INVESTMENT SECTION

PA State Fish: Brook Trout

COMMONWEALTH OF PENNSYLVANIA
PUBLIC SCHOOL EMPLOYEES' RETIREMENT SYSTEM

James H. Grossman Jr., CPA, CFA
Chief Investment Officer

November 5, 2021

Dear PSERS Board of Trustees:

It is a privilege to present to you the Investment Section of the Annual Comprehensive Financial Report for the fiscal year ended June 30, 2021.

Authority and Fiduciary Standard

The Board has the responsibility to invest funds of the System in accordance with guidelines and limitations set forth in the Code and other applicable state law. Pursuant to the Board's enabling legislation, the members of the Board, employees of the Board, and their agents are fiduciaries to the System's members and beneficiaries and must invest and manage the fund for exclusive benefit of the System's members and beneficiaries (24 Pa. C. S. §8521(e)). As such, they must act consistent with the duty of prudence as well as the duty of loyalty

In performance of their duties, the trustees shall exercise "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." (24 Pa. C.S.§8521(a)).

The System shall at all times be managed in accordance with all applicable state and federal laws, rules, and regulations, as well as this Investment Policy Statement and other applicable policies of the Board.

Policies and Objectives and Investment Philosophy

The Board is responsible for the formulation of investment policies for the System. Professional Staff is responsible for the implementation of those investment policies. The overall investment objectives of the System are as follows:

- to generate returns to support the System's actuarial soundness so it may provide its members with benefits as required by law;
- to earn a long-term total return, net of fees, and investment and administrative expenses, that equals or exceeds the actuarial assumed rate approved by the Board (currently 7.00%);
- to earn a long-term total return, net of fees and investment expenses, that equals or exceeds the Policy Index approved by the Board; and
- to prudently manage investment risks that are related to the achievement of investment goals.

The PSERS Board of Trustees believes the System's assets should be managed in accordance with the System's unique liability stream, funding sources, cash flows, and portfolio size, focusing on the prudent accumulation of wealth over the long term to meet the retirement benefit obligations established by the plan sponsor to its members. The System's assets should be managed based on the following beliefs:

1. Uncertainty - The future is difficult to forecast with any accuracy or certainty, particularly changes in the economic and market environment.
2. Asset Allocation - The strategic asset allocation mix, more than implementation or any other factor or decision, largely determines the portfolio's overall risk and return.
3. Diversification - Diversification is the best approach to addressing future uncertainty and therefore meeting PSERS' long-term investment objectives.

4. Risk - For an underfunded plan or for a plan with negative external cash flow (benefits paid exceed contributions received), the path of compounding of investment returns – from month to month, quarter to quarter, and year to year matters more than for a plan that is fully funded or has positive external cash flow; for the former type of plan, peak- to-trough declines transform unrealized losses into permanent ones. Drawdown risk should be mitigated, especially since the environment in which drawdowns occur is likely to take place when the plan sponsor's willingness and ability to make contributions to the plan may be less than in normal times. Liquidity should be managed to reasonably ensure that the fund can meet its obligations during periods of market dislocations.
5. Leverage - Leverage at the total fund level can be an effective tool to enhance diversification, since asset classes, over the long-term, have similar risk-adjusted returns, different correlations to each other, and different responses to changes in the economic and market environment. Leverage can be a vital tool to increase or decrease total fund risk in a diversified manner.
6. Rebalancing - Disciplined rebalancing enhances long-term returns as it is an inherently contrarian process. Rebalancing restores strategic asset allocation as the primary driver of return and risk.
7. Portfolio Size - Managing a large pool of assets provides investors unique access to investment opportunities not available to smaller institutional investors or individual investors. PSERS should use its size to its advantage to enhance its net-of-fees return and diversification opportunities.
8. Private Investments - Allocations to Private Equity, Private Credit, Private Real Estate, Private Infrastructure, and other illiquid asset classes may be justified by the illiquidity risk premium available to investors. Allocations to these asset classes may also be justified by the diversification benefit they provide, through exposure to sectors, businesses, and mode of corporate governance not obtainable through public markets.
9. Active Management - Passive investing, rather than active management, is the default choice to be used for any asset class that is highly efficient or where skilled active managers are less likely to be identified. Certain asset classes continue to exhibit information inefficiency, where skilled active management and well-resourced investors such as PSERS can potentially persistently outperform peers and the benchmark for that asset class. There will be short- term periods when a skilled active manager may underperform peers and the benchmark; that is to be expected and accepted; therefore a long-term perspective will be employed.
10. Internal Management - PSERS has developed skilled internal investment managers; as such internal investment management is preferred over external investment management in cases where internal management most likely can match or exceed the long-term, net of fees, risk-adjusted returns provided by external managers, provided the internal investment and operational resources are available to do so.
11. Investment Fees - Investment management fees for external management are one of the few aspects of investment management that are certain and over which the investor has control. Investment management and performance fees should be managed to (i) maximize long-term, net of fees, risk-adjusted returns, (ii) split the value added fairly between the investment manager and PSERS, and (iii) align the interests of the investment manager with PSERS.

To achieve the System's objectives, the Board meets during the second half of the calendar year to review the overall asset allocation plan and investment policies for the System. Implementation of investment policy decisions necessitates asset management. Implementation is accomplished through the use of external investment management firms who act as agents for the System as well as through the use of internal investment managers. The Board also retains various investment consultants to assist with the formulation and implementation of investment policies.

Operations

The Board, via its Investment Committee, provides oversight of investment activities. The Investment Committee generally conducts six meetings per year and may meet more frequently as needed. Investment Office professionals, as well as external investment advisors, Investment Accounting professionals, and Internal Audit professionals, assist the Board in achieving investment objectives and monitoring compliance with investment policies. For the fiscal year ended June 30, 2021, Verus Advisory, Inc. is the Board's investment consultant to provide the Board with investment oversight consulting services. Aon Investment Consulting, Inc. (Aon) served as the general investment consultant to assist the Board and Professional Staff in formalizing investment objectives, establishing an asset allocation plan, conducting investment advisor searches, reviewing performance, and commenting on compliance with investment policies. The Board retained Aksia, LLC as an absolute return and private credit consultant and Hamilton Lane Advisors, L.L.C. as an alternative, private credit, private infrastructure, and private real estate investment consultant. In addition, Constellation Advisers LLC was retained by the Board and Professional Staff to provide various investment compliance services to the System. Investment Office professionals implement investment decisions within the guidelines established in the Investment Policy Statement, Objectives and Guidelines regarding asset allocation, manager selection, security selection, and other objectives directed by the Board.

The Board employs both external investment management firms and internal investment managers to manage the investment portfolio of the System. At fiscal year-end, 22 external public market investment management firms were managing \$11.7 billion in assets of the System, \$33.4 billion in assets were managed by the System's internal investment managers, and the remaining $26.5 billion in assets were managed by numerous absolute return, private equity, private credit, private infrastructure, and private real estate investment managers. The performance of each external investment management firm and each internal manager is monitored quarterly against a pre-established benchmark as well as the performance of the manager's peer group.

