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Summary



Methodology

CORE INPUTS

- We use a fundamental building block approach based on several inputs, including historical data and academic research to create asset class return forecasts.
- For most asset classes, we use the long-term historical volatility after adjusting for autocorrelation.
- Correlations between asset classes are calculated based on the last 10 years. For illiquid assets, such as private equity and private real estate, we use BarraOne correlation estimates.

Asset	Return Methodology	Volatility Methodology*
Inflation	25% weight to the University of Michigan Survey 5-10 year ahead inflation expectation and the Survey of Professional Forecasters (Fed Survey), and the remaining 50% to the market's expectation for inflation as observed through the 10-year TIPS breakeven rate	-
Cash	Real yield estimate + inflation forecast	Long-term volatility
Bonds	Nominal bonds: current yield; Real bonds: real yield + inflation forecast	Long-term volatility
International Bonds	Current yield	Long-term volatility
Credit	Current option-adjusted spread + U.S. 10-year Treasury – effective default rate	Long-term volatility
International Credit	Current option-adjusted spread + foreign 10-year Treasury – effective default rate	Long-term volatility
Private Credit	Bank loan forecast + 1.75% private credit premium**	Long-term volatility
Equity	Current yield + real earnings growth (historical average) + inflation on earnings (inflation forecast) + expected P/E change	Long-term volatility
Intl Developed Equity	Current yield + real earnings growth (historical average) + inflation on earnings (intl. inflation forecast) + expected P/E change	Long-term volatility
Private Equity	US large cap domestic equity forecast * 1.85 beta adjustment	1.2 * Long-term volatility of U.S. small cap
Commodities	Collateral return (cash) + spot return (inflation forecast) + roll return (assumed to be zero)	Long-term volatility
Hedge Funds	Return coming from traditional betas + 15-year historical idiosyncratic return	Long-term volatility
Core Real Estate	Cap rate + real income growth – capex + inflation forecast	65% of REIT volatility
REITs	Core real estate	Long-term volatility
Value-Add Real Estate	Core real estate + 2%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Opportunistic Real Estate	Core real estate + 4%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Infrastructure	Current yield + real income growth + inflation on earnings (inflation forecast)	Long-term volatility
Risk Parity	Expected Sharpe Ratio * target volatility + cash rate	Target volatility

^{*}Long-term historical volatility data is adjusted for autocorrelation (see Appendix)

^{**}The private credit premium is generated by illiquidity, issuer size, and lack of credit rating



10-year return & risk assumptions

Asset Class	Index Proxy	Geometric						
Asset Class		Geometric	Arithmetic	Forecast	Forecast (g)	Forecast (a)	Sharpe Ratio (g)	Sharpe Ratio (a)
Equities								
U.S. Large	S&P 500	5.5%	6.6%	15.4%	0.23	0.31	1.01	1.02
U.S. Small	Russell 2000	5.7%	7.7%	21.1%	0.18	0.28	0.62	0.67
International Developed	MSCI EAFE	7.0%	8.4%	17.5%	0.29	0.37	0.30	0.37
International Small	MSCI EAFE Small Cap	7.2%	9.3%	21.8%	0.24	0.34	0.46	0.52
Emerging Markets	MSCI EM	7.6%	10.4%	25.6%	0.22	0.33	0.17	0.25
Global Equity	MSCI ACWI	6.4%	7.7%	16.8%	0.27	0.34	0.59	0.63
Private Equity*	Cambridge Private Equity	8.5%	11.3%	25.3%	0.26	0.37	-	-
Fixed Income								
Cash	30 Day T-Bills	1.9%	1.9%	1.2%	-	-	-	-
U.S. TIPS	BBgBarc U.S. TIPS 5-10	2.1%	2.2%	5.4%	0.04	0.06	0.65	0.66
U.S. Treasury	BBgBarc Treasury 7-10 Year	1.7%	1.9%	6.7%	-0.03	0.00	0.68	0.69
Global Sovereign ex U.S.	BBgBarc Global Treasury ex U.S.	0.1%	0.6%	9.7%	-0.19	-0.13	0.10	0.14
Global Aggregate	BBgBarc Global Aggregate	1.2%	1.4%	6.2%	-0.11	-0.08	0.39	0.37
Core Fixed Income	BBgBarc U.S. Aggregate Bond	2.2%	2.4%	6.3%	0.05	0.08	1.08	1.09
Core Plus Fixed Income	BBgBarc U.S. Corporate IG	2.7%	3.0%	8.3%	0.10	0.14	1.21	1.22
Short-Term Gov't/Credit	BBgBarc U.S. Gov't/Credit 1-3 Year	1.7%	1.8%	3.6%	-0.06	-0.03	1.16	1.17
Short-Term Credit	BBgBarc Credit 1-3 Year	1.9%	2.0%	3.6%	0.01	0.03	1.76	1.78
Long-Term Credit	BBgBarc Long U.S. Corporate	3.0%	3.4%	9.4%	0.12	0.16	0.93	0.94
High Yield Corp. Credit	BBgBarc U.S. Corporate High Yield	3.3%	4.0%	11.3%	0.12	0.18	1.25	1.26
Bank Loans	S&P/LSTA Leveraged Loan	5.3%	5.8%	10.0%	0.34	0.39	1.47	1.50
Global Credit	BBgBarc Global Credit	1.4%	1.6%	7.4%	-0.07	-0.03	0.77	0.78
Emerging Markets Debt (Hard)	JPM EMBI Global Diversified	5.0%	5.7%	12.4%	0.25	0.31	1.03	1.03
Emerging Markets Debt (Local)	JPM GBI-EM Global Diversified	5.7%	6.4%	12.0%	0.32	0.37	0.17	0.22
Private Credit	Bank Loans + 175bps	7.0%	7.5%	10.0%	0.51	0.56	-	-
Other								
Commodities	Bloomberg Commodity	3.8%	4.9%	15.4%	0.12	0.20	-0.36	-0.29
Hedge Funds*	HFRI Fund Weighted Composite	4.0%	4.3%	7.7%	0.27	0.31	0.55	0.56
Real Estate Debt	BBgBarc CMBS IG	4.0%	4.3%	7.6%	0.27	0.31	1.55	1.58
Core Real Estate	NCREIF Property	6.6%	7.3%	12.4%	0.38	0.44	1.84	1.89
Value-Add Real Estate	NCREIF Property + 200bps	8.6%	10.0%	17.7%	0.38	0.46	-	-
Opportunistic Real Estate	NCREIF Property + 400bps	10.6%	12.9%	23.0%	0.38	0.48	-	-
REITs	Wilshire REIT	6.6%	8.2%	19.1%	0.25	0.33	0.80	0.83
Global Infrastructure	S&P Global Infrastructure	7.2%	8.6%	17.8%	0.30	0.38	0.52	0.56
Risk Parity	Risk Parity	6.9%	7.4%	10.0%	0.50	0.55	-	-
Currency Beta	MSCI Currency Factor Index	1.8%	1.8%	3.6%	-0.04	-0.02	0.19	0.21
Inflation		1.9%	-	-	-	-	-	-

