

**City of Marlborough  
Contributory Retirement System**

**Meeting Materials  
August 22, 2023**

**Fund Evaluation Report**

## Agenda

1. Economic and Market Update
2. Performance Update as of July 31, 2023
3. Current Issues
  - SSGA Update
  - Manager Search Authorization
  - Asset Allocation Discussion
  - Manager Due Diligence Agenda
4. Appendix

# **Economic and Market Update**

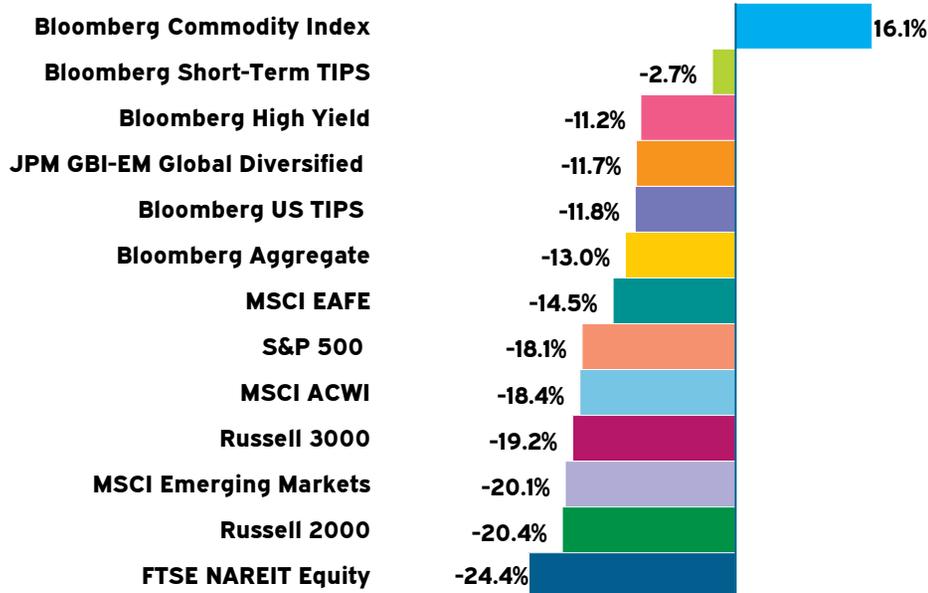
Data as of July 31, 2023

### Commentary

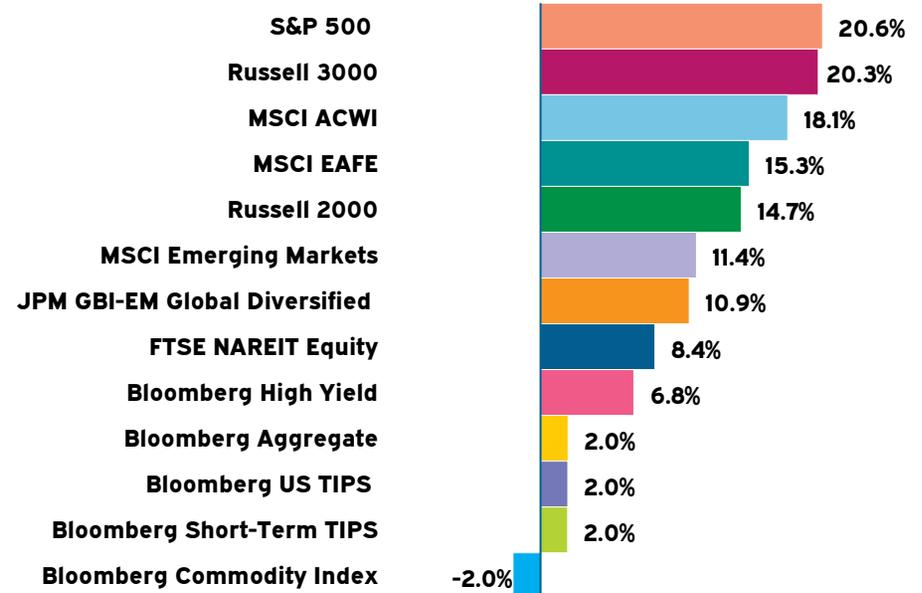
- Riskier assets continued to gain in July as economic data remained resilient while inflation receded. Except for commodities, most public market asset classes remained positive for the year, with US equities leading the way.
- After a pause in June, the Federal Reserve increased interest rates in July by 0.25% to a range of 5.25% - 5.5%, the highest level in over two decades. Markets are largely expecting that this will be the Fed's final rate increase.
  - US equity markets (Russell 3000 index) continued to rise in July (+3.8%), bringing the year-to-date gains to 20.3%. The technology sector remains the key driver of results this year, helped by artificial intelligence optimism.
  - Non-US developed equity markets also rose in July (MSCI EAFE +3.2%), but they continue to trail US markets year-to-date (15.3% versus 20.3%).
  - Emerging market equities had the strongest results in July, gaining 6.2%, driven by optimism over additional policy support in China. They continue to trail developed market equities year-to-date though, returning 11.4%, due partly to China's weak results for the period.
  - Generally, corporate bonds outperformed government bonds for the month on continued risk appetite. Overall, interest rates increased slightly in July, leading to a small decline in the broad US bond market (-0.1%). The index remains positive (+2.0%) year-to-date on declining inflation and expectations for the Fed to end their rate hikes soon.
- This year, the paths of inflation and monetary policy, slowing global growth, and the war in Ukraine will all be key.

### Index Returns<sup>1</sup>

#### 2022



#### YTD



→ After a particularly difficult 2022, most public market assets are up thus far in 2023, led by developed market equities.

→ Risk sentiment has been supported by expectations that policy tightening could be ending soon, as inflation continues to fall, while growth has remained relatively resilient.

<sup>1</sup> Source: Bloomberg. Data is as of July 31, 2023.

### Domestic Equity Returns<sup>1</sup>

Domestic Equity	July (%)	Q2 (%)	YTD (%)	1 YR (%)	3 YR (%)	5 YR (%)	10 YR (%)
S&P 500	3.2	8.7	20.6	13.0	13.7	12.2	12.7
Russell 3000	3.6	8.4	20.3	12.6	13.1	11.4	12.1
Russell 1000	3.4	8.6	20.7	12.9	13.2	11.9	12.4
Russell 1000 Growth	3.4	12.8	33.4	17.3	12.2	15.2	15.5
Russell 1000 Value	3.5	4.1	8.8	8.3	14.1	8.0	9.0
Russell MidCap	4.0	4.8	13.3	8.7	11.8	8.8	10.1
Russell MidCap Growth	3.0	6.2	19.4	13.0	6.0	9.9	11.2
Russell MidCap Value	4.4	3.9	9.8	6.2	14.9	7.2	8.9
Russell 2000	6.1	5.2	14.7	7.9	12.0	5.1	8.2
Russell 2000 Growth	4.7	7.1	18.9	11.6	6.5	4.8	8.5
Russell 2000 Value	7.5	3.2	10.2	3.9	17.5	4.7	7.4

#### US Equities: Russell 3000 Index rose 3.6% in July and 20.3% YTD.

- Equity investors continue to express optimism that the Federal Reserve’s monetary tightening will not have serious impacts on earnings. Though corporate profits were down compared to a year ago, approximately 80% of S&P 500 companies that reported second quarter results in July exceeded earnings expectations.
- In contrast to the year-to-date trend, value stocks outperformed growth stocks in July, particularly in small cap, driven by outperformance in financials and energy. So far in 2023, growth has significantly outperformed value driven by optimism over artificial intelligence.
- Small cap stocks outperformed large cap stocks in July, but trail for the full year, again due to the strength of the technology sector. The July dynamic was driven partially by the outperformance of small cap banks after regulators announced higher capital requirements for larger banks.

<sup>1</sup> Source: Bloomberg. Data is as of July 31, 2023.

### Foreign Equity Returns<sup>1</sup>

Foreign Equity	July (%)	Q2 (%)	YTD (%)	1 YR (%)	3 YR (%)	5 YR (%)	10 YR (%)
MSCI ACWI ex. US	4.1	2.4	13.9	13.4	7.1	3.9	4.7
MSCI EAFE	3.2	3.0	15.3	16.8	9.3	4.5	5.2
MSCI EAFE (Local Currency)	1.7	4.3	14.0	13.6	13.0	6.2	7.4
MSCI EAFE Small Cap	4.4	0.6	10.2	7.9	6.1	2.1	6.0
MSCI Emerging Markets	6.2	0.9	11.4	8.3	1.5	1.7	3.5
MSCI Emerging Markets (Local Currency)	5.3	1.7	11.1	8.6	3.0	3.7	6.1
MSCI China	10.8	-9.7	4.7	1.8	-9.9	-2.8	3.7

**Foreign Equity: Developed international equities (MSCI EAFE) rose 3.2% in July bringing the YTD gains to 15.3%. Emerging market equities (MSCI EM) rose 6.2% in July, rising 11.4% YTD.**

- International equities also had strong results in July, led by China and emerging markets more broadly.
- Japanese equities continued their steady rise, especially in the mid- and small-cap sectors. Eurozone and UK equities were broadly supported by falling inflation and solid corporate fundamentals.
- After a disappointing reopening of the economy, China’s government announced additional support to stimulate consumption and bolster the real estate sector, leading to double-digit gains for the month (10.8%). India underperformed as higher food costs kept inflation elevated.

<sup>1</sup> Source: Bloomberg. Data is as of July 31, 2023.

### Fixed Income Returns<sup>1</sup>

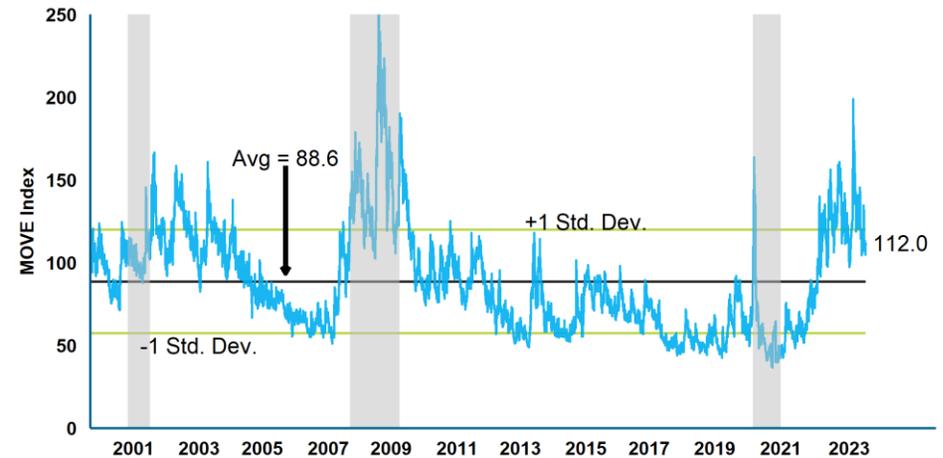
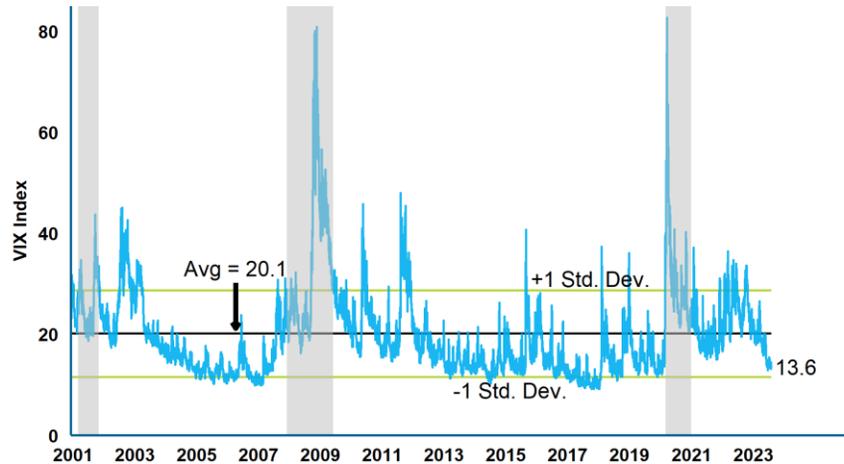
Fixed Income	July (%)	Q2 (%)	YTD (%)	1 YR (%)	3 YR (%)	5 YR (%)	10 YR (%)	Current Yield (%)	Duration (Years)
Bloomberg Universal	0.1	-0.6	2.4	-2.4	-4.0	1.0	1.8	5.2	6.2
Bloomberg Aggregate	-0.1	-0.8	2.0	-3.4	-4.5	0.7	1.5	4.9	6.5
Bloomberg US TIPS	0.1	-1.4	2.0	-5.4	-0.8	2.6	2.0	4.6	6.9
Bloomberg Short-term TIPS	0.5	-0.7	2.0	-1.2	2.3	2.9	1.7	5.3	2.7
Bloomberg High Yield	1.4	1.7	6.8	4.4	2.0	3.4	4.4	8.3	4.0
JPM GBI-EM Global Diversified (USD)	2.9	2.5	10.9	14.3	-1.5	0.5	-0.2	6.5	5.0

**Fixed Income: The Bloomberg Universal rose 0.1% in July remaining positive YTD (+2.4%), as inflation continues to decline, and yields remain high.**

- In July, riskier bonds continued to outperform government bonds on optimism over a potential soft landing of the economy.
- The broad US bond market (Bloomberg Aggregate) declined slightly for the month (-0.1%) while the TIPS index, and the short-term TIPS index both posted small gains. All three indexes now have the same results so far in 2023.
- In the risk-on environment, high yield bonds rose 1.4% for the month, while emerging market bonds were the top performer, up 2.9%. The two asset classes remain the top performers for the year.

<sup>1</sup> Source: Bloomberg. JPM GBI-EM data is from InvestorForce. Data is as of July 31, 2023. The yield and duration data from Bloomberg is defined as the index's yield to worst and modified duration respectively.

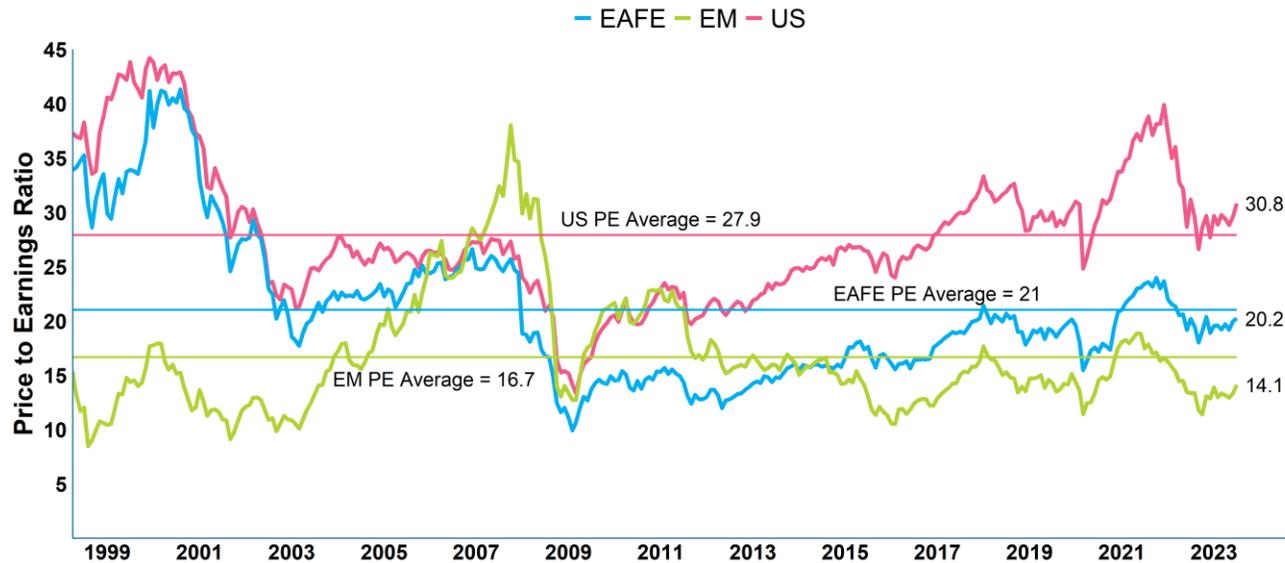
### Equity and Fixed Income Volatility<sup>1</sup>



- Volatility in equities (VIX) remains well below the historical average as investors continue to anticipate the end of the Fed's policy tightening.
- The bond market continues to be volatile after last year's historic losses and due to policy uncertainty and previous issues in the banking sector. The MOVE (fixed income volatility) remains well above (112.0) its long-run average (88.6), but off its recent peak during the heart of the banking crisis.

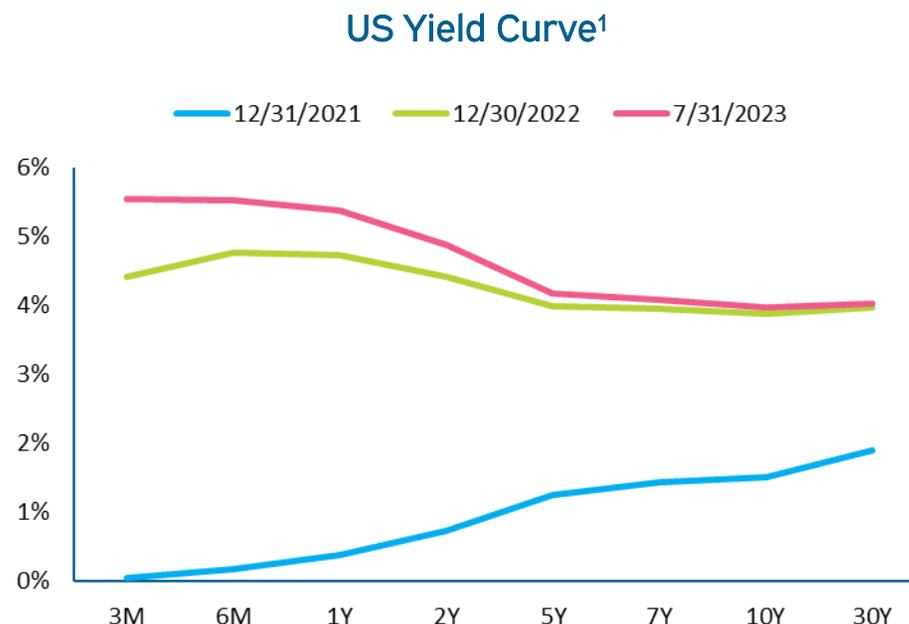
<sup>1</sup> Equity and Fixed Income Volatility – Source: Bloomberg. Implied volatility as measured using VIX Index for equity markets and the MOVE Index to measure interest rate volatility for fixed income markets. Data is as of July 2023. The average line indicated is the average of the VIX and MOVE values between January 2000 and July 2023.

**Equity Cyclically Adjusted P/E Ratios<sup>1</sup>**



- Given the strong technology-driven rally this year, the US equity price-to-earnings ratio increased above its long-run (21st century) average.
- International developed market valuations are below their own long-term average, with those for emerging markets the lowest and well under the long-term average.

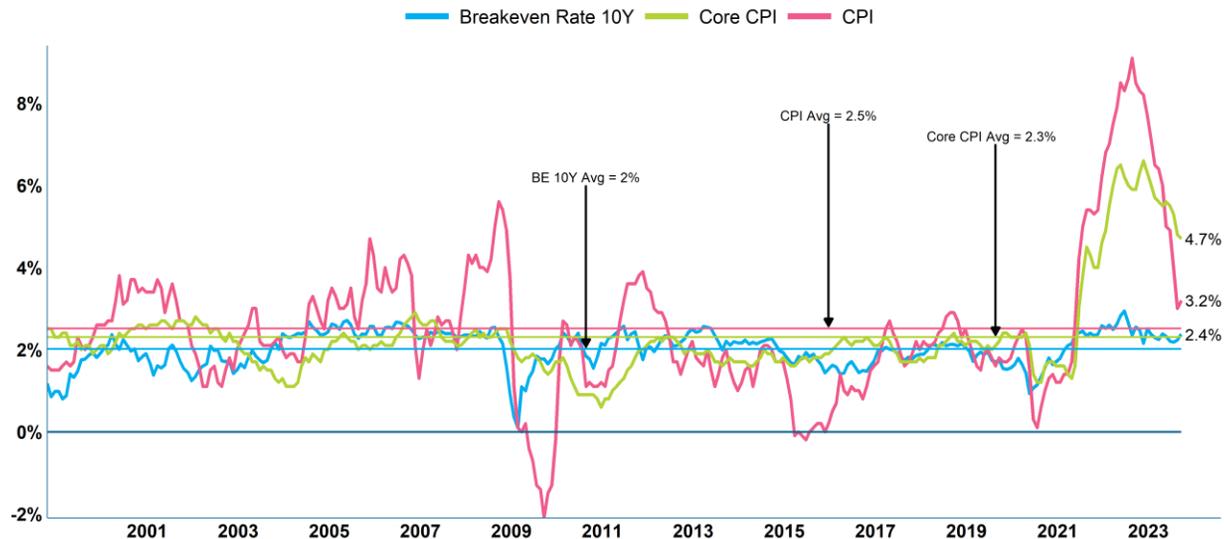
<sup>1</sup> US Equity Cyclically Adjusted P/E on S&P 500 Index. Source: Robert Shiller, Yale University, and Meketa Investment Group. Developed and Emerging Market Equity (MSCI EAFE and EM Index) Cyclically Adjusted P/E – Source: MSCI and Bloomberg. Earnings figures represent the average of monthly “as reported” earnings over the previous ten years. Data is as of July 2023. The average line is the long-term average of the US, EM, and EAFE PE values from December 1999 to the recent month-end respectively.



- In July, very short-term interest rates (6-months or less) fell as it appears interest rate hikes might be coming to an end. Longer dated maturities continued to drift higher, as economic data remains resilient. So far in 2023, rates overall remain higher, particularly the policy sensitive front-end of the yield curve.
- The yield curve remains inverted with the spread between two-year and ten-year Treasuries finishing the month at -0.91%. The more closely watched measure (by the Fed) of the three-month and ten-year Treasuries spread also remained inverted at -1.60%. Inversions in the yield curve have often preceded recessions.

<sup>1</sup> Source: Bloomberg. Data is as of July 31, 2023.

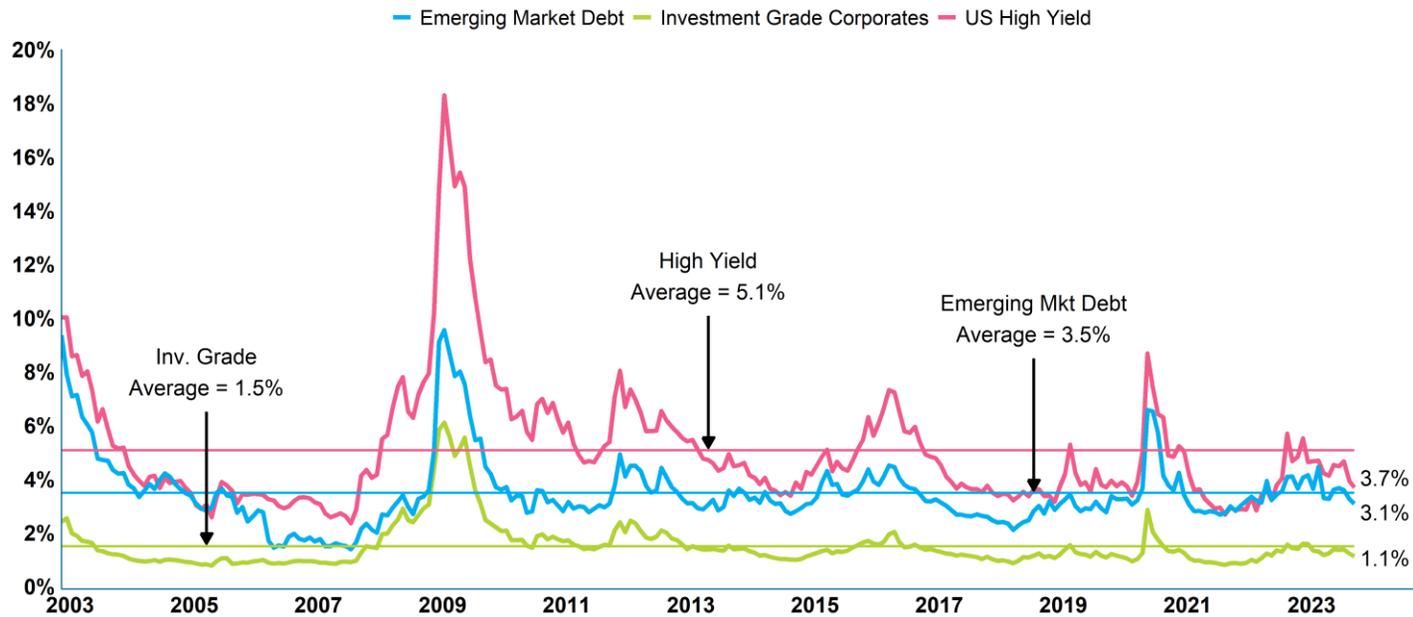
**Ten-Year Breakeven Inflation and CPI<sup>1</sup>**



- Declines in inflation while other economic data remains strong has led to optimism over the Federal Reserve potentially achieving a rarely observed soft landing for the economy.
- Year-over-year headline inflation rose slightly in July (3.0% to 3.2%) but came in below expectations. The trend of lower month-over-month price increases continued with the rate staying steady at 0.2%.
- Core inflation – excluding food and energy - fell (4.8% to 4.7%) year-over-year. It remains stubbornly high though driven by shelter costs (+7.7%), particularly owners equivalent rent, and transportation services (+9.0%).
- Inflation expectations (breakevens) remain well below current inflation as investors continue to expect inflation to track back toward the Fed’s 2% average target.