Asset Allocation

The Board reviews the long-term asset allocation targets of the System annually. The Board consults with its actuary, consultants, Investment Office professionals, and other sources of information it deems appropriate in formulating the asset allocation plan. The level of risk assumed by the System is largely determined by the Board's strategic asset allocation plan. The Board, in determining its long-term asset allocation, takes the following factors into consideration:

- The System's investment time horizon;
- The demographics of the plan participants and beneficiaries;
- The cash flow requirements of the System;
- The actuarial assumptions approved by the Board;
- The funded status of the System;
- The Board's willingness and ability to take risk; and,
- The employers' (Commonwealth and school districts) financial strength.

In approving the asset allocation for the System that is recommended by Investment Office professionals and PSERS' general investment consultant, the Board considers capital market expectations for expected return, volatility, and asset class correlations as prepared by its general investment consultant. The current long-term, top-down asset allocation targets of the Board, based on targeted exposures, are discussed in the following paragraphs. Targeted exposures include positions obtained through derivative exposure with minimal capital requirements.

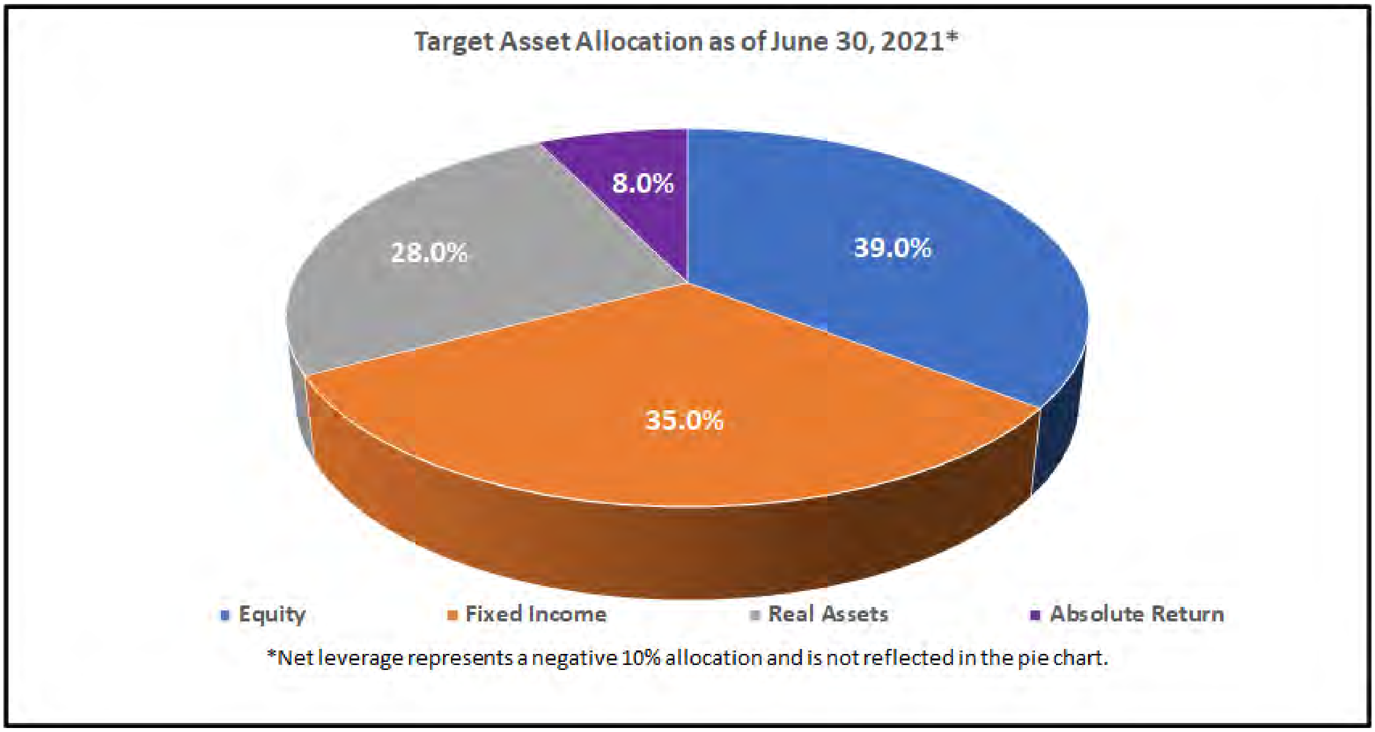
The current target allocation as of June 30, 2021, included an equity target allocation of 39.0% consisting of public equity (27.0%) and private equity (12.0%). Specific public equity targets have been established for U.S. equity (11.0%) and non-U.S. equity (16.0%). Within the U.S. equity target, the portfolios are diversified between domestically traded small, mid, and large capitalization equity. The non-U.S. equity exposure includes international developed markets and emerging markets small, mid, and large capitalization equity. The non-U.S. developed markets equity exposure is 25% currency-hedged back to the U.S. Dollar. The primary vehicle used to invest funds in private markets is the limited partnership. The partnerships are established by individual management groups that have been selected by the System for the purpose of investing in and managing private equity, venture capital, and debt positions on behalf of PSERS and other limited partners.

The fixed income target allocation of 35.0% consisted of investment grade exposure (8.0%), public credit-related exposure (4.0%), private credit exposure (8.0%) and inflation-protected exposure (15.0%). Investment grade exposure consisted of U.S. core fixed income (1.0%) and U.S. Long-term Treasuries (7.0%). Inflation protected exposure consisted of U.S. and Non-U.S. inflation-linked bonds. Within these categories, all sectors of the fixed income market are represented.

The real asset exposure of 28.0% consisted of public and private real estate (10.0%), public and private infrastructure (8.0%) and commodities (10.0%, including 7% to gold). The real estate allocation consisted of limited partnerships and publicly-traded real estate securities. The types of partnerships the System invests in include core, agriculture value-added, and opportunistic real estate limited partnership. The commodities allocation consisted primarily of commodity futures, commodity swaps, and commodity-related publicly traded stocks. Commodities are included in the allocation for inflation protection and to diversify the System's total portfolio risk. The infrastructure allocation targets stable, defensive investments primarily within the energy, power, water, and transportation sectors. Infrastructure plays a strategic role within the System by providing steady returns and cash yields, defensive growth, inflation protection, capital preservation, and diversification benefits. The infrastructure allocation consists primarily of publicly-traded companies.

The absolute return target allocation of 8.0% consisted primarily of investment managers retained by the System to generate positive returns over time that are independent of how the equity, fixed income, and commodity markets perform. Strategies implemented to achieve this target include, but are not limited to, event-driven, relative value, tactical trading and long/short equity. The absolute return program is included in the allocation to generate positive, absolute returns with low volatility and low correlation to the public financial markets to diversify the System's total portfolio risk.

Leverage was utilized at the asset allocation level to provide additional exposure to diversifying asset classes. The System utilized leverage through use of derivative instruments that allow the System to gain incremental asset class exposure with minimal margin requirements. Leverage is utilized in the fixed income and real asset allocations. 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. Total Leverage is allocated at (13.0%); Leverage is netted against the System's Cash allocation of 3% for a Net Leverage Allocation of (10%). The cash allocation consisted of short-duration, high quality government and investment grade securities. The Board, Investment Office professionals, and Aon Investment Consulting deemed it prudent to have an allocation to cash given the known and potential cash flow requirements of the System.

