Our long-term plan helps ensure that retirement promises are kept.

Investment Section

Chief Investment Officer's Report

MOSERS
MISSOURI STATE EMPLOYEES' RETIREMENT SYSTEM

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October 18, 2019

Dear Members,

MOSERS' portfolio returned a time-weighted rate of return of 4.3% for fiscal year 2019. The Fund's policy return (i.e. what we should have expected through benchmark replication) was 2.5%. Comparing what we earned, 4.3%, to what the benchmark return expectation was, 2.5%, resulted in a 1.8% out performance.

The fiscal-year return did not meet our long-term return objective this year. While we do strive to hit the long-term investment return objective each year, this objective is not always realized. This variation is because of investment risk, which all pension plans must take in order to make money. In certain years, the market environment is good and risk taking is rewarded with profits. In years like fiscal year 2019, the environment was not as rewarding and returns were below expectations. The key consideration during all of these outcomes is our long-term earnings relative to our expectations. In 2018, the Board voted to systematically reduce MOSERS' long-term investment return assumption. With this decision, the Board recognized an investment environment that was making it difficult for MOSERS to achieve its long-term return assumption.

The Board also repositioned the portfolio in 2018 to address the challenging return environment. The new Board-adopted portfolio is generally more oriented to growth investments, but maintains a large degree of portfolio balance with significant allocations to core bonds, long duration U.S. treasuries, U.S. TIPS, and trend-following strategies. We began transitioning to the new portfolio during fiscal year 2019 and will continue over the next few years.

The MOSERS staff has been working to reduce the investment fees the portfolio pays, and in fiscal year 2019, the results of those efforts were evident. We reduced our fees by $54 million, paying $44 million in total fees (down from $98 million in fiscal year 2018). In general, there are two components to investment fees: 1) management fees and 2) incentive fees. It is important to convey how we have reduced both components.

Regarding management fees, we cut those costs by $9 million. Management fees are unavoidable: they are the cost of institutional money management. Regardless of how the market performs, these fees will always reduce our returns to some extent. In fiscal year 2019, we paid $41 million in management fees (down from $50 million in fiscal year 2018). This reduction continues a broader trend for MOSERS. Over the past three years, we have decreased MOSERS' annual management fee costs by $24 million. These fee reductions have come primarily from the decrease of MOSERS use of investments associated with "high fees" like hedge funds and private-equity partnerships.

MOSERS also pays incentive fees, which are common fees within institutional money management. Incentive fees allow the investment manager to share in the profits when returns are above expectations. Because the investment manager does well if the investment does well, the manager has an "incentive" to get the best returns possible. Thus, unlike management fees, incentive fees are connected to performance: the better the performance, the higher the fee; the lower the performance, the lower the fee. Regardless of how the fee is paid, we always require MOSERS' fee arrangements to be reasonable. Over the last three years, we have successfully reduced MOSERS' allocation to manager's that charge incentive fees. This means incentive fees will continue to be a smaller component of MOSERS' fee structure.

I appreciate the opportunity to serve as the chief investment officer at MOSERS. I am a lifelong resident of central Missouri and have personal relationships with many MOSERS beneficiaries. Those relationships allow me to witness the great things that pension plans, like MOSERS, provide to Missouri state employees in retirement. Those relationships also motivate my everyday behavior to produce results that make the future benefits of the retirees secure.

Sincerely,

Seth Kelly
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 Objective

- 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 administratively to the executive director and functionally 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 has 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. In determining the optimum mix of assets, the Board considers five factors:

- 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 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 old and new portfolio.

Asset Allocation

Old Portfolio - Asset Classes	Risk Allocation Policy	Risk Allocation Ranges[1]	Benchmark[2]	Benchmark Weight
Opportunistic global equity	36%	25% - 47%	MSCI ACWI[3] + .75%	38%
Nominal bonds	24%	17% - 31%	Bloomberg Barclays Long Treasury	44%
Commodities	19%	13% - 25%	Bloomberg Barclays 1-10 TIPS	20%
Inflation-protected bonds	8%	5% - 10%	S&P GSCI/BCOM[4]	39%
Alternative beta	13%	9% - 17%	AQR DELTA[5]	31%

New Portfolio - 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 alternative beta	**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.*

[3] *Morgan Stanley Capital International All Country World Index (net dividends). Legacy real estate and timber assets are benchmarked to the Dow Jones U.S. REIT Index and NCREIF Timber, respectively.*

[4] *S&P Goldman Sachs Commodity Index/Bloomberg Commodity Index. The Board approved a three-year transition from S&P GSCI to BCOM beginning August 1, 2016.*

[5] *A diversified risk-balanced portfolio of liquid hedge fund risk premia managed by AQR Capital net of management fees.*

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 (4.75% in fiscal year 2019) 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 and strategy 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 strategy benchmarks represent decisions made by the CIO to strategically deviate from the policy asset allocation for each sub-asset class. The return of the strategy benchmarks are determined based upon the actual weight of the asset class multiplied by the appropriate benchmark.

The policy and strategy 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.

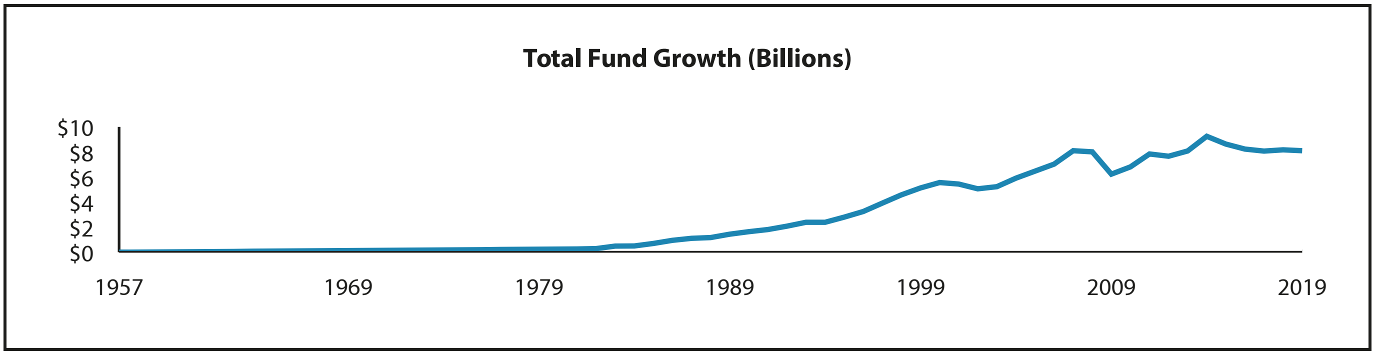
- **CIO and External Consultants' Decisions:** There are two components to decisions made by the CIO and external consultants, which are monitored by the Board on an ongoing basis. They are: 1) strategic allocation decisions, and 2) implementation decisions.

Strategy decisions are made by the CIO to deviate from the policy benchmark weight. The difference between the strategy benchmark return and the policy benchmark return captures the value added by the CIO through strategic decisions to overweight or underweight assets relative to the Board's policy allocation decisions. A strategy benchmark return greater than the policy benchmark return reflects value added through the strategic decisions. A strategy benchmark return less than the policy benchmark return reflects losses to the Fund's performance based upon strategy decisions. Strategy decisions should be measured over all periods of time with majority weight placed on outcomes that have occurred over a market cycle. Implementation decisions are money manager selection choices made by the CIO with the approval of the appropriate external consultant that the decision was made in accordance with the Board's adopted policy. The value added through these decisions is measured by the difference between the actual portfolio return and the strategy benchmark return. This difference captures the value added through these external manager selection decisions. An actual portfolio return greater than the strategy benchmark return reflects value added through these external manager selection decisions. An actual portfolio return less than the strategy benchmark return reflects losses to the Fund's performance based upon implementation decisions. Implementation 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, 2019, the MOSERS investment portfolio had a fair value of $8.1 billion. The graph below illustrates the growth of MOSERS' portfolio since the System's inception.



Investment Performance

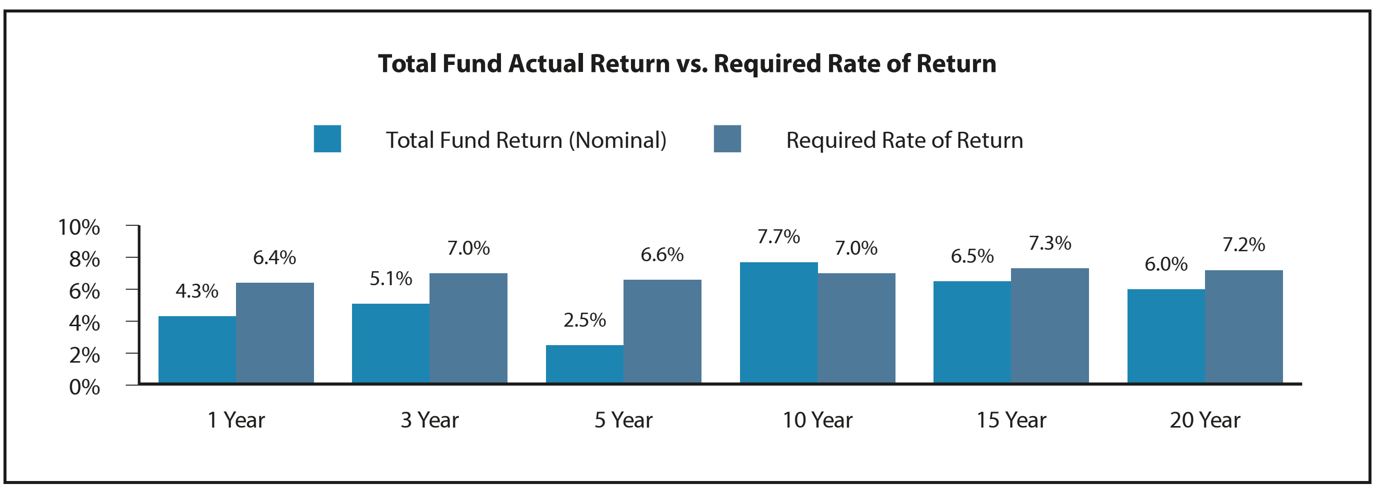
MOSERS' investments generated a time-weighted return of 4.3%, net of fees, for fiscal year 2019. The total fund return exceeded the 1-year policy benchmark of 2.5%. This additional 1.8% investment return produced $149 million over what would have been earned if the fund had been invested passively in 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 2019 is equal to the RRO of 4.75% plus inflation. The best known measure of inflation is the Consumer Price Index (CPI).[2]

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 1.2% over the 20-year period ended June 30, 2019.[3]

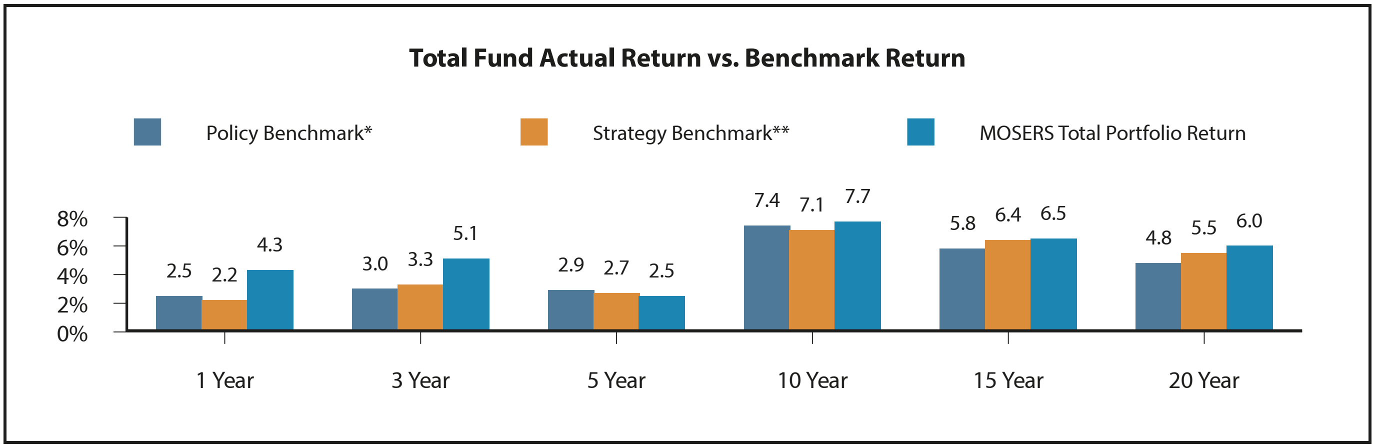


[2] *CPI Source: United States Department of Labor, Bureau of Labor Statistics (not seasonally adjusted).*

[3] *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 and the strategy benchmark. Returns for the total fund versus these benchmarks are displayed in the following bar chart.



* *As of June 30, 2019, the total fund policy benchmark was comprised of the following components: 83% old portfolio policy benchmark, 17% new portfolio policy benchmark.*

- *The old portfolio policy benchmark was comprised of the following components: 38% total opportunistic global equities policy, 44% total nominal bonds policy, 20% total commodities policy, 39% total inflation-indexed bonds policy, and 31% total alternative beta policy. This program did not begin until September 2012.*
- *The new portfolio policy benchmark was comprised of the following components: 45% total growth policy, 35% total income policy, 40% total inflation hedge policy, and 20% total alternative betas policy. This program did not begin until January 2019.*
- *All policy return components are adjusted for financing cost associated with programs.*

** *As of June 30, 2019, the total fund strategy benchmark was comprised of the following components: 83% old portfolio strategy, 17% new portfolio strategy.*

- *The old portfolio strategy benchmark was comprised of the following components: 34% total opportunistic global equities strategy, 43% total nominal bonds strategy, 17% total commodities strategy, 38% total inflation-indexed bonds strategy, and 27% total alternative beta strategy. This program did not begin until September 2012.*
- *The new portfolio strategy benchmark was comprised of the following components: 39% total growth strategy, 37% total income strategy, 40% total inflation hedge policy and 19% total alternative betas policy. This program did not begin until January 2019.*
- *All strategy return components are adjusted for financing cost associated with programs.*

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-, 10-, 15-, and 20-year actual performance over performed its policy benchmark by 1.8%, 2.1%, 0.3%, 0.7%, and 1.2%, respectively, with the actual 5-year return trailing the policy benchmarks by (0.4%).

