



STATE RETIREMENT AGENCY
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MARYLAND
STATE RETIREMENT
and PENSION SYSTEM

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January 30, 2020

The Honorable William C. Ferguson
President of Senate
State House, H-107
Annapolis, MD 21401 – 1991

The Honorable Adrienne A. Jones
Speaker of House of Delegates
State House, H-101
Annapolis, MD 21401 - 1991

Re: Report required by State Personnel and Pensions Article § 21-116(e) (MSAR #11752)

Dear President Ferguson and Speaker Jones:

On behalf of the Board of Trustees for the State Retirement and Pension System, I am submitting the required annual risk assessment of the State Retirement and Pension System.

In preparing this assessment, the Investment Division for the State Retirement and Pension System: (1) identified recent studies or actions by other U.S. state public pension funds, financial institutions, or risk experts, including those related to disclosure, risk assessment, investment principles, or other related issues or activities; (2) based on the information obtained in item 1, recommended best practices and considered whether these best practices can be incorporated into the investment policy manual; (3) examined the potential magnitude of the long-term risks and opportunities of multiple scenarios and related regulatory developments across industry sectors, asset classes, and the total portfolio of the several systems; and (4) included any other information the Board of Trustees or Investment Committee deemed necessary.

Should you require additional information, please call at either (410)625-5600 or (410)625-5620

Sincerely,

R. Dean Kenderdine
Secretary to the Board of Trustees

Andrew C. Palmer
Chief Investment Officer

Attachment

cc: Victoria L. Gruber
Sarah Albert
Board of Trustees

Maryland State Retirement and Pension System



MARYLAND
STATE RETIREMENT
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Maryland Pension Risk Mitigation Act

Risk Assessment

January 2020

Introduction

In accordance with HB 993, The Maryland Pension Risk Mitigation Act, the Board of Trustees is submitting an assessment of risk for the several Systems. The overarching risk to the System is a failure to meet pension obligations in full and on time. There are many potential causes for such a failure. This report will focus on risks associated with the investment program.

The Board of Trustees is charged with the responsibility of managing the assets of the Maryland State Retirement and Pension System. Investment policies are designed to support the fulfillment of the Board's mission to optimize risk-adjusted returns to ensure that sufficient assets are available to pay benefits to members and beneficiaries when due.

In pursuing this mission, the most powerful tool at the Board's disposal is its long-term strategic asset allocation policy. The strategic asset allocation policy establishes a mix of investment types (stocks, bonds, real estate, etc.) that collectively are modeled to produce the required return with the least risk over the horizon of the pension liabilities. The Board works with its independent investment consultant and staff to establish this long-term policy. Beyond this top-down approach, the Investment Division also contributes to the System's risk management process in its implementation of the strategic asset allocation.

A mix of techniques are utilized at both levels of the investment process. The Board of Trustees and the Investment Division regularly engage with other market participants, including public pension plan peers, financial institutions, and academia, to ensure the System's investment policies and procedures represent leading practices.

Collectively, the Board's strategic allocation and the implementation of that allocation by staff could lead to heightened risk of a funding shortfall if:

1. The collection of assets in the strategic asset allocation fail to achieve the expected returns
2. The collection of assets in the strategic asset allocation achieve the average return over long periods of time, but experience extreme negative returns in the near term, reducing the value of System assets
3. The implementation of the strategic asset allocation by Investment Division staff markedly underperforms the benchmark returns
4. The implementation of the strategic asset allocation does not maintain sufficient liquidity to make benefit payments

Assessment of the System's Investment Risk

Strategic Asset Allocation

Periodically, the System conducts an asset allocation review that evaluates long-term expected returns for the System as well as a variety of different measures of risk.

Regarding return objectives, the asset allocation review incorporates different considerations driving the System's long-term return requirements including factors such as its actuarial assumed rate of return, policy benchmark (i.e. market return of the strategic asset allocation assuming it could be invested passively), expected future inflation, projected cash flows, and liability status. This exercise analyzes the prospects for achieving the return objective using the System's existing asset classes, as well as any opportunities that may increase return or reduce risk by investing in new or alternative asset classes. In addition, the review compares the System's asset allocation to peer retirement systems. The expected return over a twenty-year horizon of the System's strategic allocation is 8.3%, based on Meketa Investment Group's capital market expectations as published in their 2019 Annual Asset Study. This exceeds the System's 7.45% actuarial assumed rate of return and produces a probability of achieving 7.45% over time in excess of 60%. It should be noted, however, that Meketa's capital markets expectations are based on cyclically depressed valuation metrics following the market decline in the fourth quarter of 2018.

The asset allocation review also analyzes numerous measures of risk including statistical and scenario-based approaches. These approaches help evaluate the risk that a period of underperformance could severely impact the existing pool of assets. These approaches include:

- **Historical Scenarios Analysis:** Assessing how the System would have performed in different historical scenarios with its current asset allocation. There are many different types of events that could result in sub-par returns for the System. In particular, extreme shocks such as the Global Financial Crisis and the Stagflation of the 1970s would have the most severe impact.

