MEKETA
INVESTMENT GROUP

Meketa Investment Group

2023

Capital Markets Expectations

Table of Contents

Executive Summary

Executive Summary

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

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

→ 2022 was a difficult year, with losses experienced for most asset classes, as interest rates increased, spreads widened, and most risk assets declined in value.

- However, there is a notable silver lining to this story – increased return assumptions.

→ Bond yields increased by the largest amount since the 1990s, driving up future returns for fixed income assets.

→ Despite lower growth projections globally, the price decline experienced by equities and many other risk assets has improved their forward-looking returns.

→ The net result is the largest increase in return assumptions in our 20+ year history of creating capital market expectations (CMEs).

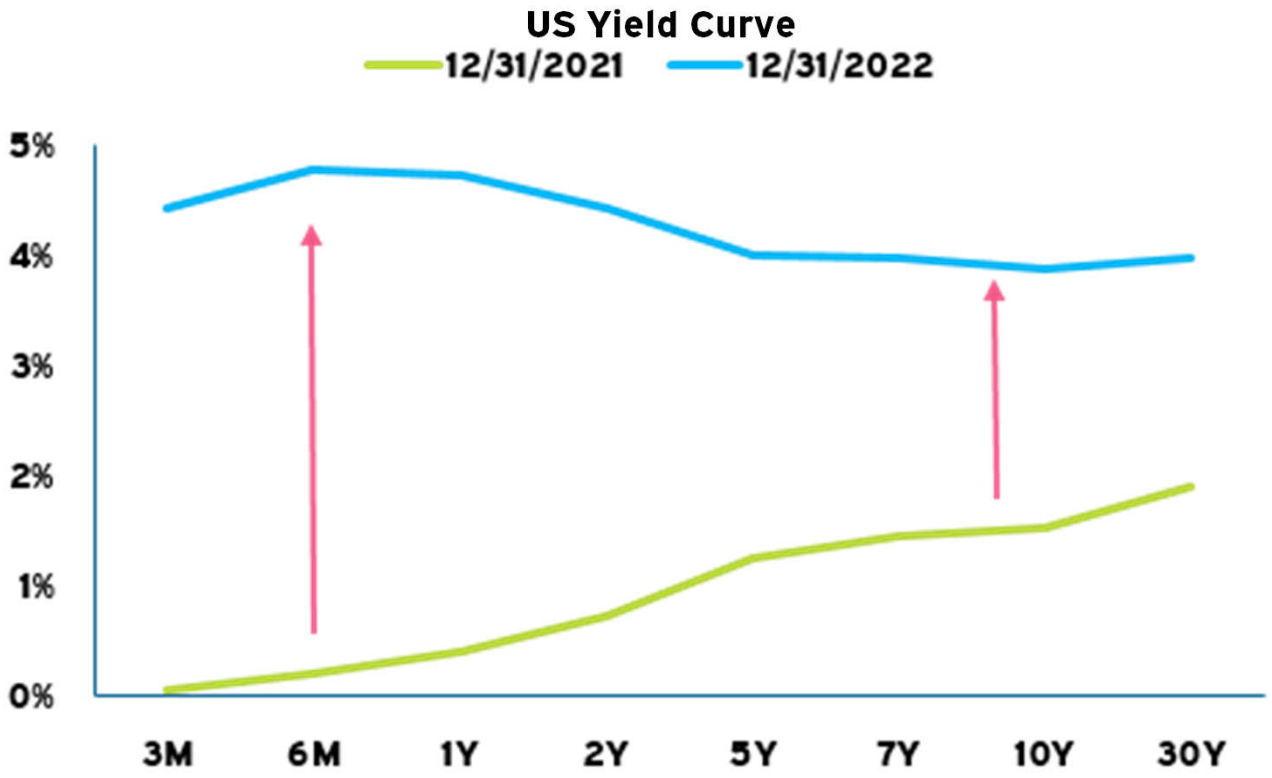
→ While our 10-year CMEs continue to be lower than many of our 20-year CMEs, this is no longer true across the board, especially in fixed income.

Market Overview

Rising Interest Rates

→ The US Treasury yield curve moved upward and flattened during 2022, even inverting in some portions of the curve.

→ The increase was particularly sharp for short-term rates, driven by the Federal Reserve's actions that were intended to battle inflation.

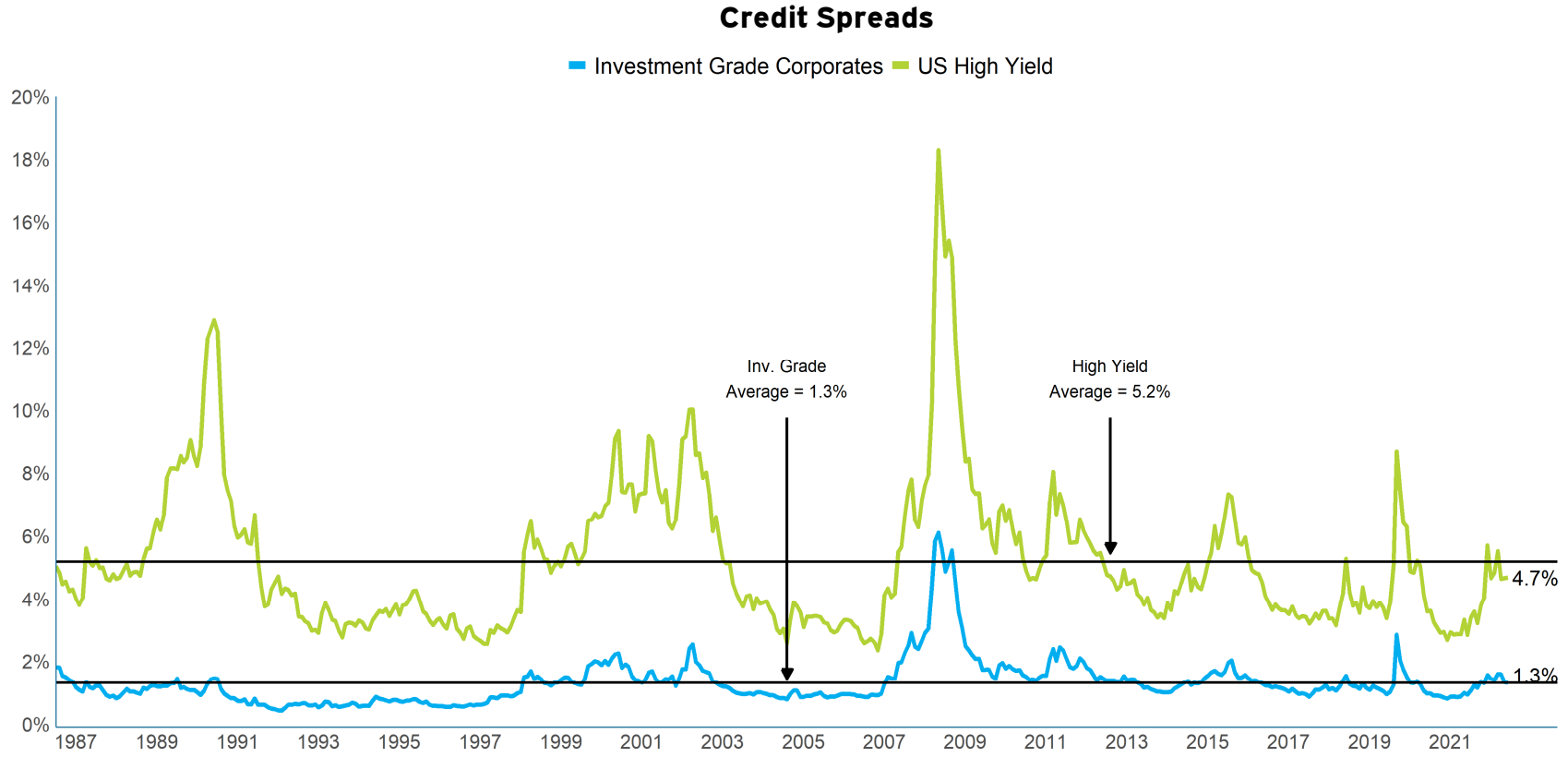


Source: Bloomberg. Data is as of December 31, 2022.

Wider Credit Spreads

→ Credit spreads rebounded from near-record lows in 2021 to more closely resembling their long-term averages in 2022.

- The spread for high yield bonds went from 283 bp to 469 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, 2022.

Rising Rates = Higher Yields

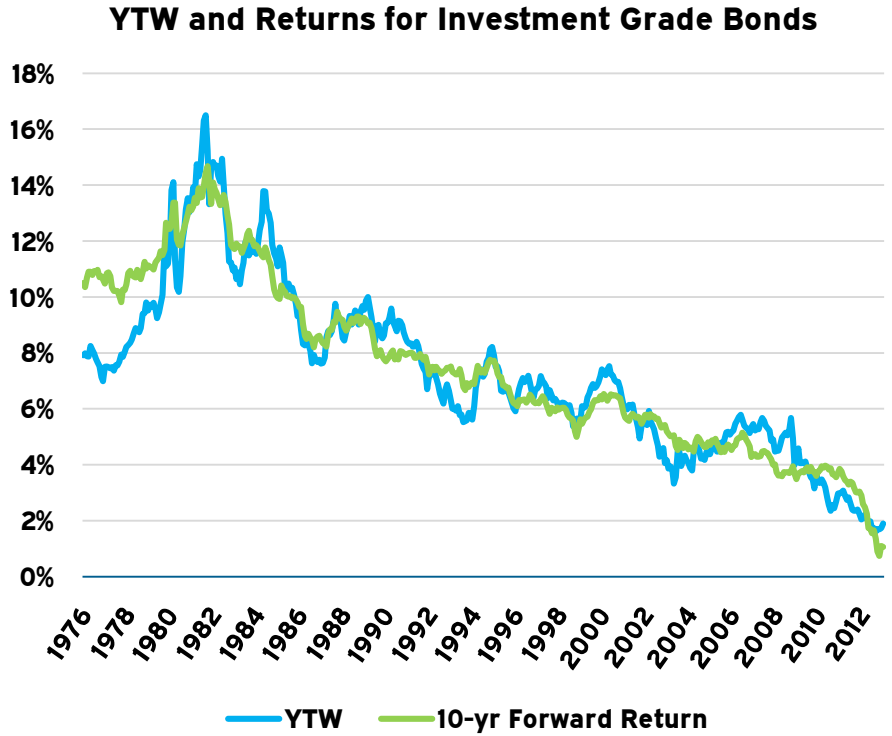
→ Rising interest rates and wider credit spreads resulted in higher yields across every major sector of the global bond market.

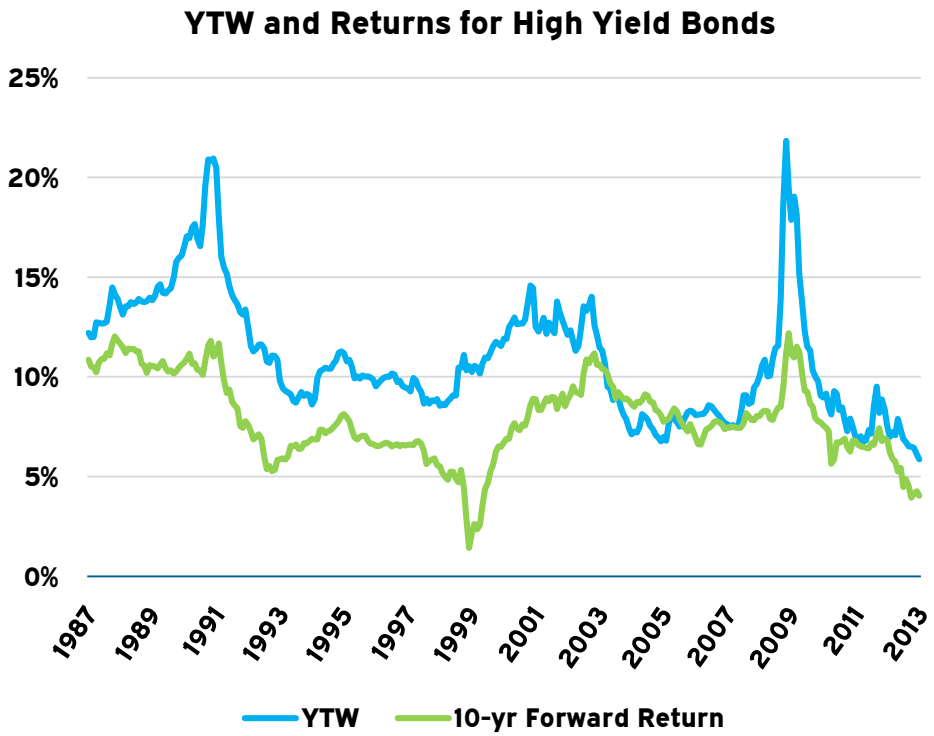
Index	Yield to Worst 12/31/22 (%)	Yield to Worst 12/31/21 (%)
Fed Funds Rate	4.25-4.50	0-0.25
10-year Treasury	3.88	1.51
Bloomberg Aggregate	4.68	1.75
Bloomberg Corporate	5.42	2.33
Bloomberg Securitized	4.75	1.98
Bloomberg Global Aggregate	3.73	1.31
Bloomberg EM Local Currency Government	4.42	3.83
Bloomberg EM Hard Currency Aggregate	7.26	3.96
Bloomberg US Corporate High Yield	8.96	4.21

Source: Bloomberg. Data is as of December 31, 2022 and 2021.

Higher Yields Means Higher Future Returns

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



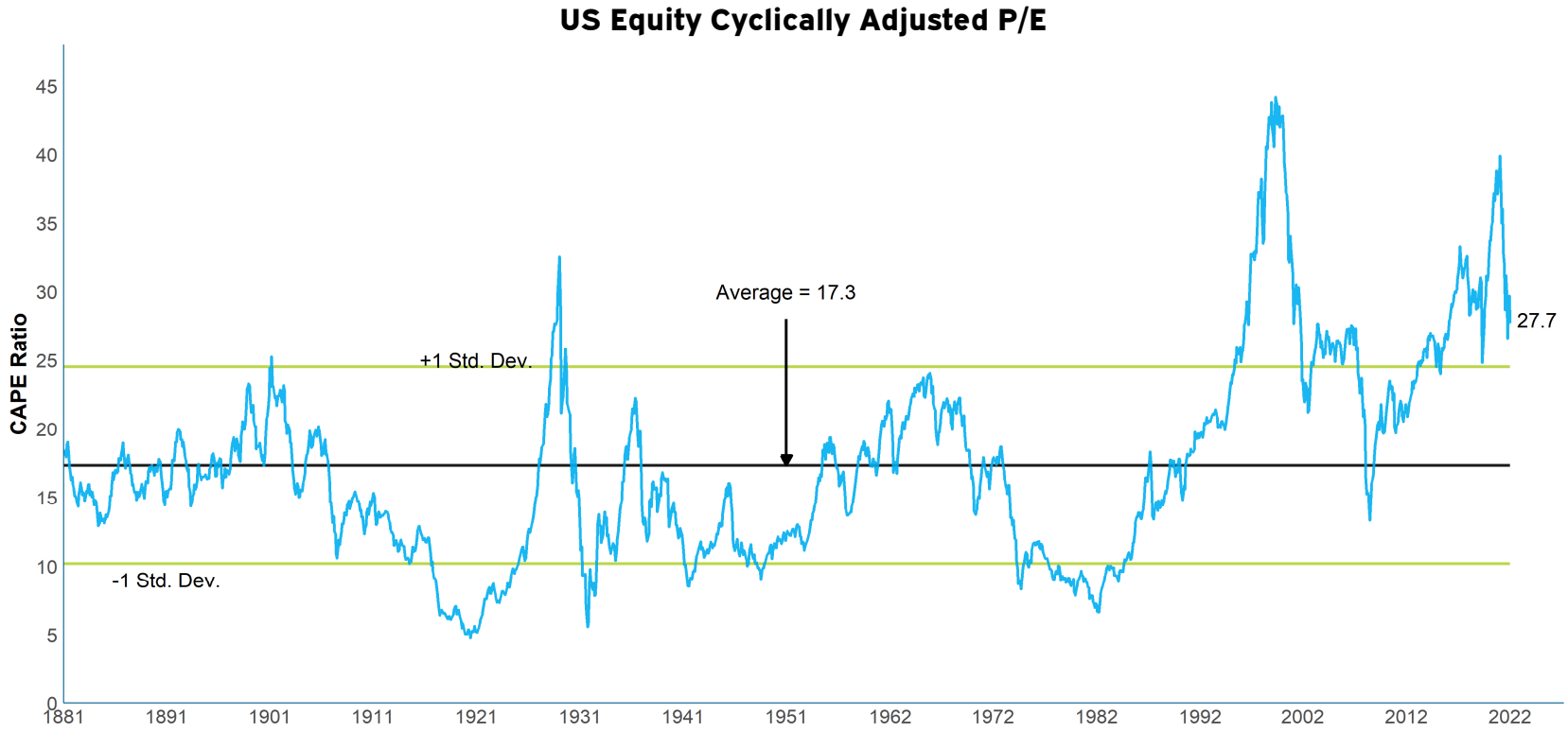


[1] When predicting returns for bonds, default risk should also be taken into account. For example, defaults are why the return for high yield bonds have generally been below the starting yield.
Source: Bloomberg Aggregate and Bloomberg High yield indices. Data is as of December 31, 2022.

