Investment Section

Mr. Robert Sprehe
Retiree From Truman State University
Kirksville, MO
Years of Service: 30 Years
Year Retired: 1992

Chief Investment Officer's Report

MOSERS
MISSOURI STATE EMPLOYEES' RETIREMENT SYSTEM

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October 29, 2021

Dear Members,

I am pleased to present the *Investment Section* of the *MOSERS Annual Comprehensive Financial Report* for the fiscal year ended June 30, 2021.

The MOSERS portfolio generated a time-weighted rate of return based on fair market value of 26.4% for the year ended June 30, 2021, net of all fees and expenses. The 26.4% was the highest fiscal year return achieved by the fund since 1986. Other highlights for the year include the following:

- At year end, pension fund assets totaled over $9.7 billion, a record high for total assets.
- The investment portfolio generated over $2 billion in net earnings during the year, representing another record high.
- The 26.4% actual return exceeded the policy return (i.e. the return expectations set by the Board) of 25.2% by 1.2%, resulting in $97.7 million of value added to the fund.

Defined by continued economic recovery, reopening of establishments, and continued government stimulus as a response to the COVID-19 pandemic, the year was certainly a risk-on investment environment. Equities and commodities led the way, each returning over 40% for the year. Public real assets, represented by real estate investment trusts (REITS) weren't far behind, generating returns in the mid 30%s. Not unexpectedly, safe haven assets, such as U.S. Long Treasuries, did not fare well during the year, returning a negative 10%. While we welcome the high earnings and performance of the portfolio this year due to the exposure to risk on assets; as long term investors, we recognize the importance of the diversifying safe haven assets to the portfolio in the long run.

As mentioned in the previous two CIO letters, the Board adopted a new asset allocation for MOSERS' portfolio in 2018. Staff began transitioning to this new portfolio in fiscal year 2019 and completed the transition at the end of February 2021, ten months ahead of schedule. The early completion of the transition proved beneficial to the fund for the year as the new allocation provided greater exposure to the risk-on assets that performed well during the year; however, the portfolio does retain some balance with meaningful exposure to diversifying safe haven assets.

I will be retiring from MOSERS before the end of 2021. As a lifetime Missourian, I have been honored to play a part in the secured retirement benefits of the fine members of this system during my 25+ year career at MOSERS. TJ Carlson has been named the successor to my CIO role. TJ brings with him years of experience as a CIO of several different public funds and he will inherit a talented, experienced staff of investment professionals. Overall, I am confident the investment program is in good hands going forward with this team.

Sincerely,

D. Shannon Davidson
Chief Investment Officer

Investment Policy Summary

The investment policy summary serves as a reference point for management of System assets and outlines MOSERS' investment philosophy and practices. Investments within this report are presented on the basis of fair value using a variety of sources such as appraisals, valuations of underlying companies and assets for limited partnerships and commingled funds, and through fair values obtained from the investment custodian.

The purpose of MOSERS' investment program is to ensure that MOSERS' members and beneficiaries receive their benefits at a reasonable and predictable cost to the employers. Plan assets may be invested, reinvested, and managed by MOSERS' investment staff or third-party investment managers, subject to the terms, conditions, and limitations provided by law and contracts, where applicable.

The MOSERS Board of Trustees (the Board), charged with the responsibility for investing the assets of the System in a manner consistent with fiduciary standards set forth in the prudent person rule, has adopted the following objectives and philosophies to guide all investment related decisions.

Investment Objectives

- Develop a Real Return Objective (RRO) intended to keep contribution rates at a reasonable level over long periods of time, absent changes in actuarial assumptions.
- Establish an asset allocation policy that is expected to meet the RRO, while minimizing the impact of the portfolio investments' volatility on the contribution rate.
- Maximize long-term investment returns by exposing plan assets to a prudent level of risk in order to support the goal of having sufficient funds available to meet projected benefit payment obligations.
- Monitor costs associated with the efficient implementation of the asset allocation policy through the use of internal and external resources.

Investment Philosophy

- A key risk to the portfolio is asset shortfall where assets are insufficient to meet promised benefit obligations. As a result, the Board will strive to minimize the potential for long-term impact from disproportionate drawdowns.
- MOSERS is willing to take measured risks for which it expects to be compensated, and will seek to avoid risks, which may not be appropriately rewarded.
- The Board will employ a disciplined, objective, and quantitatively-driven asset/liability analysis process with the goal of determining the optimal asset allocation policy to meet the investment objectives.
- In order to meet the RRO, it is necessary for the portfolio to maintain a significant allocation to growth (i.e., equity) assets. As a result, equity risk is expected to be the key contributor to the overall risk of the portfolio's investments (Total Fund). In recognition of this, the Board's asset allocation policy will seek to mitigate the risk from large equity market declines.
- Strategic asset allocation is a significant factor influencing long-term investment performance and asset volatility. The asset allocation targets, determined by the Board, will be adhered to through clearly defined rebalancing guidelines.
- The Board will seek to cause the total fund to be broadly diversified and risk-balanced in view of the fact that not all strategies will add value at all times, which should mitigate the impact of negative market environments over its long-term investment horizon.
- Risk management and performance benchmarking are integral to the investment program. The Board will establish and regularly monitor appropriate absolute and relative return risk as well as other key risks that affect the total fund.
- The Board will employ industry-accepted benchmarks for all major asset classes, using published market indices where feasible.
- Costs meaningfully impact investment returns and will be a consideration in all investment program decisions. Investment performance shall be reported net of fees to incorporate the full impact of fees and costs.

Roles and Responsibilities

Board of Trustees

The Board of Trustees (the Board) bears the ultimate fiduciary responsibility for the investment of System assets. Members of the Board must adhere to state law and prudent standards of diligence with respect to their duties as investment fiduciaries. Accordingly, they are required to discharge their duties in the interest of plan participants. They must also "act with the same care, skill, prudence, and diligence under prevailing circumstances that a prudent person, acting in a similar capacity and familiar with those matters, would use in the conduct of a similar enterprise with similar aims."[1] Specifically related to investments, the Board is responsible for prudent oversight, governance, and management of the System's assets.

Executive Director

The executive director is appointed by, and serves at the pleasure of, the Board. Pursuant to its authority to delegate functions to employees of the System under Section 104.1069, RSMo., the Board of Trustees has delegated to the executive director the responsibility to manage the staff that oversees and executes MOSERS' investment program. The executive director selects, evaluates, and terminates the chief investment officer and is responsible for monitoring the investment program compliance, as established by policies set forth by the Board.

Chief Investment Officer (CIO) and Internal Staff

The CIO serves at the pleasure of the executive director and has primary responsibility for the overall direction of the investment program. The CIO works with the Board investment consultant and executive director in advising the Board on policies related to the investment program. The CIO has primary responsibility to make hiring and termination decisions related to money managers with the approval of the staff investment consultant. The CIO is also charged with the responsibility of making strategic allocation decisions within parameters established by Board policy. Other responsibilities of the CIO include monitoring the investment of System assets, oversight of external money managers and the internally managed portfolios, and keeping the Board apprised of situations that merit their attention. The internal investment staff is accountable to the CIO.

External Consultants

The Board investment consultant serves at the pleasure of the Board. The Board investment consultant's primary duty is to provide the Board with independent and objective investment advice and assist the Board in making decisions and overseeing the investment program. Specifically, the Board investment consultant assists the Board in developing investment policy, recommends asset allocation policy as requested by the Board, and assists the Board in oversight of the investment program.

Staff investment consultants serve at the pleasure of the CIO. The primary responsibilities of the staff investment consultants are to provide independent and objective investment advice to the staff. Among other duties, as applicable, each staff investment consultant agrees in writing to the CIO's proposed hiring or termination of external investment management firms and third-party plan administrators.

Chief Auditor

The chief auditor reports directly to the executive director and if, in the opinion of the chief auditor circumstances warrant, may report directly to the Board. The chief auditor is independent of the System's investment operations and, among other duties, is responsible for providing objective audit and review services for investment operations. It is the chief auditor's objective to promote adequate and effective internal controls at a reasonable cost.

Master Custodian

Bank of New York Mellon serves as the master custodian of the System's assets except in cases where investments are held in partnerships, commingled accounts, or unique asset classes where it is impossible for them to do so. The master custodian is responsible for maintaining the official book of records, providing performance reports, and serving as an additional layer of risk control in the safekeeping of System assets.

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[1] *Section 105.688, RSMo - Investment Fiduciaries, Duties.*

Asset Allocation

Determining the System's asset allocation is one of the most important decisions in the investment management process. The Board, with advice from the Board investment consultant and the CIO, adopted a new portfolio allocation in July 2018 that is designed to provide the highest probability of meeting or exceeding the System's investment objectives at a controlled level of risk and with liquidity that is acceptable to the Board. The Board adopted a plan to transition from the old portfolio allocation to the new portfolio allocation over a period of time in order to lessen the impact of market volatility. The transition to the new portfolio allocation was completed in February 2021. In determining the optimum mix of assets, the Board considers factors such as:

- The expected risk of each asset class.
- The expected rate of return for each asset class.
- The correlation between the rates of return of the asset classes.
- The investment objectives and risk constraints of the fund.
- The impact of the portfolio's volatility on the contribution rate.

While the Board maintains a set policy allocation mix, they have taken steps to provide flexibility by granting authority to the CIO, with the approval of the general asset consultants, to make strategic allocation decisions to capitalize on attractively valued opportunities within prudent risk constraints. This flexibility has allowed the System to take advantage of changing market conditions. The table below illustrates the policy asset allocation and ranges formally adopted by the Board for the new portfolio.