Historical Negative Scenario Analysis Cumulative Return

Scenario	Current Policy (%)
Taper Tantrum (May-Aug 2013)	-1.6
Global Financial Crisis (4Q07 thru 1Q09)	-24.1
Popping of the TMT Bubble (Apr 2000 – Sep 2002)	-6.6
LTCM (Jul-Aug 1998)	-8.0
Interest Rate Spike (1994)	1.6
Crash of 1987 (Sep-Nov 1987)	-9.2
Strong US Dollar (1Q81 thru 3Q82)	4.6
Volcker Recession (Jan-Mar 1980)	-4.2
Stagflation (1Q73 thru 3Q74)	-20.0

Source: Meketa Investment Group

- Stress Testing: Estimating the possible risk of various changes in market conditions (e.g., interest rates, credit risk, currency fluctuations) by varying degrees. The largest market risk factors are equity market declines and widening credit spreads.

*Stress Testing: Impact of Market Movements
Expected Return under Stressed Conditions*

What happens if (over a 12-month period):	Current Policy (%)
10-year T-Bond rates rise 100 bps	4.0
10-year T-Bond rates rise 200 bps	0.1
10-year T-Bond rates rise 300 bps	-3.6
BBB spreads widen by 50 bps, HY by 200 bps	0.2
BBB spreads widen by 300 bps, HY by 1000 bps	-19.4
Trade-weighted USD gains 10%	-1.1
Trade-weighted USD gains 20%	-1.5
Equities decline 10%	-4.9
Equities decline 25%	-14.3
Equities decline 40%	-23.7

Source: Meketa Investment Group

- Value at Risk (VaR) and CVaR: Statistical measures of potential large drawdowns in the market value of investments. VaR is a measure of the risks to the System in the majority of potential outcomes, generally 67% to 99% of the time. The System’s conditional value at risk (CVaR), evaluates the range of outcomes assuming the market is already outside the reasonably expected range. This is often described as a tail risk or black swan event. The System’s one-month CVaR, as reflected in the below table, indicates the policy allocation could lose 8.8% of market value in a single month. This potential loss of 8.8% is an average of the worst 1% of cases, so it possible for an extreme outlying event to produce a greater loss.

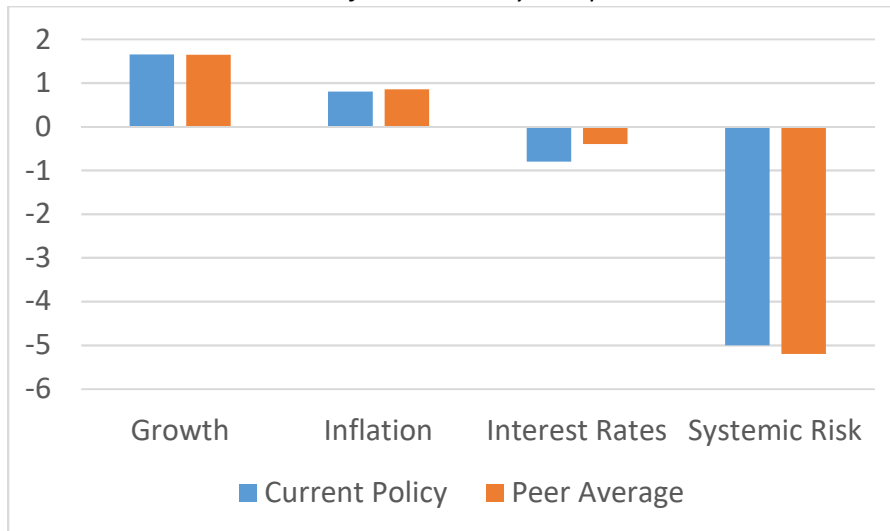
Conditional Value at Risk

Scenario	Current Policy (%)
CVaR (%):	
One Month	-8.8
Three Months	-14.4
CVaR (\$ mm):	
One Month	-4,638
Three Months	-7,589

Source: Meketa Investment Group

- Economic Regime Management (ERM) Factor Sensitivity: A measure of the System’s exposure to several economic risk factors (e.g., interest rate, growth, inflation). The largest risk exposure to the System is Systemic Risk, which was the main driver of the global financial crisis during the 2008-2009 period. Because most of the volatility of returns is a result of equity price risk, the System is also sensitive to changes in growth rates. Interest rate and inflation surprises have smaller impacts on the System.

ERM: Portfolio Sensitivity Comparison



Source: Meketa Investment Group

- **Funded Ratio Impacts:** Evaluating changes to the System’s funded ratio based on both historical scenarios and stress tests, as well as varying the sequence of investment returns over time. An equity market downturn has the most serious negative impact on funded status. Additionally, because the System currently pays more in benefits than it receives in contributions from the employees and employers, the sequence of returns is important. That is, the System could earn its actuarial rate of return, on average, over the next twenty years but still find itself well short of its anticipated funded status. For example, if the System has weak returns in years 1-10 offset by stronger returns in the future, the System’s ending funded status would be projected to be lower than if it produced its assumed rate of return in each year.