Lower Prices for Equities

→ US stocks had a rough year, with the S&P 500 index experiencing an 18.1% loss.

→ Valuations remain elevated relative to their long-term history but are much nearer their average for the past 30 years.

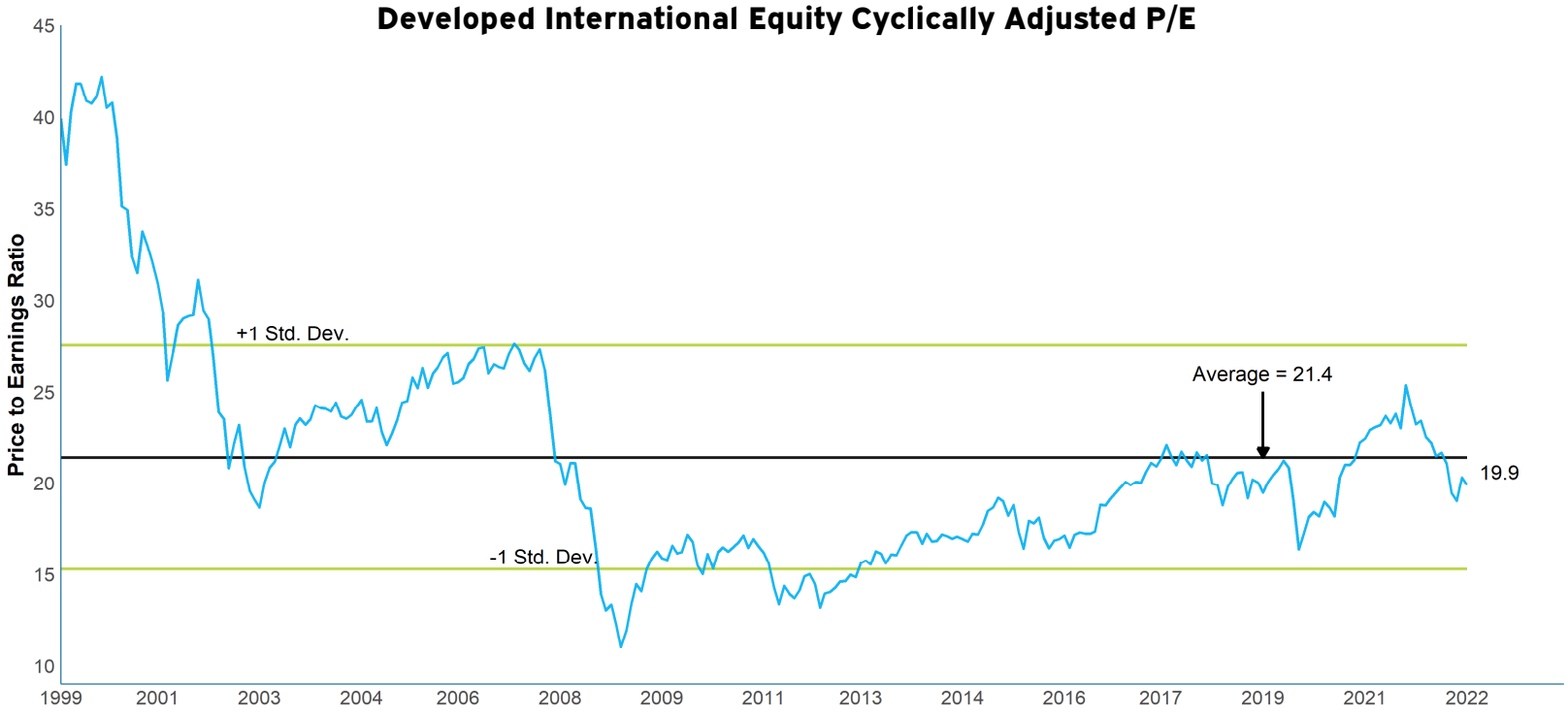


Source: Robert Shiller, Yale University, and Meketa Investment Group. Data is as of December 31, 2022 for the on S&P 500 Index.

Lower Prices in Non-US Equities, too

→ EAFE equities declined 14.5% in USD terms in 2022, though the loss was only 7.0% in local currency.

→ EAFE valuations are now relatively close to their historical average.



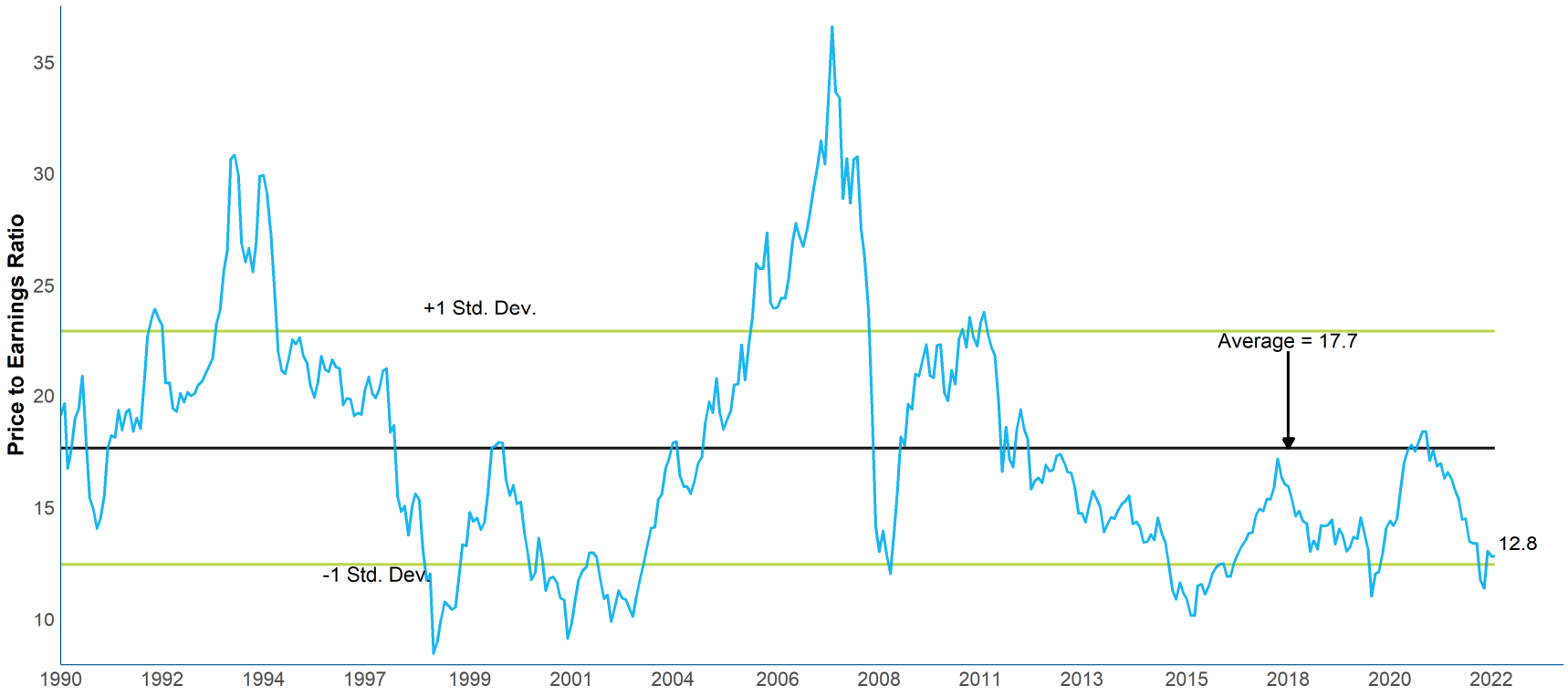
Source: MSCI and Bloomberg. Earnings figures represent the average of monthly "as reported" earnings over the previous ten years. Data is as of December 31, 2022.

And Lower Prices in Emerging Market Equities

→ Driven by a substantial downturn in Chinese equities (-21.9%), emerging market equities finished the year down 20.1%.

→ As a result, valuations are well below their long-term average.

Emerging Market Equity Cyclically Adjusted P/E

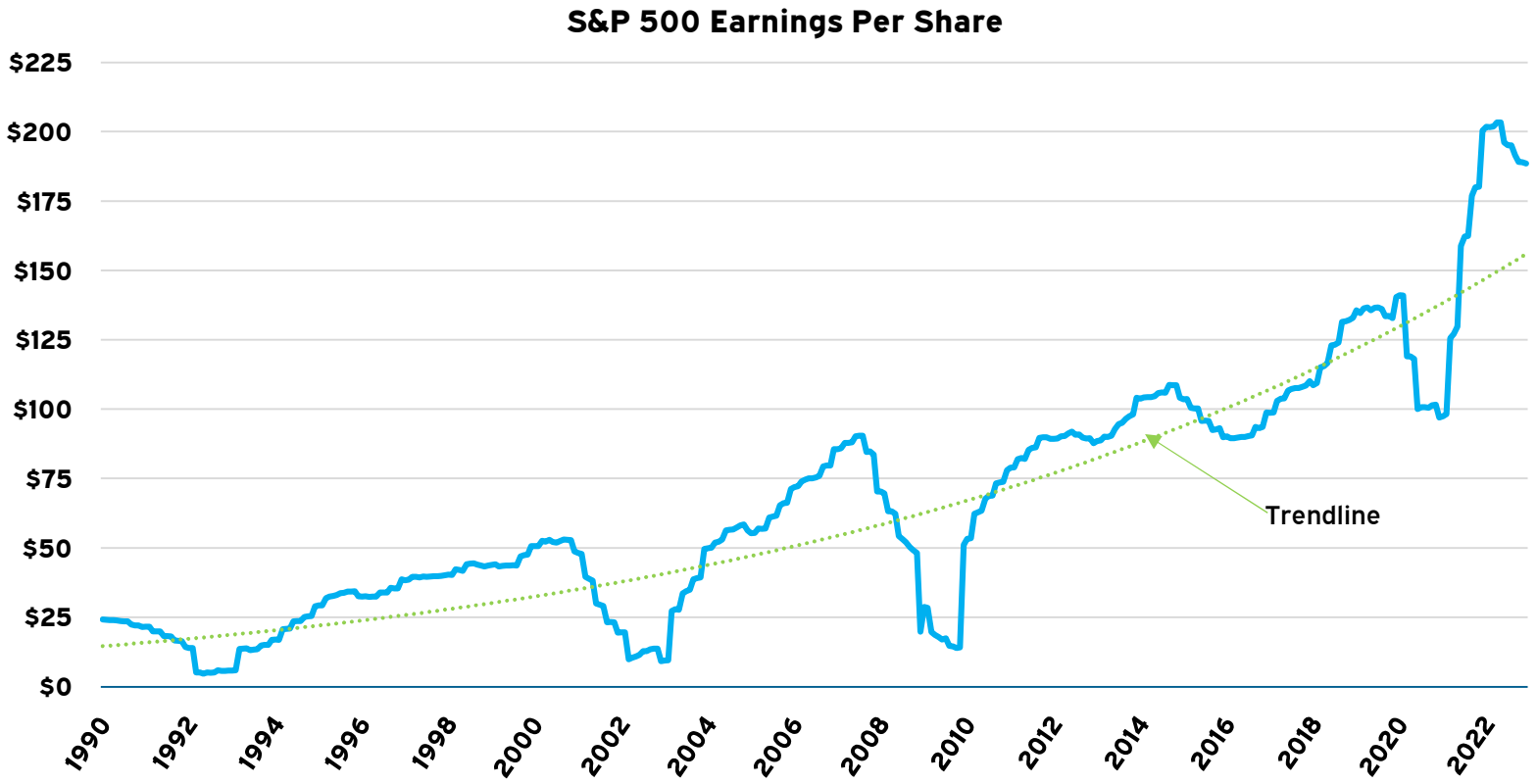


Source: MSCI and Bloomberg. Earnings figures represent the average of monthly "as reported" earnings over the previous ten years.. Data is as of December 31, 2022.

Earnings Growth

→ S&P 500 earnings continued to grow in the first half of 2022, setting a new record.

- EPS peaked at over $200 but finished the year below where it started.



Source: S&P 500 Index data from Bloomberg. Represents trailing 12-month "as reported" earnings per share. Data is as of December 31, 2022.

The Link between Economic Growth and Expected Returns

→ We have long assumed that long-term earnings growth is linked to economic growth

- However, one can exceed the other (and vice versa)

	US Nominal GDP Growth Per Annum	US Corporate Earnings Growth Per Annum	S&P 500 EPS Per Annum
Since 1990	4.7%	6.9%	6.5%
Since 2010	4.5%	5.3%	10.9%

→ Corporate profits can comprise a higher or lower share of the GDP pie

- In the US, corporate profits have grown faster than the rest of the economy

→ Net issuance vs buybacks affects EPS

- In the US, net shareholder buybacks have resulted in EPS growing faster than earnings

→ Intervention by the state & structural inefficiencies also affect earnings growth

- The degree to which maximizing shareholder wealth is a primary motivation varies by market
  - This can take many different forms, such as state-owned enterprises, state-controlled enterprises, and direct intervention by the state (see China)
- Corruption, graft, nepotism, lack of property rights or clear rule of law, can all affect the link between economic growth and earnings growth

Source: Federal Reserve Economic Data, S&P. Corporate earnings defined as Corporate Profits After Tax (without IVA and CCAdj). Data is as of September 30, 2022.

Earnings Growth

→ EPS has grown faster than earnings in the US in recent years, acting as a tailwind.

→ This is primarily due to companies using excess cash to buy back their shares.[1]

EPS with no change in shares	EPS with 2% reduction in shares
$1,578 bil / 10.5 mil shares = $150.3 per share	$1,578 bil / 10.3 mil shares = $153.2 per share

→ Over ten years, this can have a significant compounding effect.

EPS with 2% reduction in shares for ten years
$1,578 bil / 8.6 mil shares = $183.9 per share[2]

→ Data show that this trend is almost two decades long.[3]

→ This bucks the longer-term trend (still common in non-US markets) of companies being net issuers of shares.

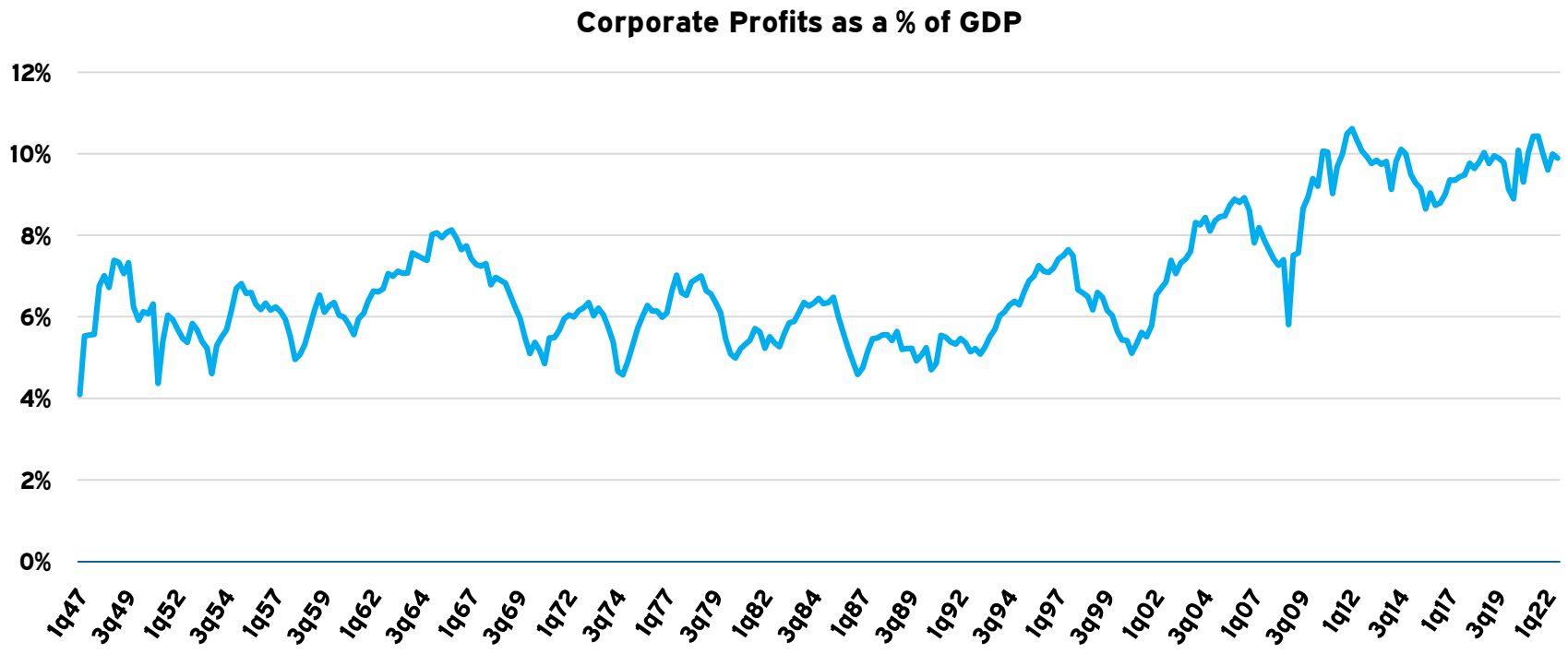
[1] Buying back shares reduces the denominator in the Earnings per Share equation, thus increasing the result of the calculation. The example shown is illustrative.
[2] Throughout this document, numbers may not sum due to rounding
[3] Source: Yardeni research

Profitability

→ The strong post-2000 growth in earnings is linked in part to profits consuming a greater proportion of the economic pie.