<sup>1</sup> Source: Bloomberg. Data is as July 31, 2023. The CPI and 10 Year Breakeven average lines denote the average values from August 1998 to the present month-end, respectively. Breakeven values represent month-end values for comparative purposes.

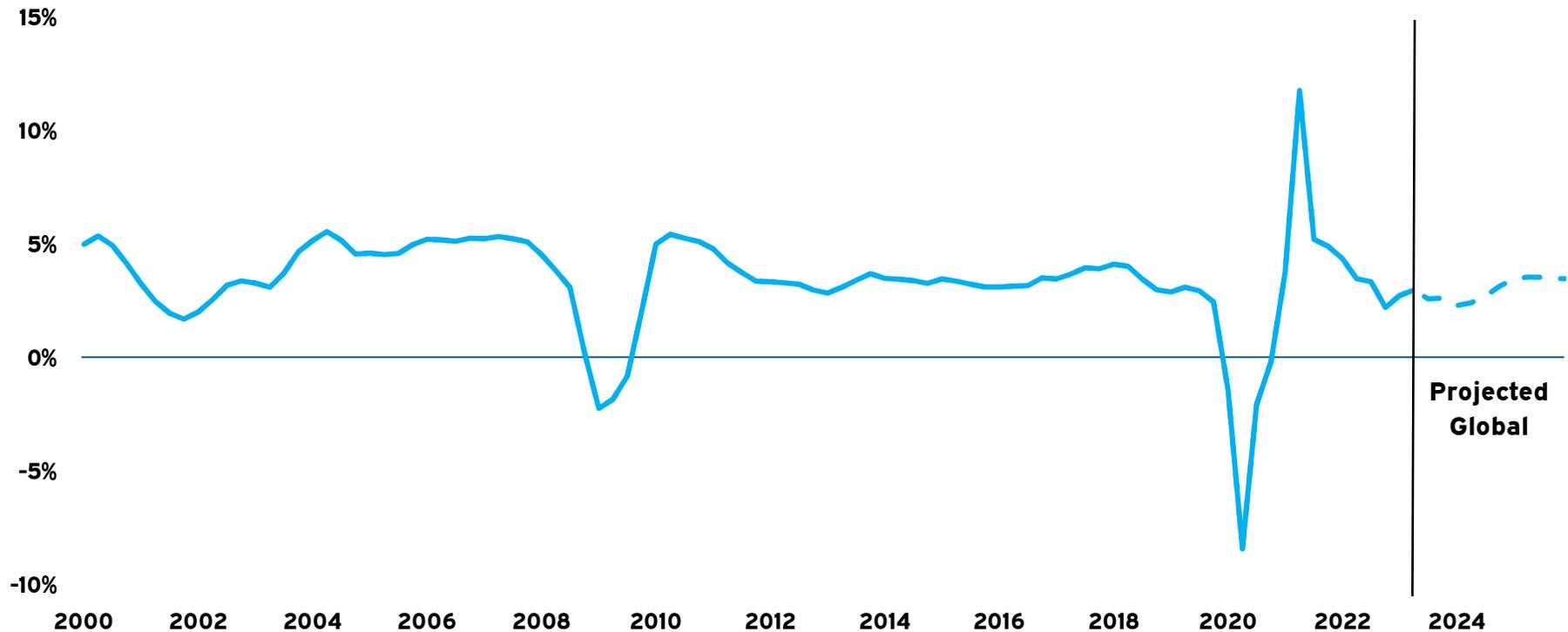
**Credit Spreads vs. US Treasury Bonds<sup>1</sup>**



- Credit markets outperformed government bonds for the month with spreads (the added yield above a comparable maturity Treasury) declining. Risk appetite was strong as growth remains resilient, while inflation continues to decline.
- High yield spreads remain well below the long-term average. Investment grade and emerging market spreads are also below their respective long-term averages, but by smaller margins.

<sup>1</sup> Sources: Bloomberg. Data is as of July 31, 2023. Average lines denote the average of the investment grade, high yield, and emerging market spread values from August 2000 to the recent month-end, respectively.

### Global Real Gross Domestic Product (GDP) Growth<sup>1</sup>



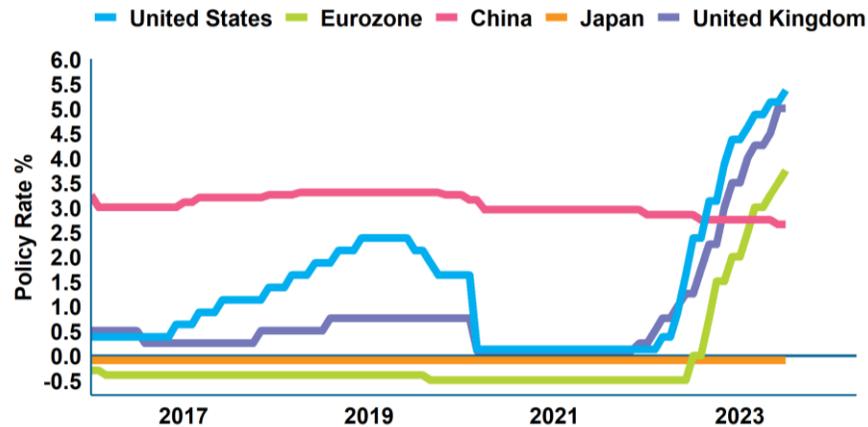
→ Global economies are expected to slow this year compared to 2022. The risk of recession remains given policymakers' aggressive tightening, but optimism has started to grow over some central banks potentially navigating a soft landing.

→ The delicate balancing act of central banks trying to reduce inflation without dramatically depressing growth will remain key.

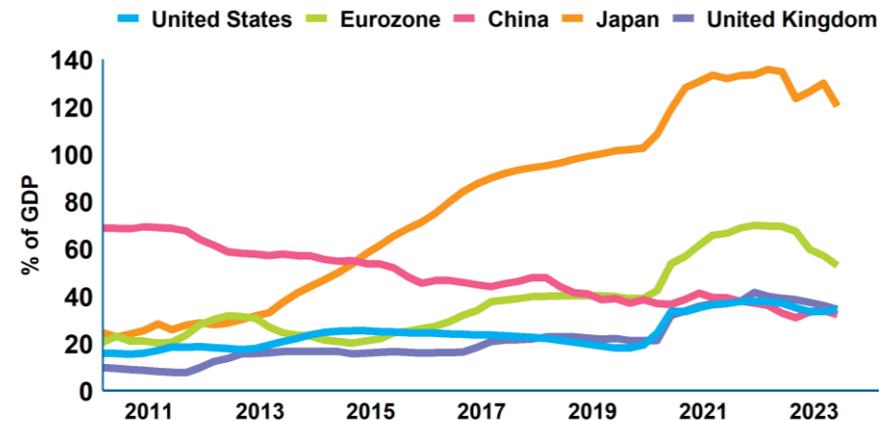
<sup>1</sup> Source: Oxford Economics (World GDP, US\$ prices & PPP exchange rate, real, % change YoY). Updated July 2023.

### Central Bank Response<sup>1</sup>

#### Policy Rates



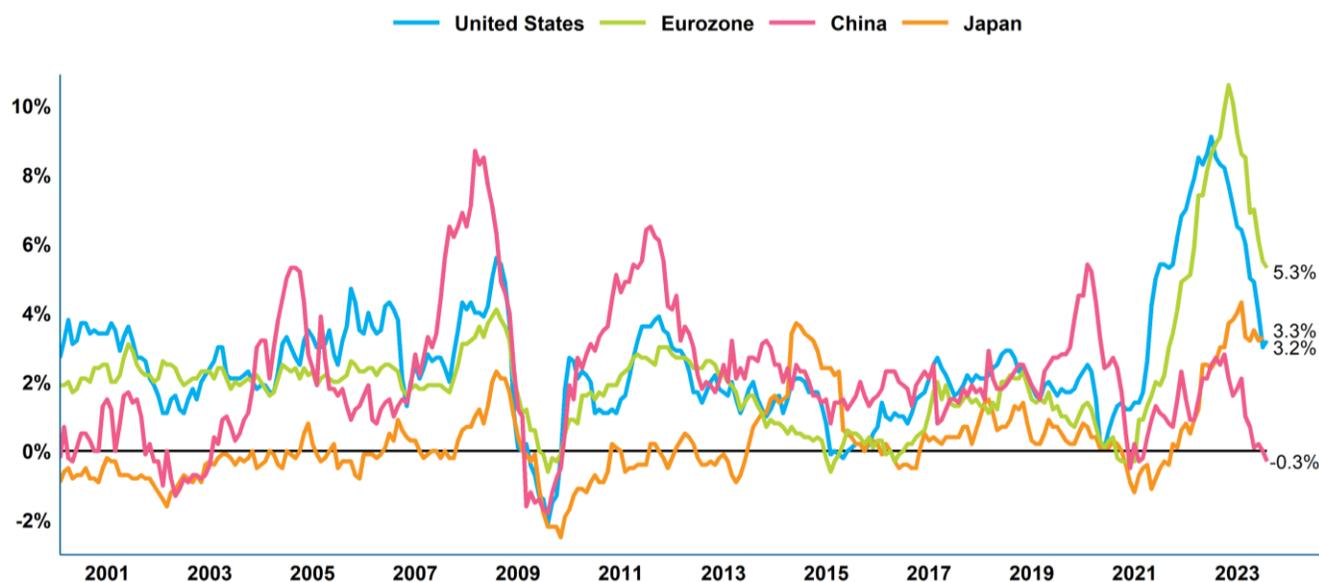
#### Balance Sheet as % of GDP



- Slowing inflation and growth have led to expectations for a reduction in the pace of aggressive policy tightening.
- In July the Fed raised rates another 25 basis points to a range of 5.25% to 5.50% with markets largely expecting this to be the last rate increase. After month-end, the FOMC paused its tightening campaign.
- The European Central Bank also increased rates in July, but they remain lower than in the US. In Japan the BOJ surprised markets by announcing they would be more flexible on their 10-year interest rate target.
- The central bank in China has continued to cut interest rates and inject liquidity into the banking system, as weaker than expected economic data appears to indicate a widespread slowdown.
- Looking ahead, risks remain for a policy error as central banks attempt to balance multiple goals, bringing down inflation, maintaining financial stability, and supporting growth.

<sup>1</sup> Source: Bloomberg. Policy rate data is as of July 31, 2023. China policy rate is defined as the medium-term lending facility 1 year interest rate. Balance sheet as % of GDP is based on quarterly data and is as of June 30, 2023.

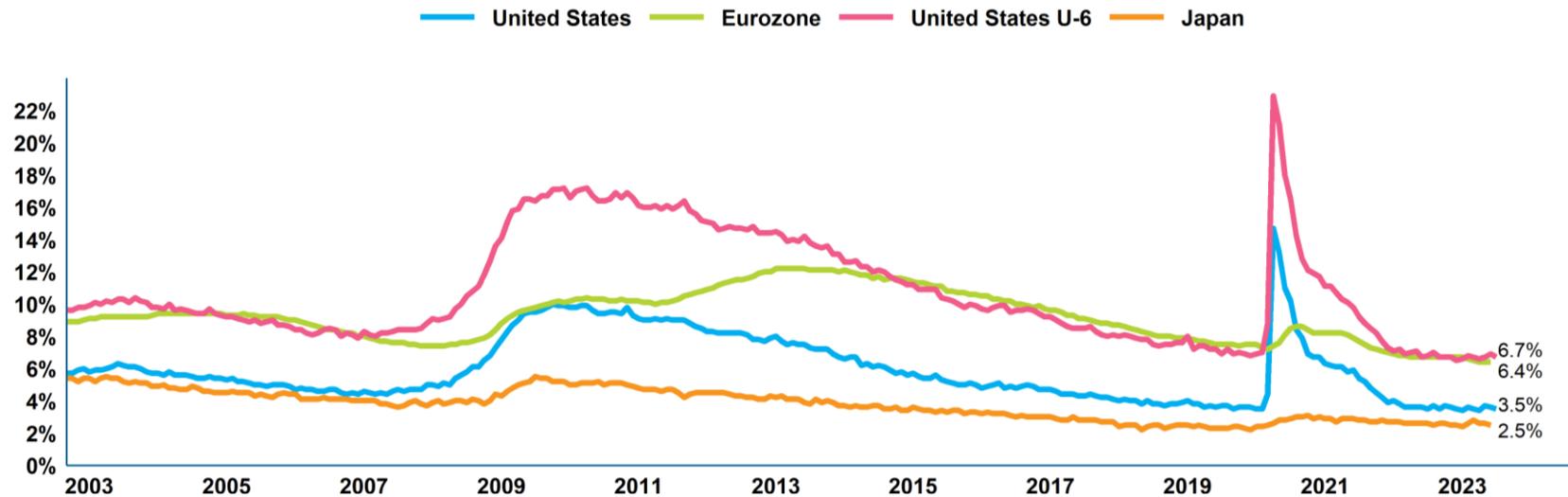
### Inflation (CPI Trailing Twelve Months)<sup>1</sup>



- The inflation picture remains mixed across the major economies.
- In the US, inflation rose slightly in July (3.0% to 3.2%), while eurozone inflation continued to fall (5.5% to 5.3%) a level well off its peak. Despite 2023's significant declines in the US and Europe, inflation levels remain elevated compared to central bank targets.
- Inflation in Japan remains elevated at levels not seen in almost a decade largely driven by food and home related items. In China, deflationary pressures emerged in July due to falling food prices, but this is expected to be temporary as high base effects from last year work their way through.

<sup>1</sup> Source: Bloomberg. Data is as July 31, 2023. The most recent Japanese inflation data is as of June 2023.

### Unemployment<sup>1</sup>



- Despite slowing growth and relatively high inflation, the US labor market continues to show signs of resilience (3.5%). Unemployment in the US, which experienced the steepest rise, recently returned to pre-pandemic levels. Broader measures of unemployment (U-6) remain higher at 6.7% but also declined dramatically from their peak.
- The strong labor market and higher wages, although beneficial for workers, motivates the Fed's efforts to fight inflation, potentially leading to higher unemployment.
- Unemployment in Europe has also declined but remains higher than the US, while levels in Japan have been flat through the pandemic given less layoffs.

<sup>1</sup> Source: Bloomberg. Data is as July 31, 2023, for the US. The most recent data for Eurozone and Japanese unemployment is as of June 2023.

### US Dollar versus Broad Currencies<sup>1</sup>



- The dollar finished 2022 much higher than it started, due to the increased pace of policy tightening, stronger relative growth, and safe-haven flows.
- Late last year and into early this year, the dollar declined, as weaker economic data and lower inflation led to investors anticipating the end of Fed tightening. Since then, the dollar has largely been range-bound due to competing forces of safe-haven flows and monetary policy expectations.
- For the rest of this year, the track of inflation across economies and the corresponding monetary policies will be key drivers of currency moves.

<sup>1</sup> Source: Bloomberg. Data as of July 31, 2023.

## Summary

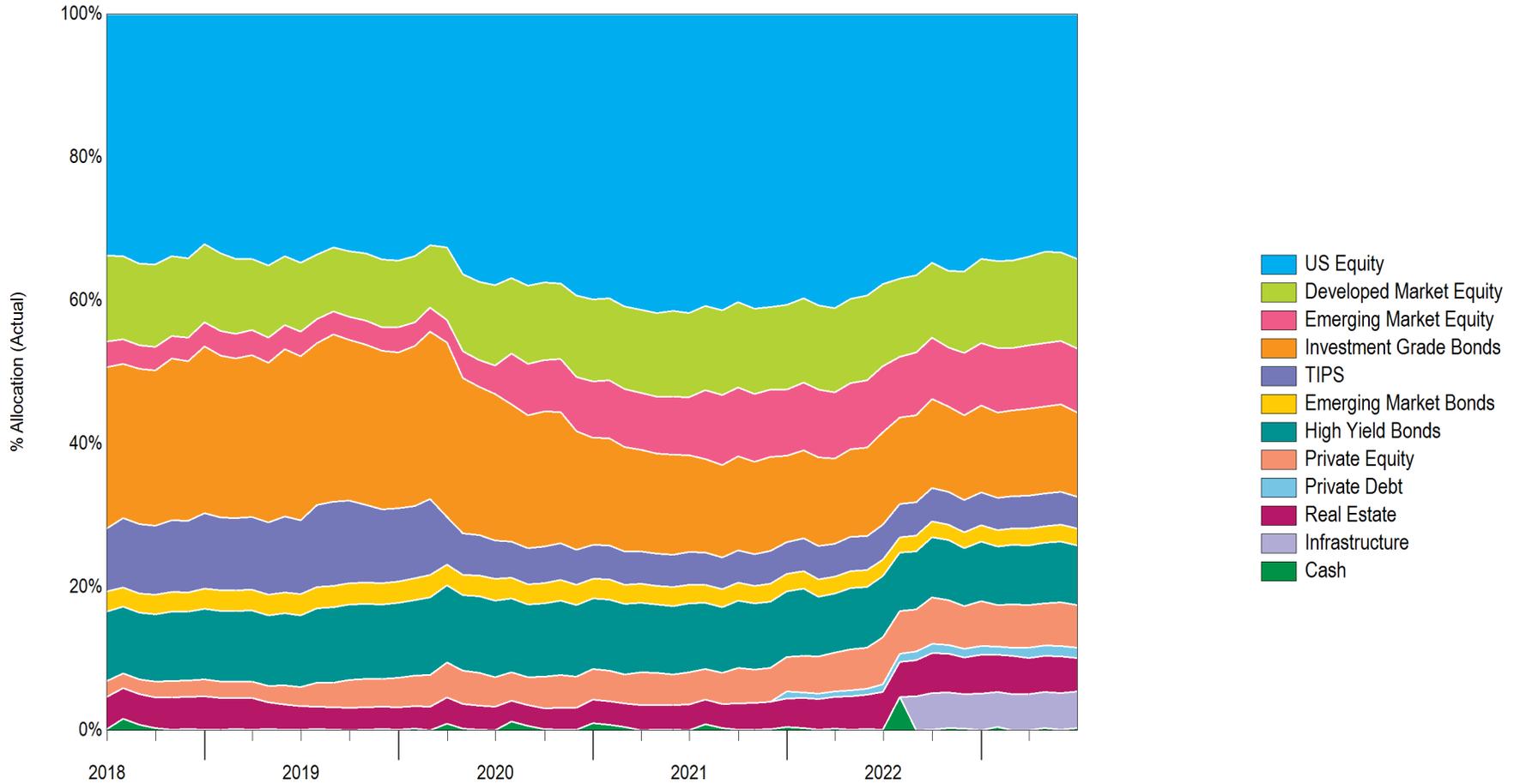
### Key Trends:

- The impact of inflation still above policy targets will remain key, with bond market volatility likely to stay high.
- Global monetary policies could diverge in 2023. The risk of policy errors remains elevated as central banks try to reduce persistent inflation while not tipping their economies into recession.
- Growth is expected to slow globally this year, with many economies forecasted to tip into recession. Optimism has been building though that some economies could experience a soft landing. Inflation, monetary policy, and the war will all be key.
- In the US, consumers could feel pressure as certain components of inflation remain high (e.g., shelter), borrowing cost are elevated, and the job market may weaken.
- The key for US equities going forward will be whether earnings can remain resilient if growth continues to slow. Also, the future path of the large technology companies that have driven market gains will be important.
- Equity valuations remain lower in emerging and developed markets, but risks remain, including potential for renewed strength in the US dollar, higher inflation weighing particularly on Europe, and China's sluggish economic reopening and on-going weakness in the real estate sector. Japan's recent hint at potentially tightening monetary policy along with changes in corporate governance in the country could influence relative results.

**Performance Update**  
As Of July 31, 2023

Allocation vs. Targets and Policy				
	Current Balance	Current Allocation	Policy	Policy Range
US Equity	\$73,328,620	34%	17%	11% - 23%
Developed Market Equity	\$26,883,675	13%	14%	6% - 18%
Emerging Market Equity	\$19,181,397	9%	14%	3% - 16%
Investment Grade Bonds	\$25,325,395	12%	5%	3% - 10%
TIPS	\$9,497,411	4%	5%	3% - 10%
Emerging Market Bonds	\$5,012,165	2%	2%	1% - 5%
High Yield Bonds	\$17,917,421	8%	5%	2% - 8%
Private Equity	\$12,740,071	6%	10%	5% - 15%
Private Debt	\$3,045,757	1%	8%	0% - 12%
Real Estate	\$10,119,559	5%	10%	3% - 13%
Infrastructure	\$10,870,617	5%	10%	0% - 13%
Cash	\$745,270	0%	0%	0% - 5%
<b>Total</b>	<b>\$214,667,359</b>	<b>100%</b>	<b>100%</b>	

**Asset Allocation History**  
5 Years Ending June 30, 2023



Asset Class Performance Summary											
	Market Value (\$)	% of Portfolio	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	20 Yrs (%)	Inception (%)	Inception Date
<b>Total Retirement System (net)</b>	<b>214,667,359</b>	<b>100.0</b>	<b>3.6</b>	<b>8.4</b>	<b>10.5</b>	<b>8.1</b>	<b>6.7</b>	<b>7.0</b>	<b>7.1</b>	<b>7.6</b>	<b>Jul-88</b>
55% MSCI World & 45% Barclays Aggregate			3.4	9.1	9.6	4.9	5.6	6.1	6.2	6.8	Jul-88
60% MSCI World & 40% Barclays Aggregate			3.7	9.8	10.6	5.7	6.0	6.5	6.5	6.9	Jul-88
InvMetrics Public DB \$50mm-\$250mm Net Median			3.3	7.8	9.0	7.5	6.5	7.2	6.7	8.0	Jul-88
<b>Domestic Equity Assets (net)</b>	<b>73,328,620</b>	<b>34.2</b>	<b>9.0</b>	<b>16.6</b>	<b>21.1</b>	<b>15.0</b>	<b>9.7</b>	<b>11.2</b>	<b>9.3</b>	<b>8.7</b>	<b>Oct-06</b>
Russell 3000			8.4	16.2	19.0	13.9	11.4	12.3	10.1	9.5	Oct-06
PRIT Domestic Equity			8.3	16.0	23.0	16.0	12.1	12.6	9.5	8.9	Oct-06
<b>International Developed Markets Equity Assets (net)</b>	<b>26,883,675</b>	<b>12.5</b>	<b>3.1</b>	<b>11.8</b>	<b>18.8</b>	<b>9.1</b>	<b>4.6</b>	<b>5.0</b>	<b>--</b>	<b>3.3</b>	<b>Oct-06</b>
MSCI EAFE			3.0	11.7	18.8	8.9	4.4	5.4	6.5	3.5	Oct-06
<b>International Emerging Markets Equity Assets (net)</b>	<b>19,181,397</b>	<b>8.9</b>	<b>2.6</b>	<b>7.7</b>	<b>4.5</b>	<b>5.4</b>	<b>3.3</b>	<b>--</b>	<b>--</b>	<b>4.6</b>	<b>Jan-15</b>
MSCI Emerging Markets			0.9	4.9	1.7	2.3	0.9	3.0	8.2	2.8	Jan-15
<b>Investment Grade Bonds Assets (net)</b>	<b>25,325,395</b>	<b>11.8</b>	<b>-0.9</b>	<b>2.3</b>	<b>-1.0</b>	<b>-4.0</b>	<b>0.7</b>	<b>1.5</b>	<b>3.0</b>	<b>5.3</b>	<b>Jul-88</b>
Bloomberg US Aggregate TR			-0.8	2.1	-0.9	-4.0	0.8	1.5	3.0	5.4	Jul-88
PRIT Core Fixed Income			-1.3	3.2	-2.6	-5.1	1.0	2.6	3.5	6.0	Jul-88
<b>High Yield Bond Assets (net)</b>	<b>17,917,421</b>	<b>8.3</b>	<b>1.9</b>	<b>5.7</b>	<b>9.5</b>	<b>3.3</b>	<b>3.6</b>	<b>4.3</b>	<b>--</b>	<b>5.9</b>	<b>Sep-03</b>
Bloomberg US High Yield TR			1.7	5.4	9.1	3.1	3.4	4.4	6.6	6.7	Sep-03
PRIT Public Value-Added Fixed Income			2.3	5.5	10.2	3.4	2.8	2.7	5.4	5.5	Sep-03
<b>TIPS Assets (net)</b>	<b>9,497,411</b>	<b>4.4</b>	<b>-1.4</b>	<b>2.0</b>	<b>-1.5</b>	<b>-0.2</b>	<b>2.4</b>	<b>2.0</b>	<b>--</b>	<b>3.3</b>	<b>Oct-05</b>
Bloomberg US TIPS TR			-1.4	1.9	-1.4	-0.1	2.5	2.1	3.6	3.3	Oct-05
<b>Emerging Market Debt Assets (net)</b>	<b>5,012,165</b>	<b>2.3</b>	<b>3.0</b>	<b>4.8</b>	<b>9.8</b>	<b>-2.2</b>	<b>0.7</b>	<b>--</b>	<b>--</b>	<b>2.2</b>	<b>Jan-15</b>
JP Morgan EMBI Global Diversified			2.2	4.1	7.4	-3.1	0.6	2.8	5.7	2.1	Jan-15
<b>Open-Ended Real Estate (net)</b>	<b>6,331,069</b>	<b>2.9</b>	<b>-5.9</b>	<b>-10.7</b>	<b>-14.8</b>	<b>7.5</b>	<b>6.5</b>	<b>8.9</b>	<b>7.1</b>	<b>7.9</b>	<b>Oct-95</b>
NCREIF ODCE			-2.7	-5.8	-10.0	8.0	6.5	8.8	7.8	8.7	Oct-95
<b>Total Closed End Real Estate (net)</b>	<b>3,788,490</b>	<b>1.8</b>	<b>-2.2</b>	<b>-4.0</b>	<b>-1.5</b>	<b>5.7</b>	<b>-7.6</b>	<b>3.6</b>	<b>--</b>	<b>3.7</b>	<b>Jan-13</b>
<b>Private Equity Assets (net)</b>	<b>12,740,071</b>	<b>5.9</b>	<b>-0.1</b>	<b>0.0</b>	<b>-0.7</b>	<b>26.2</b>	<b>18.5</b>	<b>10.3</b>	<b>--</b>	<b>8.3</b>	<b>Oct-06</b>
<b>Private Debt Assets (net)</b>	<b>3,045,757</b>	<b>1.4</b>	<b>3.4</b>	<b>6.6</b>	<b>11.2</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>11.1</b>	<b>Dec-21</b>
<b>Infrastructure (net)</b>	<b>10,870,617</b>	<b>5.1</b>	<b>2.5</b>	<b>5.2</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>9.7</b>	<b>Aug-22</b>
<b>Cash (net)</b>	<b>745,270</b>	<b>0.3</b>									