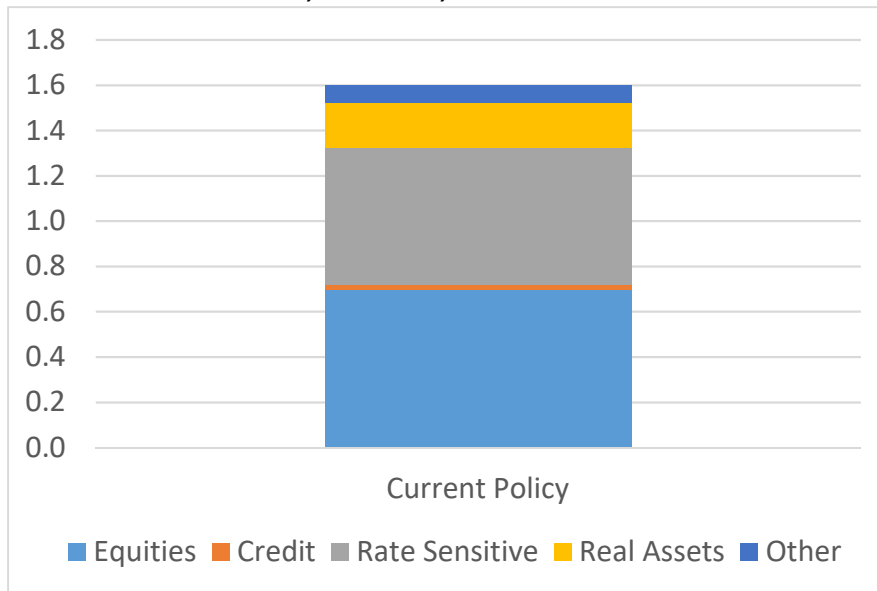
*Stress Testing: Impact of Market Movements
Funded Status under Stressed Conditions*

What happens if (over a 12-month period):	Current Policy (%)
10-year T-Bond rates rise 100 bps	74.9
10-year T-Bond rates rise 200 bps	72.1
10-year T-Bond rates rise 300 bps	69.4
BBB spreads widen by 50 bps, HY by 200 bps	72.2
BBB spreads widen by 300 bps, HY by 1000 bps	58.0
Trade-weighted USD gains 10%	71.2
Trade-weighted USD gains 20%	70.9
Equities decline 10%	68.5
Equities decline 25%	61.7
Equities decline 40%	55.0

Source: Meketa Investment Group

- Tracking Error Attribution: Estimates the expected variation in performance versus peers over time. While not a direct risk to the System, it is important for Trustees to evaluate the asset allocation relative to the peer average. Tracking error is a metric that can be used to measure the variability of the System's returns versus the peer average. With the current asset allocation, the System can expect long-term variability of the difference between the System's return and the peer average return (tracking error) (i.e., over a 20-year period) to average 1.6% per annum due to differences in asset allocation. The vast majority of tracking error stems from the System's allocations to equities and rate sensitive fixed income differing from peers. Supplemental information in the report discusses the process of determining asset class expected returns and risk, as well as a comparison to peers' expected return forecasts. However, the System's expected return exceeds the expected peer return by 0.2% per annum and the variability of that return is lower. A good portion of the 1.6% tracking error is a result of the expected peer returns being lower and more volatile.

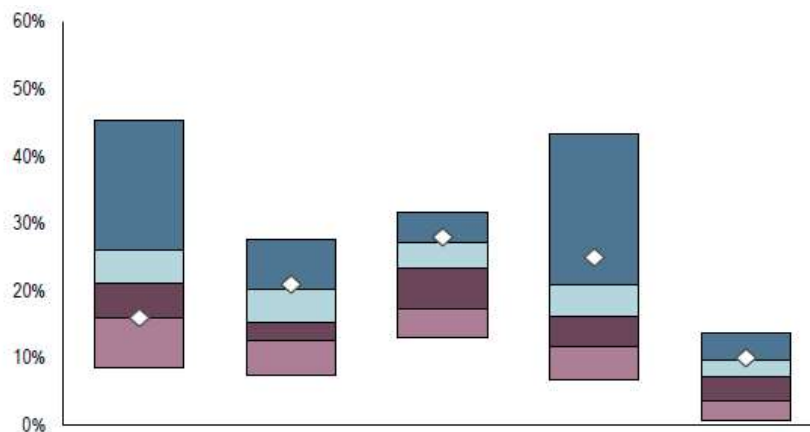
*Sources of Tracking Error
System Policy versus Peers*