- Since 2000, corporate profits averaged 8.7% of GDP, vs 6.1% prior to that.

→ Justifying higher future earnings growth implies that profits will continue to comprise a higher percentage of GDP.



Source: Meketa analysis of FRED data. Series uses Seasonally Adjusted Annual Rate for Nominal GDP and Corporate Profits After Tax with Inventory Valuation Adjustment (IVA) and Capital Consumption Adjustment (CCAdj). Data is from 1q1947 through 3q2022.

Impact of Interest Rates on Equity Valuations

→ Looking at Price-Earnings (or PE10, or PB) ratios alone results in most developed equity markets looking expensive.

- The picture looks somewhat different when accounting for interest rates.

→ The level of interest rates affects valuations when discounting future cash flows (or earnings).

→ This time value of money concept can be quantified by using the dividend discount model (DDM).

- The DDM calculates a present value for the stock market based on interest rates.

→ The low rates of the 2010's drove up valuations.

- However, the sharp increase in rates in 2022 dramatically changed the calculation.

→ Using the DDM approach, public equity markets look like they may be underpriced, despite higher rates.

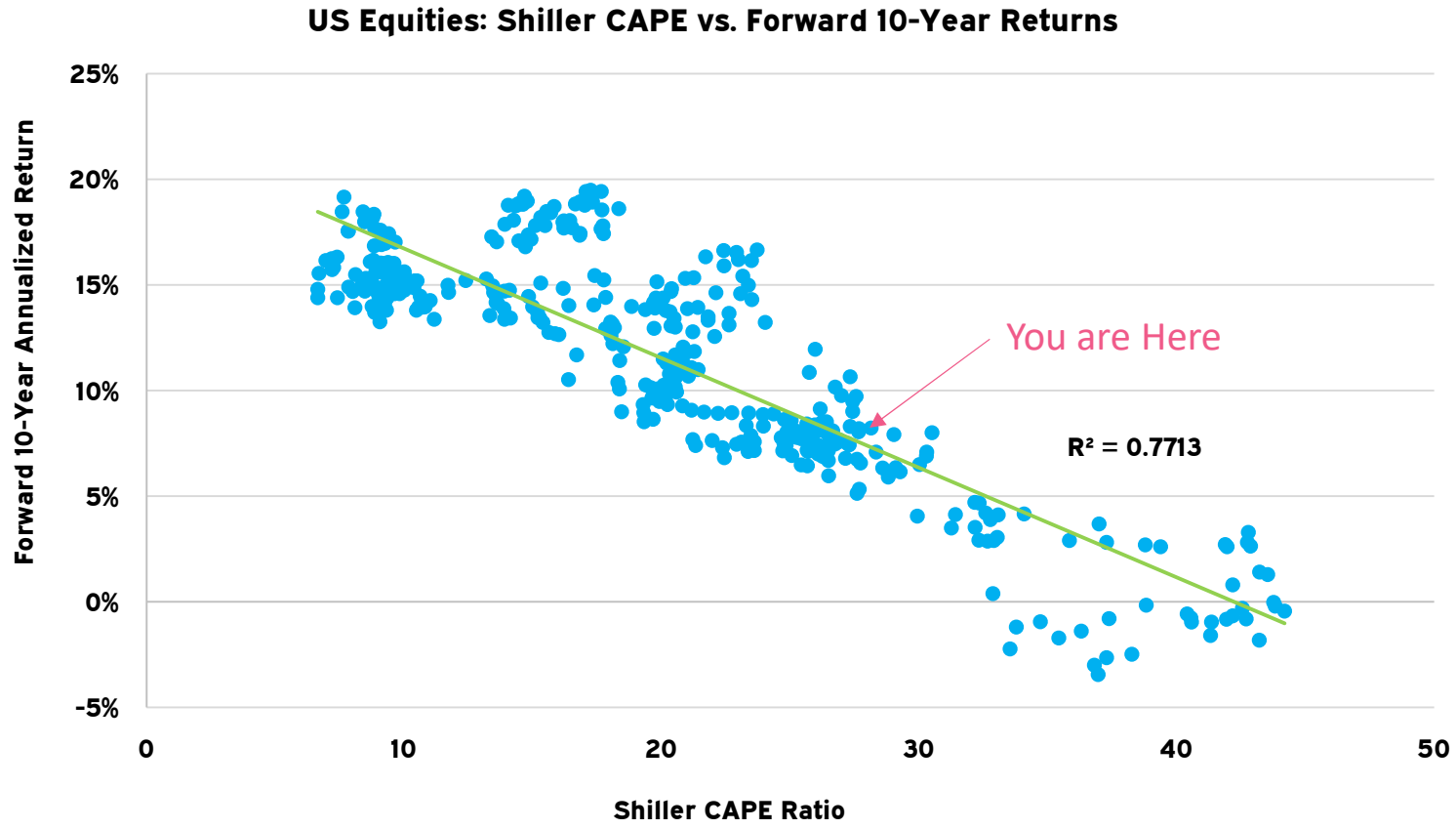
Correction in Prices Needed to Return to Historical Average

	US Equities (%)	EAFE Equities (%)	EM Equities (%)
Using PE10	-13.3	-4.3	17.3
Adjusting for Rates	3.3	0.6	-1.2

Impact of Equity Prices on Returns

→ 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 2022.

Value Stocks Look Attractive

→ Value outperformed growth in 2022.

→ But this follows a long cycle of outperformance by growth, leaving value still appearing to have better relative valuations.

US Growth vs. Value

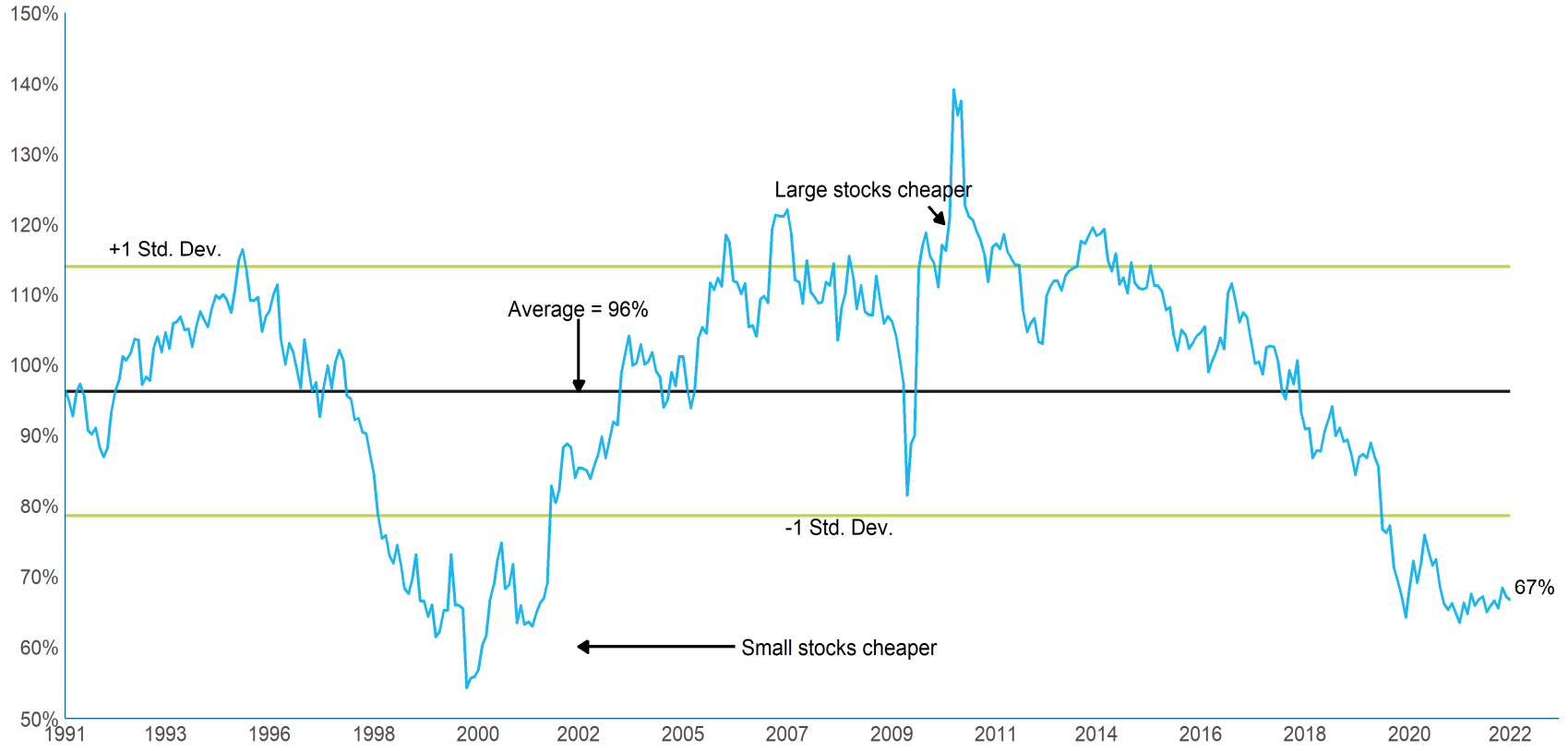
Source: Bloomberg, Russell, and Meketa Investment Group. Growth P/E (Russell 3000 Growth Index) vs. Value P/E. (Russell 3000 Value Index). Earnings figures represent 12-month "as reported" earnings. Data as of December 31, 2022.

Small Cap Stocks Look Attractive

→ Large cap and small cap stocks experienced similar performance in 2022.

→ Small cap US stocks continue to trade at low valuations relative to their long-term history versus large cap stocks.

US Small Cap vs. Large Cap

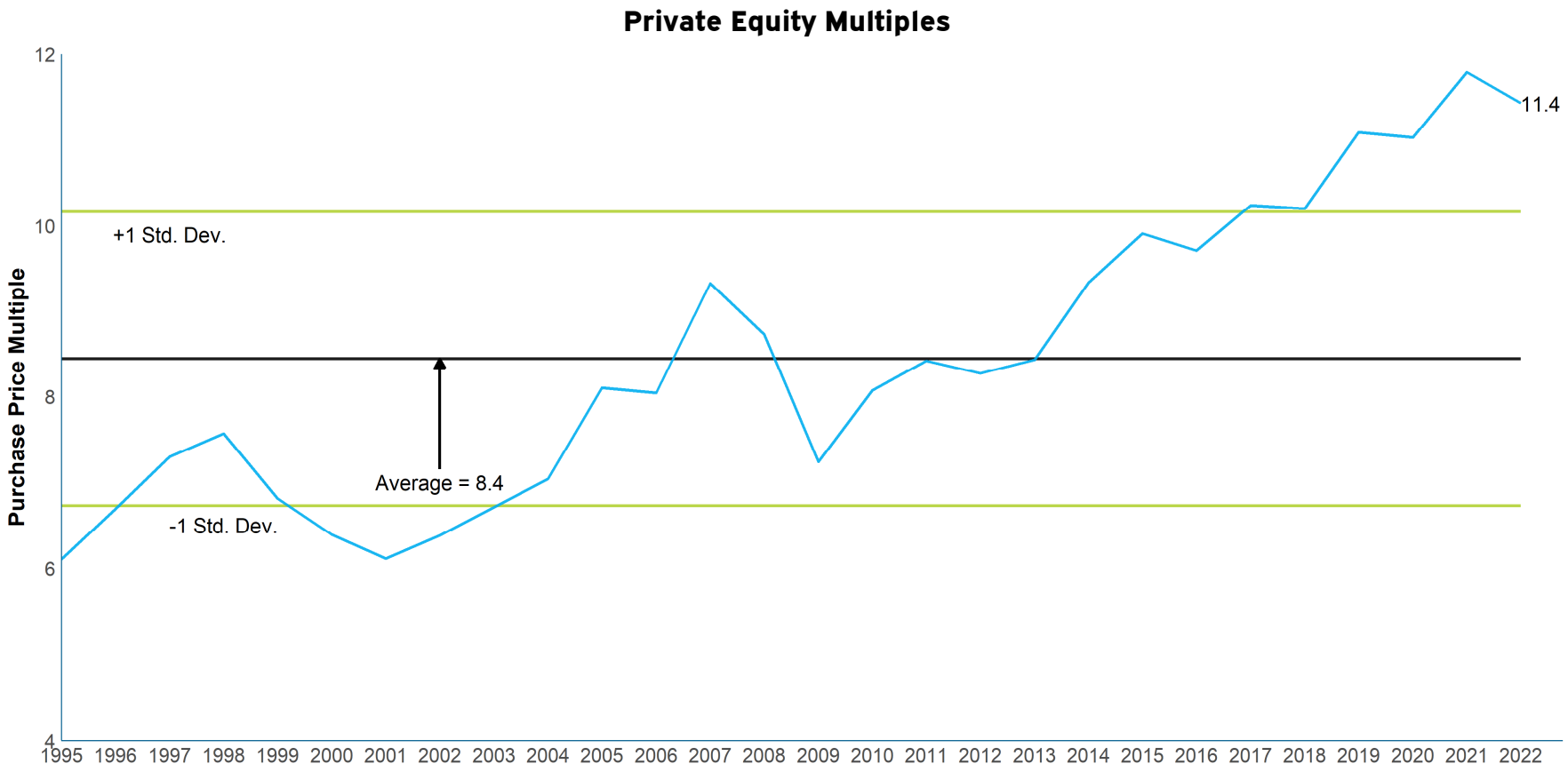


Source: Bloomberg, Russell, and Meketa Investment Group. Small Cap P/E (Russell 2000 Index) vs. Large Cap P/E (Russell 1000 Index). Earnings figures represent 12-month "as reported" earnings. Data as of December 31, 2022.

Higher Prices in Private Equity, too

→ EBITDA multiples are the closest proxy to a P-E ratio for private equity.

- The downturn in public market valuations was not experienced to the same extent in private equity prices.



Source: S&P LCD Average EBITDA Multiples Paid in All LBOs. Annual figures, except for 2022 (YTD), as of October 31, 2022.

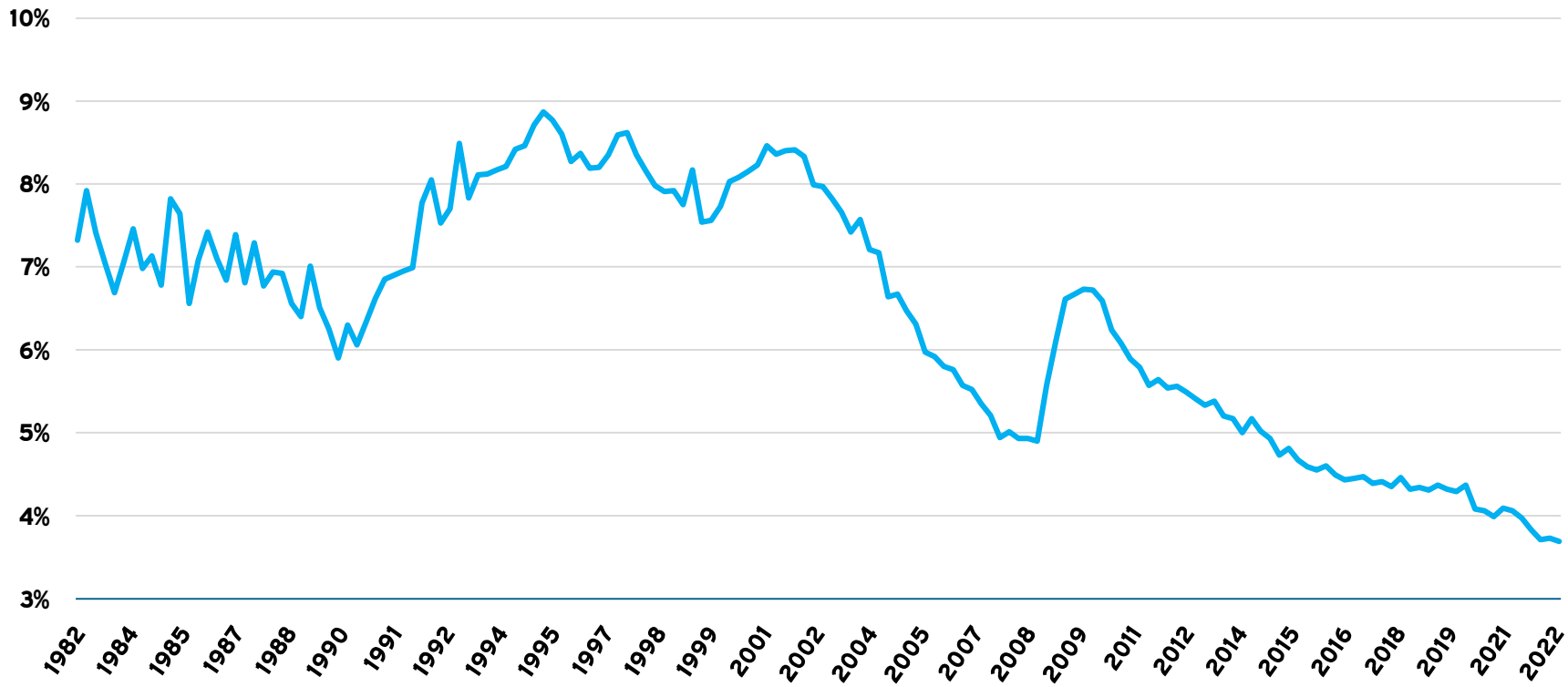
Little Change for Real Estate

→ 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.

