

# PSERS Budget Report

Fiscal Year 2019-2020



Pennsylvania Public School Employees' Retirement System

## SECTION 3 - INVESTMENT INFORMATION

<b>Investment Policy, Objectives, Risk Management and Capital Market Assumptions.....</b>	<b>Tab 8</b>
<b>Asset Exposure and Investment Program Summary.....</b>	<b>Tab 9</b>
<b>Performance .....</b>	<b>Tab 10</b>
<b>Managing Investment Expenses and Investment Fees by Manager.....</b>	<b>Tab 11</b>
<b>Commitment to Pennsylvania-Based Investments .....</b>	<b>Tab 12</b>



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### Investment Policy

The Public School Employees' Retirement Board of Trustees (the Board) is responsible for, among other things, the formulation of an Investment Policy for the Public School Employees' Retirement System (the System). As articulated in the Public School Employees' Retirement Code 24 Pa. C.S. §8521(a), the Board and PSERS' professionals delegated with investment authority must act in a manner consistent with the Prudent Investor Standard, which requires "the exercise of that degree of judgment, skill and care under the circumstances then prevailing which persons of prudence, discretion and intelligence who are familiar with such matters exercise in the management of their own affairs not in regard to speculation, but in regard to the permanent disposition of the fund, considering the probable income to be derived therefrom as well as the probable safety of their capital." The Prudent Investor Standard recognizes modern portfolio theory and guides investment and management decisions respecting individual assets so that the trade-offs between risk and return for each asset are considered in the context of an overall investment strategy.

The System's Investment Policy Statement, Objectives, and Guidelines (the Policy), which is available at [www.psers.pa.gov](http://www.psers.pa.gov), reflects the many implications of the Prudent Investor Standard. The Board reviews the Policy regularly, and makes changes as necessary. The Policy establishes clear criteria for the management of the assets by or on behalf of the Board. For example:

- The Board, PSERS' investment professionals, investment consultants, and investment managers are assigned appropriate responsibilities and made to understand clearly the objectives and policies of the Board and the System;
- Asset-Liability studies are prepared to guide the investment of the System's assets;
- Guidelines are established for each investment category so that asset quality, diversification, and return can be monitored;
- Investment managers are given guidance and limitations on the investment of the System's assets; and,
- The Board has created a meaningful basis for evaluating the investment performance of individual investment managers, as well as for evaluating overall success in meeting its objectives.

### General Return and Risk Objectives

The System seeks to provide benefits to its members through a carefully planned and well-executed investment program, and the Policy identifies the following general return and risk objectives and constraints for its investments:

#### Return Objectives

- The assets of the System shall be invested to maximize the returns for the level of risk taken; and
- The System shall strive to achieve a return that exceeds the Policy Index.

#### Risk Objectives

- The assets of the System shall be diversified to minimize the risk of losses within any one asset class, investment type, industry or sector distribution, maturity date, or geographic location; and
- The System's assets shall be invested so that the probability of investment losses (as measured by the Policy Index) in excess of 15% in any one year is no greater than 2.5% (or two standard deviations below the expected return).

#### Constraints

- The System shall maintain adequate liquidity to meet required benefit payments to the System's beneficiaries;
- The System's assets shall be invested in a manner that is consistent with the System's long-term investment horizon; and,
- As a tax-exempt investor, the System's assets may be invested without distinction between returns generated from income and returns generated from capital gains.

## Investment Risk Management

PSERS recognizes that risk management is an essential component of a prudent investment program. The implementation of a well-defined risk management framework improves the likelihood that the System is compensated adequately for the risks taken, and helps to avoid unexpected and unintended risks. Therefore, PSERS pursues a disciplined and advanced risk management approach. Through investment policies and guidelines, PSERS defines the amount of investment risk to be taken by the System, and how it is to be measured and monitored.

PSERS has created a practical framework that enables the System to implement risk-focused investment strategies, and transparently monitor active portfolio risks and returns relative to budgets and/or specific objectives. PSERS has identified over 100 specific investment risks for modeling and analysis, and categorizes those risks into the following broad classes:

- Market
- Fund and Portfolio
- Operational
- Liquidity, Leverage and Finance
- Legal
- Organizational

PSERS’ team manages these broad classes of risk consistent with its long-term investment objectives.

Investment risk reflects the possibility that the future value of investments will deviate from targeted return objectives. This deviation often occurs as a result of changes in perception of market conditions, whether those changes

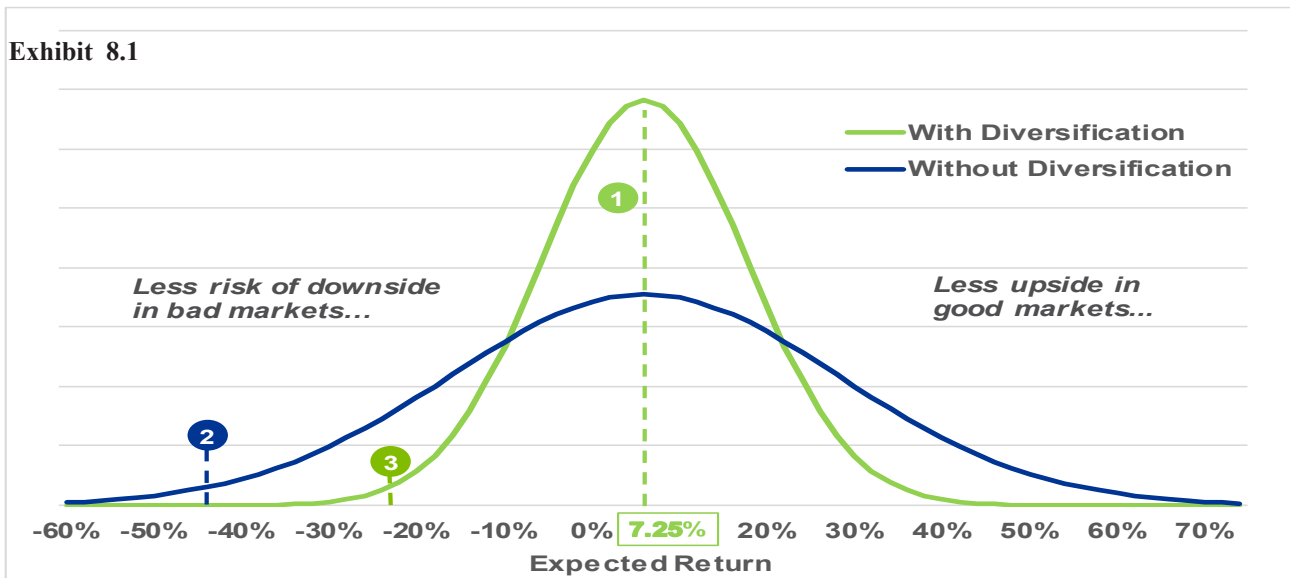
are caused by factors specific to individual investments, classes of investments or factors affecting all investments simultaneously.

The goal of investment risk management is to find the appropriate balance between expected returns and the risks taken to generate those returns. An entirely risk-free investment portfolio that has a high probability of meeting all investment goals does not exist. Therefore, PSERS does not attempt to eliminate all risk but instead seeks to limit the possibility of permanent loss. Risk itself is neither good nor bad, but it is necessary that the System expose itself to some appropriate level of risk if it is to generate the investment returns required to maintain stable and cost-effective contribution rates. In positioning for future developments, PSERS cannot know with complete certainty how markets or particular investment strategies will perform, but can understand the future as a range of probabilities, some desirable and some not, and can position its current investments to guard against undesirable outcomes and to make desirable outcomes more likely.

Given its long-term investment horizon, PSERS accepts prudent investment risk in exchange for acceptable levels of additional incremental return. PSERS diversifies across investment categories, each having different characteristics across all market environments.

The benefit of a diversified portfolio is that it reduces the probability of outsized outcomes relative to return objectives. Diversification is the only “free lunch” in finance; excess volatility is damaging to PSERS’ portfolio, while diversification is beneficial.

**Exhibit 8.1 illustrates two distributions with the same expected return. The distribution shown in blue assumes a portfolio risk of 22.5%, which reflects 100% correlations between risk factors, while the green distribution reflects the risk of PSERS’ portfolio which benefits from diversification. In the event of a negative two standard deviation move, the undiversified portfolio would experience losses more than double what the diversified portfolio would experience. In a normal distribution, the chance of a two standard deviation decline is approximately 2.3%.**



## Section 3 - Investment Information

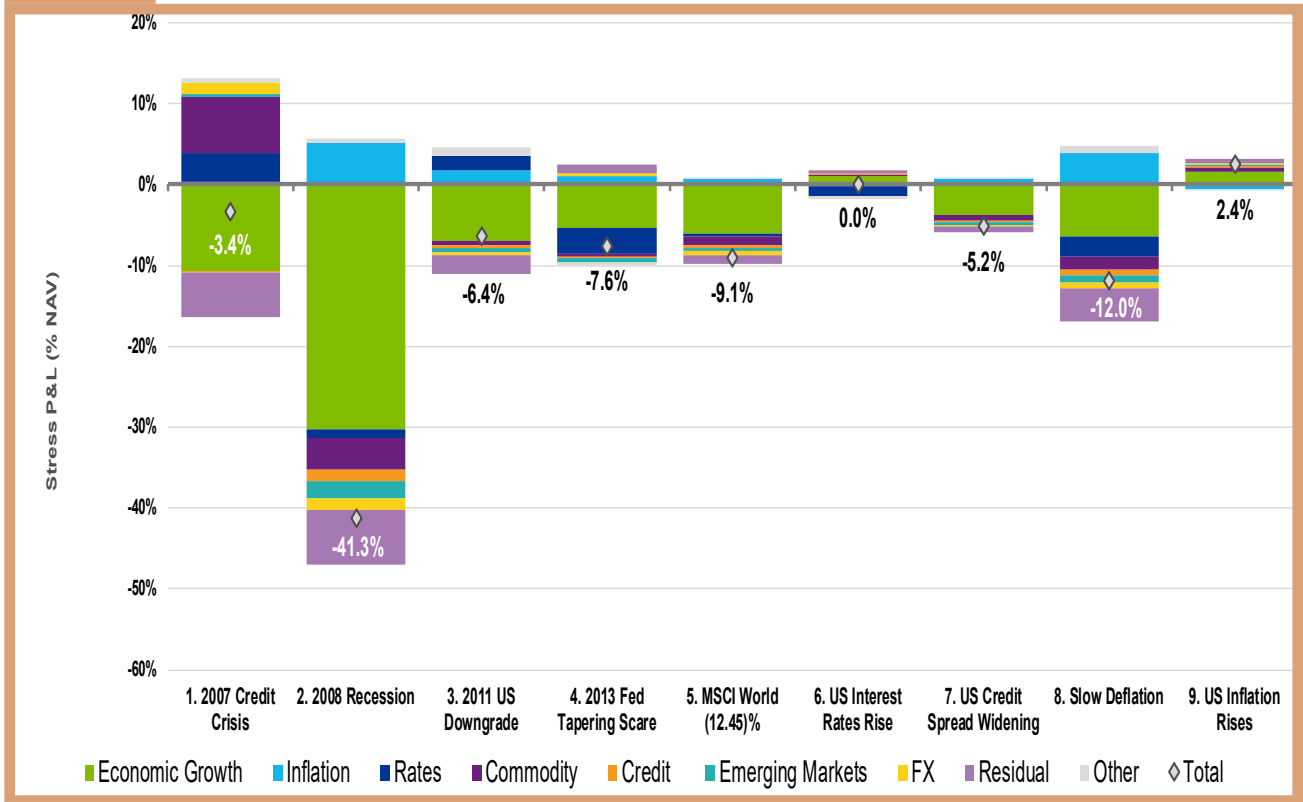
### Investment Risk Management

(continued)

One way that PSERS assesses the amount of diversification in the portfolio is through stress testing. This testing process quantifies anticipated portfolio losses under various calamitous market events. There are two types of stress tests: historical (meaningful actual past market events) and hypothetical (scenarios designed to reflect potentially calamitous market events)

Exhibit 8.2 below depicts several historical and hypothetical stress scenarios of PSERS' allocation as of June 30, 2018, and the impact of each as related to a series of common economic factors. Strategically, the exposures to each risk factor are driven by PSERS' asset allocation decisions, which could be tactically adjusted to the extent that a market event is likely, using stress scenarios to assist in these tactical decisions.

**Exhibit 8.2**



## Section 3 - Investment Information

### Capital Market Assumptions

Capital Market Assumptions (CMAs) are estimates of expected returns and risks for a given set of asset classes, and expectations of the relationship (correlations) between these asset classes over long periods of time. They are issued periodically by investment consultants, asset managers, and investment banks. Inflation, real short-term interest rates, and economic data frequently provide the foundation used by CMAs for expected returns across global asset classes. These are the primary building blocks for developing equity and fixed income returns expectations, which in turn are used in setting expectations for alternative asset class returns. PSERS collects and evaluates this information when considering its long-term actuarial rates of return assumptions and in setting its Asset Allocation Policy.

Compared to 2017, 2018 survey results under the 20-year forecast indicate a slight decrease in return assumptions across most asset classes. CMAs are forecasting slower growth and lower asset returns over the coming decade than has been experienced in past decades. Select asset classes are detailed in Table 8.1.

#### Fixed Income

Nominal government bond returns are a function of long-

term expectations for inflation and government yields. Corporate bond returns are a function of expected inflation, government yields and expectations for credit spreads, defaults and downgrades.

#### Equities

Equity return assumptions are driven by market valuations, earnings growth expectations and assumed dividend payouts:

- U.S. equity assumptions have slightly decreased as valuations have increased in recent years while Non-U.S. equities have slightly increased as valuations have decreased.

Equity market returns over the past three years have been driven by rising valuations and to a lesser extent, an increase in profits from tax cuts. A growing number of market participants worry that equities look expensive and there is an expectation for these market valuations to decline towards historical levels.