Source: Meketa Investment Group

Comparison of Asset Allocation versus Peers

Current Allocation versus InvestorForce > \$1 Billion Public DB Plan Universe



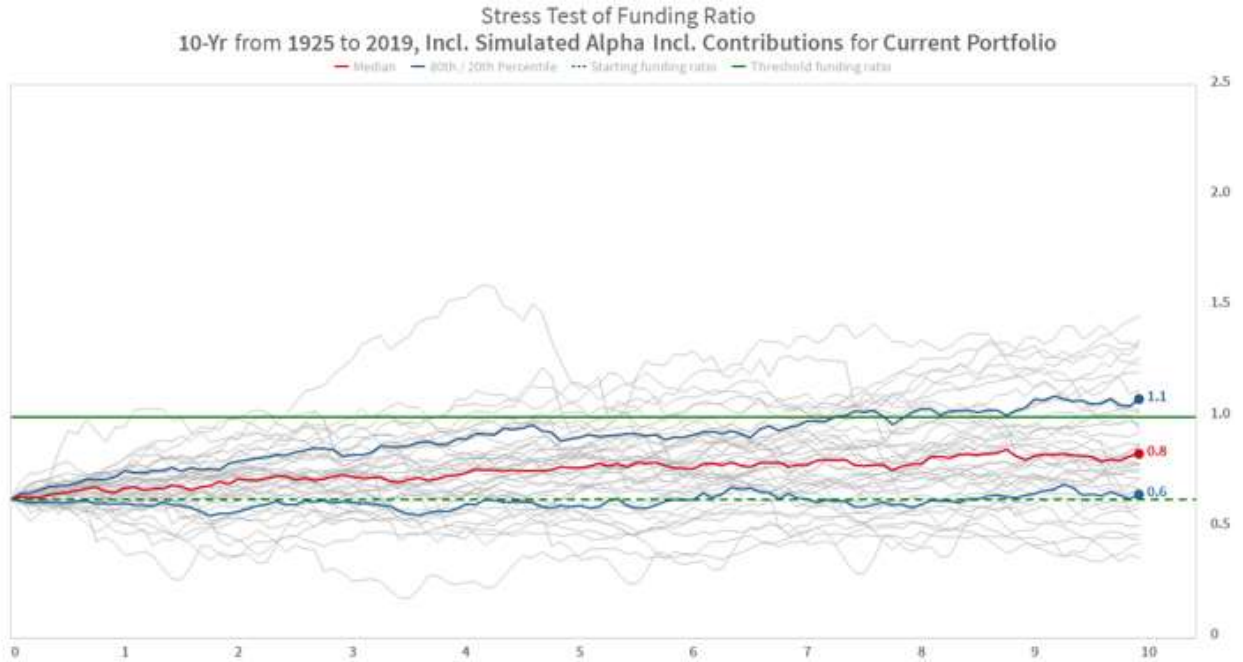
	U.S. Equity	Non-U.S. Equity	Fixed Income	Alternatives	Real estate
5th	45.5	27.6	31.7	43.5	13.8
25th	26.1	20.3	27.1	21.0	9.7
Median	21.1	15.2	23.3	16.1	7.3
75th	16.0	12.6	17.3	11.6	3.6
95th	8.5	7.4	13.0	6.9	0.8
Current Policy	16	21	28	25	10

Source: Meketa Investment Group

To complement Meketa’s analysis above, the Investment Division is also able to utilize a risk budgeting tool provided by one of the System’s investment managers, Bridgewater Associates, to perform an asset-liability management analysis of the strategic policy. The chart below presents a stress test of the System’s funding ratio using 10-year time horizons, re-sampled every two years, since 1925. According

to this analysis, using historical returns, there is a 28% chance of ending the prospective 10-year period at fully funded status, with a 19% chance of ending at a lower funding ratio than the starting point. The table below the chart supplies additional summary information on the median, as well as the 20th and 80th percentile outcomes.

Historical Stress Test of Funding Ratio over 10-year Periods (1925-Present)



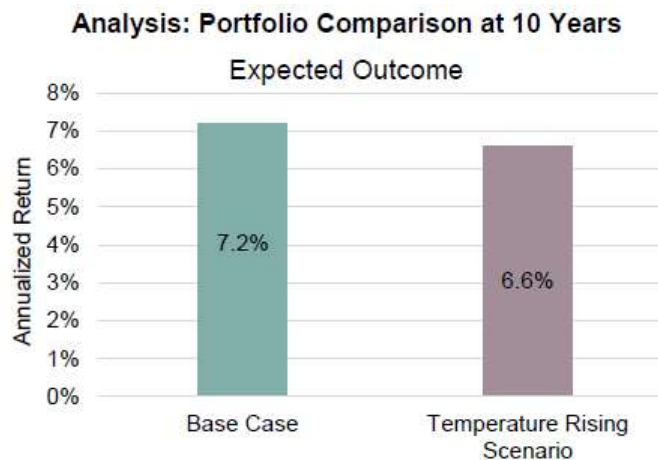
<u>Scenario Outcome</u>	<u>End Funding Ratio</u>	<u>Annualized Total Return</u>
Median	0.8	6.8%
20 th Percentile	0.6	5.2%
80 th Percentile	1.1	8.4%

Source: Maryland State Retirement Agency, Bridgewater Associates

Climate Change Analysis

In addition to the traditional tools to evaluate the risk of not generating sufficient returns, the System has worked with Meketa to evaluate the risk that an externality such as climate change could impact the results. Meketa's supplemental climate change analysis examines the impact of a 2°C increase in global average temperature and a commensurate level of carbon dioxide emissions over the next ten years. The analysis estimates financial impacts across 35 risk factors in 44 asset classes that interact both directly and indirectly. The model runs 185 million simulations to generate a range of possible impacts of climate change on the System's portfolio over a ten-year horizon.

The results of the analysis imply that, although there is significant variation across asset classes and industries, the median expected return for the System is estimated to be lower than a "Base Case" scenario where global temperatures are more stable. Over the intermediate term (10-year time horizon), Meketa would expect the climate shocked portfolio to trail a base case portfolio by approximately 0.6% per annum.