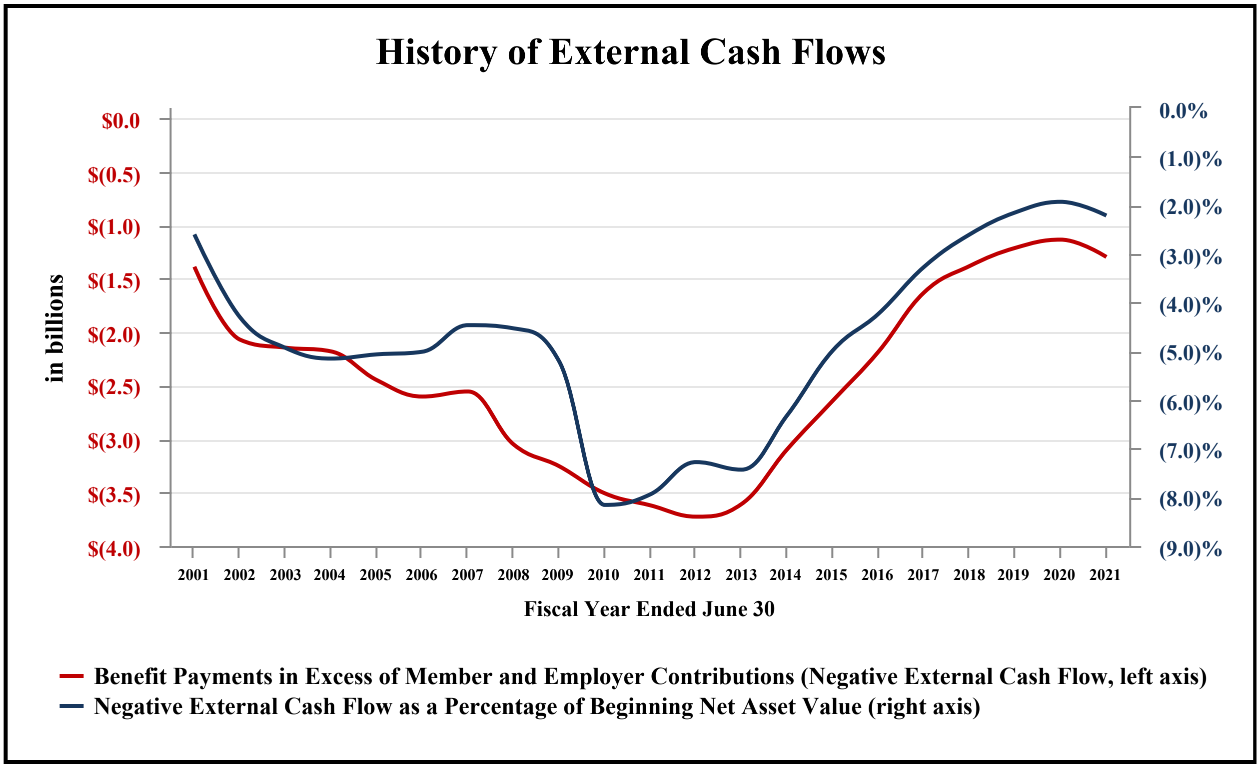


The System also participates in a securities lending program administered by Deutsche Bank AG. This program is designed to provide incremental income to the System by lending publicly-traded securities in the System's portfolio held by the System's custodial bank, The Bank of New York Mellon, to securities dealers in exchange for cash collateral, which can be reinvested to generate income. This program generated $19.8 million in net income during the year.

Liquidity and Asset Allocation

The System's risk profile is, in part, driven by its liquidity needs. Over the past twenty fiscal years, the System has paid out $50.7 billion more in benefits than it has received in member and employer contributions (i.e., the System has experienced negative external cash flow). The average negative external cash flow was approximately $2.4 billion per year during this period. This annual funding deficiency has amounted to 2.2% or more of beginning net assets each year and represents the amount of investment return needed each year to make up the shortfall (i.e., if the System earned 3.0% in a given year with a 3.0% external cash flow shortfall, then the net assets of the System will be unchanged). The negative annual external cash flow has improved significantly since fiscal year 2012 due to the implementation of Act 120 in 2010 (see chart below). Act 120 provided for increased employer contributions to the actuarial required contribution levels. The annual cash flow shortfall, while much improved, will continue over the next few years and necessitates a larger liquidity position and lower risk profile than a retirement system that has smaller liquidity requirements.

Given the significant net cash outflows, the Board has prudently reduced the risk profile of the System since the financial crisis in 2008. It has done so by decreasing its return dependence on the equity markets and increasing its risk exposures to asset classes that are less correlated to equity markets such as inflation-linked bonds, commodities, and absolute return. The goal of such an allocation is to generate the desired return profile with less volatility. While such an allocation will not provide for a large upside in returns, it is expected to minimize downside risks to the System's assets in the event of a large equity market drawdown as experienced during the financial crisis in 2008.



The Economy During The Past Fiscal Year

The Year in Review

COVID-19 dominated the headlines for the past fiscal year. It started with a lull in the virus during the first quarter, increasing cases in the second quarter, emergency approval of vaccines in the U.S.and ended with an almost fully reopened U.S. economy by the fiscal 4th quarter. The COVID-19 vaccination campaign is the largest in history and will be ongoing for the foreseeable future. However, as the fiscal year closed out, there continued to be concerns surrounding COVID-19, including new mutations of the virus, specifically the Delta variant which is more contagious than previous strains. Other headlines during the fiscal year included the U.S. presidential election, geo-political tensions between the U.S. and China, a Brexit deal between the United Kingdom and European Union, continued easy monetary policies, and ongoing fiscal support in the U.S. ($1.9 trillion COVID support package in March), Europe (€750 billion pandemic relief package), and elsewhere. As a result of easy monetary policies, loose fiscal policies, and re-opening of global economies, global equities and global risk markets, especially in the U.S., there is a growing concern that inflation will significantly increase. The biggest question about inflation is not if it will increase, but whether it will be on-going or transitory.

The U.S. Economy

The U.S. economy had some very significant tail winds during the past fiscal year. First, the Federal Reserve continued to run expansionary monetary conditions. The Federal Funds target rate range remained unchanged during the fiscal year at 0.00% - 0.25% with a commitment from the Federal Reserve to keep rates at rock bottom until at least 2022. In addition, the Federal Reserve continued to pump liquidity into the economy through its Treasury and MBS Asset Purchase program, injecting $120 billion a month through asset purchases. Second, the Federal Government approved a $1.9 trillion COVID-19 support package and is considering other fiscal programs, including an infrastructure bill. Finally, as COVID-19 cases moderated and with the deployment of a vaccine, the economy started to re-open and economic activity picked up significantly from being essentially shut down at the onset of the pandemic. The U.S. real Gross Domestic Product (GDP) increased by 12.2% over the course of the past year, with an unprecedented 33.8% quarter over quarter increase in the September 2020 quarter. With the economy re-opening, the official unemployment rate (U3 unemployment rate) fell during the fiscal year from 11.1% in June 2020 to 5.9% in June 2021. The more encompassing U6 unemployment rate, which measures not only people without work seeking full-time employment (U3 unemployment rate) but also counts “marginally attached workers and those working part-time for economic reasons”, fell to 9.8% as of fiscal year end, down significantly from 18.0% at the end of the last fiscal year.

