

2022 Asset Allocation Report

Including: Long-Term Capital Market Assumptions
Short-Term Tactical Outlook

January 17, 2022

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Executive Summary

This report presents Cliffwater recommendations for asset class return and risk (standard deviation) assumptions, intended for asset allocation studies that set long-term portfolio asset class targets. While these forward-looking or “expected” asset return and risk assumptions are intended for investment horizons of 10 years or longer, they can change as market conditions change and therefore should be used for asset allocation work conducted near the date of the report.¹

Exhibit 1 on the following page provides Cliffwater return forecasts for the major asset classes as of January 1, 2022 (column 1) and compares them with our year earlier forecasts at January 1, 2021 (column 2). Also included are the calendar 2021 returns (column 4) for the asset class benchmarks (column 5), which were selected by Cliffwater as representative of each asset class. Decreases (increases) in expected returns are often, but not always, driven by prior performance gains (losses). A full listing of asset class return, risk, and correlation forecasts is provided at the end of this report.

Key observations from our 2022 Asset Allocation Report are:

1. **Stocks** – year-over-year U.S. stock expected returns rose from 6.25% to 6.40% despite a very strong 26% return for the 2021 calendar year. Offsetting the price gains was an equally strong 36% growth in S&P 500 earnings from pre-COVID levels.
2. **Rates** – Treasury bond expected returns rose from 0.90% one year ago to 1.50% at year-end. These higher Treasury yields unfortunately do not offset the 7% inflation rate in 2021 which, if it continues, creates the lowest real returns in decades. Consequently, Treasuries remain one of two asset classes given a Negative Outlook. (Exhibit 58)
3. **Stock/Bond Spread** – the historically high 5.35% spread between U.S. stock and 10-year Treasury bond expected returns from one year ago fell to 4.90%, a level that remains attractive relative to the 4.18% average spread for the last 20 years.
4. **Credit** – Yield spreads ended 2021 lower than one year ago, putting high yield bonds within our Negative Outlook range. (Exhibit 58)
5. **Inflation** – Inflation broke out in 2021 with a 7.1% rise in the CPI. The 10-year breakeven inflation rate also rose from 2.0% to 2.6% in anticipation of higher prices in the future.
6. **Private Equity** – expected returns increased to 9.40% in line with the increase in expected returns for public equities. We expect private equity to generate a net 3% return over public stocks over longer time periods, an achievement documented in our past studies of actual private equity returns.
7. **Hedge Funds** – Our expected return forecast has risen from 3.85% to 4.15%, driven by an increase in our cash return forecast. Our alpha expectation remains modest at 1.77%.
8. **Private Debt** – Expected returns have increased slightly over the last year to 6.45% and 8.85% for unlevered and levered private debt, respectively. The increases relate to higher expected short-term rates and lower borrowing rates.
9. **Real Estate** – expected public and private real estate returns equal 5.70% and 6.70%, respectively, up from 5.45% and 5.90% one year ago due primarily to higher inflation expectations.
10. **Real Assets** – Changes in expected returns for private real assets, notably farmland and infrastructure, are mixed the past year. Expected commodity returns increased due to higher cash rates. MLP expected returns fell to 6.45% due to strong 2021 returns and a continued earnings decline.

Overall, our 2022 expected returns increased 0.31%, from 4.69% to 5.00%, based upon average values across all asset classes. The primary contributors were rising interest rates, higher expected inflation, and strong earnings growth.

¹ The terms “expected return” and “return forecast” are used interchangeably throughout the report.

Exhibit 1: Long Term (10 Year) Expected Returns for Major Asset Classes²

	(1) (2)		(3)	(4)	(6)
	Expected % Return*				
	Jan 1, 2022	Jan 1, 2021	YoY % Change	2021 Return	Benchmark Index
Stocks					
U.S. Stock	6.40	6.25	0.15	25.7%	Russell 3000
Non-U.S. Developed	6.40	6.25	0.15	11.3%	MSCI EAFE
Emerging Markets	6.90	6.75	0.15	-2.5%	MSCI EM
Global Equity	6.70	6.55	0.15	18.5%	MSCI ACWI
Rates					
Core U.S. Bonds	1.75	1.15	0.60	-1.5%	Bloomberg U.S. Aggregate Bond
IG Corporate	2.35	1.75	0.60	-1.0%	Bloomberg U.S. Corporate Bond
10-yr Treasury	1.50	0.90	0.60	-4.6%	Bloomberg 10y U.S. Treasury
10-yr TIPS	1.50	0.90	0.60	5.3%	Bloomberg 5-10y U.S. TIPS
Credit					
High Yield Bonds	4.10	4.70	-0.60	5.3%	Bloomberg U.S. High Yield Bond
Bank Loans	4.30	4.00	0.30	5.2%	S&P/LSTA U.S. Leveraged Loan
Emerging Market Debt	4.55	3.80	0.75	-1.8%	J.P. Morgan EMBI Global Diversified
Real Estate					
Public REITs	5.70	5.45	0.25	43.2%	FTSE/NAREIT Equity REITs
Private (Unlevered)	6.70	5.90	0.80	12.2%	† NCREIF Property (NPI) (gross)
Private Partnerships	7.70	6.90	0.80	13.6%	† NCREIF NFI-ODCE (net)
Private Equity					
Diversified	9.40	9.25	0.15	47.1%	† Cambridge Global PE & VC
Private Debt					
Unlevered	6.45	6.20	0.25	14.3%	† Cliffwater Direct Lending (CDLI)
Levered	8.85	8.70	0.15	18.6%	† Cliffwater BDC Index ROE
Hedge Funds					
Diversified	4.15	3.85	0.30	6.5%	HFRI FOF Composite
Other Real Assets					
Commodity Futures	1.50	0.50	1.00	27.1%	Bloomberg Commodity
MLPs	6.45	7.10	-0.65	40.2%	Alerian MLP
Farmland (core)	6.50	6.50	0.00	5.5%	† NCREIF Farmland Property (gross)
Infrastructure	7.25	7.00	0.25	14.6%	† Cambridge Infrastructure
Cash					
3M T-bill	1.25	1.00	0.25	0.0%	3 mo. T-bill
3M LIBOR	1.55	1.30	0.25	0.1%	3 mo. Libor
Inflation	2.60	2.00	0.60	7.1%	CPI-U

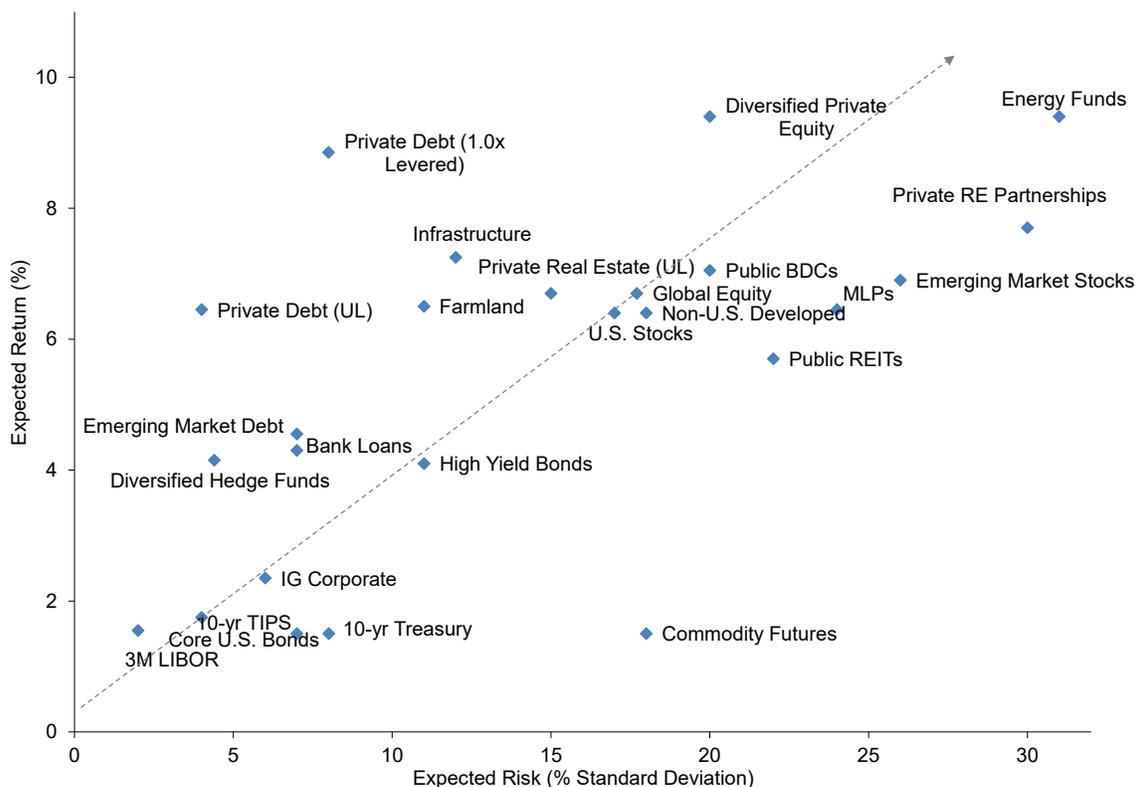
* Expected geometric annual return over the next 10 years, net of fees and expenses

† Trailing four quarters ending Sep 30, 2021

² There can be no assurance that any expected rates of return or risk will be achieved. Expected rates of return and risk may be based upon assumptions regarding future events and conditions that prove to be inaccurate. Expected rates of return and risk should not be relied upon as an indication of future performance and should not form the primary basis for an investment decision. The index returns are provided for information only. Reference to an index does not imply that a portfolio will achieve returns, volatility, or other results similar to the index. Please see additional disclosures at the end of this report.

Exhibit 2 plots Cliffwater 10-year expected asset class return and risk.

Exhibit 2: 2022 Asset Class *Expected* Return and Risk³



The dashed line in Exhibit 2 is known as the “capital market line” representing the market tradeoff between expected return and risk. That line connects the risk-free rate – Libor in our depiction – and the global equity portfolio.

A general observation is that expected returns for most asset classes fall below the 7% to 8% return that is required by most institutions – pensions, endowments, and foundations – to meet their spending/benefit payouts and preserve assets for future beneficiaries. For example, the expected annual return for a liquid 60% equity, 40% fixed income portfolio equals 5.12%, which is about 2% below most institutional needs.

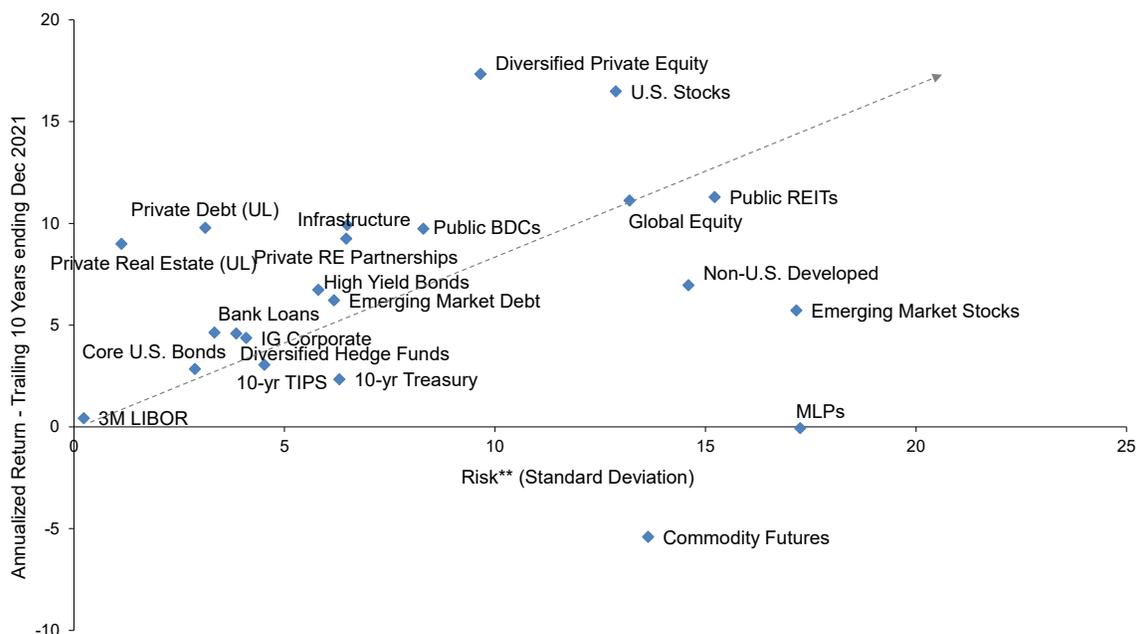
However, an endowment portfolio that is diversified into higher returning private assets has an expected return equal to 7.00%, but with much less liquidity. And a risk-parity portfolio that uses leverage to achieve higher returns might expect a return closer to 6.23%, using Cliffwater expected returns. The modest level for expected returns suggests that institutions will likely need to embrace less liquid asset classes, make use of leverage, or both to achieve their long-term objectives.

