Annual Investment Seminar

March 22, 2024

Annual Investment Seminar

- Introduction and welcome remarks
- Economic update and capital market assumptions
- Review of the Asset-Liability Study process
- Investment decisions and benchmarking
- Rebalancing and risk budget
- Overview of alternative investments
- Alternative investments quarterly performance

MEKETA
INVESTMENT GROUP

State Teachers Retirement System of Ohio

March 22, 2024

Economic Update and Capital Market Assumptions

Introduction

→ This presentation seeks to discuss two related items:

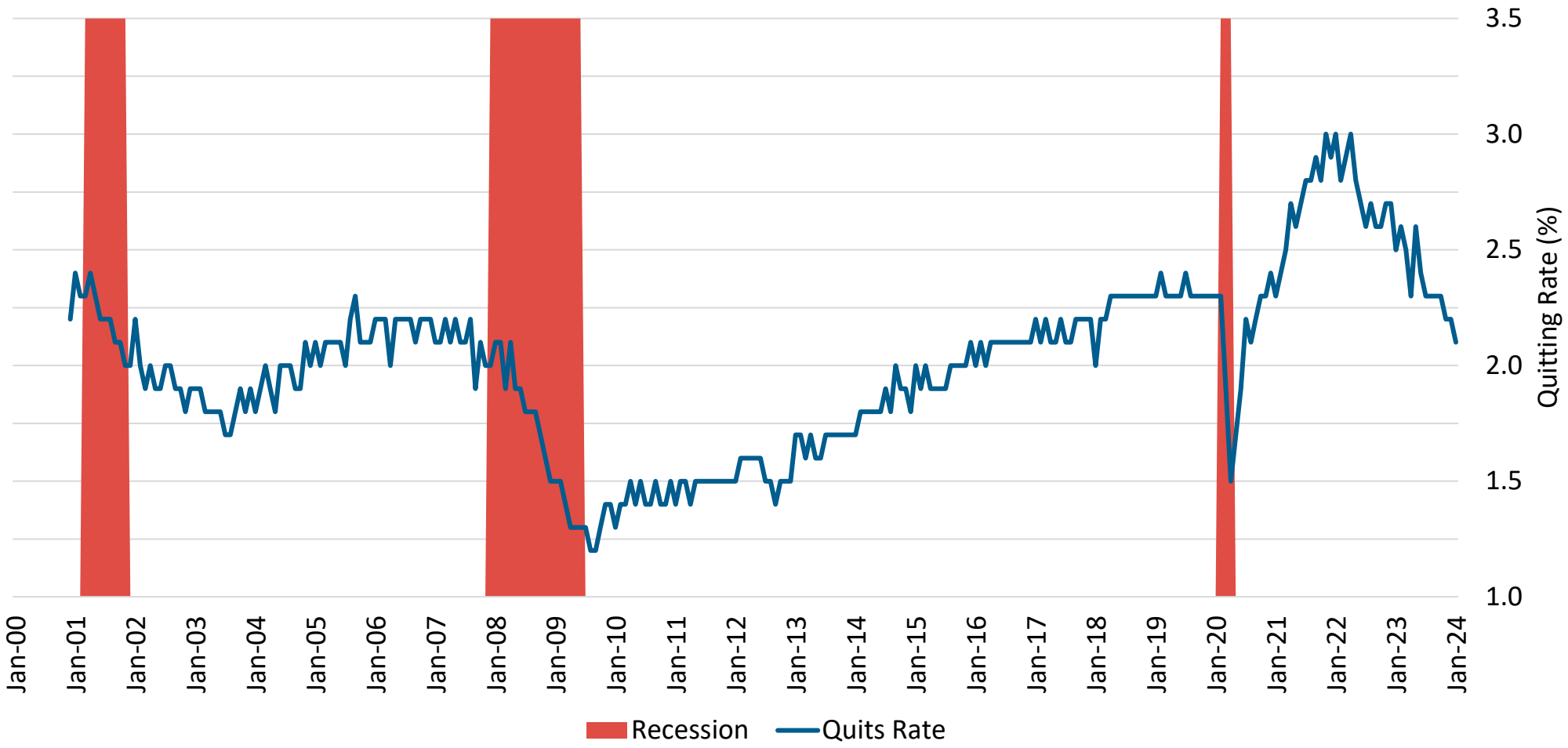
1. Update on topical economic/market information
   - These are shorter-term in nature (~1 year) and may influence 2024/2025 market behavior.
2. Detail regarding the development of long-term capital market assumptions
   - These form the basis of asset-liability studies and the long-term strategic structuring of an investment portfolio.

Economic Update

Payrolls are Weakening

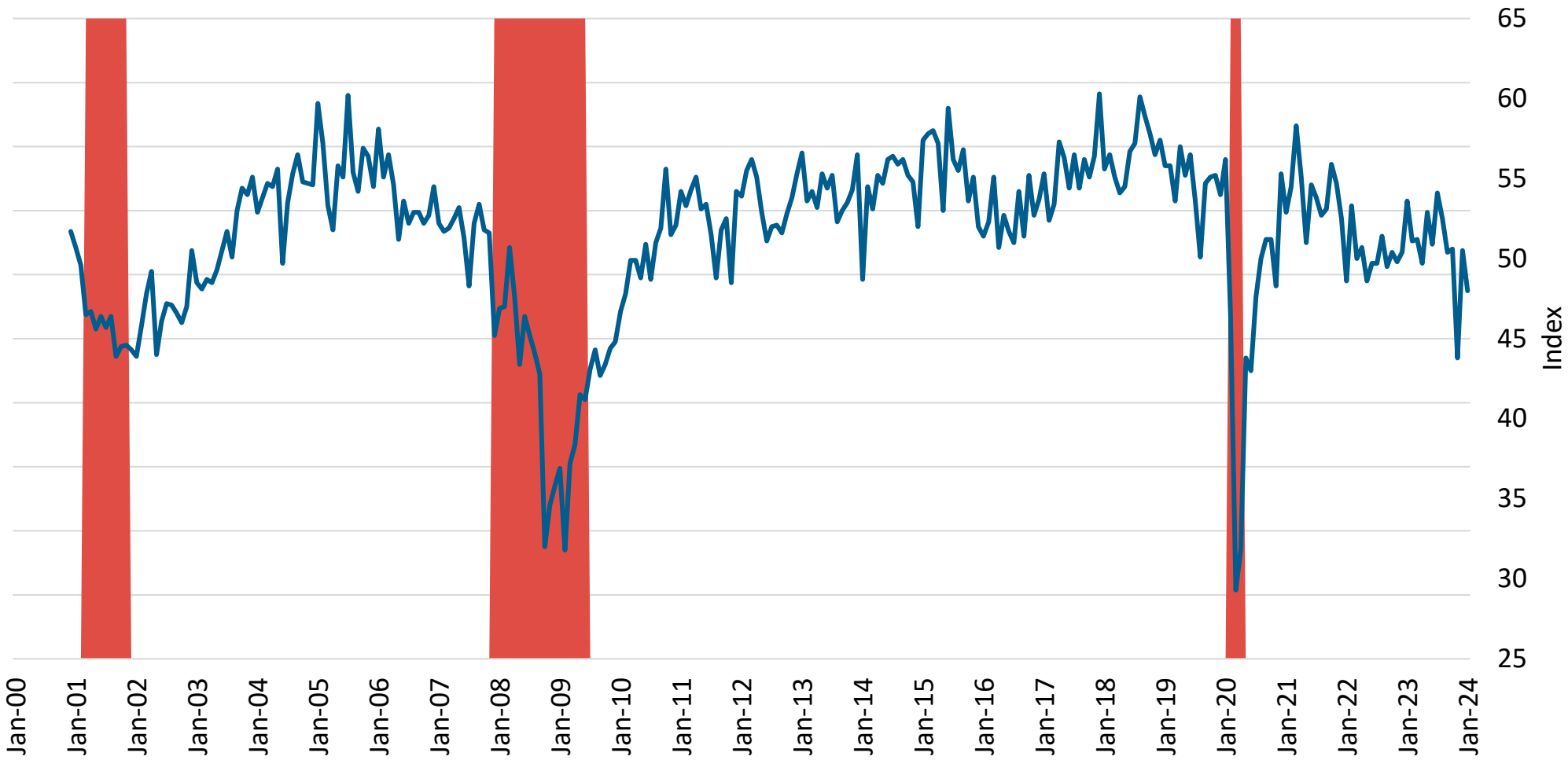
Source: Bureau of Labor Statistics as of February 2024; data provided by Bloomberg

Less Quitting = Less Confidence in Labor Market



Source: Bureau of Labor Statistics as of January 2024; data provided by Bloomberg

ISM Services Employment Back in Contraction (48)

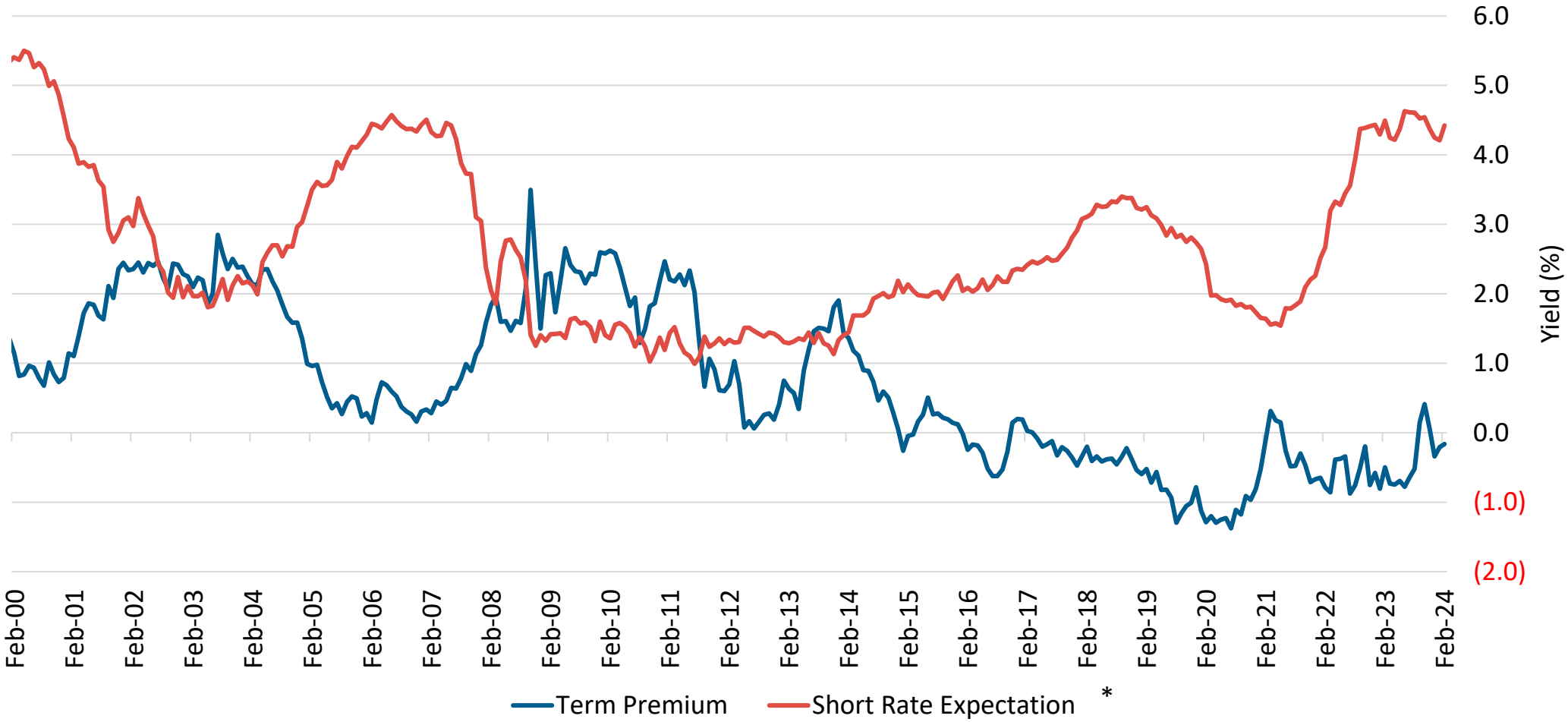


Source: Institute for Supply Management as of February 2024; data provided by Bloomberg

10-year Nominal Treasury Yield

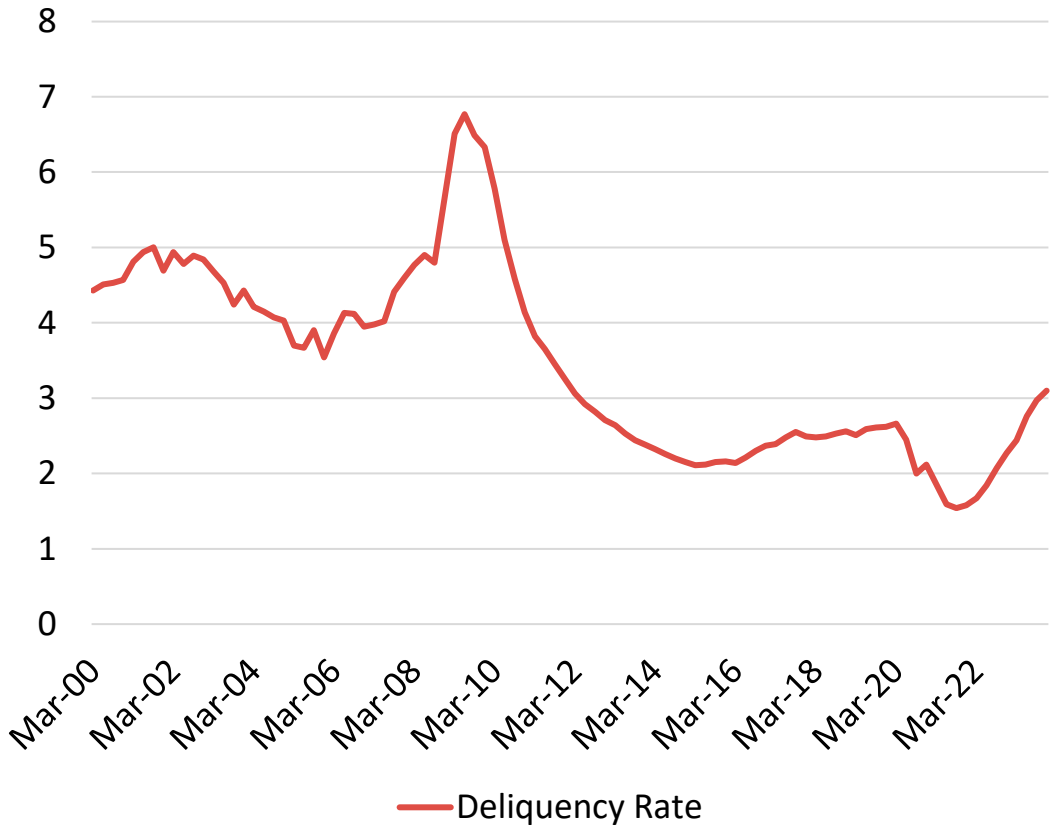
Source: Bloomberg; data as of February 2024

Policy Expectations & Fear of Higher Rates

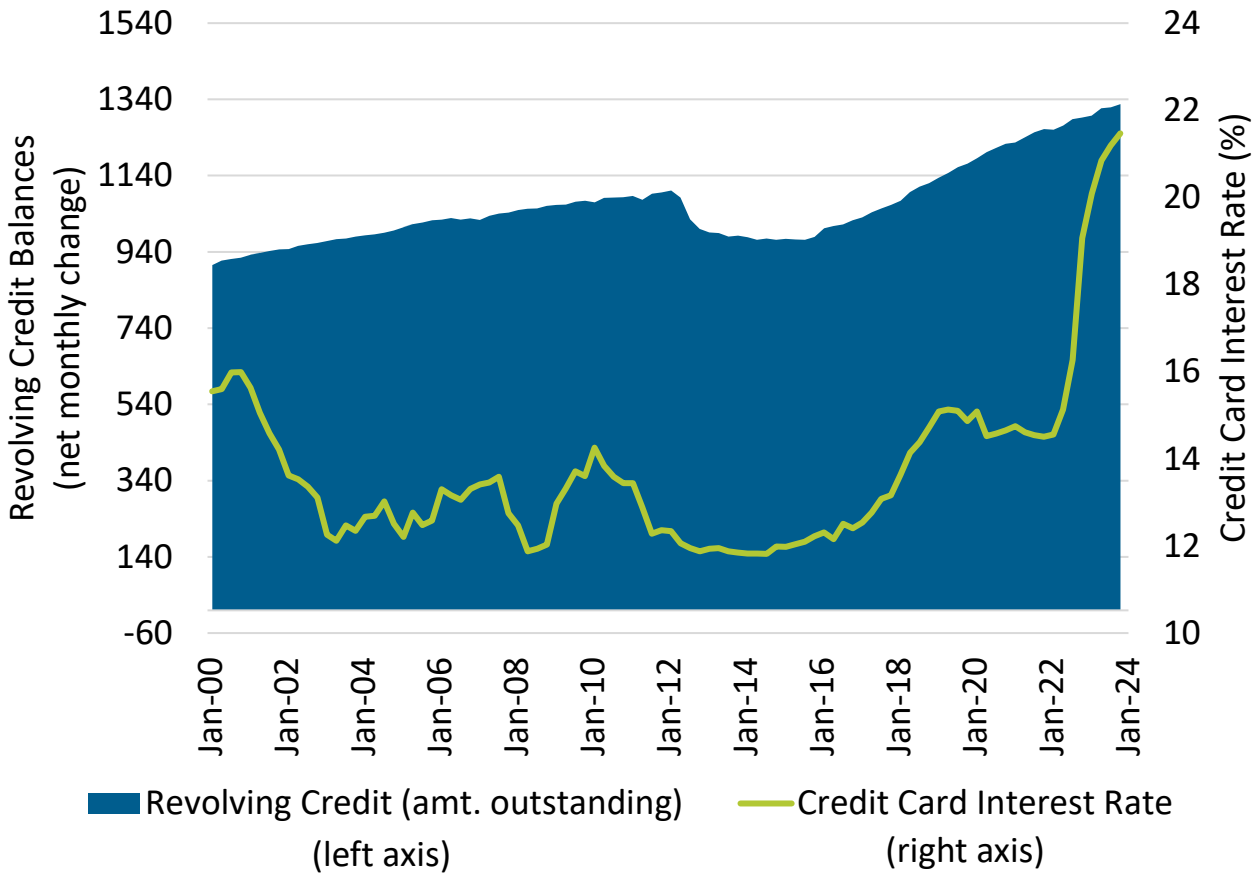


*Federal Reserve Bank of New York; Adrian, Crump, and Moench (ACM) model as of February 2024; data provided by Bloomberg

US Credit Card Delinquency Rates

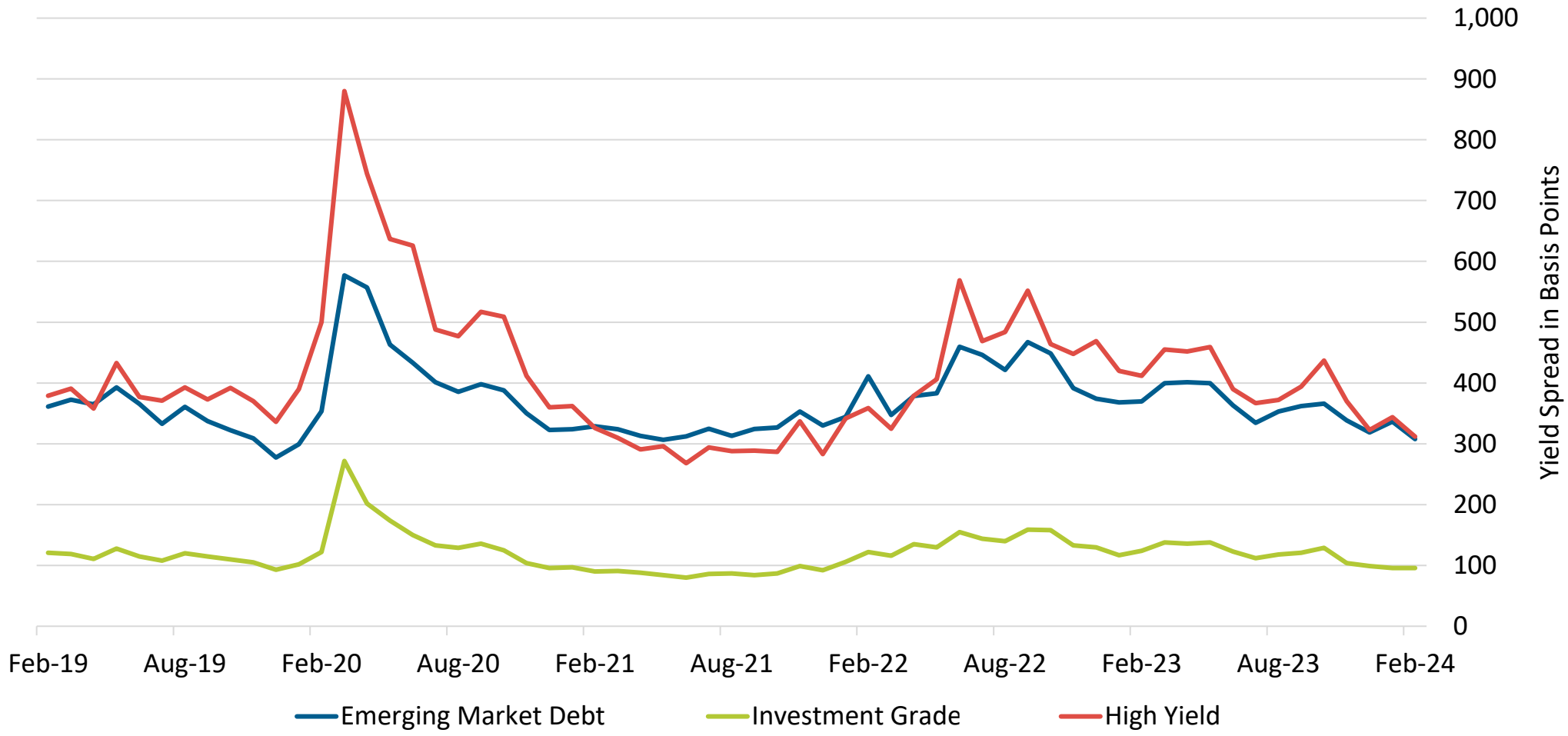


Revolving Credit Balances and Credit Card Rates Remain Elevated



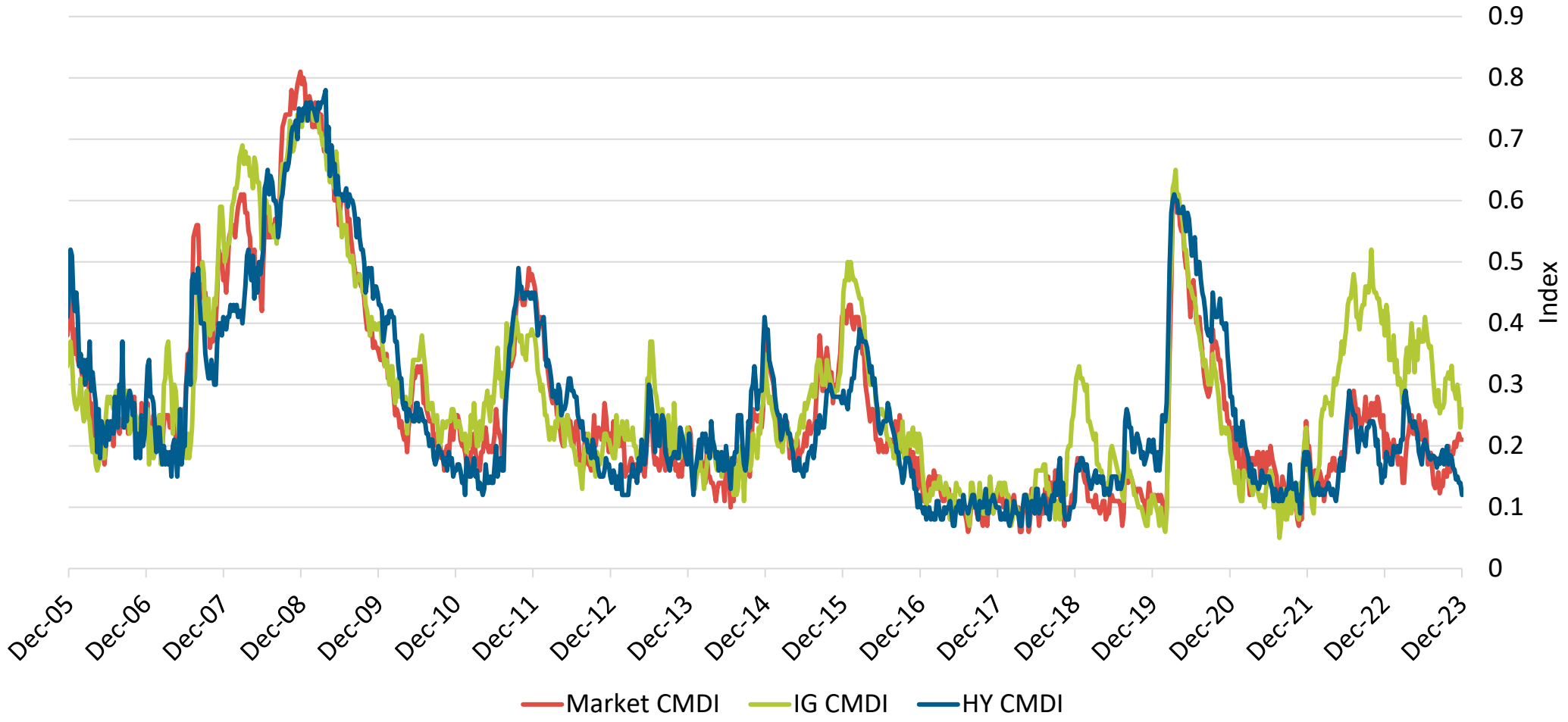
Source: Federal Reserve; data provided by Bloomberg

Select Credit Spreads (as of 2/29/24)



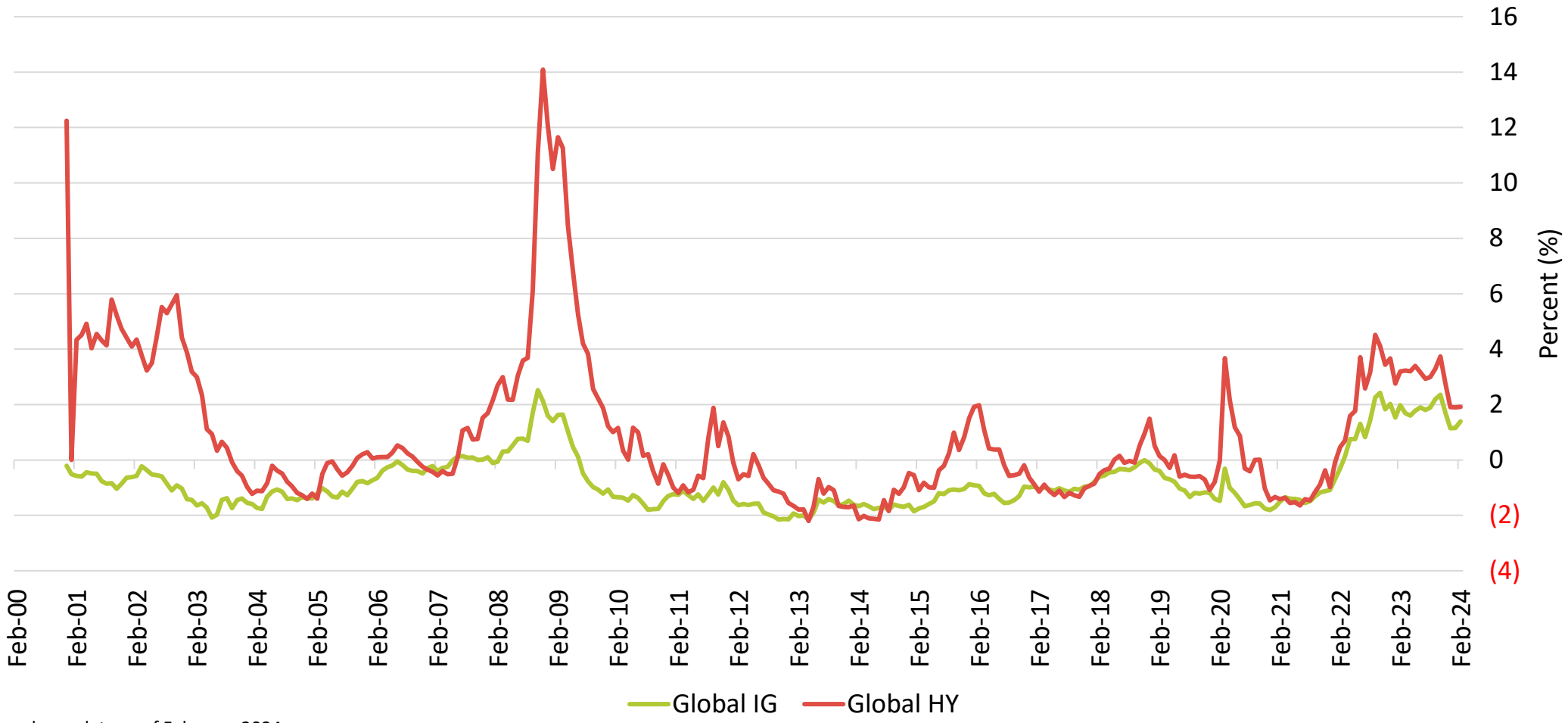
Source: Bloomberg

Corporate Bond Market Distress Index ("CMDI")



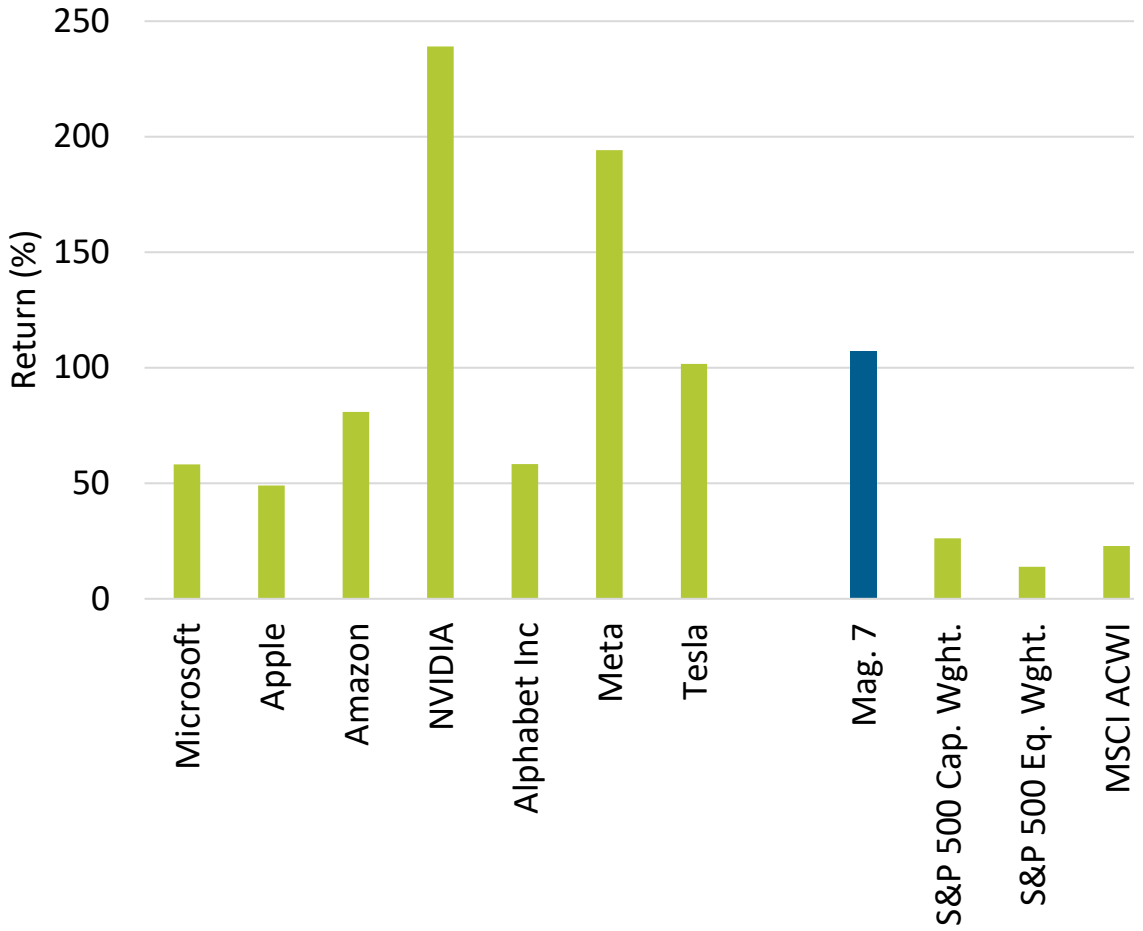
Source: Federal Reserve Bank of New York; data as of February 2024

Global IG & HY Refinancing Costs Are Starting To Ease
(Current Yield - Coupon = Cost Estimate)

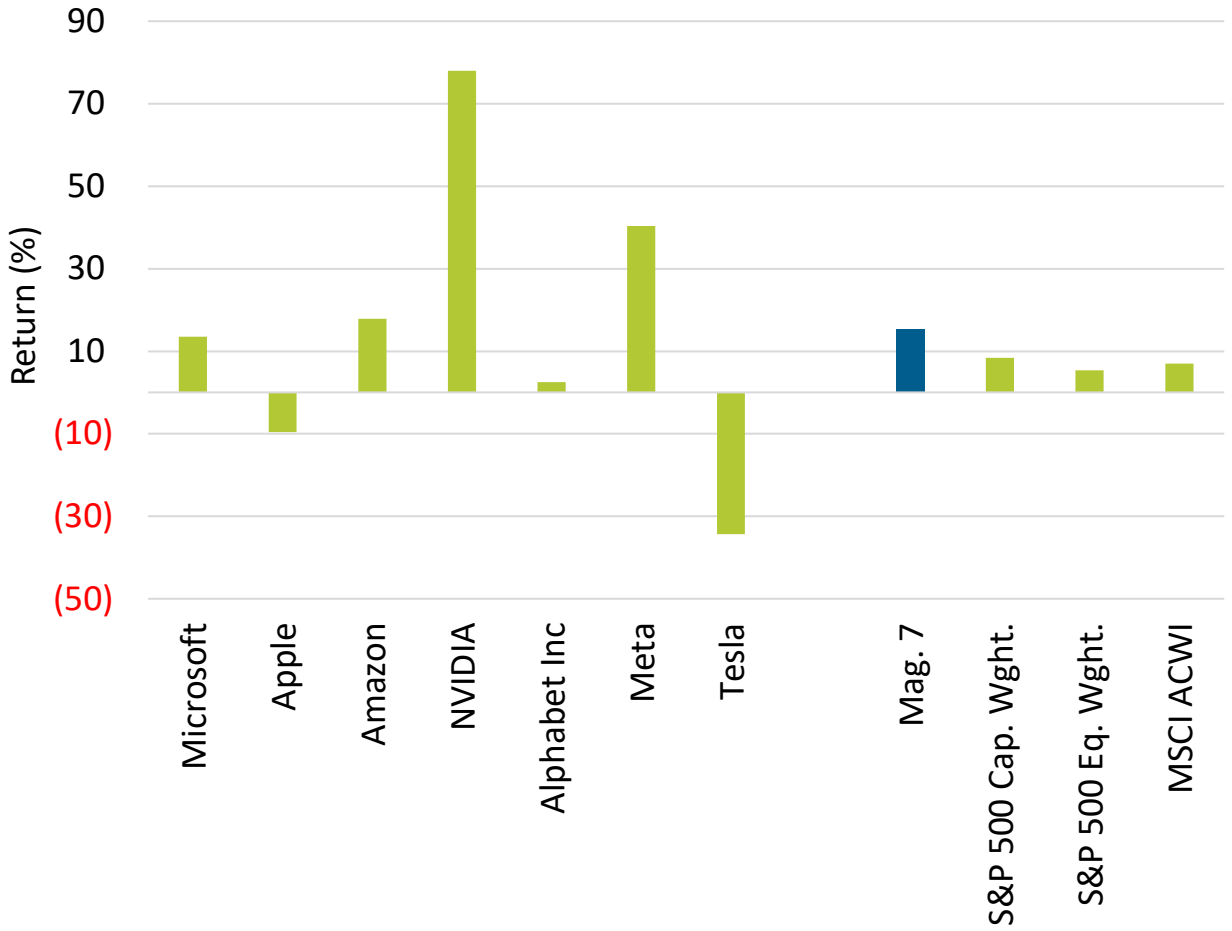


Source: Bloomberg; data as of February 2024

Select Equities | Total Return 2023



Select Equities | Total Return YTD (3/12/23)



Source: Bloomberg

Capital Market Assumptions

Executive Summary

→ We update our capital markets assumptions each year in January.

- Changes are driven by many factors, including rates, credit spreads, cap rates, and equity prices.

→ 2023 was a volatile year for most investors, but ultimately most asset classes experienced positive returns, including double-digit gains for many risky assets.

→ With the notable exception of China's markets, global bond and equity markets rallied at the end of the year, posting strong gains as inflation pressures eased and central banks appeared to be turning away from tightening policies.

- Despite short-term interest rates climbing, the yield on most Treasury bonds finished the year near where they started it.
- Credit spreads tightened, especially for lower quality credit such as high yield. The result is lower expected returns for many credit-oriented assets.
- Most equity markets rallied in 2023, generally at a much faster pace than the gain in earnings. Hence many equity markets were trading at higher valuations at year-end, thus reducing their forward-looking returns.

Setting Capital Market Assumptions ("CMAs")

→ CMAs are the inputs needed to calculate a portfolio's expected return, volatility, and relationships (i.e., correlations) to the broader markets.

- CMAs are also used in mean-variance optimization, simulation-based optimization, asset-liability modeling, and every other technique for finding "optimal" portfolios.

→ Consultants (including Meketa) generally set them once per year.

- Our results are published in January based on December 31 data.

→ This involves setting long-term expectations for a variety of asset class/strategy attributes:

- Returns
- Standard Deviations
- Correlations

→ Our process relies on both quantitative and qualitative methodologies.

STRS Ohio – Total Portfolio Expectations

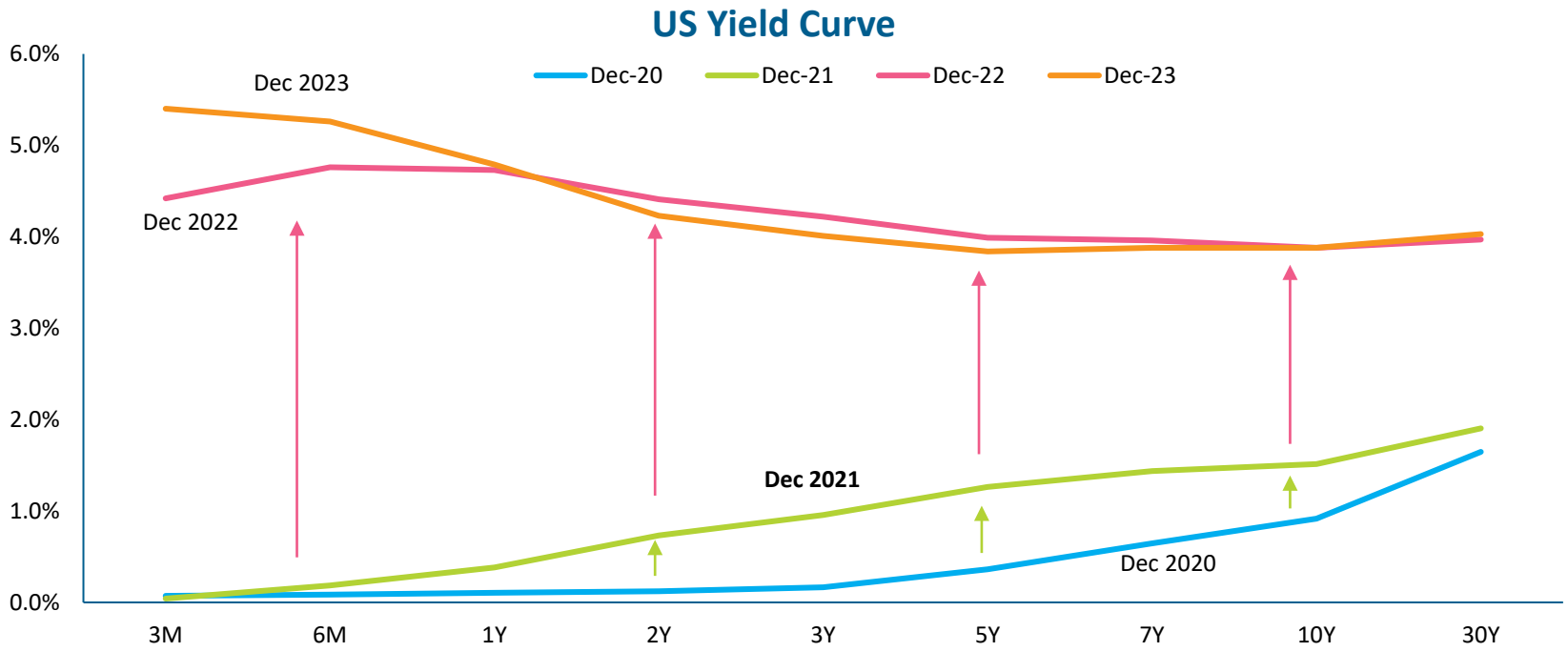
→ STRS Ohio is projected to earn a compound return of 7.04% over the next ten years.

Classes/Strategies	Policy Targets (%)	10-year Expected Return (%)
Equity	---	---
Domestic Equity	26	6.9
International Equity	22	7.7
Alternatives	19	9.1
Private Equity	9	9.9
Opportunistic/Diversified	10	7.9
Fixed Income	22	4.5
Real Estate	10	5.1
Liquidity Reserve	1	2.4
Total Portfolio Expected Return (10-year)		**7.04**
Annual Volatility		**11.76**

Interest Rate Volatility

→ Interest rate changes were a dominant storyline of 2023. While short-term rates increased throughout 2023, intermediate and long-term rates experienced significant volatility but ultimately finished the year at similar yields to where they started.