#### Real Estate

Expected returns across the global real estate markets remained in line with 2017 assumptions.

- Slightly higher initial yields are offset by expected price declines.

**Table 8.1 summarizes the average expected capital market geometric return assumptions of 20 - 30 surveyed independent investment advisors in 2014, 2015, 2016, 2017 and 2018:**

Asset Class	2014 Survey	2015 Survey	2016 Survey	2017 Survey	2018 Survey
U.S. Equity - Large Cap	7.4%	7.1%	7.9%	7.8%	7.4%
U.S. Equity - Small Cap	7.7%	7.3%	8.2%	8.4%	8.2%
Non-U.S. Equity - Developed	7.8%	7.5%	8.0%	7.6%	7.7%
Non-U.S. Equity - Emerging	8.9%	8.7%	9.1%	8.7%	8.8%
U.S. Fixed Income - Core	4.0%	3.7%	4.6%	4.4%	4.5%
U.S. Fixed Income - Long Duration Corp.	4.9%	4.0%	4.9%	4.8%	4.4%
U.S. Fixed Income - High Yield	6.0%	6.0%	6.8%	6.2%	5.8%
Non-U.S. Fixed Income - Developed	3.5%	2.7%	3.7%	3.5%	3.2%
Non-U.S. Fixed Income - Emerging	5.9%	6.0%	6.4%	6.2%	6.1%
Treasuries (Cash Equivalents)	2.7%	2.4%	3.2%	3.2%	3.1%
TIPS (Inflation-Protected)	3.5%	3.1%	3.9%	4.0%	4.0%
Real Estate	6.5%	6.3%	6.8%	6.7%	6.7%
Hedge Funds	6.3%	5.8%	6.2%	6.0%	6.2%
Commodities	4.9%	4.4%	4.8%	5.0%	4.9%
Infrastructure	7.8%	7.1%	7.1%	7.1%	7.1%
Private Equity	9.8%	9.5%	10.3%	10.1%	9.5%
Inflation	2.4%	2.2%	2.3%	2.4%	2.5%

## Section 3 - Investment Information

### Capital Market Assumptions (continued)

#### Hedge Funds

Hedge Fund assumptions reflect changes in the underlying equity, fixed income and cash capital market assumptions. Slight increases in the hedge fund assumptions reflect rising expectations for cash.

An alternative approach to asset allocation that is sometimes suggested to pension plans is to establish a stereotypical 60% equity/40% fixed income policy that remains static over time. Tables 8.1 and 8.2 illustrate one reason why such an approach would not be prudent. Because PSERS can select from a broad array of asset allocation alternatives, we can analyze alternative allocation strategies using asset

classes with varying expected returns and expected risk in order to formulate an optimal asset allocation policy most likely to achieve the investment return and investment risk goals established by the Board. In recent years, lower risk projections have afforded PSERS valuable flexibility in identifying different combinations of asset allocations that can achieve our current long-term goal of 7.25% at acceptable levels of risk even as return assumptions have fallen. Furthermore, PSERS applies leverage opportunistically in implementing its asset allocation policy, providing an additional mechanism to increase expected volatility in order to target higher expected return when warranted. A stereotypical 60%/40% strategy would have precluded such flexibility and exposed the system to artificial and harmful limits on our ability to manage the Fund.

**The CMA surveys also included forecasts for 20 year average expected risk (Table 8.2). The numbers below reflect the expected standard deviation in % around the expected return.**

Average Expected Risk (2014 - 2018)					
Asset Class	2014 Survey	2015 Survey	2016 Survey	2017 Survey	2018 Survey
U.S. Equity - Large Cap	17.5%	17.1%	16.9%	16.6%	16.4%
U.S. Equity - Small Cap	21.1%	21.0%	21.0%	20.2%	20.2%
Non-U.S. Equity - Developed	19.8%	19.6%	19.5%	18.9%	18.7%
Non-U.S. Equity - Emerging	26.4%	26.6%	26.4%	25.4%	24.9%
U.S. Fixed Income - Core	5.4%	5.6%	6.0%	5.5%	5.7%
U.S. Fixed Income - Long Duration Corp.	11.3%	10.8%	10.5%	10.4%	10.8%
U.S. Fixed Income - High Yield	11.5%	11.2%	11.0%	10.6%	10.2%
Non-U.S. Fixed Income - Developed	7.6%	7.4%	7.6%	7.4%	6.9%
Non-U.S. Fixed Income - Emerging	10.9%	11.7%	11.6%	11.8%	11.4%
Treasuries (Cash Equivalents)	2.3%	2.8%	2.8%	3.0%	2.7%
TIPS (Inflation-Protected)	6.3%	6.3%	6.5%	6.3%	6.3%
Real Estate	13.1%	13.6%	14.7%	14.5%	13.9%
Hedge Funds	9.0%	8.3%	8.4%	8.0%	7.9%
Commodities	18.0%	18.0%	18.5%	17.9%	17.6%
Infrastructure	13.5%	13.1%	13.8%	14.6%	14.7%
Private Equity	24.8%	23.6%	23.1%	22.0%	22.2%
Inflation	2.1%	1.8%	1.8%	1.7%	1.8%



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## Section 3 - Investment Information

### Asset Exposure

(as of June 30, 2018)

While the Board can choose to modify its asset allocation at any time it determines that changes are warranted (for example, due to changing liquidity circumstances or opportunities in the marketplace), the Board maintains a disciplined and thorough process to establish a new asset allocation policy annually. This process begins following the Board's review and acceptance of the actuary's

annual report, as described in Tab 5. PSERS' investment professionals and general investment consultant collaborate to analyze potential asset allocations (using actuarial as well as capital market return assumptions) in order to identify those potential asset allocations that meet the long-term return and risk objectives of the Fund. The Board is then presented with alternative asset allocations with detailed analysis of probable long-term return and risk characteristics from which it will select a new Asset Allocation Policy for further implementation by staff.

Table 9.1 represents PSERS' asset exposure and target allocation plan that became effective October 1, 2017, and was in effect on June 30, 2018:

<b>Table 9.1 PSERS' Asset Exposure and Target Asset Allocation Plan</b>						
<b>(as of June 30, 2018)</b>						
<b>Asset Class</b>	<b>Market Value (in millions)</b>	<b>Percentage of Gross Asset Exposure</b>	<b>Percentage of Net Asset Exposure</b>	<b>Target Allocation %</b>	<b>Target Allocation Range</b>	
Global Public Market Equity:						
U.S. Equity	\$ 4,282.7	6.7 %	7.8 %	7.4 %		
Non-U.S. Equity	<u>7,091.2</u>	<u>11.1</u>	<u>12.9</u>	<u>11.6</u>		
Total Global Public Market Equity	\$ 11,373.9	17.8 %	20.7 %	19.0 %		
Private Markets	<u>7,727.1</u>	<u>12.0</u>	<u>14.1</u>	<u>15.0</u>		
<b>Total Equity</b>	<b>\$ 19,101.0</b>	<b>29.8 %</b>	<b>34.8 %</b>	<b>34.0 %</b>		± 10%
Fixed Income*	<b>\$ 20,532.1</b>	<b>32.0 %</b>	<b>37.4 %</b>	<b>35.0 %</b>		± 10%
Commodities*	\$ 4,274.0	6.7 %	7.8 %	8.0 %		± 4%
Infrastructure*	3,799.5	5.9	6.9	6.0		
Real Estate*	<u>5,340.5</u>	<u>8.3</u>	<u>9.7</u>	<u>11.0</u>		
<b>Total Real Asset Exposure</b>	<b>\$ 13,414.0</b>	<b>20.9 %</b>	<b>24.4 %</b>	<b>25.0 %</b>		± 10%
Risk Parity*	\$ 5,447.6	8.5 %	9.9 %	10.0 %		± 5%
Absolute Return	<u>\$ 5,643.8</u>	<u>8.8 %</u>	<u>10.3 %</u>	<u>10.0 %</u>		± 5%
<b>Gross Asset Exposure</b>	<b>\$ 64,138.5</b>	<b><u>100.0</u> %</b>	<b>116.8 %</b>	<b>114.0 %</b>		
<b>Financing*</b>	<b><u>\$ (9,249.5)</u></b>		<b><u>(16.8) %</u></b>	<b><u>(14.0) %</u></b>		+24/-14
<b>Net Asset Exposure</b>	<b><u>\$ 54,889.0</u></b>		<b><u>100.0 %</u></b>	<b><u>100.0 %</u></b>		

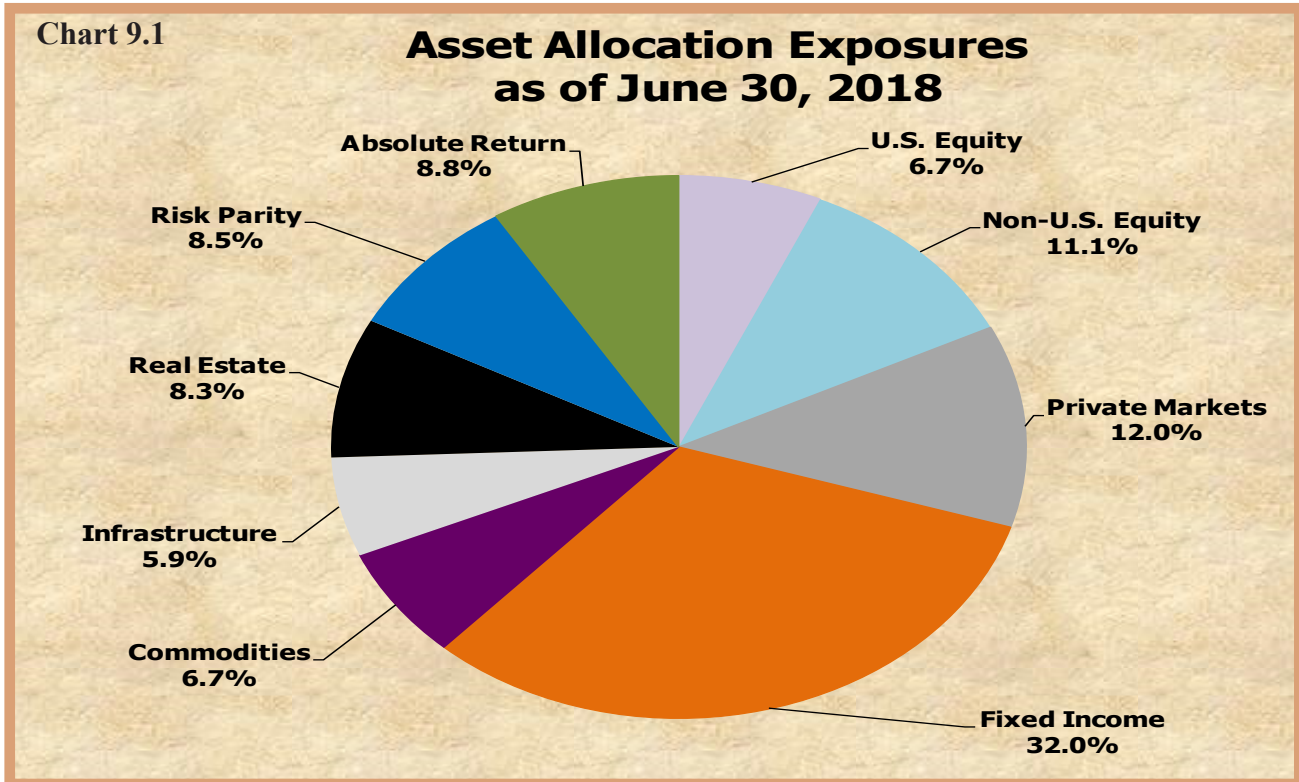
\*PSERS uses financing to achieve increased economic exposure to diversifying asset classes to manage the overall portfolio risk while maintaining an allocation designed to achieve the long-term return goals of the System. Increased economic exposure is generally achieved through the use of either derivative positions or higher volatility funds. As of June 30, 2018, PSERS had total increased economic exposure of \$9.2 billion related to the following asset classes: Fixed Income (\$5.5 billion); Risk Parity (\$0.6 billion); Infrastructure (\$0.5 billion); Real Estate (\$0.2 billion) and Commodities (\$2.4 billion).

Note: PSERS' asset allocation was updated October 1, 2018, and is available for review at <http://www.psers.pa.gov>.

