown are annualized. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

Source: S&P Dow Jones Indices.

Advocates of active investing have questioned whether the SPIVA® results are a function of high reported retail fees, and therefore surmised that institutional investors such as pension funds, who have more bargaining power on fees, would fare better. As a result, SPIVA® started tracking returns both net-of-fee and gross-of-fee. Not surprising, managers' gross-of-fee returns competed slightly better – after all, it is adding back costs to all of the performance. But, it didn't help sufficiently. The large majority of managers still underperform, even gross-of-fees. While SPIVA's® institutional data does not go as far back as the retail data, there is every indication it points in the same direction.

Figure 45: The Majority of Active Managers Underperform



Source: S&P Dow Jones Indices LLC, eVestmentAlliance. Data as of Dec. 31, 2016. Past perfonnance is no guarantee of future results. Chart is provided for illustrative purposes only.

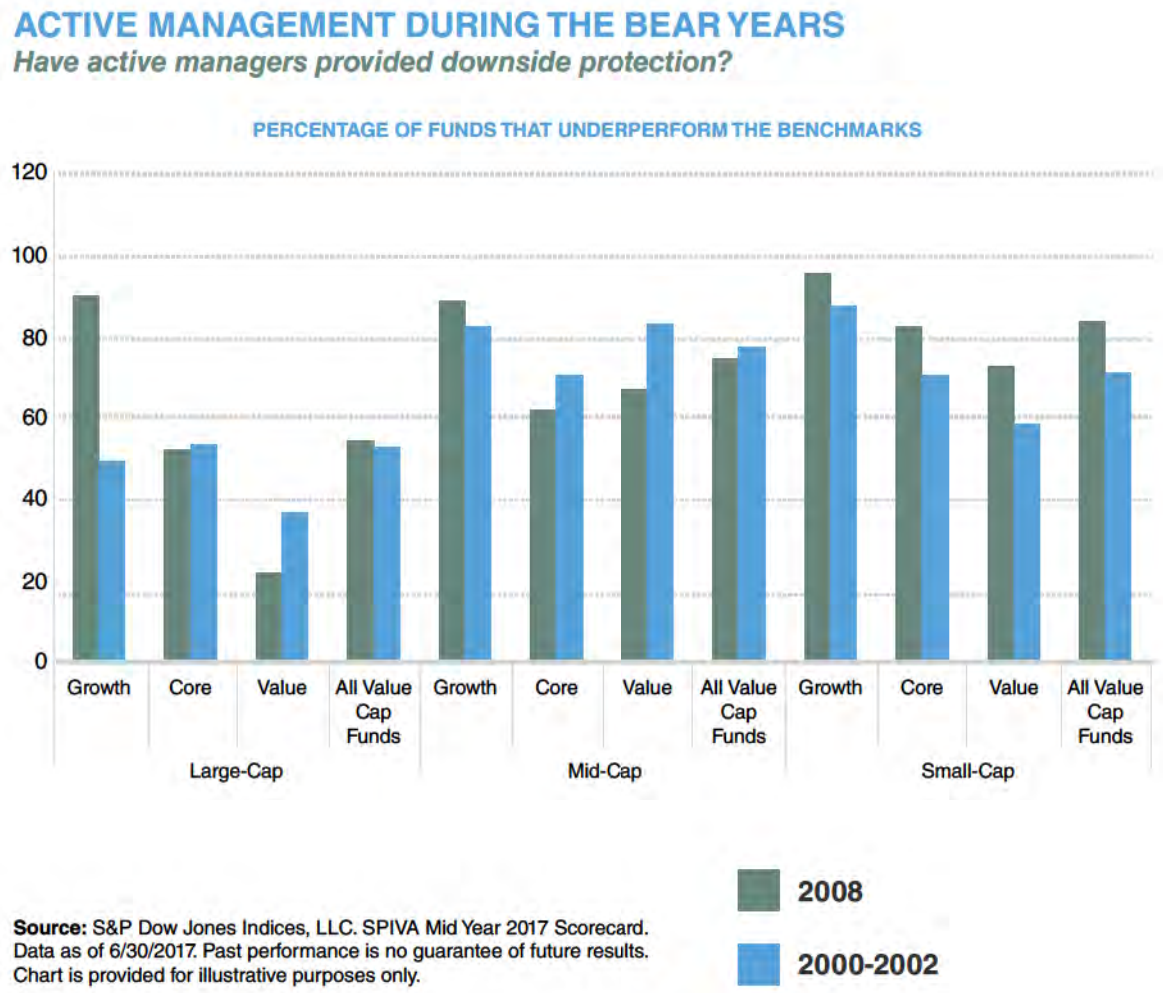
Source: S&P Dow Jones Indices

This data has been so compelling that indexing in large capitalization equities has experienced "explosive growth." According to the September PPMAIRC testimony of Aye Soe, head of Research Design at Standard and Poor's Dow Jones Indices, investors—both individual and institutional—had index funds in their portfolios for decades, but even though a close look at the data shows that active managers had been underperforming for years, it was only after the 2008 financial crisis that it really hit home for investors that their active managers had failed to provide downside risk protection.[cxvii] Today, over 40 years since the birth of indexing, there is virtually no debate that indexing is the right choice for U.S. large capitalization equities.

While other studies and samples are sometimes cited in an effort to defend active management, they are usually based on smaller samples or less rigorous methodologies, making their conclusions suspect, and they are often cited or developed by vendors promoting active management. There are a few critiques that continuously surface from those that have not followed the data:

- "Active management protects on the downside." In fact, in 2008, when the S&P 500 was down over 35%, in 12 out of 13 categories of equity funds, the large majority of active managers still underperformed their index. Today, there are many options other than active management available to protect on the downside, including low volatility indices or more conservative asset allocations.

Figure 46: Active Management During the Bear Years



Source: S&P Dow Jones Indices.

- "The success of indexing will not last. This is just this cycle." While there will be periods of time when active managers outperform indices, the consistency of the data across time suggests that the theoretical argument is sound, and periods of outperformance will be followed by, and in the long-run exceeded by, periods of underperformance.

- "Active management works better in inefficient markets like small-cap, high-yield and international." In fact, the evidence suggests that there is no difference between markets that are considered more or less efficient. In any market where public securities span the opportunity set, SPIVA® scorecards show that these arguments are unfounded. The 15-year data show that over the long-run, active managers have failed to outperform, by wide margins, in every category, including those markets typically identified as "less efficient":

> ***[. . .]over the 15-year investment horizon, 92.33% of large-cap managers, 94.81% of mid-cap managers, and 95.73% of small-cap managers failed to outperform on a relative basis[. . .] Over the 3-,5-,10-, and 15-year-investment horizons, managers across all international equity categories underperformed their benchmarks[. . .] Across all time periods studied, high-yield managers struggled to outperform their benchmark.***[cxviii]

Burton Malkiel has cited SPIVA® data in support of indexing, even in inefficient markets. According to Malkiel, "In emerging markets, because of the market inefficiencies, it is hard for active managers to outperform because the bid-ask spreads are larger, the trading markets are not as efficient, and there are big market impact costs and stamp taxes when you sell."[cxix]

Aye Soe notes that the one-year data for equity categories is more favorable, but that "one year is noisy" and, similar to international and high-yield, the number of managers who outperform dwindles over time.[cxx]

- "Active management beats indexing in fixed income." The SPIVA® data clearly refute this. Indexing in fixed income, however, has some subtleties. A manager can often appear to "beat" certain broad market fixed income indices, such as the Barclay's Aggregate, simply by shifting the risk profile of the portfolio: by, for example, taking on more credit risk, or reducing the proportion of U.S. Treasuries. In such cases, there is actually an unrecognized mismatch between benchmark and portfolio. Managers aren't "beating" the index; they are taking on more risk than the index to get higher return. Pension investors may wish to do exactly that. But with the proliferation of investable indices for virtually all subsectors of the fixed income market, investors who want their portfolios to have different risk characteristics from broad market indices can now do so through indexing. They will simply be making those choices more explicitly – and more cheaply – rather than doing so through an active manager's account.

- "Indexing increases risk." In fact, The S&P 2017 Risk Adjusted SPIVA® Scorecard found that active investing still underperformed in both equity and fixed income even when adjusted for risk:

> ***Actively managed domestic and international equity funds across almost all categories did not outperform the benchmarks on a risk-adjusted basis. The figures improved for some categories when gross-of-fees returns were used. Similarly, in fixed income, fees were the biggest detractor from performance, not risk. Therefore, we did not see evidence that actively managed funds were better risk managed than passive indices.*** [cxxi]

The assertion that indexing increases risk is often based on the mischaracterization, deliberate or accidental, that "indexing" means investing all of a fund's assets, for example, in the S&P 500. "Indexing" does not mandate a given allocation to a given fund. It is rather a prescription for a systematic approach to investing through indices and other passive vehicles, recognizing that in the public markets, returns will come from the performance of asset classes, not of managers. How the allocations to various asset and sub-asset classes are made will determine risk and return. There has been a continuing development of new index products for nearly all sectors and approaches, with innovations such as equal-weighted rather than capitalization weighted indices, or low volatility indices. In fact, institutional investors now have sophisticated tools for addressing risk-mitigation through indexing that were previously thought to be only available through active management.

Persistence of Outperformance

While the SPIVA® data shows that most managers in every segment underperform, it also shows that a few managers in every segment can outperform, at least for a time. So it is reasonable for an investor to ask: even if only a handful of managers have outperformed indices, aren't we better off identifying those managers and investing with them?

To answer "yes" means that two conditions would have to be met. First, a manager would need to consistently outperform on a net-of-fee and risk-adjusted basis. And, second, an investor would need to be able to tell – in advance – which managers will do so. Unfortunately, the data suggests that persistence of outperformance is

extraordinarily rare, and while those exceptional managers may exist, the combination of the ability to find them and to negotiate to share in the returns to their skill (through net-of-fee risk-adjusted excess returns) is rare at best.

According to S&P, "demonstrating the ability to outperform peers repeatedly is the one way to differentiate a manager's luck from skill."[cxxii] In addition, the argument to continue with an active manager is often based on the manager's past performance. The evidence reveals, however, that the disclaimer most mutual funds display up front – "past performance is not an indicator of future outcomes" – should be taken at face value. The S&P Persistence Scorecard shows that "out of 557 domestic equity funds that were in the top quartile as of March 2016, only 2.33% managed to stay in the top quartile at the end of March 2018." What's more, the ability of top-performing funds to remain in the top quartile declines over time, so that the longer the time horizon that is analyzed, the less persistence there is.[cxxiii]

In reality, the SPIVA® data shows low persistence across fund categories, which are well below random probability, including for small-cap funds. And this basic finding has been replicated in a host of other studies.

Figure 47: SPIVA data on US Equity and bond persistence

SUCCESSFUL EQUITY PERFORMANCE DOES NOT PERSIST

US EQUITY FUNDS IN THREE CONSECUTIVE YEARS	
FUND CATEGORY	**% REPEATING IN TOP QUARTILE**
All Domestic Equity	2.33%
Large Cap	0.93%
Mid Cap	0.00%
Small Cap	3.85%
Persistence if Random	6.25%

Source: S&P Dow Jones Indices LLC, CRSP. Data as of March 31, 2018. Table is provided for illustrative purposes. Past performance is no guarantee of future results.
S&P Dow Jones Indices

SUCCESSFUL BOND PERFORMANCE DOES NOT PERSIST

US FIXED INCOME FUNDS IN THREE CONSECUTIVE YEARS	
FUND CATEGORY	**% REPEATING IN TOP QUARTILE**
Government- Long	7.14 %
Investment Grade - Long	4.35%
Investment Grade - Intermediate	2.04%
High Yield	1.96%
Persistence if Random	6.25%

Source: S&P Dow Jones Indices

The lack of evidence for the persistence of outperformance, and the lack of a reliable method for identifying outperformers with certainty in advance, is why we should be skeptical of basing decisions to actively manage based on the performance of any small set of managers, but rather look to the broader evidence. A given investor may say "But my manager has outperformed during a particular period," and that may indeed be true. But what the broader evidence tells us – even assuming such outperformance has been correctly measured – is that it is probably not statistically significant, and potentially simply reflects luck rather than skill. Moreover, the evidence also tells us that past performance of a manager simply does not predict future performance: in the long run, results will revert to the mean.

So, an investor who has beaten the odds and succeeded at active management is better off harvesting those gains and switching to indexing, rather than naively believing he will continue to be the exception rather than the rule.

As Warren Buffett put it:

> ***There are, of course, some skilled individuals who are highly likely to out-perform the S&P over long stretches. In my lifetime, though, I've identified – early on – only ten or so professionals that I expected would accomplish this feat. There are no doubt many hundreds of people – perhaps thousands – whom I have never met and whose abilities would equal those of the people I've identified. The job, after all, is not impossible. The problem simply is that the great majority of managers who attempt to over-perform will fail. The probability is also very high that the person soliciting your funds will not be the exception who does well . . . Further complicating the search for the rare high-fee manager who is worth his or her pay is the fact that some investment professionals, just as some amateurs, will be lucky over short periods.*** – Warren Buffet, Berkshire Hathaway, Inc., Letter to Shareholders, February 25, 2017, 24.

Foregoing Excess Return

Advocates of active investment management argue that investors who index will never "beat the market" because, by definition, their return will be equal to the market return, before costs.[cxxiv] This was the argument given by Fidelity Investments Chairman Edward Johnson when John C. Bogle started Vanguard, as he was quoted as saying that he "[couldn't] believe that the great mass of investors are going to be satisfied with receiving just average returns."[cxxv]

While forgoing the possibility of outperformance may seem like a disadvantage, indexing also forgoes the possibility of underperformance. Moreover, outperformance is uncertain, but the fees are not. As the data above shows, there is higher probability of underperforming than outperforming, particularly after costs.

In 2017, index management fees averaged 0.15%.[cxxvi] Some index fund fees are now as low as zero.[cxxvii] By contrast, in 2017, active fund fees averaged 0.72%.[cxxviii] Active managers argue that those fees pay for the analytics, skills, and "trade secrets" that enable them to outperform.

In his October testimony before the PPMAIRC, renowned investment consultant Charley Ellis agreed that active managers are investing heavily in research and technology and processes, but he explained that doing so was necessary but not sufficient to generate true alpha:

> ***Every firm that I've talked to knows that they're better. They've got better computers, they've got more carefully trained staff, they've got much better models on their computers, they've learned a lot, and they are raring to go because they know they're better than they were 10 years ago. What they don't recognize, but only an outsider might be able to recognize, is that they are actually getting closer and closer and closer and closer to being equal in their capabilities because they all have Bloomberg, they all have the Internet, they all have SEC Regulation Fair Disclosure, they all have 600 analysts at every major securities firm pumping stuff into them all the time. They all have everything you could dream of having. And they're therefore more and more and more and more equal. And when they get more and more equal it's harder for them to beat the other guys enough to cover their costs or the fees and you get back to even again. So they fall short. But it's real short. And it's not going to change.***[cxxix]

Ellis urged the Commission to continue to move away from active management and toward indexing. "... it doesn't make any sense for someone to say, 'I am going to pay the fees that are being charged and I'm going to put up all the capital for a very unlikely rate of return,' he said."[cxxx]

> ***The fees conventionally described as "only 1 per cent" of assets are better seen for what they really are in a 7 per cent return market—15 per cent of returns. Worse, try taking incremental fees as a percentage of incremental returns—both versus indexing. When you do, incremental fees for active investment management are now actually over 100 per cent—a price-to-value ratio seldom seen.***[cxxxi]

Any choice to index will almost certainly result in periods where the indexed portfolio underperforms some active alternatives, whether quarters, years, or whole market cycles. But in the long run, indexing will – by definition – capture the market return, no more and no less. And the certainty of getting that market return at very low cost is a better proposition for investors than the bad odds of trying to "beat" the market on any consistent basis.

SURVIVORSHIP BIAS

When an actively-managed retail mutual fund underperforms its benchmark for a period of time, it will begin having difficulty attracting new investors and lose its current investors to other funds in the same fund family – or to competing fund families. This can lead to the fund closing or being merged with another fund in the same fund family, skewing any analysis of actively-managed fund performance. The issue of closed funds not being included in an analysis of actively-managed performance is generally referred to as survivorship bias. The SPIVA® analysis is unique in that it accounts for survivorship bias in its analysis. Charley Ellis, in a July 2018 piece by Elizabeth Macbride for CNBC, described survivorship bias as follows:

> *Imagine you sent 100 bombers on a mission. Fifty crashed, and 50 dropped their payloads and returned. What if you looked at the 50 that returned, called the mission successful and then wrote a report that never mentioned the 50 lost planes?*

Similar patterns occur at the institutional level, but a greater impact is caused by the practice of manager rotation. Pension funds, for example, may say that "our managers have beat their benchmarks," which may certainly be the case. However, pension funds regularly monitor manager performance and terminate those managers that have consistent periods of underperformance, as they very well should. By the time managers are terminated, the damage has already been done and can result in losses to the pension fund in the tens or hundreds of millions. This reinforces the importance of transparency in the reporting of performance by each individual manager (see Transparency Chapter for practices by peer funds that can be implemented at SERS and PSERS to address this).

Use of Active Management and Indexing in Public Markets Investments at Pennsylvania's State Pension Systems

The tables below show the assets managed by active investment managers versus those held in indices, for each of the two funds, as well as the potential savings from moving to indexing. (This section only considers the funds' holdings in equities and fixed income; it does not review other areas, such as real estate or commodities, which also have both active and index implementations.)

Figure 48: Public Equity Assets under active management v. invested in indices at SERS

	ALLOCATION		ANNUAL FEES		ESTIMATED ANNUAL FEES IF INDEXED	ESTIMATED ANNUAL SAVINGS
Active	$3,418,000,000	22%	$16,371,500	91%	$4,211,650	**$12,159,850**
Indexed	$12,086,000,000	78%	$1,562,200	9%		
Total	**$15,504,000,000**		**$17,933,700**			

Source: Analysis of SERS data.

Figure 49: Fixed Income Assets Under Active Management v. Invested in Indices at SERS

	ALLOCATION		ANNUAL FEES		ESTIMATED ANNUAL FEES IF INDEXED	ESTIMATED ANNUAL SAVINGS
Active	$3,007,000,000	71%	$7,071,400	96%	$2,525,800	**$4,545,600**
Indexed	$1,232,000,000	29%	$308,000	4%		
	$4,239,000,000		**$7,379,400**			

Source: Analysis of SERS data.

Figure 50: Public Equity Assets under active management v. invested in indices at PSERS[27]

	ALLOCATION		ANNUAL FEES		ESTIMATED ANNUAL FEES IF INDEXED	ESTIMATED ANNUAL SAVINGS
Active	$4,198,600,000	36%	$19,723,599	91%	2,525,800	**$17,197,799**
Indexed						
Passive Plus	$7,392,489,000	64%	$2,045,920	9%		
Total	**$11,591,089,000**		**$21,769,519**			

Source: Analysis of PSERS data.

[27] Estimated Fixed Income savings only includes public market managers. Internal management fees estimated using total internal expenses, ratio of allocation, and a 50% discount.

Figure 51: Fixed Income Assets Under Active Management v. Invested in Indices at PSERS

	ALLOCATION		ANNUAL FEES		ESTIMATED ANNUAL FEES IF INDEXED	ESTIMATED ANNUAL SAVINGS
Active	$9,199,871,000	78%	$108,525,000	91%	$106,713,942	$1,811,058
Indexed	$1,388,310,000	12%	$576,054	1%		
Passive Plus	$1,235,757,000	10%	$510,841	0%		
TOTAL	$11,823,938,000		$109,611,895			

Source: Analysis of PSERS data.