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

^{*}Return expectations differ depending on method of implementation



Correlation assumptions

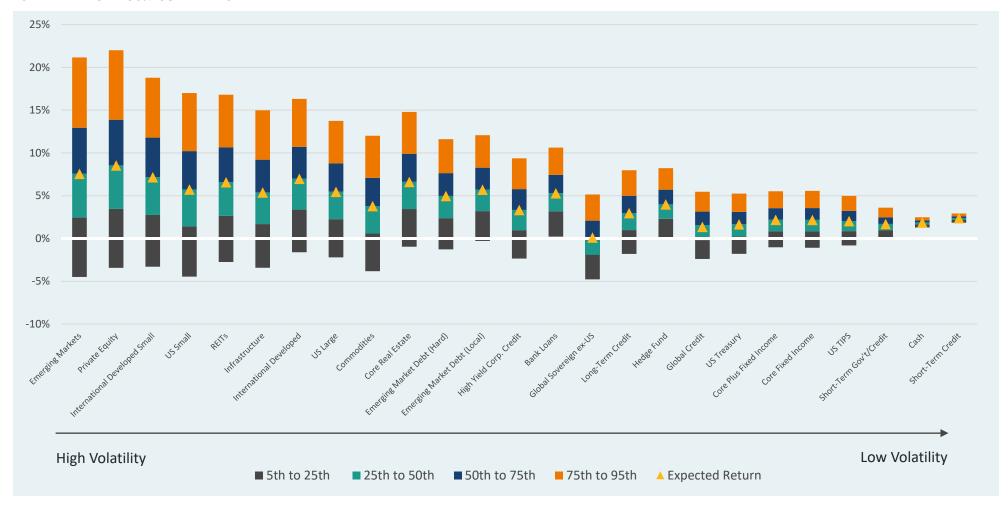
	Cash	US Large	US Small	Intl Large	Intl Small	EM	Global Equity	PE	US TIPS	US Treasury	Global Sovereign	US Core	Core Plus	Short- Term Gov't/Cre dit	Short- Term Credit	Long- Term Credit	US HY	Bank Loans	Global Credit	EMD USD	EMD Local	Commodi ties	Hedge Funds	Real Estate	REITs	Infrastruc ture	Risk Parity	Currency Beta
Cash	1.0																											
US Large	0.0	1.0																										
US Small	-0.1	0.9	1.0																									
Intl Large	0.0	0.9	0.7	1.0																								
Intl Small	-0.1	0.8	0.7	1.0	1.0																							
EM	0.0	0.7	0.6	0.8	0.8	1.0																						
Global Equity	0.0	1.0	0.8	1.0	0.9	0.9	1.0																					
PE	-0.2	0.6	0.6	0.6	0.6	0.5	0.6	1.0																				
US TIPS	0.0	0.0	-0.1	0.1	0.1	0.2	0.1	0.0	1.0																			
US Treasury	0.1	-0.4	-0.5	-0.3	-0.3	-0.2	-0.4	-0.2	0.7	1.0																		
Global Sovereign	0.1	0.2	0.0	0.3	0.3	0.4	0.3	0.0	0.5	0.4	1.0																	
US Core	0.1	-0.2	-0.3	-0.1	-0.1	0.0	-0.1	-0.1	0.8	0.9	0.5	1.0																
Core Plus	0.1	0.1	0.0	0.2	0.2	0.3	0.2	0.0	0.8	0.7	0.6	0.9	1.0															
Short-Term Gov't/Credit	0.3	-0.1	-0.2	0.0	0.0	0.1	0.0	-0.1	0.7	0.7	0.6	0.8	0.7	1.0														
Short-Term Credit	0.2	0.2	0.1	0.4	0.3	0.4	0.3	0.0	0.6	0.4	0.6	0.6	0.8	0.8	1.0													
Long-Term Credit	0.1	0.0	-0.1	0.1	0.1	0.2	0.1	-0.1	0.7	0.7	0.5	0.8	1.0	0.6	0.6	1.0												
US HY	0.0	0.7	0.7	0.8	0.8	0.8	0.8	0.4	0.3	-0.2	0.3	0.1	0.5	0.2	0.6	0.4	1.0											
Bank Loans	-0.1	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.1	-0.3	0.0	-0.1	0.2	-0.1	0.3	0.1	0.8	1.0										
Global Credit	0.1	0.5	0.3	0.7	0.7	0.7	0.6	0.2	0.5	0.2	0.8	0.5	0.7	0.5	0.8	0.6	0.7	0.4	1.0									
EMD USD	0.0	0.4	0.3	0.6	0.5	0.7	0.6	0.2	0.5	0.3	0.6	0.5	0.7	0.4	0.6	0.6	0.7	0.3	0.8	1.0								
EMD Local	0.1	0.5	0.4	0.7	0.6	0.8	0.6	0.2	0.4	0.1	0.6	0.2	0.5	0.3	0.5	0.4	0.6	0.4	0.8	0.8	1.0							
Commodities	0.0	0.5	0.5	0.6	0.6	0.6	0.6	0.3	0.1	-0.3	0.4	-0.1	0.1	0.1	0.3	0.0	0.6	0.4	0.5	0.4	0.6	1.0						
Hedge Funds	0.0	0.8	0.7	0.8	0.8	0.7	0.9	0.6	0.1	-0.3	0.1	-0.1	0.2	0.0	0.3	0.1	0.7	0.6	0.5	0.4	0.4	0.5	1.0					
Real Estate	-0.1	0.6	0.5	0.5	0.5	0.4	0.6	0.4	0.2	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.4	0.3	0.2	0.3	0.3	0.2	0.5	1.0				
REITs	0.0	0.6	0.6	0.6	0.5	0.5	0.6	0.4	0.3	0.1	0.3	0.3	0.4	0.2	0.4	0.4	0.6	0.5	0.5	0.5	0.5	0.3	0.5	0.7	1.0			
Infrastructure	0.0	0.7	0.6	0.9	0.8	0.8	0.8	0.7	0.3	-0.1	0.5	0.1	0.4	0.2	0.5	0.3	0.8	0.5	0.7	0.7	0.7	0.5	0.7	0.3	0.7	1.0		
Risk Parity	0.0	0.5	0.4	0.6	0.5	0.6	0.6	0.4	0.6	0.3	0.5	0.5	0.7	0.5	0.6	0.6	0.7	0.4	0.7	0.7	0.6	0.6	0.6	0.3	0.5	0.6	1.0	
Currency Beta	0.0	0.2	0.2	0.1	0.0	0.1	0.1	0.2	-0.1	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.2	0.1	0.0	1.0

Note: Correlation assumptions are based on the last ten years. Private Equity and Real Estate correlations are especially difficult to model – we have therefore used BarraOne correlation data to strengthen these correlation estimates.