**Section 3 - Investment Information**

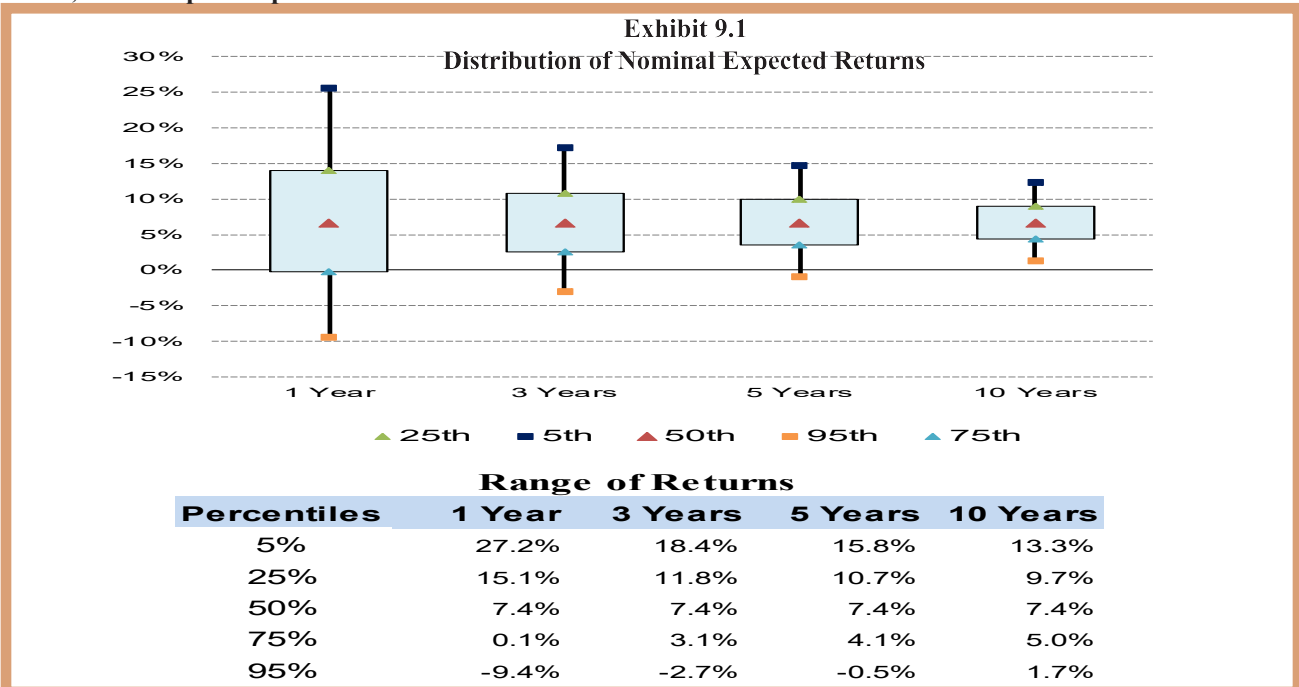
**Asset Exposure**  
(continued)

Chart 9.1 illustrates PSERS' asset allocation exposure as of June 30, 2018:



Note: Financing represents a negative 16.8% allocation and is not reflected in Chart 9.1.

The purpose of the asset allocation is to meet the long-term investment objectives of the System. PSERS considers the expected range of returns for 1, 3, 5, and 10 year periods of various alternative asset allocations (as seen in Exhibit 9.1) to select the optimal asset allocation annually. While the range of returns can be high for any single year, volatility will decrease and converge around a median return over time. This is demonstrated in Exhibit 9.1 below, which depicts expected future returns for PSERS' current asset allocation:



Source: Aon Hewitt's 30-year capital market assumptions as of June 30, 2018.

## Public Market Global Equity Investments

Public Market Global Equity includes both U.S. Equity and Non-U.S. Equity investments. PSERS' investment plan diversifies equity investments and balances equity management styles. Equities are utilized by the Fund primarily because their expected large return premiums versus inflation will, if realized, help preserve and enhance the real value of the Fund over long periods of time. Equities tend to perform well when economic growth is stronger than expected or inflation is lower than expected. The Public Market Global Equity Exposure asset class is managed on a total return basis.

Equity investments consist almost entirely of publicly-traded securities listed on major world-wide stock exchanges or derivatives such as swaps or listed futures that replicate the performance of equity indexes such as the S&P 500 Index. Swaps and futures are employed by PSERS to equitize cash.

PSERS' Asset Allocation targets a current allocation of 19.0% of assets to Global Public Market Equity. PSERS contracts with external investment managers and also uses internal portfolio managers to manage Public Market Equity portfolios.

## Private Market Investments

Private Market investments provide the opportunity to negotiate and set a price between the owner of a business and the buyer/investor in a private fashion. There exists a very large private economy of companies with various needs (for example, operating expertise, capital to grow their businesses, an exit out of family businesses, etc.). In public equity markets, thousands of buyers and sellers set prices of securities issued by companies every day, however no such mechanism exists in the private markets. Thus, private markets provide fertile grounds for investing.

For the Private Markets investment program, PSERS' long-term investment objective is to achieve a risk-adjusted total return, net of fees, that exceeds market returns for similar investments. The primary vehicle used to invest funds in this asset class is the limited partnership. Individual management groups selected by PSERS form these partnerships for the purpose of investing in and managing private equity and unlisted-subordinated debt positions on behalf of PSERS and other limited partners. PSERS' Asset Allocation currently targets an allocation of 15.0% to Private Market investments.

As an example of PSERS' private markets success, PSERS has modeled, in Table 9.2, what its returns would have been if, instead of investing in Private Equity, the cash flows into/out of Private Equity investments were made into/out of a very low cost mutual fund that seeks to replicate the global equity market. PSERS chose the Vanguard Global Equity Fund (VHGEX) due to its low cost (currently 0.03%) and its success at closely matching the returns of the global stock market. Private Market Investment sub-asset classes include:

**Private Equity** involves investments in private companies which normally do not have technology risk associated with traditional venture capital investments. It has evolved to include the financing of more mature, profitable companies that do not have access to, or qualify for, public equity and debt funding.

**Table 9.2 reflects the more recent total returns for the past 10 years (through March 31, 2018) for PSERS' Private Equity Program, the MSCI World Net Total Return USD Index, a global equity index, and the Vanguard Global Equity Fund (VHGEX).**

Table 9.2 10 Year Return Comparison	
	10 Year, Net of Fee Return (March 2008 - March 2018)
PSERS' Private Equity Program	7.40%
MSCI World Net Total Return USD Index	5.91%
Vanguard Global Equity Fund (VHGEX)	6.23%

**Venture Capital** is considered the financing of young, relatively small, rapidly growing companies. In traditional venture capital investments, companies have a 5-10 year investment horizon and develop technology for a particular market, such as pharmaceuticals, software, medical products, etc.

**Private Debt** involves investments in the secured and/or unsecured debt obligations of private and/or public companies. This debt is typically acquired through directly negotiated or competitively bid transactions. Owners of these debt instruments typically take either an active or passive role in the management of the firm.

### Private Market Investments (continued)

**PSERS Private Market Internal Co-Investment Program** consists of co-investments made alongside of General Partners with whom PSERS has a strong relationship. These relationships aid in the generation of deal flow for investments and also serve as additional due diligence for the evaluation of General Partners. The investments have the potential for higher returns as they have low or no fees and no profit sharing. This program also provides PSERS with the ability to buy secondary interests in funds from other Limited Partners usually at a discount to net asset value.

### Fixed Income Investments

**Fixed Income investments** include a wide variety of bonds and similar securities which allow PSERS to diversify Fixed Income investments and balance Fixed Income management styles. PSERS contracts with external investment managers and also uses internal portfolio managers to manage Fixed Income portfolios.

Fixed Income securities are used for a variety of purposes as follows:

*Nominal bonds* are used for their ability to serve as a hedge against disinflation and/or deflation, their general ability to produce current income in the form of periodic interest payments, and their ability to provide sufficient liquidity to meet the Fund's obligations to pay member benefits and support other investment commitments. Nominal bonds tend to do well when growth is weaker than expected or when inflation is lower than expected;

*Inflation-linked bonds* are used for their ability to serve as a hedge against inflation, their general ability to produce current income in the form of periodic interest payments, and their ability to provide sufficient liquidity to meet the Fund's obligations to pay member benefits and support other investment commitments. Inflation-linked bonds tend to do well when growth is weaker than expected or when inflation is higher than expected; and

*High yield securities and emerging market bonds* are used for their ability to generate high current income in the form of periodic interest payments as well as offering greater total return opportunities than high grade debt. High yield securities and emerging market bonds tend to do well when growth is stronger than expected.

PSERS' Asset Allocation targets a current allocation of 35.0% of assets to Fixed Income, 9.0% of which is designated to Investment Grade, 11.0% of which is designated to Credit-Related, 15.0% of which is designated to TIPS strategies. A 3.0% allocation to Cash is included in the (14)% allocation to Financing.

### Commodity Investments

**Commodity investments** such as gold, oil, and wheat are utilized by the Fund for diversification within the portfolio and to act as a hedge against unanticipated inflation. The prices of commodities are determined primarily by near-term events in global supply and demand conditions and are positively related with both the level of inflation and the changes in the rate of inflation. However, stock and bond valuations are based on longer-term expectations and react negatively to inflation. Therefore, commodity returns have had a historically negative correlation to stock and bond returns since commodities tend to do very well in periods of rising inflation. As such, commodities, when combined with stocks and bonds, lower the risk of a portfolio. PSERS contracts with external investment managers and also uses internal portfolio managers to manage Commodity portfolios.

PSERS' Asset Allocation currently targets an allocation of 8.0% of assets to Commodity investments which includes a 5.0% target allocation to a Diversified Commodity Basket and a 3.0% asset allocation to Gold. Gold is particularly useful as a contra-currency to provide protection against the debasement of fiat currencies in periods of monetary inflation.

### Infrastructure Investments

**Infrastructure investments** target stable, defensive investments primarily within the energy, power, water, and transportation sectors. The program plays a strategic role within the System by providing steady returns and cash yields, defensive growth, inflation protection, capital preservation and diversification benefits. Historically, Infrastructure investments have performed better in environments of falling growth and falling inflation. PSERS contracts with external investment managers and also uses internal portfolio managers to manage Infrastructure portfolios.

*Master Limited Partnership (MLP)* securities, which are publicly traded on a securities exchange, avoid federal and state income taxes by meeting specific qualifications of the IRS related to the production, processing or transportation of oil, natural gas, and coal. MLP securities are utilized by the System due to their low correlation to stock and bond returns, attractive growth characteristics, and their ability to produce current income in the form of periodic distributions. MLP securities tend to do well when economic growth is stronger than expected and when inflation is higher than expected. PSERS contracts with external investment managers and also uses internal portfolio managers to manage MLP portfolios.

PSERS' Asset Allocation currently targets an allocation of 6.0% of assets in Infrastructure investments, inclusive of the 4.0% target for MLP investments.

### Real Estate Investments

Real Estate investments provide PSERS exposure to real property directly or indirectly through global publicly-traded real estate securities (PTRES), direct investments, commingled fund investments, limited partnerships, and direct private placements. This is done in a prudent manner to create a diversified real estate portfolio of high quality investments which will enhance PSERS' overall long-term investment performance, diversify the asset base, and reduce the volatility of the total investment portfolio returns. Real Estate investments tend to perform well in periods of stronger than expected growth and lower than expected inflation.

The real estate program is designed to create the highest possible risk-adjusted returns in a controlled, coordinated, and comprehensive manner. Recognizing that real estate market conditions and PSERS' objectives for real estate may change over time, the program is reviewed periodically and updated as needed. The existing target allocation is 11.0% of total assets, of which 10.0% is designated for Private Real Estate and 1.0% for PTRES.

PSERS seeks to diversify its real estate portfolio by investing in a mix of Opportunistic (30%), Value Added (50%) and Core (20%) real estate investments.

*Opportunistic* real estate investing is the financing, acquisition or investment in real estate assets, real estate companies, portfolios of real estate assets, and private and public Real Estate Investment Trusts (REIT's) that do not have access to traditional public equity or debt financing. Opportunistic real estate consists of investment strategies that seek to exploit market inefficiencies with an emphasis on total return. Opportunistic investments require specialized expertise and the flexibility to respond quickly to market imbalances or changing market conditions. Investments may include non-traditional property types and/or assets that involve development, re-development, or leasing risks.

*Value Added* real estate investing typically focuses on both income growth and appreciation potential, where opportunities created by dislocations and inefficiencies between and within segments of the real estate capital markets are capitalized upon to enhance returns. Investments can include high-yield equity and debt investments and undervalued or impaired properties in need of repositioning, re-development, or leasing.

*Core* real estate investing is the financing, acquisition or investment in real estate assets, real estate companies, portfolios of real estate assets, and private REITs that are broadly diversified by property type and location, focused primarily on completed, well-leased properties with modest levels of leasing risk, using relatively low leverage, and investing mainly in institutional property types and qualities allowing for relative ease of resale.

**PSERS Real Estate Internal Co-Investment Program** consists of co-investments made alongside of General Partners with whom PSERS has a strong relationship. These relationships aid in the generation of deal flow for investments and also serve as additional due diligence for the evaluation of General Partners. The investments have the potential for higher returns as they have low or no fees and profit sharing. This program also provides PSERS with the ability to buy secondary interests in funds from other Limited Partners usually at a discount to net asset value.

### Risk Parity Investments

Risk Parity investments are designed to generate investment returns through a more diversified allocation by endeavoring to balance market risk factor exposures as opposed to capital exposures. PSERS' Risk Parity investment managers each have proprietary methods to define and measure the risk factors upon which they manage their portfolios. Inclusion of this asset class is expected to reduce the portfolio's overall risk exposure over long-term horizons because it is designed to be more resistant to market downturns than traditional investment strategies, and further enhances the System's diversification due to the risk-balancing portfolio construction. Risk Parity portfolios are designed to perform consistently well in periods of rising or falling growth or inflation. PSERS contracts with external investment managers and also uses internal portfolio managers to manage Risk Parity portfolios.

PSERS' Asset Allocation currently targets an allocation of 10.0% of assets to Risk Parity investments. The Risk Parity investments are targeted to be 100% actively managed.

### Absolute Return Investments

Absolute Return investments, sometimes referred to as hedge funds, are used by the Fund primarily to generate returns that are uncorrelated to the equities, fixed income, and commodities asset classes and to diversify the overall Fund. As such, returns are driven more by manager skill than changes in economic growth and inflation which affects other financial assets. PSERS contracts with external investment managers to manage Absolute Return portfolios.

Absolute Return investments are made in a variety of unique, non-directional investment strategies, including global macro, relative value, event driven, capital structure arbitrage, reinsurance, volatility and other opportunistic strategies. The Fund diversifies this program by manager and style.

PSERS' Asset Allocation currently targets an allocation of 10.0% of assets in Absolute Return investments.