→ Cap rates declined in 2022, continuing their long-term downward trend.

Core Real Estate Cap Rates



Source: NCREIF NPI value-weighted cap rates. As of September 30, 2022.

2023 Expected Returns and Changes from Prior Years

10-year Geometric Expected Returns
Rate Sensitive

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
Cash Equivalents	3.1	1.1	2.0	Higher yields
Short-term Investment Grade Bonds	3.8	1.2	2.6	Higher yields
Investment Grade Bonds	4.8	1.7	3.1	Higher yields
Intermediate Government Bonds	3.7	1.1	2.6	Higher yields
Long-term Government Bonds	4.3	1.4	2.9	Higher yields
Mortgage-Backed Securities	4.7	1.9	2.8	Higher yields
Investment Grade Corporate Bonds	5.6	2.3	3.3	Higher yields
Long-term Corporate Bonds	5.3	2.7	2.6	Higher yields
Short-term TIPS	3.9	1.3	2.6	Higher yields
TIPS	4.3	1.6	2.7	Higher yields
Long-term TIPS	4.7	2.1	2.6	Higher yields
Global ILBs	4.7	1.3	3.4	Higher yields
Foreign Bonds	3.8	1.9	1.9	Higher yields
US Inflation	*2.5*	*2.6*	*-0.1*	*Slightly lower near-term economist and market projections*

10-year Geometric Expected Returns
Credit

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
High Yield Bonds	8.0	3.3	4.7	Higher yields
Higher Quality High Yield	7.1	3.0	4.1	Higher yields
Bank Loans	7.6	2.7	4.9	Higher yields
Collateralized Loan Obligations(CLOs)	8.0	3.2	4.8	Higher yields
Convertible Bonds	6.1	2.2	3.9	Higher yields
Emerging Market Bonds (major)	6.7	3.6	3.1	Higher yields
Emerging Market Bonds (local)	6.4	5.0	1.4	Higher yields
Private Debt	9.4	6.7	2.7	Higher yields
Direct Lending	8.5	6.5	2.0	Higher yields
Asset Based Lending	9.4	6.8	2.6	Higher yields
Special Situations Lending	10.8	NA		*New*

10-year Geometric Expected Returns
Equities

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
US Equity	7.8	5.4	2.4	Lower valuations
US Small Cap	8.7	6.3	2.4	Lower valuations
Developed Non-US Equity	10.1	6.7	3.4	Lower valuations
Dev. Non-US Small Cap	10.5	6.4	4.1	Lower valuations
Emerging Market Equity	10.3	8.1	2.2	Lower valuations
Emerging Market Small Cap	10.0	7.5	2.5	Lower valuations
Emerging Market ex-China	10.7	NA		*New*
China Equity	9.0	NA		*New*
Frontier Market Equity	11.2	8.1	3.1	Lower valuations
Global Equity	8.8	6.1	2.7	Lower valuations
Low Volatility Equity	7.9	5.5	2.4	Lower valuations
Private Equity	9.7	8.9	0.8	Higher earnings and slightly lower valuations
Buyouts	9.4	8.8	0.6	Higher earnings and slightly lower valuations
Growth Equity	10.1	9.0	1.1	Higher earnings and slightly lower valuations
Venture Capital	10.4	9.1	1.3	Higher earnings and slightly lower valuations

10-year Geometric Expected Returns
Real Estate & Infrastructure

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
Real Estate	5.9	6.4	-0.5	Higher REIT yields, more than offset by higher borrowing costs
US REITs	6.4	6.0	0.4	Higher REIT yields
Core Private Real Estate	4.3	4.9	-0.6	Lower cap rates, higher borrowing costs
Value-Added Real Estate	6.5	7.4	-0.9	Higher borrowing costs
Opportunistic Real Estate	7.6	8.4	-0.8	Higher borrowing costs
Infrastructure	6.9	7.1	*-0.2*	Lower public valuations offset by higher borrowing costs
Infrastructure (Public)	8.0	6.4	1.6	Lower valuations
Infrastructure (Core Private)	6.4	6.9	-0.5	Higher borrowing costs
Infrastructure (Non-Core Private)	7.4	8.3	-0.9	Higher borrowing costs

10-year Geometric Expected Returns
Natural Resources & Commodities

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
Natural Resources (Public)	7.8	7.1	0.7	Higher earnings offset by higher valuations
Natural Resources (Private)	8.6	7.5	1.1	Higher earnings in some sectors partly offset by higher valuation and borrowing costs
Energy	9.3	7.6	1.7	Higher earnings
Mining	9.8	7.7	2.1	Lower valuations
Timberland	5.7	5.9	-0.2	Flat prices
Farmland	3.9	6.6	-2.7	Higher valuations, higher borrowing costs
Sustainability	9.2	8.2	1.0	Higher earnings
MLPs	5.2	6.2	-1.0	Higher valuations exceeding higher earnings
Gold Mining	9.0	7.4	1.6	Lower valuations
Gold (Metal)	2.5	2.7	-0.2	Lower near-term inflation expectations
Commodities	6.3	4.3	2.0	Higher cash yield

10-year Geometric Expected Returns
Alternative Strategies (Other)

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
Hedge Funds	5.4	3.4	2.0	Higher yields
Long-Short	4.2	2.2	2.0	Lower equity prices & higher cash yield
Event Driven	7.7	4.7	3.0	Higher cash and distressed debt yields
Global Macro	5.2	4.3	0.9	Higher cash yield
CTA – Trend Following	3.9	3.9	0.0	Lower beta assumption
Fixed Income/L-S Credit	6.3	3.2	3.1	Higher yields
Relative Value/Arbitrage	6.2	4.6	1.6	Higher cash yield
Long Vol	1.0	NA		*New*
Insurance Linked Strategies	5.7	4.8	0.9	Lower expected default rates
Alternative Risk Premia	5.5	4.5	1.0	Higher cash yield
Risk Parity (10% vol)	7.8	4.3	3.5	Higher yields and lower valuations
TAA	5.6	3.4	2.2	Higher yields and lower valuations
Digital Currencies	2.4	NA		*New*

20-year Geometric Expected Returns
Rate Sensitive

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
Cash Equivalents	2.9	1.7	1.2	Higher yields
Short-term Investment Grade Bonds	3.5	1.9	1.6	Higher yields
Investment Grade Bonds	4.7	2.4	2.3	Higher yields
Intermediate Government Bonds	3.7	1.9	1.8	Higher yields
Long-term Government Bonds	5.0	2.8	2.2	Higher yields
Mortgage Backed Securities	4.6	2.5	2.1	Higher yields
Investment Grade Corporate Bonds	5.4	3.0	2.4	Higher yields
Long-term Corporate Bonds	5.7	3.7	2.0	Higher yields
Short-term TIPS	3.6	1.9	1.7	Higher yields
TIPS	4.5	2.4	2.1	Higher yields
Long-term TIPS	5.2	3.2	2.0	Higher yields
Global ILBs	4.7	2.3	2.4	Higher yields
Foreign Bonds	4.0	2.3	1.7	Higher yields
US Inflation	*2.6*	*2.2*	*0.4*	*Higher long-term economist and market projections*

20-year Geometric Expected Returns
Credit

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
High Yield Bonds	7.3	4.4	2.9	Higher yields
Higher Quality High Yield	6.7	4.2	2.5	Higher yields
Bank Loans	7.0	4.0	3.0	Higher yields
Collateralized Loan Obligations (CLOs)	7.2	4.2	3.0	Higher yields
Convertible Bonds	6.4	3.9	2.5	Higher yields
Emerging Market Bonds (major)	6.4	4.2	2.2	Higher yields
Emerging Market Bonds (local)	6.0	4.6	1.4	Higher yields
Private Debt	9.0	7.3	1.7	Higher yields
Direct Lending	8.3	7.1	1.2	Higher yields
Asset Based Lending	9.0	7.3	1.7	Higher yields
Special Situations Lending	10.2	NA		*New*

20-year Geometric Expected Returns
Equities

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
US Equity	8.7	6.8	1.9	Lower valuations and higher risk-free rate
US Small Cap	9.3	7.4	1.9	Lower valuations and higher risk-free rate
Developed Non-US Equity	9.8	7.5	2.3	Lower valuations and higher risk-free rate
Dev. Non-US Small Cap	10.1	7.4	2.7	Lower valuations and higher risk-free rate
Emerging Market Equity	10.0	8.4	1.6	Lower valuations and higher risk-free rate
Emerging Market Small Cap	10.0	8.2	1.8	Lower valuations and higher risk-free rate
Emerging Market ex-China	10.3	NA		*New*
China Equity	9.3	NA		*New*
Frontier Market Equity	10.7	8.7	2.0	Lower valuations and higher risk-free rate
Global Equity	9.2	7.2	2.0	Lower valuations and higher risk-free rate
Low Volatility Equity	8.3	6.5	1.8	Lower valuations and higher risk-free rate
Private Equity	11.0	10.0	1.0	Lower valuations and higher risk-free rate
Buyouts	10.7	9.8	0.9	Lower valuations and higher risk-free rate
Growth Equity	11.2	10.1	1.1	Lower valuations and higher risk-free rate
Venture Capital	11.6	10.3	1.3	Lower valuations and higher risk-free rate

20-year Geometric Expected Returns
Real Estate & Infrastructure

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
Real Estate	7.8	7.4	0.4	Higher REIT yields, risk-free rate, and borrowing costs
US REITs	8.0	7.1	0.9	Higher REIT yields and risk-free rate
Core Private Real Estate	6.5	6.1	0.4	Higher borrowing costs and risk-free rate
Value-Added Real Estate	8.3	8.1	0.2	Higher borrowing costs and risk-free rate
Opportunistic Real Estate	9.6	9.6	0.0	Higher borrowing costs and risk-free rate
Infrastructure	8.3	7.7	0.6	Higher borrowing costs offset by higher risk-free rate
Infrastructure (Public)	8.8	7.4	1.4	Lower valuations and higher risk-free rate
Infrastructure (Core Private)	7.8	7.3	0.5	Higher borrowing costs and risk-free rate
Infrastructure (Non-Core Private)	9.5	9.3	0.2	Higher borrowing costs and risk-free rate

20-year Geometric Expected Returns
Natural Resources & Commodities

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
Natural Resources (Public)	8.7	7.7	1.0	Higher earnings and risk-free rate
Natural Resources (Private)	9.8	8.5	1.3	Higher earnings in some sectors and higher risk-free rate partly offset by higher valuation and borrowing costs
Energy	10.4	8.9	1.5	Higher earnings and risk-free rate
Mining	10.2	8.5	1.7	Lower valuations and higher risk-free rate
Timberland	7.4	6.8	0.6	Higher risk-free rate
Farmland	6.5	7.2	-0.7	Higher valuations and borrowing costs
Sustainability	10.3	9.3	1.0	Higher earnings and risk-free rate
MLPs	7.4	7.2	0.2	Higher valuations offset by higher risk-free rate
Gold Mining	9.7	8.2	1.5	Lower valuations and higher risk-free rate
Gold (Metal)	3.3	2.8	0.5	Higher long-term inflation expectations
Commodities	5.7	4.6	1.1	Higher cash yield and risk-free rate

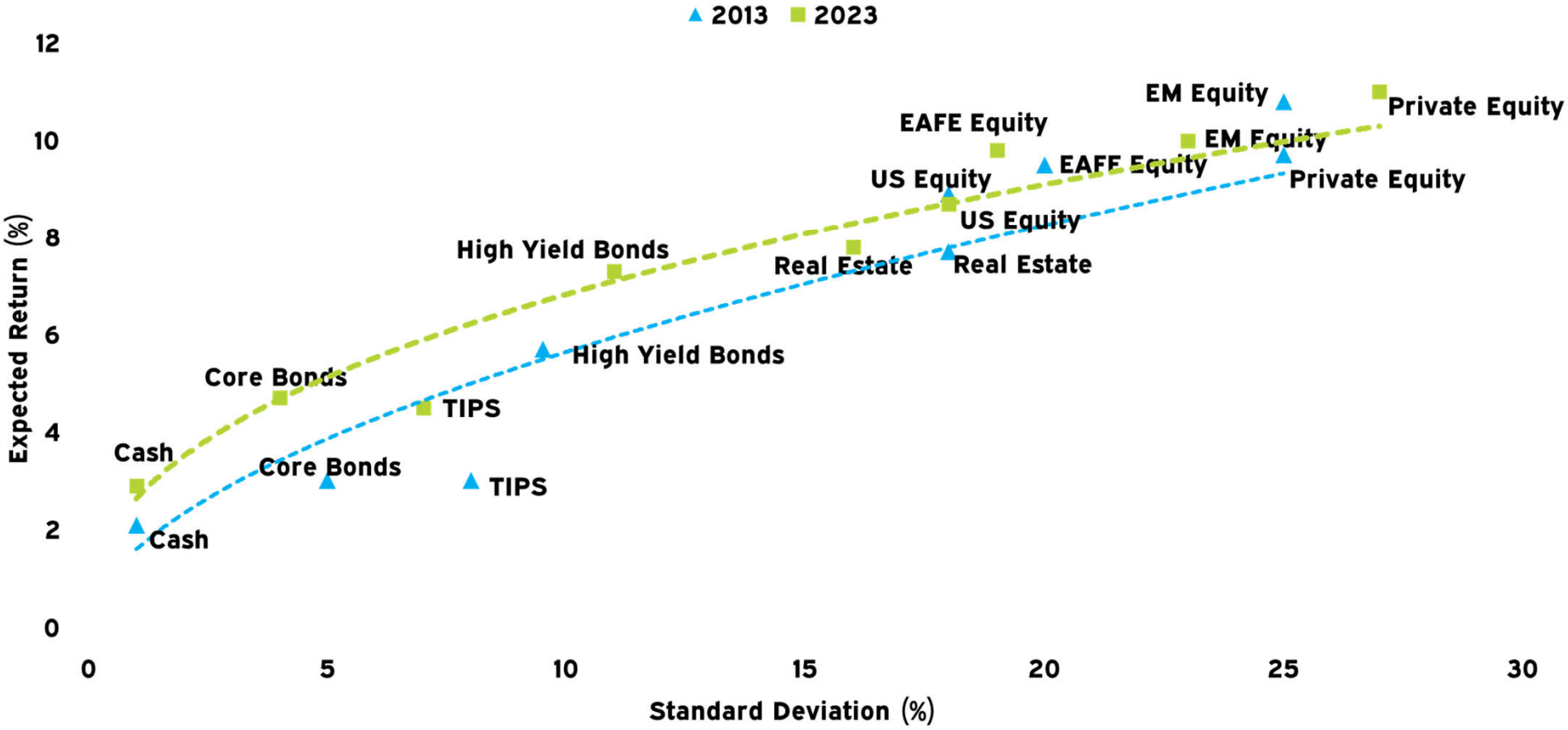
20-year Geometric Expected Returns
Alternative Strategies (Other)

	2023 E(R) (%)	2022 E(R) (%)	Δ From 2022 (%)	Notes
Hedge Funds	6.1	4.4	1.7	Higher yields and risk-free rate
Long-Short	5.6	4.1	1.5	Lower equity prices & higher cash yield
Event Driven	7.7	5.2	2.5	Higher yields and risk-free rate
Global Macro	5.7	5.0	0.7	Higher cash yield and risk-free rate
CTA – Trend Following	4.8	4.8	0.0	Lower beta assumption
Fixed Income/L-S Credit	6.5	3.8	2.7	Higher yields and risk-free rate
Relative Value/Arbitrage	6.7	5.1	1.6	Higher cash yield and risk-free rate
Long Vol	1.1	NA		*New*
Insurance Linked Strategies	6.2	5.0	1.2	Lower expected default rates
Alternative Risk Premia	5.6	4.6	1.0	Higher cash yield and risk-free rate
Risk Parity (10% vol)	7.7	5.2	2.5	Higher yields and risk-free rate
TAA	5.7	4.5	1.2	Higher yields and risk-free rate
Digital Currencies	3.3	NA		*New*

The Big Picture: Higher Return for the ~Same Risk[1]

→ The relationship between long-term return expectations and the level of risk accepted is not static.

→ We anticipate many investors can take on less risk than they have over the past decade if they want to achieve their target returns.



[1] Expected return and standard deviation are based upon Meketa Investment Group's 2013 and 2023 20-year capital market expectations.

Structural Changes and FAQs

Structural Changes for 2023

→ We added the following "asset classes" (total now at 104):

- Emerging Market ex-China equity
- China equity
- Foreign equity (e.g., ACWI ex-US)
- Global REITs
- Special Situations Lending (broad private credit category)
- Market Neutral hedge funds
- Long Volatility (RMS/tail risk hedging)
- RMS Aggregate (typical combination of RMS strategies – 1st, 2nd, and diversifiers)
- RMS Diversifiers (typical combination of RMS Diversifying strategies)
- Digital Currencies (e.g., bitcoin)

→ We renamed Specialty Finance to Asset Based Lending

→ We retired several "asset classes"

- Distressed Debt and Mezzanine Debt (folded into special situations lending)
- Long Puts (using long vol instead)

Model Changes for 2023

→ New weightings for Private Debt composite.