The expected returns in Exhibit 2 generally fall below the 10-year historical returns shown in Exhibit 3, particularly for equity-oriented asset classes. The 10-year historical returns exclude the period covering the Great Financial Crisis but include the extended bull market for risky assets and the COVID market downturn.

³ See footnote 2, above.

Exhibit 3 plots actual historical asset class return and risk for the 10 years ending December 31, 2021.⁴

Exhibit 3: 10-Year *Historical* Asset Class Benchmark Return and Risk⁵



* Returns for Diversified Private Equity, Energy Funds, Infrastructure, Private Debt (UL), Private RE Partnerships, Private Real Estate (UL) are lagged by one quarter.
 ** 10-year risk values are adjusted for smoothing where appropriate.
 Source: Bloomberg Barclays, S&P Dow Jones, FTSE Russell, NCREIF, FTSE NAREIT, Cambridge, Cliffwater, MSCI, HFRI

Private equity reported the highest 10-year return followed by U.S. stocks. Compared to U.S. stocks, the weak returns for non-U.S. developed and emerging market stocks over the past 10 years stands out in Exhibit 3. This is partly attributable to the strength of the dollar which climbed 1.3% per year on average over the last 10 years.⁶ Currency aside, non-U.S. stocks experienced a disappointing decade, likely attributable to their continuing low growth or commodity-based economies.

The bust in commodity prices is a second outlier, reflecting a prolonged commodity deflationary cycle within the developed world and, more specifically, technological changes brought to oil & gas exploration.

Cliffwater Expected Return and Risk Methodology

Cliffwater uses a *fundamental model-based approach* to forecasting asset class returns, simply expressed in the equation below:

$$\text{Return Forecast} = \underbrace{\text{Cash Yield} + \text{Cash Flow Growth}}_{\text{Buy \& Hold Component}} + \underbrace{\text{Change In Valuation (Yield, P/E, Growth)}}_{\text{Tactical Component}} + \text{Manager Alpha}$$

⁴ Returns for private equity, private debt (UL), private real estate (UL), private real estate partnerships, energy funds, infrastructure and farmland are lagged by one quarter. Historical risk calculations are “unsmoothed” for private investments, excluding hedge funds. See Cliffwater Expected Return and Risk Methodology.

⁵ See column 5 of Exhibit 1 for the asset class benchmark Cliffwater selected as representative of each asset class.

⁶ U.S. Dollar Index (DXY)

We believe that long term (buy and hold) asset class returns come from current cash yield and future cash flow growth, a formulation known as the “Gordon Model.” Cliffwater’s long term expected returns (Capital Market Assumptions or CMA) are largely based upon the Gordon Model alone.

For example, our expected return on bonds looks at current cash yield, provided through coupons, plus cash flow growth. Coupons don’t normally grow so most of the time bond expected return equals current cash yield. However, bonds experiencing credit losses will generate negative cash flow growth which we will incorporate into our calculations. On the flip side, cash flow growth could be positive if future reinvestment of coupons is expected to be at a higher rate. We use market forward rates to account for adjustments such as this.

You will find that most of our report focuses on cash yield and growth expectations by asset class in order to give the reader a firm basis for understanding the underpinnings of our long-term return expectations.

The second tactical component to return is not used in our long-term return assumptions. Tactical return forecasts are derived from expected (short-term) changes in valuation, such as yield or price-earnings multiples. These valuation changes happen frequently but are very difficult to predict. Fortunately, tactical returns from valuation changes average toward zero over longer time periods, such as 10 years, and can be ignored for return forecasting, though they are important in short term measurements of risk.

Our last component to return is manager alpha. Our practice is to assume manager alpha equal to zero in asset classes that are known to exhibit market efficiency and where active management has proved challenging. For these asset classes our expected return assumptions would reflect what would be earned by a passive (index fund) investor where diversification is broadest, and expenses are small. However, in a number of alternative asset classes, such as private equity and hedge funds, we do factor in an alpha component to long term expected return. These expected returns from alpha are reexamined annually based upon our measurement of past alpha generation, and changes are made accordingly.

Cliffwater return volatility and correlation forecasts rely upon calculations using monthly historical returns when the asset class is liquid and broadly captured by an index that is accepted industry-wide. However, returns for many of the major alternative asset classes, including private equity, private debt, and real estate, are quarterly in frequency with values determined by accounting or appraisal standards that frequently understate true volatility and correlation. This occurs because valuations done by professionals, as opposed to market traders, tend to be less frequent and backward looking. The result is a time series of returns (values) that exhibit lower periodic change and serial correlation, which together is characterized as “smoothing.”

We statistically “unsmooth” the asset returns for those indices representing private asset classes. While the full description of our unsmoothing procedure is outside the scope of this report, we follow a framework described by Nesbitt (2019).⁷ The remainder of this report reviews how the assumptions were developed for the individual asset classes.

U.S. Stocks

Cliffwater’s long-term stock return forecast equals 6.40%, an increase from 6.25% forecast last year. The increase in expected return happened despite a 26% return in stocks for 2021, which would normally reduce the return forecast. Strong earnings growth during the year returned earning levels to well above their pre-COVID levels, raising future earnings projections, and offsetting higher prices.

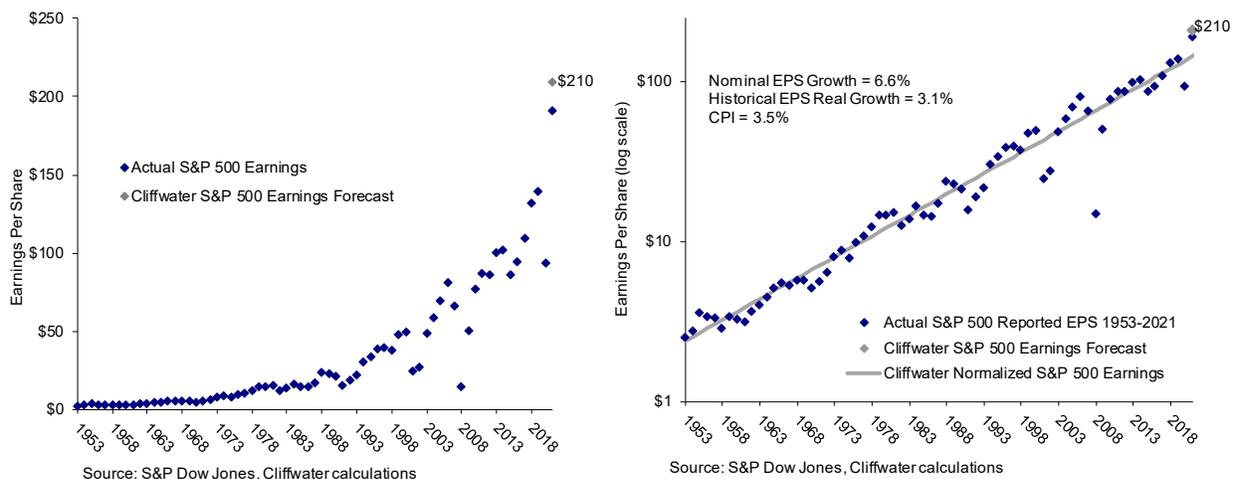
Our proprietary dividend discount model is used to forecast long term stock returns. It is similar in method to the yield-to-maturity on a bond except that future stock dividends are discounted instead of coupon and principal payments. While future bond payments are fixed, stock dividends are not, and forecasting

⁷ “Forecasting Risk for Illiquid Asset Classes”, Cliffwater Research (October 2019)

dividends and their growth largely determines expected stock returns. Key to forecasting dividend growth is forecasting earnings growth.

Fortunately, long term earnings growth has been predictable. Exhibits 4(a) and 4(b) show historical S&P 500 earnings per share.

Exhibits 4(a) and 4(b): Historical S&P 500 Reported Earnings



A useful way to put earnings into perspective is shown in Exhibit 4(b). It is identical to Exhibit 4(a) except that the vertical axis uses a log scale. A straight line on a log scale means that the growth rate is constant, and we use it here to demonstrate that S&P 500 earnings growth has been largely constant through time. Long term nominal earnings growth has averaged 6.6% per year over the 69 years shown, comprised of approximately 3.1% real growth and 3.5% inflation. The 3.1% real earnings growth is roughly in line with real U.S. GNP growth over the same time period.

In forecasting future earnings growth, we use a 2.00% real growth assumption and a 2.50% long term inflation assumption. Together this gives a nominal future earnings growth forecast equal to 4.50%. The 2.00% real growth assumption is below the historical rate but more consistent with growth

Having settled on an earnings growth forecast, we next determine our current base value for earnings. The current S&P 500 earnings “run rate” is approximately \$200 per share, and we use that as our base value for earnings.

The final input is future dividends, which is largely a function of earnings and the dividend payout ratio. Exhibit 5 provides data describing the relationship between S&P 500 earnings and dividends. Two earnings definitions, operating and reported, are plotted. Reported earnings are those typically cited by the financial press and include ongoing revenues and expenses as well as one-time write-offs. Operating earnings take out one-time write-offs and are thought by some to better represent profits going forward.

Exhibit 5 compares reported and operating earnings over the past 33 years. Not only are S&P 500 earnings per share volatile but so is the disparity between operating earnings and reported earnings, with wide differences during market downturns. However, expectations are that the two measures will converge as write-downs abate. Historically, reported earnings average approximately 87% of operating earnings and dividends (repurchases included) average 45% of reported earnings. We believe that reported earnings are a better reflection of the potential to pay dividends and consequently we focus on that earnings definition.

Exhibit 5: Relationship between S&P 500 Operating Earnings, Reported Earnings, and Dividends



Currently, dividend payouts are below their long term 45% average but we expect them to climb back to that historical average.

Exhibit 6 summarizes our stock inputs and reports our 6.40% expected stock return based on our dividend discount model. S&P Price is the value of the S&P 500 Index at year-end. Normalized earnings equal S&P 500 earnings per share for the two quarters prior and two quarters following December 31, 2021, using S&P estimates. The 4.50% long term earnings growth forecast implies a real (inflation-adjusted) earnings growth equal to 2.0%, assuming a 2.50% inflation assumption.