→ Rates remained materially higher as of 12/31/2023 compared to 2020 and 2021.

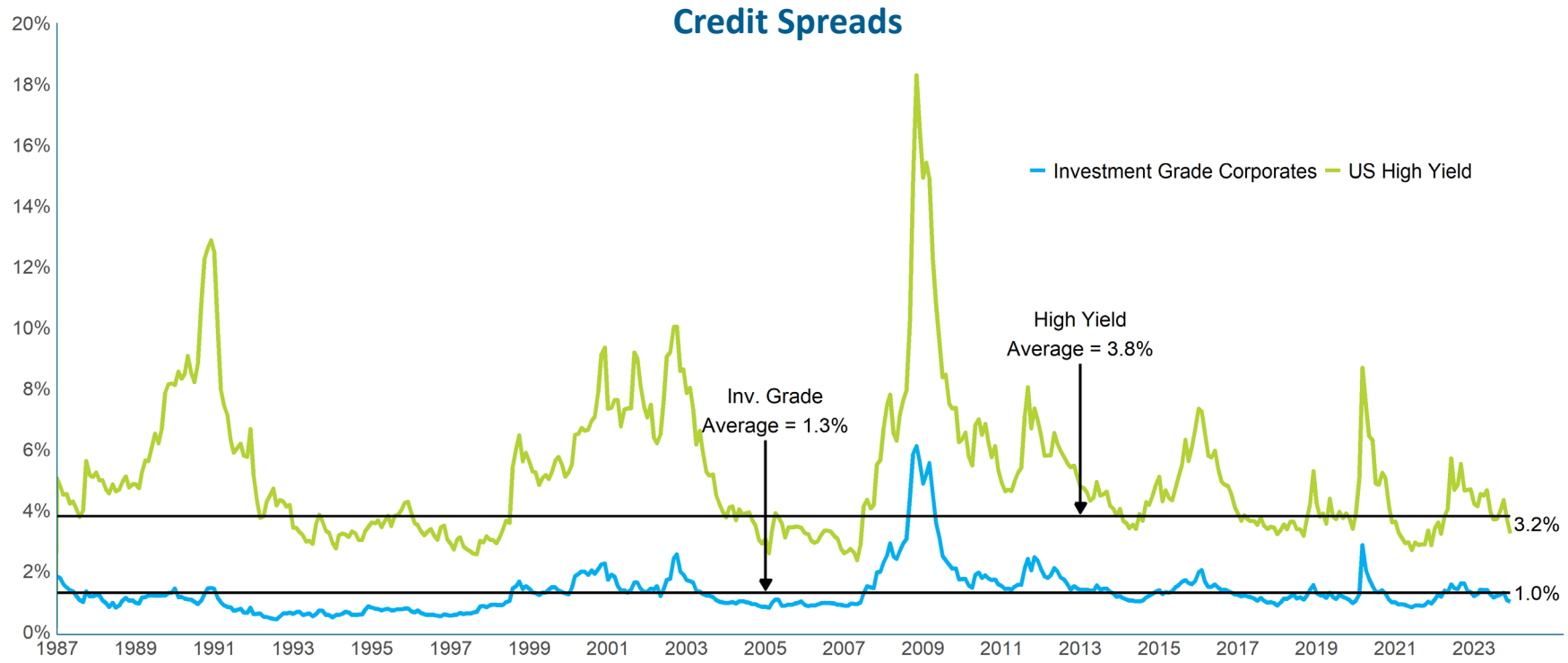


Source: Bloomberg. Data is as of December 31, 2023.

Narrower Credit Spreads

→ Credit spreads tightened slightly in 2023, though they remain close to their long-term averages.

- Lower quality credit spreads experienced a more substantial tightening. The spread for high yield bonds declined from 469 bp to 323 bp.



Source: Bloomberg. High Yield is proxied by the Bloomberg High Yield Index and Investment Grade Corporates are proxied by the Bloomberg US Corporate Investment Grade Index. Spread is calculated as the difference between the Yield to Worst of the respective index and the 10-Year US Treasury yield. Data is as of December 31, 2023.

Similar or Lower Yields (12/23 vs. 12/22)

→ Short-term interest rates were higher than one year ago, while the 10-year Treasury yield ended the year where it started it.

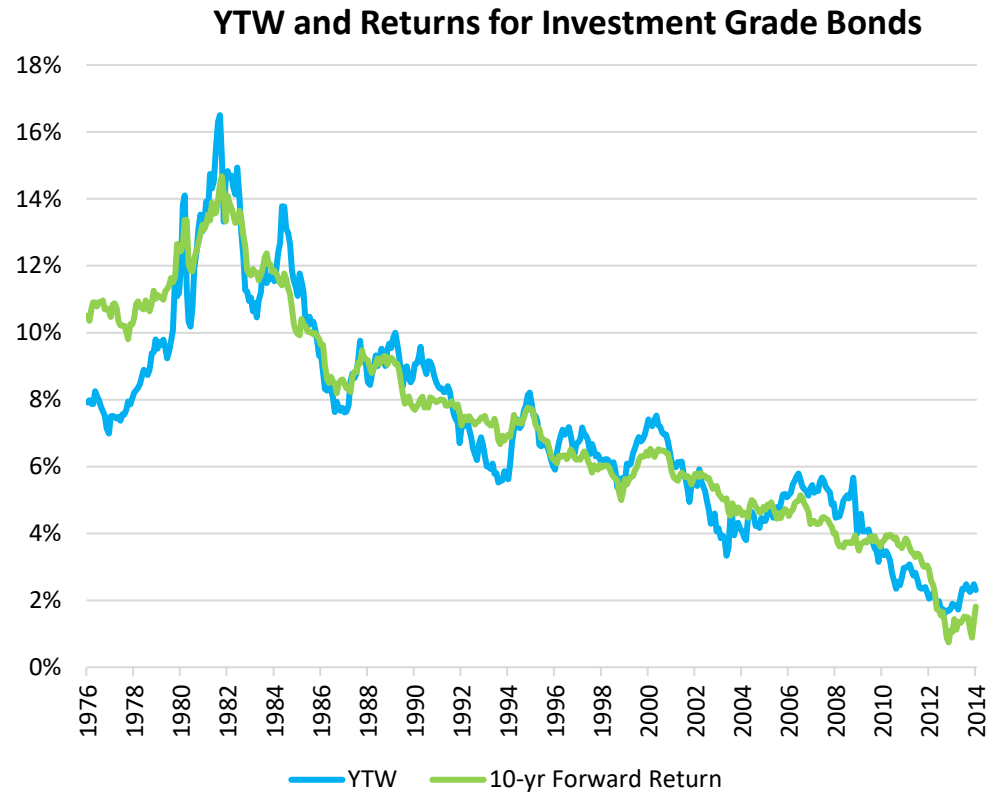
→ Similar levels of interest rates combined with tighter credit spreads results in slightly lower yields for most sectors of the global bond market.

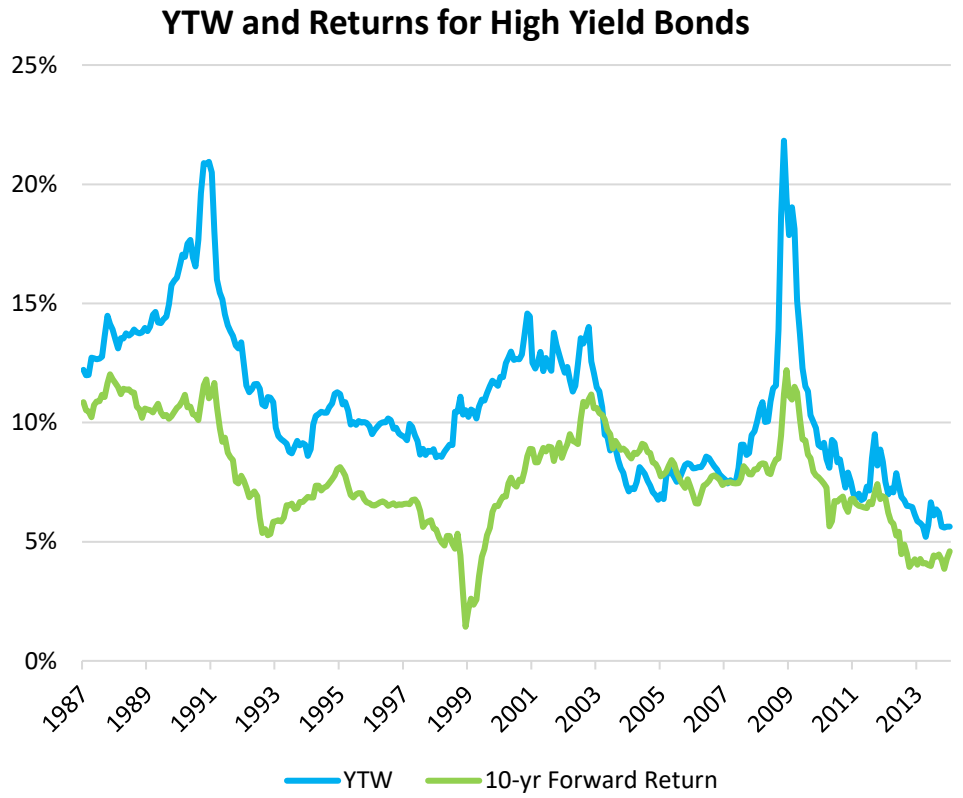
Index	Yield to Worst 12/31/23 (%)	Yield to Worst 12/31/22 (%)	Yield to Worst 12/31/21 (%)	Yield to Worst 12/31/20 (%)
Fed Funds Rate	5.25-5.50	4.25-4.50	0-0.25	0-0.25
10-year Treasury	3.88	3.88	1.52	0.93
Bloomberg Aggregate	4.53	4.68	1.75	1.12
Bloomberg Corporate	5.06	5.42	2.33	1.74
Bloomberg Securitized	4.72	4.75	1.98	1.25
Bloomberg Global Aggregate	3.51	3.73	1.31	0.83
Bloomberg EM Local Currency Government	4.08	4.42	3.83	3.20
Bloomberg EM Hard Currency Aggregate	6.77	7.26	3.96	3.20
Bloomberg US Corporate High Yield	7.59	8.96	4.21	4.18

Source: Bloomberg.

Yields Drive Future Returns

→ Changes in interest rates matter because yields are a very good predictor of future returns for bonds[1], at least over a 10-year horizon.





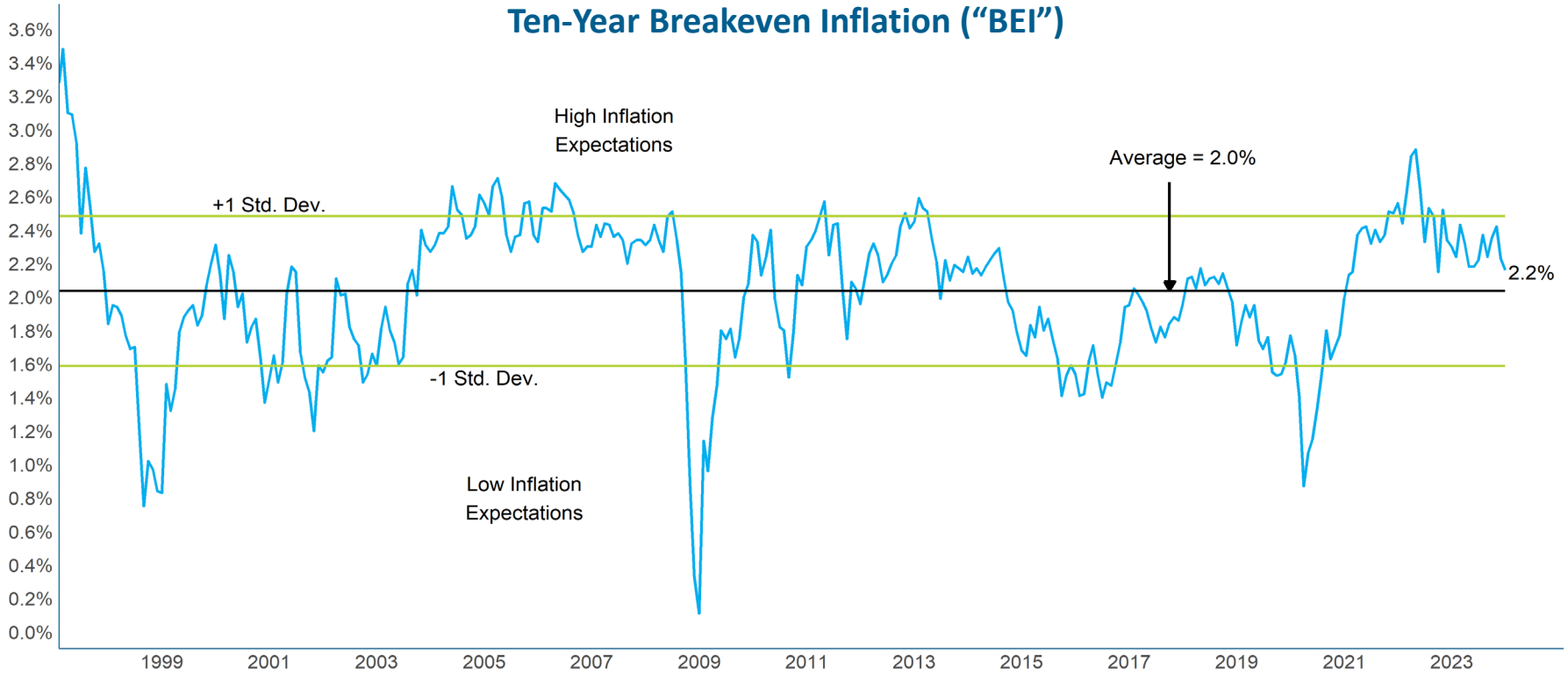
[1] When predicting returns for bonds, default risk should also be taken into account. For example, defaults are why the return for high yield bonds have generally been below the starting yield.

Source: Bloomberg Aggregate and Bloomberg High yield indices. Data is as of December 31, 2023.

Slightly Lower Inflation Expectations

→ After substantial changes in inflation expectations in recent years, the market's expectations for inflation were little changed at the end of 2023.

- The 10-year BEI rate dropped from 2.3% to 2.2%. The 5-year BEI was slightly lower, at 2.1%.

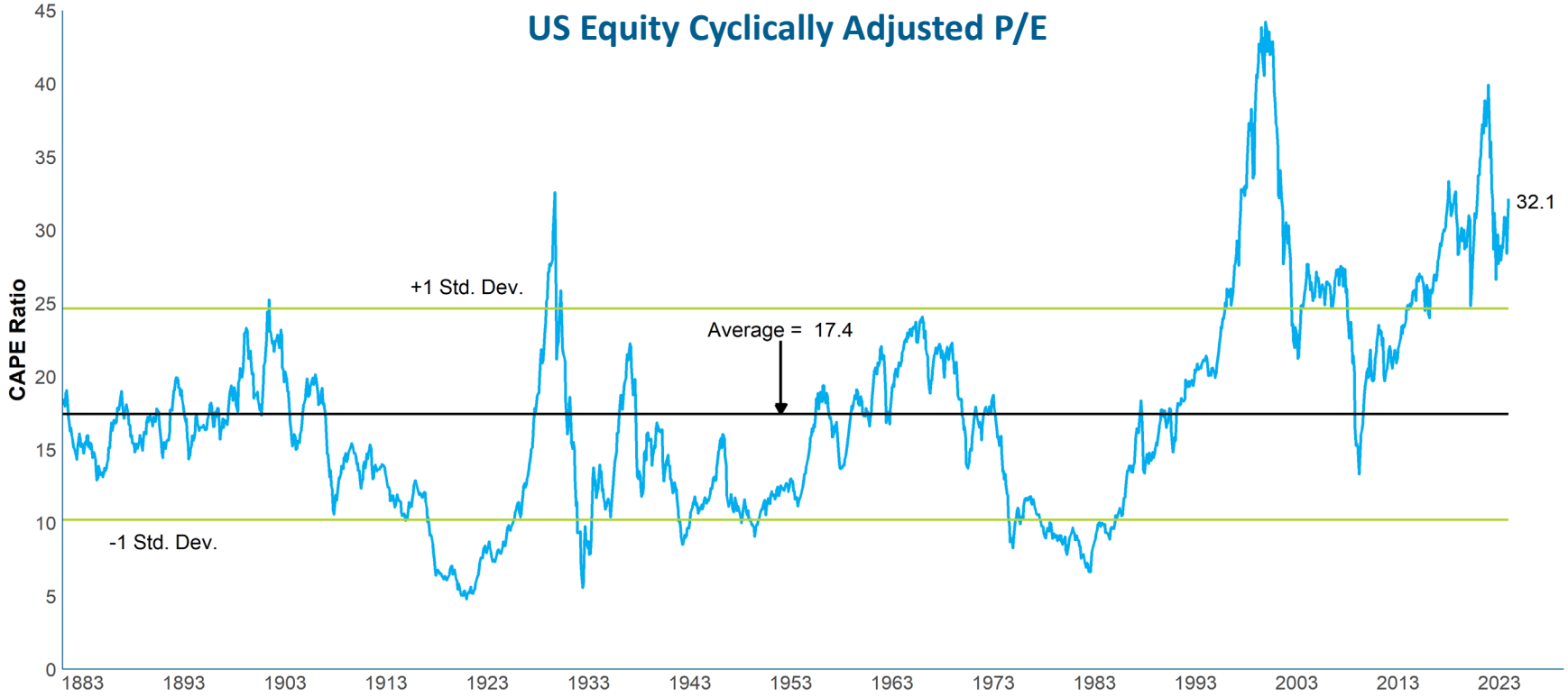


Source: US Treasury and Federal Reserve. Inflation is measured by the Consumer Price Index (CPI-U NSA). Data is as of December 31, 2023.

Higher Valuations for US Equities

→ US stocks had a very good year, with the S&P 500 index gaining 26.3% in 2023.

→ Valuations increased and remain elevated relative to their long-term history, though they are much nearer their average for the past 30 years.

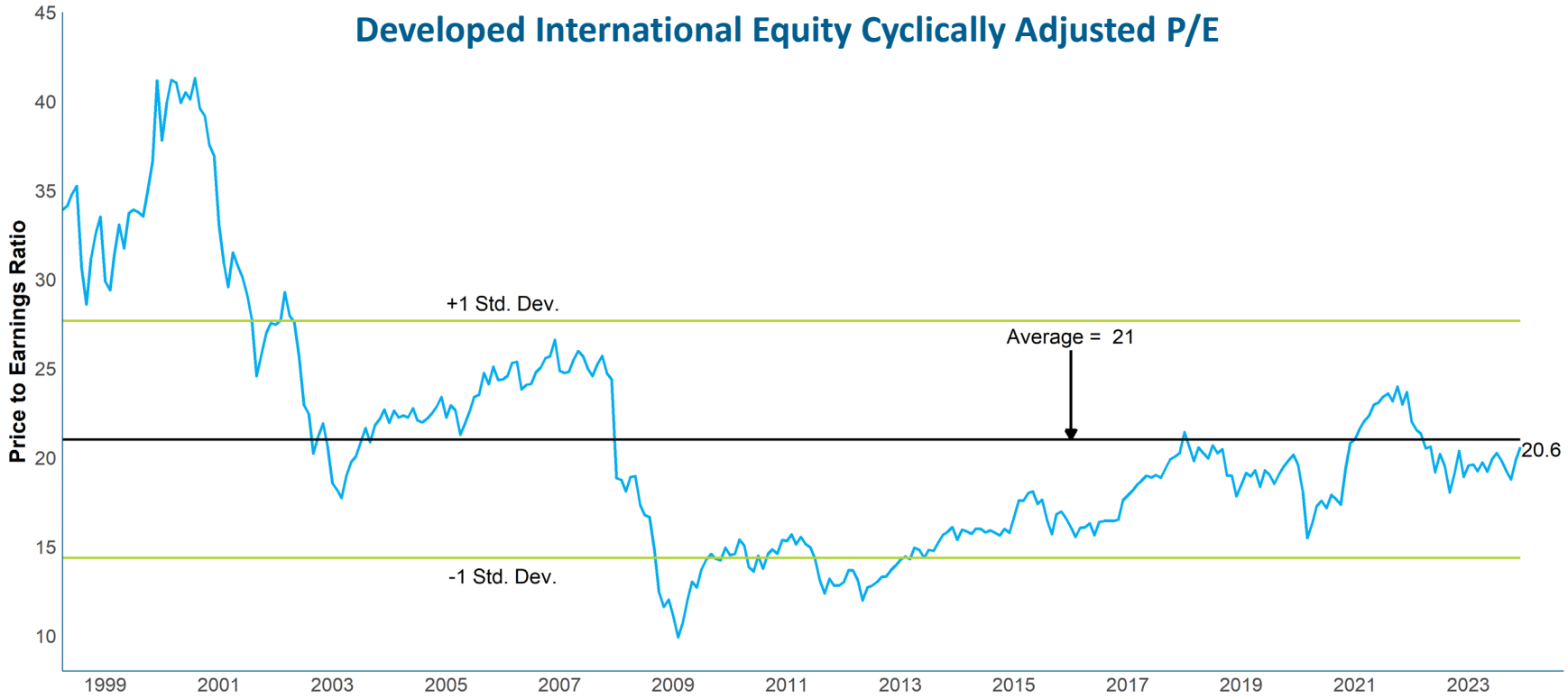


Source: Robert Shiller, Yale University, and Meketa Investment Group. Data is as of December 31, 2023.

Slightly Higher Prices in Non-US Equities, too

→ EAFE equities gained 18.2% in USD terms in 2023, benefiting slightly from a currency tailwind.

→ Despite increasing from one year ago, EAFE valuations remain close to their 25-year historical average.

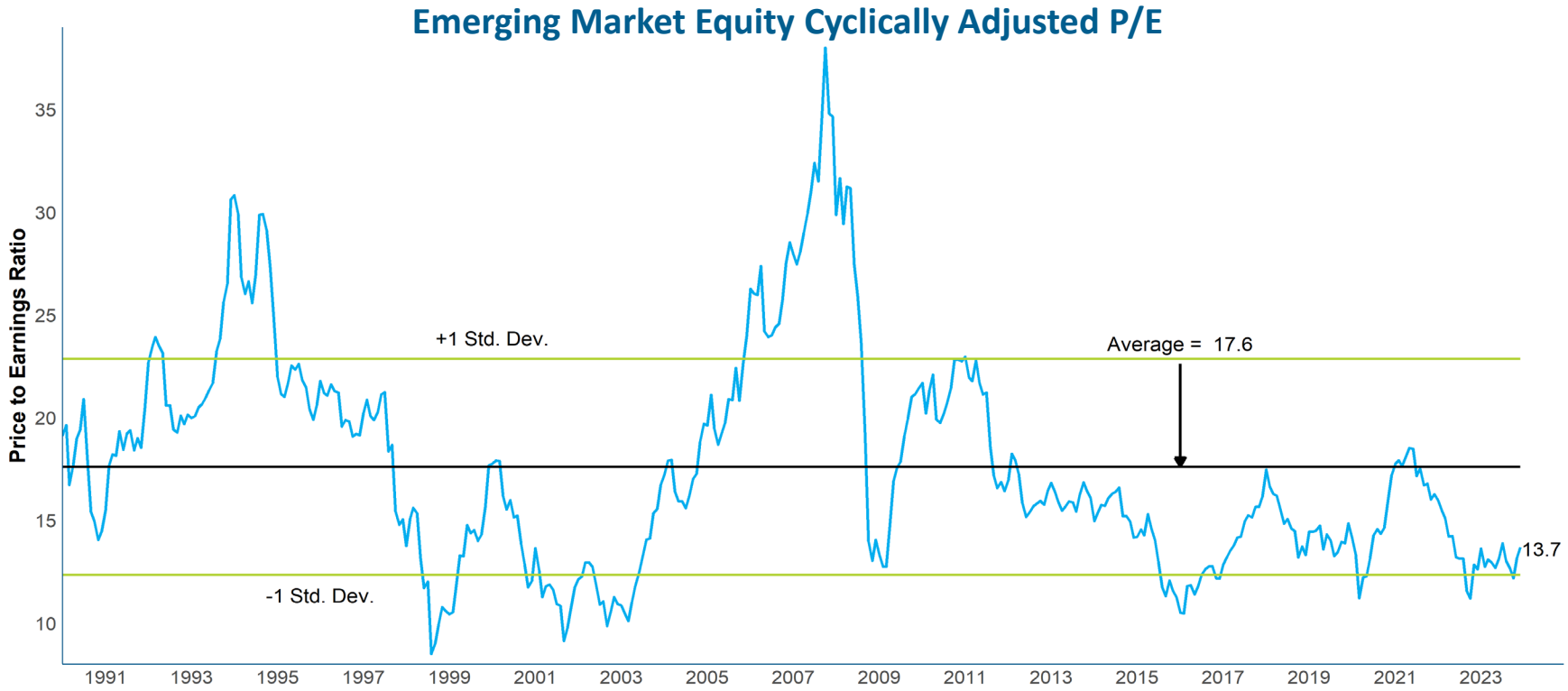


Source: MSCI and Bloomberg. Earnings figures represent the average of monthly "as reported" earnings over the previous ten years. Data is as of December 31, 2023.

And Slightly Higher Prices in Emerging Market Equities

→ Emerging market equities gained 9.8% in 2023, despite Chinese equities declining -11.2%.

→ EM equity valuations remain well below their long-term average, though there is a significant difference between EM ex-China and China valuations.

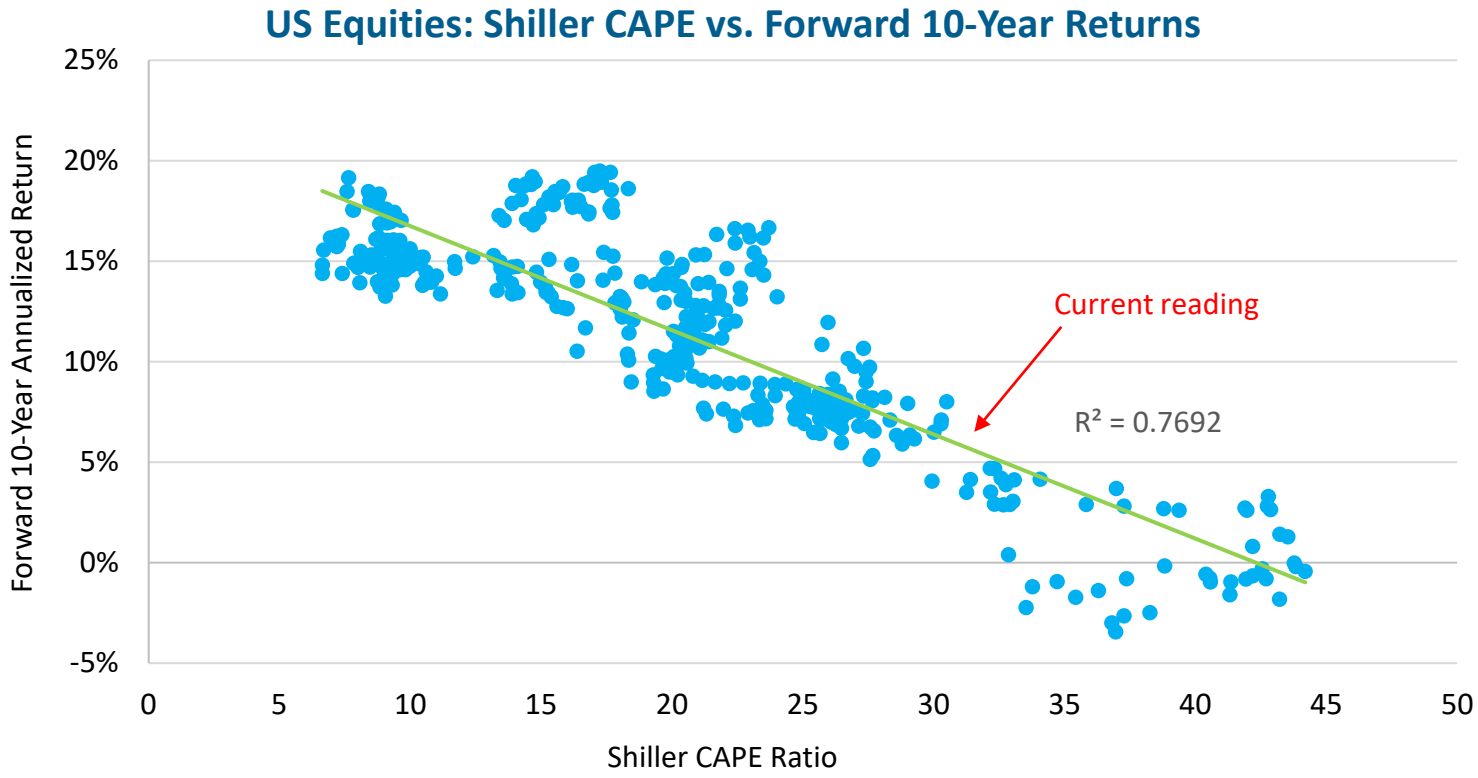


Source: MSCI and Bloomberg. Earnings figures represent the average of monthly "as reported" earnings over the previous ten years. Data is as of December 31, 2023.

Higher Prices Imply Lower Returns for Equities

→ Relative prices have been indicative of future equity returns.

→ Higher prices have led to lower future returns, and vice versa.

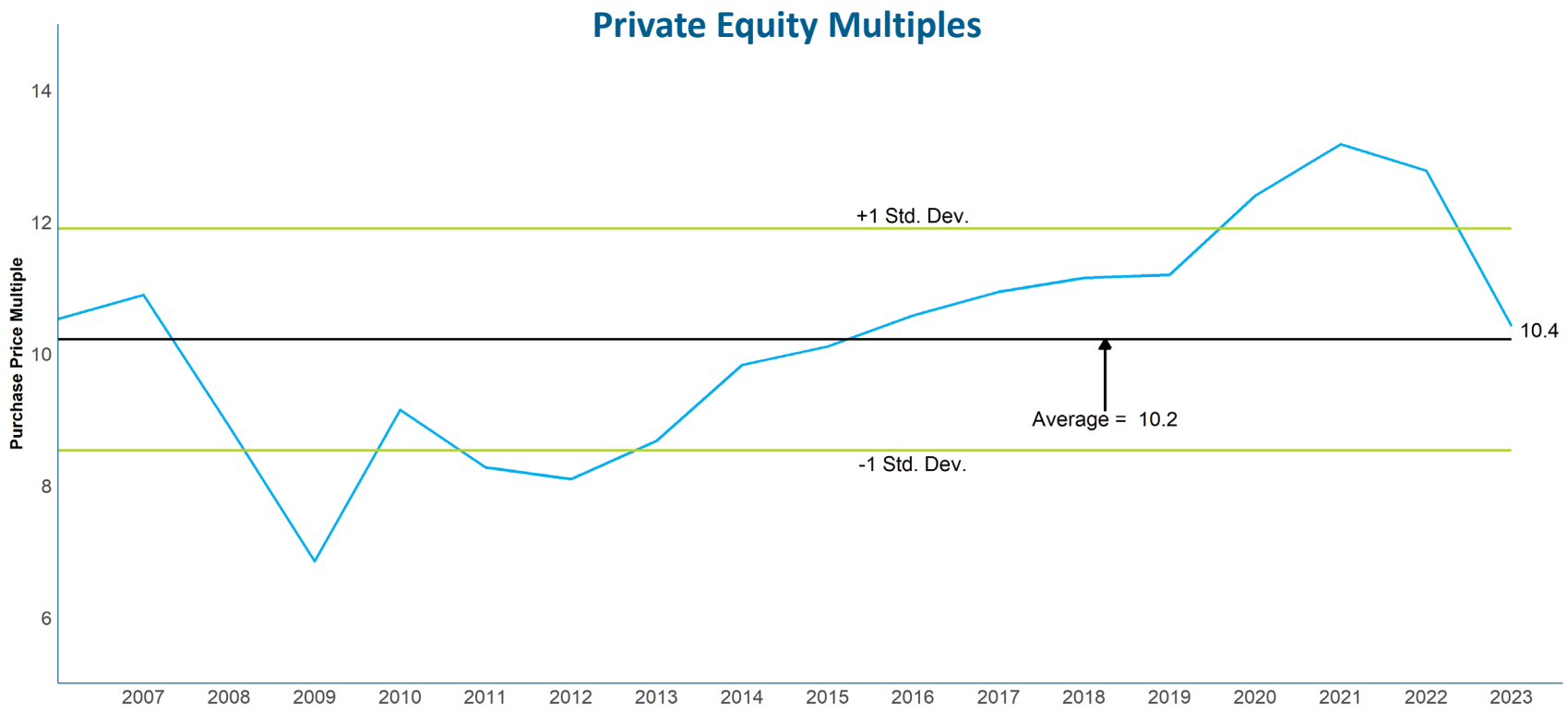


Source: Robert Shiller, Yale University, and Meketa Investment Group. Data is based on monthly returns and Cyclically Adjusted P/E ratio on S&P 500 Index for the period from January 1980 through December 2023.

Private Equity Prices Coming Back Down

→ EBITDA multiples fell in the first half of 2023 for buyouts.

- Valuations remained above their post-GFC average.



Source: Preqin Median EBITDA Multiples Paid in All LBOs, as of June 30, 2023.

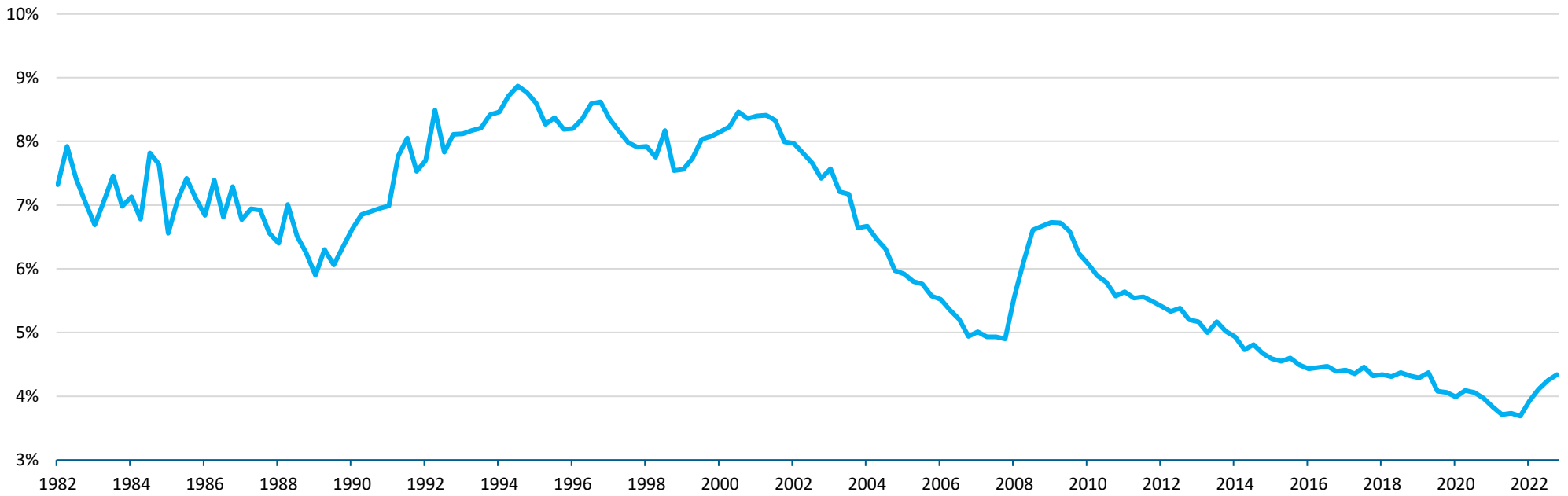
Increasing Real Estate Yields

→ Real estate cap rates are similar to an earnings yield (the inverse of the P/E ratio) for equities.

- Cap rates are indicative of future returns.

→ While cap rates have been gradually declining for decades, they have recently increased largely due to lower core real estate prices.

Core Real Estate Cap Rates



Source: NCREIF NPI value-weighted cap rates. As of September 30, 2023.

2024 vs. 2023 Summary

→ Many investors achieved returns in calendar year 2023 that were above their target return.

- Much of the strong performance was driven by a rebound in public equity markets.

→ Short-term interest rates increased or remained relatively stable in 2023.

→ Longer-term interest rates experienced material volatility in 2023 but ended the year at similar yields as they began the period.

- However, credit spreads for many fixed income assets generally tightened during the year.

→ With increasing public equity prices and relatively stable fixed income yields (in aggregate due to offsetting effects), our 2024 CMAs project lower total portfolio returns over the next decade compared to early-2023.

- Additionally, due to lower private markets activity in 2023 (e.g., real estate transactions, private equity exits, etc.), there is additional uncertainty regarding private markets projections.

Developing Expected Returns

→ Market practitioners generally make use of three methods for developing long-term expected returns:

- Historical average returns
- Financial/economic theory (e.g., higher risk = higher returns, capital structures, etc.)
- Current measures (e.g., starting valuations relative to history)

→ In addition to the above, practitioners also incorporate general projections for macroeconomic metrics such as GDP and inflation, among others.

→ Meketa's methods are in-line with industry standards and represent a mixture of the three mechanisms.

- Historical average returns play the smallest role in our assumptions.

Building 10-year Forecasts

→ Our first step is to develop 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.
- Leverage (and cost of debt) is also directly incorporated, where applicable.

CMA Development Example: Public Equities

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

$$E(R) = Dividend\ Yield + Price\ Return + Currency\ Effect$$

$$Price\ Return = Earnings\ Growth + Multiple\ Effect$$

→ We use the current dividend yield on the respective index.[1]

→ Earnings growth is a function of real GDP growth, inflation, and exposure to foreign revenue sources.

→ We use three approaches to calculate the multiple effect.

- The models assume reversion to the mean or fair value.

→ We arrive at our preliminary 10-year assumption (in local currency)

$$US\ Equity\ E(R) = 1.5\% + [(1 + 6.4\%)\ x\ (1 - 1.0\%) - 1] = 6.9\%$$

→ For non-US equities, we add the expected currency effect vs. the US Dollar to the local expected return.

[1] The source for dividend yields is S&P 500 for the US and MSCI for non-US equities.

CMA Development Example: Bonds

→ The short version for most investment grade bond models is: *E(R) = Current YTW (yield* to worst)

→ The longer version accounts for the expected term structure in the future.

- If the average duration is roughly five years, we calculate the expected yield in five years.
- The net effect tends to be minimal, since higher income in years 5 to 10 is offset by price declines in years 1 to 5.

→ For corporate bonds, we assume the spread vs. Treasuries will revert most of the way back to their mean since 1990.

→ For cash, we use an average of the current rate and the rate suggested by the Taylor Rule (inputs are current & potential GDP, current & desired inflation).

→ For TIPS, we add the real yield for the TIPS index to the expected inflation rate used in the equities models.

→ As with equities, we also make currency adjustments when necessary.

- This currently provides a tailwind to foreign and EM local currency debt.

CMA Development Example: Bonds (cont'd)

→ For anything with credit risk, we also take into account the expected default & recovery rates.

	Inv. Grade Corporate (%)	LT Corporate (%)	Foreign Debt (%)	EM Debt (major) (%)	EM Debt (local) (%)	High Yield (%)	Bank Loans (%)
Default Rate	0.08	0.08	0.09	1.78	0.40	2.50	2.50
Loss Rate	50	50	50	50	50	45	40

→ As a guide, we use Moody's historical global default & recovery data for each bucket as it is currently rated.

ex: EM Debt (local currency)

Rating	Weighting (%)	Default Rate (%)	Weighted Default (%)
Aa	6.2%	0.06%	0.00%
A	29.3%	0.09%	0.03%
Baa	44.1%	0.27%	0.12%
Ba	18.9%	1.06%	0.20%
B	1.5%	3.40%	0.05%
Total Weighted Average Default Rate:			**0.40%**

CMA Development Example: Private Equity

→ For Buyouts, we start with public equity expected returns.

→ We add a premium or discount based on the pricing of buyouts relative to stocks.

- EBITDA multiples provide an indication of pricing.
- 2022 and 2023 have seen the first meaningful reduction in multiples since the GFC.

→ We add a premia for control (e.g., for greater operational efficiencies) and leverage.

- We assume leverage of 1.4x - 1.6x.

→ We subtract borrowing costs and estimated fees.

- We assume borrowing costs are consistent with the yield on bank loans.

→ We also look at how closely valuations (through September 30) compared to price changes occurring in the public markets, given that buyouts pricing often lags that of public equities.

CMA Development Example: Private Equity (cont'd)

→ For Venture Capital (VC), we create a public market proxy that we can compare through time.

- The composite is composed of: traditional technology, biotech, pharmaceuticals, life sciences, IT services, internet, and clean tech & environmental stocks.
  - The weighting to each sector varies through time.
  - The data is an imperfect proxy and the correlation with future returns is not high.
  - Still, this proxy provides some indication of pricing relative to small cap stocks.
- We also look at how VC valuations (through September 30) compared to price changes for public markets.

→For Growth Equity, we infer a return that is between that of buyouts and venture capital.

- The relative weightings place the return closer to that of VC than buyouts.

Aggregate private equity assumption utilizes a weighted average based on a typical institutional allocation to private equity.

Component	Weight	E(R)
Buyouts	65%	9.5%
Growth Equity	10%	10.4%
Venture Capital	25%	10.8%
Private Equity Composite		**9.9%**

CMA Development Example: Real Estate

→ For Core Real Estate, we used two models.

- The first model adds a premium to the Cap Rate[1].
  - Core RE has historically returned approximately 1.0% more than its cap rate at the start of the period over the subsequent ten years.
- The second model combines income with capital appreciation potential.
  - The income for core RE has historically been the cap rate minus 2-3% (for Cap Ex).
  - We assume income (NOI) grows at the rate of inflation.
  - We assume there is some measure of fair value for cap rates relative to bond yields.
    - We make a price adjustment based on the forward yield curve.
- We adjust for leverage, borrowing costs, and fees.