Range of likely 10-year outcomes

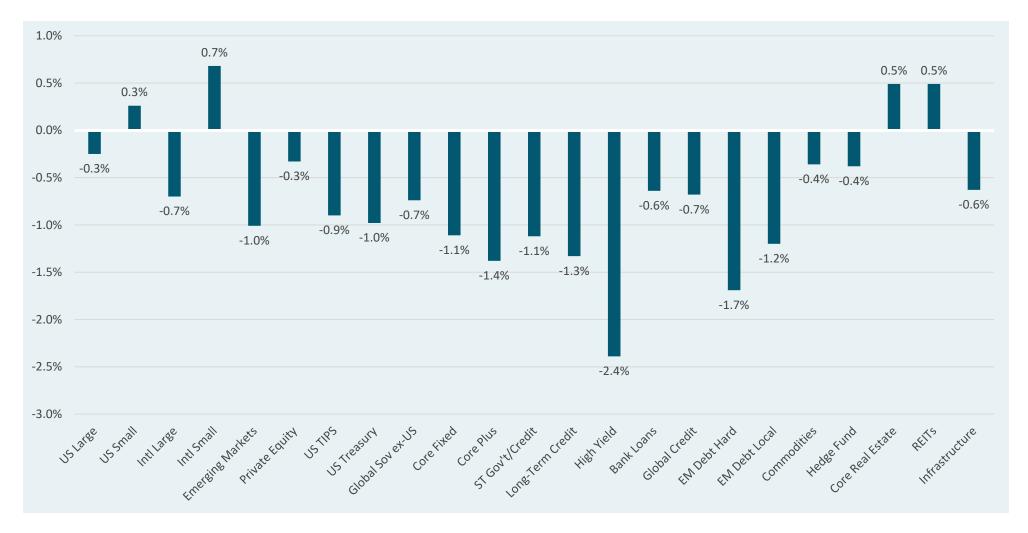
10-YEAR RETURN 90% CONFIDENCE INTERVAL



Source: Verus, MPI



2020 vs. 2019 return forecast



Note: year-over-year change of the select group of asset classes above is based on the 2020 CMA methodology



Relevant forecast changes

- Return expectations fell broadly across most asset classes as bond yields moved lower, equities recovered from their 2018 end-of-year drawdown, and valuations became richer. This effect resulted in a decrease of between 0.7%-1.0% to non-U.S. equity expectations.
- Market pricing indicates lower inflation over the next decade. The 10yr U.S. TIPS breakeven inflation rate fell from 1.7% to 1.5% year-to-date, while the University of Michigan Inflation Expectations Survey fell from 2.5% to 2.4%. Inflation is an important component to the performance of asset classes such as equities, real estate, and commodities. Return expectations for these asset classes has come down by 0.1% to 0.2% to reflect this inflation trend. It is important to note that lower inflation expectations decrease nominal returns, but do not impact real returns.
- Credit spreads dropped throughout the year as the asset class delivered strong performance, which resulted in lower return forecasts for credit assets. Core fixed income spreads fell from 72 bps to 62 bps, and high yield spreads fell from 529 bps to 396 bps.
- The short end of the yield curve fell as the Federal Reserve reversed course, and U.S. markets moved towards a decreasing interest rate environment. The U.S. effective fed funds rate dropped from 2.3% at the beginning of the year to 1.9% in September. The three-month U.S. dollar LIBOR reference rate fell from 2.8% to 2.1%.
- Emerging market hard and local currency debt forecasts have both declined, following strong performance year-to-date.
 Hard currency-denominated debt spreads to U.S. Treasury yields fell from 421 bps to 351 bps, while yields of local-denominated debt fell from 7.2% to 6.0%.

All data cited above is as of 9/30/19



Inflation

Inflation

We use a weighted average of market expectations (50%), consumer expectations (25%), and professional forecasts (25%) to create a 10-year inflation forecast. The market's expectations for 10-year inflation can be inferred by taking the difference between the U.S. 10-year Treasury yield and the 10-year Treasury Inflation-Protected (TIPS) yield (referred to as the breakeven inflation rate).

Inflation drifted upward in 2019, reaching the levels not seen in the past decade. However, investors generally expect the low inflation environment to continue well into the future. Breakeven rates rose in the first quarter but then trended downward in Q2 and Q3, likely affected by

pessimism around the U.S. economy. Overall, inflation levels remain mild, relative to past economic cycles.

Consumer inflation expectations increased very slightly from 2.7% to 2.8% in September, based on the University of Michigan Consumer Inflation Expectations Survey. Inflation expectations from the Survey of Professional Forecasters fell from 2.4% to 2.3% - this measure has historically been fairly stable, especially in environments characterized by suppressed inflation volatility.

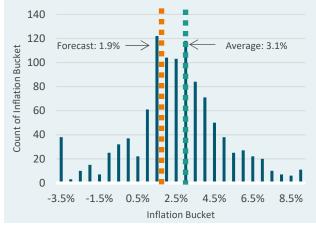
Our inflation forecast decreased slightly from 2.0% to 1.9%.

INFLATION EXPECTATIONS



Source: U. of Michigan, Philly Fed, as of 9/30/19

U.S. 10-YR ROLLING AVERAGE INFLATION SINCE 1923



Source: Bloomberg, as of 9/30/19

FORECAST

	10-Year Forecast
University of Michigan Survey (25% weight)	+2.4%
Survey of Professional Forecasters (25% weight)	+2.2%
US 10-Year TIPS Breakeven Rate (50% weight)	+1.5%
Inflation Forecast	1.9%



Fixed income



Cash

The U.S. Treasury yield curve further flattened in the latter half of the year, inverting temporarily between the 10- and 2-year yields. By other measures, such as the spread between 10-year and 3-month yields, the curve remains inverted. From the time of inversion, the U.S. economy has historically entered recession within 1-3 years. However, unprecedented monetary policy and central bank involvement in the markets may be having an outsized impact on fixed income pricing, which could be muddying this signal.

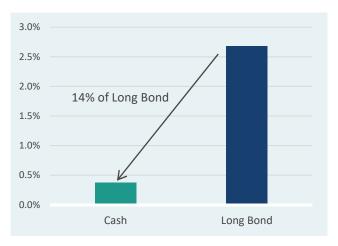
Over rolling ten-year time periods, the average historical real return to

cash has been 14% of the real return to long-term bonds.

By applying this historical real return relationship, we arrive at a -3 bps expected real return to cash (14% of our -25 bps 10-year U.S. Treasury real return forecast) as real yields are now negative.

Adding our inflation forecast of 1.9% results in a nominal return to cash of 1.9%.

AVERAGE REAL RETURN



U.S. TREASURY YIELD CURVE



FORECAST

	10-Year Forecast
Cash	+1.88%
Inflation Forecast	-1.91%
Real Return	-0.03%

Source: Bloomberg, as of 9/30/19 Source: Verus, as of 9/30/19



Source: Bloomberg

Rates

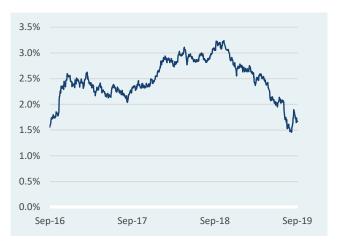
We forecast the return from rates based upon the current 10-year Treasury yield, with all cash flows reinvested at the current yield. The 10-year yield fell from 2.7% to 1.7% through September.