Exhibit 6: Dividend Discount Model Inputs as of December 31, 2021

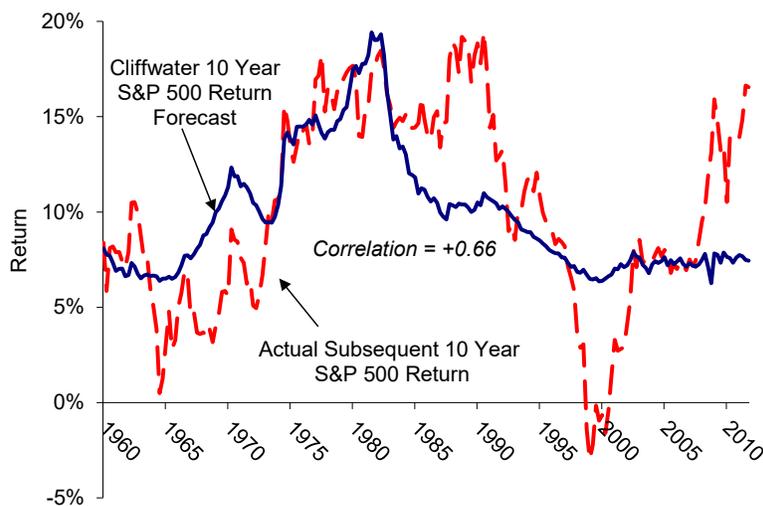
S&P Price per Share	\$4,766
Normalized Earnings per Share	\$200
Initial Earnings Growth Rate	4.50%
Long Term Earnings Growth	4.50%
Initial Dividend Payout Ratio	45%
Terminal Dividend Payout Ratio	45%
Calculated Discount Rate	6.38%

Our 6.40% expected return is the discount rate (rounded to the nearest 5 basis points), or internal rate of return, that equates the forecast dividend payments to the current S&P 500 price.

Forecast versus Actual Return

The dividend discount model has proven to be a very effective, though imperfect, tool for forecasting long-term stock returns. The historical accuracy of this method is demonstrated in Exhibit 7.

Exhibit 7: Cliffwater 10-Year S&P 500 Return *Forecast* versus *Actual* Subsequent 10-Year S&P 500 Returns⁸



Source: S&P Dow Jones, Cliffwater calculations

The solid blue line in Exhibit 7 plots our 10-year return forecast for stocks (S&P 500) from 1960 through 2011, utilizing the above dividend discount model applied retroactively. The dashed red line plots actual 10-year subsequent returns. For example, the first data points are for January 1, 1960. The forecasted S&P 500 10-year return using data from January 1, 1960 would be 8.25% and the actual return for the subsequent 1960-1969 period was 8.19%. The final two data points correspond to a forecasted return of 7.45% at January 1, 2012, the last date for which there is a 10-year subsequent return history, and an actual return of 16.45% for the 2012 to 2021 period. The correlation between forecasted and actual return is 0.66 (R-squared of 44%) for the entire time period, which we believe demonstrates that our forecasting methodology for stocks is powerful for asset allocation studies whose purpose is setting long-term policy.

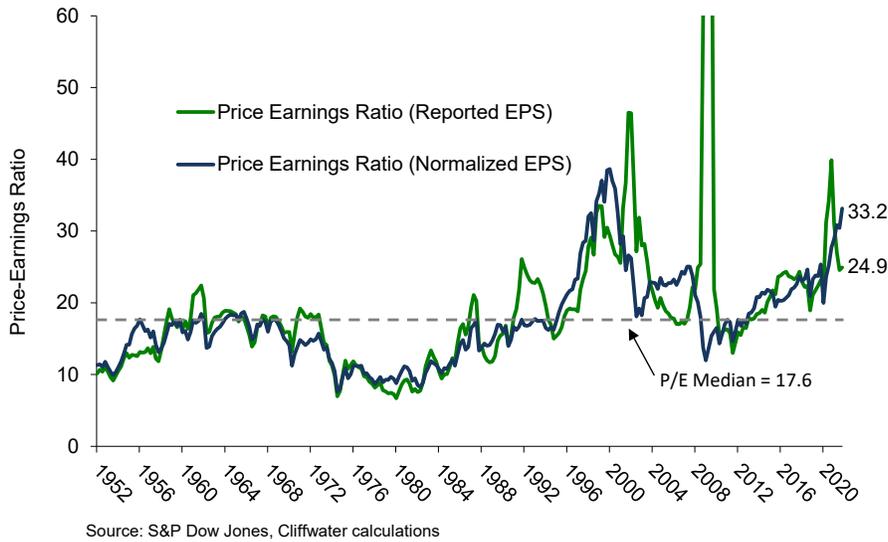
Exhibit 7 shows three periods where Cliffwater's forecasting approach materially overstated or understated subsequent returns. Return forecasts using data from the mid and late 1960s exceeded subsequent returns. This was caused by the severe 1973-74 bear market when price-earnings ratios dropped to 7.0. The opposite occurred in the late 1980s and early 1990s when a technology bubble in the late 1990s caused stock prices to skyrocket. Our stock return forecast was again too high using data for the 10-year period ending 2010 due to market drawdowns in 2000-02 and 2008. Cliffwater return forecasts are less likely to be accurate during periods when changes in investor sentiment produce wide swings in price-earnings multiples, which a dividend discount model does not capture. That has been true over the most recent 10-year period.

Exhibit 8 shows S&P 500 price-earnings multiples over the last 70 years. Over that period, they average 17.6 but have been subject to significant swings, falling to 7 during the 1970s, climbing to 46 at their peak in 1999 (except for a price-earnings spike in 2009 as earnings fell from write-offs and recession), then falling again to 13 at the end of 2008.

Today, price-earnings ratios equal 24.9, measured by reported earnings, which represents a 41% premium to the 17.6 historical median price-earnings multiple and a new peak. Last year the price-earnings ratio stood at a 56% premium to the historical median.

⁸ The Cliffwater return forecast shown is calculated by applying the current Cliffwater return forecast methodology to historically available market information. It does not reflect actual performance of any account(s) managed by Cliffwater. Cliffwater may change its return forecast methodology at any time and the Cliffwater return forecast should not be used to predict the actual future performance of any Cliffwater account.

Exhibit 8: S&P 500 Price-Earnings Ratios, 1952 to 2021

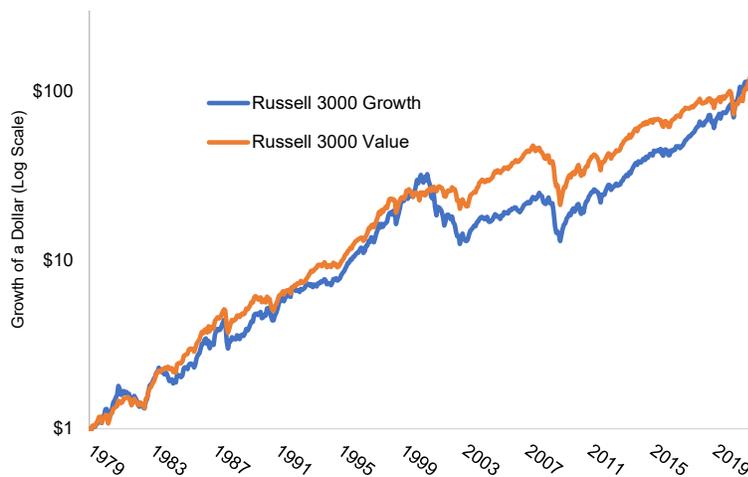


Growth Stocks versus Value Stocks

The segmentation of US stocks into growth and value was initially proposed over 40 years ago to accommodate managers that focus on one or the other and the desire to better benchmark their performance. Since that time a lot of attention has been given to forecasting their relative performance. History has informed investors that (1) long-term performance is roughly equal among growth and value stocks, (2) no investment approach has survived that can tactically time the difference in growth and value stock performance, and (3) active management has struggled equally in the growth and value categories.

Exhibit 9 shows cumulative returns for Russell 3000 growth and value stocks over a 43-year time period through 2021. As the graph illustrates, the recent attention to growth stock outperformance reflects a catch-up from the prior underperformance rather than a long-term performance separation from value stocks.

Exhibit 9: Growth Stocks versus Value Stocks, 1978 to 2021



Over the entire 43-year time period growth stocks have earned an 12.23% return, slightly higher compared to the 11.97% return earned by value stocks.

Large Cap Stocks versus Small Cap Stocks

Over 43 years of providing return forecasts at Cliffwater and other institutions, Cliffwater professionals have often been asked why we use the same return forecast for large and small stocks, when most other advisory firms have higher expected returns for small stocks compared to large stocks. While the theory that higher beta small stocks should perform above lower beta larger stocks is reasonable, the fact is that small stocks have not outperformed large stocks over the 43 years for which accurate small stock records have been kept. In fact, large stocks performed almost identically to small stocks over the entire 43 years, as shown in Exhibits 10 and 11.

Exhibit 10: Large Stocks (S&P 500) versus Small Stocks (Russell 2000), 1978 to 2021

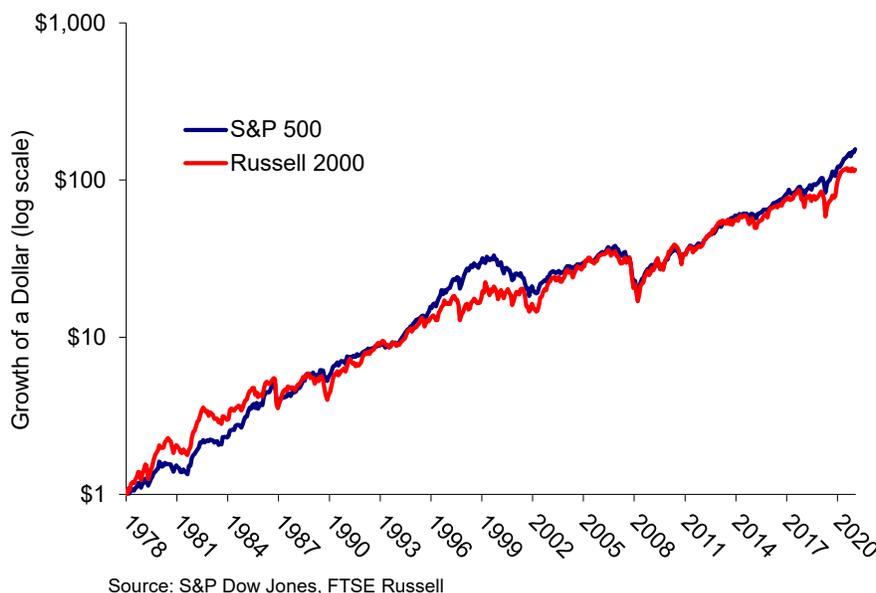


Exhibit 11: Return and Risk for Large and Small Cap Stocks, Dec 1978 to Dec 2021

	S&P 500	Russell 2000
Annual Return	12.48%	11.69%
Annual Risk	15.01%	19.59%

Source: S&P Dow Jones, FTSE Russell

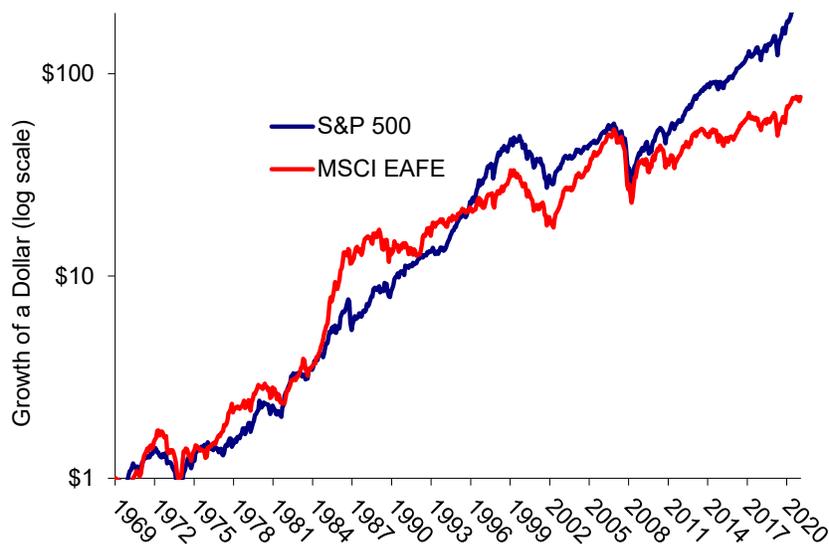
Exhibit 10 illustrates the strong performance of small cap stocks in the late 1970s and early 1980s. During the last half of the 1990s large cap stocks surged. Since the early 2000s, large and small cap stocks have largely moved together. Exhibit 11 reports very little difference in return between large and small stocks over the entire 43-year period, though small stocks have experienced greater volatility. Our conclusion is to use the same expected return for large and small cap stocks and, without a difference in expected return, we recommend that a single U.S. equity asset class be used for asset allocation forecasting and that equity return and risk assumptions represent the entire capitalization weighted U.S. equity market.