Asset Allocation

Asset Classes	Asset Allocation Policy	Asset Allocation Ranges[1]	Benchmark[2]
Total growth	**45%**	**35% - 55%**	**Blended**
Global public equities	30%	15% - 45%	MSCI ASCWI
Global private equities	15%	5% - 20%	Burgiss All Equity Universe (weighted by vintage year)
Total income	**35%**	**30% - 40%**	**Blended**
Long treasuries	25%	20% - 30%	Bloomberg Barclays Long Treasury
Core bonds	10%	5% - 15%	Bloomberg Barclays Aggregate Bond
Total inflation hedge	**40%**	**35% - 45%**	**Blended**
Commodities	5%	0% - 10%	Bloomberg Commodity Index (BCOM)
TIPS	25%	20% - 30%	Bloomberg Barclays 1 - 10 yr TIPS
Private real assets	5%	0% - 10%	NCREIF ODCE
Public real assets	5%	0% - 10%	NAREIT Index
Total absolute return	**20%**	**15% - 25%**	**Blended**
Hedge funds	5%	0% - 10%	HFRI Fund Weighted Composite Index
Alternative beta	10%	5% - 15%	HRFX Macro/CTA
Private credit	5%	0% - 10%	S&P/LSTA U.S. Leveraged Loan Index + 2%

[1] *The Board has granted the CIO the authority to operate within the risk allocation and policy asset allocation ranges.*

[2] *Benchmarks are net of MOSERS' actual leveraging costs on borrowed assets.*

Rebalancing

It is the responsibility of staff to ensure that the asset allocation adheres to the System's rebalancing policy. MOSERS utilizes a combination of cash market and derivative transactions to maintain the total portfolio's allocation at the broad policy level. Month-end reviews are conducted to bring the portfolio back within allowable ranges of the broad policy targets.

Risk Controls

MOSERS' investment program faces numerous risks; however, the primary risk to MOSERS is that the assets will not support the liabilities over long periods of time. In order to control this risk and numerous other risks that face the System, the Board has taken the following steps, on an ongoing basis, to help protect the System:

- Actuarial valuations are performed each year to ensure the System is on track to meet the funding objectives of the plan. In addition, every five years an external audit of the actuary is conducted to ensure that the assumptions being made and calculation methods being utilized are resulting in properly computed liabilities.
- Asset/liability studies are conducted at least once every five years. The purpose of these studies is to ensure that the current portfolio design is structured to meet the System's liabilities. During these studies, investment expectations are also reexamined in more detail.
- An investment policy statement is in place to ensure that Board policies are clearly identified. Within these documents, desired outcomes are identified, responsibilities for individuals are identified in relation to particular areas of the portfolio's management, and details are provided for measuring outcomes. Reporting requirements are clearly identified to ensure appropriate checks and balances are in place. In addition, annual performance audits are conducted to ensure the performance measurement tools and methodologies being utilized are proper.

Performance Objectives and Monitoring Process

Generating returns net of expenses equaling the RRO (4.70% in fiscal year 2021) plus inflation remains the primary performance objective for the total portfolio.

The reason for the long-term focus on this objective is to preclude the temptation to overreact to events in the marketplace that have no relevance in the management of the relationship between the System's assets and liabilities. The resulting dilemma is the conflicting need to evaluate investment policy implementation decisions over shorter time frames while maintaining the longer-term focus necessary to manage and measure the fund's performance relative to the RRO. To address this problem, the Board evaluates performance relative to policy benchmarks. This helps to evaluate the Board's broad policy decisions and the staff and external consultant's implementation decisions. Policy benchmarks measure broad investment opportunities of each sub-asset class in which MOSERS has chosen to invest. The difference between the policy benchmarks and the actual portfolio returns represent decisions made by the CIO to strategically deviate from the policy asset allocation for each sub-asset class.

The policy benchmarks are used in the following manner to evaluate Board and staff decisions:

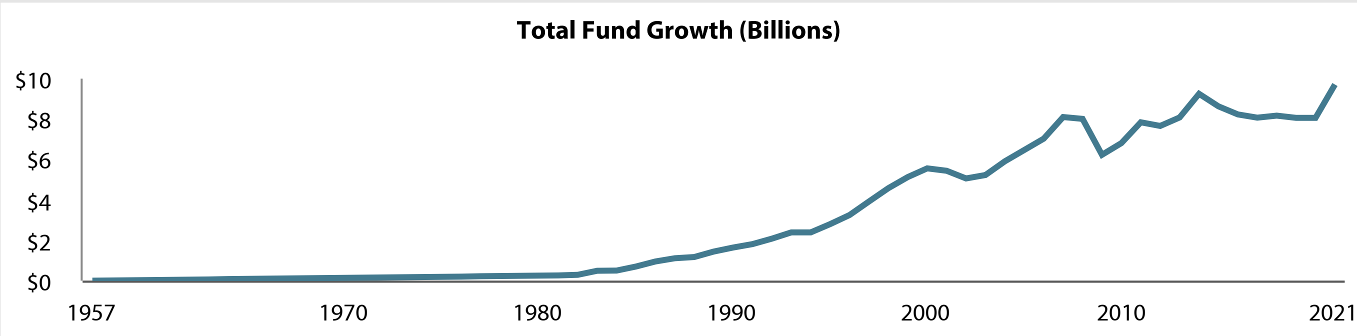
- **Board Decisions:** The value added through Board policy decisions is measured by the difference between the total fund policy benchmark return and the RRO. This difference captures the value added by the Board through their policy asset allocation decisions relative to the return necessary to fund the System's liabilities. A policy benchmark return greater than the RRO reflects the achievement of the RRO goals. A policy benchmark return less than the RRO reflects losses or shortfalls in performance in funding the liabilities. These policy decisions are measured over long periods of time.
- **CIO and External Consultants' Decisions:** There are two components to decisions made by the CIO and external consultants, which are monitored by the Board on an ongoing basis. They are: 1) strategic allocation decisions, and 2) implementation decisions.

Strategy decisions are made by the CIO to deviate from the policy benchmark weight. Implementation decisions are money manager selection choices made by the CIO with the agreement of the appropriate external consultant and the acknowledgement from the executive director that the decision was made in accordance with the Board's adopted policy. The value added through both strategic and implementation decisions is measured by the difference between the actual portfolio return and the policy benchmark return. An actual portfolio return greater than the policy benchmark return reflects value added through these decisions of the CIO and the external consultants. An actual portfolio return less than the policy benchmark return reflects losses to the fund's performance based upon these decisions. These CIO and external consultant decisions should be measured over all periods of time with a majority weight placed on outcomes that have occurred over a market cycle.

The Board reviews performance information on a quarterly basis to help ensure adequate monitoring of the fund's overall performance objectives.

Total Fund Review

As of June 30, 2021, the MOSERS investment portfolio had a fair value of $9.7 billion. The graph below illustrates the growth of MOSERS' portfolio since the System's inception.



Investment Performance

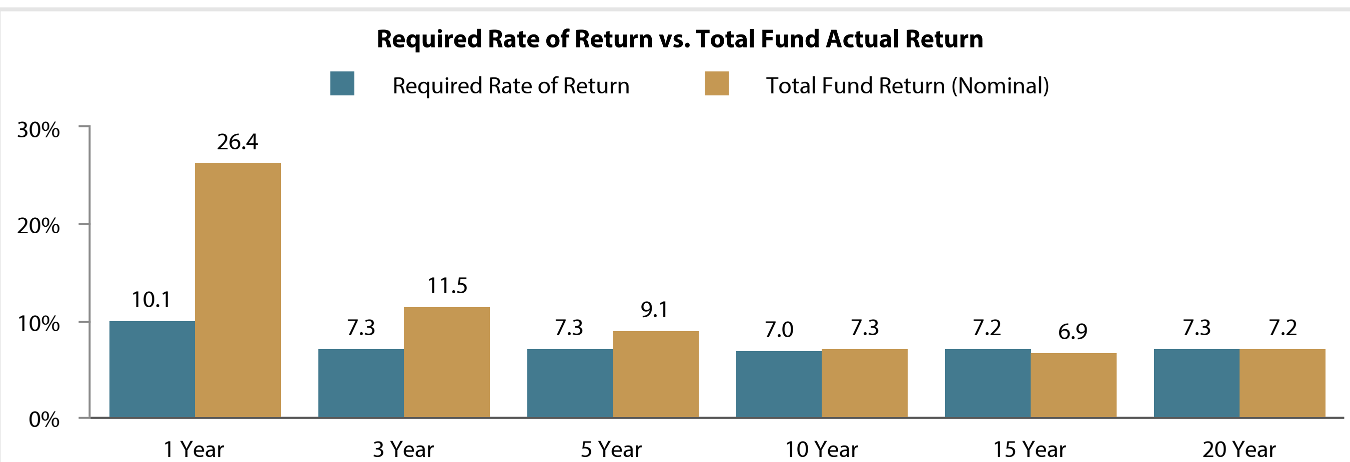
MOSERS' investments generated a time-weighted return of 26.4%, net of fees, for fiscal year 2021. The total fund return exceeded the 1-year policy benchmark of 25.2%. This additional 1.2% investment return produced $97.7 million in excess of what would have been earned if the fund had been invested passively in the policy benchmark.

Investment Performance vs. Required Rate of Return

The total fund investment return is compared to a required rate of return. The required rate of return is established by the Board to determine how well the fund is performing over the long term in order to meet future plan obligations after accounting for inflation. The required rate of return for fiscal year 2021 is equal to the RRO of 4.70% plus inflation. The best known measure of inflation is the Consumer Price Index (CPI). [1]

Given the volatility of the investment markets, the portfolio should not be expected to meet the required rate of return every year. A review of long periods of time is best to evaluate whether or not the total return has kept pace with the System's funding objectives.

As indicated in the following bar chart, MOSERS' investment returns trailed the required rate of return by 0.1% over the 20-year period ended June 30, 2021. [2]

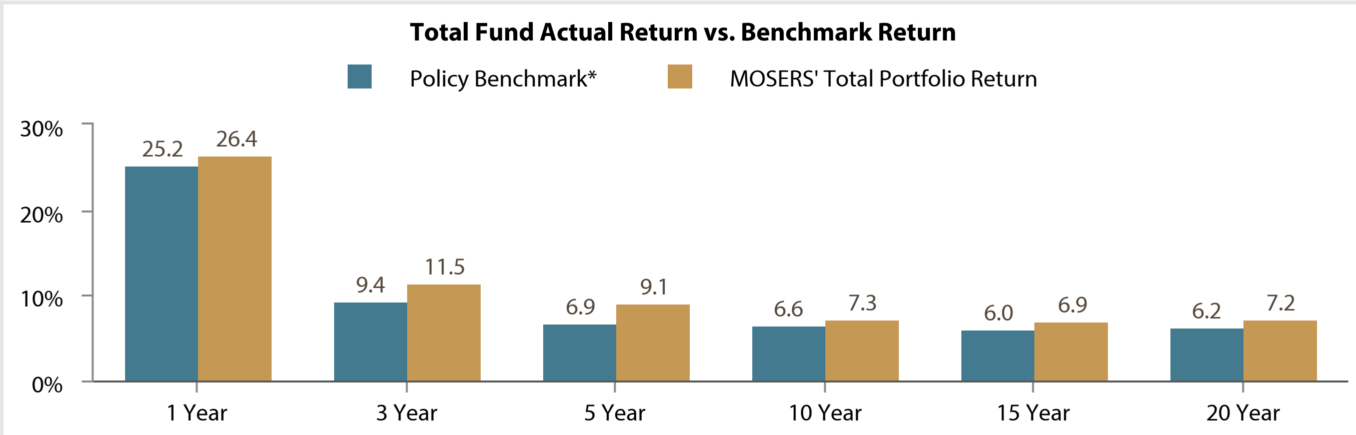


[1] *CPI Source: United States Department of Labor, Bureau of Labor Statistics (not seasonally adjusted).*

[2] *Performance returns are calculated using a time-weighted rate of return on fair values.*

Investment Performance vs. Benchmark Comparisons

In addition to measuring performance relative to the required rate of return, the Board also compares fund returns to the policy benchmark. Returns for the total fund versus policy benchmarks are displayed in the following bar chart.