Trailing Performance												
	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	20 Yrs (%)	Inception (%)	Inception Date
<b>Total Retirement System</b>	<b>214,667,359</b>	<b>100.0</b>	<b>--</b>	<b>3.6</b>	<b>8.4</b>	<b>10.5</b>	<b>8.1</b>	<b>6.7</b>	<b>7.0</b>	<b>7.1</b>	<b>7.6</b>	<b>Jul-88</b>
<i>55% MSCI World &amp; 45% Barclays Aggregate</i>				3.4	9.1	9.6	4.9	5.6	6.1	6.2	6.8	Jul-88
<i>60% MSCI World &amp; 40% Barclays Aggregate</i>				3.7	9.8	10.6	5.7	6.0	6.5	6.5	6.9	Jul-88
<i>InvMetrics Public DB \$50mm-\$250mm Net Median</i>				3.3	7.8	9.0	7.5	6.5	7.2	6.7	8.0	Jul-88
<b>Domestic Equity Assets</b>	<b>73,328,620</b>	<b>34.2</b>	<b>34.2</b>	<b>9.0</b>	<b>16.6</b>	<b>21.1</b>	<b>15.0</b>	<b>9.7</b>	<b>11.2</b>	<b>9.3</b>	<b>8.7</b>	<b>Oct-06</b>
<i>Russell 3000</i>				8.4	16.2	19.0	13.9	11.4	12.3	10.1	9.5	Oct-06
<i>PRIT Domestic Equity</i>				8.3	16.0	23.0	16.0	12.1	12.6	9.5	8.9	Oct-06
RhumbLine S&P 500 Index	24,836,284	11.6	33.9	8.7	16.8	19.6	14.5	12.2	12.8	10.1	7.4	Mar-99
<i>S&amp;P 500</i>				8.7	16.9	19.6	14.6	12.3	12.9	10.0	7.4	Mar-99
<i>eV US Passive S&amp;P 500 Equity Net Median</i>				8.7	16.8	19.5	14.5	12.2	12.8	10.0	7.3	Mar-99
Frontier Capital Appreciation	23,698,372	11.0	32.3	10.1	18.4	25.4	16.8	8.2	10.4	--	11.1	Feb-13
<i>Russell 2500 Growth</i>				6.4	13.4	18.6	6.6	7.0	10.4	10.3	10.8	Feb-13
<i>eV US Small-Mid Cap Growth Equity Net Median</i>				5.3	12.9	16.6	7.3	8.6	10.5	10.9	11.0	Feb-13
RhumbLine HEDI	24,793,963	11.5	33.8	8.1	15.0	19.2	--	--	--	--	13.0	Nov-20
<i>Russell 1000 HEDI Moderate GR USD</i>				8.1	15.1	19.3	14.1	13.5	13.8	11.4	13.1	Nov-20
<i>eV US Large Cap Core Equity Gross Median</i>				7.5	13.4	17.4	14.0	11.7	12.5	10.4	13.3	Nov-20

## Total Retirement System | As of June 30, 2023

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	20 Yrs (%)	Inception (%)	Inception Date
<b>International Developed Markets Equity Assets</b>	<b>26,883,675</b>	<b>12.5</b>	<b>12.5</b>	<b>3.1</b>	<b>11.8</b>	<b>18.8</b>	<b>9.1</b>	<b>4.6</b>	<b>5.0</b>	<b>--</b>	<b>3.3</b>	<b>Oct-06</b>
<i>MSCI EAFE</i>				3.0	11.7	18.8	8.9	4.4	5.4	6.5	3.5	Oct-06
RhumbLine MSCI EAFE Index	26,883,675	12.5	100.0	3.1	11.8	18.8	9.1	4.6	--	--	4.0	Aug-14
<i>MSCI EAFE</i>				3.0	11.7	18.8	8.9	4.4	5.4	6.5	3.8	Aug-14
<i>eV EAFE All Cap Equity Net Median</i>				2.8	11.2	16.7	8.4	3.9	5.6	7.2	4.2	Aug-14
<b>International Emerging Markets Equity Assets</b>	<b>19,181,397</b>	<b>8.9</b>	<b>8.9</b>	<b>2.6</b>	<b>7.7</b>	<b>4.5</b>	<b>5.4</b>	<b>3.3</b>	<b>--</b>	<b>--</b>	<b>4.6</b>	<b>Jan-15</b>
<i>MSCI Emerging Markets</i>				0.9	4.9	1.7	2.3	0.9	3.0	8.2	2.8	Jan-15
DFA Emerging Markets	10,207,279	4.8	53.2	2.9	8.7	7.1	8.1	3.3	--	--	4.1	Jan-15
<i>MSCI Emerging Markets</i>				0.9	4.9	1.7	2.3	0.9	3.0	8.2	2.8	Jan-15
<i>eV Emg Mkts All Cap Equity Net Median</i>				1.8	6.3	5.3	2.9	2.0	3.7	8.8	3.5	Jan-15
Driehaus Emerging Market Equity	8,974,118	4.2	46.8	2.2	6.5	1.8	2.5	3.1	--	--	4.9	Jan-15
<i>MSCI Emerging Markets</i>				0.9	4.9	1.7	2.3	0.9	3.0	8.2	2.8	Jan-15
<i>eV Emg Mkts All Cap Equity Net Median</i>				1.8	6.3	5.3	2.9	2.0	3.7	8.8	3.5	Jan-15
<b>Investment Grade Bonds Assets</b>	<b>25,325,395</b>	<b>11.8</b>	<b>11.8</b>	<b>-0.9</b>	<b>2.3</b>	<b>-1.0</b>	<b>-4.0</b>	<b>0.7</b>	<b>1.5</b>	<b>3.0</b>	<b>5.3</b>	<b>Jul-88</b>
<i>Bloomberg US Aggregate TR</i>				-0.8	2.1	-0.9	-4.0	0.8	1.5	3.0	5.4	Jul-88
<i>PRIT Core Fixed Income</i>				-1.3	3.2	-2.6	-5.1	1.0	2.6	3.5	6.0	Jul-88
SSgA U.S. Aggregate Bond Index	25,325,395	11.8	100.0	-0.9	2.3	-1.0	-4.0	0.7	1.5	3.0	3.6	May-01
<i>Bloomberg US Aggregate TR</i>				-0.8	2.1	-0.9	-4.0	0.8	1.5	3.0	3.6	May-01
<i>eV US Core Fixed Inc Net Median</i>				-0.7	2.3	-0.5	-3.6	1.0	1.7	3.2	3.9	May-01

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	20 Yrs (%)	Inception (%)	Inception Date
<b>High Yield Bond Assets</b>	<b>17,917,421</b>	<b>8.3</b>	<b>8.3</b>	<b>1.9</b>	<b>5.7</b>	<b>9.5</b>	<b>3.3</b>	<b>3.6</b>	<b>4.3</b>	<b>--</b>	<b>5.9</b>	<b>Sep-03</b>
<i>Bloomberg US High Yield TR</i>				1.7	5.4	9.1	3.1	3.4	4.4	6.6	6.7	Sep-03
<i>PRIT Public Value-Added Fixed Income</i>				2.3	5.5	10.2	3.4	2.8	2.7	5.4	5.5	Sep-03
Shenkman Capital	17,917,421	8.3	100.0	1.9	5.7	9.5	3.3	3.6	4.3	--	5.8	Apr-06
<i>Bloomberg US High Yield TR</i>				1.7	5.4	9.1	3.1	3.4	4.4	6.6	6.2	Apr-06
<i>eV US High Yield Fixed Inc Net Median</i>				1.4	4.8	8.3	3.2	3.2	4.1	6.1	5.7	Apr-06
<b>TIPS Assets</b>	<b>9,497,411</b>	<b>4.4</b>	<b>4.4</b>	<b>-1.4</b>	<b>2.0</b>	<b>-1.5</b>	<b>-0.2</b>	<b>2.4</b>	<b>2.0</b>	<b>--</b>	<b>3.3</b>	<b>Oct-05</b>
<i>Bloomberg US TIPS TR</i>				-1.4	1.9	-1.4	-0.1	2.5	2.1	3.6	3.3	Oct-05
SSgA TIPS Index-NL	9,497,411	4.4	100.0	-1.4	2.0	-1.5	-0.2	2.4	2.0	--	3.3	Oct-05
<i>Bloomberg US TIPS TR</i>				-1.4	1.9	-1.4	-0.1	2.5	2.1	3.6	3.3	Oct-05
<i>eV US TIPS / Inflation Fixed Inc Net Median</i>				-1.4	1.8	-1.2	0.0	2.5	2.0	3.6	3.3	Oct-05
<b>Emerging Market Debt Assets</b>	<b>5,012,165</b>	<b>2.3</b>	<b>2.3</b>	<b>3.0</b>	<b>4.8</b>	<b>9.8</b>	<b>-2.2</b>	<b>0.7</b>	<b>--</b>	<b>--</b>	<b>2.2</b>	<b>Jan-15</b>
<i>JP Morgan EMBI Global Diversified</i>				2.2	4.1	7.4	-3.1	0.6	2.8	5.7	2.1	Jan-15
Payden Emerging Market Bond	5,012,165	2.3	100.0	3.0	4.8	9.8	-2.2	0.7	--	--	2.2	Jan-15
<i>JP Morgan EMBI Global Diversified</i>				2.2	4.1	7.4	-3.1	0.6	2.8	5.7	2.1	Jan-15
<b>Open-Ended Real Estate</b>	<b>6,331,069</b>	<b>2.9</b>	<b>2.9</b>	<b>-5.9</b>	<b>-10.7</b>	<b>-14.8</b>	<b>7.5</b>	<b>6.5</b>	<b>8.9</b>	<b>7.1</b>	<b>7.9</b>	<b>Oct-95</b>
<i>NCREIF ODCE</i>				-2.7	-5.8	-10.0	8.0	6.5	8.8	7.8	8.7	Oct-95
Clarion Partners	6,331,069	2.9	100.0	-5.9	-10.7	-14.8	7.5	6.5	8.9	7.1	7.2	Oct-02
<i>NCREIF ODCE</i>				-2.7	-5.8	-10.0	8.0	6.5	8.8	7.8	7.9	Oct-02

### Total Retirement System | As of June 30, 2023

	Market Value (\$)	% of Portfolio	% of Sector	QTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	20 Yrs (%)	Inception (%)	Inception Date
<b>Total Closed End Real Estate</b>	<b>3,788,490</b>	<b>1.8</b>	<b>1.8</b>	<b>-2.2</b>	<b>-4.0</b>	<b>-1.5</b>	<b>5.7</b>	<b>-7.6</b>	<b>3.6</b>	<b>--</b>	<b>3.7</b>	<b>Jan-13</b>
Rockwood Capital Real Estate Partners Fund XI, L.P. <i>NCREIF-ODCE</i>	3,788,490	1.8	100.0	-2.2 -2.7	-4.0 -5.8	-1.5 -10.0	6.5 8.0	-- 6.5	-- 8.7	-- 7.8	5.4 6.9	Dec-19 Dec-19
<b>Private Equity Assets</b>	<b>12,740,071</b>	<b>5.9</b>	<b>5.9</b>	<b>-0.1</b>	<b>0.0</b>	<b>-0.7</b>	<b>26.2</b>	<b>18.5</b>	<b>10.3</b>	<b>--</b>	<b>8.3</b>	<b>Oct-06</b>
North American Strategic Partners 2006	14,091	0.0	0.1									
Ironsides Partnership Fund IV	2,511,231	1.2	19.7									
Ironsides Direct Investment Fund IV	1,411,709	0.7	11.1									
Ironsides Partnership Fund V, L.P.	2,068,044	1.0	16.2									
Ironsides Direct Investment Fund V, L.P.	3,112,034	1.4	24.4									
HarbourVest 2019 Global Fund	3,622,962	1.7	28.4									
<b>Private Debt Assets</b>	<b>3,045,757</b>	<b>1.4</b>	<b>1.4</b>	<b>3.4</b>	<b>6.6</b>	<b>11.2</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>11.1</b>	<b>Dec-21</b>
NB Private Debt Fund IV	3,045,757	1.4	100.0									
<b>Infrastructure</b>	<b>10,870,617</b>	<b>5.1</b>	<b>5.1</b>	<b>2.5</b>	<b>5.2</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>9.7</b>	<b>Aug-22</b>
IFM Global Infrastructure <i>CPI + 3%</i>	10,870,617	5.1	100.0	2.5 1.8	5.2 4.3	-- 6.1	-- 8.9	-- 7.0	-- 5.8	-- 5.6	9.7 5.8	Aug-22 Aug-22
<b>Cash</b>	<b>745,270</b>	<b>0.3</b>	<b>0.3</b>									

Closed End Real Estate, Private Equity, and Private Debt market values are as of March 31, 2022 and adjusted for subsequent flows.

North American Strategic Partners market value is cash adjusted as of December 31, 2022. The fund is currently in the liquidation process and will only be reported on annually (as of December 31).

	Calendar Year Performance									
	2022 (%)	2021 (%)	2020 (%)	2019 (%)	2018 (%)	2017 (%)	2016 (%)	2015 (%)	2014 (%)	2013 (%)
<b>Total Retirement System</b>	<b>-12.5</b>	<b>13.8</b>	<b>14.2</b>	<b>17.5</b>	<b>-4.5</b>	<b>13.0</b>	<b>8.7</b>	<b>-0.2</b>	<b>6.3</b>	<b>14.0</b>
<i>55% MSCI World &amp; 45% Barclays Aggregate</i>	<i>-15.6</i>	<i>10.9</i>	<i>12.9</i>	<i>19.1</i>	<i>-4.6</i>	<i>13.6</i>	<i>5.5</i>	<i>0.0</i>	<i>5.5</i>	<i>13.0</i>
<i>60% MSCI World &amp; 40% Barclays Aggregate</i>	<i>-15.9</i>	<i>12.0</i>	<i>13.3</i>	<i>20.0</i>	<i>-5.1</i>	<i>14.5</i>	<i>5.7</i>	<i>-0.1</i>	<i>5.4</i>	<i>14.5</i>
<b>Domestic Equity Assets</b>	<b>-16.9</b>	<b>24.8</b>	<b>13.4</b>	<b>27.6</b>	<b>-6.9</b>	<b>20.1</b>	<b>14.6</b>	<b>-1.6</b>	<b>13.1</b>	<b>33.1</b>
<i>Russell 3000</i>	<i>-19.2</i>	<i>25.7</i>	<i>20.9</i>	<i>31.0</i>	<i>-5.2</i>	<i>21.1</i>	<i>12.7</i>	<i>0.5</i>	<i>12.6</i>	<i>33.6</i>
<i>PRIT Domestic Equity</i>	<i>-15.8</i>	<i>27.8</i>	<i>18.9</i>	<i>30.5</i>	<i>-5.1</i>	<i>20.7</i>	<i>12.8</i>	<i>0.1</i>	<i>11.6</i>	<i>33.6</i>
RhumbLine S&P 500 Index	-18.1	28.6	18.3	31.4	-4.4	21.8	11.9	1.4	13.6	32.2
<i>S&amp;P 500</i>	<i>-18.1</i>	<i>28.7</i>	<i>18.4</i>	<i>31.5</i>	<i>-4.4</i>	<i>21.8</i>	<i>12.0</i>	<i>1.4</i>	<i>13.7</i>	<i>32.4</i>
Frontier Capital Appreciation	-18.0	18.2	18.1	28.9	-13.9	19.1	20.5	-6.5	12.4	--
<i>Russell 2500 Growth</i>	<i>-26.2</i>	<i>5.0</i>	<i>40.5</i>	<i>32.7</i>	<i>-7.5</i>	<i>24.5</i>	<i>9.7</i>	<i>-0.2</i>	<i>7.1</i>	<i>40.6</i>
RhumbLine HEDI	-15.2	25.5	--	--	--	--	--	--	--	--
<i>Russell 1000 HEDI Moderate GR USD</i>	<i>-15.1</i>	<i>25.5</i>	<i>18.5</i>	<i>32.7</i>	<i>-0.9</i>	<i>23.4</i>	<i>11.4</i>	<i>4.8</i>	<i>15.4</i>	<i>30.9</i>
<b>International Developed Markets Equity Assets</b>	<b>-14.2</b>	<b>11.5</b>	<b>7.9</b>	<b>22.3</b>	<b>-13.5</b>	<b>24.9</b>	<b>1.4</b>	<b>-0.8</b>	<b>-8.7</b>	<b>21.2</b>
<i>MSCI EAFE</i>	<i>-14.5</i>	<i>11.3</i>	<i>7.8</i>	<i>22.0</i>	<i>-13.8</i>	<i>25.0</i>	<i>1.0</i>	<i>-0.8</i>	<i>-4.9</i>	<i>22.8</i>
RhumbLine MSCI EAFE Index	-14.2	11.5	7.9	22.3	-13.5	24.9	1.4	-0.8	--	--
<i>MSCI EAFE</i>	<i>-14.5</i>	<i>11.3</i>	<i>7.8</i>	<i>22.0</i>	<i>-13.8</i>	<i>25.0</i>	<i>1.0</i>	<i>-0.8</i>	<i>-4.9</i>	<i>22.8</i>
<b>International Emerging Markets Equity Assets</b>	<b>-19.3</b>	<b>2.3</b>	<b>21.1</b>	<b>20.7</b>	<b>-15.4</b>	<b>39.7</b>	<b>9.4</b>	<b>-12.7</b>	<b>--</b>	<b>--</b>
<i>MSCI Emerging Markets</i>	<i>-20.1</i>	<i>-2.5</i>	<i>18.3</i>	<i>18.4</i>	<i>-14.6</i>	<i>37.3</i>	<i>11.2</i>	<i>-14.9</i>	<i>-2.2</i>	<i>-2.6</i>
DFA Emerging Markets	-16.4	5.8	13.9	16.0	-15.2	36.6	12.4	-14.9	--	--
<i>MSCI Emerging Markets</i>	<i>-20.1</i>	<i>-2.5</i>	<i>18.3</i>	<i>18.4</i>	<i>-14.6</i>	<i>37.3</i>	<i>11.2</i>	<i>-14.9</i>	<i>-2.2</i>	<i>-2.6</i>
Driehaus Emerging Market Equity	-22.4	-1.5	28.0	25.3	-15.6	43.0	6.5	-10.6	--	--
<i>MSCI Emerging Markets</i>	<i>-20.1</i>	<i>-2.5</i>	<i>18.3</i>	<i>18.4</i>	<i>-14.6</i>	<i>37.3</i>	<i>11.2</i>	<i>-14.9</i>	<i>-2.2</i>	<i>-2.6</i>

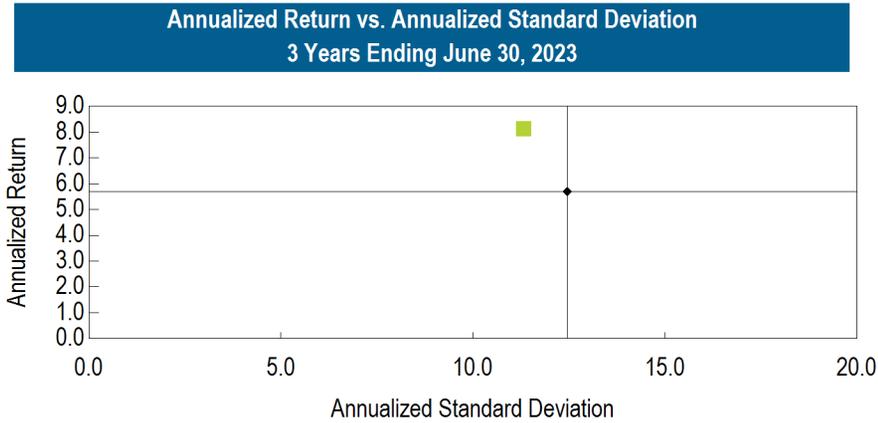
## Total Retirement System | As of June 30, 2023

	2022 (%)	2021 (%)	2020 (%)	2019 (%)	2018 (%)	2017 (%)	2016 (%)	2015 (%)	2014 (%)	2013 (%)
<b>Investment Grade Bonds Assets</b>	<b>-13.2</b>	<b>-1.6</b>	<b>7.5</b>	<b>8.7</b>	<b>0.0</b>	<b>3.6</b>	<b>2.6</b>	<b>0.6</b>	<b>6.0</b>	<b>-2.0</b>
<i>Bloomberg US Aggregate TR</i>	-13.0	-1.5	7.5	8.7	0.0	3.5	2.6	0.5	6.0	-2.0
<i>PRIT Core Fixed Income</i>	-18.3	0.1	12.0	11.2	-0.9	5.3	3.9	-2.0	15.1	-2.9
SSgA U.S. Aggregate Bond Index	-13.2	-1.6	7.5	8.7	0.0	3.6	2.6	0.6	6.0	-2.0
<i>Bloomberg US Aggregate TR</i>	-13.0	-1.5	7.5	8.7	0.0	3.5	2.6	0.5	6.0	-2.0
<b>High Yield Bond Assets</b>	<b>-8.9</b>	<b>4.0</b>	<b>6.3</b>	<b>14.0</b>	<b>-1.8</b>	<b>6.5</b>	<b>12.6</b>	<b>-2.3</b>	<b>2.9</b>	<b>6.4</b>
<i>Bloomberg US High Yield TR</i>	-11.2	5.3	7.1	14.3	-2.1	7.5	17.1	-4.5	2.5	7.4
<i>PRIT Public Value-Added Fixed Income</i>	-7.8	3.5	4.3	10.7	-2.5	8.5	11.2	-5.2	-0.7	-2.0
Shenkman Capital	-8.8	4.0	6.3	14.0	-1.8	6.5	12.6	-2.3	2.9	6.4
<i>Bloomberg US High Yield TR</i>	-11.2	5.3	7.1	14.3	-2.1	7.5	17.1	-4.5	2.5	7.4
<b>TIPS Assets</b>	<b>-12.1</b>	<b>5.8</b>	<b>10.9</b>	<b>8.4</b>	<b>-1.4</b>	<b>3.0</b>	<b>4.7</b>	<b>-1.4</b>	<b>3.6</b>	<b>-8.6</b>
<i>Bloomberg US TIPS TR</i>	-11.8	6.0	11.0	8.4	-1.3	3.0	4.7	-1.4	3.6	-8.6
SSgA TIPS Index-NL	-12.1	5.8	10.9	8.4	-1.4	3.0	4.7	-1.4	3.6	-8.6
<i>Bloomberg US TIPS TR</i>	-11.8	6.0	11.0	8.4	-1.3	3.0	4.7	-1.4	3.6	-8.6
<b>Emerging Market Debt Assets</b>	<b>-17.4</b>	<b>-2.4</b>	<b>6.2</b>	<b>16.5</b>	<b>-7.0</b>	<b>12.0</b>	<b>11.5</b>	<b>-0.8</b>	<b>--</b>	<b>--</b>
<i>JP Morgan EMBI Global Diversified</i>	-17.8	-1.8	5.3	15.0	-4.3	10.3	10.2	1.2	7.4	-5.3
Payden Emerging Market Bond	-17.4	-2.4	6.2	16.5	-7.0	12.0	11.5	-0.8	--	--
<i>JP Morgan EMBI Global Diversified</i>	-17.8	-1.8	5.3	15.0	-4.3	10.3	10.2	1.2	7.4	-5.3
<b>Open-Ended Real Estate</b>	<b>9.6</b>	<b>23.4</b>	<b>2.2</b>	<b>7.3</b>	<b>8.6</b>	<b>7.9</b>	<b>9.1</b>	<b>15.7</b>	<b>13.2</b>	<b>12.8</b>
<i>NCREIF ODCE</i>	7.5	22.2	1.2	5.3	8.3	7.6	8.8	15.1	12.5	13.9
Clarion Partners	9.6	23.4	2.2	7.3	8.6	7.9	9.1	15.7	13.2	12.8
<i>NCREIF ODCE</i>	7.5	22.2	1.2	5.3	8.3	7.6	8.8	15.1	12.5	13.9