U.S. Treasury yields remain high relative to other developed nations, specifically Japan and Germany. U.S. yields marched upward in 2017 and 2018, but reversed sharply in 2019 as expectations for U.S. economic growth soured and the Federal Reserve shifted to an easing stance. The U.S. yield curve remains surprisingly flat.

Developed world central banks have shifted their narrative from tightening to easing. Discussions have taken place over fiscal stimulus or perhaps renewed quantitative easing. It is unclear how potent a return to monetary easing would be, now that interest rates have been low (or negative) for some time.

In the U.S., further rate cuts are expected, with rate stabilization possibly occurring in late 2020. It is possible that the next recession may bring negative interest rates to the U.S., in line with secularly low interest rates elsewhere.

U.S. 10-YR TREASURY YIELD



U.S. TREASURY YIELD CURVE



Source: Bloomberg, as of 9/30/19

FORECAST

	10-Year Forecast
U.S. 10-Year Treasury	+1.7%
Inflation Forecast	-1.9%
Real Return	-0.2%

Source: Verus, as of 9/30/19



Source: Bloomberg, as of 9/30/19

Real rates

TIPS provide high sensitivity to duration (interest rate risk) over short periods and track inflation (CPI) fairly well over longer periods. Changing inflation expectations, demand for inflation protection, and rate movements contribute to the price volatility of TIPS. Currently, future inflation is expected to be mild, there is low demand for inflation protection, and interest rates are expected to fall. This environment may be muting the price of TIPS.

The U.S. 10-year real yield fell steadily through Q3, along with U.S. TIPS Breakeven rates. Inflation rose slightly, depressing real yields.

Breakeven rates rose in the first quarter but trended downward in Q2 and Q3, likely impacted by pessimism around the domestic economy.

To arrive at a nominal 10-year forecast, we add the current real TIPS yield to our 10-year inflation forecast. Our real rates forecast fell markedly from 1.0% to 0.1% as nominal interest rate dropped much further than inflation expectations.

NOMINAL YIELD VS. REAL



INFLATION EXPECTATIONS



FORECAST

	10-Year Forecast
U.S. 10-Year TIPS Real Yield	+0.14%
Inflation Forecast	+1.91%
Nominal Return	2.05%

Source: Bloomberg, as of 9/30/19 Source: Verus, as of 9/30/19

Source: Bloomberg, as of 9/30/19



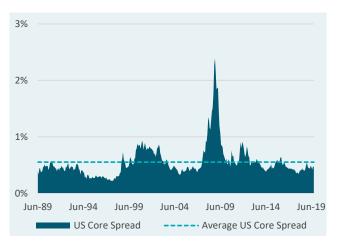
Core fixed

Credit fixed income return is composed of a bond term premium (duration) and credit spread. The bond term premium is represented by the 10-year U.S. Treasury yield.

We use default rates and credit spreads for each respective fixed income category to provide our 10-year return forecast. Our default rate assumption is derived from a variety of sources, including historical data and academic research. The effective default that is subtracted from the return forecast is based on our assumed default and recovery rates.

Spreads tightened throughout the year, which resulted in lower return forecasts for credit assets. Core fixed income spreads remain below their 30-year average of 1.25%. Widening credit spreads are typical of late-cycle behavior, as investors demand greater compensation for higher perceived credit risk. Recent activity suggests investors are not yet concerned about late-cycle credit market issues.

U.S. CORE CREDIT SPREAD



ROLLING EXCESS RETURN (10-YR)



Source: Barclays, as of 9/30/19

FORECAST

	10-Year Forecast
Barclays U.S. Option- Adjusted Spread	+0.6%
Effective Default	-0.1%
U.S. 10-Year Treasury	+1.7%
Nominal Return	2.2%
Inflation Forecast	-1.9%
Real Return	0.3%

Source: Verus, as of 9/30/19



Source: Barclays, as of 9/30/19

Credit summary

	Core	Long-Term Credit	Global Credit	High Yield	Bank Loans	EM Debt (USD)	EM Debt (Local)	Private Credit	Real Estate Debt
Index	BBgBarc U.S. Aggregate	BBgBarc Long U.S. Corporate	BBgBarc Global Credit	BBgBarc U.S. High Yield	S&P LSTA	JPM EMBI	JPM GBI-EM	S&P LTSA + 1.75%	BBgBarc CMBS IG
Method	OAS + U.S. 10-Year	OAS + U.S. 10-Year	OAS + Global 10-Year Treasuries	OAS + U.S. 10-Year	LIBOR + Spread	OAS + U.S. 10-Year	Current Yield	Bank Loans+ 1.75% private premium	LIBOR + Spread
Spread to	Intermediate U.S. Treasury	Long-Term U.S. Treasury	Global Long- Term Treasuries	Intermediate U.S. Treasury	LIBOR	Intermediate U.S. Treasury	-	-	LIBOR
Default Assumption	-0.5%	-4.5%	-3.0%	-3.8%	-3.5%	-0.5%	-0.5%	-	-3.7%
Recovery Assumption	80%	95%	40%	40%	90%	60%	40%	-	47%
Spread	0.6%	1.5%	2.0%	4.0%	3.6%	3.5%	-	-	4.0%
Yield	-	-	-	-	-	-	6.0%	-	-
Risk Free Yield	1.7%	1.7%	1.1%	1.7%	2.1%	1.7%	-	-	2.0%
Effective Default	-0.1%	-0.2%	-1.8%	-2.3%	-0.4%	-0.2%	-0.3%	-	-2.0%
Nominal Return	2.2%	3.0%	1.4%	3.4%	5.3%	5.0%	5.7%	7.1%	4.0%
Inflation Forecast	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%
Real Return	0.3%	1.1%	-0.6%	1.4%	3.4%	3.1%	3.8%	5.2%	2.1%

Source: Verus



Equities

Equities

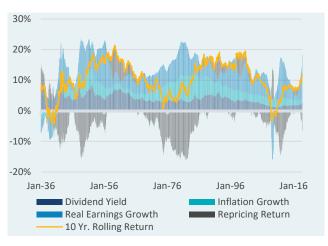
Investment returns in the equity space can be broken down into earnings growth, dividend yield, inflation, and repricing. Over the very long-term, repricing represents a small portion of return to equity investors, but over shorter time frames, the impacts on return can vary considerably.

If investors are willing to pay more for earnings, it could signal that investors are more confident in positive earnings growth going forward, while the opposite is true if investors pay less for earnings. It is somewhat surprising that investor confidence varies so much given that the long-term earnings growth is relatively stable.