* *As of June 30, 2021, the total fund policy benchmark was comprised of the following components: 45% total growth policy, 35% total income policy, 40% total inflation hedge policy and 20% total absolute return policy.*

All policy return components are adjusted for financing cost associated with the program.

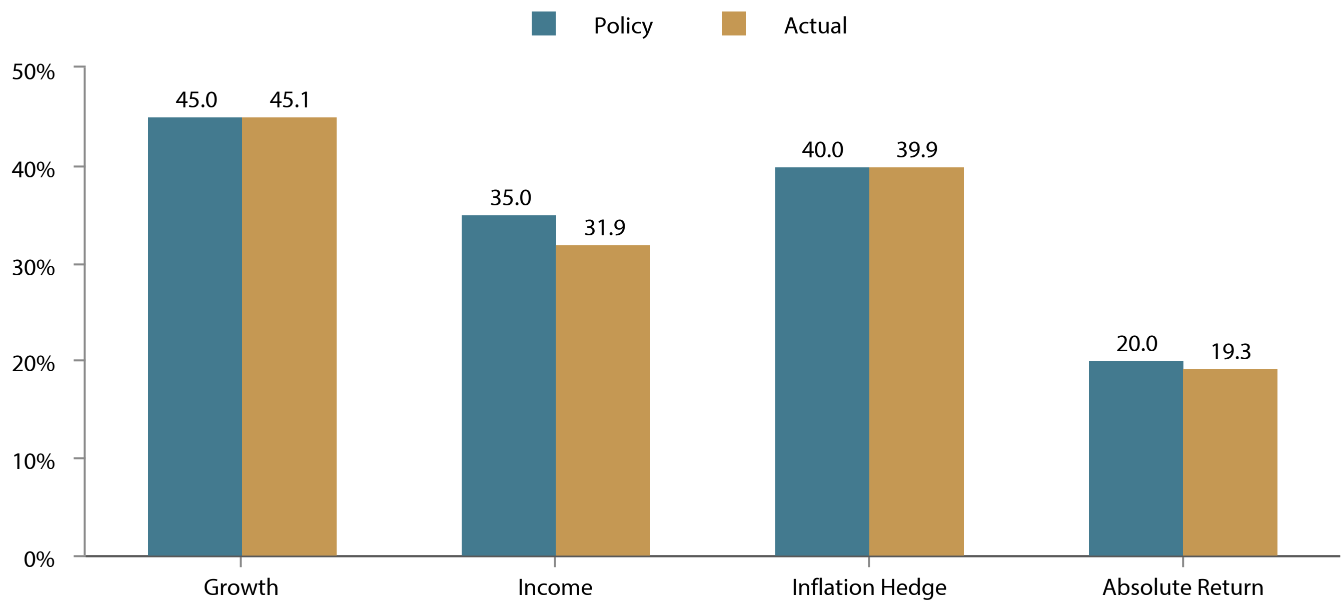
The policy benchmark provides an indication of the returns that could have been achieved (excluding transaction costs) by a portfolio invested in the designated benchmarks for each asset class at the percentage weights allocated to each asset class in MOSERS' policy asset allocation. Comparison of the total return to the policy benchmark reflects the total value added or detracted by the CIO through strategic and manager implementation decisions. Value is added when the total fund return exceeds the policy benchmark return. The total fund 1-, 3-, 5-, 10-, 15-, and 20-year actual performance over performed its policy benchmark by 1.2%, 2.2%, 2.2%, 0.7%, 0.9%, and 1.0%, respectively.

Total Fund Policy Allocation Overview

As of June 30, 2021, the Board's broad policy allocation mix was 45% growth assets, 35% income assets, 40% inflation assets, and 20% absolute return assets. The policy target, as of June 30, 2021, for each sub-asset class, along with the actual strategic allocation to each type of investment, is shown in the bar graph below.

The Board has granted authority to the CIO to make strategic decisions. A strategic decision should be thought of as any decision that might cause MOSERS' actual portfolio to differ from the policy asset allocation. This has allowed MOSERS to capitalize on investment opportunities at the margin by over-weighting asset classes that are viewed as "cheap" relative to their historical norm and under-weighting asset classes that are "expensive" relative to their historical norm.

Total Fund Asset Allocation | Policy vs. Actual by Sub-Asset Class
(As a Percentage of the Total Fund)



Schedule of Fees and Commissions

	Commissions Paid	Volume of Trades*	Shares Traded
B Riley and Co., LLC	$ 2,606	$ 1,528,633	67,656
Barclays Capital, Inc.	27,076	322,688,326	5,414,994
BTIG, LLC	79,469	125,529,462	5,249,920
CJS Securities, Inc.	199	47,885	6,633
Credit Suisse	51,528	41,538,099	45,468
Davidson & Co., Inc.	1,521	653,211	38,016
Dougherty & Co., Inc.	1,265	346,909	39,616
Goldman Sachs & Co.	396	100,523	14,080
Guggenheim Capital Markets, LLC	537	164,124	14,410
J.P. Morgan Securities, Inc.	68	16,849	2,129
Jefferies & Co., Inc.	5,731	44,844,928	1,146,082
Jones Trading Institutional Services	3,417	1,530,975	170,863
Keefe Bruyette & Woods, Inc.	291	95,168	7,431
Keybanc Capital Markets, Inc.	1,018	354,069	26,039
Knight Equity Markets, LP	975	296,260	38,132
Ladenburg Thalman & Co.	4,081	1,029,146	128,755
MKM Partners, LLC	1,668	1,483,355	83,409
Morgan Stanley & Co.	451,225	400,076,890	1,542,343
National Financial Services Corporation	3,464	994,117	123,398
Needham & Co., LLC	225	134,508	9,482
Northland Securities, Inc.	4,559	1,184,711	162,571
Oppenheimer & Co., Inc.	182	90,849	5,143
Pershing, LLC	349	222,982	9,575
Piper Jaffray & Co.	21,853	31,184,332	2,141,222
Raymond James & Associates, Inc.	406	120,755	10,138
Robert W Baird & Co., Inc.	63	85,156	1,584
Roth Capital Partners, LLC	455	155,878	14,367
Sidoti and Co., LLC	2,329	824,782	62,715
Sterne Agee & Leach, Inc.	1,982	491,438	61,076
Stifel Nicolaus	92	24,271	3,070
Suntrust Capital Markets, Inc.	283	126,822	12,523
Virtu Americas, LLC	94,183	70,074,488	4,617,702
Wedbush Morgan Securities, Inc.	6,515	1,192,339	262,944
Wells Fargo Securities, LLC	10	3,446	252
William Blair & Co.	1,421	559,542	37,848
Total	$ 771,442	$ 1,049,795,228	21,571,586

* *Volume does not include futures notional value*

Schedule of Investment Portfolios by Asset Class

As of June 30, 2021

	Portfolio Value	Percentage of Investments	Market Exposure	Percentage of Investments at Market Exposure
Growth	$ 4,172,694,467	43.0 %	$ 4,380,166,669	45.1 %
Income	1,839,886,154	19.0	3,094,962,979	31.9
Inflation hedge	1,810,016,709	18.6	3,866,527,154	39.9
Absolute return	1,878,952,910	19.4	1,874,459,987	19.3
Total portfolio	9,701,550,240	100.0	13,216,116,789	136.2
Residual accounts	6,883,904	0.1	6,883,904	0.1
Cash reserve	1,578,496	0.0	1,578,496	0.0
MOSERS Total Fund	$ 9,710,012,640	100.0 %	$ 13,224,579,189	136.2 %

Reconciliation to Statement of Fiduciary Net Position	
Total portfolio value	$ 9,710,012,640
Obligations under repurchase agreements	3,723,313,448
Receivable - investment income	(122,323,803)
Receivable - investment sales	(607,273,197)
Investment activities payable	7,030,674
Management and incentive fee payable	21,668,506
Payable for investments purchased	117,961,778
Investments per *Statement of Fiduciary Net Position*	$ 12,850,390,046

Total Fund – Top Ten Publicly Traded Separate Account Holdings

Ten Largest Holdings as of June 30, 2021*	Fair Value	Percent of the Total Fund
U.S. Treasury Bond - 3.375% 2048	$ 136,879,010	1.38%
U.S. Treasury Bond CPI Inflation - 0.125% 2023	108,816,995	1.12
U.S. Treasury Bond CPI Inflation - 0.625% 2024	107,132,362	1.10
U.S. Treasury Bond CPI Inflation - 0.375% 2023	105,853,014	1.09
U.S. Treasury Bond CPI Inflation - 0.125% 2024	105,686,731	1.09
U.S. Treasury Bond CPI Inflation - 0.125% 2031	98,428,580	1.01
U.S. Treasury Bond CPI Inflation - 0.250% 2025	97,567,569	1.00
U.S. Treasury Bond CPI Inflation - 0.375% 2025	95,995,005	0.99
U.S. Treasury Bond CPI Inflation - 0.125% 2030	92,125,856	0.95
U.S. Treasury Bond CPI Inflation - 0.625% 2023	91,081,465	0.94

* *For a complete list of holdings, contact MOSERS.*

Schedule of Investment Results

1-, 3-, 5-, 10-, 15- and 20-Year Periods

Total Fund – As of June 30, 2021, the total fund policy benchmark was comprised of the following components: 45% total growth policy, 35% total income policy, 40% total inflation hedge policy and 20% total absolute return policy. This program did not begin until January 2019.