## Section 3 - Investment Information

### Performance

PSERS' general investment consultant calculates the total investment return of the System as well as the performance of each external investment management firm and each internal investment manager retained by the Board to invest the System's assets. Performance is calculated using a time-weighted return methodology. For the one-year period ended June 30, 2018, the System

generated a total net of fee return of 9.27%. This return was above the Total Fund Policy Index return of 7.95% by 132 basis points. Annualized total net of fee returns for the three-, five-, and ten-year periods ended June 30, 2018 were 6.84%, 7.62%, and 5.03%, respectively. The three-, five- and ten-year returns ended June 30, 2018, exceeded the Total Fund Policy Index returns by 39, 32, and trailed by 3 basis points, respectively.

Table 10.1 provides the System's total time-weighted investment returns for each major asset class and the total portfolio, including, where applicable and available, respective benchmark indexes used by asset class and median performance by asset class:

Table 10.1	Annualized Total Returns (%)					
	Net of Fees					
	Ended June 30, 2018					
	1 Year	3 Years	5 Years	10 Years	15 Years	20 Years
<b>PSERS Total Portfolio</b>	<b>9.27</b>	<b>6.84</b>	<b>7.62</b>	<b>5.03</b>	<b>7.69</b>	<b>6.39</b>
Total Fund Policy Index	7.95	6.45	7.30	5.06	6.95	5.66
Median Public Defined Benefit Plan (DBP) Fund Universe (Aon Hewitt Database)	8.17	6.55	7.79	6.50	6.93	5.98
60% Global Equity / 40% Barclays U.S. Aggregate Bond Index	6.19	5.67	6.60	5.42	6.77	5.55
<b>PSERS U.S. Equity Portfolios</b>	<b>14.02</b>	<b>12.19</b>	<b>13.51</b>	<b>10.21</b>	<b>9.62</b>	<b>N/A</b>
U.S. Equity Policy Index (1)	14.93	11.65	13.34	10.17	9.69	N/A
<b>PSERS Non-U.S. Equity Portfolios</b>	<b>10.44</b>	<b>7.55</b>	<b>9.91</b>	<b>6.10</b>	<b>10.25</b>	<b>N/A</b>
Non-U.S. Equity Policy Index (2)	8.48	6.34	9.12	4.76	9.16	N/A
<b>PSERS Fixed Income Portfolios (10)</b>	<b>6.42</b>	<b>6.07</b>	<b>5.97</b>	<b>7.21</b>	<b>6.54</b>	<b>6.70</b>
Fixed Income Policy Index (3)	2.18	3.85	3.34	5.35	5.08	5.64
<b>PSERS Commodity Portfolios (10)</b>	<b>5.36</b>	<b>0.11</b>	<b>-2.10</b>	<b>-5.76</b>	<b>N/A</b>	<b>N/A</b>
Commodity Policy Index (4)	4.67	-2.22	-4.04	-7.90	N/A	N/A
<b>PSERS Absolute Return Portfolios</b>	<b>4.85</b>	<b>3.34</b>	<b>4.20</b>	<b>5.01</b>	<b>N/A</b>	<b>N/A</b>
Absolute Return Policy Index (5)	5.34	4.62	5.02	6.40	N/A	N/A
<b>PSERS Risk Parity Portfolios (11)</b>	<b>6.76</b>	<b>4.60</b>	<b>6.02</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
Risk Parity Policy Index (6)	6.11	5.68	6.40	N/A	N/A	N/A
<b>PSERS Master Limited Partnership (MLP) Portfolios</b>	<b>0.27</b>	<b>-5.31</b>	<b>0.73</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
Standard & Poor's MLP Index	-1.76	-6.32	-3.03	N/A	N/A	N/A
<b>PSERS Infrastructure Portfolios</b>	<b>1.39</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
Infrastructure Policy Index*	0.53	N/A	N/A	N/A	N/A	N/A
<b>PSERS Real Estate (7) (10)</b>	<b>13.63</b>	<b>10.26</b>	<b>12.02</b>	<b>2.50</b>	<b>8.48</b>	<b>8.52</b>
Blended Real Estate Index (8)	12.80	9.69	11.20	6.40	9.22	9.47
<b>PSERS Alternative Investments (7)</b>	<b>16.26</b>	<b>11.21</b>	<b>10.03</b>	<b>7.48</b>	<b>12.87</b>	<b>10.31</b>
Burgiss Median Return, Vintage Year Weighted (9)	15.87	11.47	12.41	8.71	8.82	6.15

\*FTSE Developed Core Infrastructure 50/50 (Hedged to USD) Index (Net) effective October 1, 2015. This represents a blend of three broad sectors: 50% Utilities, 30% Transportation (with rails capped at 7.5%) and 20% mix of other sectors including pipelines, satellites, and communication towers.

**Other Footnotes to the Total Portfolio are available on page 87 of PSERS Comprehensive Annual Financial Report.**

### Performance (continued)

The past fiscal year was a strong year for the System with a net of fee return of 9.3%. The following asset classes generated solid returns this past fiscal year:

- Private Real Estate, as represented by Burgiss (Lagged) – Opportunistic and Burgiss (Lagged) – Value Added, were both up 15.8%.
- Public Equity, as represented by the MSCI ACWI IMI with USA Gross Index (net), was up 11.5%. Returns in global equities were driven by the prospects of US tax cuts and strong corporate and economic fundamentals.
- Commodities, as represented by the Bloomberg Commodity Index Total Return, were up 7.3%. Returns were supported by increased oil prices on the back of strong global growth and a supportive supply-demand balance.

Significant detractors from performance this past fiscal year included:

- U.S. Core Fixed Income, as represented by the Bloomberg Barclays U.S. Aggregate Index, were down -0.4%. Returns were driven by rising interest rates in the U.S.
- U.S. Long Treasuries, as represented by the Bloomberg Barclays U.S. Treasury Long Index, were down -0.1%. Returns in long-term treasuries were driven by rising interest rates.

As noted, one of the best performing asset classes this past fiscal year was public equity, which was up over 11%. Public equity is also one of the most volatile asset classes as illustrated by its return in fiscal year 2016, -4.97%. This illustrates the importance of diversification. Many investment professionals discuss diversification using terms such as standard deviation, correlation, and covariance. However, at its most basic level, diversification is insurance against bad outcomes. The System diversifies simply because it doesn't know how actual events in the future will transpire relative to what is priced into the market. Diversification is a very humble approach to investing. If an investor knew with certainty which asset class would perform best the next month, quarter, or year, the investor would simply invest in that one asset class. However, without such perfect foresight, the downside risk of such a strategy could be devastating. PSERS employs diversification across a wide variety of public and private markets. Exposure to private equity, private real estate, and high yield strategies all provided return enhancement and diversification benefits in FY 2018. Diversification into asset classes such as U.S. long treasuries and absolute

return resulted in a drag on overall performance during this past fiscal year.

In analyzing performance, PSERS' Board, general investment consultant and staff pay particular attention to the Sharpe ratio, which tells an investor what portion of a portfolio's performance is associated with risk taking. The Sharpe ratio measures a portfolio's added value relative to its total risk; the higher a portfolio's Sharpe ratio, the better its risk-adjusted return. PSERS' Sharpe ratio, as calculated by the general investment consultant, was 1.75 for the 5 year period ending June 30, 2018, a top 15th percentile score.

The fiscal year continued a recent trend of strong performance but with volatility introduced into the markets, with the VIX peaking in the mid 30's during February. Global equities advanced steadily higher throughout the 12 month period to June 2018 with the MSCI ACWI IMI with USA Gross Index (net) returning 11.5%. The strong equity performance came despite uncertainties created by increasing political risks. Concerns over the health of the Chinese economy resurfaced, new political parties engendered fears of a potential Italian exit from the European Monetary Union, and the US administration set out plans for rebalancing global trade with the imposition of tariffs on members of NAFTA, the European Union and in particular, China. Equity markets were driven by the prospects of US tax cuts and strong corporate and economic fundamentals.

Major central bank policy continued to diverge over the period, the US Federal Reserve (Fed) has been tightening monetary policy at a faster rate than its peers with an additional 25 basis point (bp) rate hike in June and reaching 1.75-2.00%. In the UK, the Monetary Policy Committee (MPC) decided to refrain from tightening policy citing weak domestic economic data. Meanwhile, the European Central Bank (ECB) announced that its quantitative easing program would end in December 2018 while also insisting that any tightening to conventional monetary policy would only take place in the second half of 2019. Within Asia, the People's Bank of China (PBoC) loosened monetary policy as it cut the reserve requirement ratio – the proportion of deposits required to be held as central bank reserves. Commodity prices were positive over the 12 months ended June 2018. Crude oil prices have risen on the back of strong global growth and a supportive supply-demand balance. The reintroduction of US sanctions against Iran and imposition of additional sanctions on Venezuela provided additional support to crude oil prices with the price of WTI crude oil increasing by 61% over the past 12 months to US\$74.13/bbl.

While it has been a challenging return environment as evidenced by the System's three-, and ten-year annualized returns, since the first quarter after the Great Recession, PSERS' annualized net of fee return was 9.28%, comfortably above the actuarial assumed rate of return of 7.25%. With

**Performance  
(continued)**

cash rates below 2%, the System needs to take prudent risks to achieve its long-term goal of a 7.25% return. An important concept to remember from the last sentence is “long-term.” The System has built a diversified allocation to allow it to collect risk premiums over the long- term. In the short-term, no one knows what will happen and the System can go through periods of time of sub-7.25% annual returns. The System continues to believe the best way to achieve its long-term objectives is to maintain a very diversified portfolio which includes all asset classes available to it, such as equities, fixed income, real assets, risk parity and absolute return. In any given year, the System expects some assets to perform well, such as public equities and high yield did this past fiscal year, and expects some to not do as well, such as U.S. Long Treasuries this past fiscal year. However, over the long run, the System expects each of its asset classes to generate a positive return commensurate with the risks taken. The future is uncertain, but PSERS believes it is well positioned to accomplish its objectives.



Performance  
(continued)

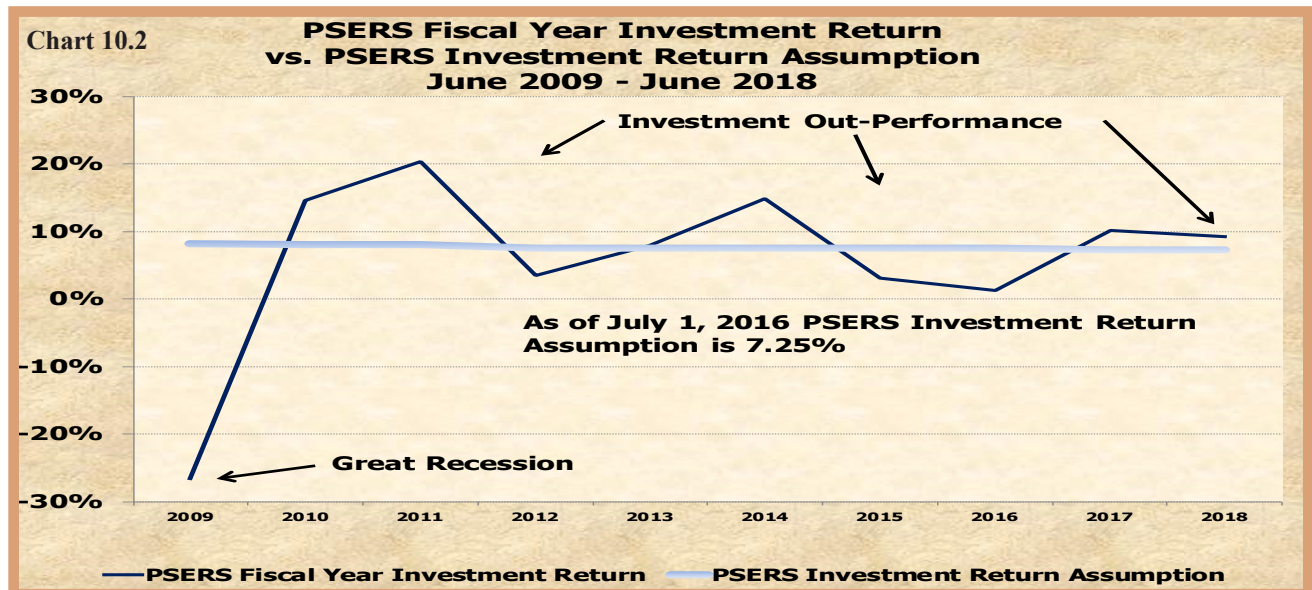
Long Term Investment Performance Consistently Outperforms

The assets of the System are invested to maximize the returns for the level of risk taken. Chart 10.1 shows PSERS' 25 Year Trailing Investment Return for each of the past 10 fiscal years and Chart 10.2 depicts PSERS' Fiscal Year Investment Return versus PSERS' Investment Return Assumption for the past 10 fiscal years.

As shown in Chart 10.1, the 25 year trailing investment return has exceeded the investment return assumption over the last ten years including the Great Recession.



As depicted in chart 10.2, PSERS' one-year investment return has remained above the investment return assumption for six of the past ten fiscal years. The notable exception is the Great Recession period from December 2007 through June 2009 which resulted in the largest decrease in stock market performance since the Great Depression.



## Section 3 - Investment Information

### Performance (continued)

Table 10.2 demonstrates that over the past 19 fiscal years, on average, every dollar PSERS has spent in investment fees and expenses has resulted in investment earnings of \$2.35 above the Policy Benchmark's dollar returns.