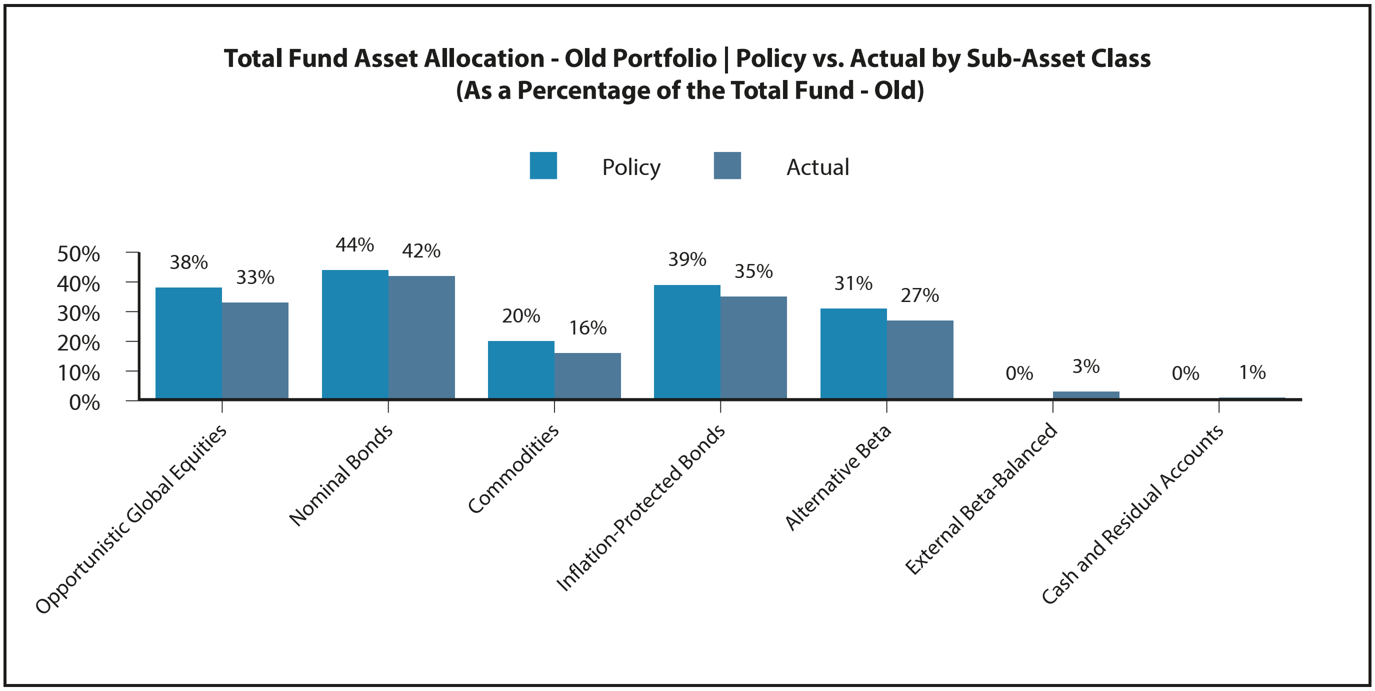
The strategy benchmark is more narrowly defined and focuses on sub-asset class allocation decisions made by the CIO. Comparison of the strategy benchmark to the policy benchmark reflects the component of value added or detracted which can be attributed to the strategic sub-class allocation decisions made by the CIO. Value is added when the strategy benchmark return exceeds the policy benchmark return. Comparison of the strategy benchmark to the total return reflects the component of the value added which can be attributed to the manager implementation (manager hiring and firing) decisions made by the CIO and approved by the external asset consultant. Value is added when the total fund return exceeds the strategy benchmark return.

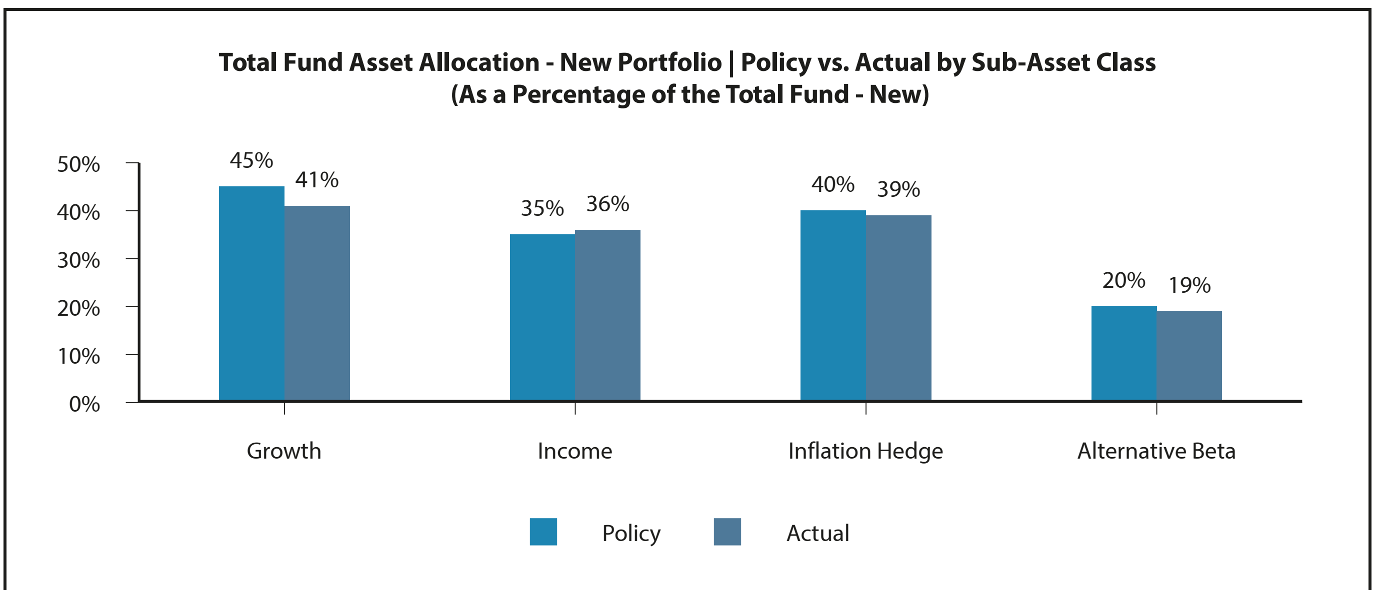
Total Fund Policy Allocation Overview

As of June 30, 2019, the Board's broad old portfolio policy allocation mix was 38% opportunistic global equities, 44% nominal bonds, 20% commodities, 39% inflation-protected bonds, and 31% alternative beta. The policy target, as of June 30, 2019, for each sub-asset class, along with the actual strategic allocation to each type of investment, is shown in the bar graph below.

As of June 30, 2019, the Board's new portfolio broad policy allocation mix was 45% growth assets, 35% income assets, 40% inflation assets, and 20% alternative betas/absolute return assets. The policy target, as of June 30, 2019, 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 overweighting 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.





The asset allocation is built upon the belief that diversification is critical. The tables below reflect the asset classes and their correlation to each other and the statistical performance data, net of fees, of the total fund, as of June 30, 2019.

Total Fund – Correlation Table (5 Years)

	Opportunistic Global Equities	Nominal Bonds	Commodities	Inflation-Protected Bonds	Alternative Beta
Opportunistic global equities	1.00				
Nominal bonds	(0.23)	1.00			
Commodities	0.49	(0.37)	1.00		
Inflation-protected bonds	0.16	0.66	0.18	1.00	
Alternative beta	0.33	0.13	(0.18)	0.04	1.00

Total Fund – Statistical Performance

Portfolio Characteristics	1 Year	3 Year	5 Year	10 Year	15 Year	20 Year
Annualized return	4.3%	5.1%	2.5%	7.7%	6.5%	6.0%
Annualized standard deviation	7.8%	5.8%	6.4%	7.1%	7.9%	8.6%
Sharpe ratio	0.26	0.64	0.26	1.03	0.66	0.49
Excess return*	1.8%	2.1%	(0.4)%	0.3%	0.7%	1.2%
Beta*	0.77	0.76	0.82	0.79	0.75	0.81
Annualized alpha*	2.3%	2.7%	0.2%	1.8%	2.0%	2.0%
Correlation*	0.99	0.98	0.94	0.96	0.95	0.96
Value added in dollars**	$149M	$519M	($238M)	$262M	$1.2B	$2.7B

* *As compared to the total fund policy benchmark.*

** *MOSERS' earnings above what would have been earned if assets had been invested passively.*

Schedule of Brokerage Activity

	Commissions Paid	Volume of Trades*	Shares Traded
B Riley and Co, LLC	$ 15,022	$ 9,378,494	500,722
Baird, Robert W & Co, Inc.	11	28,721	1,100
Barclays Capital, Inc.	1,161	21,564,553	205,252
Berstein Sanford C & Co.	224	1,283,084	44,671
BTIG, LLC	16,663	188,473,039	3,323,830
Cantor Fitzgerald & Co.	435	1,368,246	44,505
Citigroup Global Markets	890	740,022	29,951
Cowen and Co.	266	968,374	30,546
Credit Suisse	88,857	48,129,387	4,467
Deutsche Bank Securities, Inc.	4,219	60,825,428	843,582
Friedman, Billings, and Ramsey	298	163,623	9,947
Goldman Sachs & Co.	94	107,327	3,306
Jefferies & Co, Inc.	1,033	6,295,658	204,636
Mizuho Securities USA, Inc.	94	380,105	18,800
Morgan Stanley & Co.	408,364	342,054,101	27,089
Pickering Energy Partners	33	23,171	1,086
Raymond James & Assoc, Inc.	239	213,029	7,967
RBC Capital Markets, LLC	629	3,528,886	118,086
UBS Securities, LLC	54	86,649	2,048
USCA Securities, LLC	182	107,748	6,058
Weeden & Co.	36	44,816	1,826
Wells Fargo Securities, LLC	1,599	7,638,051	273,971
Total	$ 540,403	$ 693,402,512	5,703,446

* *Volume does not include futures notional value*

Schedule of Investment Portfolios by Asset Class

As of June 30, 2019

	Portfolio Value	Percentage of Investments	Market Exposure	Percentage of Investments at Market Exposure
Old Portfolio - 83% of Total Fund				
Global opportunistic equities	$ 1,986,279,605	29.7%	$ 2,224,931,883	33.2%
Nominal bonds	1,340,932,910	20.0	2,787,877,942	41.6
Commodities	337,258,691	5.0	1,086,644,833	16.2
Inflation-protected bonds	953,793,455	14.2	2,343,316,387	34.9
Alternative beta	1,796,780,647	26.8	1,796,780,647	26.8
External beta-balanced	215,941,308	3.2	215,941,308	3.2
Residual accounts from old portfolio	32,424,056	0.5	32,424,056	0.5
Cash reserve	45,459,117	0.6	45,459,117	0.6
Total old portfolio	6,708,869,789	100.0%	10,533,376,173	157.0%
New Portfolio - 17% of Total Fund				
Growth	548,167,871	40.5	549,682,452	40.6
Income	290,260,212	21.4	483,073,724	35.7
Inflation hedge	258,022,015	19.1	521,526,262	38.5
Alternative beta	257,477,438	19.0	257,477,438	19.0
Total new portfolio	1,353,927,536	100.0%	1,811,759,876	133.8%
MOSERS Total Fund	$ 8,062,797,325	100.0%	$ 12,345,136,049	153.1%

Reconciliation to Statement of Fiduciary Net Position	
Total portfolio value	$ 8,062,797,325
Obligations under repurchase agreements	3,921,700,618
STIF	(262,690,914)
Investment income receivable	(133,438,630)
Investment sales receivable	(194,365,813)
Investment activities payable	61,010,531
Management and incentive fees payable	10,642,069
Payable for investments purchased	130,605,628
Investments per *Statement of Fiduciary Net Position*	$ 11,596,260,814

Schedule of Investment Advisors

Investment Advisors	Style	Portfolio Fair Value
Actis Emerging Markets	Opportunistic global equities – emerging markets	$ 44,900,440
AQR Capital Management	Alternative beta – multi-strategy	287,917,786
AQR Capital Management	External beta balanced – risk parity	2,314,546
Axiom Asia Private Capital Associates	Opportunistic global equities – emerging markets	98,047,161
Axxon Group	Opportunistic global equities – emerging markets	24,242,590
Bayview Asset Management	Opportunistic global equities – opportunistic mortgages	3,118,447
Blackstone Alternative Asset Management	Alternative beta – fund-of-funds	216,254,406
Blackstone Real Estate Partners	Opportunistic global equities – active real estate	55,430,622
Blakeney Management	Opportunistic global equities – emerging markets	1,166,236
Bridgewater Associates	Alternative beta – global macro	120,780,748
Bridgewater Associates	External beta balanced – risk parity	213,626,740
CarVal Investors	Opportunistic global equities – distressed real estate debt	4,300,000
Catalyst Capital Group	Opportunistic global equities – Canadian distressed debt	79,421,926
Cornwall Capital	Alternative beta – multi-strategy	10,612,999
DRI Capital	Opportunistic global equities – intellectual property	13,005,352
EIG Energy Partners	Opportunistic global equities – energy - mezzanine	58,988,477
Elliott Management Corporation	Alternative beta – multi-strategy	240,034,000
Farallon Capital Partners	Alternative beta – multi-strategy	1,440,000
Gaoling Fund	Opportunistic global equities – long/short - equity	6,610,032
Gateway Energy Partners	Opportunistic global equities – energy - diversified	9,403,575
Glenview Capital Management	Opportunistic global equities – long/short - equity	39,094,901
Glenview Capital Management Sidecar	Opportunistic global equities – active equity	72,012,287
Harvest Fund Advisors	Opportunistic global equities – active MLP	38,587,050
HBK Capital Management	Alternative beta – merger arbitrage	129,416,249
JLL Partners	Opportunistic global equities – corporate buyout	22,660,661
King Street Capital Management	Alternative beta – credit driven	2,118,603
Linden Capital Partners	Opportunistic global equities – corporate buyout	21,867,499
Mast Capital Management	Alternative beta – credit driven	10,690,823
Merit Energy Company	Alternative beta – energy - oil & gas	3,398,368
MHR Fund Management	Alternative beta – distressed debt	76,668,778
Millennium Technology Value Partners	Opportunistic global equities – direct secondaries	20,733,766
NISA Investment Advisors	Opportunistic global equities – passive equities	753,405,427
NISA Investment Advisors	Nominal bonds – passive long term U.S. treasuries	807,497,914
NISA Investment Advisors	Commodities – passive commodities	26,154,759
NISA Investment Advisors	Alternative beta – strategy	702,821,674
NISA Investment Advisors	Inflation-protected bonds – passive TIPS	333,471,025
NISA Investment Advisors	Core bonds – passive core bonds	132,599,157
NISA Investment Advisors	Private credit – passive private credit	17,979,885
NISA Investment Advisors	Public real assets – pass real estate	106,363,931
Oaktree Capital Management	Opportunistic global equities – corporate buyout	6,583,160
Oaktree Capital Management	Opportunistic global equities – distressed debt	11,098,389
Pharo Management	Alternative beta – global macro	62,607,474
Silchester International Investors	Opportunistic global equities – active international equity	683,048,852
Silver Creek Capital Management	Opportunistic global equities – fund-of-funds (special situations)	15,860,086
SIR Capital Management	Alternative beta – equity market neutral	87,891,420
Siris Capital Group	Opportunistic global equities – corporate buyout	17,398,594
State Street Global Advisors	Opportunistic global equities – passive emerging markets	94,730,817
StepStone Group	Alternative beta – fund-of-funds (corporate buyouts)	5,716,147
Stone Harbor Investment Partners	Alternative beta – emerging market debt	54,338,067
TPG-Axon Capital Management	Alternative beta – multi-strategy	1,049,386
Other (each less than $1M)		3,908,928
Total investment advisors		$ 5,853,390,160