- We added special situations lending, which required its inclusion in the private debt aggregate.
- The target allocation to mezzanine and distressed debt was eliminated.
- Our weights reflect a blend of the market opportunity and typical Meketa portfolio.

→ New weightings for Real Estate composite.

- Increased core and decreased debt.

→ New weightings for Natural Resources composite.

- Decreased farmland & mining, increased sustainability and energy.

Model Changes for 2023 (continued)

→ Using market projections for rate changes based on the appropriate location in the term structure (i.e., not just changes in short-term rates).

→ Increased proportion of buyouts allocated to US vs. non-US (85/15).

→ Decreased risk premia for several global macro sub-strategies.

→ Decreased risk premia for CTAs (i.e., trend following strategies).

→ Decreased risk premia for ARP (Alternative Risk Premia) strategies.

FAQs for 2023

→ How do these CMEs compare to prior years' assumptions?

→ To help evaluate this, we created a weighted average of expected returns for the asset classes that comprise a typical Meketa client portfolio.[1]

→ The value of the expected return for the portfolio is not a precise expected return (i.e., it has not been run via MVO), but the magnitude of the change is what is relevant.

→ In short, the average of 20-year expected returns is 170 basis points higher than last January.

- This is the largest change in our 20+ year history of creating CMEs.

Year	Weighted Average Expected Return (%)	Change from Prior Year (%)
2023	8.2	+1.7
2022	6.5	+0.4
2021	6.1	-0.7
2020	6.8	-0.6
2019	7.4	+0.7
2018	6.7	-0.2

[1] The weights are as follows: 10% investment grade bonds, 3% LT government bonds, 4% TIPS, 3% high yield, 2% bank loans, 3% EM debt, 3% private debt, 25% US equity, 12% EAFE equity, 8% EM equity, 10% private equity, 10% real estate, 2% natural resources, 3% infrastructure, 2% hedge funds.

FAQs for 2023 (continued)

What is driving the changes from last year?

→ The changes relative to last year are being driven by what happened in the market.

→ The sharp increase in interest rates across the yield curve affected many asset classes, as did lower valuations for many riskier asset classes.

- Higher borrowing costs and wider spreads also had an impact.

→ Higher expected rates also provide a tailwind in our 20-year projections, as the bridge from 10 to 20 years is made via a risk premia being added to a (higher) future risk-free rate.

- The risk-free rate jumped from 2.78% to 4.17%

How do Meketa's CMEs compare to peers?

→ We believe our CMEs are in the same ballpark as our peers.

→ We generally cite the survey conducted each year by Horizon Actuarial Services for making peer comparisons, as it is the most comprehensive survey of CMEs of which we are aware.

- However, this survey is usually not published until July or August.

→ It is important to distinguish between intermediate term assumptions (e.g., 7-10 years) and long-term assumptions (e.g., 20-30 years) when making these comparisons.

FAQs for 2023 (continued)

Did volatility expectations change?

→ Not systematically. There were changes in a few individual asset classes, but these tended to be small and netted out to no upward or downward trend.

→ Our methodology includes a 15-year look back, which includes the volatile years of 2022, 2020 and 2008.

Did Meketa make any qualitative adjustments?

→ As usual, we made some qualitative adjustments to the CMEs.

→ We decreased Frontier Markets equity, as high dividend yields and inflation are unlikely to persist at current levels.

→ We made modest increases to non-core private real estate and infrastructure, as the current situation of borrowing costs exceeding cap rates/income is unlikely to persist indefinitely.

→ We decreased public natural resources, as earnings and valuations for this sector are exceptionally volatile and the current situation may not reflect the long-term reality.

→ We increased MLPs, as earnings and valuations for this sector are exceptionally volatile and the current situation may not reflect the long-term reality.

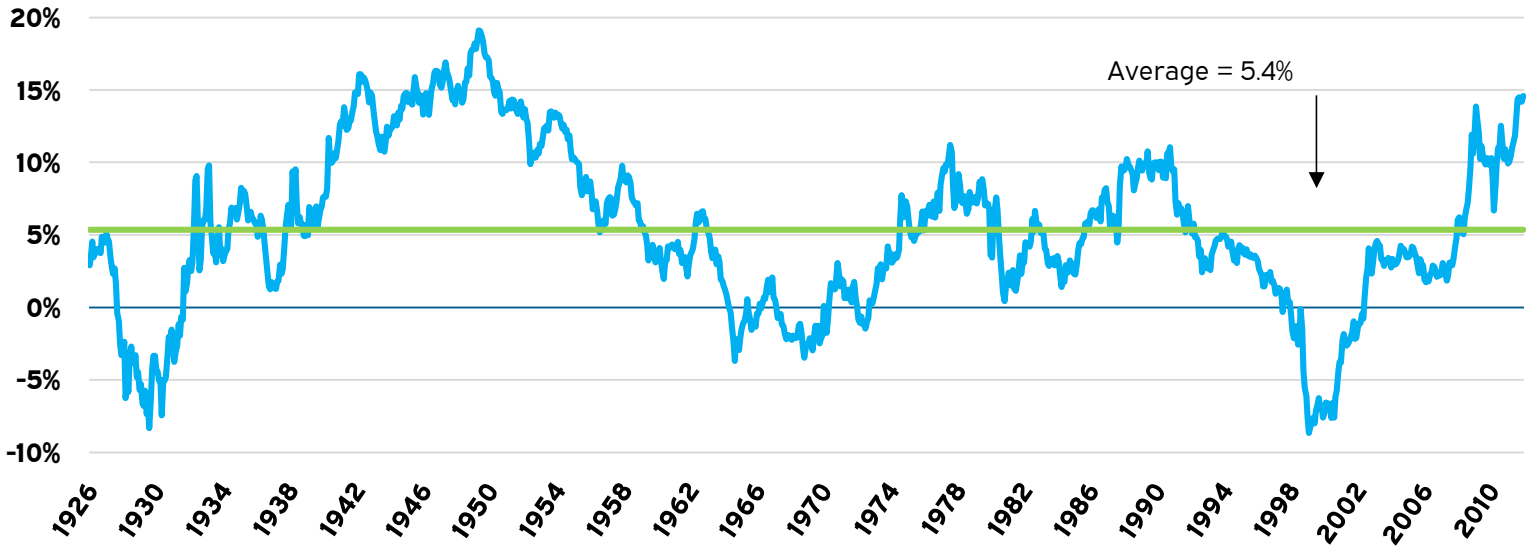
FAQs for 2023 (continued)

Is Meketa comfortable with the equity risk premium implied by the CMEs?

→ Yes. We assume a 5.5% risk premium for US equities over 10-year Treasuries.

→ Historically, the risk premium for the S&P 500 over the yield for the 10-year has averaged 5.4%.

Equity Risk Premia over 10-year Treasury[1]



[1] Represents the ten-year risk premium for the S&P 500 index over the 10-year Treasury yield at the start of the period.

FAQs for 2023 (continued)

Is Meketa assuming that interest rates will go up?

→ We use the market's projections for future rates, based on what was priced in at the time of our analysis.

→ For example, the market is projecting that the ten-year Treasury will be yielding approximately 4.2% in ten years, versus 3.8% as of 12/31/22.

→ By contrast, the FOMC is expecting the Fed Funds Rate to fall to ~3% by 2025, implying a return to a more normally shaped yield curve.

Is the yield curve you imply steeper than recent history?

→ Our 20-year model implies a spread between cash and the 10-year Treasury of 150 bp.

→ This is a much steeper yield curve than currently exists, but it consistent with history.

- The yield on the 10-year Treasury has averaged 150 bp over that for T-bills since 1934.

FAQs for 2023 (cont.)

How does Meketa arrive at its inflation assumption? Is it based on a combination of breakeven rates and other data?

→ Most of our economic projections come from the IMF's World Economic Outlook. Their inflation projections are in the table below.

- They are projecting elevated inflation for the US in 2023, followed benign levels thereafter.

→ We combine the five-year average for the US with the 5-year-5 inflation swap (i.e., what the market is projecting 5-year inflation will be five years from now), which is 2.6%, to arrive at our 10-year number of 2.5%.

Inflation Estimates

	2023	2024	2025	2026	2027	5-Year Average	5-yr-5 Inflation Swap	10-year Inflation Estimate
US	3.5	2.2	2.0	2.0	2.0	2.4	2.6	2.5
Euro Area	6.8	3.0	2.3	2.0	2.0	3.2	2.4	2.8
UK	9.0	3.7	1.8	2.0	2.0	3.7	3.6	2.4
Japan	1.4	1.0	1.0	1.0	1.0	1.1	0.8	0.7

Sources: IMF World Economic Outlook, October 2022; Bloomberg.

FAQs for 2023 (continued)

If 20-year US inflation is expected to be 2.6%, and the real yield on 20-year TIPS is 1.5%, shouldn't the expected return for long TIPS be closer to 4.1% than 4.7%?

→ Arguably, it is only our 10-year inflation number that matters, as it flows through the models for several asset classes, while the 20-year inflation forecast does not. This includes our TIPS models. Hence it is possible for there to be a disconnect for the 20-year horizon.

→ It is not uncommon to see modest disconnects between economists' projections, the swap market, and the breakeven inflation rate (BEI).

Why do put/write expected returns decline along with higher equity prices (i.e., declines in equity expected returns)?

→ It makes intuitive sense that as expected returns for equities decline, the E(R) for options based on those equities also declines (else you could get a much better risk-adjusted return from the options).

Why do US Equities imply a positive mean reversion when adjusting for rates?

→ US equities have a lower implied discount rate. This increases the present value of future earnings. And current pricing is much closer to historical averages than it was a year ago.

FAQs for 2023 (continued)

Why did the spread for private equity over public equity shrink?

→ Valuations moved down more quickly and to a greater extent for public equities (e.g., PE ratios) than they did for private equity (e.g., EBITDA multiples).

→ Of note, the private equity data (as always) is through 9/30.

- It is possible that buyout multiples will "catch up" with public equity valuations in 2023, but this has not been the case historically.

How does Meketa look at valuations for venture capital?

→ Venture capital tends to be focused on a smaller part of the broad economy, concentrating mostly on a few sectors such as technology and healthcare.

→ To get a feel for how VC is currently priced, we create a proxy composed of public market indices that focus on these sectors.

→ The proxy is currently composed of: NASDAQ; Pharma, Biotech & Life Sciences; IT Services; and Clean Tech/Environment. The composition and weightings have changed over time.

→ That said, we take our VC model with a large grain of salt, as there is very little data available.

FAQs for 2023 (continued)

What effect do we expect net buybacks to have, if any?

→ We believe US companies will continue to be net buyers of their shares over the next decade, but to a lesser extent than they have for the past decade. This will be a net tailwind.

→ We expect other markets to be net issuers of shares (i.e., this will be dilutive to shareholder wealth). This is most pronounced in emerging markets, due to their anticipated growth.

Do we still expect US earnings to grow faster than the broad economy?

→ Yes, until/unless there is a structural shift, perhaps due to political events, US companies are likely to earn a greater share of economic growth than they have over the post-WWII era.

What about the political climate in China and the direction taken by the CCP?

→ While the possibility of greater state intervention was always possible, the CCP has made abundant use of their power to influence/harm certain sectors or companies in 2021 and 2022.

→ As a result, we are placing a greater discount on Chinese (and hence, emerging market) growth translating to EPS growth and thus to shareholder wealth.

FAQs for 2023 (continued)

Why do we believe US companies will be net buyers of their stock for an extended period, and why does that matter?

→ There are several reasons why we can/should believe US companies will be net buyers of their stock for an extended period (e.g., the next ten years), and why that may change.

→ First, it would be a continuation of a nearly two-decade trend that CFOs have decided it is in their interest to prioritize buybacks over dividends or other uses of cash.

- This could obviously change, but the catalyst for this is not obvious nor apparently on the horizon.

→ The second factor is if labor finally starts clawing back a larger portion of GDP.

- This clearly could happen, but despite an incredibly tight labor market, it is not happening (at least not yet). Rather, companies have had success passing on their higher labor costs to their customers and hence maintaining their profitability.

→ This matters in our models because it impacts what portion of GDP growth translates to EPS growth.

- If companies are more profitable and they are buying back shares, this will be much more beneficial to EPS than if companies are less profitable and are diluting their shares (e.g., via new issuance).

FAQs for 2023 (continued)

For public NR, earnings look much stronger than they have in some time and valuations appear low. Why is our expected return not higher?

→ Public NR is probably the asset/sector where there is the greatest dispersion in thinking/forecasting about the future, due to the energy transition.

→ NR stock have always been cyclical, and they are enjoying their best relative performance in a long time. We mute our expectations due to the cyclicality of the sector.

Do we consider inflation when building expected returns for real assets like real estate, infrastructure, and natural resources?

→ Yes, inflation is a component for the vast majority of these assets, and their growth is generally linked to inflation in our models.

How are you accounting for the distinctly non-linear return profile of Long Vol?

→ We assume that the payoff of a long vol strategy is significantly and positively skewed during periods of poor equity market returns.

- In particular, we analyze the historical distribution of returns during periods when equity markets increase or decrease by 10%.

→ However, the average return in most years is driven by the effective "insurance premium" investors pay for this strategy.

FAQs for 2023 (continued)

Why do longer duration fixed income assets have a higher 20-year versus 10-year expected return, while the reverse is the case for shorter duration bonds?

→ The majority of asset classes have a higher return assumption for the 20-year period due to the increase in the risk-free rate (recall that we use a risk premia approach for years 11-20).

→ This tends not to be the case for our shorter duration fixed income assets due to the return to a more normally shape yield curve over the next ten years that is implied by the model.

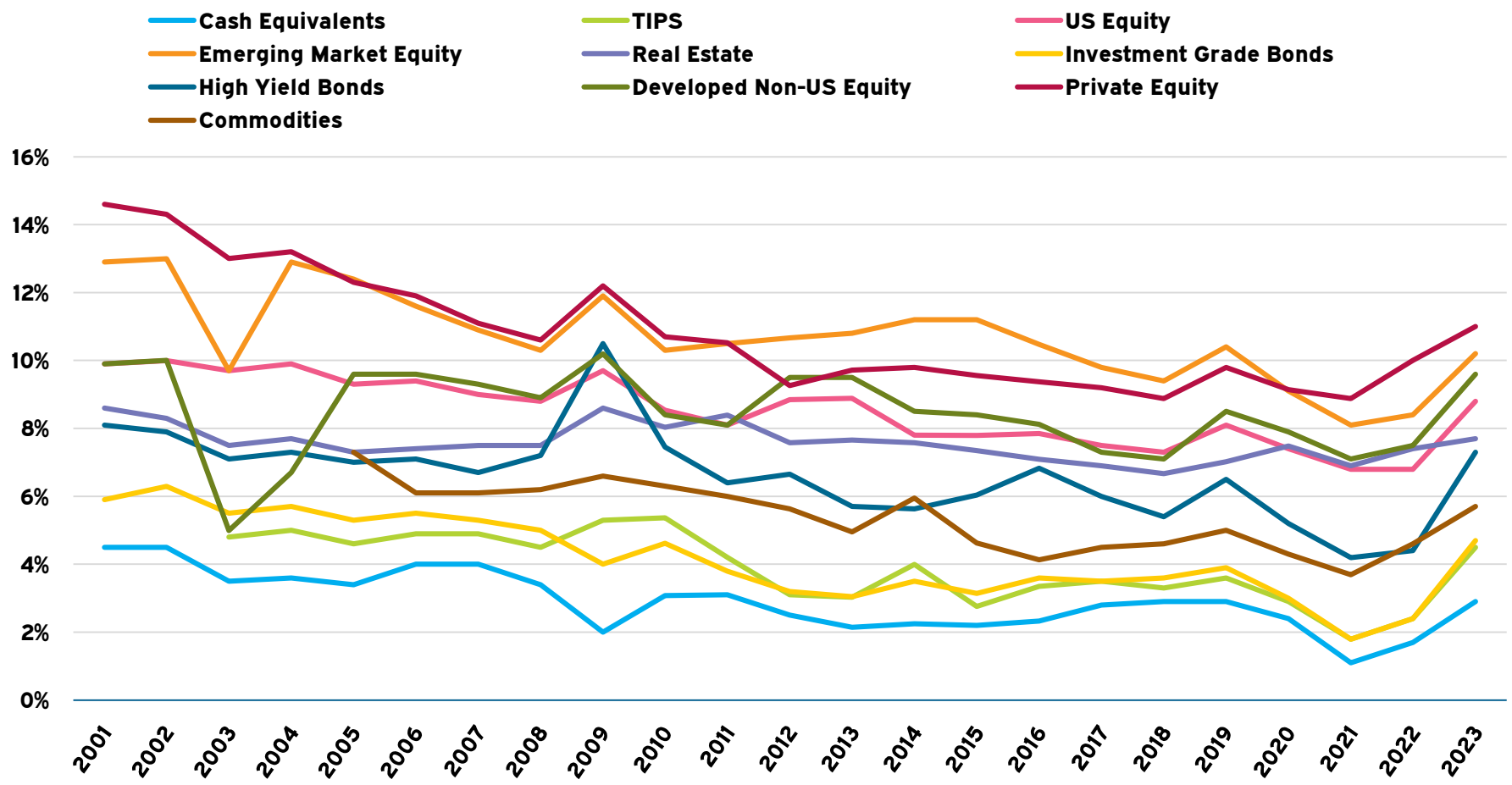
- That is, the higher risk premia we use for longer duration bonds implies a more normal term structure to the yield curve in years 11-20.

