EXHIBIT 1

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

2018

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December 13, 2018

Dear Honorable Governor Wolf and Fellow Members of the Pennsylvania General Assembly:

The massive obligation facing Pennsylvania within the state's two largest public employee pension funds may not be readily apparent to most, yet the impact is felt by every Pennsylvanian. The numbers are difficult to comprehend and the effect of over $60 billion in pension debt manifests itself in much more than dollars and cents. Core government services are affected; from protecting our most vulnerable and aging citizens to maintaining our highways and funding our schools. The resulting tax burden on property owners, families and businesses is substantial.

In recent years, policymakers have placed greater scrutiny on pension investment fees. A study conducted by the Maryland Public Policy Institute showed Pennsylvania's investment expenses for 2012 were the 3rd and 4th highest among a peer group of 47 other state pension plans, with returns lagging behind most. In a 2014 conversation with then-Budget Secretary Charles Zogby, he indicated his staff had done some research into the investment fees paid by SERS and PSERS. His office determined the costs were substantial; nearly $1 billion between the two systems, and the returns were not outsized. Support for an analysis of these fees has grown and compelled the systems and policymakers to look at this issue more seriously.

Through pension benefit reform legislation, Act 5 of 2017, the Public Pension Management and Asset Investment Review Commission was given a broad mandate to examine and make recommendations regarding investment fee transparency, pension system stress testing, active versus passive investment strategies and performance.

The report identifies positive steps that have been taken by SERS and PSERS. The Commission commends PSERS for its recent stress-testing report and its acceptance of a standard financial industry template. SERS is to be commended for maintaining rigorous fund-level benchmarking and for conducting regular transaction cost analyses, yet more can be accomplished.

Included in the findings are several areas of concern. For example, it is estimated that total fees, revenue share and investment expense for PSERS in fiscal year 2016-17 were greater than all employee contributions to the system during the same period. Also, an analysis of the systems' performance among 52 U.S. public pension plans by the Commission's consultant shows that PSERS and SERS ranked poorly in 10-year investment return performance.

A significant charge of the Commission has been to develop recommendations to reduce expenditures that will generate actuarial savings of $3 billion over a 30-year period. Some may minimize the impact of the report's recommendations, citing that immediate relief is needed. However, the nature of these long-term obligations and what has often been a short-term perspective has helped lead us into this crisis. Perhaps the Commission's most significant finding is that the report identifies potential actuarial savings of nearly $10 billion over the projected period.

To put this number into perspective, consider the following; the average retirement benefit provided by the systems today stands at approximately $25,500 per year. If that average increases threefold to reflect inflation over three decades, $10 billion in savings equates to the benefit payments of thousands of employees. The payments are not due immediately, but our responsibility to fund them is. Our need to improve performance is imperative. A careful, thoughtful and disciplined approach is required and the expectation for world-class performance must be our mindset.

The ultimate responsibility for establishing and maintaining SERS and PSERS falls squarely on the shoulders of the General Assembly. As such, it is both the purview and responsibility of the legislature to respond to the effectiveness of these systems, establish mechanisms for independent examination and ultimately, consider legislation to implement meaningful reform.

It is my pleasure to present the report which follows. Many testifiers pointed to the formation of the Commission as ground-breaking and a potential template for other states, since Pennsylvania does not stand alone in its struggle to pay the cost of retiree benefits. The Commission members, who serve with varied expertise, perspective, background and resources, have contributed greatly to this undertaking. The findings would not be as extensive without the work of our consultants, the Joint State Government Commission, testifiers and dedicated staff. Treasurer Torsella, Vice Chair of the Commission, called upon his vast network in order to establish panels of extremely competent experts and his office oversaw much of the compilation of this document. I also thank the Speaker of the House of Representatives for the opportunity to work with these exceptional groups of people.

Hindsight in investing is 20/20 and past performance is not an indicator of future results. However, it has been pointed out by many that the only certainty over which we have control is cost. It has not been proven that higher investment fees have resulted in increased returns, or have reduced risk. Markets are changing, transparency is becoming more commonplace, and a greater degree of fiduciary responsibility lies with everyone in the process. The work of this Commission offers the potential for great improvement in all of these areas. The effective execution of its recommendations will, without doubt, improve our ability to provide for our workforce, reduce the burden on our citizens and position Pennsylvania as a leader in fiscal stewardship.

Sincerely,

Representative,
Michael G Tobash
Chairman, PPMAIRC

TREASURY DEPARTMENT
COMMONWEALTH OF PENNSYLVANIA
HARRISBURG, PA 17120

JOSEPH M. TORSELLA
TREASURER

December 2018

Letter from the Vice Chairman

It is my pleasure to present the final Report and Recommendations of the Public Pension Management and Asset Investment Review Commission. Established pursuant to Act 5 of 2017, the Commission was charged with the ambitious mandate to comprehensively review the investment operations of the Commonwealth's two largest public retirement funds, with the goal of identifying efficiencies and best practices in pension fund management. The attached Report provides a detailed analysis of past practices and the performance of each retirement system and outlines improvements to be considered by the General Assembly, the two systems and other policymakers.

At the onset, I wish to thank Governor Wolf for the privilege of serving on this Commission, my fellow Commissioners for making that service so productive and gratifying, and the Commission's Chairman, Representative Michael Tobash, for his patient and thoughtful leadership.

The Commission was able to identify significant cost savings measures which, if implemented, have the potential of providing nearly $10 billion in actuarial savings over the next 30 years for both retirement systems. Those savings would represent an improvement to each fund's financial position, benefiting both retirement system members and state taxpayers.

In addition to these cost-savings initiatives, the Commission has also recommended important reporting and public disclosure enhancements intended to encourage greater public transparency of investment expenses, performance, and performance benchmarks and call attention to areas of portfolio risk.

Two policy principles are repeated throughout the Commission's Report – costs and transparency matters. Both of these concepts are fundamental to prudent fiduciary oversight. Unlike economic and market conditions that are difficult, if not impossible, to predict, costs and expenses are well within the control of fund managers. Likewise, clear, open and detailed reporting of investment fund metrics, including expenses, performance, risks and robust benchmarks, is critical to informed and well-considered decisions.

My hope is that this Report represents the beginning, not the end, of an important and overdue conversation about public institutional investment management. An open and vigorous conversation is not only important for Pennsylvania, given the challenges facing the Commonwealth's two retirement funds, but also has relevance for public institutions across the country.

Public pensions represent a promise of a secure retirement to those who dedicate their lives to public service. The attached Report is an important step in ensuring this promise is kept.

Sincerely,

Joe Torsella

Joseph M. Torsella
State Treasurer

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[1] *All figures are in sequence. Figures 2.1-2.20 correspond to the figures in Chapters VI-VIII, authored by Ashby Monk, et al.*

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LIST OF ACRONYMS APPEARING IN THIS REPORT

1. **ACWI** – All Country World Index
2. **ADC** – Actuarially Determined Contribution
3. **ARC** – Annual/Actuarially Required Contribution
4. **AUM** – Assets Under Management
5. **BPS** – Basis Points
6. **CAFR** – Comprehensive Annual Financial Report
7. **CIO** – Chief Investment Officer
8. **CPI** – Consumer Price Index
9. **CY** – Calendar Year
10. **DCIO** – Deputy Chief Investment Officer
11. **GASB** – Governmental Accounting Standards Board
12. **GP** – General Partner
13. **HY** – High Yield
14. **IBOR** – Investment Book of Record
15. **IFO** – Pennsylvania Independent Fiscal Office
16. **ILPA** – Institutional Limited Partners Association
17. **IMA** – Investment Management Account
18. **IMI** – Investible Market Index
19. **IRR** – Internal Rate of Return
20. **LDI** – Liability Driven Investment
21. **LP** – Limited Partner
22. **MIFID** – Markets in Financial Instruments Directive
23. **MLP** – Master Limited Partnerships
24. **MSCI** – Morgan Stanley Capital International
25. **NASRA** – National Association of State Retirement Administrators
26. **NCREIF** – National Council of Real Estate Investment Fiduciaries
27. **ODCE** – Open-end Diversified Core Equity
28. **OECD** – Organisation for Economic Cooperation and Development
29. **PE** – Private Equity
30. **PME** – Public Market Equivalent
31. **PPMAIRC** – Public Pension Management and Asset Investment Review Commission
32. **PMRS** – Pennsylvania Municipal Retirement System
33. **PSERS** – Pennsylvania Public School Employees' Retirement System
34. **REIT** – Real Estate Investment Trust
35. **SBA** – State Board of Administration (Florida)
36. **SDIC** – South Dakota Investment Council
37. **SERS** – Pennsylvania State Employees' Retirement System
38. **SPIVA** – S&P Indices Versus Active
39. **SWIB** – State of Wisconsin Investment Board
40. **TCDRS** – Texas County & District Retirement System
41. **VC** – Venture Capital

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

EXECUTIVE SUMMARY

Executive Summary

The Report and Recommendations of the Public Pension Management and Asset Investment Review Commission (Commission) marks a significant milestone in the 100 year history of the Commonwealth's commitment to ensure a secure retirement for its public servants and educators. As the first independent and detailed review of Pennsylvania's public pension systems' investment operations, with the stated goal of identifying cost savings opportunities, the Commission's Report and Recommendations provide an important roadmap to stakeholders and policymakers for the modernization and improvement of public pension management, investment benchmarking and execution, and the clear reporting of investment expenses, performance and risk. Broad in scope, the recommendations contained in this report identify an **estimated annual savings opportunity, for both state retirement systems, of $97.3 to $116.8 million. Expressed as actuarial savings over 30 years at the 7.25% assumed rate of return, the estimated savings opportunity would be between $8.2 and $9.9 billion.**

In arriving at its recommendations, the Commission conducted three public hearings and received the testimony of national and international academic experts, experienced institutional investment professionals, state pension fund managers and representatives from the Pennsylvania Public School Employees' Retirement System and the State Employees' Retirement Systems. Countless pages of studies, reports, presentations, articles and records from other jurisdictions were submitted to the Commission for review. Overcoming substantial challenges in accessing retirement system records, possessing limited resources and working within a limited time frame, the Commission was able to identify and detail important steps necessary to improve the operating efficiency and the effective management of the retirement system funds.

While the Commission was careful to draft a report that was well sourced and accurate, there are two important caveats – first, as a consequence of limited access to each systems' investment records, expenses and performance data, the Commission was compelled to rely upon outside sources, make reasonable assumptions and perform independent calculations. Doing so may have resulted in some inaccuracies or misstatements. However, any such variances are not intentional and do not detract from the general conclusions or assertions contained in the report. Pinpoint accuracy is unnecessary to demonstrate general under or over performance, or comparatively high expense ratios.

Secondly, the conclusions and recommendations contained herein are not intended to cast blame on past policies or decisions by either system. Hindsight, as the saying goes, is always 20-20. Accordingly, the Commission does not wish to second guess any decision made in good faith under circumstances that may no longer exist. Rather, the Commission's recommendations are forward looking, and conclusions are made in the service of insight: understanding past and current experience in order to chart a better course for the future. It is the objective of these recommendations to encourage improvements and foster a management culture that facilitates the adoption of "best practices" that will enhance the ability of the retirement systems to satisfy the retirement needs of future generations of public employees.

To be clear, there are many things that both retirement systems do and have done well. PSERS has adopted important elements of stress testing protocols, and has adopted policies that promote greater transparency as compared to other retirement systems. PSERS has embraced passive-based investing strategies for public equities, and has recently reported fully on "carried interest" costs of private investments. SERS is commended for acknowledging that "costs matter," for adopting comparatively robust benchmarks, and for purposefully adopting a strategy that has reduced investment expenses of their overall investment portfolio. Additionally, it is acknowledged that there are significant factors that are outside the control of either system, most significantly the Commonwealth's disruptive payment history of its portion of the actuarially determined amount to fund each pension fund.

The Commission also found, however, that both funds have underperformed relative to peers, and have "consistently underperformed simple multi-asset portfolios" on a risk-adjusted basis. While costs have decreased by over 50% over a ten-year period at SERS and are now approaching peer group averages, both funds have higher-than-average expenses. PSERS is among the highest-cost public pension funds and its selected benchmarks appear less rigorous compared to peers. The Commission also noted significant areas of risk in current allocations, practices, and strategy, especially around illiquidity, complexity and leverage: at one fund, by a standard measure, risk has nearly doubled.

In general and without limiting the detailed recommendations contained herein, the Commission's recommendations to the General Assembly, the Governor and to the trustees of each of the two retirement system boards include:

- **Maintaining full payment of the annual actuarially determined contribution amount** necessary to fund each public pension plan as doing so is fundamental and required to ensure the future financial viability of both retirement systems. The Commission acknowledges and commends both the General Assembly and Governor for making this requirement a budgetary priority. Without full annual funding, none of the following recommendations will be sufficient to ensure the availability of retirement benefits for future generations of public servants.

- **Establishing a Consolidated Central Pension Investment Office** that would be exclusively responsible for all investment functions on behalf of and as directed by each retirement system. The Office would be staffed by investment professionals who would act in a fiduciary capacity on behalf of each state retirement system. The Office would leverage the combined size of the Commonwealth's two pension funds to obtain more favorable investment contract terms, eliminate redundancies between the two retirement systems and develop internal capacity.

- **Enacting legislation mandating annual stress testing** of each retirement system in a manner that is aligned with the recommendations of the Society of Actuaries Blue Ribbon Panel and publicly reporting, including to the trustees of each board, the findings of such stress tests.

- **Establishing policies at both system boards that favor and encourage open public reporting best practices,** including, without limitation, public reporting of and access to all investment costs and expenses at fund and manager level, full disclosure of all costs of private market investments, quarterly investment performance by asset class (net-of and gross-of-fees) as measured against robust benchmarks, investment manager expense terms and materials submitted to board trustees during open meetings.

- **Enacting legislation mandating, as well as the repeal of existing laws that frustrate, increased public reporting of all investment expenses** (gross fees), total fund and asset class investment performance (net of fees and gross fees) as measured against similar risk alternative indices and benchmarks, disclosure of investment manager contract expense terms and mandate that all investment managers use the Institutional Limited Partner Association reporting template. Legislation should include the repeal of the Right-to-Know Law loophole that permits SERS to avoid disclosing alternative investment records.

- **Moving to fully index all public market investments in both equities and fixed income at both retirement systems.** The Commission heard compelling evidence demonstrating that active management of public securities underperforms, net of costs, in all sectors over the long term when compared to the appropriate risk adjusted index benchmark, and that there is no "persistence" of manager outperformance or reliable way to select outperforming managers in advance.

- **Adopting, at both retirement systems, measures to reduce risk**, including: revised Investment Policy Statements that include a "risk budget;" specific rebalancing policies; a diversified index policy benchmark; setting limits on the level of illiquid investments; reducing exposure to illiquid private investments from current targets to more appropriate levels at both funds; and, paying particular attention to levels of leverage and illiquid investments at PSERS, which were identified as a "significant outlier" relative to peer funds.

Additional recommendations to encourage diverse emerging manager selection, expanded use of the Commonwealth's procurement process, and other operational efficiencies.

The General Assembly's charge to the Commission was ambitious, directing the completion of a study and report on current pension system investment strategies, the benefits of active and passive investment strategies, alternative strategies, and the reporting of expenses, performance and risks. The Commission was also requested to publish detailed findings on – assets, returns, financial managers, consultants, requests for proposals and investment performance measured against benchmarks. In addressing these issues, the Commission identified two common policy principles that serve as the foundation for each recommendation – cost efficiency and increased transparency.

Costs Matter

Throughout this Report, the Commission has focused on investment costs and expenses. At an early stage, the Commission recognized that, as with most business enterprises, "costs matter." Measuring and managing, and the disclosure of, costs, fees and expenses associated with the execution of differing investment strategies has assumed increasing importance to most institutional investors. The Commission is not alone. In fact, according to a recent survey by *Private Equity International*, 65% of all surveyed private equity investors have requested greater fee transparency from General Partners over the past year, with 63% of those surveyed agreeing that "fees charged by private equity funds are now difficult to justify."[i]

Unfortunately, the Commission confronted the persistent belief that when making investment decisions, "you get what you pay for." The fact is, there is no established correlation between high fees and high performance in modern investment management.[ii] Such a claim is premised on the concept that excess returns – so-called "alpha" – can be bought. They cannot. The Commission was presented with an abundance of evidence from academics that when strategies are properly adjusted for risk – leverage, illiquidity, and specific exposures – most managers underperform low cost alternatives. The assumption that high fees are a predictor of outperformance is not only wrong, but dangerously misleading when included in any serious investment management discussion.

Future economic events, market behavior and ultimately investment performance cannot be accurately predicted or controlled. However, expenses and costs are controllable. Accordingly, a focus on costs and an effort to identify strategies to reduce investment expenses has been a polestar of the Commission's work. Beyond the statutory directive to the Commission to identify expenditure reductions to generate actuarial savings of at least $1.5 billion over thirty years for each of the two retirement systems, the Commission sought to recommend strategic and structural changes, that if adopted, would substantially exceed this goal, as directed by Act 5's language to recommend "the lowest amount of investment fees to be paid…". Pursuing more cost efficient investment strategies, renegotiating existing fee terms, developing greater internal capacity and eliminating operating redundancies between the two retirement systems by creating a new Central Investment Office provides both pension systems the opportunity to conservatively create between $8.2 billion to $9.9 billion in total projected savings – and therefore a corresponding improvement in the position of the funds -- over a 30 year period.

In particular, these cost savings recommendations include:

ESTABLISHMENT OF A CENTRAL INVESTMENT OFFICE FOR SERS / PSERS	FIRST YEAR PROJECTION (MILLION DOLLARS)
Elimination of redundant expenses	9.0
In house management of indexed equities and fixed income	1.8
Leverage size for reduced external costs (PE)	10.2
TOTAL 30 YEAR ACTUARIAL SAVINGS	$2.1 BILLION
SERS ESTIMATED SAVINGS OPPORTUNITIES	**FIRST YEAR PROJECTION (MILLION DOLLARS)**
Renegotiate existing public equity contracts	4.9
OR, index all public equity contracts	12.8
Indexing of existing fixed income contracts	4.5
Renegotiate existing private equity contracts upon reinvestment	12.2
PSERS ESTIMATED SAVINGS OPPORTUNITIES	**FIRST YEAR PROJECTION (MILLION DOLLARS)**
Renegotiate existing public equity contracts	4.9
OR, index all public equity contracts	17.2
Indexing of existing public fixed income contracts	1.8
Indexing of private high yield LPs	42.5
Renegotiate existing private equity contracts upon reinvestment	15.5
TOTAL 30 YEAR ACTUARIAL SAVINGS FOR SERS/PSERS	$8.2 – 9.9 BILLION[2]

Transparency Matters

A second important principle that guided the Commission's work is an understanding of the important connection between clear, complete, accurate and open reporting of investment data and well-considered decisions by trustees, management, stakeholders and policy makers. Peter Drucker, credited as the founder of modern business management, was fond of saying that "you can't manage what you can't measure." The same can be said about investment expenses, performance and risk: if you cannot account for and measure each of these elements, investment funds cannot be prudently managed. As one consultant writes in this report, a lack of transparency "serves only one party's interests: the asset manager's."

The Commission noted the efforts of other peer pension systems to make available, publicly, information and data involving investment and portfolio expenses, and performance history at asset, sub-asset and manager levels. In some cases, pension systems in other jurisdictions go as far as providing investment manager performance score cards and ranking. Practical improvements such as publicly posting board meeting materials (as in Alaska, California, Montana, Florida, Texas and Wisconsin), video recording of system

[2] Low end of savings range based on renegotiating current mandates; higher end of range based on indexing mandates and estimated using high end of possible fee terms in order to arrive at conservative estimates (meaning, savings from indexing could be higher). Private Equity and High Yield savings of $12.2, $42.5, and $15.5 million per year described above based on 5-year implementation period (see "Cost Savings" chapter). Savings for "Leverage size for reduced external costs (PE)" not included in total range of $97.25 to $116.83 per year or the $8.2 to $9.9 billion of accumulated savings over 30 years out of abundance of caution as there is overlap in mandates under estimates for "Renegotiating existing private equity contracts upon reinvestment." 30 year total estimates determined using results in "Cost Savings" chapter and/or the future value of the first-year savings over 30 years using the 7.25% assumed rate of return. Present value of savings is between $1 and $1.2 billion at 7.25% rate and $2.8 and $3.4 billion at a 3.6% rates referenced in actuarial note for Act 5.

meetings (as in Arizona, New Mexico, South Carolina, Tennessee, and Texas), manager level performance reporting (as in Arizona, Louisiana, Michigan, Minnesota, Nebraska, New York and Washington), detailed performance reports of alternative investments (as in Connecticut, New Mexico, New York City, Los Angeles and Nebraska), publication of all fee, cost and expense terms of investment management contracts (as in Louisiana, New Jersey, Nebraska, Rhode Island and South Dakota) and all fees paid per investment manager (as in Illinois, Maryland, Missouri, North Carolina, North Dakota and South Carolina) are recommended in order to elevate the Commonwealth's retirement systems to national leadership in fund management transparency.

Unfortunately, current state laws are a roadblock against greater open access to pension fund investment records. Embedded within each system's retirement code are statutory provisions that permit both systems to broadly shield any "sensitive investment or financial information" from public disclosure pursuant to a Right-to-Know request, if either system deems the record to potentially cause "substantial competitive harm" or "substantial detrimental impact" to the related investment. While the statute neither articulates an independent standard nor provides any guidance defining either "substantial harm" or "detrimental impact," both systems have broadly interpreted such language as precluding the public reporting of much underlying investment manager performance and cost information. SERS, in particular, has adopted a very aggressive interpretation of the statutory provisions to support its refusal of information requests from the Commission as well as members of its own Board.

Inexplicably, while state law requires PSERS to report alternative investment records, including expenses and valuation, no such requirement applies to SERS. Because SERS has no comparable legal requirement to publicly disclose alternative investment records, very little information related to individual alternative investment mandates are publicly reported or made available to stakeholders. Any effort to increase public disclosure of system investment costs, performance and risks must include a reevaluation of the current statutory framework relied upon by both systems to maintain the confidentiality of many investment records.

Conclusion

Throughout its work, the Commission has recognized that the abstractions of investment theory and the jargon of investment professionals often obscure what matters most: the needs of the many Pennsylvanians, beneficiaries of the systems, who have dedicated their lives to public service. In considering appropriate levels of investment management fees and expenses, the Commission was considering the livelihood of tens of thousands of public servants who have contributed to these systems in the assurance of a safe and secure retirement. They, along with the taxpayers they have faithfully served and whose hard-earned dollars also support these systems, deserve our best efforts to learn from the past in order to deliver the future we have promised.

The Commission recognizes that critical examination and change, in any enterprise, can be difficult and threatening. But, as the Commission has heard over and over, the process of squarely examining facts, even uncomfortable ones – whether through stress-testing, transparency around fees and performance, or considering the risks in an allocation or strategy – is healthy and necessary. It is only through honest self-reflection and external accountability that any organization will take steps to improve. As one consultant wrote, "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."

This report and these recommendations are offered in the hopes that they do just that: reinvigorate and re-empower all stakeholders to consider, from first principles, how Pennsylvania's public pension funds should operate, so that we indeed live up to the promises made to their beneficiaries.

Commissioner Gallagher, at the request of his appointing legislative caucus, has submitted, to be reflected as part of the record and incorporated in this report under Appendix III: "An Independent Review of the PPMAIRC Report Submitted by Commissioner Gallagher.", a divergent view as to some of the recommendations and findings within the final report. Because not every recommendation or finding of fact is disputed, the submitted report is intended to be an overlay to the underlying, larger report.

The included report, "An Independent Review of the PPMAIRC Recommendation Report," was prepared by Stephen L. Nesbitt, CEO, Cliffwater LLC. Mr. Nesbitt is an institutional investment advisor to large public and private pension funds. His review provides additional context to parts of the report that, Commissioner Gallagher and his appointing legislative caucus believe, needed further qualification.

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

INTRODUCTION

Introduction

The year 2017 brought fundamental change for Pennsylvania's two largest public pension systems – the Public School Employees' Retirement System (PSERS) and the State Employees' Retirement System (SERS) – as the General Assembly enacted sweeping legislation intended to ensure the future ability of both funds to meet retirement commitments made by the Commonwealth to state workers and public school employees. Following several years in which the state fell short of its funding commitment to both retirement systems, Act 5 was passed with broad bipartisan support by the legislature.[iii] The goal of Act 5 was to provide new and sustainable retirement options and benefit structures for future employees, to stabilize the long-run financial health of the retirement funds, and to improve the operation and governance of both systems. In order to achieve additional operating and management improvements for the systems, as well as significant cost-savings, Act 5 established an independent, quasi-legislative commission tasked with investigating, researching and recommending specifically identified improvements to oversight and investment practices at both systems.

Designated as the "Public Pension Management and Asset Investment Review Commission," this commission was established to study the operations of the Commonwealth's statewide pension systems and report its findings and recommendations to the General Assembly, Governor and both retirement systems. The five-member Commission is composed of appointees, who are to be an "investment professional [or] retirement advisor," designated by each of the following: the Governor, the President Pro Tempore of the Senate, the Minority Leader of the Senate, the Speaker of the House, and the Minority Leader of the House. Notably, the Commission is independent from the retirement systems. The legislature could have delegated the Commission's responsibilities to either or both of the retirement systems, but chose differently. Instead, Act 5 established a commission that would provide an independent and up-to-date review of the retirement systems' operations, without attachment or association with past investment or management decisions. Each Commissioner's work was voluntary; no Commissioner received compensation for his work.

The five members of the Commission bring a diverse background of financial and public policy experience to this endeavor:

James J. Bloom is with the Pennsylvania Department of Banking and Securities. For over a decade prior, Mr. Bloom was the president of a government affairs, business consulting and business management firm. Mr. Bloom has over 35 years of experience in the financial services industry and is intimately familiar with SEC rules and regulations. Mr. Bloom served as a Treasurer, Finance Committee Chair, Investment Committee Chair, Audit Committee Chair and Chief Executive Officer of several for profit and not for profit companies and organizations. Mr. Bloom has held Series 7 and 63 investments licenses and a life insurance license.

Bernard Gallagher is a budget analyst for the Appropriations Committee in the state House of Representatives, and serves as a designee for trustees to both SERS and PSERS. Gallagher previously worked as a budget analyst in Colorado.

Michael Tobash is serving his fourth term as the State Representative of the 125th legislative district serving a portion of Schuylkill and Dauphin counties. Tobash has established himself as a leader on pension issues, advocating significant reform measures. He is a deputy chair on the House Republican Policy Committee and majority chair of the Sub-Committee on Technical Education and Career Readiness. His private sector experience comes through FINRA licensing Series 6, 63, 65, and 26 as a Registered Representative and Registered Investment Advisor with a national broker dealer. He is the principal of Tobash Agencies, specializing in property and casualty insurance and individual and group retirement planning. Tobash has served as the Chairman of the Commission.

Michael J. Torbert has over 33 years experience as a Vice President/Senior Investment Officer and Wealth Advisor for several bank investment management and trust divisions and financial firms in the Lehigh Valley. In that capacity, he served on investment committees and managed portfolios ranging up to $15,000,000 in assets. He serviced in the U.S. Navy. Worked for several large Plastics Companies in sales and marketing and traveled extensively throughout the U.S. and Canada over 12 years before joining the investment business in 1984. He has served and still serves on non-profit, educational and financial industry boards. He held Series 7, 63 and 66 Investment licenses, a PFP Certificate and Life Insurance license.

Joseph M. Torsella was elected State Treasurer in 2016. As State Treasurer, he is the sole statutory custodian of over $100 billion in public funds, with independent management authority over $20 billion in assets, and is a board member of the Public School Employees Retirement System, the State Employees Retirement System and the Pennsylvania Municipal Employees Retirement System. Prior to his election as State Treasurer, Torsella served as U.S. Ambassador to the United Nations for Management and Reform, President and CEO of the National Constitution Center, and a Deputy Mayor of the City of Philadelphia. Torsella has served as the Vice-Chair of the Commission.

The Commission was statutorily assigned an extensive and complex list of tasks to accomplish within a six-month period,[iv] including the following:

- Evaluate the performance and investment strategies of SERS and PSERS to benchmarks, considering investment expenses associated with active and indexing strategies;
- Compare costs and benefits of both active management and indexing investment strategies in relation to future investment activities of SERS and PSERS;
- Study future investment strategies with the objective of maximizing future rates of return, net of fees;
- Issue recommendations to improve fee transparency consistent with the reporting guidelines of the Institutional Limited Partners Associations;
- Recommend implementation of the recommendations of the Society of Actuaries Blue Ribbon Panel on stress testing;
- Report findings on pension fund assets, returns, management, requests for proposals and benchmarks; and,
- Recommend the lowest amount of investment fees and costs to be incurred to achieve each fund's anticipated annual rate of return, and develop recommendations to reduce expenditures to generate an actuarial savings of $1.5 billion, per fund, over 30 years.

The completed report and resulting recommendations of the Commission are intended to serve as the foundation for additional improvements to the retirement systems. The Commission's report of findings and recommendations are to be submitted to the Governor and the General Assembly. Additionally, both retirement systems are directed to consider the recommendations of the Commission, implement each recommendation deemed appropriate and "strive to achieve actuarial savings of $1.5 billion over 30 years" while maintaining the assumed annual rate of return for each fund. Improved investment efficiency is an explicitly stated objective of Act 5.

In seeking to fulfill its statutory mandate, the Commission conducted three lengthy hearings with 19 hours of testimony. At each hearing, materials and testimony from international academic experts and national industry leaders on pension management, institutional investment strategies, retirement fund operations and regulatory oversight was provided. In addition to representatives from SERS and PSERS, over 25 expert witnesses testified before the Commission, from 4 countries, 14 states and 5 public retirement funds. The Commission also received and reviewed in excess of 5,000 pages of studies, articles, reports and presentations from countless academic sources, industry professionals and public pension experts, as well as more than 200 pages of written materials submitted directly from testifiers.

The work of the Commission has not been without challenges. The Commission was expected to complete its work within a short six-month period: a limited period in which to comprehensively identify recognized expert witnesses, schedule their appearance and conduct hearings; research, review and analyze relevant academic studies and industry papers; and draft, consider and issue a comprehensive report and recommendations that address each statutorily identified matter.