Total Fund – Top Ten Publicly Traded Separate Account Holdings

Ten Largest Holdings as of June 30, 2019*	Fair Value	Percent of the Total Fund
U.S. Treasury Bond – 2.500% 2045	$ 147,445,000	1.83%
U.S. Treasury Bond – 3.000% 2047	139,592,406	1.73
U.S. Treasury - CPI Inflation – 0.125% 2022	137,133,829	1.70
U.S. Treasury - CPI Inflation – 0.125% 2023	136,386,674	1.69
Ishares Core U.S. Aggregate	132,521,866	1.64
U.S. Treasury Bond – 3.000% 2045	132,106,125	1.64
U.S. Treasury - CPI Inflation – 0.125% 2024	128,799,274	1.60
U.S. Treasury - CPI Inflation – 0.625% 2021	121,510,592	1.51
U.S. Treasury - CPI Inflation – 0.125% 2021	120,578,806	1.50
U.S. Treasury - CPI Inflation – 0.625% 2024	119,909,988	1.49

** 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, 2019, the total fund policy benchmark was comprised of the following components: 83% old portfolio policy, 17% new portfolio policy.

As of June 30, 2019, the old portfolio policy benchmark was comprised of the following components: 38% total opportunistic global equities policy, 44% total nominal bonds policy, 20% total commodities policy, 39% total inflation-protected bonds policy, and 31% total alternative beta policy. All policy return components are adjusted for financing cost associated with the beta-balanced program. This program did not begin until September 2012.

As of June 30, 2019, the new portfolio policy benchmark was comprised of the following components: 45% total growth policy, 35% total income policy, 40% total inflation hedge policy and 20% total alternative betas policy. This program did not begin until January 2019.

- *Opportunistic global equities* – As of June 30, 2019, the opportunistic global equities policy was MSCI ACWI Net + .75%. Legacy real estate and timber assets are benchmarked to the Dow Jones U.S. Select REIT Index and NCREIF Timber respectively.
- *Nominal bonds* – As of June 30, 2019, the total nominal bonds policy was Bloomberg Barclays Long Treasury.
- *Commodities* – As of June 30, 2019, the total commodities policy was 3% S&P GSCI and 97% BCOM.
- *Inflation-protected bonds* – As of June 30, 2019, the total inflation-protected bonds policy was Barclays U.S. TIPS 1-10 Year.
- *Alternative beta* – As of June 30, 2019, the total alternative beta policy was AQR Delta.

	1 Year	3 Year	5 Year	10 Year	15 Year	20 Year
Total fund*	4.3 %	5.1 %	2.5 %	7.7 %	6.5 %	6.0 %
Total fund policy benchmark	2.5 %	3.0 %	2.9 %	7.4 %	5.8 %	4.8 %
Old portfolio	4.4 %	5.1 %	2.5 %	N/A	N/A	N/A
Old portfolio policy benchmark	2.4 %	2.9 %	2.8 %	N/A	N/A	N/A
Opportunistic global equities	1.1 %	9.3 %	5.5 %	10.8 %	8.5 %	N/A
Opportunistic global equities policy benchmark	6.70 %	10.9 %	7.9 %	12.1 %	8.5 %	N/A
Nominal bonds	10.0 %	0.4 %	4.8 %	N/A	N/A	N/A
Nominal bonds policy benchmark	10.5 %	0.2 %	4.9 %	N/A	N/A	N/A
Commodities	(11.4)%	(3.3)%	(16.1)%	(4.5)%	(4.0)%	1.1 %
Commodities policy benchmark	(9.9)%	(1.3)%	(14.9)%	(6.0)%	(5.2)%	(0.1)%
Inflation-protected bonds	2.4 %	0.4 %	0.4 %	3.0 %	3.7 %	5.8 %
Inflation-protected bonds policy benchmark	2.8 %	0.8 %	0.7 %	3.1 %	3.7 %	5.7 %
Alternative beta	0.6 %	3.3 %	3.4 %	N/A	N/A	N/A
Alternative beta policy benchmark	(13.4)%	(5.7)%	(0.6)%	N/A	N/A	N/A
External risk parity	9.6 %	8.4 %	4.0 %	N/A	N/A	N/A
Old portfolio policy benchmark	2.4 %	2.9 %	2.8 %	N/A	N/A	N/A
New portfolio	N/A	N/A	N/A	N/A	N/A	N/A
New portfolio policy benchmark	N/A	N/A	N/A	N/A	N/A	N/A

* *Time-weighted rates of return on fair values adjusted for cash flows.*

Schedule of Investment Manager Fees
For the Year Ended June 30, 2019

	Portfolio Market Value June 30, 2019	Total Fees	Manager Fees	Fund Pass Through Expenses *	Incentive Fees Earned in FY19
Equity					
Blakeney Onyx, LP	$ 1,166,236	$ 118,464	$ 20,518	$ 59,174	$ 38,772
Harvest Fund Advisors, LLC	38,587,050	175,510	175,510	0	0
Silchester International Investors	683,048,852	4,179,110	4,179,110	0	0
SSGA Emerging Markets	94,730,817	84,170	84,170	0	0
Total Equity	817,532,955	4,557,254	4,459,308	59,174	38,772
Fixed income					
Stone Harbor Investment Partners	54,338,067	153,100	153,100	0	0
Total fixed income	54,338,067	153,100	153,100	0	0
Multi-asset					
NISA Investment Advisors	2,880,293,772	5,757,915	5,757,915	0	0
Total multi-asset	2,880,293,772	5,757,915	5,757,915	0	0
Alternatives					
Actis Emerging Markets III	4,532,000	202,000	194,000	8,000	0
Actis Emerging Markets IV	40,368,440	592,268	508,000	81,000	3,268
Alinda Infrastructure Fund I, LP	85,210	15,040	2,029	13,011	0
AQR DELTA Sapphire Fund, LP	287,917,786	3,524,543	3,052,519	472,024	0
AQR Global Risk Premium Fund IV, LP	2,314,546	831,204	696,950	134,254	0
Axiom Asia Private Capital Fund II, LP	26,031,468	284,001	255,879	33,039	(4,917)
Axiom Asia Private Capital Fund III, LP	72,015,693	1,076,001	438,750	45,603	591,648
Axxon Brazil Private Equity Fund II B, LP	24,242,590	246,798	204,068	42,730	0
Bayview Opportunity Domestic IIIb, LP	3,118,447	643,415	119,426	122,656	401,333
Bayview Opportunity Domestic, LP	0	15,348	2,874	12,474	0
Blackstone Real Estate Partners IV	597,646	(308,512)	0	29,486	(337,998)
Blackstone Real Estate Partners V	7,281,108	(163,693)	0	12,591	(176,284)
Blackstone Real Estate Partners VI	6,777,539	226,263	37,883	21,889	166,491
Blackstone Real Estate Partners VII	41,371,975	1,018,858	516,520	40,843	461,495
Blackstone Topaz Fund, LP	216,254,099	3,051,603	2,126,767	273,801	651,035
Bridgewater Associates - All Weather @ 12%, LLC	213,626,740	1,378,002	1,168,824	209,178	0
Bridgewater Associates - Diamond Ridge Fund, LLC	120,780,748	4,237,950	4,105,598	132,352	0
CarVal Investors CVI Global Value Fund A, LP - private debt	2,150,000	13,405	0	13,405	0
CarVal Investors CVI Global Value Fund A, LP - real estate	2,150,000	13,405	0	13,405	0
Catalyst Fund Limited Partnership III	37,572,954	989,566	902,460	87,106	0
Catalyst Fund Limited Partnership IV	13,497,581	423,922	337,751	86,171	0
Catalyst Fund Limited Partnership V	28,351,391	860,719	1,977,504	288,514	(1,405,299)
Catterton Partners V, LP	0	11,013	0	11,013	0
Cornwall Domestic, LP	10,612,999	134,569	0	145,187	(10,618)
DRI Capital - LSRC	13,005,352	168,487	0	108,191	60,296
EIG Energy Fund XIV, LP	5,041,694	173,976	134,173	39,803	0

Schedule of Investment Manager Fees continued on page 88

Schedule of Investment Manager Fees continued from page 87

	Portfolio Market Value June 30, 2019	Total Fees	Manager Fees	Fund Pass Through Expenses*	Incentive Fees Earned in FY19
EIG Energy Fund XV, LP	22,415,116	433,946	364,274	69,672	0
EIG Energy Fund XVI, LP	28,346,132	(326,491)	333,374	64,277	(724,142)
Elliott International, Ltd.	240,034,000	7,627,472	3,470,934	2,301,468	1,855,070
Farallon Capital Institutional Partners, LP	1,440,000	26,239	0	0	26,239
Gaoling Fund, LP	6,610,032	(1,745,002)	1,823,464	81,748	(3,650,214)
Garnet Sky Investors Company, Ltd.	0	(783,755)	200,194	141,549	(1,125,498)
Gateway Energy & Resource Holdings, LLC	9,403,575	340,390	1,351	345,796	(6,757)
Glenview Capital Opportunity Fund, LP	39,094,901	563,866	320,421	243,445	0
Glenview Sidecar	72,012,287	201,004	0	201,004	0
Global Forest Partners GTI7 Institutional Investors Company, Ltd.	447,493	33,939	0	33,939	0
HBK Merger Strategies Offshore Fund, Ltd.	129,416,249	2,966,936	940,520	299,255	1,727,161
JLL Partners Fund V, LP	3,815,136	216,450	10,848	8,071	197,531
JLL Partners Fund VI, LP	18,845,525	(74,256)	226,734	21,629	(322,619)
King Street Capital, LP	2,118,603	(238,006)	34,926	0	(272,932)
King Street Capital, Ltd.	42,533	11,177	1,786	0	9,391
Linden Capital Partners II, LP	21,867,499	646,112	395,930	15,548	234,634
Mast Credit Opportunities I, LP	10,690,823	523,119	206,167	316,952	0
Merit Energy Partners F-II, LP	3,398,368	84,748	49,003	35,745	0
MHR Institutional Partners IIA, LP	38,791,842	1,159,584	0	39,127	1,120,457
MHR Institutional Partners III, LP	26,599,245	(3,447,656)	296,247	66,304	(3,810,207)
MHR Institutional Partners IV, LP	21,919,760	913,805	832,153	81,652	0
Millennium Technology Value Partners II	17,155,882	1,001,873	394,875	41,405	565,593
OCM Opportunities Fund VIIb, LP	2,235,723	196,641	96,977	16,456	83,208
OCM Opportunities Fund VIIIb, LP	8,862,666	246,989	208,559	38,430	0
OCM Power Opportunities Fund III, LP	6,583,160	131,790	150,125	69,621	(87,956)
OCM Real Estate Opportunities Fund III, LP	0	530	0	21,802	(21,272)
OCM/GFI Power Opportunities Fund II, LP	1	27,950	0	34,903	(6,953)
Perry Partners, LP	16,825	152	152	0	0
Pharo Macro Fund, Ltd.	62,607,474	1,937,593	1,178,949	58,098	700,546
Resource Management Service - Wildwood Timberlands, LLC	0	(834,520)	0	0	(834,520)
Silver Creek Special Opportunities Fund I, LP	6,386,475	29,173	0	29,173	0
Silver Creek Special Opportunities Fund II, LP	9,473,611	35,110	0	35,110	0
Silver Lake Partners II, LP	273,700	85,534	0	1,190	84,344
Standard Investment Research Hedged Equity Fund	87,891,420	2,930,729	1,943,186	168,325	819,218
StepStone Capital Buyout Fund I, LP	3,989	14,672	0	13,995	677
StepStone Capital Buyout Fund II, LP	5,511,800	(737,855)	50,483	29,601	(817,939)
StepStone Opportunities Fund II, LP	200,358	37,094	286	32,144	4,664
Total alternatives	2,084,210,209	33,897,227	30,313,893	7,435,160	(3,851,826)
Total fees	$ 5,836,375,003	$ 44,365,496	$ 40,684,216	$ 7,494,334	$ (3,813,054)

* *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 - Old Portfolio

During the fiscal year, the economy showed signs of moderating compared to the strength demonstrated in prior years. This resulted in markets being more volatile and most showing lower returns than the prior fiscal year. There was a divergence in asset class performance during the fiscal year with five asset class delivering positive returns and one delivering a negative return. The positive returning asset classes were: opportunistic global equities at 1.1%, nominal bonds at 10.0%, inflation-protected bonds at 2.4%, and alternative betas at 0.6%. Commodities were down 11.4% and were the only major asset class with negative performance this fiscal year. The external risk parity portfolio returned 9.6% during the past year..