**Table 10.2 PSERS' Investment Earnings over Policy Benchmark**  
**Fiscal Years Ended June 30**  
**(Dollar Amounts in Millions)**

<i>Fiscal Year</i>	<i>Total Investment Expenses*</i>	<i>PSERS' Net Return over Policy Benchmark (AFTER Payment of all Expenses)</i>	<i>PSERS' Investment Earnings over Policy Benchmark Net of Total Investment Expenses*</i>	<i>\$1 of Investment Expenses Translates into \$\$\$ in Excess Earnings</i>
2018	\$ 468	1.32 %	\$ 661	\$ 2.41
2017	474	1.75 %	800	2.69
2016	416	(1.78)%	(853)	(1.05)
2015	455	(0.04)%	(31)	0.93
2014	482	0.55 %	240	1.50
2013	558	1.28 %	590	2.06
2012	481	1.10 %	521	2.08
2011	515	1.02 %	416	1.81
2010	522	2.20 %	1,754	4.36
2009	478	(5.22)%	(3,131)	(5.55)
2008	399	(0.98)%	(618)	(0.55)
2007	314	4.36 %	2,360	8.52
2006	211	2.36 %	1,635	8.75
2005	193	2.36 %	1,090	6.65
2004	191	3.51 %	1,388	8.27
2003	179	(0.43)%	(141)	(0.21)
2002	163	0.57 %	319	2.96
2001	144	2.13 %	1,200	9.33
2000	<u>125</u>	1.85 %	<u>934</u>	8.47
<b>Total</b>	<b><u>\$ 6,768</u></b>		<b><u>\$ 9,134</u></b>	<b><u>\$ 2.35</u></b>

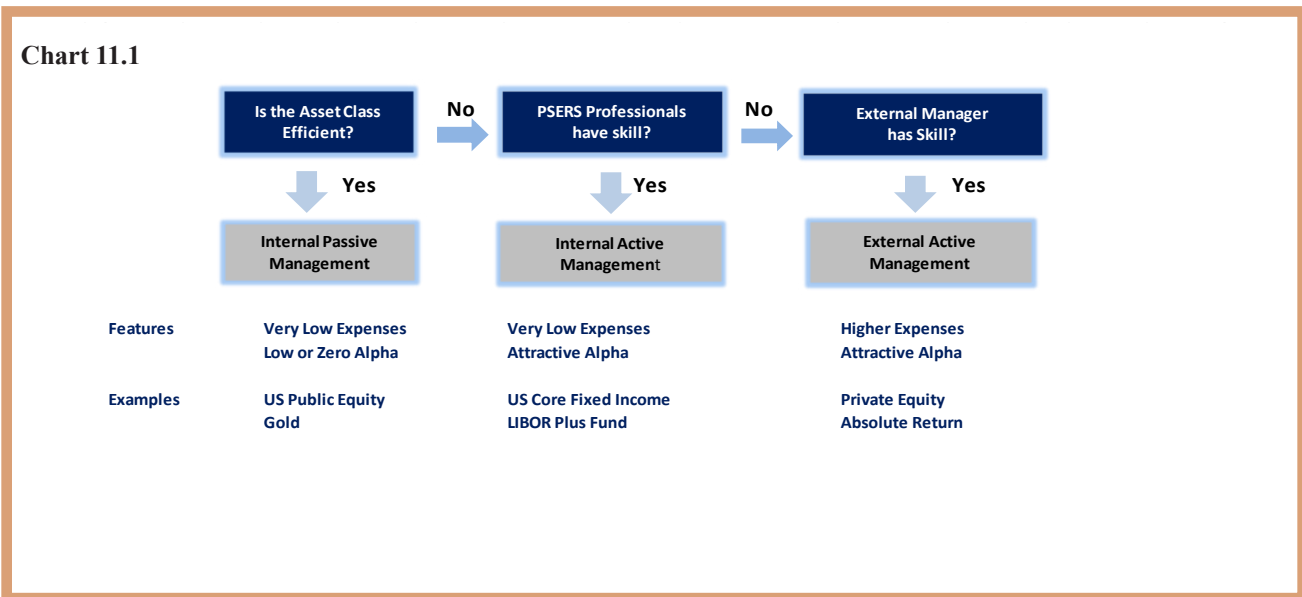
\*Dollar amounts in millions.



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## Managing Investment Fees and Expenses

PSERS’ professionals annually formulate an Asset Allocation Policy (as more fully described in Tab 9) with input from the general investment consultant, and works on an ongoing basis to implement the Policy through identification of attractive investment strategies and well-qualified investment managers. The Board reviews and approves the long-term asset allocation targets of the System annually. A fundamental part of this implementation process is making key decisions with regard to use of active or passive strategies implemented by internal professionals or external investment managers, as depicted in Chart 11.1.



Management of investment fees and expenses is integrated into the process of making these key decisions, so analysis of these costs must also occur within this context. If one assumes that, under PSERS’ Asset Allocation Policy, all of PSERS’ investments could be made in a passive manner resulting in negligible fees and expenses while earning investment returns equal to the Policy Benchmark, then one can also assume that all of PSERS’ actual investment fees and expenses are incurred with the goal of earning investment returns that exceed the Policy Benchmark (of course, as the prudent investor realizes, not all investments can be made in passive strategies, not all passive strategies have low fees, and not all passive strategies deliver the market returns targeted). These assumptions allow PSERS to analyze how much excess investment return above the Policy Benchmark the System has been able to generate over time for the level of fees and expenses actually paid.

PSERS’ ability to select a prudent combination of both internal and external managers, and both active and passive strategies, has generated and continues to generate significant excess risk-adjusted, net of fee returns relative to the Policy Benchmarks.

# Managing Investment Fees and Expenses

(continued)

Chart 11.2 below demonstrates that over the past 19 fiscal years, PSERS has earned \$8.3 billion in additional investment returns above the Board-approved Policy Index, net of fees.

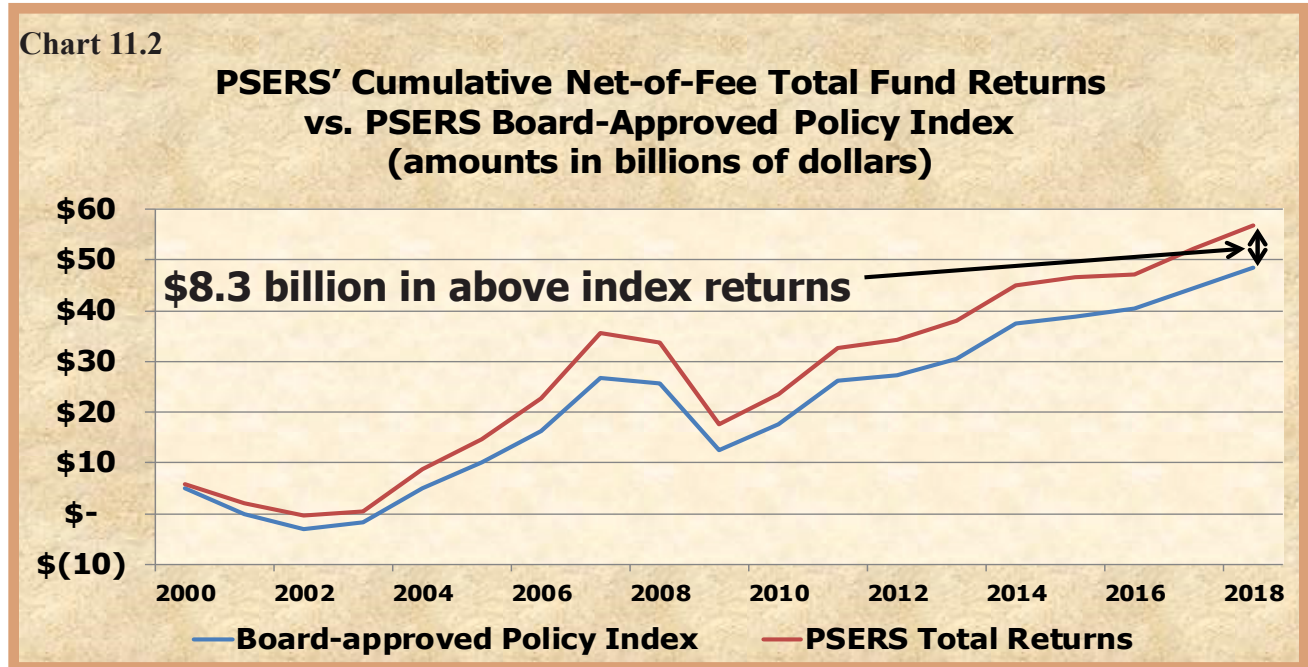
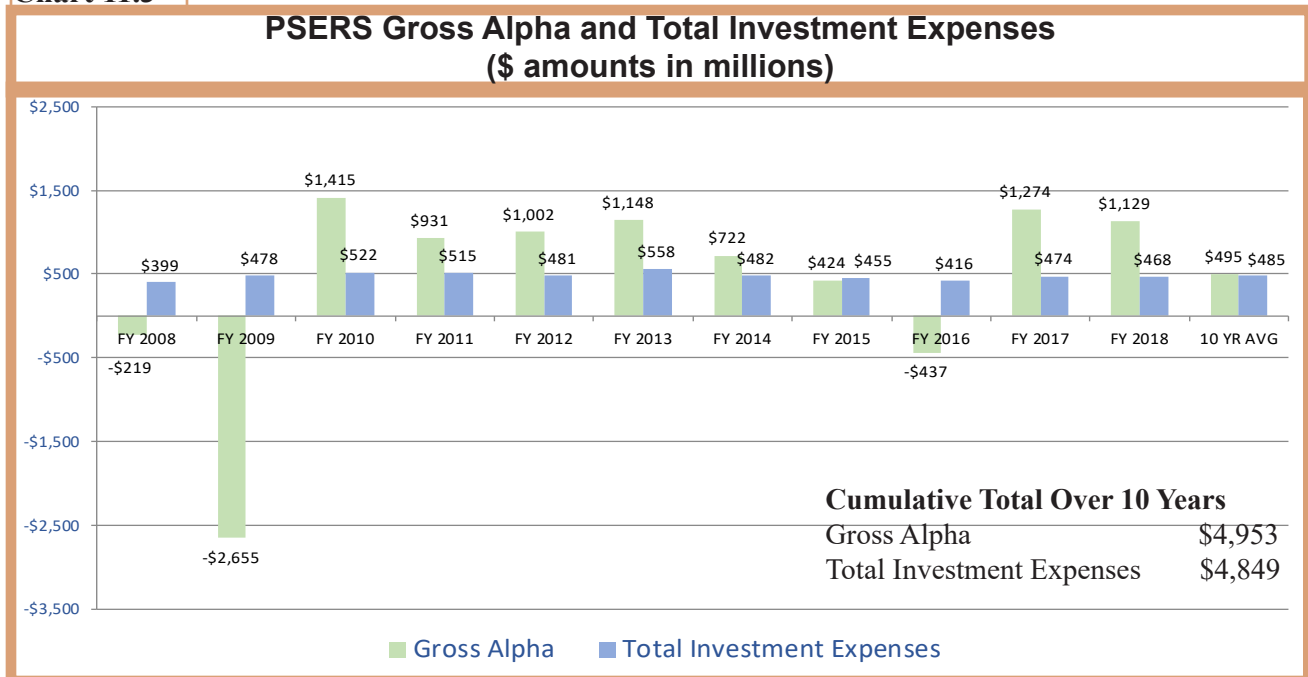


Chart 11.3 shows that PSERS has earned \$1,129 in gross alpha during fiscal year 2018, or \$2.41 of gross alpha for every \$1 of total investment expenses. Over the last ten years PSERS has earned \$4,953 million in gross alpha, or \$1.02 in gross alpha for every \$1 spent on total investment expenses.

**Chart 11.3**



Gross Alpha is excess earnings (without regard for investment expenses) above the earnings of the relevant benchmark index.

### Section 3 - Investment Information

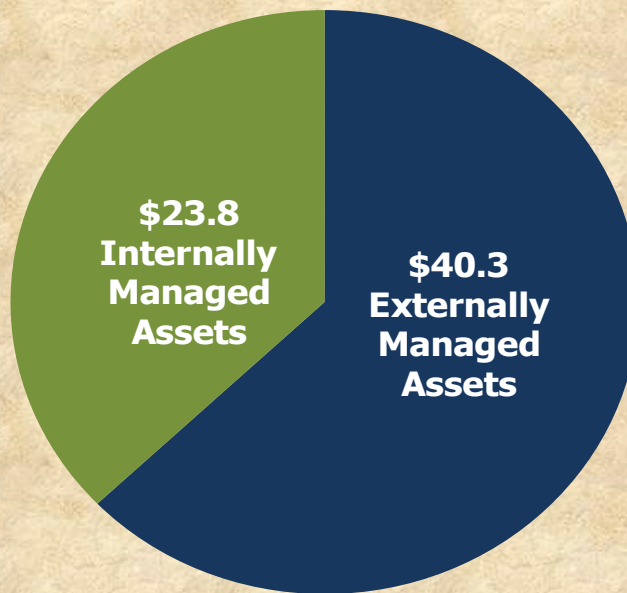
#### Key Decision: Internal vs. External Investment Management

PSERS generally prefers to assign investment management responsibilities to internal professionals rather than to external investment management companies when certain conditions are present (see Chart 11.1). For example, it must be clear that internal professionals can achieve risk-adjusted returns that are at least equal to what might be earned by external investment managers in equivalent strategies, and PSERS' professionals must simultaneously have the operational capacity to take on the additional work. When assets are assigned to PSERS' professionals, the total costs (e.g., salary and benefits, computers and office supplies) are much lower than using even the largest "very low fee" index mutual fund companies charge, giving PSERS a significant advantage.

When PSERS does select external investment managers, the decision is based in part on the fees the System has negotiated and in part on the likelihood the manager will meet or exceed the performance expected. Fee negotiations begin with the expectation that the contract with the investment manager will have a "Most Favored Nations" clause guaranteeing that PSERS' fees will be at least as low as other clients with a similar investment amount, and the System then negotiates fees lower from that point wherever possible.

Chart 11.4 displays the distribution of PSERS managed assets as of June 30, 2018.

