MEKETA
INVESTMENT GROUP

Meketa Investment Group

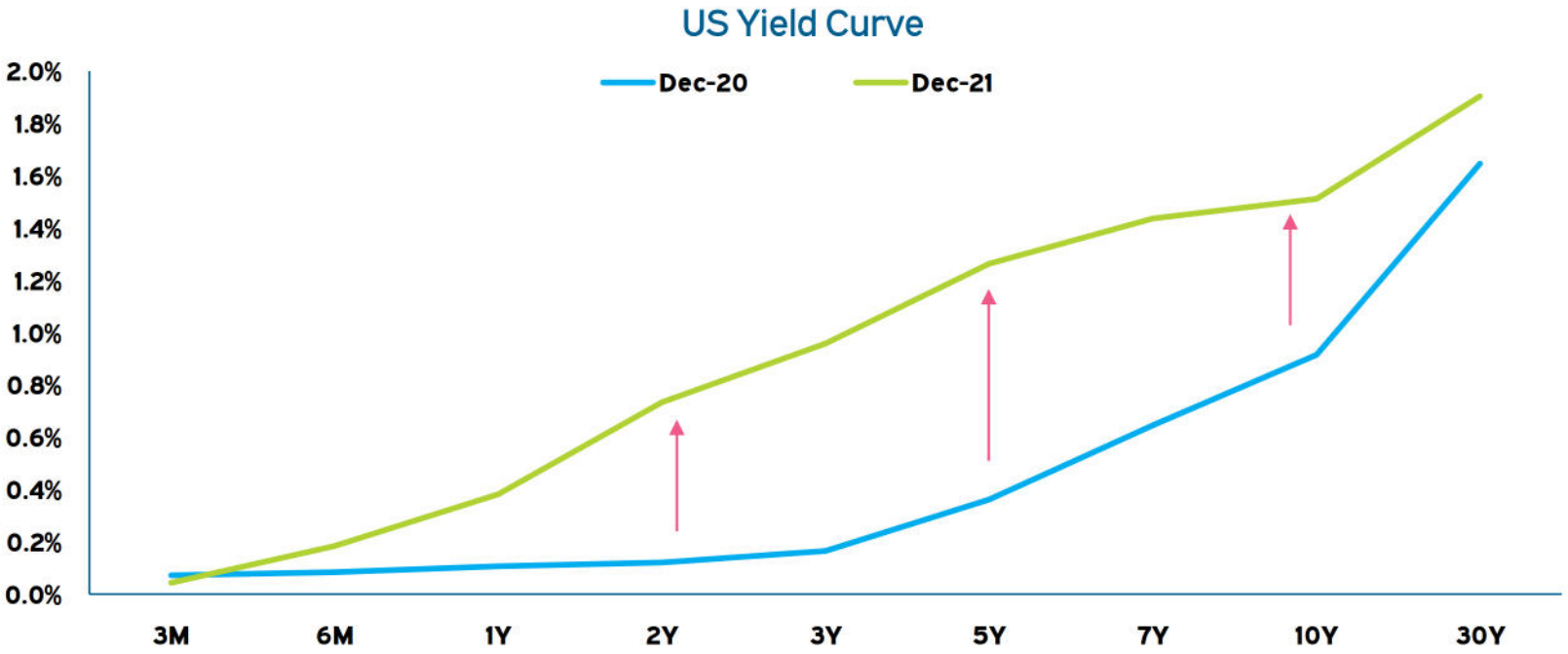
2022 Capital Markets Expectations

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.
- Many investors achieved returns in 2021 that were above their target return.
  - Much of the strong performance was driven by an increase in prices for most risk assets.
- Bond yields increased in 2021, which has an upward impact on our CMEs.
  - However, this was offset by tightening credit spreads for many fixed income assets.
- Moreover, higher rates are being priced into future bond yields.
  - This has a meaningful positive impact on our long-term CMEs.
  - As a result, our 20-year expected returns increased, on average.
- That said, some of these same factors (e.g., higher valuations and future rate increases) will serve as headwinds over the next decade.
  - Absent significant growth and only modest increases in rates, this will be a damper on future returns, especially in relationship to those realized during the post-GFC period.
  - Hence our 10-year CMEs are lower than our 20-year CMEs.

Rising Interest Rates

- The US Treasury yield curve steepened during 2021, as concerns about inflation battled with the demand for safe-haven assets (e.g., Treasuries) and Federal Reserve polices designed to maintain low rates (e.g., the quantitative easing program).
- The increase in rates manifested itself at the middle and longer end of the curve.

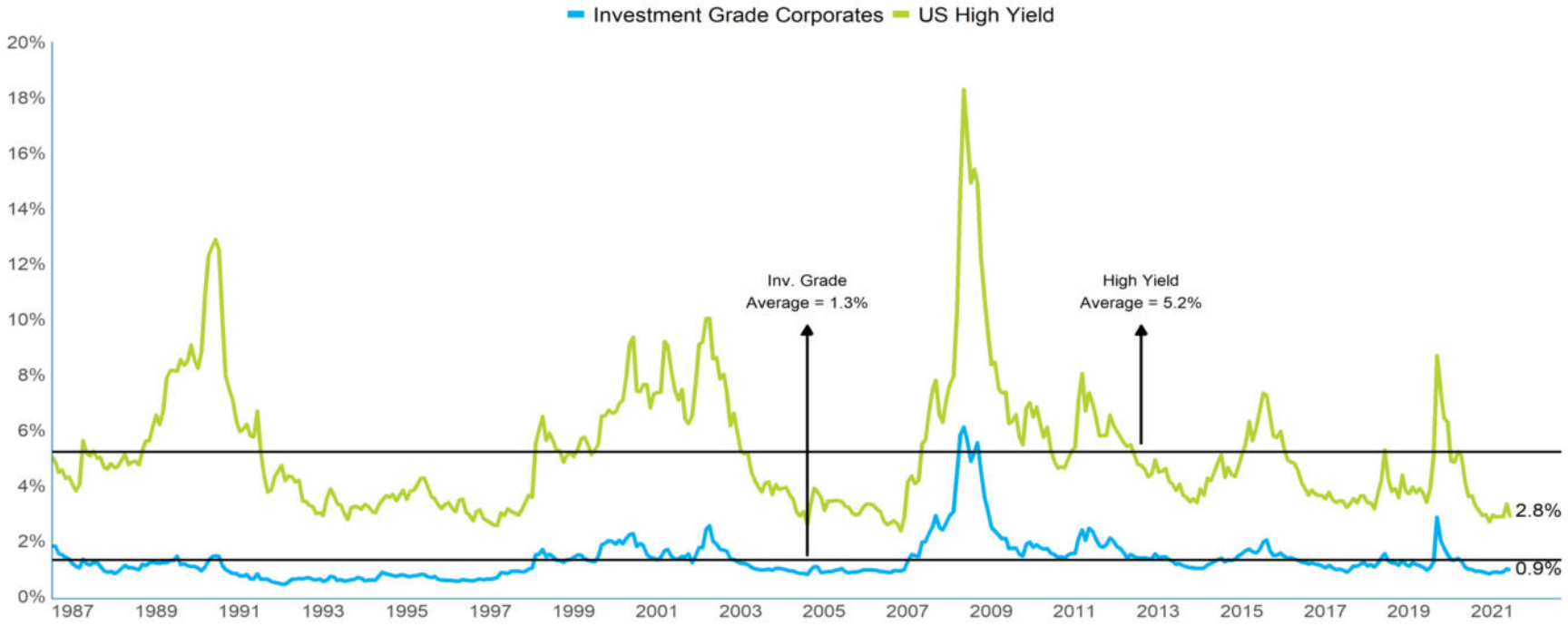


Source: Bloomberg. Data is as of December 31, 2021.

Tighter Credit Spreads

- A combination of policy support (by the Fed) and the search for yield pushed spreads even further below their long-term averages in 2021.
  - The spread for high yield bonds went from 359 bp to 283 bp.

Credit Spreads



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, 2021.

Rising Rates = Higher Yields

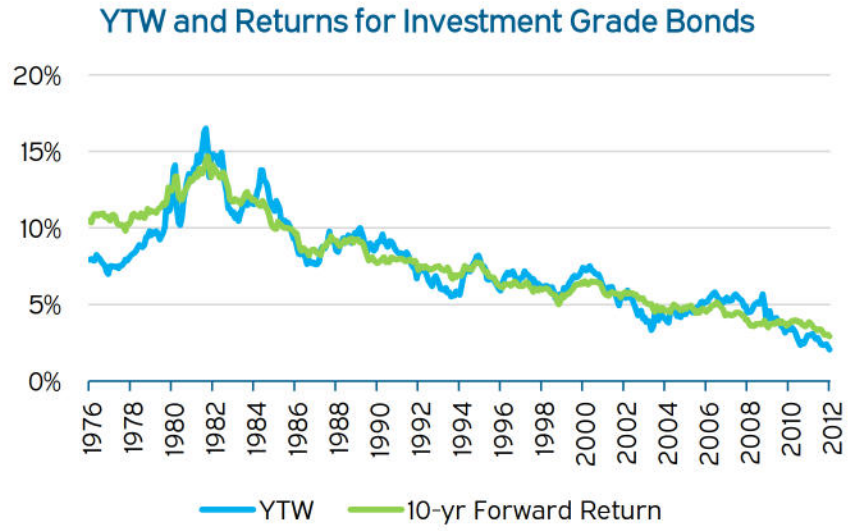
- Rising interest rates more than offset the tightening of credit spreads to result in higher yields across every major sector of the global bond market.

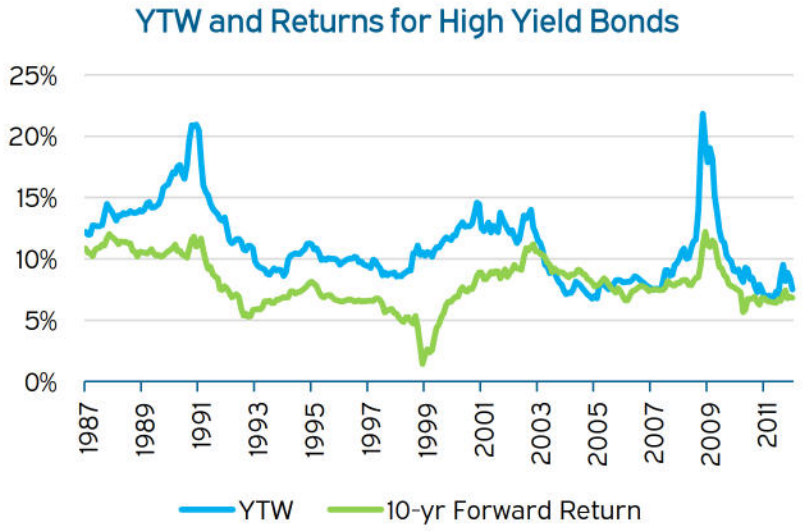
Index	Yield to Worst 12/31/21 (%)	Yield to Worst 12/31/20 (%)
Fed Funds Rate	0.1	0.1
10-year Treasury	1.51	0.91
Bloomberg Aggregate	1.75	1.12
Bloomberg Corporate	2.33	1.74
Bloomberg Securitized	1.98	1.25
Bloomberg Global Aggregate	1.31	0.83
Bloomberg EM Local Currency Government	3.83	3.20
Bloomberg EM Hard Currency Aggregate	3.96	3.20
Bloomberg US Corporate High Yield	4.21	4.18

Source: Bloomberg. Data is as of December 31, 2021 and 2020.

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.