SERS has made impressive and commendable progress in the consolidation of managers and increased use of indexing in its public equity portfolio, of which 78% is now indexed. SERS continues to use active managers for the bulk of its fixed income portfolio, and in its international and small cap equity allocations. As a result, SERS' overall public equity and fixed income portfolio is approximately 67% indexed and 33% actively managed.

PSERS has significant portions of its portfolio, including all U.S. equities, that are not actively managed externally, but has a far smaller percentage of its public securities that are, strictly speaking, indexed: just $1.3 billion of its fixed income allocation, or 6% of all its public equity and fixed income portfolio. PSERS manages many of its assets using a strategy it calls "Passive Plus." This is described elsewhere in this report, but typically involves combining some form of index replication with an overlay of an active management strategy to create "alpha" over the index. This approach is similar to an index in its low cost of execution, but can be similar to active management in its risks, and can produce returns which are markedly different from index returns. Concerns about those risks are detailed elsewhere in this report. Like SERS, PSERS relies on conventional active management for the bulk (78%) of its fixed income portfolio, and slightly more than half of its international equity portfolio. All US equities are managed through "Passive Plus."

While performance reporting of active managers should be interpreted in the context of discussions elsewhere in this report about, *inter alia*, benchmarking and indexing in fixed income, the data the Commission was able to review generally show what one would expect: some managers in some periods outperform, and some managers in some periods do not. The consultant performance report supplied by SERS, for example, shows that overall "manager skill" detracted slightly (20 bps) from fund performance in the most recent quarter, while adding slightly (10 bps) in the most recent year.

The survivorship effect is also relevant: of the 61 public equities and fixed income managers used by PSERS in June 2013, for example, fewer than 40% continued to manage money for the funds a short five years later (10-year data not readily available). Certainly not all of the managers no longer managing money for SERS and PSERS five years ago were terminated because of underperformance. But these numbers simply provide an illustration that looking at manager performance using the current roster can provide incomplete results.

In any case, the cautions heard in testimony to the Commission about outperformance persistence are especially relevant here. As Craig Lazarra testified: "Even if you find one [a manager] who's been successful, either relative to a peer group or relative to a benchmark, historical success has no predictive value in predicting future success."[cxxxii]

The October testimony of Marcel Staub, CEO of Novarca Group, a firm that assists institutional investors in negotiating favorable contract terms, also sheds light on some of the data. His findings showed that the systems' passive mandates had more favorable terms than their active ones. He congratulated SERS for its index mandates, finding that in general all of SERS' index mandates were well-priced. In contrast, he found

some active mandate prices to be high, and recommended that four of those contracts be renegotiated.[28] With regard to one actively managed fund at SERS, he stated, "Almost half of the gross alpha has been, you know, paid through the manager. And we've had that discussion before, how much of the alpha could go to a manager or partner, and how much of that would be justified. And there's a general understanding that 20 percent is acceptable. However, in this case, it's been almost 50 percent, so we think that should be definitely renegotiated."[cxxxiii] Staub also recommended that PSERS renegotiate eight of its mandates, including one for which SERS pays lower fees.

Recommendations

- The Commission recognizes that some level of investment in private markets, which are by definition actively managed, is likely reasonable for the two funds, and therefore that there is an appropriate role for active management in those allocations.
- Based on the compelling and substantial evidence and information presented to the Commission, we recommend that SERS and PSERS move to fully indexing all public market investments. Evidence clearly indicates that active management underperforms in the long run, and that outperformers cannot be reliably predicted in advance.
- We commend SERS for its strong movement toward indexing public equities in recent years, and recommend that it complete the move in that direction by indexing the remaining portions of its public equity portfolio that are currently actively managed. If this recommendation is adopted, SERS would save roughly $12.2 million annually, for a savings of $1.2 billion over 30 years.
- We recommend that SERS index its fixed income portfolio, for a savings of $4.5 million annually, and $449 million over 30 years.
- We commend PSERS for using an index approach for the passive portion of its "Passive Plus" management of all U.S. Equities, and we recommend that PSERS fully index its public equity portfolio, for an estimated savings of $17.2 million annually, and $1.7 billion over 30 years.
- We recommend that PSERS index the public security portion of its fixed income portfolio, for a savings of $1.8 million annually, and $179 million over 30 years. Even more savings would be had if they also convert all of their private market fixed income mandates (see Fee Analysis Chapter).
- We recommend that for every non-public investment considered, there is a careful pre-investment selection of a risk appropriate (levered if needed) investable market index or indices.

[28] *See the "Performance and Asset Allocation Analysis," "Cost-savings Options," and "Cost-saving Analysis" chapters for the full report on mandates to be renegotiated.*

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

PERFORMANCE EVALUATION

V. Performance Evaluation

Careful and rigorous performance evaluation is the best means for assessing the quality of past decisions and assumptions. Through performance evaluation we learn from past mistakes, allowing us to make changes to do better in the future.

A repeated refrain from some investors is that "it is only net-of-fee returns that matter." The logic is that we should only care about where we are, and not about how we got there. Performance evaluation – in any sphere – is useful exactly because it does matter how we got there.

To do meaningful performance evaluation, returns must be judged within the context of the decisions and risk that generated them. Outcomes – good or bad – may result from luck rather than the quality of decisions – or lack thereof. Good decisions will sometimes have bad outcomes and vice versa.

The outcome of an investment decision, the realized investment return, is therefore compared to that from alternative choices – specifically, the returns of a benchmark portfolio or of a peer group. The choice of benchmark is critical. It must reflect the investment decision(s), it must be risk appropriate, and evaluation must account for additional risk such as premiums for illiquidity. Failure to have appropriate benchmarks, and therefore to properly account for risk, is among the most common mistakes made by investment professionals and boards.

Except for peer comparisons, it is best practice for benchmarks to be investable at low cost and to be highly liquid. That benchmark can then be adjusted for risk and the cost of illiquidity by adding a premium to it.

This chapter briefly reviews the different types of risk that need to be considered in establishing a benchmark, the risk adjustments to be made, and then the investment decisions that performance evaluation can inform. For further discussion of these risks, please refer back to the chapter on Portfolio Implementation.

Investment risk comes in many shapes and sizes. Risk has to do with the specific systematic risk exposures of an investment, its individual or idiosyncratic risk, as well as its liquidity, and leverage characteristics. There is also portfolio risk that results from how readily risks are monitored and managed.

Systematic Risk Exposures of an Investment. Any investment portfolio or specific investment security will have varying degrees of systematic risk exposure. Systematic risk exposure is the sensitivity of the security or the investment portfolio to economic risk factors that impact more than just the one security – for example, exposure (often measured as correlation) to the S&P 500 index, to a specific industry index, to changes in inflation expectations, or credit spreads. When these exposures are estimated, tested, or evaluated using correlation statistics, it is imperative to use gross-of-fee returns, not net-of-fee returns. The timing of fees paid has nothing to do with the underlying riskiness of the investment.

Liquidity. Liquidity measures how quickly and easily an investment can be exchanged for cash at values close to current market values. Levels of liquidity range from perfectly liquid, for cash, to highly illiquid – for example, limited partnership investments which typically are not liquidated for over ten years from the time of commitment. Liquidity is an important risk factor in two ways. First, illiquidity limits the ability to rebalance into or out of the particular investment. Second, on a portfolio level, there are levels of illiquidity which would result in forced sales at distressed values under certain market conditions simply to stay solvent, much less maintaining a desired asset allocation. An illiquid investment and illiquid portions of the portfolio must be limited and must earn a return over liquid benchmarks to compensate.

Leverage. Leverage is another unique and important risk factor. Leverage is borrowing money, either directly or indirectly,[29] for the purpose of increasing the exposure to a security or strategy. Leverage magnifies returns, making good performance even better and bad performance even worse. When markets rise, returns from more leveraged exposures outperform. Without adjusting benchmarks for the use of leverage, riskier portfolios may be mistaken for better performing ones.

While a levered position is always riskier than the unlevered position in the same security, a levered position in one security may or may not be riskier than an unlevered position in a different security. For example, most investment professionals and finance academics would agree that a 2-year Treasury note levered 2 to 1 (or 100%) would be considered less risky than an unlevered position in a 30-year Treasury bond.

In addition to magnifying returns, leverage is its own risk factor because of the obligation to fund investments or losses and post additional collateral in order to maintain positions. While performance evaluation cannot directly take that risk into account, it should inform risk constraints.

Leverage must be fully understood, disclosed, and analyzed. Comparing returns generated with leverage to a benchmark without leverage is misleading. Performance should always be reported on a levered and an unlevered basis and compared to an equally levered benchmark. As described below, private markets returns should always be reported with and without the use of subscription lines of credit, and unlevered returns of the underlying assets should be measured.

What Questions Should Performance Evaluation Answer?

The purpose of performance evaluation is to assess investment decisions and assumptions driving those decisions. When asked what the right response would be if an investor shows persistent underperformance, Aon Hewitt's Kristen Doyle responded that an investor must "study it and learn about why it's happening and understand what might be different about the asset allocation or the way the performance of the asset classes is. And then determine if you think that there's something there that needs to be changed or tweaked or enhanced or improved."[cxxxiv]

What follows is a list of best practice questions that stakeholders should evaluate. This follows the discussion of investment decisions in the chapter on Portfolio Implementation.

For each decision point outlined below, stakeholders should compare the pension fund's returns to a carefully chosen risk-appropriate benchmark(s), established at the time the investment decision is made, including an appropriate peer performance measure.

A NOTE ABOUT TIME PERIODS FOR ANALYSIS:

While it is standard practice to report 1- , 3- , 5- and 10- year returns that all end at the most recent observation date, this is not the best practice. Statistically, those return periods are autocorrelated, meaning that they each contain overlapping periods – they all contain the most recent 1-year return, the 5-year return only has two years of returns that are different than the 3-year return, and so forth. As such, they can all be significantly influenced by any unusual experience of the overlapping time periods. It is much more rigorous to look at the consistency of performance comparisons as shown by rolling returns of different lengths. This involves displaying much more data, but if reports focus on the question the data is meant to address, simple graphics are quite useful.

[29] *Direct leverage occurs when the pension fund borrows money directly to fund an investment. For example, using a line of credit or issuing bonds. Indirect leverage occurs when the pension fund buys securities with embedded leverage. For example, an investment in a share of a company's equity has indirect leverage if the company has issued debt. There are sources of leverage that are more of a hybrid, where the pension fund is obligated to cash outlays dependent on market or other events out of their control. Unfunded capital commitments, swaps and futures are examples. The amount of cash collateral needed to buy a future contract is much smaller than the economic exposure of the futures contract. However, the pension fund is obliged to fund losses and post additional collateral if the value of the contract moves against their position. An unfunded capital commitment can be called at any time by the general partner.*

Total portfolio risk budget. A pension fund board will establish an acceptable risk budget and a simple index-based investment strategy, say 70% S&P 500 and 30% aggregate bond index, that maximizes expected return for that level of risk (the simple benchmark). The performance evaluation questions are:

- How has the pension fund performed relative to this simple risk portfolio?
- Was the risk budget prudent: How has the simple risk portfolio performed relative to other simple risk portfolios – either more or less risky? For example, comparing a 60/40 to a 70/30 or a 65/35.

Investment allocations. Using an asset or risk allocation model, a pension board establishes a second benchmark portfolio that is more diversified across other market or systematic risks, but still invested in liquid markets indices (the diversified benchmark). Note that if the portfolio is levered the risk budget above must reflect that risk and the allocation considered here should include the leverage. The performance evaluation questions are:

- How has the pension fund performed relative to this diversified benchmark?
- How did the diversified benchmark perform compared to the simple benchmark –did diversification across other systematic/market risks add value? This can be evaluated in aggregate and separating out the risk-seeking allocations relative to the equity index and the risk-mitigating allocations relative to the bond index.

Manager selection. If active management is used, at the time any active manager is hired, or an active management style is employed by internal investment staff, three decisions are made: (1) what allocation in the diversified benchmark is replaced; (2) what portfolio of market risk exposures through indices most closely reflects the risk exposures of the strategy – the replicating portfolio; (3) what is a tolerable level of performance deviation from the replicating portfolio. For example, a manager that invests in U.S. technology stocks may be considered part of the domestic equity allocation, but their performance should also be compared to a technology index since the pension fund could have implemented the decision to concentrate in technology with an index. If the manager uses more leverage than the technology index, then the correct benchmark would be a levered investment in the technology index. The performance evaluation questions are:

- How has the manager performed relative to the portion of the diversified benchmark that it replaced?
- How does that relative performance break down between the change in systematic risk exposures that could have been achieved with indices and the added value of the manager relative to that replicating portfolio (after fees and costs and adjusted for leverage, of course)?

Peer Analysis. In addition to evaluating each layer of investment decisions relative to low fee alternatives, it is also important to consider peer performance. At each decision point above, an analysis of performance relative to a robust peer set is informative, as it will highlight when decisions have been significantly better or worse than those made by peers with similar opportunity sets.

Areas for additional performance analysis. Using the same risk-appropriate choices for benchmarks, there are certain choices of investment styles and implementation that should be analyzed regularly.

- **Active management versus index performance**: There is a large body of evidence produced by S&P and others that shows that active management underperforms appropriate risk equivalent indices. To the extent that active management is used, the aggregate added/detracted value after fees is important to measure. It should be analyzed in aggregate as well as in different asset classes.

- **Internal asset management**: A pension fund board has additional responsibility relative to internal asset management as discussed elsewhere in this report. The board provides the only level of risk oversight for internal assets. The aggregate performance of investments managed directly by internal staff, as well as subsectors of them, must be reviewed independently. Returns relative to benchmarks – either positive or negative – must be consistent with the risk exposures and risk limits granted. Tactical asset allocation positions should be measured and reported on as their own category as well.

- **Co-Investing**: Co-investments are a unique vehicle where a pension fund may invest in a particular security alongside a manager, often at reduced fees. There is significant debate about whether or not co-investing is subject to negative selection bias where co-investments underperform alternatives, even after fees. Co-investments therefore need to be evaluated very carefully and consistently, again adjusting for leverage and liquidity. In addition to being compared to a similar risk public market portfolio, there needs to be a comparison to other investments of the sponsor.[30]

Private Investment Performance – Unique Issues with Measurement and Evaluation:

Private markets investing is described in detail in other chapters of this report. This section highlights some unique challenges that exist when evaluating performance of private markets investments.

Valuations and Illiquidity. Private markets investments are often largely illiquid for 10-15 years. In the interim, the general partner supplies valuations of their investments based on their models of future cash flows and multiples, amongst other assumptions. While general partners give their best estimate of market value, these valuations may have little to do with a currently available sales price.[31] If these reported values are smoothed – valuations increase/decrease more slowly in a market where public equity values are increasing/decreasing – then measures of performance based on these valuations will under-report risk relative to public markets. It is estimated that 21% of the SERS portfolio and 31% at PSERS are reported at Net Asset Value (see sidebar on "Net Asset Valuations" for additional information).

Timing of cash flows. Private markets investments have inflows and outflows that are driven by capital calls and distributions made by the general partner. As will be discussed below, the meaning of commonly used performance measures such as IRR or multiples is greatly affected by the timing of cash flows. By using subscription lines of credit to time these cash flows, a general partner can attempt to increase reported IRRs. While not perfect, PME is a measure that accounts for timing of cash flows in the comparison metric.

"PASSIVE PLUS"

"Passive plus" – also known as "alpha transfer" – is an active management style used by PSERS where derivatives are used to generate the return of a given index (less the financing rate implied by the derivative), and then the cash that would have otherwise purchased that index exposure is invested in other securities with the aim of outperforming the implied financing rate. A common example is investing in a swap contract to earn the total return of an index less a financing rate, and then using the cash in excess of the collateral needed for that swap to invest in 1-3 year duration debt securities with credit risk exposures. Whenever the debt securities earn a return in excess of the financing rate inherent in the swap contract, this strategy will "outperform" the index. This is a riskier and different strategy than simply investing in an index portfolio. It employs leverage and all of the complexity associated with leverage discussed in the Portfolio Implementation chapter. If the index has a significant drawdown and additional collateral has to be posted and/or returns need to be paid, it may be that the debt securities have to be liquidated at distressed levels. Understanding these risks and evaluating the performance of these strategies with the correct risk context is critical.

[30] *In other words, compare the performance of co-investments offered by the manager to how the manager's overall portfolio performs as well as how well the pension staff selects amongst co-investment opportunities.*

[31] *The website https://www.bison.co/blog/how-do-gps-calculate-net-asset-value/ provides a very good write up of the techniques used for these valuations and the distinction between Level 1, 2, and 3 assets in financial statements.*

Leverage. Private markets investments involve making a legally binding commitment of capital to a partnership. The general partner has the right to call the pension fund's capital, up to the amount of the committed capital, at any time during the investment period. Failure to fund the partnership with cash as requested by the general partners has legal and financial consequences. The unfunded commitment to such an investment is therefore a type of leverage representing true economic value – in fact, general partners can and will establish subscription lines of credit against these commitments. There is no commonly accepted value associated with this liability, but it should impact the appropriate level of excess return these investments require.

Private markets investing also uses leverage at the asset level. Because this leverage is usually within a limited partnership legal structure, it is not generally recourse to the pension fund, but it still impacts the riskiness of the underlying investments. A fund manager that takes less risk by using less asset level leverage should not be penalized in performance evaluation.

Best practice requires private markets managers to report on their use of subscription lines, performance with and without the use of subscription lines, and to report the levered and unlevered returns of their investments, using both gross fees and net of fees, as always – since gross fee returns help monitor the riskiness of the investments.

Performance Measures. Since private markets investments are levered vehicles, illiquid and subject to general partner valuations of their assets, there is no perfect way to compare performance to a liquid public market alternative. We discuss here the common measures used and some cautions about each: IRR, Multiples, PME.

- All of the performance measures discussed below share two common problems: (1) unless the investment is fully realized, some portion of the return calculation depends on the net asset valuations described above. (2) If risk appropriate benchmarks are not used, then comparisons will conflate returns from skill with returns to systematic risks or leverage.

- Internal rates of return (IRRs): This is the most commonly reported measure of performance of a private markets investment and performance-based fees are often tied to it. It is the rate of return that will bring a series of cash flows to a net present value of zero. IRR has been identified by many academics as subject to factors that either by design or coincidence can enhance reported performance and potentially the fees earned by managers.[cxxxv] In the following example, Fund A has consistent cash distributions that over the life of the investment equals $4,150. Fund B, on the other hand, has a much smaller total return – less than half – but the same IRR-based "return" due to distributions being received early in the life of the fund.

Figure 52: IRR

	FUND A			FUND B		
	COST	DISTRIBUTED	NET CASH FLOW	COST	DISTRIBUTED	NET CASH FLOW
1990	100	-	(100)	100	-	(100)
1991	100	-	(100)	100	-	(100)
1992	100	-	(100)	100	-	(100)
1993	100	225	125	100	-	(100)
1994	100	225	125	100	500	400
1995	100	225	125	100	500	400
1996	100	225	125	100	500	400
1997	100	225	125	100	35	(65)
1998	100	225	125	100	35	(65)
1999	100	225	125	100	35	(65)
2000	100	225	125	100	35	(65)
2001	100	225	125	100	35	(65)
2002	100	225	125	100	35	(65)
2003	100	225	125	100	35	(65)
2004	100	225	125	100	35	(65)
2005	100	225	125	100	35	(65)
2006	100	225	125	100	35	(65)
2007	100	1,000	125	100	35	(65)
	1,800	**4,150**	**31%**	**1,800**	**1,885**	**31%**

Source: Ludovic Phalippou, 2018.

Same IRR even though Fund A has delivered over twice the distributions of Fund B

Source: Ludovic Phalippou, 2018.