The U.S. economy was strongly expanding for the fiscal year as measured by the manufacturing Institute of Supply Management (ISM) Purchasing Managers Index (PMI), an indicator of activity in the sector. During the fiscal year, the ISM PMI remained in expansionary territory from 52.6 at June 30, 2020 to a high of 64.7 on March 30, 2021 before falling back to a still strong 60.6 on June 30, 2021 (a contraction/expansion is indicated whenever the index is below 50/above 50). Concurrently, U.S. consumer confidence, as measured by the Conference Board's Consumer Confidence Index, strengthened from 98.3 at June 2020 to 128.9 at June 2021.

With the economy re-opening and consumers having significant savings from fiscal benefits such as one-time checks and enhanced unemployment benefits, inflation increased above the Fed's target inflation rate of 2.0%. Inflation significantly increased, with the U.S. Core Consumer Price Index (CPI) increasing to 4.5% year-over-year as of June 2021 from 1.2% one year ago. During the fiscal year, the Federal Reserve changed its inflation targeting approach and is now looking to achieve inflation moderately above 2% for some time so that inflation averages 2% over time and longer-term inflation expectations remain well anchored at 2%. This will potentially have the impact of inflation running higher for a period of time before the Federal Reserve reacts by increasing interest rates.

One area where significant inflation is showing up is housing. According to the S&P CoreLogic Case-Shiller U.S. National Home Price Index, home prices have increased by 18.5% over the past 12 months ended June 30,2021, the largest year-over-year increase since the index was created in 1990. Increases in home prices are being driven by a number of factors, including record low interest rates, record low inventory of homes, and the desire for more space during the COVID-19 work-from-home environment.

Select Non-U.S. Economies

The Euro Area benefited from similar but weaker tail winds as the U.S. during the past fiscal year. Europe's economy did not open as quickly due to stricter lock downs and a slower pace of COVID-19 vaccination rollout. The European Central Bank increased its asset purchase program from €500 billion to €1.85 trillion to support the market and stimulate growth. On the fiscal side, the European Union approved a €2.2 trillion budget and stimulus package which included a €750 billion pandemic relief package to be funded by joint debt. Also, a Brexit deal between the European Union and the United Kingdom was reached in late December 2020, just days before the Brexit Deadline. The EU-UK Trade and Cooperation Agreement sets out arrangements in areas such as trade in goods and services, digital trade, and other provisions which endeavor to ensure a level playing field and respect for fundamental rights between the two parties. As of the second quarter 2021, the Euro Area had strong year-over-year growth of 13.7%, driven by a re-opening of the economy from COVID-19 restrictions, loose monetary policy, and strong fiscal support. The unemployment rate remained stable at 7.7%, the same as a year earlier. It is important to note that fiscal stimulus in Eurozone countries is focused on getting money to companies who are encouraged to keep people on payroll; while in the U.S. fiscal stimulus is focused on individuals, not companies so there is more volatility in unemployment. Eurozone inflation trends remained stable during the past fiscal year, with Eurozone Core Inflation modestly increasing from 0.8% on an annualized basis in June 2020 to 0.9% in June 2021, continuing well below the European Central Bank (ECB) target of 2.0%. The Euro Area economy expanded this past fiscal year as evidenced by the Markit Eurozone Manufacturing PMI measurement of 63.4% in June 2021 and above 50 the entire fiscal year (a contraction/expansion is indicated whenever the index is below 50/above 50). Aggressive fiscal and monetary actions have generated improvements in growth but have failed to increase inflation to the ECB's target. The ECB continued its policy of very accommodative overnight interest rates (negative 0.5% since September 2019).

Japan, and Asia in general, did not suffer from a health perspective as much as the western economies from COVID-19 due to cultural differences related to mask wearing from prior pandemics such as SARS. However, Japan did have its share of economic lockdowns which impacted the economy and has also been slower in vaccinating its population which could lead to the impact of more rolling lockdowns to control communal spread of the virus. The significant event for Japan this past fiscal year was the resignation of Prime Minister Shinzo Abe who was replaced by Yoshihide Sugu. Prime Minister Abe had been aggressive in trying to revive Japan's economy and escape deflation using an economic policy referred to as Abenomics. While Abe's policy goals were not fully accomplished, they did help put Japan on better economic footing. As of the second quarter 2021, Japan's real GDP increased by a rate of 1.9% versus a -10.1% as of June 2020. Japan's demographics are poor as the population ages which generally means that robust growth will be difficult to sustain over the long term. However, since the size of the working age population is decreasing, unemployment has been very low compared to the U.S. and Europe and was 2.9% in June 2021, up from 2.8% last fiscal year. The inflation rate in Japan was negative 0.5% over the past year, down form 0.1% one year earlier. Japanese policy makers continue to aggressively attempt to stimulate their economy through a combination of low interest rates (the Bank of Japan policy rate is negative 0.1%), the purchase of higher risk assets by the Bank of Japan, coordinated diversification into higher risk assets by large public investors, and fiscal spending policies to encourage liquidity to move into riskier assets. Economic conditions improved as the Japanese manufacturing sector followed Europe into expansion territory as evidenced by the Jibun Bank Japan Manufacturing PMI which increased by 12.3 points from 40.1 at June 2020 to 52.4 at June 2021 (a contraction/expansion is indicated whenever the index is below 50/above 50).

China had robust growth compared to the other developed regions of the world and their aggressive actions fighting the COVID-19 virus allowed them to economically recover more quickly. China had strong real GDP growth of 7.9% over the past year, significantly faster than the 3.2% pace for the year ended June 2020 due to a reopening of the economy from COVID-19 shutdowns last fiscal year. Inflation in China remained well contained and relatively low over the past year at 1.1% compared to 2.5% last year. Economic conditions remained stable over the past year as evidenced by the China Manufacturing PMI at 50.9, unchanged from last year (a contraction/expansion is indicated whenever the index is below 50/above 50).

Investment Results

Aon Investment Consulting 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, 2021, the System generated a total net of fee return of 24.58%. This return exceeded the total fund Policy Index return of 20.58% by 400 basis points. Annualized total net of fee returns for the three-, five- and ten-year periods ended June 30, 2021 were 10.35%, 10.10% and 8.04%, respectively. The three-, five- and ten-year returns ended June 30, 2020 exceeded the total fund Policy Index returns by 25, 71 and 44 basis points, respectively.

PSERS' asset classes that were significant positive contributors to performance this past fiscal year included:

- Private Equity was up 57.0% from the post-COVID bounce in equity markets
- MLPs were up 53.5% due to the economy re-opening creating increased demand for energy
- Emerging Market Equity was up 52.2%
- U.S. Equities were up 46.7%
- Non-U.S. Equities were up 40.4%

PSERS' asset classes that were significant detractors from performance this past fiscal year included:

- U.S. Treasuries were down 10.4% due to rising interest rates
- Gold was down 3.9% as capital moved from diversifying assets to risk-on assets like equities
- Cash & Cash Equivalents were up 0.9%
- U.S. Core Fixed Income was up 3.9% as tightening credit spreads offset increasing interest rates

Given the strong tail winds for the global economy this past year, equity markets around the world were generally very strong. The strength in these markets stemmed from very easy monetary conditions around the world, strong fiscal support from the U.S. and European Union, and moderating COVID-19 cases leading economies to start re-opening with a commensurate pickup of economic activity. Equity markets were also strongly supported by TINA: There Is No Alternative, meaning that with interest rates globally at rock-bottom levels, capital flowed towards riskier, higher returning equities from lower returning safe assets such as U.S. Treasuries to meet investment return objectives.