Growth – As of June 30, 2021, the total growth policy was 66.7% global public equities policy and 33.3% global private equities policy.

- Global public equities policy - As of June 30, 2021, the total global public equities policy was MSCI All Country World Index (ACWI).
- Global private equities policy - As of June 30, 2021, the total global private equities policy was Burgiss All Equity Universe, weighted by vintage year.

Income – As of June 30, 2021, the total income policy was 71% long treasuries policy and 29% core bonds policy.

- Long treasuries - As of June 30, 2021, the long treasuries policy was Bloomberg Barclays Long Treasury Index.
- Core bonds - As of June 30, 2021, the core bonds policy was Bloomberg Barclays Aggregate Bond Index.

Inflation hedge – As of June 30, 2021, the total inflation hedge policy was 12.5% commodities policy, 62.5% inflation indexed bonds policy, 12.5 % private real assets policy and 12.5% public real assets policy.

- Commodities - As of June 30, 2021, the commodities policy was Bloomberg Commodities Index (BCOM).
- Treasury inflation protected securities (TIPS) - As of June 30, 2021, the TIPS policy was Barclays U.S. 1-10 Year TIPS.
- Private real assets - As of June 30, 2021, the private real assets policy was NCREIF ODCE.
- Public real assets - As of June 30, 2021, the public real assets policy was FTSE Nareit All REITS Index.

Absolute return – As of June 30, 2021, the total absolute return policy was 50.0% alternative beta policy, 25.0% hedge fund policy and 25.0% private credit policy.

- Alternative beta - As of June 30, 2021, the alternative beta policy was HFRX Macro/CTA Index.
- Hedge funds - As of June 30, 2021, the hedge fund policy was HFRI Fund Weighted Composite Index.
- Private credit - As of June 30, 2021, the private credit policy was S&P/LSTA US Leveraged Loan Index +2%.

Schedule of Investment Results (continued)

	1 Year	3 Year	5 Year	10 Year	15 Year	20 Year
Total fund*	26.4%	11.5%	9.1%	7.3%	6.9%	7.2%
Total fund policy benchmark	25.2%	9.4%	6.9%	6.6%	6.0%	6.2%
Growth	44.9%	N/A	N/A	N/A	N/A	N/A
Growth policy benchmark	45.0%	N/A	N/A	N/A	N/A	N/A
Global public equities	40.0%	11.3%	13.0%	9.9%	8.4%	8.2%
Global public equities policy benchmark	39.5%	14.5%	14.7%	10.0%	7.5%	7.2%
Global private equities	63.0%	N/A	N/A	N/A	N/A	N/A
Global private equities policy benchmark	55.1%	N/A	N/A	N/A	N/A	N/A
Income	(7.2)%	N/A	N/A	N/A	N/A	N/A
Income policy benchmark	(7.8)%	N/A	N/A	N/A	N/A	N/A
Long treasuries	(10.0)%	7.0%	2.4%	N/A	N/A	N/A
Long treasuries policy benchmark	(10.7)%	6.8%	2.1%	N/A	N/A	N/A
Core bonds	0.6%	N/A	N/A	N/A	N/A	N/A
Core bonds policy benchmark	(0.3)%	N/A	N/A	N/A	N/A	N/A
Inflation hedge	16.2%	N/A	N/A	N/A	N/A	N/A
Inflation hedge policy benchmark	14.2%	N/A	N/A	N/A	N/A	N/A
Commodities	45.0%	3.1%	2.3%	(5.8)%	(4.7)%	0.0%
Commodities policy benchmark	45.4%	2.2%	2.6%	(6.1)%	(6.1)%	(1.4)%
Inflation-indexed bonds	6.4%	4.3%	2.5%	2.4%	3.9%	5.1%
Inflation-indexed bonds policy benchmark	6.3%	4.2%	2.2%	2.2%	3.9%	5.1%
Private real assets	21.6%	N/A	N/A	N/A	N/A	N/A
Private real assets policy benchmark	7.1%	N/A	N/A	N/A	N/A	N/A
Public real assets	34.1%	N/A	N/A	N/A	N/A	N/A
Public real assets policy benchmark	34.2%	N/A	N/A	N/A	N/A	N/A
Absolute return	13.2%	N/A	N/A	N/A	N/A	N/A
Absolute return policy benchmark	13.4%	N/A	N/A	N/A	N/A	N/A
Hedge funds	17.1%	N/A	N/A	N/A	N/A	N/A
Hedge funds policy benchmark	27.5%	N/A	N/A	N/A	N/A	N/A
Alternative beta	10.1%	(0.1)%	0.6%	N/A	N/A	N/A
Alternative beta policy benchmark	6.7%	(5.8)%	(4.2)%	N/A	N/A	N/A
Private credit	16.0%	N/A	N/A	N/A	N/A	N/A
Private credit policy benchmark	13.7%	N/A	N/A	N/A	N/A	N/A

* *Results are based on time-weighted rates of return on fair values adjusted for cash flows.*
** *Where applicable, benchmarks are calculated net of financing costs.*
*** *Broad asset allocations (Growth, Income, Inflation Hedge, and Absolute Return) were established with the new asset allocation adopted by the Board in 2018. Therefore, 3-, 5-, 10-, 15-, and 20-Year returns are not available yet as of June 30, 2021*

Schedule of Investment Manager Fees

For the Year Ended June 30, 2021

	Portfolio Fair Value	Total Fees	Manager Fees	Fund Pass Through Expenses *	Incentive Fees Earned
Equity					
Kennedy Capital Management	$ 0	$ 616,086	$ 616,086	$ 0	$ 0
Silchester International Investors	462,700,894	2,615,734	2,615,734	0	0
State Street Global Advisors	0	18,002	18,002	0	0
Total equity	462,700,894	3,249,822	3,249,822	0	0
Multi-asset					
Blackrock	926,245,781	440,112	440,112	0	0
NISA Investment Advisors	2,675,843,972	5,730,212	5,730,212	0	0
Total multi-asset	3,602,089,753	6,170,324	6,170,324	0	0
Alternatives					
Aberdeen Standard Investments	575,993,624	161,572	161,572	0	0
Actis Emerging Markets III	1,918,000	52,000	0	52,000	0
Actis Emerging Markets IV	26,368,867	2,901,000	554,000	55,000	2,292,000
AQR DELTA Sapphire Fund, LP	1,844,708	1,223,740	1,062,847	160,893	0
Axiom Asia Private Capital Fund II, LP	20,896,449	581,511	207,262	30,822	343,427
Axiom Asia Private Capital Fund III, LP	149,916,533	5,358,966	355,388	45,423	4,958,155
Axiom Asia Fund VI	5,641,858	162,264	117,808	44,456	0
Axxon Brazil Private Equity Fund II B, LP	11,046,445	176,162	151,790	24,372	0
Bayview Opportunity Domestic IIIb, LP	0	24,087	6,102	13,774	4,211
Blackstone Real Estate Partners IV	1,327,989	421,327	0	(1,363)	422,690
Blackstone Real Estate Partners V	3,298,850	371,783	0	(1,288)	373,071
Blackstone Real Estate Partners VI	2,633,610	43,528	0	15,491	28,037
Blackstone Real Estate Partners VII	26,955,627	(51,545)	349,710	33,324	(434,579)
Blackstone Topaz Fund, LP	286,913,837	3,720,830	2,296,273	269,508	1,155,049
Blackstone Topaz Private Credit	181,574,720	2,204,334	1,141,895	129,318	933,121
Brevan Howard Alpha Strategies Fund, LP	183,071,724	4,419,222	951,065	2,786,923	681,234
Bridgewater Associates - Diamond Ridge Fund, LLC	5,335	1,969,178	1,909,321	59,857	0
CarVal Investors CVI Global Value Fund A, LP - private debt	50,000	3,059	0	3,059	0
CarVal Investors CVI Global Value Fund A, LP - real estate	50,000	3,059	0	3,059	0
Catalyst Fund Limited Partnership III	13,433,546	159,900	224,801	(64,901)	0
Catalyst Fund Limited Partnership IV	3,430,750	22,703	50,641	(27,938)	0
Catalyst Fund Limited Partnership V	62,899,114	1,712,383	1,728,661	(16,278)	0
CBRE US Core Partners, LP	121,129,443	318,920	318,920	0	0
Cornwall Domestic, LP	6,175,599	73,977	0	73,977	0
DRI Capital - LSRC	4,986,871	521,046	0	264,568	256,478
EIG Energy Fund XIV, LP	2,301,044	169,984	0	169,984	0
EIG Energy Fund XV, LP	8,923,739	411,550	259,108	152,442	0
EIG Energy Fund XVI, LP	24,343,321	325,743	291,060	34,683	0
Eisler Capital Fund, LP	224,619,563	2,229,733	562,400	531,674	1,135,659

Schedule of Investment Manager Fees continued on following page

Schedule of Investment Manager Fees (continued)