- Multiples of invested capital measure the sum of distributed capital and the remaining net asset value divided by the amount of capital paid into the fund. These measures can be useful when combined with IRR, but are particularly challenging to interpret because they need to be contextualized with the investment time horizon. The doubling of invested capital over a five-year period, for example, is certainly preferred to the doubling of invested capital over a ten-year period.

- The most useful metric of performance increasingly used in recent years by investors and academics is the Kaplan-Schoar Public Market Equivalent (PME), which provides a value of over 1 to indicate outperformance compared to a public market index (such as S&P 500), equal to 1 to indicate equivalent performance, and under 1 to indicate underperformance. While this metric, like others, is biased by the accuracy of the reported net asset values determined by the manager and only independently-audited periodically, and the appropriateness of the public markets index chosen, it allows investors to evaluate how well private markets did relative to the specific investable public alternative chosen.

NET ASSET VALUATIONS

SERS

The Comprehensive Annual Financial Report dated December 31, 2017, (SERS CAFR) notes that:

> *Management of SERS has made certain estimates and assumptions relating to the reporting of assets and liabilities, and the disclosure of contingent assets and liabilities to prepare these basic financial statements in conformity with U.S. generally accepted accounting principles. Actual results could differ from those estimates.*
>
> *Private equity, real estate, hedge funds, and commingled fixed income funds are reported at fair value as estimated and reported by general partners, based upon the underlying net asset value (NAV) of the fund or partnership as a practical expedient of fair value. Adjustments from NAV are required when SERS expects to sell the investment at a value other than NAV.*[cxxxvi]

And later:

> *Private equity limited partnerships are valued at the NAV of SERS ownership interest in partners' capital, which approximates fair value. NAV is determined by the general partners using assumptions and estimates that have been reviewed and approved by valuation committees. Since private equity investments in such partnerships are generally illiquid with holding periods lasting seven to 10 years, the value realized by SERS upon disposition may differ from estimated values reflected in the basic financial statements.*[cxxxvii]

The amounts of these investments total $6,261,925,000 (21%) for SERS as of December 31, 2017 (SERS CAFR).

The SERS reports are audited to the standards of the Governmental Accounting Standards Board. The SERS Auditors, KPMG, sample the values that are submitted to SERS by the General Partners. All values submitted by the General Partners are audited by the General Partners' auditors. There is some non-audited reporting, but the non-audited reports (by General Partners) are primarily, if not always, older legacy investments. SERS Auditors will also evaluate a sampling of the General Partners' investments.

The invested companies report their value (some audited/some not audited by the invested companies) to the General Partners who then audit all, or samplings of the companies invested in and report the value of the General Partner's calculations to the systems. SERS is invested in over three hundred and fifty Private Equity General Partnerships reporting the value of thousands of investments. All of these values are based on unobservable data. There are formulas, testing and discussion but the NAV will always involve educated guessing and two experts could arrive at different values.

The amount of $6,261,925,000 is an estimated value. This calculation is included in the value of the entire SERS investment portfolio and is noted in the SERS CAFR as quoted above (italicized).

PSERS

The Comprehensive Annual Financial Report June 30, 2018 (PSERS CAFR), in the "Notes to Financial Statements," notes on the Net Asset Value Investments that

> *For alternative investments, which include private equity, private debt, venture capital and equity real estate investments where no readily ascertainable market value exists, management, in consultation with the general partner and investment advisors, has determined the fair values for the individual investments based upon the partnership's most recent available financial information.*
>
> *Directly-owned real estate investments are primarily valued based on appraisals performed by independent appraisers and, for properties not appraised, the present value of the projected future net income stream is used.*[cxxxviii]

The amounts of PSERS Net Asset Value investments totaled $17,046,603,000 (30.6%) for PSERS as of June 30, 2017 (PSERS CAFR). The table on page 52 (PSERS 2018 CAFR) states the amount of the NAV investments to be $31,057,796,000, but $14,011,193,000 representing Collective Trust Funds has been subtracted from the total.

The PSERS reports are audited to the standards of the Governmental Accounting Standards Board. PSERS Auditors, CliftonLarsonAllen LLP, sample the values that are submitted to PSERS by the General Partners. All values submitted by the General Partners are audited by the General Partners' auditors. There is some non-audited reporting, but the non-audited reports (by General Partners) are primarily, if not always, older legacy investments. PSERS' Auditors will also evaluate a sampling of the General Partners' investments.

The invested companies report their value (some audited/some not audited by the invested companies) to the General Partners who then audit all, or samplings, of the companies invested in and report the value of the General Partners' calculations to the systems. PSERS is invested in over 200 Private Equity General Partnerships reporting the value of thousands of investments. All of these values are based on unobservable data. There are formulas, testing and discussion but the NAV will always involve educated guessing, and two experts could arrive at different values.

The amount of $17,046,603,000 is an estimated value. This calculation is also included in the value of the entire PSERS investment portfolio and is noted in the PSERS CAFR as quoted above (italicized).

Case Studies in Performance Evaluation: SERS and PSERS

Private Equity

The private equity programs of SERS and PSERS provide examples of the different ways that performance can be reported and evaluated. The following image shows the private equity performance of SERS as reported by the general consultant and in the CAFR, by the staff when discussing performance, and by the private equity consultant (which is using IRR). Finally, a variety of public equity market benchmarks are provided to illustrate how benchmark choice can impact the evaluation of performance.

Figure 53: SERS Private Equity Performance

RETURNS AS OF DECEMBER 31, 2017*	1 YEAR	3 YEARS	5 YEARS	7 YEARS	10 YEARS	15 YEARS	20 YEARS	25 YEARS	30 YEARS	SINCE SERS INCEPTION (1/1/86)
General Consultant (RVK) and CAFR										
SERS PE Performance	12.8	8.6	10.3	10.8	7.5					10.9
Burgiss All Private Equity Custom Index	14.9	11.1	13.0	12.9	8.5					16.6
Russell 3000 Index+3%	22.3	14.1	17.7	17.7	10.8					14.3
Staff Presentation										
SERS PE Performance						11.4	11.8	13.7		
Presentation - U.S. Stock Index (R3000)						10.4	7.2	9.5		
Private Equity Consultant (StepStone)										12.30
StepStone - PE IRR	15.50	8.40	11.50		6.90					
Burgiss Private IQ Pooled PE	17.70	11.40	13.30		9.00					
Russell 3000*	21.10	11.10	15.60		8.60					10.10
Russell 3000 + 300 bps**	24.10	14.10	18.60		11.60					13.10
Additional Information										
SERS PE Performance	12.83	8.64	10.31	10.80	7.46	11.41	11.75	13.74	12.16	10.92
Russell 3000 + 3%	21.51	12.11	17.59	18.35	10.30	11.69	10.47	12.73	12.68	13.72
Russell 3000 Index	18.71	10.74	14.23	14.28	7.57	10.37	7.20	9.75	9.60	11.00
Russell 2000 Index	20.74	12.18	13.79	13.51	7.85	11.37	7.53	10.01	9.08	10.05
S&P 500 - Total Return Index	18.61	10.81	14.22	14.38	7.44	10.04	7.00	9.62	9.53	11.09
S&P MidCap 400 Index	17.52	11.18	14.43	13.92	9.00	11.97	10.29	12.21	12.31	13.39
S&P Smallcap 600 Index	21.05	14.07	15.60	15.60	9.27	12.34	9.34	11.77	10.19	10.85

Red text: indicates underperformance against both board-approved or staff-utilized indices

Green text: indicates performance against one board-approved or staff-utilized indices

Blue text: indicates underperformance against one board-approved index

*Benchmarks lagged 3 months
*Benchmark is a dollar-weighted calculation of quarterly changes in the Russell 3000® Index
***(1/1/86-12-31-17, 10/11/85-9/30/17 for indices)

Source: BNY Mellon, RVK, StepStone and SERS CAFR.

Additionally, the tables below provide Kaplan-Schoar Public Market Equivalent (K-S PME) values for both SERS and PSERS (please see Transparency chapter for additional information on how estimates were calculated). As discussed earlier, Kaplan-Schoar PME values for an individual fund provide the under performance or over performance for the life of that fund. For example, a value of 1.20 equates to a roughly 20% outperformance over the public market index for the life of the fund. A fund with a life of ten years would work out to an approximate 2% outperformance per year. For an entire portfolio, average fund duration is used to interpret what a PME value would approximate on an annual basis. Dr. Ludovic Phalippou in his analysis for Treasury estimated a weighted average implied investment duration of 5.01 years for SERS and 4.01 years for PSERS. Harris, Jenkinson, Kaplan describe their findings of the average buyout PME of 1.20 "works out to an outperformance of at least 3% per year" based on a five-year duration.

> ***I'm not going to give you any information on IRRs and money multiples to address that balance because many academics say there is far too much focus on these metrics. I'm going to show you private equity returns relative to public equity returns, which allows you to answer the question . . . "why bother?"*** - Dr. Tim Jenkinson, testimony before the Commission, September 20, 2018

Figure 54: SERS PME Estimates versus Reported Values Since Inception

SERS PRIVATE EQUITY PERFORMANCE VS:	S&P 500	RUSSELL 3000	RUSSELL 2000
KS-PME –Estimate July 2018	1.22	1.20	1.15
KS-PME – SERS Reported October 2018	1.26*	N/A	N/A

*reported as 1.3, rounded up from actual value 1.26

Source: Analysis using PSERS and Preqin data.

Figure 55: PSERS PME Estimates versus Reported Values Since Inception

PSERS PRIVATE EQUITY PERFORMANCE VS:	S&P 500	RUSSELL 3000	RUSSELL 2000	DJ WILSHIRE 5000	RUSSELL 3000 70% / MSCI ACWI IMI EX US 30%
KS-PME – Estimate July 2018	1.10	1.09	1.07	N/A	N/A
KS-PME – PSERS Reported October 2018	1.10	1.09	1.05	1.09	1.11

Source: Analysis using PSERS and Preqin data.

Kaplan Schoar PMEs reflect estimates of investment duration as well as the index chosen to reflect the types of companies managed by private equity managers. Index selection can be lead to non-trivial differences in reported performance. These KS-PMEs **do not** reflect liquidity and complexity risk. Pensions funds should expect a liquidity premium for investing in high cost and illiquid investment vehicles. Some funds, such as the New Mexico Educational Retirement Board, use a benchmark of Russell 3000+ 3% for calculating its PME values in order to account for the expected liquidity premium for investing in private equity.[cxxxix] SERS' private equity consultant, StepStone, recommends that a liquidity premium be included in the evaluation of performance: "StepStone believes the Russell 3000® Index plus 300 bps from inception appropriately reflects the opportunity cost of investing in Buyout, Venture, and Special Situations investments versus publicly traded common stocks and therefore is an appropriate benchmark for SERS."[cxl] While there is ongoing debate about the most appropriate public market index to which private equity should be compared, Dr. Ludovic Phallipou has suggested that based on the size of companies in most PE deals, the Russell 2000 index is the nearest and most accurate proxy.

It is not known how/why SERS determined the S&P 500 as an index choice at which to compare private equity performance. The S&P 500 is not mentioned as a benchmark for SERS' private equity program in the CAFR, the RVK performance reports, or the board-approved Strategic Investment Plan. Compared to the PME values of other benchmarks and to the PSERS' results, it appears to exaggerate outperformance.

Recommendations

- We recommend that returns be measured and reported such that actual investments can be compared for risk and return versus a low-cost, index implementation, including:
    - o Gross-of-fee and net-of-fee performance should be reported.
    - o Report manager returns relative to both a risk matched benchmark established at the time of the investment and relative to the investible liquid allocation it replaces.
    - o Returns for the portfolio, asset classes, and individual mandates should include annual returns, 1-, 3-, 5-, 10-, 15-, and 20-year returns ending in the current period, along with rolling 5-year returns.
    - o Attribution analysis should be performed for each manager to identify whether the drivers of performance were aligned with expectations.
- We recommend that where portfolio leverage is used, both levered and unlevered returns should be reported, against an appropriately levered or unlevered benchmark.
- We recommend private markets, including private equity, performance be measured against relevant stylistic benchmarks, as well as the liquid public market Kaplan-Schoar PME values, where the choice of the market index is first that which is consistent with the risk taken by the manager and second, with the index that the manager replaces in the diversified portfolio benchmark.
- We recommend private market risk reports measure and describe subscription lines with performance adjusted for the use of those financing facilities as well as other uses of leverage.

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

CONSULTANT REPORT

Public Pension Management and Asset Investment Review Commission Consultant Report

November 2018

This report (also referred to herein as "set of chapters") has been prepared pursuant to a financial consulting agreement between RCI App 1, Inc. ("Consultant") and the Pennsylvania Treasury Department ("Client"), dated on or about June 1, 2018, which terms govern Consultant's and Client's respective rights and obligations with respect to the report and its content. The report is intended for Client's exclusive use, and Consultant assumes no responsibility or liability to any other person or entity who relies upon the information contained herein. This report is not intended to be an exhaustive source of information on the topics covered herein, and Client is advised to consult with its independent legal, tax, and other professional advisors before taking any action based upon Consultant's conclusions and recommendations. Many of the conclusions and recommendations contained herein are based on information provided to Consultant by Client, and Consultant assumes no responsibility or liability for its conclusions and recommendations to the extent they are based on inaccurate or incomplete information provided by Client.

This consulting engagement was led by Dr. Ashby Monk with assistance from Dr. Rajiv Sharma, Marcel Staub (Novarca), Jorge Madrazo Gonzalez, Amit Bansal (Novarca), and David Goerz (Strategic Frontier Management).

Executive Summary

This report (also referred to herein as "set of chapters") has been prepared to assist the Public Pension Management and Asset Investment Review Commission (PPMAIRC) established by the Commonwealth of Pennsylvania through Act 5 of 2017, to study the investment performance, fees and costs of the State's two largest pension funds, Public School Employees' Retirement System (PSERS) and State Employees' Retirement System (SERS). Specifically, this set of chapters set out to analyze the asset allocation and investment performance of the two plans as well as the fees and costs of the plans' external asset managers. Based on this analysis, we put forward recommendations to help the PPMAIRC generate actuarial savings of $1.5 billion over 30 years for each plan from the effective date of the legislation.

At the outset, we note that the analysis for this project has not come without its challenges, specifically with regards to obtaining the necessary data to carry out a comprehensive evaluation. We have not been granted access by the pension plans to the full amount of data needed to carry out an exhaustive performance and fees/costs analysis. We were also not granted access to conduct a full governance analysis of the two plans. The lack of data forthcoming has been surprising and in some ways alarming to us. This data was requested by a Commission set up by the State Legislature for oversight. Notwithstanding these limitations, we have applied best practice methodologies to publicly available information to achieve meaningful insights that the Commission can use in their recommendations.

The analysis in this set of chapters is structured in three main sections. The first provides a detailed account of the performance and asset allocation of the two PA plans against a peer group. This section includes a risk-adjusted performance analysis specifically of the two plans. The second analysis section provides an overview of the different cost-saving strategies on offer to the PA plans highlighting which of these strategies might not be currently appropriate. This section provides a preliminary assessment of the PA plans' governance structure. The final analysis section provides a detailed evaluation of the current public equity mandates for the two plans and identifies from where the statutorily-required cost-savings can come. This analysis culminates with the specific cost-saving calculations required by the Commission.

The objective of the first section of analysis in this set of chapters was to assess the asset allocation and investment performance against a peer group with comparable characteristics to the PA pension plans. The peer group for the analysis consisted of 11 U.S. public pension funds that had similar characteristics to SERS and PSERS in terms of size of assets, discount rate and funding ratio. Analysis was carried out on data from all plans in the peer group between June 30, 2007, and June 30, 2017, from the Public Pension Database (PPD) at the Center for Retirement Research at Boston College. Our findings from this analysis are summarized as follows:

- Over the ten-year time period examined, SERS has progressively increased its allocation to public equities, while PSERS has decreased its public equities allocation. PSERS has increased its hedge fund, commodities and fixed income allocations and maintained a relatively high private equity allocation.
- The 2017 asset allocation of SERS was relatively consistent with the peer group. The asset allocation of PSERS contained a number of differences compared with the peer group:

namely, it had the lowest allocation to public equity, the highest allocation to fixed income, commodities and one of the highest allocations to private equity and hedge funds. PSERS was the only fund to use leverage in their asset allocation.

- Excluding one fund that used the CPI, the total portfolio benchmark performance for PSERS was the lowest in the peer group across the 1-year, 3-year, 5-year and 10-year time horizons. The total portfolio benchmark performance of SERS in contrast was consistently above the average for the peer group across all time periods.
- The absolute performance of PSERS and SERS were the lowest in the peer group over ten years at 3.8% and 3.9%, respectively. To control for bias in the peer group, we analyzed the two PA funds' performance in the wider universe of the PPD. From the wider database, PSERS and SERS ranked 50th and 49th, respectively, out of 52 U.S. public pension plans.

We acknowledge that there are challenges in conducting peer comparisons because of the unique characteristics of each fund. Despite the limitations, our analysis clearly shows that the PA plans have underperformed the peer universe over the last 5 and 10 years, and there are certain anomalies in asset allocation (particularly for PSERS) compared with the peer universe.

We also conducted analysis on risk-adjusted performance of the two plans specifically, calculating their Sharpe ratios and information ratios over the 10- and 30-year periods from June 2018 for PSERS and December 2017 for SERS. We constructed various multi-asset benchmark portfolios using simple public total return indices to compare the funds and calculate the information ratios. These benchmarks (which included a simple U.S.-based balanced portfolio, a global balanced portfolio, a global mix of public indices similar to the policy allocation of the two funds, and a quasi-LDI [Liability Driven Investing] benchmark) compounded monthly data to provide annual returns comparable to annual plan returns. We used 30 years of data to develop a comparable history with large enough sample size to provide significant calculations.

Our risk-adjusted performance figures confirm the absolute performance assertions. The Sharpe Ratios for PSERS and SERS were calculated to be slightly lower than the alternative simple balanced indices at the 30-year level and significantly less at the 10-year level. Negative information ratios for both plans at the 10-year level and 30-year level for SERS indicate that both plans have significantly and consistently underperformed simple multi-asset index portfolios.

The performance and asset allocation analyses indicate that the asset allocation strategy of the funds might need to be addressed. For PSERS, it would appear that the use of leverage to extend duration in fixed income, the allocation to illiquid asset classes such as private equity, and the allocation to commodities and hedge funds should all be looked at and reconsidered. For SERS, the allocation to private equity should be addressed, although we note that SERS' allocation to public equities is more in line with its peers and what is likely to contribute most to total portfolio returns.

The second area of analysis for this project highlighted the various cost-saving pathways available to institutional investors. We summarized the drivers and related strategies to be:

- Investment innovation – seeding new managers, new collaborative vehicles, platform companies.

- Strategy simplification – active to index, illiquid to public.
- Cost Arbitrage – risk factor approach for more efficient access points, internal management.
- Monitoring and Revisiting – renegotiating current mandates.

We highlight with illustrative examples how the above strategies can lead to significant savings for pension plans. We do note, however, that some of these strategies are not likely appropriate for PA because of their unique characteristics and the governance requirements for investment innovation and internal management.

After conducting a preliminary governance assessment, we note that both PSERS and SERS do not appear to have the governance expertise to adequately oversee complex strategies such as investment innovation and internal management. This is evident from the number of board members, the composition and nomination procedures for expertise when compared with best-practice investment boards, as adopted by certain other U.S. public pension funds that have implemented innovative strategies. **Our cost-saving recommendations therefore focus on strategy simplification and monitoring/revisiting current mandates.**

The recommendation of strategy simplification is in line with our asset allocation and performance analysis where, particularly in the case of PSERS, we observed complexity in the portfolio with regards to the use of leverage, private equity, and internal management. Our risk-adjusted performance analysis indicates that a shift to a lower-cost simple balanced public index would have performed significantly better on a risk-adjusted basis than the current complex strategies. There are a number of aspects that would need to be addressed when considering a simplification of strategy such as how the change in active risk exposure would impact the plans as well as the potential for increased volatility that would be associated with moving to public indices. Our preliminary analysis in this project would suggest that strategy simplification should be explored as a cost-saving strategy for the two plans. Further analysis would be needed to confirm this.