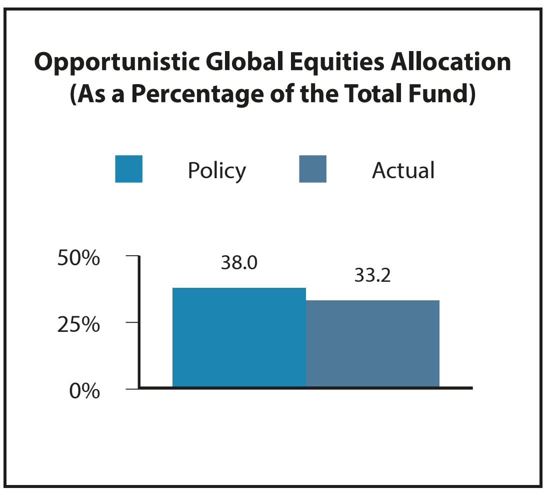
Opportunistic Global Equities

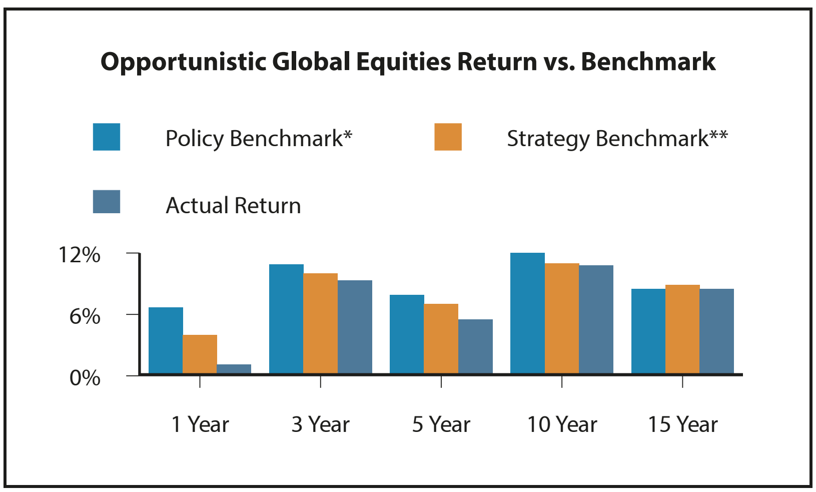
It is expected that investments in this asset class will perform well during periods of rising economic growth and/or falling inflation. Investments in this asset class include U.S. and non-U.S. equity investments with varying characteristics related to market capitalization and investment style. Because of the non-U.S. nature of some of these investments, foreign currency exposure will be part of this portfolio.

Global equities were up 5.7% during the fiscal year with most of it occurring in the first four months of the last half of the fiscal year. The first six months of the fiscal year were poor for global equities as they were down over 9%. The remaining six months of the fiscal year saw strong performance of over 16.2%. In a continuation from last year, domestic equity returns were stronger than foreign equity markets. Domestic equities returned 10.2% for the fiscal year while developed international equities and emerging markets were up only 1.3% amd 1.2%, respectively.

Within the U.S equity market this fiscal year, the utilities and real estate sectors performed best with returns of 19.0% and 16.8%, respectively. The energy and materials sectors were the worst performing sectors with returns of (13.3%) and 3.2%, respectively. Across developed country equity markets, Switzerland and New Zealand posted the best returns during the fiscal year with a 17.9% and 15.7% return, respectively. Austria and Belgium returned the least with a (15.6%) and (10.8%) return, respectively.

The market exposure of the equity portfolio on June 30, 2019, was $2,224,931,883, representing 33.2% of total market value. The graph below (left) illustrates the actual exposure compared to policy. For the fiscal year, the equity allocation returned 1.1% versus 6.7% for the global equity policy benchmark. The underperformance was driven predominantly by manager underperformance within domestic and international equities, a portfolio underweight to domestic equities, and the opportunistic equity portfolio lagging its benchmark by 6.0%. The graph below (right) illustrates actual performance as compared to the policy and strategy benchmarks.





* *As of June 30, 2019, the opportunistic global equities policy was MSCI ACWI Net + .75%.*

** *As of June 30, 2019, the total opportunistic global equities strategy benchmark was comprised of the following components: 37.7% actual return domestic equity exposure/MSCI US, 1.7% S&P MLP, 43.4% MSCI World ex. U.S. (Net), 7.5% MSCI Emerging Markets (Net), 3.5% MSCI China, and 6.1% Dow Jones Wilshire REIT.*

The tables below shows the statistical performance for the opportunistic global equity portfolio as of the fiscal year end.

Opportunistic Global Equities – Statistical Performance

Portfolio Characteristics	1 Year	3 Year	5 Year	10 Year	15 Year
Return	1.1 %	9.3%	5.5%	10.8%	8.5%
Annualized standard deviation	13.3 %	8.6%	7.8%	8.9%	10.0%
Sharpe ratio	(0.09)	0.92	0.60	1.16	0.72
Excess return*	(5.6)%	(1.60)%	(2.40)%	(1.30)%	0.0%
Beta*	0.80	0.78	0.66	0.72	0.71
Annualized alpha*	(4.3)%	0.7%	0.2%	2.0%	2.3%
Correlation*	0.99	0.95	0.91	0.94	0.93

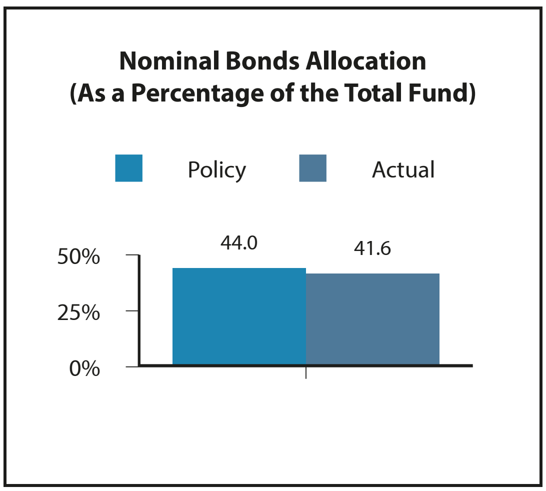
* *As compared to the total opportunistic global equities policy benchmark.*

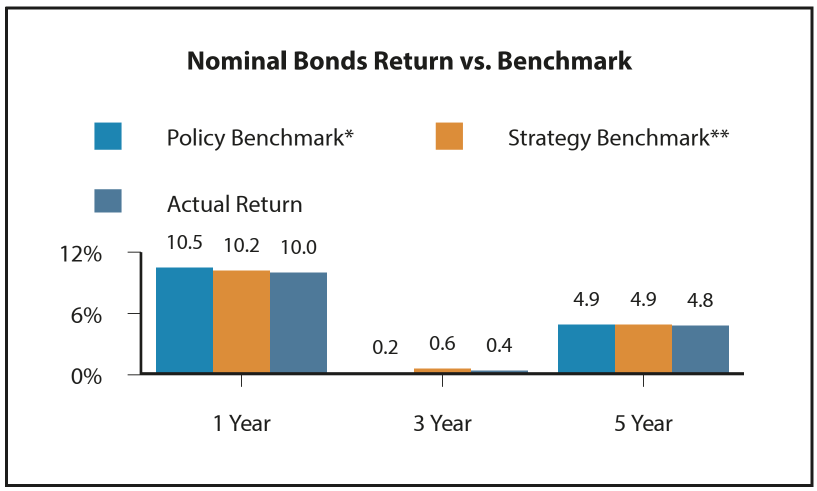
Nominal Bonds

It is expected that investments in this asset class will perform well in periods of 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. Because this asset class is invested in all U.S. bonds, there is currently not any foreign currency exposure as part of this portfolio.

The U.S. government bond exposure outperformed most other allocations this year. The 10-year U.S. treasury rate increased a little over 0.85% as the Federal Reserve reversed its tightening monetary policy in the second half of the fiscal year with easing policy. Longer-term treasuries outperformed shorter-term treasuries during the fiscal year. For example, treasuries with a maturity of 20 years and longer returned 12.3%, while treasuries with a maturity under 10 years returned 6.2%.

As of June 30, 2019, the market exposure of the nominal bond portfolio was $2,787,877,942, representing 41.6% of total market value. The bar chart below (left) illustrates the actual exposure compared to policy. For the fiscal year, the nominal bond allocation returned 10.0% versus 10.5% for the nominal bond policy benchmark. A strategic decision preferring to own TIPS in lieu of nominal treasuries detracted from performance and implementation decisions were a small drag on performance. The bar chart below (right) illustrates actual performance as compared to the policy and strategy benchmarks.





* *As of June 30, 2019, the total nominal bonds policy benchmark was Bloomberg Barclays Long Treasury.*

** *As of June 30, 2019, the nominal bonds strategy benchmark was comprised of the following components: 94.5% total nominal bonds policy, and 5.5 % Barclays US Treasury Inflation Notes 10+ Year.*

The table below shows the statistical performance that occurred within the nominal bond portfolio in fiscal year 2019. There was no commission brokerage activity within the nominal bond portfolio in fiscal year 2019.

Nominal Bonds – Statistical Performance

Portfolio Characteristics

	1 Year	3 Year	5 Year
Return	10.0%	0.4%	4.8%
Annualized standard deviation	11.0%	9.3%	9.9%
Sharpe ratio	0.70	(0.11)	0.39
Excess return*	(0.5)%	0.2%	(0.1)%
Beta*	0.96	0.95	0.96
Annualized alpha*	(0.1)%	0.2%	0.0%
Correlation*	1.00	1.00	1.00

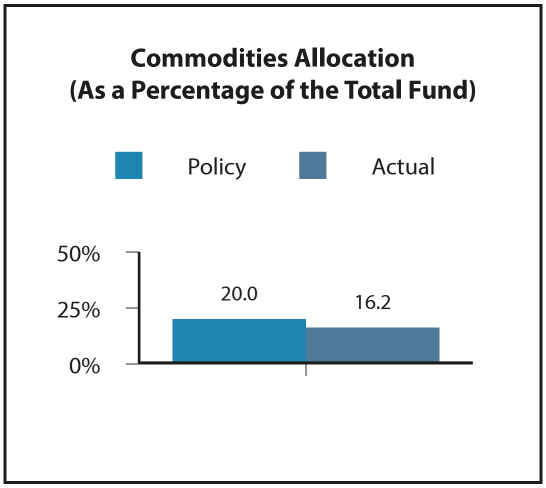
* *As compared to the total nominal bonds policy benchmark.*

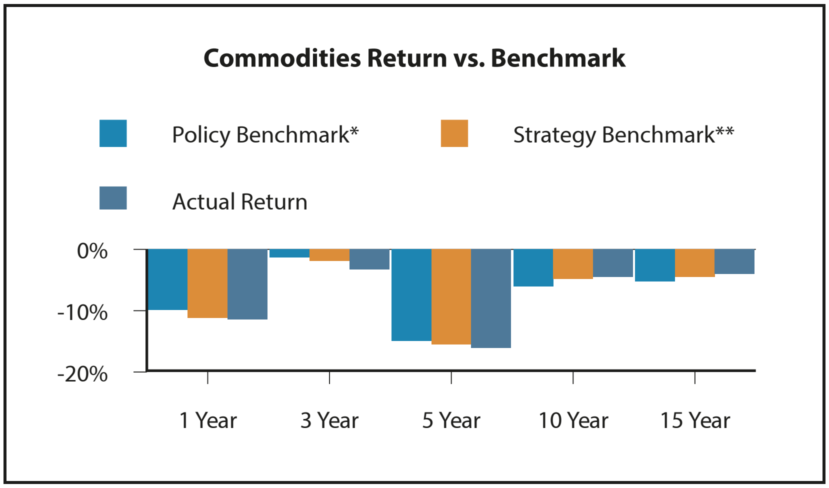
Commodities

It is expected that investments in this asset class will perform well during periods of rising economic growth and rising inflation. Investments in the asset class may include investments in raw materials, materials required in the manufacturing of finished products, the owners of raw goods, and the producers of raw materials. Because this asset class is invested in all U.S. dollar denominated commodities there is no currency exposure as part of this portfolio.

Commodities reversed last year's positive performance as only one of the four commodity sectors producing positive returns this fiscal year. Energy, after producing a 32.8% return in fiscal year 2018, produced a (16.2%) return in fiscal year 2019, followed by industrial metals at (13.0%). Precious metal was the only positive commodity sector this fiscal year, returning 5.2%. Within these sectors, gold and corn were the best performing commodities with 9.5% and 3.7% returns, respectively. The worst performing commodities during the fiscal year were cotton and natural gas with (24.2%) and (22.5%) returns respectively.

As of June 30, 2019, the market exposure of the commodities portfolio was $1,086,644,833, representing 16.2% of the total market value. The bar chart below (left) illustrates the actual exposure compared to policy. The commodity allocation returned (11.4%) versus (9.9%) for the commodity policy benchmark for the fiscal year. The primary driver of the underperformance was implementing the exposure through a modified futures roll strategy compared to the benchmark. The actual performance as compared to the policy and strategy benchmarks is illustrated in the bar chart below (right).





* *As of June 30, 2019, the commodities policy benchmark was S&P Goldman Sachs Commodity Index and Bloomberg Commodity Index.*

** *As of June 30, 2019, the commodities strategy benchmark was comprised of the following components: 2.7% Goldman Sachs Commodity Index, 10.9% Bloomberg Commodity Index, 86.4% Bloomberg Roll Select Commodity Index.*

The table below shows the statistical performance for the commodities portfolio as of the fiscal year end.