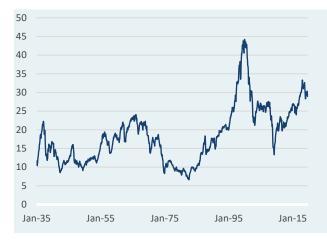
Investor confidence in earnings growth can be measured using both the Shiller P/E ratio and the trailing 12-month P/E ratio. We take an average of these two valuations metrics when determining our repricing assumption. In short, if the P/E ratio is too high (low) relative to history, we expect future returns to be lower (higher) than the long-term average. Implicit in this analysis is the assumption that P/E's will exhibit mild mean reversion over 10 years.

We make a conservative repricing estimate given how widely repricing can vary over time. We then skew the repricing adjustment because the percentage change in index price is larger with each incremental rise in valuations when P/E's are low, compared to when they are high.

TRAILING 10-YR S&P 500 RETURN COMPOSITION



U.S. LARGE SHILLER P/E



Source: Shiller, S&P 500, as of 9/30/19

P/E REPRICING ASSUMPTION

Average P/E			
Percentile Bucket	Lower P/E	Upper P/E	Repricing Assumption
Lower 10%	-	10	2.00%
10% - 20%	10	13	1.50%
20% - 30%	13	15	0.75%
30% - 45%	15	18	0.50%
45% - 55%	18	19	0.0%
55% - 70%	19	21	-0.25%
70% - 80%	21	22	-0.50%
80% - 90%	22	24	-0.75%
Top 10%	24	-	-1.00%

Source: Verus



Source: Shiller, Standard & Poor's, as of 9/30/19

Global equity

Global Equity is a combination of U.S. large, international developed, and emerging market equities. We can therefore combine our existing return forecasts for each of these asset classes to arrive at our global equity return forecast.

We use the MSCI ACWI Index as our benchmark for global equity and apply the country weights of this index to determine the weightings for our global equity return calculation. As with other equity asset classes, we use the historical standard deviation of the benchmark (MSCI ACWI Index) for our volatility forecast.

The valuation of global equities are driven by the richness/cheapness of the underlying markets, as indicated by the current price-to-earnings ratio.

Our return building blocks produce a local return forecast for international equities. For investors who wish to incorporate market implied currency movements into the return forecast, please see the adjustments and explanation in the Appendix.

GLOBAL EQUITY P/E RATIO HISTORY



MARKET PERFORMANCE (3-YR ROLLING)



Source: MSCI, Standard & Poor's, as of 9/30/19

FORECAST

Market	Weight	CMA return
U.S. Large	54.2%	5.5%
Developed Large	32.4%	7.0%
Emerging Markets	10.3%	7.6%
Canada	3.1%	8.9%
Global Equity Forecast		6.4%

Source: Verus, as of 9/30/19



Source: MSCI, as of 9/30/19

Equity summary

	U.S. Large	U.S. Small	EAFE	EAFE Small	EM
Index	S&P 500	Russell 2000	MSCI EAFE Large	MSCI EAFE Small	MSCI EM
Method	Building Block Approach: current dividend yield + historical average real earnings growth + inflation on earnings + repricing				
Current Shiller P/E Ratio	29.0	45.1	17.5	-	10.5
Regular P/E Ratio	19.5	41.0	16.7	18.7*	13.3
2019 Shiller P/E Change	+1.8%	+5.6%	+9.4%	-	+4.0%
2019 Regular P/E Change	+14.0%	-8.3%	+24.6%	-21.4%	+14.9%
Current Shiller P/E Percentile Rank	81%	93%	34%	-	18%
Current Regular P/E Percentile Rank	74%	90%	46%	18%*	34%
Average of P/E Methods' Percentile Rank	77%	92%	40%	18%*	26%
2019 YTD Return	20.5%	14.2%	12.8%	12.1%	5.9%
Shiller PE History	1982	1988	1982	Not Enough History	2005
Long-Term Average Shiller P/E	22.9	31.1	22.6	-	15.1
Current Dividend Yield	2.0%	1.8%	3.5%	2.7%	3.0%
Long-Term Average Real Earnings Growth	2.1%	3.1%	1.9%	1.9%	1.9%
Inflation on Earnings	1.9%	1.9%	1.1%	1.1%	1.9%
Repricing Effect (Estimate)	-0.5%	-1.0%	0.5%	1.5%	0.8%
Nominal Return	5.5%	5.7%	7.0%	7.2%	7.6%
Inflation Forecast	1.9%	1.9%	1.9%	1.1%	1.9%
Real Return	3.6%	3.8%	5.1%	6.1%	5.7%

Data as of 9/30/19

NOTE: For all equities, we exclude data prior to 1972, which allows for a more appropriate comparison between data sets



^{*}Average trailing P/E from previous 12 months is used

Alternatives

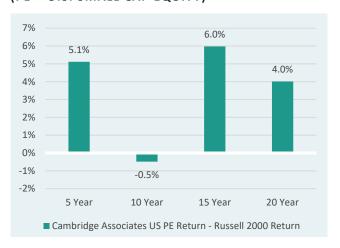
Private equity

Private equity and public equity returns have been correlated historically because the underlying economic forces driving these asset class returns are quite similar. The return relationship between the two can vary in the short-term, but over the long-term investors have received a premium, driven by leverage, concentrated factor exposure (smaller and undervalued companies), skill, and possibly illiquidity.

Historically, the beta of private equity relative to public equities has been high. We use a beta assumption of 1.85 to U.S. large cap equities in our capital market forecast.

Private equity performance typically differs based on the implementation approach. We provide a 10-year forecast for the entire private equity universe of 8.5%. Direct private equity programs have historically outperformed the broader universe by approximately 1.0%, and we forecast direct private equity accordingly with a forecast of 9.5%. Private equity fund-of-fund programs have historically lagged the universe by 1.0%, and we forecast private equity FoF at 7.5% to reflect this drag.

PRIVATE EQUITY EXCESS RETURN (PE – U.S. SMALL CAP EQUITY)



Source: Cambridge, Russell, as of 3/31/19

PRIVATE EQUITY IMPLEMENTATION FORECASTS

	10-Year Forecast
Private Equity Universe Forecast	+8.5%
Private Equity FoF Forecast	+7.5%
Private Equity Direct Forecast	+9.5%

Source: Verus, as of 9/30/19

PRIVATE EQUITY UNIVERSE FORECAST

	10-Year Forecast
U.S. Large Cap Forecast	+5.5%
1.85 Beta Multiplier	+3.0%
Nominal Return	+8.5%
Inflation Forecast	-1.9%
Real Return	+6.6%



Hedge funds

Hedge fund performance variation through time can be partly explained by public market betas (ex: equity, rates, credit, commodities) and partly explained by non-public sources of return (ex: alternative betas, skill, luck). Certain hedge fund strategies can be mostly explained by public market betas, while other types of hedge fund strategies are driven mostly by non-public sources of return.

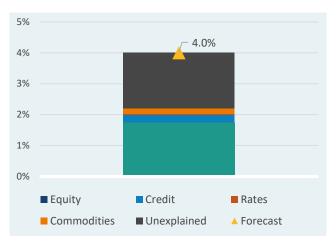
To forecast hedge fund returns, we identified the portion of historical hedge fund performance that can be attributed to public market betas, and the portion of hedge fund returns that cannot be attributed to public market beta. This means our forecast has two components:

the public market return (explained return) and the non-public market return (unexplained return).