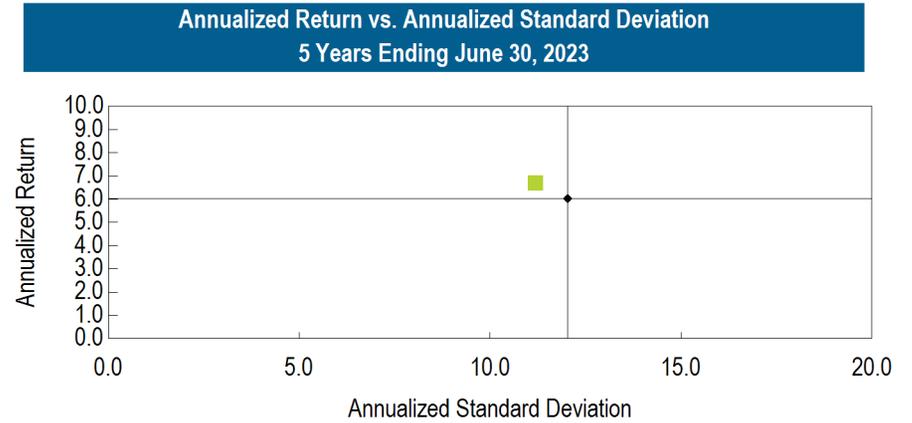
### Total Retirement System | As of June 30, 2023

	2022 (%)	2021 (%)	2020 (%)	2019 (%)	2018 (%)	2017 (%)	2016 (%)	2015 (%)	2014 (%)	2013 (%)
<b>Total Closed End Real Estate</b>	<b>10.2</b>	<b>14.3</b>	<b>-5.3</b>	<b>-38.2</b>	<b>-1.8</b>	<b>15.1</b>	<b>9.5</b>	<b>23.8</b>	<b>13.3</b>	<b>18.8</b>
Rockwood Capital Real Estate Partners Fund XI, L.P.	10.2	14.3	0.0	--	--	--	--	--	--	--
<i>NCREIF-ODCE</i>	7.5	22.2	1.2	5.3	8.3	7.6	8.8	15.0	12.5	13.9
<b>Private Equity Assets</b>	<b>10.2</b>	<b>39.5</b>	<b>22.9</b>	<b>17.7</b>	<b>10.2</b>	<b>-5.3</b>	<b>-2.8</b>	<b>8.6</b>	<b>5.5</b>	<b>9.1</b>
North American Strategic Partners 2006										
Ironsides Partnership Fund IV										
Ironsides Direct Investment Fund IV										
Ironsides Partnership Fund V, L.P.										
Ironsides Direct Investment Fund V, L.P.										
HarbourVest 2019 Global Fund										
<b>Private Debt Assets</b>	<b>10.8</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>
NB Private Debt Fund IV										
<b>Infrastructure</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>
IFM Global Infrastructure	--	--	--	--	--	--	--	--	--	--
<i>CPI + 3%</i>	9.6	10.2	4.4	5.3	5.0	5.2	5.1	3.7	3.8	4.5
<b>Cash</b>										

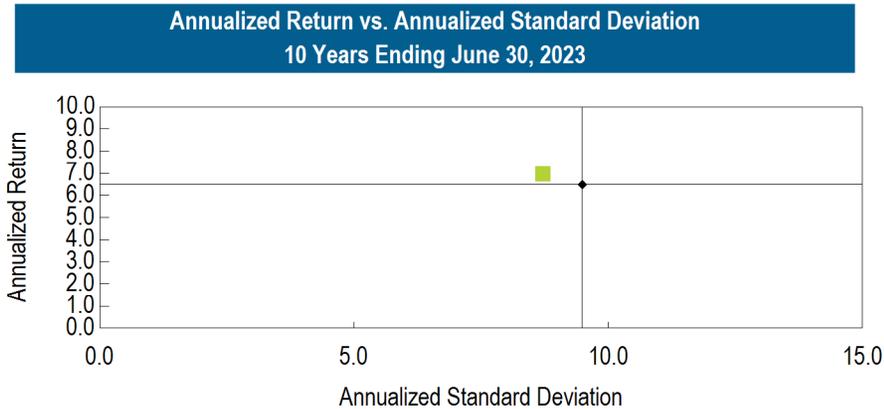
Infrastructure Aggregate returns will be shown after the first full year of performance.



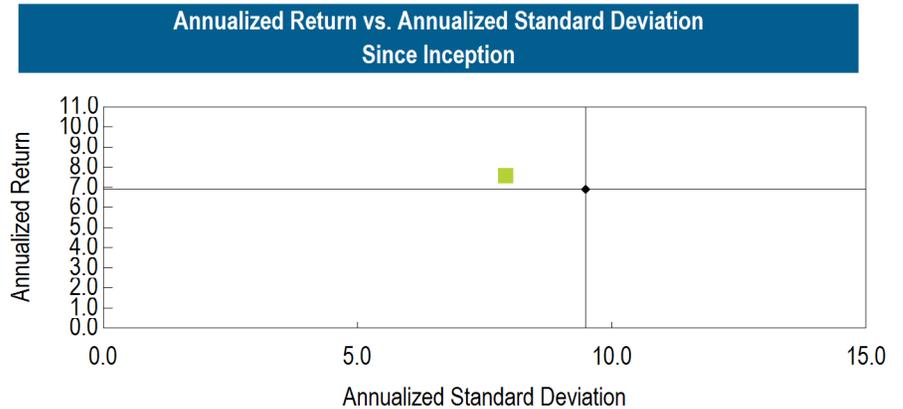
- Total Retirement System
- ◆ 60% MSCI World & 40% Barclays Aggregate



- Total Retirement System
- ◆ 60% MSCI World & 40% Barclays Aggregate

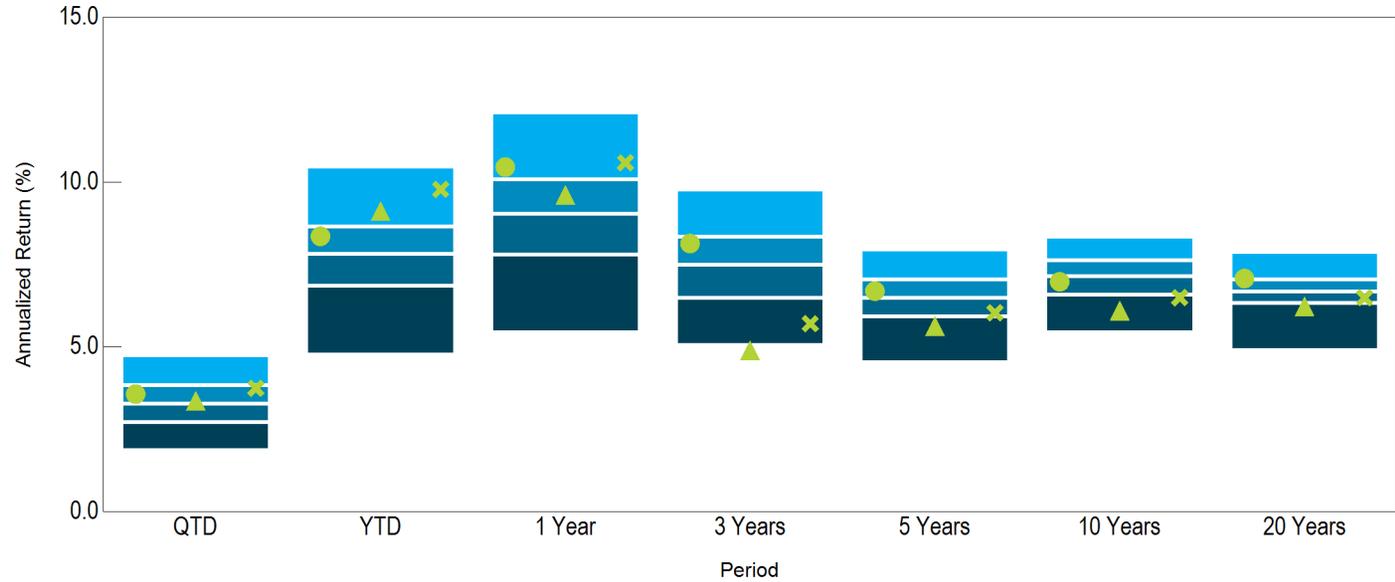


- Total Retirement System
- ◆ 60% MSCI World & 40% Barclays Aggregate



- Total Retirement System
- ◆ 60% MSCI World & 40% Barclays Aggregate

**InvMetrics Public DB \$50mm-\$250mm Net Return Comparison**  
Ending June 30, 2023



	Return (Rank)						
	QTD	YTD	1 Year	3 Years	5 Years	10 Years	20 Years
5th Percentile	4.7	10.5	12.1	9.8	7.9	8.3	7.9
25th Percentile	3.9	8.7	10.1	8.3	7.1	7.6	7.1
Median	3.3	7.8	9.0	7.5	6.5	7.2	6.7
75th Percentile	2.7	6.9	7.8	6.5	5.9	6.6	6.3
95th Percentile	1.9	4.8	5.5	5.1	4.5	5.4	4.9
# of Portfolios	153	153	153	147	142	119	54
● Total Retirement System	3.6 (37)	8.4 (36)	10.5 (17)	8.1 (31)	6.7 (41)	7.0 (62)	7.1 (25)
▲ 55% MSCI World & 45% Barclays Aggregate	3.4 (46)	9.1 (17)	9.6 (36)	4.9 (97)	5.6 (81)	6.1 (90)	6.2 (79)
✕ 60% MSCI World & 40% Barclays Aggregate	3.7 (28)	9.8 (8)	10.6 (16)	5.7 (89)	6.0 (74)	6.5 (82)	6.5 (63)

Statistics Summary

5 Years Ending June 30, 2023

	Anlzd Return	Anlzd Standard Deviation	Information Ratio	Beta	Sharpe Ratio	Tracking Error
Total Retirement System	6.7%	11.2%	0.5	1.0	0.5	2.0%
55% MSCI World & 45% Barclays Aggregate	5.6%	11.3%	--	1.0	0.4	0.0%
Equity Assets	7.7%	18.6%	-1.0	0.9	0.3	3.8%
Russell 3000	11.4%	19.4%	--	1.0	0.5	0.0%
Domestic Equity Assets	9.7%	19.9%	-0.6	1.0	0.4	2.8%
Russell 3000	11.4%	19.4%	--	1.0	0.5	0.0%
RhumbLine S&P 500 Index	12.2%	18.8%	-1.5	1.0	0.6	0.0%
S&P 500	12.3%	18.8%	--	1.0	0.6	0.0%
Frontier Capital Appreciation	8.2%	26.8%	0.1	1.1	0.2	9.3%
Russell 2500 Growth	7.0%	23.6%	--	1.0	0.2	0.0%
RhumbLine HEDI	--	--	--	--	--	--
Russell 1000 HEDI Moderate GR USD	13.5%	17.4%	--	1.0	0.7	0.0%
International Developed Markets Equity Assets	4.6%	17.7%	0.8	1.0	0.2	0.3%
MSCI EAFE	4.4%	17.8%	--	1.0	0.2	0.0%
RhumbLine MSCI EAFE Index	4.6%	17.7%	0.8	1.0	0.2	0.3%
MSCI EAFE	4.4%	17.8%	--	1.0	0.2	0.0%
International Emerging Markets Equity Assets	3.3%	18.0%	0.8	0.9	0.1	3.2%
MSCI Emerging Markets	0.9%	18.9%	--	1.0	0.0	0.0%

RhumbLine HEDI funded on 10/5/2020. Statistics will be reflected after first full five calendar years.

	Anlzd Return	Anlzd Standard Deviation	Information Ratio	Beta	Sharpe Ratio	Tracking Error
DFA Emerging Markets	3.3%	19.5%	0.6	1.0	0.1	3.9%
MSCI Emerging Markets	0.9%	18.9%	--	1.0	0.0	0.0%
Driehaus Emerging Market Equity	3.1%	17.2%	0.4	0.9	0.1	5.3%
MSCI Emerging Markets	0.9%	18.9%	--	1.0	0.0	0.0%
Investment Grade Bonds Assets	0.7%	5.5%	-0.4	1.0	-0.1	0.1%
Bloomberg US Aggregate TR	0.8%	5.5%	--	1.0	-0.1	0.0%
SSgA U.S. Aggregate Bond Index	0.7%	5.5%	-0.4	1.0	-0.1	0.1%
Bloomberg US Aggregate TR	0.8%	5.5%	--	1.0	-0.1	0.0%
High Yield Bond Assets	3.6%	8.2%	0.2	0.9	0.3	1.2%
Bloomberg US High Yield TR	3.4%	9.3%	--	1.0	0.2	0.0%
Shenkman Capital	3.6%	8.2%	0.2	0.9	0.3	1.2%
Bloomberg US High Yield TR	3.4%	9.3%	--	1.0	0.2	0.0%
TIPS Assets	2.4%	6.0%	-0.8	1.0	0.2	0.1%
Bloomberg US TIPS TR	2.5%	6.0%	--	1.0	0.2	0.0%
SSgA TIPS Index-NL	2.4%	6.0%	-0.8	1.0	0.2	0.1%
Bloomberg US TIPS TR	2.5%	6.0%	--	1.0	0.2	0.0%
Emerging Market Debt Assets	0.7%	12.8%	0.1	1.1	-0.1	2.5%
JP Morgan EMBI Global Diversified	0.6%	11.2%	--	1.0	-0.1	0.0%
Payden Emerging Market Bond	0.7%	12.8%	0.1	1.1	-0.1	2.5%
JP Morgan EMBI Global Diversified	0.6%	11.2%	--	1.0	-0.1	0.0%

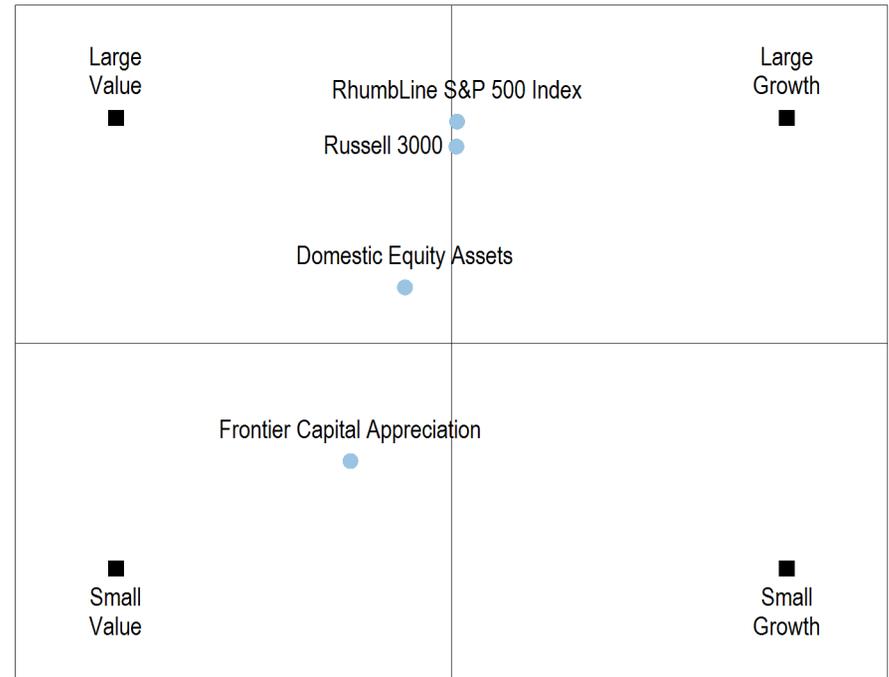
	Anlzd Return	Anlzd Standard Deviation	Information Ratio	Beta	Sharpe Ratio	Tracking Error
Open-Ended Real Estate	6.5%	8.2%	0.0	1.1	0.6	2.3%
NCREIF ODCE	6.5%	7.1%	--	1.0	0.7	0.0%
Clarion Partners	6.5%	8.2%	0.0	1.1	0.6	2.3%
NCREIF ODCE	6.5%	7.1%	--	1.0	0.7	0.0%
Total Closed End Real Estate	-7.6%	22.1%	-0.6	0.6	-0.4	21.9%
NCREIF ODCE	6.5%	7.1%	--	1.0	0.7	0.0%
Rockwood Capital Real Estate Partners Fund XI, L.P.	--	--	--	--	--	--
NCREIF-ODCE	6.5%	7.1%	--	1.0	0.7	0.0%
IFM Global Infrastructure	--	--	--	--	--	--
CPI + 3%	7.0%	1.4%	--	1.0	4.0	0.0%
EB Temporary Investment Fund	1.4%	1.2%	0.0	1.5	0.0	1.1%
91 Day T-Bills	1.5%	0.4%	--	1.0	0.0	0.0%

Rockwood Capital XI and IFM Global Infrastructure statistics will be reflected after first full five calendar years.

# Retirement System Detail

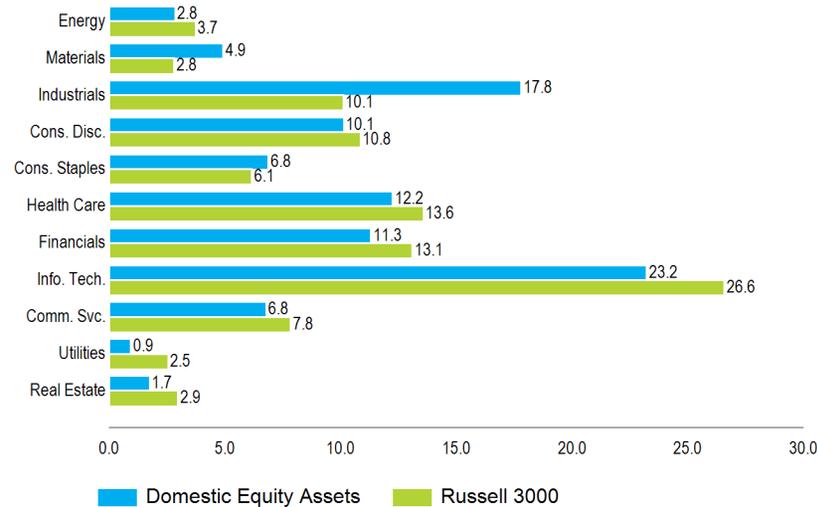
Asset Allocation on June 30, 2023		
	Actual	Actual
Frontier Capital Appreciation	\$23,698,372	32.3%
RhumbLine HEDI	\$24,793,963	33.8%
RhumbLine S&P 500 Index	\$24,836,284	33.9%
<b>Total</b>	<b>\$73,328,620</b>	<b>100.0%</b>

Domestic Equity Assets Style Map  
3 Years Ending June 30, 2023



Domestic Equity Assets Characteristics			
	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Market Value</b>			
Market Value (\$M)	73.3	--	71.3
Number Of Holdings	661	3010	663
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	428.8	591.9	363.8
Median Market Cap (\$B)	26.5	2.4	25.3
P/E Ratio	22.9	22.6	21.0
Yield	1.3	1.5	1.3
EPS Growth - 5 Yrs.	17.0	15.7	18.4
Price to Book	4.0	4.2	3.8

#### Sector Allocation (%) vs Russell 3000

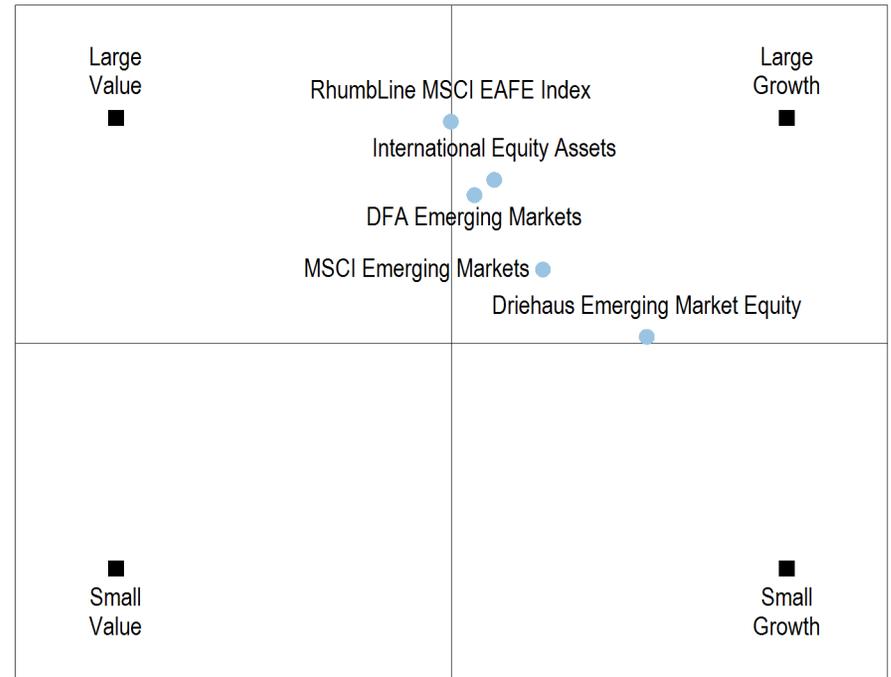


#### Top 10 Holdings

APPLE INC	4.8%
MICROSOFT CORP	4.3%
AMAZON.COM INC	1.6%
NVIDIA CORPORATION	1.4%
ALPHABET INC	1.3%
ALPHABET INC	1.2%
META PLATFORMS INC	0.9%
BERKSHIRE HATHAWAY INC	0.9%
SIRIUS XM HOLDINGS INC	0.8%
TESLA INC	0.8%
<b>Total</b>	<b>18.1%</b>

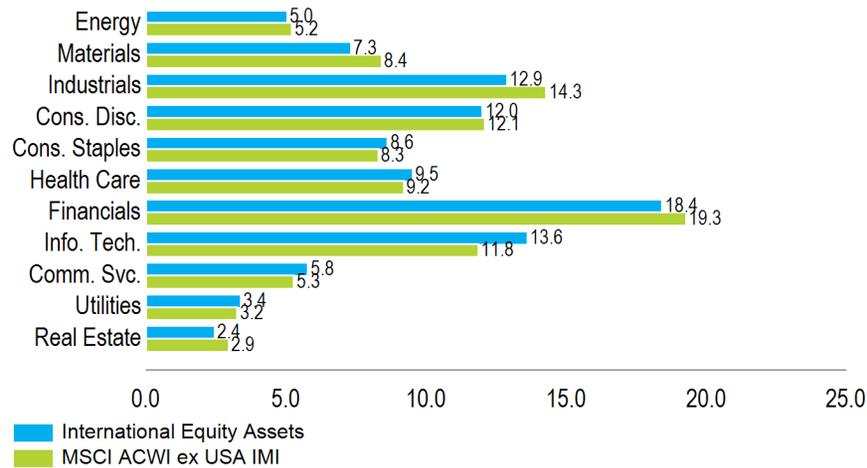
Asset Allocation on June 30, 2023		
	Actual	Actual
DFA Emerging Markets	\$10,207,279	22.2%
Driehaus Emerging Market Equity	\$8,974,118	19.5%
RhumbLine MSCI EAFE Index	\$26,883,675	58.4%
<b>Total</b>	<b>\$46,065,072</b>	<b>100.0%</b>

International Equity Assets Style Map  
3 Years Ending June 30, 2023



International Equity Characteristics			
	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Market Value</b>			
Market Value (\$M)	46.1	--	44.8
Number Of Holdings	7286	6702	7303
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	93.6	78.8	94.2
Median Market Cap (\$B)	0.7	1.6	0.7
P/E Ratio	13.1	13.7	12.9
Yield	3.3	3.3	3.3
EPS Growth - 5 Yrs.	11.3	10.0	10.8
Price to Book	2.5	2.4	2.5