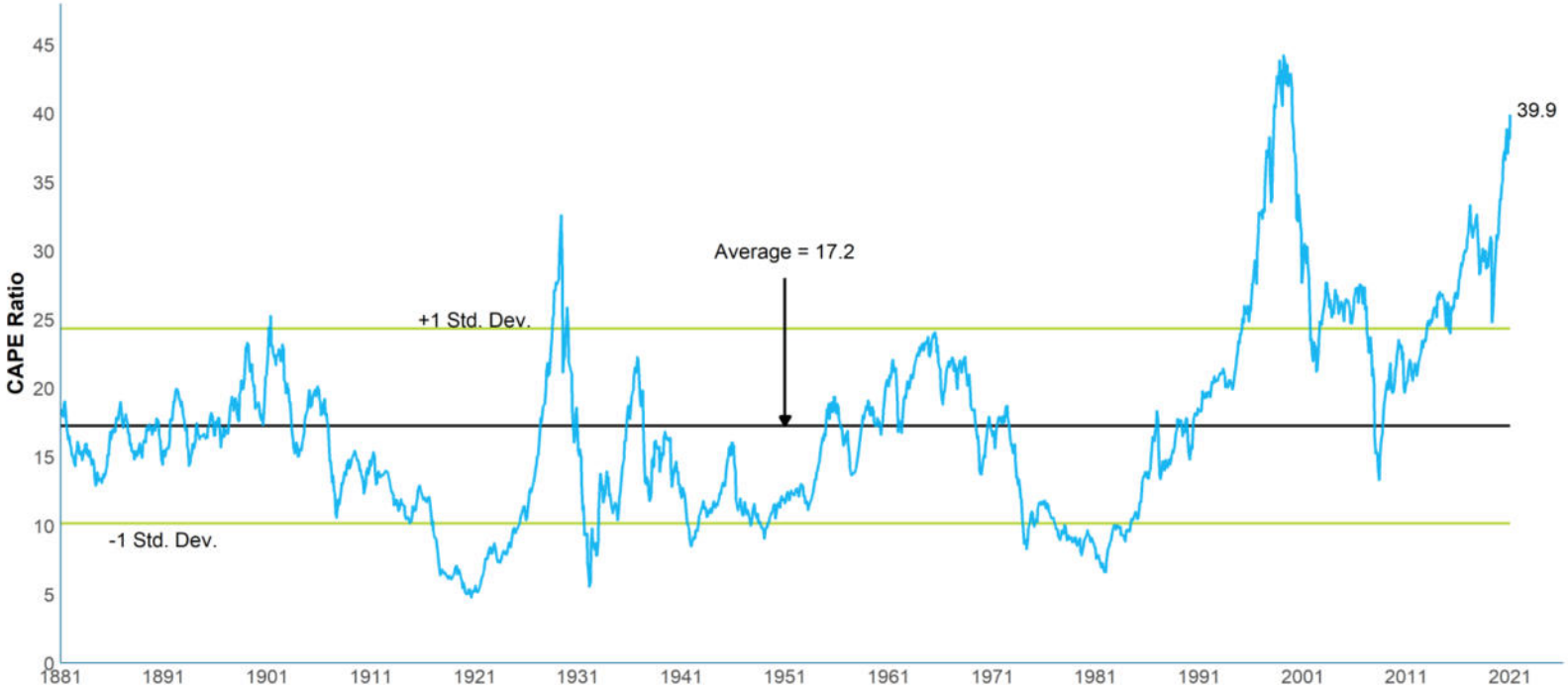
[1] When predicting returns for bonds, default risk should also be taken into account. For example, defaults are why the return for high yield bonds have generally been below the starting yield.

Source: Bloomberg Aggregate and Bloomberg High yield indices. Data is as of December 31, 2021.

Higher Prices for Equities

- US stocks had a very good year, with the S&P 500 index producing a 28.7% gain.
- Valuations are approaching the peak last seen during the dot.com bubble.

US Equity Cyclically Adjusted P/E



[1] US Equity Cyclically Adjusted P/E on S&P 500 Index. Source: Robert Shiller, Yale University, and Meketa Investment Group. Data is as of December 31, 2021.

Higher Prices in Non-US Equities, too

- EAFE equities had a solid 2021, gaining 11.3%.
- EAFE equities are now at their highest valuation since just prior to the GFC.

Developed International Equity Cyclically Adjusted P/E

[1] 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, 2021.

Lower Prices in Emerging Market Equities

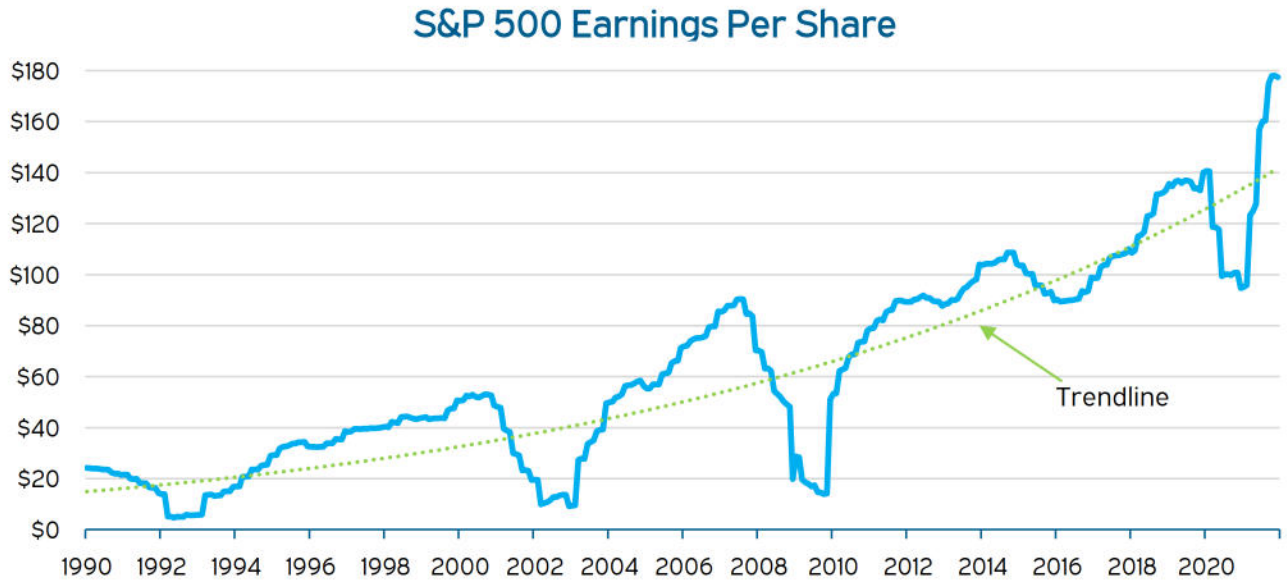
- Driven by a substantial downturn in Chinese equities (-21.7%), emerging market equities finished the year slightly negative.
- As a result, PE ratios fell back below their long-term average.

Emerging Market Equity Cyclically Adjusted P/E

[1] 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, 2021.

Earnings Growth

- It was an amazing year for the S&P 500, which set a new earnings record
  - EPS rebounded from $95 to $177 (representing an 87% increase), well above the previous earnings trend



Source: S&P 500 Index data from Bloomberg. Represents trailing 12-month "as reported" earnings per share. Data is as of December 31, 2021.

The Link between Economic Growth and Expected Returns

- We have long assumed that earnings growth is linked to economic growth
  - However, one can exceed the other (and vice versa)

1948 - 2019[1]	
Nominal GDP Growth P.A.	Corporate Earnings Growth P.A.
6.4%	6.5%

- Net issuance vs buybacks affects EPS
  - In the US, net shareholder buybacks have resulted in EPS growing faster than earnings
- 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
- 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 SOEs, state-controlled enterprises, and direct intervention by the state (see China, 2021)
  - Corruption, graft, nepotism, lack of property rights or clear rule of law, can all affect the link between economic growth and earning growth

[1] Source: Federal Reserve Economic Data. Corporate earnings defined as Corporate Profits After Tax (without IVA and CCAdj).

Earnings Growth

- EPS has grown faster than earnings in the US in recent years, acting as a tailwind.
- This is 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	$1,578 bil / 10.3 mil shares
= $150.3 per share	= $153.2 per share

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

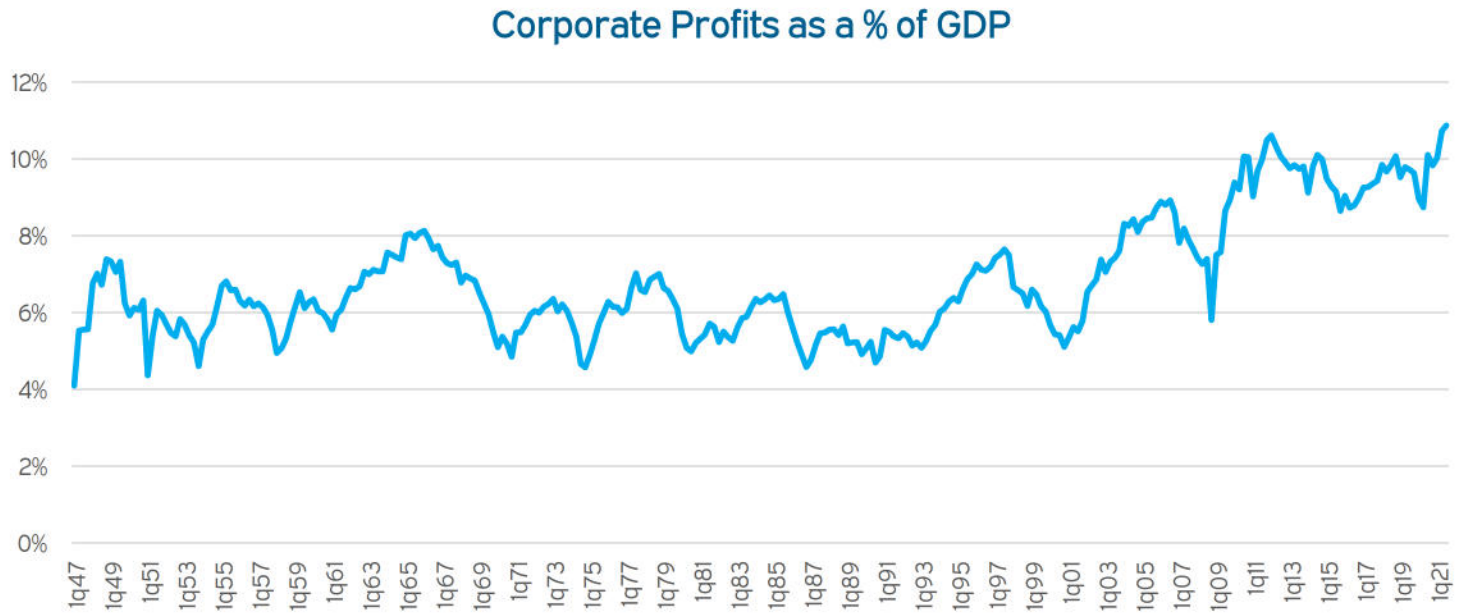
EPS with 2% reduction in shares for ten years
$1,578 bil / 8.6 mil shares
= $183.9 per share

- Data show that this trend is almost two decades long.[2]
- 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.
[2] Source: Yardeni research

Profitability

- The strength in earnings is linked to profits consuming a greater proportion of the economic pie.
  - Prior to 2000, corporate profits averaged 6.1% of GDP.
  - Since 2000, they have averaged 8.6% of GDP.
- 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 3q2021.

Impact of Interest Rates on Equity Prices

- Looking at Price-Earnings (or PE10, or PB) ratios alone results in most equity markets looking historically expensive.
- It is unclear how much of an impact low interest rates are having in supporting these elevated valuations and whether they will continue to provide that support if rates remain low.
- Low rates drive up valuations when discounting future cash flows (or earnings).
  - This is based on the time value of money concept.
- One way analysts quantify this is by using what's known as the dividend discount model (DDM).
  - The bond market's current (lower) interest rates can be used to calculate a present value for the stock market using the DDM.
- Using this approach, developed market equities do not look quite as expensive.