For the Year Ended June 30, 2021

	Portfolio Fair Value	Total Fees	Manager Fees	Fund Pass Through Expenses*	Incentive Fees Earned
Elliott International, Ltd.	$ 220,894,000	$ 10,907,564	$ 3,012,022	$ 2,075,785	$ 5,819,757
Exodus Point	141,820,569	7,277,779	0	1,515,964	5,761,815
Farallon Capital Institutional Partners, LP	750,000	143	0	0	143
Gateway Energy & Resource Holdings, LLC	0	16,386	0	16,386	0
Glenview Capital Opportunity Fund, LP	0	21,031	15,549	5,482	0
Global Forest Partners GTI7 Institutional Investors Company, Ltd.	447,058	4,582	2,282	2,300	0
HBK Merger Strategies Offshore Fund, Ltd.	146,114,118	2,902,994	977,172	409,999	1,515,823
JLL Partners Fund V, LP	3,026,008	23,827	0	6,079	17,748
JLL Partners Fund VI, LP	1	601,667	32,752	16,802	552,113
King Street Capital, LP	1,828,657	72,823	28,521	0	44,302
King Street Capital, Ltd.	0	999	420	0	579
LaSalle Property Fund	69,698,776	164,618	149,497	15,121	0
Linden Capital Partners II, LP	20,335,979	715,253	82,157	87,960	545,136
Merit Energy Partners F-II, LP	0	29,605	27,066	2,539	0
MHR Institutional Partners IIA, LP	35,843,778	9,901,007	0	27,973	9,873,034
MHR Institutional Partners III, LP	47,821,967	166,465	137,267	29,198	0
MHR Institutional Partners IV, LP	17,788,821	3,667,595	874,344	165,603	2,627,648
Millennium Technology Value Partners II	22,353,842	3,052,540	320,297	101,679	2,630,564
OCM Opportunities Fund VIIb, LP	77,762	(1,611)	0	8,945	(10,556)
OCM Opportunities Fund VIIIb, LP	7,990,434	182,673	152,900	29,773	0
OCM Power Opportunities Fund III, LP	1,905,051	719,449	84,238	19,193	616,018
OCM/GFI Power Opportunities Fund II, LP	1	43,566	0	15,794	27,772
Perry Partners, LP	1	89	89	0	0
Pharo Macro Fund, Ltd.	63,489,185	3,187,822	1,298,621	47,183	1,842,018
Portfolio Advisors Secondary Fund IV, LP	28,401,976	433,540	122,613	310,927	0
Silver Creek Special Opportunities Fund I, LP	3,832,937	28,363	0	28,363	0
Silver Creek Special Opportunities Fund II, LP	6,647,168	34,260	0	34,260	0
Silver Lake Partners II, LP	13,305	(2,191)	0	786	(2,977)
Standard Investment Research Hedged Equity Fund	109,396,165	6,618,854	1,948,286	176,467	4,494,101
StepStone Capital Buyout Fund II, LP	0	39,289	0	39,289	0
TA Realty Core Property Fund, LP	30,366,001	26,902	26,902	0	0
Voleon Institutional Strategies Fund, LP	53,478,375	1,462,704	1,017,780	200,330	244,594
Voleon Investors Fund, LP	17,264,283	407,063	316,582	90,481	0
Total alternatives	3,003,337,384	82,399,666	23,327,981	10,323,500	48,748,185
Total fees	$ 7,068,128,031	$ 91,819,812	$ 32,748,127	$ 10,323,500	$ 48,748,185

* *Fund pass through expenses are administrative expenses charged to the fund and paid by the limited partners (including MOSERS), in addition to the management fee. These expenses may include, but are not limited to, accounting, audit, legal, and custody expenses directly related to the administration of the underlying fund investments.*

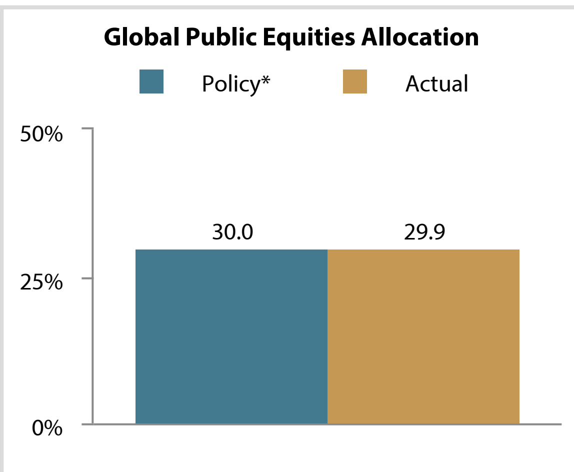
Asset Class Summary

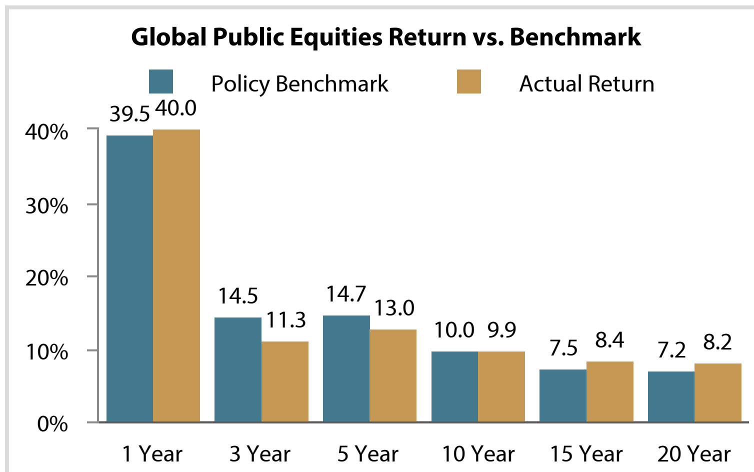
The portfolio consists of four broad investment allocations: growth, income, inflation hedge, and absolute return. Each of these allocations are made up of a number of different asset classes. Three of the four allocations had positive performance during the fiscal year. The growth allocation returned 44.9%, while the income allocation was down 7.2%. The inflation hedge allocation was up 16.2% and the absolute return allocation returned 13.2%.

Growth Allocation

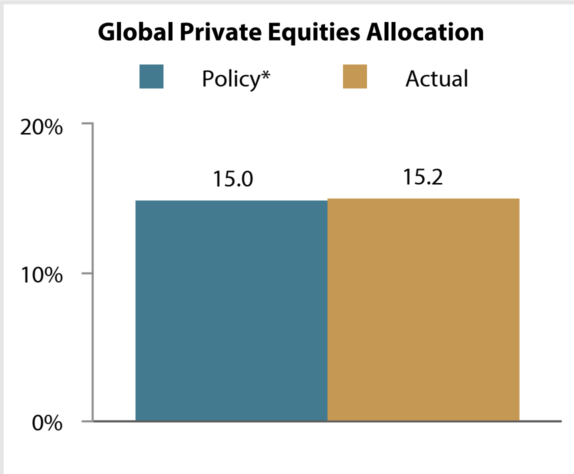
The growth allocation is designed to provide capital appreciation by accessing both an equity-risk premium and a liquidity risk premium. In addition, it is expected that investments in this category would perform well in periods of rising economic growth. Investments in this allocation include U.S. and non-U.S. equity investments with varying characteristics related to market capitalization and investment style. Because of the non-U.S. nature of some of these investments, this allocation is subject to foreign currency exposure.

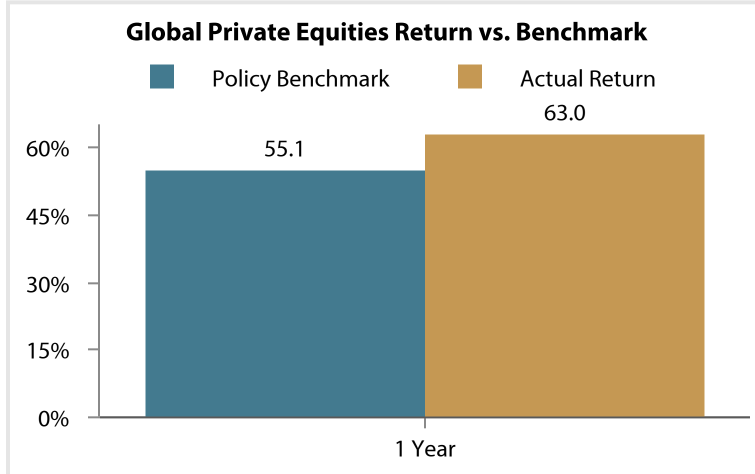
The growth allocation is made up of global public equities and global private equities. As of the fiscal year end, global public equities and global private equities were 66.7% and 33.3% of the growth allocation, respectively. For the fiscal year, public equities returned 40.0% versus 39.5% for the policy benchmark. Private equities, for the fiscal year, returned 63.0% compared to its policy benchmark return of 55.1%. This outperformance was the result of manager implementation that outperformed the benchmark.





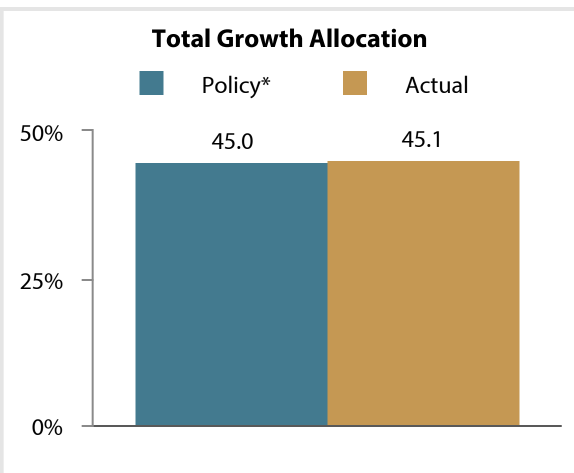
* *As of June 30, 2021, the global public equities policy benchmark was MSCI ACWI.*

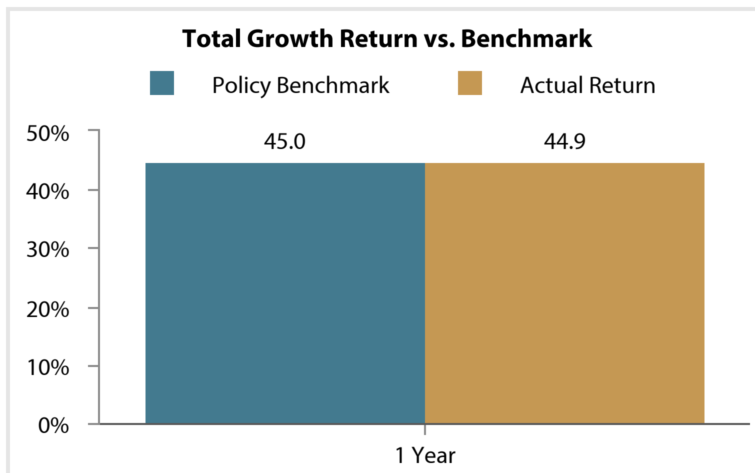




* *As of June 30, 2021, the global private equities policy benchmark was the Burgiss All Equity Universe, weighted by vintage year.*

The market exposure of the growth allocation on June 30, 2021, was $4.38 billion, representing 45.1% of total market value of the portfolio. The bar chart below (left) illustrates the actual exposure compared to policy. For the fiscal year, the growth allocation returned 44.9% versus 45.0% for the policy benchmark. The slight underperformance was due to being overweight public equities and underweight private equities during the fiscal year. The bar chart below (right) illustrates actual performance as compared to the policy benchmark.