Commodities – Statistical Performance

Portfolio Characteristics	1 Year	3 Year	5 Year	10 Year	15 Year	20 year
Return	(11.4)%	(3.3)%	(16.1)%	(4.5)%	(4.0)%	1.1%
Annualized standard deviation	11.5%	11.1%	18.6%	17.8%	22.6%	22.3%
Sharpe ratio	(1.19)	(0.42)	(0.91)	(0.28)	(0.23)	(0.03)
Excess return*	(1.6)%	(1.9)%	(1.2)%	1.5%	1.2%	1.2%
Beta*	0.94	0.97	1.05	0.99	1.01	1.01
Annualized alpha*	(2.4)%	(2.0)%	(0.5)%	1.6%	1.4%	1.3%
Correlation*	0.99	0.99	0.99	0.97	0.98	0.99

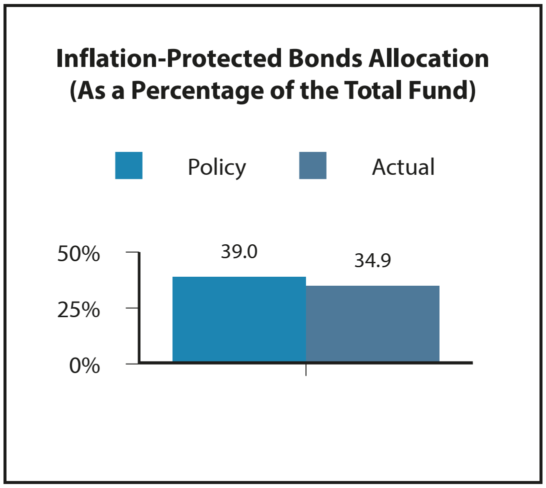
* *As compared to the total commodities policy benchmark.*

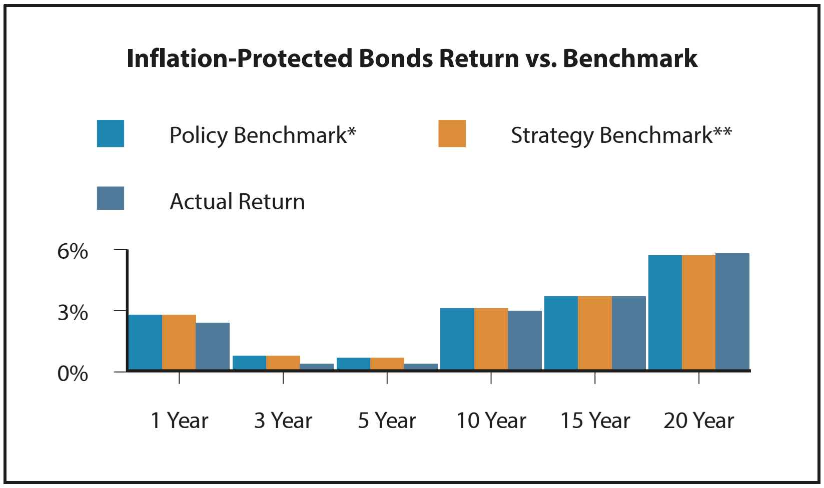
Inflation-Protected Bonds

It is expected that investments in this asset class will perform well during periods of falling economic growth and rising 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. All such securities must derive a significant portion of their value from changes in the respective issuer's domestic inflation. Because this asset class is invested in all U.S. bonds, there is no foreign currency exposure as part of this portfolio.

Inflation in the U.S. decreased during the fiscal year to 1.6% year-over-year versus 2.9% as of June 30, 2018. The 10-year real rate (the interest rate after subtracting the inflation rate) on U.S. Treasury Inflation Protected Securities ("TIPS") increased about 0.4% during the fiscal year and the implied inflation rate decreased by about 0.4% resulting in lower performance for inflation-indexed bonds versus nominal bonds.

As of June 30, 2019, the market exposure of the inflation-protected bond portfolio was $2,343,316,387, representing 34.9% of total market value. The bar chart below (left) illustrates the actual exposure compared to policy. For the fiscal year, the inflation-protected bond allocation returned 2.4% versus 2.8% for the inflation-protected bond policy benchmark. There was no internal or external active management strategy utilized during the year; thus providing a return that closely matched the benchmark. The bar chart below (right) illustrates actual performance as compared to the policy and strategy benchmarks.





* *As of June 30, 2019, the inflation-protected bonds policy benchmark was Bloomberg Barclays U.S. TIPS 1-10 YR.*

** *As of June 30, 2019, the inflation-protected bonds strategy benchmark is equal to the inflation-protected bonds policy.*

The table below shows the statistical performance for the inflation-protected bond portfolio as of the fiscal year end.

Inflation-Protected Bonds – Statistical Performance

Portfolio Characteristics	1 Year	3 Year	5 Year	10 Year	15 Year	20 Year
Return	2.4 %	0.4 %	0.4 %	3.0 %	3.7%	5.8%
Annualized standard deviation	2.4 %	2.1 %	2.7 %	4.0 %	5.3%	6.8%
Sharpe ratio	0.03	(0.46)	(0.18)	0.64	0.45	0.59
Excess return*	(0.5)%	(0.4)%	(0.4)%	(0.2)%	0.0%	0.0%
Beta*	1.01	1.00	1.00	1.01	1.00	1.01
Annualized alpha*	(0.5)%	(0.4)%	(0.3)%	(0.2)%	0.0%	0.0%
Correlation*	1.00	1.00	1.00	1.00	1.00	1.00

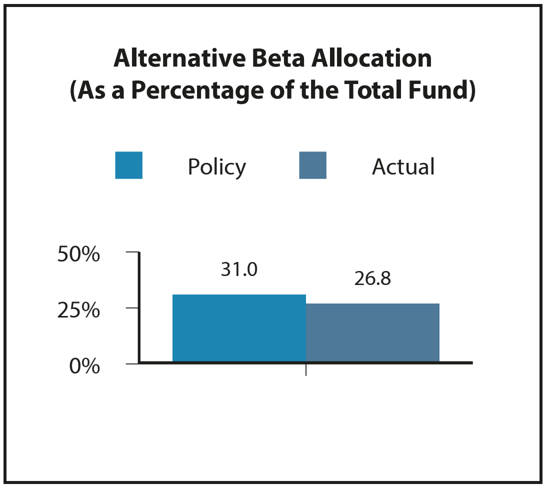
* *As compared to the total inflation-protected bonds policy benchmark.*

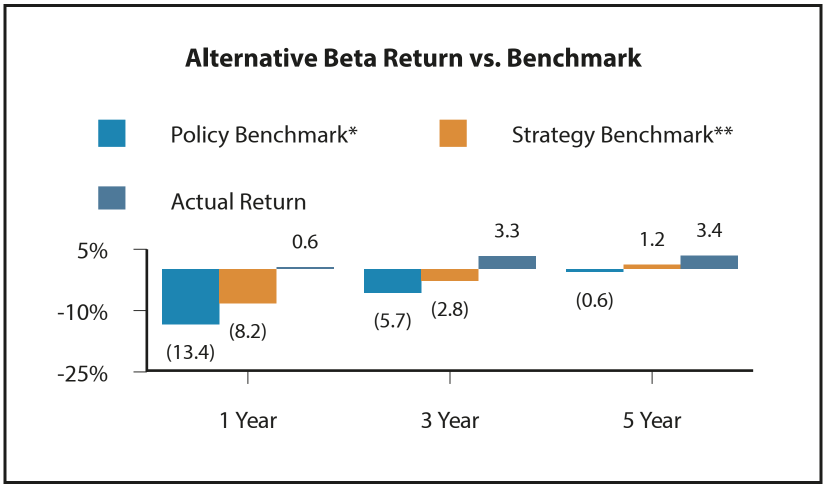
Alternative Beta

This asset class represents a collection of strategies, commonly referred to as hedge fund or alternative betas, because they access risk premiums that provide a reasonable return for the risk taken and are diversifying to the other market risks in the portfolio. Alternative betas are expected to produce positive returns with the distinction that they can be obtained passively at fees lower than active hedge fund managers. In addition and 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 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, foreign currency exposure will be part of this portfolio.

The alternative beta benchmark performed poorly during the fiscal year led by weak performance from equity market neutral and dedicated short bias strategies which returned (18.0%) and (13.6%), respectively. Event driven and convertible arbitrage strategies performed best as they returned 4.3% and 3.8% during the fiscal year, respectively.

As of June 30, 2019, the market exposure of the alternative beta portfolio was $1,796,780,647, representing 26.8% of total market value. The bar chart below (left) illustrates the actual exposure compared to policy. The alternative beta allocation returned 0.6% for the fiscal year versus (13.4%) for the alternative beta policy benchmark. The outperformance was attributable to two areas of the portfolio. First, the active hedge fund managers returned 6.1% for the year. Second, there was also outperformance due to the passive alternative beta strategies that returned 1.4% and (7.0%) for the fiscal year. The bar chart below (right) illustrates actual performance as compared to the policy and strategy benchmarks.





* *As of June 30, 2019, the alternative beta policy benchmark was AQR Delta.*

** *As of June 30, 2019, the alternative beta strategy benchmark was comprised of the following components: 58.1% total alternative beta policy, 2.9% JPM GBI-EM Global Diversified, 19.2% S&P Systematic Global Macro Index,19.1% Barclays U.S. Aggregate Excess Return plus 90 day T-bill and 0.6% actual return of one strategy.*

The table below shows the statistical performance for the alternative betas portfolio as of fiscal year end.

Alternative Beta – Statistical Performance

Portfolio Characteristics	1 Year	3 Year	5 Year
Return	0.6%	3.3%	3.4%
Annualized standard deviation	3.4%	2.6%	2.6%
Sharpe ratio	(0.49)	0.77	0.97
Excess return*	14.0%	9.1%	4.0%
Beta*	0.48	0.33	0.27
Annualized alpha*	7.4%	5.2%	3.5%
Correlation*	0.80	0.78	0.67

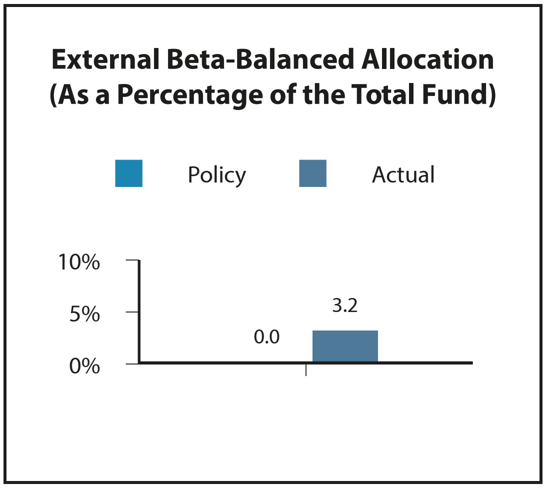
* *As compared to the total alternative betas policy benchmark.*

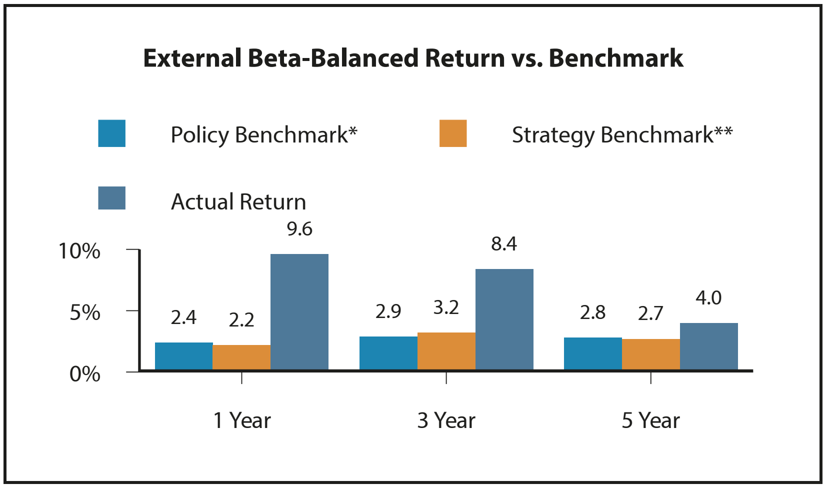
External Beta-Balanced

Bridgewater All-Weather and AQR Global Risk Premium are utilized for the external portion of the risk-balanced portfolio, while the internal portion is managed by staff utilizing NISA Investment Advisors to implement the trading and operational aspects of the program.

Bridgewater returned 7.3% for the fiscal year after returning 8.9% last fiscal year. AQR returned 15.8% for the fiscal year after returning 9.1% last fiscal year. These active managers invest in similar asset classes as the internal portfolio but hold them in different weights and have wider active risk boundaries.

As of June 30, 2019, the external risk parity portfolio returned 9.6% for the fiscal year and represented 3.2%, or $215,941,308 of market value. The bar chart below (left) illustrates the actual exposure compared to policy. These managers hold similar asset classes but can have different weights to those asset classes as compared to their benchmark. As a portfolio, these two managers outperformed their benchmark for the year by 7.2%. The bar chart below (right) illustrates actual performance as compared to the policy and strategy benchmarks.





* *As of June 30, 2019, the policy benchmark was the old portfolio policy benchmark.*

** *As of June 30, 2019, the strategy benchmark was the old portfolio strategy benchmark.*

The table below shows the statistical performance for the external risk parity portfolio as of fiscal year end.