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[1] (%)
Bank Loans	6.5	-2.9	10.0
FI/L-S Credit	5.8	-2.7	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).

[1] Note that we typically round our standard deviation assumptions to whole numbers.

Moving from 10-year to 10-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.

Putting it all Together

→ STRS Ohio is projected to earn a compound return of 7.04% over the next ten years.

Classes/Strategies	Policy Targets (%)	10-year Expected Return (%)
Equity	---	---
Domestic Equity	26	6.9
International Equity	22	7.7
Alternatives	19	9.1
Private Equity	9	9.9
Opportunistic/Diversified	10	7.9
Fixed Income	22	4.5
Real Estate	10	5.1
Liquidity Reserve	1	2.4
Total Portfolio Expected Return (10-year)		**7.04**
Annual Volatility		**11.76**

MEKETA
INVESTMENT GROUP

State Teachers Retirement System of Ohio

March 22, 2024

Review of Asset-Liability Study Process

Introduction

→ This presentation seeks to review the overall asset-liability study process.

- *Note: The examples/graphics in this presentation are for illustrative purposes only and may not be specific to STRS Ohio plan provisions/data.*

→ The last STRS Ohio asset-liability study was completed in 2022.

→ It is expected that STRS Ohio will embark on a new asset-liability study during the second half of 2024.

- Industry best practices are to conduct an asset-liability study every 3-5 years or when market conditions materially change.
- Given capital market dynamics (i.e., higher interest rates), shifting to the shorter end of the 3-5 year range is prudent.
- The 2024 asset-liability study would be completed in mid-2025.

Asset-Liability Study Overview

Strategic Allocation: The foundation for long-term portfolio structure

Key aspect:
Define risk & determine Board's tolerance for that risk

Tolerance for risk:
Heavily influences policy selection

Plan Assets

Heavily influence overall plan risk

~90%

% of Investment Risk explained by asset allocation policy

STRS Ohio completed its last Asset-Liability Study in 2022

3 key high-level steps to the A/L process:

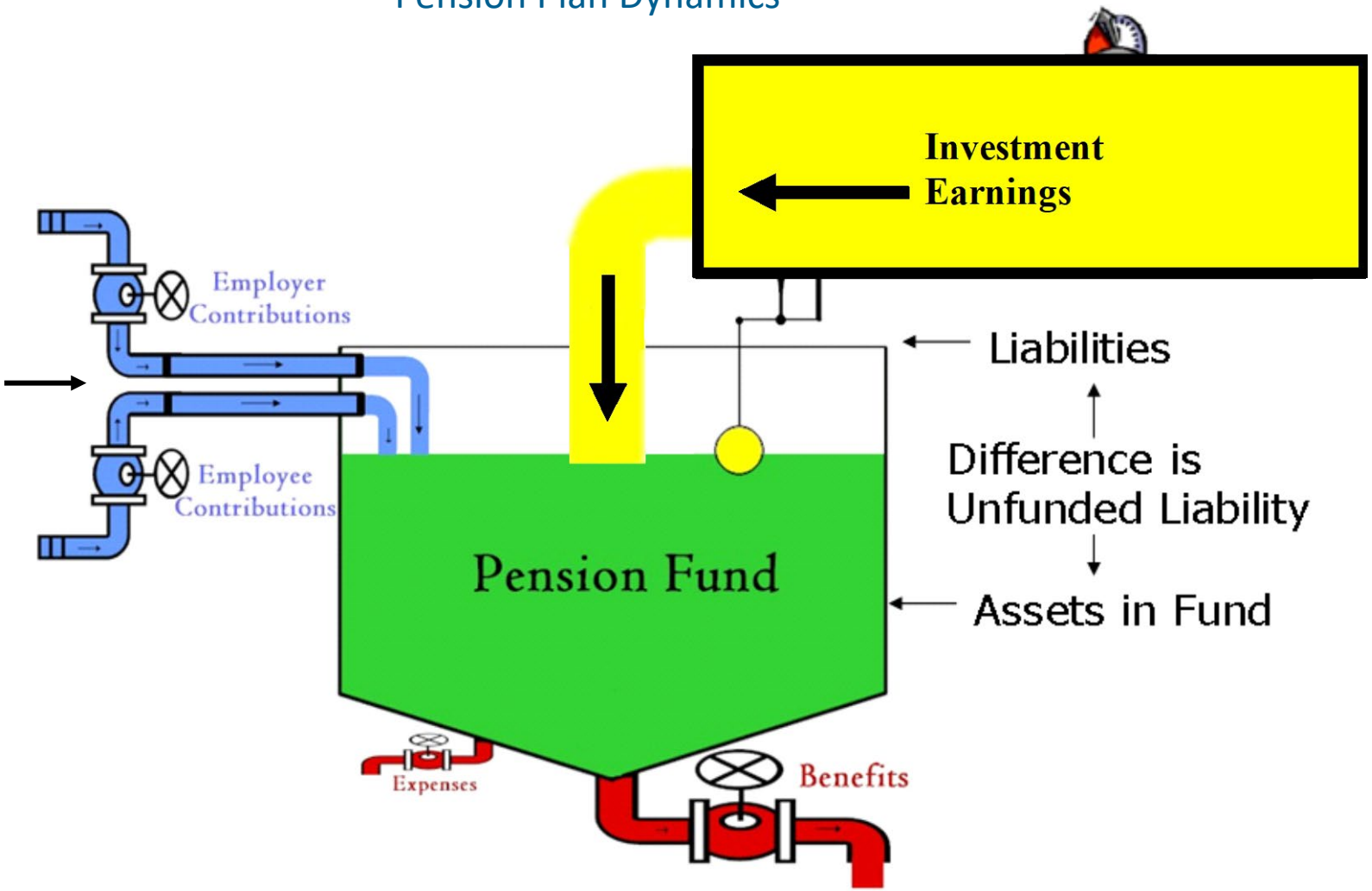
1.
Develop an understanding of **how the financial condition of STRS Ohio might vary** based on outcomes of the investment portfolio.

2.
Set a consensus definition and view of the risk(s) STRS Ohio should bear.

3.
Once a view/tolerance for risk has been established, **select an appropriate long-term investment strategy** (i.e., a policy portfolio / strategic allocation).

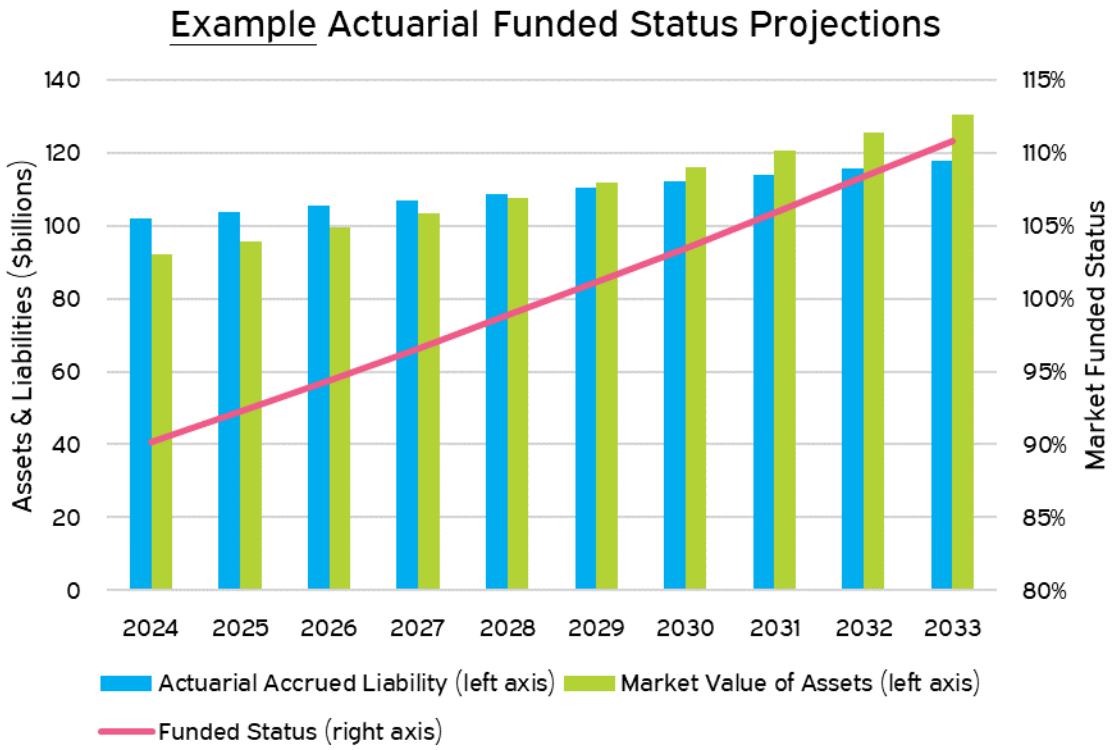
Pension Plan Dynamics

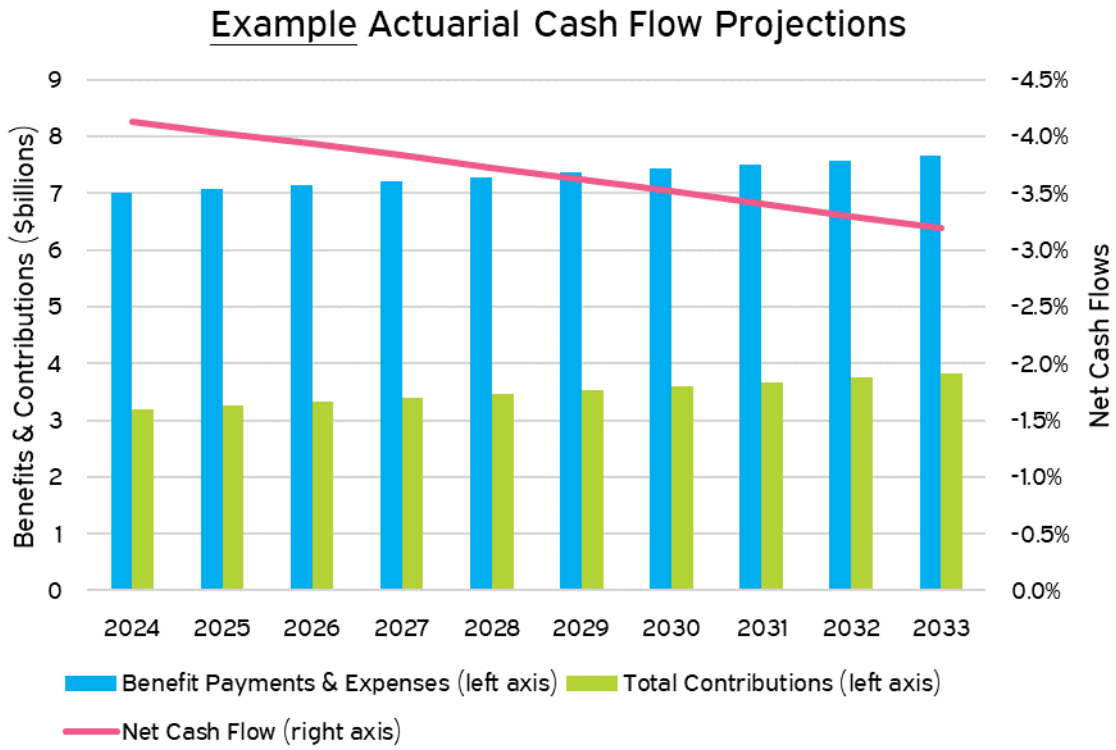
Fixed contribution rates is an attribute that results in unique challenges for STRS Ohio.



Source: Harvard Business Review, 1965

Asset-Liability Studies vs. Actuarial Reports





→ Actuarial reports focus on deterministic projections of the main asset-liability metrics (i.e., funded ratio & cash flows).

→ Asset-liability studies focus on stochastic projections of the same asset-liability metrics and how different asset allocations may impact those metrics over time.

Changes in Funded Status

→ The actuarial value of assets (AVA) and actuarial accrued liability (AAL) change from one year to the next in a formulaic fashion.

- Note: actuarial losses/gains are important considerations that are generally related to experience vs. assumptions.

Asset-liability studies examine a wide range of modeled returns and corresponding impacts. →

Example: Change in AVA and AAL	
AVA at Beginning of Year	**AAL at Beginning of Year**
+ Contributions	+ Service cost (benefits accrued during year)
+ Actual return (accounting for any smoothing)	+ Interest cost
- Benefits paid	+/- Actuarial losses/gains during the year
- Expenses	- Benefits paid
= AVA at End of Year	**= AAL at End of year**

Tread Water Measure

→ For underfunded plans, one metric to monitor is Moody's "Tread Water" Measure.

→ This metric is the bare minimum for a system to maintain solvency.

Moody's "Tread Water" Measure:
Service Costs + Interest Costs on UAAL ≈ Minimum Contribution Threshold

(i.e., contributions cover accrual of new benefits + interest costs,
meaning UAAL is not increasing)

$$\frac{\text{Actual Contributions}}{\text{Service Costs + Interest Costs on UAAL}} > 1.0$$

→ If the ratio of a plan's employer contributions to its Tread Water Measure > 1.0, then the plan exhibits a sustainable ability to continue financing its long-term obligations, otherwise, it is not even "treading water."

Asset-Liability Study Philosophy

Strategic allocation: the BIGGEST decision

STRS Ohio is unique with specific attributes	→ Know the asset classes' *Roles & Risks*
The real world isn't theoretical	→ The *journey* matters
Your risk tolerance matters	→ Define risk *before* you optimize
Prudence over precision	→ Be aware of model error

Objective: A process that blends awareness/understanding with a reasonably effective policy.

Approach to Asset-Liability Studies

→ An asset-liability study is a dimension reducing exercise.

- Take the immense complexities of a defined benefit system and the global capital markets and reduce them to a digestible form.

→ We are continually improving our methodologies and models to better reflect the real world and the full dynamics of retirement systems.

- Be humble, but rigorous, about the models.
- There is "error" at every level of the modeling process (inputs, outputs, etc.).
- "As simple as possible but as complex as necessary"

Integrated Asset-Liability Study

→ Meketa's approach to asset-liability studies is unique.

→ Traditional approach => explore how pre-selected asset allocation options simulate with the liability structure over time.

→ Meketa's approach => asset allocation options are based on integrated asset-liability simulations.

→ Objective functions (i.e., what we are seeking to optimize) are custom designed for STRS Ohio specific objectives.

- Ex: What asset allocation gives us the highest probability that contributions will exceed the treadwater measure in 10 years?

Asset-Liability Study Detail

Process: First Steps

→ There are two important steps that Meketa recommends at the onset of an asset-liability study.

- Both of these items involve significant discussion and trustee/staff/consultant feedback.

Step #1
Risk and Implementation Survey

Approximately 12-20 questions that will serve as the foundation of the asset-liability study and corresponding optimization process

Step #2
Asset Classes and Capital Market Assumptions

Discussion regarding what asset classes should be explicitly modeled along with their corresponding capital market assumptions ("CMAs")

Trustee Risk and Implementation Survey

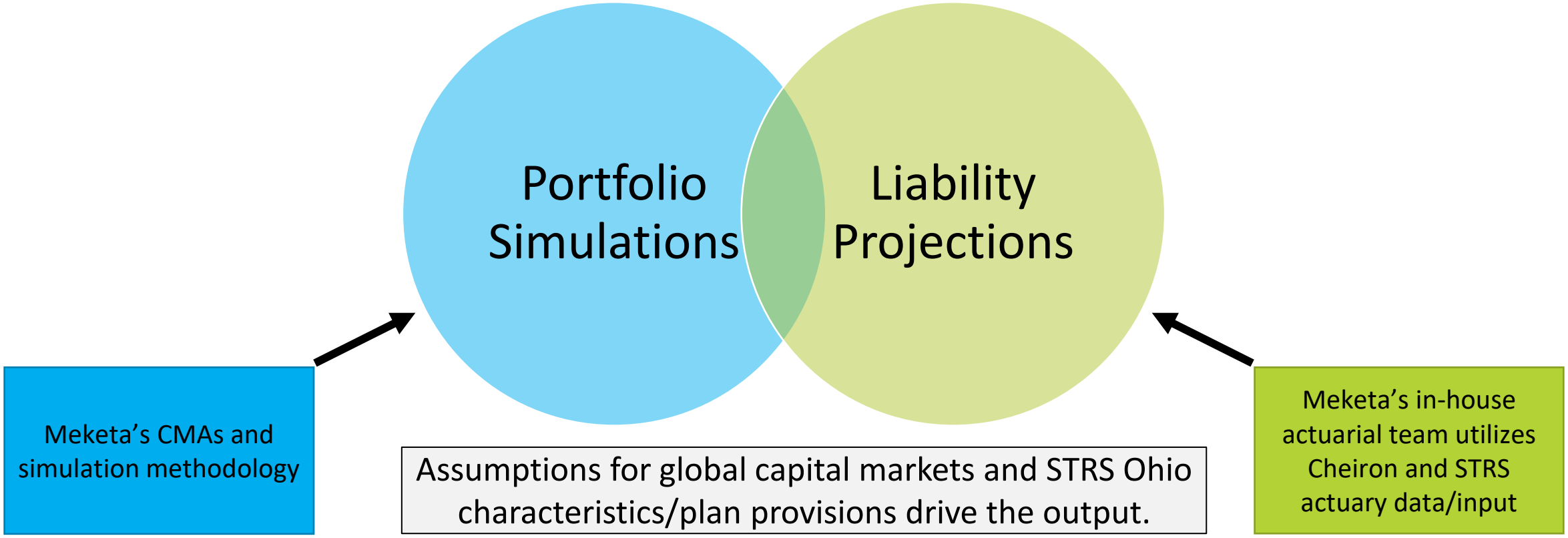
→ Example Survey Questions

- **Objective** - Rank the following priorities:
  - Maintain progress along the “funding path”.
  - Minimizing total portfolio declines of -10% or more in a fiscal year.
  - Achieving 100% funded in X years.
  - Minimizing tread water threshold breaches.
- **Subjective** - Agree or Disagree?
  - During a market crisis, the plan sponsor will be able to increase its contribution rate.
  - Alternative asset classes can help stabilize the total portfolio.
  - The cash-flow position is a key consideration when constructing an investment portfolio.
  - Producing a return pattern that is different than peers is a risk (given the same long-term return).
  - Different strategies and/or asset classes are interchangeable if they perform similar portfolio functions.

→ Answers to such questions help frame the optimization parameters and guide the ultimate decision-making process.

Asset and Liability Integration

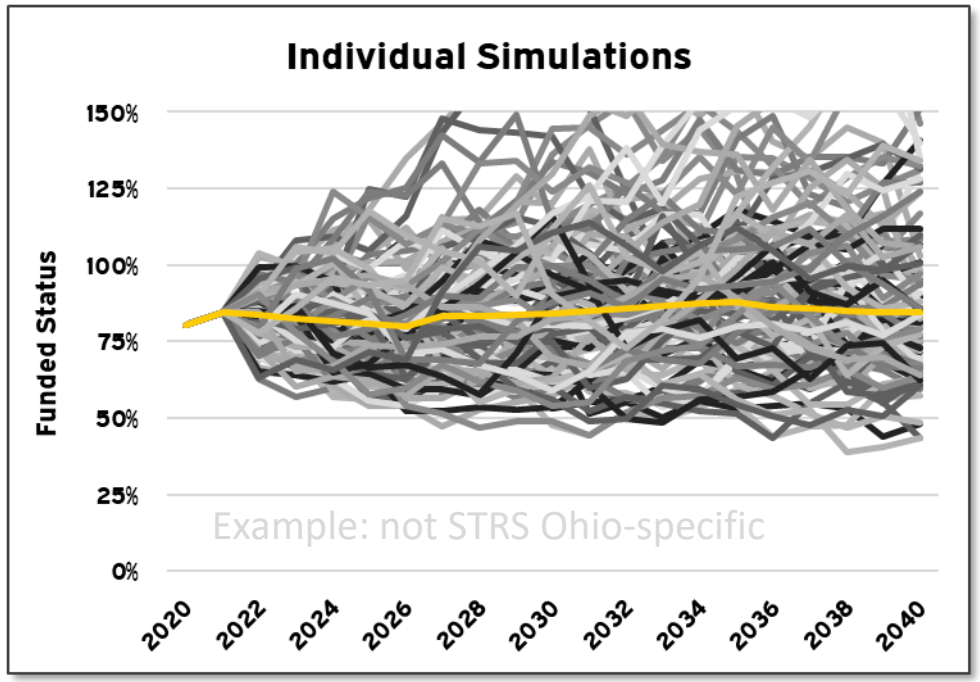
→ Asset-liability studies are the intersection of asset and liability projections.

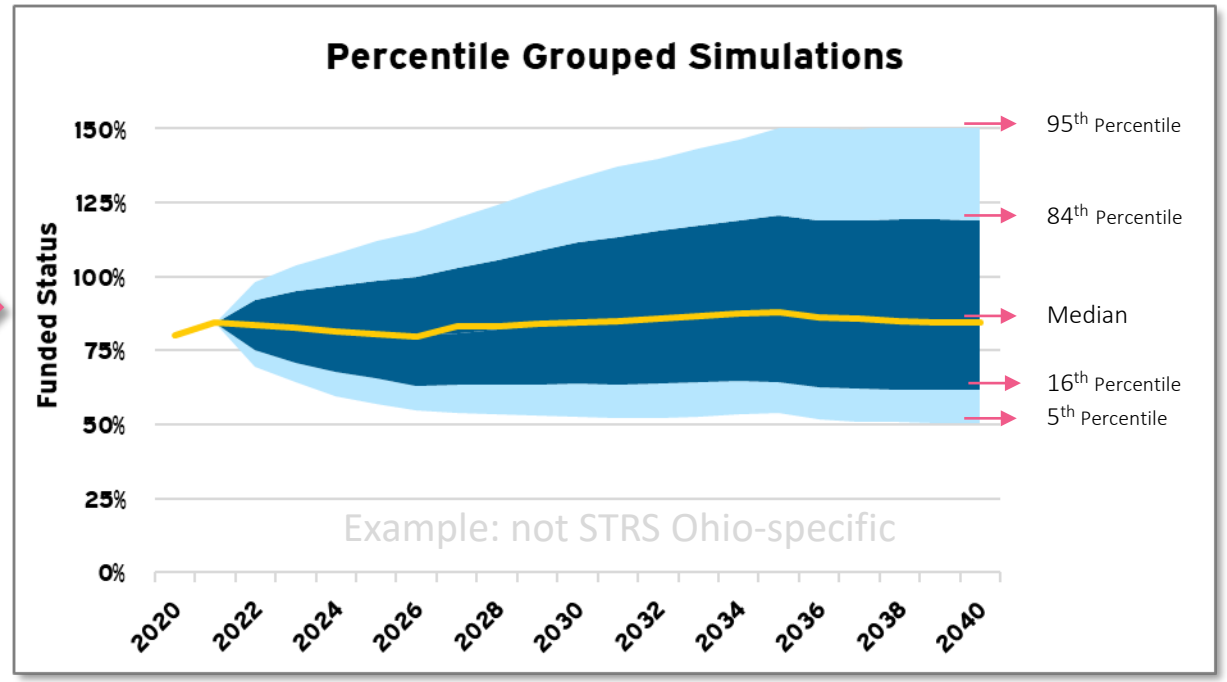


Example Asset-Liability Output

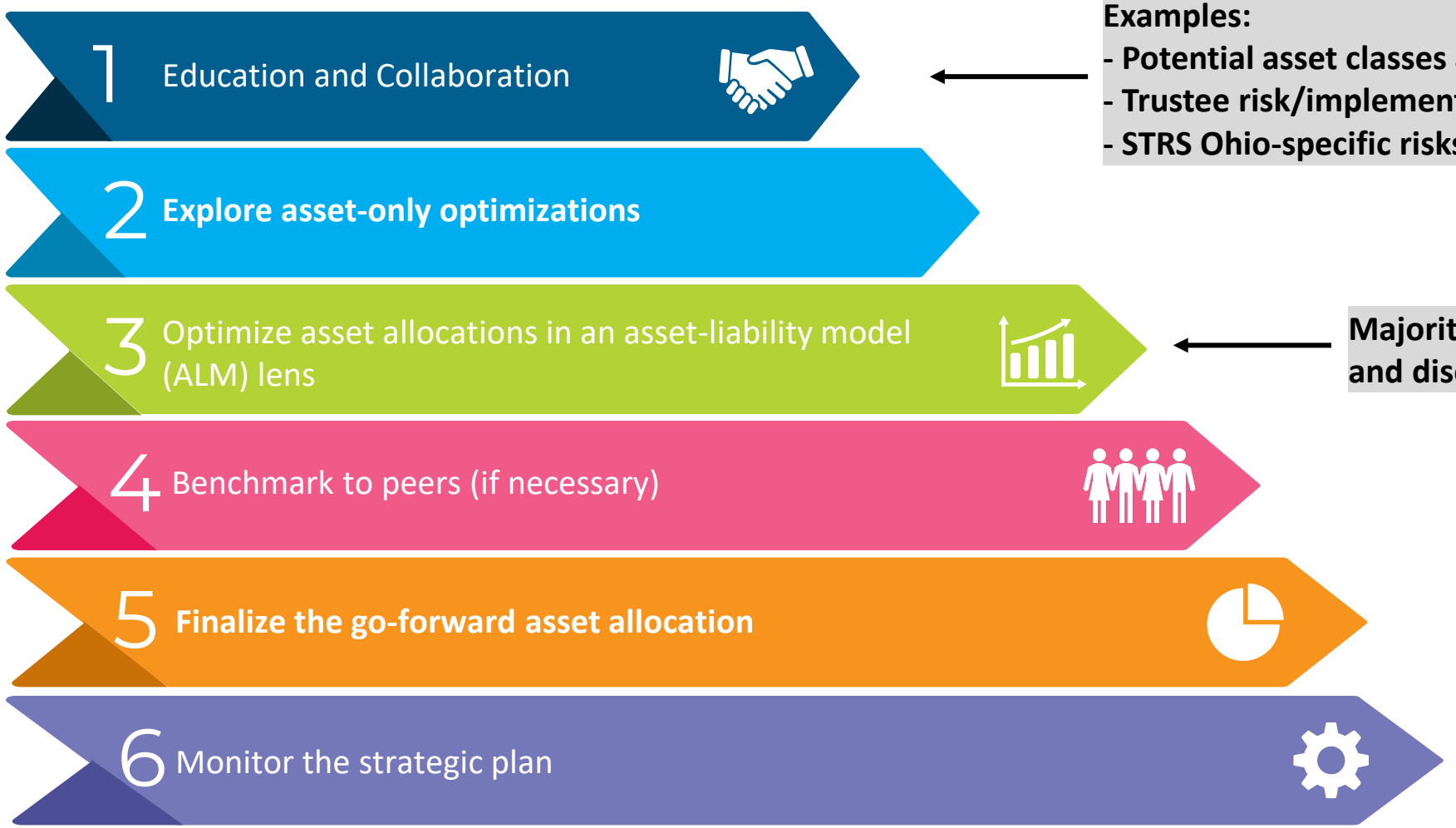
→ Individual simulations that explore major asset-liability metrics (e.g., funded ratio) are combined into corridors of percentiles.

→ Discussions shift to focus on probabilities/groupings rather than point estimates.





Asset-Liability Study Process



Examples:
- **Potential asset classes and CMAs**
- **Trustee risk/implementation survey**
- **STRS Ohio-specific risks**

Majority of the work and discussion

Key Risks to a Pension System

01 Investments

→ Long-term asset appreciation in value
→ Asset return volatility

02 Inflation

→ Depreciating value of the assets
→ Strength of the participant benefits

03 Liquidity

→ Ability of assets to be liquidated
→ Maintain investment policy targets

04 Workforce

→ Constant/growing/shrinking headcount
→ Level of hours worked or wages earned

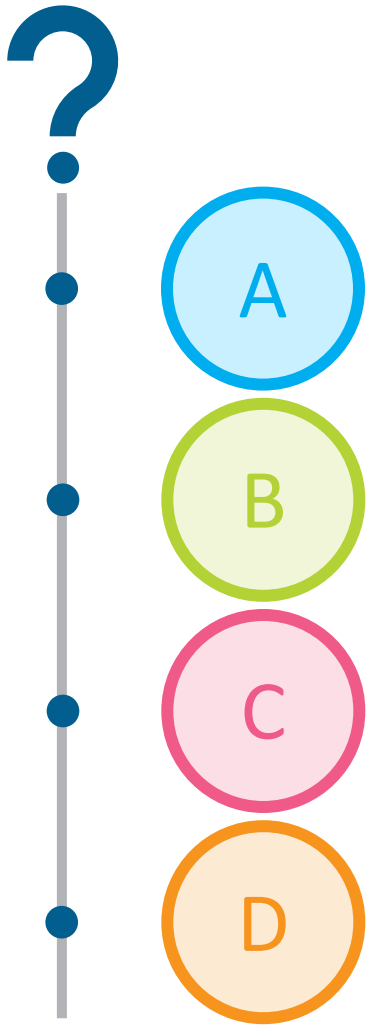
05 Cash Inflow

→ Volatility of contribution requirements
→ Employer ability to make contributions

06 Longevity

→ Participants receiving benefits beyond expectations

Evaluating Risks in Isolation



Likelihood

→ How likely is a risk to deviate from an assumption?
→ Example: What is the probability the assets return 7% every year?

Materiality

→ If the risk occurs, how detrimental or beneficial will the result be?
→ Example: Less retirees passed away than expected and the outcome increased the liability by 0.001%.

Quantitative

→ Can the outcomes be measured or are the results subject to interpretation?
→ Example: The appreciation a participant has for the size of the pension benefit varies from person to person. It cannot be measured precisely.

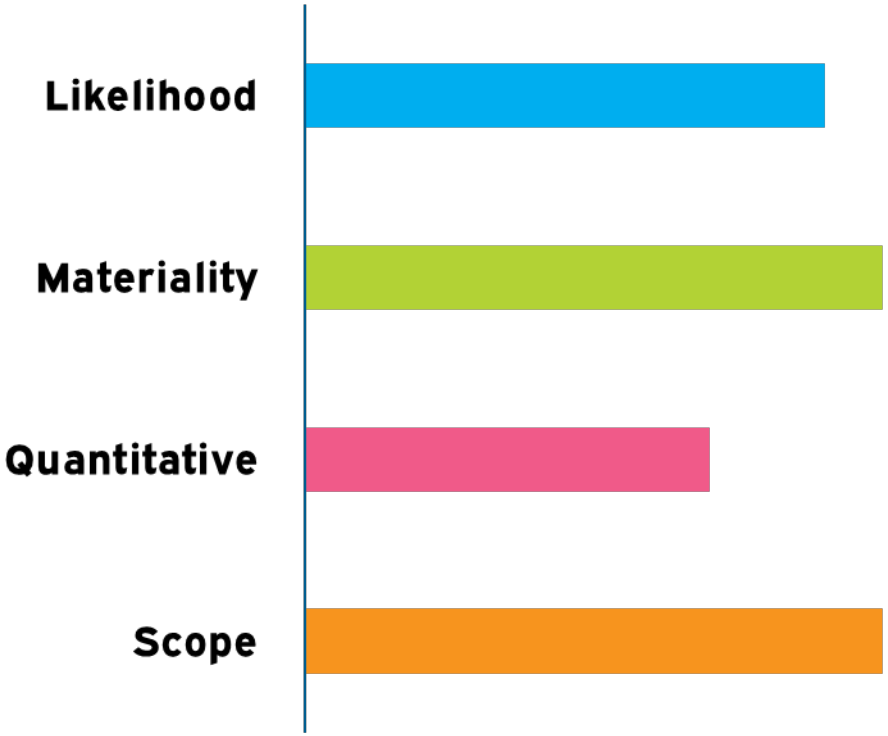
Scope of Responsibility

→ Can the risk be mitigated with a change to the asset allocation?
→ Example: Will adjusting the asset allocation affect an employer's ability to make required contributions?

01

Investments
→ Long-term asset appreciation in value
→ Asset return volatility

Example of the methodology Meketa uses to analyze the risks in isolation

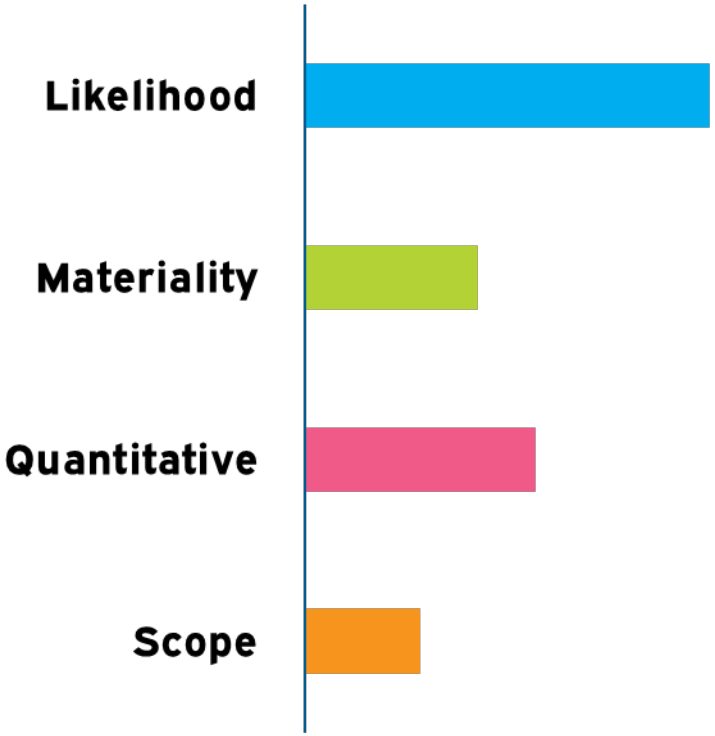


- ✓ There is a high likelihood that *annual* asset returns differ from the assumed rate of return (the journey matters).
- ✓ Over the *long-term*, it is expected that returns will approximate the assumption.
- ✓ Volatile asset returns can have a very material effect on the Plan's funded status.
- ✓ The effects of various asset returns are quantifiable.
- ✓ However, there are many different, valid opinions on asset class return expectations.
- ✓ A Plan's asset allocation is the biggest driver of investment risk.

04

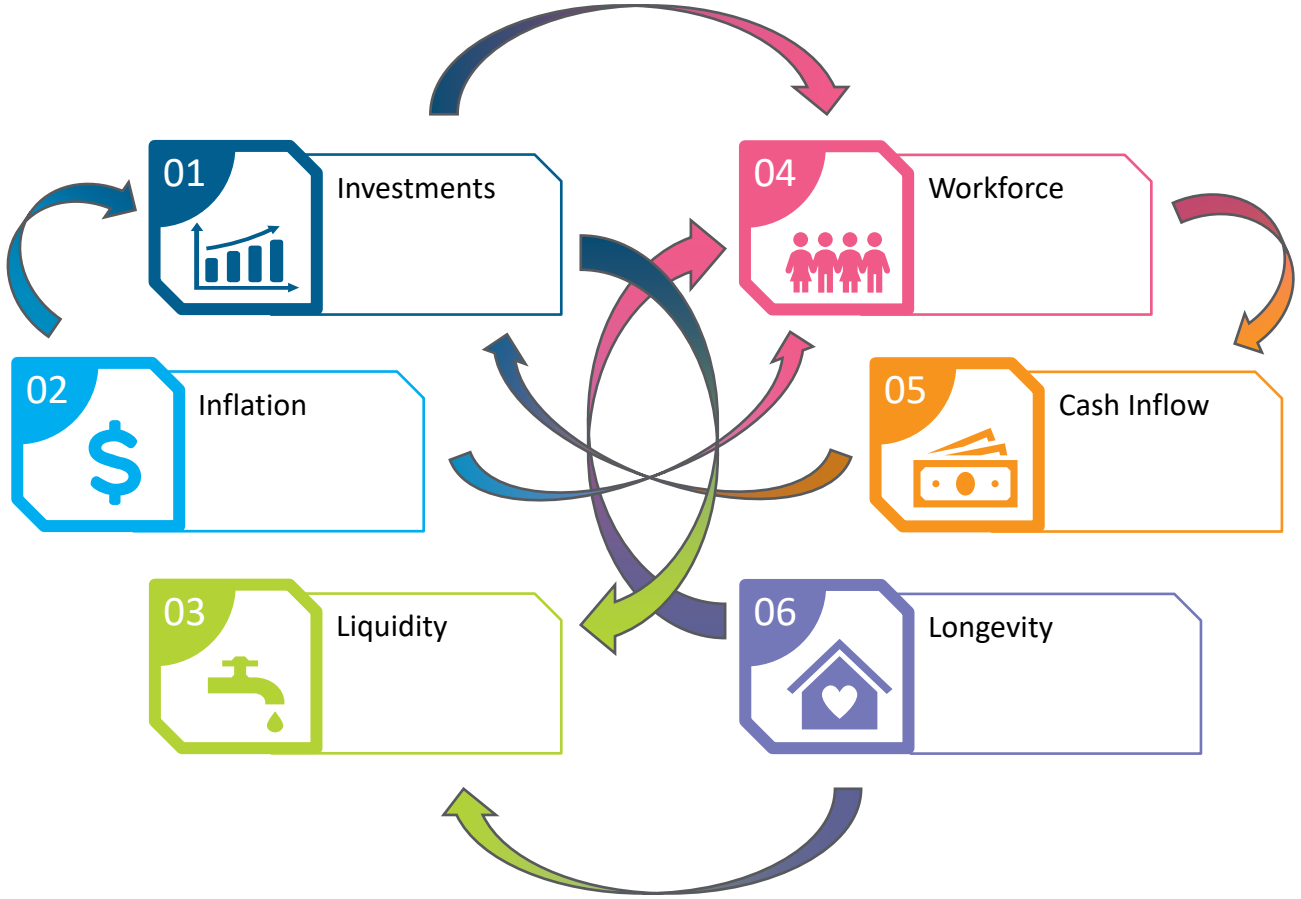
Workforce
→ Constant/growing/shrinking headcount
→ Level of hours worked or wages earned

Example of the methodology Meketa uses to analyze the risks in isolation



- ✓ The current assumption of 3% payroll growth is based in simplicity with a high likelihood of being somewhat incorrect (e.g., shrinking workforce over time).
- ✓ Percent of payroll is a way to measure plan contribution levels.
- ✓ Headcount and payroll changes tend to be less volatile and take time to deviate from assumptions.
- ✓ Prediction of headcount/wages worked can be very difficult due to various outside influences.
- ✓ By and large, asset allocation is not viewed as a means to mitigate workforce risks.

→ The asset-liability study aims to bring together all of the enterprise risks in a dialogue with the Board.

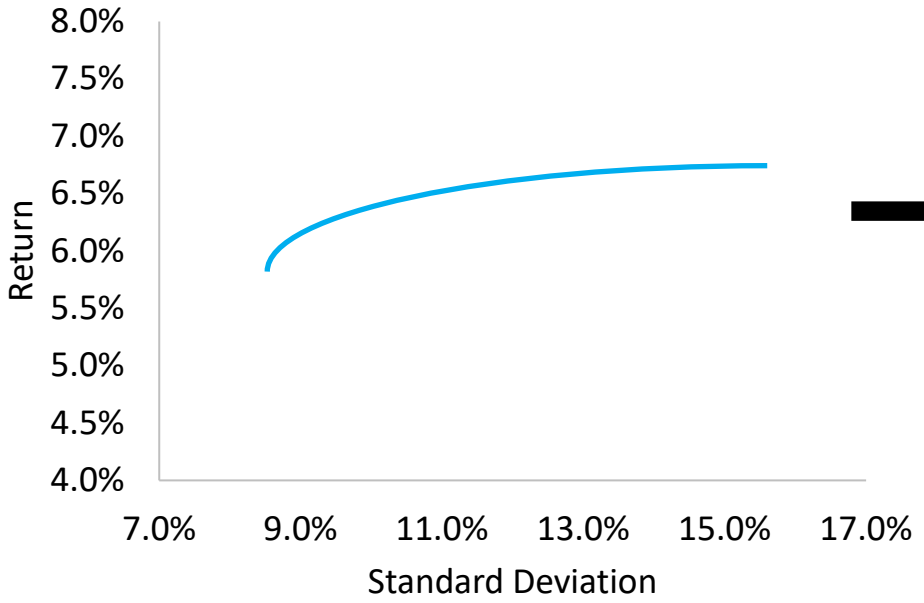


Outputs of Asset-Liability Study Process

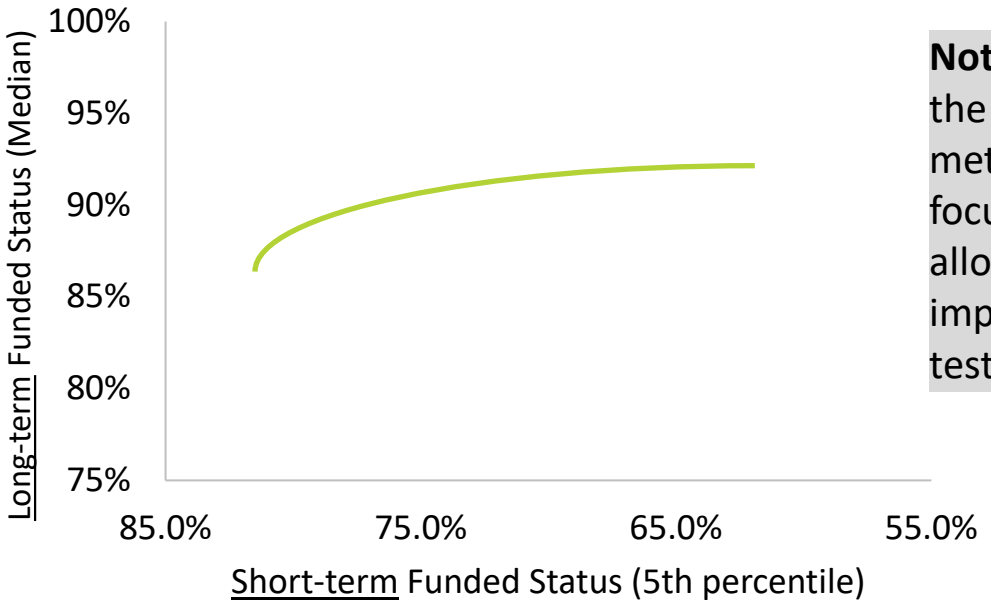
→ Asset-liability studies are based on a variety of assumptions. The assumptions should be discussed along with the potential variations of reality vs. assumptions.