No budget appropriation was provided to pay for the cost of retaining independent financial experts and consultants. The State Treasurer, an appointee of the Governor, was able to allocate sufficient funds and direct Treasury Department resources to assist the Commission in satisfying its legislative mandate, and in so doing retained the services of several financial consultants and academic experts.

The Commission also encountered difficulty in obtaining investment data and financial information from the two retirement systems. The source of much of the resistance to completely satisfying information requests can be attributed to the broad statutory authority contained within the two retirement codes that permits both retirement systems to shield investment-related information from public disclosure – such as individual fund manager fees, investment expenses, performance and the identity of underlying investments. Multiple non-disclosure agreements were negotiated and executed to permit underlying investment fund data to be shared with Treasury's expert consultants. Where information was not provided from the retirement systems, consultants supplemented information from subscription database services and publicly posted investment reports from other state funds.

Fortunately, the Commission was able to overcome these challenges If fully implemented, the recommendations are intended to significantly enhance the performance, management and oversight of SERS and PSERS, and would strengthen both systems, benefiting both their beneficiaries and taxpayers. More than a set of specific list of recommendations, however, this report marks an important milestone – the first and only independent study and critical review of the investment management of the Commonwealth's two largest retirement systems.

A critical review, in this context, does not mean to suggest that past decisions have been made in bad faith or for wrong motives. Pennsylvania's pension systems, like others around the country, are full of talented, hardworking and dedicated men and women who are motivated by a noble mission: ensuring that we can keep the promises made to other employees who similarly gave their careers to public service. But a critical review, in the sense of an unflinching and honest appraisal of what has worked and what hasn't, does not diminish their efforts. It is, in fact, exactly what we owe to such an important mission. In public pension management as in every area of public policy, it is only by honestly examining the lessons of the past that we can steer towards a better future.

Such a review is also what we owe to the citizens of the Commonwealth, because understanding the state and improving the health of Pennsylvania's public pension fund management should concern every citizen. Although the language of investing is often obscure and technical, the stakes could not be higher or the outcomes of more common concern.

From Orange County, California, to Wall Street, financial history — public and private — is littered with examples of avoidable catastrophes in which intelligent, usually well-intentioned people believed that they'd discovered the secret to "beating the market" without undue risk, until their complex cocktails of leverage, risk, and secrecy exploded. Yet even in the midst of every financial scandal or crisis, other investors, grounded in common sense and good judgment, have managed to avoid such pitfalls, and to quietly and steadily build wealth.

We believe that Pennsylvania's public pension funds can not only be in the second group, but can chart a new course to take their place among its leaders. The Commission therefore hopes this report will be the beginning, not the end, of an important and long overdue policy dialogue as to how best to ensure the future viability of Pennsylvania's promise of a secure retirement to its public employees and educators.

On a final note, Commissioner Gallagher, at the request of his appointing legislative caucus, has submitted, to be reflected as part of the record and incorporated in this report under Appendix III, a divergent view as to some of the recommendations and findings within the final report. Because not every recommendation or finding of fact is disputed, the sumitted report is intended to be an overlay to the underlying, larger report.

The included report, "An Independent Review of the PPMAIRC Recommendation Report," was prepared by Stephen L. Nesbitt, CEO, Cliffwater LLC. Mr. Nesbitt is an institutional investment advisor to large public and private pension funds. His review provides additional context to parts of the report that, Commissioner Gallagher and his appointing legislative caucus believe, needed further qualification.

A NOTE ABOUT THE COMMISSION'S WORK

The statutory mandate to the Public Pension Management and Asset Investment Review Commission is broad, covering many aspects of public pension management, oversight and operation. However, it is noteworthy that Act 5's directives to the Commission do not include any reference or mandate to consider or review pension benefit levels. Consequently, this Commission has not sought to investigate existing or future retirement benefits. Rather, it has been the exclusive focus of the Commission to consider recommendations intended to improve public pension management with the objective of ensuring the continuity of the existing benefit structures for future generations of state employees and public school workers.

Accordingly, it would be inappropriate for any portion of this report or resulting recommendations from this Commission to be cited or referenced in support of any change in the existing schedule of retirement benefits or plan design. Each of the members of this Commission is sensitive to the concern that the Commission's work could be misappropriated as part of a legislative agenda that was neither contemplated nor advocated by the members of the Commission.

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

BACKGROUND

Background[v]

Retirement security for Pennsylvania's public employees has been an important state policy priority for over 100 years. Beginning with the legislative establishment of the Public School Employees' Retirement Board in 1917, the Commonwealth has recognized the importance of providing, to those whose careers have been dedicated to public service, a fair and secure retirement. Six years later, in 1923, the General Assembly created the State Employees' Retirement System. Collectively, as of 2018, both retirement systems estimate that they serve over 725,000 public educators, school employees, state workers and retirees.

Each retirement system oversees investment offices that together manage over $85 billion in total fund assets – PSERS, $55.6 billion; SERS, $29.4 billion. Combined, the retirement funds of PSERS and SERS would rank 9th in size nationally among state retirement funds. As of last year, the average annual retirement defined benefit paid to qualifying annuitants is modest: in the case of a retired PSERS member, $25,000; for a retired SERS member, it was $28,400. In each case, the average career length for either a PSERS or SERS member is between 22-23 years.

Funding for the two retirement funds is statutorily provided, consisting of an annual employee contribution and assessment paid by the employer. In the case of SERS, the average state employee contribution rate is 6.25% of salary, automatically deducted from their biweekly pay. For public school employees, the average contribution rate is 7.57% of salary. The rate of contribution for employing state agencies, public school districts or other public schools consists of two components – a "normal" cost for benefits, and an "unfunded liability" cost to cover the shortfall between projected assets and liabilities. Together, these two components account for a total "composite" rate of payroll, as an annual contribution to the retirement funds.

The 2017-18 employer contribution rate to SERS was 4.91% of payroll for benefits earned during the period and a rate of 28.33% of payroll for the unfunded liability component. Collectively, the employer composite rate to SERS was 33.24% of payroll. As to PSERS, the employer composite rate is 33.43% of payroll, consisting of approximately 8.3% of payroll for benefits and 25.1% of payroll that is attributed to the unfunded liability.

Unfunded Liability

Over the years, several terms have been used to define the contribution rate that employers must provide to adequately fund a public pension plan. The rate has been defined as the annual required contribution or actuarially required contribution (ARC) and more recently by the Governmental Accounting Standards Board as the actuarially determined contribution amount necessary to fund the public pension plan. Regardless of the term used, the rate refers to the amount needed to be contributed by employers to prudently fund a public pension plan utilizing accepted actuarial standards. The contribution rate represents the amount needed to fund benefits over time.[vi] An employer that has paid the contribution rate in full has made an appropriation to the pension fund to cover the benefits accrued that year and to pay down a portion of any liabilities that were not pre-funded in previous years. Conversely, when an employer does not pay the contribution rate in full, the unfunded liability of the system will grow and require greater contributions in future years, thus increasing the long-term costs of funding a pension plan.

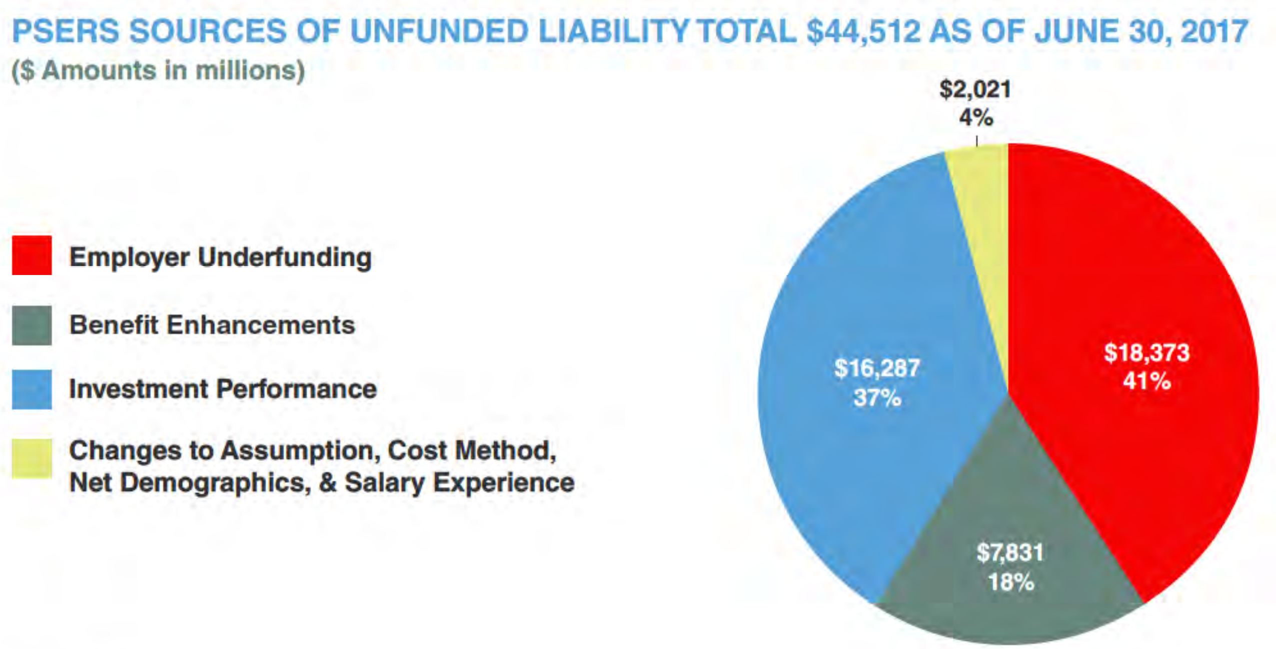
Unfortunately, this is exactly what has occurred with both of the Commonwealth's largest retirement funds. The annual contribution to both retirement funds has repeatedly fallen short, often far short, of the actuarially determined amount, contributing to the accrual of a substantial unfunded liability. In the case of PSERS, as of June 2017, existing fund assets were approximately $44.5 billion short of projected liabilities. Expressed as a percentage, PSERS was actuarially underfunded by 43.7% (in other words, it was 56.3% funded). For SERS, as of December 2017, it was approximately $19.66 billion short of projected liabilities, or was actuarially underfunded by 39.3% (it is 60.7% funded).

The unfunded pension liability that has impacted both funds was not a sudden occurrence. Rather, it was the direct and foreseeable consequence of past policy decisions, principally deferring actuarially determined contributions in favor of other budgetary priorities, as well as of investment underperformance. On a ten-year basis, neither fund has met its actuarially assumed rate of return: PSERS' ten-year annual return has been 5.03%, while SERS has returned 4.1%.

Using PSERS' experience to demonstrate the financial consequences to both retirement funds, the following are a series of graphs developed by PSERS that illustrates the sources of underfunding, PSERS' historical funding levels, the years and amounts of funding shortfalls, and the impact on current employer contribution levels.

This first chart identifies the primary contributing causes of the existing unfunded liability of PSERS. The largest single cause of the existing unfunded liability is employer contribution shortfalls (41%), with underperformance of investments the second largest factor (37%).

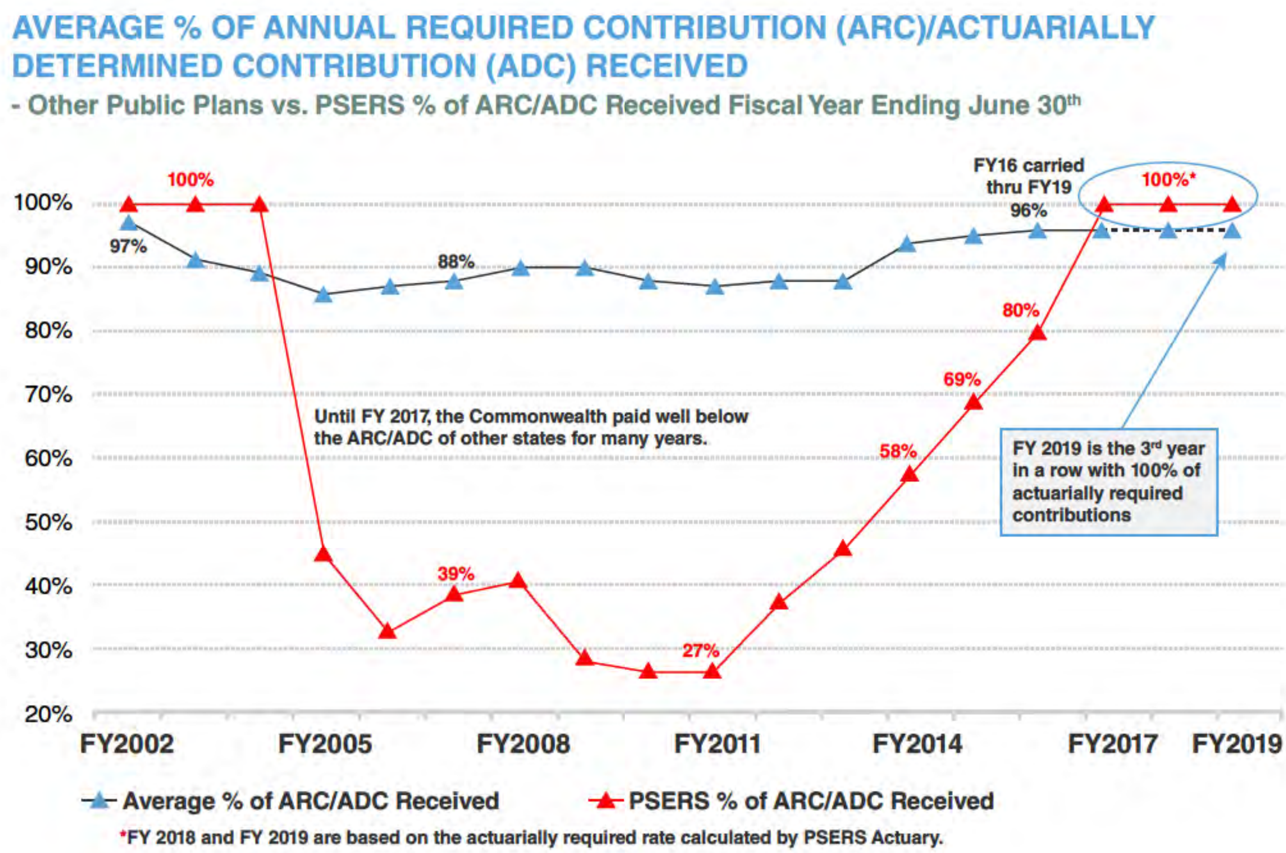
Figure 1: PSERS Sources of Unfunded Liability



Source: PSERS

The second chart marks the employer contribution rate made to PSERS as compared to the national average received by other public pension plans. A significant point illustrated by this graph is that the largest contribution deficit occurred during the economic downturn of the 2008-09 national recession. At a time of significant investment loss and liquidity demands on the retirement funds, the employer contributions dropped to 70% below the annual actuarially determined amount. During the same period, the national average contribution was no less than 80% of the actuarially determined amount. This graph also marks the recent return to 100% funding over the past three fiscal years, an important and welcome new chapter.

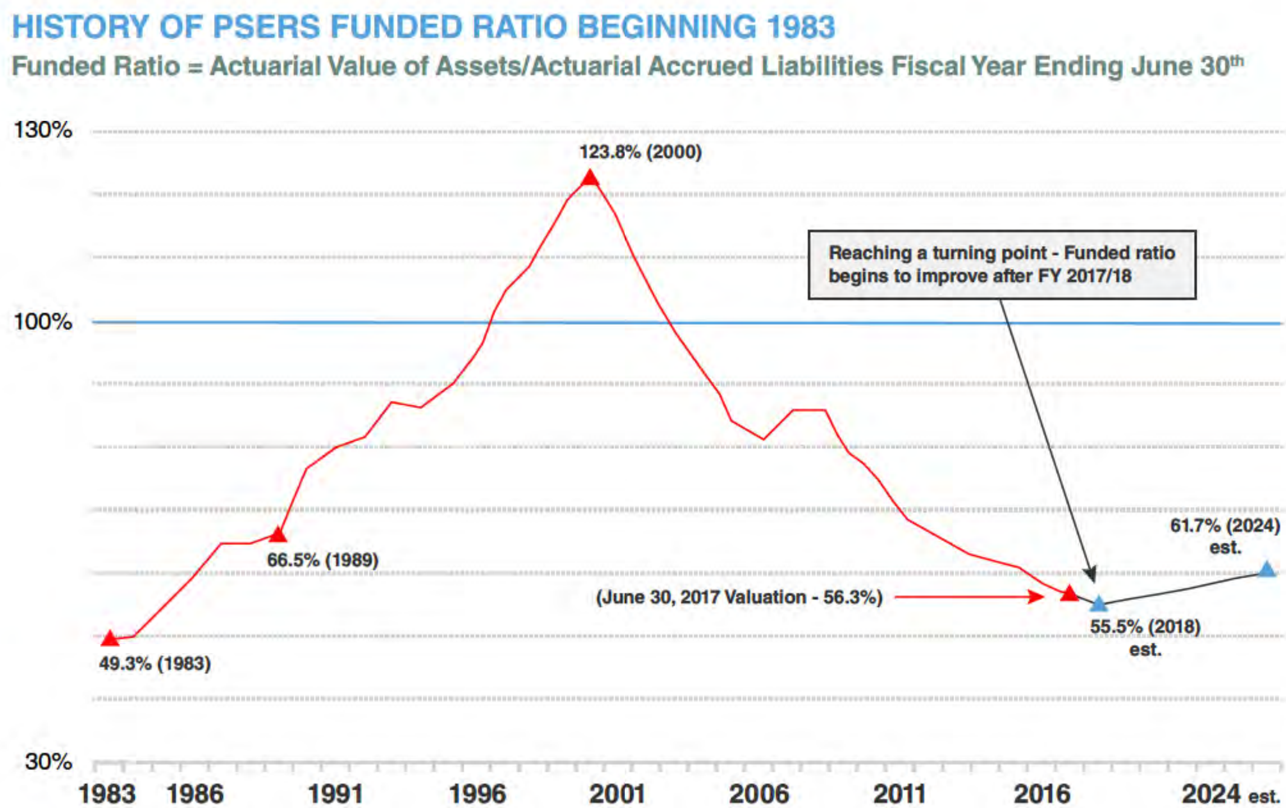
Figure 2: Percentage of ARC/ADC Received, PSERS v. National Average



Source: PSERS

The graph below marks the historical funding level of PSERS. Notably, the current underfunded level is not an historical low. In 1983 PSERS was only 49.3% funded. However, that deficit was erased by 1996, and PSERS' funded level peaked at 123.8% in 2000. Also notable, it is only with the 2017/18 fiscal year that the funded level is projected to – modestly – begin to improve.

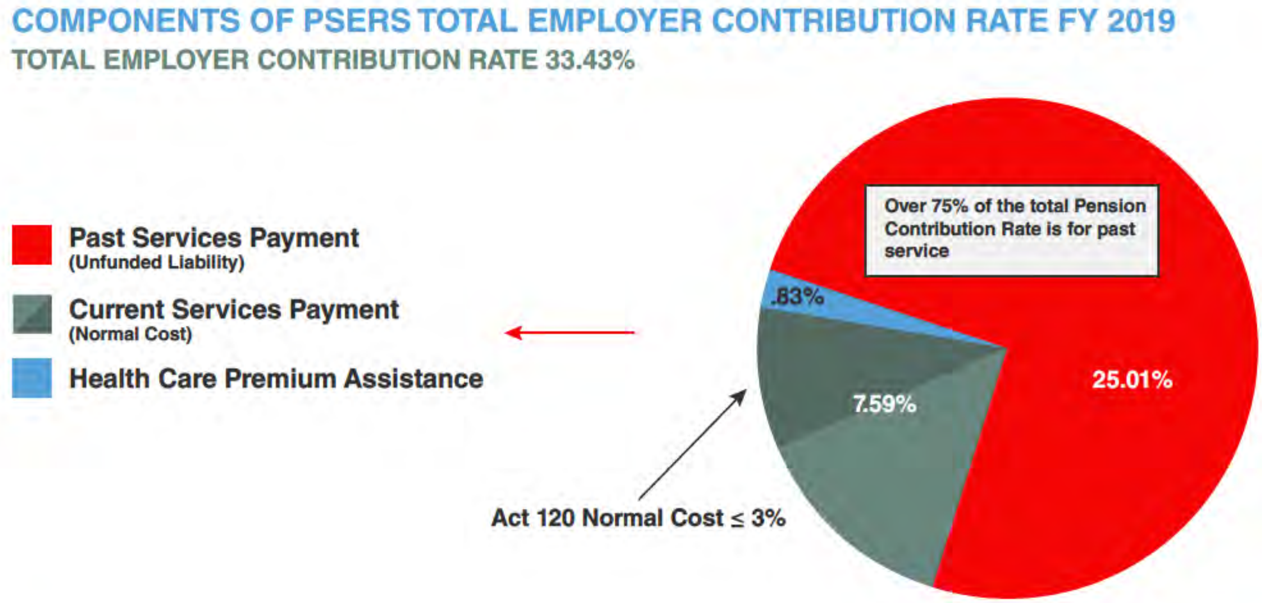
Figure 3: History of PSERS Funding Ratio



Source: PSERS

This last chart highlights the consequences associated with past funding and investment performance shortfalls. Significantly, over 75% of every employer dollar contributed to the fund is associated with payment of the unfunded liability.

Figure 4: Components of PSERS Total Employer Contribution Rate



Source: PSERS

Act 5 of 2017

With broad bipartisan support, the General Assembly enacted Act 5 of 2017.[vii] Advocated as an "important" and "historic" proposal, the Act was designed to address "structural" problems associated with significant unfunded liabilities at both retirement funds. It was also meant to provide for the "long-term financial solvency" of the funds, Changing the benefit schedule for future employees, altering the governance boards for both systems and establishing this Commission to study investment management of the two systems, Act 5 was ambitious in its scope.

The central component of Act 5 is the creation of a hybrid retirement benefit structure for both systems. Under Act 5, beginning in 2019, new state and school employees will be offered a choice among two hybrid options that combine a reduced defined benefit with a defined contribution component and a third stand-alone defined contribution option. The defined benefit plans currently administered by SERS and PSERS, which provide a guaranteed monthly pension payment to retired employees based upon an average of their three highest salary years calculation, will no longer be made available to new employees entering the pension systems. In addition to changing the defined benefit structure for new employees in both retirement systems, Act 5 raised the retirement age for new employees from 65 years to 67, and changed the calculation basis of final average salary from the highest three years to the highest five years.

The movement of all new employees into either a hybrid defined benefit / defined contribution plan or a stand-alone defined contribution plan is anticipated to reduce employer contributions and employer risk. According to the actuarial note by the Independent Fiscal Office, for fiscal years 2018-19 through 2049-50, the benefit structure change is anticipated to reduce employer contributions by $1.2 billion on a cash flow basis and $592 million on a present value basis.[viii] Additionally, the Independent Fiscal Office estimates that by the end of fiscal year 2049-50, the financial position of the two retirement systems will improve slightly, by $4.2 billion on a cash flow basis and $1.4 billion on a present value basis.

However, it is the work of this Commission that has the greater potential of improving the financial position of the two funds in the nearer term. Act 5 charged the Commission with a broad review of investment operations at both funds, and a specific charge to identify cost-savings in investment fees and expenses. The Independent Fiscal Office acknowledged the mandate to the Commission to develop recommendations to reduce expenditures to generate actuarial savings of at least $1.5 billion for each retirement system over 30 fiscal years.[ix] The recommendations contained in this report identify an estimated annual savings opportunity, for both retirement systems, in the range of $97.3 to $116.8 million, or, expressed as an actuarial savings over 30 years, between $8.2 and $9.9 billion.[3]

It is this savings expectation and comprehensive investment review, intended to ensure the future financial stability of both retirement funds, which creates the background for this Commission's work.

(3) Low end of savings range based on renegotiating current mandates; higher end of range based on indexing mandates and estimated using high end of possible fee terms in order to arrive at conservative estimates (meaning, savings from indexing could be higher). Private Equity and High Yield savings of $12.2, $42.5, and $15.5 million per year described above based on 5-year implementation period (see "Cost Savings" chapter). Savings for "Leverage size for reduced external costs (PE)" not included in total range of $97.25 to $116.83 per year or the $8.2 to $9.9 billion of accumulated savings over 30 years out of abundance of caution as there is overlap in mandates under estimates for "Renegotiating existing private equity contracts upon reinvestment." 30 year total estimates determined using results in "Cost Savings" chapter and/or the future value of the first-year savings over 30 years using the 7.25% assumed rate of return. Present value of savings is between $1 and $1.2 billion at 7.25% rate and $2.8 and $3.4 billion at a 3.6% rates referenced in actuarial note for Act 5.

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

RECOMMENDATIONS OF THE COMMISSION

Recommendations of the Commission

Over the past six months, the Public Pension Management and Asset Investment Review Commission has received extensive expert testimony and compiled research and best practices in each of the issue areas identified in Act 5. As part of this process, the Commission received considerable input on how to satisfy the objectives of the Act. Specifically,

> *(3.1) The commission shall evaluate and make recommendations on:*
>
> *(i) Improving investment fee transparency on alternative investments as specified in the Standardized Reporting Guidelines of the Institutional Limited Partners Association.*
>
> *(ii) Implementing the recommendations of the Society of Actuaries Blue Ribbon Panel on stress testing, to test the ability of the plan to withstand a period of investment returns above or below the level of assumed return.*
>
> *(4) Publish extensive and detailed findings online, including findings about:*
>
> *(i) assets;*
>
> *(ii) returns;*
>
> *(iii) financial managers;*
>
> *(iv) consultants;*
>
> *(v) requests for proposals; and*
>
> *(vi) investment performance measured against benchmarks.*
>
> *(5) Recommend the lowest amount of investment fees to be paid by the board for the board to achieve the board's anticipated annual rate of return and to develop recommendations to reduce expenditures to generate actuarial savings of $1,500,000,000 over 30 years from the effective date of this section.*

The Commission has carefully considered numerous recommendations and suggestions for meeting the goals of Act 5. Recommendations were evaluated as to the following criteria:

- Legal and Practical. *Solutions should be both lawful and capable of being implemented.*
- Purposeful. *Recommendations should support and enhance the ability of retirement systems to provide promised retirement benefits.*
- Effective. *Proposals should improve investment decision making, operational execution and management accountability.*
- Sustainable. *Any changes made to how the pension systems carry out their missions should promote sustainable, long term solutions.*

In addition to these three criteria, recommendations are made consistent with the following principles:

- The State has, and wishes to maintain, a commitment to providing fair and secure retirement benefits to those whose careers have been dedicated to public service.
- Maintaining trust amongst stakeholders is critical to facilitating best decision making and fostering support for the plans.
- Ongoing and rigorous review of investment decision making processes and assumptions improves investment management, reduces unnecessary or unrewarded risks, and equips the plans to thrive in changing and complex financial markets.

- Consistent with the mandate of Act V, fees and other costs must be monitored and managed. Reducing costs is one of the only certain ways to enhance the investment portfolio's expected return without increasing its risk.

With these principles and criteria in mind, and based upon the preceeding Report, the Commission makes the following recommendations to present to the Governor and General Assembly:

Notes

Except where otherwise stated, the Commission's recommendations are not exclusively directed to the General Assembly, but may be implemented pursuant to an Executive Directive issued by the Governor, by resolution adopted by either of the two retirement system's Board of Trustees, or by retirement system staff practice. In most cases, the Commission's focus was on the content of the recommendation, not the means by which they are to be adopted.

Full Funding of the Retirement Funds

- We recommend that the Commonwealth annually maintain full payment of the actuarially determined contribution amount necessary to fund each public pension plan as a fundamental and necessary requirement to ensure the future viability of both retirement systems.

- We recommend that the General Assembly consider additional legislation mandating full funding of each retirement fund, pursuant to Act 120 of 2010, as an annual budgetary priority.

- We recommend that the General Assembly consider legislation requiring the pre-funding of any future benefit structure enhancement or cost-of-living increase.

- We recommend that the General Assembly consider the creation of a rate stabilization fund as a precaution against annual underfunding of the two retirement systems during period of state budgetary stress.

Other Recommendations

- We recommend, with recognition that pension fund management is complex and that best practices are continuously evolving, that at the termination of this Commission, work continue through the establishment of a review commission to explore questions beyond the purview of PPMAIRC.

- We recommend that Pennsylvania lead an effort to form a consortium of major state pension funds to reset the balance of power between asset owners and investment managers.

Stress Testing

- We recommend that the General Assembly enact legislation requiring an annual stress test of each system, broadly aligning with the Blue Ribbon Panel (Panel) recommendations and including at least a 2-percentage point variation in a baseline benchmark return, as well as a quantifiable contribution risk such as the 80 percent measure recommended by the Panel. Although the Panel recommends a 3-percentage point variation, a 2 percent variation would be consistent with practices in states that have enacted similar legislation. In addition, assumptions used in baseline analysis calculations made by the Systems should be reported, as these may include actuarial assumptions differing from those recommended by the Panel.

- We recommend that the Systems' stress tests report the impact of the stress on other financial measures—including expected contributions in dollars, expected contributions as a percentage of payroll, funded ratios, ratio of benefit payments to payroll, ratio of funding liability to payroll, and the ratio of the market value of assets to payroll—and cover a period of at least 30 years, in accordance with the Panel recommendations.

- We recommend that stochastic models be used in addition to—not in place of—deterministic modelling. We commend PSERS for its recent stress testing report and encourage them to continue to do stress testing consistent with the Blue Ribbon Panel recommendations.

- We recommend that the Systems make their stress test reports publicly available. Reports should be provided to stakeholders and policy makers, including plan beneficiaries, the Governor, the Legislature, Board of Trustees, staff, the Auditor General, and the general public.

- We recommend that the Systems' stress test charts be simple to understand, with the policy question or decision that the chart addresses featured prominently and clearly at the top of each chart.

- We recommend that the Systems' stress tests be conducted by an experienced actuary, not an investment consultant. Although investment consultants can provide useful input, only actuaries have the tools and techniques to conduct stress tests of a pension fund.

- We recommend that the Systems conduct and publish "reverse" stress tests showing the market events and funding scenarios that would cause certain undesirable outcomes, including but not limited to the funds' investment portfolios to become more illiquid than a Board-determined threshold limit (expressed as a multiple of annual distributions).