Non-U.S. Equity (Developed Markets)

Cliffwater is assuming a 6.40% return for non-U.S. stocks, the same as for U.S. stocks. Studies of the major global stock markets, which date back over a century, show that the non-U.S. markets perform no better than the U.S. market when returns are measured over long periods of time. In fact, the U.S. market was the best performing market of all the developed stock markets during the prior century.

Exhibit 12 illustrates the similar long-term performance of U.S. stocks (S&P 500) and non-U.S. stocks (MSCI EAFE) starting December 31, 1969, the longest period for which MSCI EAFE returns are available. Except for the Japanese stock market bubble in the 1980s and current post-Crisis bull market in U.S. stocks, U.S. and foreign stock markets have shown very similar performance over the last 52 years.

Exhibit 12: S&P 500 and MSCI EAFE Returns, Dec 1969 to Dec 2021



Source: S&P Dow Jones, MSCI Indices

Exhibit 13 provides return, risk and correlation for the U.S. market (S&P 500) and non-U.S. developed market (MSCI EAFE) over this same period. The historical 11.06% annual return for the S&P 500 is 3.65% above the MSCI EAFE return of 8.71%. The difference in risk between the S&P 500 and MSCI EAFE indices is small at 15.29% and 16.86%, respectively, but it is worth noting that the U.S. market has a lower volatility compared to all developed stock markets combined.

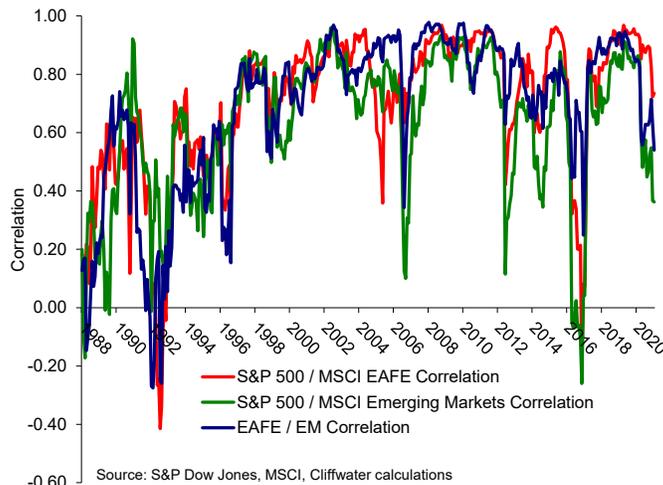
Exhibit 13: S&P 500 and MSCI EAFE Return and Risk, 1970 to 2021

	S&P 500	MSCI EAFE
Annual Return	11.06%	8.71%
Annual Risk	15.23%	16.75%
Correlation w/S&P		0.65
10 Yr. Correlation w/S&P		0.85

Source: S&P Dow Jones, MSCI

Geographic diversification by balancing U.S. and non-U.S. stocks in an equity portfolio has been a major trend among institutional investors over many years. The belief is that by doing so, risk can be significantly reduced. Unfortunately, the benefits to global diversification greatly diminished around 2000 and have generally remained low (high correlation) except for a few short-term spikes. Exhibit 14 captures these diversification shifts visually by showing cross correlations between the S&P 500, the MSCI EAFE, and the MSCI Emerging Markets indices over the last 33 years starting January 1988, when the MSCI Emerging Markets Index was first published. Current correlations across the three regional indices are again high.

Exhibit 14: Rolling 12-Month Correlations between U.S., EAFE, and Emerging Market Equity Indices, 1989 to 2021



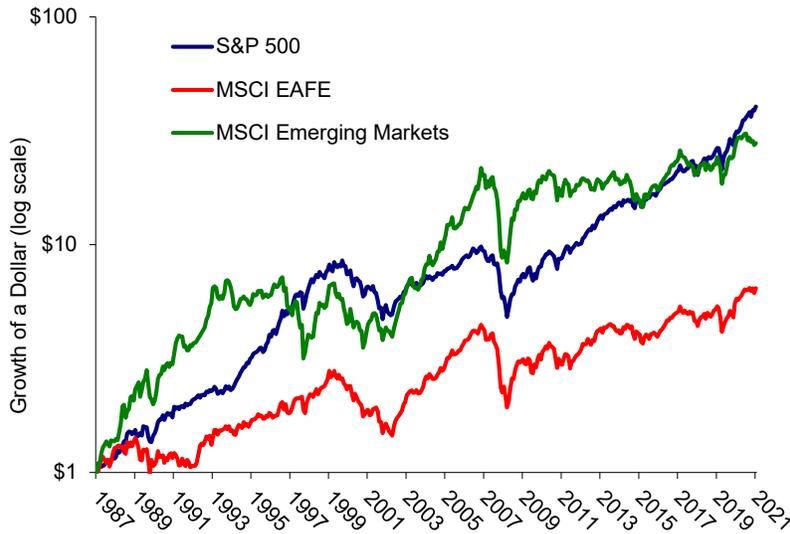
Recent return correlations among the global equity markets averaged 0.73 during the last decade, meaning that global diversification benefits dwindled compared to the 1980s and 1990s when correlations averaged less than 0.50. From a portfolio perspective, equity risk declines by roughly 20% (i.e. from an 18% standard deviation to a 14.7% standard deviation) from global diversification at a 0.50 correlation. At a 0.90 correlation, global diversification reduces equity risk by only 4% (i.e. from an 18% standard deviation to a 17.4% standard deviation). At a 0.73 correlation level of the past 10 years, equity risk declines by 7%, from 18.0% to 16.8%, from global diversification. Support for global equity diversification continues to remain weak, though significantly lower price-earnings outside the U.S. might support overweight to non-U.S. stocks.

Non-U.S. Equity (Emerging Markets)

Cliffwater is forecasting a 6.90% return for the emerging stock markets, or 0.50% above our return forecast for the U.S. and other developed equity markets.

Exhibit 15 shows the performance of the U.S., non-U.S. developed, and the emerging stock markets (measured by S&P 500, the MSCI EAFE, and the MSCI Emerging Markets indices, respectively, for the period 1988 through 2021. The starting date is when MSCI first calculated equity index returns for the emerging markets. Over this 33-year period, the emerging equity markets earned a return slightly lower than the S&P 500. Despite historical returns suggesting no return premium to emerging market stocks, Cliffwater is maintaining a modest premium for emerging markets in recognition of the higher GDP growth potential in those markets, particularly China.

Exhibit 15: Emerging Market, EAFE, and S&P 500 Returns, 1988 to 2021



Source: S&P Dow Jones, MSCI

Exhibit 16 contains return, risk, and correlation statistics for the three indices over the entire 33-year period.

Exhibit 16: S&P, EAFE, Emerging Market Return and Risk, 1988 to 2021

	S&P 500	MSCI EAFE	MSCI Emerging Markets
Annual Return	11.50%	5.63%	10.28%
Annual Risk	14.43%	16.71%	22.20%
Correlation w/S&P		0.75	0.67
Correlation w/EAFE			0.71

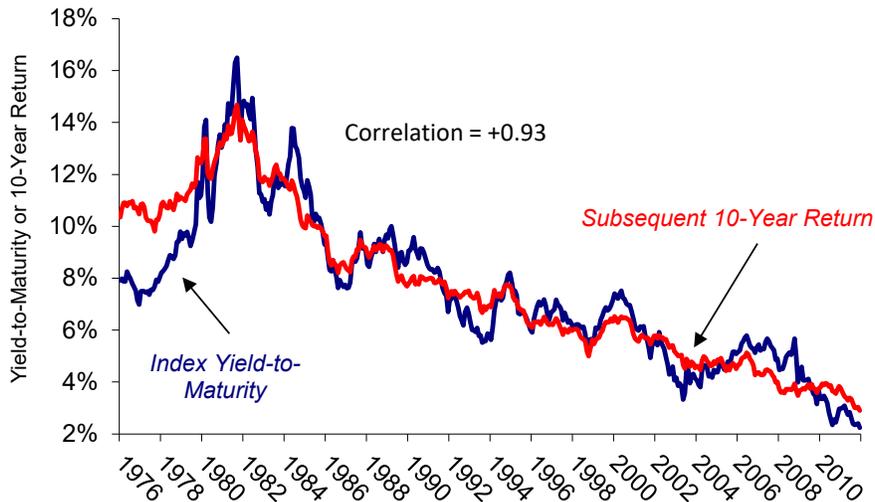
Source: S&P Dow Jones, MSCI

U.S. Bonds

Cliffwater's long term return forecast for core U.S. bonds is 1.75%, equal to the Bloomberg U.S. Aggregate Bond Index's yield-to-maturity at year-end, which is higher than the 1.15% expected return from the prior year. The rise in interest rates over the past year is responsible for the change.

Cliffwater relies upon the bond market's yield-to-maturity to forecast 10-year bond returns. Exhibit 17 shows that yield-to-maturity has been a very reliable methodology for forecasting future bond returns, with a 0.93 correlation between forecast and actual returns. The blue line plots the monthly yield-to-maturity for the Bloomberg U.S. Aggregate Bond Index starting January 1, 1976 and ending December 31, 2011. These yields are used as our forecasts for bond returns over subsequent 10-year periods, which are shown by the red line. For example, the final date on the x-axis is December 31, 2011, when our bond return forecast – equal to the yield-to-maturity on the Bloomberg U.S. Aggregate Bond Index – was 2.24% (blue line). The actual bond return for the subsequent 10-year period ending December 31, 2021, was 2.90% (red line).

Exhibit 17: Cliffwater 10-Year Bloomberg U.S. Aggregate Bond Return *Forecast* (Index Yield-to-Maturity) versus *Actual* Subsequent 10-Year Bloomberg U.S. Aggregate Bond Return⁹

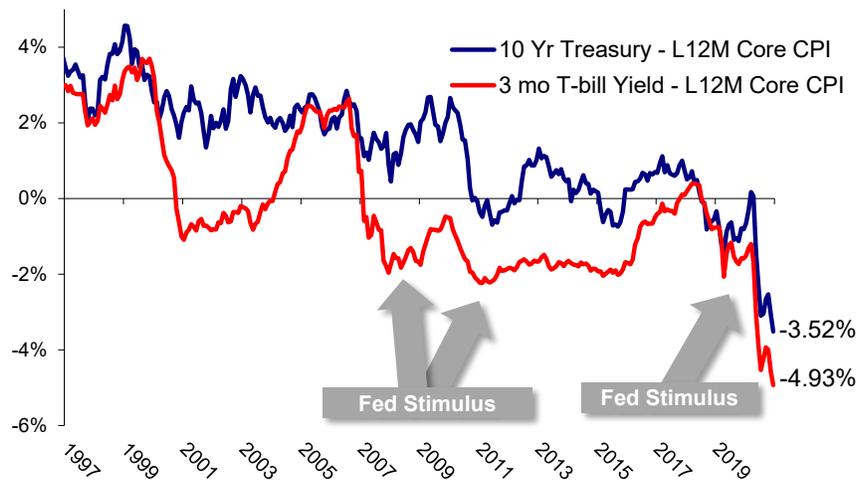


Source: Bloomberg Barclays, Cliffwater calculations

We believe the graph shows that our use of yield-to-maturity to predict future bond returns works very well over 10-year horizons.

Exhibit 18 plots real interest rates over the past 25 years. The red line shows real short-term rates while the blue line shows real long term (10-year) rates. Real rates are calculated by subtracting trailing 12-month inflation from nominal yields.