→ The final asset allocation should be discussed in the context of a system-oriented efficient frontier.

Traditional Efficient Frontier



System-oriented Efficient Frontier



Note: It is likely that the STRS Ohio metrics will be focused on asset allocations that improve the SBEP tests.

Conclusion

→ A defined benefit plan can ultimately be treated as a balance sheet:

- Left side = assets
- Right side = liabilities (benefits)

→ Actuarial methods determine how the left and ride side of this balance sheet are determined and calculated.

- These methods are complex, but they can be treated in a more simplified manner to improve decision-making.

→ Asset-liability studies seek to examine this balance sheet over a long-term period in a probabilistic manner that examines a wide range of scenarios and metrics.

→ **The selection of a strategic asset allocation is the most important decisions trustees make from an asset perspective. As such, this process takes ~9 months.**

- The overall process can be sped up or slowed down depending on Trustee comfort, overall dialogue, and capital market dynamics.

Appendix

Key Terms

- **PBO (projected benefit obligation)**
  - Actuarial present value (at an assumed discount rate) of all future pension benefits earned to date.
  - Includes:
    - Remaining benefits for currently retired employees;
    - Retirement benefits earned to date for active employees;
    - Impact of future salary increases and service on the benefits for active employees.
- **AAL (actuarial accrued liability)**
  - For most public plans, this is the same as the PBO.
- **AVA (actuarial value of assets)**
  - The asset value for valuation purposes. Can be based on market value + any "smoothing" methods.
- **UAAL (unfunded actuarial accrued liability)**
  - AAL – AVA = UAAL
- **Funded Status (Ratio)**
  - AVA/AAL = Funded Status (Ratio)
- **Discount Rate**
  - The interest rate used to compute the present value of benefits and current service costs. The actuarial recommendation is for this rate to stay at or below the portfolio's expected long-term rate of return.
- **Expected Return**
  - The expected return of the investment portfolio. This may or may not equal the discount rate.

Key Terms

- **Normal Cost or Current Service Cost**
  - Present value of benefits expected to be earned during the upcoming period.
- **Interest Cost**
  - Increase in the liability due to the passage of time.
- **ADC or ARC (actuarial determined contribution or actuarial required contribution)**
  - The amount needed to fund benefits over time.
  - Typically, this is the amount necessary to fund the normal cost and amortize the unfunded liability per the amortization schedule (if applicable).
- **Valuation Report**
  - Utilizing current assumptions, an annual report that describes the financial position of a plan.
- **Experience Study**
  - A study performed every few years to ensure the assumptions are in-line with the plan's demographic and economic experience.
- **Actuarial gains/losses**
  - Changes in the UAAL due to alterations in assumptions/methods (e.g., discount rate) or experience (e.g., salary growth).

MEKETA
INVESTMENT GROUP

State Teachers Retirement System of Ohio

March 22, 2024

Investment Decisions and Benchmarking

Introduction

→ This presentation seeks to discuss two related topics:

- Major investment decisions that pension systems make.
- Approaches to assessing the success of the investment decisions (i.e., benchmarking).

→ This represents a preliminary education presentation that will serve as a foundation for additional Board discussions throughout 2024.

Investment Decisions

Major Investment Decision Authority Areas[1]

- Overall asset allocation, objectives, and roles
- Setting implementation boundaries
- High-level portfolio construction blueprints
- Setting appropriate risk levels/budgets

- Selection and budgets for mission-critical staff and vendors

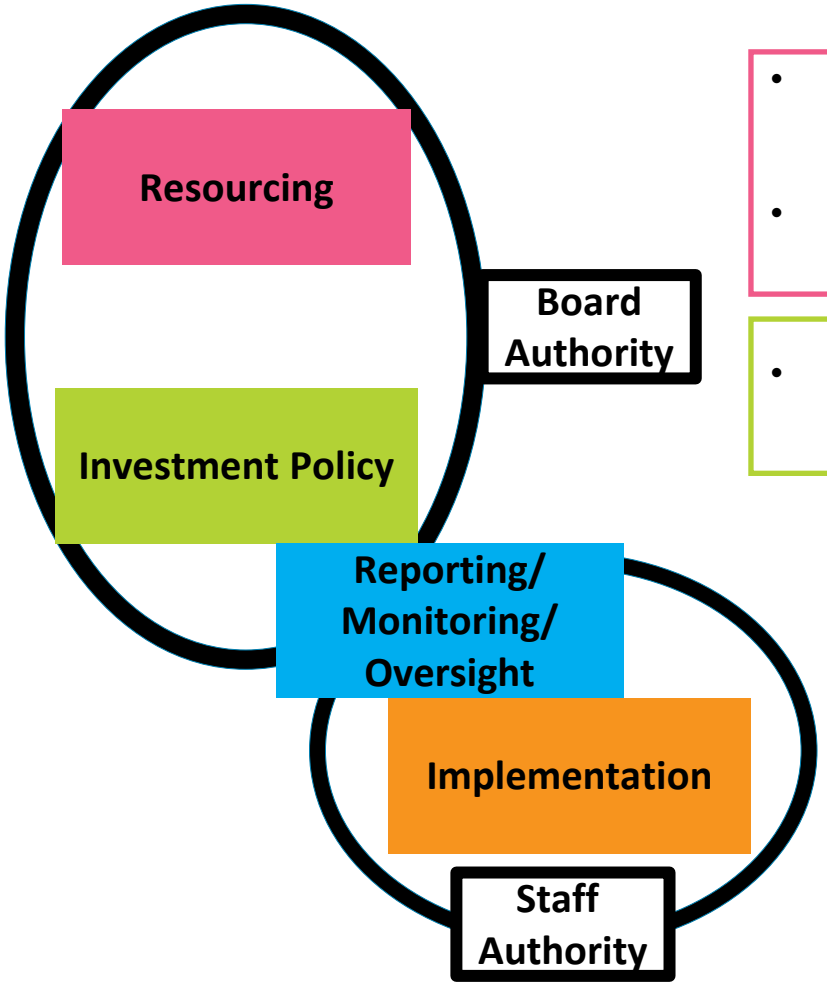
Investment Policy	Resourcing
Implementation	Reporting/Monitoring/ Oversight

- Selecting managers and investment vehicles
- Funding and de-funding investments
- Negotiating terms & conditions
- Day-to-day monitoring and compliance
- Rebalancing among portfolio classes and managers
- Adhering to guidelines and risk levels

- Developing and receiving ongoing reports
- Conducting and assessing due diligence
- Performance analysis and attribution

[1] Presented framework draws heavily from *"Investment Governance for Fiduciaries,"* CFA Institute Research Foundation, ©2019.

Major Investment Decision Authority Areas



- Board's effort on resourcing is critical: select and/or monitor the primary entities that assist with the investment effort (e.g., staff, consultants, actuaries, etc.).
- Fundamental system-related policies remain with Board (e.g., setting actuarial rate, benefit enhancement provisions, reviewing legislation, etc.).

- Board authority is to set overall asset allocation, portfolio risk budgets, allocation boundaries/thresholds, and high-level guidelines.

- Key function of Board is monitoring of portfolio results and Staff decision-making activities relative to policy.
- Staff oversees/monitors day-to-day activities and external managers.
- Key consideration: formal documentation process and/or reporting of major activities/metrics (e.g., due diligence, boundaries/thresholds, etc.).

- Within assigned thresholds, Staff executes all investment decisions and tasks (active/passive, internal/external, rebalancing, terms and conditions, etc.).

Trailing Period Performance (as of 12/31/23)	Market Value ($)	% of Portfolio	QTD (%)	FYTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)
Total Fund	**91,630,549,529**	**100.00**	**5.98**	**4.20**	**11.64**	**6.43**	**9.89**	**8.12**
Total Fund Benchmark			*6.40*	*4.51*	*12.40*	*5.53*	*9.24*	*7.65*

→ The actual experience of STRS Ohio is a result of two major investment decisions:

1. <u>Asset Allocation (Board decision)</u>

   — The asset classes and corresponding policy weights that the Board selected as a result recent asset-liability studies.

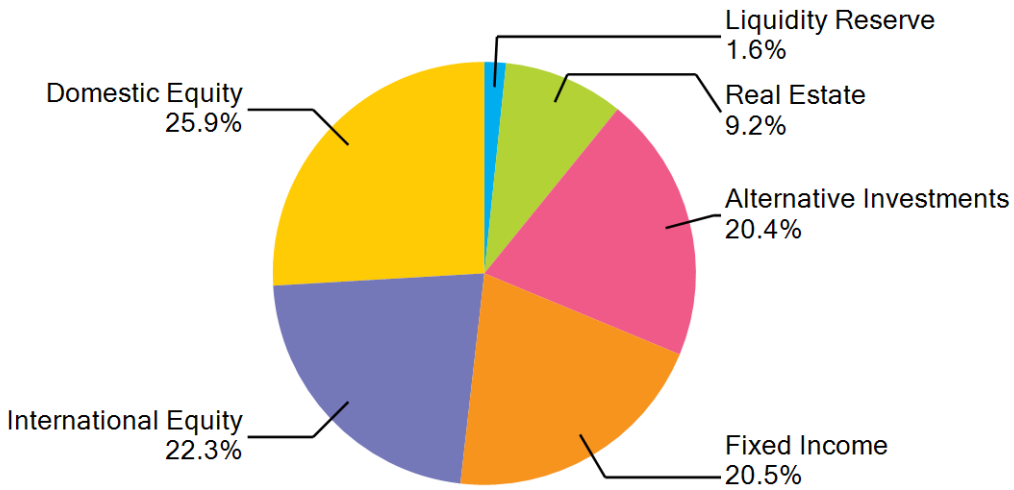
2. <u>Portfolio Implementation (Staff decision)</u>

   — Within asset classes, the specific approaches that are used to put the dollars to work.

→ There are different approaches, and corresponding pros/cons, for assessing both decisions.

→ Benchmarking is the primary form of assessment.

STRS Ohio Actual Asset Allocation
As of 12/31/23



Benchmarking Investment Decisions

→Benchmarking is a form of assessment.

→As it relates to the two investment decisions, assessment can be reframed to the following:

- Asset Allocation (Board decision)
  - —"Are we in the correct asset classes?"
- Portfolio Implementation (Staff decision)
  - —"Within a given asset class, how did we do?"
  - —"Across asset classes, did allocation decisions contribute or detract from performance?"

→Total fund benchmarks often measure a mixture of decisions which can obfuscate their utility.

→As public pension portfolios increased in complexity over time, benchmarking did not keep up.

- This is changing, but it comes with a cost (e.g., multiple benchmarks for different purposes).

Meketa's Benchmarking Philosophy

→ Benchmarking can also be viewed as an approach to interpreting investment results.

→ With a large-scale investment staff and delegated authority, measuring investment results requires more nuance and discussion.

- This often means examining multiple benchmarks for different reasons.
- Attribution results increase in importance.

Reference Portfolio Benchmark	Policy Portfolio Benchmark	Asset Class and Manager Benchmarks
- Used primarily to determine asset allocation success. - A form of opportunity cost. - Can be simple equity/bond mix or more detailed mix of liquid market proxies.	- Consistent with STRS Ohio's current policy benchmark. - Compared to reference benchmark for asset allocation decisions. - Compared to actual portfolio to examine certain elements of implementation success.	- Measurement of selection/implementation success. - Primarily used to examine more granular drivers of performance. - This is not the focus of this presentation.

Benchmark Roles

→ Benchmarks serve three general roles[1]:

- As portfolios/implementation options (e.g., index funds)
- As measurements/comparisons for implementation success
- As proxies for classes in asset allocation

→ When examining the usefulness of a given benchmark, it should be examined from the point of view of all three principal uses.

→ To best serve those three roles, there are ideal benchmark characteristics.

→ The "Bailey Criteria" is commonly used to describe the archetypical characteristics:

[1] *Benchmarks and Investment Management*, 2003, CFA Institute (fka, The Research Foundation of AIMR).

Benchmark Characteristics

→ **Bailey Criteria[1]:**

- Unambiguous – well-defined identities and weights;
- Investable – one can own the benchmark's constituents;
- Measurable – can calculate performance at reasonable intervals;
- Appropriate – consistent with the investment approach/style;
- Reflective of current investment options – representative of the segment; and
- Specified in advance – constructed before evaluation period.

- Excluding liquid asset class benchmarks, achieving all of these criteria is near impossible.

[1] The Bailey Criteria: Financial Analysts Journal, CFA Institute, 1992.

Approaches to Total Plan Benchmarking

→ There are three commonly used approaches at the total portfolio level:

- Reference Portfolio
  - — Can also be referred to as a "Simple Portfolio."
  - — Consists of a mix of a relatively few public market investments (e.g., 60% equity/40% bonds).
- Static/Policy
  - — A blend of individual asset class benchmarks represented at their policy target weights.
  - — Asset class benchmarks are often one of the following:
    - Broad market (e.g., MSCI ACWI)
    - Return target (e.g., Tbills + 2.5%, CPI + 3%, etc.)
    - Peer fund universes for private markets (e.g., NCREIF ODCE, Cambridge Private Equity Index, HFRI Fund of Fund Index, etc.)
- Dynamic
  - — Similar to Static/Policy, but blends asset class benchmarks at their actual weights.

Approaches to Total Plan Benchmarking

→ The three approaches to total portfolio benchmarking serve different purposes:

Reference Portfolio Benchmark

- Used primarily to determine asset allocation success.
- Represents an "opportunity cost" portfolio, particularly as it relates to the payoff of alternatives/complexity.
- Requires a long-term (e.g., 10-year) horizon to ensure efficacy and align with investment horizon.
- Needs to exhibit a similar risk posture as the Board-selected asset allocation.

Static/Policy Portfolio Benchmark

- Compared to the actual portfolio, it measures the two components of implementation success: asset class weightings and selection within asset classes. Requires attribution analysis to separate.
- Because there are no perfect benchmarks for all asset classes, there are challenges to this approach.
- Over short-term time periods, it is the best gauge of implementation success.
- Over longer-term time periods, it can be compared to reference benchmark for asset allocation decisions.

Dynamic Portfolio Benchmark

- While similar to the Static/Policy Portfolio Benchmark, it largely focuses on the selection within asset classes because it seeks to removes weighting decisions.
- Exhibits similar shortcomings as the Static/Policy Benchmark in that its components may be imperfect.

Key Considerations of Total Plan Benchmarking

→ There is no such thing as a "passive" total plan benchmark.

- Even when using a simple reference portfolio benchmark (e.g., 60% equity / 40% bonds), the underlying weights are actively selected based on a Board's risk level.

→ No single total plan benchmark encompasses all elements of assessment.

→ Even when using a relatively simple benchmark, its utility remains as a form of long-term (~10+ years) assessment.

- When illiquid asset classes are included in the portfolio, this time horizon inherently increases.

→ Understanding the flaws in a given benchmarking approach is just as important as understanding its role.

→ All benchmarks are hypothetical and ignore frictions that are required for actual implementations (e.g., transaction costs, rebalancing, taxes, dividend reinvestment, etc.).

→ **From Meketa's perspective, exploring a Reference Portfolio Benchmark for STRS Ohio is a worthwhile endeavor.**

Questions for the Board

Questions for the Board

→ What does “passive” mean?

→ What are examples of passive benchmarks?

→ Where do you believe passive management exists within the STRS Ohio portfolio?

Questions for the Board (cont'd)

→ What does active investing/management mean?

→ Where would you use active management?

→ Where do you believe active management exists within the STRS Ohio portfolio?

Passive Definition and Global Market

→ A passive benchmark implies that the investable universe is held at market capitalization weights.

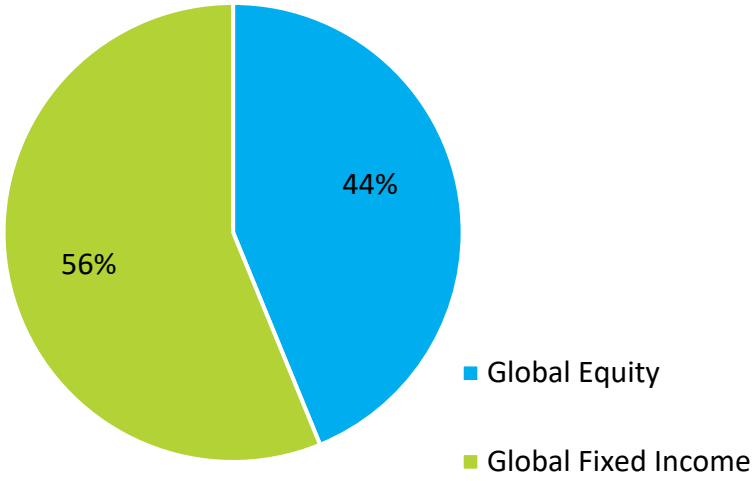
- Market capitalization weights represent the average holding weights of all market participants. This is the foundation of capital market efficiency and related theories (e.g., efficient market hypothesis, CAPM, etc.)

→ Passive benchmarks are most applicable for liquid asset classes (e.g., public equity and fixed income).

→ For global, multi-asset class investors, the global market capitalization is impossible to define.

→ Even if only accounting for public market investments, the global market capitalization weights are not appropriate for long-term investors targeting actuarial rates near 7%.

Estimated Global Market Portfolio*



Expected Return (10-year)**	**~5.5%**
Expected Annual Volatility**	**~9.5%**

*Total market capitalizations estimated by 2023 Securities Industry and Financial Markets Association Capital Markets Fact Book – data from Bank of International Settlements and World Federation of Exchanges

**Based on 2024 Meketa Capital Market Assumptions

A Look at STRS Ohio Benchmarks

STRS Ohio Benchmarks

→ At a high-level, Meketa does not have any major concerns regarding the policy benchmark.

Asset Class	Policy Weight	Benchmark
Liquidity Reserves	1%	90-day Treasury Bill
Fixed Income	22%	Pro-rata actual weight * Bloomberg US Universal Index Pro-rata actual weight * Bloomberg US Intermediate Treasury Index
Domestic Equity	26%	Russell 3000 Index
International Equity	22%	80% MSCI World ex-US Index (50% hedged) 20% MSCI Emerging Markets Index
Real Estate	10%	85% NCREIF Property Index 15% FTSE NAREIT Equity Index
Alternative Investments	19%	47.4% Cambridge Associates Private Equity and Venture Capital Index 52.6% * Pro-rata actual weight * Cambridge Associates Private Credit Index 52.6% * Pro-rata actual weight * HFRI Fund-of-Funds Composite Index

→ Minor note: usage of pro-rata/actual weights results in mixture of policy/dynamic benchmark.

STRS Ohio Benchmarks – Meketa Takeaways

→ In its current form, the STRS Ohio benchmark represents a mixture of both a Static/Policy Benchmark as well as a Dynamic Benchmark

- This is exclusively due to the partial usage of pro-rata actual weights within the policy benchmark construction.

→ Because this is only a minor issue, Meketa would recommend maintaining the existing benchmark until the completion of an asset-liability study.

- Moreover, we would not expect a material difference in historical benchmark returns if solely policy/fixed weights were used instead of pro-rata actual weights

→ As it stands right now, STRS Ohio is not an outlier compared to peers, however, improvements could be made:

- Utilization of a Reference Portfolio Benchmark
- Move to all fixed weights within the Policy Benchmark

STRS Ohio Benchmarks – Bailey Criteria

→ The table below maps the STRS asset class benchmarks to the Bailey Criteria. As discussed earlier, it is nearly impossible to fulfill all criteria for all asset classes.

→ The STRS Ohio benchmarks fulfill the Bailey Criteria at a similar or higher level than other large-scale public pensions.

STRS Asset Classes	Bailey Criteria					
	Unambiguous	Investable	Measurable	Appropriate	Reflective	Specified in Advance
Liquidity Reserves	X	X	X	X	X	X
Fixed Income	X	X	X	X	X	
Domestic Equity	X	X	X	X	X	X
International Equity	X	X	X	X	X	X
Real Estate	X		X	X		
Alternative Investments	X		X	X	X	

STRS Ohio Benchmarks – Bailey Criteria

→ In the asset classes where the STRS benchmarks fall short of Bailey Criteria, the issues are commonplace among other public pension peers.

Asset Class	Bailey Criteria Shortcomings
Fixed Income	Specified in Advance The usage of pro-rata actual weights implies that it is only determined just prior to calculation.
Real Estate	Investable NCREIF NPI is not investable. Reflective NCREIF NPI solely reflects unlevered, core private real estate. Specified in Advance We only know the underlying weights of NCREIF NPI after the fact.
Alternative Investments	Investable Cambridge Associates benchmarks are not investable. HFRI benchmarks can be closely mirrored, but they are not directly investable. Specified in Advance Neither the Cambridge Associates nor HFRI benchmark weights/constituents are specified ahead of time. The usage of pro-rata actual weights implies that it is only determined just prior to calculation.

Conclusion

→ Benchmarks are objective standards to measure the performance of an investment against a reasonable alternative and whether it is meeting the investor's goal.

- They may be applied at different levels of the portfolio.
- There are a number of widely-accepted criteria for effective benchmarks, not all of which are available for every asset class.
- Therefore, combined "total portfolio/plan benchmarks" will have flaws in most cases. This has been exacerbated by the growing allocations of "alternatives" and hard-to-benchmark areas.

→ Due to the intricacies and diverse composition of total portfolio/plan benchmarks, no single total portfolio benchmark can provide a perfect comparison for all time periods.

- Because of this limitation, institutional investors often utilize two or more total portfolio level benchmarks, while being aware of the structure (and flaws) of each.

→ Fiduciaries should understand why each benchmark performs the way it does in different capital market environments, as this understanding adds context to the investment pool's total return.

Rebalancing and Risk Budget

March 22, 2024

Rebalancing Requires Portfolio Management

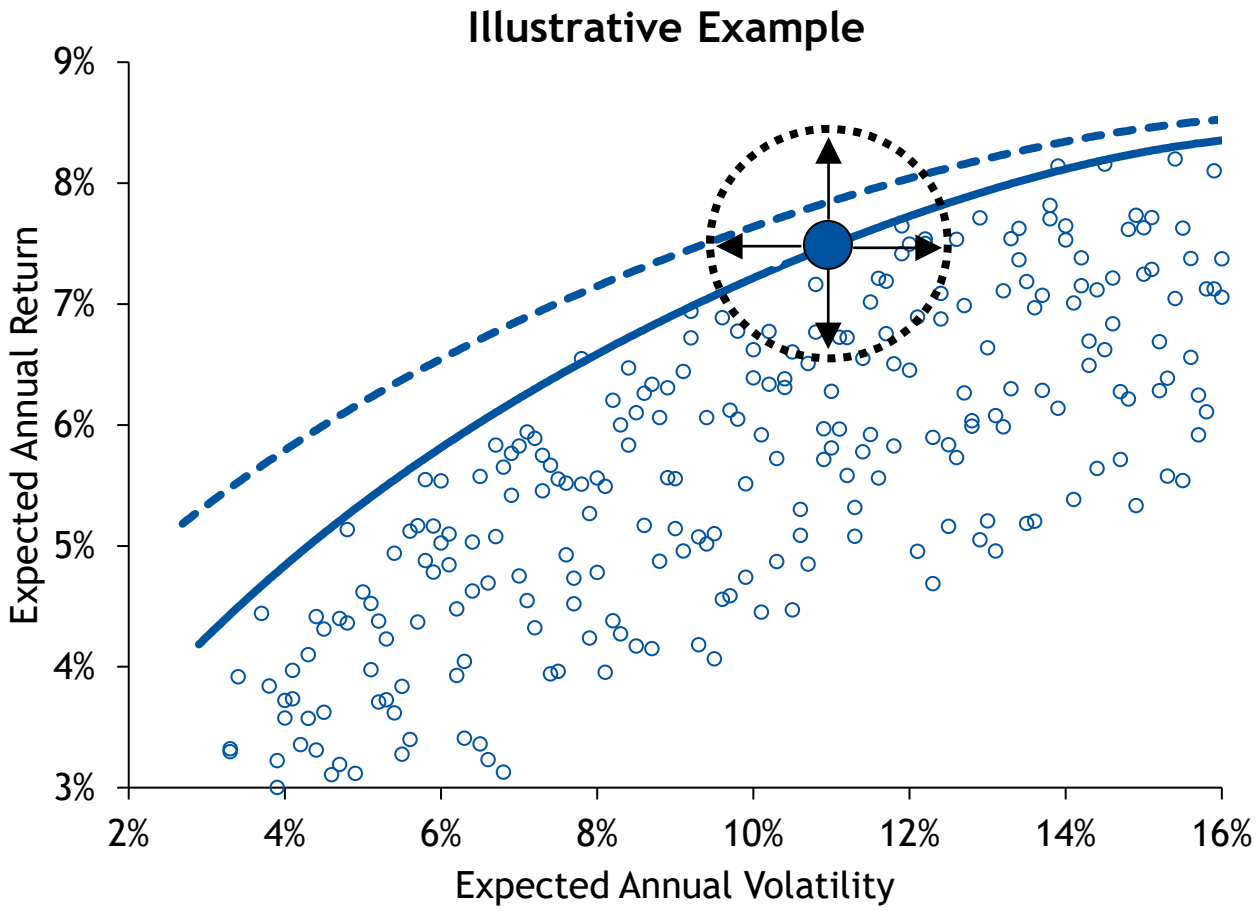
The act of buying and selling securities to achieve three objectives:

1. Manage portfolio in line with the board's asset allocation
2. Ensure sufficient liquidity is available to pay member benefits
3. Improve upon board's asset allocation by integrating new information

Rebalancing is a coordination effort:

- Implemented under the direction of the chief investment officer and the director of asset allocation
- Work together with individual asset class teams and traders

Rebalancing Improves Risk-Adjusted Returns



Asset-Liability Study:

- Board selects asset allocation
- Optimal portfolio at a point in time

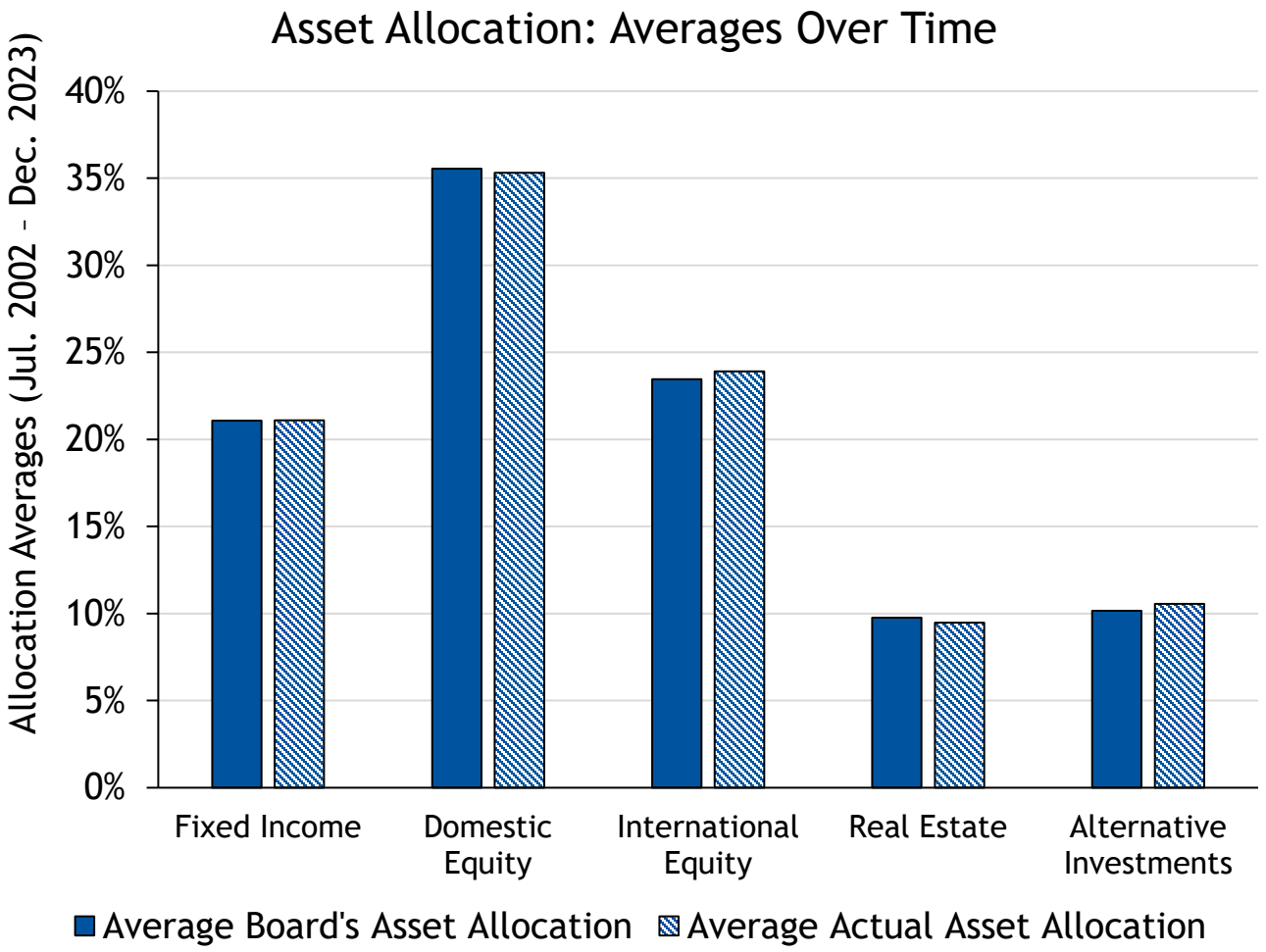
Mere passing of time calls for rebalancing:

- Portfolio would drift without portfolio management
- Liquidity needs require active decisions

Market events create opportunities

- New information offer opportunities to improve expected return/risk tradeoff
- Ranges ensure closeness to board's target

Portfolio Management Aligns Reality to Theory



Board's asset allocation:

- Preferred at time of Asset-Liability Study
- Updated at each Asset-Liability Study

Actual portfolio:

- Implementation managed by the investment staff

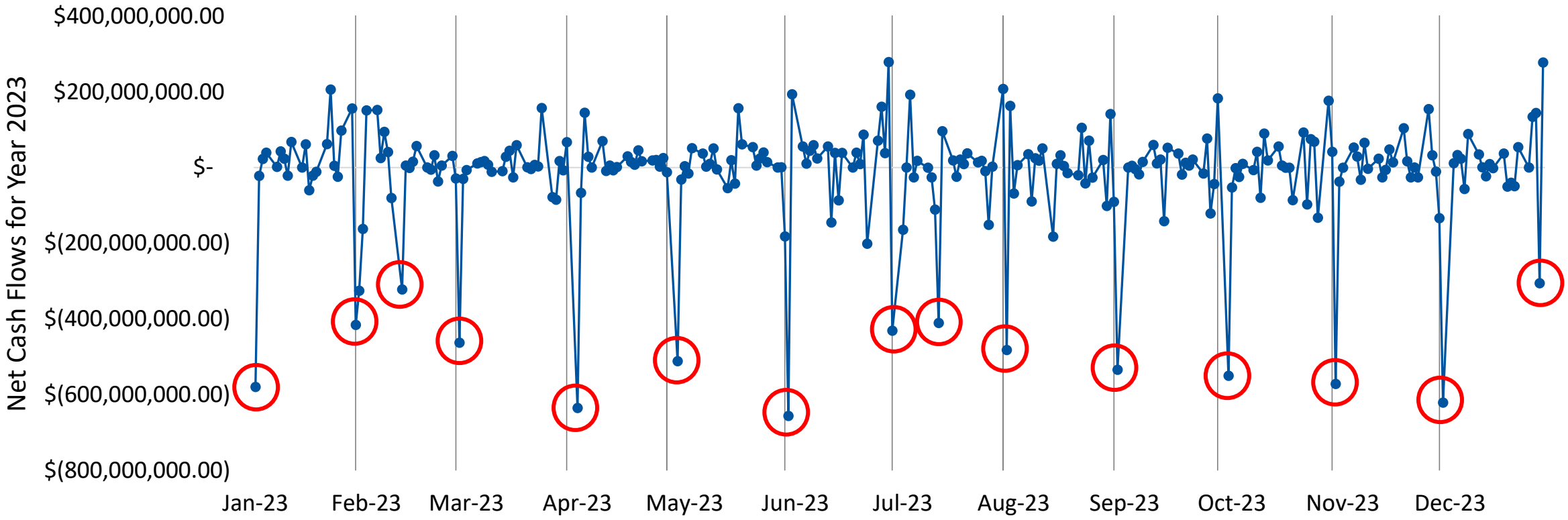
Rebalancing complexity:

- Cash flows
- Varying liquidity of markets

Notes: In this chart, the Fixed Income asset class includes Liquidity Reserves, Liquid Treasury Portfolio and Core Fixed Income.

Rebalancing Complexity: Cash Flows Matter

- In 2023, about $4.05 billion of total net outflows to pay member benefits



Rebalancing ensures cash is in hand to pay benefits and portfolio is in line with board's asset allocation

Market Liquidity Varies

	Rebalancing Horizon			
Assets	*Days*	*Weeks*	*Months*	*Years*
Cash	✓			
Derivatives	✓			
Treasuries	✓			
High Yield	✓	✓	✓	
Public Equities	✓	✓		
Private Credit			✓	✓
Private Equity			✓	✓
Real Estate	✓	✓	✓	✓

Liquidity varies across asset classes and market conditions

- During periods of market stress, the liquidity of all asset diminishes
- In the long run, illiquidity should be compensated by an illiquidity premium

Portfolio management and rebalancing account for different time horizons, varying liquidity and risk premia

Our Approach to Rebalancing

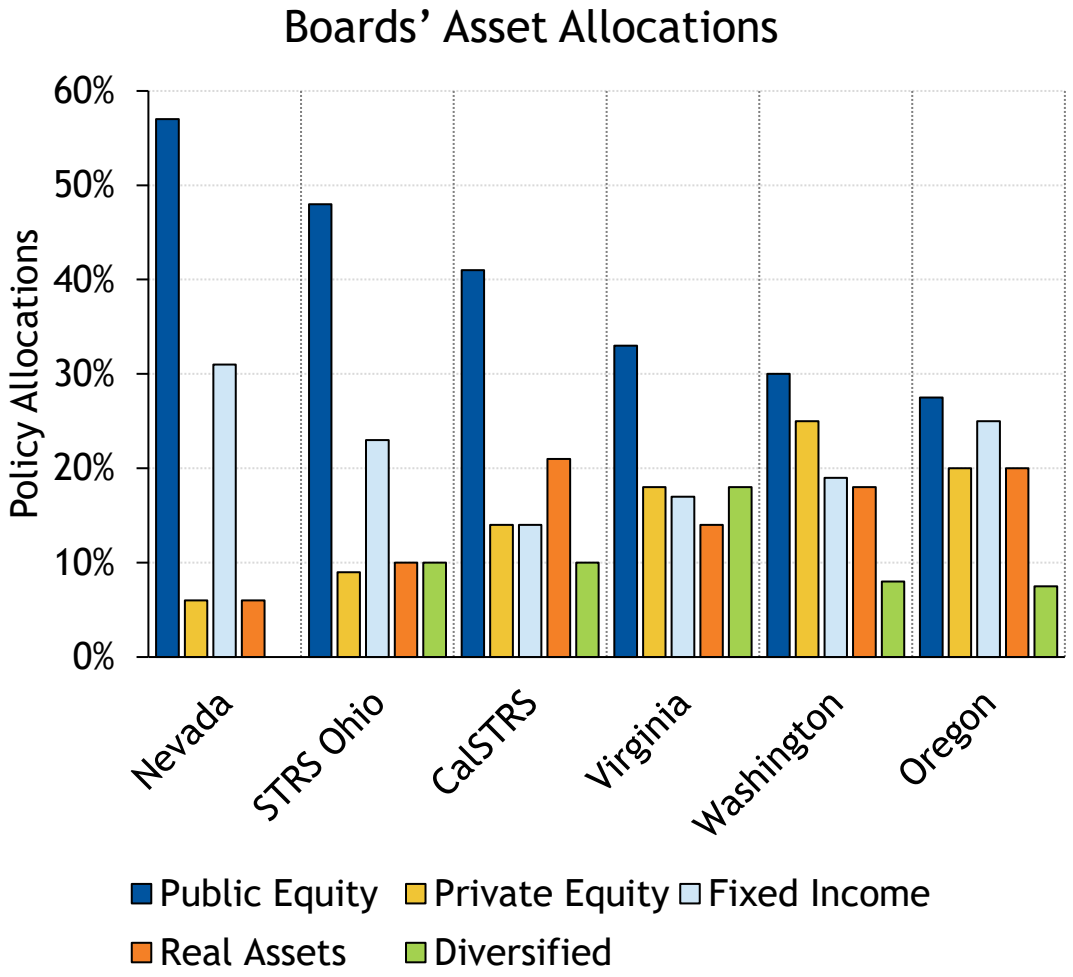
- **Policy questions:**
  - Are we within asset allocation ranges?
  - Are within the risk budget?
- **Near-term rebalancing (liquid)**
  - Focuses on stocks, bonds, cash and derivatives
  - Focuses on liquidity needs of the system to pay benefits
- **Long-term rebalancing (less liquid)**
  - Focus on alternative investments and real estate
  - Manage the pacing of contributions and distributions to achieve targeted allocations

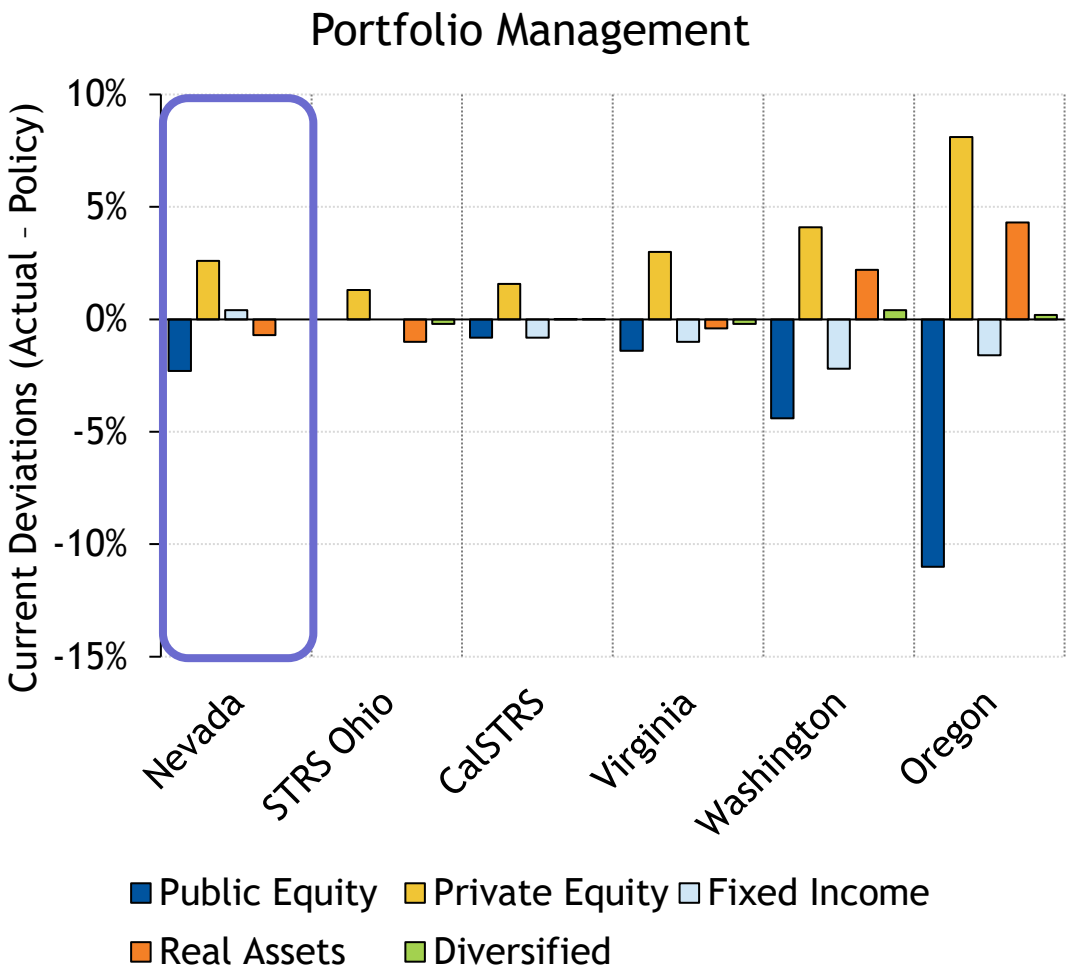
Board's Asset Allocation Ranges Constrain Rebalancing

Asset Classes	Ranges Min	Target	Max
Public Equities			
Domestic Equities	21%	26%	31%
International Equities	17%	22%	27%
Fixed Income	13%	22%	29%
Core Bonds	13%	17%	22%
Liquid Treasuries	0%	5%	7%
Alternatives	12%	19%	25%
Private Equity	6%	9%	14%
Opportunistic/Diversified	6%	10%	14%
Real Estate	6%	10%	13%
Liquidity Reserves	0%	1%	5%

Portfolio management and rebalancing ensure allocations are within ranges while providing latitude to sensibly manage the portfolio

Allocations Across Assets of Varying Liquidity Can Vary Greatly

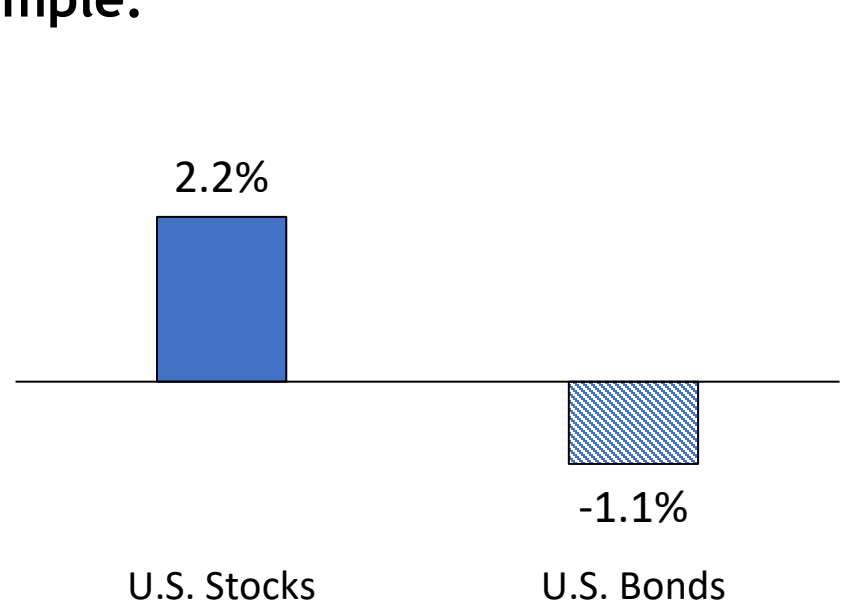




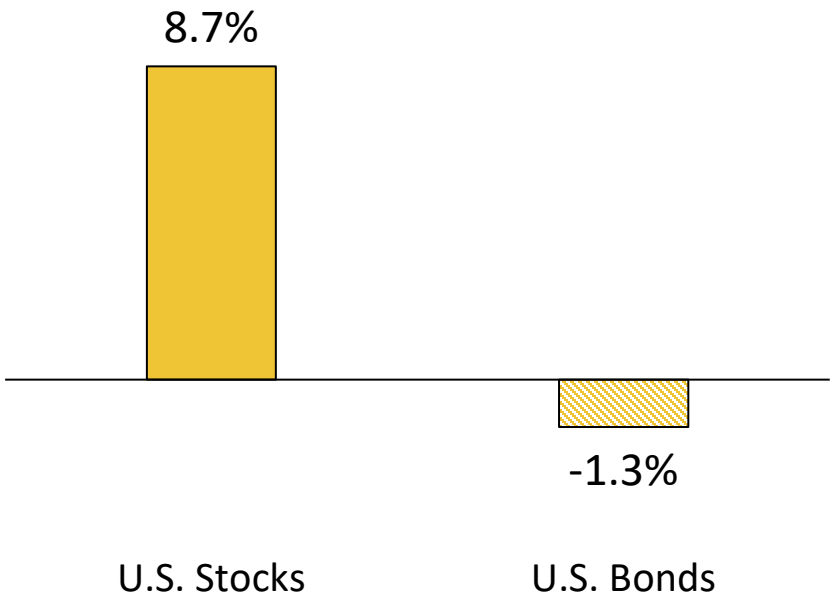
Notes: For STRS OH, the Fixed Income asset class includes Liquidity Reserves, Liquid Treasury Portfolio, and Core Fixed Income, while Real Assets coincides with Real Estate. For the other pension funds, we mapped their asset allocation to the five categories shown in the charts. Numbers based on reports between Q2 and Q4 of 2023 depending on fund (due to differences in reporting availability).