Our fee and cost analysis of current mandates was restricted to the public equity asset class for the two plans. We were not provided with the necessary information to do a detailed analysis on the other asset classes of the plans.

From the analysis conducted on SERS, we note that most of the public equity index mandates are priced fairly. There are four active mandates of SERS that are primary candidates for in-depth review and potential renegotiation, based on being old agreements that should be updated and appear expensive compared to best practice.

For PSERS, we found, contrary to their explicit assertion that more expensive mandates lead to better returns, the cheapest out of their five mandates in International All Cap Equities (which is almost half the cost) has enjoyed the best returns. All of the five International Small Cap Equities mandates should be reviewed for renegotiation, as should one index mandate where SERS pays lower fees for the same allocation, and two active mandates, where there is an absence of tiers for discounts above $200m in one and the other is the worst performer in its category, despite having the highest fixed fee. We also found that within the High Yield/Opportunistic asset class for

PSERS, there are significant savings that can be achieved based on the current fee levels paid and performance achieved.

Having not had full access to the Private Equity investment details of both plans, it is very difficult to make a thorough statement on cost-savings here. Nevertheless, based on our experience, we have made reasonable estimates of the potential cost-savings from the asset class for the two plans.

From the analysis carried out on the current mandates in Public Equity and through estimations of Private Equity, we believe that both plans are able to meet and exceed the cost-savings target stated in Act 5, although due to the different size of the plans, achieving the target proves to be more difficult for the smaller of the two plans, SERS.

Over a 30-year time horizon, taking into account a 7.25% expected return for both SERS and PSERS, our analysis in this set of chapters shows that without changing the plans' current investment strategies, the following actuarial savings can be achieved:

Plan	Identified Savings Potential
PSERS	**4.96 B USD**
SERS	**1.51 B USD**

Our analysis and recommendations above are premised on not having the full amount of data to do a comprehensive analysis on the plans. We thus caveat the recommendations put forward as being subject to doing a fuller analysis in certain areas such as governance and in analyzing cost-savings on the plans' current mandates in all asset classes.

Table of Contents

Section 1: Background and Context

1.1 Introduction

This set of chapters is intended to complement and assist the work carried out by the Public Pension Management and Asset Investment Review Commission (PPMAIRC), set up by the Commonwealth of Pennsylvania as part of the broader pension reforms of Act 5, which, in relation to the two largest Pension systems in the State, has been tasked to study:

(1) The performance of current investment strategies and procedures of the Systems, comparing realized rates of return to established benchmarks considering the associated fees paid for active and index management,

(2) The costs and benefits of active and index investment strategies in relation to future investment activities, and

(3) Alternative investment strategies that will maximize future rates of return net of fees.

Furthermore, this set of chapters also provides guidance to the PPMAIRC for developing a plan to identify at least $1.5 billion in cost-savings over 30 years for each of the two systems and to identify the lowest amount of fees to achieve the actuarial assumed rate of return. At the core of the Commission and the impetus behind this set of chapters are two key objectives: (1) To understand whether the current practices employed by the pension systems are in the best interest of the plans' beneficiaries and (2) to explore how the funds' investment operations could be improved.

This set of chapters aims to understand how the Pennsylvania funds are performing in the context of the fees and costs they are paying to external managers. This set of chapters provides a detailed analysis of the performance and asset allocation of the systems in comparison to their benchmarks and a peer grouping of funds. This performance analysis provides context for how the current PA funds are performing and operating in comparison with other similar funds in terms of size, return expectations and funding status. The performance of the PA funds is also specifically analyzed on a risk-adjusted basis.

The second part of this set of chapters' analysis presents the various options available to the plans for achieving at least $1.5 billion in savings each, over the next 30 years. There are a number of strategies that investors have adopted to run more cost-effective investment operations, without compromising performance. We go through these options and highlight some key factors that need to be considered when adopting and implementing these strategies. We highlight that governance plays a key role in adopting certain cost-saving strategies and, as a result, we suggest that certain approaches to saving costs, such as those that are particularly governance-intensive, may not be appropriate for the PA plans.

The final part of the analysis for this set of chapters focuses on the fees and costs associated with the current external managers utilized by the pension plans in the public equity asset class. This set of chapters analyzes the performance of these managers in the context of the fees they charge, examining the extent of these fees and identifying areas where the systems can improve. The analysis of fees and costs is restricted to the public equity mandates of the PA plans due to the PPMAIRC not being given access to necessary data for other asset classes. From this analysis and from other publicly available information, we put forward the specific strategies and accompanying calculations for saving at least $1.5 billion for each of the PA plans over 30 years.

1.2 Setting the Scene - Fees, Risks and Performance

In the wake of challenging macroeconomic conditions (including stagnant economic growth, geopolitical uncertainties, and aging populations), it seems unlikely that pension funds will be able to overcome their underfunded liabilities without making well-considered changes. The threat of deep funding shortfalls is quite real, and this precarious investment climate is making many plan sponsors (which are ultimately on the hook for the pension promises) rather uncomfortable. But the choices available to plan sponsors are all seemingly bad: cutting benefits, increasing contributions, delaying people's retirement, or improving investment returns. The one that has seemed the least painful to stomach by politicians and plans alike has been the latter.

In the pursuit of higher returns, however, funds have moved into riskier and alternative investment strategies, which are associated with more expensive asset manager relationships. While this move into more costly, riskier investment products has resulted in some investment outperformance among some American public pensions, most stakeholders of these funds have not clearly understood the process of taking more risk via external managers in complex strategies. Many have also not grasped the sheer scale of compensation that these investors have paid to external managers and the associated consequences. In many cases, investors around the world and in the U.S. took this delegated approach without explaining all aspects of it clearly to their stakeholders. This lack of understanding was a recipe for stakeholder conflict and loss of trust.

Today, there is a lack of understanding among pension stakeholders about the external costs because much of the compensation data has been buried in fund footnotes, hidden in net asset value calculations, waived away as profit sharing or ignored by the funds themselves under the false protection of a most favored nation ("MFN") provision. A lot of this information has not been reported, measured, tracked and ultimately not managed. The obfuscation of fees and costs by managers has enabled these managers to gain economies of scale, which have been wielded back against pension plans at the negotiating table. The gap in skills, capabilities and resources between public pension funds and private managers has grown, without much understanding as to the reasons since the fees weren't being tracked diligently. This reinforced the asymmetries of information, skill and ultimately power in favor of the managers. Managers have thus been able to demand more and more of the returns to capital as a fee.

A major consequence of opaque fees and costs has been pension fund under-resourcing. The responsibility of a pension fund Board and senior management team is often as much about building professional and effective investment organizations as it is about making investment decisions. The Board has a duty to help ensure their plans remain the principals in the complex chain of principal-agent relationships. In order to properly resource an investment organization for success, to remain the principal, a pension fund has to first assess the true cost of producing a target return – whether those returns are produced internally or externally, *i.e.*, how much it costs to generate a certain amount of return per unit of risk.

In sum, fee opacity may have allowed the pensions to pursue riskier and higher returning strategies, but it also prevented the Boards from properly resourcing and thus overseeing and holding accountable their pension organizations and the associated strategies. The principals (pension funds) have found themselves increasingly subservient to their own agents (investment managers).

We thus applaud the efforts of the Commonwealth of Pennsylvania in addressing the issue of fees and costs for pension fund investment management through setting up the PPMAIRC. The SEC has investigated fees and costs of alternative managers and has uncovered a startling amount of over-charging. The process of achieving fee and cost transparency can be one of the most powerful catalysts for Boards and legislators to become reinvigorated and re-empowered to consider, from first principles, how they should design their organizations to achieve their investment objectives.

1.3 Data Considerations

As will be documented throughout this set of chapters, we have come across a number of challenges in carrying out the analysis, none more so than the lack of data provided by the Plans to do a thorough analysis. Access to reliable and accurate data is essential to any robust financial and investment analysis.

Most notably, we have not received any reliable data on illiquid investments from either of the PA plans, especially as it pertains to performance and the contracts associated with managers used for these investments. We have therefore not been able to appraise in detail the costs associated with the illiquid investments made by the plans, in particular in private equity, which is widely regarded as the most expensive asset class, and where overcharging of fees by managers has been found to be prevalent.

Furthermore, while we were able to get access to the PSERS' public equity agreements, SERS did not provide unredacted contracts for their public equity mandates. The analysis on fees and costs has thus been restricted and is incomplete. We were forced to use consultant reports where certain information could be extracted, but these also mostly just provided headline figures without underlying fund or investment-related data required to perform independent analysis and deductions. Within the public equity mandates, and in particular for SERS, we have not been able to get an appreciation of the true cost of

investment with external managers, including Holding Costs, Transaction Costs, Other Operating Expenses and 2nd Tier Fund costs.

As part of our analysis for providing cost-saving recommendations to the plans, we needed to conduct a thorough governance analysis. In order to carry out this analysis, we requested on-site individual meetings with senior investment staff and board members of each plan in an off-the-record setting. We were not granted access to meet individually with members, which has meant a thorough governance analysis was not possible.

The lack of data forthcoming has been surprising to us particularly given that this analysis was commissioned by the Legislature. We understand that even more data of underlying cash flows of private equity investments have been provided by public pension funds in other states for academic research, which further emphasizes the irregularity of the situation here in Pennsylvania.

Not being transparent about asset managers' contractual details serves only one party's interests: the asset managers. A reason SERS claimed for not providing the information was that the contracts contained confidential proprietary information and/or trade secrets. From our experience, whenever clients are told that contractual terms are a trade secret of the manager, it is an indication that these should be reviewed immediately.

Notwithstanding the data challenges, the analysis has adopted methodological best practices using the available data to provide and produce meaningful insights and evidence for the recommendations put forward. The data and methodology used for the analysis in this set of chapters are documented in the individual sections.

The next section provides the detailed analysis of the asset allocation and performance of the two plans. Section 3 outlines the available options to investors looking to save costs across their portfolio and highlights the key factors that need to be considered before adopting any of these strategies. It then provides an analysis of which cost-saving strategies are most appropriate to the PA plans. Section 4 provides a detailed analysis of the current public equity mandates for the two plans and a detailed breakdown for where the $1.5 billion of cost-savings can be achieved for the plans. The final section summarizes the findings from this project.

Section 2 - Performance and Asset Allocation Analysis

2.1 Objectives and Scope

The objectives of this body of work were to assess the asset allocation and investment performance of SERS and PSERS in relation to a select group of pension funds ("the peer group") with comparable characteristics.

The scope of the assessment focuses on the asset allocation and investment performance of SERS, PSERS, and the peer group. The following four elements were defined at the outset and guided the team's efforts throughout the project:

- Time range – The time range for analysis was defined as a 10-year period ending with the last year of readily available data for analysis. The time range was set for fiscal years 2008-2017.
- Data – While certain fund documents were made available by both SERS and PSERS for this work, due to inconsistencies in the data, the bulk of analysis leveraged publicly available data.
- Analysis – The analysis for the project was scoped to cover both asset allocation and investment performance for each fund in the peer group across the 10-year time frame, subject to data availability. To support data rationalization and comparability, the level of analysis was set to a primary asset category level (*e.g.*, Equity), rather than a sub-asset class level (*e.g.*, Domestic Equity, International Equity, Global Equity, Emerging Market Equity, etc.). The major areas of analysis focused on:
    - Asset allocation variations for 2017 and over the 2008-2017 period.
    - Annualized 1-year, 3-year, 5-year, and 10-year absolute performance at the total fund and asset class levels from the last year of available data.
    - Risk-Adjusted Performance (Sharpe Ratio, Information Ratio) was calculated specifically for the two PA funds over the 5-year, 10-year and 30-year period.
- Peer Group – A range of 10-12 funds for the peer group was established at the beginning of the project with the anticipation that funds would potentially drop-off as the criteria for selection and analysis evolved throughout the project. The final peer group consisted of 11 funds and constitutes a group of U.S. state-based public pension funds that are comparable to both SERS and PSERS across a set of pre-established criteria.

2.2 Analysis Structure

The analysis in this section is structured in four main parts. The first part consists of a literature review on key topics for the analysis such as asset allocation, investment performance, benchmarks, as well as important features of pensions like funded status and discount rate. The second part provides a description of the methodology used for the assessment and it highlights the major challenges associated with performing asset

allocation and investment performance assessments for pension funds. The third part consists of the asset allocation analysis across the peer group. The final part includes the investment performance analysis of SERS and PSERS against the peer group for absolute returns and the risk-adjusted performance specifically for the two funds.

2.3 Literature Review and Background Information

2.3.1 Asset Allocation Literature Review

Asset Allocation Overview

Asset allocation refers to how funds allocate their investments across different asset classes. It consists of the deployment of strategies that seek to balance rewards in the form of investment returns and risk in the form of investment losses through the selection of a specific asset mix based on an investor's profile and return objectives.

At a high-level, a pension fund's asset allocation should balance risk, return, and cost. However, several other internal and external factors that can influence each other should be considered holistically, rather than in isolation. A recent study on global pension fund best practices illustrates that drivers such as diversification, risk management, inflation hedging, asset liability management, and return on investments should all be key determinants of asset allocation.[i]

These drivers can influence very different decisions across pension funds, as each must consider their specific internal objectives and external constraints. For example, a pension fund that is mostly focused on guaranteeing long-term solvency may follow an asset allocation strategy that enables investments in a manner that is more risk-averse than others.

Given that the overarching objectives of public pension funds are usually determined by its board and public officials, asset allocation decisions are also normally influenced by the larger economic and political context at play. For example, a pension fund that seeks to avoid imposing short-term increases in employee contributions may choose to adopt an asset allocation strategy that enables the organization to chase riskier investments that could generate higher returns.

To set their asset allocations, pension funds usually identify a specific objective or set of objectives and the considerations that will help execute against them. This is usually done through a board-approved strategic investment plan that includes a pension fund's investment strategy, structure, implementation, and asset allocation. While the process is different for each organization, in general an asset allocation structure is developed and weighted by considering each asset class's expected return, volatility and correlation with other asset classes. The pension fund's investment office, usually in consultation with its board and external investment consultants, then combines these asset classes in ways that could provide the highest expected returns for a level of risk, subject to liquidity and diversification constraints.[ii]

Asset Allocation and Investment Performance

Asset allocation is widely accepted across industry and academia as a critical driver of fund performance.[iii] A study often cited on this topic was released by Brinson, Hood and Beebower in 1986 and argues that 93.6% of the variation in quarterly returns for a typical large fund can be attributed to their asset allocation.[iv] In 1994, Jack Bogle, the founder of the Vanguard Group, noted that "the most fundamental decision of investing is the allocation of your assets. How much should you own in stocks? How much should you own in bonds? How much should you own in cash reserves? This decision has accounted for 94 percent of the differences in total returns achieved by institutionally managed pension funds."[v] Other studies, such as Ibbotson, Roger G., and Kaplan, Paul D. argue that a fund's allocation roughly accounts for 40% of the variance among funds.[vi]

While the magnitude of impact of asset allocation is still up for debate, most academics and industry experts agree that "asset allocation is the most important decision for any pension fund and that there is no right or wrong way of determining asset allocation. In the end it is a question of finding the best solution to a set of constraints, some implicit (fund structure) and some explicit (legislation)."[vii]

Given the relevance of asset allocation to a fund's performance, it is crucial that pension funds design appropriate strategies that consider the asset diversification needed to respond to their individual objectives and constraints. Diversification of assets is important because it enables funds to reduce or spread risk while maintaining expectations of returns. Asset classes do not produce the same results in particular economic contexts; therefore, funds must diversify their investments to help reduce overall volatility.

Funds must also continuously revisit and adapt their asset allocation plans. This is particularly important when considering how pension funds have shifted their investments over the past two decades.

2.3.2 Investment Performance Literature Review

Absolute Investment Performance

A fund's investment performance is usually assessed in two ways. The first is a comparison of the fund's actual returns against the fund's benchmark returns. This view helps to assess the plan's ability to execute their investment strategy (*i.e.*, beat their benchmark returns and add value). The second method of assessment consists of a comparison of investment returns across similar plans, both at the total fund level and for the various asset classes in which the plans invest. This second method helps to determine the relative performance of a fund against other similar players in the market.

These two assessments are usually performed for absolute returns and risk-adjusted returns. An absolute return is simply what an asset or portfolio returns over a certain

period of time. This measure looks at the appreciation or depreciation of an asset expressed as a percentage. For example, if a stock or bond returns 10% in a certain year, that is the absolute return.

Risk-adjusted returns is a measure that helps investors assess how an asset has performed relative to the amount of risk the investment has taken over a period of time.[viii] This is important when comparing different investments because, if two or more assets have the same return over a given period of time, the one with the lowest risk will have better risk-adjusted returns and therefore could be more attractive for investors looking to maximize returns while minimizing risk.

Investment Risk and Risk-Adjusted Performance

Investment risk is commonly defined as volatility of security returns or changes in asset prices. Investors must be compensated by return for the risk that they assume, but there are various dimensions of portfolio risk that investors need to consider. Investment risk can be a function of either allocations to market risk factor exposures or active management decisions, deviating from a representative single index or multi-asset benchmark. As mentioned, portfolio asset allocation is the most significant decision that affects long-term appreciation, and thus must be aligned with not only investors' investment objectives, but also their risk tolerance. It is important to note that all performance ratios and risk measures can be historically representative, but past performance may be inconsistent or even misleading predictors of future return and/or risk.

Risk-adjusted performance is an effective way to compare different portfolio strategies from within asset classes to strategic allocation policies of multi-asset funds. Investors focus over various time horizons on total returns as well as active returns or value added in excess of index benchmarks net of costs and fees. Below we discuss the use of various risk-oriented statistics that can be useful for evaluating both total return and value added at the total fund or individual strategy level, as well as how portfolio diversification improves performance efficiency, as described in Modern Portfolio Theory. Finally, we highlight some practical assumptions and challenges related to performance measurement, portfolio attribution, and risk management that can be critical to achieving successful outcomes relative to investment objectives.

The likelihood of achieving or exceeding an expected return over a given time horizon is a function of its risk factor exposures (asset allocation) and specific or idiosyncratic risk (security selection). Just as a portfolio of securities can diversify company or issuer specific risk, a portfolio of different asset classes (i.e., equities, bonds, alternative assets, etc.) and across countries, sectors, currencies, industries, investment styles, or capitalization size, for example, can diversify market risk factors or systematic risks. Similarly, we can adjust cumulative active performance or value-added returns (excess return versus a similar representative index or benchmark) by tracking error (standard deviation of excess return) to evaluate performance between different strategies.

Academic literature has repeatedly confirmed the need to manage investment risk, as well as the importance of asset allocation to achieving desired investment objectives to more recent studies that reinforce the need to appropriately classify risk.[ix]

All investments involve various types of risk; thus, assessing investment risk is critical to performance evaluation and attribution. There is no guarantee any particular asset allocation or investment mix will achieve or exceed given return objectives over any particular time horizon. Adverse fluctuations in the financial markets may not affect the inherent value of investments, but misunderstanding risk inherent in particular portfolio holdings may be inconsistent with an investor's risk tolerance, resulting in adverse behavior with respect to future investment decisions.

By risk-adjusting investment performance, one can compare total and active management performance of different strategies or investment allocations more effectively. Risk-adjusted returns also help management to make strategic organizational decisions for a fund.

Although the importance of measuring risk-adjusted performance is widely recognized, different methods exist through which to do so. A common set of measures used across the investment management industry are the Sharpe Ratio, the Sortino Ratio, and the Information Ratio.