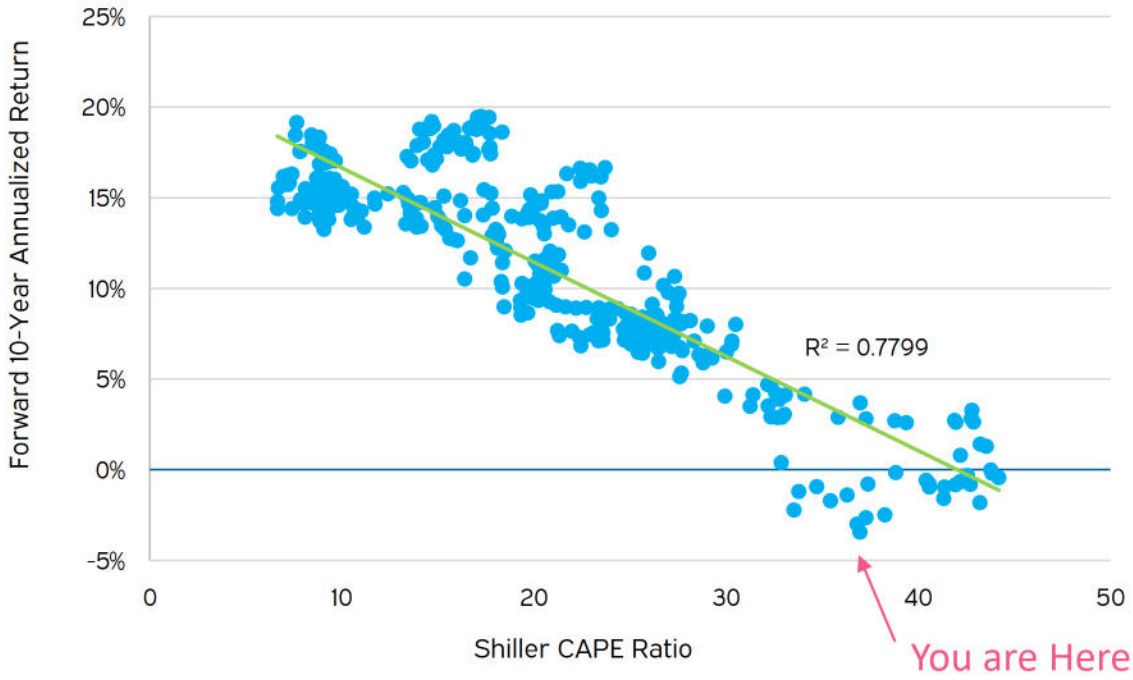
Correction in Prices Needed to Return to Historical Average

	US Equities (%)	EAFE Equities (%)	EM Equities (%)
Using PE10	-36.0	-23.9	-6.8
Adjusting for Rates	-9.7	-16.7	-23.3

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.

US Equities: Shiller CAPE vs. Forward 10-Year Returns

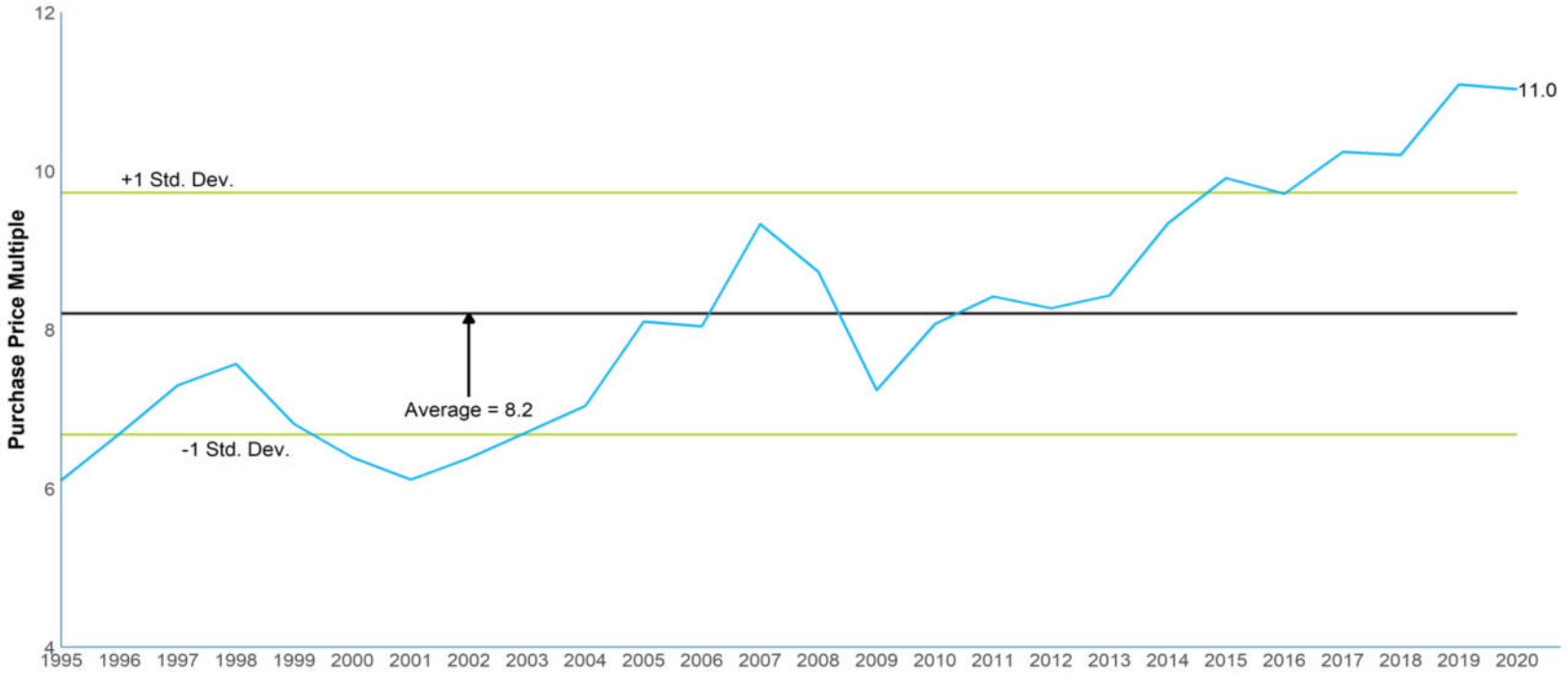


Source: Robert Shiller, Yale University, and Meketa Investment Group. Data is based on monthly returns and Cyclically Adjusted P/E ratio on S&P 500 Index for the period from January 1980 through December 2021.

Higher Prices in Private Equity, too

- EBITDA multiples are the closest proxy to a P-E ratio for private equity.
  - Like public markets, private markets have seen prices continue to climb to new highs.

Private Equity Multiples[1]

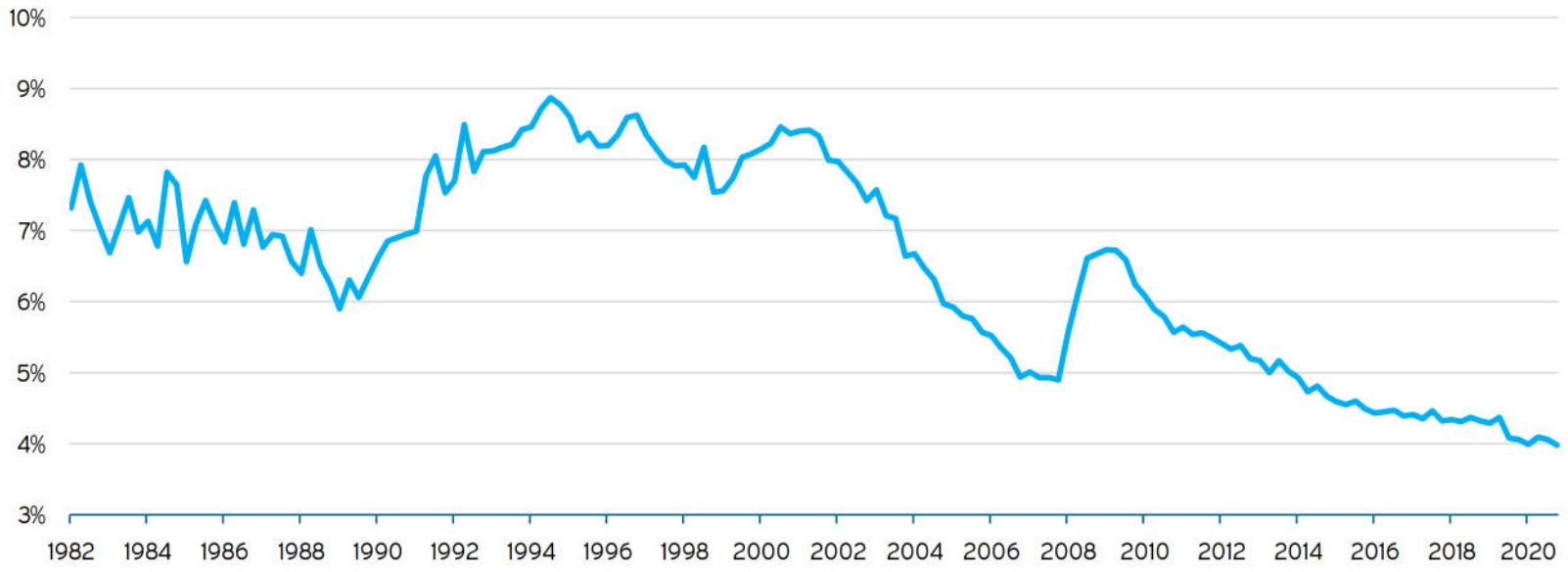


[1] Source: S&P LCD Average EBITDA Multiples Paid in All LBOs. Annual figures, except for 2021 (YTD), as of September 30, 2021.

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.
- While cap rates have been gradually declining for decades, they were relatively flat over the past year.

Core Real Estate Cap Rates[1]



[1] Source: NCREIF NPI value-weighted cap rates. As of September 30, 2021.

2022 Expected Returns and Changes from Prior Years

10-year Geometric Expected Returns
Rate Sensitive

	2022 E(R) (%)	2021 E(R) (%)	Δ From 2021 (%)	Notes
Cash Equivalents	1.1	0.7	0.4	higher future yields expected
Short-term Investment Grade Bonds	1.2	0.9	0.3	higher future yields
Investment Grade Bonds	1.7	1.2	0.5	higher yields
Intermediate Government Bonds	1.1	1.2	0.5	higher yields
Long-term Government Bonds	1.4	1.6	-0.2	higher yields offset by losses from future rate increases
Mortgage Backed Securities	1.9	1.2	0.7	higher yields
Investment Grade Corporate Bonds	2.3	1.5	0.8	higher yields
Long-term Corporate Bonds	2.7	2.0	0.7	higher yields
Short-term TIPS	1.3	1.0	0.3	higher inflation expectations
TIPS	1.6	1.2	0.4	higher inflation expectations & higher real yields
Long-term TIPS	2.1	1.9	0.2	higher inflation expectations
Global ILBs	1.3	1.2	0.1	higher yields
Foreign Bonds	1.9	1.5	0.4	higher yields
US Inflation	*2.6*	*2.3*	*0.3*	*Higher economist and market projections*

10-year Geometric Expected Returns
Credit

	2022 E(R) (%)	2021 E(R) (%)	Δ From 2021 (%)	Notes
High Yield Bonds	3.3	3.3	0.0	higher yields offset by tighter spreads
Higher Quality High Yield	3.0	3.1	-0.1	higher yields offset by tighter spreads
Bank Loans	2.7	3.5	-0.8	higher prices and tighter spreads
Collateralized Loan Obligations(CLOs)	4.2	4.2	0.0	higher prices/lower yields
Emerging Market Bonds (major)	3.6	3.5	0.1	higher yields
Emerging Market Bonds (local)	5.0	4.3	0.7	higher yields
Private Debt	6.7	6.6	0.1	higher yields
Direct Lending	6.5	6.3	0.2	higher yields
Specialty Finance	6.8	NA	NA	*New asset class*
Mezzanine Debt	6.7	6.8	-0.1	higher yields offset by tighter spreads
Distressed Debt	7.5	7.0	0.5	higher yields