Rebalancing as a Form of Active Management

- **Nevada PERS' rebalancing policy introduces active risk via tactical asset allocation**
  - Rebalance less frequently
  - Infrequent rebalancing translates into "momentum", a type of active strategy
- **Q2 2023 Example:**



Change in Portfolio Weights (Q2 2023)



Quarterly Returns (Q2 2023)

Notes: Data obtained from nvpers.org.

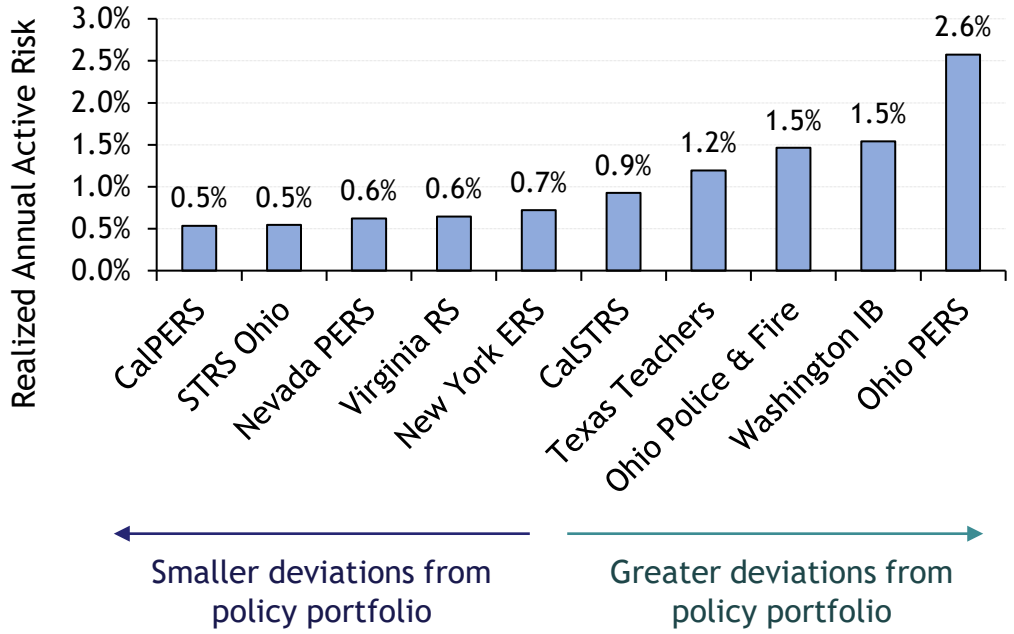
Board-Approved Risk Budget Constrains Rebalancing

- **What is a risk budget?**
  - A risk budget establishes guardrails around the amount of expected active risk
  - Active risk is a measure of how close the actual portfolio is to the board's asset allocation, index, or benchmark
- **Why a risk budget?**
  - Single metric that captures risks associated with deviating from board's asset allocation
    - Tactical asset allocation: overweight/underweight an asset class relative to policy portfolio
    - Security selection: overweight/underweight certain securities within an asset class
  - While allocation ranges are informative, some assets are more volatile than other ones
    - Active risk captures this dimension

Risk budget is one metric that captures multiple facets of risk relative to board's asset allocation

Differences in Active Risk Across Pension Funds

- **Differences in portfolio management and rebalancing across funds**
- **Data from Boston College Retirement Center (annual data, FY 2012-2021)**



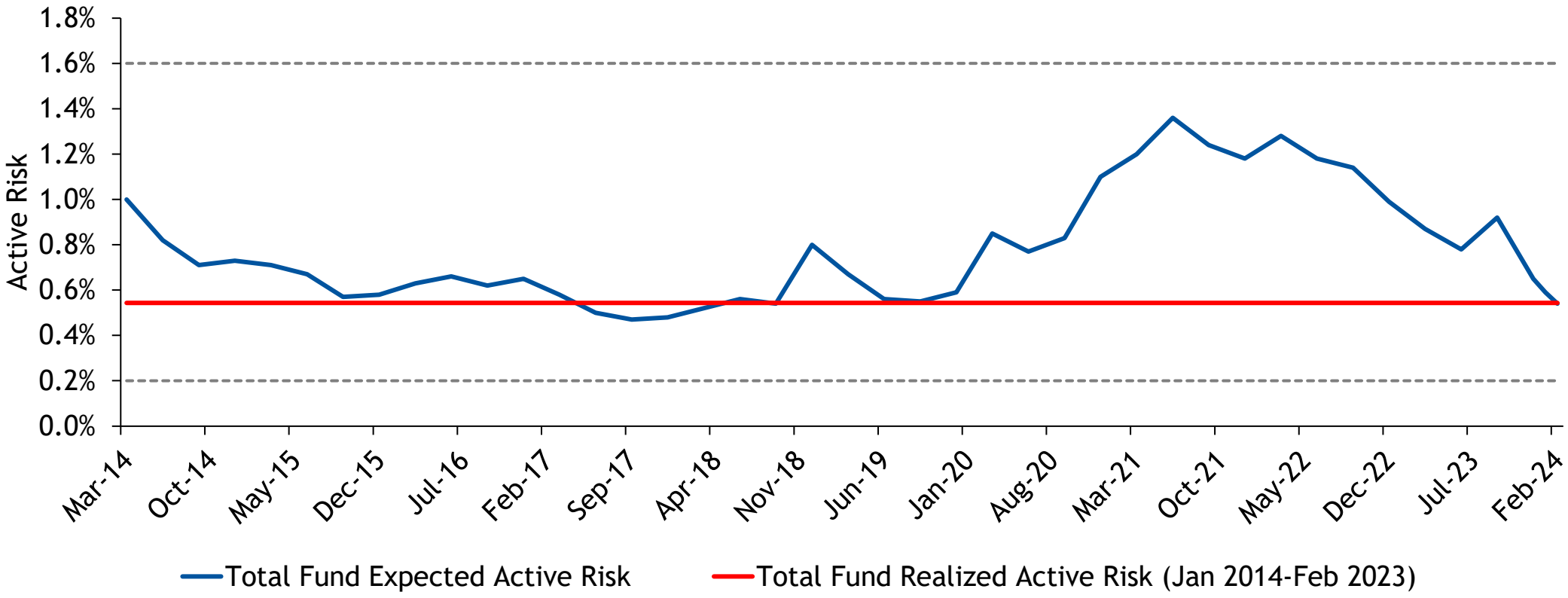
Active risk depends on various factors:

1. Tactical asset allocation
2. Assets actively managed
3. Assets internally managed
4. Proportion of less liquid assets in portfolio

Risk budgets are actively managed through rebalancing and reflect various factors

Active Risk at STRS Ohio

- **STRS Ohio Policy**
  - Board's risk budget range is 0.2%–1.6%



Rebalancing: February 2024 Example

Asset Classes	Fixed Income	Domestic Equities	International Equities
Return	-1.2%	+5.7%	+3.0%
Activity	Purchased $950 mil.	Sold $722 mil.	Sold $500 mil
Investments	Gov. Bonds Corporate Bonds Mortgages	Internal portfolios External portfolios	Internal portfolios External portfolios
Final allocations:	21.9%	26.1%	21.9%
Exp. Active Risk	Changed from 0.59% to 0.54%		
Duration:	Actions coordinated over a period of two weeks		

Sales greater than purchases providing liquidity for benefit payments

Concluding Remarks

- **Rebalancing is a critical portfolio management activity:**
  - Aligns actual portfolio to board policies
  - Ensures sufficient liquidity is available to pay member benefits
  - Enhances expected risk-adjusted returns
- **Our activities and ongoing research**
  1. Rebalancing in liquid markets:
     - Identify frequency for rebalancing liquid markets (collaboration with OSU professor)
  2. Rebalancing over the long term:
     - Identify optimal pacing model to private markets and cross-asset tradeoffs
  3. Liquidity management and overlays:
     - Re-evaluate role of liquid derivatives and leverage in enhancing total fund management

Questions?

Alternative Investment Program

STRS Ohio Investment Seminar

March 22, 2024

Pete Keliuotis, CFA
Alternatives Consulting

Tony Lissuzzo, CFA
Fund Sponsor Consulting

David Smith, CFA
Alternatives Consulting

Agenda

- Key Takeaways
- Alternative Investment Trends
- Asset Class Overviews
  - Private Equity
  - Private Credit
- Best Practices Considerations for STRS Ohio
- Private Markets Trends
- Summary and Q&A
- Appendix

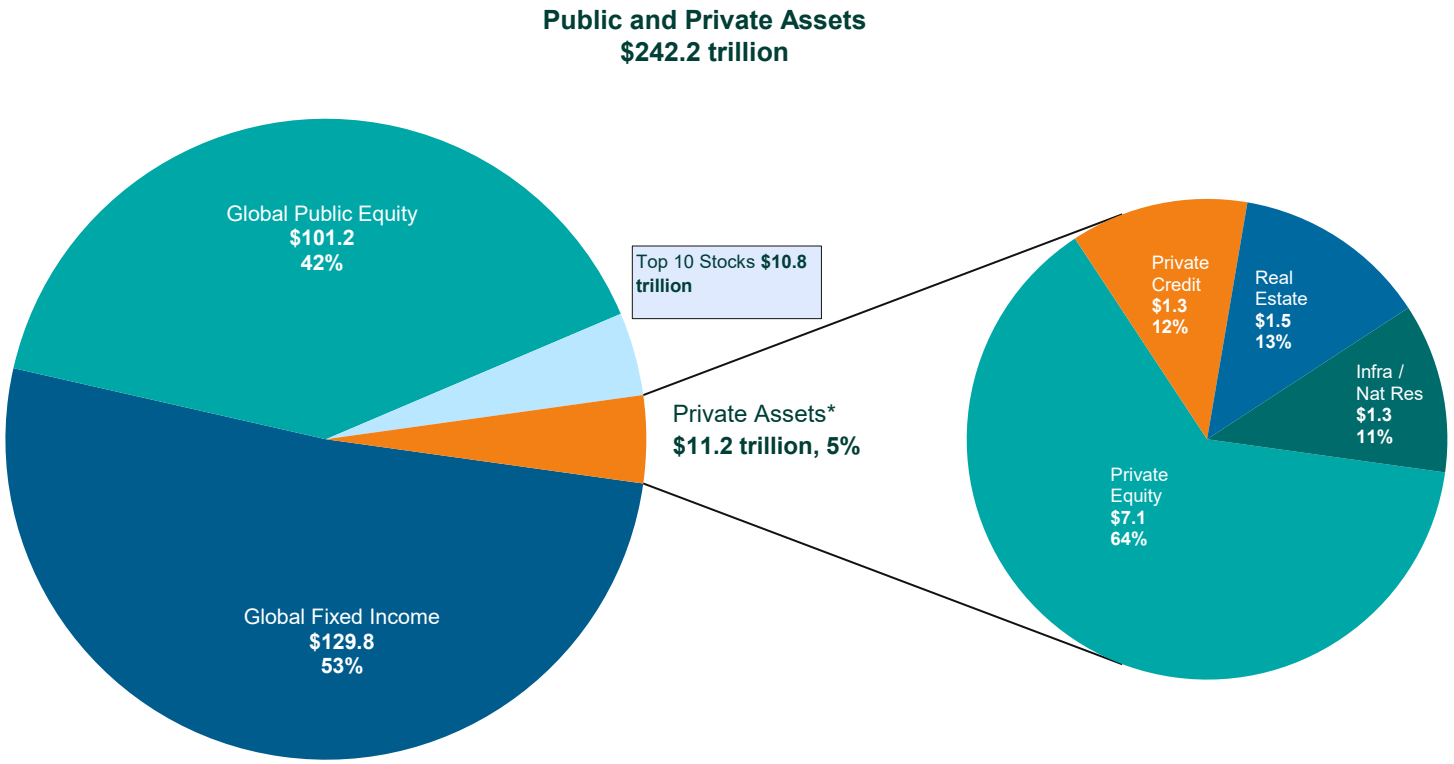
- Private Markets represent an increasingly large portion of global capital markets but still have room to grow.
- Investors look to alternative investments to improve their risk-adjusted returns.
- Callan believes alternative investments will continue to have a positive impact on performance.
- Private equity delivers consistent return enhancement.
- Private credit offers an attractive risk-adjusted yield and potential for additional distressed returns.
- The wide return spread between top and bottom performing funds highlights the importance of manager selection.
- Callan recommends investors use a mix of private and public markets benchmarks to assess performance.
- Callan is developing a new dashboard for monitoring STRS Ohio alternatives portfolio risk.

Alternative Investment Trends

Size of the Private Markets

Private markets estimated at $11.2 trillion

Public and Private Market Assets Under Management ($ trillion)



- Total private markets assets under management grew **17% annually** from 2017-22 to $11.2 trillion from $5.2 trillion
- Comparatively, global equity and fixed income assets grew just 4% and 5%, respectively, over the same period
- Private markets have expanded beyond private equity with private credit, infrastructure, and natural resources becoming mainstream asset classes.
- Private markets have become increasingly complex, with new strategies and return drivers providing diversification opportunities.

* Percentages shown as a % of private assets

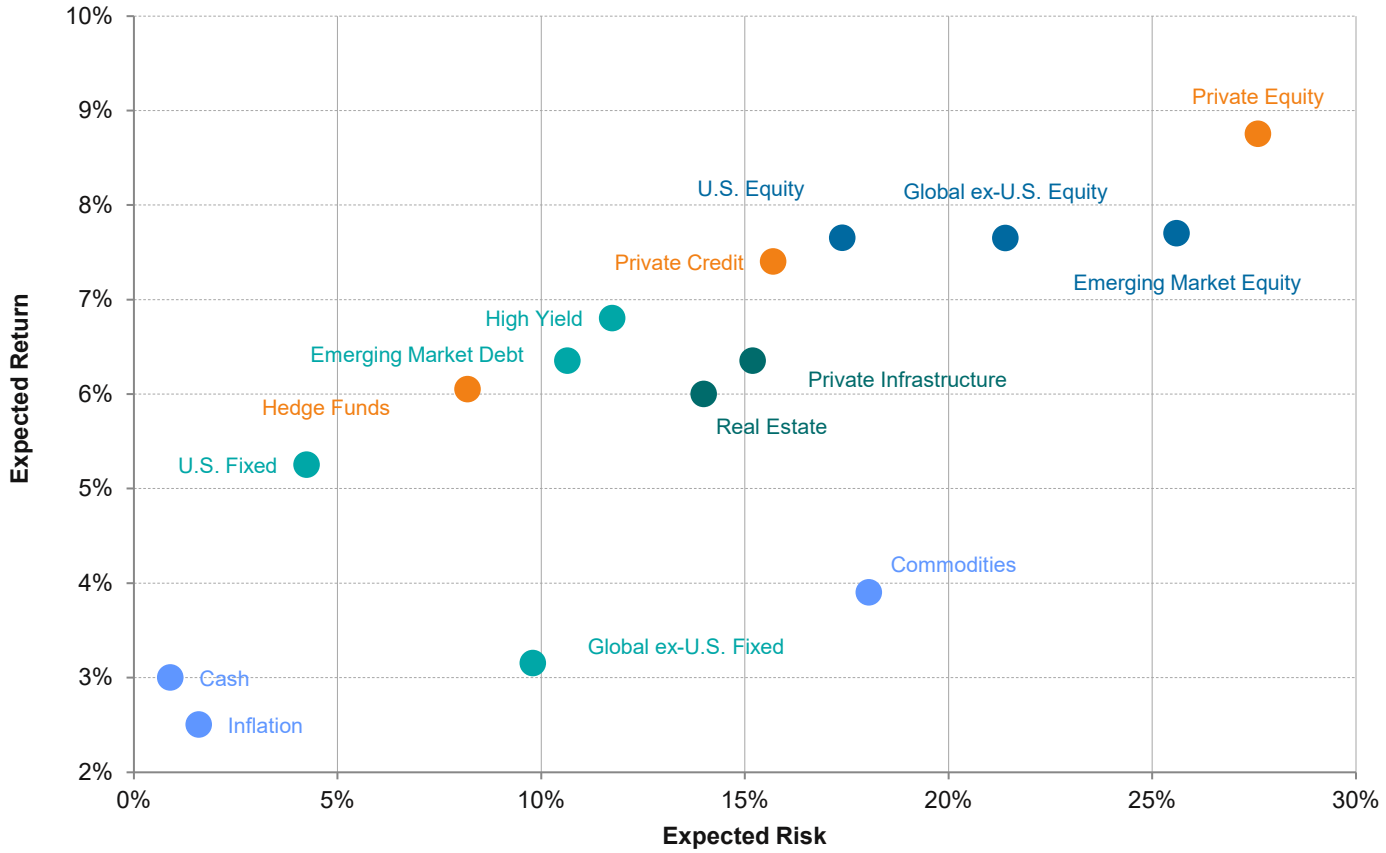
Source: McKinsey analysis, Preqin, SIFMA, as of December 31, 2022

Relationship Between Expected Return and Risk

Visualizing Callan's 2024–2033 Capital Market Assumptions

Forecasts link expected return to risk

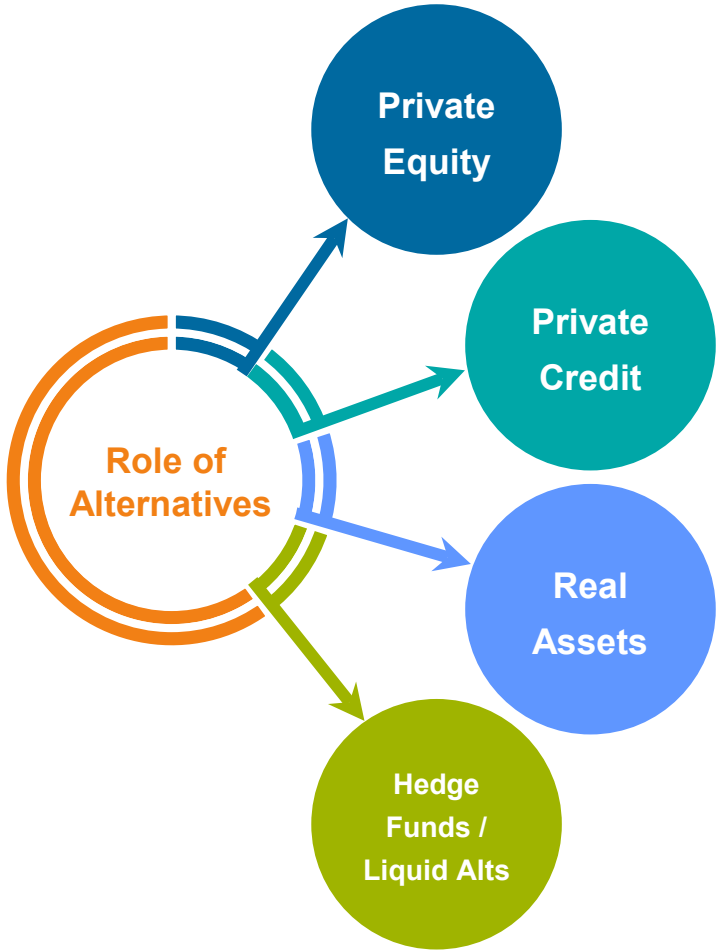
- For example, investors demand a greater return from private equity than public equity as compensation for higher risk
- Private equity expected return of 8.75% are about 110 bps above U.S. Equity – more conservative than most
- Private credit expectations of 7.4% are about 60 bps above HY and 135 bps below private equity
- Callan expects private markets to outperform public market equivalents due to illiquidity and complexity



Source: Callan

Illustrative Benefits of Alternative Investments

Improve risk-adjusted returns



Problem: Investors need return enhancement: **7.3%** median discount rate for public defined benefit plans, **5%** (real) spend for endowments and foundations

Solution: Private equity expected to return **8.75%** over the next decade, outperforming public equity by **1% to 2%** annually

Problem: Rates have risen but **5.25%** core fixed return still well below discount rate

Solution: Private Credit return of **7.4%**, plus potential for additional returns from diversifying strategies

Problem: Fixed income yields have risen and equities have experienced more volatility

Solution: Core real estate expected to return **6.0%**, only 165 bps lower than broad U.S. equities, but with a standard deviation 340 bps lower at **14**%

Problem: **5** equity market downturns of > **10%** over the past 10 years

Solution: Diversified hedge fund/liquid alternatives portfolio expected to return **6.05%** (cash = **3.0%**, core bonds = **5.25%**)

Projections based on Callan's 2024–2033 Capital Markets Assumptions

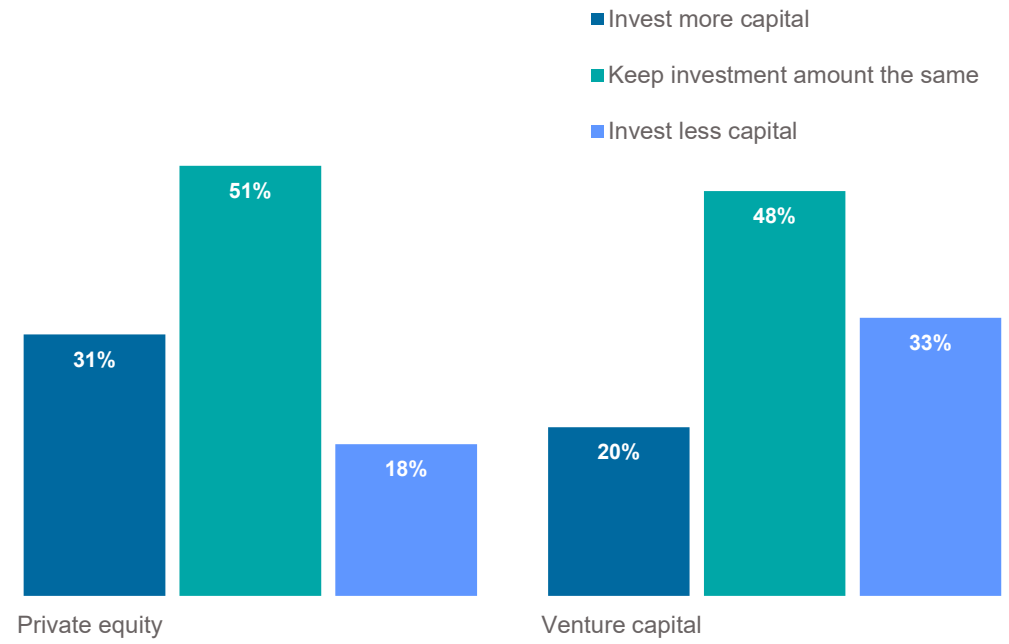
Asset Class Overview: Private Equity

What Is Private Equity?

Definition: Private, unlisted investments in operating companies, typically accessed through limited partnerships

- Often viewed as a separate asset class, private equity is an extension of equity that encompasses ownership stakes in companies but, unlike public equity, engages in private transactions
- Provides a differentiated return stream and diversification in a portfolio with publicly traded securities
- Primary appeal: potential to outperform publicly traded stocks and bonds
- Primary considerations: illiquidity, program complexity, high return dispersion
- As shown, most surveyed investors intend to maintain or increase investments in private equity and venture capital

Plans to Invest In Private Equity and Venture Capital in 2024
(percentage of investors)

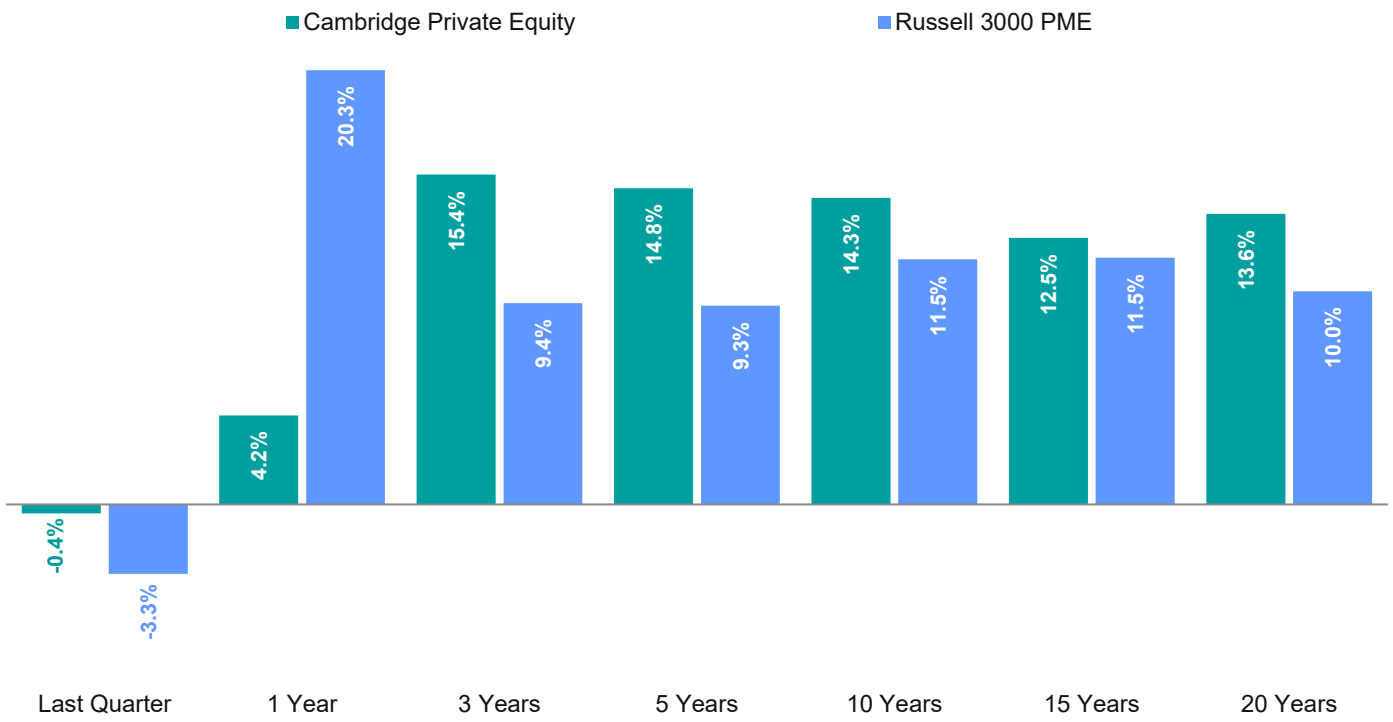


Source: Private Equity International's LP Perspectives 2023 Survey

Why Invest in Private Equity?

- Potential to outperform public equity
- Control over operations the key differentiator from public equity
- Private equity fund managers control and execute value-creation plans:
  - Can grow companies fast, optimizing the use of leverage where applicable
  - Bring best resources to companies, managements, boards, and customers
- Companies managed for long-term gain, not quarterly earnings:
  - Different objectives and incentives than public companies

Historical Trailing Returns as of 09/30/23



Pooled Horizon IRR measures the return for a specific time period, factoring in all the cash flows and the timing of the cash flows for the strategy or funds under review. The IRR is the discount rate that makes the net present value of all cash flows equal to zero.
* Public market equivalent

Characteristics of Private Equity

Complexity

Merits

A structured program, a well-defined process and strategy, an experienced staff, and a supportive board can achieve targeted returns

Considerations

- Successful execution requires a long-term plan and collaboration of board and staff
- Requires depth and breadth of staff for execution
- Access to quality general partners may be limited
- Distinct agreements; buyer's remorse can be costly

Return

Merits

- Historically higher returns relative to public equities
- Opportunity set unique relative to public equities

Considerations

- High return dispersion—manager selection integral to developing a successful program
- No replicable benchmark
- Investing primarily in blind pool funds

Illiquidity

Merits

- No mark-to-market volatility as associated with public equities
- Long-term focus, with emphasis on ROI

Considerations

- Imperfect and infrequent valuations
- Difficult to "rebalance"—structural hindrances to selling partnership interests
- Unpredictable cash flows—managing liquidity and exposure is challenging

Cost

Merits

- Carried interest generated only if return hurdle is met
- Greater, not complete, transparency on fees and expenses
- Lower costs do not equate to higher returns

Considerations

- High fee structure relative to public equities—management fees and other embedded costs
- Lack of complete fee and expense transparency

Private Equity Strategy Types

Buyout

Acquire control positions in mature businesses that typically have long operating histories, established end markets, and developed product or service offerings

Growth Equity

Acquire minority interests in growing businesses that are typically at or near profitability and need the capital to scale

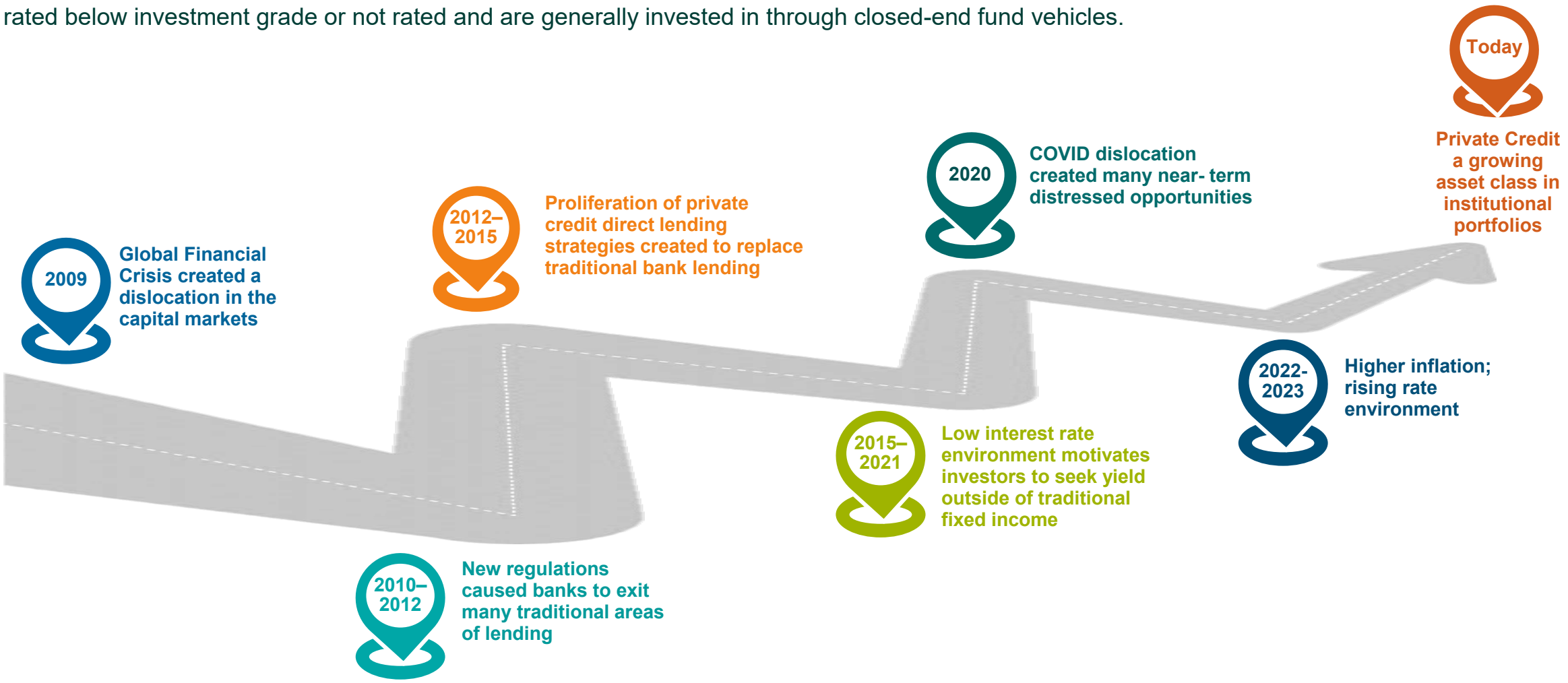
Venture Capital

Acquire minority interests in startup businesses or ideas with significant growth potential, generally in the technology, consumer, or health care industries

Asset Class Overview: Private Credit

What Is Private Credit?

A growing and diverse asset class that largely invests in private loans that are not publicly traded. These assets are typically rated below investment grade or not rated and are generally invested in through closed-end fund vehicles.



Callan's Framework for Private Credit Investing

Private credit strategies generate returns in excess of traditional fixed income through additional compensation for illiquidity and complexity.

Private credit is less liquid than traditional fixed income. Cash coupon distributions from some strategies help mitigate this illiquidity.

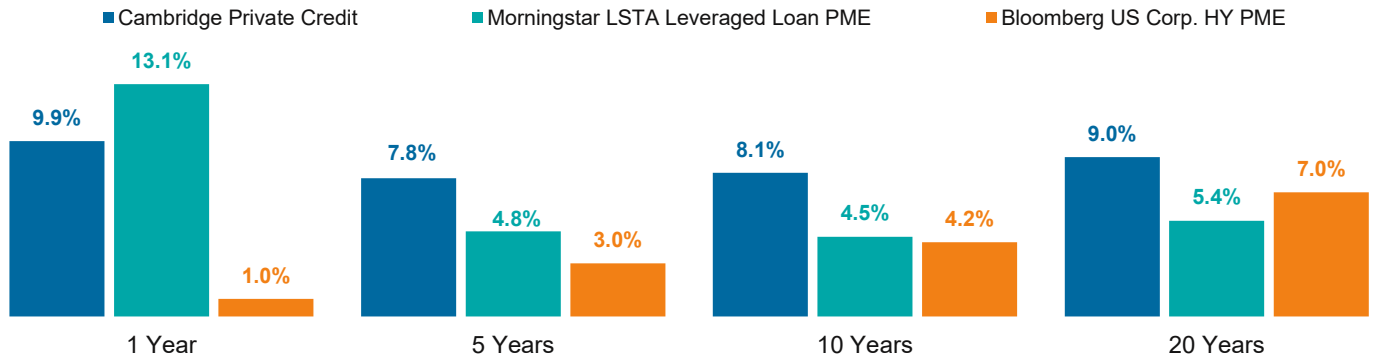
Private credit strategies are diversified by sub-strategy, industry, geography, and underlying collateral.

Private credit assets are structured to limit capital loss through priority of payment and other legal protections compared to equity holders.

Private Credit: Yield Enhancer

- On average, private credit has generated net IRRs of 8% to 10%.
- This has provided yield enhancement relative to bank loans and high yield bonds.
- Private credit also provides diversification through different return drivers and collateral types.
- Private credit performance varies across sub-asset class:
  - Higher-risk strategies such as mezzanine have had higher returns than lower-risk strategies such as senior debt.
  - Senior debt strategy returns are driven primarily by coupon income with less equity upside than higher-risk strategies.

Historical Trailing Returns as of September 30, 2023



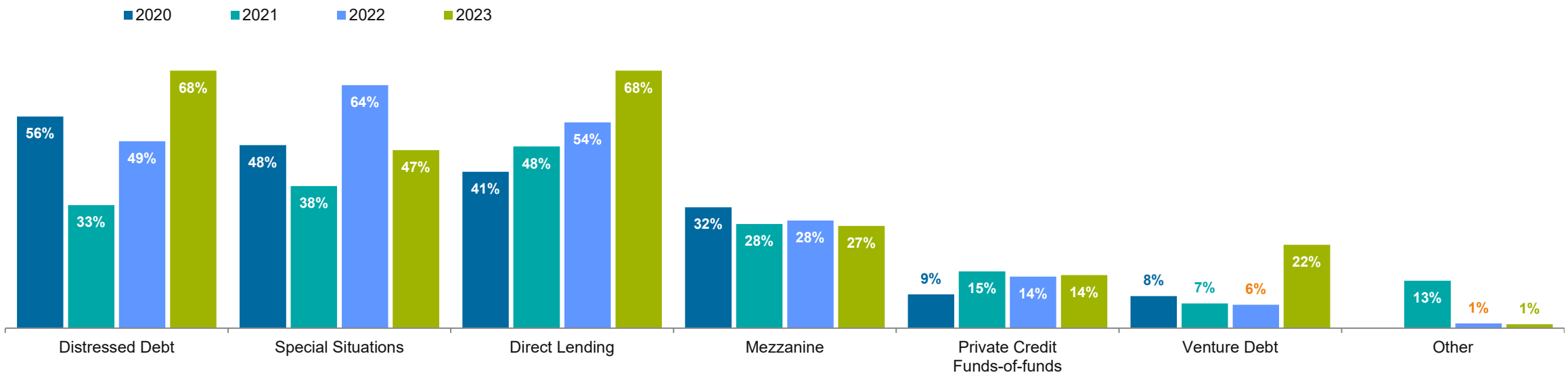
Returns by Strategy as of September 30, 2023

Strategy	1 Year	5 Years	10 Years	20 Years
Senior Debt	11.4%	5.9%	6.6%	6.8%
Subordinated Credit	13.0%	11.0%	11.1%	10.6%
Credit Opportunities	8.2%	7.1%	7.5%	8.9%
Total Private Credit	**9.9%**	**7.8%**	**8.1%**	**9.0%**

* PME: Public Market Equivalent, a benchmark that applies the cash flows of the private credit funds to a public market index and then calculates an IRR.
Source: LSEG/Cambridge

Private Credit Demand

Investor Views on Fund Types Presenting the Best Opportunities in Private Credit



- Demand for Distressed and Special Situations varies by market conditions.
- Demand for Direct Lending, the largest component of the STRS Ohio Opportunistic portfolio, has been steadily increasing.
- Interest in Venture Debt has increased in line with a drop in IPOs and venture-backed company exits.