To forecast the public market beta portion of hedge funds, we take the historical sensitivity of hedge funds to equity, rates, credit, and commodities and pair these with our current 10-year public market forecasts for each asset class. To forecast the non-public market return portion of hedge funds (unexplained return) we simply assume the historical performance contribution of these sources will continue over the next 10 years.

FORECAST

HEDGE FUND FORECAST



HEDGE FUND PUBLIC MARKET SOURCES OF RETURN (EXPLAINED RETURN)

Equity	
Rates	
Credit	
Commodities	
HEDGE FUND NON- (UNEXPLAINED RET	PUBLIC SOURCES OF RETURN URN)
(UNEXPLAINED RET	

Source: Verus

	10-Year Forecast
Public Market % of Return	+2.2%
Non-Public Market % of Return	+1.8%
Nominal Return	+4.0%
Inflation Forecast	-1.9%
Real Return	+2.1%

Source: Verus, as of 9/30/19



Private core real estate/REITS

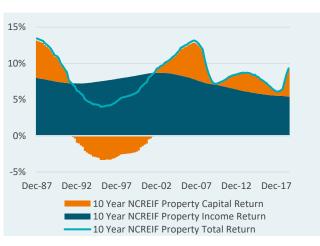
Performance of the NCREIF property index can be decomposed into an income return (cap rate) and capital return. The return coming from income has historically been more stable than the return derived from capital changes.

The cap rate is the ratio of earnings less expenses to price, and does not include extraordinary expenses. A more accurate measure of the yield investors receive should include non-recurring capital expenditures; we assume a 2.0% capex expenditure. We also assume income growth will track inflation as higher prices are passed through to rents.

Private real estate and REITs have provided very similar returns over the long-term. Investors should be careful when comparing riskadjusted returns of publicly traded assets to returns of appraisal priced assets, due to smoothing effects. While private real estate appears to be less volatile than REITs, the true risks to investors are very similar.

We assume the effects of leverage and liquidity offset each other. Therefore, our return forecast is the same for private real estate and REITs.

TRAILING 10-YR NCREIF RETURN COMPOSITION



Source: NCREIF, as of 6/30/19

PRIVATE REAL ESTATE

	Private Real Estate 10- Year Forecast
Current Cap Rate	+4.4%
Real Income Growth	+2.3%
Capex Assumption	-2.0%
Inflation	+1.9%
Nominal Return	6.6%
Inflation Forecast	-1.9%
Real Return	4.7%

Source: Verus, as of 9/30/19

REITS

	10-Year Forecast
Nominal Return Forecast	6.6%
Inflation Forecast	-1.9%
Real Return	4.7%



Value-add & opportunistic real estate

Value-add real estate includes properties which are in need of renovation, repositioning, and/or lease-up. Properties may also be classified as value-add due to their lower quality and/or location. Opportunistic real estate can also include development and distressed or very complex transactions. Greater amounts of leverage are usually employed within these strategies. Leverage increases beta (risk) by expanding the purchasing power of property managers via a greater debt load, which magnifies gains or losses. Increased debt also results in greater interest rate sensitivity. An increase/decrease in interest rates may result in a write-up/write-down of fixed rate debt, since debt holdings are typically marked-to-market.

Performance of value-add real estate is composed of the underlying private

real estate market returns, plus a premium for additional associated risk, which is modeled here as 200 bps above our core real estate return forecast. Performance of opportunistic real estate strategies rest further out on the risk spectrum, is modeled as 400 bps above the core real estate return forecast.

Additional expected returns above core real estate are justified by the higher inherent risk of properties which need improvement (operational or physical), price discounts built into properties located in non-core markets, illiquidity, and the ability of real estate managers to potentially source attractive deals in this less-than-efficient marketplace.

CAP RATE SPREADS



Source: NCREIF, Bloomberg, as of 6/30/19

FORECAST	Value-Add 10-Year Forecast	Opportunistic 10-Year Forecast
Premium above core	+2.0%	+4.0%
Current Cap Rate	+4.4%	+4.4%
Real Income Growth	+2.3%	+2.3%
Capex Assumption	-2.0%	-2.0%
Inflation	+1.9%	+1.9%
Nominal Return	8.6%	10.6%
Inflation Forecast	-1.9%	-1.9%
Real Return	6.7%	8.7%

Source: Verus, as of 9/30/19

FORECAST



Infrastructure

Infrastructure includes a variety of investment types across a subset of industries. There is not one definition for what can be included within infrastructure. The asset class has grown dramatically in the last decade as investors sought assets that might provide more attractive yield relative to fixed income along with the potential for inflation protection.

Similar to real estate investment, income plays a significant role in the returns investors receive. Income yields are currently lower than average due to higher prices and competition in the space, which

might reasonably be expected to translate into lower expected future returns.

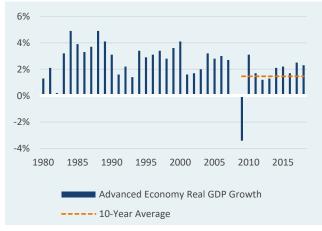
Due to the discount rate effect, infrastructure asset valuations would generally be negatively affected by material increases in interest rates. Because leverage is used in this space, higher interest rates would also impact investors in the form of higher borrowing costs.

5-YR ROLLING RETURN COMPOSITION

Source: S&P Global Infrastructure Index, as of 9/30/19



ADVANCED ECONOMY REAL GDP GROWTH



Source: IMF, as of 9/30/19

FORECAST

	10-Year Forecast
Inflation	1.7%
Yield	4.1%
Income Growth	1.5%
Nominal Return	7.2%
Global Inflation Forecast	-1.7%
Real Return	5.5%

Source: Verus, as of 9/30/19, may not sum due to rounding



Commodities

Commodity returns can be decomposed into three sources: collateral return (cash), spot changes (inflation), and roll yield.

Roll return is generated by either backwardation or contango present in futures markets. Backwardation occurs when the futures price is below the spot price, which results in positive yield. Contango occurs when the futures price is above the spot price, and this results in a loss to commodity investors. Historically, futures markets have fluctuated between backwardation and contango but with a net-zero effect over the very long-term (since 1877). Therefore, roll return is assumed to

be zero in our forecast. Over the most recent 10-year period, roll return has been negative, though this is likely the result of multiple commodity crises and a difficult market environment.

Our 10-year commodity forecast combines collateral (cash) return with spot return (inflation) to arrive at the nominal return, and subtracts out inflation to arrive at the real return.