Source: Meketa Investment Group

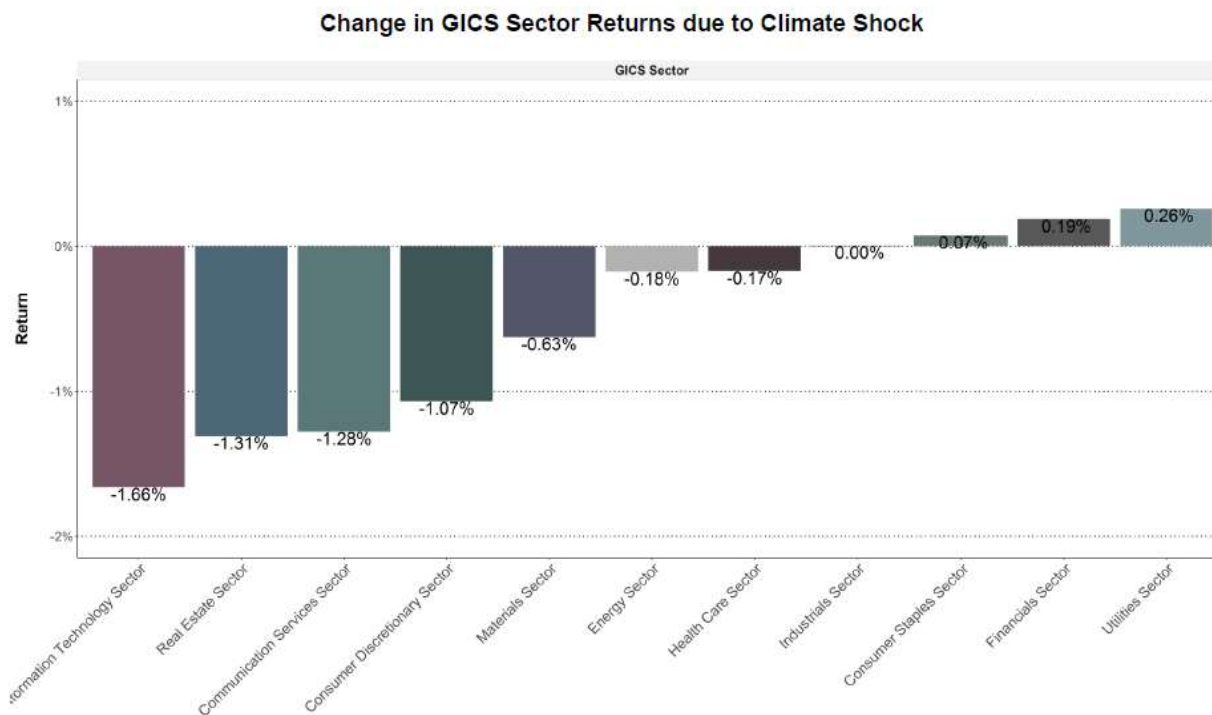
As shown in the table below, Meketa's analysis suggests Treasury Inflation Protected Securities (TIPS) may outperform other asset classes due to higher inflation projections. Equities are sensitive to the shock given the relatively high volatility of the asset class. Natural resources and commodities are very sensitive to a rise in carbon dioxide emissions, while real estate and infrastructure may also be negatively affected by rising sea levels and temperatures.

10-year Return Comparison by Asset Class

Asset Class	Base Case	Temp Rising	Difference
Private Equity	13.2%	9.5%	-3.7%
Emerging Market Equity	13.2%	9.8%	-3.4%
Natural Resources	9.9%	7.0%	-2.9%
International Developed Equity	9.3%	7.3%	-2.0%
Commodities	6.4%	4.5%	-1.9%
Infrastructure	9.2%	7.3%	-1.9%
US Equity	9.1%	7.4%	-1.7%
Emerging Market Bonds	7.0%	5.9%	-1.1%
High Yield Bonds	6.8%	6.0%	-0.8%
Long Gov't Bonds	4.6%	3.8%	-0.8%
Core Private Real Estate	6.5%	5.8%	-0.7%
<i>Total System Portfolio</i>	<i>7.2%</i>	<i>6.6%</i>	<i>-0.6%</i>
Hedge Funds	5.8%	5.3%	-0.5%
Bank Loans	6.0%	5.5%	-0.5%
Inv Grade Bonds	3.6%	3.5%	-0.1%
Cash	2.8%	2.8%	0.0%
TIPS	1.5%	3.5%	2.0%

Source: Meketa Investment Group

Meketa's analysis also examines the impact on industry sectors using the MSCI USA Index as a reference universe of publicly traded stocks. Information technology, communication services, and consumer discretionary are relatively high volatility sectors resulting in greater sensitivity to the shock. Energy and materials companies are expected to be negatively impacted, as would be assumed. Like the core private real estate asset class, public stocks of real estate firms likely would be hurt in the temperature rising scenario. Finally, the utilities sector is largely comprised of energy producers with large investments in renewables which results in the slightly better returns.