Exhibit 18: Real Interest Rates on Short and Long Maturity Treasuries, Dec 1997 to Dec 2021



Source: Bloomberg Barclays, Bureau of Labor Statistics, Cliffwater calculations

Short term real rates typically are negative during recessions, driven by Fed policy to stimulate the economy. What was different after the Financial Crisis was the depth and prolonged length of negative real

⁹ The Cliffwater return forecast shown is calculated by applying the current Cliffwater return forecast methodology to historically available market information. It does not reflect actual performance of any account(s) managed by Cliffwater. Cliffwater may change its return forecast methodology at any time and the Cliffwater return forecast should not be used to predict the actual future performance of any Cliffwater account.

short-term rates. Since that time, the Fed has largely kept short-term real interest rates in negative territory and long-term interest rates well below their historical levels.

As we noted in our last eight Asset Allocation Reports we believe that Treasury rates have been distorted to the low side – at least by any historical measure – and that this presents investment risks that do not fall under the investor-driven speculative bubble category. We have written that the risk is that rising rates could bring down all asset prices and that the length and severity of such a change could cause market disruptions. The good news is that there has been no disruption, and stock markets have continued to be strong despite the end to Fed bond-buying and several rate increases. Furthermore, we believe that while the Fed may prefer to take the additional step of reducing, rather than maintaining, the size of its balance sheet, any such measures are likely to be gradual given the known risks.

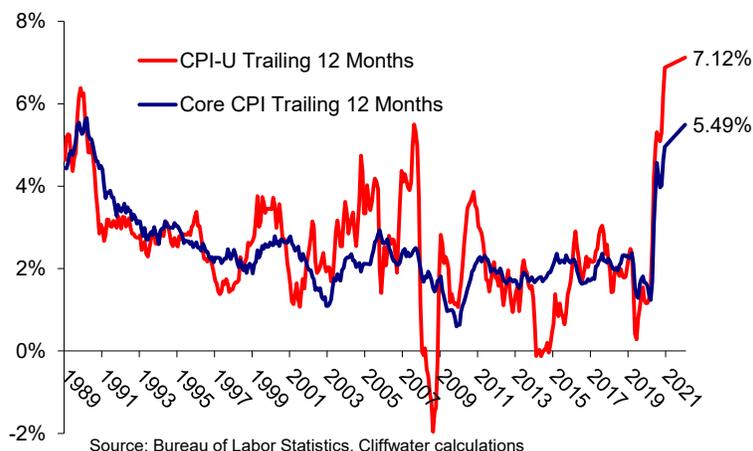
Cash Equivalents

Cliffwater is forecasting average cash equivalent returns (Libor) of 1.55% over the next 10 years, up from a 1.30% forecast last year. For T-bills, we forecast a somewhat lower return of 1.25% over the next 10 years. Cash equivalent yields generally track inflation, but Fed policies have driven nominal yields near zero and negative real cash yields. Our 10-year forecast assumes that monetary stimulus will recede over time.

Inflation and Treasury Inflation Protection Securities (“TIPS”)

Exhibit 19 plots trailing 12-month inflation covering the last 33 years. Two measures of inflation are displayed: CPI-U, the most common measure and core CPI, which excludes more volatile food and energy prices. Over the past year (ending December), headline inflation accelerated, with CPI-U rising to 7.12% and Core CPI climbing to 5.49%, well above Fed targets.

Exhibit 19: Trailing 12-Month Inflation (CPI), Dec 1989 to Dec 2021

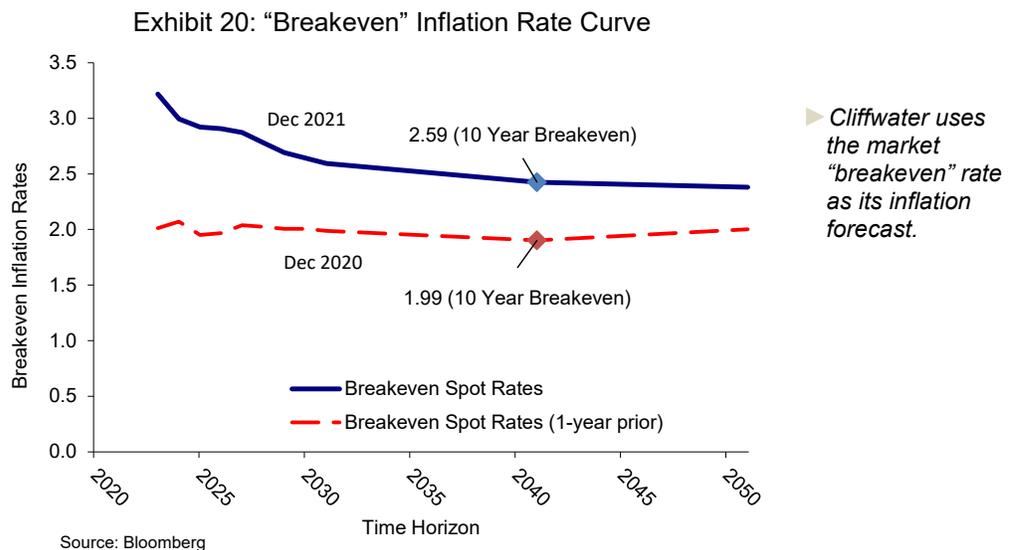


Cliffwater's inflation forecast is 2.60%, which reflects long-term market-based expectations measured through yield differences between TIPS and nominal Treasury bonds.

TIPS are bonds issued by the U.S. Treasury that, like traditional nominal Treasury bonds, come with a coupon, principal amount, and maturity. However, unlike nominal Treasuries, the stated principal of TIPS increases (decreases) monthly by the rate of CPI inflation (deflation). The monthly adjustment in principal for inflation not only protects the final payment's value from erosion due to inflation, but coupon payments are regularly adjusted upwards with inflation since the coupon rate is applied to the inflation-adjusted principal value. Given these unique features, many institutional investors place TIPS in an asset class separate from bonds, either self-standing or incorporated into a "real asset" portfolio of investments that is expected to provide a hedge against inflation.

The difference in yields between Treasury bonds and TIPS is commonly referred to as the *breakeven inflation rate*, because it is the rate of inflation over the life of the TIPS that would produce a return equal to the return on the Treasury bonds. And because the TIPS and Treasuries are otherwise almost identical, most institutional investors use the breakeven inflation rate as the consensus market forecast for inflation.

Exhibit 20 plots breakeven inflation rates across maturities, extending out 30 years. Time horizon, or maturity, is shown on the horizontal axis and breakeven inflation on the vertical axis. A curve is fitted to the data in order to get a clearer picture of how inflation expectations change as the time horizon increases. The breakeven inflation curve from our prior year report is also included (red dashed line). As shown, the breakeven curve as of December 31, 2021 has shifted up significantly compared to the breakeven curve from December 31, 2020. Also note that the line is not flat, indicating that the market believes inflation will be much higher in the next few years compared to the 2.59% 10-year number and lower in the back-end of the period.



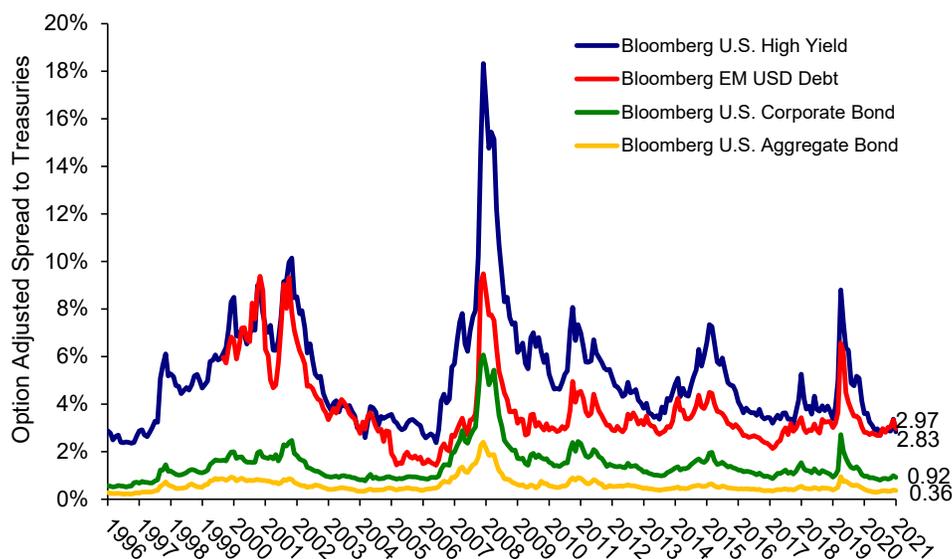
The two breakeven curves are *spot* rates that show breakeven inflation rates from the beginning date at December 31, 2021 to the December-end date identified on the horizontal axis.

Our expected return on TIPS is identical to comparable maturing Treasury bonds since we assume inflation would add to the TIPS return just enough to offset their lower quoted yields. Hence our 2021 expected return forecast for 10-year TIPS is 1.50%, equal to our expected return on the 10-year Treasury bond.

High Yield Bonds, Bank Loans, and Emerging Market Debt

Year over year, high yield bond spreads (OAS) fell. Exhibit 21 plots U.S. high yield bond spreads to comparable maturity Treasuries (blue line) since 1996. Over the past year, high yield bond spreads (OAS) dropped from 3.60% one year ago to 2.83% at Dec 2021.

Exhibit 21: Yield Spreads on Bloomberg U.S. High Yield, Emerging Market USD Debt, U.S. Corporate Bond, and U.S. Aggregate Bond Indices, Dec 1996 to Dec 2021



Note: Bloomberg EM USD Debt inception in Aug 2000

Exhibit 21 shows a spiking and retrenchment in yield spreads for the Bloomberg Emerging Market USD Debt, U.S. Corporate Bond (investment grade), and U.S. Aggregate Bond indices.

The volatility in credit spreads over time is apparent from Exhibit 21 and raises the question whether credit spread returns can be enhanced, or risk mitigated, by timing investments to spread levels. While tactical spread timing is not part of our long-term return forecasts, we have developed tactical models that incorporate time changing spreads to see if return can be enhanced. Our findings show that spread timing produces modest but inconsistent tactical gains over time.

Exhibit 22 provides a comparison of current yield spreads with historical median spreads for the major bond indices. Note that current yield spread levels are now below their historical averages.

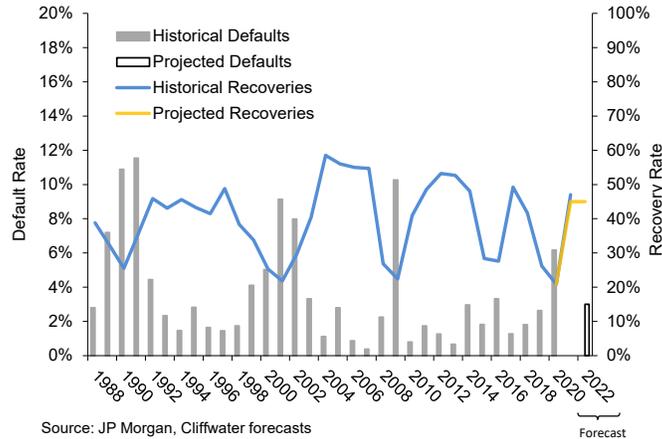
Exhibit 22: Current versus Historical (Dec 1996 to Dec 2021) Option-Adjusted Yield Spreads

	Bloomberg U.S. High Yield Bond	Bloomberg EM USD Debt	Bloomberg U.S. Corporate Bond	Bloomberg U.S. Aggregate Bond
Current Spread	2.83	2.97	0.92	0.36
Historical Median	4.24	3.30	1.18	0.48
Difference	-1.41	-0.33	-0.26	-0.12

Source: Bloomberg Barclays

Exhibit 23 provides 33 years of historical high yield default and recovery rates and Cliffwater forecast for 2022.