Transparency

Although nothing precludes the Funds from implementing the following recommendations on their own, we recommend that the General Assembly act to require full public disclosure of fee and performance data by the funds through legislation, to institutionalize and make permanent these practices.

Transparency of decision-making processes:

- We recommend that complete board materials be posted on each system's public websites, including manager presentations with proposed fee terms, no less than one week before each board or investment committee meeting, and that materials remain online for a period of seven years.

- We recommend that each public board and committee meeting be live streamed and video and audio recordings of public board proceedings be published and archived.

- We recommend that all investment marketing ("pitch") materials, investment agreement terms, including side letters, related to fees, costs, expenses, performance and risk be publicly available, that fee terms not be redacted in contracts posted to e-contracts website, and that both retirement systems utilize a common standard checklist for transparency issues when evaluating managers (see Appendix I for sample).

- We commend the Systems for disclosing investment policy guidelines and asset allocation plans as well as other statements of their processes, and we recommend that they continue.

Transparency of performance reporting:

- We commend the Systems for disclosing total fund performance and performance of certain asset classes relative to benchmarks, and recommend that they continue to do so.

- We recommend that both retirement systems publish net-of-fee and gross-fee returns when reporting investment performance, and that the General Assembly consider enacting legislation to require that.

- We recommend that, to facilitate understanding by stakeholders and policymakers, each fund should report total fund performance against a risk-appropriate and commonly understood reference portfolio benchmark as Rhode Island, such as a global 60/40 or 70/30 index, with and without leverage if used, and for one, three, five, seven, ten, fifteen, twenty, and twenty-five year periods, as well as year by year.

- We recommend that both retirement systems publish returns, costs and fees of individual investments relative to a similar risk public markets alternative, on a levered and unlevered basis.

- We recommend that returns of internal investments are reported in the same manner as other investments – by investment, by asset class, by vintage year (if appropriate) and as a portfolio – on a levered and unlevered basis.

- We recommend that performance reports for the two retirement systems also include a rolling 3- and 5-year return comparison in graphic form, and annual returns for the last 5 years, in addition to the returns over 3-, 5-, 10-, 15-, and 20-year periods ending at the current period, in situations where they do not do so already.

- We recommend that both retirement systems publicly post detailed quarterly portfolio performance reports received from general consultants, with per-manager returns versus benchmarks, and alternative investment performance reports received from specialty consultants, including public market equivalent (PME) values for each individual fund/manager based on a board-approved index.

- We recommend the General Assembly repeal statutory provisions within the two retirement codes that permit both retirement systems to shield investment performance, risk and expense information from public disclosure pursuant to a Right-to-Know Request. Specifically, 71 Pa. C.S.A. § 5902 (e) and 24 Pa. C.S.A § 8502 (e).

- We recommend the General Assembly enact legislation that designates all retirement system records related to investment performance, risk and expense information as public records, using Arkansas (broadly identifying "all records" kept by the retirement system as open to the public), Nevada (declaring "books of the retirement system" are public records), Texas (affirmatively listing most all investment records as "not exempt from disclosure"), and, New York (mandating "records of the retirement system" as public) as examples of model legislation.

- At a minimum, we recommend the General Assembly enact legislation that would apply the provisions of the Public School Employees' Retirement Code (24 Pa. C.S.A § 8502 (e)(5)), which designates valuation and expense information related to alternative investments as public records, to SERS' alternative investments. Inexplicitly, SERS is presently not subject to this disclosure requirement.

Transparency of fees, costs, and expenses:

- We recommend that both retirement systems require all external managers to use the ILPA template. We commend PSERS for its policy, and urge that it be continued, and recommend that SERS also require, rather than request, this of managers.

- We recommend that both retirement systems publicly disclose all travel or other expenses incurred by staff and paid for by an external investment manager, fund or consultant.

- We recommend that both retirement systems utilize and report information from the ILPA template for each manager for the public reporting of fees, costs, and expenses of its alternative investments, including carried interest. In addition, we recommend that the General Assembly consider enacting legislation to require that information be reported in this manner. For traditional investments, we also recommend that the Systems publish investment management fees, costs, and expenses both by manager and aggregated by asset class, separately identifying base management, performance/carried interest, and other expenses (as reported by CalPERS, Missouri, and South Carolina). In addition, we recommend that the General Assembly consider enacting legislation to require the publication of this information.

- We recommend that policymakers and stakeholders should be prepared and willing to defend the systems against false comparisons that may be made as a result of increased transparency on fees. Increased disclosure comes with a risk of unflattering but also unfair comparisons to less transparent systems. The solution is not to avoid transparency, but for policymakers to avoid "penalizing" Pennsylvania's funds for doing the right thing.

Portfolio Implementation

- We recommend that the Boards of SERS and PSERS review their Investment Policy Statements and ensure that:

  - There is a risk budget that specifies the tolerable volatility, downside risk, and illiquidity and the associated simple benchmark portfolio

  - There is a diversified policy benchmark that is composed of investable index funds

  - Systematic risk calculations are defined and targets established

  - Idiosyncratic risk limits are defined

  - 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.

Active and Indexing

- 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.

Performance Evaluation

- 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-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.

Performance and Asset Allocation

- We recommend that each fund revisit and reconsider its asset allocation in light of the findings in the consultant report as to past risk-adjusted and relative performance of the current models.
  - o At SERS, we recommend that such a reconsideration focus on the role of illiquid investments in the portfolio, particularly private equity. We note the finding that through the 2008 financial crisis, SERS allocation, heavy in illiquid investments, performed worse than a balanced public market index. We do not recommend that SERS exit private equity as an asset class, and note that SERS performance in this asset category has been stronger than PSERS. However, we recommend that SERS carefully reconsider the risks of its current allocation targets to illiquid private investments, particularly private equity, and reduce them to more appropriate levels, noting that the 2017 allocation was found to be "in line" with peers.
  - o At PSERS, where one measure of total fund risk was found to have "nearly doubled" in recent years and unusual levels of portfolio complexity noted, we find greater cause for concern, and we recommend that such a reconsideration focus on the role of illiquid investments more broadly, particularly private equity, hedge funds, and commodities. We note the troubling finding that PSERS level of illiquid investments overall at 43% (not including unfunded commitments to these investments) is a "significant outlier" and far more than either SERS or peer funds. We therefore urge that PSERS carefully reconsider the risks of its current allocation targets for illiquid private investments, and reduce them to more appropriate levels.
- We also recommend that PSERS, as a matter of priority, revisit and reexamine its use of leverage. The use of leverage – borrowing – by U.S. pension funds is extremely rare, and the extent to which PSERS uses leverage (effectively borrowing against over 17% its portfolio) is an anomaly, the potential risks of

which are not widely understood by stakeholders. As the report notes, leverage can be "treacherous" and has sometimes led to catastrophic outcomes. We recommend that a PSERS review of leverage clearly examine and communicate risks, and ensure that robust board-level guidelines are in place and understood by all stakeholders.

- We commend SERS for maintaining a more rigorous fund-level benchmark, and note the finding that SERS performance weakness appears to have been more of "execution" rather than "strategy." We recommend SERS continue to use such a rigorous benchmark, and focus its efforts on continuing to improve execution.

- We recommend that PSERS reconsider and revise its fund-level benchmark, found to be the lowest among a peer group over every period. We note the finding that PSERS performance weakness appears to have been both of "strategy" and "execution," and recommend PSERS comprehensively reexamine both.

- We recommend that the investment management of the systems be redirected towards simplicity. Because complexity increases costs and risks without any assurance of higher returns, because the Consultant report shows that lower-cost simpler portfolios in fact would have performed "significantly better on a risk-adjusted basis than the current complex strategies," and because findings in the Consultant report suggest the funds do not currently have the expertise and oversight in place to properly oversee their current complex (particularly in the case of PSERS) portfolios, we recommend the funds take a new and simpler approach.

Cost-savings Options

- We note the findings that there is a fundamental "mismatch" between oversight capacities for such complex portfolios as PSERS has adopted, particularly internal management, derivatives, and illiquid investments, and that such capacities appear "stretched" at SERS, particularly in the large number of allocations to private equity and real estate. We therefore recommend that new commitments of capital to these strategies, at either fund, are limited until these issues are addressed.

- We note the findings that sufficient accountability, risk monitoring, and management structures are not currently in place, and we recommend that certain "innovation" cost-savings options, such as further internal management, co-investments, seeding new managers and/or forming exclusive relationships with new firms, should NOT be pursued at this time.

- We note that the cost-savings recommendations in the Consultant report below are limited in that they were only able to analyze public mandates, and the recommendations are made in the context of presuming no change to current allocations or strategies. Thus, the following recommendations should be understood as options that may be superseded by recommendations found elsewhere in this report.

Cost-savings Analysis

- We note the Consultant report's finding that in practice at both SERS and PSERS, "active mandates that cost more do not necessarily represent better value for money" and indeed, at one asset class at PSERS, the cheapest mandates were the best performing.

- We recommend that PSERS comprehensively review and revise its benchmarks for asset classes, sub-asset classes and managers, particularly all benchmarks used for performance-based compensation, noting the report's finding that PSERS benchmarks across the board are not "sufficiently granular."

- We note the report's finding that in the PSERS high yield allocation, managers have been paid 93% of the "alpha over the 10-year period ending June 30, 2018 (100% in the 10-year period ending June 30, 2017)", and we recommend that performance pay arrangements at both funds be rigorously reviewed, appropriately benchmarked, and entered into only after modeling total costs to the fund of different options. We recommend that all fees, whether base or performance, be considered and tracked, and do not recommend pursuing fee "savings" that are simply shifting costs from base fees to performance fees.

- We recommend that both funds adopt the following best practices to minimize fees:

    - track the age of all fee schedules, and reviewing at least every two years

    - track the age of all manager relationships, and considering longevity of relationship in recurring fee reviews and negotiations

    - require all asset managers to confirm in writing that they do not receive commissions, rebates and the like in connection with fund investments

    - require all asset managers to confirm in writing that they have not paid fees, commissions and the like in connection with obtaining investments into their funds

    - establish a fee budget, at the fund level, for all investment managers, subject to waiver by the board

    - prohibit the use of bundled brokerage by brokers and managers.

- We commend SERS for conducting regular transaction cost analysis, and recommend that PSERS do the same.

- We recommend that both funds establish a better process for considering specific alternatives to each proposed investment under consideration, which the Consultant report findings suggest need improvement. Any proposed investment should be evaluated not in a vacuum, but against a specific low-fee equivalent-risk alternative, as a way of strengthening a commitment to cost discipline and better evaluation of expected and realized performance.

- We recommend that both funds evaluate procurement guidelines for asset management services.

- We recommend that both funds adopt the practices detailed in the Consultant report to negotiate harder on private markets investments, particularly when the Systems together would constitute one of the top investors in terms of asset size, including but not limited to: seeking to pay fees based only on invested rather than committed capital; seeking fee reductions during the investment phase; capping monitoring, oversight, and legal fees; negotiating carry terms more carefully and modeling different scenarios; seeking full transparency on waterfall terms, and whether other waterfall terms have been offered to other investors; recalculating GP-determined carry payments; having a process to ensure that all terms contained in marketing materials or arrived at in negotiations are legally documented and monitored; and monitoring and auditing all fees and costs charged by general partners in limited partnership structures.

- We recommend that both funds retain the services of an outside expert who, with proper access to full information, could assist them in developing and implementing further cost-savings.

    - We recommend that SERS, with the assistance of an outside expert, immediately renegotiate public security mandates identified in the Consultant report that are mispriced to achieve at least $4.87 million in savings on an annual basis, or $584 million compounded over 30 years, while noting that this recommendation is not meant to preclude action on other savings recommendations elsewhere in this report that may supersede it.

- o We recommend that deploying these and other approaches, SERS, with the assistance of an outside expert, renegotiate all new (or renewed) private equity investment agreements to achieve at least $12.18 million in savings on an annual basis, or $926 million compounded over 30 years.

- o We recommend that PSERS, with the assistance of an outside expert, immediately renegotiate the public security mandates identified in the Consultant report that are mispriced to achieve at least $4.91 million in savings on an annual basis, or $560 million compounded over 30 years, while noting that this recommendation is not meant to preclude action on other savings recommendations elsewhere in this report that may supersede it.

- o We recommend that deploying these and other approaches, PSERS, with the assistance of an outside expert, renegotiate all new (or renewed) private equity investment agreements to achieve at least $15.48 million in savings on annual basis, or $1.17 billion compounded over 30 years.

- o We recommend that PSERS, with the assistance of an outside expert, immediately restructure its high yield allocation as suggested in the Consultant report, to achieve savings of at least $42.5 million on an annual basis, or $3.23 billion compounded over 30 years, while noting that this recommendation is not meant to preclude action on other savings recommendations elsewhere in this report that may supersede it.

- We recommend that, in the absence of the legislatively-created consolidated Central Pension Investment Office, the systems establish structures to share manager selection, monitoring, and risk control work between the two Systems.

Consolidation of Pension Investment Operations

It is recommended that the General Assembly enact legislation to establish a consolidated central pension investment office ("Office") to manage and execute all investment mandates on behalf of and as directed by each of the Commonwealth's retirement systems. While maintaining the existing governance structure for both retirement systems, the Office would avoid duplication of investment operations, enhance internal execution capacities, and leverage their combined fund size. The Office would have the following responsibilities:

- The Office would be responsible for the management, implementation, and execution of all investment mandates on behalf of both Systems pursuant to each retirement board's adoption of asset allocation plans;

- The Office should be composed of high caliber investment professionals;

- The Office would be subject to a fiduciary standard requiring it to act in the sole and best interest of each client System and shall maintain vigorous reporting and disclosure standards consistent with those recommended in the Commission's report; and

- The Office, in consultation with the respective System, should be the sole contracting authority to retain external investment management and consulting services on behalf of the Systems.

Procurement

- We recommend that both PSERS and SERS consider the benefits and limitations of adopting open competitive-bidding processes for investment managers.

- We recommend that SERS adopt an open competitive-bidding process for all investment consultants. (PSERS already has this in place.)

- We recommend that both PSERS and SERS publish policy documents that address the following:
    - o Circumstances (if any), for which asset classes, and for which categories of investment professionals are RFIs and RFPs issued?
    - o Publish all RFIs and RFPs. Publish the names of all respondents.
    - o Publish the contents of the responses.
    - o Identify the criteria and justification for exercising the single source / sole source exemption.
- We commend PSERS for urging investment management firms to comply with the CFA Manager Code and recommend that SERS do the same. We recommend SERS and PSERS include a firm's compliance with the CFA Manager Code as part of the evaluation and due diligence process.

Diversity

We recommend that the Pennsylvania General Assembly follow the lead of other states by enacting legislation to encourage diversity and inclusion efforts to increase the use of minority- and woman-owned asset management managers and firms. These initiatives include but are not limited to:

- Encouraging the Commonwealth's public pension systems and other investment boards to use minority investment managers in managing their assets, encompassing all asset classes, and to increase the racial, ethnic, and gender diversity of their fiduciaries, to the greatest extent feasible within the bounds of financial and fiduciary prudence, and to take affirmative steps to remove any barriers to the full participation in investment opportunities.
- Requiring the public pension systems and other investment boards to report annually on the ethnicity and gender of the members of their own staffs and boards as well as money managers they hire.[4]
- Requiring the public pension systems and other investment boards to obtain diversity information on each current and prospective manager and produce a minority inclusion report annually.
- Creating a Commonwealth online database of minority- and woman-owned asset managers.
- Adopting minimum goals for the utilization of minority- and woman-owned asset management firms.

[4] *(For reference, the Chicago Teachers' Pension Fund Response to the 2017 Senate Committee on Public Pensions and State Investments Minority and Female Investment Hearing Questionnaire can be found at https://www.ctpf.org/sites/main/files/file-attachments/2017_senate_questionnaire_report_final_vk3_0.pdf.)*

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

STRESS TESTING

I. Stress Testing

The Importance of Stress Testing

Stress testing is a tool for understanding risk. A stress test evaluates how a pension fund's assets and liabilities – and any associated changes to funding needs – are expected to respond to a specific set of events. As an example, a stress test might consider the impact on a pension funds' assets and liabilities of experiencing a 3-year period where the total return of the portfolio is 3% per annum below the current actuarial assumed rate of return. In contrast to other commonly used and reported risk measures, such as volatility, which measure average expected deviations from current return expectations, stress tests are more intuitive and useful for many decision makers.[x] In general, stress tests measure the financial impact of moderate to severe adverse experience relative to key actuarial assumptions. Stress tests enable decision makers to identify a variety of specific and understandable scenarios in order to evaluate directly whether or not the probability and severity of certain adverse events are tolerable, to inform decision making, and to take appropriate steps to mitigate risk.

Stress testing is a crucial planning tool to help ensure fund solvency in good times and bad. All stakeholders—state lawmakers, taxpayers, plan beneficiaries, employers, and employees—can use stress test results to understand the risks being assumed by a pension fund and how they may impact the need for future funding to maintain a healthy plan. Pension fund board members and staff can use the results of stress tests to understand the financial risks facing the systems they oversee and to ensure that assets will be adequate to cover liabilities over both the short term and the long term.

For state lawmakers and officials who are tasked with writing the annual state budget, stress tests are particularly useful in giving insight into the circumstances that could impact the actuarially required contribution or the funding ratio. Stress tests also give insight into the potential implications of policy decisions. As actuary Joe Newton of GRS Consulting testified to the Commission, stress testing is a critical tool to show lawmakers the importance of maintaining discipline in contributing ARC even during favorable economic periods. He spoke of his

HISTORY OF STRESS TESTING

The concept of mandated stress testing of financial institutions is a relatively new concept that did not gain widespread industry acceptance in the United States until after the 2008-2009 recession. As part of the federal Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, regulatory provisions were enacted to protect the stability of the U.S. financial system. A central component was the requirement that large banks and bank holding companies undergo periodic "stress tests" to assist regulators and banks to better understand the impact of economic "shocks" to the banking system.[xi] Acknowledging that regulators and bank directors cannot predict or control every economic risk, mandated stress testing is intended to evaluate the strength of a bank's financial position and balance sheet in order to reduce financial stress during challenging economic conditions.

Conceptually, financial stress testing is intended to (1) verify and identify specific structural risks within the financial institution; (2) provide greater understanding and insight into the management and operation of the institution; and, (3) maintain and improve risk management practices as a constant, even during periods of high profitability[xii] Each of these objectives is applicable to public pension funds.

The Commission heard from Prof. Chester Spatt, a former member of the Federal Reserve Board's Model Validation Council, which was charged with evaluating and providing expert advice on banking stress testing models. Prof. Spatt testified that similar to banks, public pension funds are expected to maintain payment commitments during all types of economic conditions, including periods of economic stress. Also like banks, pension fund regulators and managers are unable to predict or identify every risk or its impact on investment fund portfolios, their liquidity and valuation. Citing the experience in the banking industry following the recent recession, Prof. Spatt advocated, as a best practice adopted in other state jurisdictions, the mandatory stress testing of each pension fund's investment portfolio and ability to fulfill annuitant payment commitments.

work in Hawaii, where several years of strong returns meant that decision makers could have reduced the state's contribution in the short term, but forward-looking projections of risks and funding levels ensured that they took the long view:

> ***In Hawaii, we worked and worked and worked for years to get a solution put in place. And the solution is going to work and it's going to take time, but it's going [to] work. But the first two years after the solution was put in place, they had really good market returns. So all of a sudden, it looked like maybe they didn't have to go so far, maybe... the contribution rate didn't have to go quite so high. And so you get all the talk, "well, let's pull back on that." No, no, no. Stress tests can help you say "no." You have a 28-year problem, stop worrying about it, and let's move forward. Don't try to gobble at little cookies. Get your hand out of the cookie jar, and let's go forward, right?***[xiii]

Similarly, stress testing can give insight into the implication of other policy decisions, such as changes in benefits. As David Draine, a Senior Officer at Pew Charitable Trusts, testified before the Commission:

> ***Stress testing analysis can also avoid policy changes that add risk or unexpected cost in otherwise healthy pension systems. Pennsylvania has experience with this. In 2000, the state's pension plans were reporting a surplus, but subsequent decisions to provide the largest unfunded benefit increase in any state and to artificially lower contributions until 2010 contributed to a massive swing from surplus to funding gap. If policymakers and the public had more complete information about the cost of these changes and the risk of future downturns that would erase some of the investment gains from the late 90s, perhaps those decisions could have been avoided, leaving Pennsylvania in a much stronger position today.***[xiv]

The pension funds' boards, working through staff and consultants, are responsible for the asset allocation and risk controls of the investment portfolio. They need to understand what types of risks are tolerable and make tradeoffs between expected risk and expected return. To do this well, they need to understand how different potential investment portfolio structures will perform under certain economic and market stresses. For example, a higher allocation to illiquid investments exposes a pension fund to greater risk of not having cash on hand to make benefit payments. This risk could be particularly undesirable if that event – not having cash on hand to make benefit payments – is more likely to happen at the same time that tax revenues decline significantly, because of the budgetary strain placed on the state to make a higher ARC at a time when resources are scarce. Stress tests should be used by investment professionals to study the impact of specific investment assumptions – what may happen to the portfolio, for example, in a global decline of public markets, or a period of stagnant growth accompanied by significant inflation, or if private equity does not outperform public equity over the next 10 years, or if private markets' distribution rates decline significantly and contribution rates increase significantly relative to the assumptions. In these ways, stress tests can be used to determine better portfolio structures, including reasonable limits on the levels of illiquidity, leverage and volatility.

Stress testing is a critical tool to help all stakeholders – plan sponsors, investment staffs, boards, taxpayers, and beneficiaries – understand what can go wrong or right and how those events will change the funded status or the current ability to fund benefit payments from assets. It enables more informed planning and decision making. The Society of Actuaries Blue Ribbon Panel on Public Pension Plan Funding ("the Panel") says regular stress testing is "a means to analyze potential management strategies, with the objective of helping users assess how well the trust stands up to 'stress,' i.e., a period of market returns significantly above or below a baseline assumed return."[xv]

What a Pension Fund Stress Test Should Measure

Pension fund stress tests measure the impact of specific events or sets of events (inputs) which can affect the aggregate measures of the pension fund's health (outputs) typically by affecting the value of the pension fund's assets, liabilities, and liquidity.[xvi]

Inputs: The variables or inputs that can impact the aggregate measures of a pension fund's health are numerous. The value and liquidity of the assets of a pension fund are impacted, for example, by the total fund performance,[5] the volatility of investment returns, the level of illiquid investments and contingent liabilities (such as unfunded commitments or derivative contracts that have legal claims on the assets of the fund), and the level and consistency of contributions (including the amortization rate). On the liability side, inputs typically include actuarial assumptions including mortality/longevity expectations and future employment and wage levels, as well as inflation rates.

Outputs: Stress tests typically produce outputs that represent aggregate measures of the health of a fund, including the liquidity of the fund (*i.e.*, is there enough liquidity to pay current expenses while rebalancing to continue the assumed investment strategy), the funding ratio, the probability of achieving full funding within a certain number of years, pension costs (including projected employer contributions), and the present value of the promised benefits and the costs of operating and investing the fund. As will be discussed below, the Blue Ribbon Panel lists the following as important outputs:

- Expected contributions (in dollars)
- Expected contributions as a percentage of payroll
- Funded ratios
- Ratio of benefit payments to payroll
- Ratio of funding liability to payroll
- Ratio of the market value of assets to payroll

Deterministic v. Stochastic Simulations: Typically stress tests measure the impact of a specific set of events. They are conducted using a deterministic simulation of how a portfolio performs under those

WHAT DOES STRESS TESTING TELL YOU?

It is commonly accepted that an investment portfolio for a young person starting out in a financially lucrative career can be less liquid and higher risk than that of an 80-year-old individual that must live off of his or her life savings. The difference between those two portfolios is intuitive: the younger person can tolerate a more severe decline in their investment portfolio because they can fund their living expenses from income in such a circumstance, whereas the older person cannot. This analysis is effectively a kind of mental stress test which highlights and responds to risks that other measures, such as volatility and Sharpe ratios, hide. In the world of pension funds, there are more variables that must be considered, and intuition alone is often insufficient. Formal stress testing provides needed discipline and information. It is an important risk analysis tool for determining appropriate asset allocations given the specific pension fund's circumstances.

"REVERSE" STRESS TESTING

Another way to go about stress testing is to start with the negative outcome and work backwards to determine what inputs are needed to avoid it. Because most stakeholders can agree on what qualifies as a negative outcome, this type of "reverse stress testing" can be even more effective than starting with inputs and identifying probabilities of projected outcomes. Newton described the process in his testimony:

> *Define a bad outcome […] we're currently putting in 30 percent of pay, we don't want to put in 34 percent of pay. Great, there's your line. What scenarios create 34 percent of pay? […] decision-makers, I find, can relate to that quicker. Because they can say, 'Okay, how likely is that outcome? What can we do to manage that outcome? But we can all agree that's a bad outcome.' 'We're currently 60 percent funded; we don't want to be below 50 percent.' Okay, well, then draw that line. What scenarios push you below 50 percent?*[xvii]

(5) *There are numerous expected return and correlation assumptions that aggregate to a particular portfolio structure's expected investment return and volatility. Stress tests can be used to measure the impact of deviations from expectations of any of these assumptions.*

precise circumstances in which the probability of the event is not part of the analysis. In a world of uncertainty, it is also possible to test how aggregate measures are impacted by changes in the probabilities assigned to future events. This is done through stochastic simulations where the distributions of future returns and risks are different than they are in the baseline. The Blue Ribbon Panel acknowledges that stochastic study can be a powerful decision making tool, and in fact is "more sophisticated" than deterministic stress testing,[xviii] but that deterministic stress tests are more useful for communicating among diverse stakeholder audiences.

An important characteristic of a robust stress test is that it accounts for multiple specific scenarios of events. In his testimony before the Commission in July, Kenneth Kent, an actuary who has conducted past analyses for the Commonwealth, explained why having multiple projections to compare to a baseline is important: "Without projections, you have no idea if your funding policy works. Baseline projections are never right. Uncertainty increases over time. [...] forward-looking potential outcomes are important decision-making factors."[xix]

Blue Ribbon Panel Recommendations & Other Best Practices

The Society of Actuaries chartered the Blue Ribbon Panel on Public Pension Plan Funding in April 2013 with a call to:

- *Develop recommendations for plan trustees, legislators and plan advisors on how to improve plan financial management and strengthen plan funding going forward*
- *Assess the principal factors influencing the changing funding status of plans.*[xx]

The Panel, which included actuaries, economists, former pension plan trustees, and government finance experts, were guided by the principle that "plans should keep the pension promises made to participants." The Panel's primary objective was to "develop recommendations that will enhance stakeholders' understanding of the financial position and risk profile of the trust, support decisions to make plans financially stronger, and improve the ability of funding entities to respond to adverse conditions."[xxi]

As a result of this mission, the Society of Actuaries' Blue Ribbon Panel on Public Pension Plan Funding released recommendations in 2014 regarding improvements in disclosure and risk- measurement practices—including stress testing—with the intention of ensuring that stakeholders have the information necessary to make informed decisions on public pension funding."[xxii]

According to Robert Stein, former chair of the Panel, failure of investments to meet the target rate of return and failure of a state to make ARC are the two greatest risks to a pension system.[xxiii] The Panel's formal recommendation on stress testing is that public pension stress tests evaluate three different scenarios:

1. The effect of the state paying only 80 percent of ARC.
2. The effect of investment returns being three percentage points above the baseline.[6]
3. The effect of investment returns being three percentage points under the baseline.

For each of these scenarios, the Panel recommended conducting the stress test for a total projection of 30 years: 20 years in which the "stress" occurs annually, and an additional ten years to observe any residual effects from the stress.

The Commission heard testimony arguing that extreme scenarios can be no more telling than more moderate or realistic scenarios (e.g., observing 20 years of stress is not a more useful exercise than observing a short period of stress, and that observing three percentage points below the baseline is not a more useful exercise

(6) The baseline is not the plan's assumed rate of return, but a forward-looking analysis based on the U.S. Treasury rate and risk premia as well as other actuary assumptions; the investment return used in the baseline is typically lower than most plans' assumed rate of return. Methodology for developing the baseline is described in Appendix III of the Blue Ribbon Panel report.

than observing one or two percentage points below the baseline). In fact, actuary Joe Newton of GRS argued that an extreme scenario can have the effect of either desensitizing lawmakers to the reality of risks, or overwhelming them in their efforts to make decisions/find reasonable solutions. This commentary was echoed by SERS in a document submitted to the Commission, which stated that "the three tests recommended by the panel are not relevant enough for most governmental plans because they consider excessively long periods of time (20 years)."[xxiv]

Considered to be a more moderate set of best practices than the Blue Ribbon Panel recommendations, the Actuarial Standards Board has issued Actuarial Standard of Practice (ASOP) No. 51, which states that scenario analysis, including stochastic modeling and stress testing, should be used as part of risk assessments; the standard does not offer a specific scenario to test but does recommend stress testing for investment, interest rate, and contribution risk ("where contributions are not made in accordance with funding policy"), as well as a lower discount rate based on bond market yields and U.S. Treasury rates.[xxvi] ASOP No. 51 took effect on November 1, 2018. Additionally, GASB Statement No. 67 requires a sensitivity analysis of pension funding under a scenario showing +/- 1 percent of the discount rate, as well as a 10-year lookback at actual v. actuarially determined contributions, and actual contributions as a percent of payroll, to illustrate the impact of investment and contribution risks.[xxvii] A comparison of the Blue Ribbon Panel recommended risk measures and disclosures with GASB 67 requirements and ASOP No. 51 is excerpted below.

EFFECTIVE USE OF STRESS TESTING – SEAT BELT SAFETY EXAMPLE

The following example was provided by Joe Newton of GRS Consulting to highlight what makes a stress test so useful and where they can go wrong.

A company wants to gauge the effectiveness of its seat belts and airbags. Now, if they go to extremes in their testing, the results are predictable. Run the car into a wall at 200 mph, and the vehicle is smashed to smithereens. Run the car into the wall at 10 mph, and there may not even be a ding in the bumper. Neither test reveals anything important about the effectiveness or potential design flaws of the seat belts and airbags.