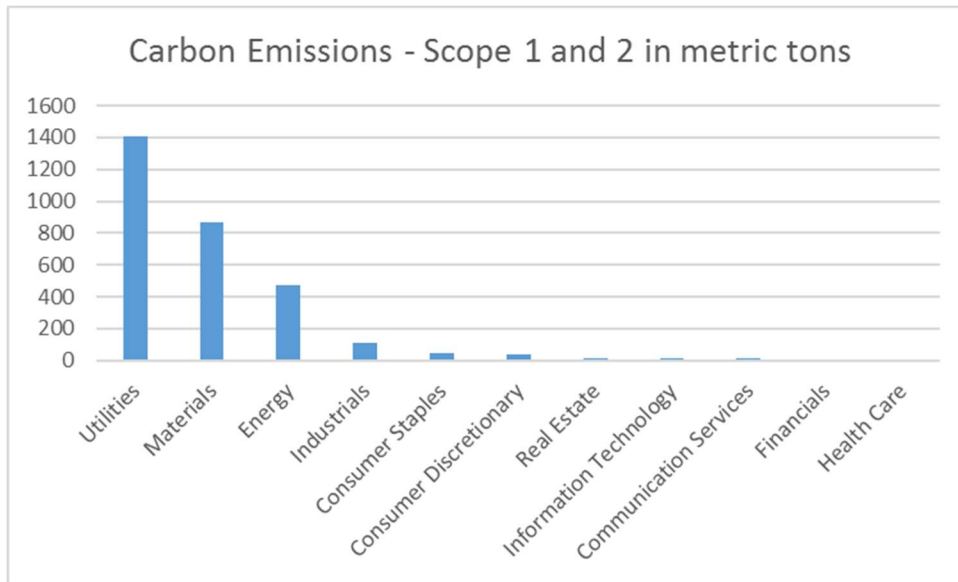
Source: Meketa Investment Group

Carbon Footprint of Public Equity Portfolio

Another tool to evaluate the risks associated with climate change is through the System's exposure to carbon emissions. Through its risk analytics service, MSCI BarraOne, the Investment Division is able to gain insights on carbon exposure in financial markets, as well as the System's policy portfolios. MSCI ESG Carbon Metrics is a system that seeks to measure a company's carbon exposure along two dimensions of current emissions and fossil fuel reserves. The latter represents potential future emissions. MSCI and many other analytics firms continue to enhance their capabilities around measuring the carbon footprint of investment portfolios. However, the current state of the industry remains focused on public equity markets and relies on self-reported data and extrapolations of information provided by reporting companies to non-reporting companies. As shown in the literature review section of this report, many organizations are working to broaden reporting across asset classes and improve measurement techniques.

The exhibit below shows carbon footprint by sector according to MSCI data. The data is applied to the relative sector weights of the System's public equity portfolio versus the public equity policy index. The portfolio's carbon footprint is 147.66 metric tons as compared to 147.65 for the policy index. This result is expected because Staff's implementation is designed to be close to the policy index in terms of sectors. In terms of more carbon intensive sectors, the portfolio is slightly overweight utilities and industrials and underweight energy and materials.

MSCI All Country World IMI Index – Carbon Footprint by Sector



Source: Maryland State Retirement Agency, MSCI BarraOne

Implementation Risk Management

Once the Board of Trustees establishes the System’s strategic asset allocation, the Chief Investment Officer, working with investment staff, specialty consultants and asset managers, is responsible for implementation. To capture the different types of risks associated with the implementation process, the Investment Division utilizes MSCI’s x-sigma-rho methodology based on “Manager Risk Contribution: Attributing Risk in a Multi-Manager Portfolio” (Miller, Rao, 2014). The Investment Division utilizes this approach to calculate a forward-looking tracking error, which measures the variability in the difference between realized and benchmark returns, broken down according to three distinct phases of the investment process as follows:

1. Allocation risk – the risk that results from an over- or under-weight position in a particular asset class
2. Misfit risk – the risk that results from assigning a benchmark to a manager that is different from a particular asset class benchmark
3. Selection risk – the risk that results from a manager building a portfolio of securities that is different from the constitution of the assigned benchmark

The System’s portfolio produces an expected tracking error, or “total active risk,” of 0.94% versus the strategic policy index as of 6/30/2019, meaning that approximately 67% of the time, the realized return will be within a range of +/- 0.94% around the expected outperformance above the benchmark return. At June 30, 2019, the vast majority – more than 95% – of total active risk can be attributed to security selection decisions, a function of the Investment Division’s belief that markets exhibit varying degrees of efficiency across asset classes and geographies, providing opportunities for skilled investors to add value. Selection risk within the Growth asset class, which includes public and private equity, constitutes

the bulk of overall selection risk. Allocation risk represented less than 5% of total active risk. Finally, misfit decisions serve to reduce total active risk largely due to the diversifying properties of strategies chosen for investments in the Absolute Return asset class.

Total Active Risk (basis points)

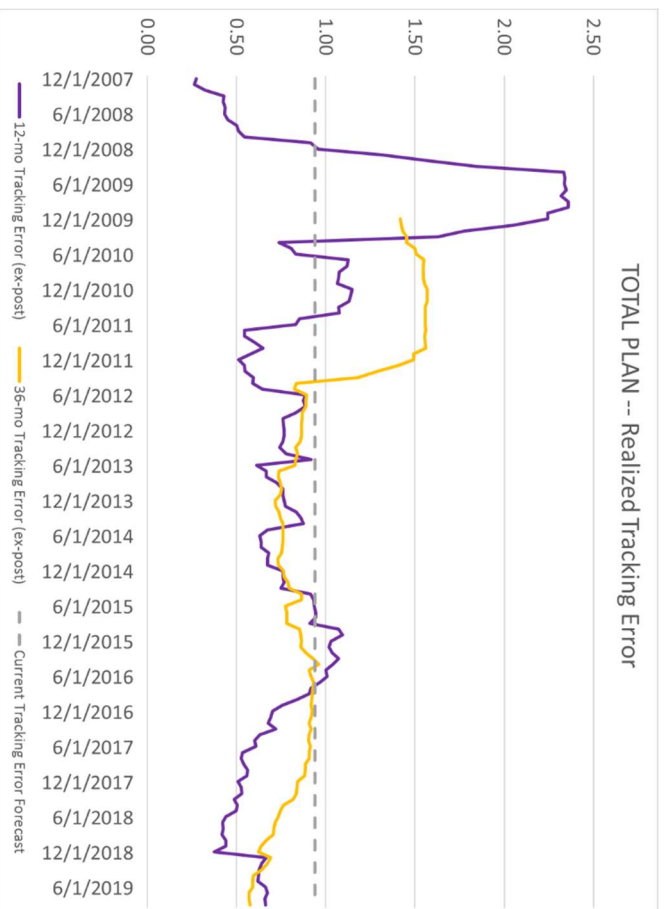
Asset class	Active weight	Allocation Risk (bps)	Selection Risk (bps)	Misfit Risk (bps)	Total Active Risk (bps)
Growth	0.32%	1	60	7	69
Rates	-1.53%	2	5	4	11
Credit	-0.04%	0	3	0	3
Real Assets	-0.02%	0	18	-3	15
Absolute Return	-0.63%	-2	8	-10	-3
Multi Asset	1.34%	0	-2	0	-1
Cash	0.56%	1	0	0	1
Total	0.00%	4	91	-1	94