Why did the 10-year expected returns for private real estate decline while it went up for REITs?

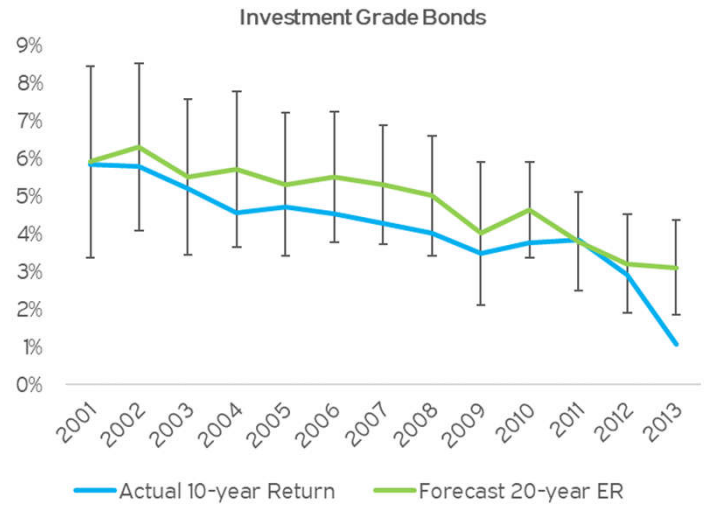
→ Cap rates and REIT yields have moved in opposite directions over the past year, such that REIT yields are now higher than (value-weighted) cap rates.

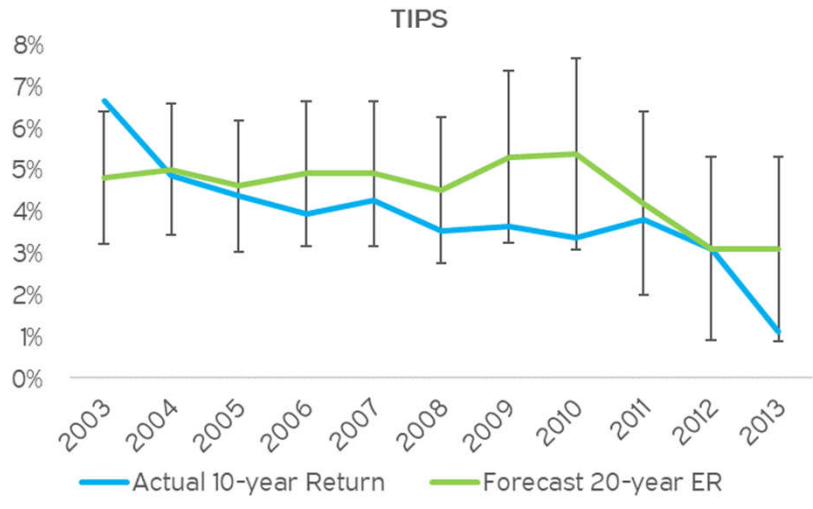
→ Cap rates are also well below the (new, higher) cost of borrowing, so leverage is barely helpful for core, and potentially harmful (in our model) for non-core where the cost of debt is even higher.

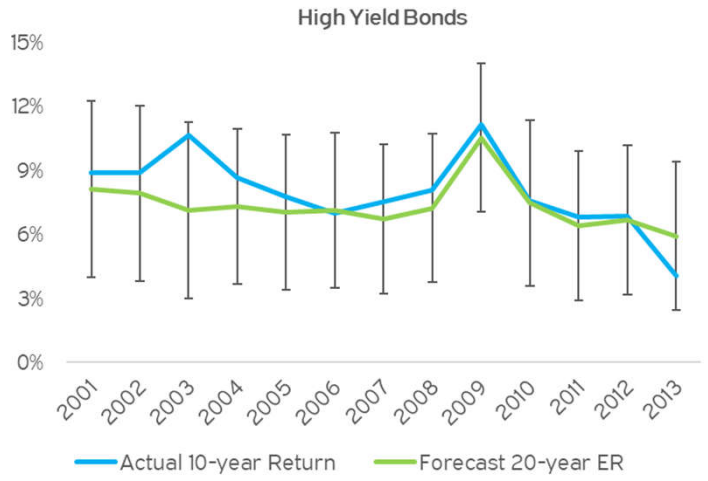
Our 20-year CMEs since 2000



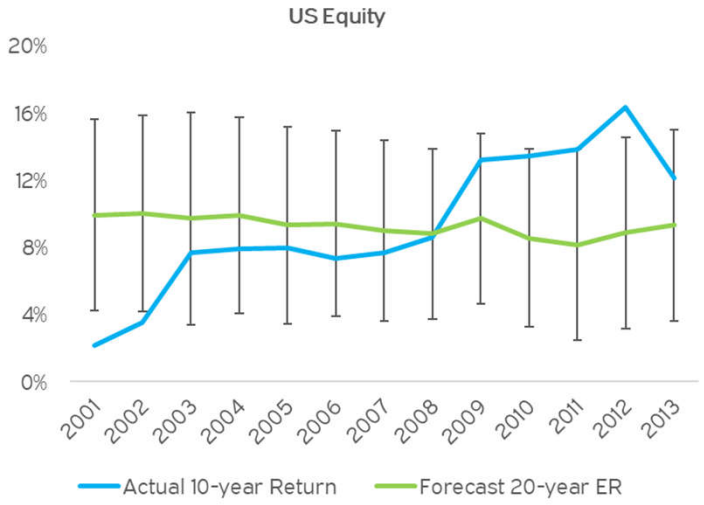
Our Track Record

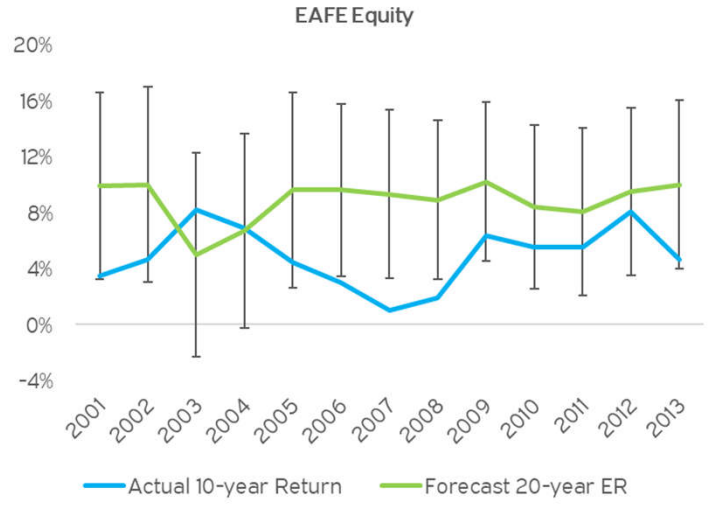


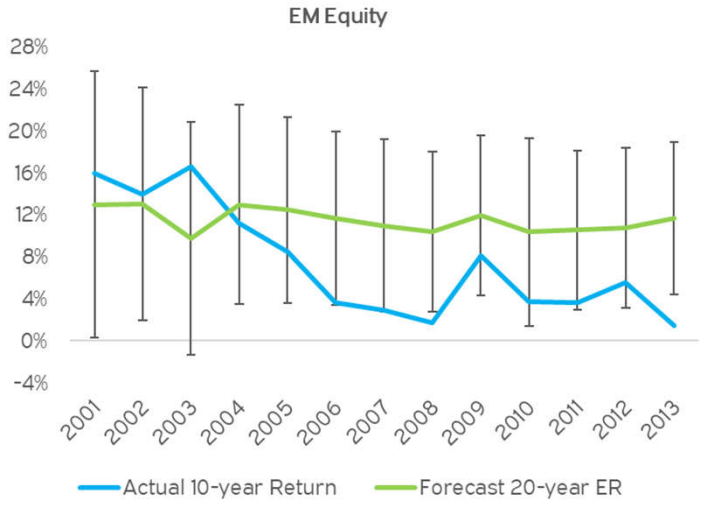




Our Track Record (continued)







Our Process

Setting Capital Market Expectations

→ Capital markets expectations (CMEs) are the inputs needed to determine the long-term risk and returns expectations for a portfolio.

- They serve as the starting point for determining asset allocation.

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

- Our results are published in January and based on data as of December 31 for public markets and September 30 for private markets.
- Changes are driven by many factors, including interest rates, credit spreads, cap rates, and equity prices.

→ Setting CMEs involves crafting long-term forecasts for:

- Returns
- Standard Deviation
- Correlations (i.e., covariance)

→ Our process relies on both quantitative and qualitative methodologies.

Asset Class Definitions

→ We identify asset classes and strategies that are both investable and appropriate for the long-term allocation of funds.

→ Several considerations influence this process:

- Unique return behavior,
- Observable historical track record,
- A robust market,
- And client requests.

→ We then make forecasts for each asset class.

- We created inputs for 104 "asset classes" for our 2023 Capital Markets Expectations.

Building 10-year Forecasts

→ Our first step is to develop 10-year forecasts based on fundamental models.

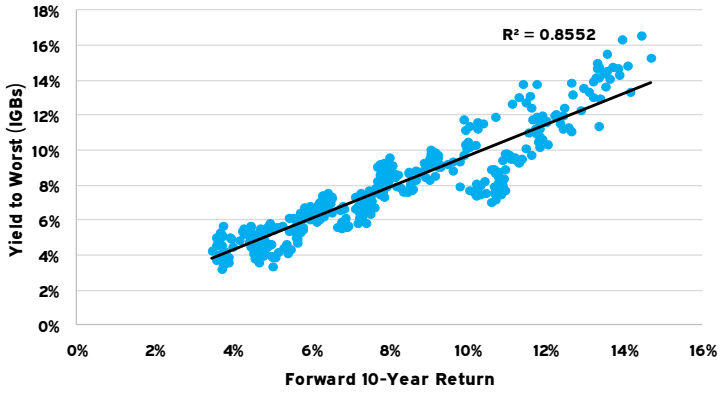
- Each model is based on the most important factors that drive returns for that asset class:

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

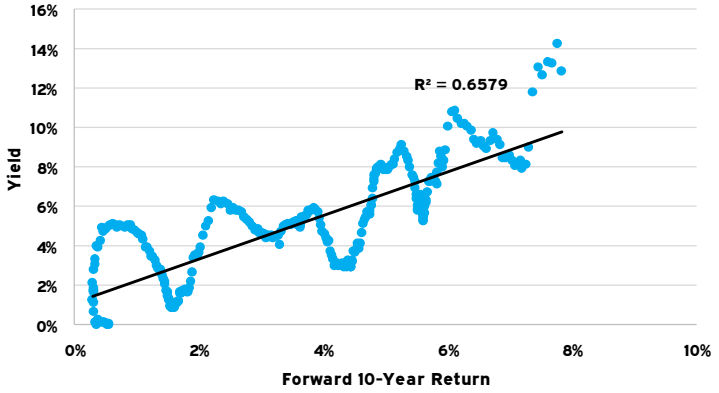
- The common components are income, growth, and valuation.

Some factors are naturally more predictive than others

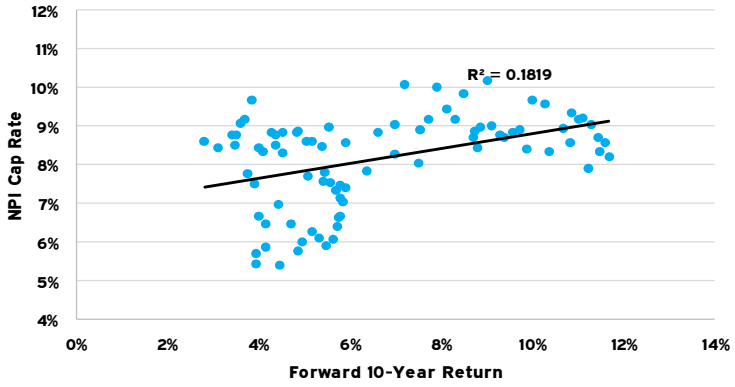
Investment Grade Bonds
Yield to Worst vs. Forward 10-Year Returns



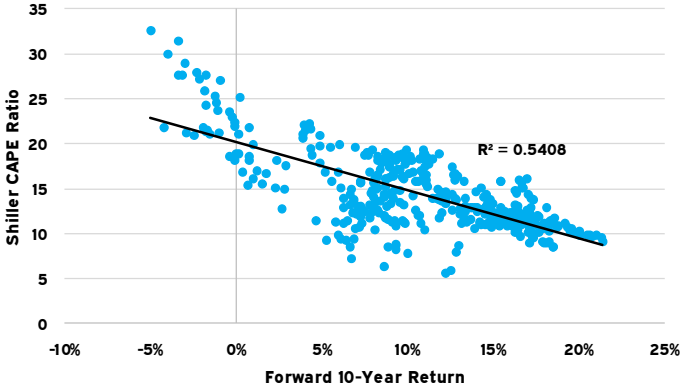
Cash (90-day T-Bill)
Yield vs. Forward 10-Year Returns



Core Real Estate
Cap Rates vs. Forward 10-Year Returns



US Equities
Shiller CAPE vs. Forward 10-Year Returns



Sources: Bloomberg, FRED, NCREIF, S&P, Robert Shiller (Yale University), and Meketa Investment Group.

10-year Model Example: Bonds

→ The short version for investment grade bond models is:

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

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

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

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

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

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

10-year Model Example: Equities

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

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

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

- Earnings growth is a function of Real GDP growth, inflation, and exposure to foreign revenue sources.
- We assume that long-term earnings growth is linked to regional economic growth.
- However, many factors can cause differences between economic growth and EPS growth.

→ Our models assume that there is a reversion toward mean pricing over this time frame.

Moving from 10-Year to 20-Year Forecasts

→ Our next step is to combine our 10-year forecasts with projections for years 11-20 for each asset class.

→ We use a risk premia approach to forecast 10-year returns in ten years (i.e., years 11-20).

- We start with an assumption (market informed, such as the 10-year forward rate) for what the risk-free rate will be in ten years,
- We then add a risk premia for each asset class.
- We use historical risk premia as a guide, but many asset classes will differ from this, especially if they have a shorter history.
- We seek consistency with finance theory (i.e., riskier assets will have a higher risk premia assumption).

→ Essentially, we assume mean-reversion over the first ten years (where appropriate), and consistency with CAPM thereafter.

→ The final step is to make any qualitative adjustments.

- The Investment Policy Committee reviews the output and may make adjustments.

Equities

→ We use a fundamental model for equities that combine 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)

$$US\ Equity\ E(R) = 1.8\% + [(1 + 5.4\%)\ x\ (1 + 0.6\%) - 1] = 7.8\%$$

→ 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.

Equities: Model[1]

→ To calculate the price return, we estimate the fair value of the index in ten years.

- We first calculate future Earnings Per Share (EPS) by compounding current EPS[1] at the projected earnings growth rate.
- We average the next ten years of projected EPS to arrive at an EPS 10.

Year	US	EAFE	EM	EAFE Sm	EM Small	Frontier
2023	219.6	158.0	84.1	17.7	92.7	53.0
2024	231.6	165.2	89.1	18.5	98.4	56.5
2025	244.2	172.7	94.4	19.2	104.4	60.2
2026	257.5	180.6	100.0	20.0	110.8	64.2
2027	271.5	188.9	106.0	20.8	117.6	68.4
2028	286.2	197.5	112.3	21.6	124.9	72.9
2029	301.8	206.5	119.0	22.5	132.5	77.6
2030	318.2	215.9	126.1	23.4	140.7	82.7
2031	335.5	225.7	133.6	24.3	149.3	88.2
2032	353.8	236.0	141.6	25.3	158.4	94.0
2033	373.0	246.8	150.0	26.3	168.2	100.1
Average EPS10 in 10 years	***297.3***	***203.6***	***117.2***	***22.2***	***130.5***	***76.5***

[1] We use As Reported trailing 12-month earnings for the S&P 500 and trailing 12-month earnings from MSCI for the non-US indices.

Equities: Model 1 (continued)

→ For projected earnings growth, we add expected real GDP and expected inflation to arrive at nominal GDP.[1]

- We assume that GDP growth is a close long-term proxy for earnings growth.
- We assume that the amount of economic growth that translates to EPS growth varies.[2]

	US	EAFE	EM	Frontier
% of Growth Translating to EPS	110%	90%	75%	65%

→ The model is based on the theory that a region's companies will grow at roughly the same rate as its economy, as defined by GDP, over the long term.

- We also adjust for the percentage of earnings that is derived from foreign countries.[3]

	Earnings from US	Earnings from EAFE	Earnings from EM	Earnings from Frontier
S&P 500	64.1%	17.4%	17.0%	1.5%
MSCI EAFE	20.6%	54.6%	22.7%	2.1%
MSCI Emerging Markets	10.8%	7.9%	80.0%	1.3%

[1] We constructed 5-year GDP based on the IMF World Economic Outlook as of October 2022 and Oxford Economics projections, and then use Oxford Economics projections for the remaining five years to arrive at a ten-year forecast for each. We constructed inflation projections based on the IMF World Economic Outlook as of October 2022, historical averages and 5-year Inflation swaps maturing 5 years from now where available (e.g., US, Euro Area, UK, and Japan).
[2] We believe the percentage of GDP growth translating to earnings growth varies due to net issuance, state intervention, etc.
[3] Source: MSCI Economic Exposure indices for USA, EAFE, Emerging Markets, and Frontier Markets as of December 31, 2022.