10-year Geometric Expected Returns
Equities

	2022 E(R) (%)	2021 E(R) (%)	Δ From 2021 (%)	Notes
US Equity	5.4	5.2	0.2	higher earnings offset by higher prices
US Small Cap	6.3	5.9	0.4	
Developed Non-US Equity	6.7	6.7	0.0	lower earnings growth offset by lower prices
Dev. Non-US Small Cap	5.8	6.4	0.0	
Emerging Market Equity	8.1	7.5	0.6	lower earnings growth offset by lower prices & higher dividends
Emerging Market Small Cap	7.5	7.6	-0.1	
Frontier Market Equity	8.1	9.3	-0.9	lower earnings growth and higher prices
Global Equity	6.1	6.1	0.0	Changes in earnings offset by changes in prices
Low Volatility Equity	5.5	5.5	0.0	
Private Equity	8.9	8.0	0.9	
Buyouts	8.8	7.9	0.9	Higher earnings and multiples have not expanded as much as public markets
Growth Equity	9.0	NA	NA	*New asset class*
Venture Capital	9.1	8.1	1.0	Higher earnings and pricing has not expanded as much as public markets

10-year Geometric Expected Returns
Real Estate & Infrastructure

	2022 E(R) (%)	2021 E(R) (%)	Δ From 2021 (%)	Notes
Real Estate	6.4	6.5	0.2	lower REIT yields, slightly less attractive pricing in private markets
REITs	6.0	6.9	-0.9	lower REIT yields
Core Private Real Estate	4.9	5.0	-0.1	Flat cap rates
Value-Added Real Estate	7.4	7.5	-0.1	slightly less attractive pricing
Opportunistic Real Estate	8.4	8.5	-0.1	slightly less attractive pricing
Infrastructure	7.1	*NA*	*NA*	*New aggregate*
Infrastructure (Public)	6.4	7.2	-0.8	worse pricing (depending on the index)
Infrastructure (Core Private)	6.9	7.1	-0.2	slightly more expensive
Infrastructure (Non-Core Private)	8.3	8.5	-0.2	slightly more expensive

10-year Geometric Expected Returns
Natural Resources & Commodities

	2022 E(R) (%)	2021 E(R) (%)	Δ From 2021 (%)	Notes
Natural Resources (Public)	6.6	7.1	0.0	strong earnings rebound but questions about the future
Natural Resources (Private)	7.5	7.9	-0.4	higher prices offset by higher real income
Energy	7.6	8.5	-0.9	more expensive and questions about the future
Mining	7.7	7.8	-0.1	Slightly more expensive
Timberland	5.9	5.7	0.2	slightly higher real income
Farmland	6.6	6.2	0.4	slightly higher real income
Sustainability	8.2	8.0	0.2	
Gold Mining	7.4	7.5	-0.2	mining slightly more expensive
Gold (Metal)	2.7	2.5	0.2	higher inflation expectations
Commodities	4.3	3.4	0.9	higher cash yield and inflation expectations

10-year Geometric Expected Returns
Alternative Strategies (Other)

	2022 E(R) (%)	2021 E(R) (%)	Δ From 2021 (%)	Notes
Hedge Funds	3.4	3.4	0.0	revised to include CTAs & adjusted current asset weights
Long-Short	2.2	2.1	0.1	higher cash yield
Event Driven	4.7	4.2	0.4	higher cash and distressed debt yields
Global Macro	4.3	3.6	0.6	higher yields
CTA – Trend Following	3.9	4.5	-0.6	assuming lower signal benefits (due to arbitrage)
Fixed Income/L-S Credit	3.2	3.2	0.0	higher yields offset by tighter spreads
Relative Value/Arbitrage	4.6	4.5	0.1	steeper curve for carry trade offset by lower convert arb yields
Insurance Linked Strategies	4.8	4.8	0.0	higher coupon offset by higher expected loss
Risk Parity (10% vol)	4.3	3.4	0.9	higher yields and leverage
TAA	3.4	3.1	0.3	higher yields
Alternative Risk Premia	4.5	4.3	0.2	higher cash yield

20-year Geometric Expected Returns
Rate Sensitive

	2022 E(R) (%)	2021 E(R) (%)	Δ From 2021 (%)	Notes
Cash Equivalents	1.7	1.1	0.6	higher future yields expected
Short-term Investment Grade Bonds	1.9	1.3	0.6	higher future yields
Investment Grade Bonds	2.4	1.8	0.6	higher yields
Intermediate Government Bonds	1.9	1.4	0.5	higher yields
Long-term Government Bonds	2.8	2.5	0.3	higher yields offset by losses from future rate increases
Mortgage Backed Securities	2.5	1.8	0.7	higher yields
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Global ILBs	2.3	1.9	0.4	higher future yields
Foreign Bonds	2.3	1.7	0.6	higher yields
US Inflation	*2.2*	*2.1*	*0.1*	*Higher economist and market projections*

20-year Geometric Expected Returns
Credit

	2022 E(R) (%)	2021 E(R) (%)	Δ From 2021 (%)	Notes
High Yield Bonds	4.4	4.2	0.2	higher yields partly offset by tighter spreads
Higher Quality High Yield	4.2	3.8	0.4	higher yields partly offset by tighter spreads
Bank Loans	4.0	4.0	0.0	higher prices and tighter spreads
Collateralized Loan Obligations(CLOs)	4.2	4.2	0.0	higher prices/lower yields
Emerging Market Bonds (major)	4.2	3.7	0.5	higher yields
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Private Debt	7.3	6.8	0.5	higher yields
Direct Lending	7.1	6.7	0.4	higher yields
Specialty Finance	7.3	NA	NA	*New asset class*
Mezzanine Debt	7.2	6.9	0.3	higher yields
Distressed Debt	7.7	7.0	0.7	higher yields

20-year Geometric Expected Returns
Equities

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US Equity	6.8	6.8	0.0	higher earnings offset by higher prices
US Small Cap	7.4	7.1	0.3	
Developed Non-US Equity	7.5	7.1	0.4	lower earnings growth offset by lower prices
Dev. Non-US Small Cap	7.4	7.0	0.4	
Emerging Market Equity	8.4	8.1	0.3	lower earnings growth offset by lower prices & higher dividends
Emerging Market Small Cap	8.2	8.2	0.0	
Frontier Market Equity	8.7	8.9	-0.2	lower earnings growth and higher prices
Global Equity	7.2	7.1	0.1	lower earnings mostly offset by lower prices
Low Volatility Equity	6.5	6.4	0.1	
Private Equity	10.0	9.1	0.9	
Buyouts	9.8	9.0	0.8	Higher earnings and multiples have not expanded as much as public markets
Growth Equity	10.1	NA	NA	*New asset class*
Venture Capital	10.3	9.6	0.7	Higher earnings and pricing has not expanded as much as public markets

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Core Private Real Estate	6.1	5.5	0.6	Flat cap rates offset by higher future rates
Value-Added Real Estate	8.1	7.7	0.4	slightly less attractive pricing offset by higher future rates
Opportunistic Real Estate	9.6	9.2	0.4	slightly less attractive pricing offset by higher future rates
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Mining	8.5	8.2	0.3	more expensive offset by and higher future rates
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Farmland	7.2	6.6	0.4	slightly higher real income and higher future rates
Sustainability	9.3	8.8	0.5	higher future rates
Gold Mining	8.2	7.9	0.3	mining slightly more expensive
Gold (Metal)	2.8	2.3	0.5	higher inflation expectations
Commodities	4.6	3.7	0.9	higher cash yield and inflation expectations

20-year Geometric Expected Returns
Alternative Strategies (Other)

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Hedge Funds	4.4	4.3	0.1	revised to include CTAs & adjusted current asset weights
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Event Driven	5.2	4.9	0.3	higher cash and distressed debt yields
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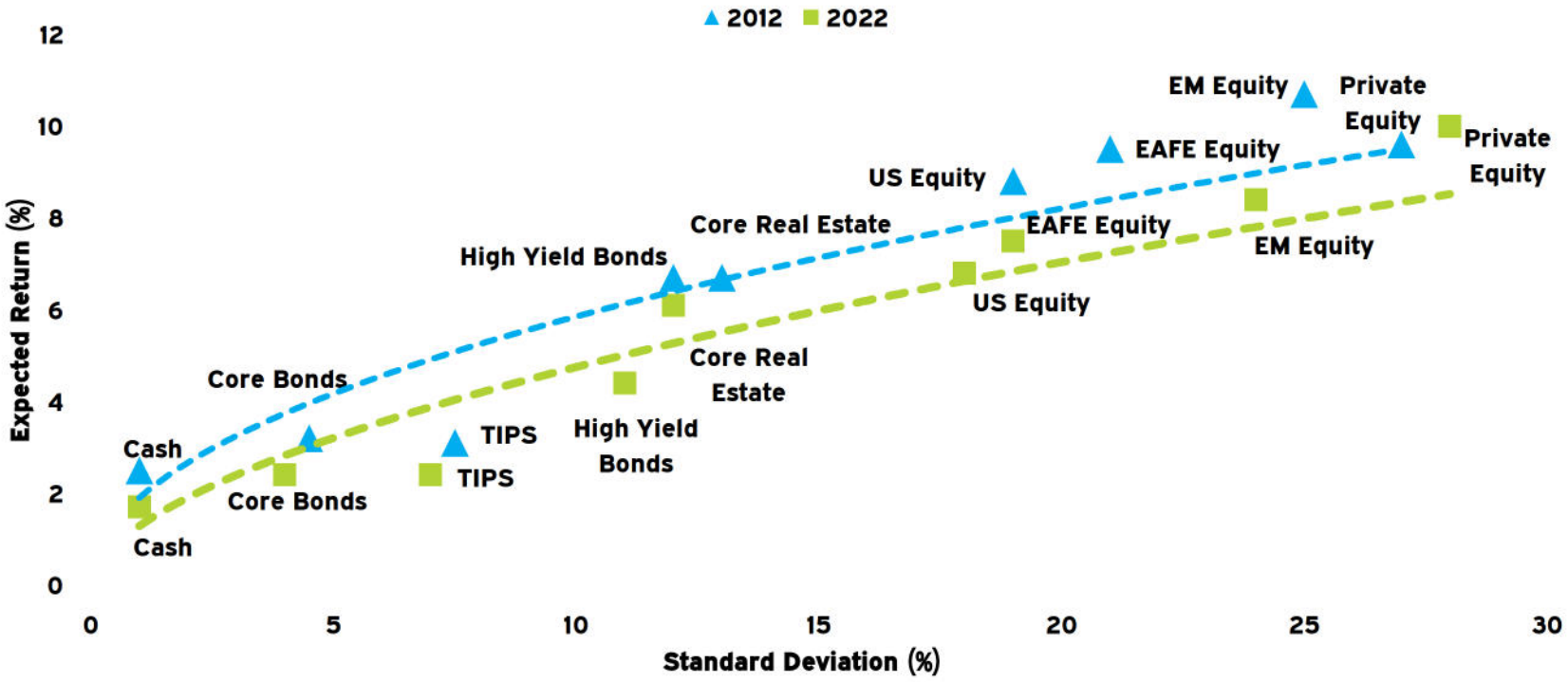
Risk Parity (10% vol)	5.2	4.0	1.2	higher yields and leverage
TAA	4.5	4.1	0.4	higher yields
Alternative Risk Premia	4.6	4.1	0.5	higher cash yield

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

- The relationship between long-term return expectations and the level of risk accepted is not static.
- We anticipate investors will have to take on greater levels of risk than they have historically if they want to achieve the returns they have in the past.



[1] Expected return and standard deviation are based upon Meketa Investment Group's 2012 and 2022 20-year capital market expectations.

Structural Changes and FAQs

Structural Changes for 2022

- We added the following assets (total now at 97):
  - Growth Equity (private markets).
  - Specialty Finance (aka, high yield ABS).
  - Infrastructure (aggregating the core-, non-core, and public IS categories).
  - Growth & Value for US, EAFE, EM, and Global Equities.
- We renamed Opportunistic Green to Sustainability (see our white paper).