In contrast, by testing within reasonably expected conditions, the company determines that existing technology provides a fine line between success and failure. At 53 mph, everyone lives. At 55 mph, everyone dies. So now the company wants to figure out how to raise the crash survival speed to 65 mph. They will run all sorts of design variations until the goal is accomplished.

This serves to explain stress testing. Run it at extreme circumstances, catastrophic or soft, and absolutely nothing is learned, or worse, the results could be used to mislead constituents into a false sense of safety or risk.

In the pension fund world, the safety features are the portfolio structure, the speed of the crash event is the economic crisis scenario being tested, and the outcome is the financial impact on contributions and future returns. The goal of stress testing is to understand how well the portfolio structure will stand up to different size and type economic events and for what size events there will be a real problem. Pension fund boards must then attempt to find portfolio structure designs that enable success under most scenarios without taking undo risk.[xxv]

Figure 5 : Approaches to Measuring Risks for Public Pensions

APPROACHES TO MEASURING RISKS FOR PUBLIC PENSIONS

SOA BLUE RIBBON PANEL'S 2014 RECOMMENDATIONS COMPARED TO CURRENT AND PROPOSED ACCOUNTING REQUIREMENTS AND ACTUARIAL GUIDELINES

BLUE RIBBON PANEL REPORT CATEGORY (Purpose) [a]	BLUE RIBBON PANEL RECOMMENDATION	GOVERNMENTAL ACCOUNTING STANDARDS BOARD (GASB)	ACTUARIAL STANDARDS BOARD (ASB) ACTUARIAL STANDARD OF PRACTICE (ASOP) NO. 51 AND PROPOSED REVISIONS TO ASOP NO. 4 [f]	
			AREA OF RISK	METHOD FOR ASSESSING RISK
RISK MEASURES AND ANALYSES				
Measures of Risk to Financial Position (Understanding Current Risk Levels)	(1) Standard deviation of expected returns on asset portfolio; **(2) Plan Liability and normal cost at risk free rate;** (3) Standardized plan contribution.	**Sensitivity** of the net pension liabilities to changes in the discount rate at +/- 1% vs. single discount rate. [b] Single (blended) discount rate is determined by comparing projections of the plan's fiduciary net position to projected benefit payments. [c]	**Investment risk defeasement measure** (included in exposure draft of proposed changes to ASOP No.4) supplement disclosure of obligation (plan liability) measures to reflect the cost of defeasing investment risk. [g]	Calculating liabilities using discount rates consistent with market yields for a bond portfolio whose cash flows match benefits expected to be paid; based on yield for U.S. Treasuries or fixed-income securities that receive one of the two highest ratings.
Stress Testing (Measuring Investment and Contribution Risk)	Financial projections over 30 years using baseline investment return assumptions as well as returns at +/- 3% investment returns vs. baseline and 80 to 100% of ARC payments.	10-year schedules comparing actual contribution amounts with actuarially determined contribution requirements and rations of actual contributions to payroll allows tracking of the past impact of investment and contribution risk. [d]	**Investment, Interest rate, & Contribution risk** (ASOP No.51); Definition of Contribution Risk cites instances "where contributions are not made in accordance with funding policy."	**Stress testing, scenario, and stochastic analysis**
ENHANCED DISCLOSURE				
Un-Discounted Cash Flows (Providing Data for Independent Assessment of Plan Obligations)	Disclosure of projected benefit payments for current employees to allow for independent assessment of plan obligations.	N/A	N/A	Unit credit method in ASOP No.4 §3.11 (b) uses un-discounted cash flows but does not require thee calculations to be disclosed.
Financial and Demographic Trends	10 years historical data of assets, benefit payments, and liabilities to payroll, as well as recommended contributions to revenue; and actual to recommended contributions.	10-year schedule of changes to net pension liability by source. [e]	**Longevity and Other Demographic Risk** (ASOP No.51 S 3.2); **Plan maturity measures** (ASOP No.51 3.7) five ratios.	(a) Assets/payroll; (b) retired liability to total liability (AAL basis); (c) Cash flow to assets; (d) benefit payments/ contributions; (e) durations of AAL.

Source: Pew Charitable Trusts 2018[7]

By the time of this writing, five states (California, Connecticut, Hawaii, New Jersey, and Virginia) have enacted legislation that requires public pension systems to conduct stress testing.[8] While there is considerable variation among these laws, all require regular stress testing, most of them require stress tests to be posted publicly or reported to the elected officials such as the legislature or governor and require the projections of pension contributions and/or pension costs – which are of interest to state budget writers—under various scenarios. Tables comparing these states and their requirements are presented here.

(7) *For original matrix and associated footnotes, see Appendix I.*

(8) *Colorado law also requires that its pension employees' retirement system undergo a sensitivity analysis, which is similar to a stress test. Washington state law does not specifically require stress testing, but the Office of the State Actuary regularly conducts risk assessments of its public pension systems as part of its biennial "Report on Financial Condition and Economic Experience," which is required by statute. As a result, a total of seven states have some kind of formal risk assessment requirement.*

Figure 6: States with Stress Testing Laws for Public Pensions

STATE	FREQUENCY	ACCESSIBILITY	INPUTS & SCENARIOS	OUTPUTS
California	Annual	Reported to the Legislature, Governor, and Chair of the California Actuarial Advisory Panel; presented in a public hearing within 30 days of report	1. The investment return assumption used to determine contribution rates, +/-2% 2. Amortization period for any unfunded liabilities, based on estimated average remaining service periods of employees covered by the contributions 3. Discount rate utilized by the board for reporting liabilities, -2% below actuarially assumed ROR	1. Calculation of contribution rates. 2. Calculation of contribution rates. 3. Liabilities 4. Market value of the assets and explanation of how the actuarial value assigned to those assets differs from the market value of those assets
Connecticut	Annual	Reported to General Assembly, posted publicly online	Inputs not specified. "Various economic and investment scenarios."	Benefit levels, pension costs, liabilities, debt reduction.
Hawaii	Annual	Conducted by actuary, submitted to Legislature.	At least four scenarios, including baseline assumptions; investment returns -2% below assumed RoR with no adjustment to contributions; a one-year investment loss of 20% followed by a 20-year period of investment returns -2% below plan assumptions, with no adjustment to employer contributions; a discount rate equal to the 10-year average of the yield of thirty-year Treasury notes.	Include assets; liabilities; pension debt; service costs; employee contributions; employer contributions; net amortization; benefit payments; payroll; funded ratio; accrued liability; total plan normal cost for all benefit tiers; employer normal cost for all benefit tiers
New Jersey	Regular	Approved by actuaries of the State-administered retirement systems and posted publicly online	25 years of past performance data 25 years, including gross and net of fee investment returns, and returns by asset class	"Investment performance"
Virginia	Regular	Not specified, but report is available online.	Inputs not specified. "Various economic and investment scenarios."	Benefit levels, pension costs, liabilities, debt reduction.

Source: California: Cal. Gov't. Code § 20229 (Deering, Lexis through 2018 Reg. Sess.); Connecticut: Act of October 31, 2017, Public Act No. 17-2, § 109 (June 2017 Spec. Sess.); Hawaii: Haw. Rev. Stat. § 88-105.5 (Lexis through 2018 Sess.); N.J. Rev. Stat. § 43:3C-26 (Lexis through 218th First Ann. Sess.); Virginia: Va. Code Ann. § 51.1-124.30:1 (Lexis through 2018 Spec. Sess. I).

Figure 7: States with Risk Assessment Laws

STATE	FREQUENCY	ACCESSIBILITY	INPUTS & TEST CONDITIONS	OUTPUTS
Colorado	Annual	Conducted by actuary and reported to Governor, the joint budget committee, the legislative audit committee, and the finance committees of the senate and the house of representatives, or any successor committees. Report to public annually on status of plan to reach full funding	Inputs not specified, although separate statute requires that economic and investment assumptions be independently reviewed every 3 years. Conditions: "sensitivity analysis to determine when, from an actuarial perspective, model assumptions are meeting targets and achieving sustainability."	Not specified.
Washington	Biennial	Not specified.	Not specified.	Not specified.

Source: Colorado: Colo. Rev. Stat. § 24-51.4(a)(III) and § 24-51-614(6) (Lexis through 2018 Legis. Sess.); Washington: Wash. Rev. Code Ann. § 41.45.030 (Lexis through 2018 Reg. Sess.).

Evaluation of PSERS & SERS Stress Test Practices

Both SERS and PSERS responded to the Commission's request for information on their stress testing practices. The Commission considered their practices as reflected by their responses with respect to the Blue Ribbon Panel recommendations and other practices mentioned above. The Systems' stress test reports and information on their practices, which are included in Appendix II, are discussed below and evaluated in three areas: (1) content, primarily whether or not they meet the Blue Ribbon Panel recommended practices; (2) accessibility, *i.e.* the availability of the reports and the frequency with which they are produced; and (3) presentation, *i.e.* the usefulness of the reports to a wide group of stakeholders.

A. SERS Stress Test Evaluation

System Practices v. Blue Ribbon Panel Recommendation

SERS' answers "SERS-001-1.1 SERS Stress Test Analysis," "SERS -001-1.2 SERS Investment Fee Reduction Plan," and "SERS -001-1.3 2018-03 PASERS - The Analytic Foundation for the 2018-2019 SERS Strategy Investment Plan", as well as "SERS-004" – a questionnaire that includes several questions on stress testing -- are included in Appendix II.[xxviii] The Commission evaluated these documents and practices in terms of the specific recommendations of the Blue Ribbon Panel. SERS' current practices do not comport with the Panel recommendations, as presented in the table below:

Figure 8: SERS' Stress Testing Practices

AREA OF CONSIDERATION BLUE RIBBON PANEL GUIDELINE	SERS PRACTICE
Baseline Calculation Report – key aggregate metrics under a set of actuarial assumptions and a benchmark return derived from market yields	An ad hoc stress test, in response to a board inquiry, was completed examining the impact of various 1-year horizon equity events. The asset-liability study, last completed in 2015 and appended to SERS-001-1.3 2018, includes a report of projected plan aggregate statistics in 2034 resulting from: • 20 years of falling short of the actuarial assumed rate of return by 1%[xxvi] • Contributions remain at 25% of salary The asset-liability study also includes a stochastic analysis using the current assumption about expected returns and variance-covariance. This does not test for average returns being lower than expected and it is impossible to interpret the percentile results in terms of realized returns. The study does show some very limited analysis of an overall increase in correlations and overall increase in volatility.
20 Years of a Specific Stress Event, 30 Years of Projections	
• Stress Event 1: Earning 3% less than the benchmark return for 20 years	
• Stress Event 2: Earning 3% more than the benchmark return for 20 years	
• Stress Event 3: Receiving contributions at 80% of recommendation	
Accessibility: Frequency & Availability	Asset-liability studies appear to be completed only once every several years. Stress testing should be part of a rigorous risk analysis and not completed ad-hoc at the request of a Board member. Stress tests are not readily available to public.
Presentation & Usefulness	Analysis of issues is lacking: for example, on page 9 of Stress Test Analysis, the Fund would experience a negative liquidity position with a 10th percentile equity event, but no further analysis or discussion of policy implications is provided.

Source: PSERS

Specifically, SERS' practices vary from the Panel's stress test recommendations in the following ways:

- The asset-liability study looks at 20-year projections as compared to the 30-year projections suggested by the Blue Ribbon Panel.
- The stress test analysis (SERS-001-1.1) focuses primarily on short-term equity stress. The Panel suggests that both financial and contribution stress be studied, as well as other risks such as longevity. Changes in interest rate levels, credit spreads, and equity levels can all be considered together and are particularly important because non-traditional assets, which comprise a significant portion of SERS' investments, may be more sensitive to some of those variables. The 2008 financial crisis is a good example of conditions that should be modeled.
- Neither document captures the key recommendation of the Panel, projecting a baseline return that is distinct from the actuarially assumed rate of return. The BRP recommends modelling funding statistics related to realizing that baseline return, realizing 3 percent per annum more than that return for 20 years and realizing 3 percent per annum less than that return for 20 years, looking over a 30-year horizon. It also recommends calculating the sensitivity to funding at only 80 percent of the recommended funding levels. It does not appear that SERS makes or reports either of these calculations.

<u>Accessibility of Stress Test Reports: Frequency & Availability</u>

The Commission also considered whether stress tests are conducted regularly and how widely they are made available.

- ***Frequency:*** While the Blue Ribbon Panel is silent on the frequency with which stress tests are conducted, best practices, the practices of other states, and common sense imply that these tests should be conducted on a regular basis. A form of stress tests—again, not in accordance with Panel recommendations—are included in documents that are produced no more frequently than every other year: Stress testing is included as a part of the investment strategy plan produced "at least every other year" and as a part of asset-liability studies, which are conducted "generally every three or four years" (SERS-004 question #1). On an ad hoc basis and "at the request of the Board" (SERS-004 question #1), SERS will conduct "customized" stress tests such as the one shown in SERS-001-1.1. Of the states that have recently enacted stress testing or other risk assessment requirements, four states (CA, CO, CT, and HI) require annual testing; two states (NJ and VA) require "regular" stress testing and one (WA) undergoes biennial testing.
- ***Availability:*** SERS' stress test reports are presented to trustees and are not available online. The Blue Ribbon Panel endorsed the practice of publishing stress tests: "The Panel believes that recommended risk measures, analyses and other risk management information should be shared with others responsible for funding decisions: elected and civil service officials as well as other parties of interest, including taxpayers/service recipients, plan members and union officials, other stakeholders, and the media."[xxx] All but one of the seven states with stress test or similar risk assessment laws require that results be reported to the public or to an elected official (such as a governor, auditor, or legislature).

<u>Presentation & Usefulness</u>

The Commission considered whether or not SERS' stress test reports would be useful for the wide audience of stakeholders interested in the health of the pension fund. SERS current practices, while professionally prepared, are opaque, highly technical, and lack independence.

- The stress test analysis (SERS-001-1.1) was prepared by SERS' general investment consultant rather than an independent party or actuary. The Panel recommends that an actuary is in a unique position to conduct the independent analysis necessary for a robust stress test.
- The stress test analysis is insufficiently detailed: for example, on page 9 it shows the Fund would experience a negative liquidity position with a 10th percentile equity event, but has no further analysis or discussion of policy implications.
- The stress tests that appear in the asset-liability study and the asset allocation study are highly technical and would be difficult for a lay reader to understand without context or explanation. In

addition, they appear intended more to help the Board to compare and contrast asset allocations, rather than for a policy-maker audience trying to garner insight into specific risks facing the systems.

- State legislators and the public are particularly interested in pension funds from the perspective of the cost of contributions. The Panel recommends that stress testing include baseline financial measures that would be of interest to legislators and the public, including expected contributions (in dollars), expected contributions as a percentage of payroll, funded ratios, and the ratio of benefit payments to payroll. Five of the seven states with recent stress test or similar risk assessment laws included requirements that analyses measure the impact of various scenarios on projected pension costs or contributions. SERS' stress tests do not measure the contribution risk (risk of deviating from the recommended contribution level), nor do they regularly measure the impact of stress scenarios on the contribution by the employer or the state.

B. Evaluation of PSERS Stress Test Practices

System Practices v. Blue Ribbon Panel Recommendation

- PSERS submitted three documents to the Commission, including a 2017 asset-liability study (PPMAIRC PSERS-001 #1), a 2017 asset-liability follow-up report (PPMAIRC PSERS-004 #8B Aon2), and a 2018 asset-liability study (PSERS-Asset-Liability Study Results (20180723) FINAL), as well as a questionnaire (PPMAIRC PSERS-004 Responses).[xxxi] Results of the Commission's consideration are presented below.

Figure 9: PSERS Stress Testing Practices

AREA OF CONSIDERATION BLUE RIBBON PANEL GUIDELINE	PSERS PRACTICE
Baseline Calculation Report – key aggregate metrics under a set of actuarial assumptions and a benchmark return derived from market yields	PSERS provided copies of the 2017 and 2018 asset-liability studies conducted by AON. The analysis covers 30 years of projections. Page 92 of the 2018 study includes stress tests similar to that recommended by the Blue Ribbon Panel stress tests. There are two deficiencies: PSERS use their actuarially assumed rate of return for the baseline rather than the calculation that BRP recommends. PSERS reports on some but not all of the aggregate measures recommended. There is also a stochastic analysis of the current assumptions. There is a section in the 2018 analysis on deterministic scenarios labeled base, blue skies, recession and black skies. The return assumptions are described on page 86 and 88 and address only short term stress of less than 5 years.
20 Years of a Specific Stress Event, 30 Years of Projections	
• Stress Event 1: Earning 3% less than the benchmark return for 20 years	
• Stress Event 2: Earning 3% more than the benchmark return for 20 years	
• Stress Event 3: Receiving contributions at 80% of recommendation	
Accessibility: Frequency and Availability	Annual; published on website.
Presentation and Usefulness	There is important information in these reports, but it is difficult to locate, digest, and interpret buried within 100+ pages.

Source: PSERS

The Commission notes:

- PSERS' latest asset-liability report does stress tests consistent with the Blue Ribbon Panel recommendations, although it is noted that PSERS uses their normal actuarial assumptions including their normal actuarially expected rate of return rather than the baseline calculations recommended by the BRP. The outputs of the stress test also do not include all of the aggregate measures recommended.
- The results of this work are important and should be featured more prominently than in the appendix of a 100+ page document.

Accessibility of Stress Test Reports: Frequency & Availability

- *Frequency*: PSERS stress tests are included in their asset-liability study, conducted annually by their general investment consultant.
- *Availability*: PSERS informed the Commission that these documents are available on the PSERS website.

Presentation & Usefulness

In terms of presentation, a shorter, more concise deliverable would be more useful to constituents and policy makers. The presentation should include brief objective commentary on specific stressors and specific risks to monitor and/or results that stand out as positive or negative. These analyses are designed to highlight areas where investment allocation or policy changes need to be considered and clarity is critical. As Robert Stein observed:

> ***There is a lot of good work in these reports and very much complex modeling. But even as a knowledgeable reader, I find the core issues, recommendations and basis therefore, and implications to the overall condition of the plans, i.e., considering both contribution and funded ratio outlook, difficult to extract and focus on. Good and clear communication should not take 100 pages.***[xxxii]

The Commission considered the Blue Ribbon Panel's example stress test reports, and included these in Appendix I.

Additionally, as with SERS, the fact that the stress tests are conducted by PSERS' investment consultant presents an opportunity for bias. In general, investment consultants may have reasons for favoring one allocation or strategy over another. Actuaries' focus is on risk measurement, whereas the focus of investment professionals is to develop an asset allocation that best meets the trustees' risk appetite. Investment professionals have greater capital market understanding and expertise than actuaries. An actuary can and should incorporate information provided by investment professionals about risks associated with variability of investment returns (along with other risk factors as mentioned above).

Testifiers at the July 2018 Commission hearing noted that all pension funds already work with outside actuaries, and therefore have the necessary tools in place to conduct stress tests.[xxxiii] Stein stated not only that the Blue Ribbon Panel views stress testing as an "essential tool when considering plan changes," but that it is "Really the best way, maybe the only good way, to get objective evidence of the affordability and sustainability of proposed plan changes, and that an analysis should be done, of course, before those plan changes are adopted."[xxxiv]

It is especially important for mature public pension such as Pennsylvania's to regularly conduct rigorous stress tests. Because retirees outnumber active employee, mature plans have a negative cash flow. According to Pew,

> ***For states like Pennsylvania with low funded levels that may already be at budget capacity for funding pensions, it may be difficult for their retirement systems to achieve fully funded status and the attendant reduction in costs within a 30-year time horizon if returns fall short of current targets. As a result, the state's continued attention to managing unfunded liabilities, including a current study to lower investment fees and to adopt regular stress test reporting, is essential."***[xxxv]

Recommendations

- We recommend that the General Assembly enact legislation requiring an annual stress test of each system, broadly aligning with the Blue Ribbon Panel (Panel) recommendations and including at least a 2-percentage point variation in a baseline benchmark return, as well as a quantifiable contribution risk such as the 80 percent measure recommended by the Panel. Although the Panel recommends a 3-percentage point variation, a 2 percent variation would be consistent with practices in states that have enacted similar legislation. In addition, assumptions used in baseline analysis calculations made by the Systems should be reported, as these may include actuarial assumptions differing from those recommended by the Panel.

- We recommend that the Systems' stress tests report the impact of the stress on other financial measures—including expected contributions in dollars, expected contributions as a percentage of payroll, funded ratios, ratio of benefit payments to payroll, ratio of funding liability to payroll, and the ratio of the market value of assets to payroll—and cover a period of at least 30 years, in accordance with the Panel recommendations.

- We recommend that stochastic models be used in addition to—not in place of—deterministic modelling. We commend PSERS for its recent stress testing report and encourage them to continue to do stress testing consistent with the Blue Ribbon Panel recommendations.

- We recommend that the Systems make their stress test reports publicly available. Reports should be provided to stakeholders and policy makers, including plan beneficiaries, the Governor, the Legislature, Board of Trustees, staff, the Auditor General, and the general public.

- We recommend that the Systems' stress test charts be simple to understand, with the policy question or decision that the chart addresses featured prominently and clearly at the top of each chart.

- We recommend that the Systems' stress tests be conducted by an experienced actuary, not an investment consultant. Although investment consultants can provide useful input, only actuaries have the tools and techniques to conduct stress tests of a pension fund.

- We recommend that the Systems conduct and publish "reverse" stress tests showing the market events and funding scenarios that would cause certain undesirable outcomes, including but not limited to the funds' investment portfolios to become more illiquid than a Board-determined threshold limit (expressed as a multiple of annual distributions).

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

TRANSPARENCY

II. Transparency

Why Transparency Matters

Transparency refers to the way in which information – data, analyses, or processes – is disclosed. Full transparency means that pertinent information is complete, accurate, easily understandable and accessible. Transparency is critical to improved investing outcomes, because it gives decision makers and stakeholders the information that they need, in a format that they can use, to make prudent decisions and evaluate performance.

Complete information means that all pertinent information is included. Accuracy means that information is correct, that calculations are made with processes that can be monitored and verified, and that any assumptions used in calculations are identified and explained. Critical to transparency is that the information is easily understandable: an unnecessary overloading of data lacks as much transparency as omitting relevant facts. Of course, if decision makers and interested parties cannot access the information easily and in a timely fashion, then transparency is thwarted rather than advanced.

A call for transparency has become common in many public policy debates. Often lost, however, is an identification of the underlying objective associated with the demands for greater openness and transparency. In other words, why is transparency important? In the realm of public pension funds, transparency leads to better management of the pension assets, better budgeting for and planning of contributions, and better oversight of both. Transparency serves to keep public pension systems accountable to their beneficiaries, their overseers, and their public.

There are two ways in which full transparency enables better management and oversight of public pension funds. First, full transparency facilitates good decision making. It is impossible to make the best decisions – or to evaluate decisions made – without knowing all of the material facts. Second, full transparency is critical for establishing and maintaining trust among all stakeholders: beneficiaries, boards, staff, employees, employers, taxpayers, legislators and other elected officials. When information is incomplete or selectively reported, it raises questions for all involved. What is missing and why? In all transactions, but especially those involving public dollars, trust is fundamental. That trust can be easily eroded, with devastating consequences.

What Transparency Means for Public Pension Fund Management

In discussing transparency for public pension fund management, we need to go beyond the concepts of complete, accurate, understandable and accessible to define *what* information is shared *with whom, in what format and when.*

What: Stakeholders are entitled to a transparent disclosure of investment risks and exposures, investment performance, fees and costs, and the decision-making processes governing them:

Investment Risks and Exposures: Stakeholders should clearly understand the risks being taken with public pension fund assets. In today's financial markets, the following risk information is the minimum required for prudent investment management.

- Allocations and Systematic Investment Risk – Exposures/allocations – reported both in dollar value and as a percentage of total assets, as well as aggregate risk metrics[9] – to broad asset classes, geographies, investment styles, sectors and industries. These allocations detail not only current net asset values, but also exposures from unfunded commitments, the leverage used both directly and indirectly to achieve the exposure, and the liquidity profile within each allocation. Gross long and gross short positions must also be disclosed.[10]

(9) Aggregate risk metrics would be measures such as net US Equity beta, duration, spread duration, inflation expectations sensitivity and currency exposures. Calculations and assumptions used to estimate those measures should be clearly disclosed and defined. Sophisticated investors measure and monitor these risk exposures looking through to the holdings of underlying investments of any investment fund.
(10) A position that is 1000 times long Facebook and 1000 times short Amazon may have zero equity beta, but it is far from a riskless position.

- Diversification Risk – disclosures on diversification including the maximum exposure to any one investment manager, one company or investment vehicle, the exposure to internal active investment management, internal index management, and the exposures to any one industry or sector.

- Liquidity Risk – In addition to reporting current liquidity estimates with the allocations, a separate analysis of liquidity is required when leverage and/or illiquid investments are employed. This involves clear calculations of the liquidity of the portfolio under different scenarios – including tests of assumptions related to the pacing of private markets capital commitments and distributions, broad market events and their impact on the value of the portfolio and on contingent liabilities,[11] and funding policy, and the interactions between them – to ensure sufficient liquidity to pay benefits and maintain an appropriately balanced portfolio. Liquidity needs are best understood in the context of cash flow statements and forecasts and stress tests of them.

- Leverage Risk – Related to liquidity is the need to understand leverage and any contingent liabilities. From Lehman Brothers' bankruptcy, the Orange County bankruptcy, to the failure of Long Term Capital Management, most past significant financial crises have been related in some way to a lack of understanding of and preparation for the risks associated with leverage and liquidity. Leverage can be direct borrowing, but it is also embedded in unfunded capital commitments, exposure to swaps, futures, options and other derivative contracts. Details of these exposures is critical to prudent management. (See footnote 4.)

Investment Performance: Stakeholders need to be able to examine pension fund investment performance and feel confident that the board and staff do, too. The purpose, as will be discussed in greater detail in a later section of this report, is to evaluate critically: How have investment decisions fared? Should any processes or assumptions that have been driving those decisions be re-evaluated? Disclosure should include an evaluation of the performance of the systematic risk exposures (often referred to as asset allocation), of portfolio allocations to particular market segments, of individual managers, of the manager selection process, and of internal asset management decisions. This performance information should include risk measures and adjustments including benchmark returns, net-of-fee returns, and gross-fee returns, the latter being particularly important for measuring and evaluating risk. Top performers are unafraid of having their records evaluated critically by others, or of having their assumptions challenged in order to improve their own thinking.

Fees/Costs: Without a comprehensive reporting of investment costs and expenses, it is simply impossible to accurately measure and evaluate performance, either internally or externally. As Dr. Ashby Monk testified, "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 pension. . . the information was thus not reported. Not measured. Not tracked. And not managed."

- Both gross-fee and net of fee returns matter for proper evaluation of performance. Some pension funds, including PSERS, have defended the non-reporting and/or monitoring of certain fees and investment costs by claiming that it is only net-of-fee returns that matter.[xxxvi] In fact, net of fee returns often mask the quality of the investment decisions by distorting and hiding the real risks of the underlying investment. The Governmental Accounting Standards Board in its Statements 25 and 67, which provide guidelines for which pension performance is reported, has stressed the value in stakeholders having information on both gross and net performance.[xxxvii] It is worth noting that SERS' consultant, RVK, provides reporting on both a gross and net basis for the Commonwealth's Deferred Compensation program.

- Investors must understand all fees and costs charged by a manager in order to form an intelligent judgment as to the manager's ability to consistently outperform a low fee alternative with similar risk characteristics. Active management by definition involves taking risk with the goal of generating

(11) *Contingent liabilities exist in many forms. An important example is that from a swap contract where the investor agrees to receive/pay the positive/negative returns from a broad market index (over the implied financing rate). When the index declines, the investor is obligated to make a payment from other assets of the investor and must have the liquidity to do so.*

investment return outperformance. As the fee paid to the active manager increases, the higher the (gross of fees) excess returns over the alternative must be in order to deliver the same net of fee performance.

- Alignment of interests or lack thereof between manager and investor cannot be understood without full transparency of fees and costs. When an investment manager earns fees from additional activities related to the management of the assets, it is possible, even likely, that there will be conflicts of interest. For example, an investment manager earning monitoring or consulting fees related to its investment in a particular company may be incentivized to hold the company longer. Base asset management fees can incentivize asset gathering and performance-based fees share upside returns but not downside risk. Without transparency of all fees and costs, neither the pension fund staff nor board members have the ability to monitor or manage these conflicts.

Processes and Decisions: A critical component of evaluating performance is monitoring the quality of past decision making and processes, and using the information to refine assumptions, procedures, and implementation where necessary. Knowing exactly what the decision-making processes are, what risk controls are in place, and what compliance systems are used to ensure smooth operations should be part of that evaluation – particularly when public assets and liabilities are at stake.

- Board decisions: Public pension decisions and the process that leads to them should be transparent. Board meetings are public for a reason. The public has a right to observe the debate of an engaged board that adds value through probing questions and not simply accepting whatever is presented to them. The materials presented at board meetings, the data to make the decisions, should be accessible in unredacted format. The board is also responsible for ensuring sufficient risk controls in the form of investment policies and compliance procedures and these should be publicly available.

- Portfolio Implementation: In addition to setting risk limits and setting current risk exposure targets, a pension fund board oversees portfolio implementation. As such, the processes for manager (including internal management) evaluation, selection, and monitoring should be written and publicly available. Procedures for disclosing any conflicts of interests should be clear and verifiable, and any additional diligence consistently done to eliminate conflicts of interest should be disclosed.

- Risk Measuring, Monitoring and Controlling: Performance evaluation, risk monitoring, portfolio rebalancing, and compliance are critical functions of a well-managed investment portfolio. Decisions and processes related to these functions need to be fully disclosed.

With whom: All stakeholders have a right to know that public money is being managed prudently. Unlike private pension funds, endowments or foundations whose constituents are limited, public pensions are unique investment entities with a wide group of stakeholders, including not only the current and past employees, but all taxpayers in the state and their representatives in the General Assembly. Benefits are a legal obligation that must be fulfilled even if at the expense of other state spending. Poor investment results risk higher taxes, lower state services, and/or changes to retirement benefits or employee contributions. It is imperative, therefore, that all stakeholders feel confident that best practices are used and resources are effectively deployed. Full transparency with all stakeholders is critical to ensuring that trust.