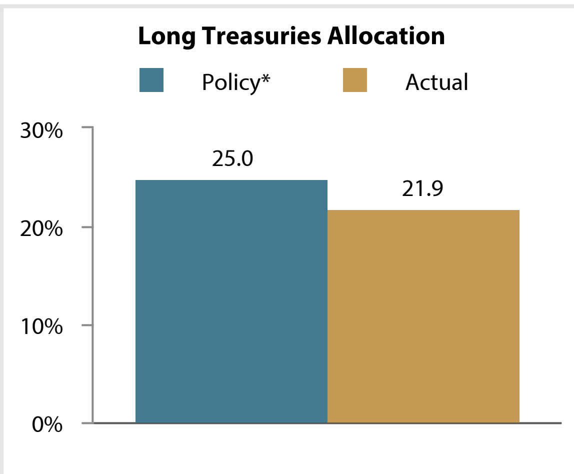


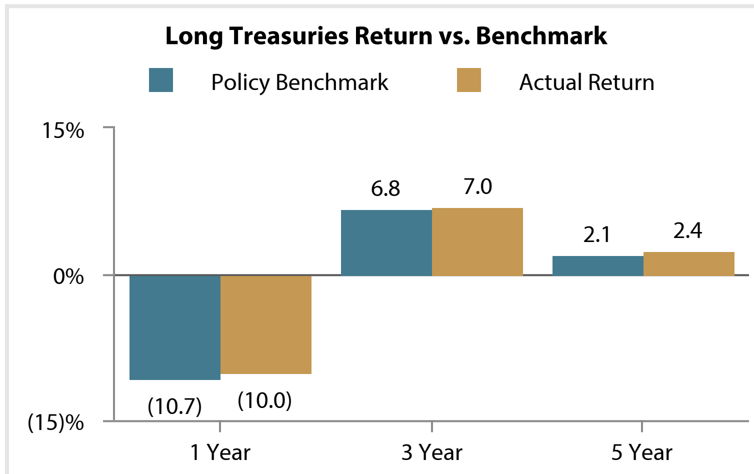
* *As of June 30, 2021, the total growth policy benchmark was comprised of 66.7% global public equities policy benchmark and 33.3% global private equities policy benchmark.*

Income Allocation

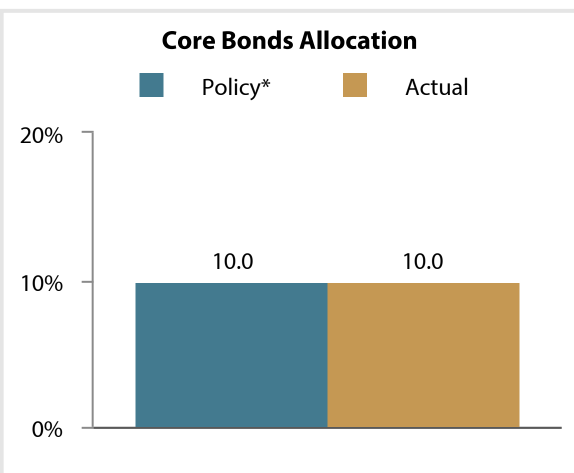
This allocation is designed to provide a source of current income and to reduce overall fund volatility. It is expected that investments in this asset class will perform well in periods of stable or falling economic growth and falling inflation. Investments in this asset class include U.S. bonds that have been issued, collateralized, or guaranteed by the U.S. Government, its agencies, or its instrumentalities. Core bonds may also include debt issued by corporations, or securitized debt. Because this asset class is invested in all U.S. bonds, there is currently not any foreign currency exposure as part of this allocation.

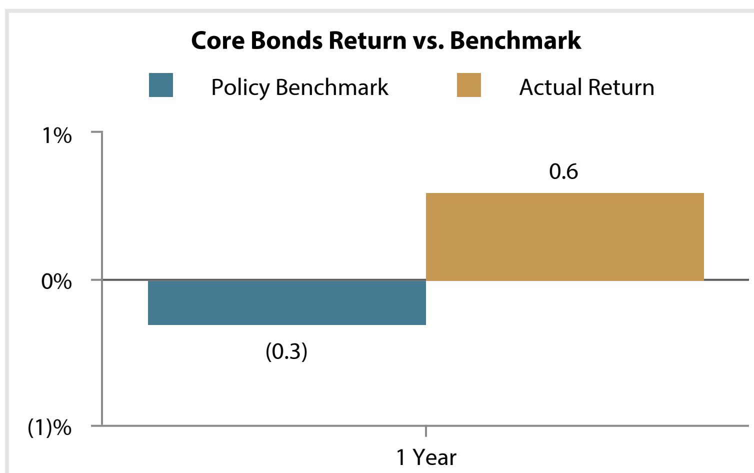
The income allocation is made up of long treasuries and core bonds. As of the fiscal year end, long treasuries and core bonds were 69% and 31% of the income allocation, respectively. For the fiscal year, long treasuries returned (10.0%) versus (10.7%) for the policy benchmark. The exposure to long treasuries is gained passively with minimal tracking error. Core bonds, for the fiscal year, returned 0.6% compared to its policy benchmark return of (0.3%). This outperformance was the result of manager implementation that outperformed the benchmark.





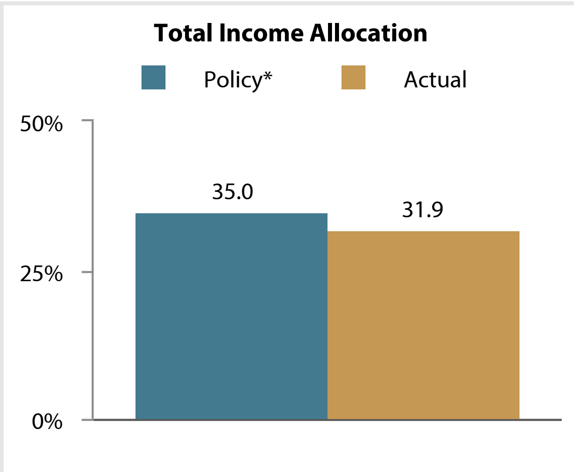
* *As of June 30, 2021, the long treasuries policy benchmark was Bloomberg Barclays Long Treasury Index.*

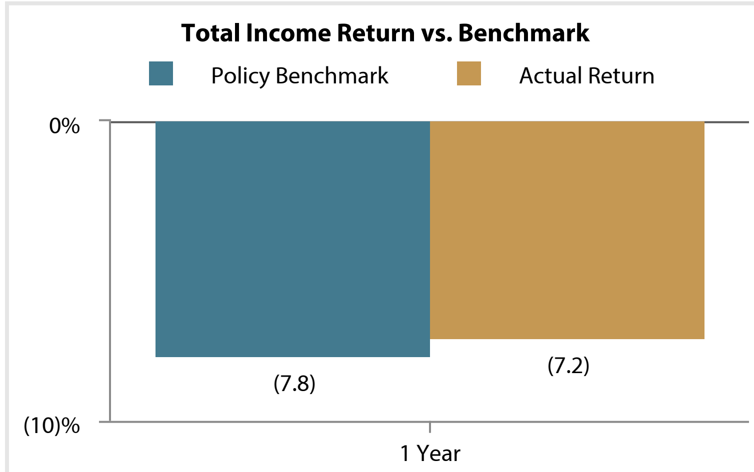




* *As of June 30, 2021, the core bonds strategy benchmark was Bloomberg Barclays Aggregate Bond Index.*

As of June 30, 2021, the market exposure of the income allocation was $3.09 billion, representing 31.9% of total market value of the portfolio. The bar chart below (left) illustrates the actual exposure compared to policy. For the fiscal year, the income allocation returned (7.2%) as compared to (7.8%) for the income allocation policy benchmark. The outperformance was mainly driven by core bonds that outperformed the policy benchmark by 0.9%. The bar chart below (right) illustrates actual performance as compared to the policy benchmark.



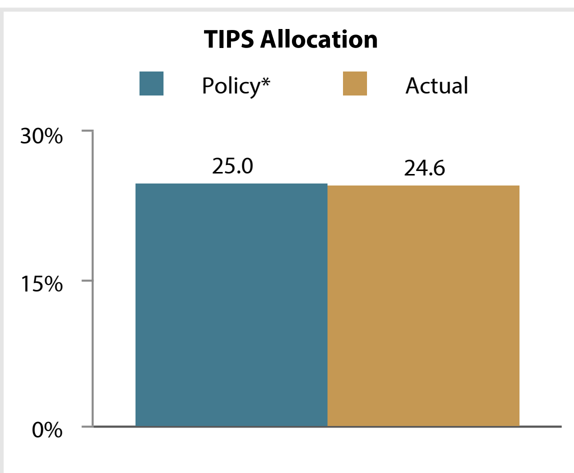


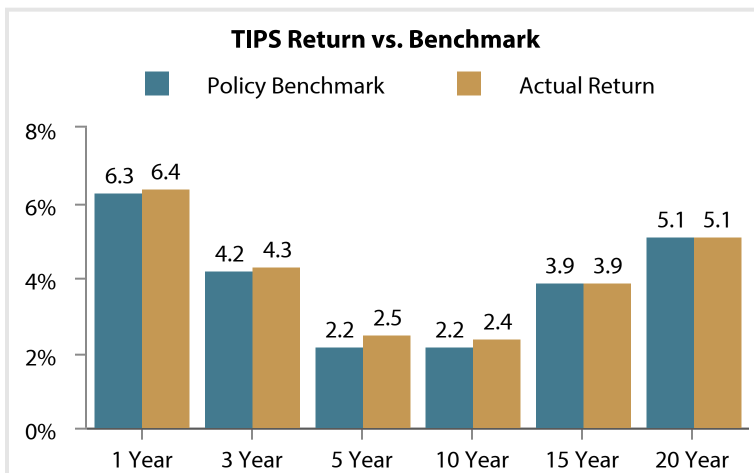
* *As of June 30, 2021, the total income policy benchmark was comprised of 71.4% long treasuries policy benchmark and 28.6% core bonds policy benchmark.*

Inflation Hedge Allocation

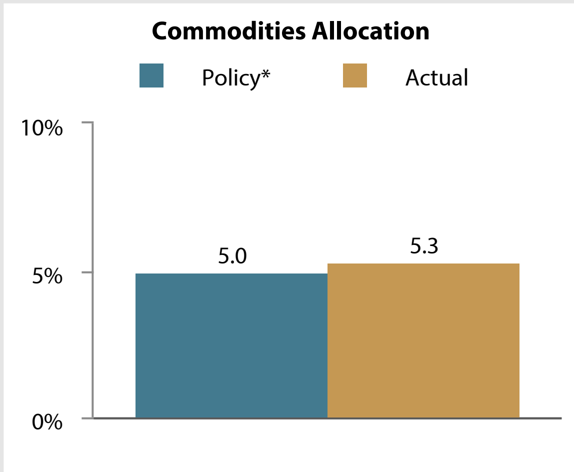
It is expected that investments in this asset class will perform well during periods of rising inflation. Investments in this asset class include U.S. Government treasury inflation protected securities (TIPS), commodities, private real estate, and public real estate. TIPS are designed to provide a source of current income and protect against actual inflation. It is expected that investments in this asset class will perform well during periods of falling economic growth and rising inflation. Commodities are designed to provide protection from an unexpected rise in inflation. In addition, it is expected that investments in this category would perform well in periods of rising economic growth. Private real assets are designed to provide capital appreciation and income and provide access to a form of equity-risk premium and liquidity risk premium. It is expected that investments in this category would perform well in periods of rising economic growth and rising inflation. Public real assets are designed to provide capital appreciation and income and provide access to a form of equity risk premium. In addition, it is expected that investments in this category would perform well in periods of rising economic growth and rising inflation. Because this asset class is invested primarily in U.S. denominated assets, there is not expected to be meaningful foreign currency exposure as part of this allocation.