Model Changes for 2022

- New weightings for Private Equity composite:
  - We added growth equity as an asset class, which required its inclusion in the private equity aggregate.
  - The target allocation to venture capital has also been increasing in private equity portfolios, so we increased its weight.
- New weightings for Private Debt composite.
  - We added specialty finance as an asset class, which required its inclusion in the private debt aggregate.
  - The target allocation to mezzanine and distressed debt has been decreasing in private debt portfolios, so we decreased the weight of both.
- New weightings for Hedge Fund composite.
  - We added CTAs to the composite, as many hedge fund universes include a meaningful allocation to them.
  - We also re-weighted the composite based on more recent asset weights. The allocations to event driven and RV/arb decreased, while FI/credit and long-short equity increased.

Model Changes for 2022, cont.

- New weightings for Portable Alpha:
  - We included Alternative Risk Premia (ARP) strategies in the portable alpha model, as we see institutions using such market neutral strategies in their portable alpha programs.
  - The "alpha engine" component is 2/3 hedge funds, 1/3 ARP.
- We are changing our calculation methodology for converting from geometric to arithmetic.
  - Arithmetic returns are currently calculated using the ½ variance methodology.
  - We are switching to the (slightly more complex) La Grandville compounding methodology.
    - The methodologies can produce different results over time horizons of 10 or 20 years
  - This approach better aligns our CME methodology with that of MVO.
    - It also allows for easier and more accurate conversion of arithmetic to geometric returns and visa-versa.
  - However, this will have a downward impact on the expected return of portfolios.

FAQs for 2022

How do these CMEs compare to last year's 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 ~40 basis points higher than last January.
- Looking at past years' CMEs, this is the smallest change since 2018.

Year	Weighted Average Expected Return (%)	Change from Prior Year (%)
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
2017	6.9	-0.3

[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 2022 (cont.)

What is driving the changes from last year?

- The changes relative to last year are being driven by what happened in the market, not by methodology changes.
- The increase in interest rates affected many asset classes, as did higher inflation expectations. Tighter credit spreads & higher valuations also have an impact.
- Higher expected rates 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.

How do Meketa's CMEs compare to peers?

- We believe our CMEs are in the same ballpark as our peers. We note that in recent years there has been a trend of money managers tending to have lower return expectations than consultants.
- 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 that we are aware of. 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 2022 (cont.)

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 2020 and 2008.

Did Meketa make any qualitative adjustments?

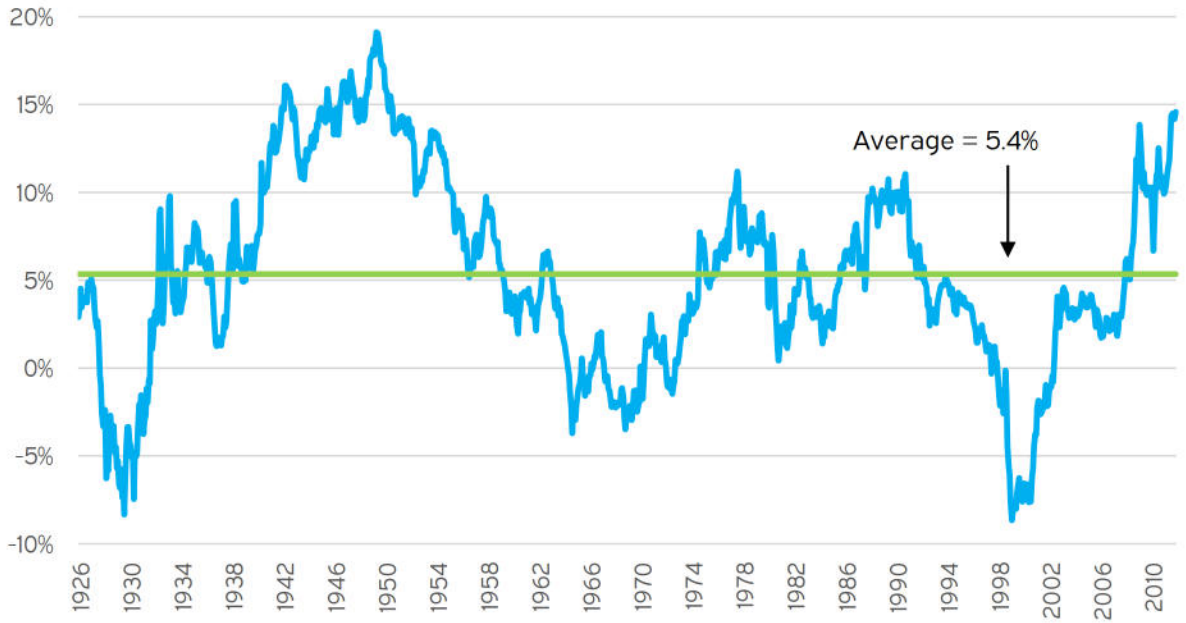
- As usual, we made some qualitative adjustments to the CMEs.
- We made changes for EM small cap (as usual), as earnings data is unreliable at best., resulting in non-intuitive outcomes from our models.
- We made modest decreases to private equity and core private real estate, based on anticipated mark-ups at December 31 valuations.
- The biggest decrease was for public natural resources, as we believe prices reflect a re-pricing of risk and lower anticipated secular earnings for the sector.

FAQs for 2022 (cont.)

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 2022 (cont.)

Is Meketa assuming that interest rates will go up?

- Yes, though indirectly. We use the market's projections for future rates, as they were priced in at the time of our analysis.
- For example, we observe that the market is projecting that the ten-year Treasury will be yielding approximately 2.8% in ten years.
- This was a meaningful increase from 2.0% one year ago, and a full 130 bp higher than what the 10-year Treasury was yielding as of 12/31/21.

Is the yield curve you imply steeper than recent history?

- Our model implies a spread between cash and the 10-year Treasury of ~50 bp. This is a flatter yield curve than has historically been the case.
- The yield on the 10-year Treasury has averaged 150 bp over that for the 90-day T-bill since 1934.

Why is the 10-year expected return for long-term corporate bonds lower than the yield?

- Defaults (modest) and rising rates. When rates have gone up historically, the return has been lower than the starting yield. This is particularly true with longer duration assets.

FAQs for 2022 (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 higher inflation numbers for the US than had been seen until 2021, with 2022 expected to be the highest level.
- 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 2.6%.

Inflation Estimates

	2022	2023	2024	2025	2026	5-Year Average
US	3.5	2.7	2.6	2.5	2.3	2..7
Euro Area	1.7	1.4	1.5	1.6	1.7	1.6
UK	2.6	2.0	2.0	2.0	2.0	2.1
Japan	0.5	0.7	0.8	1.0	1.0	0.8

Source: IMF World Economic Outlook, October 2021.

FAQs for 2022 (cont.)

If 20-year US inflation is expected to be 2.2%, and the real yield on 20-year TIPS is -0.6%, shouldn't the expected return for long TIPS be closer to 1.6% than 3.2%?

- 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 EM Equities have a more negative correction when adjusting for rates?

- EM equities have a higher historical discount rate – both in real and nominal terms – than do developed markets. We assume this will continue to be the case for the horizon of this analysis.

FAQs for 2022 (cont.)

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

- For the second year in a row, multiples moved up more quickly for public equities than they did for private equity (e.g., EBITDA multiples for buyouts).
- Of note, the private equity data (as always) is through 9/30; it is possible that buyout multiples will "catch up" with public equity in early 2022.

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 2022 (cont.)

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 actions taken by the CCP?

- While the possibility of greater state intervention was always possible, the CCP made abundant use of their power to influence/harm certain sectors or companies in 2021.
- As a result, we are placing a greater discount on Chinese (and hence, emerging market) growth translating to EPS growth and thus shareholder wealth.

FAQs for 2022 (cont.)

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 that 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.
- All of 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 2022 (cont.)

Although higher bond yields justify an increase in expected return for bonds, would it not also create losses to existing fixed income portfolios?

- Yes, rising rates will cause losses in bond portfolios. While YTW has been a great predictor of future bond returns, it tends to slightly overestimate those returns in a rising rate environment.
  - This is particularly true for longer duration bonds.
- And this is reflected in our models, and hence their output. The 10-year expected return for core bonds is about 10 bp below the yield, and for long-term Treasuries it is 50 bp lower.

If yields increased, why did the 10-year expected return for long-term Treasuries decrease?

- The market is projecting higher future rates; the losses from rising rates are magnified for longer duration bonds, and in this case overwhelms the increase in yields.

Is the drop in REIT return expectations due to higher rate/mortgage rate expectations?

- REIT yields dropped from 4.0% to 3.0%, likely reflecting stronger expectations by the market for the prospects for REITs following the sharp downturn in real estate in 2020.

FAQs for 2022 (cont.)

For NR, many economists believe we are at the beginning of a bull market that could last a decade or longer, and valuations appear low. Why is our expected return so low?

- Public NR is probably the asset/sector where there is the greatest dispersion in thinking/forecasting about the future, due to the energy transition.
- The market (via pricing) appears to be forecasting lower growth rates for the sector than it is for the broader economy.

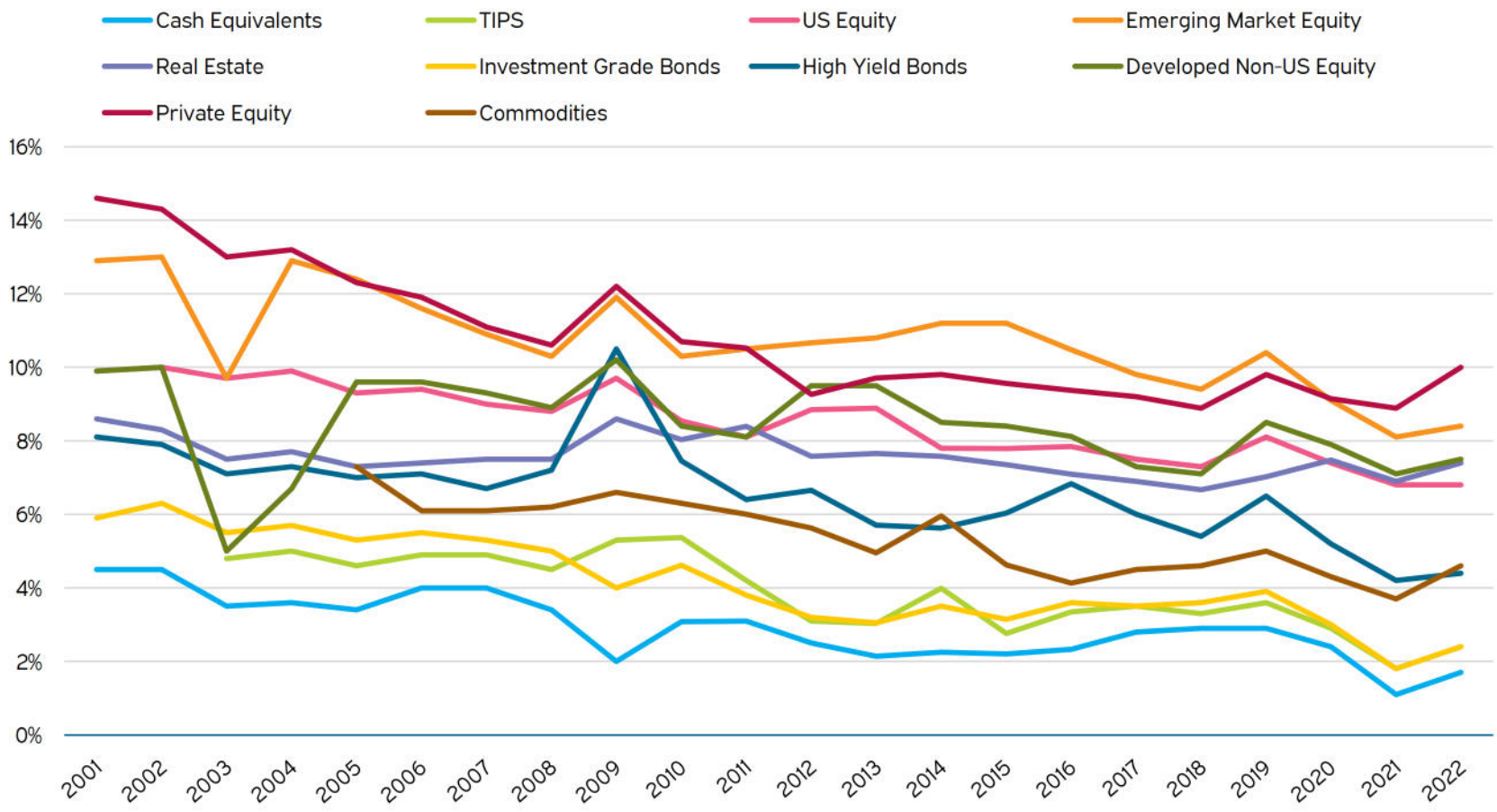
What is driving the cut in 10-year bank loan expected return?