Sector Allocation (%) vs MSCI ACWI ex USA IMI



Top 10 Holdings

SAMSUNG ELECTRONICS CO LTD	1.9%
TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	1.5%
TENCENT HOLDINGS LTD	1.5%
NESTLE SA, CHAM UND VEVEY	1.3%
ASML HOLDING NV	1.1%
NOVO NORDISK 'B'	1.0%
LVMH MOET HENNESSY LOUIS VUITTON SE	1.0%
ASTRAZENECA PLC	0.8%
ROCHE HOLDING AG	0.8%
TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	0.8%
<b>Total</b>	<b>11.7%</b>

Country Allocation Report

As of 6/30/2023

Region	% of Total	% of Bench	% Diff
North America ex U.S.	0.4%	7.5%	-7.2%
United States	0.9%	0.0%	0.9%
Europe Ex U.K.	32.5%	31.7%	0.8%
United Kingdom	7.1%	9.6%	-2.5%
Pacific Basin Ex Japan	8.8%	7.7%	1.1%
Japan	13.3%	15.3%	-2.0%
Emerging Markets	36.1%	27.4%	8.7%
Other	0.9%	0.8%	0.1%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>0.0%</b>

International Equity Country Allocation				
vs MSCI ACWI ex USA IMI				
Country	% of Total	% of Bench	% Diff	
ARGENTINA	0.2%	0.0%	0.2%	
AUSTRALIA	4.1%	5.0%	-0.9%	
AUSTRIA	0.1%	0.2%	-0.1%	
BAHRAIN	0.0%	0.0%	0.0%	
BANGLADESH	0.0%	0.0%	0.0%	
BELGIUM	0.5%	0.6%	-0.2%	
BRAZIL	2.6%	1.5%	1.0%	
CANADA	0.4%	7.5%	-7.2%	
CHILE	0.1%	0.2%	0.0%	
CHINA	7.4%	7.4%	0.0%	
COLOMBIA	0.0%	0.0%	0.0%	
CROATIA	0.0%	0.0%	0.0%	
CZECH REPUBLIC	0.0%	0.0%	0.0%	
DENMARK	1.8%	1.9%	-0.1%	
EGYPT	0.0%	0.0%	0.0%	
ESTONIA	0.0%	0.0%	0.0%	
FINLAND	0.6%	0.6%	0.0%	
FRANCE	6.8%	7.3%	-0.5%	
GERMANY	4.9%	5.3%	-0.3%	
GREECE	0.3%	0.1%	0.2%	
HONG KONG	3.7%	1.6%	2.1%	
HUNGARY	0.0%	0.1%	0.0%	
INDIA	7.3%	4.4%	2.9%	
INDONESIA	1.0%	0.6%	0.5%	

### International Equity Assets | As of June 30, 2023

Country	% of Total	% of Bench	% Diff
IRELAND	0.7%	0.5%	0.2%
ISRAEL	0.3%	0.6%	-0.3%
ITALY	1.5%	1.7%	-0.3%
JAPAN	13.3%	15.3%	-2.0%
JORDAN	0.0%	0.0%	0.0%
KAZAKHSTAN	0.0%	0.0%	0.0%
KENYA	0.0%	0.0%	0.0%
KOREA	4.4%	3.5%	0.9%
KUWAIT	0.0%	0.2%	-0.2%
LEBANON	0.0%	0.0%	0.0%
LITHUANIA	0.0%	0.0%	0.0%
LUXEMBOURG	0.4%	0.0%	0.4%
MALAYSIA	0.3%	0.4%	-0.1%
MAURITIUS	0.0%	0.0%	0.0%
MEXICO	1.5%	0.8%	0.8%
MOROCCO	0.0%	0.0%	0.0%
NETHERLANDS	4.7%	2.8%	1.9%
NEW ZEALAND	0.2%	0.2%	0.0%
NIGERIA	0.0%	0.0%	0.0%
NORWAY	0.4%	0.6%	-0.2%
OMAN	0.0%	0.0%	0.0%
OTHER	0.4%	0.0%	0.4%
PAKISTAN	0.0%	0.0%	0.0%
PERU	0.1%	0.1%	0.1%
PHILIPPINES	0.3%	0.2%	0.1%
POLAND	0.3%	0.2%	0.1%
PORTUGAL	0.1%	0.1%	0.0%

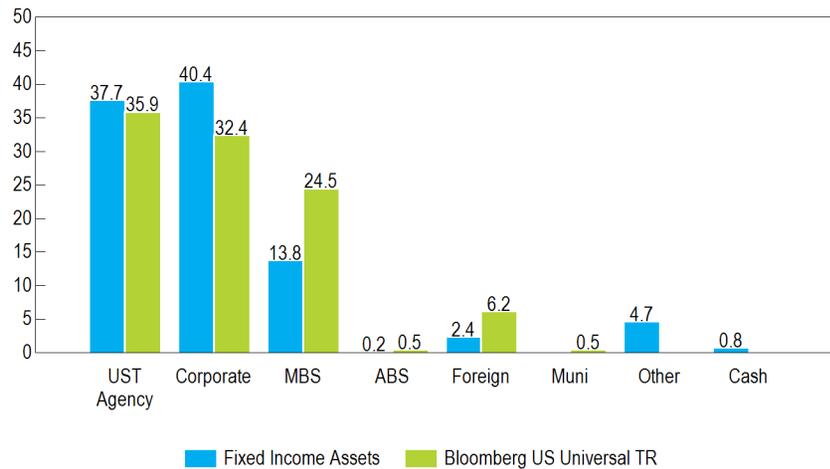
### International Equity Assets | As of June 30, 2023

Country	% of Total	% of Bench	% Diff
QATAR	0.2%	0.2%	0.0%
ROMANIA	0.0%	0.0%	0.0%
SAUDI ARABIA	1.3%	1.2%	0.1%
SERBIA	0.0%	0.0%	0.0%
SINGAPORE	0.9%	1.0%	-0.1%
SLOVENIA	0.0%	0.0%	0.0%
SOUTH AFRICA	0.8%	0.9%	-0.1%
SPAIN	1.7%	1.6%	0.1%
SRI LANKA	0.0%	0.0%	0.0%
SWEDEN	1.8%	2.3%	-0.5%
SWITZERLAND	6.2%	6.0%	0.2%
TAIWAN	6.4%	4.6%	1.8%
THAILAND	0.7%	0.6%	0.1%
TUNISIA	0.0%	0.0%	0.0%
TURKEY	0.3%	0.2%	0.1%
UNITED ARAB EMIRATES	0.7%	0.3%	0.4%
UNITED KINGDOM	7.1%	9.6%	-2.5%
UNITED STATES	0.9%	0.0%	0.9%
VIETNAM	0.0%	0.0%	0.0%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>0.0%</b>

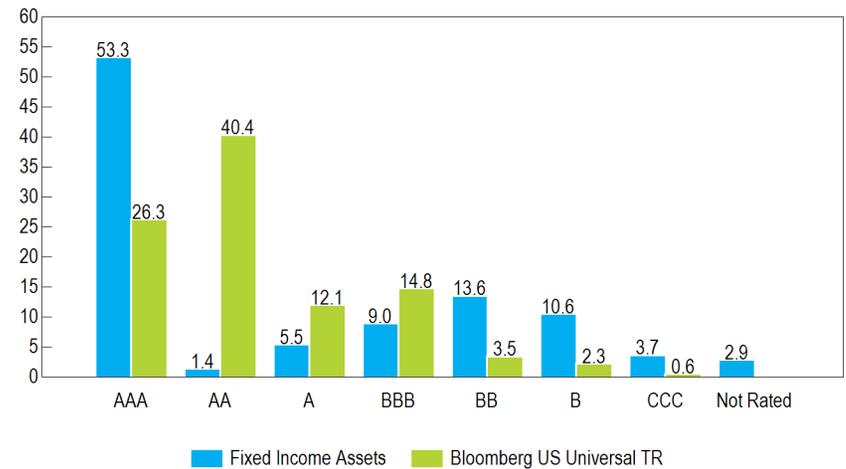
Asset Allocation on June 30, 2023		
	Actual	Actual
Payden Emerging Market Bond	\$5,012,165	8.7%
Shenkman Capital	\$17,917,421	31.0%
SSgA TIPS Index-NL	\$9,497,411	16.4%
SSgA U.S. Aggregate Bond Index	\$25,325,395	43.9%
<b>Total</b>	<b>\$57,752,392</b>	<b>100.0%</b>

Fixed Income Characteristics vs. Bloomberg US Universal TR			
	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
Fixed Income Characteristics			
Yield to Maturity	6.2	5.2	5.8
Average Duration	5.1	6.1	5.2
Average Quality	A	AA	A
Weighted Average Maturity	7.6	8.3	7.6

#### Sector Allocation



#### Credit Quality Allocation



# Portfolio Reviews

### RhumbLine S&P 500 Index | As of June 30, 2023

#### Account Information

Account Name	RhumbLine S&P 500 Index
Account Structure	Commingled Fund
Investment Style	Passive
Inception Date	3/01/99
Account Type	US Equity
Benchmark	S&P 500
Universe	eV US Passive S&P 500 Equity Net

#### Portfolio Performance Summary

	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
RhumbLine S&P 500 Index	8.7	19.6	14.5	12.2	12.8	7.4	Mar-99
S&P 500	8.7	19.6	14.6	12.3	12.9	7.4	Mar-99

#### Top 10 Holdings

APPLE INC	7.7%
MICROSOFT CORP	6.8%
AMAZON.COM INC	3.1%
NVIDIA CORPORATION	2.8%
ALPHABET INC	1.9%
TESLA INC	1.9%
META PLATFORMS INC	1.7%
ALPHABET INC	1.7%
BERKSHIRE HATHAWAY INC	1.6%
UNITEDHEALTH GROUP INC	1.2%
<b>Total</b>	<b>30.3%</b>

#### RhumbLine S&P 500 Index Equity Characteristics

vs S&P 500	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Market Value</b>			
Market Value (\$M)	24.8	--	22.8
Number Of Holdings	503	503	504
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	673.4	676.7	536.5
Median Market Cap (\$B)	31.3	31.1	30.6
P/E Ratio	23.8	24.1	21.1
Yield	1.6	1.5	1.7
EPS Growth - 5 Yrs.	16.2	16.0	18.3
Price to Book	4.5	4.5	4.2
<b>Sector Distribution</b>			
Energy	4.1	4.0	4.6
Materials	2.5	2.4	2.6
Industrials	8.5	8.5	8.6
Consumer Discretionary	10.6	11.0	10.1
Consumer Staples	6.6	7.2	7.2
Health Care	13.2	13.1	14.0
Financials	12.9	12.6	13.4
Information Technology	28.1	27.8	25.9
Communication Services	8.3	8.5	8.1
Utilities	2.5	2.5	2.8
Real Estate	2.4	2.3	2.5

Account Information	
Account Name	RhumbLine HEDI
Account Structure	Separate Account
Investment Style	Passive
Inception Date	11/01/20
Account Type	US Equity
Benchmark	Russell 1000 HEDI Moderate GR USD
Universe	eV US Large Cap Core Equity Gross

Portfolio Performance Summary							
	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
RhumbLine HEDI	8.1	19.2	--	--	--	13.0	Nov-20
<i>Russell 1000 HEDI Moderate GR USD</i>	<i>8.1</i>	<i>19.3</i>	<i>14.1</i>	<i>13.5</i>	<i>13.8</i>	<i>13.1</i>	<i>Nov-20</i>

Top 10 Holdings	
APPLE INC	6.5%
MICROSOFT CORP	5.9%
SIRIUS XM HOLDINGS INC	2.4%
ALPHABET INC	2.0%
ALPHABET INC	1.8%
BROWN-FORMAN CORP	1.8%
AMAZON.COM INC	1.7%
ORACLE CORP	1.6%
WALMART INC	1.4%
ROLLINS INC	1.3%
<b>Total</b>	<b>26.4%</b>

Rhumbline HEDI Characteristics		
	Portfolio Q2-23	Portfolio Q1-23
<b>Market Value</b>		
Market Value (\$M)	24.8	26.9
Number Of Holdings	222	229
<b>Characteristics</b>		
Weighted Avg. Market Cap. (\$B)	549.1	473.1
Median Market Cap (\$B)	37.2	37.0
P/E Ratio	26.0	24.2
Yield	1.5	1.5
EPS Growth - 5 Yrs.	15.3	16.7
Price to Book	5.3	4.9
<b>Sector Distribution</b>		
Energy	1.0	0.9
Materials	2.5	2.6
Industrials	18.0	17.9
Consumer Discretionary	8.8	9.0
Consumer Staples	13.0	11.8
Health Care	11.3	12.0
Financials	12.4	14.3
Information Technology	22.5	22.7
Communication Services	8.9	7.2
Utilities	0.2	0.3
Real Estate	1.4	1.3

Russell 1000 HEDI benchmark characteristic data is unavailable.

## Frontier Capital Appreciation | As of June 30, 2023

### Account Information

Account Name	Frontier Capital Appreciation
Account Structure	Commingled Fund
Investment Style	Active
Inception Date	2/01/13
Account Type	US Equity
Benchmark	Russell 2500 Growth
Universe	eV US Small-Mid Cap Growth Equity Net

### Portfolio Performance Summary

	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Frontier Capital Appreciation	10.1	25.4	16.8	8.2	10.4	11.1	Feb-13
<i>Russell 2500 Growth</i>	<i>6.4</i>	<i>18.6</i>	<i>6.6</i>	<i>7.0</i>	<i>10.4</i>	<i>10.8</i>	<i>Feb-13</i>

### Top 10 Holdings

AZUL SA	2.1%
ATI INC	2.1%
BUILDERS FIRSTSOURCE INC	2.1%
JABIL INC	2.0%
ARRAY TECHNOLOGIES INC COM	1.8%
BEACON ROOFING SUPPLY INC	1.7%
MRC GLOBAL INC	1.6%
EAGLE MATERIALS INC	1.6%
CARPENTER TECHNOLOGY CORP	1.5%
WOLFSPEED INC	1.5%
<b>Total</b>	<b>18.1%</b>

### Frontier Capital Appreciation Characteristics

	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Market Value</b>			
Market Value (\$M)	23.7	--	21.5
Number Of Holdings	136	1281	139
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	8.4	6.0	7.7
Median Market Cap (\$B)	4.9	1.7	4.3
P/E Ratio	18.9	22.9	17.4
Yield	0.6	0.7	0.7
EPS Growth - 5 Yrs.	22.1	19.1	22.1
Price to Book	2.9	4.9	2.6
<b>Sector Distribution</b>			
Energy	3.4	3.9	3.6
Materials	10.0	3.7	9.8
Industrials	27.3	19.2	27.6
Consumer Discretionary	11.0	12.9	13.5
Consumer Staples	0.5	3.6	0.0
Health Care	12.1	22.6	12.3
Financials	8.3	8.2	8.6
Information Technology	18.7	20.9	18.2
Communication Services	2.7	2.2	2.3
Utilities	0.0	1.1	0.0
Real Estate	1.4	1.5	1.5

Account Information	
Account Name	RhumbLine MSCI EAFE Index
Account Structure	Commingled Fund
Investment Style	Passive
Inception Date	8/01/14
Account Type	Non-US Stock Developed
Benchmark	MSCI EAFE
Universe	eV EAFE All Cap Equity Net

Rhumbline MSCI EAFE Index Characteristics			
	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Market Value</b>			
Market Value (\$M)	26.9	--	26.1
Number Of Holdings	781	798	785
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	87.8	86.8	86.1
Median Market Cap (\$B)	12.3	12.4	12.4
P/E Ratio	14.9	14.8	14.7
Yield	3.2	3.3	3.2
EPS Growth - 5 Yrs.	8.7	8.7	8.3
Price to Book	2.5	2.5	2.6

Portfolio Performance Summary							
	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
RhumbLine MSCI EAFE Index	3.1	18.8	9.1	4.6	--	4.0	Aug-14
MSCI EAFE	3.0	18.8	8.9	4.4	5.4	3.8	Aug-14

Sector Distribution			
Energy	4.2	4.2	4.5
Materials	7.3	7.4	7.7
Industrials	16.2	16.3	15.5
Consumer Discretionary	12.7	12.6	12.1
Consumer Staples	9.8	10.1	10.2
Health Care	13.2	13.2	13.1
Financials	18.3	18.2	18.0
Information Technology	8.1	8.2	7.8
Communication Services	4.2	4.1	4.5
Utilities	3.5	3.5	3.4
Real Estate	2.3	2.3	2.4

Top 10 Holdings	
NESTLE SA, CHAM UND VEVEY	2.1%
ASML HOLDING NV	1.9%
NOVO NORDISK 'B'	1.7%
LVMH MOET HENNESSY LOUIS VUITTON SE	1.7%
ASTRAZENECA PLC	1.4%
ROCHE HOLDING AG	1.4%
NOVARTIS AG	1.3%
SHELL PLC	1.3%
TOYOTA MOTOR CORP	1.1%
HSBC HOLDINGS PLC	1.0%
<b>Total</b>	<b>15.0%</b>

DFA Emerging Markets | As of June 30, 2023

Account Information	
Account Name	DFA Emerging Markets
Account Structure	Mutual Fund
Investment Style	Active
Inception Date	1/01/15
Account Type	Non-US Stock Emerging
Benchmark	MSCI Emerging Markets
Universe	eV Emg Mkts All Cap Equity Net

Portfolio Performance Summary							
	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
DFA Emerging Markets	2.9	7.1	8.1	3.3	--	4.1	Jan-15
MSCI Emerging Markets	0.9	1.7	2.3	0.9	3.0	2.8	Jan-15

Top 10 Holdings	
SAMSUNG ELECTRONICS CO LTD	3.3%
TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	3.1%
TENCENT HOLDINGS LTD	2.5%
TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	1.3%
ALIBABA GROUP HOLDING LTD	1.0%
CHINA CONSTRUCTION BANK CORP	0.8%
SK HYNIX INC	0.8%
ALIBABA GROUP HOLDING LTD	0.7%
RELIANCE INDUSTRIES LTD	0.6%
PETROLEO BRASILEIRO S.A. - PETROBRAS	0.6%
<b>Total</b>	<b>14.8%</b>

DFA Emerging Markets Characteristics			
	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Market Value</b>			
Market Value (\$M)	10.2	--	9.9
Number Of Holdings	6483	1421	6496
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	71.3	111.9	70.6
Median Market Cap (\$B)	0.5	6.7	0.5
P/E Ratio	10.8	12.2	10.3
Yield	3.9	3.4	4.2
EPS Growth - 5 Yrs.	14.0	13.5	13.8
Price to Book	2.2	2.4	2.2
<b>Sector Distribution</b>			
Energy	5.2	5.0	5.0
Materials	11.8	8.1	12.5
Industrials	9.7	6.3	9.4
Consumer Discretionary	11.3	13.2	11.5
Consumer Staples	6.2	6.4	6.3
Health Care	4.3	3.8	4.3
Financials	16.9	21.9	16.2
Information Technology	20.8	21.2	20.6
Communication Services	7.2	9.8	7.6
Utilities	3.0	2.6	2.9
Real Estate	2.9	1.7	3.1

**Account Information**

Account Name	<b>Driehaus Emerging Market Equity</b>
Account Structure	<b>Commingled Fund</b>
Investment Style	<b>Active</b>
Inception Date	<b>1/01/15</b>
Account Type	<b>Non-US Stock Emerging</b>
Benchmark	<b>MSCI Emerging Markets</b>
Universe	<b>eV Emg Mkts All Cap Equity Net</b>

**Portfolio Performance Summary**

	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Driehaus Emerging Market Equity	2.2	1.8	2.5	3.1	--	4.9	Jan-15
MSCI Emerging Markets	0.9	1.7	2.3	0.9	3.0	2.8	Jan-15

**Top 10 Holdings**

TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	6.4%
SAMSUNG ELECTRONICS CO LTD	5.9%
TENCENT HOLDINGS LTD	5.0%
NORTHERN INSTITUTIONAL U.S. GOVERNMENT SELECT PORTFOLIO	3.7%
ICICI BANK LTD	2.3%
INDUSTRIAL AND COMMERCIAL BANK OF CHINA LIMITED	2.1%
BANCO DO BRASIL ON	2.0%
PT BANK MANDIRI (PERSERO) TBK	1.8%
GALAXY ENTERTAINMENT GROUP LTD	1.7%
RELIANCE INDUSTRIES LTD	1.7%
<b>Total</b>	<b>32.6%</b>

**Driehaus Emerging Market Equity Characteristics**

	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Market Value</b>			
Market Value (\$M)	9.0	--	8.8
Number Of Holdings	114	1421	104
<b>Characteristics</b>			
Weighted Avg. Market Cap. (\$B)	136.8	111.9	148.9
Median Market Cap (\$B)	17.1	6.7	20.8
P/E Ratio	12.8	12.2	13.2
Yield	2.9	3.4	2.5
EPS Growth - 5 Yrs.	16.5	13.5	15.1
Price to Book	2.6	2.4	2.7
<b>Sector Distribution</b>			
Energy	7.3	5.0	5.7
Materials	2.0	8.1	2.1
Industrials	6.5	6.3	7.1
Consumer Discretionary	10.8	13.2	12.5
Consumer Staples	7.9	6.4	6.6
Health Care	4.5	3.8	5.2
Financials	20.6	21.9	18.2
Information Technology	21.9	21.2	21.8
Communication Services	8.9	9.8	9.5
Utilities	3.5	2.6	3.3
Real Estate	2.4	1.7	3.4

#### Account Information

Account Name	<b>SSgA U.S. Aggregate Bond Index</b>
Account Structure	<b>Commingled Fund</b>
Investment Style	<b>Passive</b>
Inception Date	<b>5/01/01</b>
Account Type	<b>US Fixed Income Investment Grade</b>
Benchmark	<b>Bloomberg US Aggregate TR</b>
Universe	<b>eV US Core Fixed Inc Net</b>

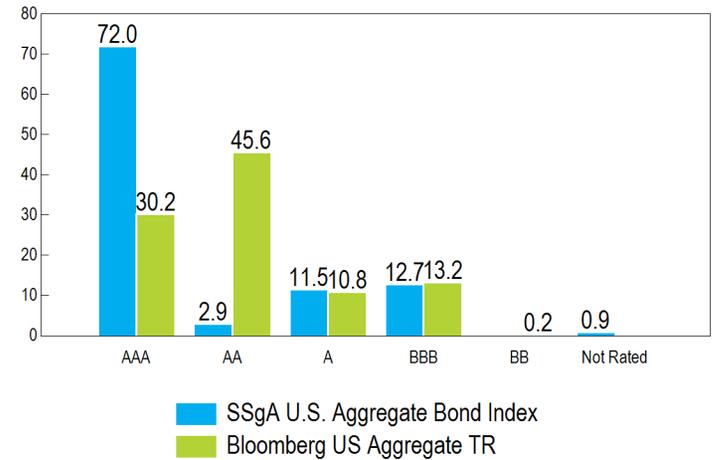
#### Portfolio Performance Summary

	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
SSgA U.S. Aggregate Bond Index	-0.9	-1.0	-4.0	0.7	1.5	3.6	May-01
Bloomberg US Aggregate TR	-0.8	-0.9	-4.0	0.8	1.5	3.6	May-01

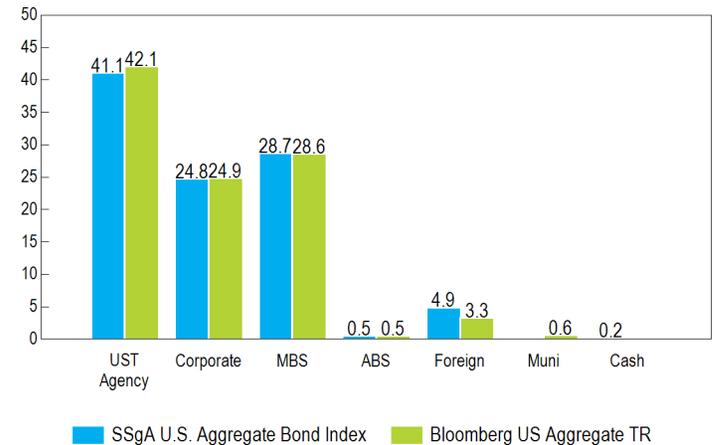
#### SSgA U.S. Aggregate Bond Index Characteristics vs. Bloomberg US Aggregate TR

	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Fixed Income Characteristics</b>			
Yield to Maturity	4.8	4.8	4.4
Average Duration	6.3	6.3	6.3
Average Quality	AA	AA	AA
Weighted Average Maturity	8.8	8.6	8.6