Exhibit 23: Historical and Projected High Yield Bond Default and Recovery Rates



Default rates (left scale) equal the value of debt defaulting each year divided by the par value of debt outstanding. Recovery rates (right scale) equal the market value of the bonds defaulting divided by their par value. Default rates have historically averaged under 3.6% but vary inversely with the business cycle, peaking at 10% and 12% levels during the 1990 and 2000 recessions. Recovery rates averaged 40% but tend to fall during periods of recession and high default rates. High yield default rates dropped to 0.30%, in 2021, down from 6.17% in 2021. At the same time recovery rates rose to 47% in 2021, up from 21% in 2020.

Exhibit 24: Calculations underlying Cliffwater High Yield Bond and Bank Loan Return Forecasts¹⁰

(A) High Yield Bonds												
	Dec-21	Dec-22	Dec-23	Dec-24	Dec-25	Dec-26	Dec-27	Dec-28	Dec-29	Dec-30	Dec-31	Cum
1 Default rate		3.0%	3.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	
2 Recovery rate		45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	
3 Principal	\$1,000	\$970	\$941	\$917	\$894	\$872	\$850	\$829	\$808	\$788	\$768	
4 Recoveries		\$14	\$13	\$11	\$10	\$10	\$10	\$10	\$9	\$9	\$9	
5 Coupon	5.77%	\$57	\$56	\$56	\$56	\$56	\$56	\$56	\$56	\$55	\$54	
6 Current Price	\$1,027					-\$27						
7 Cash Flows	-\$1,027	\$70	\$69	\$66	\$66	\$39	\$66	\$66	\$65	\$64	\$832	
8 IRR (Expected Return) =	4.11%											
Time Weighted Return	4.89%	4.03%	4.10%	4.54%	4.71%	4.88%	5.07%	5.24%	5.35%	5.44%	5.52%	
Credit Loss Rate		1.65%	1.65%	1.38%	1.38%	1.38%	1.38%	1.38%	1.38%	1.38%	1.38%	14.3%
(B) Bank Loans												
	Dec-21	Dec-22	Dec-23	Dec-24	Dec-25	Dec-26	Dec-27	Dec-28	Dec-29	Dec-30	Dec-31	Cum
9 Default rate		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	
10 Recovery rate		70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	
11 Principal	\$1,000	\$975	\$951	\$927	\$904	\$881	\$859	\$838	\$817	\$796	\$776	
12 Recoveries		\$18	\$17	\$17	\$16	\$16	\$15	\$15	\$15	\$14	\$14	
13 Interest Spread	3.55%	\$45	\$44	\$43	\$46	\$45	\$44	\$43	\$42	\$41	\$40	
14 Current Price	\$985											
15 Cash Flows	-\$985	\$63	\$61	\$59	\$63	\$61	\$60	\$58	\$57	\$55	\$830	
16 IRR (Expected Return) =	4.28%											
Time Weighted Return	4.11%	3.76%	3.76%	3.76%	4.26%	4.26%	4.26%	4.26%	4.26%	4.26%	4.26%	
Credit Loss Rate		0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	7.5%

Source: Bloomberg Barclays Bond Indices, S&P/LSTA Indices, Cliffwater calculations

¹⁰ The Cliffwater return forecasts are calculated by applying the current Cliffwater return forecast methodologies to currently available market information and Cliffwater's professional judgment. Due to the forward-looking nature of the forecasts, they are necessarily speculative and may prove to be inaccurate. The return forecasts reflect expected returns for the entire high yield bond and bank loan asset classes and not for specific investments within the respective asset classes. Specific investments within each asset class will perform differently and may underperform the forecasted returns. The forecasted returns do not reflect actual performance of any account(s) managed by Cliffwater. Cliffwater may change its return forecast methodology for an asset class at any time and the Cliffwater return forecast should not be used to predict the actual future performance of any Cliffwater account.

In section A of Exhibit 24, we derive our 4.11% high yield bond return forecast based upon current high yield spreads and our default and recovery forecasts. Default and recovery rates are projected through 2030. Our high yield default rate projections begin at 3.0% in 2021, with a cumulative default rate totaling 26% for the entire period. As a comparison, the worst historical 10-year cumulative default rate was 56% that covered the period 1984 to 1993, so our forecast is better than that period and below the average (39%) cumulative default rate over 10-year periods.

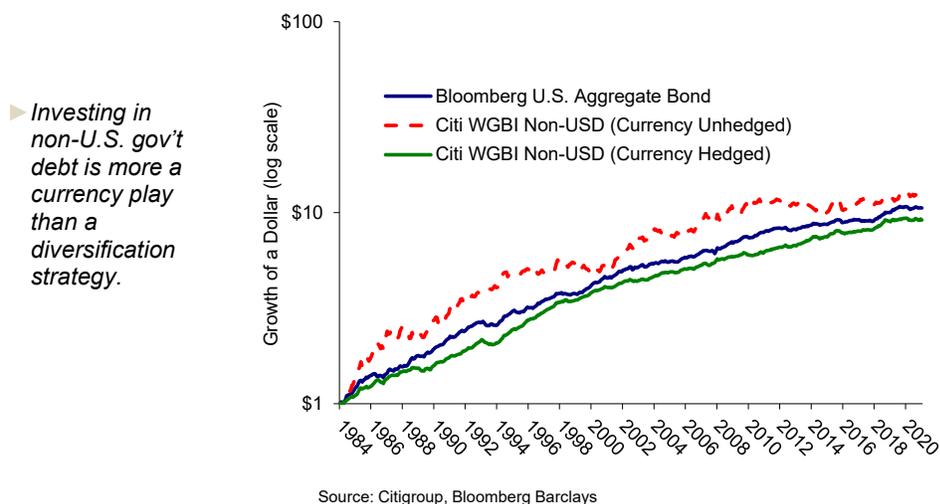
Factoring in recovery rates, our forecast is consistent with historical averages. Row 3 shows how defaults reduce the \$1,000 initial principal (par) value of the portfolio until \$768 in par value remains at the end of 2028, or a cumulative loss of 32%. By comparison, the average 10-year cumulative loss since 1982 has been 21%. In rows 4 and 5, we assume that all interest payments and recoveries are paid out as cash flows in row 7. Row 6 shows the \$1,027 December 31, 2021 price needed to purchase \$1,000 in par high yield bonds, down from \$1,044 last year. We assume all cash flows are distributed and calculate a 4.11% IRR, which is rounded to 4.10% to represent the long-term expected return on high yield bonds.

In section B of Exhibit 24, similar calculations are shown for bank loans. Bank loan prices equaled \$985 at December 31, 2020. In row 9, annual default rates for bank loans are slightly lower than for high yield bonds with higher recovery rates, offsetting the lower yield on bank loans compared to high yield bonds. The expected return for bank loans is 4.30%, rounded up from the projected 4.28% IRR shown in row 16.

Non-U.S. Bonds

Non-U.S. bonds should produce equivalent returns as U.S. bonds for similar interest rate and credit risk according to capital market pricing theory. Differences in interest rates do exist across nations but they are largely due to differences in inflation expectations which are offset by movements in exchange rates. When currency is hedged, credit risk is the same, and if capital flows freely, U.S. and non-U.S. bond returns should be identical. However, the investment character of the U.S. and non-U.S. markets is not identical. Foremost is the fact that government debt represents a much larger fraction of the non-U.S. bond markets when compared to the U.S. bond market and consequently, yields on U.S. bond indices are fractionally higher. This should produce somewhat higher realized returns for U.S. bonds. Exhibit 25, which graphs realized U.S. and non-U.S. bond returns over a 37-year period, supports this view.

Exhibit 25: U.S. and Non-U.S. Bond Returns, Dec 1984 to Dec 2021



Returns are plotted for the Bloomberg U.S. Aggregate Bond Index and the Citi World Government Bond Non-U.S. Dollar (WGBI Non-USD) Index, currency hedged and unhedged. Note the strong similarity between the Bloomberg U.S. Aggregate Bond and the hedged Citi WGBI Non-USD. The small differences are likely due to differences in credit spreads. The correlation between the two indices is a relatively high

0.66, as reported in Exhibit 26, and their risk levels are similar as well. The better performing index is the unhedged version of the Citi WGBI Non-USD, but this is only because of rapid dollar depreciation in the late 1980s caused by central banks' collective action to force a lower dollar as part of the 1985 Plaza Accord.

Exhibit 26: Non-U.S. Bond Return and Risk, 1985 to 2021

	Annual Return	Annual Risk	Correlation w/ Bloomberg U.S. Aggregate
Bloomberg Barclays U.S. Aggregate Bond	6.59%	3.97%	
Citi WGBI Non-USD			
Currency Unhedged	6.88%	9.20%	0.44
Currency Hedged	6.17%	3.23%	0.66

Source: Bloomberg, Citigroup

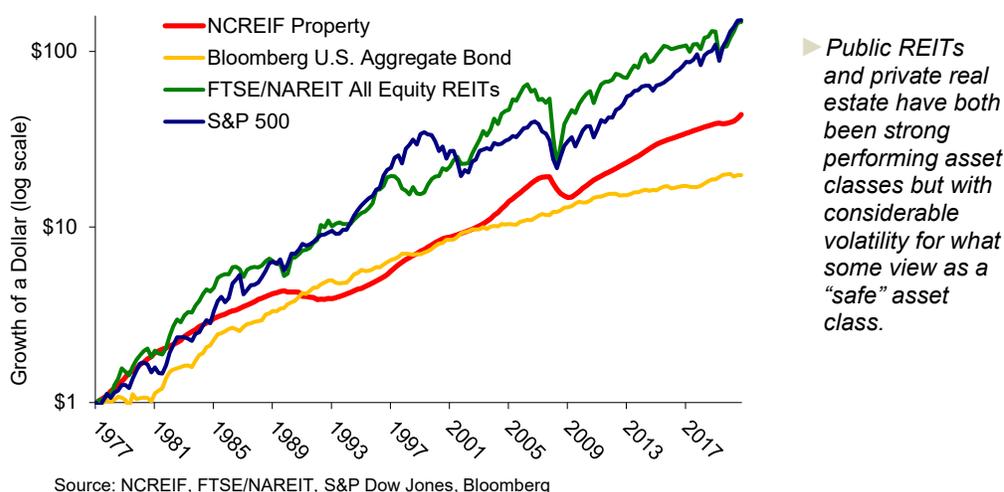
Our expected return for both unhedged and hedged non-U.S. bonds is 1.65%, lower than our 1.75% expected return for core U.S. bonds. The 0.10% difference reflects a difference in credit risk and higher costs associated with non-U.S. investments. There is no reason to expect currency exposure will accrue to the future benefit or detriment of investors, and therefore we forecast a 0% return to currency.

Real Estate (Direct Property, REITs, and Partnerships)

Institutional investment in real estate has three forms. The first is separately managed accounts. This form of ownership is used by very large public and private pension funds, generally using an unleveraged or limited leverage buy and hold strategy. The NCREIF Property Index measures the performance of this real estate strategy. A second form of real estate investing is through publicly-traded REITs (Real Estate Investment Trusts). REIT investing first gained popularity in the 1990s and the FTSE/NAREIT Equity REIT Index tracks 217 separate equity REITs with a combined market capitalization of approximately \$1.5 trillion as of December 31, 2021, larger than the \$785 billion value for the NCREIF Property Index as of September 30, 2021. Finally, real estate private partnerships seek higher private equity-like returns through opportunistic investing that may include multiple strategies.

Exhibit 27 graphs performance for the NCREIF Property Index containing unlevered separate account properties and the FTSE/NAREIT Equity REITs Index of public equity REITs over a 44-year period from December 1977 through September 2021 and compares them to U.S. stock and bond index returns.