Source: 2024 *Preqin Global Report Private Debt:* (data through Nov 2023)

Best Practices Considerations for STRS Ohio

Private Markets Program Best Practices

Four essential building blocks

Program Design

- Governance, staffing, and resources
- Implementation models — buy, build, or both?
- Objectives and risk specifications
- Investment policy statement

Monitoring and Evaluation

- Qualitative and quantitative monitoring
- Benchmark selection
- Reporting

Strategic Planning

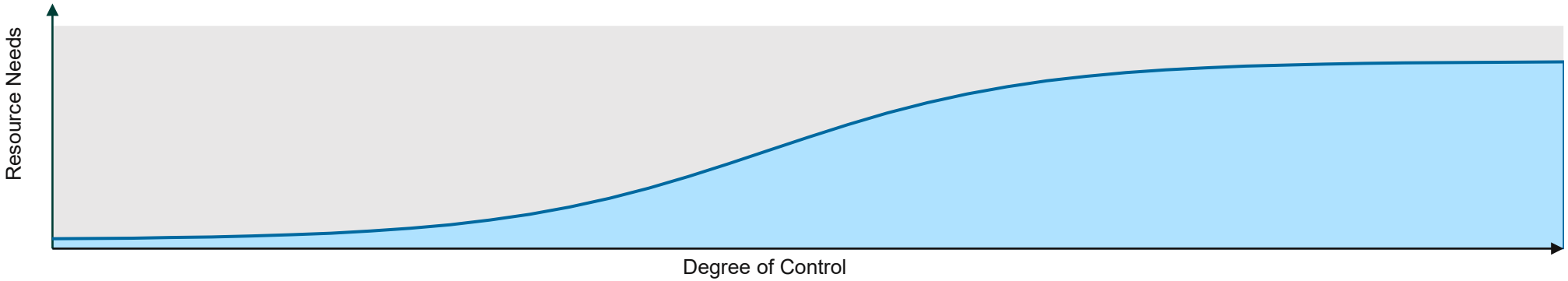
- Capital budget/commitment pacing
- Strategy selection
- Vehicle structure
- Liquidity management

Manager Selection

- Forward calendar
- Due diligence
- Terms and conditions

Private Markets Implementation Options

Optimal implementation choice depends on desired control and available resources

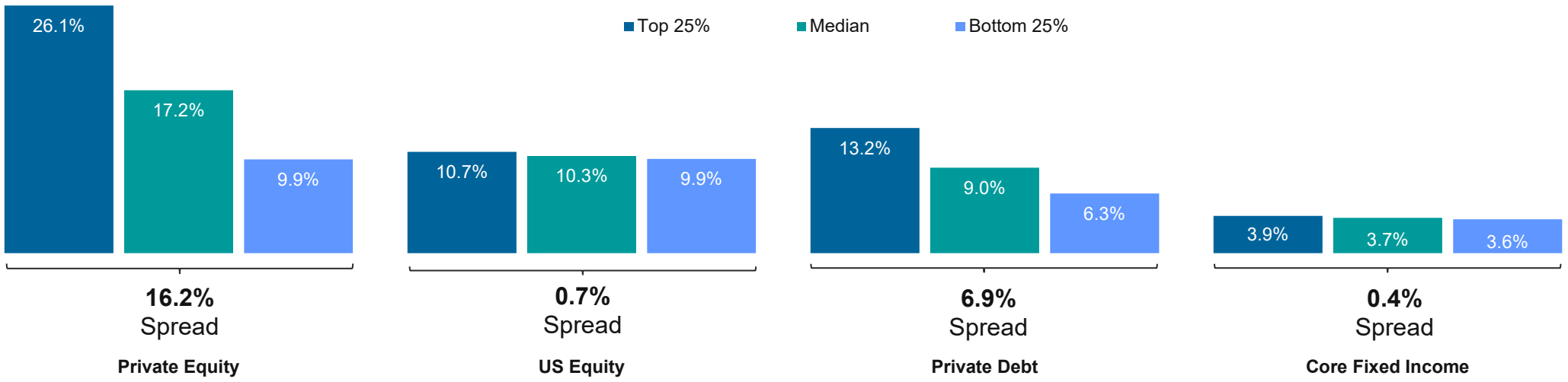


	Fund-of-Funds (Outsourced)	Direct Program (Board-Driven)	STRS Ohio (Internal Active)
Implementation Risk »	Lower	Higher	Moderate
Program Complexity for STRS »	Lower	Higher; Custom	Higher; Custom
Diversification »	Higher	Custom	Custom
Total Fee Load »	Higher	Lower	Lowest; Custom
Net of Fee Returns »	Lower	Potentially Higher	Potentially Higher
Return Dispersion »	Lower	Highest	Moderate

Importance of Manager Selection

- Spread of returns between top and bottom quartile performing funds are much wider in private markets.
- The ability to select strong performers and avoid poor performers can have a large impact on asset class results.

Global Net IRR Quartile Spreads by Asset Class
As of 03/31/2023 for vintage 2009–19 funds



Source: LSEG/Cambridge; Callan Large Public Funds Database for Domestic Equity and Core Fixed Income
Methodology: Internal rate of return (IRR) spreads calculated for funds within vintage years separately and then averaged out. Median IRR was calculated by taking the average of the median IRR for funds within each vintage year.

Benchmarking Best Practices

Three benchmark methodologies

Absolute Return

- Investor chooses a minimum absolute return hurdle (e.g., 10%) for a fund or program to be deemed successful
- Should be measured over the full life of the fund; does not capture return volatility or downside risk
- May vary by strategy type (buyout vs. venture capital)
- Callan recommends avoiding Absolute Return benchmark in most cases

Private Markets Index

- Commonly used benchmarks include Refinitiv/Cambridge and Burgiss
- Partnerships classified by vintage year, strategy, industry sector, and geography
- Allows “apples-to-apples” comparison, yet significant flaws and biases still exist
- Appropriate for Short-Intermediate Term (3-10 years)

Public Markets Index + Premium

- Can be either a broad public benchmark (typically S&P 500, Russell 2000, or MSCI) or industry-specific (S&P Health Care)
- Most investors apply a spread (typically 200–300 bps) to reflect the expected illiquidity return premium
- Index can be used to create a PME (public market equivalent) benchmark to reflect opportunity cost vs. public markets
- Appropriate for Long Term (>10 yrs)

Benchmark comparisons should be made on a “net-net” basis (net of all fees, expenses, and carried interest)

STRS Ohio Portfolio Risk Dashboard

In Development

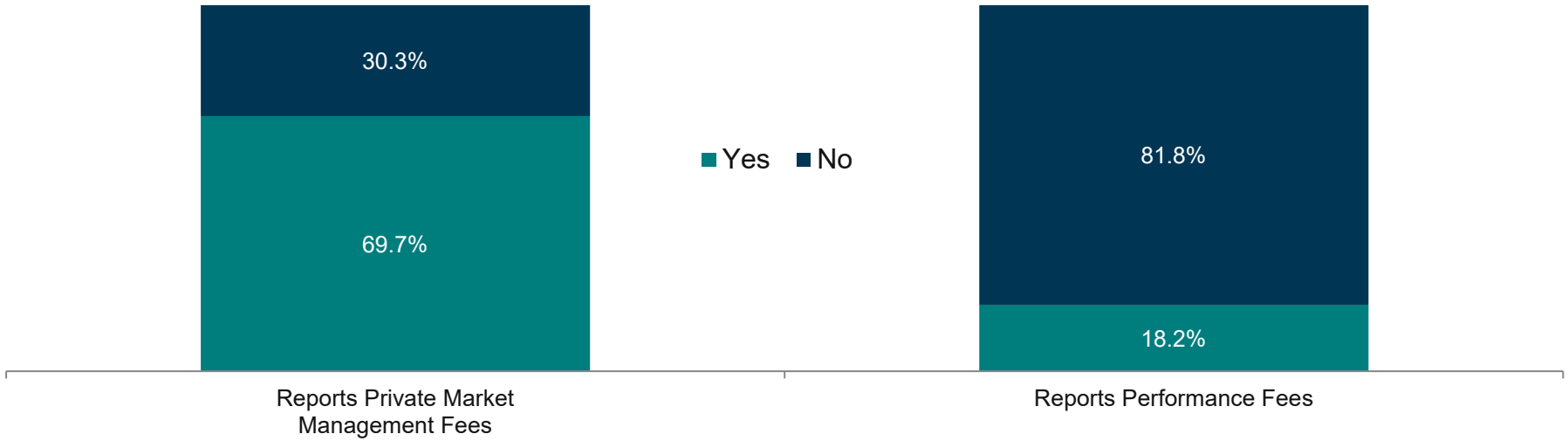
		STRS Ohio Private Equity	STRS Ohio Opportunistic/Diversified	STRS Ohio Total Alternative Investments
Organizational Risk (Based on Stoplight Report)	»	[ ]	[ ]	[ ]
Portfolio Performance (Performance vs. Benchmark)	»	[ ]	[ ]	[ ]
Manager Selection (Based on Stoplight Report)	»	[ ]	[ ]	[ ]
Diversification (Returns by Vintage NAV)	»	[ ]	[ ]	[ ]
Liquidity (Days Liquidity by Strategy)	»	[ ]	[ ]	[ ]

- Risk Dashboard objective is to monitor, assess, track and efficiently communicate risk using multiple parameters.
- Parameters must be quantitatively measured and tracked over time to help identify trends.

STRS Ohio Fee Reporting

Best Practices Comparison

Public Plan Private Market Fee Reporting Survey (2022)



- While most public plans in Callan's study report private markets management fees, only a small minority report performance fees.
- Callan believes STRS Ohio has more transparent fee disclosure practices than most public pension plans.
- Increased fee transparency can provide greater comfort for boards to maintain private markets programs.
- LPs must be careful not to provide too much transparency on proprietary/custom fee arrangements.

Private Markets Trends

Current Private Equity Environment

1 Demand

Established, strategic asset class for institutional LPs

Institutional demand remains strong

Increased interest and access by high net worth investors

2 Drop in Pricing

Investors waiting for valuations to fall further

Private equity returns fell modestly in 2022, **-5 to 10%**, vs. **-20 to 30%** for public equities

But lagged public equity recovery in 2023

Are private equity companies fundamentally different than public companies?

3 Deal Activity I

Fundraising continues to be challenging

Down **~30%** from peak volumes in 2021 to YTD 2023

"Flight to quality" as larger funds increase market share

4 Deal Activity II

Big slowdown in transactions

M&A exits down: **44%** drop for private equity; **60%** for venture capital*

IPO window closed: PE/VC activity down by **2/3**

Venture capital financing rounds down **55%*** … plus impact of regional bank crisis

5 Drop in Distributions

Fewer transactions today means less distributions in future quarters

6 Denominator Effect

Many investors becoming over-allocated due to these factors

… *creating secondary market opportunities*

*Venture Capital 2H 2021 to 1H2023

Current Private Credit Environment

1 Demand

Rapid asset growth through the low-rate environment over the past decade

Target allocations typically 2–10%

Strategic asset class

2 Diversification

Non-corporate, diversifying exposures sought by investors

Specialty finance, asset-based, and niche strategies

3 Direct Lending

Portfolios show resilience with improved pricing

Higher rates; spreads widened in 2023 but have since narrowed

Disintermediation of high yield and broadly syndicated loans from larger deals

4 Distressed

Likelihood of traditional distressed opportunity is falling

Traditional corporate distressed opportunity becoming less likely in the U.S.

Capital solutions demand are still expected to increase in emerging markets and Europe

5 Downside Protection

Stronger structural protections in newer deals

Lower leverage: deal level and fund level

More stringent covenants

6 Design

Growth of creative investment structures

Evergreen funds, business development companies, interval funds

Pros: liquidity, flexibility, recycling

Cons: asset-liability mismatch risk

- Alternatives represent an increasingly large portion of global capital markets but still have room to grow.
- Investors look to alternative investments to improve their risk-adjusted returns.
- Callan believes alternative investments will continue to have a positive impact on performance.
- Private equity delivers consistent return enhancement, but investors are worried about valuations.
- Private credit offers an attractive risk-adjusted yield and potential for additional distressed returns, but investors are worried about the yield premium.
- The wide return spread between top and bottom performing funds highlights the importance of manager selection.
- Callan recommends investors use a mix of private and public markets benchmarks to assess performance.
- Callan is developing a new dashboard for monitoring STRS Ohio alternatives portfolio risk.


Q...
A...

Appendix

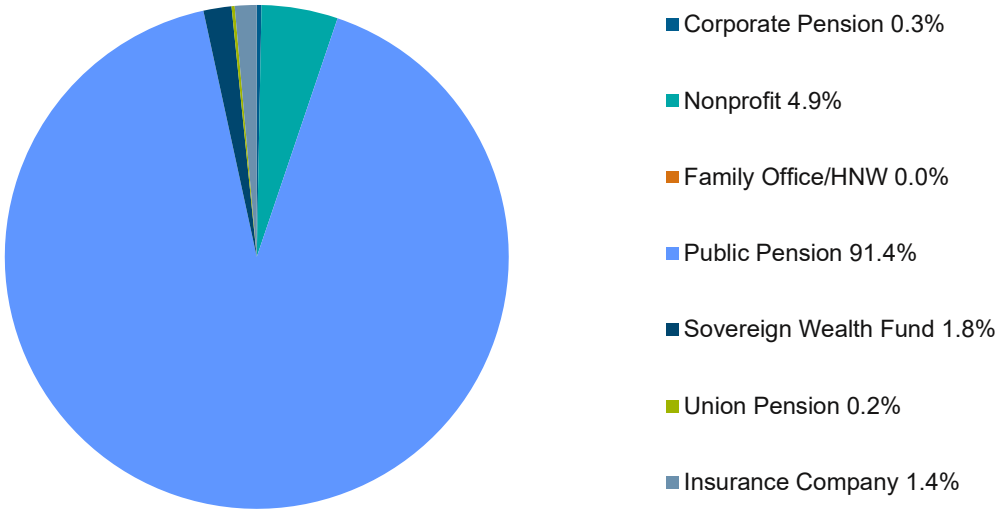
Private Markets Performance Metrics

% Paid-In	**Paid-In Capital** divided by **Committed Capital**
Total Value to **Paid-In Capital** (TVPI)	**Total Value** divided by since inception **Paid-In Capital**
Distributions to **Paid-In Capital** (DPI)	**Distributions** divided by since inception **Paid-In Capital**, also referred to as the "realization multiple"
Residual Value to **Paid-In Capital** (RVPI)	**Residual Value** divided by since inception **Paid-In Capital**
Internal Rate of Return (IRR)	The implied discount rate or effective compounded rate of return that equates the present value of cash outflows (**Paid-In Capital**) with the present value of cash inflows (**Distributions**)
Public Market Equivalent (PME)	The performance of a public market index expressed in terms of an IRR, using the same cash flows and timing as those of the composite over the same time period. A PME can be used as a benchmark by comparing the IRR of a private equity composite with the PME of a public market index.

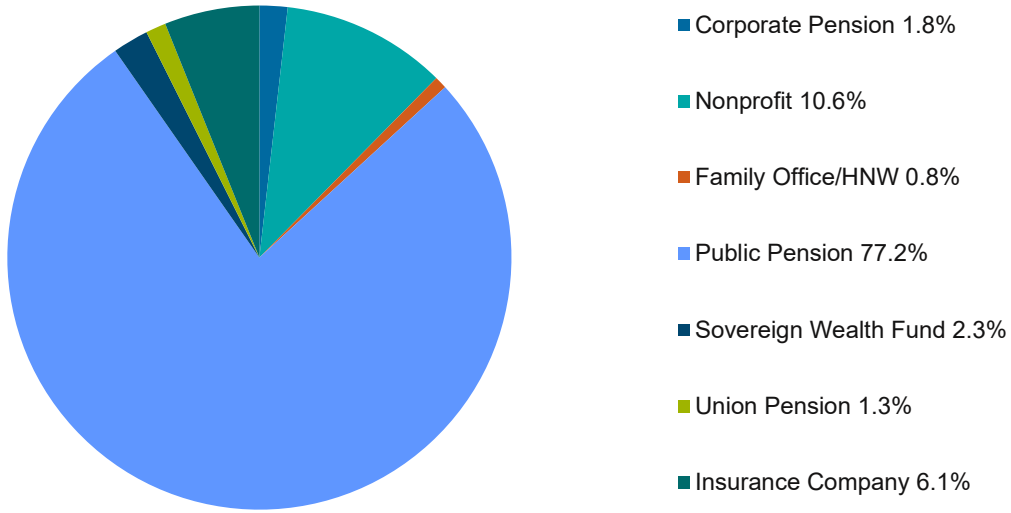
Who Invests in Private Equity?

- A diverse set of limited partners invests in private equity in search of high returns to enhance the performance of their portfolios.
- In addition to Institutions, individual/taxable investors also represent one of the faster growing segments of the private equity LP base, partly due to the development of new vehicles, broader use of technology platforms to enable access to 3(c)7 funds, and significant wealth creation leading to rapid growth in the establishment of new single and multi-family investment offices.

LP Type by Commitment Amounts



LP Type by Number



Source: PitchBook, as of December 2023

Biographies

Pete Keliuotis, CFA, is an executive vice president and the head of Callan's Alternatives Consulting group. He joined Callan in 2019 to lead the private equity, private credit, and hedge fund consulting teams, in addition to advising clients' alternative investment portfolios. Pete is a member of Callan's Alternatives Review, Client Policy Review, Management, and Editorial committees. Pete earned an MBA from the University of Chicago Graduate School of Business and a BA in economics from the University of Illinois – Urbana-Champaign. He is a shareholder of the firm and a holder of the right to use the Chartered Financial Analyst® designation.

Tony Lissuzzo, CFA, is a senior vice president and consultant in Callan's Chicago consulting office. His responsibilities include client education, strategic planning and implementation, portfolio and fee reviews, and investment policy development. Tony is a member of Callan's Alternatives Review Committee. Tony earned an MBA from the University of Chicago Graduate School of Business and a BS in economics from the University of Wisconsin–Madison. He is a holder of the right to use the Chartered Financial Analyst® designation.

David Smith, CFA, is a senior vice president and senior member of Callan's Alternatives Consulting group. His responsibilities include consulting on private equity program development, private equity and venture capital fund sourcing and underwriting, and client education on private markets. David earned an MBA from the Syracuse University School of Management and a BBA from Western Illinois University. He is a holder of the right to use the Chartered Financial Analyst® designation and also holds the Certified Treasury Professional Designation.

Callan

March 22, 2024

State Teachers Retirement System of Ohio

Quarterly Alternative Investment Portfolio Performance Summary

Pete Keliuotis, CFA
Executive Vice President

David Smith, CFA, CTP
Senior Vice President

Daniel Brown
Senior Analyst

Tony Lissuzzo, CFA
Senior Vice President

Catherine Beard, CFA
Senior Vice President

Executive Summary

The STRS Ohio Alternatives Portfolio has improved the risk-adjusted returns of the total fund through added diversification benefits and strong performance.

- **Overview**
  - The Alternative Investments (or “Alternatives”) program has 20+ year history
  - The program is diversified by strategy type and is designed to provide both return enhancement and risk mitigation. The components of the Alternative Program include:
    - Private Equity:
      - *Investments in private, non-liquid companies that provide high return potential relative to public market asset classes*
    - Opportunistic / Diversified (or “O/D”):
      - *Opportunistic: Investments are expected to provide both return enhancement and downside protection in equity bear markets*
      - *Diversified: uncorrelated, liquid strategies, expected to provide diversification benefits for the total fund*
- **Performance Comments**
  - The Total Alternative Investments Program has positively contributed to total fund performance over the trailing 20-year period
  - The Private Equity and Opportunistic Portfolios have performed well relative to private market counterparts, ranking solidly in the second quartile of relevant peer groups
  - The Alternatives Program has primarily been self-funded over the last ten years

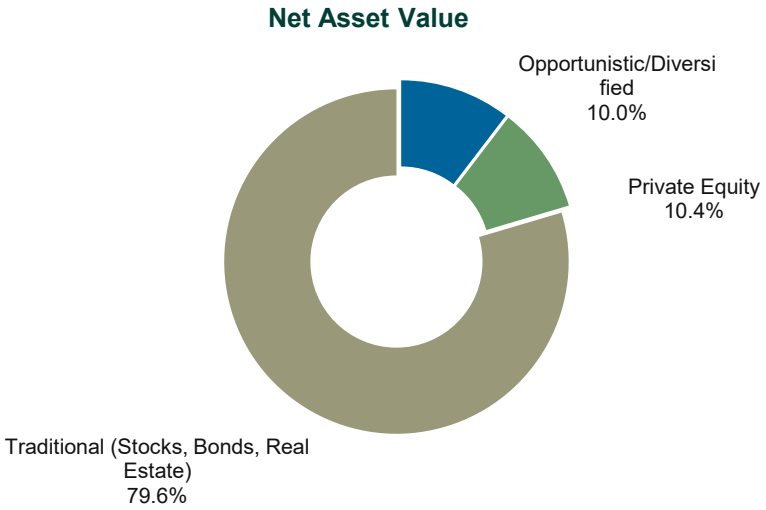
Total Alternative Investments

STRS Ohio Alternative Investments

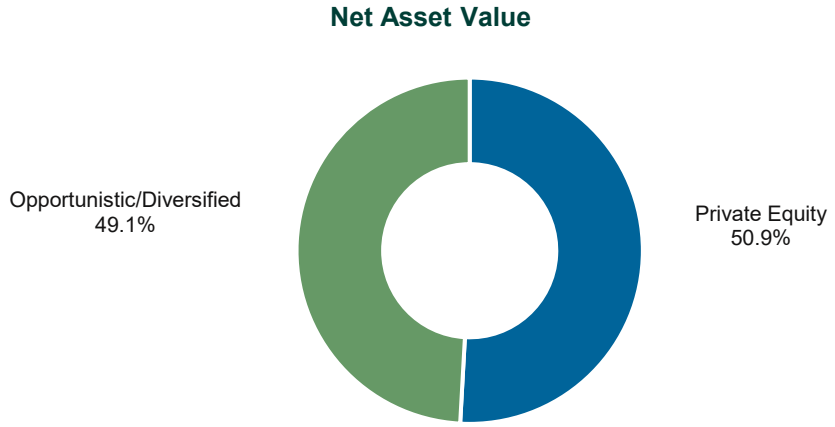
Private Equity and O/D segments differ in terms of risk/return expectation, providing diversification benefits to the STRS Ohio Total Fund

The following tables illustrate total current and potential exposure by Private Equity and Opportunistic/Diversified, as of December 31, 2023 in USD millions.

Total Fund Portfolio Composition



Alternatives Portfolio Composition



Portfolio Exposure by Strategy Type	Net Asset Value[1]	%	Unfunded Commitment[1]	%	Potential Exposure	%	5 Year TWR[2]	10 Year TWR[2]
Private Equity	$9,516	50.9%	$2,974	42.7%	$12,490	48.7%	15.65%	15.23%
Opportunistic/Diversified	$9,187	49.1%	$3,994	57.3%	$13,181	51.3%	8.37%	6.61%
Total Alternatives Program	**$18,703**	**100.0%**	**$6,968**	**100.0%**	**$25,671**	**100.0%**	**12.22%**	**10.98%**

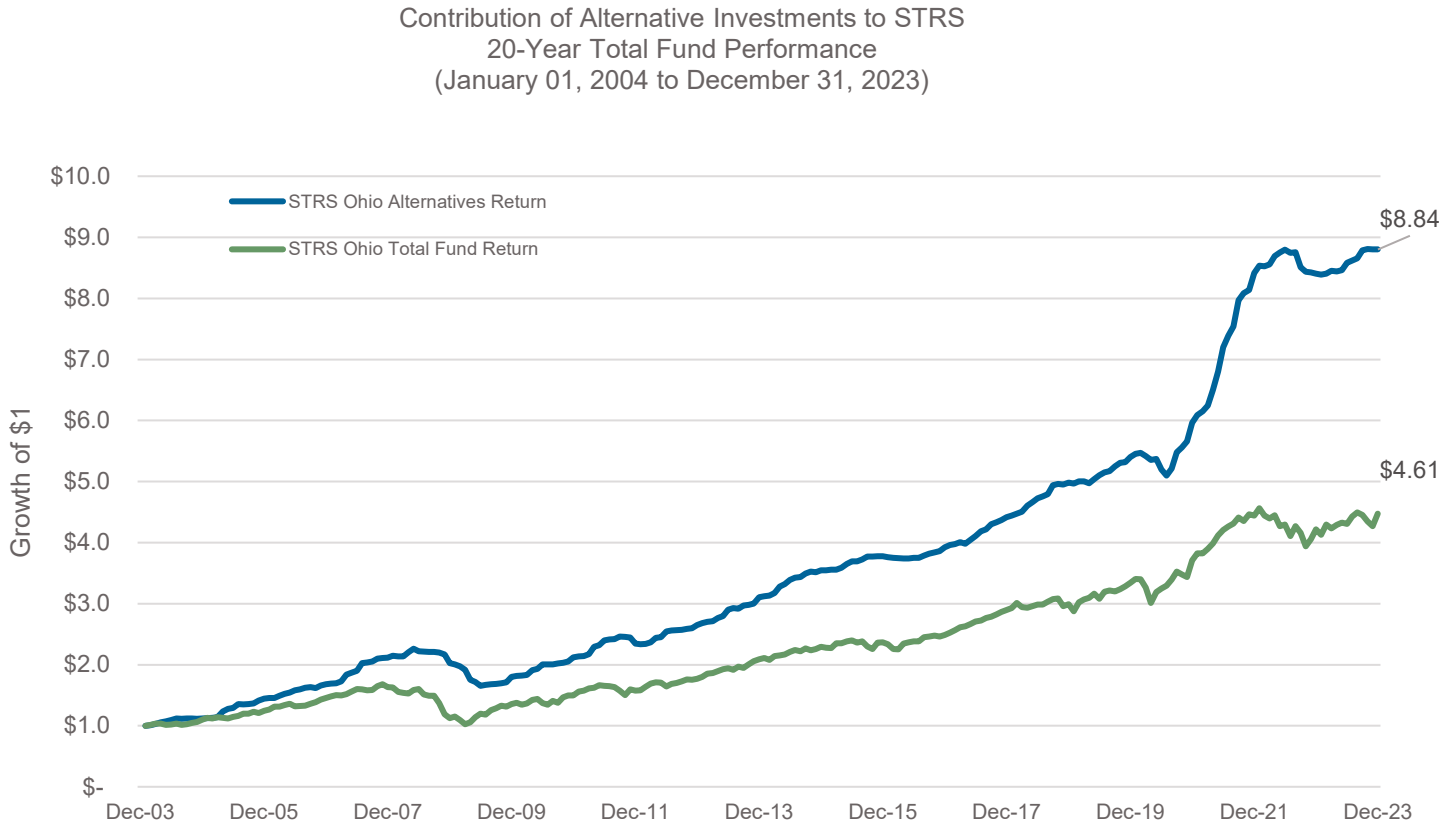
In $ millions

[1] Source is Hamilton Lane.

[2] STRS Ohio Alternative Investments returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.

STRS Ohio 20-Year Performance: Alternatives and STRS Ohio Total Fund

STRS Ohio Alternatives have enhanced Total Fund return and reduced Total Fund risk over the last 20 years



	STRS Ohio Total Fund Return [1]	STRS Ohio Alternatives Return [2]
Annualized Return	7.94%	11.51%
Annualized Risk	10.24%	8.21%
Sharpe Ratio	0.63	1.22

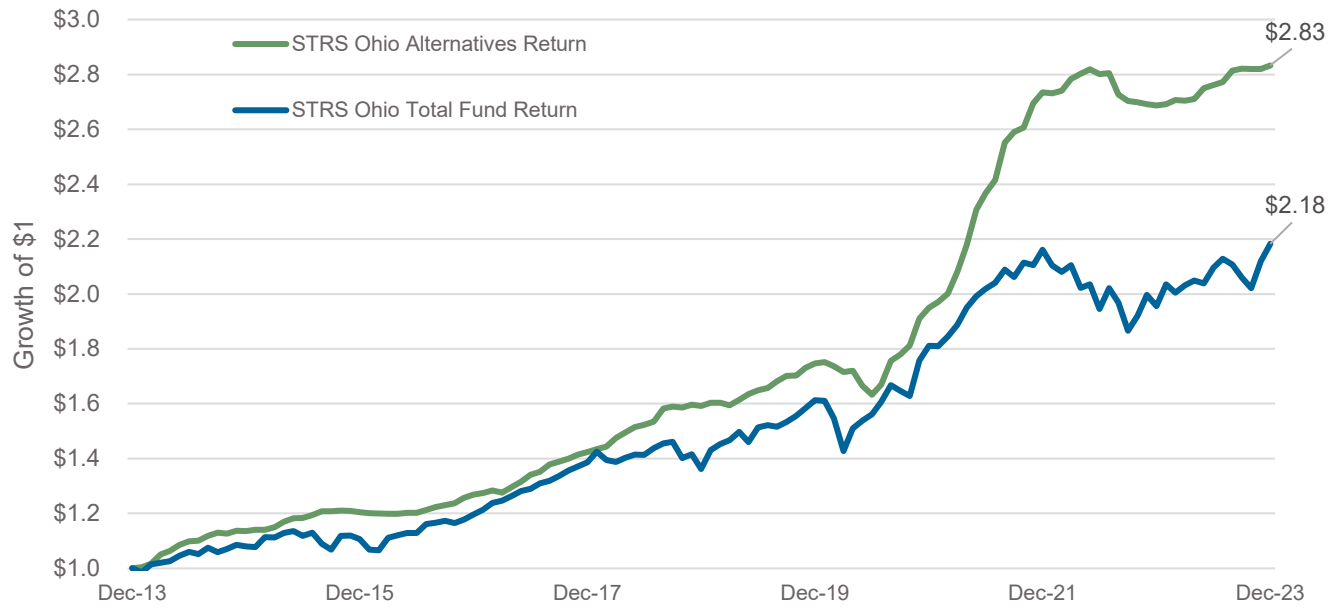
[1] The Total Fund return shown includes Alternative Investments & Real Estate where the return is also net of all external investment management fees and costs, including carried interest and other fund expenses.

[2] STRS Ohio Alternative Investments returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.

STRS Ohio 10-Year Performance: Alternatives and STRS Ohio Total Fund

As of December 31, 2023

STRS Ohio 10-Year Alternative Investment Performance – Time-Weighted Returns
(January 01, 2014 – December 31, 2023)



STRS Ohio Alternatives Performance
Annualized Returns ending December 31, 2023[1]

	STRS Ohio Alternatives	STRS Ohio Total Fund	Alternatives Blended Benchmark
Last 10 years	10.98%	8.12%	
Last 5 years	12.22%	9.89%	
Last 3 years	13.26%	6.43%	
Last 2.5 years	7.46%	3.18%	5.89%
Last 1 year	5.44%	11.64%	6.52%
Last Quarter	0.42%	5.98%	0.38%
Risk (10-Yr)	7.08%	8.73%	
Sharpe Ratio (10-Yr)	1.37	0.79	

- STRS Ohio Alternatives return exceeds STRS Ohio Total Fund return in all time periods except the last quarter and last one year.
- STRS Ohio Alternatives return trails the STRS Ohio Alternative Investment Blended Benchmark over the last year; however, exceeds the benchmark over the last quarter and two and one half year period since it has been adopted.

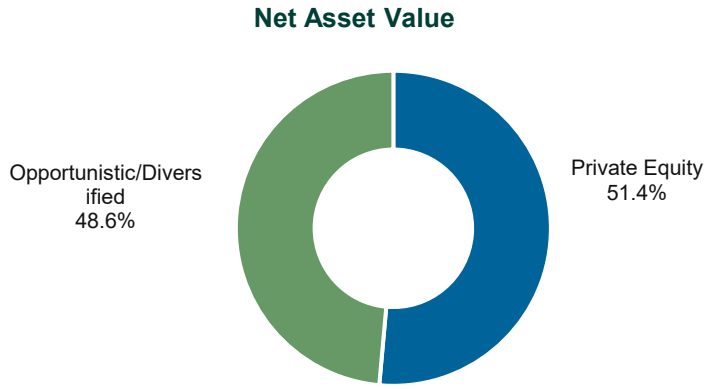
[1] STRS Ohio Alternatives Investments returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.

Private Equity

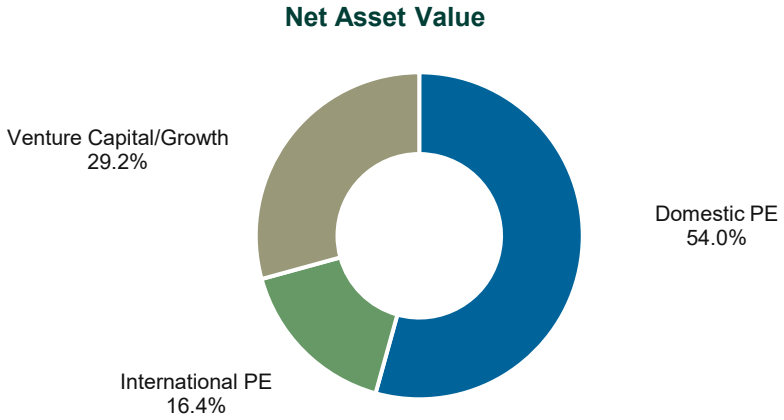
STRS Ohio Private Equity Investments

The following tables illustrate total current and potential exposure by Private Equity and Opportunistic/Diversified, as of December 31, 2023 in USD millions.

Alternatives Portfolio Composition



Private Equity Portfolio Composition



Portfolio Exposure by Strategy Type	Net Asset Value [1]	%	Unfunded Commitment [1]	%	Potential Exposure	%	5 Year TWR[2]	10 Year TWR[2]
Domestic Private Equity	$5,141	54.0%	$2,259	76.0%	$7,400	59.2%	17.22%	16.47%
International Private Equity	$1,557	16.4%	$448	15.1%	$2,005	16.1%	13.24%	14.15%
Venture Capital/Growth	$2,781	29.2%	$267	9.0%	$3,047	24.4%	14.60%	13.68%
Stock Distribution	$38	0.4%	-	-	$38	0.3%	-	-
Total Private Equity Program	**$9,516**	**100.0%**	**$2,974**	**100.0%**	**$12,490**	**100.0%**	**15.65%**	**15.23%**

In $ millions

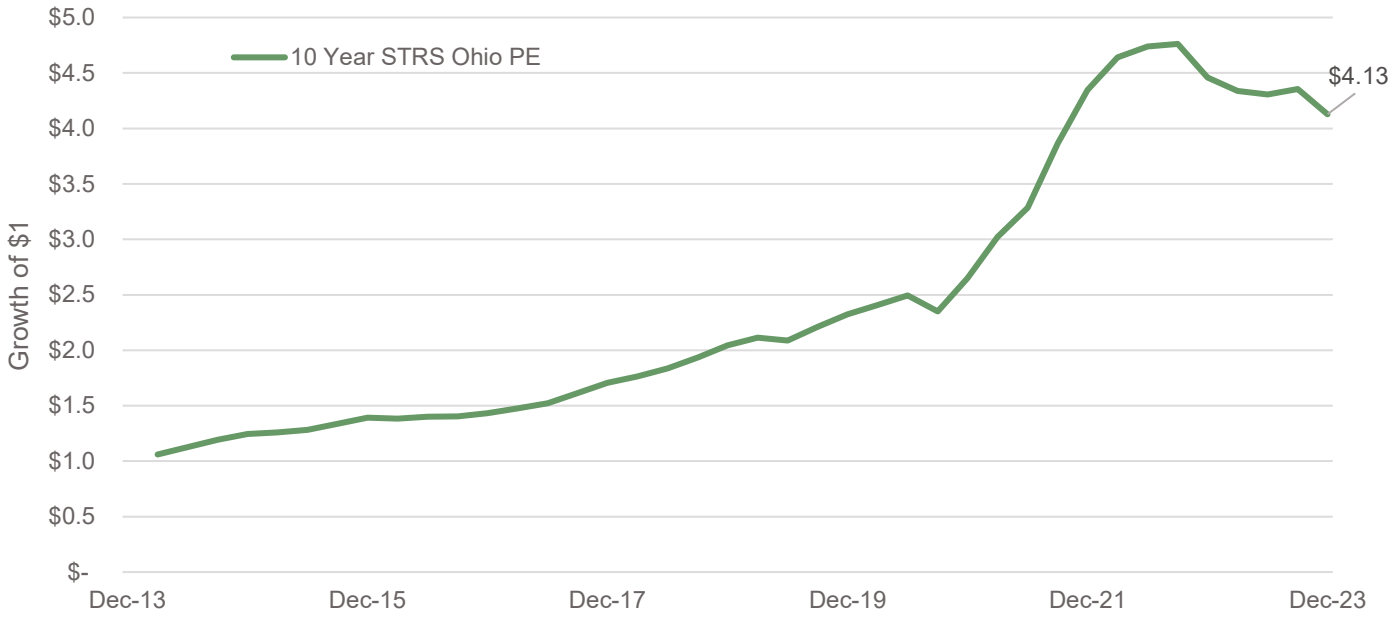
[1] Source is Hamilton Lane.

[2] STRS Ohio Private Equity returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.

STRS Ohio Private Equity Performance

As of December 31, 2023

10-Year Private Equity Performance: Time-Weighted Returns
(January 01, 2014 to December 31, 2023)



STRS Ohio Private Equity Performance
Annualized Returns ending December 31, 2023[1]

	STRS Ohio Private Equity	STRS Ohio Private Equity Benchmark
Last 10 years	15.23%	
Last 5 years	15.65%	
Last 3 years	13.09%	
Last 2.5 years	5.06%	5.95%
Last 1 year	0.77%	3.67%
Last Quarter	(1.23%)	(0.60%)
Risk (10-Yr)	9.66%	
Sharpe Ratio (10-Yr)	1.45	

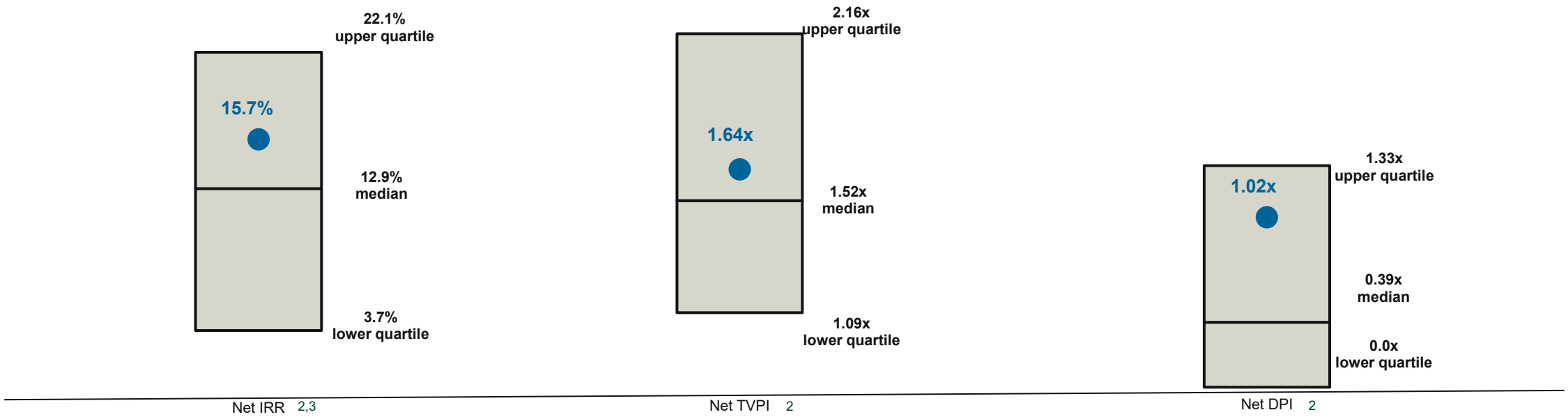
- STRS Ohio Private Equity returns trail the Private Equity Benchmark for the last two and a half years[2], last one year, and last quarter.

[1] STRS Ohio Private Equity returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.
[2] Reflects time period the new Private Equity benchmark has been in place.

STRS Ohio Private Equity 10-Year Relative Performance

10-year performance of the STRS Ohio PE Program ranks solidly in the second quartile in terms of net IRR, net TVPI, and net DPI

10-Year Private Equity Relative Performance [1]
(January 01, 2014 to December 31, 2023)

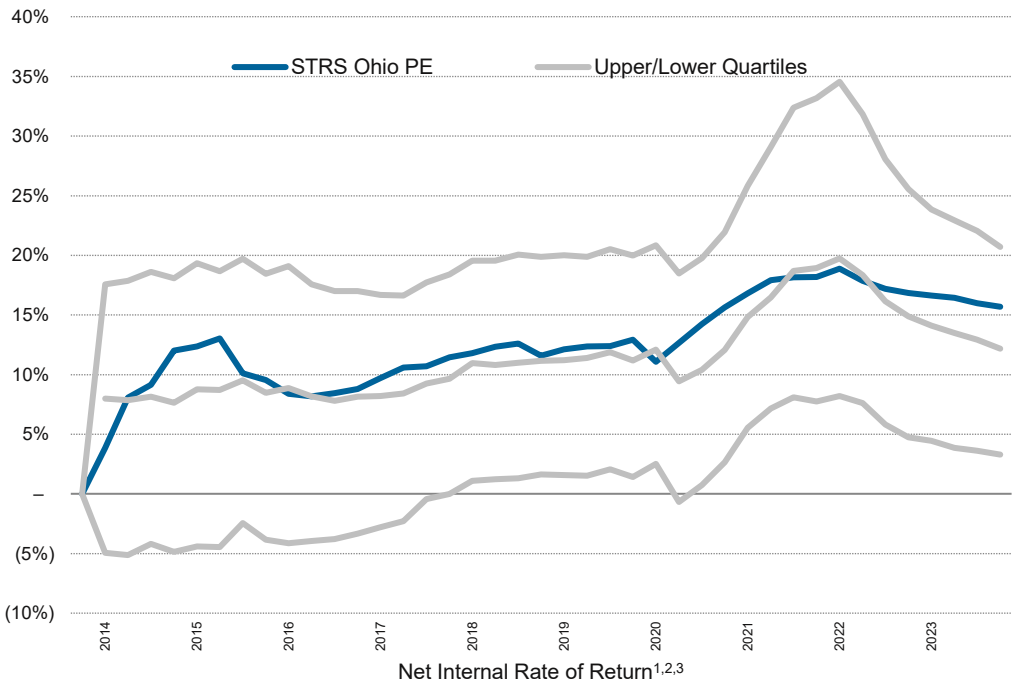


[1] Quartile Rankings against the Global Private Equity LSEG/Cambridge database.
[2] STRS Ohio Private Equity returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.
[3] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.