#### Credit Quality Allocation



#### Sector Allocation



#### Account Information

Account Name	<b>Shenkman Capital</b>
Account Structure	<b>Commingled Fund</b>
Investment Style	<b>Active</b>
Inception Date	<b>4/01/06</b>
Account Type	<b>US Fixed Income High Yield</b>
Benchmark	<b>Bloomberg US High Yield TR</b>
Universe	<b>eV US High Yield Fixed Inc Net</b>

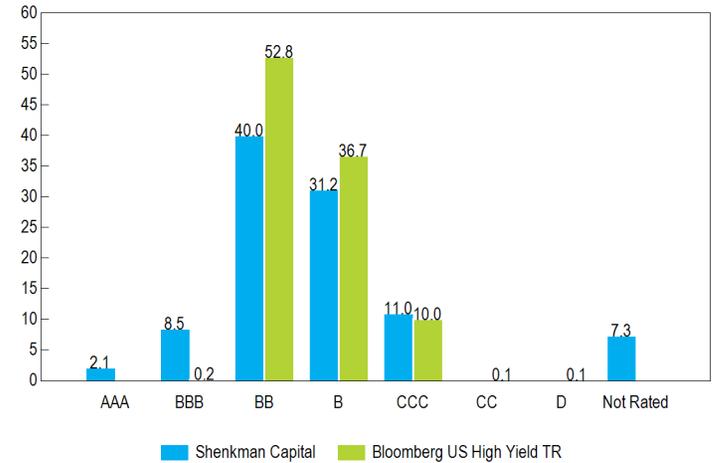
#### Portfolio Performance Summary

	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Shenkman Capital	1.9	9.5	3.3	3.6	4.3	5.8	Apr-06
Bloomberg US High Yield TR	1.7	9.1	3.1	3.4	4.4	6.2	Apr-06

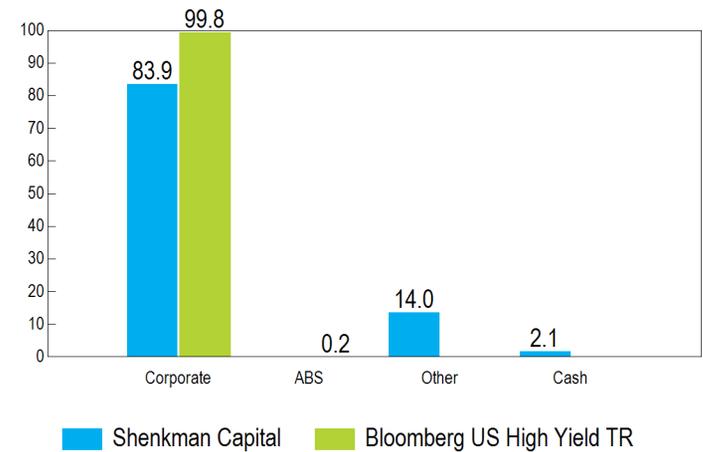
#### Shenkman Capital Characteristics vs. Bloomberg US High Yield TR

	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Fixed Income Characteristics</b>			
Yield to Maturity	8.0	8.5	8.0
Average Duration	3.3	4.1	3.3
Average Quality	BB	B	BB
Weighted Average Maturity	4.9	5.1	5.1

#### Credit Quality Allocation



#### Sector Allocation



### SSgA TIPS Index-NL | As of June 30, 2023

#### Account Information

Account Name	<b>SSgA TIPS Index-NL</b>
Account Structure	<b>Commingled Fund</b>
Investment Style	<b>Passive</b>
Inception Date	<b>10/01/05</b>
Account Type	<b>US Inflation Protected Fixed</b>
Benchmark	<b>Bloomberg US TIPS TR</b>
Universe	<b>eV US TIPS / Inflation Fixed Inc Net</b>

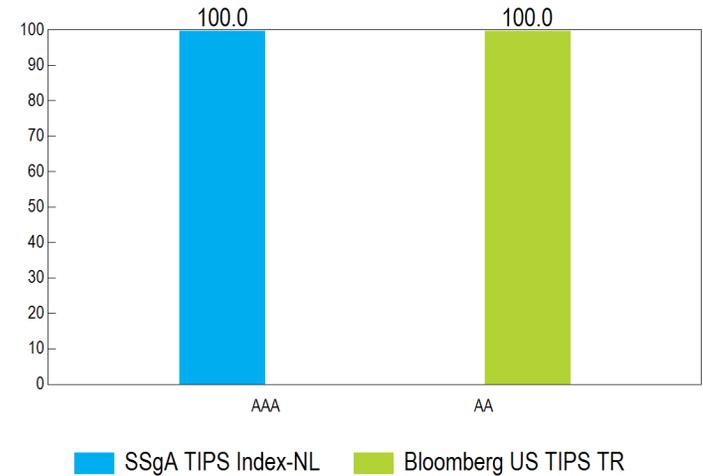
#### Portfolio Performance Summary

	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
SSgA TIPS Index-NL	-1.4	-1.5	-0.2	2.4	2.0	3.3	Oct-05
Bloomberg US TIPS TR	-1.4	-1.4	-0.1	2.5	2.1	3.3	Oct-05

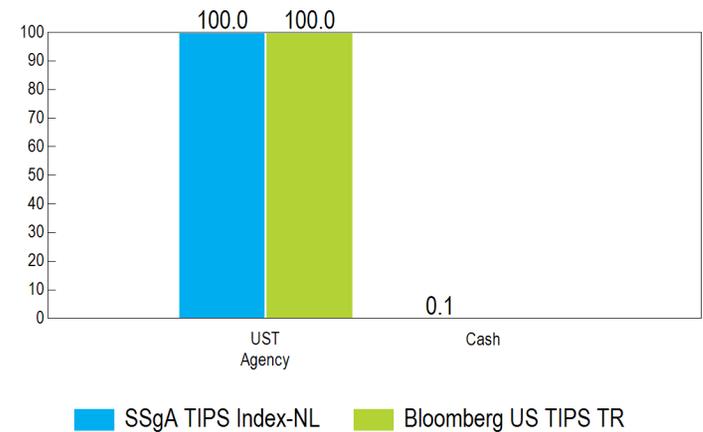
#### SSgA TIPS Index-NL Characteristics vs. Bloomberg US TIPS TR

	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
<b>Fixed Income Characteristics</b>			
Yield to Maturity	4.6	4.3	4.0
Average Duration	4.5	6.7	5.1
Average Quality	AAA	AA	AAA
Weighted Average Maturity	7.2	7.2	7.4

#### Credit Quality Allocation



#### Sector Allocation



### Account Information

Account Name	Payden Emerging Market Bond
Account Structure	Mutual Fund
Investment Style	Active
Inception Date	1/01/15
Account Type	International Emerging Market Debt
Benchmark	JP Morgan EMBI Global Diversified
Universe	

### Portfolio Performance Summary

	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Payden Emerging Market Bond	3.0	9.8	-2.2	0.7	--	2.2	Jan-15
JP Morgan EMBI Global Diversified	2.2	7.4	-3.1	0.6	2.8	2.1	Jan-15

### Fund Characteristics as of April 30, 2023

Versus JP Morgan EMBI Global Diversified

Sharpe Ratio (3 Year)	-0.1
Average Duration	6.9
Average Coupon	5.7%
Average Effective Maturity	11.9
R-Squared (3 Year)	1.0
Alpha (3 Year)	0.1%
Beta (3 Year)	1.1

### Payden Emerging Market Bond Characteristics vs. JP Morgan EMBI Global Diversified

	Portfolio Q2-23	Index Q2-23	Portfolio Q1-23
Fixed Income Characteristics			
Yield to Maturity	9.7	7.9	9.3
Average Duration	6.9	6.8	6.8
Average Quality	BB	BB	BB
Weighted Average Maturity	11.9	11.7	11.6

### Fixed Income Sectors as of April 30, 2023

GOVERNMENT	68.1%
MUNICIPAL	0.0%
CORPORATE	11.8%
SECURITIZED	0.2%
CASH & EQUIVALENTS	3.0%
DERIVATIVE	16.8%

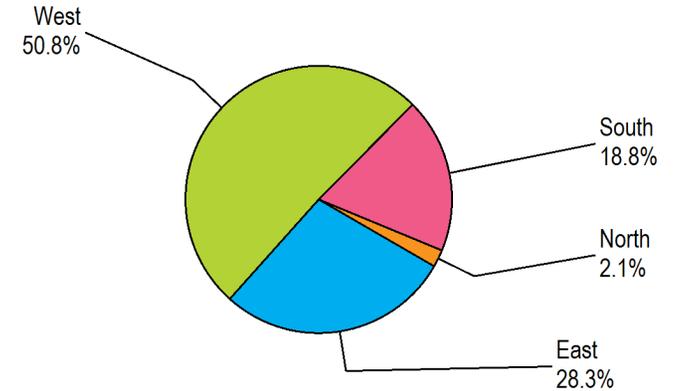
### Credit Quality as of June 30, 2023

AAA	4.0%
AA	4.0%
A	7.0%
BBB	32.0%
BB	28.0%
B	15.0%
Below B	9.0%
Not Rated	1.0%

#### Account Information

Account Name	<b>Clarion Partners</b>
Account Structure	<b>Commingled Fund</b>
Investment Style	<b>Active</b>
Inception Date	<b>10/01/02</b>
Account Type	<b>Real Estate</b>
Benchmark	<b>NCREIF ODCE</b>
Universe	

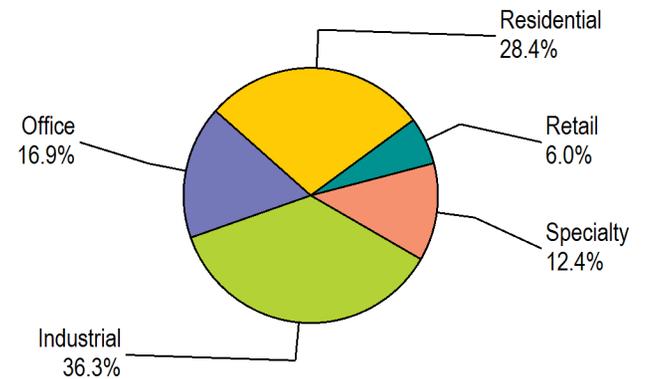
#### Geographic Diversification



#### Portfolio Performance Summary

	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Clarion Partners	-5.9	-14.8	7.5	6.5	8.9	7.2	Oct-02
NCREIF ODCE	-2.7	-10.0	8.0	6.5	8.8	7.9	Oct-02

#### Property Type Allocation

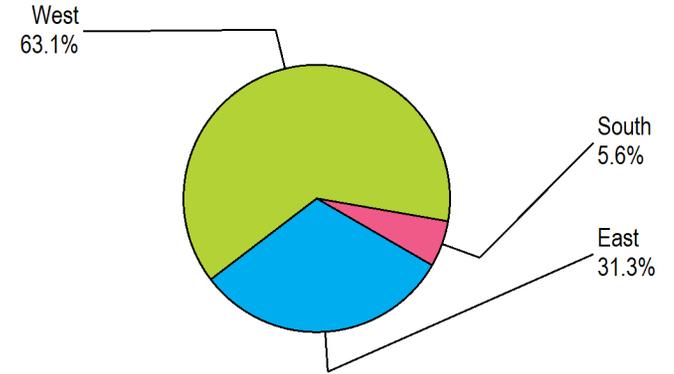


Clarion Partners characteristics are as of 6/30/2023.

#### Account Information

Account Name	Rockwood Capital Real Estate Partners Fund XI, L.P.
Account Structure	Other
Investment Style	Passive
Inception Date	12/01/19
Account Type	Real Estate
Benchmark	NCREIF-ODCE
Universe	

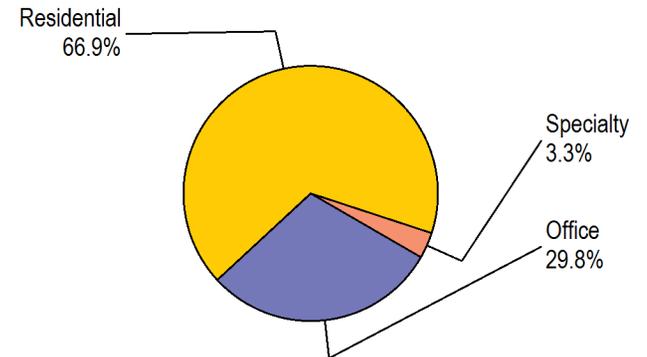
#### Geographic Diversification



#### Portfolio Performance Summary

	QTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Inception (%)	Inception Date
Rockwood Capital Real Estate Partners Fund XI, L.P.	-2.2	-1.5	6.5	--	--	5.4	Dec-19
NCREIF-ODCE	-2.7	-10.0	8.0	6.5	8.7	6.9	Dec-19

#### Property Type Allocation



Rockwood Real Estate characteristics are as of 3/31/2023.

#### Non-Marketable Securities Overview

As of June 30, 2023

Account	Vintage Year	Commitment	Cumulative Takedown	Cumulative Distributions	Value (RV)	IRR (%)
North American Strategic Partners 2006	2006	\$4,539,998	\$4,411,659	\$2,094,251	\$14,091	6.4
Ironsides Partnership Fund IV	2015	\$2,500,000	\$1,544,324	\$1,609,619	\$2,511,231	30.5
Ironsides Direct Investment Fund IV	2015	\$2,500,000	\$2,419,534	\$3,126,965	\$1,411,709	23.5
Ironsides Partnership Fund V, L.P.	2019	\$2,000,000	\$1,461,799	\$0	\$2,068,044	27.9
Ironsides Direct Investment Fund V, L.P.	2019	\$2,000,000	\$2,538,377	\$436,888	\$3,112,034	35.6
HarbourVest 2019 Global Fund	2019	\$4,000,000	\$2,728,386	\$564,538	\$3,622,962	28.2
<b>Total Account</b>		<b>\$17,539,998</b>	<b>\$15,104,078</b>	<b>\$3,643,758</b>	<b>\$12,740,071</b>	

IRRs are as of 3/31/2023. Exceptions include North American Strategic Partners 2006 which is as of 12/31/2022.

Non-Marketable Securities Overview							
As of June 30, 2023							
Account Type	Account	Vintage Year	Commitment	Cumulative Takedown	Cumulative Distributions	Value (RV)	IRR (%)
Private Debt	NB Private Debt Fund IV	2021	\$5,000,000	\$3,750,000	\$1,097,566	\$3,045,757	--
	<b>Total Account</b>		<b>\$5,000,000</b>	<b>\$3,750,000</b>	<b>\$1,097,566</b>	<b>\$3,045,757</b>	

IRRs for investments less than 2 years are not shown.

Annual Investment Expense Analysis As Of June 30, 2023				
Name	Fee Schedule	Market Value	Estimated Fee Value	Estimated Fee
<b>Equity Assets</b>		<b>\$119,393,692</b>		
<b>Domestic Equity Assets</b>		<b>\$73,328,620</b>		
RhumbLine S&P 500 Index	0.07% of First 25.0 Mil, 0.05% of Next 25.0 Mil, 0.04% Thereafter	\$24,836,284	\$17,385	0.07%
Frontier Capital Appreciation	0.79% of Assets	\$23,698,372	\$187,217	0.79%
RhumbLine HEDI	0.05% of Assets	\$24,793,963	\$12,397	0.05%
<b>International Equity Assets</b>		<b>\$46,065,072</b>		
<b>International Developed Markets Equity Assets</b>		<b>\$26,883,675</b>		
RhumbLine MSCI EAFE Index	0.08% of First 25.0 Mil, 0.07% of Next 25.0 Mil, 0.05% Thereafter	\$26,883,675	\$21,319	0.08%
<b>International Emerging Markets Equity Assets</b>		<b>\$19,181,397</b>		
DFA Emerging Markets	0.39% of Assets	\$10,207,279	\$39,808	0.39%
Driehaus Emerging Market Equity	0.90% of Assets	\$8,974,118	\$80,767	0.90%
<b>Fixed Income Assets</b>		<b>\$57,752,392</b>		
<b>Investment Grade Bonds Assets</b>		<b>\$25,325,395</b>		
SSgA U.S. Aggregate Bond Index	0.04% of Assets	\$25,325,395	\$10,130	0.04%
<b>High Yield Bond Assets</b>		<b>\$17,917,421</b>		
Shenkman Capital	0.45% of Assets	\$17,917,421	\$80,628	0.45%
<b>TIPS Assets</b>		<b>\$9,497,411</b>		
SSgA TIPS Index-NL	0.04% of Assets	\$9,497,411	\$3,799	0.04%
<b>Emerging Market Debt Assets</b>		<b>\$5,012,165</b>		
Payden Emerging Market Bond	0.69% of Assets	\$5,012,165	\$34,584	0.69%
<b>Real Estate Assets</b>		<b>\$10,119,559</b>		
<b>Open-Ended Real Estate</b>		<b>\$6,331,069</b>		
Clarion Partners	1.10% of Assets	\$6,331,069	\$69,642	1.10%

Name	Fee Schedule	Market Value	Estimated Fee Value	Estimated Fee
<b>Total Closed End Real Estate</b>		<b>\$3,788,490</b>		
Rockwood Capital Real Estate Partners Fund XI, L.P.	1.4% of committed capital during investment period; 1.4% on invested equity thereafter	\$3,788,490		
<b>Private Equity Assets</b>		<b>\$12,740,071</b>		
North American Strategic Partners 2006	0.8% on drawn and undrawn capital less investments sold or written off   5% carried interest, 8% preferred return	\$14,091		
Ironsides Partnership Fund IV	0% Management fee, 8% Preferred Return, 5% Carried Interest	\$2,511,231		
Ironsides Direct Investment Fund IV	0.5% Management fee, 8% Preferred Return, 15% Carried Interest	\$1,411,709		
Ironsides Partnership Fund V, L.P.		\$2,068,044		
Ironsides Direct Investment Fund V, L.P.	0.5% Management fee, 8% preferred return, 15% carried interest	\$3,112,034		
HarbourVest 2019 Global Fund	0.69% average annual management fee; 8.0% preferred return on secondary and direct investments and with corresponding carried interest of 12.5% on secondary and direct investments	\$3,622,962		
<b>Private Debt Assets</b>		<b>\$3,045,757</b>		
NB Private Debt Fund IV	1.0% on invested capital	\$3,045,757		
<b>Infrastructure</b>		<b>\$10,870,617</b>		
IFM Global Infrastructure	0.77% Management fee, 8% Preferred Return, 10% Carried Interest	\$10,870,617		
<b>Cash</b>		<b>\$745,270</b>		
EB Temporary Investment Fund		\$745,270		
<b>Total</b>		<b>\$214,667,359</b>	<b>\$557,677</b>	<b>0.26%</b>

Meketa has negotiated a 50% discount on fees for NB Private Debt Fund IV through June 2022. After June 2022, depending on Meketa's aggregate investment, the fee will become 0.7% or return to 1%.

## **Current Issues**

## **SSGA Update**

## **Manager Search Authorization**

## MEMORANDUM

**TO:** Retirement Board - Marlborough Retirement System  
**FROM:** Henry Jaung, Steve MacLellan - Meketa Investment Group  
**DATE:** July 20, 2023  
**RE:** Manager Search Authorization

Consistent with the Public Employee Retirement Administration Commission (PERAC) investment guidelines, the following mandates with existing managers are due for an RFP and a competitive evaluation process this year.

Asset Class	Current Manager	Market Value as of June 30, 2023 (\$ mm)
Domestic Equity	RhumbLine S&P 500 Index	24.8
Domestic Equity	Frontier Capital Appreciation	23.7
International Developed Markets Equity	RhumbLine MSCI EAFE Index	26.9
International Emerging Markets Equity	DFA Emerging Markets	10.2
International Emerging Markets Equity	Driehaus Emerging Market Equity	9.0
Emerging Market Debt	Payden Emerging Market Bond	5.0

The purpose of this memo is to request an authorization for Meketa Investment Group to issue RFPs on behalf of the Retirement System.

If you have any questions, please call us at (781) 471-3500.

cc: Beth Matson, Administrator

HJ/SJM/JL

## Asset Allocation Discussion

## **Introduction**

## Introduction

- This document evaluates the current asset allocation policy and presents alternative asset allocation options for the System.
- We provide various approaches to assessing risk in order to provide a “mosaic” of the risks faced by the System.
- The goal of this review is not to declare one portfolio the “right” choice or the only prudent choice, but to highlight the risk and return tradeoffs of different policy portfolios.
- This year’s asset allocation review differs from other recent years’ reviews due to the vast change in market- circumstances, primarily the large increase in interest rates during 2022.
  - The abrupt increase of investment grade yields alongside relatively consistent credit spreads has meaningfully increased long-term expected returns across fixed income instruments.
  - As a result, pension investors seeking mid-to-high single digit levels of nominal return are able to realistically consider lower equity asset allocations for the first time in over a decade.

## Asset Allocation Overview

### Mean Variance Optimization

- MVO is the traditional starting point for determining asset allocation.
- MVO mathematically determines an “efficient frontier” of policy portfolios with the highest risk-adjusted returns.
- All asset classes exhibit only three characteristics, which serve as inputs to the model:
  - Expected return
  - Expected volatility
  - Expected covariance with all other assets
- The model assumes:
  - Normal return distribution
  - Stable volatility and covariances over time
  - Returns are not serially correlated
- The MVO model tends to underestimate the risks of large negative events.

## Proposed Policy Options

Asset Allocation Policy Options<sup>1</sup>

	Current Policy (%)	Actual Allocation (%)	Option A (%)	Option B (%)	Option C (%)
Growth/Equity	55	61	60	60	65
US Equity	17	34	15	10	10
US Small Cap	0	0	5	5	10
Developed Market Equity (non-US)	14	12	15	15	15
Developed Market Small Cap	0	0	5	5	5
Emerging Market Equity	14	9	10	10	10
Private Equity	10	6	10	15	15
Credit	15	11	18	18	15
High Yield Bonds	5	8	5	5	5
Private Debt	8	1	8	8	5
Emerging Market Bonds (major)	2	2	5	5	5
Rate Sensitive	10	18	12	12	10
Investment Grade Bonds	5	12	7	7	5
TIPS	5	5	5	5	5
Real Assets	20	10	10	10	10
Real Estate	10	5	5	5	5
Infrastructure (Core Private)	10	5	5	5	5
Expected Return (20 years)	9.1	8.5	9.1	9.2	9.3
Standard Deviation	14.3	13.4	14.6	14.9	15.5
Probability of Achieving 7.5% over 20 Years	68.9	63.1	68.3	69.4	69.7

<sup>1</sup> Based upon Meketa Investment Group's 2023 Annual Asset Study for 20 year expected returns, state expected return estimated based on publicly available information. Throughout document, returns for periods longer than one year are annualized.

### Review of Proposed Asset Allocation Policies

- The System's expected portfolio return has increased drastically due primarily to an increase in returns for fixed income instruments.
- We prepared portfolios with the following aims in mind:
  - Maintaining expected returns.
    - Maintaining protection against other risks to the portfolio, primarily but not limited to, inflation.
    - Reducing implementation lag for private market asset classes.
  - The asset allocation policies outlined incorporate various changes.
    - Moving toward global equity weight in public equity (contrast with emerging overweight)
    - Increasing public fixed income exposure.
    - Adding dedicated small cap exposure.
    - Decreasing targets to private asset classes with significant implementation lag.
- Ultimately, the three alternative policy portfolios on the previous page were selected for presentation to the Board.

## Diversification and Risk Analysis

### Diversification

- The primary motive for diversifying a portfolio is to reduce risk.
- Diversification is the sole “free lunch” available to investors. That is, it represents the only way to reduce risk without reducing expected returns.
- Therefore, investments should be allocated across multiple classes of assets, based in part on the expected correlation of their returns.
- Within each asset type, investments should be distributed across strategies and risk factors to further reduce volatility.