TRAILING 10YR BLOOMBERG COMMODITY RETURN COMPOSITION (%)



Source: MPI, Bloomberg, as of 9/30/19

BLOOMBERG COMMODITY RETURN COMPOSITION (%)



Source: MPI, Bloomberg, as of 9/30/19

FORECAST

	10-Year Forecast
Collateral Return (Cash)	+1.9%
Roll Return	+0.0%
Spot Return (Inflation)	+1.9%
Nominal Return	3.8%
Inflation Forecast	-1.9%
Real Return	1.9%



Currency beta

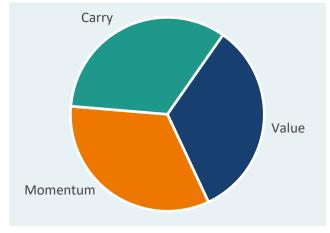
Currency beta is a long-short portfolio of G10 currencies constructed by investing in three equally weighted factors: carry, momentum, and value. A significant amount of academic research has concluded that these factors demand a risk premium in the currency market. Studies have also shown that currency beta explains a high portion of active currency managers' returns, indicating it may be a good neutral starting point or benchmark for currency investing. Currency beta portfolios gain exposure to the carry, momentum, and value factors in a systematic and transparent manner. For more detailed information on currency beta, please contact your consultant.

We model each factor in the currency beta portfolio separately, and then take a weighted average to get an overall return forecast. For the carry portfolio, the main driver of returns is the yield an investor receives from holding currencies with relatively higher interest rates. We therefore use a 12-month average of the portfolio's yield as the expected return. For value, our return forecast assumes a certain level of mean reversion to PPP fair value based on historical data. Lastly, for momentum, we simply assume the average historical return due to lack of long-term fundamental return drivers. Short-term volatility levels typically drive returns in the momentum portfolio, which is difficult to model in a 10-year return forecast.

3-YEAR ROLLING PERFORMANCE



CURRENCY BETA CONSTRUCTION



RETURN FORECAST

Factor	Weight	Return Forecast	Weighted return
Carry	33.3%	2.7%	0.9%
Momentum	33.3%	-0.2%	-0.1%
Value	33.3%	2.8%	0.9%
Currency Beta			1.8%

Source: Verus Source: Verus, as of 9/30/19



Source: MSCI, as of 9/30/19

Risk parity

Risk parity is built upon the philosophy of allocating to risk premia rather than to asset classes. Because risk parity by definition aims to diversify risk, the actual asset allocation can appear very different from traditional asset class allocation.

We model risk parity using an assumed Sharpe Ratio of 0.5, which considers the historical performance of risk parity. This assumed Sharpe Ratio is higher than other asset class forecasts, but is consistent with these forecasts because *portfolios* of assets tend to deliver materially higher Sharpe Ratios than individual assets.

The expected return of Risk Parity is determined by this Sharpe Ratio forecast, along with a 10% volatility assumption.

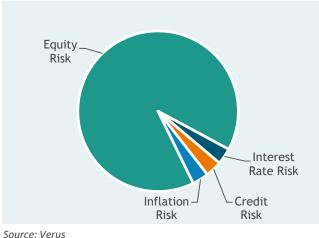
We used a 10-year historical return stream from a market-leading product to represent risk parity correlations relative to the behaviors of each asset class. Risk parity funds are suggested to be better able to withstand various difficult economic environments - reducing volatility without sacrificing return, over longer periods.

It is difficult to arrive at a single model for risk parity, since strategies can differ significantly across firms/strategies. Risk parity almost always requires explicit leverage. The amount of leverage will depend on the specific strategy implementation style, as well as expected correlations and volatility.

VS. TRADITIONAL ASSET CLASSES



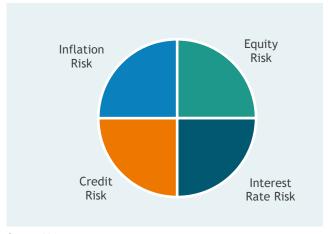
TRADITIONAL ASSET ALLOCATION



Source. Verus

Note: Risk parity is modeled here using the AQR GRP-EL 10% Volatility fund. Performance is back tested prior to February 2015

RISK PARITY



Source: Verus



Appendix

30-year return & risk assumptions

- Occasionally investors may have a specific need for longer-term capital market forecasts. We have developed a set of 30-year assumptions to meet those needs.
- The return forecasts below have been constructed using our existing building block approach, but with longer-term inputs. Risks and correlations are estimated using the same approach as our 10-year forecasts, using full-history autocorrelation-adjusted realized risk and past 10 year realized correlations.
- These return figures must be thought of separately from our 10-year forecasts, and are not meant to imply performance for the 20 years beyond our 10 year forecasts.
- Please reach out to your Verus consultant with questions regarding whether 30-year Capital Market Assumptions might be appropriate for your needs.

Asset Class	Index Press	Thirty Year R	Thirty Year Return Forecast		Sharpe Ratio Forecast (g) Sharpe Ratio Forecast (a)	
Asset Class	Index Proxy	Geometric	Arithmetic	Forecast	Snarpe Katio Forecast (g) Snarpe Katio Forecast (a)
Equities						
U.S. Large	S&P 500	5.5%	6.6%	15.4%	0.25	0.32
U.S. Small	Russell 2000	6.1%	8.1%	21.1%	0.21	0.30
International Developed	MSCI EAFE	6.7%	8.0%	17.5%	0.29	0.36
International Small	MSCI EAFE Small Cap	6.2%	8.3%	21.8%	0.21	0.31
Emerging Markets	MSCI EM	6.8%	9.6%	25.6%	0.20	0.31
Global Equity	MSCI ACWI	6.0%	7.3%	16.8%	0.26	0.34
Private Equity*	Cambridge Private Equity	8.7%	11.5%	25.3%	0.28	0.39
Fixed Income						
Cash	30 Day T-Bills	1.7%	1.7%	1.2%	-	-
U.S. TIPS	BBgBarc U.S. TIPS 5 - 10	2.1%	2.3%	5.4%	0.08	0.11
U.S. Treasury	BBgBarc Treasury 7-10 Year	2.1%	2.3%	6.7%	0.07	0.10
U.S. 30-year Treasuries	BBgBarc U.S. Treasury 20+ Year	2.1%	2.9%	12.5%	0.04	0.10
Global Sovereign ex U.S.	BBgBarc Global Treasury ex U.S.	0.7%	1.1%	9.7%	-0.10	-0.06
Global Aggregate	BBgBarc Global Aggregate	1.1%	1.3%	6.2%	-0.09	-0.06
Core Fixed Income	BBgBarc U.S. Aggregate Bond	3.0%	3.2%	6.3%	0.21	0.24
Core Plus Fixed Income	BBgBarc U.S. Corporate IG	3.6%	4.0%	8.3%	0.24	0.28
Short-Term Gov't/Credit	BBgBarc U.S. Gov't/Credit 1 - 3 year	2.3%	2.3%	3.6%	0.17	0.18
Short-Term Credit	BBgBarc Credit 1-3 Year	2.9%	2.9%	3.6%	0.33	0.35
Long-Term Credit	BBgBarc Long U.S. Corporate	3.5%	3.9%	9.4%	0.20	0.24
High Yield Corp. Credit	BBgBarc U.S. Corporate High Yield	5.3%	5.9%	11.3%	0.32	0.37
Bank Loans	S&P/LSTA Leveraged Loan	4.7%	5.2%	10.0%	0.30	0.35
Global Credit	BBgBarc Global Credit	0.8%	1.1%	7.4%	-0.12	-0.08
Emerging Markets Debt (Hard)	JPM EMBI Global Diversified	6.1%	6.8%	12.4%	0.35	0.41
Emerging Markets Debt (Local)	JPM GBI EM Global Diversified	5.7%	6.4%	12.0%	0.34	0.39
Private Credit	Bank Loans + 175bps	6.4%	6.9%	10.0%	0.48	0.52
Other						
Commodities	Bloomberg Commodity	3.2%	4.4%	15.4%	0.10	0.18
Hedge Funds*	HFRI Fund Weighted Composite	4.5%	4.8%	7.7%	0.37	0.40
Real Estate Debt	BBgBarc IG CMBS	4.1%	4.4%	7.6%	0.32	0.35
Core Real Estate	NCREIF Property	6.8%	7.5%	12.4%	0.41	0.47
Value-Add Real Estate	NCREIF Property + 200bps	8.8%	10.2%	17.7%	0.40	0.48
Opportunistic Real Estate	NCREIF Property + 400bps	10.8%	13.0%	23.0%	0.40	0.49
REITs	Wilshire REIT	6.8%	8.4%	19.1%	0.27	0.35
Global Infrastructure	S&P Global Infrastructure	7.0%	8.4%	17.8%	0.30	0.38
Risk Parity	Risk Parity	7.1%	7.6%	10.0%	0.54	0.59
Currency Beta	MSCI Currency Factor Index	2.2%	2.2%	3.6%	0.14	0.15
Inflation		1.6%	-	-	-	-