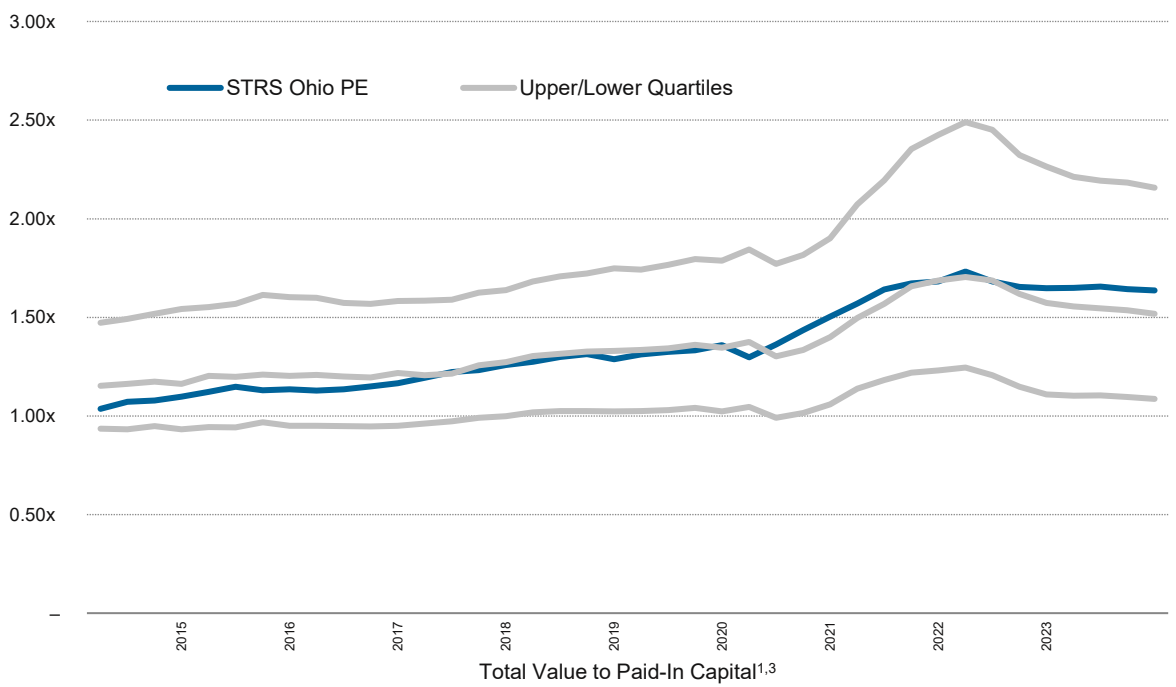
STRS Ohio Private Equity Investments 10-Year Performance Trends

Progression of the STRS Ohio Private Equity Program over the past 10 years has been positive, with the program consistently ranking in the second quartile across net IRR and net TVPI performance metrics

The following charts reflect the progression over time of various performance metrics of the fund relative to the respective top, median and lower quartiles of the LSEG/Cambridge private equity peer group.



Net Internal Rate of Return[1,2,3]



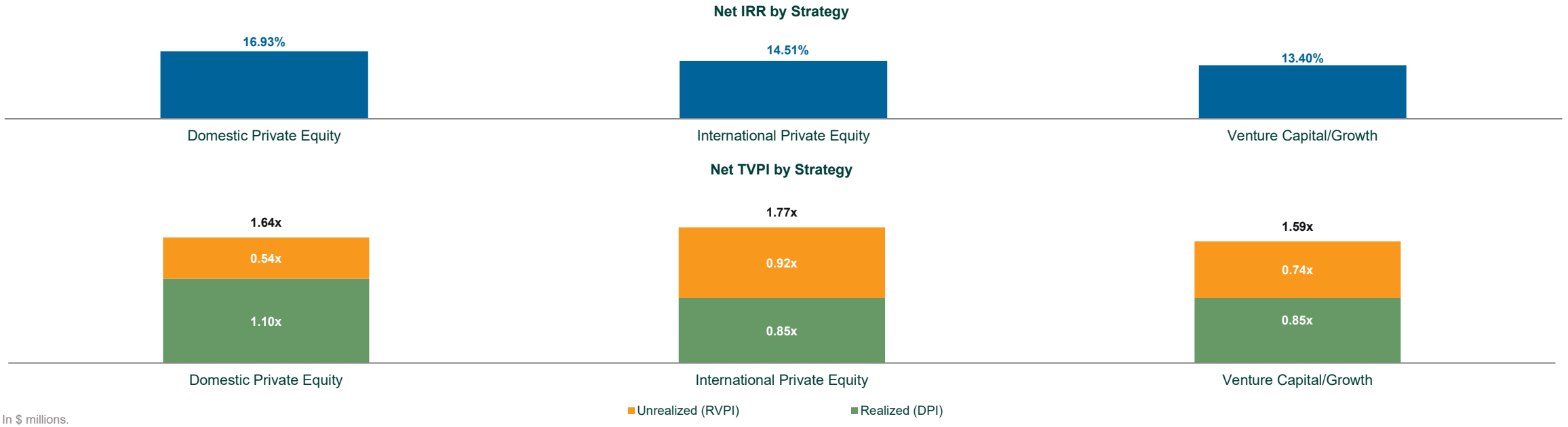
Total Value to Paid-In Capital[1,3]

Source: Hamilton Lane, LSEG/Cambridge.
[1] STRS Ohio Private Equity returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.
[2] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.
[3] Quartile Rankings against the Private Equity peer group includes Global Buyout, Growth Equity, and Venture Capital funds from the LSEG/Cambridge database.

STRS Ohio Private Equity 10-Year Performance by Portfolio

The following table reflects private equity performance by strategy type over a rolling 10-year period. Net IRR and TVPI quartile rankings are relative to a peer group from the LSEG/Cambridge database.

Portfolio Exposure by Strategy Type	Commitment[1]	Funded Amount[1]	Unfunded Commitment[1]	Distributions[1]	Net Asset Value[1]	10 Year TWR[2]	10 Year Net IRR[2,3]	TVPI[2]	DPI[2]	TVPI/IRR Quartile[4]	Performance Status
Domestic Private Equity	$12,064	$6,412	$2,259	$10,449	$5,141	16.47%	16.93%	1.64x	1.10x	3rd/2nd	●
International Private Equity	$2,581	$1,921	$448	$1,813	$1,557	14.15%	14.51%	1.77x	0.85x	3rd/2nd	●
Venture Capital/Growth	$3,803	$2,009	$267	$2,574	$2,781	13.68%	13.40%	1.59x	0.85x	2nd/2nd	●
Stock Distribution	-	-	-	-	$38	-	-	-	-	-	-
Total Private Equity	**$18,449**	**$10,342**	**$2,974**	**$14,836**	**$9,516**	**15.23%**	**15.69%**	**1.64x**	**1.02x**	**2nd/2nd**	●



In $ millions.

[1] Source is Hamilton Lane.

[2] STRS Ohio Private Equity returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.

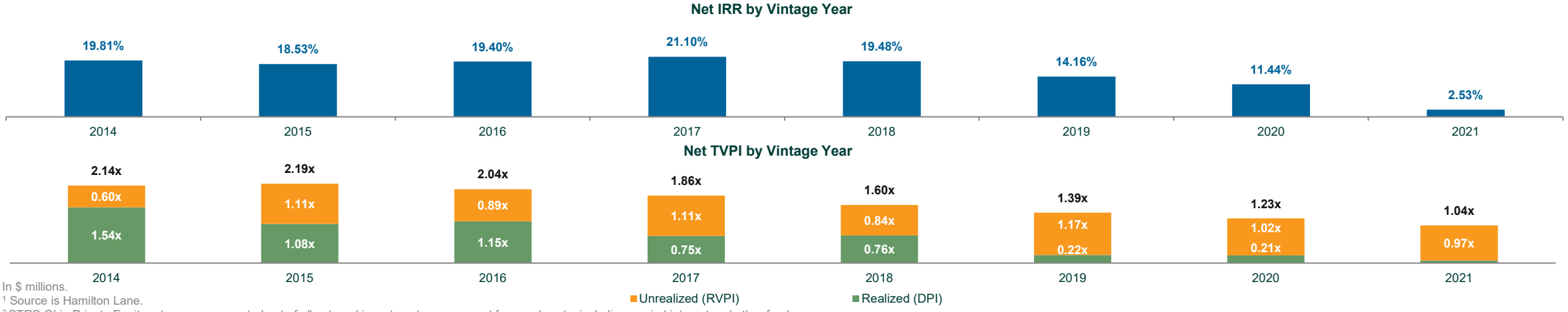
[3] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.

[4] Quartile Rankings against the Global Private Equity LSEG/Cambridge database.

STRS Ohio Private Equity Portfolio Summary Performance by Vintage Year

The following table reflects private equity vintage year performance over a 10-year period. Quartile ranks for vintage years less than five years old are labelled as not meaningful. Net IRR and TVPI quartile rankings are relative to a peer group from the LSEG/Cambridge database.

Portfolio Exposure by Vintage Year	Commitment[1]	Funded Amount[1]	Unfunded Commitment[1]	Distributions[1]	Net Asset Value[1]	DPI[2]	TVPI[2]	TVPI Quartile[2,3]	Net IRR[2,4]	IRR Quartile[3]	Performance Status
2014	$652	$824	$84	$1,269	$492	1.54x	2.14x	2nd	19.81%	2nd	●
2015	$855	$777	$69	$840	$862	1.08x	2.19x	2nd	18.53%	2nd	●
2016	$1,010	$1,050	$9692	$1,212	$926	1.15x	2.04x	2nd	19.40%	2nd	●
2017	$1,111	$1,481	$289	$1,104	$1,662	0.75x	1.86x	3rd	21.10%	2nd	●
2018	$2,062	$2,028	$166	$1,541	$1,698	0.76x	1.60x	3rd	19.48%	2nd	●
2019	$1,760	$1,388	$257	$309	$1,632	0.22x	1.39x	3rd	14.16%	3rd	●
2020	$685	$290	$70	$61	$298	0.21x	1.23x	2nd	11.44%	2nd	●
2021	$630	$591	$253	$41	$577	0.07x	1.04x	NM	2.53%	NM	-
2022	$890	$145	$745	$0	$146	0.00x	0.98x	NM	NM	NM	-
2023	$591	$14	$577	$0	$13	0.01x	0.68x	NM	NM	NM	-



In $ millions.

[1] Source is Hamilton Lane.

[2] STRS Ohio Private Equity returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.

[3] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.

[4] Quartile Rankings against the Global Private Equity LSEG/Cambridge database.

STRS Ohio Private Equity 10-Year Performance by General Partner

The following table reflects aggregate 10-year performance of the top ten STRS Ohio GP relationships by NAV. Net IRR and TVPI quartile rankings are relative to a peer group from the LSEG/Cambridge database. Organization status is reflective of Callan's opinion of stability and health of each investment manager.

Portfolio Exposure by General Partner	Organization Status	Performance Status	Commitments[1]	Funded Amount[1]	Uncalled[1]	Distributed[1]	NAV[1]	Net IRR[2,3]	Net TVPI[2]	IRR/TVPI Quartiles[4]
Thoma Bravo	🟢	🟢	$1,085	$1,236	$245	$1,463	$999	24.10%	1.94x	1st / 2nd
Bain Capital/Ventures	🟢	🟢	$1,366	$599	$39	$1,351	$581	14.89%	1.68x	3rd / 2nd
GCM Grosvenor	🟢	🟢	$875	$658	$147	$1,399	$524	39.85%	2.54x	1st / 1st
Tiger Iron Capital *	🟢	🟡	$450	$352	$100	$10	$520	12.23%	1.51x	3rd / 3rd
TA Associates	🟢	🟢	$502	$397	$108	$339	$442	29.10%	1.86x	1st / 1st
Francisco Partners	🟢	🟢	$690	$341	$199	$695	$422	23.93%	2.40x	2nd / 1st
Commonfund	🟡	🟢	$245	$186	$7	$365	$416	20.97%	3.08x	2nd / 2nd
General Catalyst	🟢	🟢	$272	$230	$20	$144	$412	20.73%	2.20x	1st / 1st
Silver Lake Partners	🟢	🟢	$468	$387	$39	$407	$388	18.12%	1.73x	2nd / 2nd
Hermes GPE *	🟢	🟡	$450	$488	$45	$428	$336	15.20%	1.56x	3rd / 3rd

Stoplight Review Legend

- 🟢 Above median performance or less than three years old; no organizational concerns
- 🟡 Two performance metrics third quartile; organizational issues to monitor
- 🔴 At least one performance metric in the fourth quartile; significant organizational issues
- – No observations or updates to report

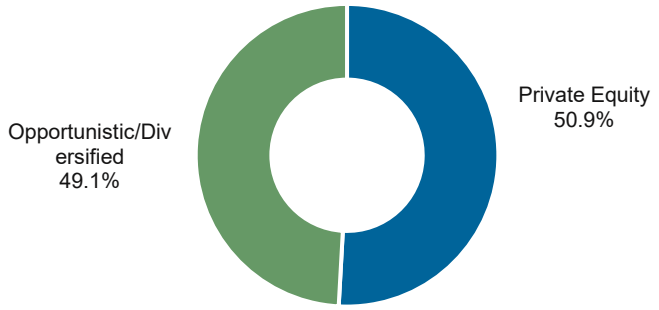
In $ millions.
Refer to the Peer Group Definitions slide in the Appendix for individual benchmarks used.
* Less than 10 years of history. Net IRR and TVPI represent since inception returns from STRS Ohio first commitment to the GP.
[1] Source is Hamilton Lane.
[2] STRS Ohio Private Equity returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.
[3] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.
[4] Quartile Rankings against the Global Private Equity LSEG/Cambridge database.

Opportunistic/Diversified

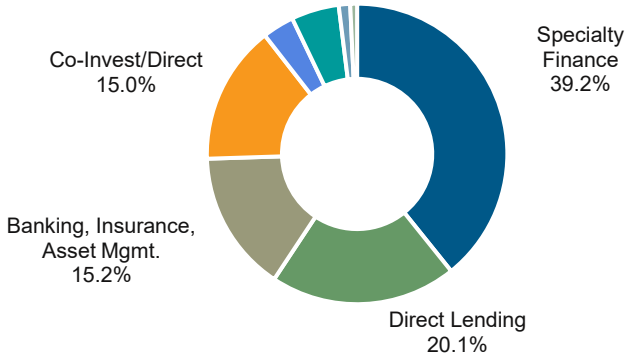
STRS Ohio Opportunistic/Diversified Investments

The following tables illustrate total current and potential exposure by Private Equity and Opportunistic/Diversified, as of December 31, 2023 in USD millions.

Alternatives Portfolio Composition
Net Asset Value



O/D Portfolio Composition
Net Asset Value



	Portfolio Exposure by Strategy Type	Net Asset Value[1]	%	Unfunded Commitment[1]	%	Potential Exposure	%	5 Year TWR[2]	10 Year TWR[2]
Opportunistic	Specialty Finance	$3,603	39.2%	$2,071	51.8%	$5,674	43.0%	7.99%	9.91%
	Direct Lending	$1,845	20.1%	$824	20.6%	$2,668	20.2%	-	-
	Banking, Insurance, & Asset Mgmt.	$1,395	15.2%	$476	11.9%	$1,871	14.2%	16.23%	15.21%
	Co-Invest/Direct	$1,377	15.0%	$497	12.4%	$1,874	14.2%	14.69%	-
	Natural Resources	$314	3.4%	$52	1.3%	$366	2.8%	0.70%	(1.95%)
	Infrastructure	$68	0.7%	$71	1.8%	$139	1.1%	4.50%	4.88%
	Public-Private Investment Funds	$0.4	0.0%	$3	0.1%	$4	0.0%	0.40%	5.60%
Diversified	Liquid Alternatives	$472	5.1%	-	-	$472	3.6%	7.08%	-
	Hedge Funds	$113	1.2%	-	-	$113	0.9%	1.5%	1.98%
	Total Opportunistic/Diversified	**$9,187**	**100.0%**	**$3,994**	**100.0%**	**$13,180**	**100.0%**	**8.37%**	**6.61%**

In $ millions.
[1] Source is Hamilton Lane.
[2] STRS Ohio Private Equity returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.

STRS Ohio 10-Year Opportunistic/Diversified Performance

STRS Ohio O/D Performance
Annualized Returns ending December 31, 2023

	STRS Ohio O/D	STRS Ohio O/D Benchmark
Last 10 years	6.61%	
Last 5 years	8.37%	
Last 3 years	12.76%	
Last 2.5 years	9.99%	6.29%
Last 1 year	10.88%	9.13%
Last Quarter	2.19%	1.26%
Risk (10-Yr)	5.26%	
Sharpe Ratio (10-Yr)	1.02	

- STRS Ohio O/D returns exceed the O/D Benchmark over the last two and a half years [2], last one year, and last quarter.

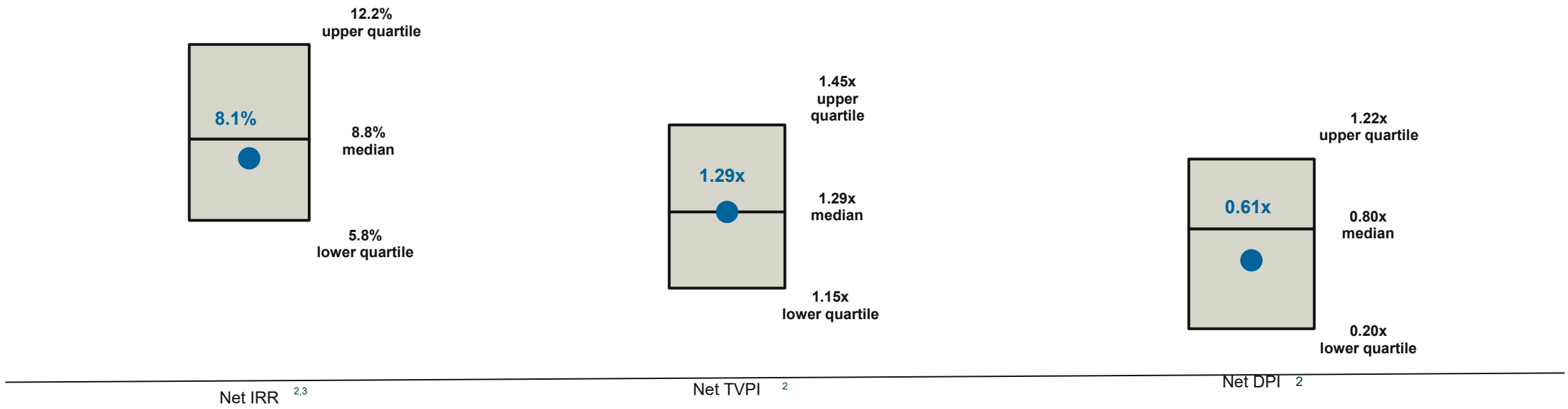
[1] STRS Ohio Opportunistic/Diversified returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.
[2] Reflects time period the new Opportunistic/Diversified benchmark has been in place.

Opportunistic

STRS Ohio Opportunistic 10-Year Relative Performance

The STRS Ohio Opportunistic Portfolio ranks near the median across all performance metrics

10-Year Opportunistic Relative Performance[1]
(January 01, 2014 to December 31, 2023)

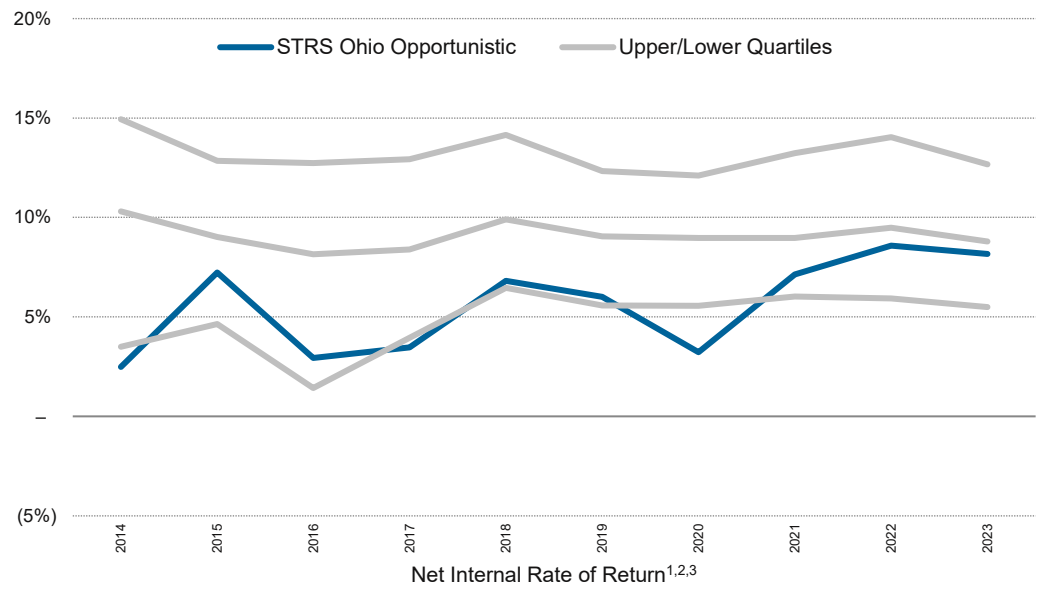


- The Opportunistic portfolio has generated 3rd quartile performance in terms of net IRR and DPI. The portfolio ranks at the median in terms of net TVPI.
- The lower net DPI is due to the increasing allocation to the Opportunistic/Diversified strategy during the 10-year period.

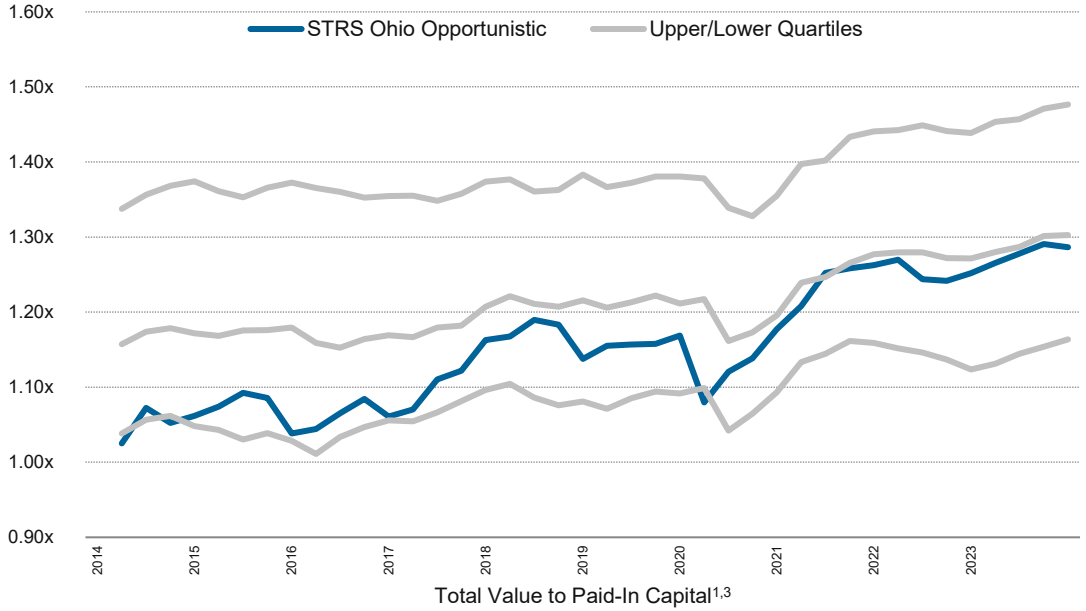
Source: Hamilton Lane, LSEG/Cambridge.
[1] Quartile Rankings against the Global Private Credit LSEG/Cambridge database.
[2] STRS Ohio Opportunistic returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.
[3] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.

STRS Ohio Opportunistic Investments 10-Year Performance Trends

The following charts reflect the progression over time of various performance metrics of the fund relative to the respective top, median and lower quartiles of the LSEG/Cambridge private credit peer group.



Net Internal Rate of Return[1,2,3]



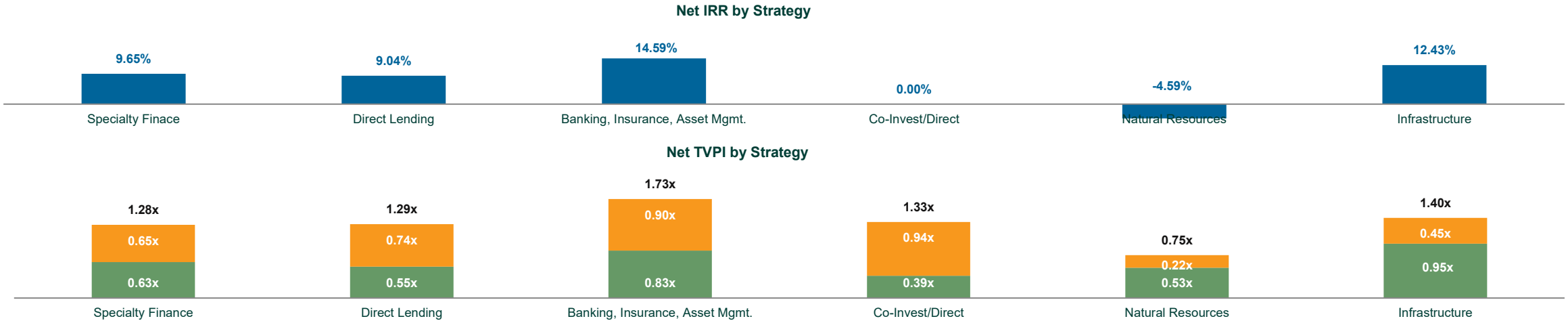
Total Value to Paid-In Capital[1,3]

Source: Hamilton Lane, LSEG/Cambridge.
[1] STRS Ohio Opportunistic returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.
[2] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.
[3] Quartile Rankings against the Private Credit peer group includes Senior Debt, Credit Opportunities, and Subordinated Debt funds from the LSEG/Cambridge database.

STRS Ohio Opportunistic 10-Year Performance by Portfolio

The following table reflects Opportunistic performance by strategy type since inception. Net IRR and TVPI quartile rankings are relative to a peer group from the LSEG/Cambridge database.

Portfolio Exposure by Strategy Type	Commitments[1]	Funded Amount[1]	Unfunded Commitment[1]	Distributions[1]	Net Asset Value[1]	10 Year TWR[2]	10 Year Net IRR[2,3]	TVPI[2]	DPI[2]	TVPI/IRR Quartile[4]	Performance Status
Specialty Finance	$6,285	$4,831	$2,071	$3,519	$3,603	9.91%	9.65%	1.28x	0.63x	2nd/2nd	●
Direct Lending *	$2,984	$2,481	$824	$1,396	$1,845	-	9.04%	1.29x	0.55x	2nd/2nd	●
Banking and Insurance	$1,424	$1,298	$476	$1,274	$1,395	15.21%	14.59%	1.73x	0.83x	1st/1st	●
Co-Invest/Direct *	$1,629	$1,455	$497	$564	$1,377	-	14.95%	1.33x	0.39x	1st/1st	●
Natural Resources	$1,039	$627	$52	$722	$314	(1.95%)	(4.59%)	0.75x	0.53x	4th/4th	●
Infrastructure	$325	$93	$71	$140	$68	4.88%	12.43%	1.40x	0.95x	1st/2nd	●
Public-Private Funds	$188	$9	$3	$66	$0.4	5.60%	15.27%	1.37x	1.37x	-	-
Total Opportunistic	**$13,899**	**$10,793**	**$3,994**	**$7,681**	**$8,601**	**8.16%**	**8.05%**	**1.29x**	**0.61x**	**2nd/3rd**	●



* Less than 10 years of history. Net IRR, Net TVPI, and TWR represent since inception returns from STRS Ohio's first commitment to the portfolio strategy.

[1] Source is Hamilton Lane.

[2] STRS Ohio Opportunistic returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.

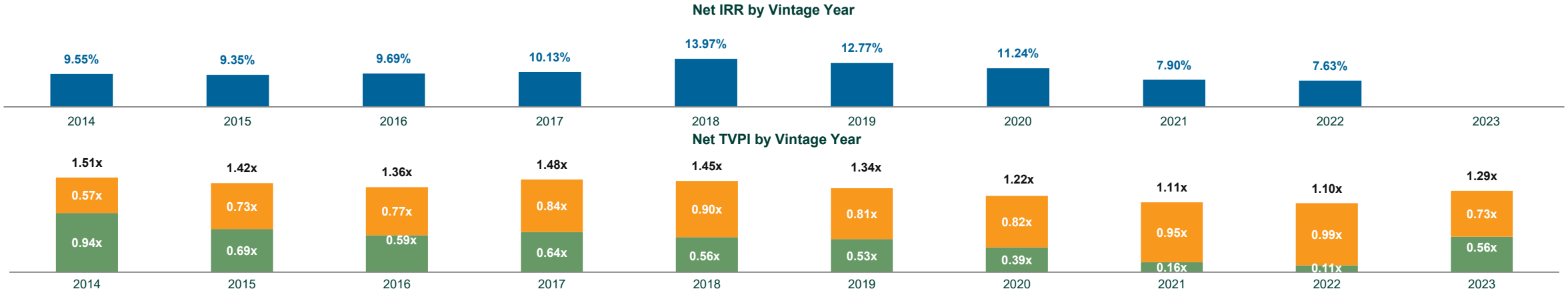
[3] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.

[4] Quartile Rankings against the Private Credit peer group includes Senior Debt, Credit Opportunities, and Subordinated Debt funds from the LSEG/Cambridge database.

STRS Ohio Opportunistic Performance by Vintage Year

The following table reflects Opportunistic vintage year performance over a rolling 10-year period. Only mature vintages, defined as four years and up, are shown. Net IRR and TVPI quartile rankings are relative to a peer group from the LSEG/Cambridge database.

Portfolio Exposure by Vintage Year	Commitment[1]	Funded Amount[1]	Unfunded Commitment[1]	Distributions[1]	Net Asset Value[1]	DPI[2]	TVPI[2]	TVPI Quartile[3]	Net IRR[2,4]	IRR Quartile[3]	Stoplight Status
2014	$1,057	$1,306	$134	$1,233	$741	0.94x	1.51x	1st	9.55%	1st	●
2015	$1,143	$1,625	$320	$1,116	$1,196	0.69x	1.42x	2nd	9.35%	2nd	●
2016	$202	$234	$48	$138	$179	0.59x	1.36x	3rd	9.69%	2nd	●
2017	$746	$472	$39	$301	$396	0.64x	1.48x	2nd	10.13%	2nd	●
2018	$1,473	$1,410	$404	$784	$1,267	0.56x	1.45x	1st	13.97%	1st	●
2019	$1,464	$1,695	$597	$890	$1,394	0.53x	1.34x	2nd	12.77%	1st	●
2020	$1,186	$955	$355	$376	$786	0.39x	1.22x	NM	11.24%	NM	-
2021	$2,425	$1,633	$973	$259	$1,561	0.16x	1.11x	NM	7.90%	NM	-
2022	$1,486	$796	$581	$87	$788	0.11x	1.10x	NM	7.63%	NM	-
2023	$403	$191	$425	$108	$139	0.56x	1.29x	NM	NM	NM	-



[1] Source is Hamilton Lane.
[2] STRS Ohio Opportunistic returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.
[3] Quartile Rankings against the Private Credit peer group includes Senior Debt, Credit Opportunities, and Subordinated Debt funds from the LSEG/Cambridge database.
[4] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.

STRS Ohio Opportunistic 10-Year Performance by General Partner

The following table reflects aggregate 10-year performance of the top 10 STRS Ohio Opportunistic GP relationships by NAV. Net IRR and TVPI quartile rankings are relative to a peer group from the LSEG/Cambridge database. Organization status is reflective of Callan's opinion of stability and health of each investment manager.

Portfolio Exposure by General Partner	Organization Status	Performance Status	Commitments[1]	Funded Amount[1]	Uncalled[1]	Distributed[1]	NAV[1]	Net IRR[2,3]	Net TVPI[2]	IRR/TVPI Quartiles[4]
Sixth Street Partners	●	●	$1,794	$1,452	$617	$1,206	$957	10.74%	1.38x	2nd/2nd
Blue Owl Capital *	●	●	$778	$683	$325	$441	$780	16.54%	1.79x	1st/1st
Ares Management Corporation	●	●	$1,316	$799	$325	$783	$669	12.07%	1.39x	2nd/1st
Reverence Capital Partners *	●	●	$599	$534	$204	$499	$638	24.50%	2.05x	1st/1st
Oaktree Capital Management	●	●	$549	$463	$127	$290	$383	8.79%	1.35x	2nd/2nd
TPG Angelo Gordon	●	●	$381	$396	$27	$133	$327	8.86%	1.15x	3rd/3rd
Fortress Investment Group LLC *	●	●	$518	$435	$226	$258	$276	12.24%	1.23x	2nd/2nd
Golub Capital *	●	●	$327	$389	$1	$314	$270	7.82%	1.50x	3rd/1st
Stone Point Capital *	●	●	$300	$224	$84	$25	$249	11.25%	1.23x	2nd/2nd
Cerberus Capital *	●	●	$350	$219	$158	$58	$235	12.89%	1.34x	2nd/2nd

Stoplight Review Legend

●	Above median performance or less than three years old; no organizational concerns
●	Two performance metrics third quartile; organizational issues to monitor
●	At least one performance metric in the fourth quartile; significant organizational issues
–	No observations or updates to report

*Less than 10 years of history. Net IRR and TVPI represent since inception returns from STRS Ohio's first commitment to the GP.

[1] Source is Hamilton Lane.

[2] STRS Ohio Opportunistic returns are presented net of all external investment management fees and costs, including carried interest and other fund expenses.

[3] IRRs are calculated by HL using the XIRR method and have not been calculated by the GPs.

[4] Quartile Rankings against the Private Credit peer group includes Senior Debt, Credit Opportunities, and Subordinated Debt funds from the LSEG/Cambridge database.

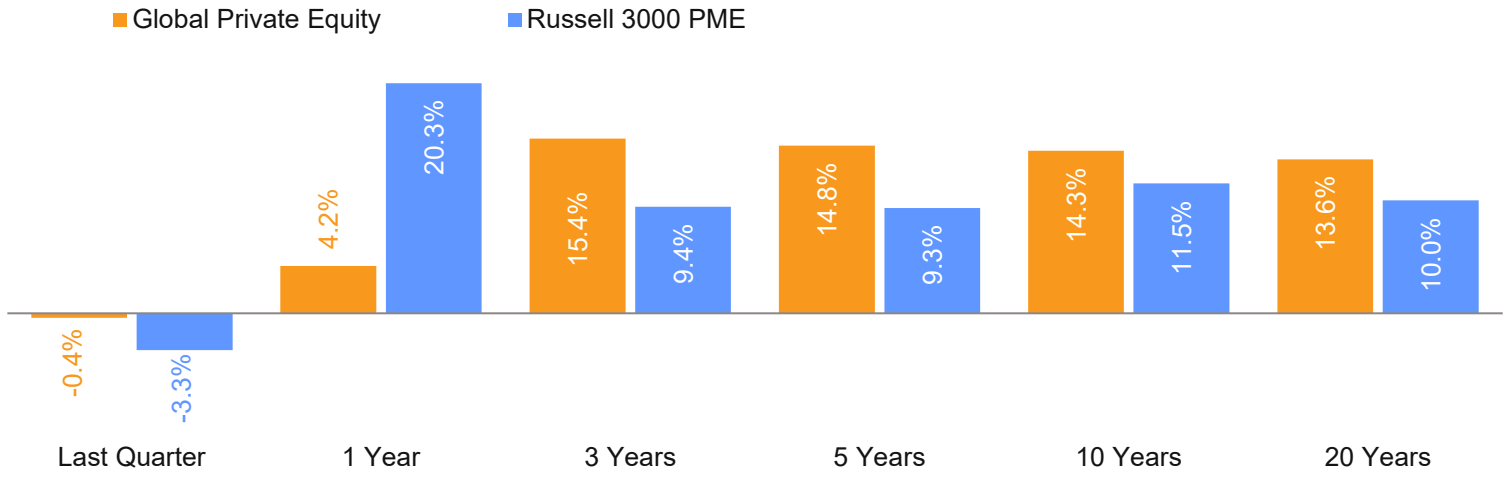
Private Equity Market Overview

Private Equity Trends

Performance

- Public equity's strong recovery in 2023 (led by the "Magnificent 7" technology stocks) has left private equity in its wake.
- Private equity doesn't recover as quickly as the public markets, because the smoothing effect dampens private equity returns in both up and down markets.
- Private equity only saw about a fifth of the gains of the public markets over the last year, on a PME basis.
- While buyouts saw solid performance for the year, venture capital and growth equity continued to struggle. These strategies have seen the largest valuation adjustments from the highs of 2021.

Net IRRs as of 09/30/2023



Net IRRs by Strategy as of 09/30/2023

Strategy	Last Quarter	1 Year	3 Years	5 Years	10 Years	20 years
Venture Capital	-2.4%	-8.9%	14.8%	17.2%	17.2%	12.5%
Growth Equity	-0.6%	0.8%	12.3%	14.8%	14.3%	13.8%
Buyouts	0.1%	10.2%	16.8%	15.0%	14.6%	14.6%
Mezzanine	1.8%	13.0%	13.5%	11.0%	11.1%	11.1%
Credit Opportunities	1.2%	8.2%	11.1%	7.1%	7.5%	9.3%
Control-Oriented Distressed	0.4%	5.6%	19.4%	13.6%	11.7%	11.6%
Total Private Equity	**-0.4%**	**4.2%**	**15.4%**	**14.8%**	**14.3%**	**13.6%**

Source: Refinitiv/Cambridge. PME: Public Market Equivalent.

Private Equity Trends

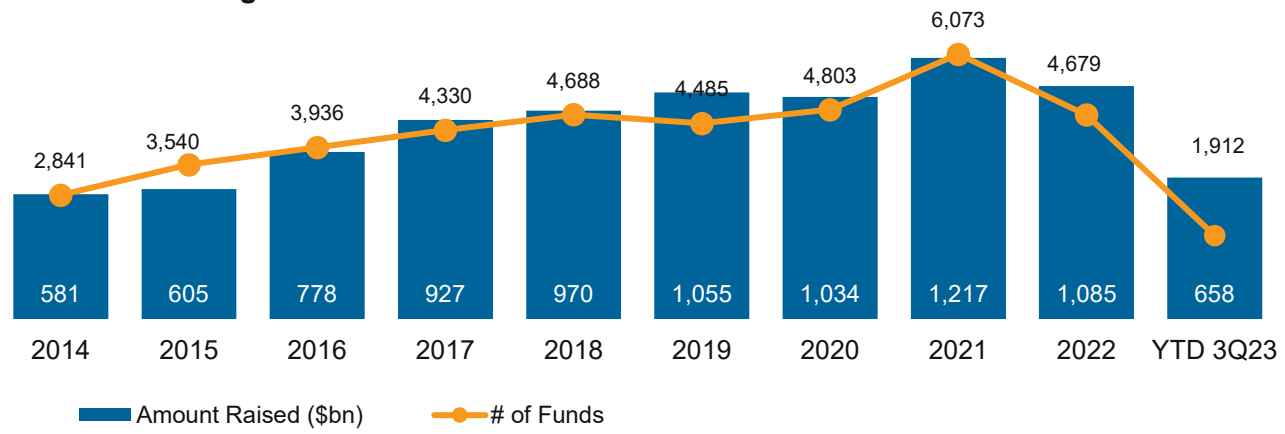
Fundraising

- Fundraising declined back closer to historical levels in 2022 after its frenzied peak in 2021.
- So far, 2023 has been another down year, with LPs being more selective with their commitments.
- With significantly fewer funds closing this year and constrained LP commitment budgets, many GPs are reluctant to come back to market in the near term.

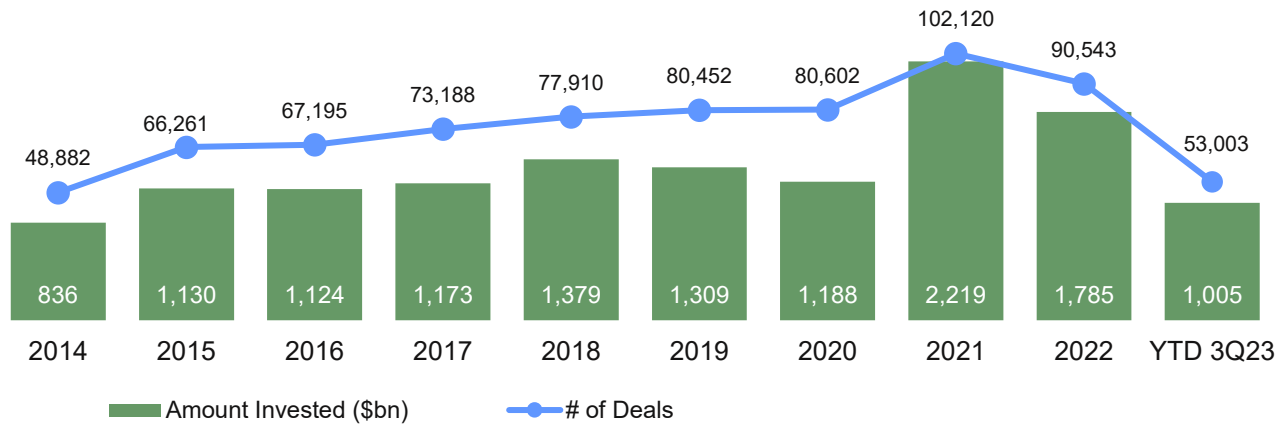
Deal Activity

- Both new investment activity and exit activity slowed markedly in 2023, following rising interest rates, declines in the public markets, and continued price uncertainty.

Annual Fundraising



Annual Deal Activity



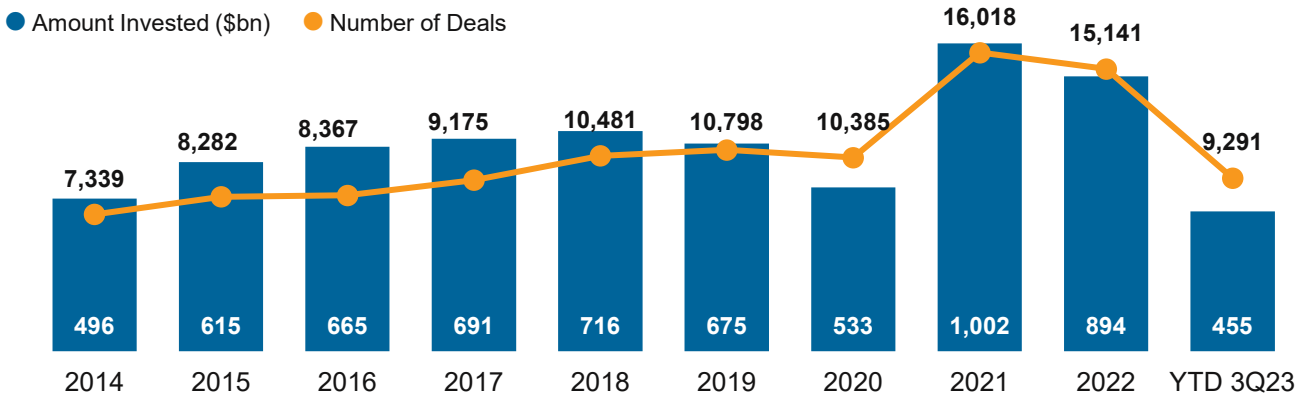
Source: PitchBook.