### Types of Risk Analysis Addressed

→ Risk budgeting<sup>1</sup>

- Attributes overall portfolio risks to specific asset classes
- Highlights the source and scale of portfolio-level risk

→ MVO-based risk analytics

- Includes worst-case return expectations and Value at Risk (VaR)<sup>2</sup>
- Relies on assumptions underlying MVO

→ Scenario analysis

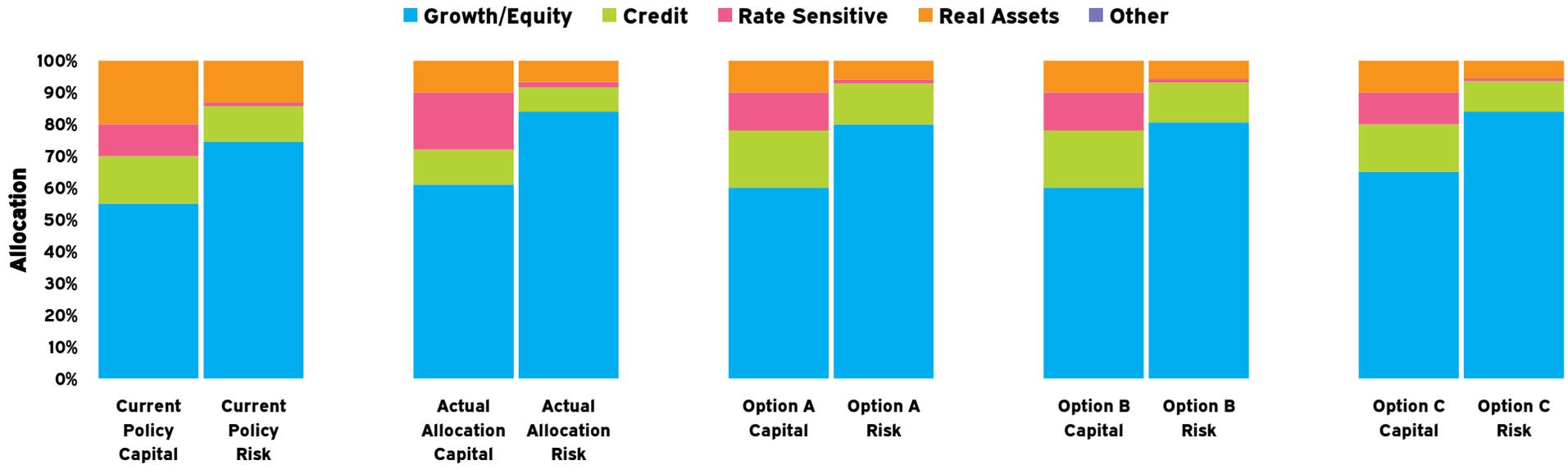
- Stress tests policy portfolios using actual historical examples
- Stress tests policy portfolios under specific hypothetical scenarios.

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<sup>1</sup> Risk budgeting seeks to decompose the aggregate risk of a portfolio into different sources (in this case, by asset class), with risk defined as standard deviation.

<sup>2</sup> VaR is a risk measure that estimates the maximum loss on a portfolio over a given time horizon and a given confidence level (usually 95% or 99%).

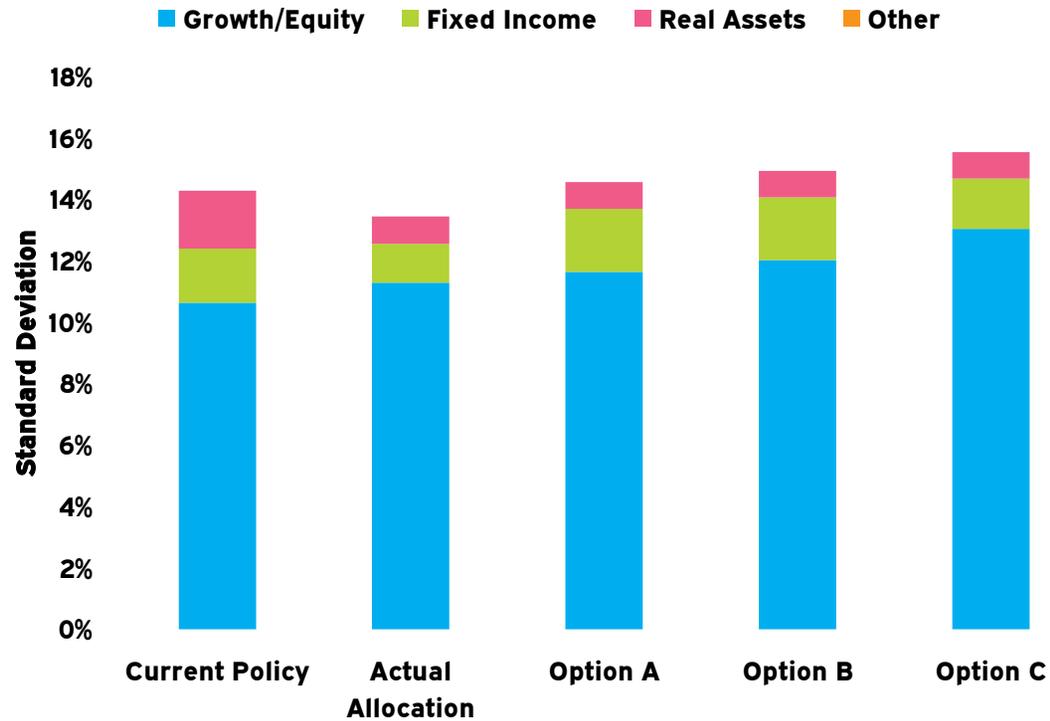
#### Risk Budgeting Analysis<sup>1</sup> (Capital Allocation vs. Risk Allocation)



→ Assets with low relative volatility, such as rate sensitive fixed income, contribute less to risk than their asset weighting implies.

<sup>1</sup> Risk allocation is calculated by multiplying the weight of the asset class by its standard deviation and its correlation with the total portfolio and then dividing this by the standard deviation of the total portfolio.

#### Risk Budgeting Analysis<sup>1</sup> (Absolute Contribution to Risk)



In each policy option, equity risk dominates the risk profile of the portfolio.

<sup>1</sup> Contribution to risk is calculated by multiplying the weight of the asset class by its standard deviation and its correlation with the total portfolio.

MPT-Based Risk Analysis

Scenario	Current Policy (%)	Actual Allocation (%)	Option A (%)	Option B (%)	Option C (%)
<b>Worst Case Returns</b>					
One Year (annualized)	-19.3	-18.4	-19.8	-20.2	-21.1
Three Years (annualized)	-8.3	-8.0	-8.7	-8.9	-9.5
Five Years (annualized)	-4.7	-4.5	-5.0	-5.1	-5.6
Ten Years (annualized)	-0.9	-0.9	-1.1	-1.2	-1.5
Twenty Years (annualized)	1.9	1.8	1.8	1.8	1.6
<b>Probability of Experiencing Negative Returns</b>					
One Year	25.2	25.3	25.6	25.8	26.4
Three Years	12.3	12.5	12.8	13.0	13.7
Five Years	6.7	6.9	7.2	7.3	7.9
Ten Years	1.7	1.8	1.9	2.0	2.3
Twenty Years	0.1	0.1	0.2	0.2	0.2
<b>Probability of Achieving at least a 7.5% Return</b>					
One Year	54.4	53.0	54.2	54.5	54.6
Three Years	57.6	55.2	57.3	57.8	57.9
Five Years	59.7	56.6	59.4	60.0	60.2
Ten Years	63.6	59.3	63.1	64.0	64.2
Twenty Years	68.9	63.1	68.3	69.4	69.7

Conditional Value at Risk<sup>1</sup>

Scenario	Current Policy	Actual Allocation	Option A	Option B	Option C
CVaR (%):					
1 month	-10.2	-9.6	-10.4	-10.6	-11.1
3 months	-16.5	-15.6	-16.9	-17.4	-18.1
6 months	-21.9	-20.7	-22.5	-23.1	-24.1

→ According to the cVaR model, the Fund could lose roughly 10% in a single month and 22% in 6 months with the current policy.

→ cVar rises in the alternative portfolios due to their higher forecast standard deviation.

**Historical Negative Scenario Analysis<sup>1</sup>**  
*(Cumulative Return)*

Scenario	Current Policy (%)	Actual Allocation (%)	Option A (%)	Option B (%)	Option C (%)
COVID-19 Market Shock (Feb 2020-Mar 2020)	-17.9	-21.3	-20.6	-19.2	-21.0
Taper Tantrum (May - Aug 2013)	-0.7	-0.7	-0.7	-0.5	-0.2
Global Financial Crisis (Oct 2007 - Mar 2009)	-30.2	-30.3	-31.3	-30.4	-32.2
Popping of the TMT Bubble (Apr 2000 - Sep 2002)	-14.4	-18.3	-17.1	-16.3	-18.3
LTCM (Jul - Aug 1998)	-9.3	-10.0	-10.6	-10.0	-11.3
Asian Financial Crisis (Aug 97 - Jan 98)	0.1	0.8	0.3	1.0	0.8
Rate spike (1994 Calendar Year)	0.8	0.2	1.0	1.7	1.4
Early 1990s Recession (Jun - Oct 1990)	-6.7	-8.2	-7.9	-7.1	-8.6
Crash of 1987 (Sep - Nov 1987)	-11.0	-14.2	-12.2	-10.8	-12.5
Strong dollar (Jan 1981 - Sep 1982)	0.3	2.1	-0.9	-1.0	-1.6
Volcker Recession (Jan - Mar 1980)	-3.5	-4.4	-4.7	-4.6	-5.0
Stagflation (Jan 1973 - Sep 1974)	-22.8	-25.0	-24.5	-23.3	-25.6

<sup>1</sup> See the Appendix for our scenario inputs. In periods where the ideal benchmark was not yet available we used the next closest benchmark(s) as a proxy.

Stress Testing: Impact of Market Movements  
(Expected Return under Stressed Conditions)<sup>1</sup>

Scenario	Current Policy (%)	Actual Allocation (%)	Option A (%)	Option B (%)	Option C (%)
10-year Treasury Bond rates rise 100 bps	4.8	4.5	5.0	5.0	5.4
10-year Treasury Bond rates rise 200 bps	-1.1	-2.0	-1.7	-1.6	-1.6
10-year Treasury Bond rates rise 300 bps	-2.8	-2.5	-3.0	-3.5	-2.5
Baa Spreads widen by 50 bps, High Yield by 200 bps	0.1	0.2	-0.2	-0.1	-0.5
Baa Spreads widen by 300 bps, High Yield by 1000 bps	-23.2	-23.7	-24.4	-23.9	-25.0
Trade Weighted Dollar gains 10%	-5.2	-4.6	-5.8	-5.8	-6.1
Trade Weighted Dollar gains 20%	-2.7	-1.3	-3.4	-3.8	-3.6
US Equities decline 10%	-6.2	-6.6	-6.7	-6.7	-7.2
US Equities decline 25%	-18.5	-18.6	-19.1	-19.0	-20.2
US Equities decline 40%	-28.3	-29.4	-29.6	-28.7	-30.9

→ Each policy portfolio has a different sensitivity to four major risk factors: interest rates, credit spreads, currency fluctuations, and equity values.

→ The Fund’s primary risk factors would continue to be an equity market decline and a widening of credit spreads, no matter the policy.

<sup>1</sup> Assumes that assets not directly exposed to the factor are affected nonetheless. See the Appendix for further details.

## Appendices

## Setting Capital Market Expectations

### Overview of Annual Asset Study Methodology

- In order to construct an optimal portfolio from a risk-return standpoint, conventional financial wisdom dictates that one develop return, volatility, and correlation expectations over the relevant investing horizon.
- Given the uncertainty surrounding financial and economic forecasts, expectations development is challenging, and any of several methodological approaches may meaningfully contribute to this complex task.
- Meketa Investment Group's process relies on both quantitative and qualitative methodologies.
- First, we employ a large set of quantitative models to arrive at a set of baseline expected ten-year annualized returns for major asset classes.
- These models attempt to forecast a gross "beta" return for each public market asset class; that is, we specifically do not model "alpha," nor do we apply an estimate for management fees or other operational expenses.<sup>1</sup>
- Our models are fundamentally based (based on some theoretically defined return relationship with current observable factors).
- Some of these models are more predictive than others. For this reason, we next overlay a qualitative analysis, which takes the form of a data-driven deliberation among the research team and our Investment Policy Committee.
- Return assumptions for hard-to-predict asset classes as well as those with limited data will be influenced more heavily by our qualitative analysis.

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<sup>1</sup> Our expectations are net of fees where passive management is not available (e.g., private markets and hedge funds).

### Overview of Annual Asset Study Methodology (continued)

- As a result of this process, we form our ten-year annualized return expectations, which serve as the primary foundation of our longer-term, twenty-year expectations.
- We form our twenty-year annualized return expectations by systematically considering historical returns on an asset class by asset class level. Specifically, we construct a weighted average of our ten-year expectations and average historical returns in each asset class.
- The weights are determined by a qualitative assessment of the value of the historical data. Generally, if we have little confidence that the historical average return is representative of what an investor can expect,<sup>1</sup> we will weight our ten-year forecast more heavily. Therefore, the weight on our ten-year forecasts ranges from 0.5 to 0.9.
- We develop our twenty-year volatility and correlation expectations differently. We rely primarily on historical averages, with an emphasis given to the experience of the trailing fifteen years.
- Qualitative adjustments, when applied, usually serve to increase the correlations and volatility over and above the historical estimates (e.g., using the higher correlations usually observed during a volatile market).
- We also make adjustments to the volatility based on the historical skewness of each asset class (e.g., increasing the volatility for an asset class that has been negatively skewed).

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<sup>1</sup> For example, we have less confidence in historical data that do not capture many possible market scenarios or that are overly polluted by survivorship bias.

### Overview of Annual Asset Study Methodology (continued)

- In the case of private markets and other illiquid asset classes where historical volatility and correlations have been artificially dampened, we seek public market equivalents on which to base our estimates before applying any qualitative adjustments.
- These volatility and correlation expectations are then combined with our twenty-year return expectations to assist us in subsequent asset allocation work, including mean-variance optimization and scenario analyses.
- Capital Markets Expectations are the inputs needed to conduct MVO.
  - MVO is the traditional starting point for determining asset allocation.
- Consultants (including Meketa) generally set them once a year.
  - Our results are published in January, based on December 31 data.
- This involves setting long-term expectations for a variety of asset classes for the following.
  - Returns.
  - Standard Deviation.
  - Correlations(i.e., covariance).
- Our process relies on both quantitative and qualitative methodologies.

### Asset Class Definitions

- We identify asset classes and strategies that are appropriate for long-term allocation of funds, and that also are investable.
- Several considerations influence this process.
  - Unique return behavior.
  - Observable historical track record.
  - A robust market.
  - Client requests.
- We then make forecasts for each asset class.
  - We created inputs for 97 “asset classes” in 2022.

### Building 10-Year Forecasts

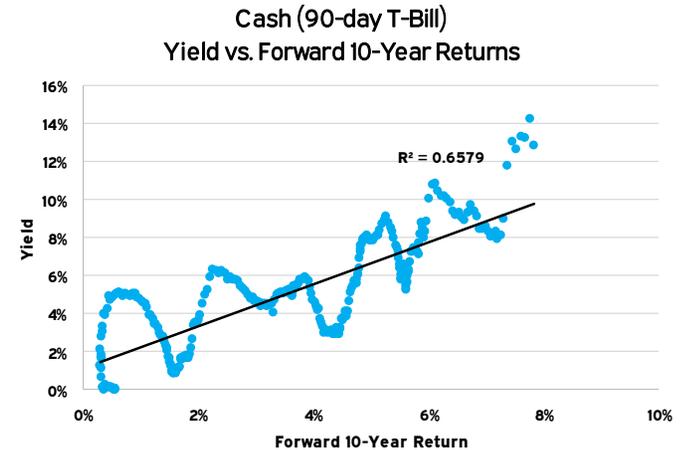
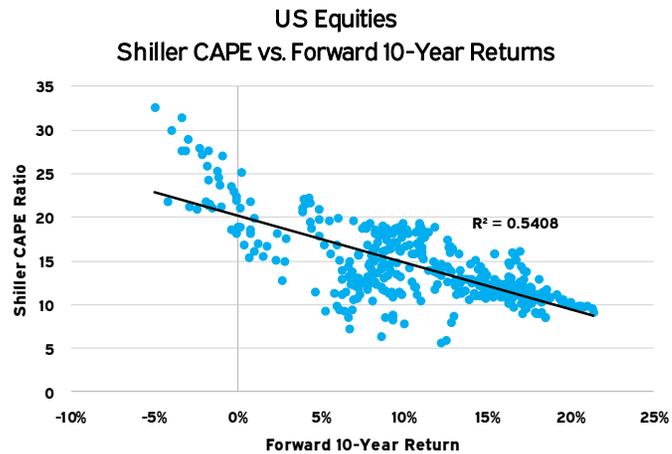
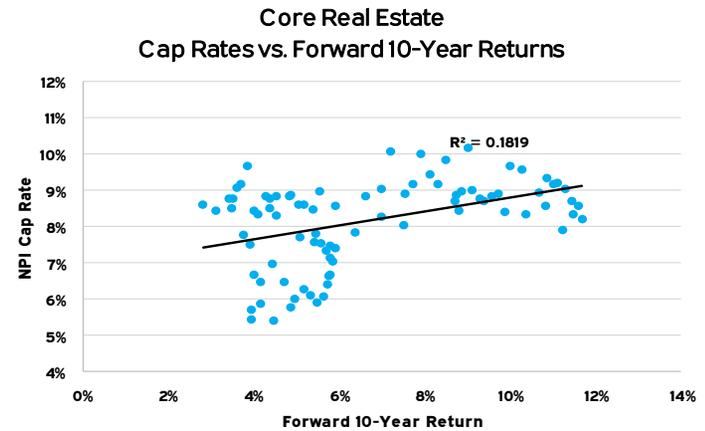
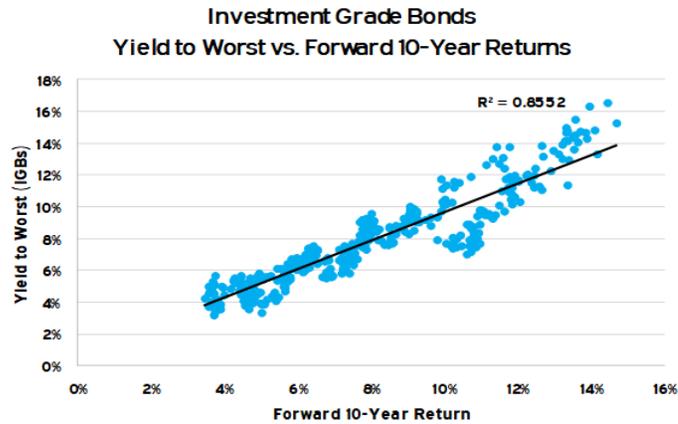
→ The first step is to build our 10-year forecasts based on fundamental models.

- Each model is based on the most important factors that drive returns for that asset class.

Asset Class Category	Major Factors
Equities	Dividend Yield, GDP Growth, Valuation
Bonds	Yield to Worst, Default Rate, Recovery Rate
Commodities	Collateral Yield, Roll Yield, Inflation
Infrastructure	Public IS Valuation, Income, Growth
Natural Resources	Price per Acre, Income, Public Market Valuation
Real Estate	Cap Rate, Yield, Growth
Private Equity	EBITDA Multiple, Debt Multiple, Public VC Valuation
Hedge Funds and Other	Leverage, Alternative Betas

→ The common components are income, growth, and valuation.

Some factors are naturally more predictive than others.



### Moving from 10-Year to 20-Year Forecasts

- Our next step is to combine our 10-year forecasts with projections for years 11-20 for each asset class.
- We use a risk premia approach to forecast 10-year returns in ten years (i.e., years 11-20).
  - We start with an assumption (market informed, such as the 10-year forward rate) for what the risk-free rate will be in ten years.
  - We then add a risk premia for each asset class.
  - We use historical risk premia as a guide, but many asset classes will differ from this, especially if they have a shorter history.
    - We seek consistency with finance theory (i.e., riskier assets will have a higher risk premia assumption).
  - Essentially, we assume mean-reversion over the first ten years (where appropriate), and consistency with CAPM thereafter.
  - The final step is to make any qualitative adjustments.
    - The Investment Policy Committee reviews the output and may make adjustments.

### Capital Market Assumption Development Example

#### Equities

→ We use a fundamental model for equities that combines income and capital appreciation.

$$E(R) = \text{Dividend Yield} + \text{Expected Earnings Growth} + \text{Multiple Effect} + \text{Currency Effect}$$

→ Meketa Investment Group evaluates historical data statistically to develop expectations for dividend yield, earnings growth, the multiple effect, and currency effect.

→ Our models assume that there is a reversion to the mean over long time periods.

#### Bonds

→ The short version for investment grade bond models is:

$$E(R) = \text{Current YTW (yield to worst)}$$

→ Our models assume that there is a reversion to the mean for spreads (though not yields).

→ For TIPS, we add the real yield of the TIPS index to the breakeven inflation rate.

→ As with equities, we make currency adjustments when necessary for foreign bonds.

→ For bonds with credit risk, Meketa Investment Group estimates default rates and loss rates, in order to project an expected return:

$$E(R) = \text{YTW} - (\text{Annual Default Rate} * \text{Loss Rate})$$

The Other Inputs: Standard Deviation and Correlation

- Standard Deviation:
- We review the trailing fifteen-year standard deviation, as well as skewness.
- Historical standard deviation serves as the base for our assumptions.
- If there is a negative skew, we increased the volatility assumption based on the size of the historical skewness.

Asset Class	Historical Standard Deviation (%)	Skewness	Assumption (%)
Bank Loans	7.7	-2.7	10.0
FI/L-S Credit	6.8	-2.5	9.0

- We also adjust for private market asset classes with “smoothed” return streams.
- Correlation:
- We use trailing fifteen-year correlations as our guide.
- Again, we make adjustments for “smoothed” return streams.
- Most of our adjustments are conservative in nature (i.e., they increase the standard deviation and correlation).

### Horizon Study

- Annually, Horizon Actuarial Services, LLC publishes a survey of capital market assumptions that they collect from various investment advisors.
- In the 2021<sup>1</sup> survey there were 39 respondents.
- The Horizon survey is a useful tool for Board members to determine whether their consultant’s expectations for returns (and risk) are reasonable.

Asset Class	10-Year Average (%)	Meketa 10-Year (%)	20-Year Average (%)	Meketa 20-Year (%)
Cash Equivalents	1.2	0.7	1.9	1.1
TIPS	1.6	1.2	2.4	1.8
US Core Bonds	2.1	1.2	3.2	1.8
US High Yield Bonds	3.8	3.3	5.0	4.2
Emerging Market Debt	4.2	3.9	5.3	3.8
Private Debt	6.5	6.6	6.9	6.8
US Equity (large cap)	5.8	5.2	6.7	6.8
Developed Non-US Equity	6.4	6.7	7.1	7.1
Emerging Non-US Equity	7.2	7.5	7.8	8.1
Private Equity	8.8	8.0	9.6	9.1
Real Estate	5.5	6.5	6.2	6.9
Infrastructure	6.2	7.1	6.8	7.0
Commodities	3.1	3.4	4.0	3.7
Hedge Funds	4.5	3.4	5.3	4.3
Inflation	2.1	2.3	2.2	2.1

<sup>1</sup> The 10-year horizon includes all 39 respondents and the 20-year horizon includes 24 respondents. Figures are based on Meketa's 2021 CMEs.

### Notes and Disclaimers

- <sup>1</sup> The returns shown in the Policy Options and Risk Analysis sections rely on estimates of expected return, standard deviation, and correlation developed by Meketa Investment Group. To the extent that actual return patterns to the asset classes differ from our expectations, the results in the table will be incorrect. However, our inputs represent our best unbiased estimates of these simple parameters.
- <sup>2</sup> The returns shown in the Policy Options and Risk Analysis sections use a lognormal distribution, which may or may not be an accurate representation of each asset classes' future return distribution. To the extent that it is not accurate in whole or in part, the probabilities listed in the table will be incorrect. As an example, if some asset classes' actual distributions are even more right-skewed than the lognormal distribution (i.e., more frequent low returns and less frequent high returns), then the probability of the portfolio hitting a given annual return will be lower than that stated in the table.
- <sup>3</sup> The standard deviation bars in the chart in the Risk Analysis section do not indicate the likelihood of a 1, 2, or 3 standard deviation event—they simply indicate the return we expect if such an event occurs. Since the likelihood of such an event is the same across allocations regardless of the underlying distribution, a relative comparison across policy choices remains valid.