Diversification is Undeniably Effective

Diversification into asset classes such as U.S. treasuries, gold, cash & cash equivalents, and U.S. core fixed income were a drag on overall performance this past fiscal year.As noted by Ben Hunt in his newsletter Epsilon Theory, "Diversification isn't a pretty bird. Diversification doesn't make my heart skip a beat like a flock of goldfinches in July. Diversification, by design, is going to have winners and losers simultaneously. Diversification, by design, is never going to look pretty doing its job, because if your portfolio is all working in unison, swooping through the market in a beautiful glint of gold...well, you may be making money, but you sure aren't diversified. Diversification is undeniably effective..." Many investment professionals discuss diversification using terms such as standard deviation, correlation, and co-variance. However, at its most basic level, diversification is insurance against bad future 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. As Peter Bernstein, the late American financial historian, economist, and educator once wrote, "Diversification is the only rational deployment of our ignorance."

Accomplishments

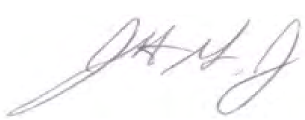
The Investment Office has exceeded the Board's stated investment objectives over the past 10 years. During this time, PSERS return has been more than sufficient to support the System's actuarial soundness and provide all required benefits to its members, exceeded the actuarial assumed rate of return, exceeded the Board's Policy Index, and was accomplished while prudently managing the investment risks required to achieve those goals. In fact, the returns generated over the past 10 years were done so with one of the lowest risk profiles, as measured by standard deviation of investment returns, among public pension funds in the country as well as one of the highest investment return to risk ratios. This accomplishment shows the power of a diversified investment program.

The Investment Office continued to successfully work from home during the fiscal year as a result of the COVID-19 pandemic. The investment team had the necessary equipment to make remote work productive. The team has access to all necessary service providers and tools necessary to manage the portfolio as well as communicate with our external service providers and each other through tools such as Microsoft Teams.

The Operations team in the Investment Office successfully completed phase one of the migration to SimCorp, PSERS' Investment Book of Record (IBOR). The IBOR project started in December 2017 and is slated to be completed in 2022. The IBOR is a technological solution designed to deliver the current best available view of investment data suitable for investment decision-making, incorporating the current status and forward projections of portfolio investment holdings and cash position, as well as reference data and derived analytics supporting the investment decision-making process. Benefits sought from the IBOR include, among other things, modernization of processes, increased transparency, and increased functionality.

Summary

This past fiscal year was very rewarding for taking investment risk, especially equity risk, with strong tailwinds from monetary policy, fiscal policy, and a relaxation of COVID-19 restrictions leading to increased mobility and economic activity. Returns this past fiscal year were stellar, up 24.58%. Years like the past fiscal year should not be expected often, but are enjoyed nonetheless. PSERS is built to generate long-term returns, so one good or bad year is not going to make or break the Fund. The System is proud to report that its annualized, net of fee return for the past 10 years is 8.04%, comfortably above our actuarial assumed rate of return of 7.00%. This return was accomplished in a very risk-controlled fashion, generating one of the highest investment risk to return ratios in the country and achieving all of the Board's stated investment goals. Looking forward, with cash rates of around 0.00%, the System still needs to take prudent risks to achieve its long-term goal of 7.00%. 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 should expect to go through years where returns are below 7.00%, perhaps significantly below. 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 the Fund, such as public and private equities, fixed income, and real assets. In any given year, the System expects some assets to perform well, such as U.S. equities did this past fiscal year, and some to not do as well, such as core fixed income 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 we believe the Fund is well positioned to accomplish its objectives.



James H. Grossman Jr., CPA, CFA
Chief Investment Officer

Annualized Time-Weighted Returns (%) Net of Fees (1)

Periods Ended June 30, 2021

	1 Year	3 Years	5 Years	10 Years
PSERS Total Portfolio	24.58	10.35	10.10	8.04
Total Fund Policy Index	20.58	10.10	9.39	7.60
Median Public Defined Benefit Plan (DBP) Fund Universe (Aon Investment Consulting Database)	26.98	10.86	10.55	8.22
PSERS U.S. Equity Portfolios	46.73	17.77	17.32	14.54
U.S. Equity Policy Index	45.60	17.88	17.39	14.47
PSERS Non-U.S. Equity Portfolios	40.41	13.69	14.78	9.01
Non-U.S. Equity Policy Index	35.56	10.51	12.36	7.32
PSERS Fixed Income Portfolios (4)	6.16	7.07	6.60	6.36
Fixed Income Policy Index	3.77	6.93	5.19	4.39
PSERS Commodity Portfolios (4)	14.36	9.11	5.73	-0.66
Commodity Policy Index	14.65	3.78	1.83	-3.28
PSERS Absolute Return Portfolios	12.72	4.73	5.60	4.23
Absolute Return Policy Index	16.16	7.86	6.68	6.36
PSERS Master Limited Partnership (MLP) Portfolios	53.52	0.22	1.01	4.99
Standard & Poor's MLP Index	53.15	2.96	2.05	2.70
PSERS Real Estate (2) (4)	14.72	8.18	9.29	10.18
Blended Real Estate Index	12.17	5.63	7.39	9.34
PSERS Alternative Investments (3)	57.14	18.75	17.35	12.56
Burgiss Median, Vintage Year Weighted Index	42.48	16.46	15.93	13.12

1. For more specific details on policy indices, refer to PSERS Investment Policy Statement at www.psers.pa.gov.
2. Returns reported on a one-quarter lag, except for publicly traded real estate security investments.
3. Returns reported on a one-quarter lag.
4. Returns are presented on an unleveraged basis for comparability purposes to the Policy Index.