Total Active Risk (Contribution to Risk)

Asset class	Active weight	Allocation Risk	Selection Risk	Misfit Risk	Total Active Risk
Growth	0.32%	1.42%	63.50%	7.68%	72.60%
Rates	-1.53%	2.05%	4.83%	4.36%	11.24%
Credit	-0.04%	-0.01%	3.04%	0.40%	3.43%
Real Assets	-0.02%	0.10%	19.04%	-2.88%	16.27%
Absolute Return	-0.63%	-1.69%	8.31%	-10.23%	-3.60%
Multi Asset	1.34%	0.43%	-1.93%	0.00%	-1.50%
Cash	0.56%	1.58%	0.00%	0.00%	1.58%
Total	0.00%	3.88%	96.79%	-0.67%	100.00%

Source: Maryland State Retirement Agency, State Street, FactSet

To assess the effectiveness of this forward-looking, ex-ante tracking error, the following chart displays the tracking error forecast as of 6/30/2019 against historical realized tracking error. While actual realized tracking error generally has been below the current forecasted tracking error after the spike following the global financial crisis, the Investment Division believes the forecast is a reasonable long-term estimate supported by a bottom-up review of each manager in the System's current portfolio. Realized tracking error steadily decreased since the beginning of 2016 due in part to a market regime characterized by low volatility before turning marginally higher in 2018.



Source: Maryland State Retirement Agency, State Street, FactSet

- Liquidity Analysis: Another area where the combination of strategic asset allocation and implementation could create undo risk is liquidity. Meketa, evaluates the System’s ability to continue to meet its cash needs amidst a weak equity market scenario. Even in an extremely negative scenario, similar to the Global Financial Crisis, the System would still maintain ample liquidity to meet its near-term obligations.

Liquidity Stress Test

	Year 1	Year 2	Year 3	Year 4	Year 5
Ending Market Value (\$ mm)	53,607	41,495	39,351	39,349	39,348
Net Outflows (\$ mm)	1,100	1,200	1,300	1,400	1,500
Outflows as % of Market Value	2.1%	2.9%	3.3%	3.6%	3.8%
% of Assets sold in duress	0.0%	0.0%	0.0%	0.0%	0.0%
Remaining Liquid Market Value (\$ mm)	41,818	31,674	30,943	30,942	30,940

Note: Remaining liquid market value includes all System assets that could be readily liquidated within 30 days. Returns in Years 1, 2 and 3 reflect asset class returns from the 4th Quarter 2007, Calendar Year 2008, and 1st Quarter 2009, respectively. Years 4 and 5 assume 0% returns in all asset classes.
 Source: Meketa Investment Group

Review of Recent Studies and Actions

The State Retirement Agency staff, in conjunction with Meketa Investment Group, conducted a review of recent studies and actions with respect to portfolio risks with the goal of identifying leading practices not currently employed that could be recommended for inclusion in the Investment Policy Manual. As is the case with long-term returns, the primary determinant of portfolio risk is asset allocation. Academic and commercial finance professionals have been developing tools to analyze these risks for many decades. In the last decade, innovations have changed the analysis from a focus on asset class risks relating to stocks and bonds, to one of risk classes such as growth and inflation. These innovations have provided helpful insights into asset allocation but have not substantially changed the mix of assets employed. More recently, the advent of “Big Data” and artificial intelligence has offered the hope that traditional risk management tools may be used more effectively. For example, with the exception of the climate change analysis, the scenario analyses described above are only performed for a handful of potential scenarios. Enhanced computing techniques allow for a much more comprehensive set of scenarios, and artificial intelligence can improve the choice of scenarios to consider.

Much of the recent literature addressing investment risk has focused on Environmental, Social and Governance (ESG), including climate change, as investment risks that should be incorporated in the investment process. While the notion of ESG risk is not new, the measurement of ESG risk is still in its early stages. Most research focuses on risks to individual companies and industries, particularly companies with publicly traded stocks and bonds. The measurement of ESG risk at the company level is challenged by the lack of standardization in the types, level and forms of disclosure made by public companies, and the paucity of data available for private companies. Moreover, from a risk management perspective, individual company risks are best addressed at the portfolio implementation level. The industry is still developing portfolio construction tools focused on asset classes or risk classes that incorporate ESG and climate change.

Listed below are areas of research that were explored for the potential identification of leading practices, including samples of activities and research conducted by staff and Meketa Investment Group:

Risk Management and Asset Allocation

Maryland State Retirement and Pension System Investment Risk Management Update (September 2019). Staff presented an update on investment risk management activities to the Board at the September Investment Committee meeting. The document highlights key reporting exhibits to demonstrate that Staff’s implementation of the strategic asset allocation policy is conducted in a manner with appropriate risk controls and monitoring tools in place. This was the first such update to the Board since the Senior Risk Manager position was created in fall 2018.