Chart 11.4 **PSERS' Asset Exposures under Management as of June 30, 2018 (\$ Billions)**



**Note:** Financing represents a negative \$9.2 billion allocation exposure and is not reflected in Chart 11.4.

## Section 3 - Investment Information

### Key Decision: Internal vs. External Investment Management (continued)

PSERS' Investment staff managed 19 portfolios internally, with a total estimated net asset value of over \$23 billion on June 30, 2018, resulting in significant fee savings. For the entire fiscal year, PSERS incurred costs of approximately \$14 million to manage these portfolios internally, as well as oversee all of the external managers, manage the asset allocation, oversee risk, and perform other tasks in managing the overall investment program.

As shown in Table 11.1 below, managing these assets externally would have cost PSERS over \$43 million in additional fees:

<i>Account</i>	<i>Asset Class</i>	<i>Market Value as of 6/30/18* (000s)</i>	<i>Estimated Annual Fee %</i>	<i>Estimated Cost to Manage Externally (000s)</i>
PSERS - S&P 500 Index	U.S. Equities	\$3,124,356	0.01%	\$312
PSERS - S&P 400 Index	U.S. Equities	545,220	0.03%	164
PSERS - S&P 600 Index	U.S. Equities	567,573	0.04%	227
Misc. PSERS Equity Accounts	U.S. Equities	45,554	0.00%	-
	<b>U.S. Equities Total</b>	<b>4,282,703</b>		<b>703</b>
PSERS ACWI ex. U.S. Index	Non U.S. Equities	3,152,720	0.08%	2,522
	<b>Non U.S. Equities Total</b>	<b>3,152,720</b>		<b>2,522</b>
Private Markets Co-Investments	Private Markets	493,983	1.38%	6,817
PA Investment Fund - Private Equity.	Private Markets	3,778	1.38%	52
	<b>Private Markets Total</b>	<b>497,761</b>		<b>6,869</b>
Special Situations Internal	Fixed Income	41,646	1.00%	416
PSERS Active Aggregate	Fixed Income	1,243,914	0.21%	2,612
PSERS TIPS Portfolio	Fixed Income	1,943,835	0.13%	2,527
PSERS Long Treasuries	Fixed Income	1,778,897	0.18%	3,202
	<b>Fixed Income Total</b>	<b>5,008,292</b>		<b>8,758</b>
PSERS Infrastructure Index	Infrastructure	1,034,990	0.50%	5,175
	<b>Infrastructure Total</b>	<b>1,034,990</b>		<b>5,175</b>
PSERS Commodity Beta	Commodities	1,748,381	0.15%	2,623
PSERS Gold Fund	Commodities	1,700,000	0.15%	2,550
	<b>Commodities Total</b>	<b>3,448,381</b>		<b>5,173</b>
PSERS S&P MLP Index	MLP	476,238	0.50%	2,381
	<b>MLP Total</b>	<b>476,238</b>		<b>2,381</b>
PSERS REIT Index	Real Estate	454,734	0.08%	364
Real Estate Co-Investments	Real Estate	116,518	0.49%	565
	<b>Real Estate Total</b>	<b>571,252</b>		<b>929</b>
PSERS Risk Parity	Risk Parity	2,811,232	0.30%	8,434
	<b>Risk Parity Total</b>	<b>2,811,232</b>		<b>8,434</b>
PSERS Cash Management	Cash Management	2,489,293	0.10%	2,489
	<b>Cash Management Total</b>	<b>2,489,293</b>		<b>2,489</b>
	<b>Grand Total</b>	<b>\$23,772,862</b>		<b>\$43,433</b>

*\*Market values include cash and derivatives exposure*

### Key Decision: Active vs. Passive Investment Management

Passive investment strategies form the basis that the Fund uses to attain market exposure in many public market asset classes. The advantage of passive strategies, such as indexing, is that they are generally very inexpensive to implement. If solely using passive strategies, however, performance will be limited to general market performance with little or no potential for excess earnings.

PSERS evaluates and selects active managers on a case by case basis with strong emphasis on understanding the manager's sustainable investment edge. If PSERS' investment professional and consultants have conviction that the manager's process will generate attractive and potentially uncorrelated risk-adjusted net of fee returns in excess of the most competitive passive benchmarks, the active manager will be considered. Active strategies are also used by PSERS in asset classes where passive strategies are not available, such as Private Equity.

In selecting active managers, PSERS strives to hire managers that meet the following criteria:

- have a unique insight or process;
- have the ability to add long-term excess returns above passive alternatives, net of fees;
- have adequate capacity to execute the strategy;
- add diversification to PSERS' existing investment structure;
- do not exhibit style drift; and
- exhibit a high level of ethical behavior.

The advantage of active strategies is that they endeavor to generate net of fee returns in excess of the passive alternatives, if available, and/or provide diversification benefits which help manage total portfolio risk. The disadvantages of active strategies include being more expensive to implement than passive strategies and the risk that they may underperform passive strategies.

PSERS regularly measures the performance of active strategies relative to alternative passive strategies. In cases where PSERS is not receiving investment earnings from its active strategies in excess of alternative passive strategies, when all investment fees are taken into account, capital is redeployed either to other active strategies or to passive strategies. If PSERS determines that the active managers are not meeting expectations as a group, the Fund would endeavor to exit active strategies altogether and move to a purely passive implementation.



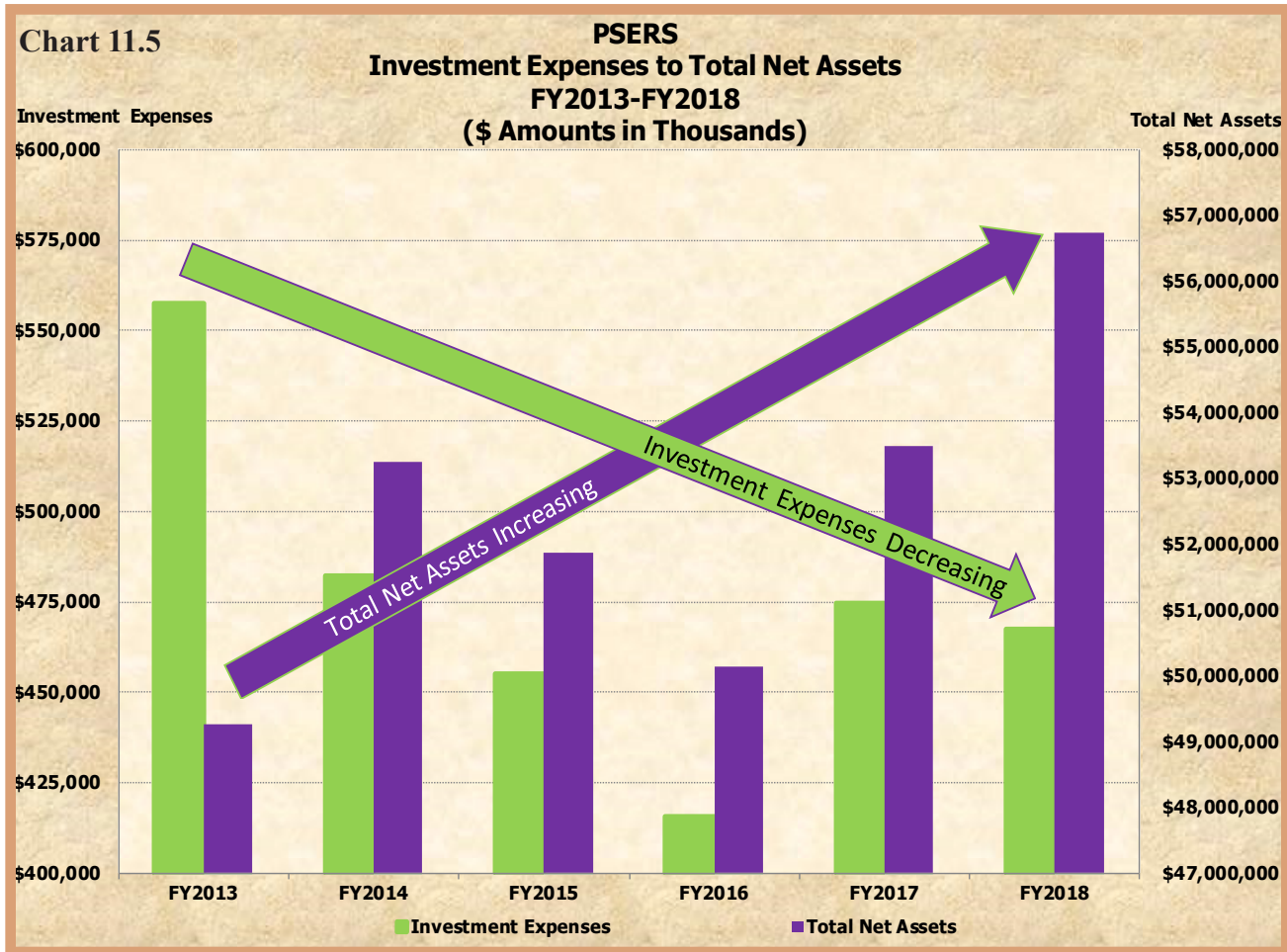
### Section 3 - Investment Information

**Table 11.2 summarizes total investment expenses for the fiscal year ended June 30, 2018.** “Total External Management” includes all fees paid to external investment managers as either a base fee or a share of profits earned (performance fee). “Total Internal Management” includes all staff salaries related to PSERS’ Investment Office as well as costs needed to support their work (e.g., vendor services, hardware and software, office supplies). “Total Other Expenses” include fees paid to the custodian bank, consultants, and legal services providers.

<b>Table 11.2 Summary of Investment Advisory Fees</b>				
<b>Fiscal Year Ended June 30, 2018</b>				
<b>(Dollar Amounts in Thousands)</b>				
	<u>Base Fees</u>	<u>Performance Fees</u>	<u>Total Fees</u>	<u>Basis Points</u>
<b>External Management</b>				
U.S. Equity	\$ 1,479	\$ 572	\$ 2,051	59
Non - U.S. Equity	22,220	6,144	28,364	30
Fixed Income	98,076	12,594	110,670	88
Real Estate	49,640	-	49,640	101
Alternative Investments	98,176	-	98,176	141
Absolute Return	83,243	32,086	115,329	216
Commodities	5,534	4,449	9,983	126
Master Limited Partnerships	7,887	987	8,874	48
Infrastructure	<u>1,707</u>	--	1,707	173
Risk Parity	<u>20,372</u>	<u>1,862</u>	<u>22,234</u>	81
<b>Total External Management</b>	<b>\$ 388,334</b>	<b>\$ 58,694</b>	<b>\$ 447,028</b>	113
<b>Total Internal Management</b>			<b><u>14,474</u></b>	6
<b>Total Investment Management</b>			<b>461,502</b>	73
Custodian Fees			2,268	
Consultant and Legal Fees			<u>3,942</u>	
<b>Total Other Expenses</b>			<b><u>6,210</u></b>	
<b>Total Investment Expenses</b>			<b>\$ <u>467,712</u></b>	74

### Section 3 - Investment Information

Increasing the number and size of portfolios managed internally has been a core initiative in reducing PSERS' Total Investment Expenses in recent years. As Chart 11.5 illustrates, Total External Management fees have decreased from \$558 million in Fiscal Year 2013 to \$468 million in Fiscal Year 2018, while Total Net Assets have increased from \$49.3 billion to \$56.7 billion. It is worth noting that these decreases have occurred while Total Internal Management and Total Other Expenses have remained flat. As discussed elsewhere, PSERS is hopeful that it will be permitted to increase its investment professional complement in order to maintain and even expand these savings.



### Section 3 - Investment Information

External management fees are treated as a reduction of the investment revenue of the Fund rather than as a budgeted administrative expense.

**Table 11.3 Investment Fees by Manager**  
**Fiscal Year Ended June 30, 2018**  
(Dollar Amounts in Thousands)

<u>Manager</u>	<u>Total Fees</u>
<b><u>U.S. Equity</u></b>	
Radcliffe Capital Management, L.P.	\$ 2,051
<b>Total - U.S. Equity</b>	<b>2,051</b>
<b><u>Non - U.S. Equity</u></b>	
Acadian Asset Management, LLC	1,143
Baillie Gifford Overseas Ltd.	4,481
BlackRock Financial Management, Inc.	4,500
BlackRock Institutional Trust Company, N.A.	5,103
Fidelity Institutional Asset Management LLC	284
Marathon Asset Management Limited	3,680
Oberweis Asset Management, Inc.	1,863
Pareto Investment Management, Ltd.	1,150
QS Batterymarch Financial Management, Inc.	738
Wasatch Advisors, Inc.	5,422
<b>Total - Non - U.S. Equity</b>	<b>28,364</b>
<b><u>Fixed Income</u></b>	
AllianceBernstein L.P.	270
Apollo European Principal Finance Fund II (Dollar A), L.P.	1,406
Apollo European Principal Finance Fund III (Dollar A), L.P.	2,374
Avenue Energy Opportunities Fund, L.P.	2,000
Avenue Energy Opportunities Fund II, L.P.	218
Avenue Europe Special Situations Fund III (U.S.), L.P.	1,527
Bain Capital Credit Managed Account (PSERS), L.P.	1,877
Bain Capital Distressed and Special Situations 2013 (A), L.P.	1,144
Bain Capital Distressed and Special Situations 2016 (A), L.P.	1,655
Bain Capital Middle Market Credit 2010, L.P.	249
Bain Capital Middle Market Credit 2014, L.P.	1,789
BlackRock Financial Management, Inc.	11,884
Bridgewater Associates, L.P.	23,488
Brigade Capital Management, LLC	7,443
Capula Investment Management, LLP	872
Carlyle Energy Mezzanine Opportunities Fund II, L.P.	2,964
Carlyle Energy Mezzanine Opportunities Fund-Q, L.P.	1,474
Cerberus Levered Loan Opportunities Fund I, L.P.	123
Cerberus Levered Loan Opportunities Fund II, L.P.	1,680