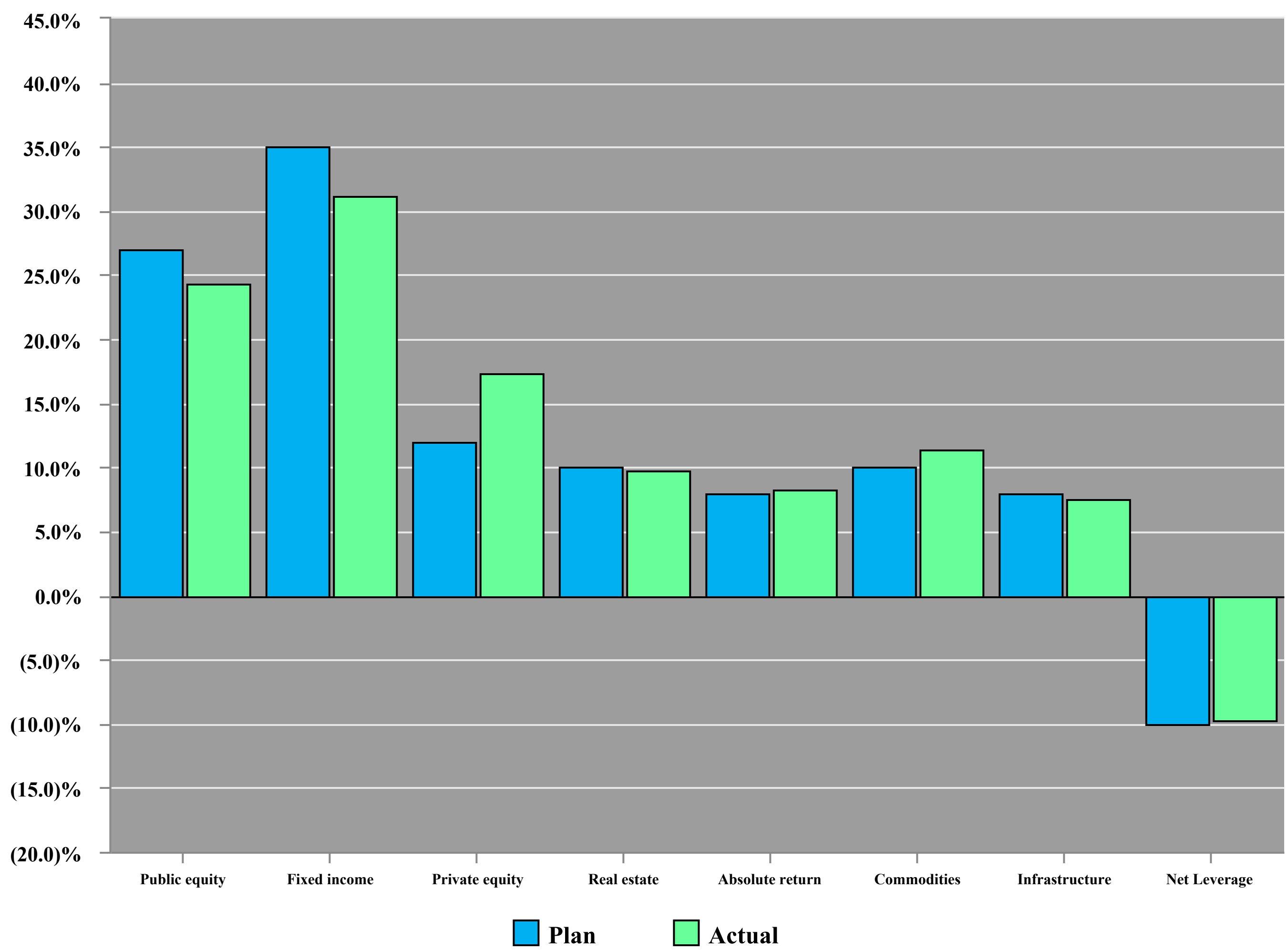
Portfolio Summary Statistics
Asset Allocation Basis
As of June 30, 2021
(Dollar Amounts in Thousands)

Pension investments	Fair Value	% Fair Value
Common and preferred stock (Public equity):		
Large and mid cap stocks	$ 7,590,762	10.6
Small cap stocks	730,387	1.0
Emerging markets stocks	2,581,506	3.6
Total Non-U.S. equity	**10,902,655**	**15.2**
Large cap stocks	4,793,059	6.7
Mid and small stocks	1,744,565	2.4
Total U.S. equity	**6,537,624**	**9.1**
Total Common and preferred stock	**17,440,279**	**24.3**
Fixed income:		
Investment grade fixed income	12,456,523	17.4
Private credit	7,485,220	10.5
Total U.S. Fixed income	**19,941,743**	**27.9**
Non-U.S. developed markets fixed income	1,914,720	2.7
Emerging markets fixed income	391,848	0.5
Total Non-U.S. Fixed income	**2,306,568**	**3.2**
Total Fixed income	**22,248,311**	**31.1**
Real estate	**6,979,375**	**9.7**
Private equity	**12,405,306**	**17.3**
Absolute return	**5,919,848**	**8.3**
Commodities	**8,199,903**	**11.5**
Infrastructure	**5,429,476**	**7.6**
Tail Risk Mitigation	**36,589**	**—**
Leverage:		
Leverage	(10,299,847)	(14.4)
Cash and cash equivalents	3,275,291	4.6
Total Net Leverage	**(7,024,556)**	**(9.8)**
Total Pension investments	**71,634,531**	**100.0**
Net Asset Allocation Adjustment*	(8,298)	
Pension investments per Statement of Fiduciary Net Position	**71,626,233**	
Postemployment Healthcare investments	**$ 471,906**	**100.0**
Defined Contribution plan investments	**$ 63,314**	**100.0**

* Includes reclassifications of certain investments between asset classes and investment receivables/payables to adjust the Statement of Fiduciary Net Position classification to the basis used to measure Asset Allocation. See the table and graph which follow.

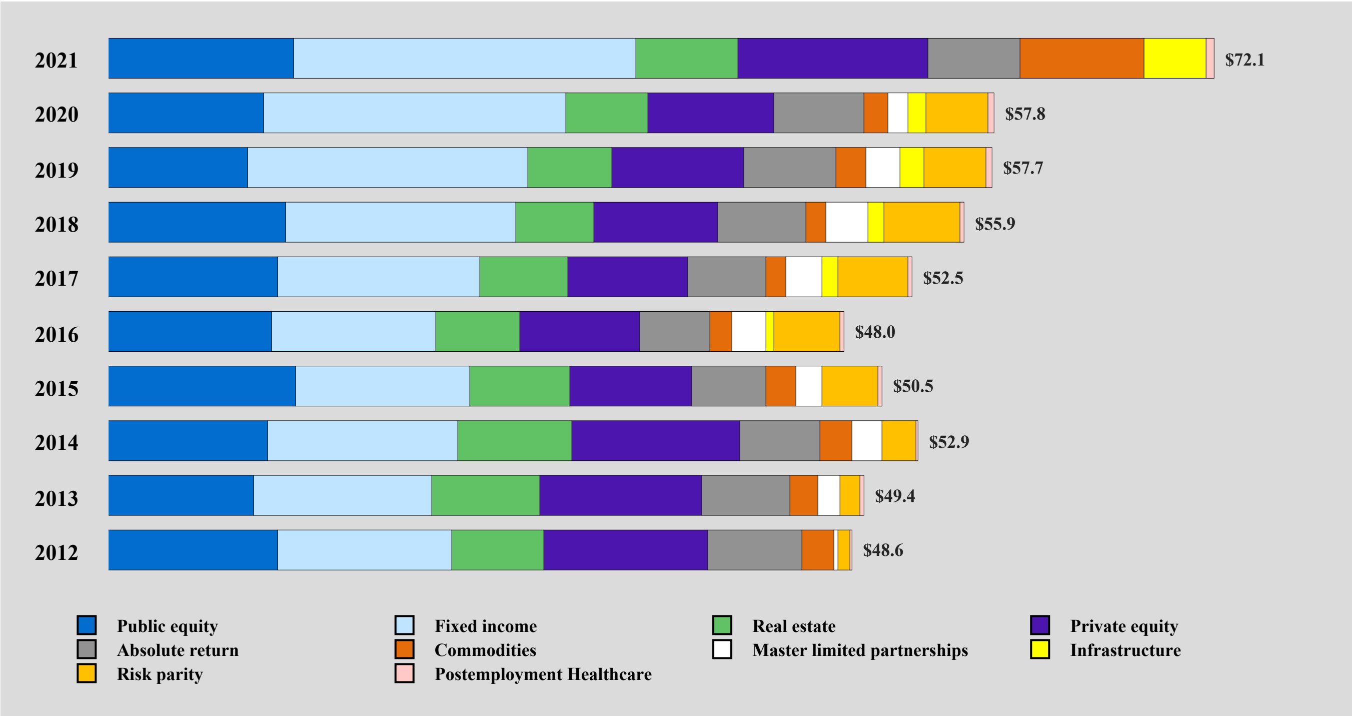
Comparison of Actual Portfolio Distribution to Asset Allocation Plan As of June 30, 2021

Asset Category	Plan	Actual
Common and preferred stock (Public equity)	27.0%	24.3%
Fixed income	35.0	31.1
Private equity	12.0	17.3
Real estate	10.0	9.7
Absolute return	8.0	8.3
Commodities	10.0	11.5
Infrastructure	8.0	7.6
Net Leverage	(10.0)	(9.8)
Total	**100.0%**	**100.0%**



Portfolio Capital Distribution 10 Year Trend*

(Fair Value - Dollar Amounts in Billions)



*Defined Contribution Plan and Tail Risk Mitigation are not included in the above chart.