### Scenario Return Inputs

Asset Class	Benchmark Used
Investment Grade Bonds	Barclays Aggregate
TIPS	Barclays US TIPS
Intermediate-term Government Bonds	Barclays Treasury Intermediate
Long-term Government Bonds	Barclays Long US Treasury
EM Bonds (local)	JPM GBI-EM Global Diversified Composite
Bank Loans	CSFB Leveraged Loan
High Yield Bonds	Barclays High Yield
Direct Lending	Cliffwater Direct Lending Index
Mezzanine Debt	Preqin Associates Mezzanine
Distressed Debt	Preqin Distressed Debt Index
Core Real Estate	NCREIF Property
Value-Added RE	NCREIF Townsend Value Added
Opportunistic RE	NCREIF Townsend Opportunistic
REITs	NAREIT Equity
Infrastructure (private)	S&P Global Infrastructure
Natural Resources (private)	S&P Global Natural Resources
Timber	NCREIF Timberland
Commodities	Bloomberg Commodity Index
US Equity	Russell 3000
Public Foreign Equity (Developed)	MSCI EAFE
Public Foreign Equity (Emerging)	MSCI Emerging Markets
Private Equity	Preqin Private Equity Composite
Long-short Equity	HFRI Equity Hedge
Global Macro	HFRI Macro
Hedge Funds	HFRI Fund Weighted Composite
Private Debt	Weighted average of Distressed Debt, Mezzanine Debt and Direct Lending (2nd Lien)

### Negative Historical Scenario Returns - Sample Inputs

	Covid-19 Market Shock (Feb 2020-Mar 2020)	Taper Tantrum (May - Aug 2013)	Global Financial Crisis (Oct 2007 - Mar 2009)	Popping of the TMT Bubble (Apr 2000 - Sep 2002)	LTCM (Jul - Aug 1998)
Cash Equivalents	0.4	0.0	2.6	9.9	0.8
Short-term Investment Grade Bonds	0.4	-0.1	7.9	21.9	1.6
Investment Grade Bonds	-0.9	-3.7	8.5	28.6	1.8
Long-term Corporate Bonds	-18.4	-9.3	-10.3	26.9	-0.6
Long-term Government Bonds	12.7	-11.6	24.2	35.5	4.1
TIPS	-0.4	-8.5	8.2	37.4	0.7
Global ILBs	-6.5	-7.4	-3.9	39.7	0.7
High Yield Bonds	-20.8	-2.0	-22.8	-6.3	-5.0
Bank Loans	-20.3	0.8	-23.7	6.3	0.7
Direct Lending	-4.8	2.6	-3.3	-2.6	-2.3
Foreign Bonds	-4.5	-3.2	2.1	8.5	3.5
Mezzanine Debt	-4.8	4.6	-26.4	-2.0	-2.6
Distressed Debt	-12.2	4.6	-26.4	-2.0	-2.6
Emerging Market Bonds (major)	-15.3	-11.5	-5.0	6.3	-28.2
Emerging Market Bonds (local)	-13.9	-14.3	-7.9	7.2	-34.1
US Equity	-35.0	3.0	-45.8	-43.8	-15.4
Developed Market Equity (non-US)	-32.7	-2.2	-52.1	-46.7	-11.5
Emerging Market Equity	-31.2	-9.4	-51.2	-43.9	-26.7
Global Equity	-33.6	-0.7	-49.3	-46.7	-14.0
Private Equity/Debt	-7.8	5.7	-27.7	-23.4	-3.2
Private Equity	-7.4	5.8	-28.2	-26.0	-3.3
Private Debt Composite	-10.1	4.6	-22.3	-1.7	-2.3
REITs	-41.0	-13.3	-63.0	45.4	-15.3
Core Private Real Estate	0.7	3.6	-10.6	23.6	2.3
Value-Added Real Estate	-3.5	3.8	-20.2	177.0	1.8
Opportunistic Real Estate	-8.6	4.0	-25.7	21.4	1.5
Natural Resources (Private)	-22.1	2.5	-31.2	-3.9	-16.9
Timberland	0.1	1.3	20.7	-1.5	0.5
Farmland	-0.1	3.3	26.7	11.4	0.8
Commodities (naïve)	-18.9	-2.4	-36.9	18.5	-12.0
Core Infrastructure	-1.3	3.7	-0.8	24.8	-0.3
Hedge Funds	-9.1	-0.4	-17.8	-2.1	-9.4
Long-Short	-10.9	1.0	-26.4	-8.8	-8.3
Hedge Fund of Funds	-7.6	-0.5	-19.5	-0.4	-7.7

Negative Historical Scenario Returns-Sample Inputs (Continued)

	Rate spike (1994 Calendar Year)	Crash of 1987 (Sep-Nov 1987)	Strong dollar (Jan 1981-Sep 1982)	Volcker Recession (Jan-Mar 1980)	Stagflation (Jan 1973-Sep 1974)
Cash Equivalents	3.9	1.4	24.4	2.9	13.5
Short-term Investment Grade Bonds	0.5	2.3	29.9	-2.6	4.3
Investment Grade Bonds	-2.9	2.2	29.9	-8.7	7.9
Long-term Corporate Bonds	-5.8	1.5	29.6	-14.1	-12.0
Long-term Government Bonds	-7.6	2.6	28.4	-13.6	-1.8
TIPS	-7.5	2.8	15.6	-7.8	4.3
Global ILBs	-7.9	2.9	16.5	-8.3	4.5
High Yield Bonds	-1.0	-3.6	6.9	-2.3	-15.5
Bank Loans	10.3	-1.7	3.3	-1.1	-7.5
Direct Lending	7.6	-2.3	3.2	-1.0	-7.2
Foreign Bonds	5.3	-0.3	34.8	-6.5	-1.4
Mezzanine Debt	7.6	-2.3	3.2	-1.0	-7.2
Distressed Debt	7.6	-2.3	3.2	-1.0	-7.2
Emerging Market Bonds (major)	-18.9	-9.2	-1.6	-2.6	-20.2
Emerging Market Bonds (local)	-22.8	-11.0	-2.0	-3.2	-23.9
US Equity	1.3	-29.5	-2.3	-4.1	-42.6
Developed Market Equity (non-US)	7.8	-14.5	-18.0	-7.0	-36.3
Emerging Market Equity	-7.3	-25.3	-12.1	-6.6	-44.2
Global Equity	5.0	-21.5	-11.2	-5.8	-39.3
Private Equity/Debt	13.2	-0.7	-2.7	-2.5	-18.2
Private Equity	14.2	-0.5	-3.9	-2.7	-20.1
Private Debt Composite	6.2	-1.8	3.0	-1.0	-6.9
REITs	-3.5	-19.5	2.5	-3.6	-33.9
Core Private Real Estate	6.4	2.5	23.9	5.5	-4.4
Value-Added Real Estate	11.2	4.3	44.2	9.6	-7.6
Opportunistic Real Estate	18.8	3.1	30.7	7.0	-5.6
Natural Resources (Private)	12.6	-9.9	-9.5	-9.1	19.3
Timberland	15.4	9.2	23.6	-7.4	5.5
Farmland	9.4	5.3	13.3	-4.2	3.1
Commodities (naïve)	16.6	1.8	-16.0	-9.6	139.5
Core Infrastructure	-11.5	-0.1	-0.2	-0.1	-0.5
Hedge Funds	4.1	-7.8	-3.8	-1.9	-15.7
Long-Short	2.6	-10.0	-4.9	-2.5	-19.8
Hedge Fund of Funds	-3.5	-5.7	-2.7	-1.4	-11.5

Stress Test Return Assumptions-Sample Inputs<sup>1</sup>

	10-year Treasury Bond rates rise 100 bps	10-year Treasury Bond rates rise 200 bps	10-year Treasury Bond rates rise 300 bps	Baa Spreads widen by 50 bps, High Yield by 200 bps	Baa Spreads widen by 300 bps, High Yield by 1000 bps	Trade Weighted Dollar gains 10%	Trade Weighted Dollar gains 20%	US Equities decline 10%	US Equities decline 25%	US Equities decline 40%
Cash Equivalents	-0.2	-0.4	-0.5	2.8	1.1	4.0	1.3	3.1	2.3	0.4
Short-term Investment Grade Bonds	-1.2	-2.5	-3.7	2.2	1.5	1.2	1.4	1.3	0.7	0.8
Investment Grade Bonds	-4.3	-8.3	-11.9	3.9	-0.4	1.7	4.2	2.4	0.7	-1.0
Long-term Corporate Bonds	-8.9	-16.2	-20.9	2.6	-13.4	0.8	8.1	0.5	-8.3	-12.3
Long-term Government Bonds	-10.6	-18.8	-23.6	7.8	7.3	3.7	12.8	3.0	2.6	2.4
TIPS	-4.9	-9.8	-13.7	2.8	-6.1	-2.1	-0.2	2.6	-2.3	-8.7
Global ILBs	-1.6	-7.9	-11.9	2.4	-11.1	-3.1	-4.8	2.8	-5.4	-16.3
High Yield Bonds	2.7	-3.4	-3.6	-1.8	-23.0	-3.5	-0.6	-4.9	-15.5	-21.2
Bank Loans	1.4	-0.8	-5.1	-2.8	-20.8	-3.2	-0.6	-3.7	-13.2	-17.4
Direct Lending	0.0	-3.7	-6.3	-1.8	-9.1	-4.3	-0.6	-4.1	-7.6	-5.7
Foreign Bonds	-4.6	-9.8	-15.7	6.6	-2.9	-3.3	-8.8	1.8	-4.6	-9.2
Mezzanine Debt	3.8	-0.9	-6.1	-1.9	-19.4	-2.8	-6.4	-4.9	-15.6	-20.4
Distressed Debt	4.4	-1.1	-6.4	-2.2	-21.4	-3.5	-9.0	-5.4	-17.3	-21.8
Emerging Market Bonds (major)	1.0	-4.9	-3.6	-0.1	-14.7	-1.4	-4.2	-3.3	-12.5	-15.4
Emerging Market Bonds (local)	1.8	-5.1	-3.0	0.1	-12.8	-1.4	-12.2	-2.8	-13.3	-20.5
US Equity	7.2	0.9	2.8	-1.2	-32.0	-2.5	1.6	-10.6	-26.5	-42.4
Developed Market Equity (non-US)	9.2	3.1	-5.6	0.3	-35.1	-12.9	-9.0	-8.7	-23.4	-41.4
Emerging Market Equity	10.3	5.5	0.1	-1.1	-42.8	-15.1	-15.7	-11.9	-30.8	-46.9
Global Equity	7.8	2.1	-0.5	-0.7	-33.6	-8.3	-5.9	-9.8	-25.3	-41.5
Private Equity/Debt	6.4	0.9	-5.5	-0.2	-22.5	-4.3	-7.2	-10.1	-22.5	-25.3
Private Equity	6.8	1.0	-5.3	0.0	-22.8	-4.1	-6.4	-10.9	-23.3	-25.7
Private Debt Composite	2.5	-2.0	-6.2	-1.8	-15.8	-3.5	-4.3	-4.6	-12.8	-15.0
REITs	4.1	-3.5	1.2	-3.8	-37.3	-1.0	12.4	-6.5	-32.8	-55.7
Core Private Real Estate	2.4	2.7	5.0	2.0	-7.1	1.2	9.7	-0.2	-8.5	-14.0
Value-Added Real Estate	4.8	7.4	14.1	7.2	-13.5	13.8	6.4	1.3	-13.6	-23.1
Opportunistic Real Estate	4.1	6.5	9.9	1.1	-20.6	0.8	15.6	-1.5	-17.1	-26.3
Natural Resources (Private)	13.1	5.8	-3.5	-0.9	-27.5	-6.5	-21.5	-5.4	-20.9	-35.9
Timberland	1.4	1.6	-9.9	5.0	6.9	2.5	8.6	0.1	2.7	3.9
Farmland	2.4	-0.1	-9.2	3.9	10.1	0.8	8.0	0.6	4.9	10.3
Commodities (naïve)	9.6	5.3	-6.6	-4.3	-25.0	-5.6	-24.0	4.8	-11.1	-37.8
Core Infrastructure	0.3	-6.4	-6.1	1.2	0.1	-1.8	3.6	-1.1	-5.0	-7.8
Hedge Funds	3.0	-1.4	-5.1	-0.6	-14.5	-2.1	-1.7	-4.3	-12.2	-15.7
Long-Short	5.3	-0.7	-4.2	-0.1	-21.0	-3.0	-4.3	-7.3	-17.7	-23.5
Hedge Fund of Funds	2.2	-2.1	-5.7	-1.3	-14.8	-2.7	-2.4	-4.9	-12.5	-16.0

<sup>1</sup> Assumptions are based on performance for each asset class during historical periods that resembled these situations.

Meketa Investment Group 2023 Annual Asset Study  
 Twenty-Year Annualized Return and Volatility Expectations for Major Asset Classes

Asset Class	10-year Expected Return (%)	20-year Expected Return (%)	Standard Deviation (%)	11-20 year Risk Premia <sup>1</sup> (%)
Cash Equivalents	3.1	2.9	1.0	-1.5
Investment Grade Bonds	4.8	4.7	4.0	0.4
Long-term Government Bonds	4.3	5.0	12.0	1.5
TIPS	4.3	4.5	7.0	0.5
High Yield Bonds	8.0	7.3	11.0	2.5
Bank Loans	7.6	7.0	10.0	2.2
Emerging Market Debt (local)	6.4	6.0	12.0	1.5
Private Debt	9.4	9.0	15.0	4.6
US Equity	7.8	8.7	18.0	5.5
Developed Non-US Equity	10.1	9.8	19.0	5.4
Emerging Non-US Equity	10.3	10.0	23.0	5.6
Global Equity	8.8	9.2	18.0	5.5
Private Equity	9.7	11.0	27.0	8.0
Real Estate	5.9	7.8	16.0	5.5
Infrastructure	6.9	8.3	15.0	5.6
Commodities	6.3	5.7	17.0	1.0
Hedge Funds	5.4	6.1	7.0	2.6
Inflation	2.5	2.6	3.0	-1.5

Meketa Investment Group 2023 Annual Asset Study: Correlation Expectations

	Inv. Grade Bonds	Long-term Gov't Bonds	TIPS	High Yield Bonds	US Equity	Dev. Non-US Equity	Em. Market Equity	Private Equity	Real Estate	Commod.	Infra.	Hedge Funds
Investment Grade Bonds	1.00											
Long-term Government Bonds	0.83	1.00										
TIPS	0.76	0.53	1.00									
High Yield Bonds	0.22	-0.22	0.41	1.00								
US Equity	0.02	-0.31	0.20	0.74	1.00							
Developed Non-US Equity	0.09	-0.28	0.26	0.76	0.89	1.00						
Emerging Market Equity	0.14	-0.23	0.34	0.76	0.77	0.87	1.00					
Private Equity	0.00	-0.10	0.05	0.70	0.85	0.80	0.75	1.00				
Real Estate	0.20	0.05	0.10	0.50	0.50	0.45	0.40	0.45	1.00			
Commodities	0.00	-0.29	0.31	0.55	0.53	0.61	0.65	0.30	0.15	1.00		
Infrastructure	0.29	0.09	0.31	0.64	0.63	0.65	0.58	0.50	0.57	0.41	1.00	
Hedge Funds	0.03	-0.34	0.26	0.77	0.86	0.87	0.85	0.60	0.45	0.69	0.65	1.00

Manager Due  
Diligence Agenda

## MARLBOROUGH RETIREMENT SYSTEM

Manager Due Diligence Meetings  
Tuesday, August 22, 2023

Dial: (646) 558-8656  
Meeting ID: 995 8291 2329  
Passcode: 047489

Manager Due Diligence Meetings

9:30 – 10:00 a.m.

Manager/Product	Asset Class
<b>Frontier Capital Management Company</b> <i>Frontier Capital Appreciation</i>	Domestic Equity
<b>Dimensional Fund Advisors</b> <i>DFA Emerging Markets</i>	International Emerging Markets Equity
<b>Driehaus Capital Management</b> <i>Driehaus Emerging Market Equity</i>	International Emerging Markets Equity
<b>Clarion Partners</b> <i>Clarion Lion Properties Fund</i>	Open-Ended Real Estate

# Appendix

## **Disclaimer, Glossary, and Notes**

WE HAVE PREPARED THIS REPORT (THIS "REPORT") FOR THE SOLE BENEFIT OF THE INTENDED RECIPIENT (THE "RECIPIENT").

SIGNIFICANT EVENTS MAY OCCUR (OR HAVE OCCURRED) AFTER THE DATE OF THIS REPORT AND THAT IT IS NOT OUR FUNCTION OR RESPONSIBILITY TO UPDATE THIS REPORT. ANY OPINIONS OR RECOMMENDATIONS PRESENTED HEREIN REPRESENT OUR GOOD FAITH VIEWS AS OF THE DATE OF THIS REPORT AND ARE SUBJECT TO CHANGE AT ANY TIME. ALL INVESTMENTS INVOLVE RISK. THERE CAN BE NO GUARANTEE THAT THE STRATEGIES, TACTICS, AND METHODS DISCUSSED HERE WILL BE SUCCESSFUL.

INFORMATION USED TO PREPARE THIS REPORT WAS OBTAINED FROM INVESTMENT MANAGERS, CUSTODIANS, AND OTHER EXTERNAL SOURCES. WHILE WE HAVE EXERCISED REASONABLE CARE IN PREPARING THIS REPORT, WE CANNOT GUARANTEE THE ACCURACY OF ALL SOURCE INFORMATION CONTAINED HEREIN.

CERTAIN INFORMATION CONTAINED IN THIS REPORT MAY CONSTITUTE "FORWARD - LOOKING STATEMENTS," WHICH CAN BE IDENTIFIED BY THE USE OF TERMINOLOGY SUCH AS "MAY," "WILL," "SHOULD," "EXPECT," "AIM," "ANTICIPATE," "TARGET," "PROJECT," "ESTIMATE," "INTEND," "CONTINUE" OR "BELIEVE," OR THE NEGATIVES THEREOF OR OTHER VARIATIONS THEREON OR COMPARABLE TERMINOLOGY. ANY FORWARD-LOOKING STATEMENTS, FORECASTS, PROJECTIONS, VALUATIONS, OR RESULTS IN THIS PRESENTATION ARE BASED UPON CURRENT ASSUMPTIONS. CHANGES TO ANY ASSUMPTIONS MAY HAVE A MATERIAL IMPACT ON FORWARD - LOOKING STATEMENTS, FORECASTS, PROJECTIONS, VALUATIONS, OR RESULTS. ACTUAL RESULTS MAY THEREFORE BE MATERIALLY DIFFERENT FROM ANY FORECASTS, PROJECTIONS, VALUATIONS, OR RESULTS IN THIS PRESENTATION.

PERFORMANCE DATA CONTAINED HEREIN REPRESENT PAST PERFORMANCE. PAST PERFORMANCE IS NO GUARANTEE OF FUTURE RESULTS.

**Credit Risk:** Refers to the risk that the issuer of a fixed income security may default (i.e., the issuer will be unable to make timely principal and/or interest payments on the security).

**Duration:** Measure of the sensitivity of the price of a bond to a change in its yield to maturity. Duration summarizes, in a single number, the characteristics that cause bond prices to change in response to a change in interest rates. For example, the price of a bond with a duration of three years will rise by approximately 3% for each 1% decrease in its yield to maturity. Conversely, the price will decrease 3% for each 1% increase in the bond's yield. Price changes for two different bonds can be compared using duration. A bond with a duration of six years will exhibit twice the percentage price change of a bond with a three-year duration. The actual calculation of a bond's duration is somewhat complicated, but the idea behind the calculation is straightforward. The first step is to measure the time interval until receipt for each cash flow (coupon and principal payments) from a bond. The second step is to compute a weighted average of these time intervals. Each time interval is measured by the present value of that cash flow. This weighted average is the duration of the bond measured in years.

**Information Ratio:** This statistic is a measure of the consistency of a portfolio's performance relative to a benchmark. It is calculated by subtracting the benchmark return from the portfolio return (excess return), and dividing the resulting excess return by the standard deviation (volatility) of this excess return. A positive information ratio indicates outperformance versus the benchmark, and the higher the information ratio, the more consistent the outperformance.

**Jensen's Alpha:** A measure of the average return of a portfolio or investment in excess of what is predicted by its beta or "market" risk.  $\text{Portfolio Return} - [\text{Risk Free Rate} + \text{Beta} * (\text{market return} - \text{Risk Free Rate})]$ .

**Market Capitalization:** For a firm, market capitalization is the total market value of outstanding common stock. For a portfolio, market capitalization is the sum of the capitalization of each company weighted by the ratio of holdings in that company to total portfolio holdings; thus it is a weighted-average capitalization. Meketa Investment Group considers the largest 65% of the broad domestic equity market as large capitalization, the next 25% of the market as medium capitalization, and the smallest 10% of stocks as small capitalization.

**Market Weighted:** Stocks in many indices are weighted based on the total market capitalization of the issue. Thus, the individual returns of higher market-capitalization issues will more heavily influence an index's return than the returns of the smaller market-capitalization issues in the index.

**Maturity:** The date on which a loan, bond, mortgage, or other debt/security becomes due and is to be paid off.

**Prepayment Risk:** The risk that prepayments will increase (homeowners will prepay all or part of their mortgage) when mortgage interest rates decline; hence, investors' monies will be returned to them in a lower interest rate environment. Also, the risk that prepayments will slow down when mortgage interest rates rise; hence, investors will not have as much money as previously anticipated in a higher interest rate environment. A prepayment is any payment in excess of the scheduled mortgage payment.

**Price-Book Value (P/B) Ratio:** The current market price of a stock divided by its book value per share. Meketa Investment Group calculates P/B as the current price divided by Compustat's quarterly common equity. Common equity includes common stock, capital surplus, retained earnings, and treasury stock adjusted for both common and nonredeemable preferred stock. Similar to high P/E stocks, stocks with high P/B's tend to be riskier investments.

**Price-Earnings (P/E) Ratio:** A stock's market price divided by its current or estimated future earnings. Lower P/E ratios often characterize stocks in low growth or mature industries, stocks in groups that have fallen out of favor, or stocks of established blue chip companies with long records of stable earnings and regular dividends. Sometimes a company that has good fundamentals may be viewed unfavorably by the market if it is an industry that is temporarily out of favor. Or a business may have experienced financial problems causing investors to be skeptical about its future. Either of these situations would result in lower relative P/E ratios. Some stocks exhibit above-average sales and earnings growth or expectations for above average growth. Consequently, investors are willing to pay more for these companies' earnings, which results in elevated P/E ratios. In other words, investors will pay more for shares of companies whose profits, in their opinion, are expected to increase faster than average. Because future events are in no way assured, high P/E stocks tend to be riskier and more volatile investments. Meketa Investment Group calculates P/E as the current price divided by the I/B/E/S consensus of twelve-month forecast earnings per share.

**Quality Rating:** The rank assigned a security by such rating services as Fitch, Moody's, and Standard & Poor's. The rating may be determined by such factors as (1) the likelihood of fulfillment of dividend, income, and principal payment of obligations; (2) the nature and provisions of the issue; and (3) the security's relative position in the event of liquidation of the company. Bonds assigned the top four grades (AAA, AA, A, BBB) are considered investment grade because they are eligible bank investments as determined by the controller of the currency.

**Sharpe Ratio:** A commonly used measure of risk-adjusted return. It is calculated by subtracting the risk free return (usually three-month Treasury bill) from the portfolio return and dividing the resulting excess return by the portfolio's total risk level (standard deviation). The result is a measure of return per unit of total risk taken. The higher the Sharpe ratio, the better the fund's historical risk adjusted performance.

**STIF Account:** Short-term investment fund at a custodian bank that invests in cash-equivalent instruments. It is generally used to safely invest the excess cash held by portfolio managers.

**Standard Deviation:** A measure of the total risk of an asset or a portfolio. Standard deviation measures the dispersion of a set of numbers around a central point (e.g., the average return). If the standard deviation is small, the distribution is concentrated within a narrow range of values. For a normal distribution, about two thirds of the observations will fall within one standard deviation of the mean, and 95% of the observations will fall within two standard deviations of the mean.

**Style:** The description of the type of approach and strategy utilized by an investment manager to manage funds. For example, the style for equities is determined by portfolio characteristics such as price-to-book value, price-to-earnings ratio, and dividend yield. Equity styles include growth, value, and core.

**Tracking Error:** A divergence between the price behavior of a position or a portfolio and the price behavior of a benchmark, as defined by the difference in standard deviation.

**Yield to Maturity:** The yield, or return, provided by a bond to its maturity date; determined by a mathematical process, usually requiring the use of a “basis book.” For example, a 5% bond pays \$5 a year interest on each \$100 par value. To figure its current yield, divide \$5 by \$95—the market price of the bond—and you get 5.26%. Assume that the same bond is due to mature in five years. On the maturity date, the issuer is pledged to pay \$100 for the bond that can be bought now for \$95. In other words, the bond is selling at a discount of 5% below par value. To figure yield to maturity, a simple and approximate method is to divide 5% by the five years to maturity, which equals 1% pro rata yearly. Add that 1% to the 5.26% current yield, and the yield to maturity is roughly 6.26%.

$$\frac{5\% \text{ (discount)}}{5 \text{ (yrs. to maturity)}} = 1\% \text{ pro rata, plus } 5.26\% \text{ (current yield)} = 6.26\% \text{ (yield to maturity)}$$

**Yield to Worst:** The lowest potential yield that can be received on a bond without the issuer actually defaulting. The yield to worst is calculated by making worst-case scenario assumptions on the issue by calculating the returns that would be received if provisions, including prepayment, call, or sinking fund, are used by the issuer.

**NCREIF Property Index (NPI):** Measures unleveraged investment performance of a very large pool of individual commercial real estate properties acquired in the private market by tax-exempt institutional investors for investment purposes only. The NPI index is capitalization-weighted for a quarterly time series composite total rate of return.

**NCREIF Fund Index - Open End Diversified Core Equity (NFI-ODCE):** Measures the investment performance of 28 open-end commingled funds pursuing a core investment strategy that reflects funds' leverage and cash positions. The NFI-ODCE index is equal-weighted and is reported gross and net of fees for a quarterly time series composite total rate of return.

Sources: [Investment Terminology](#), International Foundation of Employee Benefit Plans, 1999.  
[The Handbook of Fixed Income Securities](#), Fabozzi, Frank J., 1991

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Throughout this report, numbers may not sum due to rounding.

Returns for periods greater than one year are annualized throughout this report.

Values shown are in millions of dollars, unless noted otherwise.