- The market bid up the price for bank loans in 2021, probably in anticipation of rising rates.
- The average price went from 95.73 to 98.64, hence all of the price appreciation we were expecting occurred in a single year (as opposed to being spread over ten years).
- Likewise, the average spread dropped from 325 to 279 bp.

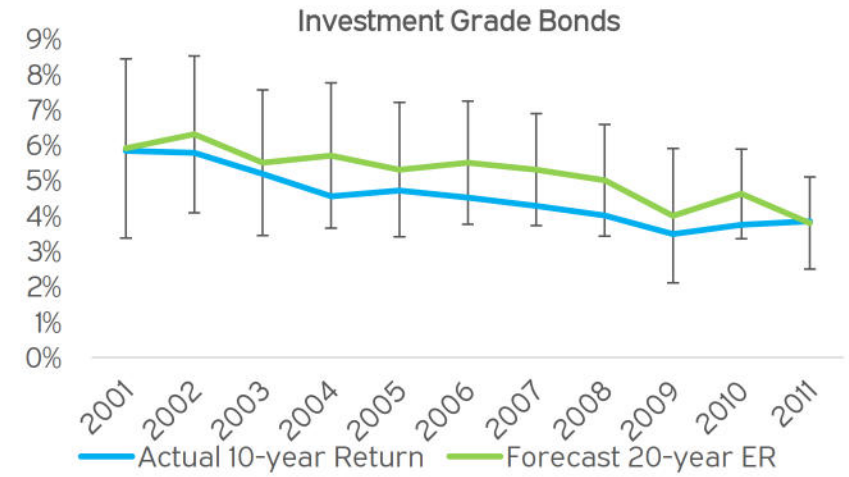
Do we consider inflation when building expected returns for real assets like real estate, infrastructure, and natural resources?

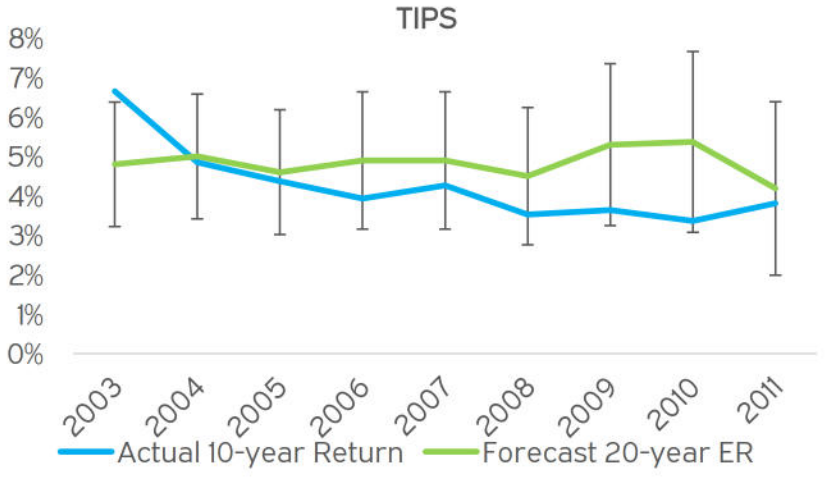
- Yes, inflation is a component for the vast majority of these assets, and their growth is generally linked to inflation in our models.

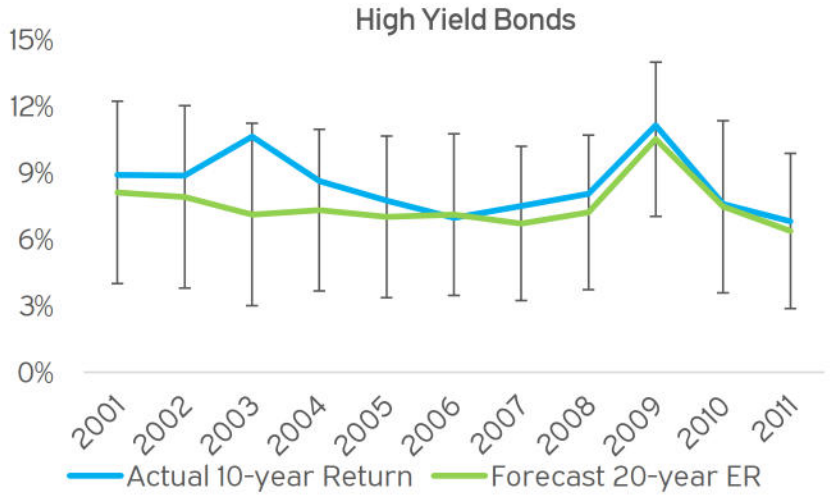
Our 20-year CMEs since 2000



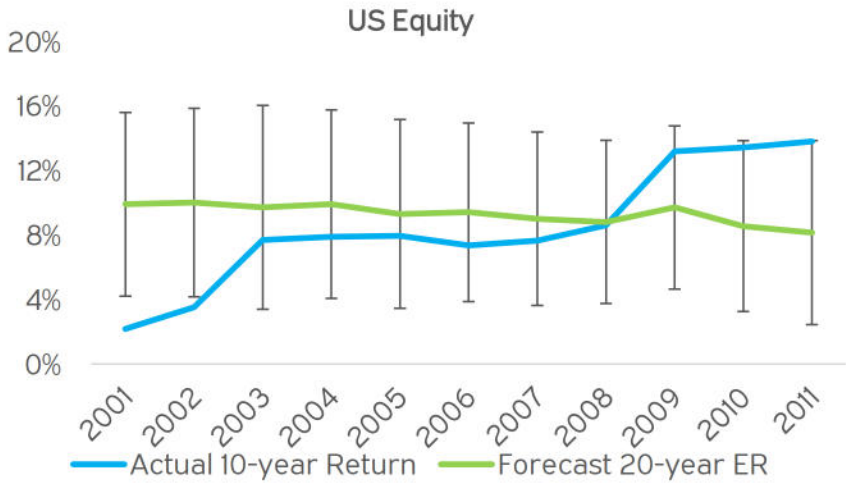
Our Track Record

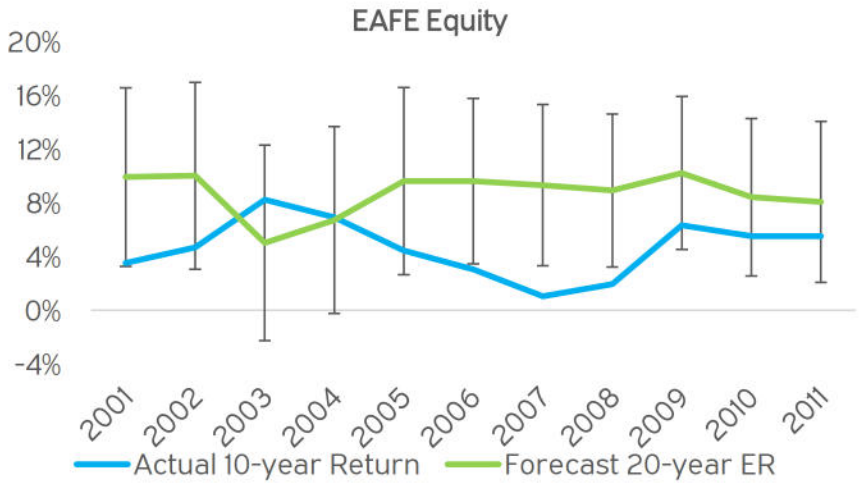


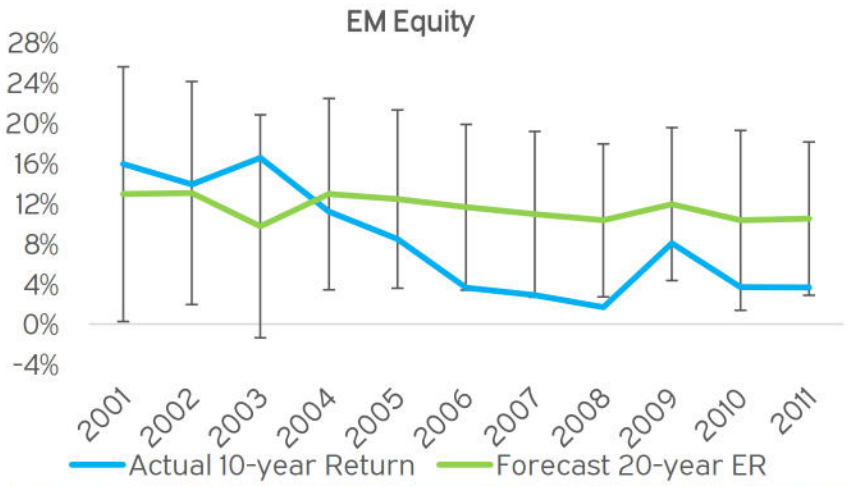




Our Track Record (cont.)







Our Process

Setting Capital Market Expectations

- Capital Markets Expectations are the inputs needed to conduct MVO.
  - MVO is the traditional starting point for determining asset allocation.
- Consultants (including Meketa) generally set them once a year.
  - Our results are published in January and based on December 31 data.
- This involves setting long-term expectations for a variety of asset classes 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 97 "asset classes" in 2022.

Building 10-year Forecasts

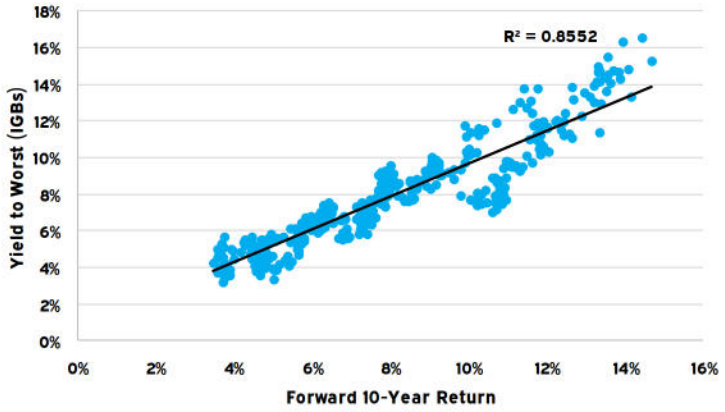
- Our first step is to develop 10-year forecasts based on fundamental models.
  - Each model is based on the most important factors that drive returns for that asset class:

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

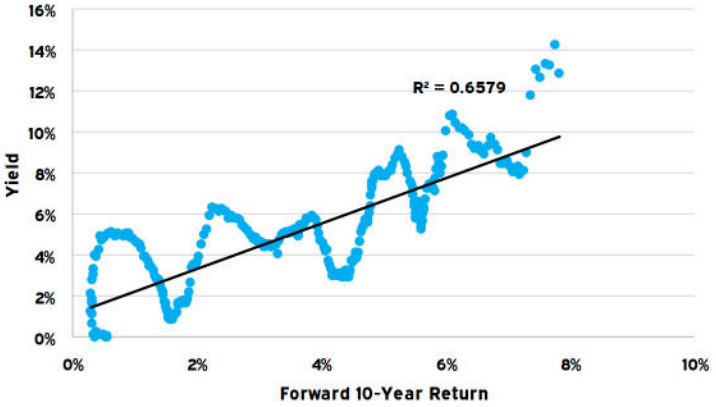
  - The common components are income, growth, and valuation.

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

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

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:

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

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)

$$\text{US Equity } E(R) = 1.4\% + [(1 + 5.5\%) \times (1 - 1.4\%) - 1] = 5.4\%$$

- 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 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.