It is also critical for a pension system to be transparent with itself. Board members and investment staff must know what the system does well, what it does not do well, and how to act accordingly. Transparency fosters a culture of honesty, a pursuit of continuous improvement, and an openness to – not defensiveness against – challenging thinking.

In what format and when: Information needs to be easily accessible in a timely manner in a format that is easy to use. Decisions based on out-of-date information will not be as good as decisions with the most current information. The decision points that the data impact should be noted. Since best practices are continually evolving, the systems should regularly review and revise what is being shared and in what format and where. As an example, there is currently tremendous effort across the country to develop real time dashboards for the use of many institutional investors.

Concerns about Transparency

Some concerns have been raised about providing full transparency, some with more evidence than others. But a closer examination suggests that these objections do not justify avoiding transparency, especially when weighed against its benefits.

- Access to managers. Some have claimed that providing transparency on manager fee terms and performance will lead to managers refusing to permit funds from investing with them. The idea is that managers are loathe to reveal their "trade secrets" – for example, proprietary pricing models. But fee structures of *managers* are not trade secrets of the *underlying businesses*. Secrecy around the former only serves the interests of the assets managers at the expense of public investors. Requiring transparency on the names of managers, their fee structures, and their performance is not comparable to asking for the formula to make Coca Cola. While there may be instances where managers have refused to take an investment, there are also many instances where the lack of transparency hid issues, ultimately at great cost to investors, as in the memorable case of the Madoff scandal. Moreover, one should ask if public funds should, in any case, invest with managers who insist on hiding their performance and fees. Finally, the experience of funds that have moved toward full transparency suggests that the reduction in available managers is quite limited: Rhode Island, which posts fee terms, fees paid, and performance per manager on its website, has found that doing so has not meaningfully affected either access to managers or performance.[xxxviii] CalPERS has reported it has only missed out on three "opportunities" due to the California transparency requirements. [xxxix] So while there may be a slight tradeoff, the evidence suggests it is a manageable and worthwhile one.

- No one else does it. There is some sentiment that until all public pension funds are transparent, none should be. This misunderstands the nature of leadership: changes in practice by individual funds is in fact how changes in practice by funds overall will occur. Moreover, the evidence shows that many peer institutions are being transparent. A review of over 60 pension plans and investment boards/councils shows the following:

    - <u>**Decisions**</u>: 39% post full board packets, many including investment manager presentations with proposed fees, and 30% provide live stream, video, audio, and/or full transcripts of board meetings.

    - <u>**Performance**</u>: 44% publish quarterly performance reports that show each manager's performance against its benchmark, many on both a gross and net basis.

    - <u>**Fees/Costs**</u>: While not a majority, a significant and growing number of leading funds are reporting carried interest/performance fees for private equity, including CalPERS, South Carolina, Missouri, Arizona, Texas County, Rhode Island, etc. See discussion of ILPA below.

- Transparency is expensive. The cost of transparency has been either directly or indirectly mentioned as a rationale to maintain the status quo, in that there may be additional staff that may need to be hired and technology platforms that may need to be purchased in order to provide stakeholders with increased access to information. Rhode Island reports that its transparency efforts required minimal staff time and only $30 per month in additional website costs.[xl] An even starker example is the $3 billion Santa Barbara County Employees' Retirement System. The System has essentially "flipped the switch" on the permission settings for its online board meeting management platform ("BoardDocs," also used by SERS for its Board meetings) from "private" to "public."[xli] What this means is that the stakeholders can see an overwhelming majority of the documents that are provided to the board, without the need to develop and administer separate websites. While there are certainly more user-friendly options, this is a striking example to illustrate that increased transparency can often be provided without significant cost.

Transparency Practices at SERS, PSERS, and Best Practice Funds

This section provides an overview of key transparency practices of SERS and PSERS compared to other pension funds and investment boards known for best practices. Both funds publish per-manager asset management fees, PSERS was an early leader in posting versions of investment memoranda publicly, and PSERS established a committee in October 2018 with the stated objective of "making PSERS a national public pension fund leader in fee and performance disclosure and transparency."[xlii] PSERS, however, can improve in several key areas of transparency. SERS, when measured against many of the best practices discussed below, remains arguably among the least transparent of funds.

Decisions:

Although board meetings are open to the public, SERS and PSERS do not stream Board meetings, nor do they publish any detailed materials presented at the meeting. The only information provided to the public is summary level agenda, typically only a page or two. Minutes are posted afterwards, often four to six months later because minutes are not finalized/approved until the subsequent board meeting. These minutes are also typically summary level consisting of only a few pages. To its credit, PSERS has posted Board resolutions that include staff recommendation memorandums for managers approved at board meetings since 2006. However, resolutions are only for those managers that have been approved by the Board, are heavily redacted, and do not include the original presentations, *i.e.*, "pitch materials" that the manager presented to the system. By contrast, many peer pension funds and investment boards in recent years have begun live streaming and/or posting video of board proceedings online, along with the complete or near-complete packets of materials provided to board members. These packets include detailed performance reports and "pitch materials" by managers presenting before the board, many of which include the proposed fee terms on which the board will be voting to invest member funds.

Funds such as the Nebraska Investment Council (which manages $27 billion of public funds) publishes board agendas in PDF form that include embedded links to documents presented or discussed during board meetings, including comprehensive performance reports and manager presentations that contain proposed fee terms.[xliii] The Florida State Board of Administration, while it does not include proposed fee terms in board packets, does include a complete written transcript of the previous board meeting in its board packet. The Investment Advisory Council for the Florida State Board of Administration publishes a video file that contains audio of the Council's meetings matched up with any presentations made during the meeting – essentially providing an archived webinar of the meeting for interested parties. [xliv]

Investment Performance: SERS[xlv] and PSERS [xlvi] have traditionally provided fund performance by asset class on an annual basis in the CAFR and quarterly online.

Figure 10: SERS periodic reporting of performance

Recent Performance

Each quarter, the SERS board is provided with an update about the fund's returns, based on asset class. Such information is preliminary, unaudited and subject to change. We do, however, share the information in post-board-meeting press release and provide the most recent four updates here, for your information. To confirm actual annual performance, please see our comprehensive annual financial report.

2017 QUARTER FOUR	Total Fund	5.2%
	Cash	0.3%
	Fixed Income	0.5%
	Global Public Equity	5.2%
	Multi-Strategy	3.7%
	Private Equity	3.3%
	Real Estate	0.0%

Source: SERS

Figure 11: PSERS periodic reporting of performance

PSERS' PERFORMANCE (Net of Fees)
AS OF JUNE 30, 2018

ASSET CLASS	QUARTER	FISCAL YEAR TO DATE *	1 YEAR	3 YEARS (Annualized)	5 YEARS (Annualized)	10 YEARS (Annualized)
Equities						
U.S. Equities	4.32%	14.02%	14.02%	12.19%	13.51%	10.21%
Non-U.S. Equities	0.82	10.44	10.44	7.55	9.91	6.10
Private Equity / Venture Capital / Private Debt	1.97	16.26	16.26	11.21	10.03	7.48
Fixed Income	1.43	6.42	6.42	6.07	5.97	7.21
Master Limited Partnership	13.94	0.27	0.27	(5.31)	0.73	N/A
Infrastructure	11.37	1.39	1.39	N/A	N/A	N/A
Commodities	(2.01)	5.36	5.36	0.11	(2.10)	(5.76)
Real Estate	3.70	13.63	13.63	10.26	12.20	2.50
Risk Parity	1.20	6.76	6.76	4.60	6.02	N/A
Absolute Return	0.37	4.85	4.85	3.34	4.20	5.01
TOTAL	2.08%	9.27%	9.27%	6.84%	7.62%	5.03%

*-- PSERS' Fiscal Year ends on June 30.

Source: PSERS

A growing number of funds, in efforts to be more transparent, publish the comprehensive general consultant reports on a quarterly basis, in some cases even monthly. These reports provide performance for each manager of the pension fund compared to its assigned benchmark, in many cases on both gross- and net-of-fees bases. The publishing of consultant reports provides additional accountability to ensure that managers are not consistently underperforming their benchmarks without repercussion. For example, the Montana Board of Investments publishes the performance report that it receives from its consultant, RVK (also the general consultant for SERS), that includes per manager performance on both a gross and net basis.

Figure 12: Excerpt from Performance Report for the Montana State Board of Investments

MONTANA BOARD OF INVESTMENTS COMPARATIVE PERFORMANCE DOMESTIC EQUITY MANAGERS

AS OF MARCH 31, 2018

DOMESTIC LARGE CAP EQUITY	QTD/ CYTD	FYTD	1 YEAR	3 YEARS	5 YEARS	7 YEARS	10 YEARS	2017	2016	2015	2014	2013	SINCE INCEP.	INCEP. DATE
BlackRock MSCI US Equity Index (CF)-Net	-0.63	10.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.61	07/01/2017
MSCI US Index (USO) (Gross)	-0.63	10.60	14.03	10.55	13.23	12.65	9.52	21.90	11.61	1.32	13.36	32.61	10.60	
Difference	0.00	0.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.01	
BlackRock MSCI US Equity Index (CF)-Gross	-0.63	10.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.61	07/01/2017
SPOR S&P 500 ETF (SPY) - Net	-2.82	8.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.31	07/01/2017
S&P 500 Index (Cap Wld)	-0.76	10.58	13.99	10. 78	13.31	12.71	9.49	21.83	11.96	1.38	13.69	32.39	10.58	
Difference	-2.06	-2.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-2.27	
Domestic Equity Pool STIF - Net	0.35	0.95	1.19	0.65	N/A	N/A	N/A	1.00	0.50	N/A	N/A	N/A	0.65	04/01/2015
ICE 1 Mo LIBOR Index (USD)	0.42	1.09	1.36	0.75	0.52	0.44	0.55	1.15	0.52	0.21	0.16	0.19	0.75	
Difference	-0.07	-0.14	-0.17	-0.10	N/A	N/A	N/A	-0.15	-0.02	N/A	N/A	N/A	-0.10	
T. Rowe U.S. Structured Research (SA) - Net	-0.15	11.28	15.87	11.74	13.96	13.16	10.06	23.94	10.68	3.30	12.58	33.23	9.22	06/01/2006
S&P 500 Index (Cap Wtd)	-0.76	10.58	13.99	10.78	13.31	12.71	9.49	21.83	11.96	1.38	13.69	32.39	8.66	
Difference	0.61	0.70	1.88	0.96	0.65	0.45	0.57	2.11	-1.28	1.92	-1.11	0.84	0.56	
T. Rowe U.S. Structured Research (SA) - Gross	-0.08	11.50	16.16	12.04	14.28	13.49	10.39	24.24	10.98	3.61	12.92	33.63	9.55	06/01/2006
IM U.S. Large Cap Core Equity (SA+CF) Median	-0.44	10.79	14.02	10.23	13.32	12.73	9.75	21.82	10.50	1.39	13.43	32.98	9.00	
Rank	34	43	30	15	25	25	25	22	45	23	59	45	26	
Jacobs Levy Partial L/S (SA) - Net	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	04/01/2018
MSCI US Index (USD)	-0.63	10.60	14.03	10.55	13.23	12.65	9.52	21.90	11.61	1.32	13.36	32.61	N/A	
Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Jacobs Levy Partial L/S (SA) - Gross	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	04/01/2018
IM U.S. Large Cap Core Equity (SA+CF) Median	-0.44	10.79	14.02	10.23	13.32	12.73	9.75	21.82	10.50	1.39	13.43	32.98	N/A	
Rank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Jacobs Levy Partial L/S (SA) - Net	-1.72	10.34	12.54	9.40	13.73	12.80	10.59	22.86	10.30	0.01	15.38	37.55	10.46	03/01/2008
MSCI US Index (USO)	-0.76	10.58	13.99	10.78	13.31	12.71	9.49	21.83	11.96	1.38	13.69	32.39	9.37	
Difference	-0.96	-0.24	-1.45	-1.38	0.42	0.09	1.10	1.03	-1.66	-1.37	1.69	5.16	1.09	
Jacobs Levy Partial US (SA) - Gross	-1.51	11.01	13.43	10.20	14.55	13.62	11.39	23.79	11.09	0.72	16.21	38.53	11.26	03/01/2008
IM U.S. Large Cap Core Equity (SA+CF) Median	-0.44	10.79	14.02	10.23	13.32	12.73	9.75	21.82	10.50	1.39	13.43	32.98	9.57	
Rank	79	47	60	51	20	22	8	26	44	58	15	11	9	

Net performance shown is net of all manager fees and expenses (Net-All). Gross returns are compared to median performance of similar managers. A peer group of similar managers may not exist for all funds. Fiscal year ends on 6/30. Since inception performance may vary from State Street reported performance due to calculation methodology differences.

Source: Montana State Board of Investments

To reiterate, the periodic reporting of performance by each individual manager – compared to their benchmark and on both a gross and net basis – provides accountability for all parties responsible for a pension fund's investments: from the manager, to the pension fund staff and management, to the trustees who hired the manager, and finally to the taxpayers who are ultimately responsible for financial consequences made by these parties. Comprehensive, yet well-designed and easy-to-understand reporting helps create a culture of "crowdsourcing" the investment manager monitoring program. This means that many eyes are potentially looking for any irregularities, such as consistent underperformance that is being permitted on a long-term basis.

Some funds have taken the best practice of reporting performance per manager and improved it even more by posting investment manager "report cards" or manager "watch lists." These reports provide a concise listing of managers with simple indicators to show whether or not they are performing as should be expected. An excerpt from one of these reports publicly made available by the Los Angeles City Retirement System is below.

Figure 13: Excerpt of Manager Report Card from LA City Employees' Retirement System

MANAGER REPORT CARD

NON-U.S. EQUITY MANAGERS	INCEPTION DATE	MANDATE	CURRENT QUARTER (Net)		1 YEARS (Net)		3 YEARS (Net)		5 YEARS (Net)		SINCE INCEPTION (Net)	ANNUAL MGT FEE PAID $ (000)	2016
			Index	Universe	Index	Universe	Index	Universe	Index	Universe	Index		
Axiom International	Mar - 14	Emerging Markets	✗	✓	✗	✓	✗	✗	N/A	N/A	✗	1,866.9	Performance compliant with LACERS' Manager Monitoring Policy
Q.M.A.	Apr - 14	Emerging Markets	✗	✗	✓	✓	✗	✗	N/A	N/A	✓	1,219.4	Performance compliant with LACERS' Manager Monitoring Policy
DFA Emerging Markets	Jul - 14	Emerging Markets	✓	✓	✓	✗	✓	✗	N/A	N/A	✓	1,188.2	Performance compliant with LACERS' Manager Monitoring Policy
AQR	Feb - 14	Non-U.S. Developed	✗	✗	✓	✗	✓	✓	N/A	N/A	✓	2,314.2	Performance compliant with LACERS' Manager Monitoring Policy
Oberweis Asset Mgt.	Jan - 14	Non-U.S. Developed	✓	✓	✓	✓	✓	✓	N/A	N/A	✓	568.5	Performance compliant with LACERS' Manager Monitoring Policy
Barrow, Hanley, Mewhinney & Strauss	Nov - 13	Non-U.S. Developed	✗	✗	✓	✗	✗	✓	N/A	N/A	✓	2,097.9	Performance compliant with LACERS' Manager Monitoring Policy
Lazard Asset Mgt.	Nov - 13	Non-U.S. Developed	✓	✓	✓	✓	✗	✗	N/A	N/A	✓	2,467.4	Performance compliant with LACERS' Manager Monitoring Policy
MFS Institutional Advisors	Oct - 13	Non-U.S. Developed	✓	✓	✓	✓	✓	✓	N/A	N/A	✓	2,313.6	Performance compliant with LACERS' Manager Monitoring Policy
SsgA (Passive)	Aug - 93	Non-U.S. Developed	✓	✓	✓	✗	✓	✗	✓	✗	✓✓	368.9	Performance compliant with LACERS' Manager Monitoring Policy

Note: Managers are placed on Watch List for concerns with organization, process and performance. Managers are normally on the Watch List for 12 months though may be longer if managers issues remain but not severe enough to warrant termination recommendation.

- Annual Management Fee Paid as fiscal year ending June 30, 2017.
- Where net of fees performance is not available gross of fee returns are evaluated.

LEGEND	
✓	Outperformed
✗	Underperformed
=	Equal to
✓✓	Gross Return

Source: Los Angeles City Employees' Retirement System

Alternative Investment Portfolio Performance: The quality of public reporting for alternative investments by SERS and PSERS lags a number of peers, in particular at SERS. PSERS, to its credit, publishes quarterly fund-level performance information on its private market and real estate investments.

SERS points to the lack of a provision in the State Employees' Retirement Code that, by contrast, is contained in the Public School Employees' Retirement Code, mandating transparency on alternative investments as a defense of its policy of only disclosing incredibly limited data on its private equity and real estate investments (see sidebar).[xlvii] The image below shows performance information on private equity investments that was provided by SERS to the Commission. This information is similar to what is made publicly available online and in the Comprehensive Annual Financial Report; however, the information is barely legible, with information necessary to evaluate individual fund performance redacted.

Figure 14: Excerpt from SERS Private Equity Performance Report provided to the Commission

Commonwealth of Pennsylvania State Employees' Retirement System

Schedule of Private Equity Investments by Sector

As of June 30, 2017

Investment	Vintage	Commitments	Contributions [1]	Distributions	Market Value	Unrealized Gain/(Loss)	IRR [1]	TVM	Upper Quartile [1]	Upper Quartile [1]	Quartile Ranking (TVM)
Buyout					[redacted]						
ABRY Broadcast Partners III	1997	25,000,000	20,394,093	28,932,345							
ABRY Partners IV	2000	35,000,000	22,500,122	74,633,973							
ABRY Partners V	2004	45,000,000	36,658,306	81,985,960							
ABRY Partners VI	2008	50,000,000	54,962,201	105,219,960							
ABRY Partners VII	2011	30,000,000	34,226,469	39,158,084							
ABRY Partners VIII	2015	25,000,000	21,020,610	3,599,240							
ABS Capital Partners III	1999	35,000,000	27,764,683	18,757,336							
ABS Capital Partners IV	2000	35,000,000	28,789,304	68,253,149							
ABS Capital Partners V	2005	20,000,000	19,404,254	48,986,604							
ABS Capital Partners VI	2009	40,000,000	35,589,138	17,444,057							
Advent International GPE VI-A	2008	35,000,000	34,034,207	52,362,090							
Advent International GPE VII-B	2012	40,000,000	34,073,050	15,159,752							
Advent International GPE VIII-B	2016	50,000,000	10,770,205	-							
Advent Latin American Private Equity Fund IV	2007	30,000,000	29,810,236	32,090,921							
Advent Latin American Private Equity Fund V	2010	15,000,000	13,058,177	2,670,000							
Advent Latin American Private Equity Fund VI	2015	25,000,000	4,521,463	375,000							
Alpha Private Equity Fund 4	2002	26,508,000	35,605,050	77,986,040							
Alpha Private Equity Fund 5	2006	57,796,800	62,184,152	82,402,625							
APAX Capital Risque III (France)	1990	5,000,000	5,103,877	11,622,362							
APAX Europe IV	1999	32,424,000	29,909,800	40,876,051							
APAX Europe V	2000	53,262,000	68,764,274	150,037,403							
Apax Europe VI	2004	76,349,190	74,145,979	134,550,076							
Apax Europe VII	2007	132,170,285	131,963,257	145,865,152							
Apax Excelsior VI	2000	35,000,000	33,957,540	56,527,379							
Apollo Investment Fund IV	1997	75,000,000	72,079,063	124,814,033							
Apollo Investment Fund V	2000	50,000,000	42,484,039	122,268,807							
Apollo Investment Fund VI	2005	40,000,000	38,289,202	52,606,408							
Apollo Investment Fund IX	2017	85,400,000	-	-							
Asia Alternatives Capital Partners	2006	50,000,000	23,406,269	34,732,699							
Asia Alternatives Capital Partners II	2007	50,000,000	26,583,918	20,136,025							
Asia Alternatives Capital Partners III	2012	50,000,000	45,804,166	16,768,065							
Asia Alternatives Korea Buyout Investors (Hahn & Co)	2011	7,000,000	8,017,051	4,096,324							
Asia Pacific Growth Fund III	1999	15,000,000	14,627,000	16,708,736							
Audax Private Equity Fund	2000	35,000,000	33,157,787	55,936,816							
Audax Private Equity Fund II	2005	25,000,000	25,506,073	45,110,929							
Audax Private Equity Fund III	2007	37,000,000	39,579,527	73,271,872							
Audax Private Equity Fund V	2015	50,000,000	10,928,119	280,051							
Bain Capital Asia Fund	2007	12,000,000	11,020,944	15,143,534							
Bain Capital Europe III	2008	72,432,276	62,972,190	112,389,602							
Bain Capital Fund IX	2006	75,000,000	72,937,500	107,913,972							
Bain Capital Fund VII	2000	25,000,000	23,562,500	47,998,008							
Bain Capital Fund VIII-E	2004	12,144,000	12,299,670	19,631,405							
Bain Capital Fund X	2007	90,000,000	86,374,239	100,560,312							
Bain Capital IX Coinvestment Fund	2006	15,000,000	14,456,250	21,969,013							
Bain Capital X Coinvestment Fund	2007	5,000,000	1,225,000	1,061,774							
Baring India Private Equity Fund III Limited	2008	5,000,000	4,829,380	8,515,232							
Baring Vostok Private Equity Fund IV	2007	30,000,000	27,455,543	14,782,680							

Source: SERS, StepStone

Conversely, the Los Angeles County Employees Retirement Association (LACERA) is a good example of a fund that provides comprehensive and transparent reporting with various metrics to analyze performance. Various data points are provided for the sophisticated reader, and color codes are provided for those who may not be familiar with how to interpret the various metrics. SERS holds at least 90 of the private equity funds also held by LACERA that would be included in this report – approximately 20-25% of the funds in its entire portfolio shared by this one peer pension fund alone.

It is possible to pay for subscriptions to databases that provide more complete information about SERS' investments than SERS provides to the Pennsylvania public, legislators, beneficiaries, and even the Board. Industry research platforms aggregate data obtained from more transparent funds, from funds through Right-to-Know requests, and even from the investment managers who voluntarily provide the information themselves. The information from these platforms can be used to essentially create a shadow investment performance profile for SERS. While this information may not always match SERS holdings and performance exactly due to potentially different fee terms and slight intricacies in the timing of reporting performance, staff working in support of the Commission was able to find data on over **90% of the funds held by SERS, 85% with detailed performance information**. An example of the detailed information on funds held by SERS that is available to paid subscribers is shown on page 78.

SERS' RIGHT-TO-KNOW LAW LOOPHOLE

Pennsylvania law permits both retirement systems to shield most investment records from the public. The Public School Employees' and the State Employees' Retirement Codes contain identical provisions that authorize both retirement systems to exclude "sensitive investment or financial information" from any Right-to-Know request. If either Board determines that a record could harm that investment, the record would be exempt from disclosure.[xlviii] The statutory grant of broad discretion to both retirement systems to avoid public disclosure of most investment cost and performance information is extraordinarily broad and unusual among most state jurisdictions.

However, there is an important exception favoring public disclosure. Applicable only to PSERS, the Public School Employees' Retirement Code provides that "[n]otwithstanding" any of the exclusions from public disclosure, information related to alternative investment vehicles, including valuation, performance, fees and costs, are public records and therefore "subject to public access under the Right-to-Know Law."[xlix] This provision does not apply to SERS. Consequently, SERS, and only SERS, is statutorily exempt from publically disclosing most information related to alternative investments, an investment class that constitutes over 30% of SERS' entire investment portfolio.

Even outside of the context of a Right-to-Know request, SERS has interpreted the phrase "sensitive investment or financial information" to be a grant of confidentiality to most information involving alternative investment fees, expenses, cost structures, performance history, even the identity of sub-asset class managers. This Right-to-Know exemptions has frustrated inquiries into its private equity and alternative investments by this Commission as well as SERS Board members and other stakeholders. SERS has sought to exclude this information from publication, citing a threat to investment deal opportunities, despite the fact that the same information is widely available by subscription from financial database providers.

There is no evidence that the publication of investment records, including alternative investment information, relating to performance, value and expenses hampers or otherwise undermines investment opportunities or performance. PSERS has operated for years without its alternative investment records being exempt from public disclosure. In fact, a significant number of state jurisdictions explicitly and statutorily provide broad public access to investment records of their public pension systems, including, by way of example, California, Texas, Arkansas, Nevada, Idaho, Alabama, New York, Iowa, Kansas, Michigan and Kentucky.[l] Pennsylvania's law is unique.

Figure 15: Excerpt from a LACERA Private Equity Performance Report

Portfolio Investment Report

As of December 31, 2017
($ in millions)