Equities: Model 1 (continued)

→ We multiply EPS10 by our projected PE10 ratio to arrive at a ten-year price target.

- We assume investors will pay slightly different ratios for earnings in different regions.[1]

$$US\ Price\ Target = 297.3 \times 25.9 = 7{,}702$$

→ We divide this future price by the current price and then annualize the price change.

$$US\ Price\ Return = (7702 \div 3840)\ \hat{}\ 1/10 - 1 = 7.2\%$$

→ We subtract the projected earnings growth[2] from the price change to arrive at the Multiplier Effect.

$$Multiplier\ Effect_{Model\ 1} = 7.2\% - 5.5\% = 1.7\%$$

[1] We assume that PE reverts 75% of the way back to its historical median. For the US, we use 25.0x, which is consistent with its median PE10 since 1990. We assume a lower PE10 for other regions that is consistent with their valuation relative to the US over the past two decades. Throughout this document, numbers may not sum due to rounding.

[2] Projected Earnings growth for Model 1 equals the US nominal GDP growth projection.

Equities: Model 2

→ To calculate the price return, we estimate the fair value of the index in ten years.

- We first calculate future EPS by multiplying current EPS by projected earnings growth.

$$US\ EPS = 219.6 \times (1 + 5.5\%) \wedge 10 = 375.1$$

- For projected earnings growth, we may use a subjective growth rate.
  - This rate can be slightly higher or lower than the historical average based on our assessment of whether we are nearer a peak or a trough in the earnings cycle.

→ We multiply EPS by our projected PE ratio[1] to arrive at a ten-year price target.[2]

$$US\ Price\ Target = 375.1 \times 17.7 = 6{,}648$$

→ We divide this future price by the current price and then annualize the price change.

$$US\ Price\ Return = (6648 \div 3840) \wedge 1/10 - 1 = 5.6\%$$

→ We subtract the projected earnings growth[3] from the US Price return to arrive at the Multiplier Effect.

$$Multiplier\ Effect_{Model\ 2} = 5.6\% - 5.5\% = -0.1\%$$

[1] For the US, we use a historical PE (trailing twelve months) of 17.8x which is consistent with its median since 2008. We assume a lower PE for other regions that is consistent with their valuation relative to the US over this common period.
[2] Throughout this document, numbers may not sum due to rounding.
[3] Projected Earnings growth for Model 2 equals an assumed rate of 5.5% for the US, 4.5% for EAFE, and 5.7% for EM.

Equities: Model 3

→ Our third equity model uses a form of the dividend discount model (DDM).

→ This is based on the premise that low rates drive up valuations when discounting future cash flows (or earnings).

→ First, we figure out what the implied cost of equity (i.e., discount rate) has been historically.

- This is based on historical interest rates, growth rates, and prices.

→ We then turn that into a "premium" over government bond rates that can be applied to the current level of (real) interest rates to arrive at a new discount rate.

→ This can be used to calculate a present value for the market using the DDM.

Equities: Model 3 (continued)

→ To calculate fair value, we use the Dividend Discount Model.

$$Fair\ Value = E \times (1 + G) \div (D - G)$$

- For earnings (E), we use EPS10
- For the growth rate (G), we use our projected earnings growth rate
- For the discount rate (D), we use a rate implied by the projected real rate, the historical discount rate, and the historical real rate[1]

US Implied Discount Rate = 0.0% + 11.3% - 2.3% = 9.0%

→ The fair value can be calculated as:

$$Fair\ Value = 133.4 \times (1 + 5.4\%) \div (9.0\% - 5.4\%) = 3{,}965$$

→ We find the difference between fair value and current value, and we assume reversion to fair value is achieved over a ten-year period.

$$Multiplier\ Effect_{Model\ 3} = [1 + (3965 - 3840) \div 3840]\ \wedge\ (1/10) - 1 = 0.3\%$$

[1] The historical discount rate is calculated based on historical valuations, earnings, and growth rates.

Currency Effect

→ For non-US equities, we calculate an adjustment for the expected impact of currency movements.

- We use a three-factor model that weights 40% on PPP theory, 30% on IRP theory, and 30% on current account differential theory.
  - PPP posits that money will flow to the currency with lower cost of goods and services[1]
  - IRP posits that money will flow to the currency with the lower interest rate[2]
  - Current account differential posits that money will flow to the currency with the lower current account deficit[3]

Market	Expected Inflation (%)	PPP Impact (%)	Interest Rates (%)	IRP Impact (%)	Current Account Impact (%)	Net Effect (%)	Adjusted Net Effect[4] (%)
EAFE	2.4	3.0	2.3	-2.3	2.0	1.1	1.0
EM	4.8	5.7	5.1	0.5	2.4	3.2	1.0
US	2.5	NA	4.6	NA	NA	NA	NA

[1] Sources for PPP data: World Bank (PPP Conversion Factor) and The Economist (Big Mac Index).
[2] We use the central bank discount rate or equivalent for the major countries of each region (source: FRED). Due to lack of data for frontier markets, we used yield-to-worst on longer-term bonds and then adjusted the yield down subjectively (to adjust for term structure).
[3] We use the differential between each region's current account as a % of global trade (source: FRED & The World Fact Book)
[4] We cap the currency adjustment at +/- 1% per annum, given the unpredictable nature of currency markets.

Equities: US Mid, Small & Micro

→ The models are similar to that used for the overall equity model.

→ To calculate the price return, we estimate the fair value of the index in ten years. We do this using both price-earnings and price-book ratios.

→ We calculate future EPS by looking at a similar ratio of historical earnings growth for each index vs. the R1k.

- We assume earnings will grow 1.1x faster for midcap, 1.15x faster for small cap, and 1.2x faster for microcap (this is subjective yet fairly consistent with their respective relationships since 1978).
- We multiply EPS by our projected PE ratio[1] to arrive at a ten-year price target.

→ We take a similar approach for price-book, comparing current ratios to historical ratios.

- Price-book can be particularly helpful for small and micro cap, as short-term earnings volatility can distort PE comparisons.

→ We divide the future price by the current price and then annualize the price change.

→ We add the price change to the dividend yield to arrive at the expected return.

[1] For the US, we use the median PE (trailing twelve months) for the longest available period. For the Russell Top 200, this was 19.0x. We assume a higher PE for mid, small, and micro that is consistent with their historical valuations relative to large cap. We assume reversion 75% back toward the median.

Bonds

→ The short version for most investment grade bond models is: E(R) = current YTW.

→ 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; for example, if rates rise, 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.

Bonds (continued)

→ 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	1.27	0.21	3.00	3.00
Loss Rate	50	50	50	50	50	50	40

- As a guide, we use Moody's historical global default & recovery data for each bucket as it is currently rated.
  - Example: EM Debt local currency (based on the Bloomberg EM Local Currency Govt Universal index):

Rating	Weighting	Default Rate	Weighted Default
Aaa	13.4%	0.06%	0.01%
Aa	61.4%	0.09%	0.06%
Baa	17.5%	0.27%	0.05%
Ba	6.9%	1.06%	0.07%
B	0.7%	3.40%	0.02%
Total Weighted Average Default Rate:			**0.21%**

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

Private Credit

→ For direct lending & asset based lending (formerly specialty finance), we use a building blocks approach that is based on income and loss thereof.

- For income, we make an estimate based on our private credit team's assessment of what the current average coupon rate is.
- We add an upfront fee (paid by the borrower) or original issue discount if applicable.
  - This usually ranges between 1% and 3%.
- We incorporate default & recovery rates.
  - We use a default rate and recovery rate roughly the same as for bank loans.
  - These are subjective, as no long-term data exists on private credit defaults.
- We add leverage (more applicable in direct lending) and subtract the cost of borrowing.
- We add an equity kicker (more applicable in asset based lending), adjusted for defaults.
  - Managers expect 2.5% to 5% return from warrants, co-invests or other equity structures.
- We subtract management fees and carried interest.

Private Credit (continued)

→ For Special Situations Lending, we use a combination of models for capital solutions and more traditional distressed debt.

- The capital solutions model resembles that for direct lending, but with higher equity kickers, coupons, and default rates.
- The distressed debt model resembles that for public high yield bonds and is based on data for the Bloomberg US CCC and Ca-D indices.
  - It uses a much high default rate than high yield bonds (the historical rate is approximately 30%).
- We subtract management fees and carried interest.

→ For aggregate private credit, we take a weighted average based on a mix of the broad opportunity set and a typical client allocation to private debt.

Component	Weight (%)	E(R) (%)
Direct Lending	50	8.5
Asset Based Lending	20	9.4
Special Situations	30	10.8
Private Debt Composite		9.4

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.[1]

→ 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 fees.

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

→ We also look at how valuations (through September 30) compared to price changes for public markets.

[1] Sources: Cambridge Associates, S&P LCD.

Private Equity (continued)

→ 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.

Real Estate

→ For Core Real Estate (RE), we used two models.

- The first model adds a premium to the Cap Rate[1].
  - Core RE has historically returned approximately 1.2% 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.

→ For High Yield Real Estate Debt, we used our high yield bond model.

- Data is sparse on default rates and spreads.
  - We use the same default rate as high yield bonds.
  - We use the YTW on the Bloomberg CMBS BBB index and then add a "high yield" spread on top of this.
  - We adjust for leverage, borrowing costs, and fees.

[1] Source: NCREIF.

Real Estate (continued)

→ For Non-Core Real Estate, we start with historical premiums versus core RE.

- This includes the effect of greater control, development, buying at distress, etc.

→ We add a non-US component (e.g., premium for lower cap rates) and a currency effect.

- We assume 20% to 40% of non-core commitments will be ex-US (majority in Europe).

→ We lever the portfolio and then subtract the cost of borrowing.

- Value-added leverage ranges 50-70% while opportunistic ranges 60-80%.
- The cost of debt is higher for value added than core, and higher still for opportunistic.

→ Finally, we subtract management fees and carried interest.

Real Estate (continued)

→ For REITs, we focus on historical pricing and yields.

- We first look at current REIT Yields.[1]
  - REITs have historically returned 2.7% more than their yield at the start of the period over the subsequent ten years.
- We next look at spreads versus Treasuries and Baa corporates.
  - REITs have yielded 1.8% more than 5-year Treasuries since 1990.
  - REITs have historically yielded 1.1% less than Baa corporate bonds since 1990.
- We also looked at the price change required for REITS to return to the average REIT yield spread implied in 5 years.

REIT Yield (%)	Price Change implied by spread vs 5-year Treasury Yield (%)	Price Change implied by spread vs Baa Yield (%)
4.2	-5.0	7.4

- We average the impact of these pricing factors and then add this to income and income growth.

[1] Source: FTSE NAREIT.

Real Estate (continued)

→ To arrive at the aggregate RE assumption, we took a weighted average of our expectations for each of the five components.

- These reflect the weights of a typical client portfolio.

Component	Weight (%)	E(R) (%)
REITs	10	6.4
Core Private RE	45	4.3
Value-added RE	20	6.5
Opportunistic RE	20	7.6
High Yield RE Debt	5	10.0
Aggregate Real Estate		**5.9**

Infrastructure

→ For public IS, we first take the weighted average of the regional public equity expected returns.

Region	Weighting (%)	Weighted E(R) (%)
US	39	3.1
Developed	24	2.4
EM	37	3.7
Weighted Equity E(R):		**9.3**

→ We then look at the P-E and P-B ratios of the various public IS indices vs. the global equity market to derive a signal as to how discounted or expensive IS stocks may be.[1]

- We assume some reversion in pricing to half the difference between the two.

	MSCI P-E	MSCI P-B	S&P P-E	DJB P-E
Price Adjustment	-4.2	17.2	-24.5	-39.5

→ Finally, we add the average of the price adjustments (per annum) to the expected equity return to arrive at our preliminary expected return for public IS.

$$E(R) = 9.3\% - 1.3\% = 8.0\%$$

[1] We used the MSCI World Infrastructure, S&P Global Infrastructure, DJ Brookfield Global Infrastructure, and MSCI World indices. Throughout this document, numbers may not sum due to rounding.

Infrastructure (continued)

→ For private infrastructure, our model combines income and capital appreciation.

→ For income, we used our best estimate of expected yield.

- Assume a range of 4-6% for core and 2-4% for non-core.

→ We assume asset prices keep up with inflation and/or GDP growth.

- We use inflation for core IS and GDP for non-core, since the latter is more economically sensitive.

→ We then make a qualitative judgment based on our infrastructure team's assessment of current market pricing.

- There is a paucity of publicly available data on pricing for private infrastructure.

→ We add a control premium for non-core IS (as these more closely resemble buyouts).

→ We lever the portfolios and then subtract the cost of borrowing.

- Core levered at 1.8:1, non-core at 1.7:1
- Cost of debt for non-core is similar to buyouts, while the cost for core is slightly lower.

→ Finally, we add any currency effect and subtract management fees and carry.

Natural Resources

→ For public Natural Resources (NR), we take the weighted average of the regional public equity expected returns.

Region	Weighting (%)	Weighted E(R) (%)
US/Canada	50	3.9
Developed	40	4.0
EM	10	1.1
Expected Equity Return:		**6.2**

→ We then look at the P-E, P-B and EV/EBITDA ratios of two NR indices vs. the global and US equity markets and average them to derive a signal as to how discounted or expensive NR stocks may be and assume reversion in pricing between the two.[1]

Price Adjustment	P-E	EBITDA	P-B
S&P Global NR vs. S&P Global BMI	63.8%	61.2%	18.5%
S&P North American NR vs S&P 500	42.3%	51.3%	33..4%

→ Finally, we add the price adjustment (per annum) to the expected equity return to arrive at our preliminary expected return for public NR.

[1] We used the trailing 12-month P-E ratio for the S&P Global Natural Resource and S&P Global BMI indices and the S&P NA Natural Resources and S&P 500, respectively. We assume reversion to half of the historical difference. Throughout this document, numbers may not sum due to rounding.

Natural Resources (continued)

→ Most "private" mining partnerships consist of investments in "junior" mining stocks.

- We again take the weighted average of the regional public equity markets & mining stocks.
  - We use a 50/50 split between USA/Canada and Australia.
- We then look at the P-E, P-B and EV/EBITDA ratios of the indices vs. their own history and their local market to derive a signal as to how discounted or expensive mining stocks may be.

	Current PE	Avg. PE	Current P-B	Avg. P-B	Current EV/EBITDA	Avg. EV/EBITDA
MSCI Australia Small Met/ Min	9.2	13.4	2.5	2.3	4.9	6.1
S&P TSX Div. Met /Min	7.6	26.7	1.3	0.9	4.6	6.6

- We add a control premium (as these resemble buyouts) and subtract fees & carry.

→ For energy, we use a similar approach.

- We again take the weighted average of the regional public equity returns.
  - 80% in US/Canada, 15% EAFE, and 5% EM
- We then look at the relative pricing of large and small cap energy stocks.
- We add a control premium (and subtract management fees & carry).

Natural Resources (continued)

→ For Timberland, we combine land pricing with income potential.

→ We examine the average price per acre of timberland transactions since 1995, excluding the highest and lowest numbers for each year[1].

- We then adjust these prices for inflation and derive a long-term average.

Current Price/Acre	Inflation-Adjusted Average	Price Adjustment
$1,250	$1,601	14%

- We assume that prices move halfway back toward their historical inflation-adjusted average.

→ We assume that property values grow in the future at the rate of inflation.

→ We assume that real income will be consistent with its trailing 5-year average of 0.1% and then add this to our inflation assumption to arrive at expected income.

→ We add a non-US component (premium for lower cap rates) and a currency effect.

- We assume ~25% of commitments will be ex-US (e.g., Latin America and Australasia).

→ We lever the portfolio at 1.15:1 and then subtract the cost of borrowing.

→ Finally, we subtract management fees and carried interest.

[1] Source: RISI.

Natural Resources (continued)

→ For Farmland, we use essentially the same model as Timberland.

→ We looked at the average price per acre of farmland and cropland[1].

- We then adjusted these prices for inflation and derived a long-term average.

	Current Price/Acre ($)	Inflation-Adjusted Average ($)	Price Adjustment (%)
Farmland	3,800	2,280	-24
Cropland	5,050	3,615	-12

- We assume that prices move halfway back toward their historical inflation-adjusted average.

→ We again assume that property values grow in the future at the rate of inflation.

→ We assume that real income will be consistent with its trailing 5-year average of 1.0% and then add this to our inflation assumption to arrive at expected income.

→ We add a non-US component (premium for lower cap rates) and a currency effect.

- We assume ~25% of commitments will be ex-US (e.g., Latin America and Australasia).

→ We lever the portfolio at 1.4:1 and then subtract the cost of borrowing.

→ Finally, we subtract management fees and carried interest.

[1] Source: RISI and USDA. Farmland includes dwellings on properties as well as pastureland.

Natural Resources (continued)

→ To arrive at the aggregate NR assumption, we take a weighted average of our expectations for each of the five components.