Exhibit 27: Real Estate Index Performance, Dec 1977 to Sept 2021



There are three observations to note. First, the FTSE/NAREIT All Equity REITs Index of publicly traded REITs has produced returns equal or greater than stocks and above the NCREIF Property Index of direct investments in properties, which has performed midway between stocks and bonds over the entire time period. Second, REITs have tended to behave differently than stocks. This relatively low correlation was particularly noticeable during the last technology bubble, when REITs performed well just as the bubble burst. However, like other equity-oriented asset classes, REITs fell in line with stocks during the global financial crisis and subsequent recession. And finally, returns of direct investments in property, measured by the NCREIF Property Index, exhibit lower volatility. This lower risk is partly driven by lag effects in the real estate appraisal valuation process that dampen reported price changes for properties in the NCREIF Property Index. It is also driven by differences in leverage; REITs are roughly 50% levered while the NCREIF Property Index returns are reported on an unlevered basis.

Exhibit 28 provides additional return and risk detail for real estate and public market indices.

Exhibit 28: Historical Real Estate Return, Risk, Adjusted Risk¹¹, and Correlation

Periods ending Sep 2021	NCREIF Property	Bloomberg U.S. Aggregate Bond	FTSE/ NAREIT All Equity REITs	S&P 500
<u>Annualized Return:</u>				
Last 25 years	9.23%	5.06%	9.97%	9.65%
Last 10 years	8.99%	3.01%	11.23%	16.63%
<u>Risk:</u>				
Last 25 years	4.29%	3.49%	20.46%	16.98%
Last 10 years	2.00%	3.17%	16.05%	13.95%
<u>Adjusted Risk:</u>				
Last 25 years	9.77%			
Last 10 years	4.56%			
<u>Correlations:</u>				
NCREIF Property				
Last 25 years	1.00	-0.09	0.20	0.15
Last 10 years	1.00	-0.18	0.13	-0.14
NAREIT				
Last 25 years	0.20	0.03	1.00	0.62
Last 10 years	0.13	0.17	1.00	0.70

Source: NCREIF, Bloomberg, FTSE/NAREIT, S&P 500

Returns of direct investments in property (NCREIF Property Index) in Exhibit 28 average almost four percentage points above bond returns (Bloomberg U.S. Aggregate Bond Index) for the last 25 years and about the same as REIT returns (FTSE/NAREIT All Equity REITs Index).

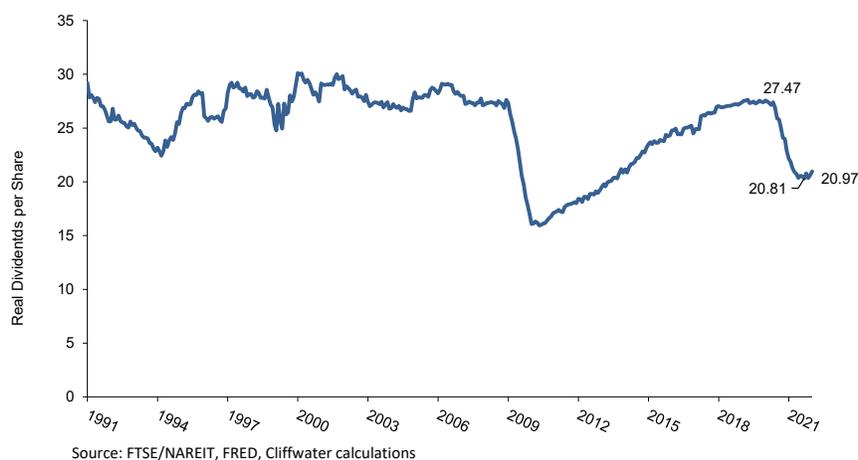
Some of the long-term performance disadvantage for the NCREIF Property Index compared to REITs comes from the absence of leverage. Our conclusion is that direct property and REITs have comparable return prospects after adjustment for leverage. This might be surprising to some, given the liquidity provided by REITs, but Cliffwater believes that REITs might have an offsetting advantage over direct property from their stronger governance, which is driven by greater transparency required from public capital market scrutiny and regulation.

¹¹ Risk calculations for private real estate, private equity, and timber are based upon quarterly appraisals that likely understate the true risk of these investments because they likely do not incorporate fully market changes. This “stickiness” in valuation from quarter to quarter can be measured by the correlation between returns for one quarter with those of prior quarters. The greater the correlation, the less market-like the valuations are likely to be and the more understated traditional risk measures will be. To correct for this, Cliffwater adjusts the measured standard deviation for the correlations between quarterly periods to arrive at an “adjusted risk” measure that approximates what risk would be if valuations were based on market prices rather than appraised values.

The similarity in long-term returns between REITs and the S&P 500 as shown in Exhibit 28 might suggest an expected return for REITs that is equal to our 6.40% forecast for the stock market. However, the Exhibit also reveals some sharp departures between the return series over shorter time periods that we believe can be forecast. For many years we have used a model that relies on the yield difference between REITs and 10-year Treasuries to help understand whether REITs are attractive. The idea is simple. When the yield spread between REITs and the 10-year Treasury bond is wide, either REITs are attractive, or Treasuries are unattractive.

This simple comparative yield model should work better for REITs than for stocks generally because REIT earnings and dividends are more stable, a trait caused by the fact that REITs pay out in dividends almost all earnings – approximately 90% of operating earnings – to maintain their exemption from corporate tax. Other common stocks pay out a much lower 45% of earnings in the form of dividends, which creates earnings growth but also greater uncertainty in future dividends. REITs in contrast should have zero real earnings growth because of the high payout ratio and their long term expected return should simply equal their dividend yield plus expected inflation, with no additional earnings growth component.

Exhibit 29: Dividend per Share (CPI adjusted) for the FTSE/NAREIT Equity REITs Index
Dec 1991 to Dec 2021

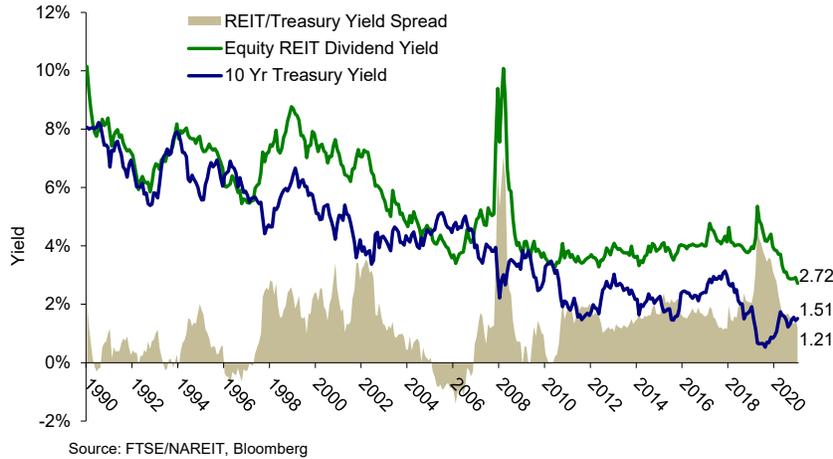


Real dividends per share for the FTSE/NAREIT Equity REITs Index are plotted in the blue line in Exhibit 29. The time period extends from 1991 through 2021. As expected, REIT dividends (and therefore earnings too) display no real growth over the 28-year period. However, real dividends did experience two distinct cycles. The first was the real estate boom of the late 1980s followed by the bust of the early 1990s. The second is the Global Financial Crisis, from which an earnings recovery appears completed. Inflation-adjusted dividends had averaged around \$25 per share (left scale) but fell to a low of \$15 per share in 2009. They have since rebounded to roughly \$27 per share and have remained at that level. We are now in a third cycle with real dividends dropping from a \$27 high to \$21, but have now apparently plateaued and we expect to climb again.

Exhibit 30 provides a 31-year history of REIT and 10-year Treasury yields. Over most periods, REIT yields were higher than 10-year Treasuries. During periods of exceedingly high (low) yield spreads, REITs performed well (poorly). On December 31, 2021, the spread between REIT and 10-year Treasury yields was 1.21%, which is just below its 1.27% long term average.

Our view is that REITs are fairly valued relative to 10-year Treasuries.

Exhibit 30: Historical Yields for FTSE/NAREIT Equity REIT Index and 10-Year Treasuries
Dec 1990 to Dec 2021

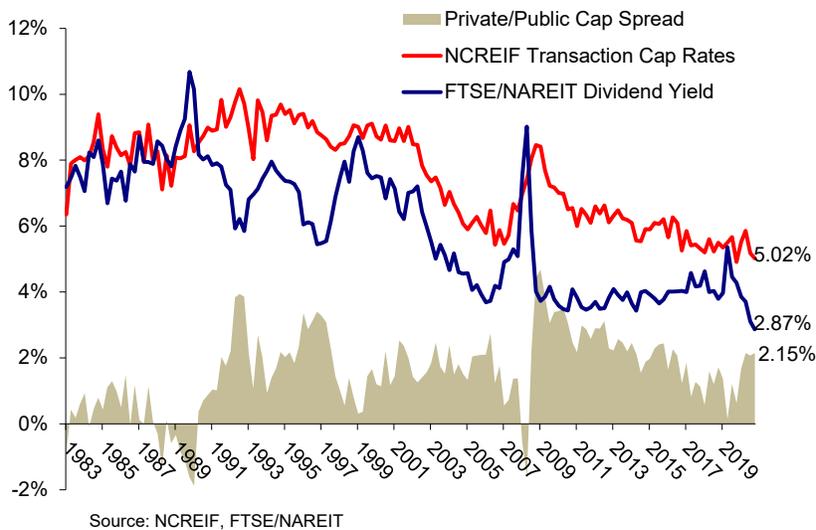


Direct Investments in Property (Unlevered)

Exhibit 31 compares NCREIF Property Index cap rates, equal to net operating income (“NOI”) divided by the current market (transactional) value of the NCREIF Index, a measure of cash yield, with REIT dividend yields (represented by the FTSE/NAREIT All Equity REITs Index dividend yield). The NCREIF Property Index transactional cap rate was 5.02% on September 30, 2021, the latest date for which NCREIF data is available, and has been gradually declining over the last 10 years.

By comparison, the REIT dividend yield was 2.87% on September 30, 2021, a 2.15% difference with NCREIF Property Index cap rates. The average difference between NCREIF Property Index transactional cap rates and REIT dividend yields is 1.29% over the last 38 years.

Exhibit 31: Comparison of NCREIF Property Index Cap Rates and FTSE/NAREIT Equity REITs Index Dividend Yields, Sep 1983 to Sep 2021



Cliffwater’s expected long-term return for direct, unlevered real estate is 6.70%. We arrive at that value by assuming that earnings on direct properties will, like REITs, rise annually by the expected inflation rate.

Adding a 2.60% expected inflation to the 5.02% cap rate, and subtracting 0.90% for investment fees and expenses, gives an expected return of 6.72%, which is rounded to 6.70%.

Private Opportunistic Real Estate Partnerships

Real estate partnership investing is akin to private equity where invested capital is pooled through a limited partnership vehicle with a limited life and strong incentives for the general partner (manager) to invest capital and realize returns over a five to seven-year horizon.

Real estate partnerships are generally divided into three groups – “core,” “value-added” and “opportunistic” – which are differentiated by their level of risk as measured by use of leverage, current income, and market risk. Opportunistic real estate partnerships were the most popular among return oriented institutional investors, totaling two-thirds of all real estate offerings.

Exhibit 32 provides performance for opportunistic real estate partnerships from Cambridge Associates, covering the period from December 2004 through September 2021.

Exhibit 32: Opportunistic Real Estate Partnership Performance, Dec 2004 to Sep 2021¹²

	Cambridge Opportunistic Real Estate Index	NCREIF Property Index
Return	8.12%	8.37%
Risk	10.93%	5.03%
Adjusted Risk	22.70%	10.55%

Source: Cambridge, NCREIF, Cliffwater Calculations

Exhibit 32 does not support the view that higher risk opportunistic real estate partnerships should outperform core unlevered real estate. Over the 17-year period, opportunistic partnerships underperformed direct buy and hold property investments.