INVESTMENTS	COMMITMENT DATE	VINTAGE YEAR	STATUS	STRATEGY	COMMITMENT	CUMULATIVE CONTRIBUTIONS	CUMULATIVE DISTRIBUTIONS	MARKET VALUE	Exposure	TOTAL VALUE	DPI MULTIPLE	TVPI MULTIPLE	SINCE INCEPTION NET IRR	IRR QUARTILE RANKING	Private IQ Benchmarks: UPPER IRR	Private IQ Benchmarks: MEDIAN IRR	Private IQ Benchmarks: LOWER IRR	KS-PME
1986 Vintage																		
Warburg Pincus Capital Company, L.P.	1/1986	1986	Exited	Buyout - Global	$50.0	$50.0	$218.4	$-	$-	$218.4	4.37x	4.37x	18.41%	2nd	19.1%	12.4%	5.0%	1.24
Copley Partners 1, L.P.	12/1986	1986	Exited	Venture Capital - Balanced	15.0	15.0	27.3	-	-	27.3	1.82x	1.82x	9.53%	3rd	13.6%	10.3%	6.0%	0.84
Copley Partners 2, L.P.	12/1986	1986	Exited	Venture Capital - Balanced	15.0	15.0	21.8	-	-	21.8	1.45x	1.45x	5.66%	4th	13.6%	10.3%	6.0%	0.66
1986 Vintage Total					80.0	80.0	267.5	-	-	267.5	3.34x	3.34x	15.72%					1.02
1987 Vintage																		
Media Communications Partners, L.P.	1/1986	1987	Exited	Venture Capital - Balanced	25.0	25.0	40.3	-	-	40.3	1.61x	1.61x	7.25%	3rd	19.5%	13.4%	3.1%	0.72
1987 Vintage Total					25.0	25.0	40.3	-	-	40.3	1.61x	1.61x	7.25%					0.72
1988 Vintage																		
Prudential Venture Partners II	1/1987	1988	Exited	Venture Capital - Late Stage	50.0	50.0	116.4	-	-	116.4	2.33x	2.33x	23.45%	2nd	24.5%	10.5%	4.1%	1.38
GKH Investments, L.P.	1/1988	1988	Exited	Buyout - Small	150.0	166.6	350.5	-	-	350.5	2.10x	2.10x	13.13%	2nd	15.1%	10.7%	10.1%	1.01
1988 Vintage Total					200.0	216.6	466.9	-	-	466.9	2.16x	2.16x	15.54%					1.09
1990 Vintage																		
Syndicated Communications II, L.P.	1/1990	1990	Exited	Venture Capital - Balanced	7.5	7.5	16.7	-	-	16.7	2.22x	2.22x	12.98%	3rd	33.1%	20.2%	9.4%	0.74
1990 Vintage Total					7.5	7.5	16.7	-	-	16.7	2.22x	2.22x	12.98%					0.74
1992 Vintage																		
Oak Investment Partners V, L.P.	11/1991	1992	Exited	Venture Capital - Balanced	11.3	11.3	17.1	-	-	17.1	1.52x	1.52x	10.55%	3rd	32.6%	13.4%	8.2%	0.76
Kidd Kamm Equity Partners, L.P.	12/1991	1992	Exited	Buyout - Small	15.0	14.9	.6	-	-	.6	0.04x	0.04x	-49.85%	4th	51.6%	21.4%	12.6%	0.02
Sevin Rosen Fund IV, L.P.	1/1992	1992	Exited	Venture Capital - Early Stage	5.0	5.0	51.2	-	-	51.2	10.18x	10.18x	87.17%	1st	32.6%	13.4%	8.2%	4.90
Symantec Corp.	1/1992	1992	Exited	Co-Investments	5.6	5.6	2.2	-	-	2.2	0.40x	0.40x	-28.51%	4th	51.6%	21.4%	12.6%	0.32
Summit Ventures III, L.P.	1/1992	1992	Exited	Venture Capital - Balanced	25.0	20.0	78.8	-	-	78.8	3.94x	3.94x	61.71%	1st	32.6%	13.4%	8.2%	2.13
Kleiner Perkins Caufield & Byers VI, L.P.	5/1992	1992	Exited	Venture Capital - Balanced	5.0	5.0	16.6	-	-	16.6	3.31x	3.31x	39.44%	1st	32.6%	13.4%	8.2%	1.73
Churchill Capital Partners II, L.P.	7/1992	1992	Exited	Mezzanine	25.0	25.0	34.3	-	-	34.3	1.37x	1.37x	10.11%	4th	41.3%	20.0%	14.2%	0.84
Whitman Heffernan & Rhein Fund II, L.P.	7/1992	1992	Exited	Buyout - Small	14.2	14.2	8.3	-	-	8.3	0.59x	0.59x	-23.34%	4th	51.6%	21.4%	12.6%	0.40
ASC Network Corporation	12/1992	1992	Exited	Co-Investments	5.0	5.0	8.5	-	-	8.5	1.70x	1.70x	14.24%	3rd	51.6%	21.4%	12.6%	0.92
First Data Corporation	12/1992	1992	Exited	Co-Investments	5.0	5.0	24.9	-	-	24.9	4.98x	4.98x	91.84%	1st	51.6%	21.4%	12.6%	3.80
1992 Vintage Total					116.0	111.0	242.5	-	-	242.5	2.19x	2.19x	29.03%					1.50
1993 Vintage																		
Berkshire Fund III, L.P.	10/1992	1993	Exited	Buyout - Large	5.0	4.8	18.5	-	-	18.5	3.82x	3.82x	55.07%	1st	19.1%	17.4%	13.9%	2.01
Landmark Equity Partners III, L.P.	1/1993	1993	Exited	Secondaries	10.0	10.3	26.8	-	-	26.8	2.60x	2.60x	35.08%	2nd	48.2%	21.6%	14.0%	1.46
The 1818 Fund II, L.P.	1/1993	1993	Exited	Buyout - Small	15.0	12.9	24.0	-	-	24.0	1.86x	1.86x	12.15%	4th	19.1%	17.4%	13.9%	0.90
Vestar Equity Partners, L.P.	1/1993	1993	Exited	Buyout - Mid	8.0	6.8	23.9	-	-	23.9	3.51x	3.51x	56.48%	1st	19.1%	17.4%	13.9%	2.00
Welsh, Carson, Anderson & Stowe VI, L.P.	1/1993	1993	Exited	Buyout - Large	10.0	10.0	20.7	-	-	20.7	2.07x	2.07x	13.94%	3rd	19.1%	17.4%	13.9%	0.92
Accel IV, L.P.	5/1993	1993	Exited	Venture Capital - Late Stage	5.0	5.0	40.4	-	-	40.4	8.07x	8.07x	78.00%	1st	71.7%	38.1%	16.8%	3.77
Phillips-Smith Specialty Retail Group III, L.P.	6/1993	1993	Exited	Venture Capital - Balanced	5.0	5.0	10.9	-	-	10.9	2.19x	2.19x	23.26%	3rd	71.7%	38.1%	16.8%	1.17
Enterprise Partners III, L.P.	12/1993	1993	Exited	Venture Capital - Early Stage	10.0	10.0	74.2	-	-	74.2	7.42x	7.42x	63.67%	2nd	71.7%	38.1%	16.8%	3.44
1993 Vintage Total					68.0	64.8	239.5	-	-	239.5	3.70x	3.70x	39.68%					1.65
1994 Vintage																		
Blackstone Capital Partners II, L.P.	1/1993	1994	Exited	Buyout - Global	25.0	26.3	59.0	-	-	59.0	2.24x	2.24x	37.56%	1st	29.1%	15.4%	6.7%	1.47
Kleiner Perkins Caufield & Byers VII, L.P.	5/1994	1994	Exited	Venture Capital - Balanced	3.8	3.8	121.6	-	-	121.6	32.42x	32.42x	124.57%	1st	72.1%	36.1%	9.8%	13.61
Oak Investment Partners VI, L.P.	10/1994	1994	Exited	Venture Capital - Balanced	14.0	14.0	40.7	-	-	40.7	2.91x	2.91x	34.57%	3rd	72.1%	36.1%	9.8%	1.52
Landmark Equity Partners IV, L.P.	12/1994	1994	Exited	Secondaries	10.5	11.0	16.2	-	-	16.2	1.47x	1.47x	15.81%	3rd	37.4%	21.7%	6.9%	1.00
Best Friends Pet Care	12/1994	1994	Exited	Co-Investments	3.7	3.7	.1	-	-	.1	0.02x	0.02x	0.00%	4th	29.1%	15.4%	6.7%	0.01
1994 Vintage Total					56.9	58.8	237.6	-	-	237.6	4.04x	4.04x	54.09%					2.37
1995 Vintage																		
Summit Ventures IV, L.P.	1/1995	1995	Exited	Growth Equity	24.8	24.0	181.7	-	-	181.7	7.57x	7.57x	103.98%	1st	84.8%	28.9%	14.1%	4.39
Welsh, Carson, Anderson & Stowe VII, L.P.	1/1995	1995	Exited	Buyout - Large	20.0	20.0	43.5	-	-	43.5	2.18x	2.18x	17.71%	2nd	23.9%	10.8%	3.1%	1.39
Apollo Investment Fund III, L.P.	3/1995	1995	Exited	Buyout - Large	15.0	17.2	24.7	-	-	24.7	1.43x	1.43x	9.62%	3rd	23.9%	10.8%	3.1%	0.98
GS Capital Partners II, L.P.	4/1995	1995	Exited	Buyout - Mid	20.0	19.7	24.3	-	-	24.3	1.23x	1.23x	4.78%	3rd	23.9%	10.8%	3.1%	0.85
Sierra Ventures V, L.P.	4/1995	1995	Exited	Venture Capital - Early Stage	5.0	5.0	21.3	-	-	21.3	4.25x	4.25x	80.00%	2nd	84.8%	28.9%	14.1%	2.56
Cypress Merchant Banking Partners, L.P.	11/1995	1995	Exited	Buyout - Mid	10.0	10.5	12.6	-	-	12.6	1.21x	1.21x	2.57%	4th	23.9%	10.8%	3.1%	0.79
MetroPCS	11/1995	1995	Exited	Co-Investments	5.8	5.9	54.5	-	-	54.5	9.21x	9.21x	26.34%	1st	23.9%	10.8%	3.1%	4.23
1995 Vintage Total					100.5	102.3	362.6	-	-	362.6	3.54x	3.54x	43.13%					2.39
1996 Vintage																		
Questor Partners Fund, L.P.	1/1995	1996	Exited	Buyout - Small	30.0	30.3	42.9	-	-	42.9	1.41x	1.41x	15.70%	1st	14.0%	8.6%	-0.5%	1.00
Cornerstone Equity Partners IV, L.P.	1/1996	1996	Exited	Buyout - Small	25.0	25.0	40.4	-	-	40.4	1.62x	1.62x	8.58%	3rd	14.0%	8.6%	-0.5%	1.31
CVC European Equity Partners, L.P.	2/1996	1996	Exited	Buyout - Global	25.0	24.3	61.1	-	-	61.1	2.51x	2.51x	22.96%	1st	20.1%	12.0%	8.9%	1.61
Accel V, L.P.	3/1996	1996	Exited	Venture Capital - Early Stage	9.0	9.0	176.6	-	-	176.6	19.62x	19.62x	188.44%	1st	177.6%	64.0%	22.9%	12.36
Bruckmann, Rosser, Sherrill & Co., L.P.	3/1996	1996	Exited	Buyout - Small	28.0	29.3	51.7	-	-	51.7	1.77x	1.77x	10.35%	2nd	14.0%	8.6%	-0.5%	1.29
Geocapital IV, L.P.	3/1996	1996	Active	Venture Capital - Early Stage	9.0	9.0	14.6	1.0	1.0	15.6	1.62x	1.73x	14.17%	4th	177.6%	64.0%	22.9%	1.15
Carlyle Partners II, L.P.	4/1996	1996	Exited	Buyout - Global	30.0	33.9	81.6	-	-	81.6	2.40x	2.40x	25.74%	1st	14.0%	8.6%	-0.5%	1.70
Sevin Rosen Fund V, L.P.	4/1996	1996	Exited	Venture Capital - Early Stage	10.0	10.0	11.1	-	-	11.1	1.10x	1.10x	9.29%	4th	177.6%	64.0%	22.9%	0.89
Berkshire Fund IV, L.P.	5/1996	1996	Exited	Buyout - Large	20.0	19.2	49.9	-	-	49.9	2.60x	2.60x	33.41%	1st	14.0%	8.6%	-0.5%	1.81
Indigo N.V.	5/1996	1996	Exited	Co-Investments	8.4	7.0	9.3	-	-	9.3	1.32x	1.32x	5.11%	3rd	14.0%	8.6%	-0.5%	0.74
Worldview Technology Partners I, L.P.	9/1996	1996	Exited	Venture Capital - Balanced	8.5	8.5	32.2	-	-	32.2	3.79x	3.79x	68.50%	2nd	177.6%	64.0%	22.9%	2.66
Ripplewood Partners, L.P.	1/1997	1996	Exited	Buyout - Small	20.0	19.6	36.4	-	-	36.4	1.86x	1.86x	13.62%	2nd	14.0%	8.6%	-0.5%	1.54
1996 Vintage Total					222.9	225.2	607.7	1.0	1.0	608.7	2.70x	2.70x	37.42%					1.81
1997 Vintage																		
KKR 1996 Fund, L.P.	9/1996	1997	Exited	Buyout - Global	125.0	131.8	235.1	-	-	235.1	1.78x	1.78x	13.18%	1st	7.2%	2.7%	-0.2%	1.38
Blackstone Capital Partners III Merchant, L.P.	1/1997	1997	Exited	Buyout - Global	50.0	54.1	105.6	-	-	105.6	1.95x	1.95x	14.63%	1st	7.2%	2.7%	-0.2%	1.54
DLJ Merchant Banking Partners II, L.P.	1/1997	1997	Exited	Buyout - Mid	25.0	28.5	36.7	-	-	36.7	1.28x	1.28x	6.01%	2nd	7.2%	2.7%	-0.2%	1.12
RSTW Partners III, L.P.	1/1997	1997	Exited	Mezzanine	25.0	23.0	21.6	-	-	21.6	0.94x	0.94x	-1.19%	4th	12.9%	6.0%	1.3%	0.86

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Source: Los Angeles County Employees Retirement Association

Figure 16: Excerpt of detailed performance information on SERS's private equity investments

Fund Name	Vintage	SERS Commitment	SERS Contributions	SERS Distributions	Firm Name	Status	Fund Value (mn)	Fund Value (mn USD)	Fund Value (mn EUR)	Fund Target Value (mn)	Fund Target Value (mn USD)	Type	Buyout Size	Region Focus	GP Location	Called (%)	Distr. (%) DPI	Value (%) RVPI	Net Multiple (X)	Net IRR (%)	Bench. Net IRR (%)	Net IRR Diff. (% pts.)	Quartile	Date Reported
Abingworth Bioventures IV	2003	20,000,000	19,700,000	23,712,133	Abingworth Management	Closed	350 USD	350	304.29	275 USD	275	Venture (General)		Europe	UK	98.5	119.6	10.2	1.3	3.9	4.8	-0.9	2nd	12/31/2017
Abingworth Bioventures V	2007	33,775,000	26,267,424	37,245,978	Abingworth Management	Closed	300 GBP	587.38	445.24	250 GBP	501.58	Venture (General)		Europe	UK	93.8	142.9	40.3	1.83	17.1	9.4	7.7	1st	3/31/2017
ABRY III	1997	25,000,000	20,394,093	28,932,345	ABRY Partners	Liquidated	581 USD	581	513.55	400 USD	400	Buyout	Mid	US	US	90.6	127.2	0	1.27	4.2	1.9	2.3	2nd	6/30/2018
ABRY IV	2000	35,000,000	22,500,122	74,633,973	ABRY Partners	Closed	776 USD	776	812.99			Buyout	Large	US	US	72.9	292.4	1.3	2.94	18.4	12.6	5.8	1st	12/31/2016
ABRY Mezzanine Partners	2001	30,000,000	24,857,300	49,707,116	ABRY Partners	Liquidated	508 USD	508	599.48			Mezzanine		US	US	89.1	177.3	0	1.77		11.7		2nd	6/30/2018
ABRY V	2005	45,000,000	36,658,306	81,985,960	ABRY Partners	Closed	950 USD	950	701.73	900 USD	900	Buyout	Mid	US	US	91.7	200.1	4.1	2.04	17.3	9.2	8.1	1st	12/31/2017
ABRY VI	2008	50,000,000	54,942,201	105,219,960	ABRY Partners	Closed	1,350 USD	1350	854.16	1,350 USD	1350	Buyout	Mid	US	US	88.5	204.4	3	2.07	19.7	16.7	3.1	2nd	12/31/2017
ABRY VII	2011	30,000,000	34,226,469	39,158,084	ABRY Partners	Closed	1,600 USD	1600	1195.84	1,600 USD	1600	Buyout	Large	US	US	105.9	132.2	47.8	1.8	15.6	19.1	-3.5	3rd	12/31/2017
ABRY VIII	2015	25,000,000	21,020,610	3,999,240	ABRY Partners	Closed	1,900 USD	1900	1504.61	1,900 USD	1900	Buyout	Large	US	US	86	12.2	106.9	1.19	8.9	20.1	-11.2	3rd	12/31/2017
ABS Capital III	1999	35,000,000	27,764,683	18,757,336	ABS Capital Partners	Liquidated	427 USD	427	414.16			Growth		US	US	84.1	63.7	0	0.64	-9.1	11.7	-20.8	4th	6/30/2018
ABS Capital IV	2000	35,000,000	28,789,304	68,253,149	ABS Capital Partners	Closed	449 USD	449	470.4	400 USD	600	Growth		US	US	100	220.5	0.1	2.21	20.2	8.2	12	1st	9/30/2017
ABS Capital V	2005	20,000,000	19,404,254	48,986,604	ABS Capital Partners	Closed	286 USD	286	225.43	500 USD	500	Growth		US	US	100	290.9	0.5	2.91	17.2	17.4	-0.2	2nd	9/30/2017
ABS Capital VI	2009	40,000,000	35,589,138	17,444,057	ABS Capital Partners	Closed	418 USD	418	325.12	400 USD	400	Growth		US	US	97	46	46.9	0.93	-1.3	7.6	-8.9	3rd	3/31/2018
Accel Europe Investors 2001	2001	15,000,000	11,350,000	16,931,685	Accel	Closed	500 EUR	423.7	500	587 EUR	497.34	Early Stage		Europe	US	100	124	10.1	1.34	3.5	4.5	-1	2nd	3/31/2018
Adams Capital Management III	2000	30,000,000	30,000,000	7,011,905	Adams Capital Management	Closed	420 USD	420	440.02	300 USD	300	Early Stage		US	US	100	23.1	3.6	0.29		-0.6		4th	12/31/2017
ADV Opportunities Fund I	2015	50,000,000	36,078,170	(138,445)	ADV Partners	Closed	550 USD	550	490	500 USD	500	Special Situations		Asia	Hong Kong	80.5	13	123	1.36	16.7	13.2	3.5	1st	12/31/2017
Advanced Tech Ventures VI	2000	10,000,000	10,000,000	4,498,689	Advanced Technology Ventures	Closed	400 USD	400	419.07			Venture (General)		US	US	100	45.1	1.7	0.47	-7.4	-0.4	-7.1	4th	12/31/2017
Advanced Tech Ventures VII	2001	27,000,000	26,797,500	28,185,753	Advanced Technology Ventures	Closed	800 USD	800	898.78			Venture (General)		US	US	100	107.7	8.3	1.16	2.3	1.5	0.8	2nd	3/31/2018
Advent Global Private Equity VI	2008	35,000,000	34,034,207	52,362,090	Advent International	Closed	6,600 EUR	10431.3	6600	5,000 EUR	7874	Buyout	Mega	Europe	US	110.2	173.6	46.5	2.2	20.1	14.8	5.3	1st	12/31/2017
Advent Global Private Equity VII	2012	40,000,000	34,073,050	15,159,752	Advent International	Closed	8,500 EUR	10803.25	8500	7,000 EUR	8580.53	Buyout	Mega	Europe	US	92.1	43.2	126.4	1.7	18.7	18.5	0.3	2nd	12/31/2017
Advent Latin American Fund IV	2007	30,000,000	29,810,216	32,090,921	Advent International	Closed	1,300 USD	1300	961.54	1,000 USD	1000	Buyout	Mid	Americas	US	102.9	121.8	31	1.53	9.9	9.9	0	3rd	12/31/2017
Advent Latin American Fund V	2011	15,000,000	13,058,177	2,670,000	Advent International	Closed	1,650 USD	1650	1230.9	1,500 USD	1500	Buyout	Large	Americas	US	95.7	25.6	97.1	1.23	5.4	19.1	-13.7	4th	12/31/2017
Advent Latin American Fund VI	2015	25,000,000	4,521,463	375,000	Advent International	Closed	2,100 USD	2100	1689.24	2,000 USD	2000	Buyout	Large	Americas	US	53.6	37.3	100	1.37		16.1		1st	3/31/2018
Advent VII	1993	25,000,000	25,000,000	96,585,406	TA Associates	Liquidated	300 USD	300	253.11			Buyout	Mid	US	US	100	375.6	0	3.76	56.7	27.5	29.2	1st	6/30/2018
AGCapital Recovery Partners II	2001	17,600,000	17,600,000	27,534,983	Angelo, Gordon & Co	Liquidated	800 USD	800	879.22			Distressed Debt		US	US	100	154.1	0	1.54	19.1	22.7	-3.6	4th	6/30/2018
AGCapital Recovery Partners III	2002	20,000,000	16,000,000	25,183,359	Angelo, Gordon & Co	Liquidated	1,000 USD	1000	1012.25			Distressed Debt		US	US	59.2	156.7	0	1.57	29.1	19.8	9.4	2nd	6/30/2018
AGCapital Recovery Partners IV	2003	50,000,000	35,415,216	55,993,470	Angelo, Gordon & Co	Liquidated	1,000 USD	1000	917.43	1,000 USD	1000	Distressed Debt		US	US	70.8	158	0	1.58	28.7	24.5	4.2	2nd	6/30/2018
AG Capital Recovery Partners V	2006	20,000,000	20,000,000	21,834,353	Angelo, Gordon & Co	Closed	756 USD	756	638.4	750 USD	750	Distressed Debt		US	US	100	112	0.2	1.12	2.9	6.2	-3.3	4th	3/31/2018
Alloy Ventures 2002	2002	25,000,000	24,832,999	15,448,474	Alloy Ventures	Closed	300 USD	300	304.38	250 USD	250	Early Stage: Seed		US	US	100	62.5	3.2	0.66	-8.1	-2.7	-5.5	3rd	12/31/2017
Alpha Private Equity Fund 4	2002	26,508,050	35,605,050	77,996,040	Groupe Alpha	Liquidated	500 EUR	435.85	500	500 EUR	492.8	Buyout	Mid	Europe	Luxembourg	100	210	0	2.1	29	19.3	9.7	2nd	6/30/2018
Alpha Private Equity Fund 5	2006	57,796,800	62,184,152	82,402,625	Groupe Alpha	Closed	720 EUR	874.03	720	700 EUR	849.73	Buyout	Mid	Europe	Luxembourg	100	143.2	14	1.57	9.2	9.1	0.1	2nd	12/31/2017
APA / Fostin - Fund I	1987	20,000,000	20,000,000	77,278,523	Apax Partners	Liquidated	40 USD	40.4	33.59			Balanced		US	UK	100	385.6	0	3.86	19.9	15.2	4.7	2nd	6/30/2018
Apax Capital Risque II	1990	5,000,000	5,103,877	11,622,162	Apax Partners	Liquidated	96 EUR	117.4	96			Venture (General)		Europe	UK	100.1	227	0	2.27	13.4	18	-5.6	2nd	6/30/2018
Apax Europe IV	1999	32,424,000	29,909,800	40,876,051	Apax Partners	Liquidated	1,803 EUR	1858.89	1803			Balanced		Europe	UK	100	134.1	0	1.34	2.4	11.5	-9	3rd	6/30/2018
Apax Europe V	2001	53,262,000	68,764,274	150,017,403	Apax Partners	Closed	4,404 EUR	3872.88	4404	4,400 EUR	3728.56	Buyout	Mega	Europe	UK	100	234.7	0.3	2.35	36.3	29.2	7.1	2nd	9/30/2017
Apax Europe VI	2005	76,349,190	74,145,979	134,550,076	Apax Partners	Closed	4,310 EUR	5590.03	4310.3	4,300 EUR	5444.11	Buyout	Mega	Europe	UK	124.7	170.1	14.7	1.85		10		2nd	12/31/2017
Apax Europe VII	2007	132,170,235	131,961,257	145,865,152	Apax Partners	Closed	11,204 EUR	17707.93	11204	8,500 EUR	12217.46	Buyout	Mega	Europe	UK	114.3	125.6	20.6	1.46		9.8		3rd	12/31/2017
Apax Germany I	1990	5,200,000	5,246,602	12,685,354	Apax Partners	Liquidated	49 EUR	59.92	49			Venture (General)		Europe	UK	100	278.7	0	2.79	28.6	19	9.6	1st	6/30/2018
Apax Partners - Germany II	1997	8,737,262	8,455,477	17,367,332	Apax Partners	Liquidated	131 EUR	150.7	131.2			Venture (General)		Europe	UK	100	231.1	0	2.31	60.7	32.1	28.7	2nd	6/30/2018
Apax UK VI	1997	6,918,899	6,918,899	13,274,506	Apax Partners	Liquidated	313 GBP	521.48	460.93			Venture (General)		Europe	UK	100	232	0	2.32	43.1	32.1	11.1	1st	6/30/2018
Apex Investment Fund IV	1999	25,000,000	25,000,000	5,661,282	Apex Venture Partners	Liquidated	165 USD	165	160.04	100 USD	100	Early Stage		US	US	100	7.6	0	0.08	-13.3	-6.1	-7.2	4th	6/30/2018
Apex Investment Fund V	2002	20,000,000	20,122,702	7,739,736	Apex Venture Partners	Liquidated	212 USD	211.9	181.89			Early Stage		US	US	100	38	0	0.38	-13.7	-2.7	-11	4th	6/30/2018
Apollo Investment Fund IV	1998	75,000,000	72,079,063	124,814,033	Apollo Global Management	Closed	3,600 USD	3600	3265.2			Buyout	Mega	US	US	102.9	164.8	0.1	1.65	8.5	5.8	2.7	2nd	12/31/2017
Apollo Investment Fund V	2001	50,000,000	42,484,039	122,268,807	Apollo Global Management	Closed	3,742 USD	3742	4415.86	3,600 USD	3600	Buyout	Mega	US	US	159.9	197.2	1	1.98	38.8	23.4	15.4	2nd	12/31/2017
Apollo Investment Fund VI	2006	40,000,000	38,289,202	52,606,408	Apollo Global Management	Closed	10,136 USD	10136	8559.36	5,000 USD	5000	Buyout	Mega	US	US	95.8	141.3	28.3	1.7	8.9	8.4	0.6	1st	12/31/2017
Artiman Ventures II	2007	25,000,000	20,967,427	13,141,575	Artiman Ventures	Closed	180 USD	180	131.34	150 USD	150	Early Stage		US	US	100	52.6	42.1	0.95	-1.2	8.1	-9.3	3rd	3/31/2018
Artiman Ventures III	2010	20,000,000	18,910,000	-	Artiman Ventures	Closed	200 USD	200	145.58	150 USD	150	Early Stage		US	US	95.6	0	77.4	0.77	-0.1	42	-42.1	4th	3/31/2018
ASF VII B NYC Co-Invest	2016	50,000,000	406,198	-	Ardian	Closed						Co-Investment		Europe	France	44.8	0	138.9	1.39	n/m		n/m		12/31/2017
Asia Alternatives Capital Partners I	2007	50,000,000	23,406,269	34,732,699	Asia Alternatives Management	Closed	515 USD	515	385.08	350 USD	350	Fund of Funds		Asia	Hong Kong	106.7	142.9	42.4	1.85	12	8.1	3.9	1st	12/31/2017
Asia Alternatives Capital Partners II	2008	50,000,000	26,583,918	20,136,025	Asia Alternatives Management	Closed	950 USD	950	674.67	850 USD	850	Fund of Funds		Asia	Hong Kong	101	79.4	150.4	2.3	20	9.4	10.6	1st	12/31/2017
Asia Alternatives Capital Partners III	2012	50,000,000	45,804,166	16,768,065	Asia Alternatives Management	Closed	908 USD	908	739.02	800 USD	800	Fund of Funds		Asia	Hong Kong	96.9	42	104.5	1.46		12.8		2nd	9/30/2017
Asia Pacific Growth Fund III	1999	15,000,000	14,627,000	16,708,736	H&Q Asia Pacific	Closed	750 USD	750	727.45			Venture (General)		Asia	US	100	106.3	3	1.09	0.9	-3.2	4.1	2nd	12/31/2016
Atlas Ventures VI	2001	24,800,000	23,283,720	16,191,410	Atlas Venture	Closed	600 USD	600	674.08	1,100 USD	1100	Early Stage		US	US	100	67.6	48.6	1.16	0.8	-2	2.7	2nd	3/31/2018
Audax Private Equity Fund	2000	35,000,000	33,157,787	55,986,816	Audax Private Equity	Closed	500 USD	500	496.52			Buyout	Mid	US	US	100	153.2	0.4	1.54	12.1	14.8	-2.7	3rd	6/30/2018
Audax Private Equity Fund II	2005	25,000,000	25,506,073	45,110,929	Audax Private Equity	Closed	700 USD	700	591.12	600 USD	600	Buyout	Mid	US	US	100	178.4	3.7	1.82	14	9.2	4.8	1st	6/30/2018
Audax Private Equity Fund III	2007	37,000,000	39,579,527	73,271,872	Audax Private Equity	Closed	1,000 USD	1000	739.64			Buyout	Mid	US	US	100	189.7	17.3	2.07	14.9	12.3	2.6	2nd	6/30/2018
Audax Private Equity Fund V	2015	50,000,000	10,928,119	280,051	Audax Private Equity	Closed	2,250 USD	2250	2089.58	1,750 USD	1750	Buyout	Large	US	US	47.7	1.2	117.9	1.19	32.1	20.1	12	2nd	12/31/2017
Austin Ventures IX	2006	15,000,000	15,127,754	16,396,495	Austin Ventures	Closed	525 USD	525	433.96	525 USD	525	Venture (General)		US	US	101	112.8	22.4	1.35	5.1	5	0.1	2nd	3/31/2018
Austin Ventures VIII	2001	20,932,340	20,932,140	33,669,094	Austin Ventures	Closed	830 USD	830	979.47			Venture (General)		US	US	100	161.1	5.1	1.66	7	1.5	5.5	1st	12/31/2017
Avenue Asia Special Situations Fund IV	2006	50,000,000	31,897,973	33,606,114	Avenue Capital Group	Closed	3,000 USD	3000	2364.62	3,000 USD	3000	Distressed Debt		Asia	US	90.5	108.6	0.9	1.09	2	5.9	-3.9	4th	12/31/2017
Avenue Europe Special Situations Fund	2008	38,632,500	25,306,863	37,888,419	Avenue Capital Group	Liquidated	1,138 EUR	1405.08	1138	1,000 EUR	1574.8	Distressed Debt		Europe	US	96.3	147.3	0	1.47	15.4	13.1	2.3	2nd	6/30/2018
Avenue Special Situations Fund III	2002	50,000,000	37,387,969	62,628,424	Avenue Capital Group	Liquidated	628 USD	628	705.34			Distressed Debt		US	US	100	133	0	1.33	18.4	19.8	-1.4	3rd	6/30/2018
Avenue Special Situations Fund IV	2006	50,000,000	49,911,855	69,076,799	Avenue Capital Group	Liquidated	1,680 USD	1680	1383.97			Distressed Debt		US	US	100	141.7	0	1.42	8.7	6.2	2.5	2nd	6/30/2018
Avenue Special Situations Fund V	2007	70,000,000	69,901,575	92,690,854	Avenue Capital Group	Liquidated	6,000 USD	6000	3810.01	6,000 USD	6000	Distressed Debt		US	US	118.3	128.3	0	1.28	11.3	9.4	1.9	3rd	6/30/2018
Avenue Special Situations Fund VI	2010	20,000,000	19,977,798	17,801,933	Avenue Capital Group	Closed	1,926 USD	1925.5	1342.46	2,500 USD	2500	Distressed Debt		US	US	102.2	94	13.5	1.07	1.7	10.5	-8.8	4th	12/31/2017
AXA Secondary Fund III	2004	26,000,000	21,733,291	37,244,706	Ardian	Closed	1,040 USD	1040	768.21	800 USD	800	Secondaries		Europe	France	83.6	170.2	0.3	1.7	43.5	10	33.5	1st	12/31/2017
AXA Secondary Fund IV	2006	80,000,000	66,908,452	82,302,114	Ardian	Closed	2,854 USD	2854	2110.94	2,700 USD	2700	Secondaries		Europe	France	87.7	139.3	2.4	1.42	8.5	5.6	2.9	2nd	12/31/2017
AXA Secondary Fund V	2011	75,000,000	57,721,809	58,318,674	Ardian	Closed	5,085 USD	5084.5	4041.67	3,500 USD	3500	Secondaries		Europe	France	80.1	134.3	26.7	1.61	15.6	17.4	-1.8	2nd	12/31/2017
B III Capital Partners	1996	35,000,000	34,423,917	50,540,347	DDJ Capital Management	Liquidated	539 USD	539	435.08	500 USD	500	Distressed Debt		US	US	100	150	0	1.5	9.4	11.1	-1.7	3rd	6/30/2018
Bachow Investment Partners III	1994	25,000,000	24,969,997	26,202,538	Bachow & Associates	Liquidated	140 USD	140	118.73			Balanced		US	US	101.9	156.2	0	1.56	9.5	23.7	-14.2	3rd	6/30/2018
Bain Capital Asia	2007	12,000,000	11,020,944	15,143,534	Bain Capital	Closed	1,000 USD	1000	747.72	1,000 USD	1000	Buyout	Mid	Asia	US	96	131	13	1.44	7.7	9.9	-2.2	3rd	6/30/2017
Bain Capital Europe III	2008	72,432,276	62,972,190	112,389,602	Bain Capital	Closed	3,500 EUR	5539.23	3500	2,500 EUR	3520.25	Buyout	Mega	Europe	US	98.8	201	26	2.27	22.3	14.8	7.5	1st	6/30/2017
Bain Capital Fund IX	2006	75,000,000	72,937,500	107,913,972	Bain Capital	Closed	8,000 USD	8000	6590.33	6,000 USD	6000	Buyout	Mega	US	US	97.5	145.9	15.1	1.61		8.4		2nd	12/31/2017
Bain Capital Fund IX Coinvestment Fund	2006	15,000,000	14,456,250	21,969,013	Bain Capital	Closed	2,000 USD	2000	1647.58	2,000 USD	2000	Co-Investment		US	US	99	143	22	1.65		8	0	2nd	6/30/2017
Bain Capital Fund VII	2000	25,000,000	23,562,500	47,998,008	Bain Capital	Closed	2,500 USD	2500	2530.62	2,000 USD	2000	Buyout	Mega	US	US	108.6	197	25	2.22	29.6	20.1	9.5	1st	12/31/2017
Bain Capital Fund VIII Coinvestment Fund	2004	12,344,000	12,299,670	19,631,405	Bain Capital	Closed	562 USD	562	461.45			Co-Investment		US	US	97.2	181	7	1.88	12.8	8.1	4.7	1st	6/30/2017
Bain Capital Fund X	2008	90,000,000	86,374,239	100,560,312	Bain Capital	Closed	10,707 USD	10707	7332.05	10,000 USD	10000	Buyout	Mega	US	US	97.2	126.9	36.2	1.63	9.8	14.8	-5	3rd	3/31/2018
Bain Capital Fund X Co-investment Fund	2008	5,000,000	1,225,000	1,061,774	Bain Capital	Closed	299 USD	299.1	210.35	4,000 USD	4000	Co-Investment		US	US	62.5	119.4	22.6	1.42	7	13.2	-6.2	4th	12/31/2017
Baring India Private Equity Fund III	2008	5,000,000	4,829,380	3,515,232	Baring Private Equity Partners (India)	Closed	550 USD	550	347.99	400 USD	400	Growth		Asia	India	97.8	79	91.9	1.71	11.6	10.2	1.4	2nd	12/31/2017
Baring Vostok Private Equity Fund IV	2007	30,000,000	27,455,543	14,782,880	Baring Vostok Capital Partners	Closed	1,103 USD	1102.6	824.43			Buyout	Mid	Europe	Russia	109.1	50.9	51.7	1.03	0.6	9.9	-9.3	4th	9/30/2016
Battery Ventures VIII	2007	25,000,000	25,000,000	44,528,658	Battery Ventures	Closed	750 USD	750	554.73	750 USD	750	Venture (General)		US	US	100	178.1	67.5	2.46	17.3	9.4	7.9	1st	12/31/2017
Battery Ventures VIII Side Fund	2008	9,000,000	6,768,000	17,412,210	Battery Ventures	Closed	225 USD	225	159.79	250 USD	250	Co-Investment		US	US	100	257.3	22.5	2.8	30.4	13.2	17.2	1st	12/31/2017
BC European Cap IX	2011	26,472,535	23,406,353	12,246,295	BC Partners	Closed	6,687 EUR	8821.9	6687	6,000 EUR	8473.38	Buyout	Mega	Europe	UK	106.5	62.7	84.6	1.47	13.3	15.3	-2	3rd	3/31/2018
BC European Cap VII	2000	32,658,500	37,740,202	96,576,440	BC Partners	Liquidated	4,272 EUR	4077.91	4272.3	4,200 EUR	4008.9	Buyout	Mega	Europe	UK	100	209.2	0	2.09	17.9	17.9	0	2nd	6/30/2018
BC European Cap VIII	2005	98,107,500	97,137,090	104,856,917	BC Partners	Closed	5,881 EUR	7626.81	5880.8	5,500 EUR	6653.93	Buyout	Mega	Europe	UK	95.2	122.1	9.8	1.32	5.9	10	-4.1	3rd	9/30/2017
Berkshire Fund VI	2002	20,000,000	17,260,685	44,220,291	Berkshire Partners	Closed	1,700 USD	1700	1724.84			Buyout	Large	US	US	93.1	246.6	57.2	3.04	25.2	17	8.2	1st	12/31/2017
Berkshire Fund VII	2006	32,000,000	29,159,510	44,446,671	Berkshire Partners	Closed	3,135 USD	3135	2471.03	3,000 USD	3000	Buyout	Large	US	US	98.5	163.6	35.1	1.99	16.6	11.8	4.8	1st	12/31/2017
Berkshire Fund VIII	2011	30,000,000	24,660,545	5,306,179	Berkshire Partners	Closed	4,549 USD	4549	3221.15	4,000 USD	4000	Buyout	Mega	US	US	95.5	55.5	87.2	1.43	12.4	13.9	-1.5	3rd	12/31/2017
Birchmere Ventures III	2005	10,000,000	9,082,885	8,092,184	Birchmere Ventures	Liquidated	50 USD	49.5	40.92	100 USD	100	Early Stage		US	US	100	89.3	0	0.89	-3.4	1.6	-5	3rd	6/30/2018
Blackstone Capital Partners II	1994	40,000,000	42,438,924	96,997,924	Blackstone Group	Liquidated	1,271 USD	1271	1077.94			Buyout	Large	US	US	106.1	223.3	0	2.23	37.3	20.5	16.8	1st	6/30/2018
Blackstone Capital Partners III	1997	75,000,000	74,295,009	151,123,498	Blackstone Group	Liquidated	3,750 USD	3750	3314.63			Buyout	Mega	US	US	108.1	195.4	0	1.95	14.6	8.4	6.2	1st	6/30/2018
Blackstone Capital Partners IV	2003	75,000,000	67,747,508	184,308,060	Blackstone Group	Closed	6,450 USD	6450	6544.23	5,000 USD	5000	Buyout	Mega	US	US	103.4	267.1	10	2.77	37	13	24.1	1st	3/31/2018
Blackstone Capital Partners V	2006	150,000,000	141,252,710	228,895,260	Blackstone Group	Closed	20,363 USD	20365	15916.28	13,500 USD	13500	Buyout	Mega	US	US	107.3	156.7	9.3	1.66	8.8	8.4	0.5	2nd	12/31/2017
Blackstone Capital Partners VII	2016	50,000,000	6,245,583	17,717	Blackstone Group	Closed	18,000 USD	18000	16396.2	17,500 USD	17500	Buyout	Mega	US	US	22	6.1	99	1.05	n/m		n/m		12/31/2017