	US	EAFE	EM	EAFE Sm	EM Small	Frontier
2022	181.8	133.7	88.1	12.8	60.6	45.6
2023	191.8	139.4	93.4	13.3	64.7	48.2
2024	202.3	145.4	99.0	13.8	69.2	51.0
2025	213.4	151.6	105.0	14.3	73.9	53.9
2026	225.2	158.1	111.3	14.8	79.0	57.0
2027	237.5	164.9	118.1	15.4	84.4	60.3
2028	250.6	172.0	125.2	15.9	90.2	63.8
2029	264.3	179.4	132.8	16.5	96.4	67.5
2030	278.8	187.1	140.8	17.1	103.0	71.4
2031	294.2	195.1	149.3	17.8	110.0	75.5
2032	310.3	203.5	158.3	18.4	117.6	79.8
Average EPS10 in 10 years	**246.8**	**169.7**	**123.3**	**15.7**	**88.8**	**62.8**

[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 (cont.)

- 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	105%	93%	78%	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	65%	17%	18%	1%
MSCI EAFE	23%	48%	21%	2%
MSCI Emerging Markets	18%	9%	76%	1%
MSCI Frontier Markets	4%	5%	9%	79%

[1] We constructed 5-year GDP based on the IMF World Economic Outlook as of October 2021 and Oxford Economics projections, and then use Oxford Economics projections for the remaining five years to arrive at a ten-year forecast for each. Note that the inflation history for emerging and frontier markets is subjective. We constructed inflation projections based on the IMF World Economic Outlook as of October 2021, 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 North America, EAFE, and Emerging Markets; estimates for small cap and frontier markets.

Equities: Model 1 (cont.)

- 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]

$$\text{US Price Target} = 246.8 \times 28.5 = 7{,}025$$

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

$$\text{US Price Return} = (7025 \div 4766) \text{ ^ } 1/10 - 1 = 4.0\%$$

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

$$Multiplier\ Effect_{Model\ 1} = 4.0\% - 5.5\% = -1.5\%$$

[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.
[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.

$$US\ EPS = 181.8 \times (1 + 5.5\%)\ \text{^}\ 10 = 310.6$$

  - For projected earnings growth, we used a subjective growth rate.
    - For the US, we used a rate lower than the historical average due to our current assessment that we are nearer a peak than a trough in the earnings cycle.
- We multiply EPS by our projected PE ratio[1] to arrive at a ten-year price target.

$$\text{US Price Target} = 310.6 \times 19.9 = 6181.5$$

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

$$\text{US Price Return} = (6181.5 \div 4766.2)\ \text{^}\ 1/10 - 1 = 2.6\%$$

- We subtract the projected earnings growth[2] from the US Price return to arrive at the Multiplier Effect.

$$Multiplier\ Effect_{Model\ 2} = 2.6\% - 5.5\% = -2.9\%$$

[1] For the US, we use a PE (trailing twelve months) of 17.0x which is consistent with its median since 1954. We assume a lower PE for other regions that is consistent with their valuation relative to the US over the past two decades.
[2] Projected Earnings growth for Model 2 equals an assumed rate of 5% for the US, 4.5% for EAFE, and 6.5% 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 (lower) discount rate.
- This can be used to calculate a present value for the market using the DDM.

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

Equities: Model 3 (cont.)

- 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 a subjective 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]

$$\text{Implied Discount Rate} = -0.5\% + 11.3\% - 2.3\% = 8.5\%$$

- The fair value can be calculated as:

$$Fair\ Value = 122.3 \times (1 + 5.5\%) \div (8.5\% - 5.5\%) = 4{,}302.1$$

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

$$Multiplier\ Effect_{Model\ 3} = [1 + (4302.1 - 4766.2) \div 4766.2] \wedge (1/10) - 1 = -1.0\%$$

[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	1.7	2.5	-0.4	-0.4	2.3	1.6	1.0
EM	4.4	5.7	4.5	4.4	2.5	4.3	1.0
US	2.6	NA	0.1	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 (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 17.8x. 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, 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.

Bonds (con't)

- 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	1.16	0.26	3.00	3.00
Loss Rate	50	60	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)

Rating	Weighting (%)	Default Rate (%)	Weighted Default (%)
Aaa	14.8	0.06	0.01
Aa	45.9	0.09	0.04
Baa	31.6	0.27	0.09
Ba	5.7	1.06	0.06
B	2.0	3.40	0.07
Total Weighted Average Default Rate:			**0.26**

Private Credit

- For mezzanine debt, we use a building blocks approach that is based on income and loss thereof.
  - We use the average coupon rate (including PIKs) of observed mezz deals.
  - We add an equity kicker, adjusted for expected defaults.
    - Managers expect 2.5% to 5% return from warrants and co-invests.
  - We add an upfront fee (paid by the borrower) that usually ranges 1-3%.
  - We incorporate default & recovery rates.
    - These are subjective, as no hard data exists on mezz debt defaults.
    - We use a default rate roughly twice that for high yield bonds.
  - We subtract management fees and carried interest.
- For distressed debt, we use a model similar to that for public credit.
  - It is based on the yield of the Barclays US Ca-D index and adjusts for defaults and recoveries.
    - It uses a much high default rate than high yield bonds (the historical rate is approximately 30%).
  - We subtract management fees and carried interest.

Private Credit (cont.)

- For direct lending & specialty finance, we use a building blocks approach that is based on income and loss thereof.
  - We use the average coupon rate.
  - We add an upfront fee (paid by the borrower) or original issue discount if applicable.
  - We incorporate default & recovery rates.
    - We use a default rate and recovery rate roughly the same as for bank loans.
  - We subtract management fees and carried interest.
- For aggregate private credit, we take a weighted average based on a typical client allocation to private debt.

Component	Weight (%)	E(R) (%)
Mezzanine Debt	10	6.7
Distressed Debt	10	7.5
Direct Lending	40	6.5
Specialty Finance	40	6.8
Private Debt Composite		6.7

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.
- 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.

[1] Source: Venture Economics, S&P. We use the middle-market as a proxy given our long-standing bias toward this area.

Private Equity (cont.)

- For Venture Capital, 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.
- The proxy was trading roughly in line with the small cap market as of year end.

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.
- 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 Barclays CMBS 2.0 BBB index and then add a "high yield" spread onto this.
    - We adjust for leverage, borrowing costs, and fees.

[1] Source: NCREIF.

Real Estate (cont.)

- For Non-Core Real Estate, we start with a 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 40-70% while opportunistic ranges 50-80%.
  - Value-added cost of debt ranges at LIBOR plus 200-350 and opportunistic at LIBOR plus 300-500.
- Finally, we subtracted management fees and carried interest.

[1] Source: NCREIF, Townsend.

Real Estate (cont.)

- For REITs, we focus on historical pricing and yields.
  - We first look at current REIT Yields[1].
    - REITs have historically returned 2.4% more than their yield at the start of the period over the subsequent ten years.
  - We next looked at spreads versus Treasuries and Baa corporates.
    - REITs have yielded 1.8% more than 5-year Treasuries since 1990.
    - REITs have historically yielded 1.2% 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 (%)	5-year Treasury Yield (%)	Baa Yield (%)
3.0	1.2	2.1

  - We combine these factor by averaging the impact of pricing factors and then adding this to income and income growth.

[1] Source: NAREIT.

Real Estate (cont.)

- 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	6.0
Core Private RE	40	4.9
Value-added RE	20	7.4
Opportunistic RE	20	8.4
High Yield RE Debt	10	6.2
Aggregate Real Estate		**6.3**

Infrastructure

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

Region	Weighting (%)	Weighted Return (%)
US	47.3	2.6
Developed	43.0	2.9
EM	9.7	0.8
Weighted Equity E(R):		**6.2**

- 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	17.6	21.4	-15.9	-15.0

- 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.

$$E(R) = 6.2\% + 0.2\% = 6.4\%$$

[1] We used the MSCI World Infrastructure, S&P Global Infrastructure, DJ Brookfield Global Infrastructure, and MSCI World indices.

Infrastructure (con't)

- For private infrastructure, we built a model that 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 2.5:1, non-core at 1.7:1
  - Cost of debt ranges from LIBOR plus 300-400 for core IS to plus 300-700 for non-core IS.
- Finally, we add any currency effect and subtract management fees and carry.

Natural Resources

- For public NR, we take the weighted average of the regional public equity returns.

Region	Weighting (%)	Weighted Return (%)
US/Canada	49.8	2.7
Developed	39.9	2.7
EM	10.3	0.8
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].

P-E Ratio	Public NR	Global / US Equities	Price Adjustment
S&P Global NR vs. S&P Global BMI	–12.3	22.6	41.5%
S&P North American NR vs S&P 500	18.6	26.2	20.3%

[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

Natural Resources (cont.)

EV/EBITDA	Public NR	Global/ US Equities	Price Adjustment
S&P Global NR vs. S&P Global BMI	6.8	13.9	52.4%
S&P North American NR vs S&P 500	10.2	17.2	34.4%

P-B Ratio	Public NR	Global/ US Equities	Price Adjustment
S&P Global NR vs. S&P Global BMI	1.7	2.7	29.5%
S&P North American NR vs S&P 500	2.1	4.9	68.9%

$$Average\ Price\ Adjustment = 41\%$$

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

$$E(R) = 6.2\% + 3.5\% = 9.6\%^{1}$$

[1] Numbers may not sum due to rounding.

Natural Resources (cont.)

- Most "private" mining partnerships consist of investments in "junior" mining stocks.
  - We again take the weighted average of the regional public equity returns.
    - Roughly 50/50 USA/Canada and Australia.
  - Similarly to Public Natural Resources, we then look at the P-E, P-B and EV/EBITDA ratios of the regional 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	12.6	14.6	2.3	2.2	6.4	6.5
S&P TSX Div. Met /Min	18.5	29.2	1.1	0.7	4.3	6.6

  - We add a control premium (as these resemble buyouts) and subtract fees & carry.
- For oil & gas, we use a similar approach.
  - We again take the weighted average of the regional public equity returns.
    - 30% in US/Canada, 65% EAFE, and 5% EM
  - We then look at the relative pricing of small cap oil & gas stocks.
  - We add a control premium (and subtract management fees & carry.

Natural Resources (cont.)

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

Current Price/Acre	Inflation-Adjusted Average	Price Adjustment
$1,477	$1,585	7.3%

  - 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 1.1%.
- We add a non-US component (premium for lower cap rates) and a currency effect.
  - We assume 25-50% of commitments will be ex-US (Latin America and Australasia).
- We lever the portfolio at 1.15:1 and then subtract the cost of borrowing, which is estimated at LIBOR plus 250-350 basis points.
- Finally, we subtract management fees (as well as carry).

[1] Source: RISI.

Natural Resources (cont.)

- 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	3,380	2,123	-28
Cropland	4,420	3,406	-17

  - 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 2.5%.
- We add a non-US component (premium for lower cap rates) and a currency effect.
  - We assume 20-50% of commitments will be ex-US (Latin America and Australasia).
- We lever the portfolio at 1.6:1 and then subtract the cost of borrowing, which is estimated at LIBOR plus 300-400 basis points.
- Finally, we subtract management fees and carried interest.

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

Natural Resources (cont.)

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

Component	Weight (%)	E(R) (%)
Timberland	5	5.9
Farmland	15	6.6
Sustainability	15	8.2
Energy	45	7.6
Mining	20	7.7
Aggregate Private NR		**7.5**

Commodities

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

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

$$E(R) = 1.1\% + 0.0\% + 1.0\% + 2.1\% = 4.3\%$$

  - 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.
  - 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 (cont.)

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

Hedge Funds (cont.)

- 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	33	2.2
Event-Driven	10	4.6
Global Macro	16	4.2
CTAs	7	3.9
Fixed Income/L-S Credit	25	3.2
Relative Value/Arbitrage	9	4.6
Aggregate Hedge Funds		**3.4**

Alternative Risk Premia (ARP)

- We model 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 half 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 weighted each such that their contribution to risk (volatility) was equal.
  - This requires MVO (due to correlations being less than one).
- We leveraged the group (at 1.4:1) such that the aggregate standard deviation was at the target (10%).
- We subtract management fees (of 50 basis points; there is no passive option).