External Beta-Balanced – Statistical Performance

Portfolio Characteristics	1 Year	3 Year	5 Year
Return	9.6%	8.4%	4.0%
Annualized standard deviation	10.4%	7.7%	8.9%
Sharpe ratio	0.70	0.92	0.36
Excess return*	7.2%	5.7%	1.9%
Beta*	0.93	0.93	1.01
Annualized alpha*	7.1%	5.6%	1.9%
Correlation*	0.89	0.91	0.88

** As compared to the total policy benchmark.*

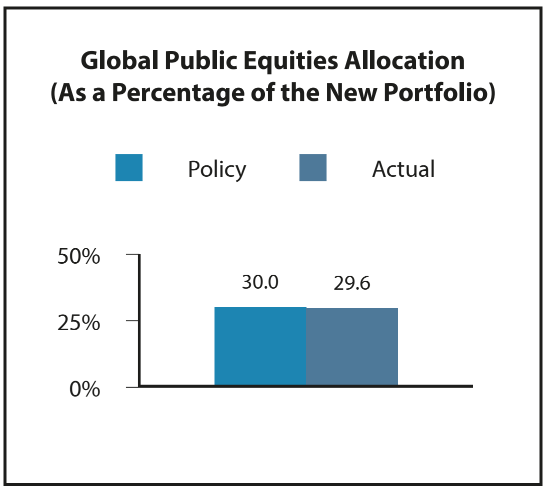
Asset Class Summary - New Portfolio

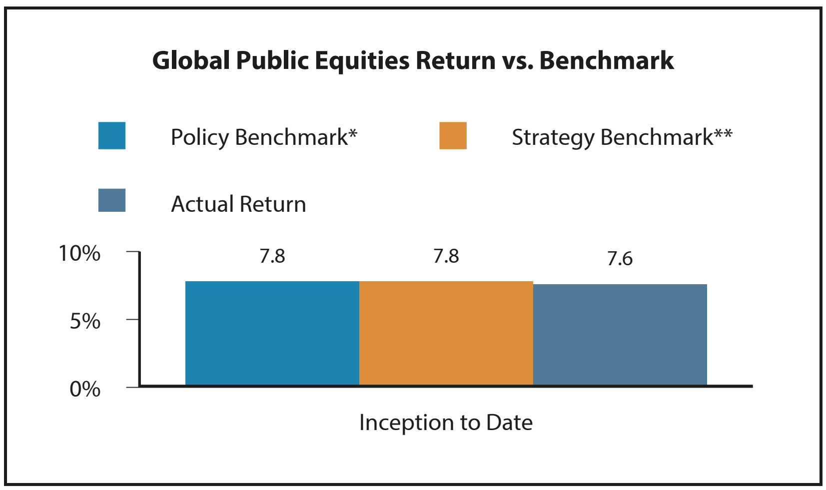
The new portfolio was initially funded at the end of January 2019; therefore, the performance numbers discussed below are for the five months ended June 2019. The portfolio consists of four broad asset buckets: growth, income, inflation hedge, and alternative betas/absolute return. Each of these asset buckets are made up of a number of different asset classes. All four asset buckets had positive performance during the five-month period. The growth bucket returned 6.8%, while the income bucket was up 8.1%. The inflation hedge bucket was up 2.8% and the alternative betas/absolute return bucket returned 0.9%.

Growth Bucket

This bucket is designed to provide capital appreciation and provide access to a form of equity-risk premium and 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 asset class 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, foreign currency exposure will be part of this bucket.

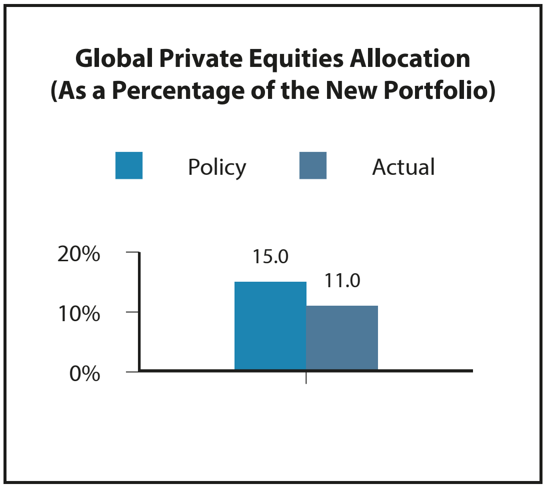
The growth bucket is made up of global public equities and global private equities. As of the fiscal year end, global public equities and global private equities were 73% and 27% of the growth bucket, respectively. For the five months, public equities returned 7.6% versus 7.8% for the policy benchmark. While the objective was to match the return of the benchmark, the slight underperformance was the result of implementation decisions that didn't perfectly match the benchmark return. Private equities, for the five months, returned 5.7% compared to its policy benchmark return of 2.8%. This outperformance was the result of external managers outperforming the benchmark.

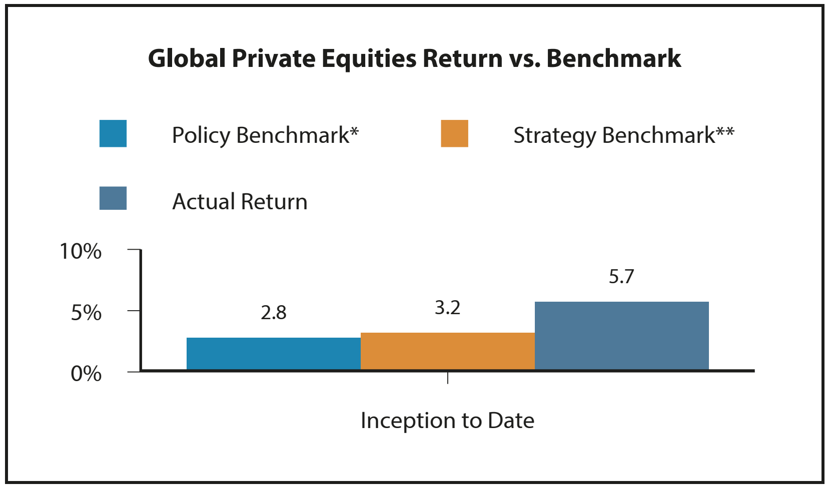




* *As of June 30, 2019, the public equities policy benchmark was MSCI ACWI Net.*

** *As of June 30, 2019, the public equities strategy benchmark is equal to the public equities policy benchmark.*

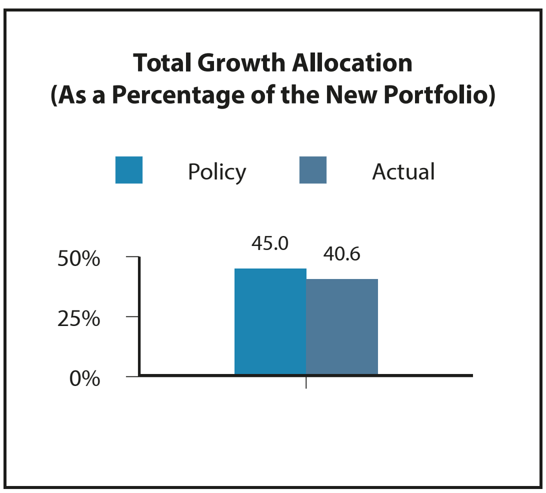


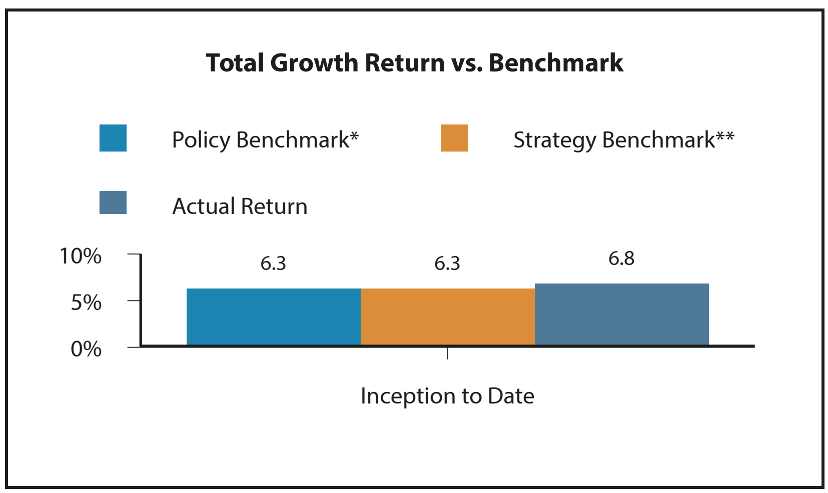


* *As of June 30, 2019, the private equities policy benchmark was the Burgiss All Equity Universe (weighted by vintage year).*

** *As of June 30, 2019, the private equities strategy benchmark was comprised of 41.2% private equities policy and 58.9% S&P 600 + 2%.*

The market exposure of the growth bucket on June 30, 2019, was $549,682,452 representing 40.6% of total market value. The bar chart below (left) illustrates the actual exposure compared to policy. For the five months, the growth allocation returned 6.8% versus 6.3% for the policy benchmark. The outperformance was driven by global private equities outperforming the policy benchmark by 2.9%. The bar chart below (right) illustrates actual performance as compared to the policy and strategy benchmarks.





* *As of June 30, 2019, the total growth policy benchmark was comprised of 66.7% global public equities policy benchmark and 33.3% global private equities policy benchmark.*

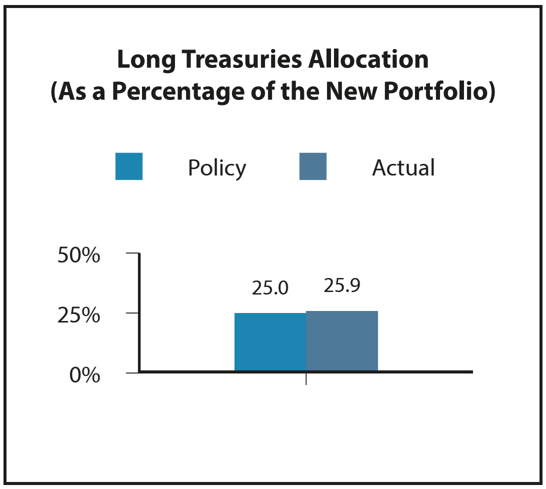
** *As of June 30, 2019, the total growth strategy benchmark was comprised of 73.6% global public equities strategy benchmark and 26.4% global private equities strategy benchmark.*

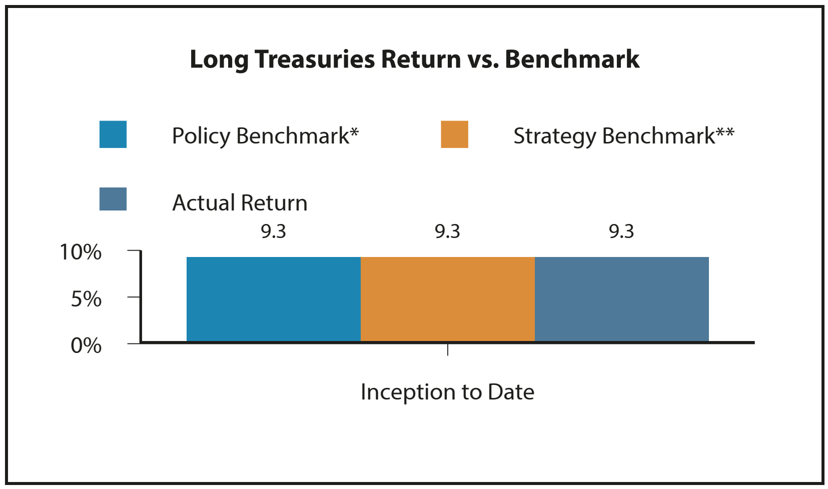
Statistical performance is not presented as the portfolio has less than one year of return data.

Income Bucket

This bucket 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, debt issued by corporations, and 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 bucket.

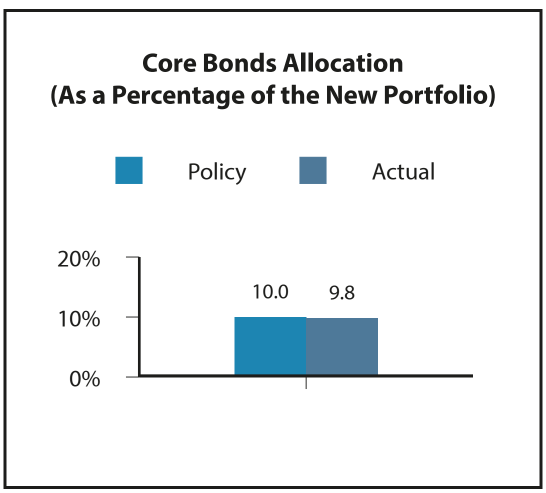
The income bucket is made up of long treasuries and core bonds. As of the fiscal year end, long treasuries and core bonds were 73% and 27% of the income bucket, respectively. For the five months, long treasuries returned 9.3% versus 9.3% for the policy benchmark. The exposure to long treasuries is gained passively with minimal tracking error. Core bonds, for the five months, returned 4.8% compared to its policy benchmark return of 5.0%. This slight underperformance was the result of passively implementing the exposure with an imperfect benchmark tracking solution.