Source: Analysis of Preqin data

Anyone with access to this data is able to calculate reasonably accurate performance results. For example, estimated Kaplan-Schoar PME values for the SERS and PSERS private equity portfolios can be computed using statistical techniques and KS-PME values from investors in the same funds as SERS/PSERS (such as LACERA, discussed earlier). The results of these estimates using public data compared to values reported by SERS and PSERS are as follows:

Figure 17: SERS PME Estimates versus reported values

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

Sources: Analysis of data from Preqin, SERS

Figure 18: PSERS PME Estimates versus reported values

PSERS PRIVATE EQUITY PERFORMANCE VS:	S&P 500	RUSSELL 3000	RUSSELL 2000
KS-PME –Estimate July 2018	1.10	1.09	1.07
KS-PME – PSERS Reported October 2018	1.10	1.09	1.05

Sources: Analysis of data from Preqin, PSERS

The purpose of this exercise, particularly in the case of SERS where even basic performance information on individual private equity performance is not made available publicly, let alone PME values, is to demonstrate that **<u>a significant amount of the data on investments is already in the public domain and the information is reasonably accurate</u>**. This casts doubt on the wisdom of treating this information as confidential and unavailable to Pennsylvanians, and makes efforts to do so futile.Retirees of SERS should not require paid subscriptions to specialty investment research platforms in order to monitor performance of individual private equity fund investments. The information should be made public, as it is at many funds including PSERS.

<u>Fee Terms</u>: Both SERS and PSERS do not appear to maintain a comprehensive report of fee terms negotiated with its managers. When asked by the Commission for a "comprehensive report that shows the complete cost terms (all levels of fees whether paid directly or indirectly and allocations of returns) for each investment manager," PSERS responded that it "doest [sic] maintain complete cost terms for each individual investment manager," and SERS provided a report that included effective management fees for only public equity and fixed income managers (not the actual terms, as will be discussed in the "Cost-saving Analysis" of this report).

By contrast, a number of pension funds and investment boards do report the fee terms they have negotiated with their managers. The methods of transparency in reporting fee terms differ – some funds/boards such as Louisiana and New Jersey provide separate reports of fee terms. The Nebraska Investment Council discloses its fee terms in performance reports prepared by its consultant, Aon Hewitt (the consultant also for PSERS), which is among public materials presented at board meetings and available on its website.

Figure 19: Excerpt of the Nebraska Investment Council reporting of fee terms

PRIVATE EQUITY

PARTNERSHIP NAME	VINTAGE YEAR	COMMITMENT	FEE SCHEDULE[1] (on an Annual Basis)	YTD MANAGEMENT FEE	TOTAL FEES (BPS)
Merit Mezzanine Fund V, L.P.	2010	15,000,000	1.75% Years 1-6 1.575% Year 7 1.40% Year 8 1.225% Year 9 1.05% Year 10	8,245	175
Ares Mezzanine Partners, L.P.	2011	15,000,000	1.50% Years 1-5 1.00% Years 6-10	0	150
Lightyear Fund III, L.P.	2011	20,000,000	1.75%	30,541	175
Ares Corporate Opportunities Fund IV, L.P.	2012	20,000,000	1.50% Years 1-5 0.75% Years 6-10	20,528	150
Dover Street VIII, L.P.	2012	25,000,000	0.50% Year 1 1.00% Year 2 1.25% Years 3-10	77,322	50
Green Equity Investors VI, L.P.	2012	20,000.000	1.50% Years 1-6 1.00% Years 7-8 0.75% Years 9-10	69,112	150
McCarthy Capital V, L.P.	2012	20,000.000	2.00%	59,164	200
New Enterprise Associates 14, L.P.	2012	20,000.000	1.25% Years 1-12	43,750	125
Accel-KKR Capital Partners IV, L.P.	2013	12,500,000	2.25%	30,948	225
Beecken Petty O'Keefe Fund IV, L.P.	2013	20,000.000	2.00%	44,172	200
Pine Brook Capital Partners II, L.P.	2013	30,000,000	1.96% blended rate	145,224	196
Wayzata Opportunities Fund III, L.P.	2013	25,000,000	1.50%	24,463	150
CVC Capital Partners VI, L.P.3	2014	19,599,150	1.50% Years 1-6 1.25% Years 7-10	33,462	150
New Mountain Partners IV, L.P.	2014	30,000,000	1.75% Years 1-5 1.00% Years 6-10	0	175
Quantum Energy Partners VI, LP	2014	30,000,000	1.65% Years 1-5 1.50% Years 6-10	43,458	165
The Energy and Minerals Group III, L.P.	2014	35,000,000	1.64% blended rate Years 1-5 1.50% Years 6-10 1.00% Years 11-12	111,448	164

1. Most funds have management fee offsets which will reduce the absolute dollars paid by the client.
2. Fund of funds that does not include fees paid to underlying managers.
3. Commitments to Bridgepoint Europe IV and CVC European Equity Partners V were both EUR 20.0mm. The USD commitments were converted at an exchange rate of 1.30 USD/EUR.
The commitment to CVC Capital Partners VI was EUR 15.0mm with a converted exchange rate of 1.30661 USD/EUR. The commitment to Bridgepoint Europe V was EUR 20.0 mm with a converted exchange rate of 1.25353 USD/EUR.
* Estimated management fee. The manager does not break out fees for this fund.

Source: Nebraska Investment Council

Asset Management Fees: SERS and PSERS do publish the asset management fees for investments on a per manager basis; with this practice and to their credit, SERS and PSERS are more transparent than many peer funds. They also report a higher percentage of management fees than a number of other peers (see sidebar, "What are GASB 25 & 67?"). The information provided by SERS and PSERS, however, provides limited contextual benefits, since information is not made publicly available on per-manager holdings or on per-manager performance compared to their assigned benchmarks. Without transparency to fees and costs within the context of the performance (absolute and relative to a risk appropriate benchmark) on a per manager basis, stakeholders are not able to answer the question "Are we getting what we pay for?"

Carried Interest and Other Costs: Neither SERS nor PSERS has historically publicly reported "carried interest" payments to managers for private equity, real estate and commodities. As shown in the image below, PSERS does not report carried interest/performance fees for alternative investments, real estate, or commodities in its CAFR. SERS simply shows a total of fees paid by asset class.[li]

Figure 20: PSERS transparency of investment expenses in its CAFR

SUPPLEMENTARY SCHEDULE 2 SUMMARY OF INVESTMENT EXPENSES*

YEAR ENDED JUNE 30, 2017 (dollar Amounts in Thousands)

EXTERNAL MANAGEMENT	INVESTMENT MANAGEMENT		OTHER EXPENSES	TOTAL
	BASE	PERFORMANCE		
Domestic Equity	$1,494	$1,490	-	$2,984
International Equity	19,771	5,392	-	25,163
Fixed Income	87,464	21,061	-	108,525
Real Estate	50,609	-	-	50,609
Alternative Investments	102,714	-	-	102,714
Absolute Return	78,202	50,784	-	128,986
Commodities	4,132	-	-	4,132
Master Limited Partnership	8,295	238	-	8,533
Risk Parity	19,632	3,466	-	23,098
Total External Management	372,313	82,431	-	454,744
Total Internal Management	-	-	12,787	12,787
Total Investment Management	372,313	82,431	12,787	467,531
Custodian Fees	-	-	2,476	2,476
Consultant and Legal Fees	-	-	4,484	4,484
Total Investment Expenses	$372,313	$82,431	$19,747	$474,491

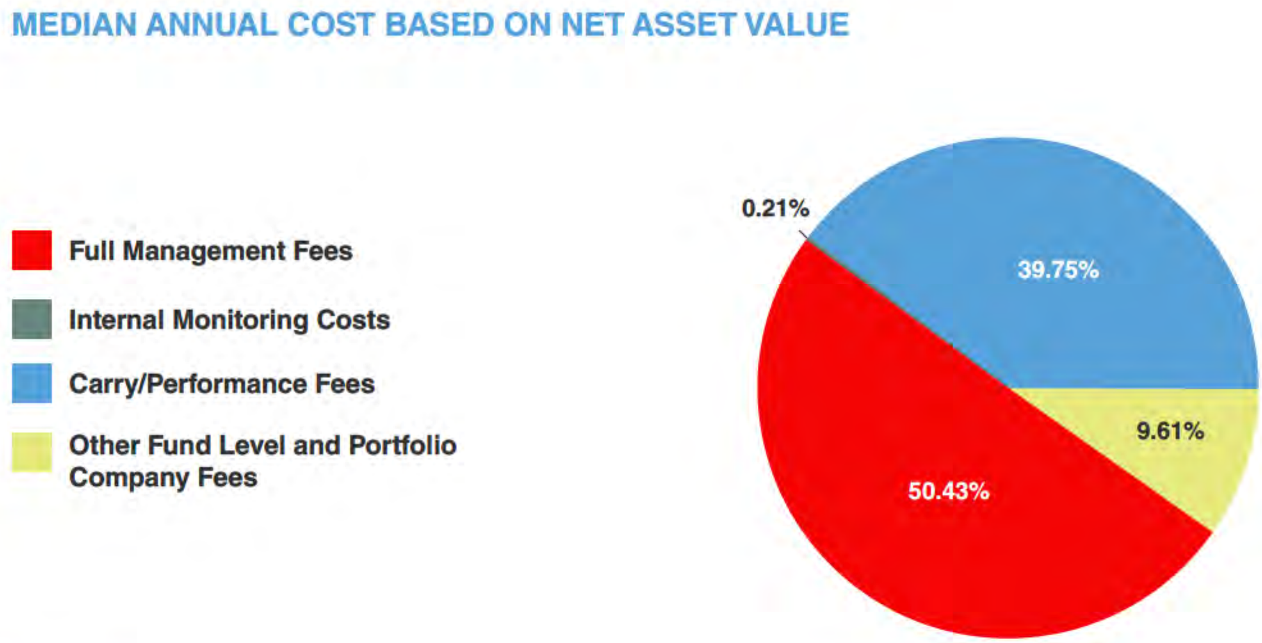
Source: PSERS

A number of pension funds, including SERS and PSERS, have cited GASB 25/67 – among other accounting standards and peer practices – as a rationale for not reporting all management fees, carried interest/performance fees, and other costs for private equity, real estate, and commodities (see sidebar, "What are GASB Statements 25 & 67?").[lii] Until this Commission heard testimony on the subject, neither SERS nor PSERS had even reported total carried interest to their respective boards. PSERS has claimed that they monitor, track and verify carried interest payments internally, while SERS has disclosed that they do not.[liii]

Each of these practices is problematic, but for different reasons. Given that the SEC found that "General Partners had violations of law or material weaknesses in controls over 50% of the time," SERS' failure to monitor and verify GP calculations of carried interest implies that there is a real danger of overpaying.

Aside from the issue of public disclosure, carried interest represents a significant cost of fund investments in private equity and other alternative investments — costs any fiduciary board should fully understand. In its 2015 report "The Time Has Come for Standardized Total Cost Disclosure for Private Equity," CEM Benchmarking estimated that carried interest represents nearly 40% of the median annual cost of private equity.[liv]

Figure 21: Private equity estimated full costs



Source: CEM

Some funds, understanding that carried interest does represent significant cost, do report on it. While a minority in number, they include a number of large peer funds: CalPERS ($326 billion), CalSTRS ($219 billion), Arizona SRS ($37 billion), South Carolina Retirement System ($31 billion), and Texas County ($30 billion). An early leader on fee transparency, South Carolina reports fees per manager, includes their assets under management, and separates fees by management, performance (carried interest) and other, as shown on the following page.

Figure 22: Excerpt from South Carolina CAFR

SOUTH CAROLINA RETIREMENT SYSTEMS
SCHEDULE OF INVESTMENT MANAGERS AND FEES (CONT.)
FOR THE YEAR ENDED JUNE 30, 2018 (Amounts Expressed in Thousands)

INVESTMENT MANAGER	FAIR VALUE OF ASSETS UNDER MANAGEMENT AT 6/30/2018 [1]	MANAGER FEES DIRECTLY INVOICED	MANAGER FEES DEDUCTED ON A NET OF FEE BASIS [2]			TOTAL INVESTMENT MANAGER FEES
			MANAGEMENT FEES	PERFORMANCE FEES	OTHER FEES	
Morgan Stanley Partnership Private Debt	6,188		105	176	121	402
Northstar Mezz V	16,997		299	401	27	727
Owl Rock Capital	68,769		807			807
Sankaty COP IV	30,056		443	3,491	27	3,961
Sankaty COP V	38,337		384	820	43	1,247
Selene I[4]				(15)	65	50
Selene II	64,175		412	208	(1,094)	(474)
SJC DL II	16,397		44	(130)	24	(62)
WL Ross - WLR Whole Loans	9,905		79	67	79	225
WL Ross Partnership Private Debt	39,329					
PRIVATE EQUITY						
Advent - Advent International GPE VII	53,004		449	2,693	12	3,154
Apax Europe VII	8,479			(88)	3	(85)
Apax Europe VIII	78,525		607	3,163	309	4,079
Apollo Partnership Private Equity	496,575		5,768	8,961	4,374	19,103
Aquiline Financial Services II	87,445		1,035	2,526		3,561
Azalea Fund IV	8,746		265			265
BC European Cap IX	26,241		243	(1,703)	110	(1,350)
Bridgepoint Europe IV[6]	37,745		352		45	397
Bridgepoint Europe V[6]	68,146		1,564		484	2,048
Brookfield Capital IV	120,675		1,741	26,438	887	29,066
Carousel Capital III	55		(27)	6		(21)
Carousel Capital IV	29,080		87	3,340		3,427
CD&R VIII	24,046					
Crestview II	66,352		629	(1,751)	328	(794)
Crestview III	34,051		1,184	(1,534)	155	(195)
Digital Colony[7]	(989)		482		468	950
Franscisco Partners	6,408		373		208	581
Goldman Sachs Partnership Private Equity	28,208		377	1,410	369	2,156
Green Equity	41,910		147	3,835	252	4,234
Industry Ventures VI	19,612		206	(289)		(83)
Industry Ventures VII	37,630		275	914		1,189
Lexington Capital VII	32,752		419	(584)	104	(61)
Lexington Middle Market II	21,986		210	(494)	28	(256)
Morgan Stanley Partnership Private Equity	181,703		1,536	(271)	304	1,569
Oaktree EOF III	35,622		641	1,065	125	1,831
Pacific Equity Partners	39,737		1,004	1,317	183	2,504
Pantheon USA VII	63,762		994	539	495	2,028
Paul Capital IX	27,664		605			605
Reservoir Capital Partners (Cayman) L.P.	48,311		314	2,082	26	2,422
Truebridge Capital I	44,812		164	175	51	390
Truebridge Capital II	79,205		288	326	76	690
Warburg Pincus X	52,221		250	2,647	392	3,289
Warburg Pincus XI	49,104		(284)	2,442	197	2,355
Welsh Carson Anderson & Stowe XI	28,136		153	(290)	13	(124)
WL Ross Partnership Private Equity	202,245		432	987	375	1,794
Various Private Equity Managers[8]	188,940		1,076	361	426	1,863

Source: South Carolina Retirement Systems

Finally, some funds continue to report a minimum level of costs (sometimes even less than typically reported by SERS and PSERS) in certain schedules of their CAFRs, while, "in the interest of greater transparency," provide a supplemental schedule containing a comprehensive accounting of carried interest. This can result in inconsistency in determining the expense ratio of a pension fund while conducting peer-to-peer comparisons, as identified by in a partially-redacted analysis prepared by SERS that was included in the PSERS fee reduction proposal. Funds operating "in the interest of greater transparency" should be commended, even if their reporting inconsistencies may cause them to appear artificially less expensive than their less transparent peer funds.

As one example, the Texas County & District Retirement System provides in its 2017 CAFR the following (emphasis added):

> *The investment management fees included in Investment Activity Expenses presented in the Statement of Changes in Fiduciary Net Position represent only those paid directly from the Pension Trust Fund and do not include fees incurred and charged by general partners in partnerships investing in private equity, distressed debt, direct lending, opportunistic credit, private real estate and hedge funds as these types of fees are netted directly against returns for those investments in accordance with FASB ASC 820.* ***In the interest of greater transparency, fees and profit shares associated with these types of investments are disclosed*** *in Table 8, based on information requested and received from fund general partners in conjunction with the annual audit.*
>
> *The investment expenses related to TCDRS' investments in partnerships investing in private equity, distressed debt, direct lending, opportunistic credit, private real estate and hedge funds fall into the* ***categories of management fees and profit share (also called "carried interest").***

CARRIED INTEREST: WHEN A FEE IS NOT A "FEE"

As noted, many public pension funds have historically not reported "carried interest" payments for certain categories of investment such as private equity, while they have reported it for other categories such as hedge funds, and this non-disclosure has its roots in GASB language about whether a given expense is "separable."

In addition to the GASB justification, however, the Commission also heard from some witnesses that carried interest payments were not, strictly speaking, "fees" because they were not paid directly. In its reply to the Commission, SERS writes "while 'fees' are reported on the templates provided in the response to the inquiry . . . in all cases, and while 'fees' are generally reported in SERS' budget materials and CAFR, the ultimate 'fee' that SERS actually pays as limited partner in a partnership are not, and cannot be, accurately known until the completion of the partnership, **and in most cases are $0**." (Emphasis added.) In testimony, a SERS official went beyond that to assert that carried interest payments were not an economic cost of any kind: "It is not a cost of investing, in my view."

Notably, the Commission only heard this line of reasoning from private equity consultants or representatives of pension funds, whether in Pennsylvania or elsewhere. Witnesses outside of pension funds uniformly described carried interest payments as a cost to the pension funds, whether acknowledged or not. As Charlie Ellis testified:

> *If I can be just blunt spoken, when somebody says "fee and carried interest are different," I agree with that mechanically, legally, and so on. But everybody I know in Wall Street and everybody I know in investment outside of Wall Street is absolutely clear, they are part of the same thing. That's what we get paid. And the cost and risk gets absorbed by the clients. This is worth paying close attention to. You put up 100 percent of the money, you take 100 percent of the risk, you have 100 percent of the liquidity [sic], and then the managers claim a 20 percent carried interest. If that isn't part of their compensation or the reason they're in business, it would be news to me, and candidly, it would be news to them.*

As Dr. Phalippou also testified, "Imagine that Vanguard has your money on your 401(k) and whenever there are dividends paid by the stocks they hold on your behalf, they keep these dividends and tell you, 'Don't worry, I'm not going to charge you any fees'."

Carried interest payments show up on the financial statements of publicly-traded private equity General Partner firms as income; elementary accounting tells us that income on one set of books is an expense on someone else's, in this case pension funds.

What the financial industry labels carried interest in its various manifestations — a fee in the case of hedge funds, maybe something else in the case of private equity — is irrelevant. It is a cost — and a significant one — that should be tracked, verified, managed . . . and disclosed.

Given that the Texas County & District Retirement System has a similarly-sized private equity portfolio to SERS, it provides a simple illustration of the potential scale of carried interest that is being unreported by SERS. SERS reported $63.14 million in management fees for the fair value of its $4.08 billion private equity portfolio. Likewise, and as shown on the following image, Texas reported $67.79 million in management fees for the fair value of its $3.76 billion private equity portfolio. Texas, however, also reported an additional $153.34 million in carried interest. Again, the similarities between the portfolio sizes and management fees reported simply provides an illustration of the scale of carried interest not being reported by SERS – potentially around $150 million. As of November 2018, SERS has yet to report its carried interest for 2017.

Figure 23: Texas County & District Retirement System Reporting of Carried Interest

TABLE 8: INVESTMENT MANAGERS' FEES
YEAR ENDED DEC 31, 2017

ASSET CLASS	FEES PAID FROM THE PENSION TRUST FUND[1]		FEES NETTED AGAINST RETURNS		FAIR VALUE AT DEC. 31, 2017
	MANAGEMENT FEES	PERFORMANCE FEES	MANAGEMENT FEES	PERFORMANCE FEES	
Equities	$9,209,371	$6,337,395	$3,502,415	-	$11,589,598,530
MLPs	4,334,337	-	-	-	916,335,125
REITs	3,818,201	-	-	-	679,400,147
Investment-Grade Bonds	2,308,108	-	-	-	
Commodities	1,348,862	-		-	
High-Yield Bonds	1,661,396	-		-	
TIPS	174,391	-		-	-
Cash & Equivalents	-	-	-	-	377,074,344
ALTERNATIVE INVESTMENTS	**MANAGEMENT FEES**	**PERFORMANCE FEES**	**MANAGEMENT FEES**	**GENERAL PARTNER CARRIED INTEREST**	**FAIR VALUE AT DEC. 31, 2017**
Private Equity	122,550	-	67,653,157	153,335,839	3,755,136,247
Private Real Estate Partnerships	2,842,564	-	13,909,659	9,886,232	625,488,282
Hedge Funds	-	-	82,246,313	64,350,861	6,590,822,320
Opportunistic Credit	-	-	18,473,366	44,240,621	1,979,344,663
Distresses Debt	-	-	8,013,374	13,791,946	
Direct Lending	-	-	10,947,248	5,377,591	
TOTAL	**$25,819,780**	**$6,337,395**	**$204,745,532**	**$290,983,090**	

Note: Fair value similar to SERS portfolio of $4 billion

Equals 1.8% compared to 1.6% at SERS

Potential scale of fees not being reported by SERS

[1] See Nondepartmental Managers' Fees on page 51.

Source: Texas County & District Retirement System

Estimating Total Fees & Costs: As discussed previously, SERS and PSERS have not historically reported carried interest payments. The Commission requested various documents in order to develop an estimate of total fees and costs for investments made by SERS and PSERS, including carried interest for private market investments. These requests intentionally only included private market investments entered into within the past five years in order to make fulfilling the request manageable. Among the information requested, as specifically worded, included:

- Quarterly contribution/distribution reports and annual performance reports for private market investment contracts entered into within the past five years.
- The applicable offering document(s)/side letter(s)/investment management agreement(s) outlining the terms of the investment arrangement for each investment made within the past five years.
- A copy of the most recent invoice showing the fee calculation (for private equity/real estate/ infrastructure/etc., please additionally provide a copy of the capital statement showing the carry calculation and a copy of the ILPA report) for each investment made within the past five years.

The information was either not provided, revised from its original format, redacted, or would only be provided upon executing a non-disclosure agreement. As a result, Dr. Ludovic Phalippou was engaged to conduct an independent analysis of fees, costs, and performance for the private equity investments of SERS and PSERS. Dr. Phalippou is a recognized expert on private equity who has developed methodologies to estimate fees, costs, and performance in private equity. He was able to provide an estimate of management fees, expenses and carried interest using only limited information on the individual investments of SERS and PSERS conservative fee terms based on industry norms. Please see Appendix I for additional information on how Dr. Phalippou conducted his analysis.

The following is a breakdown of the $12.4 billion of estimated total fees and costs for private equity incurred by SERS and PSERS that was presented to the Commission by Dr. Phalippou on September 20, 2018:

Figure 24: Private Equity Fees and Costs at PSERS and SERS

PRIVATE EQUITY FEES	MGT FEES YEARS 1-5	MGT FEES YEARS 6-10	PORTFOLIO COMPANY FEES	OTHER FUND EXP	CARRIED INTEREST	TOTAL FEES / COSTS / EXPENSES
PSERS (since 1985)	2,376.0	1,625.5	215.0	412.0	2,873.0	7,501.5
SERS (since 1980)	1,392.8	984.8	114.4	237.2	2,179.6	4,908.8
TOTAL	3,768.8	2,610.3	329.4	649.2	5,052.6	12,410.3

Source: Dr. Ludovic Phalippou analysis using PSERS and SERS data

PSERS Estimates: PSERS in its October 2018 Board Presentation on Carried Interest – which covered private markets (comprising the private equity estimates discussed previously), private credit, and real estate – reported total management fee offsets of **$220 million**, other fund expenses of **$875 million**, in addition to the carried interest of **$5.17 billion**, all of which have been previously unreported.

Figure 25: Excerpt from PSERS Carried Interest Presentation

EXCERPT FROM PSER'S CARRIED INTEREST PRESENTATION

Private Markets, Private edit, Private Management Fees, Carried Interest & Other Expenses (Dollars in Millions)

2016 Calendar Year	Mgt Fees	Offsets	Net Mgt Fees	Other Fund Exp[2]	Total Direct Exp. of Managing Partnership	Total Dollars Earned Incl. Carried Interest	Carried Interest [1]	Net Dollars Earned to PSERS	Carry as % of Gross
Private Markets	$ 141	$ (19)	$ 122	$ 38	$ 150	$ 1,154	$ 294	$ 860	25.48%
Private Credit	51	(1)	50	24	74	490	73	417	14.89%
Private Real Estate	60	(5)	55	17	72	647	118	529	18.24%
TOTAL	$ 252	$ (25)	$ 227	$ 79	$ 296	$ 2,291	$ 485	$ 1,806	21.17%

2017 Calendar Year	Mgt Fees	Offsets	Net Mgt Fees	Other Fund Exp[2]	Total Direct Exp. of Managing Partnership	Total Dollars Earned Incl. Carried Interest	Carried Interest [1]	Net Dollars Earned to PSERS	Carry as % of Gross
Private Markets	$ 138	$ (26)	$ 112	$ 47	$ 159	$ 1,724	$378	$ 1,346	21.93%
Private Credit	59	(2)	58	23	81	523	89	434	17.00%
Private Real Estate	57	(30	54	16	70	853	202	651	23.68%
TOTAL	$ 254	$ (31)	$ 224	$ 86	$ 310	$ 3,100	$669	$ 2,431	21.58%

198-2017 (Inception to Date as of 12/31/17)	Mgt Fees	Offsets	Net Mgt Fees	Other Fund Exp[2]	Total Direct Exp. of Managing Partnership	Total Dollars Earned Incl. Carried Interest	Carried Interest [1]	Net Dollars Earned to PSERS	Carry as % of Gross
Private Markets	$ 2,359	$ (214)	$ 2,145	$ 466	$ 2,611	$ 19,221	$ 3,223	$ 13,387	19.41%
Private Credit	334	(6)	328	149	477	3,028	364	2,187	14.24%
Private Real Estate	Not Collected	Not Collected	1,085	260	1,345	11,594	1,583	8,666	15.45%
TOTAL			$ 3,558	$ 875	$ 4,433	$ 33,842	$ 5,179	$ 24,239	17.58%

Not previously reported | Previously reported

Source: PSERS

It is encouraging and commendable that PSERS recently reported its estimate of these costs (see above), for the first time, to the Board and posted the report online. Given that a number of the investments are decades old, even the amounts provided by PSERS – like those provided by Dr. Phalippou – are estimates. There are a number of assumptions embedded in both cost estimates.