Component	Weight (%)	Contribution to Levered E(R) (%)	Std Dev (%)
Equities	13	1.1	18
Credit	26	0.9	9
Commodities	14	0.8	17
Currencies	20	0.9	12
Interest Rates	27	1.0	9
Aggregate Risk Parity (net)		**4.3**	

Tactical Asset Allocation

- To build our model, we used a compilation of many common traditional betas.
  - The weightings reflect a rough average of the TAA managers employed by our clients.
- We subtract management fees (of 70 basis points; there is no passive option).

Component	Weight (%)	E(R) (%)
US Equities	25	5.4
EAFE Equities	15	6.7
EM Equities	10	8.1
Commodities	5	4.3
Cash	5	1.1
Investment Grade Bonds	15	1.7
EM Debt	10	3.4 & 5.0
High Yield	5	3.3
TIPS	10	1.6
Aggregate TAA (net)		**3.4**

The Other Inputs: Standard Deviation and Correlation

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

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

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

Summary Data

Return and Risk Data

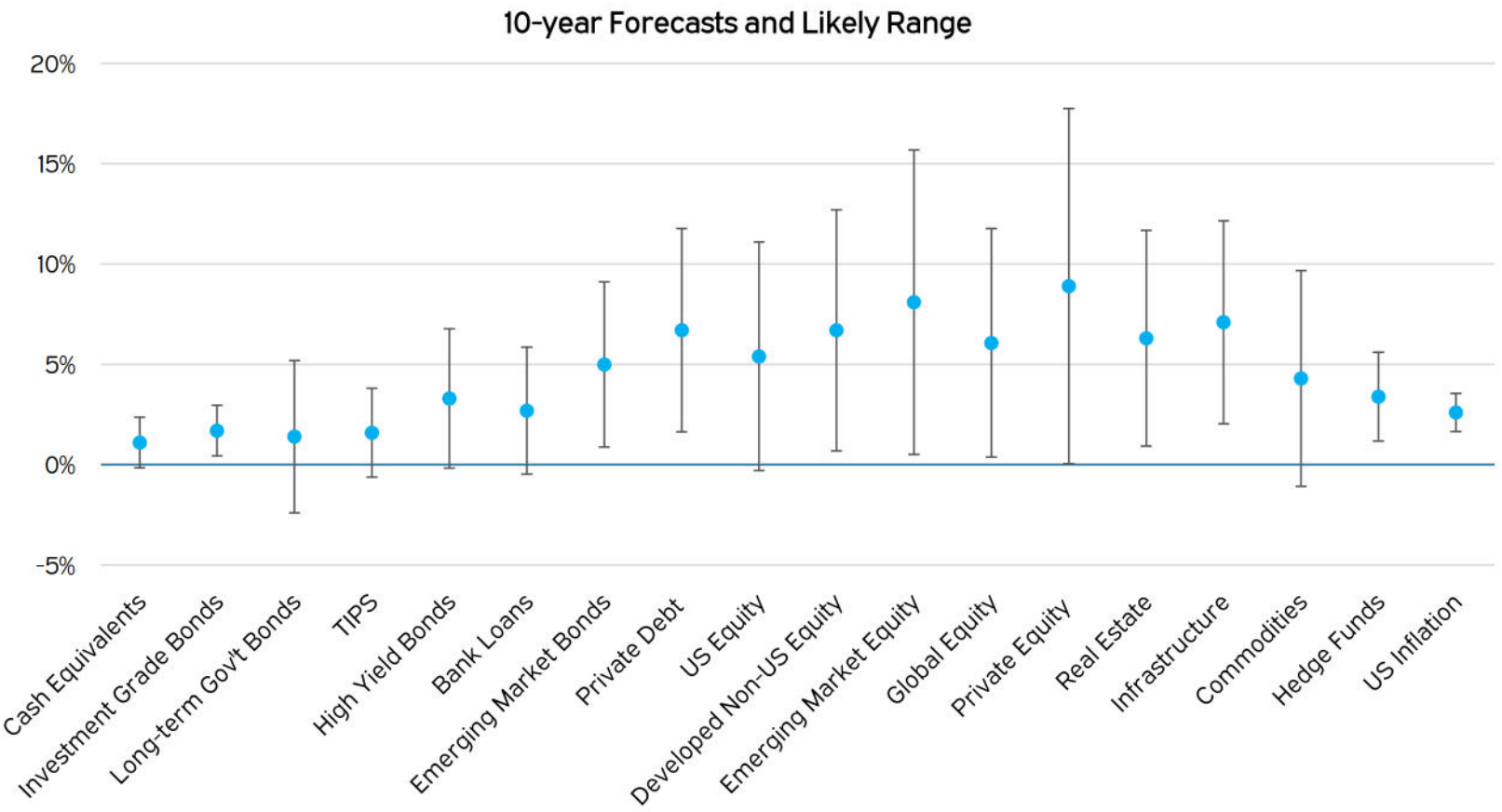
Asset Class	10-year Expected Return (%)	20-year Expected Return (%)	Standard Deviation (%)	20-year Risk Premia[1] (%)
Cash Equivalents	1.1	1.7	1.0	-0.5
Investment Grade Bonds	1.7	2.4	4.0	0.4
Long-term Government Bonds	1.4	2.8	12.0	1.15
TIPS	1.6	2.4	7.0	0.5
High Yield Bonds	3.3	4.4	11.0	2.8
Bank Loans	2.7	4.0	10.0	2.5
Emerging Market Debt (local)	5.0	4.6	13.0	1.5
Private Debt	6.7	7.3	16.0	5.0
US Equity	5.4	6.8	18.0	5.5
Developed Non-US Equity	6.7	7.5	19.0	5.5
Emerging Non-US Equity	8.1	8.4	24.0	6.0
Global Equity	6.1	7.2	18.0	5.6
Private Equity	8.9	10.0	28.0	8.2
Real Estate	6.3	7.4	17.0	5.6
Infrastructure	7.1	7.7	16.0	5.6
Commodities	4.3	4.6	17.0	2.0
Hedge Funds	3.4	4.4	7.0	2.8
Inflation	2.6	2.2	3.0	

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

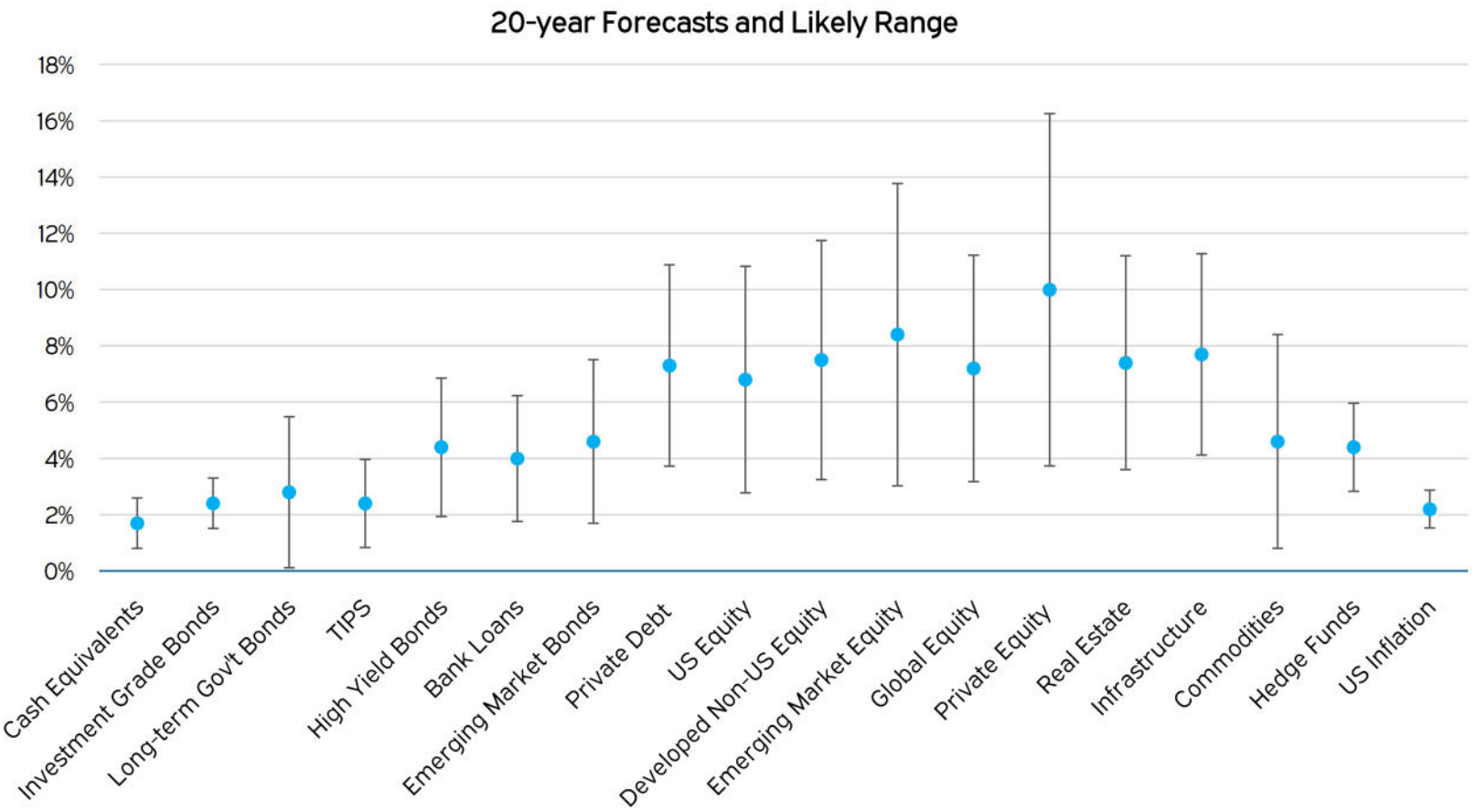
Correlation Data

	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	0.53	1.00									
High Yield Bonds	0.22	-0.22	0.41	1.00								
US Equity	0.02	-0.31	0.20	0.74	1.00							
Developed Non-US Equity	0.09	-0.28	0.26	0.76	0.89	1.00						
Emerging Market Equity	0.14	-0.23	0.34	0.76	0.77	0.87	1.00					
Private Equity	0.00	-0.10	0.05	0.70	0.85	0.80	0.75	1.00				
Real Estate	0.20	0.05	0.10	0.50	0.50	0.45	0.40	0.45	1.00			
Commodities	0.00	-0.29	0.31	0.55	0.53	0.61	0.65	0.30	0.15	1.00		
Infrastructure	0.29	0.09	0.31	0.64	0.63	0.65	0.58	0.50	0.57	0.41	1.00	
Hedge Funds	0.03	-0.34	0.26	0.77	0.86	0.87	0.85	0.60	0.45	0.69	0.65	1.00

10-Year Return Expectations



20-Year Return Expectations



2021 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	10-Year Average (%)	Meketa 10-Year (%)	20-Year Average (%)	Meketa 20-Year (%)
Cash Equivalents	1.2	0.7	1.9	1.1
TIPS	1.6	1.2	2.4	1.8
US Core Bonds	2.1	1.2	3.2	1.8
US High Yield Bonds	3.8	3.3	5.0	4.2
Emerging Market Debt	4.2	3.9	5.3	3.8
Private Debt	6.5	6.6	6.9	6.8
US Equity (large cap)	5.8	5.2	6.7	6.8
Developed Non-US Equity	6.4	6.7	7.1	7.1
Emerging Non-US Equity	7.2	7.5	7.8	8.1
Private Equity	8.8	8.0	9.6	9.1
Real Estate	5.5	6.5	6.2	6.9
Infrastructure	6.2	7.1	6.8	7.0
Commodities	3.1	3.4	4.0	3.7
Hedge Funds	4.5	3.4	5.3	4.3
Inflation	2.1	2.3	2.2	2.1

[1] The 10-year horizon included all 39 respondents, and the 20-year horizon included 24 respondents. Figures are based on Meketa's 2021 CMEs.

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