Private Equity Trends

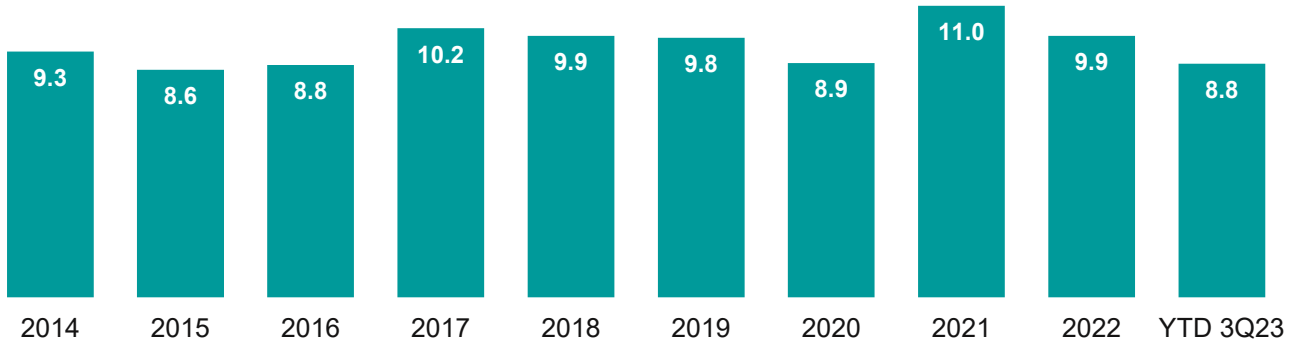
Buyout

- Significant decline in deal activity this year after the highs of 2021-2022, caused by high interest rates, a wide bid-ask spread, and lingering effects from the slowdown in the public markets
- Greater difficulty in obtaining financing this year, particularly for mega buyout deals, which has brought down leverage ratios across the industry
- In terms activity by deal type, smaller deals and add-on acquisitions have been more active as these are easier to finance. Conversely, the take-private boom of 2022 has largely receded following the public markets' strong recovery in 2023.
- Buyout valuations are finally starting to normalize in 2023 after their peak in 2021
- Buyout valuations are sensitive to changes in interest rates - as the cost of borrowing rises, it is harder to justify high valuations
- Given higher interest rates, there is a greater reliance on profitability, as opposed to multiple expansion, to drive returns

Buyouts Investments



Buyout Valuations (EV/EBITDA Multiples)



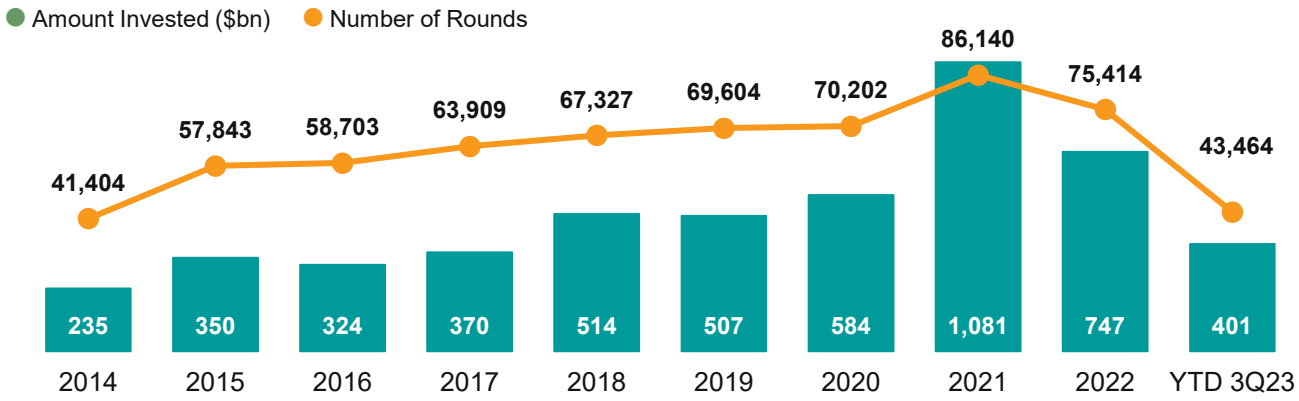
Source: PitchBook.

Private Equity Trends

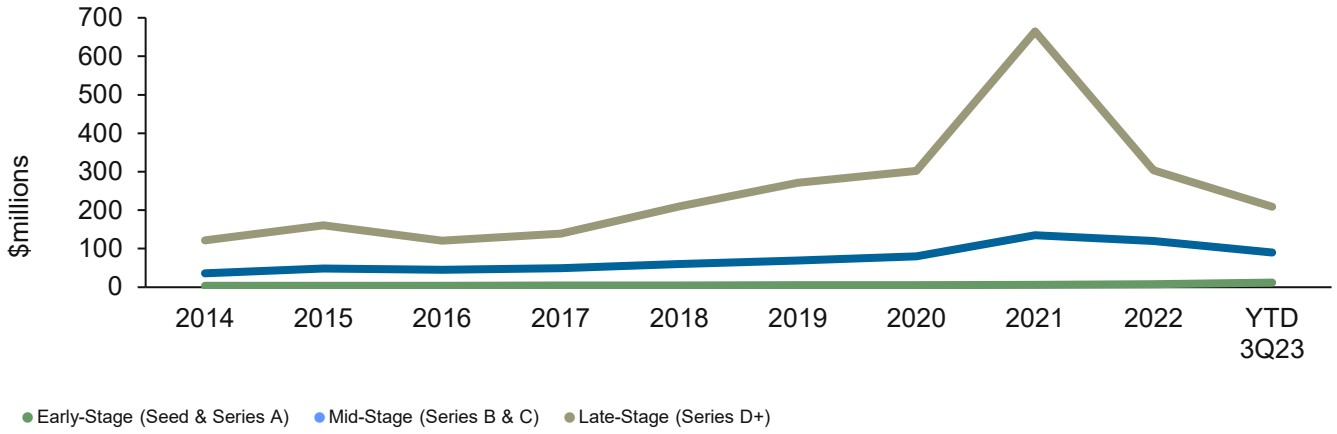
Venture Capital & Growth Equity

- Substantial decline in venture capital and growth equity activity in 2023, following the crazed highs of 2021 and early 2022
- Valuations, likewise, have reverted back to historical levels, particularly at the late stage
- There is a bifurcation by stage within the venture capital industry. A revolution in AI is accelerating early-stage deal flow and buoying their valuations, while late-stage companies struggle with slower growth, falling valuations and the lack of exit prospects
- The valuation re-sets at the late-stage have weeded out weaker companies, which is actually an important dynamic in maintaining a healthy venture capital cycle
- Although high interest rates impact the amount of capital focused on venture, interest rates have minimal impact on the underlying innovation cycle

Venture Capital & Growth Equity Investments



Venture Capital & Growth Equity Median Valuations

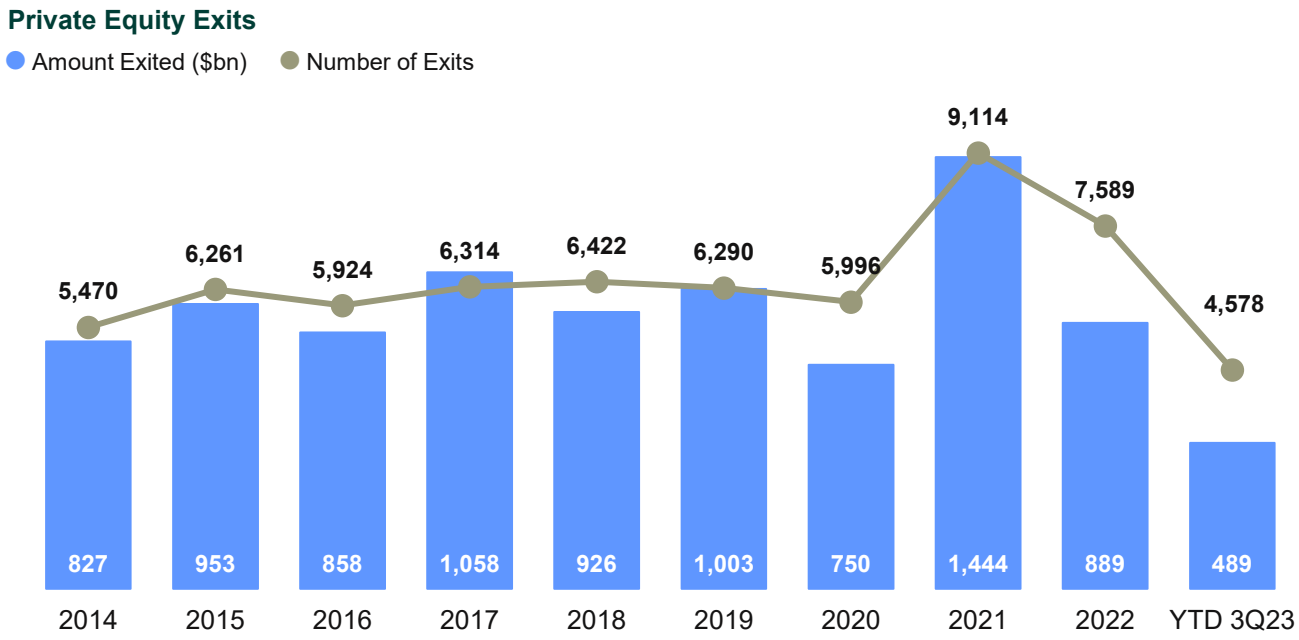


Source: PitchBook.

Private Equity Trends

Exits

- Exits have declined dramatically after hitting all-time records in 2021
- Only 8% of total private equity AUM generated liquidity in 2023 (the lowest level ever) - lower even than the depths of the Global Financial Crisis
- With the IPO window still closed, it is unclear whether exit activity will rebound in 2024. IPO exits in 2023 were at just 15% of pre-pandemic levels.
- While there is a long line of venture-backed companies waiting to go public, election years have historically seen lower levels of IPO and exit activity. And antitrust sentiment is prompting caution within the M&A markets.
- The advantage of private equity is managers don't have to be forced sellers, however waiting too long to sell can impact holding periods and ultimately hurt the IRRs of certain vintage years



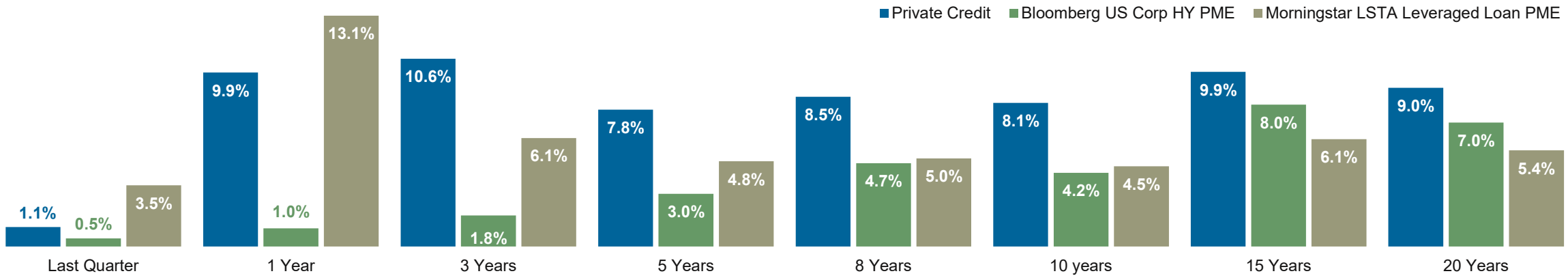
Source: PitchBook.

Private Credit Market Overview

Private Credit Market Overview

Performance over time and compared to relevant indices

Pooled Horizon Net IRRs as of September 30, 2023



Pooled Horizon Net IRRs by Strategy as of September 30, 2023

Strategy	Last Quarter	1 Year	3 Years	5 Years	8 Years	10 Years	15 Years	20 Years
Senior Debt	0.1	11.4	6.5	5.9	6.8	6.6	6.9	6.8
Subordinated Credit	1.8	13.0	13.5	11.0	11.3	11.1	10.9	10.6
Credit Opportunities	1.2	8.2	11.1	7.1	7.9	7.5	10.1	8.9
Total Private Credit	**1.1**	**9.9**	**10.6**	**7.8**	**8.5**	**8.1**	**9.9**	**9.0**

- Private credit performance varies across sub-asset class and underlying return drivers. Over the past three years, the asset class has generated a net IRR of 10.6%, outperforming leveraged loans as of September 30, 2023. Higher-risk strategies have performed better than lower-risk strategies.

Source: LSEG/Cambridge; index definitions provided in the Appendix.

3Q 2023 Private Credit Fundraising Landscape

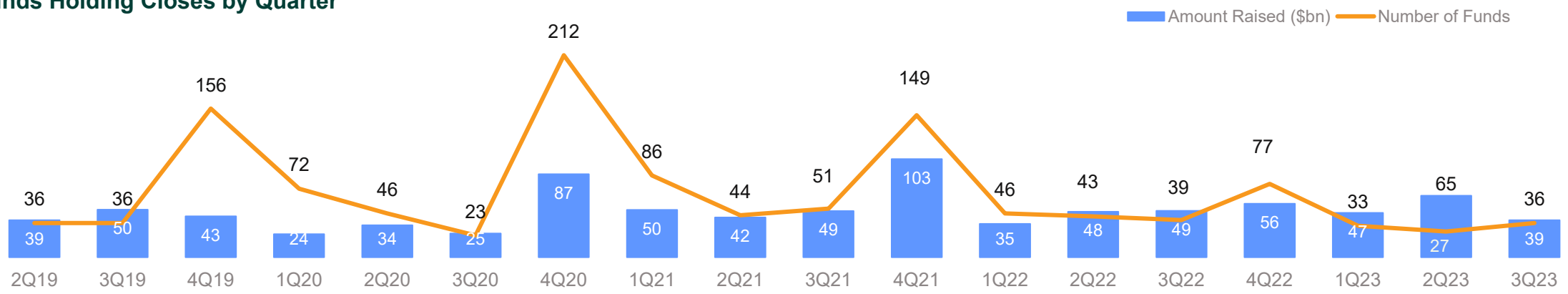
Activity remains strong through 3Q23

- Private credit fundraising was robust leading into the Covid dislocation with a particular focus on direct lending, asset-based lending and distressed strategies.
- In the current rising rate environment, a renewed focus has been placed on relative value, downside protection and managers' internal workout resources.
- Renewed interest in strategies with strong collateral protection such as asset-based lending as well as capital solutions and distressed strategies.
- Larger sponsor-backed lending seeing a new focus due to the high yield/BSL disintermediation by private debt.

Largest Funds Holding Closes in 3Q23

Name	Amount ($millions)	Strategy
HPS Strategic Investment Partners V	$17,000	Mezzanine Debt
GS Mezzanine Partners VIII	$11,700	Mezzanine Debt
HPS Core Senior Lending Fund II	$10,000	Direct Lending
Crescent Credit Solutions VIII	$8,000	Mezzanine Debt

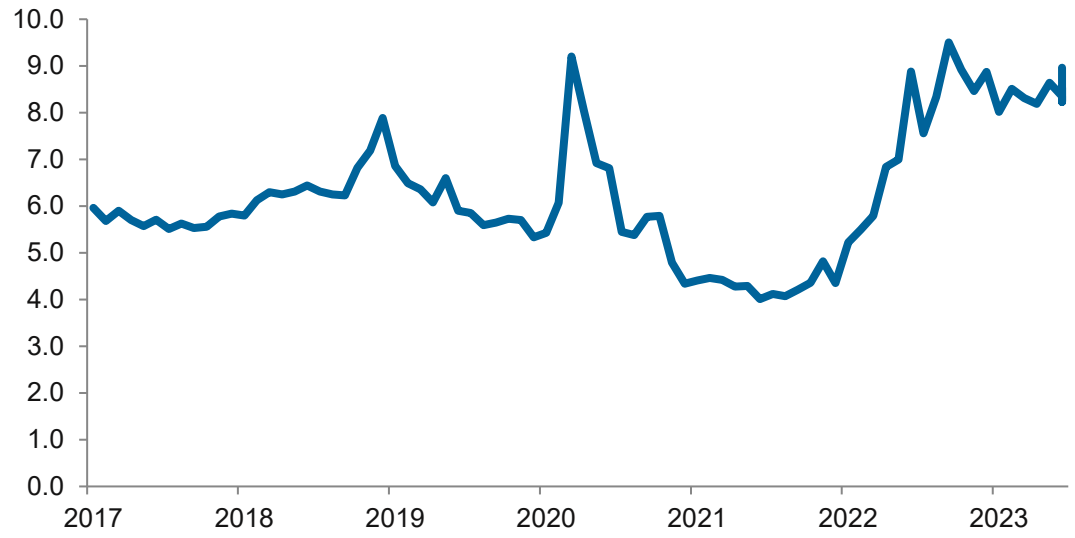
Funds Holding Closes by Quarter



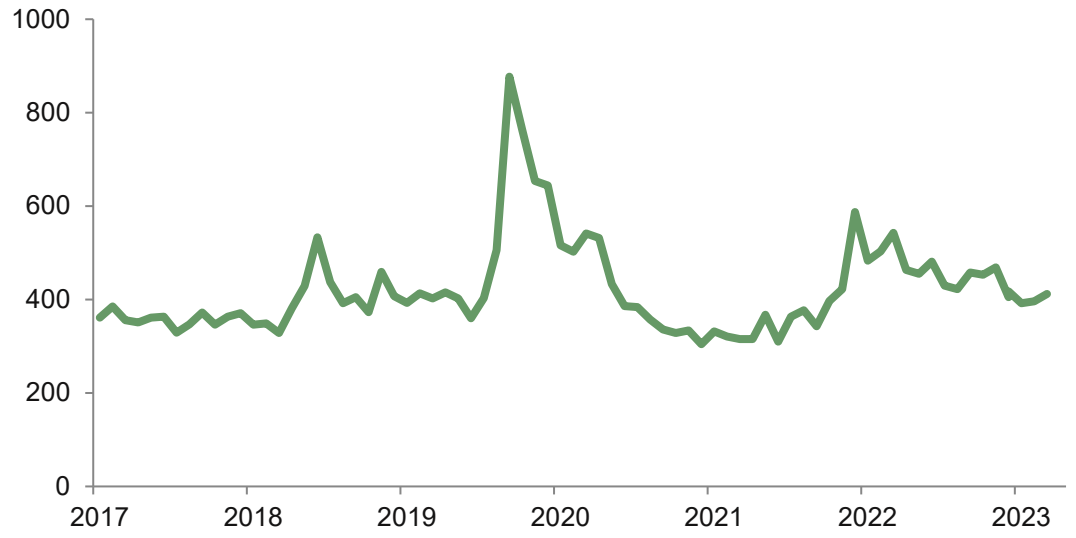
Source: Pitchbook.

3Q 2023 Yield Spreads

High Yield Effective Yields Ended 9/30/23



US Corporate High Yield Spreads Ended 9/30/23

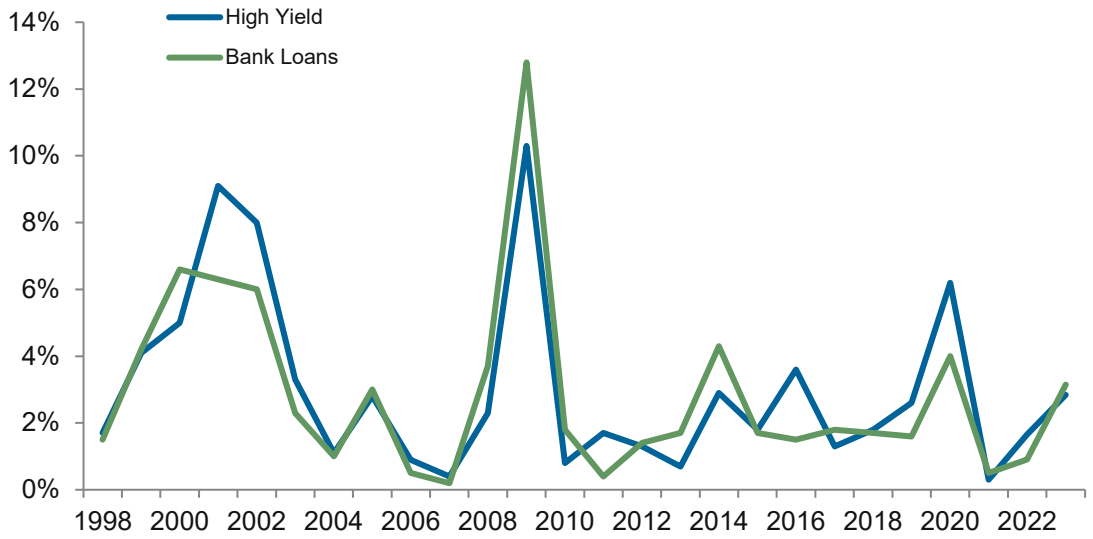


- U.S. sub-investment grade corporate yields rose dramatically at the beginning of 2022 with yields peaking in September. This was a combination of higher interest rates due to tighter Fed policy and a widening of high yield spreads. While yields have come down, they have since risen towards the end of the third quarter of 2023.
- Spreads contracted during the first half of 2023 due to stronger credit conditions as the U.S. economic outlook improved. This has since stabilized in the third quarter of 2023.

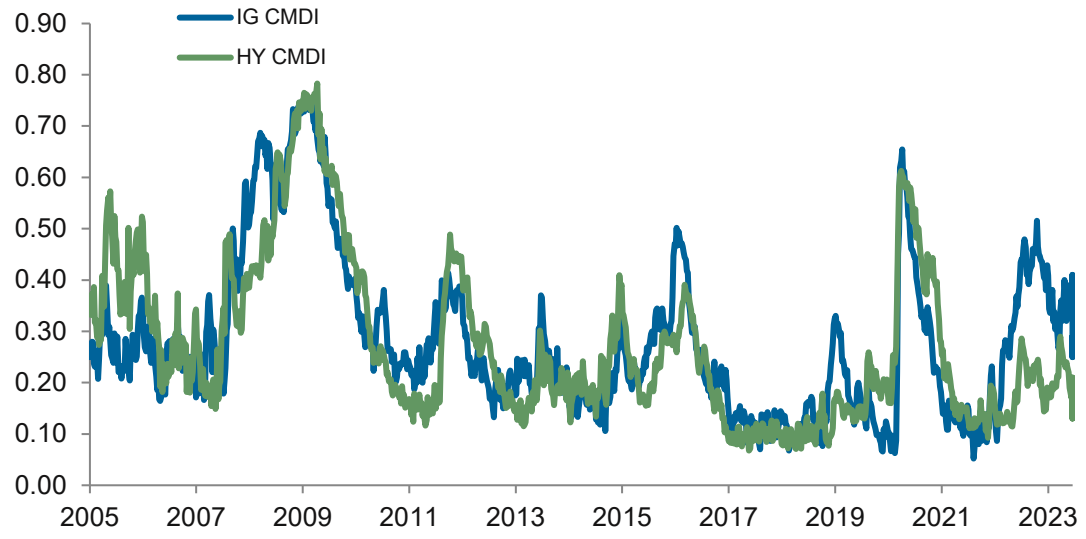
Sources: Bank of America, Federal Reserve Bank of St. Louis. Bloomberg Barclays.

3Q 2023 Distressed and Opportunistic Debt

US Corporate Default Rates Ended 9/30/23



Corporate Bond Market Distress Index (CMDI) Ended 9/30/23

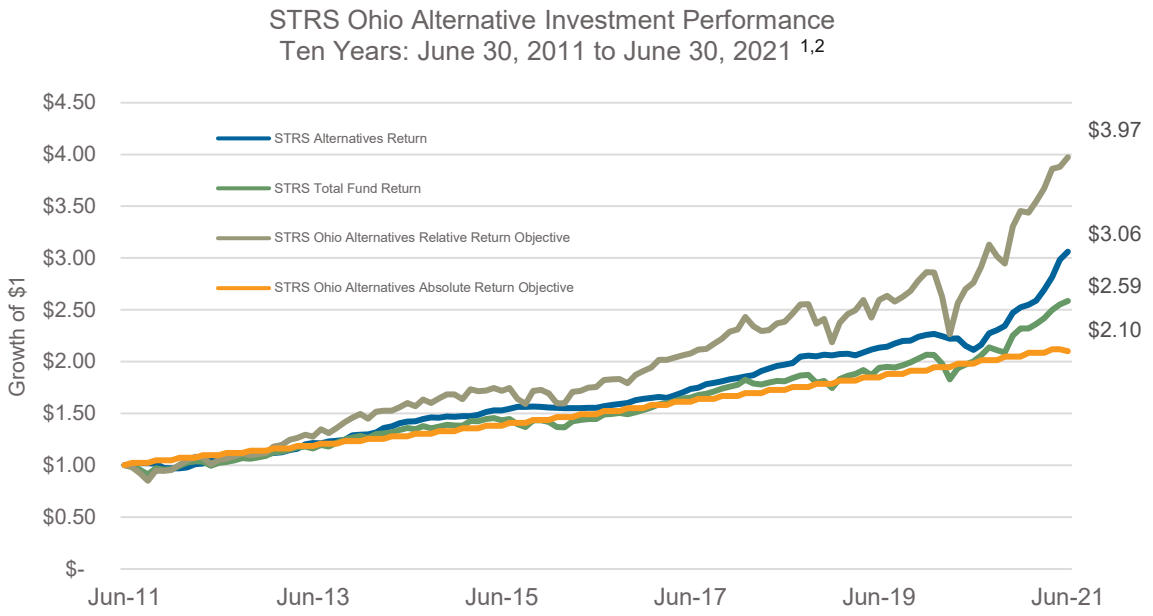


- Default rates for U.S. corporate bonds and loans ticked up in 2023 but remain slightly below the historical average of 3–4%.
- The Corporate Bond Market Distress Index (CMDI) rose rapidly during 2022, especially for investment grade bonds, but has fallen since then. In 2023, both the IG distress and HY bond indicator noticed a sharp rise midyear but has since fallen.

Source: Federal Reserve Bank of New York, JPM.

Appendix

STRS Ohio Alternatives Performance (Private Equity + O/D)



STRS Ohio Alternative Investments Performance Comparison
Annualized Periods ending June 2021

	STRS Ohio Alternatives	STRS Ohio Total Fund	STRS Ohio Alternatives Relative Return Objective [2]	STRS Ohio Alternatives Absolute Return Objective [2,3]
Last 10 years	11.84%	9.97%	14.79%	7.81%
Last 5 years	14.52%	12.34%	17.77%	7.27%
Last 3 years	15.83%	12.62%	18.55%	7.09%
Fiscal Year 2021	44.99%	29.28%	43.91%	7.09%
Risk (10-Yr)	4.91%	7.80%	14.15%	
Sharpe Ratio (10-Yr)	2.30	1.21	1.00	

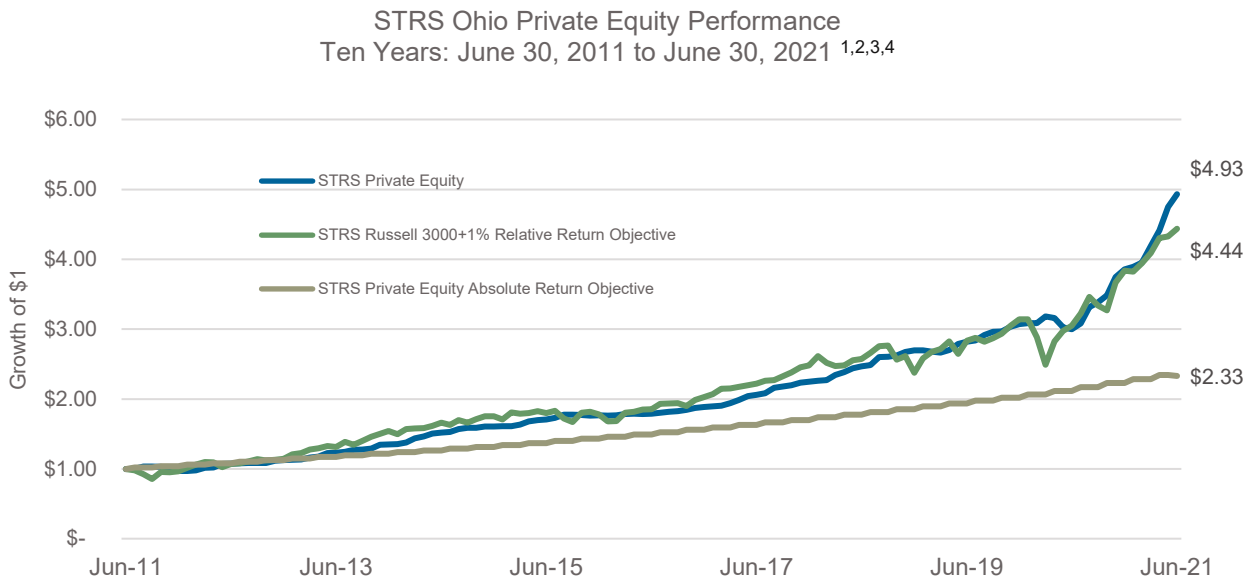
- STRS Ohio Alternatives returns exceed STRS Ohio Total Fund returns in all time periods.
- STRS Ohio Alternatives returns have meaningfully exceeded long-term Absolute Return Objectives over all time periods
- STRS Ohio Alternatives returns meaningfully exceeded the Relative Return Objective in FY2021
- STRS Ohio Alternatives returns have lagged the Relative Return Objective in longer term historical periods due to lower-risk / lower yielding Opportunistic/Diversified (or "O/D") returns (as described on a later slide), but STRS Ohio Alternatives have provided a better long-term risk-adjusted return than the Relative Return Objective as illustrated above by the significantly lower volatility and significantly higher Sharpe Ratio over the 10-year period.

[1] STRS Ohio Alternatives returns are always presented net of all management fees, fund expenses and carried interest.

[2] STRS Ohio measured Alternatives performance relative to the Alternatives Relative Return Objective and the Alternatives Absolute Return Objective through 6/30/2021.

[3] Higher returns over longer periods reflect Objectives from earlier STRS Ohio Asset Allocation Studies.

STRS Ohio Private Equity Performance



STRS Ohio Private Equity Performance
Annualized Periods ending June 2021 [1,2]

	STRS Ohio Alternatives	STRS Ohio Alternatives Relative Return Objective [2,3]	STRS Ohio Alternatives Absolute Return Objective [2,4]
Last 10 years	17.29%	16.06%	8.83%
Last 5 years	22.47%	19.05%	8.32%
Last 3 years	25.96%	19.90%	8.15%
Fiscal Year 2021	64.48%	45.56%	8.15%
Risk (10-Yr)	6.53%	14.14%	
Sharpe Ratio (10-Yr)	2.56	1.10	

- STRS Ohio Private Equity returns exceed Absolute Return Objectives for all time periods
- STRS Ohio Private Equity returns outperformed the Relative Return Objective in all time periods
- STRS Ohio Private Equity returns have also generated significantly better risk-adjusted returns than the Relative Return Objective as illustrated above by the significantly lower volatility and significantly higher Sharpe Ratio over the 10-year period

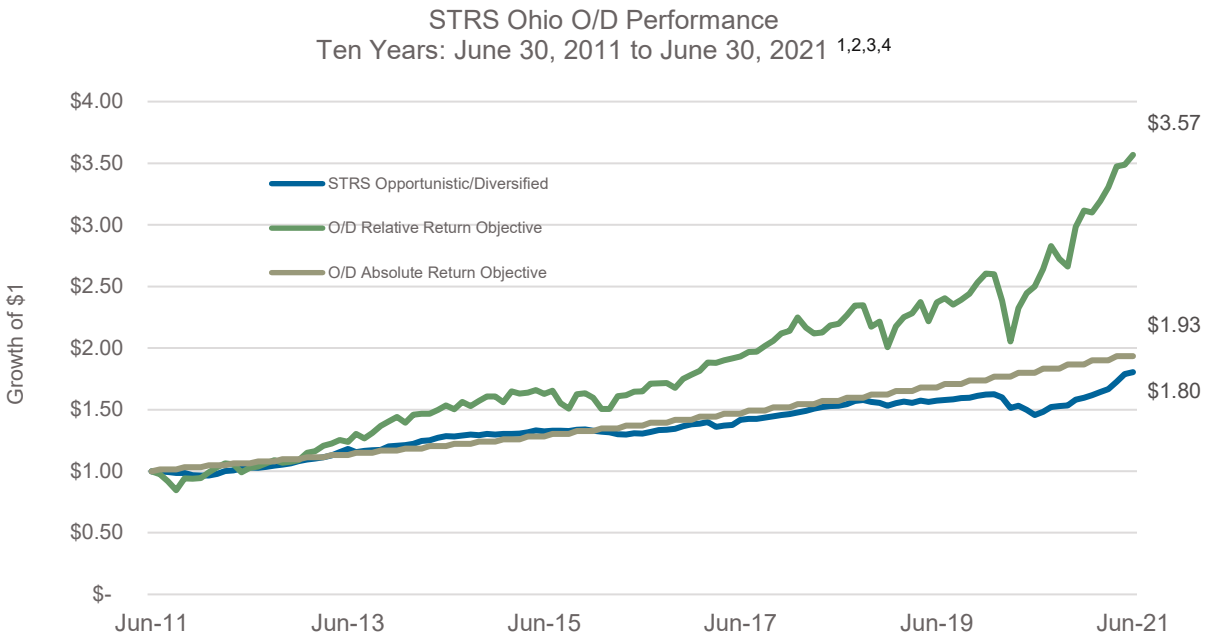
[1] STRS Ohio PE returns are always presented net of all management fees, fund expenses and carried interest.

[2] STRS Ohio measured Private Equity performance relative to the Private Equity Relative Return Objective and the Private Equity Absolute Return Objective through 06/30/2021.

[3] STRS Ohio Private Equity Relative Return Objective equals the Russell 3000 Equity Index plus 1% per year.

[4] STRS Ohio Private Equity Absolute Return Objective is based upon a 10.70% Objective starting fiscal 2007, a 9.00% Objective starting fiscal 2013 and an 8.15% Objective starting fiscal 2018.

STRS Ohio Opportunistic/Diversified (O/D) Performance



STRS Ohio Private Equity Performance
Annualized Periods ending June 2021 [1,2]

	STRS Ohio Opportunistic/ Diversified [2]	STRS Ohio O/D Relative Return Objective [3]	STRS Ohio O/D Absolute Return Objective [4]
Last 10 years	6.08%	13.57%	6.79%
Last 5 years	6.69%	16.73%	6.48%
Last 3 years	5.64%	17.57%	6.35%
Fiscal Year 2021	24.07%	42.78%	6.35%
Risk (10-Yr)	4.23%	14.15%	
Sharpe Ratio (10-Yr)	1.30	0.92	

- STRS Ohio Opportunistic/Diversified returns have trailed Relative Return Objectives over all periods shown but have exceeded the Absolute Return Objective in two of the four time periods shown. STRS Ohio Private Equity returns outperformed the Relative Return Objective in all time periods
- The Relative Return Objective underperformance is due primarily to (1) very strong public US stock returns over the last 10 years, (2) an investment emphasis on credit assets within Opportunistic and (3) an emphasis on lower risk Diversified strategies within O/D that have caused lower returns, which collectively made the Relative Return Objective difficult to outperform.

[1] STRS Ohio O/D returns are always presented net of all management fees, fund expenses and carried interest.

[2] STRS Ohio measured O/D performance relative to the O/D Relative Return Objective and the O/D Absolute Return Objective through 06/30/2021.

[3] STRS Ohio O/D Relative Return Objective equals the Russell 3000 Equity Index minus 1% per year.

[4] STRS Ohio O/D Absolute Return Objective is based upon a 7.50% Objective starting in fiscal 2009, a 7.00% Objective beginning fiscal 2013 and an 6.35% Objective beginning fiscal 2018.

Alternatives Program Benchmark Definitions

Total Fund Benchmarks – Time-Weighted	
Alternative Investments Blended Benchmark	Effective July 1, 2022, the Alternative Investment Blended Benchmark consist of the Private Equity Benchmark multiplied by 47.4% plus the Opportunistic/diversified Blended Benchmark multiplied by 52.6%. From July 1, 2021 to June 30, 2022 the Alternative Investment Blended Benchmark consisted of the Private Equity Benchmark multiplied by 41.2% plus the Opportunistic/diversified Blended Benchmark multiplied by 58.8%.
Alternative Investments Blended Relative Return Objective	Through June 20, 2021, the Alternative Investments Blended Relative Return Objective is calculated monthly using a blend of the Private Equity and Opportunistic/Diversified Relative Return Objectives based on the policy weights in effect during the respective periods.
Alternative Investments Absolute Return Objective	Through June 30, 2021, the absolute return objective for Total Alternative Investments is 7.09% (Blended), Private Equity is 8.15%, and Opportunistic/Diversified is 6.35%, all of which are based on the 2017 Asset Liability Study.
Private Equity Benchmark	The Private Equity Benchmark is the Cambridge Associates Private Equity and Venture Capital Index one quarter lagged to be consistent with external fund reporting effective July 1, 2021.
Private Equity Absolute Return Objective	Through June 30, 2021, the absolute return objective for Private Equity is 8.15%, based on the 2017 Asset Liability Study.
Private Equity Relative Return Objective	Through June 30, 2021, the Private Equity Relative Return Objective is calculated monthly and is the Russell 3000 Index plus 1%.
Opportunistic/Diversified Blended Benchmark	The Opportunistic/Diversified blended benchmark consists of the actual Opportunistic Investments Portfolio weight multiplied by the Cambridge Associates Private Credit Index one quarter lagged to be consistent with external fund reporting plus the actual weight of the Diversified Investments Portfolio multiplied by the HFRI Fund of Funds Composite Index, which is a monthly index where subsequent revisions will be reflected in the following period effective July 1, 2021.
Opportunistic/Diversified Absolute Return Objective	Through June 30, 2021, the absolute return objective for Opportunistic/Diversified is 6.35%, based on the 2017 Asset Liability Study.
Opportunistic/Diversified Relative Return Objective	Through June 30, 2021, the Opportunistic Relative Return Objective is calculated monthly and is the Russell 3000 Index minus 1%.

Alternative Investments Peer Groups	
Private Equity	LSEG/Cambridge database, includes vintage years 2007-2023, Global Buyout, Growth Equity, and Venture Capital strategy types
Opportunistic	LSEG/Cambridge database, includes vintage years 2009-2023, Global Credit Opportunities, Senior Debt, and Subordinated Debt

Private Equity Peer Group Definitions

General Partner	
Thoma Bravo	2012-2016, 2018, 2020-2022 US Buyout
Bain Capital	2007-2009, 2014-2015, 2017-2019 US Venture Capital and Buyout
Tiger Iron	2018-2019 US Venture Capital
Grosvenor	2007-2008, 2010, 2014-2015 US Buyout
Silver Lake	2007, 2013, 2017-2020 US Buyout
TA Associates	2010, 2016, 2019, 2020, 2021 Global Buyout and Growth Equity
Commonfund	2010, 2012, 2013, 2015 Global Venture Capital
Francisco Partners	2011, 2015-2016, 2018, 2020, 2022 US Buyout
General Catalyst	2011, 2013, 2016, 2018, 2020-2021 US Venture Capital
Hermes GPE	2014, 2016-2018 Global Growth Equity

Strategy	
Domestic Private Equity	2007-2023 US Buyout
Venture Capital/Growth	2007-2023 US Venture Capital
International Private Equity	2007-2023 Non-US Buyout
Total Private Equity	2007-2023 Global Buyout, Growth Equity, Venture Capital

Vintage Year	Global Buyout, Venture Capital, Growth Equity

Opportunistic/Diversified Peer Group Definitions

General Partner	
Sixth Street Partners	2011, 2012, 2014, 2015,2018-2022 Credit Opportunities
Blue Owl Capital	2014-2015, 2017-2018, 2020, 2022, 2023 Credit Opportunities, Senior Debt, Subordinated Debt
Ares Management Corporation	2012, 2017-2023 Credit Opportunities, Senior Debt
Reverence Capital Partners	2014, 2019, 2020, 2021, 2023 Credit Opportunities, Senior Debt, Subordinated Debt
Oaktree Capital Management	2011, 2013, 2015-2018 Credit Opportunities
Angelo Gordon	2019-2022 Credit Opportunities, Senior Debt, Subordinated Debt
Golub Capital	2014,2018-2020 Senior Debt, Subordinated Debt
Fortress Investment Group LLC	2014,2018-2020,2023 Credit Opportunities
Stone Point Capital	2020-2023 Subordinated Debt, Senior Debt, Buyout
Cerberus Capital	2018, 2019, 2022 Credit Opportunities

Strategy	
Specialty Finance	2011-2023 Credit Opportunities
Direct Lending	2011, 2014-2023 Senior Debt
Banking and Insurance	2014, 2015, 2017-2023 Credit Opportunities, Senior Debt, Subordinated Debt
Co-Investment/Direct	2018-2023 Subordinated Debt, Credit Opportunities, Senior Debt
Energy and Natural Resources	2010, 2012, 2013-2015, 2017-2020 Private Energy
Infrastructure	2009, 2013, 2020-2022 Infrastructure
Total Opportunistic	2009 - 2023 Credit Opportunities, Senior Debt, Subordinated Debt

Vintage Year	Credit Opportunities, Senior Debt, Subordinated Debt

Discussion

This material may contain “forward-looking” information that is not purely historical in nature. Such information may include, among other things, projections, forecasts, and estimates of yields or returns. No representation is made that the information presented will be achieved by STRS Ohio, or that every assumption made in achieving, calculating or presenting either the forward-looking information or any historical performance information has been considered or stated in preparing this material. Any changes to assumptions that may have been made in preparing this material could have a material impact on the investment returns presented herein. Past performance is no guarantee of future results.