The following lists of portfolio detail statistics present the ten largest holdings by descending order of fair value for the largest public market asset classes. Information on the complete holdings of the System can be downloaded from the PSERS website at www.psers.pa.gov.

Common and Preferred Stock (Public Equity)

10 Largest Holdings in Descending Order by Fair Value

As of June 30, 2021

(Dollar Amounts and Shares in Thousands)

Description	No. of Shares	Fair Value
The Children's Investment Fund LP	710,300	$ 713,770
BlackRock Emerging Markets Alpha Advantage Fund Ltd.- Class D	319	677,007
FIGS, Inc.	9,944	498,174
Cederberg Greater China Equity Fund	1,973	340,035
Steadview Capital Partners LP	309,935	330,876
Effissimo Capital Management Feeder Fund 2	729	280,603
Apple Inc.	1,965	269,172
Microsoft Corporation	944	255,691
Alphabet Inc.	93	230,356
Wellington Management Company LLP	30,474	221,543
Total of 10 Largest Holdings		**$ 3,817,227**

Fixed Income

10 Largest Holdings in Descending Order by Fair Value
As of June 30, 2021
(Dollar Amounts and Shares in Thousands)

Description	No. of Shares	Fair Value
BlackRock US Extended Core Global Alpha Bond Fund Ltd.	365	$ 992,899
Bridgewater International Inflation-Linked Bond Fund	130	633,388
Garda Fixed Income Relative Value Opportunity Fund Ltd.	319	632,520
Bridgewater Pure Alpha Fund II, Ltd.	138	598,316
PSERS TAO Partners Parallel Fund, LP	N/A	517,651
Cerberus PSERS Levered Loan Opportunities Fund, LP	N/A	359,034
Brigade Structured Credit Offshore Fund	200	350,042
LBC-P Credit Fund, LP	N/A	315,539
Bain Capital Credit Managed Account, LP	N/A	313,001
Park Square - PSERS Credit Opportunities Fund, LP	N/A	296,057
Total of 10 Largest Holdings		**$ 5,008,447**

Absolute Return

10 Largest Holdings in Descending Order by Fair Value
As of June 30, 2021
(Dollar Amounts and Shares in Thousands)

Description	No. of Shares	Fair Value
Bridgewater Pure Alpha Fund II, Ltd.	240	$ 953,220
Capula Global Relative Value Fund, Ltd.	4,020	466,624
OWS Credit Opportunity Offshore Fund III, Ltd.	275	424,373
PIMCO Commodity Alpha Fund, Ltd.	256	402,424
Brigade Leveraged Capital Structures Offshore Ltd.	153	363,787
Aeolus Property Catastrophe Keystone PF Fund, LP	364	350,346
PIMCO Global Credit Opportunity Offshore Fund Ltd.	280	342,481
Caspian Select Credit International, Ltd.	153	310,188
AKAZ Offshore Fund Ltd.	200	246,144
Capula Tail Risk Fund Ltd.	2,983	234,802
Total of 10 Largest Holdings		**$ 4,094,389**

Postemployment Healthcare Investments
10 Largest Holdings in Descending Order by Fair Value
As of June 30, 2021
(Dollar Amounts in Thousands)

Description	Maturity Date	Interest Rate (%)	Par Value	Fair Value
Wilmington US Government MM	N/A	Various	$ 206,727	$ 206,727
PSERS Short-Term Investment Fund	Various	Various	179,407	179,407
Verizon Owner Trust	09/20/2022	Various	6,715	6,715
Carvana Auto Receivables LLC	Various	Various	2,925	2,923
Master Credit Card	01/23/2023	0.51%	2,712	2,710
World Financial Network	08/15/2025	3.55%	2,207	2,206
Santander Drive Auto Receivables Trust	03/21/2022	0.15%	1,143	1,143
Westlake Services, LLC	03/15/2022	0.16%	970	970
Tesla, Inc.	N/A	N/A	916	916
Deere & Company	01/15/2025	2.91%	881	881
Total of 10 Largest Holdings				**$ 404,598**

Defined Contribution Plan Investments
10 Largest Holdings in Descending Order by Fair Value
As of June 30, 2021
(Dollar Amounts and Shares in Thousands)

Description	No. of Shares	Fair Value
T Rowe Price Target Date 2060	1,515	$ 23,666
T Rowe Price Target Date 2055	542	8,036
PSERS Short-Term Investment Fund	N/A	6,081
T Rowe Price Target Date 2050	382	5,663
T Rowe Price Target Date 2045	312	4,616
T Rowe Price Target Date 2040	255	3,742
T Rowe Price Target Date 2035	220	3,180
T Rowe Price Target Date 2030	168	2,369
T Rowe Price Target Date 2065	106	1,350
T Rowe Price Target Date 2025	89	1,234
Total of 10 Largest Holdings		**$ 59,937**

Comparison of Investment Activity Income
Fiscal Years Ended June 30, 2021 and 2020
(Dollar Amounts in Thousands)

Investment Activity	2021	2020
Net appreciation in fair value of investments	**$ 13,949,087**	$ 261,864
Short-term	**12,691**	102,344
Fixed income	**294,417**	268,787
Common and preferred stock	**272,651**	277,635
Collective trust funds	**913**	4,633
Real estate	**267,489**	219,762
Alternative investments	**565,392**	371,652
Total investment activity income	**$ 15,362,640**	$ 1,506,677

Brokers' fees on equity investment transactions for the fiscal year ended June 30, 2021 were $4.6 million. The System has commission recapture contracts with several brokers. These contracts generally stipulate that the brokers rebate a percentage of commissions earned on investment transactions directly to the System. During the fiscal year ended June 30, 2021, the System earned $14,000 from a commissions recapture program. A list of the brokers receiving fees in excess of $100,000 during the fiscal year follows:

Summary Schedule of Brokers' Fees
(Cumulative Fiscal Year Amounts Exceeding $100,000)
Fiscal Year Ended June 30, 2021
(Shares in Thousands)

Broker Name	Fees Paid	Shares	Broker Name	Fees Paid	Shares
Instinet LLC	$ 523,143	146,671	Citigroup Inc.	$ 164,424	34,625
Morgan Stanley & Company	268,619	87,507	UBS	153,052	36,908
Canaccord Genuity Inc.	211,598	38,618	Bank Of America Merrill Lynch	139,993	28,356
Fimat USA	200,523	82	Macquarie Bank Ltd	129,544	31,302
Liquidnet Inc.	185,914	18,850	J P Morgan Chase & Co.	129,071	50,257
Goldman Sachs & Company	174,980	41,934	Jefferies & Company Inc.	107,413	15,471
Credit Suisse	180,658	30,503	Barclays Capital	105,460	13,297