Component	Weight (%)	E(R) (%)
Timberland	5	5.7
Farmland	10	3.9
Sustainability	20	9.2
Energy	50	9.3
Mining	15	9.8
Aggregate Private NR		**8.6**

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

Commodities

→ For a traditional (or naïve) portfolio, we use the following model:

$$E(R) = Collateral\ Yield + Roll\ Return + Spot\ Return + Diversification\ Return$$

$$E(R) = 3.1\% + 0.3\% + 0.8\% + 2.1\% = 6.3\%$$

- The collateral yield represents our expected return from cash.
- The roll return should vary based on how backwardated or contagoed the market is
  - However, this state could change quickly, so our assumption is anchored near zero
- For the spot return, we use the market's expectation for inflation minus average productivity growth for advanced economies.
- The diversification return is the result of regular rebalancing between commodity futures.
  - The diversification return rises as the average variance of the securities in a portfolio rises, as the average correlation in the portfolio falls and as the number of securities in the portfolio rises.
  - However, we use a lower than historical number (2.1%) since correlations among commodities have risen since the academic research was originally conducted.[1]

[1] De Chiara and Raab (2002) document a 2.8% diversification return for the rebalanced Dow Jones AIG Commodities index during the time period 1991 to 2001. Gorton and Rouwenhorst suggest a diversification return of between 3.0% and 4.5% for an equally-weighted basket of commodity futures.

Commodities (continued)

→ In addition, we have models for several more complex strategies, specifically risk parity and real return.

→ For Commodities Risk Parity, we use a strategy with a target volatility of 15%.

- The basic inputs are the same as for a naïve portfolio, except we assume a higher diversification return (2.6%) as risk parity strategies tend to be better diversified than the broad index.
- We lever the portfolio at 1.5:1, which is in line with the average for managers using this strategy.
- We then subtract the cost of borrowing as well as management fees (as there is no passive option).

→ For Commodities Real Return, we use a "portable alpha" approach.

- We add the return of TIPS on top of the return for the naïve commodities portfolio.
- We then subtract the cost of borrowing as well as management fees.

Hedge Funds

→ To construct the hedge fund models, we use a variety of traditional and alternative betas:

- Traditional betas:
  - Equities, distressed debt, credit, commodities, bonds
- Alternative betas:
  - Carry trade, convert arb, currency, momentum

→ We also add leverage (where appropriate) and subtract the cost of debt and fees.

→ For example, our long-short equity model is fairly straight forward.

- We assume the average fund is 50-60% net long and has an equivalent beta to the global stock market.
- We multiply this beta times our expected return for global equities, then add this to our cash expected return for the portion that is not invested.

$$\text{Gross } \mathrm{E}(R) = 0.6 * 8.8\% + 0.4 * 3.1\% = 6.5\%$$

- We then subtract management fees and carried interest to arrive at a net return.

Hedge Funds (continued)

→ To arrive at the aggregate Hedge Fund assumption, we take a weighted average of our expectations for each of six components.

→ The weightings are occasionally revised based on the approximate allocation of each category in the broad hedge fund universe.

Component	Weight (%)	E(R) (%)
Long-Short	32	4.2
Event-Driven	11	7.7
Global Macro	16	5.2
CTAs	7	3.9
Fixed Income/L-S Credit	24	6.3
Relative Value/Arbitrage	10	6.2
Aggregate Hedge Funds (net)		**5.4**

Throughout this document, numbers may not sum due to rounding

Alternative Risk Premia

→ We model Alternative Risk Premia (ARP) using a build-up method of individual premia which assumes a 1/3rd risk weighting to single stock premia and 2/3rd risk weighting to macro asset class premia.

- Single stock premia is modeled with an equal risk weight to value, cross-sectional momentum, and defensive risk premia.
- Macro asset class premia is modeled with an equal risk weight to equity indices, fixed income indices, currencies, and commodities.
  - Each asset class has an equal weight to value, carry, and momentum risk premia.

→ We use conservative estimates for the Sharpe ratios for individual premia that are approximately one-third that of 10-year global equity risk premia.

→ Correlation assumptions across the premia are also adjusted to be more conservative, particularly for those premia that historically have had significant negative correlations.

→ The target volatility is assumed to be 10%, which is in-line with core manager offerings.

→ We subtract management / transaction fees (of 100 basis points) as there is no passive option.

Risk Parity

→ To build our model we used the five most common risk parity betas.

- We weight each factor such that their contribution to risk (volatility) is equal.
- This requires optimization (due to correlations being less than one).

→ We leverage the group (at 1.4:1) such that the aggregate standard deviation is at the target (10%).

Component	Weight (%)	Contribution to Levered E(R) (%)	Std Dev (%)
Equities	14	1.6	18
Credit	27	2.3	9
Commodities	14	1.2	17
Currencies	20	0.9	12
Interest Rates	24	1.5	10
Aggregate Risk Parity (gross)		**7.5**	

→ We subtract management fees (of 50 basis points) as there is no passive option.

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Tactical Asset Allocation

→ To build our model, we use a compilation of many common traditional betas.

- The weightings reflect a rough average of the Tactical Asset Allocation (TAA) managers employed by our clients.

Component	Weight (%)	E(R) (%)
US Equities	25	7.8
EAFE Equities	15	10.1
EM Equities	10	10.3
Commodities	5	6.3
Cash	5	3.1
Investment Grade Bonds	15	4.8
EM Debt	10	6.7 & 6.4
High Yield	5	8.0
TIPS	10	4.3
Aggregate TAA (gross)		**6.3**

→ We subtract management fees (of 70 basis points) as there is no passive option.

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Digital Currencies

→ This model is quite different than our others, as cryptocurrencies do not derive value from income, some future stream of cash flows, or a risk premium.

→ The model assumes that cryptocurrencies garner their value from taking advantage of speculative asset pricing.

→ Using the price and volume of bitcoin, we create two sets of expected buy and sell values for two pricing bubbles based on two separate selling behaviors.

- We consider a possibility whereby speculative behavior during a bubble is beneficial as well as a possibility where it is harmful.

→ These expected gains and losses are averaged and spread across ten years to create the 10-year horizon assumption.

The Other Inputs: Standard Deviation and Correlation

→ Standard deviation:

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

Asset Class	Historical Standard Deviation (%)	Skewness	Assumption (%)
Bank Loans	7.4	-2.6	10.0
FI/L-S Credit	6.5	-2.5	9.0

- We also adjust for private market asset classes with "smoothed" return streams.

→ Correlation:

- We use trailing fifteen-year correlations as our guide.
- Again, we make adjustments for "smoothed" return streams.

→ Most of our adjustments are conservative in nature (i.e., they increase the standard deviation and correlation).

Summary Data

Return and Risk Data

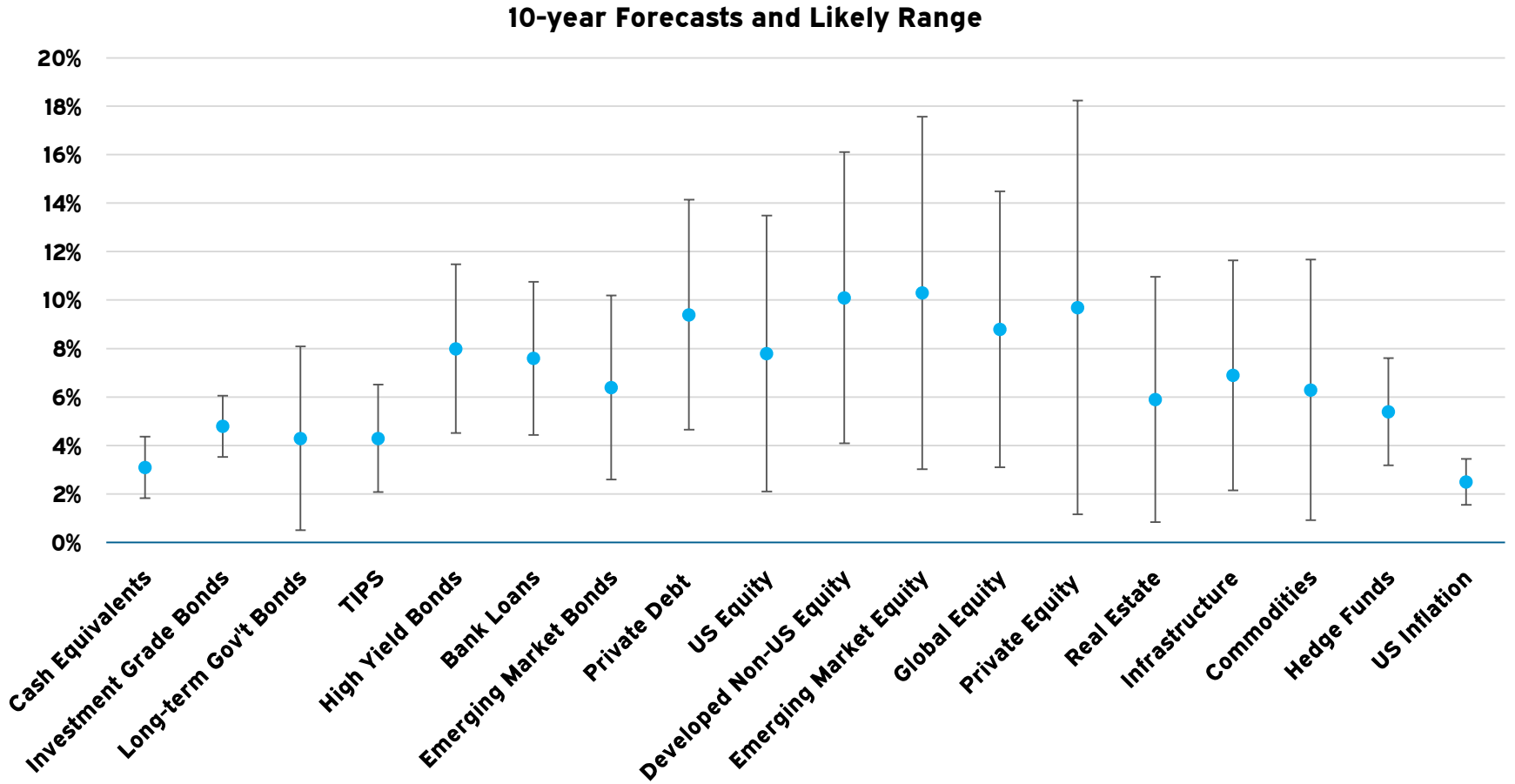
Asset Class	10-year Expected Return (%)	20-year Expected Return (%)	Standard Deviation (%)	11-20 year Risk Premia[1] (%)
Cash Equivalents	3.1	2.9	1.0	-1.5
Investment Grade Bonds	4.8	4.7	4.0	0.4
Long-term Government Bonds	4.3	5.0	12.0	1.5
TIPS	4.3	4.5	7.0	0.5
High Yield Bonds	8.0	7.3	11.0	2.5
Bank Loans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

[1] Risk Premia are calculated relative to the market's projection for the yield on the 10-year Treasury in ten years..

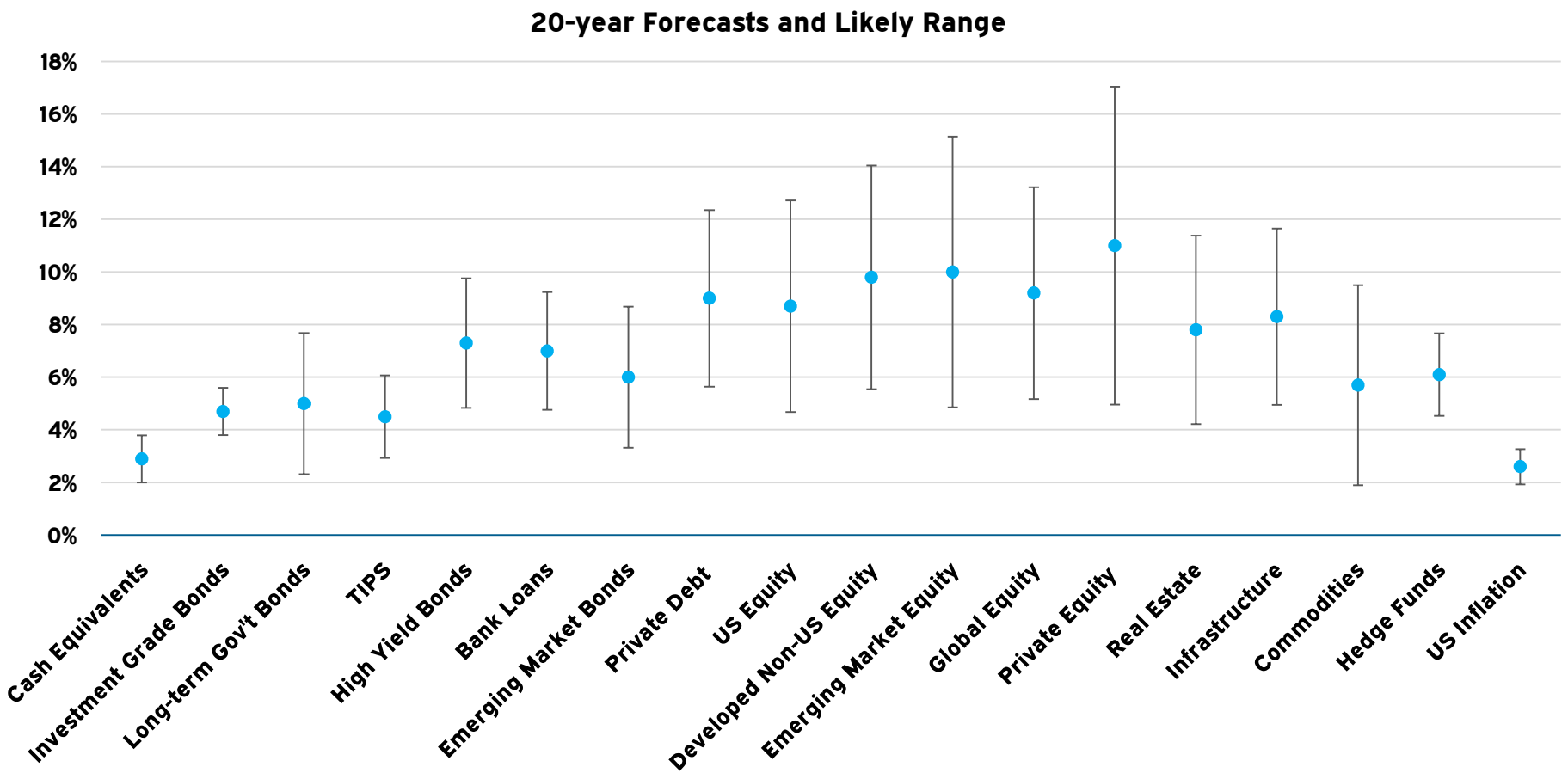
Correlation Data

	Inv. Grade Bonds	Long-term Gov't Bonds	TIPS	High Yield Bonds	US Equity	Dev. Non-US Equity	Em. Market Equity	Private Equity	Real Estate	Commod.	Infra.	Hedge Funds
Investment Grade Bonds	1.00											
Long-term Government Bonds	0.83	1.00										
TIPS	0.76	0.54	1.00									
High Yield Bonds	0.28	-0.17	0.46	1.00								
US Equity	0.10	-0.24	0.27	0.75	1.00							
Developed Non-US Equity	0.16	-0.22	0.30	0.77	0.89	1.00						
Emerging Market Equity	0.20	-0.18	0.36	0.76	0.77	0.87	1.00					
Private Equity	0.00	-0.10	0.05	0.70	0.85	0.80	0.75	1.00				
Real Estate	0.20	0.05	0.10	0.50	0.50	0.45	0.40	0.45	1.00			
Commodities	0.00	-0.28	0.31	0.54	0.52	0.59	0.63	0.30	0.15	1.00		
Infrastructure	0.29	0.09	0.31	0.64	0.63	0.65	0.58	0.50	0.57	0.41	1.00	
Hedge Funds	0.08	-0.30	0.30	0.78	0.86	0.87	0.84	0.60	0.45	0.67	0.65	1.00

10-Year Return Expectations



20-Year Return Expectations



2022 Peer Survey

→ Annually, Horizon Actuarial Services, LLC publishes a survey of capital market assumptions that they collect from various investment advisors.[1]

→ The Horizon survey is a useful tool to determine whether a consultant's expectations for returns (and risk) are reasonable.

Asset Class	Horizon 10-Year Average (%)	Meketa 10-Year (%)	Horizon 20-Year Average (%)	Meketa 20-Year (%)
Cash Equivalents	1.5	1.1	2.0	1.7
TIPS	2.0	1.6	2.6	2.4
US Core Bonds	2.6	1.7	3.5	2.4
US High Yield Bonds	4.0	3.3	5.0	4.4
Emerging Market Debt	4.6	4.3	5.3	4.4
Private Debt	6.9	6.7	7.1	7.3
US Equity (large cap)	5.9	5.4	6.5	6.8
Developed Non-US Equity	6.5	6.7	7.1	7.5
Emerging Non-US Equity	7.3	8.1	7.9	8.4
Private Equity	9.2	8.9	9.8	10.0
Real Estate	5.4	6.4	6.0	7.4
Infrastructure	6.4	7.1	6.9	7.7
Commodities	3.7	4.3	4.2	4.6
Hedge Funds	4.8	3.4	5.5	4.4
Inflation	2.5	2.6	2.4	2.2

[1] The 10-year horizon included all 40 respondents, and the 20-year horizon included 24 respondents. Figures are based on Meketa's 2022 CMEs.

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