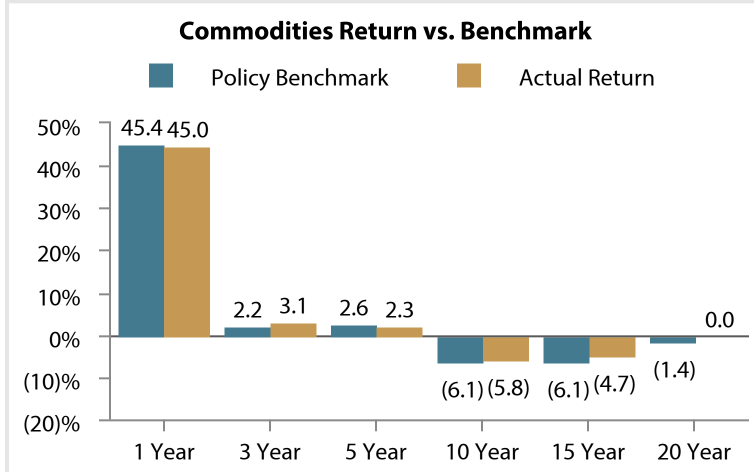
As of the fiscal year end, TIPS were 62.5% and commodities, private real assets and public real assets each made up 12.5% of the inflation hedge allocation. For the fiscal year, TIPS returned 6.4% versus 6.3% for the policy benchmark. There was no internal or external active management strategy utilized during the fiscal year; thus, providing a return that closely matched the benchmark. Commodities, for the fiscal year, returned 45.0% compared to its policy benchmark return of 45.4% providing a return similar to the benchmark. Public real assets returned 34.1%, for the fiscal year, compared to its policy benchmark return of 34.2%. There was no internal or external active management strategy utilized during the fiscal year; thus, providing a return that closely matched the benchmark. For the fiscal year, private real assets returned 21.6% versus 7.1% for its policy benchmark. This outperformance was due to the portfolio holding publicly traded real estate investment trusts as a short-term placeholder for core real estate funds.



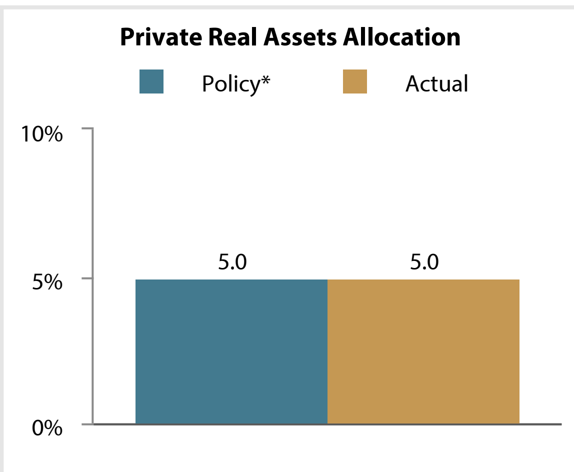


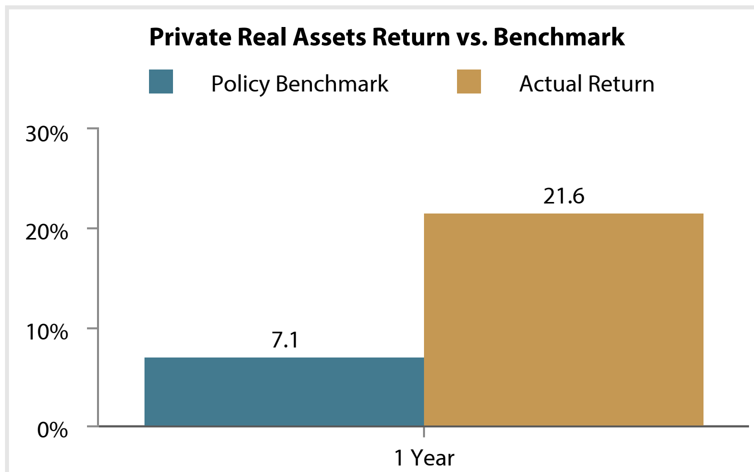
* *As of June 30, 2021, the TIPS policy benchmark was the Bloomberg Barclays 1 - 10 year TIPS Index.*



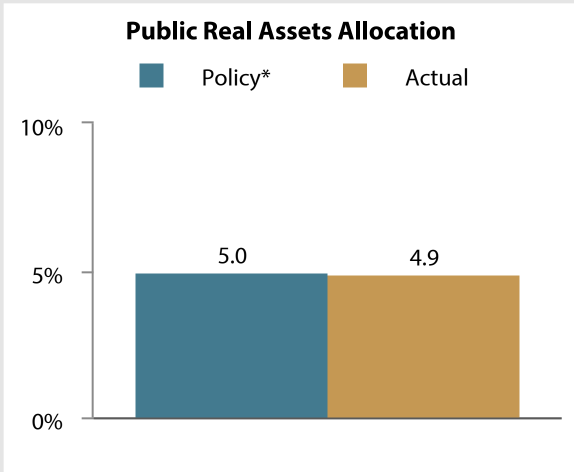


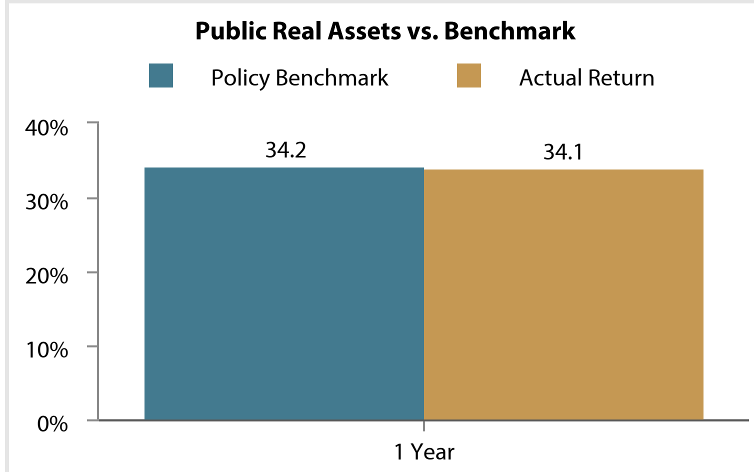
* *As of June 30, 2021, the commodities policy benchmark was the Bloomberg Commodity Index (BCOM).*





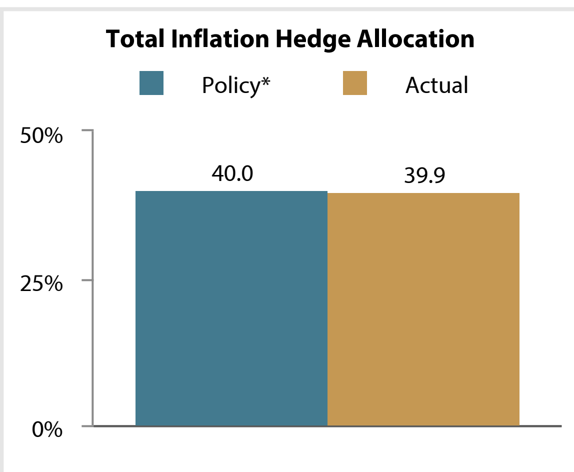
* *As of June 30, 2021, the private real assets policy benchmark was the NCREIF Fund Index - Open End Diversified Core Equity (ODCE).*

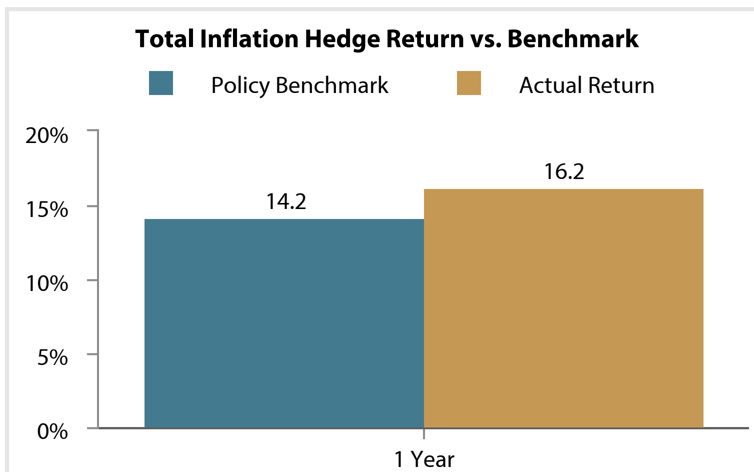




* *As of June 30, 2021, the public real assets policy benchmark was the FTSE Nareit All REITS Index.*

As of June 30, 2021, the market exposure of the inflation hedge allocation was $3.87 billion representing 39.9% of total market value of the portfolio. The bar chart below (left) illustrates the actual exposure compared to policy. For the fiscal year, the inflation hedge allocation returned 16.2% versus 14.2% for the policy benchmark. The outperformance was mainly driven by private real assets that outperformed the policy benchmark by 14.5%. The bar chart below (right) illustrates actual performance as compared to the policy benchmark.