Professional Consultants
External Investment Advisors
As of June 30, 2021

Absolute Return Managers

- Aeolus Capital Management, Ltd.
- AKAZ Investment Partners, LP
- Bridgewater Associates, LP
- Brigade Capital Management
- Capula Investment Management, LLP
- Carlyle Aviation Management Limited
- Caspian Capital, LP
- Falko Regional Aircraft Limited
- Garda Capital Partners, LP
- HS Group Ltd.
- Independence Reinsurance Partners GP, LLC
- Nephila Capital, Ltd.
- Oceanwood Capital Management, Ltd.
- One William Street Capital Management, LP
- Pacific Investment Management Company, LLC
- Venor Capital Management, LP

Non-U.S. Equity Managers

- Acadian Asset Management, LLC
- Baillie Gifford Overseas, Ltd.
- BlackRock Institutional Trust Company, N.A
- Cederberg Capital
- Effissimo Capital Management Pte. Ltd.
- Marathon Asset Management Limited
- Oberweis Asset Management, Inc.
- QS Batterymarch Financial Management, Inc.
- Steadview Capital Partners, LP
- The Children's Investment Fund, LP
- Wasatch Advisors, Inc.

Fixed Income Managers

U.S. High Yield Fixed Income Manager

- BlackRock Institutional Trust Company, N.A.

Private Credit Managers

- Apollo Global Management, LLC
- Ares SSG Capital Management Limited
- Avenue Capital Group
- Bain Capital Credit, LP
- Brigade Capital Management
- Carlyle Group, The
- Cerberus Business Finance, LLC
- Clearlake Capital Group, LP
- Galton Capital Group, LLC
- Hayfin Capital Management LLP
- Intermediate Capital Group PLC
- LBC Credit Management, LP
- Newmarket Global Management, LP
- Pacific Investment Management Company, LLC
- Park Square Capital, LLC
- Sixth Street Partners, LLC
- Summit Partners
- TCI Fund Management Limited
- Varde Partners, Inc.
- Whitehorse Liquidity Partners, Inc.

Emerging Markets Debt Manager

- Franklin Templeton Investments

Non-U.S. Inflation-Linked Securities Manager

- Bridgewater Associates, LP

LIBOR-Plus Short-Term Investment Pool Manager

- Radcliffe Capital Management

Real Assets

Commodity Managers

- Denham Capital Management, LP
- Gresham Investment Management, LLC
- NGP Energy Capital Management
- Wellington Management Company, LLP

Farmland Advisor

- Prudential Agricultural Group

Master Limited Partnership Managers

- Atlantic Trust Private Wealth Management
- Salient Capital Advisors, LLC

Professional Consultants (Continued)

Private Infrastructure Managers

- Blackstone Group, The
- GCM Grosvenor
- I Squared Capital
- Newmarket Global Management, LP

Publicly Traded Real Estate Securities Manager

- Security Capital Research & Management, Inc.

Real Estate Advisors

- Bell Partners, Inc.
- GF Management, Inc.
- L&B Realty Advisors
- O'Connor Real Estate Advisors, LLC.
- Property Management, Inc.

Real Estate Fund Managers

- Almanac Realty Investors, LLC
- Angelo, Gordon & Co., LP
- Ares Management, LLC
- Avenue Capital Group
- Bell Partners, Inc.
- BlackRock Real Estate
- Blackstone Group, The
- Brookfield Asset Management, Inc.
- Cabot Properties, Inc.
- Carlyle Group, The
- C-III Capital Partners, LLC
- DRA Advisors, LLC
- Exeter Property Group
- Fortress Investment Group
- LAI Real Estate Investors, LLC
- LaSalle Mortgage Real Estate Investors
- LEM Capital Partners, LP
- O'Connor Capital Partners
- Paramount Group, Inc.
- PGIM Real Estate
- RCG Longview Management, LLC
- Silverpeak Real Estate Partners
- Stockbridge Capital Partners
- Strategic Partners
- UBS Realty Investors, LLC

Currency Hedging Manager

- Insight Investment International Limited

Private Equity Fund Managers

Buyouts Fund Managers

- Actis LLP
- APAX Partners, LLP
- Apollo Global Management, LLC
- Arrowhead Mezzanine
- Avenue Capital Group
- Bain Capital Partners, LLC
- Baring Private Equity Asia Limited
- Black Diamond Capital Management, LLC
- Blue Point Capital Partners LLC
- Bridgepoint Capital Ltd.
- Capital Group
- L Catterton Management Company LLC
- Cerberus Capital Management, LP
- Cinven
- Clearlake Capital Group, LP
- Coller Investment Management LTD
- Crestview Advisors LLC
- CVC Capital Partners Group
- Denham Capital
- The Energy & Minerals Group
- Equistone Partners Europe Limited
- Evergreen Pacific Partners GP LLC
- First Reserve Corporation
- Gold Hill Venture Lending 03, LLC
- GoldPoint Partners LLC
- Hahn & Company
- HgCapital
- Huntsman Gay Global Capital LLC
- Incline Management Corp.
- IPC Advisors
- K4 Capital Advisors
- Landmark Partners
- Lindsay Goldberg & Bessemer
- Milestone Partners
- Morgan Stanley
- New Mountain Investments
- NGP Energy Capital Management
- Oaktree Capital Management, LP
- Odyssey Investment Partners LLC
- Orchid Asia

Professional Consultants (Continued)

- PAI Europe
- Palladium Equity Partners
- Partners Group Mgt VI LTD
- Platinum Equity Capital Partners
- Polaris Capital Group, Ltd.
- Portfolio Advisors, LLC
- Searchlight Capital Partners, LP
- StepStone Group
- Sterling Partners
- Strategic Partners
- Trilantic Capital Management, LLC
- Tulco Management, LLC.
- Venor Capital Management, LP
- Versa Capital Management, LLC
- Webster Capital Management, LLC

Growth Equity Fund Managers

- Green Oaks Capital
- Insight Venture Management, LLC
- LLR Partners
- Oak HC/FT Management Company, LLC
- Summit Partners

Venture Capital Fund Managers

- Adams Capital Management, Inc.
- Aisling Capital, LLC
- Cross-Atlantic Capital Partners
- Insight Venture Management, LLC
- Mid-Atlantic Venture Funds
- Psilos Group Investors
- Sante Ventures
- SCP Private Equity Partners
- StarVest Associates
- Sterling Partners
- Strategic Partners
- Tenaya Capital
- Valar Ventures, LLC

Custodian Bank

- The Bank of New York Mellon Corporation

Securities Lending Agent

- Deutsche Bank AG

Investment Accounting Application Service Provider

- STP Investment Services, LLC

Proxy Voting Agent

- Glass, Lewis & Co., LLC

Board Investment Consultant

- Verus Advisory, Inc.

General Investment Consultant

- Aon Investments USA Inc.

Private Equity, Private Real Estate, Private Credit, and Private Infrastructure Investment Consultant

- Hamilton Lane Advisors, LLC

Absolute Return & Private Credit Consultant

- Aksia, LLC

Risk Management System Provider

- BlackRock Solutions

Defined Contribution Investment Consultant

- CAPTRUST Financial Advisors

PA State Bird: Ruffed Grouse