The Sharpe Ratio, derived by Nobel laureate William F. Sharpe, calculates a fund's risk-adjusted return—the ratio discounts a fund's investment returns based on the risk taken on by that fund. The Sharpe Ratio is the annualized absolute investment return earned minus a risk-free rate divided by the standard deviation of the absolute return. Through this formula, the Sharpe ratio provides investors with the return a fund earns in excess of a risk-free rate, per unit of volatility (the higher the rate the better the performance on a risk-adjusted basis). While today many institutional investors use the Sharpe Ratio to examine risk-adjusted performance, a look at other measures is important in identifying some of the approaches, advantages, and limitations. The Sharpe ratio focuses on comparing a risk-free asset to measure both the combined riskiness of the fund's asset allocation, choice of security selection, and risk factor or systematic market exposures. It can also be used to compare underlying strategies or relative efficiency of different asset classes or indices.

The Information Ratio is another way of measuring performance efficiency, but focused on active or tactical management of a given strategy or portfolio. The approach is similar to other efficiency ratios of return versus risk, but here the excess return is calculated versus a similar benchmark index, rather than the risk-free rate used in the Sharpe ratio. Moreover, this excess return is divided by the standard deviation of the excess return, also known as tracking error. While the information ratio allows analysts to look at how well a fund has done relative to its benchmarks, it is important that the selected benchmark index chosen is similar and comparable to the strategy's risk profile. A benefit of information ratios is that comparable benchmarks may be either systematic

indices or peer group composite returns, but benchmark selection also can be misleading if the choice is biased (low hurdle) or inconsistent with the strategy being evaluated.

Investors utilize the Sharpe Ratio to examine risk-adjusted performance of individual strategies of multi-asset fund portfolios.[x] However, there are certain challenges and limitations that are noteworthy, whether calculating the Sharpe Ratio, Information Ratio, Performance Attribution, or other statistical characteristics of individual strategies or fund portfolio performance. One challenge of any statistical calculation is having a reasonable and representative sample size. In the special case of asset management, the period should be long enough to span at least one business or investment cycle, which can vary from 5 to 10 years or even longer, as observed recently. Thus, observation frequency over a given period becomes important, governing the sample size for the comparison of both risk and return. Another important consideration is the assumption that investment returns are normally and independently distributed, but we know that asset return distributions tend to be skewed with fat tails, and returns are hardly independent given non-zero correlations between asset class returns.

We know investors are more risk-averse to losses; thus, if the Sharpe Ratio uses the simple standard deviation of returns, this calculation does not differentiate between upside versus downside risk. For example, the Sortino ratio (Frank Sortino) is similar in construction to the Sharpe Ratio, except it subtracts a target return from net return. In addition, instead of dividing by the standard deviation of returns, risk is evaluated as the downside variability or standard deviation of "0" or underperformance versus the target return. This statistic seeks to measure the standard deviation of only negative excess returns, thus downside risk. Studies such as Rollinger & Hoffman suggest investors should consider downside volatility of returns or "bad" volatility, rather than upside or "good" volatility.[xi] For example, if a fund experiences an extraordinary positive total or excess return, Sharpe or Information Ratios are adversely penalized for such inconsistency, albeit welcomed by investors. The Sortino Ratio is therefore a complementary performance statistic that can be worth evaluating, as well, although it too will be subject to sample size concerns, if not more so than the Sharpe Ratio if downside frequency is materially less than upside frequency. Assuming total and excess returns are normal again may cause bias in Sortino Ratio calculations if positive returns are skewed or biased by significant outliers.

As discussed, a key challenge with these statistical performance ratios or measures is that investment returns are not normally distributed, which can bias these calculations. Research suggests this effect may be less pronounced for public listed markets evaluated over longer periods of time. Private markets and private funds are subject to capacity constraints (including higher cash drag), limited mark-to-market frequency (annually or quarterly), pricing uncertainty, and illiquidity that can adversely bias risk measures of volatility and correlation of hedge funds and real estate to venture capital, private equity, private debt, infrastructure, and even some derivative or option-based (hedging or speculative) strategies, where returns depart from a more normal return distribution.[xii] In 2012, the Journal of Risk, as one of many for example, outlined how a Sharpe Ratio may overstate the performance of hedge funds, which exhibit a specific type of non-normal

distribution.[xiii] Thus, statistical performance ratio analysis may be more appropriate to evaluate public market strategies, which are more normally distributed.[xiv]

Despite the challenges and limitations, statistical performance ratios are still widely used by investors across a wide range of different investment strategies, asset classes and multi-asset portfolios for comparative analysis. For example, the OECD and World Bank conducting a wide ranging performance analysis of pension funds worldwide concluded that, while there are concerns with regard to specific methodologies as applied to *individual* strategies, "one can meaningfully assess, using Sharpe ratios, whether the different pension systems have obtained a risk premium or have beaten their own benchmarks or low risk preferences."[xv] In other words, the cross-sectional universe of investment outcomes appears more normally distributed than time-series evaluations of individual strategies versus non-normal asset class returns. We conclude that the Sharpe ratio and other statistical performance analytical tools are effective in quantitatively comparing strategies and portfolios relative to peer groups or index benchmarks with a good understanding of some shortcomings, concerns, and potential ways to bias any evaluation.

Furthermore, we suggest that a range of measures provides a more useful and robust relative analysis in comparing investment performance. Data for performance analysis or security prices is too often insufficient for statistical significance, but experience and intuition may help overcome such limitations caused by limited data frequency or time period, assuming the underlying strategies are consistently implemented and security prices reflect market values. Finally, private market investments introduce various uncertainties, including infrequent limited mark-to-market pricing, which should not be mistaken for greater diversification effects or lower risk than is reasonable to assume for smaller company or illiquid securities.

2.3.3 Benchmarks Literature Review

Benchmarks allow investors to assess their performance against specific measures in the market that reflect their investment preferences. Moreover, they allow for an assessment of performance that focuses on each investor's ability to execute their own investment strategy and objectives.

Benchmarks at the portfolio level generally reflect a plan's asset allocation. They are rooted in the plan's objectives and help define investment direction, risk tolerance, as well as the strategic role of individual asset classes. They might also be influenced by regulation (*e.g.,* minimum funding requirements) and accounting standards.[xvi]

There are two main types of asset class benchmarks. The first is external asset-class benchmarks, which set a benchmark for the fund's performance in that asset class. The second consists of peer-group benchmarks, which compare an individual fund to other similar funds.[xvii]

Pension fund benchmarks are typically a combination of market indices weighted by the specific benchmark allocation of the fund.[xviii] The most commonly used indices aim to cover the investable universe in an asset class and weigh the different securities included in the index on the basis of their market value.[xix]

Focusing on benchmarks as part of a fund's assessment is important because a chosen benchmark or set of benchmarks can influence the investment strategy of a fund. For example, selecting a very high benchmark for the total portfolio could create incentives for a pension fund to increase their allocations towards riskier asset classes like hedge funds or private equity and increase their risk profile in order to try to outperform that benchmark. A benchmark can also influence the means through which a pension fund invests. For example, if a pension fund is looking to cut external management costs, it could select a benchmark that is more easily achievable by its own internal financial managers, rather than with the support of external managers.

Benchmarks can also be used to disguise underperformance. As Ania Zalewska argues in a wide-ranging study of over 4,500 pension funds in the UK, several funds may be exaggerating their performance by selecting benchmarks that are easy to outperform.[xx] The study suggests that pension fund benchmarks may not always truly reflect a fund's investment profile, as they can create a spurious impression of good performance. Therefore, as illustrated above, it is important to compare the absolute and relative performance of an individual fund against its benchmarks, as well as to its peers.

2.3.4 Discount Rate Literature Review

The discount rate is crucial for guiding investment decisions because it reflects what the plan's assets can reasonably be expected to return over the long term. In other words, the discount ratio is the rate at which pension funds expect their portfolios to appreciate over the long term. It is used to discount future benefits payments (liabilities for the pension fund) to calculate what contributions are required today.[xxi]

The theoretical basis for selecting discount rates to calculate liabilities varies among plans and is subject to ongoing debate.[xxii] Nevertheless, the assumptions behind discount rate calculations must be robust to avoid negatively impacting current pension plan members and future retirees. For example, if a discount rate assumption is too high and investments earn less returns than expected, a pension plan could face a funding shortfall and therefore require younger or future beneficiaries to contribute more to the plan today, distribute lower benefits to retirees, or both. If a discount rate assumption is too low, current members could be forced to pay more than necessary or benefits could be reduced more than necessary. The discount rate is therefore a key calculation that will impact the investment decisions of the organization and the benefits and contributions that plan members will be subject to over time.

Overall, the most important determinant of discount rate sensitivity is the mix of active and retired plan members.[xxiii] However, a fund's asset mix is also an important consideration and boards and management usually conduct studies to ensure than their

plans' target asset mix can lead to allocations that optimize the plan's ability to meet their discount rate. The discount rate therefore is a key determinant of a fund's asset allocation strategy.

According to the National Association of State Retirement Administrators, most public pension plans in the U.S. use a discount rate of between 7% and 8%, with an average of 7.6%.[xxiv] It is outside the scope of this study to scrutinize the discount rate used by SERS, PSERS, and the peer group. Instead we take the discount rate as a given and approach our analysis with this assumption.

2.3.5 Funded Status Literature Review

The funded status of a pension fund compares its assets against its liabilities. There are two main factors that determine the funded status of pension plans: the payment of annual required contributions by plan sponsors and investment returns earned on pension fund assets.[xxv] Most public pension funds rely heavily on investment returns to fund future benefits; therefore, a key component of their long-term sustainability is their ability to achieve adequate returns.

Most public pension plans face significant challenges with their funded status. Bloomberg recently reported that of the 200 largest defined-benefit plans in the S&P 500 based on assets, 186 are not fully funded.[xxvi] In other words, 93% of these large defined-benefit plans do not currently have enough money to fund current and future retirees within their plans. Poor asset returns post-financial crises and throughout the low interest rate environment are often cited as major reasons for this.

This relationship between asset allocation and funded status is dependent on various factors like types of liabilities and liabilities terms. To contextualize some of the insights from this report, it should be noted that, in general, plans tend to become more risk averse as their funded status improves.[xxvii] However, as this set of chapters will illustrate, this can translate into diverse asset allocation strategies.

A recent report of Fortune 1000 pension plans illustrates that "plans whose funded status ranged between 80% and 99% generally held less public equities and more debt than their less funded counterparts, suggesting that return/higher-risk investments become less attractive as a plan nears full funding."[xxviii] However, this was not true for funds whose funded status was 100% or higher. Through a more granular data analysis, the authors found that among plans with a funded status between 90% and 99%, more than half the assets were invested in fixed income and cash.[xxix] These insights are consistent from an earlier study from the Society of Actuaries, which illustrates that "plans that are 100% funded . . . tend to get less equity."[xxx] It should be noted, however, that actual allocation decisions depend on various other factors that have been discussed previously.

Table 2.1 Willis Towers Watson Fortune 1000 Average Asset Allocations by Plan Funded Status (2016)

ASSET CLASS	FUNDED STATUS				
	LESS THAN 70%	70% TO 79%	80% TO 89%	90% TO 99%	100% OR MORE
Cash	2.7%	2.5%	2.8%	3.5%	2.3%
Debt	38.5%	42.2%	44.7%	49.9%	43.2%
Equity	48.3%	44.5%	41.2%	40.0%	47.3%
Hedge funds	3.5%	3.3%	2.9%	0.8%	0.2%
Other	3.4%	3.3%	3.2%	2.4%	4.4%
Private equity	1.5%	2.0%	3.0%	1.5%	1.5%
Real estate	2.1%	2.3%	2.2%	1.9%	1.2%
Total %	100%	100%	100%	100%	100%
N	78	126	111	62	26

Source: Aguirre and McFarland 2018

2.4 Context and Approach

Having provided a brief literature review and an overview of key pension fund characteristics that will influence asset allocation decisions, this section moves into describing the approach, methodology, and data used for this assessment. It also provides a brief description of the main challenges associated with the performance of the asset allocation and investment performance analysis.

2.4.1 Approach and Methodology

Considering the project objectives and data required for the assessment of asset allocation and investment performance across pension funds, the research team designed a tailored analytical approach that leveraged common practices from the fields of strategy and investment management. The approach was reviewed by project staff prior to the launch of the project to validate that rigor had been applied across every project stage to ensure that the data and funds selected would provide objective and valuable insights.

The project consisted of three main phases. Phase 1 focused on defining the scope and focus of the analysis and identifying peers that are comparable to SERS and PSERS through an established set of criteria. The second phase focused on exploring data sources and gathering and validating data against individual final reports. In this phase, the research team also defined an analytical framework to guide the future peer analysis. The

final phase focused on performing the analysis and generating insights. For more information on the project approach, refer to the appendix.

Below is a summary of the methodology used to define the peer group selection criteria, the peer group selection process, and the asset allocation and investment performance analysis.

Peer Group Selection Criteria – Candidate funds for the peer group were screened and selected against five main criteria elements.

- **Size**: Funds of a comparable size to SERS/PSERS (+/- $20B from SERS' $29.1B and PSERS' $53.2B as of 2017).
- **Discount Ratio**: Funds with a similar discount ratio to SERS/PSERS' 7.25%.
- **Net Reporting Data**: Given that both SERS and PSERS report Net performance in their annual reports, funds that reported Gross performance or a combination of Gross and Net were removed from the peer group.
- **Fiscal Year End Dates**: Given that ~75% of U.S. Public Pension plans have a fiscal year end date of June 30th, funds with September and December fiscal year end dates were removed. SERS has a December 31st fiscal year end date and therefore Q2 2017 data was incorporated for this fund in order to normalize the time period with the other funds in the peer group.

These criteria were selected with the intent of establishing a set of peers for comparison that had similar characteristics to SERS and PSERS.

The appetite for selecting funds that were both smaller and larger (+/- $20B) than SERS and PSERS was also driven by the fact that, despite a common narrative that larger plans perform better than small plans due to economies of scale, smaller plans have also proven to outperform larger plans.[xxxi] Therefore, the peer group consists of plans that are similar enough in size to SERS and PSERS to control for the heterogeneity of the pension fund universe, but also with enough variability that could provide insights into differences in performance.

Table 2.2 below illustrates the final peer group selected for assessment, which is composed of U.S. state and local public pension plans. While there is a wide distribution in terms of pension fund assets ($11B South Dakota to $71B Georgia Teachers), SERS and PSERS rank towards the middle of the group in terms of size. Discount Rates range from 6.5% to 7.5%, with an overall peer group average of 7.2%. Funded Ratios vary widely across the group, with funds like South Dakota having a 100% funded ratio or Iowa PERS and LA County at 81% and 80%, respectively, to lower-funded funds like PSERS at 56% and SERS at 59%, or Illinois Teachers at 40%. Finally, it is important to highlight that except for SERS, all other funds in the peer group have a June 30th fiscal year end date. As previously described, this difference in fiscal year end date was corrected for in the analysis.

Table 2.2 Peer Group

Plan	Net Assets FY17 (000s)	FY17 Discount Rate	Funded Ratio	Fiscal Year End Date
Georgia Teachers	$71,340,972	7.50%	74%	June 30th
Virginia RS	$70,159,680	7.00%	77%	June 30th
Oregon PERS	$66,371,703	7.20%	75%	June 30th
Pennsylvania PSERS	$53,155,336	7.25%	56%	June 30th
LA County ERS	$52,225,457	7.38%	80%	June 30th
Illinois Teachers	$49,375,665	7.50%	40%	June 30th
Arizona SRS	$36,202,756	7.50%	71%	June 30th
Iowa PERS	$30,779,116	7.00%	81%	June 30th
Pennsylvania SERS	$27,934,000	7.25%	59%	December 31st
New Mexico Educational	$12,509,356	7.25%	63%	June 30th
South Dakota RS	$11,644,039	6.50%	100%	June 30th

Source: Public Plans Database (PPD) 2018

Asset Allocation Analysis - The asset allocation analysis examined the peer group's actual allocations across asset classes for the 2008-2017 period. The asset classes included in the analysis were drawn from data available from the Public Plans Database (see next section for more information on data sources) and consisted of seven major categories: equity, fixed income, real estate, private equity, hedge funds, commodities and cash. Funds within the peer group were first individually assessed to determine the extent to which their actual asset allocations reflected their target asset allocation, as well as how their portfolio asset class mix changed over time. Insights from these individual assessments were then used to compare SERS and PSERS against other funds in the peer group.

Investment Performance Analysis - The Investment Performance analysis consisted of two main components: an absolute performance assessment and a risk-adjusted assessment. While the absolute performance analysis leveraged the data from the Public Plans Database, the risk-adjusted performance incorporated additional inputs required for the calculation of the Sharpe Ratio and Information Ratio.

The absolute performance assessment looked at fund investment returns at both the total portfolio level, as well as for individual asset classes, and examined 2017 investment returns and three-, five-, and ten-year compounded absolute returns. Absolute performance was also assessed against each fund's benchmarks at the total portfolio level, as well as asset class specific benchmarks.

Recognizing that an in-depth assessment of investment performance requires the analysis of the risks that underlie a fund's absolute investment returns, the research team utilized the Sharpe Ratio and Information Ratio to calculate risk-adjusted returns. The analysis on risk-adjusted performance was carried out on the two funds themselves and not the entire

peer group. This was due to lack of access to the necessary data from the peer group to achieve statistically significant risk-adjusted performance results.

2.4.2 Data and Constraints

Project Data Source

Considering both the composition of the peer group and the project objectives, the Public Plans Database (PPD) was selected as the main data source for analysis. The PPD database has been developed and is maintained by the Center for Retirement Research at Boston College. It contains annual data on the largest state and local pensions in the U.S. from 2001 and 2017. Overall, the database includes 180 plans (114 state-run and 66 locally-run) which account for 95% of state and local pension assets and members in the U.S.[xxxii]

The database includes investment performance for each plan's overall portfolio as well as for individual asset classes. The PPD database sources its data from each plan's Comprehensive Annual Financial Report (CAFR) and other investment reports and manually aggregates the data with staff from the Center for Retirement Research.

The PPD database was selected because it has been used widely across academic research and contains the data elements that were required for the asset allocation and investment performance analysis of this assessment. To validate the accuracy of the data, an extensive audit was carried out of the PPD database against the annual reports of the funds in the peer group.

Challenges and Constraints

Prior to introducing insights from the assessment, a few comments on challenges and constraints are in order. The following describes the five major challenges and constraints faced by the authors throughout the execution of the project, as well as details of how these were addressed throughout the analysis.

Heterogeneity of the pension fund universe -The pension fund space is far from homogeneous. While most U.S. state and local government pension plans are defined-benefit plans, significant differences exist in the structure, short- and long-term goals, costs, and investment strategies of these funds. These differences make an "apples to apples" comparison of investment performance across pension funds a challenging exercise. However, to help overcome this challenge, the research team developed, validated, and applied the selection criteria described above to identify those funds that are most comparable to both SERS and PSERS and for which data was readily and comprehensively available.

There is no established methodology for performing asset allocation and investment performance assessments – Industry research and interviews with practitioners confirmed that there is no established process or methodology for performing asset

allocation and performance assessments for pension funds. Moreover, as a World Bank-OECD 2010 publication suggests, pension fund performance globally is often measured by tools that focus on short-term market gains rather than what pension funds were designed to do—provide stable and sufficient income to its members in retirement.[xxxiii] The research team addressed this challenge by ensuring that the data and measures selected would provide insights on long-term performance (10-year annualized returns) and validated the tailored approach with industry practitioners and the project team.