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

^{*}Private Equity and Hedge Fund return expectations differ if implemented through a direct program versus a fund of funds vehicle



10-year return forecasts with currency adjustment

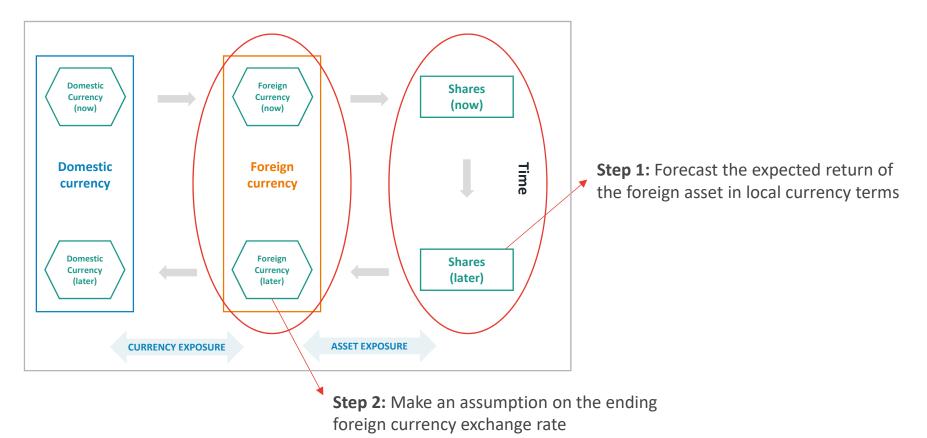
		Ten Year Return Forecast (Geometric)			Standard Deviation
Asset Class	Index Proxy	CMA Forecast	Currency Adjustment	Total	Forecast
Equities					
International Developed Equity Unhedged	MSCI EAFE	7.0%	1.8%	8.8%	17.5%
International Developed Equity Hedged	MSCI EAFE Hedged	7.0%	1.8%	8.8%	15.7%
International Small Equity Unhedged	MSCI EAFE Small Cap	7.2%	1.8%	9.0%	21.8%
International Small Equity Hedged	MSCI EAFE Small Cap Hedged	7.2%	1.8%	9.0%	19.2%
Fixed Income					
Global Sovereign ex U.S. Unhedged	BBgBarc Global Treasury ex U.S.	0.1%	1.7%	1.8%	9.7%
Global Sovereign ex U.S. Hedged	BBgBarc Global Treasury ex U.S. Hedged	0.1%	1.7%	1.8%	3.8%
Global Credit Unhedged	BBgBarc Global Credit	1.4%	0.5%	1.9%	7.4%
Global Credit Hedged	BBgBarc Global Credit Hedged	1.4%	0.5%	1.9%	5.0%

The currency adjustment is the market implied price change for major currency pairs based on forward contract pricing. Since the market implied spot price change and the cost/gain from hedging are both derived from pricing in the forward market, they are one and the same. Therefore, the currency adjustment is the same for both unhedged and hedged forecasts. See the following slides for the more detail on the currency adjustment methodology.



Explanation of the currency adjustment

Our fundamental building block approach produces a return forecast in local currency. In order to create useable forecasts for non-U.S. dollar-denominated assets, we must make an assumption about future foreign exchange rates.



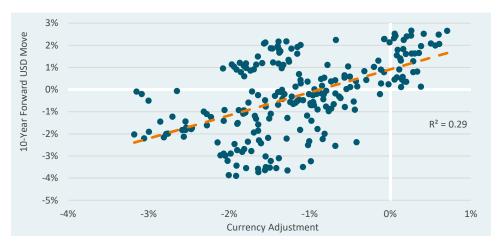
Explanation of the currency adjustment

- There are two options to adjust a local currency return forecast to a U.S. dollar forecast: make a specific exchange rate forecast or take market pricing based on the forward curve
 - It is important to note that ignoring currency is making a specific assumption that the current exchange rate will be unchanged over the next 10 years, which has rarely been the case throughout history
- Markets price future exchange rates in the forward market, which represents the SPOT currency price for FORWARD delivery
- Forward currency contracts are priced based on the interest rate differential between two currencies interest rate differentials reflect a significant amount of information, including growth, inflation, and monetary policy expectations
- A currency with a higher interest rate is priced to depreciate relative to a currency with a lower interest rate
- We adjust our local currency return forecasts based on forward market pricing because we believe this is the neutral, "no opinion" position, rather than making a specific forecast
- Historically, this currency adjustment has had a positive relationship with 10-year forward exchange rate movements

10-YEAR ROLLING ABSOLUTE CURRENCY IMPACT



CURRENCY ADJUSTMENT VS. FORWARD USD MOVEMENT



Source: Verus, MSCI, as of 9/30/19

Source: Verus, Bloomberg, using data since 1989, based on the MSCI EAFE Index



Autocorrelation adjustment

- We adjust all volatility forecasts that use the long-term historical volatility for autocorrelation.
- Autocorrelation occurs when the future returns of a time series are described (positively correlated) by past returns.
- Time series with positive autocorrelation exhibit artificially low volatility, while time series with negative autocorrelation exhibit artificially high volatility.
- Many asset classes that we tested showed positive autocorrelation, meaning the volatility forecasts that we use in the forecasting process are too low for those asset classes.
- The result of this process was that several asset classes have higher volatility forecasts than if we had made no adjustment for autocorrelation.

Russell 2000 autocorrelation, among many asset classes, is statistically significant

Notices & disclosures

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