At the same time, and acknowledging that practices and norms are changing rapidly, it is troubling that these costs – carried interest amounting to $5.17 billion over nearly 40 years ($1.15 billion from the past two years alone) – were not regularly reported to the Board, the fiduciaries of the Plan, and that SERS has not yet been reported on them to their Board. These amounts are all "significant investment-related costs" and necessary to determine gross and net performance as described by the GASB.

As to public reporting of carried interest, as numerous witnesses testified, until there is widespread and uniform reporting of these costs, the asset managers – rather than the asset owners – will continue to have the upper hand in pricing. As Dr. Monk testified, "by minimizing the importance of fees and costs and keeping them a secret from the public, we've allowed our pension organizations to go under-resourced. And we've allowed the for-profit asset management industry to enjoy an incredible advantage at the expense of this critical social welfare institution: the American public pension plan."

It is true that as yet there are more public funds not reporting these costs than reporting them. But, again, practices are rapidly changing and the trend is toward disclosure, especially among leading funds, where the evolving best practice is disclosure. Increased adoption of the ILPA reporting template described later in this report will show that these numbers are in fact "separable." They should be reported.

Summary of Practices

The following table provides summary information on the transparency practices of SERS and PSERS compared to other pension funds and investment boards on several topics.[12]

WHAT ARE GASB STATEMENTS 25 & 67?

The Governmental Accounting Standards Board (GASB) issued Statement No. 25 in 1994, which provided financial reporting standards for defined benefit pension plans. Statement 25 required reporting of "total investment expense, separately displayed, including investment management and custodial fees and all other significant investment-related costs." A footnote in the statement elaborates that "Plans are not required to include in the reported amount of investment expense those investment-related costs that are not readily separable from (a) investment income (the income is reported net of related expenses) or (b) the general administrative expenses of the plan." Pension funds have used the ambiguity in the interpretation of "readily separable" to not report carried interest withheld by investment managers, as carried interest payments are often netted from investment proceeds.

The GASB issued Statement 67 in 2012 which – among other substantial revisions -- updated the requirements for disclosure of investment expenses previously contained in Statement 25. As CEM Benchmarking described in its 2015 report *The Time Has Come for Standardized Total Cost Disclosure for Private Equity*, GASB Statement 67 does not explicitly provide a list of exclusions from reporting, such as carried interest. Additionally, "readily separable" was changed from the previous reporting requirements to simply "separable." The import of this change could be interpreted that the ease of identifying fees should not be a consideration in whether or not they are reported.

The GASB implementation guides for Statements 25 and 67 further provide that "The purpose of this requirement is to help users of the pension plan's financial statements assess both gross and net investment income." A comprehensive reporting of carried interest and other fund costs are necessary to determine the gross investment income.

Finally, it should be noted that both GASB Statements 25 and 67 direct the reporting of "significant investment-related costs."

(12) Not only do transparency practices vary among pension funds and investment boards in what information is provided, the ease of accessing the information can also vary greatly. For example, some funds may provide detailed quarterly performance reports in an easy to locate section of their websites. Other funds may produce the reports, but they may be tucked in a 500 page board report. The table was developed to show information could be readily identified, therefore, this should not be viewed as an all-inclusive analysis of transparency practices.

Figure 26: Transparency Practices among Peers

CATEGORY	SERS	PSERS	Examples of Funds/Boards Providing
Comprehensive Package of Board Meeting Materials	Not Provided	Not Provided	Alaska Permanent Fund Alaska Retirement Arizona SRS CalPERS CalSTRS Florida SBA Montana Board of Investment Nebraska Inv. Council New Mexico State Inv. Council North Dakota State Inv. Council North Carolina Teachers & State Oregon PERS Rhode Island South Carolina South Dakota Texas ERS Texas Teachers Wisconsin State Inv. Board
Live Stream, video, audio, and/or transcripts of Board Meetings	Not Provided	Not Provided	CaPERS CalSTRS Florida SBA Illinois Municipal Massachusetts Pension Reserve Montana New Mexico State New Mexico Public Employees Oregon PERS South Carolina Tennessee Consolidated Texas ERS Texas Teachers
Performance reported per manager	Not provided, returns by asset class posted quarterly.	Not provided, returns by asset class posted quarterly. Alternative Investments reported separately per manager, see below	Alaska Permanent Fund Alaska Retirement Arizona SRS Louisiana School Employees Michigan Public Schools Minnesota State Board of Investment Montana Board of Investment Nebraska Inv. Council New Mexico State Inv. Council New York State Teachers North Dakota State Inv. Council North Carolina Teachers & State Rhode Island Washington PERS
Detailed performance reports of alternative investments, including PME metrics	Reporting of commitments, contributions, and distributions provided annually. Performance and PME metrics not provided	Reporting of commitments, contributions, and distributions provided annually. Asset class performance and per manager PME metrics not provided	Connecticut Los Angeles County Employees Retirement Association, New Mexico Education Retirement Board Nebraska Investment Council New York City Employees
Fee Terms	Not provided	Public markets included in contracts posted on Treasury's e-Contract website	Louisiana New Jersey (new investments) Nebraska Investment Council Rhode Island South Dakota (management only)
Asset Management Fees Per Manager	Fees reported by manager	Fees reported by manager	Connecticut Illinois Municipal Illinois Teachers Louisiana School Employees Maryland Minnesota Public Employees Missouri State Employees Missouri Teachers Nebraska Investment Council Nevada Regular Employees New Mexico State Investment Council New York City Teachers North Dakota State Investment Board North Carolina South Carolina
Carried Interest Reported	Not historically reported, nor tracked internally.	Not historically reported. Reported per asset class in October 2018	Arizona CalPERS CalSTRS South Carolina Missouri Rhode Island Texas County

Source: Analysis of pension fund investment board websites.

The Institutional Limited Partners Association (ILPA)

Investment fee transparency has been particularly absent in alternative investments. For all of the reasons noted above, this is to the detriment of asset owners. Alternative investment managers, referred to as general partners, benefit from this opacity. In fact, it has been noted by SERS and PSERS staff and by several witnesses that the investment managers currently hold more power than asset owners when negotiating terms of many alternative investment partnership agreements. As a result, and in the best interests of the industry, the Institutional Limited Partners Association (ILPA) has developed a reporting template shown in Appendix I to facilitate more transparency between general partners and their limited partners. It is a standardized way for general partners to report all fees and costs associated with investments by their limited partners.

The ILPA reporting template has unique characteristics that provide mutual benefits to investment managers and pension fund management/staff. The ILPA reporting template was developed by a network of limited partners (investors in private equity, such as pension funds) in response to concerns with inconsistent reporting by the general partners (investment managers). A survey of the ILPA membership conducted in 2015 found that "52% of institutions had created custom templates to capture fee and expense information beyond what was being provided in standard GP reporting packages."[lv] From the perspective of the general partner, producing numerous variations of customized quarterly reporting for numerous limited partners can be burdensome and inefficient.

> ***When we have examined how fees and expenses are handled by advisers to private equity funds, we have identified what we believe are violations of law or material weaknesses in controls over 50% of the time.*** - Spreading Sunshine in Private Equity, May 6, 2014, speech by Andrew Bowden, Director, Office of Compliance and Examinations, U.S. Securities and Exchange Commission.

These concerns were heightened by findings from the United States Securities and Exchange Commission (SEC) that general partners had engaged in "violations of law or material weakness in controls over 50% of the time."[lvi] In an interview with *The New York Times*, then director for the SEC's office of compliance inspections elaborated: "These investors may be sophisticated and they may be capable of protecting themselves, but much of what we're uncovering is undetectable by even the most sophisticated investor." [lvii]

The Commission heard from Lorelei Gray, who was instrumental in developing a comprehensive reporting framework while working for the state of South Carolina. South Carolina had been recognized as an early adopter and leader in its transparency of reporting of fees – receiving both positive and negative recognition. By including a more comprehensive accounting of fees in alternative investments, the fund faced criticism for being higher cost than its peersl[viii]. Other funds have referenced the negative attention of South Carolina as a rationale to continue reporting a minimal level of fees and costs. The consistent use of a standardized reporting framework should put all pension funds on a level playing field. This is part of the benefits of the ILPA reporting template.

Jennifer Choi of the ILPA testified that the approximately 480 organizations that are members of the ILPA (including SERS, PSERS, and Pennsylvania Treasury) represent greater than 50% of private equity assets under management. General partners that have publicly endorsed the template represent 26% of private equity assets under management. Many of these managers invest for SERS and PSERS, including Advent International, Apollo, Blackstone, Bridgepoint, Hellman & Friedman, Oaktree, Permira, and TPG. SERS and PSERS have committed approximately $6 billion to managers that have endorsed the ILPA template.[13]

The ILPA also estimates that over 300 managers provide the ILPA reporting template to investors requesting its use. It is reasonable to expect that SERS and PSERS have committed funds to several of these managers and

(13) Calculations based on 6/30/17 consultant reports and ILPA GP template endorsers as of November 6, 2018 listed at https://ilpa.org/reporting-template/template-endorsers/.

that they would agree to utilize the reporting template if simply asked.

PSERS should be commended for its acceptance of the ILPA template. In its response to the Commission, it elaborated that "PSERS added a side letter provision to all new funds about a year and a half ago requiring the investment manager to utilize the ILPA reporting template as part of their reporting package to PSERS."

When asked about its implementation of the ILPA template, SERS responded that "earlier this year, the Board passed a motion to direct SERS' Investment Office to **request** from general partners/managers of private equity funds to adopt and complete the ILPA fee disclosure template" (emphasis added).

The ILPA has made significant progress on its efforts to promote enhanced uniform practices to improve the quality of reporting and disclosures. The ILPA reporting template can help SERS/PSERS and other investors improve investment fee transparency. General partners have generally embraced the ILPA template, and future investments in alternatives should require this standardized transparent report and the information should be evaluated, aggregated and shared publicly.

Recommendations

Although nothing precludes the Funds from implementing the following recommendations on their own, we recommend that the General Assembly act to require full public disclosure of fee and performance data by the funds through legislation, to institutionalize and make permanent these practices.

Transparency of decision-making processes:

- We recommend that complete board materials be posted on each system's public websites, including manager presentations with proposed fee terms, no less than one week before each board or investment committee meeting, and that materials remain online for a period of seven years.
- We recommend that each public board and committee meeting be live streamed and video and audio recordings of public board proceedings be published and archived.
- We recommend that all investment marketing ("pitch") materials, investment agreement terms, including side letters, related to fees, costs, expenses, performance and risk be publicly available, that fee terms not be redacted in contracts posted to e-contracts website, and that both retirement systems utilize a common standard checklist for transparency issues when evaluating managers (see Appendix I for sample).
- We commend the Systems for disclosing investment policy guidelines and asset allocation plans as well as other statements of their processes, and we recommend that they continue.

Transparency of performance reporting:

- We commend the Systems for disclosing total fund performance and performance of certain asset classes relative to benchmarks, and recommend that they continue to do so.
- We recommend that both retirement systems publish net-of-fee and gross-of-fee returns when reporting investment performance, and that the General Assembly consider enacting legislation to require that.
- We recommend that, to facilitate understanding by stakeholders and policymakers, each fund should report total fund performance against a risk-appropriate and commonly understood reference portfolio benchmark as Rhode Island, such as a global 60/40 or 70/30 index, with and without leverage if used, and for one, three, five, seven, ten, fifteen, twenty, and twenty-five year periods, as well as year by year.
- We recommend that both retirement systems publish returns, costs and fees of individual investments relative to a similar risk public markets alternative, on a levered and unlevered basis.

- We recommend that returns of internal investments are reported in the same manner as other investments – by investment, by asset class, by vintage year (if appropriate) and as a portfolio – on a levered and unlevered basis.

- We recommend that performance reports for the two retirement systems also include a rolling 3- and 5-year return comparison in graphic form, and annual returns for the last 5 years, in addition to the returns over 3-, 5-, 10-, 15-, and 20-year periods ending at the current period, in situations where they do not do so already.

- We recommend that both retirement systems publicly post detailed quarterly portfolio performance reports received from general consultants, with per-manager returns versus benchmarks, and alternative investment performance reports received from specialty consultants, including public market equivalent (PME) values for each individual fund/manager based on a board-approved index.

- We recommend the General Assembly repeal statutory provisions within the two retirement codes that permit both retirement systems to shield investment performance, risk and expense information from public disclosure pursuant to a Right-to-Know Request. Specifically, 71 Pa. C.S.A. § 5902 (e) and 24 Pa. C.S.A § 8502 (e).

- We recommend the General Assembly enact legislation that designates all retirement system records related to investment performance, risk and expense information as public records, using Arkansas (broadly identifying "all records" kept by the retirement system as open to the public), Nevada (declaring "books of the retirement system" are public records), Texas (affirmatively listing most all investment records as "not exempt from disclosure"), and, New York (mandating "records of the retirement system" as public) as examples of model legislation.

- At a minimum, we recommend the General Assembly enact legislation that would apply the provisions of the Public School Employees' Retirement Code (24 Pa. C.S.A § 8502 (e)(5)), which designates valuation and expense information related to alternative investments as public records, to SERS' alternative investments. Inexplicitly, SERS is presently not subject to this disclosure requirement.

<u>Transparency of fees, costs, and expenses</u>:

- We recommend that both retirement systems require all external managers to use the ILPA template. We commend PSERS for its policy, and urge that it be continued, and recommend that SERS also require, rather than request, this of managers.

- We recommend that both retirement systems publicly disclose all travel or other expenses incurred by staff and paid for by an external investment manager, fund or consultant.

- We recommend that both retirement systems utilize and report information from the ILPA template for each manager for the public reporting of fees, costs, and expenses of its alternative investments, including carried interest. In addition, we recommend that the General Assembly consider enacting legislation to require that information be reported in this manner. For traditional investments, we also recommend that the Systems publish investment management fees, costs, and expenses both by manager and aggregated by asset class, separately identifying base management, performance/carried interest, and other expenses (as reported by CalPERS, Missouri, and South Carolina). In addition, we recommend that the General Assembly consider enacting legislation to require the publication of this information.

- We recommend that policymakers and stakeholders should be prepared and willing to defend the systems against false comparisons that may be made as a result of increased transparency on fees. Increased disclosure comes with a risk of unflattering but also unfair comparisons to less transparent systems. The solution is not to avoid transparency, but for policymakers to avoid "penalizing" Pennsylvania's funds for doing the right thing.

Final Report and Recommendations:

PUBLIC PENSION MANAGEMENT AND ASSET INVESTMENT REVIEW COMMISSION

PORTFOLIO IMPLEMENTATION

III. Portfolio Implementation

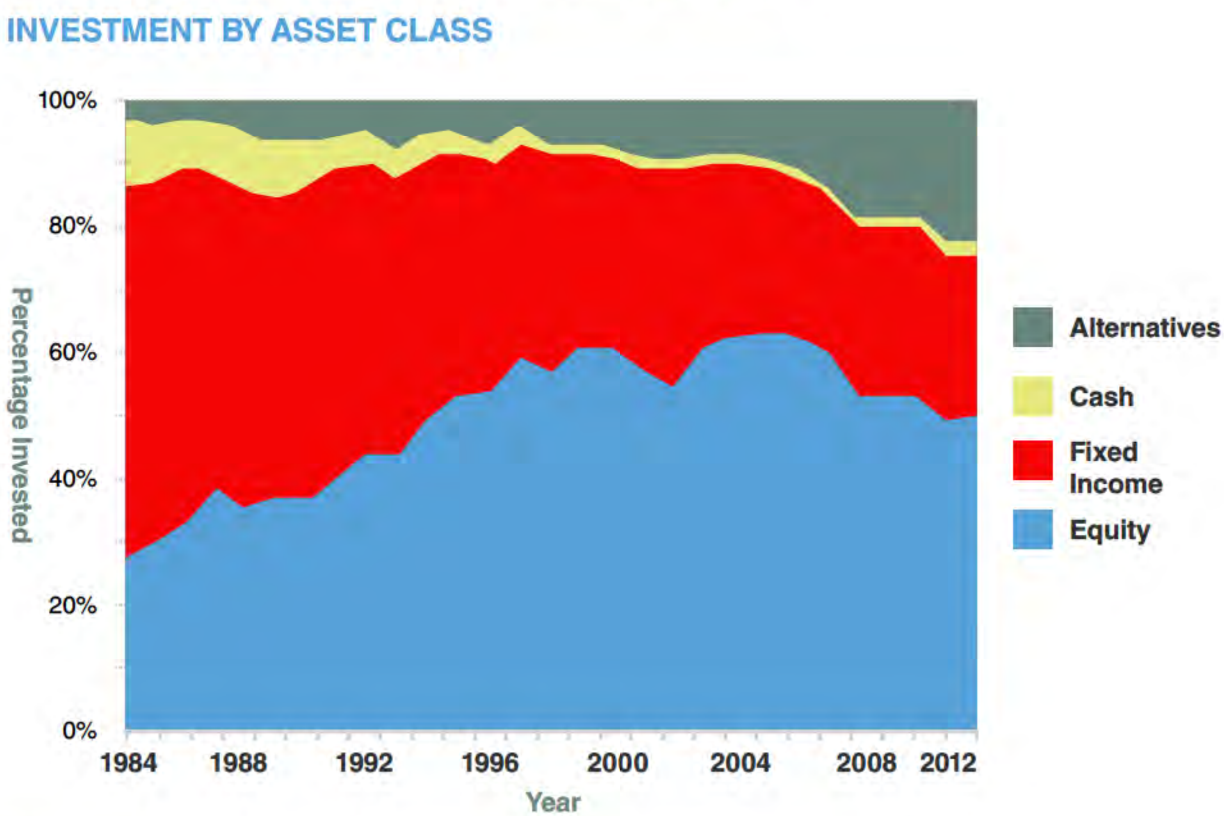
Portfolio implementation is the process by which a board manages the investment portfolio, both directly as well as through responsibilities delegated to investment staff and consultants.

Portfolio Design – Risk Constraints and Portfolio Allocations

Risk Tolerance. The most important role for any board is to establish a risk budget: the level of volatility, loss, and illiquidity that is tolerable in the investment portfolio. Just as an 80-year-old's portfolio needs more liquidity and lower risk than does a young person's with a steady income, each pension system's risk budget will depend on their cash needs. Stress tests, as discussed in a prior chapter, are the most useful analyses for determining appropriate limits. While the employer has an obligation to fund the pension benefits even if investment performance is low, the board has an obligation to consider the risk to the pension beneficiaries of its reliance on funding that has historically been unreliable. Reverse stress tests determine what levels of downside risk, volatility and illiquidity might cause funding levels to cross a threshold percent or cause contributions to increase past a given threshold level.

U.S. public pension portfolios, in general, have opted for portfolios with a greater percentage of return-seeking assets today than in years past as seen in the following chart:

Figure 27: U.S. Public Pension Plan Investments in Risky Assets, 1984-2012



Source: Society of Actuaries, Report of the Blue Ribbon Panel on Public Pension Plan Funding.

A pension board is also responsible for limiting idiosyncratic risk in the portfolio. Idiosyncratic risk is the risk from adverse events at a specific company or investment manager. In contrast to systematic risk exposures (an investment's or portfolio's return exposure to aggregate economic events, such as a decline in a broad equity index), idiosyncratic risk can be diversified in a portfolio. Therefore, a board should limit the amount of any one idiosyncratic risk, including limits on any one security, company, manager (including internal management), industry, and non-domestic country. As the saying goes, "don't have all of your eggs in one basket."

Within these risk limits, the board of a pension fund will then establish an investment allocation aimed at maximizing the portfolio's expected return as described below. However, the starting point (and a point for performance evaluation) is the simplest, completely liquid portfolio reflective of the level of risk the board has establishedAn equity index is used for return seeking and a bond index for risk mitigating. A commonly chosen benchmark would be a 70/30 portfolio (70% in S&P 500 Index and 30% in Barclay's Aggregate Bond Index),[14] but it might also be 60/40 or 75/25 depending on the established risk tolerance.[lix] This choice is the board-determined simple portfolio benchmark. Below is a table showing a calculation (described in a footnote) of how SERS' and PSERS' assets divide into return-seeking versus risk-mitigating. Note that because PSERS uses leverage, as will be discussed below, their numbers do not sum to 100%.

Figure 28: Return-Seeking v. Risk-Mitigating Assets, SERS and PSERS[15]

	RETURN SEEKING	RISK MITIGATING
SERS – December 2017	78.6%	21.4%
PSERS – June 2018	79.7%	32.7%
	89.3% if include high yield as risk seeking	23.1% if include high yield as risk seeking

Sources: RVK; Moneyline.[lx]

Asset Allocation. As financial markets have evolved, investors have tried to create more efficient portfolios (higher return without more risk) by diversifying across systematic risks beyond domestic equities and bonds. If a systematic risk exposure can be found that earns a high enough risk premium and has a low enough correlation with the rest of the portfolio, then a portfolio's characteristics will improve with some exposure to it. Within its risk budget, the board determines how to diversify across additional asset classes and systematic risks by establishing a target investment allocation.

There are several considerations when adopting an investment allocation. The first consideration is what constitutes a legitimate sustainable systematic risk justifying a separate portfolio allocation, as this is still an area of current academic study and debate. International, currency, and real estate exposures have data supporting their inclusion in a portfolio.[lxi] There is less consensus on exposures to commodities, lower grade credits, private equity and private debt markets, market capitalization or style biases. Thousands of indices have been created to attempt to generate returns from specific systematic risk without bearing idiosyncratic risk.

The lack of consensus on appropriate allocation categories is illustrated by how much terminology used by SERS and PSERS to describe asset classes changes. We show below that even within each system, and in the case of SERS even with the same Consultant, the categories change over short periods of time.

(14) There is no exact science for choosing which equity index or which fixed income index. The original premise of modern portfolio theory and mean variance optimization originated with a paper by Nobel Laureate Harry Markowitz in 1952 and was extended into the capital asset pricing theory by William Sharpe and others. The conclusion is that under certain assumptions, holding a share of the market portfolio (a claim on everything produced in the economy) is the efficient portfolio.

(15) Notes on table. SERS: "Risk Seeking" includes Private Equity, Global Public Equity, Multi-Strategy, 50% Real Estate, Legacy Hedge Funds. "Risk mitigating" includes 50% Real Estate, Fixed Income, Cash. It is unclear how safe real estate and fixed income assets are. PSERS: Use of leverage and the risk parity category makes this very difficult to calculate precisely for PSERS. Using allocations as reported in the Moneyline Report June 2018, there is 32.7% in fixed income (9.6% is in credit related, much of which is illiquid), 12.4% net leverage, which leaves the other assets (equity, risk parity, real assets – 24.4%, absolute return) at 79.7%. The risk parity category is itself leveraged, so these numbers are likely underestimating exposure.

Figure 29: SERS Allocation Categories

DEC 2012 – RVK REPORT	DEC 2017 – RVK REPORT
Alternative Investments	Private Equity
Global Public Equity	Global Public Equity
Real Assets	Real Estate
Diversifying Assets	Multi-Strategy
	Legacy Hedge Funds
Fixed Income	Fixed Income
Liquidity Reserves	Cash

Sources: RVK 2013 and 2017. [lxii]

Figure 30: PSERS Allocation Categories

DEC 2012 – WILSHIRE REPORT	JUNE 2017 – AON HEWITT REPORT	JUNE 2018 - MONEYLINE
Managed US Equity	Public Equity (US Large Cap, US Small Cap, Emerging Markets, Non-US Large Cap, Non-US Small Cap)	US Public Equity
Managed US Fixed	Alternatives Hedged	Non-US Public Equity
	Fixed Income (Investment Grade, Credit Related - High Yield and Emerging)	Private (Equity) Markets
Int'l Equity	Inflation Protected	US Fixed Income
Global Fixed Income		Non-US Fixed Income
Real Estate	Real Assets (Infrastructure, Commodities, Real Estate)	Real Assets (Real Estate, Commodities, Infrastructure)
Special Investments	Risk Parity	Risk Parity
Other (Commodities, Absolute Return, MLP, Risk Parity, other)	Absolute Return	Absolute Return
Unallocated STIF	Unallocated Cash & Cash Equivalents	Net Leverage

Sources: Wilshire; Aon Hewitt, Moneyline. [lxiii]

In addition to deciding what categories of investments (and risks) to employ, a board has to weigh the complexity of different allocations. While diversification across additional systematic risk factors may be prudent, it also adds complexity and increased reliance on forecasts. After a certain threshold, the benefits from diversification are outweighed by the costs of this additional complexity. In particular, as will be discussed below, complexity associated with illiquidity must be taken on cautiously since diversification benefits decrease with illiquidity while the costs of complexity increase.

Figure 31: Index vs. State Returns[16]

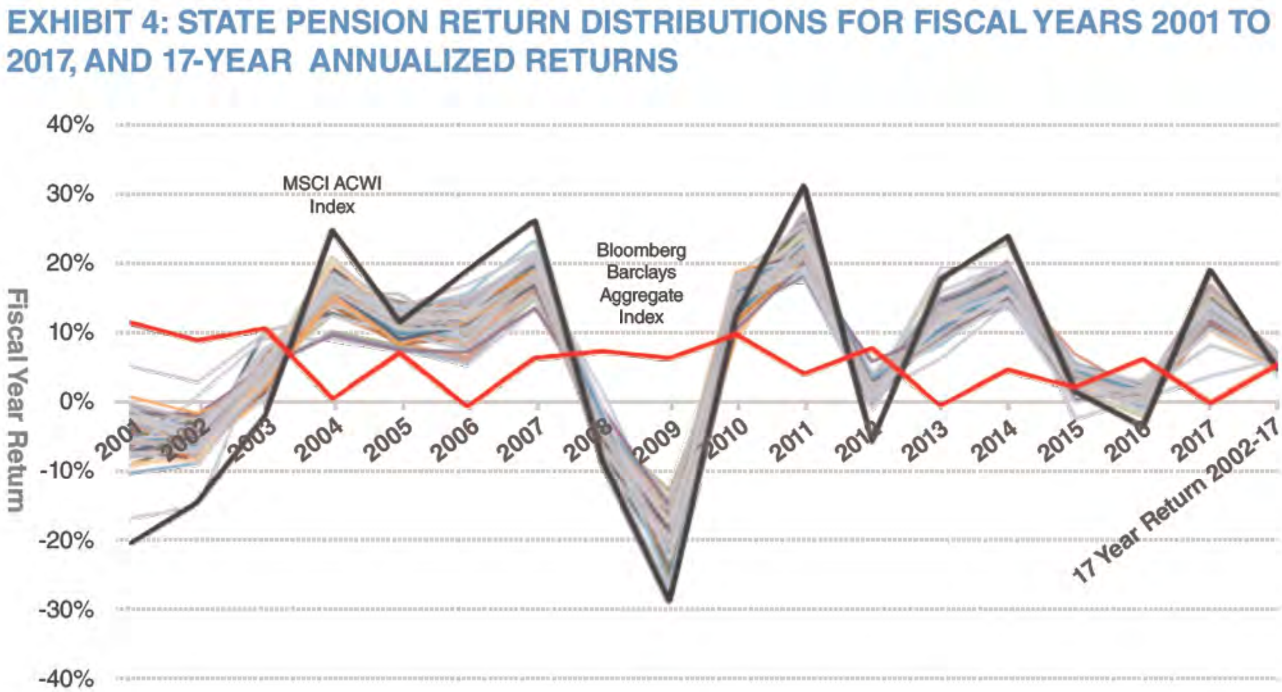


Exhibit 4 plots fiscal year-to-year returns for each of the 66 state pensions, ending with 17-year annualized return. Each line represents one state pension. Also shown are fiscal year returns for global stocks (MSCI ACWI Index) and U.S. bonds (Bloomberg Barclays Aggregate Bond Index).

Source: Cliffwater, 2018.[lxiv]

As the chart above shows, it is unclear how much pension funds have truly benefitted from adding complexity. What is clear, however, is that the skill needed to manage and monitor the portfolio properly increases (for additional information on this topic see the chapter on Cost Saving Options). As the economist and Nobel Laureate Lars Hansen explains:

> ***One argument I've heard made is that since this is a complicated problem, this requires a complicated solution. But I would argue the opposite. Because it's such a complicated problem and because there are so many things we don't understand, the best approach is to do it with simplicity and transparency and worry about fine-tuning things once our knowledge base expands.***[lxv]

A third consideration is that models used to select an allocation require assumptions about the distribution of future returns to different types of assets – at a minimum, expected returns, correlations, and covariances. But in making decisions based on models of future expected returns, buyer beware. Model outputs are only as good as the model inputs and assumptions. As an example, it is common to use a mean variance optimization model in developing asset allocation models, as the investment consultant to SERS does.[17] Consultants regularly note how sensitive the outputs of mean variance optimization are to very small changes in assumptions. RVK wrote in a recent presentation to the SERS Board:

(16) Legend: Red line is bond index, black line is stock index, lines in between are individual state returns.

(17) We use the terms asset allocation and risk allocation interchangeably even though there are important differences. Asset allocation means allocation to an asset class such as domestic equities. Risk allocation means how much risk the entire portfolio has relative to systematic risk exposures, such as movements in domestic equities, often measured as beta. This distinction is important but not meaningful for the discussion here.