Institutional Society of Risk Professionals (ISRP) Membership. ISRP was established in 2011 to encourage cooperation among investment risk professionals. The purpose of this organization is to facilitate research and sharing of leading practices in the risk industry. The members are like-minded, long-term investors with broad asset allocation mandates and similar risk management issues. The Investment Division participates on quarterly calls with other ISRP members and attends the annual conference.

Positively Negative: Stock-Bond Correlation and Its Implications for Investors (D.E. Shaw & Co., February 2019). This market insights piece explores the negative correlation between stock and bond returns that has been persisted for two decades. In the 1970s and 1980s, the correlation between these two asset classes was positive amid high inflation and high inflation expectations. Since the late 1990s, however, global central banks including, notably, the U.S. Federal Reserve have succeeded in bringing about lower inflation rates with expectations at similarly sustained low levels. As suggested in the piece, investors should expect the negative correlation of stocks and bonds to persist as central banks continue to be successful in managing inflation.

MSCI US Institutional Investor Conference in Sacramento, CA – The 60/40 portfolio at age 60: What have we learned? (October 2019). This presentation also explores the topic of stock-bond correlation. Drawing similar conclusions about central bank policy and inflation regimes, the presentation discusses the idea of extending duration in the bond portfolio as a recession hedge so long as the negative correlation of stock and bond returns continues. Possible threats to the continuation of this trend include stagflation (i.e., rising inflation and recession), unstable monetary policy that causes investors to lose confidence in central banks, and macroeconomic uncertainty.

Global Financial Stability Report: Lower for Longer (International Monetary Fund, October 2019). The third chapter of this report, “Institutional Investors: Falling Rates, Rising Risks,” examines the risk-taking of fixed income mutual funds, defined benefit pension funds, and life insurers as investors search for yield in a low interest rate regime. The authors maintain that institutional investors have herded into similar investments characterized by less liquidity, higher leverage, and higher risk. If this behavior spills over as a shock to financial markets that brings about even lower interest rates, the System’s strategic allocation to U.S. Government Long Treasury Bonds should serve its purpose as an important diversifier in such a regime.

Environmental, Social, and Governance

Maryland State Retirement and Pension System ESG Risk Committee Report (January 2020). As an update to the initial report from February 2018, this report documents the activities of the System’s ESG Risk Committee. The report reiterates the System’s principles for responsible investing and outlines how ESG considerations are integrated into the investment.

Responsible Investing in the Pension Fund Context (PRI presentation at the Board of Trustees 2019 Education Session). This presentation by Principles for Responsible Investing provided an overview and update to the Board of Trustees. The emerging trends section featured the Net-Zero Asset Owner Alliance whose members, many of the largest investors in the world, commit to reduce the carbon emissions of their investment portfolios to net-zero by 2050.

Ontario Teachers’ Pension Plan 2018 Climate Change Report. This report examines the medium- and long-term risks and impacts as the world transitions to a low carbon economy. Scenarios are contemplated along the lines of policy, technology, consumer preference, capital, and physical impact. The report also outlines Ontario Teachers’ responses to the Task Force on Climate-related Financial Disclosures (TCFD) Recommendations.

CPP Investment Board 2018 Report on Sustainable Investing. CCPIB's sustainable investing activities are described in this report. Integration, engagement, and collaboration are important themes for this asset owner when considering ESG factors in its investment strategy.

Aggregate Confusion: The Divergence of ESG Ratings (Berg/Koelbel/Rigobon, 2019). This paper documents the disagreement between the ESG ratings of five leading service providers by decomposing the sources of disagreement into scope, measurement, and weight divergences. The authors hope the granular explanation will aid investors, companies, and researchers alike as the industry grapples with inconsistent data.

Why Climate Change Matters to Us (11/8/2019 speech by Mary C. Daly, President and CEO, Federal Reserve Bank of San Francisco). This speech opened the San Francisco Fed's conference on climate change, the first of its kind for the Federal Reserve System. President Daly's remarks describe how the Fed's three core responsibilities – ensuring a safe and sound payment system, regulating and supervising the banking system, and conducting monetary policy – could be disrupted by climate change. The conference featured paper presentations and discussions by academics and Fed staff.

Recommendation of Best Practices for the Investment Policy Manual

The Board of Trustees regularly reviews and updates the Investment Policy Manual in consultation with the Investment Division. Several recent revisions have been made to enhance the policies and procedures with respect to risk management, as well as corporate governance and proxy voting. The risk management section provides the purpose, asset allocation, analytical measures, non-market risks, liquidity risk, counterparty risk, and leverage risk.

In addition, the corporate governance and proxy voting section addresses the following topics:

1. Board of Directors
2. Shareholder Rights and Defenses
3. Capital/Restructuring
4. Compensation
5. Social/Environmental Issues
 - a. Animal Rights
 - b. Consumer Issues
 - c. Climate Change and the Environment
 - d. Diversity
 - e. General Corporate Issues
 - f. International Issues, Labor Issues, and Human Rights
 - g. Sustainability
6. Routine/Miscellaneous

After reviewing the System's risk management processes in comparison with the leading practices of peers and new research from academic literature, it appears the System engages in leading practices concerning the evaluation and management of risks associated with the investment of System assets. While there are no recommendations of best practices to incorporate in the Investment Policy Manual at this time, the Board of Trustees and the Investment Division will continue to review studies and actions of other market participants to ensure the System's policies and procedures incorporate leading practices to the extent practicable.