Data transparency and availability – Public pension funds in the U.S. are required to file Comprehensive Annual Financial Reports. However, pension funds deploy diverse investment strategies across multiple asset classes, and the way asset allocations and performance are reported lacks standardization, which creates significant challenges for conducting longitudinal comparisons between pension funds. Thus, the type, level, and quality of data that is published and publicly availability for analysis varies widely. This is true not only across pension funds, but also for specific pension funds across time.

It is not uncommon for a pension fund to change how it categorizes or reports a certain asset class across different years or even within the same year. For example, Table 2.3 and Table 2.4 below illustrate how SERS reported Asset Allocation in 2015 and 2017 respectively. As it can be observed, the only consistency in naming of asset classes between both years is for Global Public Equity and Fixed Income.

Table 2.3 Pennsylvania SERS' Asset Allocation Reporting (2015)

Asset Allocation

($ millions)

Asset Class	Market Exposure[1/]	% of Total Fund	Long-Term 10-Year Strategic Target
Alternative Investments	$4,683.4	18.0%	15.0%
Global Public Equity	10,046.7	38.7	40.0
Real Assets	3,590.7	13.8	17.0
Diversifying Assets	1,673.3	6.4	10.0
Fixed Income	4,285.2	16.5	15.0
Liquidity Reserve	1,703.9	6.6	3.0
Total Fund	**$25,983.2**	**100.0%**	**100.0%**

Source: SERS Comprehensive Annual Financial Report (CAFR) 2017

Table 2.4 Pennsylvania SERS' Asset Allocation Reporting (2017)

Asset Allocation

($ millions)

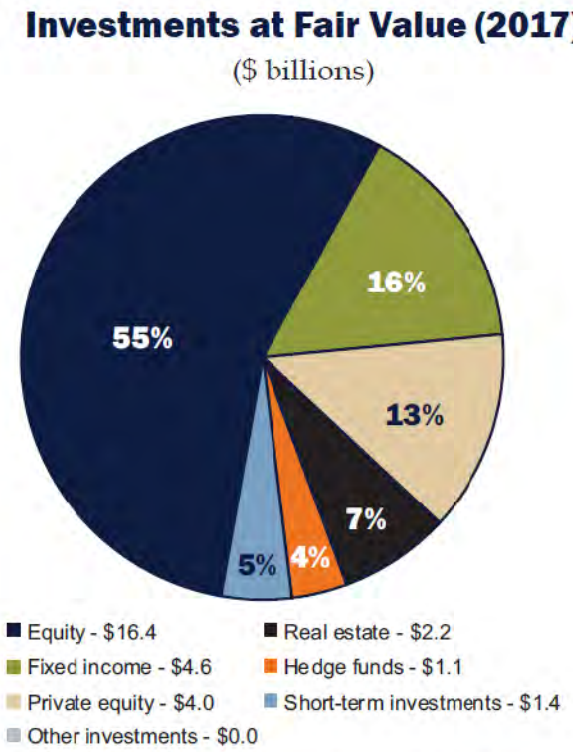
Asset Class	Market Exposure[1/]	% of Total Fund	Long-Term 10-Year Strategic Target
Private Equity	$4,077.5	13.9%	16.0%
Global Public Equity	15,505.3	53.0	43.0
Real Estate	2,207.4	7.5	12.0
Multi-Strategy	2,121.4	7.2	12.0
Legacy Hedge Funds	191.0	0.7	0.0
Fixed Income	4,238.2	14.5	14.0
Cash	948.4	3.2	3.0
Total Fund	**$29,289.2**	**100.0%**	**100.0%**

[1/]Includes securities, cash, and accruals.

Source: SERS Comprehensive Annual Financial Report (CAFR) 2017

When incorporating Figure 2.1, a view of investments at fair value for 2017, which was sourced from the same annual report document, we further see the challenges of pension fund reporting as the breakdown of assets is presented with different terminology (*e.g.*, Global Public Equity vs. Equity) and the figures are similar but don't exactly match those reported earlier in the report (*e.g.*, Global Public Equity 53% vs. Equity 55% or Fixed Income 14.5% vs. Fixed Income 16%).

Figure 2.1 Pennsylvania SERS Reporting of Investments at Fair Value (2017)



Source: SERS Comprehensive Annual Financial Report (CAFR) 2017

It is important to reiterate that the research team worked primarily with publicly available data for this assessment. As discussed elsewhere in this set of chapters, the authors were not granted full access to the plans' data for this analysis. Therefore, differences could exist between this report's inputs and findings, and those commissioned by pension funds from private consulting groups, which often have access to more updated and detailed data, as well as access to the individual pension teams and staff making asset allocation and investment performance decisions.

Rationalization of asset classes - Not all pension funds invest in the same asset classes, and even when they do have similar investments, there are differences in how they categorize their asset classes. Further to the example from SERS above, the research team identified that, for example, Nevada PERS incorporates Private Equity and Real Estate into an overall "Private Markets" category, while other funds categorize them independently. Another example can be drawn from Mississippi PERS, which breaks down Equity investments into US Equity, International Equity, and Global Equity. This contrasts with other funds, some of which categorize Equity into US Equity and International Equity, while others simply aggregate all these investments into an Equity category.

Another consideration is how pension funds report Cash investments. The team's analysis identified that various funds roll-up their Cash investments into Fixed Income, while others report it separately. Those that roll-up Cash into Fixed Income often only do so for

asset allocation, but there is often no information available for Cash benchmarks of investment returns.

It is important to note that some improvements are being made towards the rationalization of asset classes. For example, one of SERS' strategic initiatives for 2016-2017 was to "improve transparency and efficiency of managing assets by eliminating SERS' specific terminology and renaming asset classes according to common industry conventions with similar risk/return profiles."[xxxiv]

To overcome the naming convention and rationalization challenge and ensure there was an "apples to apples" comparison, the team leveraged the PPD Database, which has rationalized investment categories for 180 plans across the 9 major asset classes mentioned above. The major asset classes presented in the PPD data are generated from the specific asset classes that plans report. PPD also provides access to the raw investment data reported by plans.[xxxv] An added advantage of leveraging the PPD data is that once there is a data refresh, individual pension funds are contacted by the Center for Retirement Research to validate how their data is represented in the PPD and provide feedback as appropriate.

Differences in reporting cycles - As was previously described, pension funds have different fiscal year end dates and therefore different reporting cycles. For example, PSERS' fiscal year ends on June 30th, while SERS' fiscal year ends on December 31st. The lack of consistency in reporting and fiscal year end dates eliminated various potential funds from the peer group. To ensure the analysis of SERS covered a similar period to the rest of the peer group, the research team sourced Q2 2017 data from a performance report provided to the Commission and incorporated it as the overall 2017 data for SERS.

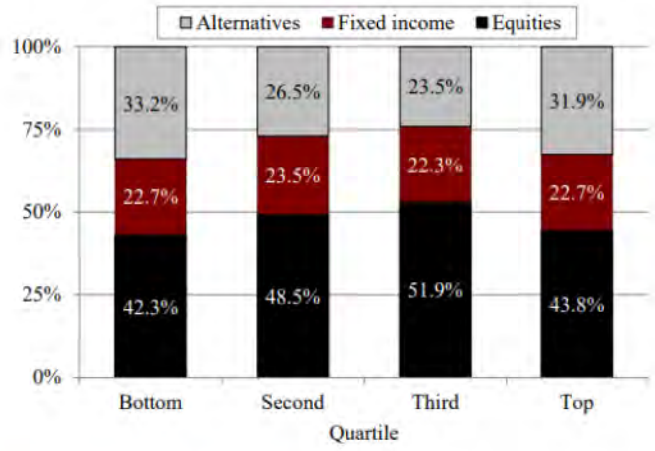
2.5 Pension Fund Asset Allocation and Investment Performance Trends

Prior to illustrating the asset allocation and investment performance of SERS and PSERS relative to the peer group, this section will provide a brief overview of U.S. public pension trends in the market.

At a high-level the asset allocation of most U.S. public pension plans has been relatively similar since 2000. A recent study published by the Center for Retirement Research looked at data collected from Comprehensive Annual Financial Reports of over 60 U.S. state and local pension plans between 2001 and 2016 and reveals various similarities and trends in the current and historical asset allocation of these funds.[xxxvi]

As Figure 2.2 below illustrates, in 2016 most pension plans (divided across four performance categories or "quartiles") had similar splits of equity, fixed income, and alternative investments.

Figure 2.2 Asset Allocation for State and Local Pension Plans 2016

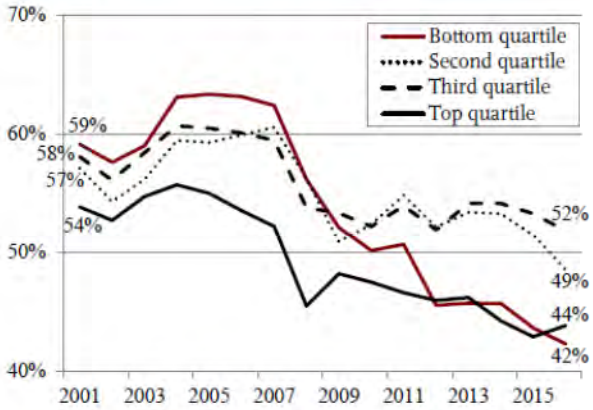


Source: Aubrey, Chen, et al., 2018

This current allocation, however, represents a significant shift from how these funds invested in 2000. Findings from this research indicate that, in general, most public plans in the U.S. have diversified their assets away from equities and fixed income and into alternatives like real estate, hedge funds, and private equity.

Figure 2.3 and Figure 2.4 illustrate this shift away from equity and fixed income, which followed the precipitous drop in values during the financial crisis in these asset classes compared to alternative investments.

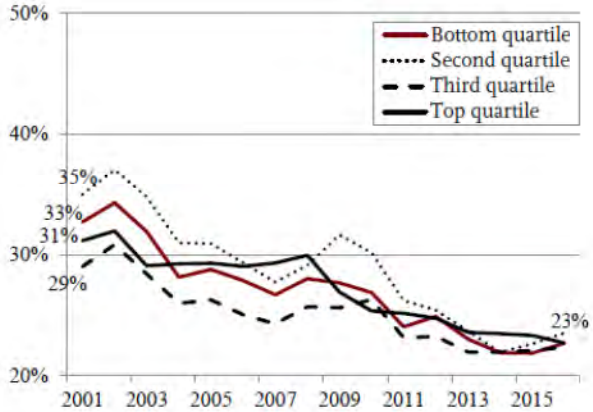
Figure 2.3 Allocation to Equities over time



Source: Authors' calculations from the PPD (2001-2016).

Source: Aubrey, Chen, et al., 2018

Figure 2.4 Fixed Income Allocations over time

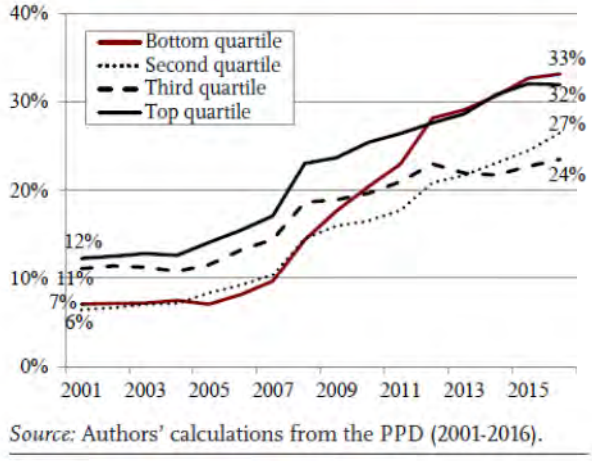


Source: Authors' calculations from the PPD (2001-2016).

Source: Aubrey, Chen, et al., 2018

The reverse trend can be observed in Figure 2.5 below, with funds across all quartiles more than tripling their investments in alternatives between 2001 and 2006. It is important to note that this trend remained even as the stock market recovered after the Great Recession in 2008, which suggests that pension funds deliberately chose to continue deploying more alternative-heavy asset allocation strategies.

Figure 2.5 Allocation to Alternatives 2001-2016



Source: Authors' calculations from the PPD (2001-2016).

Source: Aubrey, Chen, et al., 2018

This shift reflects pension funds' search for greater yields in a low growth environment beyond traditional stocks and bonds, which can be seen in Table 2.5 below.

Table 2.5 Asset Class Returns (2001-2016)

Asset class	Top	Third	Second	Bottom
Public equities	6.2%	5.1%	4.1%	4.1%
Fixed income	6.2	6.2	6.3	6.1
Alternatives				
Private equity	8.8	8.5	6.6	8.5
Hedge funds	5.7	4.5	6.3	5.0
Real estate	10.2	9.3	8.2	7.0
Commodities	5.0	6.6	-2.8	4.8

Source: Aubrey, Chen, et al., 2018

The move into alternative asset classes, however, also brings with it additional challenges and considerations for investors. To begin with, in general, alternative investments represent riskier and more illiquid investments than traditional equity and fixed income. The illiquid nature of these asset classes can pose greater risks and constraints for pension funds, which require constant liquidity for liability payments. Moreover, alternative investments are usually also more complex, and investors may not always fully understand the nature of the investments and their associated risks.[xxxvii] Finally, these asset classes will also usually be associated with higher fees from investment managers.

Although pension funds largely moved in sync towards alternative asset classes, important differences do exist in the types of alternatives selected by these funds. The Center for Retirement Research indicates that funds in the bottom quartile have invested more in commodities and hedge funds and less in private equity and real estate. In contrast, those in the second and third quartiles hold more assets in real estate, hedge

funds, and private equity. These are important differences given that these assets have generally led to different returns over time, which directly affects the overall performance of pension funds.

Table 2.6 illustrates the annualized average returns for each of these alternative asset classes between 2000 and 2016 and how they compare against traditional equity. As it can be observed, real estate and private equity generally performed better over time than hedge funds and commodities. These differences illustrate that although asset allocation could differ slightly, the returns of specific asset classes could have large implications for returns over time.

Another important insight to note is the rebound of traditional equity. While this asset class was severely affected by the global financial crisis in 2008 and 2009, with losses of -21.3%, traditional equities bounced back between 2010 and 2016 for returns of 14.9%. This is crucial because the upswing occurred while U.S. pension funds began reallocating their portfolios and maintained higher allocations towards alternative asset classes, which indicates that if these alternative asset classes performed worse than traditional equity towards the second half of the period, then the diversification strategy may not have been as fruitful as originally planned.

Table 2.6 Returns from Alternative Asset Classes and Traditional Equities (2000-2016)

Asset class	2000-2007	2008-2009	2010-2016
Private equity (before fees)	14.6 %	-13.0 %	25.0 %
Hedge funds (after fees)	10.7	-10.9	1.3
Real estate (before fees)	14.5	-6.3	12.1
Commodities (after fees)	16.2	-4.1	-3.0
Traditional equity	2.7	-21.3	14.9

Sources: Authors' calculations based on Thomson Reuters Private Equity Index, Hedge Fund Research Global Hedge Fund Index, NCREIF Property Index, S&P GSCI Index, and Wilshire 5000 Index (Total Return).

Source: Aubrey, Chen, et al., 2017

In summary, U.S. pension funds have reallocated their portfolios away from equity and fixed income in favor of riskier alternative investments in search of greater yields and greater portfolio diversification. The magnitude of these greater yields, however, has been dependent on which specific alternative investments these pension funds have moved into and how well the funds have managed the associated risks/manager selection and monitoring. As the following two sections illustrate, this has had a significant impact in performance for SERS, PSERS, and funds within the peer group.

2.6 Asset Allocation Analysis

As has been previously discussed, asset allocation is a strong determinant of fund performance and the asset allocation of most U.S. public pension plans has been quite

similar since 2000. This section will therefore explore how SERS, PSERS and funds in the peer group have made asset allocation decisions that have influenced investment performance over time.

This section will begin by assessing the current asset allocation of SERS, PSERS and funds from the peer group, including how they allocate assets to liquid and illiquid asset classes. It will then move into how the asset allocation of these funds has shifted over time and illustrate how SERS and PSERS have followed opposite trends across time. It will end with a synthesis that includes more general considerations.

2.6.1 Asset Allocation Assessments

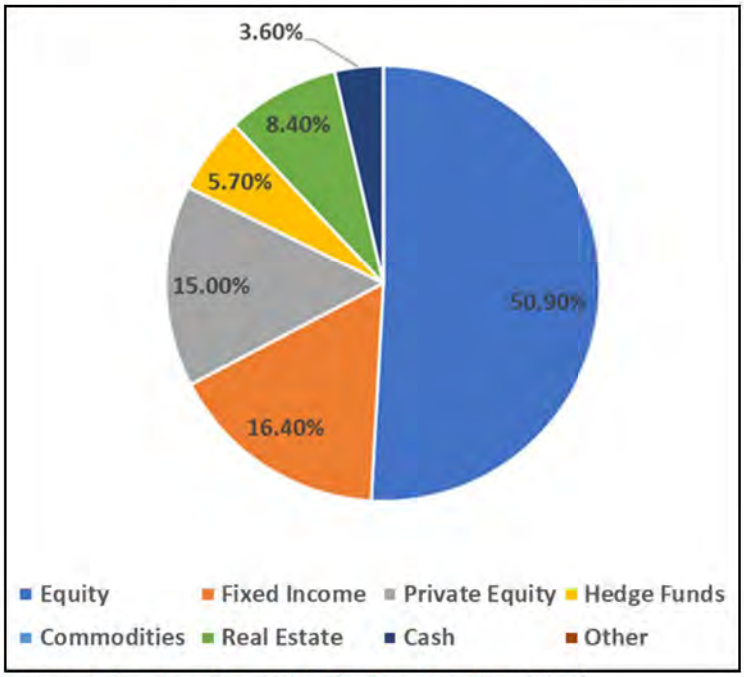
When considering asset allocation trends of the pension fund industry and more specifically the selected peer group, we can observe that SERS and PSERS have followed different and at times opposing strategies.

To develop its strategic investment plan, SERS relies on its internal investment professionals and works with consultants to "analyze major quantitative and qualitative factors—including the unique needs, preferences, objectives, and constraints of [the] pension plan and expected long-term market conditions."[xxxviii] In developing long-term asset allocation policy targets, SERS' investment teams consider:

- Maintaining an appropriate level of cash to pay retirement benefits and covenants during prolonged periods of market decline and potential state budgetary constraints;
- Improving the liquidity profile of the total fund to align with the projected increase in retirement benefits payments; and,
- Pursuing the highest returns possible at the level of risk deemed prudent by SERS' board.[xxxix]

In terms of current asset allocation, as Figure 2.6 illustrates, in 2017 SERS had a diversified asset allocation strategy with investments in equity, fixed income, private equity, hedge funds, real estate, and cash. SERS' two largest asset classes were equity at 50.9% and fixed income at 16.4%, for a total of 67.3% of the fund's portfolio.