## Section 3 - Investment Information

**Table 11.3 Investment Fees by Manager**  
**Fiscal Year Ended June 30, 2018**  
**(Dollar Amounts in Thousands)**

(continued)

<u>Manager</u>	<u>Total Fees</u>
<b><u>Fixed Income (continued)</u></b>	
Cerberus PSERS Levered Loan Opportunities Fund, L.P.	\$ 6,385
Galton Onshore Mortgage Recovery Fund III, L.P.	769
Galton Onshore Mortgage Recovery Fund IV, L.P.	160
Garda Capital Partners, L.P.	5,825
Hayfin SOF II USD Co-Invest, L.P.	30
Hayfin SOF II USD, L.P.	1,201
Hayfin Special Opportunities Credit Fund (Parallel), L.P.	1,589
ICG Europe Fund V, L.P.	1,384
ICG Europe Fund VI, L.P.	1,643
International Infrastructure Finance Company, L.P.	1,060
Latitude Management Real Estate Capital IV, Inc.	743
LBC Credit Partners II, L.P.	622
LBC Credit Partners III, L.P.	2,522
LBC-PSERS Credit Fund, L.P.	2,820
Mariner Investment Group, LLC	1,330
Oaktree Loan Fund 2X, L.P.	12
Pacific Investment Management Company (PIMCO)	1,862
Park Square - PSERS Credit Opportunities Fund, L.P.	2,638
Penn Mutual Asset Management, LLC	216
PIMCO BRAVO Fund III Onshore Feeder, L.P.	446
Pugh Capital Management, Inc.	201
PSERS TAO Partners Parallel Fund, L.P.	2,970
Radcliffe Capital Management, L.P.	878
Sankaty Credit Opportunities IV, L.P.	1,108
SEI Investments Company	739
Templeton Investment Counsel, LLC	1,821
TOP NPL (A), L.P.	163
TPG Opportunities Partners II (A), L.P.	364
TPG Opportunities Partners III (A), L.P.	2,198
Varde Scratch and Dent Feeder I-A, L.P. (The)	892
Varde Scratch and Dent Fund, L.P. (The)	<u>1,642</u>
<b>Total - Fixed Income</b>	<b>110,670</b>
<b><u>Real Estate-Direct Ownership</u></b>	
Charter Oak Advisors, Inc.	1,204
GF Management, Inc.	131
Grosvenor Investment Management U.S., Inc.	51
L & B Realty Advisors, LLP.	<u>55</u>
<b>Subtotal - Real Estate-Direct Ownership</b>	<b>1,441</b>

## Section 3 - Investment Information

**Table 11.3 Investment Fees by Manager**  
**Fiscal Year Ended June 30, 2018**  
**(Dollar Amounts in Thousands)**  
 (continued)

<u>Manager</u>	<u>Total Fees</u>
<b>Real Estate-Partnerships/Funds</b>	
AG Core Plus Realty Fund III, L.P.	\$ 341
AG Core Plus Realty Fund IV, L.P.	695
Almanac Realty Securities V, L.P.	150
Almanac Realty Securities VI, L.P.	280
Almanac Realty Securities VII, L.P.	1,068
AREFIN Co-Invest / Apollo Real Estate Finance Corp.	189
Ares European Real Estate Fund III, L.P.	252
Ares European Real Estate Fund IV, L.P.	1,124
Ares U.S. Real Estate Fund VII L.P.	312
Ares U.S. Real Estate Fund VIII, L.P.	923
Ares U.S. Real Estate Fund IX, L.P.	501
Avenue Real Estate Fund Parallel, L.P.	849
Bell Institutional Fund IV, LLC	392
Bell Institutional Fund V, LLC	895
Bell Institutional Fund VI, L.P.	965
BlackRock Asia Property Fund III, L.P.	18
BlackRock Europe Property Fund III, L.P.	2
Blackstone Real Estate Debt Strategies II, L.P.	379
Blackstone Real Estate Debt Strategies III, L.P.	944
Blackstone Real Estate Partners Europe III, L.P.	1,170
Blackstone Real Estate Partners Europe IV, L.P.	972
Blackstone Real Estate Partners VI.TE.1, L.P.	525
Blackstone Real Estate Partners VII.TE.2, L.P.	2,226
Blackstone Real Estate Partners VIII, L.P.	3,770
BPG Co-Investment Partnership L.P.	5
Brookfield Strategic Real Estate Partners, L.P.	1,564
Brookfield Strategic Real Estate Partners,II, L.P.	2,377
Cabot Industrial Core Fund	678
Cabot Industrial Value Fund IV, L.P.	518
Cabot Industrial Value Fund V, L.P.	750
Carlyle Real Estate Fund IV L.P.	53
Carlyle Real Estate Fund V L.P.	660
Carlyle Real Estate Fund VI L.P.	237
Carlyle Real Estate Fund VII L.P.	900
Carlyle Real Estate Fund VIII L.P.	1,373

### Section 3 - Investment Information

**Table 11.3 Investment Fees by Manager**  
**Fiscal Year Ended June 30, 2018**  
(Dollar Amounts in Thousands)  
(continued)

<u>Manager</u>	<u>Total Fees</u>
<b>Real Estate-Partnerships/Funds (continued)</b>	
DRA Growth and Income Fund IX, LLC	\$ 857
DRA Growth and Income Fund VI, L.P.	158
DRA Growth and Income Fund VII, L.P.	1,158
DRA Growth and Income Fund VIII, L.P.	1,927
Exeter Core Industrial Club Fund II, L.P.	325
Exeter Industrial Value Fund II, L.P.	68
Exeter Industrial Value Fund III, L.P.	735
Exeter Industrial Value Fund IV, L.P.	1,150
Fortress Investment Fund IV, L.P.	255
Fortress Investment Fund V (Fund A), L.P.	1,248
JPMCB Strategic Property Fund	211
Latitude Management Real Estate Capital III, Inc.	876
LEM Multifamily Senior Equity Fund IV, L.P.	844
LEM RE High Yield Debt & Preferred Equity Fund III, L.P.	501
LEM Real Estate Mezzanine Fund II, L.P.	75
Pramerica Real Estate Capital VI, L.P.	650
PRISA	987
RCG Longview Debt Fund IV, L.P.	20
RCG Longview Debt Fund V, L.P.	440
RCG Longview Debt Fund VI, L.P.	1,125
RCG Longview Equity Fund, L.P.	69
Senior Housing Partnership Fund IV, L.P.	637
Senior Housing Partnership Fund V, L.P.	1,017
Silverpeak/PSERS Real Estate, L.P.	84
Stockbridge Real Estate Fund, L.P.	2,653
Stockbridge Real Estate Fund II, L.P.	189
Stockbridge Real Estate Fund III, L.P.	581
Strategic Partners Fund IV RE, L.P.	118
UBS (US) Trumbull Property Fund, L.P.	813
<b>Subtotal - Real Estate-Partnerships/Funds</b>	<b>47,828</b>

## Section 3 - Investment Information

**Table 11.3 Investment Fees by Manager**  
**Fiscal Year Ended June 30, 2018**  
**(Dollar Amounts in Thousands)**  
(continued)

<u>Manager</u>	<u>Total Fees</u>
<b><u>Real Estate-Farmland</u></b>	
Prudential Agricultural Group	\$ 371
<b>Subtotal - Real Estate-Farmland</b>	<b>371</b>
<b>Total Real Estate</b>	<b>49,640</b>
<b><u>Private Equity</u></b>	
Actis Emerging Markets 3, L.P.	1,406
Actis Global 4, L.P.	1,468
Bain Capital Asia Fund II, L.P.	861
Bain Capital Asia Fund III, L.P.	2,600
Bain Capital XI, L.P.	1,243
Bain Capital XII, L.P.	1,563
Baring Asia Private Equity Fund III, L.P.	406
Baring Asia Private Equity Fund IV, L.P.	1,872
Baring Asia Private Equity Fund V, L.P.	2,794
Baring Asia Private Equity Fund VI, L.P.	1,486
Blue Point Capital Partners II (B), L.P.	157
Blue Point Capital Partners III (B), L.P.	486
Bridgepoint Development Capital III, L.P.	1,047
Bridgepoint Europe IV, L.P.	1,724
Bridgepoint Europe V, L.P.	2,625
Capital International Private Equity Fund V, L.P.	524
Capital International Private Equity Fund VI, L.P.	617
Catterton Growth Partners, L.P.	725
Catterton Growth Partners II, L.P.	1,109
Catterton Growth Partners III, L.P.	1,951
Catterton Partners V, L.P.	48
Catterton Partners VI, L.P.	1,101
Catterton Partners VII, L.P.	1,617
Catterton VIII, L.P.	1,940
Cinven Fund (Fifth), L.P. (The)	976
Cinven Fund (Sixth), L.P. (The)	1,258
Coller International Partners VI, L.P.	961
Coller International Partners VII, L.P.	1,500
Crestview Partners, L.P.	265
Crestview Partners II (PF), L.P.	1,302
Crestview Partners III, L.P.	894

### Section 3 - Investment Information

**Table 11.3 Investment Fees by Manager**  
**Fiscal Year Ended June 30, 2018**  
**(Dollar Amounts in Thousands)**  
 (continued)

<u>Manager</u>	<u>Total Fees</u>
<b>Private Equity (continued)</b>	
CVC Capital Partners Asia III Pacific, L.P.	\$ 356
CVC European Equity Partners V (A), L.P.	284
DCPF VI Oil and Gas Co-Investment Fund, L.P.	95
Denham Commodity Partners Fund VI, L.P.	588
Energy & Mineral Group Fund III, L.P.	1,281
Equistone Partners Europe Fund V E, L.P.	1,360
Evergreen Pacific Partners II, L.P.	156
First Reserve Fund XII, L.P.	1,100
GoldPoint Partners Co-Investment V, L.P.	458
HgCapital 7, L.P.	1,342
HgCapital 8 D, L.P.	541
HGGC Fund II, L.P.	887
HGGC Fund III, L.P.	218
Incline Equity Partners III, L.P.	1,087
Irving Place Capital Partners III, L.P.	464
Landmark Equity Partners XIII, L.P.	267
Landmark Equity Partners XIV, L.P.	1,014
Milestone Partners III, L.P.	346
New Mountain Partners IV, L.P.	48
New Mountain Partners V, L.P.	1,825
New York Life Capital Partners III-A, L.P.	182
New York Life Capital Partners IV-A, L.P.	158
NGP Natural Resources X, L.P.	845
NGP Natural Resources XI, L.P.	1,413
North Haven PE Asia Fund IV, L.P. (Morgan Stanley)	1,484
Odyssey Investment Partners Fund V, L.P.	1,478
Orchid Asia V, L.P.	172
Orchid Asia VI, L.P.	1,464
PAI Europe V, L.P.	275
PAI Europe VI, L.P.	882
Palladium Equity Partners IV, L.P.	515
Partners Group Secondary 2008, L.P.	1,512
Partners Group Secondary 2011, L.P.	1,491
Partners Group Secondary 2015 (USD) A, L.P.	1,530
Platinum Equity Capital Partners IV, L.P.	86
StepStone International Investors III, L.P.	558



## Section 3 - Investment Information

**Table 11.3 Investment Fees by Manager**  
**Fiscal Year Ended June 30, 2018**  
**(Dollar Amounts in Thousands)**  
(continued)

<u>Manager</u>	<u>Total Fees</u>
<b><u>Private Equity (continued)</u></b>	
Strategic Partners III-B, L.P.	\$ 500
Strategic Partners IV, L.P.	177
Strategic Partners V, L.P.	487
Strategic Partners VI, L.P.	826
Strategic Partners Fund VII, L.P.	1,250
Trilantic Capital Partners IV, L.P.	74
Trilantic Capital Partners V, L.P.	<u>1,230</u>
<b>Subtotal - Private Equity</b>	<b>70,832</b>
<b><u>Special Situations</u></b>	
Apollo Investment Fund VIII, L.P.	1,107
Avenue Special Situations Fund VI, L.P.	15
Cerberus Institutional Partners, L.P. (Series Four)	411
Cerberus Institutional Partners V, L.P.	1,083
Cerberus Institutional Partners VI, L.P.	2,616
Clearlake Capital Partners IV, L.P.	759
Clearlake Capital Partners V, L.P.	391
NYLIM Mezzanine Partners Parallel Fund II, L.P.	24
OCM Opportunities Fund VII, L.P.	143
OCM Opportunities Fund VII-B, L.P.	280
Searchlight Capital II, L.P.	1,480
Venor Special Situations Fund II, L.P.	1,068
Versa Capital Fund, L.P.	74
Versa Capital Fund II, L.P.	1,774
Windjammer Senior Equity Fund IV, L.P.	<u>1,060</u>
<b>Subtotal - Special Situations</b>	<b>12,285</b>
<b><u>Venture Capital</u></b>	
Aisling Capital III, L.P.	244
Aisling Capital IV, L.P.	858
Co-Investment Fund II, L.P. (The)	955
Insight Venture Partners X, L.P.	953
LLR Equity Partners III, L.P.	1,139
LLR Equity Partners IV, L.P.	2,474
LLR Equity Partners V, L.P.	1,955
Psilos Group Partners III, L.P.	252
Quaker BioVentures II, L.P.	782

### Section 3 - Investment Information

**Table 11.3 Investment Fees by Manager**  
**Fiscal Year Ended June 30, 2018**  
**(Dollar Amounts in Thousands)**

(continued)