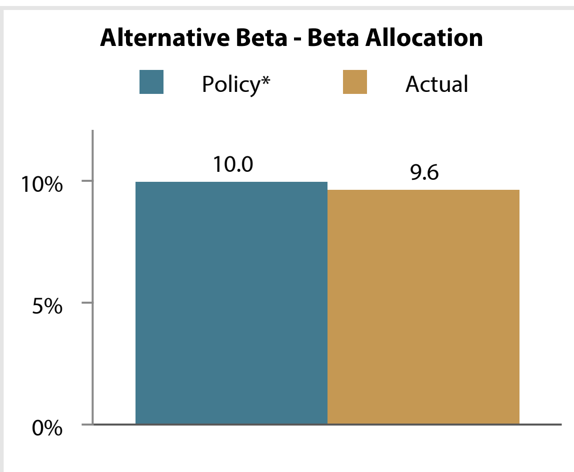
* *As of June 30, 2021, the total inflation hedge policy benchmark was comprised of 62.5% TIPS policy benchmark, 12.5% commodities policy benchmark, 12.5% private real assets policy benchmark, and 12.5% public real assets policy benchmark.*

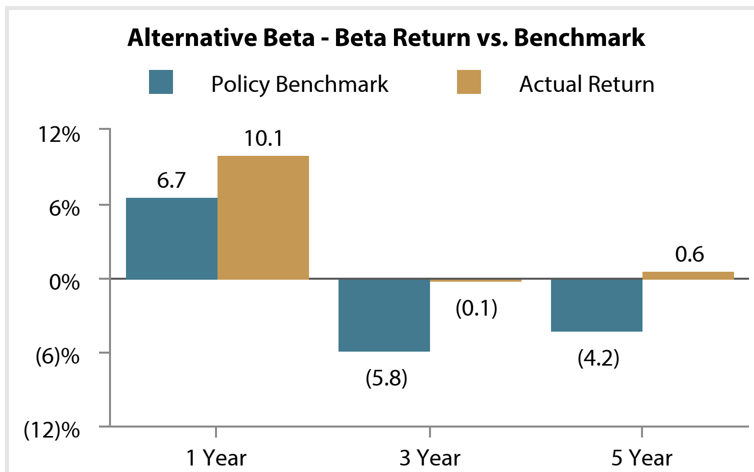
Absolute Return Allocation

This asset class represents alternative betas, hedge funds, and private credit. Alternative betas and hedge funds are designed to provide a source of stable returns and low correlations with traditional asset strategies. In addition, it is expected that investments in this category would perform well across multiple economic environments. Private credit is designed to provide a source of current income and provide access to a form of credit risk premium. It is expected that investments in this category would perform well in periods of rising economic growth.

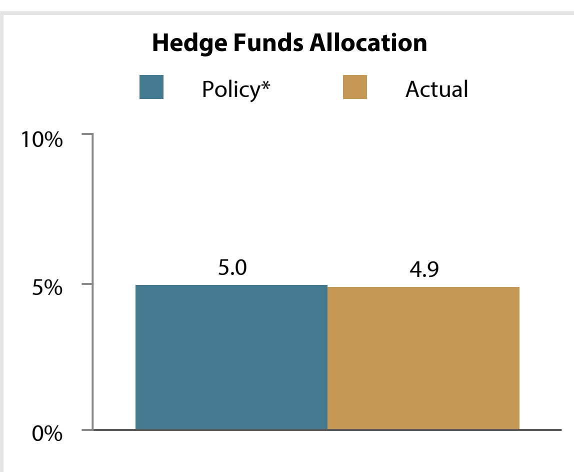
As a result of the multitude of strategies being deployed, it is expected that this asset class will provide meaningful diversification to the portfolio. While the sensitivities to economics will be dependent on positioning at the time, it is expected that these betas will have their best returns in rising growth environments and their worst returns in falling growth environments. Because of the non-U.S. nature of some of these investments, this allocation is subject to foreign currency exposure.

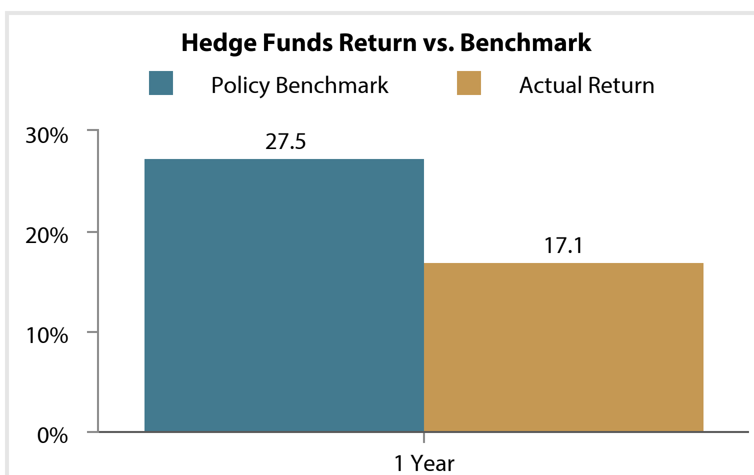
As of the fiscal year end, alternative betas were 50.0% of the allocation with hedge funds and private credit each making up 25.0% of the allocation. For the fiscal year, alternative betas returned 10.1% versus 6.7% for the policy benchmark. The outperformance was primarily related to a passive trend strategy implementation. Hedge funds, for the fiscal year, returned 17.1% compared to its policy benchmark return of 27.5%. The primary driver of the underperformance was manager selection and a lower equity beta exposure within the hedge fund class. For the fiscal year, private credit returned 16.0% versus 13.7% for its policy benchmark. This outperformance was largely due to the external managers within this portfolio outperforming the benchmark.



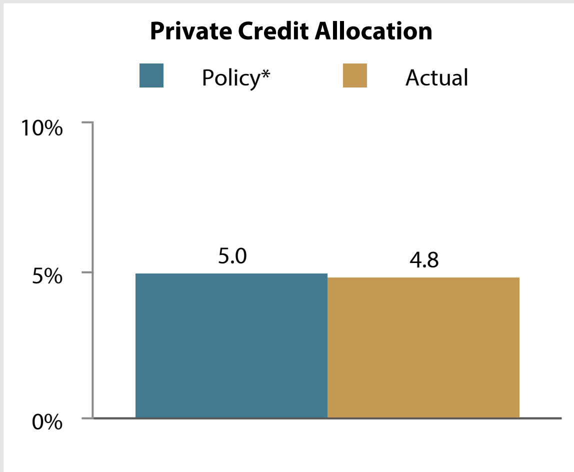


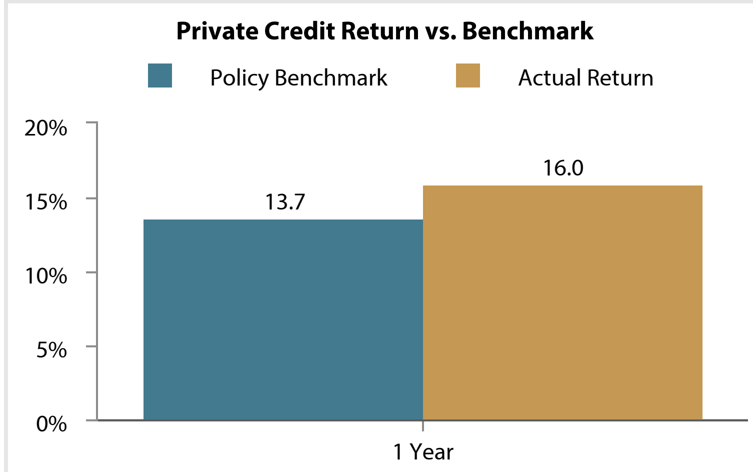
* *As of June 30, 2021, the alternative beta - beta policy benchmark was the HFRX Macro/CTA Index.*





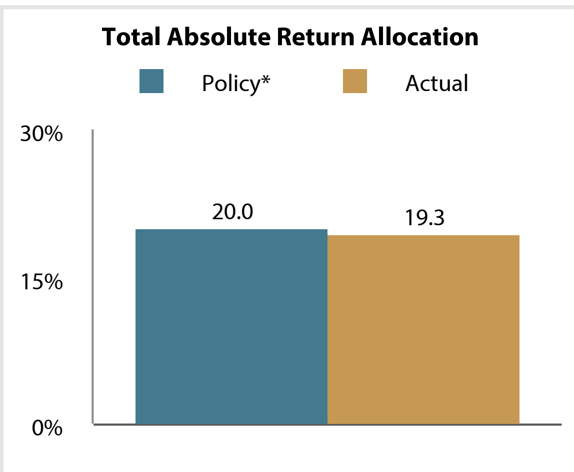
* *As of June 30, 2021, the hedge funds policy benchmark was the HFRI Fund Weighted Composite Index.*

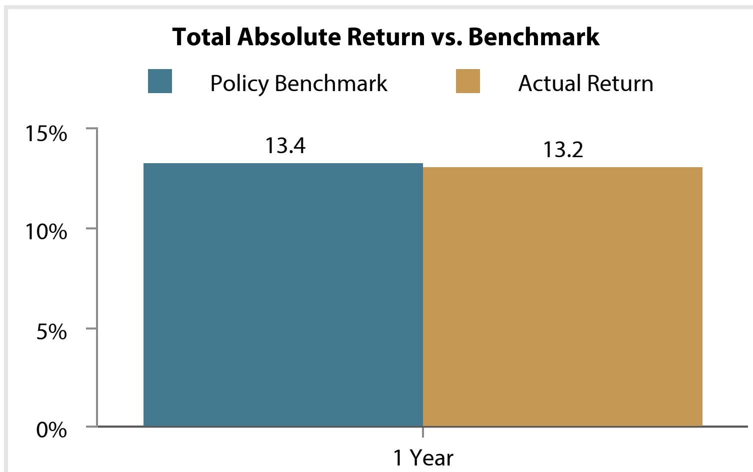




* *As of June 30, 2021, the private credit policy benchmark was the S&P/LSTA US Leveraged Loan Index + 2%.*

As of June 30, 2021, the market exposure of the absolute return allocation was $1.87 billion, representing 19.3% of total market value of the portfolio. The bar chart below (left) illustrates the actual exposure compared to policy. The absolute return allocation returned 13.2% for the fiscal year versus 13.4% for the policy benchmark. The bar chart below (right) illustrates actual performance as compared to the policy benchmark.





* *As of June 30, 2021, the absolute return policy benchmark was comprised of 50.0% alternative beta policy benchmark, 25.0% direct hedge funds policy benchmark, and 25.0% private credit policy benchmark.*