Figure 2.6 Pennsylvania SERS Asset Allocation (2017)



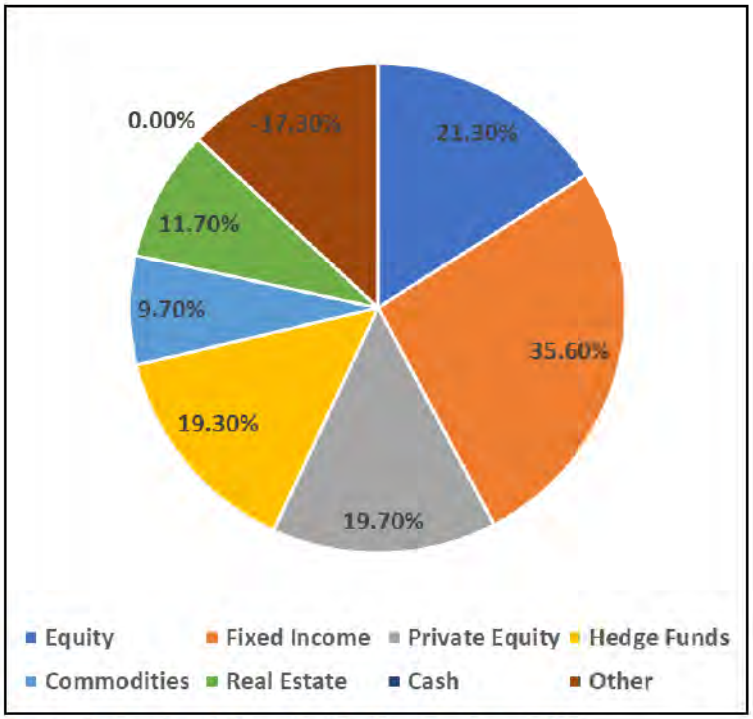
Source: Authors' analysis and Public Plans Database (2018)

In an investment document published by PSERS in August 2016, the fund notes that its "asset allocation plan is designed to meet the unique needs of a defined benefit system that is currently underfunded and had been receiving employer contributions below the actuarial required contribution for over 10 years."[xl] The investment considerations identified to guide this asset allocation are:

- PSERS' investment time horizon;
- Capital market assumptions (*e.g.*, expected return, risk, correlations);
- Return targets;
- Demographics of plan participants and beneficiaries, and actuarial analysis;
- Cash flow requirements;
- PSERS' funded status;
- The Commonwealth's and School District's financial strength; and,
- The Board's willingness and ability to take on risk[xli]

Like SERS, PSERS also had a diversified asset allocation strategy in 2017 with investments in equity, fixed income, private equity, hedge funds, and real estate. However, as Figure 2.7 illustrates, unlike SERS, PSERS had a more diversified portfolio across asset classes, with fixed income being its largest asset class at 35.6% (vs. SERS' largest asset class being equity at 53%) and with investments in commodities and leverage financing (categorized as "other").

Figure 2.7 Pennsylvania PSERS Asset Allocation (2017)



Source: Authors' analysis and Public Plans Database (2018)

Leverage finance is used by PSERS to execute its risk parity strategy. The fund uses derivative instruments to "allow [PSERS] to gain asset class exposure with minimal margin requirements and utilizes it in fixed income, real assets, and risk parity allocations."[xlii] This use of leverage financing is a characteristic that makes PSERS unique not only among funds in the peer group, but also among other U.S. public pension funds. As Table 2.7 below illustrates, only 10 out of 180 funds in the PPD database report an explicit use of leverage as part of their asset allocation strategies. Moreover, PSERS' leverage is the third largest behind Missouri State Employees at 52.1% and Ohio Policy & Fire at 20%.

Table 2.7 Major State and Local Plans That Use Leverage (2017)

Plan Name	Type of Leverage	Percentage of Portfolio That is Levered
Massachusetts SRS	Uses leverage for real estate investments	1.7%
Massachusetts Teachers	Uses leverage for real estate investments	1.7%
Missouri State Employees	Uses leverage to achieve a beta balanced portfolio	52.1%
Ohio Police & Fire	Policy to leverage fixed income portfolio 2x	20.0%
San Francisco City & County	Uses leverage for real estate investments	0.0%
Virginia RS	Uses leverage in its real assets portfolio	3.6%
Wisconsin RS	Policy to leverage in fixed income portfolio	10.0%
Sacramento County ERS	Uses leverage for real assets portfolio	0.8%
San Diego City ERS	Uses leverage for real estate investments	1.8%
Pennsylvania PSERS	Uses leverage in fixed income portfolio	17.30%

Source: Aubrey 2018

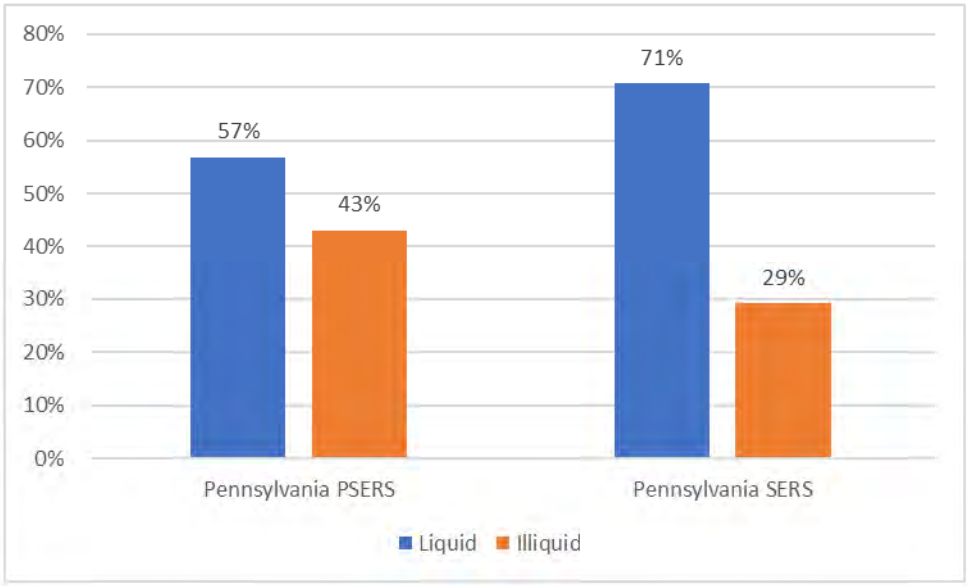
Leverage is a method of balancing risk-adjusted return within a portfolio by taking on additional economic exposure without committing a full amount of capital that an equivalent cash investment would require.[xliii] While the merits of leverage are recognized by industry and academia, investors are often reluctant to aggressively adopt the use of leverage because it is seen as a "double-edged sword," as leverage could increase both good and bad outcomes. On the one hand, it allows investors to change the payoff of an underlying investment strategy as it requires a lower return on an underlying risky portfolio to achieve a target level of performance. This is particularly attractive for investors who are looking for more upside potential. It requires more sophisticated risk management to be in place for its effective use. On the other hand, leverage introduces additional complexities and liabilities, such as additional cash-flow uncertainties. Finally, the downsides of leverage often become most apparent only at the worst times, like during a recession.

Literature on the subject illustrates that effective governance is key for the proper use of leverage. For example, since the Board sets the risk and return policy for funds, the Board should be the party that defines and specifies how and when leverage should be used. A proper governance structure that regulates leverage at the total fund should also be in place. If, for example, leverage was predominantly managed at a more local level in each individual investment program, it could lead to potential overlaps of risk that could accumulate at the total portfolio level.[xliv]

Another important differentiation between SERS and PSERS is their allocations towards liquid and illiquid asset classes. Liquidity represents how easily an investor can move in and out of assets. Therefore, an asset would be considered less liquid if an investor cannot quickly sell a significant quantity of that asset at a price near fundamental value. Academic literature classifies cash, equities and fixed income as liquid assets, while illiquid asset classes consist of real estate, private equity, hedge funds and infrastructure.[xlv]

As Figure 2.8 below illustrates, PSERS in 2017 had a higher allocation when it came to illiquid asset classes, while SERS had significantly lower (14 percentage points) allocations towards liquid asset classes.

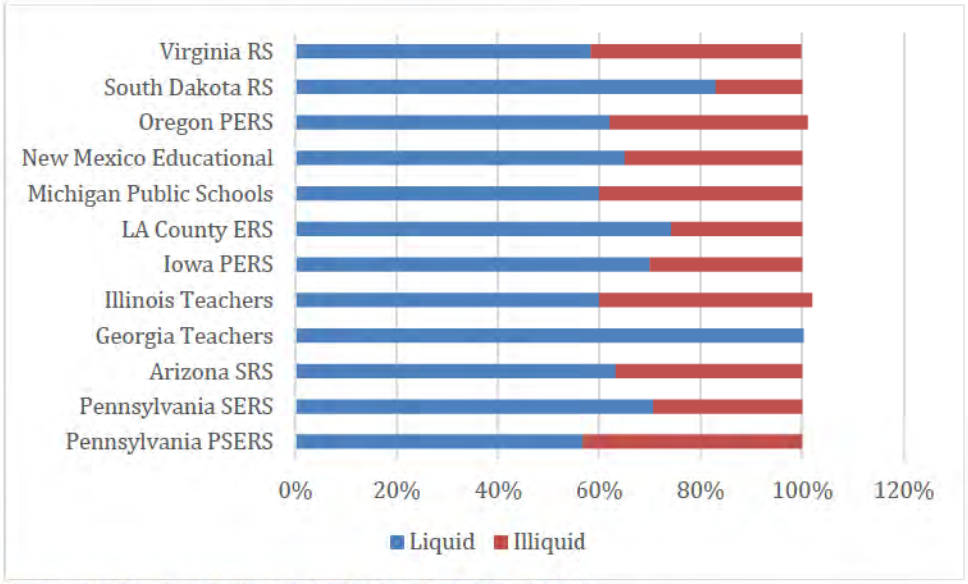
Figure 2.8 PSERS and SERS Liquid vs. Illiquid Asset Allocation (2017)



Source: Authors' analysis and Public Plans Database (2018)

A look at how the peer group allocated its assets between liquid and illiquid investments in 2017 reveals that SERS invested more in line with peer practices, which had an overall average of 69% of assets in liquid investments and 32% in illiquid investments. The same can be observed when looking at a breakdown by individual asset classes.

Figure 2.9 Peer Group Allocation of Liquid vs. Illiquid Asset Classes (2017)

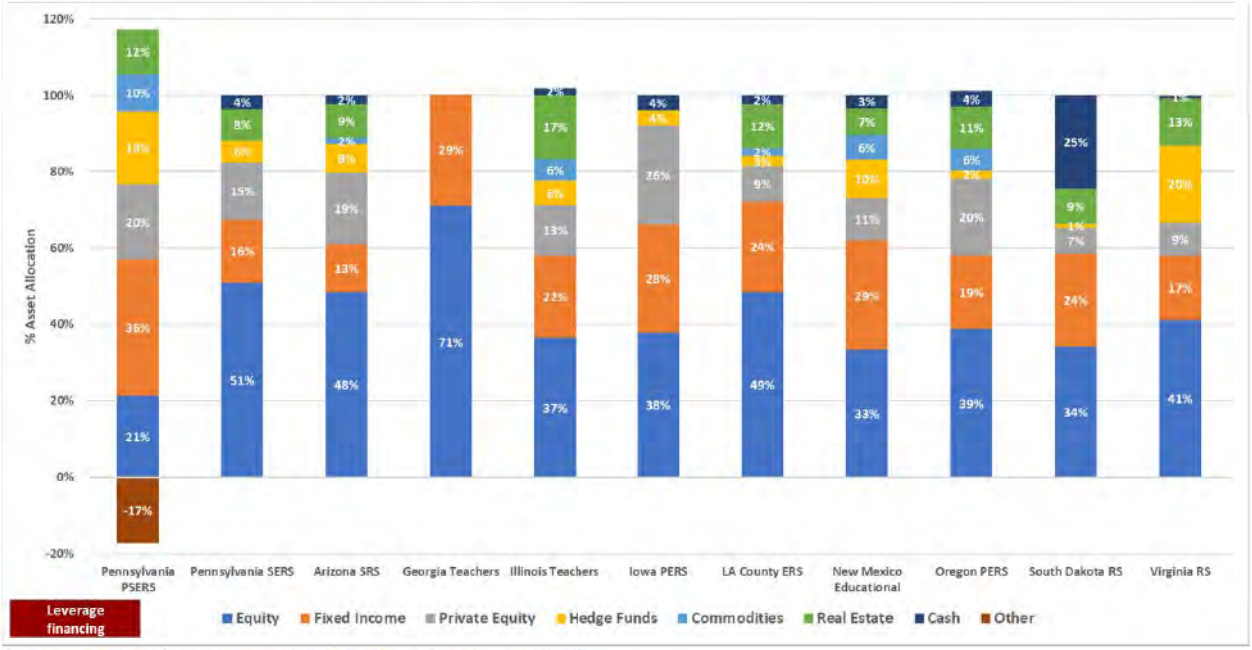


Source: Authors' analysis and Public Plans Database (2018)

Figure **2.10** illustrates the asset allocations of funds within the peer group broken down by asset class. As it can be observed, there is general consistency in how these funds

allocated their assets in 2017 based on the 7 major asset classes: equity, fixed income, hedge funds, private equity, commodities, real estate, and cash. PSERS has the highest allocation to illiquid investments of this peer group.

Figure 2.10 Peer Group Asset Allocation (2017)



Source: Authors' analysis and Public Plans Database (2018)

In general, equity is the largest asset class for funds in the peer group, followed by fixed income, with a cumulative value of more than 50% across most portfolios. Private equity is usually the third largest asset class, with allocations ranging from 7% to up to 26%.

There are also a few differences within the asset allocation of the peer group worth noting. For example, Georgia Teachers is unique in that it is the only fund that has a strategy that allocates funds solely to equity and fixed income. Also, South Dakota RS has a high percentage (25%) allocated towards cash, versus other funds in the group with ~3%. Finally, only half of the funds in the peer group have investments in commodities and for those that do invest in this asset class, PSERS is the largest investor with 10%.

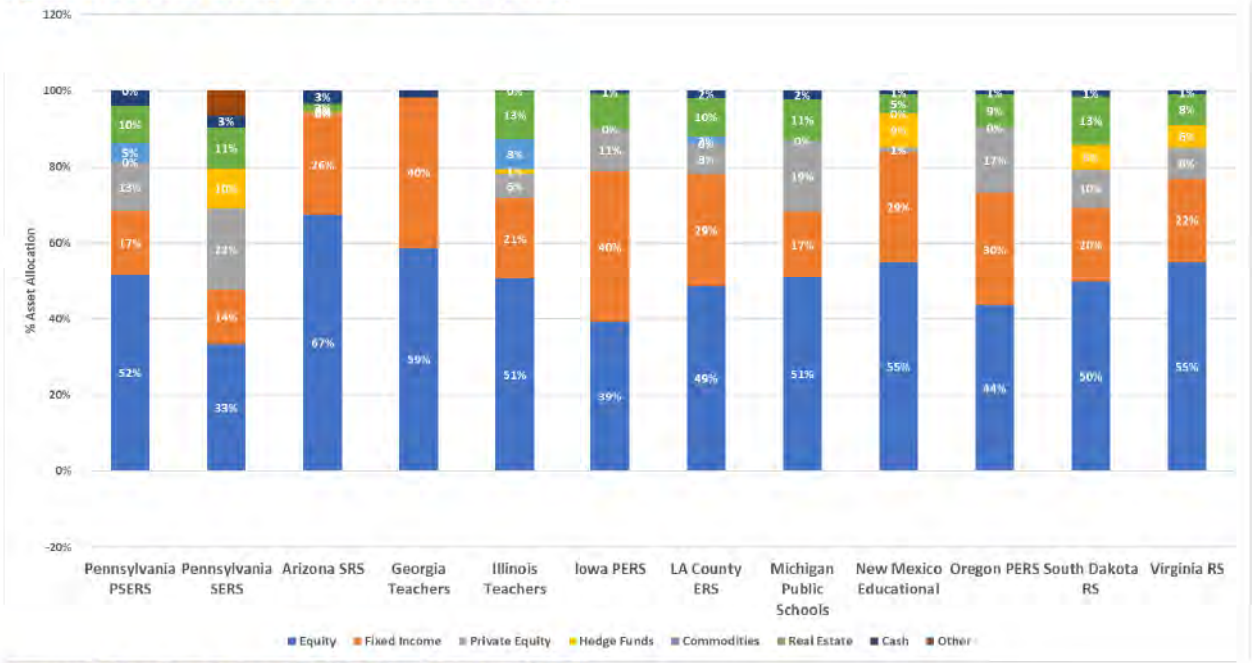
When compared against the peer group, we can see that SERS mostly allocates assets in line with the rest of the funds, while PSERS is a significant outlier. Like most funds in the peer group, SERS has a diversified asset allocation strategy with equity as its largest asset allocation (50%) and also major allocations towards fixed income (16%) and private equity (15%).

PSERS' asset allocation strategy is unique amongst the peer group due to three main characteristics. First, it is the only fund that has greater allocations to fixed income than to equity derived from its overall risk parity approach. Second, it is the only fund with the largest asset allocations towards fixed income. Finally, it is the only fund in the peer

group that uses leverage. As illustrated above, a major challenge with deploying this strategy is that it increases volatility for the fund. For example, if a fund invests all that leverage into equity, it will still have to fund that debt against it given that debt is fixed, but assets are not. The inclusion of leverage into PSERS' asset allocation therefore magnifies the fund's risk exposure, as it increases its exposure to the financial markets.

A historical (2008-2017) look at asset allocation reveals that PSERS and SERS started the period with very different asset allocations than in 2017 and moved in opposing directions throughout the period. As per Figure 2.11 below, PSERS was more aligned with the asset allocation of the peer group at the beginning of the period, with the majority of its assets allocated towards equity and fixed income. In contrast, in 2008, SERS' asset allocation was different than the rest of the group as it was the only fund to allocate the majority of its assets to alternatives (53%) instead of equity and fixed income (cumulative 47%).

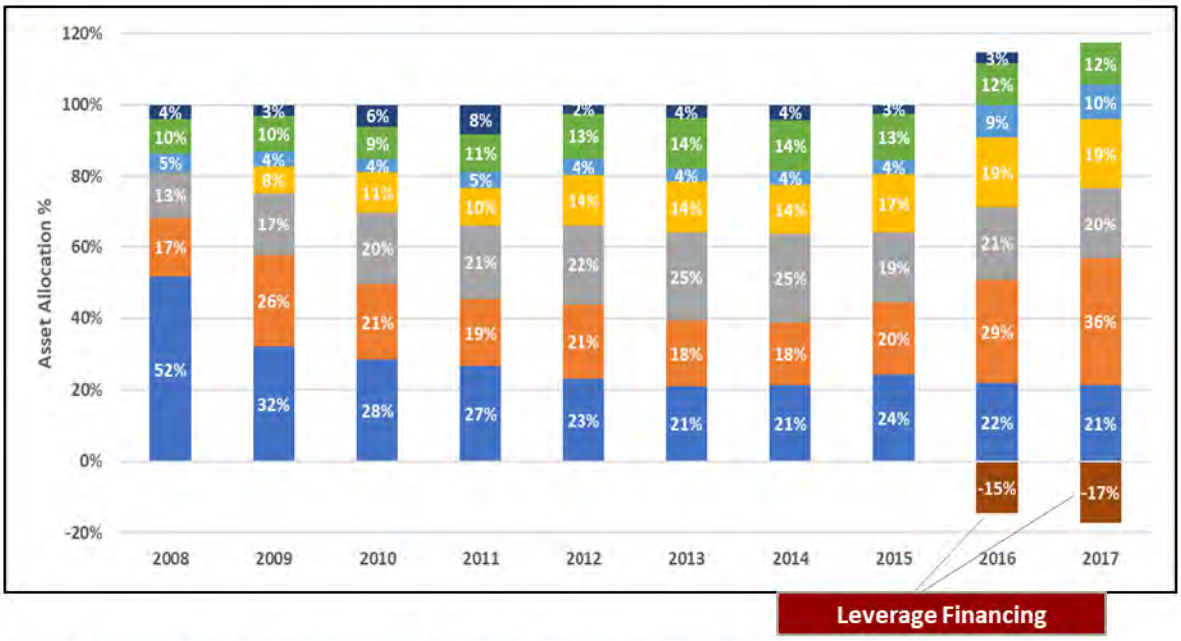
Figure 2.11 Peer Group Asset Allocation (2008)



Source: Authors' analysis and Public Plans Database (2018)

In 2008 most of PSERS' portfolio consisted of allocations towards equity and fixed income. However, similar to the trend across most U.S. pension funds, PSERS began reducing its exposure towards equity and fixed income at the beginning of the period in favor of alternative asset classes like private equity and commodities. This trend continued through to 2016, which led to significant changes in PSERS' overall portfolio across the time period. For example, equity ceased to be the largest asset class (52% in 2008 vs. 21% in 2017), allocations to fixed income (17% in 2008 vs. 36% in 2017) and commodities (5% in 2008 vs. 10% in 2017, respectively) doubled, and leverage financing was introduced in 2016. With the introduction of leverage financing, PSERS began increasing its equity and fixed income allocations once again, although they still consisted of under 50% of the fund's portfolio.