<u>Manager</u>	<u>Total Fees</u>
<b><u>Venture Capital (continued)</u></b>	
Starvest Partners II, L.P.	\$ 352
Strategic Partners IV VC, L.P.	145
Summit Partners Growth Equity Fund VIII, L.P.	1,401
Tenaya Capital V-P, L.P.	710
Tenaya Capital VI, L.P.	839
Tenaya Capital VII, L.P.	<u>2,000</u>
<b>Subtotal - Venture Capital</b>	<b>15,059</b>
<b>Total Alternative Investments</b>	<b>98,176</b>
<b><u>Absolute Return</u></b>	
Aeolus Capital Management Ltd.	5,017
BlackRock Financial Management, Inc.	9,572
Bridgewater Associates, Inc.	23,139
Brigade Capital Management, LLC	4,205
Capula Global Relative Value Fund	11,081
Capula Tail Risk Fund	6,074
Caspian Keystone Focused Fund, Ltd.	187
Caspian Select Credit International Fund	4,352
Garda Capital Partners, L.P.	9,088
Independence Reinsurance Partners GP, LLC	1,370
Nephila Capital Ltd.	2,635
Nimbus Weather Fund	2,598
Oceanwood Opportunities Fund	2,058
One William Street Capital Management, L.P.	9,503
Pacific Investment Management Company (PIMCO)	10,764
Perry Partners, L.P.	302
Sciens Aviation Special Opportunities Investment Fund II, L.P.	1,514
Sciens Aviation Special Opportunities Investment Fund III, L.P.	2,270
Sciens Aviation Special Opportunities Investment Fund IV, L.P.	1,930
Two Sigma Risk Premia Enhanced Fund	3,443
Venor Capital Offshore, Ltd.	<u>4,227</u>
<b>Total - Absolute Return</b>	<b>115,329</b>

### Section 3 - Investment Information

**Table 11.3**

### Investment Fees by Manager Fiscal Year Ended June 30, 2018 (Dollar Amounts in Thousands)

(continued)

<u>Manager</u>	<u>Total Fees</u>
<b><u>Commodities</u></b>	
Gresham Investment Management, LLC	\$ 1,019
PIMCO Commodity	7,284
Wellington Management Company, LLP	<u>1,680</u>
<b>Total - Commodities</b>	<b>9,983</b>
<b><u>Master Limited Partnerships</u></b>	
Harvest Fund Advisors, LLC	3,634
Salient Capital Advisors, LLC	2,887
Stein Roe Investment Counsel D/B/A Atlantic Trust	<u>2,353</u>
<b>Total - Master Limited Partnerships</b>	<b>8,874</b>
<b><u>Infrastructure</u></b>	
International Infrastructure Finance Company II, L.P.	370
GCM Grosvenor Customized Infrastructure Strategies II, L.P.	622
Strategic Partners Real Assets, II, L.P.	<u>715</u>
<b>Total - Infrastructure</b>	<b>1,707</b>
<b><u>Risk Parity</u></b>	
BlackRock Institutional Trust Company, N.A.	2,191
Bridgewater All Weather Fund @15%, Ltd.	2,958
Bridgewater Optimal Portfolios, Ltd.	8,237
D.E. Shaw Investment Management, LLC	<u>8,848</u>
<b>Total - Risk Parity</b>	<b>22,234</b>
<b>Total External Management</b>	<b>447,028</b>
<b>Total Internal Management</b>	<b><u>14,474</u> *</b>
<b>Total Investment Management</b>	<b><u>\$ 461,502</u></b>

\*Internal Management expenses include salaries and fringe benefits of \$10,422 and operating expenses of \$4,052.

### Investment Fees and Expenses Initiatives

PSERS continues to pursue several avenues intended to maintain a reasonable cost structure. These initiatives include:

- Identifying opportunities to invest more assets internally. PSERS' current staffing levels are too low to significantly increase internal asset management, but we continue to work with the Administration to look for ways to reduce investment fees by increasing internal investment professionals. PSERS continues to believe this is in the best interests of both the Fund and the Commonwealth and, therefore, has included additional positions in the FY2019-20 budget request.
- For external managers making traditional investments, reduce base fees and create better alignment of interests by moving to a lower base fee coupled with a profit share.
- For external managers making traditional and absolute return investments, enter into arrangements for netting of profit shares for managers with multiple PSERS mandates.
- For external managers making non-traditional investments, continue to grow co-investments (which have lower fees and profit shares).
- For external managers making non-traditional investments, move away from paying on committed capital and towards paying on invested capital whenever possible.
- For external managers, re-underwriting all fee arrangements to ensure that the fee arrangements are fair and equitable.
- Research firms specializing in investment management fee negotiations, considering their credentials, references, past performance in reducing investment management fees for clients, and probable cost effectiveness for PSERS, for possible retention.

## Section 3 - Investment Information

### Commitment to Pennsylvania Financial Services Firms (as of June 30, 2018)

The members of the Board and Professional Staff are fiduciaries and must act in the interests of the members of the System and for the exclusive benefit of the System's members. In creating the investment program, the Board hires both external and internal investment managers. The Board has determined that it is in the best interest of the System to manage assets internally when (1) the System's investment professionals have the proven ability and capacity to manage portfolios internally at least as well as the external investment managers, and (2) the cost of investing those assets is no greater than the cost that would have been incurred to have those assets externally managed. The Board will also consider the diversification benefits that may be achieved by allocating assets to external portfolio managers even when conditions (1) and (2) are met.

The Board evaluates external managers based on a variety of factors, including: (1) a unique insight or process; (2) the ability to add long-term excess returns above passive alternatives, net of fees; (3) adequate capacity to execute the strategy; (4) adding diversification to our existing investment structure; (5) not exhibiting style drift, and; (6) exhibiting a high level of ethical behavior. In selecting external managers, PSERS will show preference to Pennsylvania-based potential managers that demonstrate similar strengths to alternative managers without a Pennsylvania nexus.

PSERS has shown a strong commitment to Pennsylvania's financial services industry by having assets managed by firms based in Pennsylvania or by firms with offices in Pennsylvania. In FY 2018, investment management fees paid to external firms managing PSERS' assets from offices located in Pennsylvania amounted to \$ 30.5 million, or 6.8% of the total external investment manager fees.

**Table 12.1 lists the asset exposures managed internally by PSERS, as of June 30, 2018.**

<b>Table 12.1</b>		
<b>Pennsylvania-Based Asset Exposures</b>		
<b>Managed Internally</b>		
<b>(as of June 30, 2018)</b>		
<b><u>Asset Class</u></b>	<b><u>Market Value</u></b> <b><u>(in millions)</u></b>	<b><u>Percentage</u></b> <b><u>of Total</u></b>
U.S. Equity	\$ 4,282.7	18.0 %
Non-U.S. Equity	3,152.7	13.3
Private Markets	497.8	2.1
Fixed Income	7,497.6	31.5
Master Limited Partnerships	476.2	2.0
Commodities	3,448.4	14.5
Infrastructure	1,035.0	4.4
Real Estate	571.3	2.4
Risk Parity	<u>2,811.2</u>	<u>11.8</u>
<b>Totals</b>	<b><u>\$ 23,772.9</u></b>	<b><u>100.0 %</u></b>

## Section 3 - Investment Information

### Commitment to Pennsylvania Financial Services Firms (continued)

Chart 12.1 displays the distribution of exposures managed internally as of June 30, 2018.

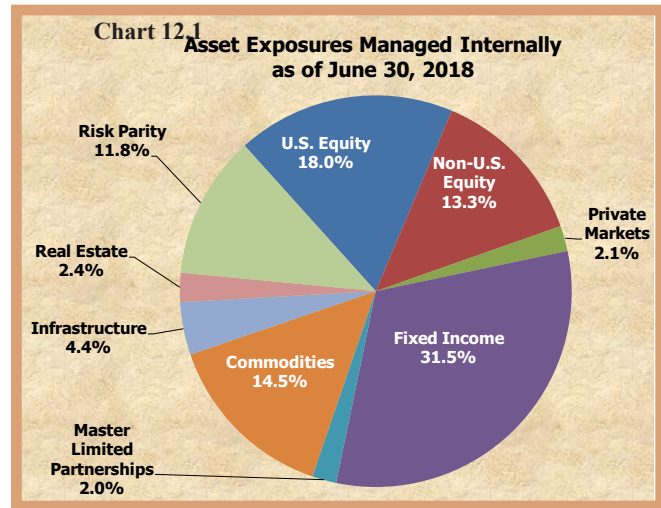


Table 12.2 is a list of assets managed by external managers with headquarters or offices located in Pennsylvania, as of June 30, 2018.

<b>Table 12.2 Pennsylvania-Based External Managers</b>	
U. S. Equity:	Private Equity and Debt:
Radcliffe Capital Management, L.P.	Incline Equity Partners III, L.P.
	Incline Equity Partners IV, L.P.
Fixed Income:	Milestone Partners III, L.P.
LBC Credit Partners II, L.P.	Milestone Partners IV, L.P.
LBC Credit Partners III, L.P.	PNC Equity Partners II, L.P.
LBC Credit Partners-P Credit Fund, L.P.	Versa Capital Fund I, L.P.
Penn Mutual Management, LLC	Versa Capital Fund II, L.P.
Radcliffe Capital Management, L.P.	Versa Capital Fund III, L.P.
SEI Investments Company	
	Venture Capital:
Master Limited Partnership:	Adams Capital Management, L.P.
Harvest Fund Advisors, LLC	Co-Investment 2000 Fund, L.P.
	Co-Investment Fund II, L.P.
Real Estate:	Cross Atlantic Technology Fund, L.P.
BPG/PSERS Co-Investment Fund	Cross Atlantic Technology Fund II, L.P.
Charter Oak Advisors, Inc.	LLR Equity Partners II, L.P.
Exeter Core Industrial Club Fund II, L.P.	LLR Equity Partners III, L.P.
Exeter Industrial Value Fund II, L.P.	LLR Equity Partners IV, L.P.
Exeter Industrial Value Fund III, L.P.	LLR Equity Partners V, L.P.
Exeter Industrial Value Fund IV, L.P.	NEPA Venture Fund II
GF Management, Inc.	Quaker BioVentures, L.P.
LEM Multifamily Senior Equity Fund IV, L.P.	Quaker BioVentures II, L.P.
LEM RE HY Debt & Preferred Equity Fund III, L.P.	SCP Private Equity Partners I, L.P.
LEM Real Estate Mezzanine Fund II, L.P.	SCP Private Equity Partners II, L.P.
	TDH III, L.P.
Infrastructure:	
International Infrastructure Finance Company Fund, L.P.	
International Infrastructure Finance Company Fund II, L.P.	

**Investments in Pennsylvania-Based Companies**  
(as of June 30, 2018)

Where investment characteristics including yield, risk, and liquidity are equivalent, the Board's policy favors investments that have a positive impact on the economy of Pennsylvania. The Board, in managing the investment portfolio, will also be cognizant of concentration risk to any one region, including Pennsylvania. The Fund will continue to seek investments in Pennsylvania-based companies when the investment characteristics are equivalent to other favorable investments, subject to diversification considerations.

**U.S. Equities**

PSERS invests in the stock of Pennsylvania-based companies through the various U.S. Equity portfolios managed by internal portfolio managers. PSERS has always had investments in large national firms located in Pennsylvania.

**Fixed Income Securities**

PSERS invests in the debt of Pennsylvania-based companies through the various Fixed Income portfolios managed by external and internal portfolio managers. PSERS has always had investments in large national firms located in Pennsylvania.

**Private Real Estate**

PSERS has investments in limited partnerships that have invested in Pennsylvania real estate properties. PSERS Real Estate program has committed \$17.2 billion to 131 partnerships. From the program inception to June 30, 2018, PSERS has committed capital to 16 partnerships headquartered in Pennsylvania.

**Venture Capital**

PSERS' Venture Capital program has committed \$3.2 billion to 60 partnerships. In addition to the current geographically diverse scope of venture capital investments, a historical objective of this program has been to target partnerships that demonstrate an ability to invest in Pennsylvania-based companies. Selected partnerships offer diversification according to geographic region and financing stage within Pennsylvania. From the program inception to June 30, 2018, PSERS has committed capital to 30 partnerships headquartered in Pennsylvania.

**Private Equity**

PSERS' Private Equity program has committed \$21.8 billion to 164 partnerships. From the program inception to June 30, 2018, PSERS has committed capital to 8 partnerships headquartered in Pennsylvania.

**Special Situations**

PSERS' Special Situations program has committed \$5.5 billion to 36 partnerships. From the program inception to June 30, 2018, PSERS has committed capital to 3 partnerships headquartered in Pennsylvania.

**Private Markets and Real Estate Pennsylvania In-House Co-Investment Program**

PSERS seeks to make co-investments in assets located in Pennsylvania from funds where PSERS or Portfolio Advisors, PSERS' former Private Market Consultant, is already a Limited Partner. PSERS has set aside \$250 million to be committed to this program. As of June 30, 2018, PSERS has invested \$75.9 million in the Private Markets and Real Estate Pennsylvania In-House Co-Investment Program. The number of employees, payroll and market value are included within their respective asset class.

### Section 3 - Investment Information

Table 12.3 displays Pennsylvania-based investments and other statistics at June 30, 2018 (\$'s in millions):

<b>Table 12.3      Statistics of Pennsylvania-Based Investments</b>				
<i>Asset Class</i>	<i>Total PA Market Value (PSERS' Portion)</i>	<i>Total PA Market Value (Total Invested)</i>	<i># of People Employed</i>	<i>Payroll</i>
U.S. Equities	\$ 141.0	\$ 141.0	*	\$ *
Fixed Income	74.9	74.9	*	*
Private Real Estate	81.3	1,087.2	227	7.0
Private Markets:				
Venture Capital	151.6	923.2	2,318	78.0
Private Equity	1,418.7	23,316.5	34,078	497.6
Special Situations	<u>313.1</u>	<u>11,601.0</u>	<u>10,015</u>	<u>71.1</u>
<b>Total</b>	<b>\$ <u>2,180.6</u></b>	<b>\$ <u>37,143.8</u></b>	<b><u>46,638</u></b>	<b>\$ <u>653.7</u></b>

\* Statistics for publicly traded companies not included due to the difficulty in obtaining the information.