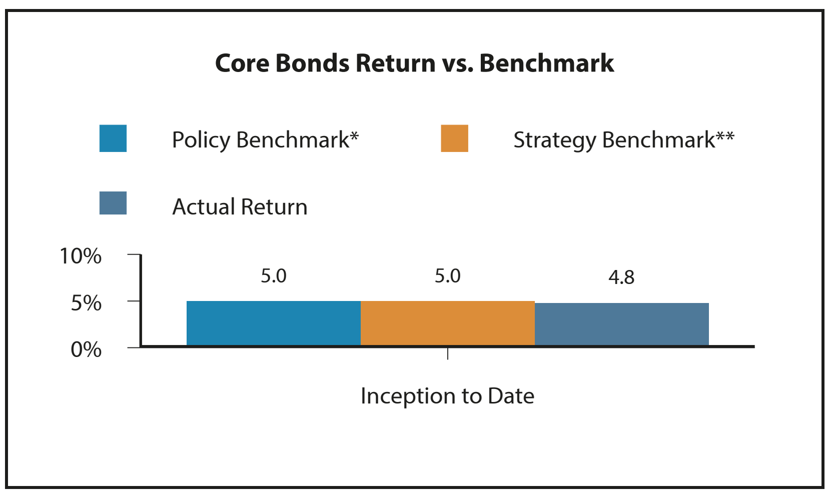




* *As of June 30, 2019, the long treasuries policy benchmark was BloombergBarclays Long Treasury Index.*

** *As of June 30, 2019, the long treasuries strategy benchmarks is equal to the long treasuries policy benchmark.*

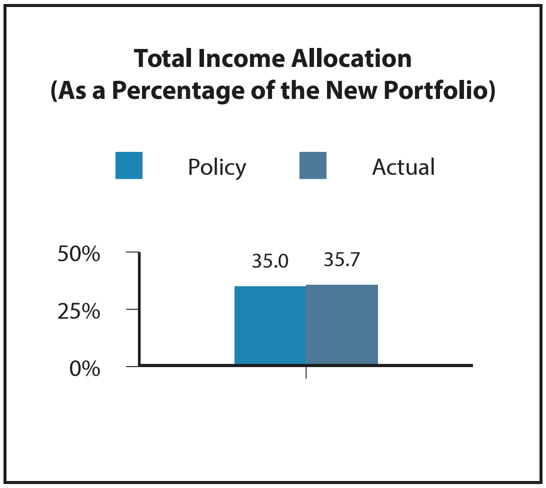


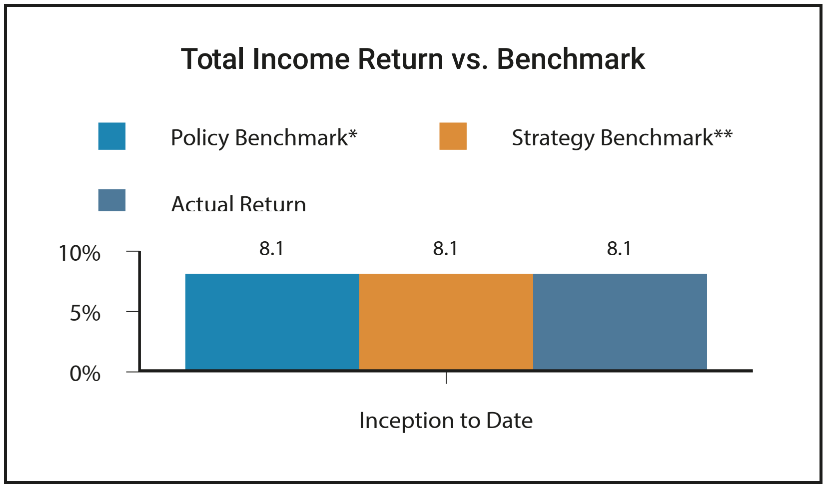


* *As of June 30, 2019, the core bonds strategy benchmark is equal to the core bonds policy benchmark.*

** *As of June 30, 2019, the core bonds strategy benchmark is equal to the core bonds policy benchmark.*

As of June 30, 2019, the market exposure of the income bucket was $483,073,724, representing 35.7% of total market value. The bar chart below (left) illustrates the actual exposure compared to policy. For the five months, the income allocation returned 8.1% versus 8.1% for the income bucket policy benchmark. There are no strategic positions in the income bucket so it tracks the benchmark closely. The bar chart below (right) illustrates actual performance as compared to the policy and strategy benchmarks.





* *As of June 30, 2019, the total income policy benchmark was comprised of 71.4% long treasuries policy benchmark and 28.6% core bonds policy benchmark.*

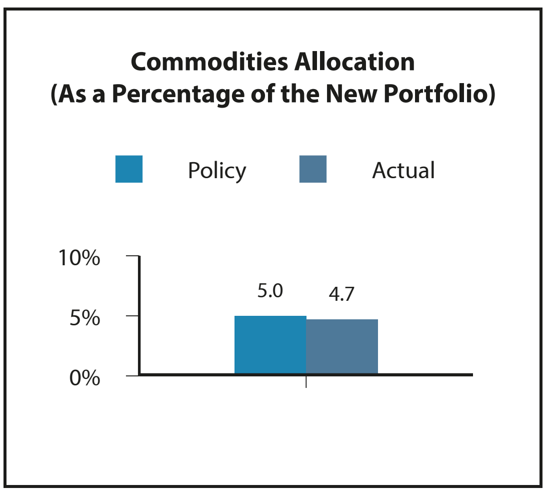
** *As of June 30, 2019, the total income strategy benchmark was comprised of 72.5% long treasuries strategy benchmark and 27.5% core bonds strategy benchmark.*

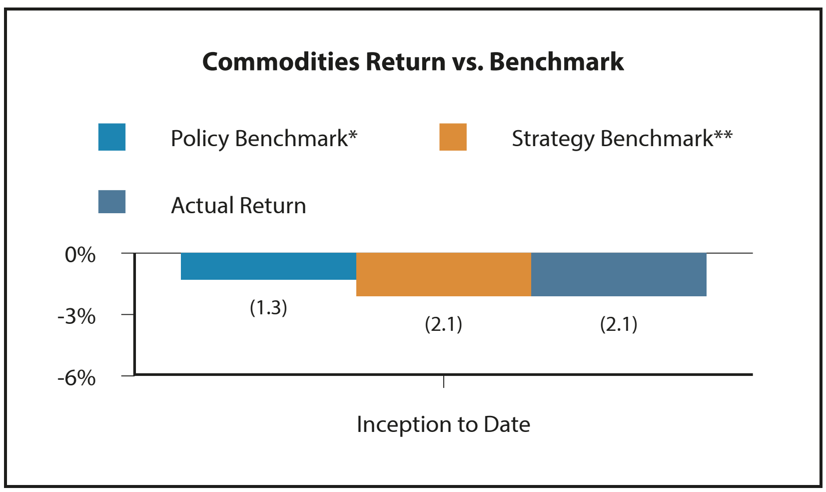
Statistical performance is not presented as the portfolio has less than one year of return data.

Inflation Hedge Bucket

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. Public and private real assets are designed to provide capital appreciation and income; as well as, exposure to equity and liquidity risk premium. 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 bucket.

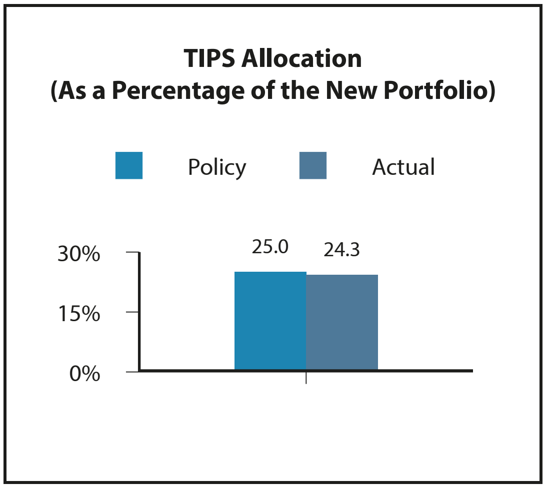
As of the fiscal year end, TIPS were 63% and public real assets were 13% of the inflation hedge bucket. Commodities and private real assets each made up 12% of the inflation hedge bucket. For the five months, TIPS returned 2.9% versus 3.0% for the policy benchmark. There was no internal or external active management strategy utilized during the five months; thus, providing a return that closely matched the benchmark. Commodities, for the five months, returned (2.1%) compared to its policy benchmark return of (1.3%). The primary driver of the underperformance was implementing the exposure through a modified futures roll strategy compared to the benchmark. Public real assets returned 6.5%, for the five months, compared to its policy benchmark return of 6.6%. There was no internal or external active management strategy utilized during the five months; thus, providing a return that closely matched the benchmark. For the five months, private real assets returned 3.8% versus 2.0% for its policy benchmark. This outperformance was due to the portfolio strategically overweighting publicly traded real estate investment trusts instead of core real estate funds.

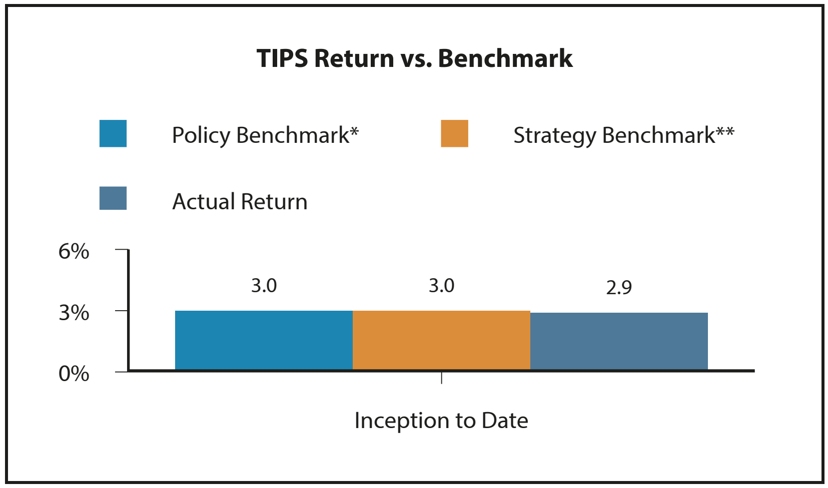




* *As of June 30, 2019, the commodities policy benchmark was the Bloomberg Commodity Index (BCOM).*

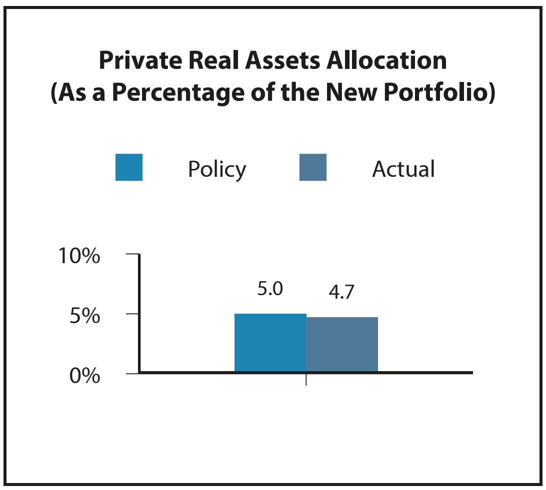
** *As of June 30, 2019, the commodities strategy benchmark is equal to the Bloomberg Barclays BCOM Roll Select Index.*

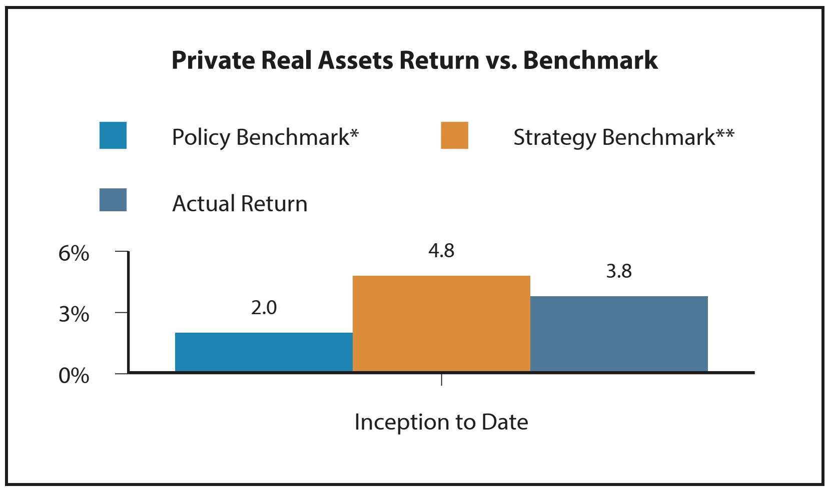




* *As of June 30, 2019, the TIPS policy benchmark was the Bloomberg Barclays 1 - 10 year TIPS Index.*

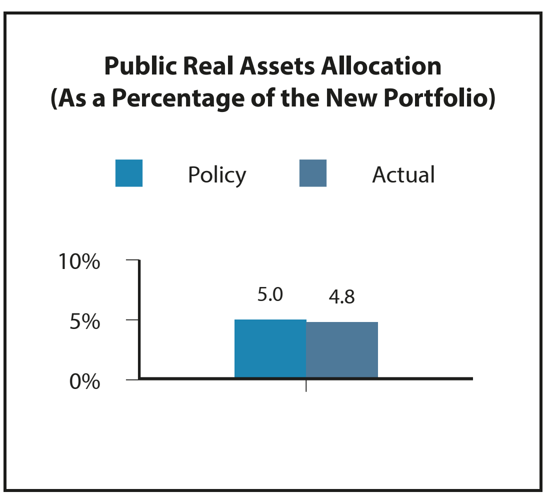
** *As of June 30, 2019, the TIPS strategy benchmark is equal to the TIPS policy benchmark.*

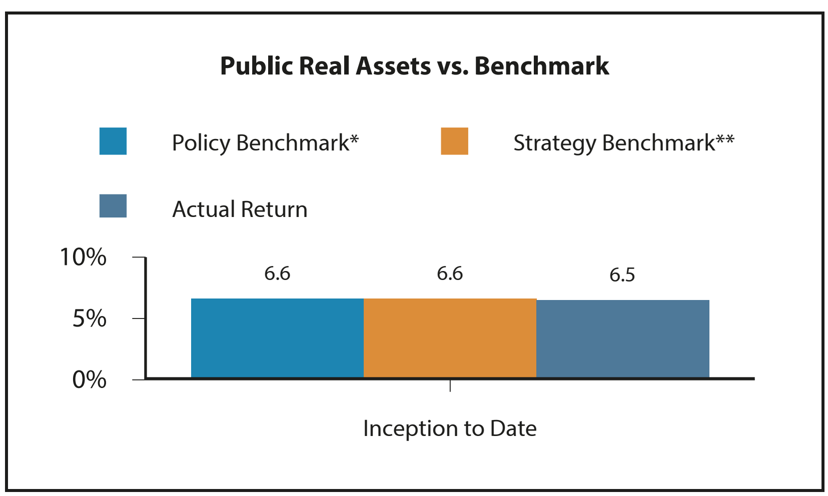




* *As of June 30, 2019, the private real assets policy benchmark was the NCREIF Fund Index - Open End Diversified Core Equity (ODCE).*

** *As of June 30, 2019, the private real assets strategy benchmark was comprised of 37.6% private real assets policy benchmark and 62.4% FTSE NAREIT ALL REITS Index.*

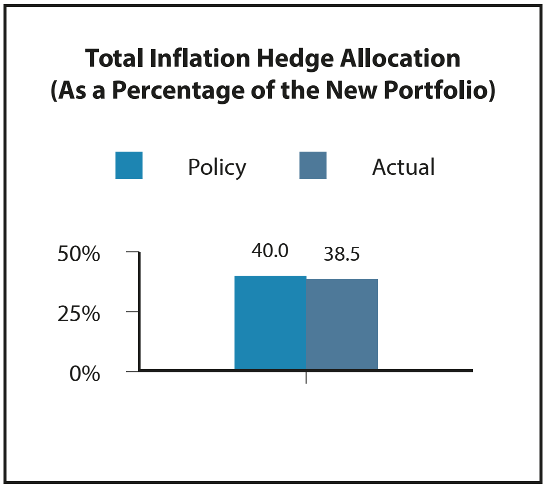


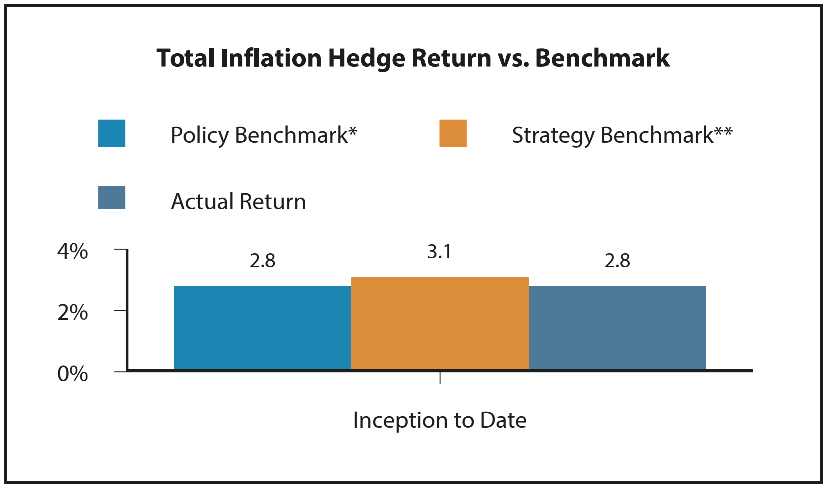


* *As of June 30, 2019, the public real assets policy benchmark was the FTSE NAREIT ALL REITS Index.*

** *As of June 30, 2019, the public real assets strategy benchmark is equal to the public real assets policy benchmark.*

As of June 30, 2019, the market exposure of the inflation hedge bucket was $521,526,262 representing 38.5% of total market value. The bar chart below (left) illustrates the actual exposure compared to policy. For the five months, the inflation hedge allocation returned 2.8%, equal to the policy benchmark. The bar chart below (right) illustrates actual performance as compared to the policy and strategy benchmarks.