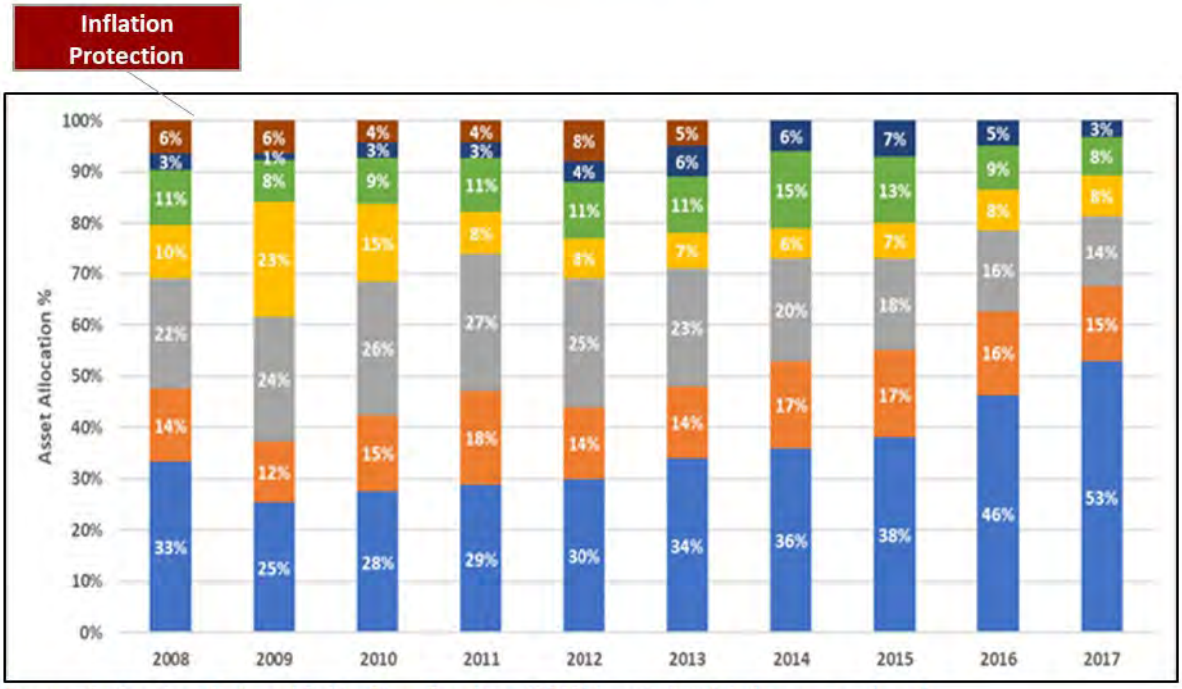
Figure 2.12 Pennsylvania PSERS Asset Allocation (2008-2017)



Source: Authors' analysis and Public Plans Database (2018) (asset class labels same as above)

- In contrast to PSERS, SERS had greater allocations towards alternatives than equity and fixed income from the beginning of the period and through to 2014. As Figure 2.13 illustrates, three major shifts can be observed for SERS across the 2008-2017 period. The first is an initial reduction in equity exposures in 2008 and 2009 following the asset class's low performance during the global financial crises. The second – after that initial reduction, we see a continuous increase in equity exposures and a reduction in hedge fund allocations. Finally, we also observe the elimination of an "Inflation Protection" strategy deployed between 2008 and 2013, which had an objective to "provide diversification within the total fund and act as a hedge against inflation."[xlvi] Therefore, SERS' portfolio in 2017 was less diversified than what it was at the beginning of the period, due to strong increases in equity and fixed income allocations vis-à-vis alternative investments.

Figure 2.13 Pennsylvania SERS Asset Allocation (2008-2017)

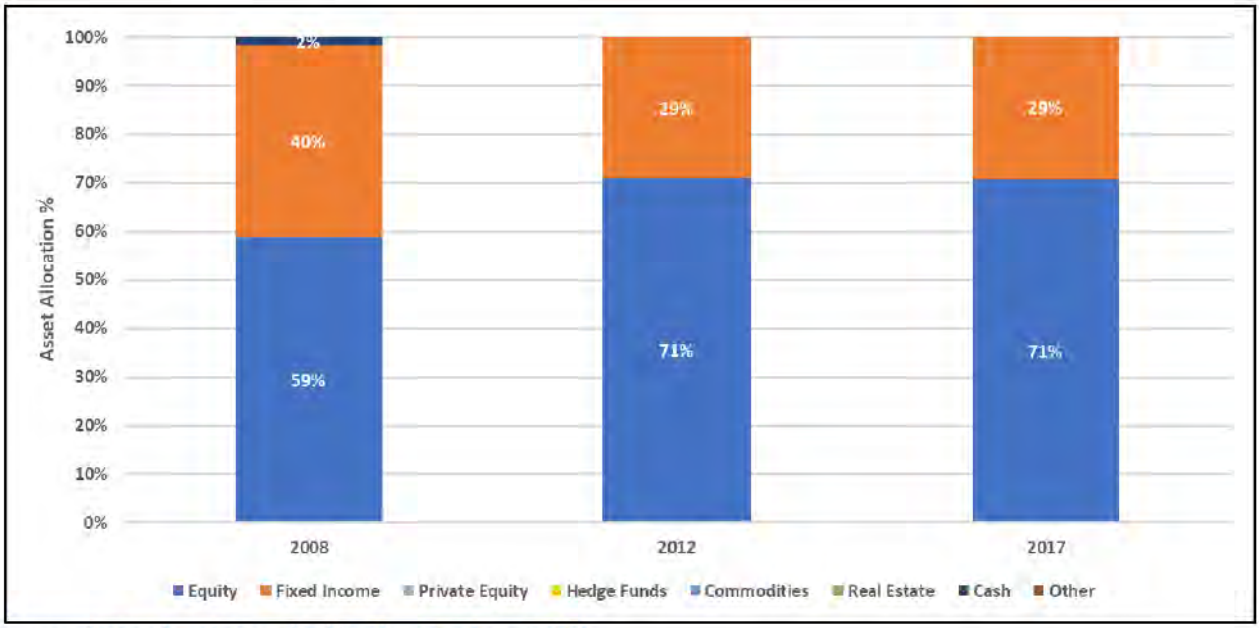


Source: Authors' analysis and Public Plans Database (2018) (asset class labels same as above)

Most funds in the peer group reduced their exposures to equity across time and further diversified their portfolios with new or increased investments in alternative asset classes like private equity, hedge funds, and commodities. SERS, as illustrated above, followed an opposite trend of moving away from alternatives and opting for less diversification in its portfolio with greater allocations in equity and fixed income.

- An important exception within the peer group to note is Georgia Teachers, which maintained a clear split between equity and fixed income allocations across the period. As Figure 2.14 illustrates, Georgia Teachers had separate allocations towards cash in 2008, but these were no longer present by 2012 and the fund maintained a defined split between equity and fixed income across the period, although equity has gradually gained over fixed income. Georgia and SERS are therefore the only two funds in the peer group that increased, rather than decreased, their equity allocations over time.

Figure 2.14 Georgia Teachers Historical Asset Allocation (2008-2017)



Source: Authors' analysis and Public Plans Database (2018)

2.6.2 Asset Allocation Synthesis

The market value in different asset classes has experienced significant shifts since 2000. Changes in historical returns of equity and fixed income at the beginning of the period, coupled with a significant downturn in 2008 and 2009 during the global financial crisis, contributed to a broad reallocation of portfolios towards alternatives and a redesign of asset allocations among U.S. public pension funds. This diversification was maintained even after equities recovered post-global financial crisis after 2010, which highlights an explicit choice by U.S. pension funds to search for greater yields through riskier and more complex alternative asset classes.

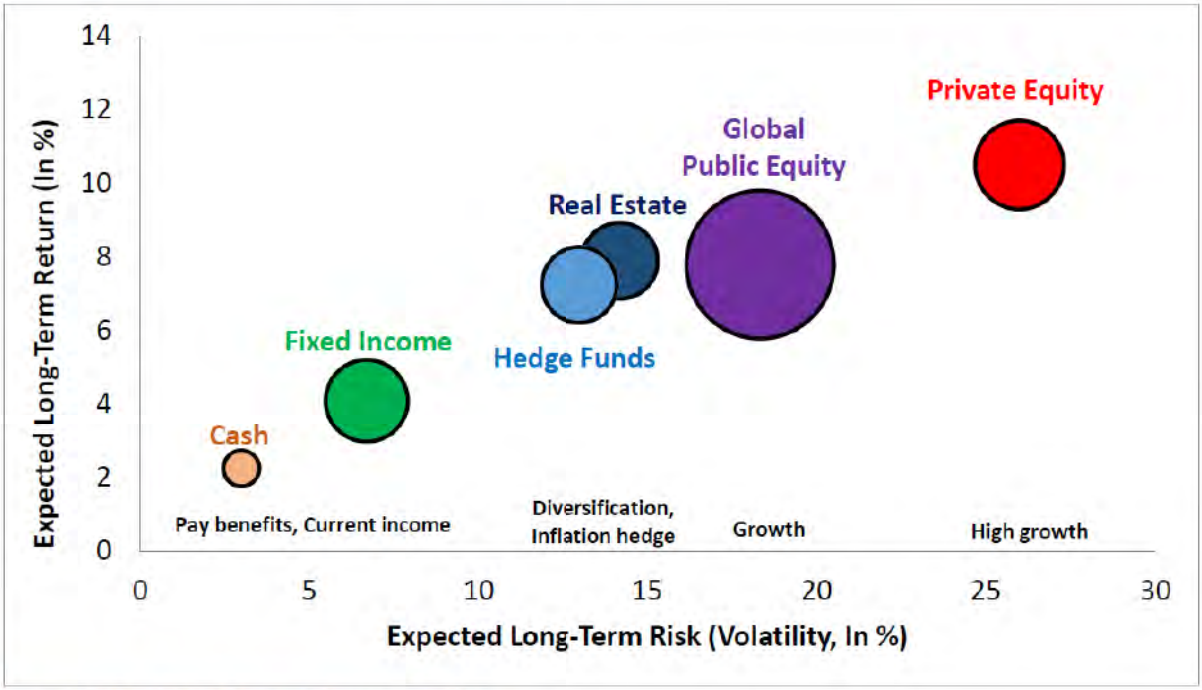
The asset allocation strategies that SERS and PSERS followed during this period brought the former more in line with the peer group, while significantly differentiating the latter.

SERS is a mature pension plan with negative cash flows, which means that retirement benefit payments are greater than contributions from employees and employers.[xlvii] The fund's asset allocation policy has been geared towards achieving the fund's actuarial rate of return, while ensuring "there is sufficient liquidity to pay retirement benefits."[xlviii] The way SERS' asset allocation strategy evolved from 2007-2018 reveals an explicit decision to increase allocations to equity and fixed income to help achieve these objectives.

In 2008, SERS' asset allocation looked very different than it does today, with more investments in alternatives (cumulative 53%) than equity and fixed income (47%). It should be noted that this allocation did not provide the expected diversification benefits, as SERS' return for calendar year 2008 was negative 28.7% — which resulted in an $11.1 billion loss to the fund.[xlix] A simple low cost Vanguard global 60-40 index fund

would have lost 26.5%.[1] While the fund followed the peer group and the majority of U.S. pension funds in an initial move away from equity and fixed income in 2008 and 2009, SERS reallocated assets mostly towards equity as the asset class recovered in 2010. Since then, equity has become a cornerstone of its investment strategy consisting of over 53% of its portfolio. The focus on equity, along with sustained allocation levels of fixed income, is consistent not only with one of its main investment plan objectives to "reduce gradually the percentage of fund assets committed to long-term illiquid investments,"[li] but also, as Figure 2.15 below illustrates, key drivers of income and growth for the fund.

Figure 2.15 SERS 10-Year Target Asset Allocation (2017)



Source: SERS 2016-2017 Strategic Investment Plan

PSERS' asset allocation over the time period indicates an explicit decision to move away from equities towards broader, more complex, and more unconventional strategies. In 2008, the fund's asset allocation was similar to the rest of the peer group. It also followed the U.S. pension fund trend of moving away from equity and fixed income during the global financial crisis. However, PSERS did not reallocate assets back into equity as the asset class began recovering in 2010. Instead, it continued to increase commitments to investments in private equity, hedge funds, and commodities. In 2016, the fund continued to reallocate away from equity and further diversified by introducing leverage financing, while at the same time, it began refocusing on fixed income and almost doubled its allocation to this asset class in two years (2015 20% vs. 2017 36%).

PSERS' emphasizes portfolio diversification as the core of its asset allocation strategy. In its 2016 Summary Annual Financial Report (SAFR), it states that "PSERS believes that the best way to achieve its long-term objectives is to maintain a very diversified portfolio

which includes all asset classes available to it, such as equities, fixed income, real assets, risk parity, and absolute return."[lii] Its reduction in exposure to equity has been motivated by significant negative cash flows experienced by the fund. As it illustrates, "PSERS' risk profile is . . . driven by its cash flow needs. Over the past fifteen years . . . PSERS paid out more than $42.6B more in benefits than it received in member and employee contributions [with] a negative cash flow of over $2.0B per year during this period."[liii] As a result, "the Board" has attempted to reduce its risk profile by decreasing PSERS' dependency on public equity markets and its exposures to other asset classes that are "less correlated to equity markets such as global inflation-linked securities and commodities."[liv] While the goal of such an asset allocation is to generate desired returns with less volatility, this strategy has not been yielding the desired results when looking at the absolute and risk-adjusted performance of the fund.

2.7 Investment Performance Analysis

As has been previously discussed, differences in overall portfolio performance could be attributed to differences in asset allocation and asset class returns. This section will therefore continue to build on the assessment of SERS and PSERS by looking at the overall performance of the funds, as well as the performance of their individual asset class investments.

The following section will dive deeper into concepts introduced in the literature review section (discount rate, funded status, and benchmarks) to illustrate how these compare against SERS and PSERS and could influence investment decisions. The next section will move into an assessment of the absolute performance of SERS and PSERS at the total portfolio level and by asset class. The final section will illustrate how SERS and PSERS perform from a risk-adjusted perspective by measuring the respective Sharpe Ratio and Information Ratio of the funds.

2.7.1 Investment Performance Assessment

Peer Group Discount Rates

Discount rates are important indicators that affect the magnitude of a pension plan's liabilities and are determinants of their ability to meet their obligations to future retirees. Given that this indicator will guide investment decisions, it is important to look at how it has evolved over time and assess it against the fund's investment returns to answer the following question: Is the pension fund generating enough investment returns to help meet its liabilities?

As Table 2.8 below illustrates, funds within the peer group have similar FY17 discount rates, with a peer group average of 7.21%. SERS and PSERS are both above the group average, with the same discount rate as New Mexico Educational at 7.25%. Three funds (Arizona SRS, Georgia Teachers, and Illinois Teachers) have slightly higher rates of 7.5%, while South Dakota has the lowest discount rate at 6.5%.

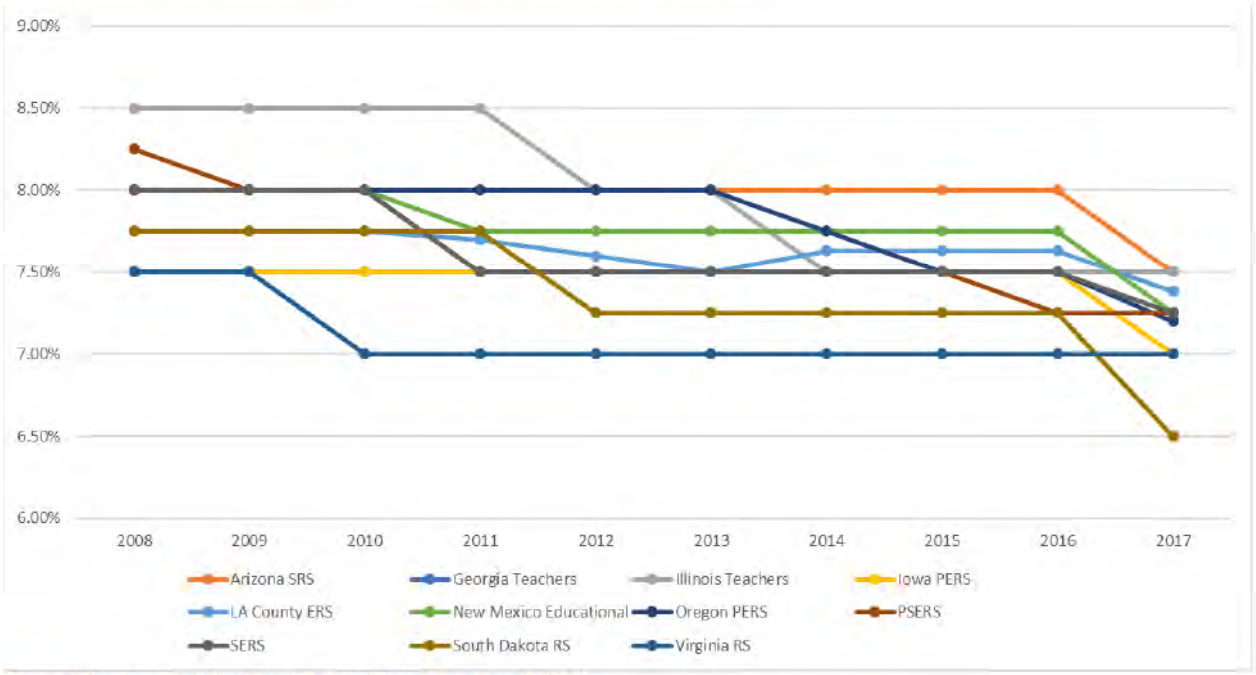
Table 2.8 Peer Group FY17 Discount Rates

Peers	FY17 Discount Rate
Arizona SRS	7.50%
Georgia Teachers	7.50%
Illinois Teachers	7.50%
Iowa PERS	7.00%
LA County ERS	7.38%
Oregon PERS	7.20%
Pennsylvania PSERS	7.25%
Pennsylvania SERS	7.25%
South Dakota RS	6.50%
Virginia RS	7.00%
New Mexico Educational	7.25%
Peer Group Average	7.21%

Source: Public Plans Database (2018)

From a historical lens (2008-2017), we can observe that discount rates have been between 8.5% and 6.5% across the peer group, with most funds experiencing relatively stable declines across the period. This is consistent with other studies which have demonstrated that despite fluctuations in interest rates and financial markets, pension funding levels have remained relatively stable since 2009.[lv] At a more granular level, however, funds within the peer group experienced a decline in their discount rate between 2016 and 2017, settling at a rate of between 7% and 7.5%.

Figure 2.16 Historical Peer Group Discount Rates (2008-2017)



Source: Authors' analysis and Public Plans Database (2018)

Funded Status

As Table 2.9 below illustrates, PSERS and SERS are among the lowest funded pension funds in the peer group with a funded status of 56% and 59% respectively. In fact, when compared to the rest of the peer group, only Illinois Teachers had a lower funded status than SERS and PSERS at 40% in FY17. After accounting for New Mexico Educational at 63%, the rest of the funds in the peer group were funded at 70%+ in 2017, with South Dakota being funded at 100%.