* *As of June 30, 2019, the total inflation hedge policy benchmark was comprised of 12.5% commodities policy benchmark, 62.5% TIPS policy benchmark, 12.5% private real assets policy benchmark, and 12.5% public real assets policy benchmark.*

** *As of June 30, 2019, the total inflation hedge strategy benchmark was comprised of 11.7% commodities strategy benchmark, 63.4% TIPS strategy benchmark, 12.4% private real assets strategy benchmark, and 12.5% public real assets strategy benchmark.*

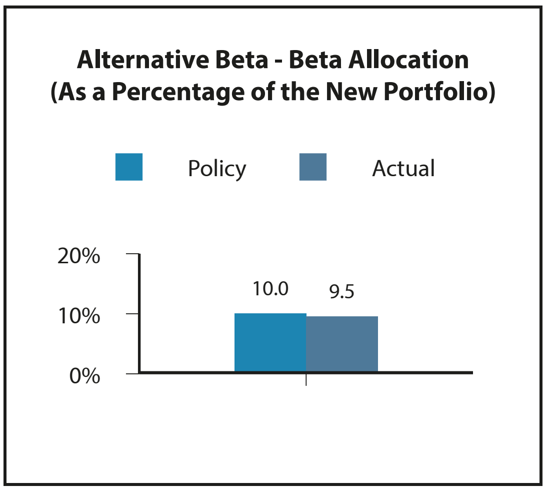
Statistical performance is not presented as the portfolio has less than one year of return data.

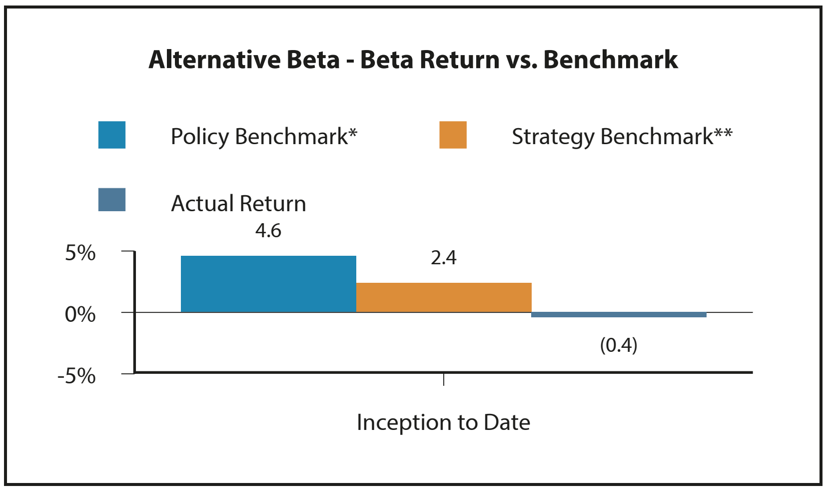
Alternative Betas/Absolute Return Bucket

This asset class represents hedge funds, alternative betas, 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 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, foreign currency exposure will be part of this bucket.

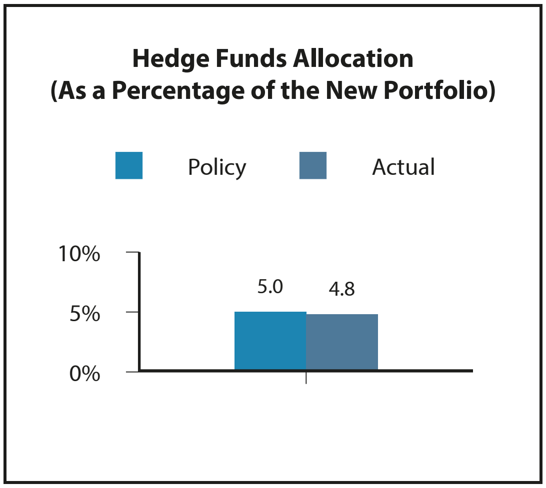
As of the fiscal year end, alternative betas were 50% of the bucket with hedge funds and private credit each making up 25% of the bucket. For the five months, alternative betas returned (0.4%) versus 4.6% for the policy benchmark. The underperformance was primarily related to manager implementation and to a lesser extent a passive implementation decision that underperformed the policy benchmark . Hedge funds, for the five months, returned 1.7% compared to its policy benchmark return of 3.6%. The primary driver of the underperformance was manager selection within hedge fund managers and the decision to strategically overweight alternative betas. For the five months, private credit returned 2.8% versus 5.7% for its policy benchmark. This underperformance was largely due to the external managers within this portfolio underperforming the benchmark by 3.9%.

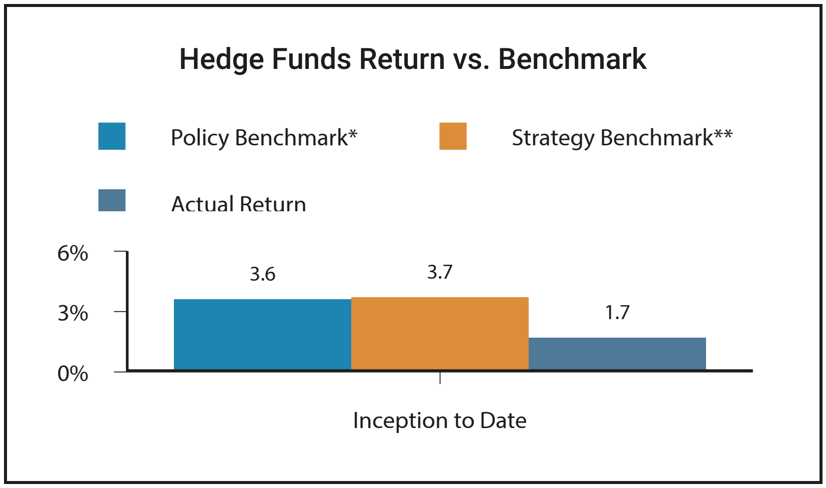




* *As of June 30, 2019, the alt beta - beta policy benchmark was the HFRX Macro/CTA Index.*

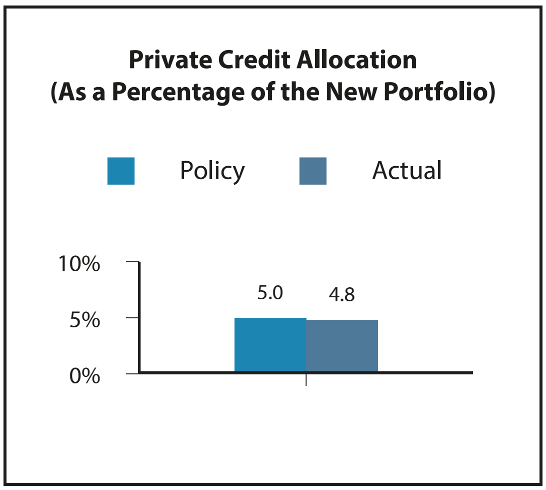
** *As of June 30, 2019, the alt beta - beta strategy benchmark is equal to 25% S&P Systematic Global Macro Index and 75% Barclays US Agg Excess Return.*

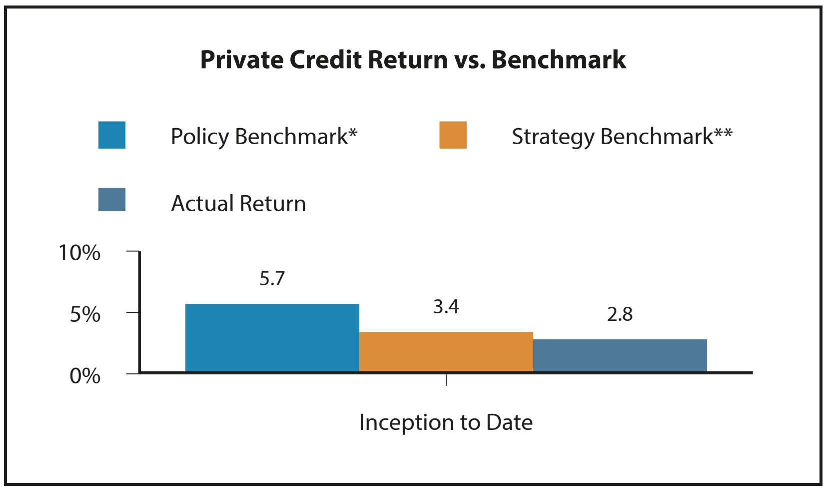




* *As of June 30, 2019, the hedge funds policy benchmark was the HFRI Fund Weighted Composite Index.*

** *As of June 30, 2019, the hedge funds strategy benchmark is comprised of 43.7% hedge funds policy benchmark, 36.1% alt beta - beta strategy benchmark, and 20.2% MSCI ACWI Net Index.*

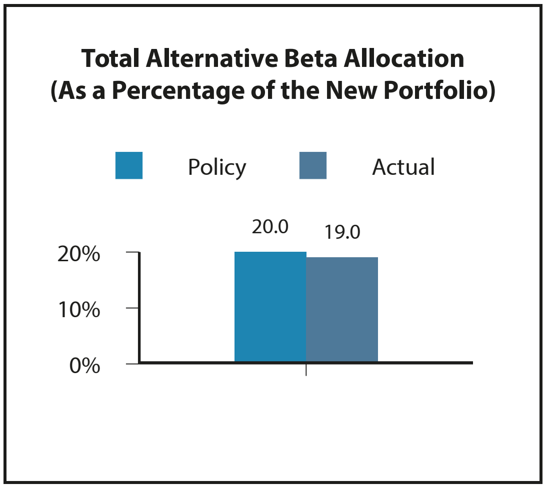


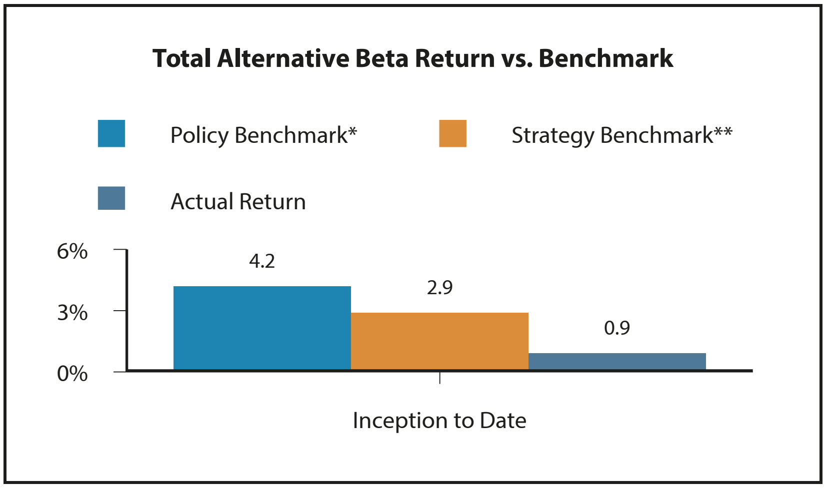


* *As of June 30, 2019, the private credit policy benchmark was the S&P/LSTA US Leveraged Loan Index + 2%.*

** *As of June 30, 2019, the private credit strategy benchmark was comprised of 45.4% private credit policy benchmark, 13.5% direct hedge fund policy benchmark, 27.7% Bloomberg/Barclays High Yield Index, and 13.3% alternative beta strategy benchmark.*

As of June 30, 2019, the market exposure of the alternative beta portfolio was $257,477,438, representing 19% of total market value. The bar chart below (left) illustrates the actual exposure compared to policy. The alternative betas/absolute return allocation returned 0.9% for the fiscal year versus 4.2% for the policy benchmark. All three asset classes within this bucket underperformed their policy benchmark over the five month period. The bar chart below (right) illustrates actual performance as compared to the policy and strategy benchmarks.





* *As of June 30, 2019, the alternative beta policy benchmark was comprised of 25.0% direct hedge funds policy benchmark, 50.0% alternative beta - beta policy benchmark, and 25.0% private credit policy benchmark.*

** *As of June 30, 2019, the alternative beta strategy benchmark was comprised of 25.0% direct hedge funds strategy benchmark, 50.1% alternative beta - beta strategy benchmark, and 24.9% private credit strategy benchmark.*

Statistical performance is not presented as the portfolio has less than one year of return data.

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