Our expected return for opportunistic real estate partnerships is 7.70%, equal to our 6.70% expected return for private real estate plus a 1% excess return. Judged against the short history of opportunistic real estate returns, our 1% excess return forecast relies upon better future performance for this asset class than has been demonstrated in the past. Our belief is that past returns reflect untimely opportunistic investments going into the Global Financial Crisis and poor deployment of leverage, characteristics that will not likely be repeated to the same degree in the future.

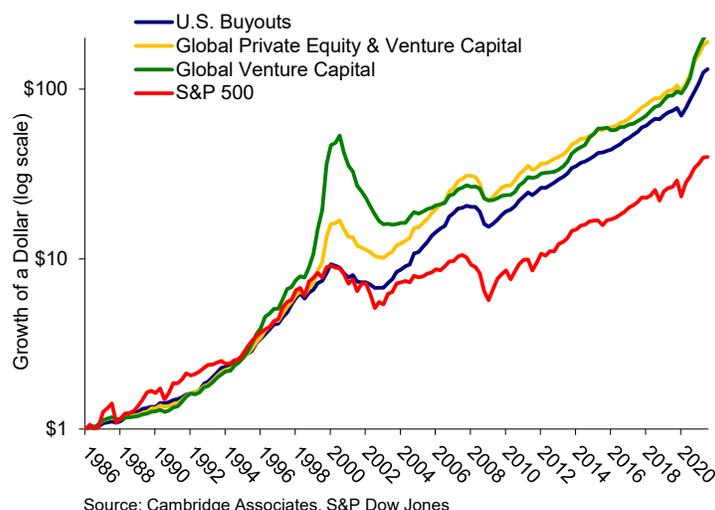
Private Equity

Private equity is commonly divided into four subcategories: U.S. Buyout, Venture Capital, Distressed, and Non-U.S. Private Equity. Each subcategory can be further broken down. For example, buyouts can be subdivided into large, mid and small. Venture capital is further divided into early, mid, and late stage. Non-U.S. private equity is geographically divided into Europe, Asia and Emerging Markets. Our forecast for Diversified Private Equity is intended to reflect a diversified portfolio that includes all the subcategories.

Exhibit 33 depicts performance for the Cambridge Associates’ U.S. Buyout, Global Venture Capital and Global Private Equity & Venture Capital (including non-U.S.) indices from March 31, 1986, the inception of the U.S. Buyout index, through September 30, 2021, together with the public equity performance for the S&P 500 index.

¹² See footnote 11, above.

Exhibit 33: Private and Public Equity Returns, March 1986 to Sept 2021



The graph shows that private equity overall and the major subcategories have all exceeded the S&P 500, particularly over the past 20 years. Exhibit 34 reports annualized private equity returns for the past 10 years and from March 1986.

Exhibit 34: Global Private Equity & Venture Capital, U.S. Buyout, Global Venture Capital, and S&P 500 Returns, Risk, and Adjusted Risk¹³ (periods ending Sep 2021)

	Global Private Equity & Venture Capital*	Subsector		S&P 500
		U.S. Buyouts*	Global Venture Capital*	
Return				
Last 10 years	18.94%	18.60%	21.89%	16.63%
Last 35.5 years	15.92%	14.72%	16.36%	10.93%
Risk				
Last 35.5 years	12.32%	9.38%	20.87%	16.15%
Adjusted Risk				
Last 35.5 years	21.01%	15.45%	40.11%	15.48%

* Cambridge Associates Indices (linked quarterly returns)
Source: Cambridge Associates, S&P Dow Jones, Cliffwater calculations

Cliffwater forecasts a 9.40% annual return for a diversified portfolio combining both buyouts and venture capital, equal to 3.00% above our 6.40% common stock return forecast. Our surveys of private equity portfolios managed by large institutional pension systems show that they have been able to earn returns 3% to 5% above public stock returns, after fees, by investing in a diversified portfolio of institutional quality buyout and venture capital partnerships.¹⁴

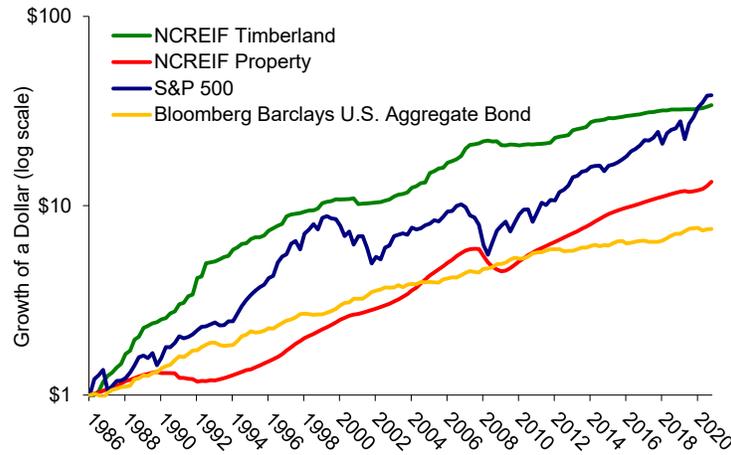
Farmland/Timber

A few pensions and endowments invest in timber partnerships to further diversify their portfolios. Investments are made through partnership vehicles like private equity and managed by Timber Investment Management Organizations (“TIMOs”).

¹³ See footnote 11, above.

¹⁴ “Long-Term Returns on Private Equity”, Cliffwater Research, March 2020.

Exhibit 35: Timber Returns, 1987 to Sep 2021



Source: NCREIF, S&P Dow Jones, Bloomberg Barclays

Exhibit 35 plots NCREIF Timberland Index investment returns from 1987 through September 2021. The NCREIF Timberland Index, like the NCREIF Property Index, is based upon manager supplied appraised values, net operating income, and capital expenditures. Performance far exceeded stocks and bonds during the 1987 through 1992 period, followed by more modest subsequent returns.¹⁵

Exhibit 36 provides returns for timber and other asset classes over the past 10 years and from inception of the NCREIF Timberland Index.

Exhibit 36: Timber Returns, Risk, and Adjusted Risk¹⁶ (periods ending Sep 2021)

	NCREIF Timberland	NCREIF Property	Bloomberg U.S. Aggregate Bond	S&P 500
<u>Annualized Return:</u>				
Last 10 years	4.89%	8.99%	3.01%	16.63%
Last 35 years	10.59%	7.69%	5.94%	10.98%
<u>Risk:</u>				
Last 10 years	2.94%	2.00%	3.17%	13.95%
<u>Adjusted Risk:</u>				
Last 10 years	5.36%	4.56%		

Source: NCREIF, S&P Dow Jones, Bloomberg

Timber investments are subject to wide performance swings due to cyclical timber pricing and the business cycle. Strong 1987-1995 and 2003-2006 performance periods have been followed by modest 1996-2002 and 2006-2013 performance periods.

Cliffwater's long-term return forecast for unlevered timber is 6.10%, broken down as follows:

Earnings yield (net)	1.50%
+ Expected inflation	2.60
+ Real growth	<u>2.00</u>
= Expected total return	6.10%

¹⁵ Protection of the spotted owl in the Northwest during this period was one factor boosting timber prices.

¹⁶ See footnote 11, above.

Unlike Timber whose weak returns over the last decade have deterred investors, Farmland is a growing institutional asset class with an expected return equal to 6.50%. NCREIF maintains a Farmland Index consisting of 1,194 properties with an aggregate value equal to \$12 billion. The NCREIF Farmland Index begins in 1991 and reports a cumulative annualized return equal to 10.64%. Over the past 10 years ending September 2021 the NCREIF Farmland Index earned a 10.19% annualized return. As with the other NCREIF indices, Farmland returns are gross of investment management fees.

Commodities

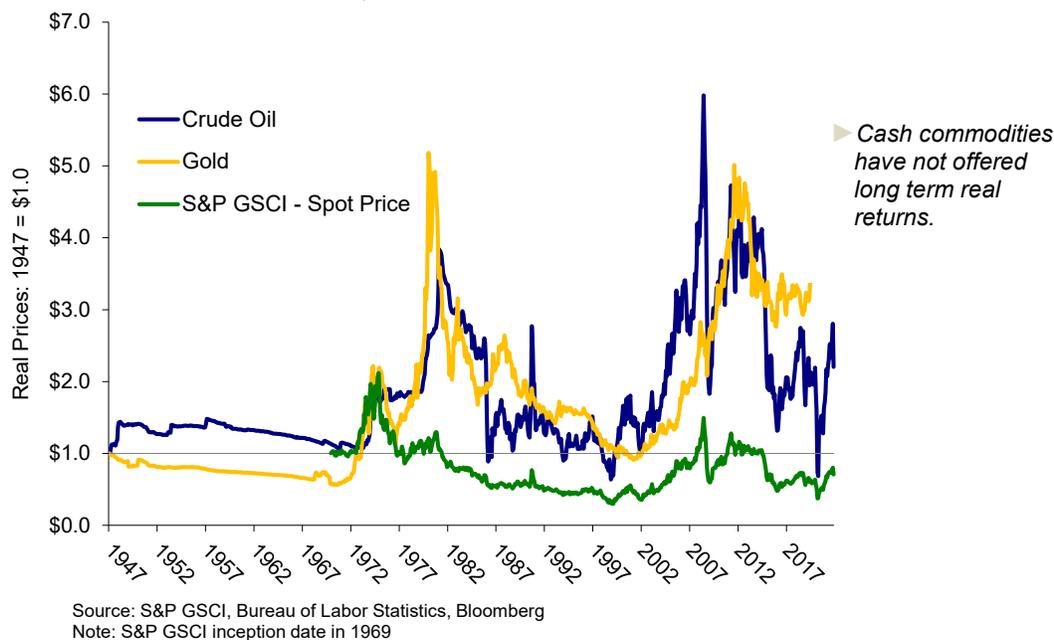
Investor interest in commodities stems from inflation concerns and potential diversification benefits.

Spot Commodities

Commodities consist of investments in various perishables (grains, food) and non-perishables (metals, energy), generally by holding futures contracts or swaps that are fully collateralized by cash equivalents. The most commonly used index of tradable commodities is the S&P Goldman Sachs Commodity Index (“S&P GSCI”), a production-weighted index of 24 commodities grouped into the following five categories with the announced weights for 2020: Energy (54%), Livestock (8%), Agriculture (19%), Industrial Metals (12%), and Precious Metals (7%). S&P GSCI returns go back to 1969. Other commodity indices are available that give less weight to the energy sector, most notably the Bloomberg Commodity Index which has a 30% weight to the energy sector for 2021.

Most investment professionals agree that there is no long term real, or inflation-adjusted, return from holding physical (or “spot”) commodities. We illustrate this in Exhibit 37, where we plot prices for two commodities: oil and gold, over a 75-year period. Oil is selected for its economic importance and gold for its perception as a store of wealth. We also plot the S&P GSCI spot price. The prices for the two commodities and the S&P GSCI spot price have been adjusted for inflation so that trends with no growth mean that prices increase with the rate of inflation.

Exhibit 37: Crude Oil, Gold and GSCI Spot Prices in Constant Dollars, Dec 1946 to Nov 2021



The graph suggests no systematic upward trend in the spot price of these commodities though, unquestionably, both oil and gold exhibit severe price spikes. The first was during the Arab Oil Embargo in

the 1970s and the second during the last decade of Middle East oil disruptions. As we have suggested repeatedly in prior Asset Allocation Reports, the question for investors in gauging long-term return is whether pricing will return to inflation adjusted levels, through increased production, substitution, or as in the case of gold, reduced speculative demand. Our own view has been that real commodity (oil, gold) prices will decline from peak levels either through inflation or declining prices, though we have expressed no expectation about timing. It appears that the timing is now with the doubling of U.S. oil production over the last 10 years from new extraction technologies that will likely become even more prevalent as they continue to make their way overseas.

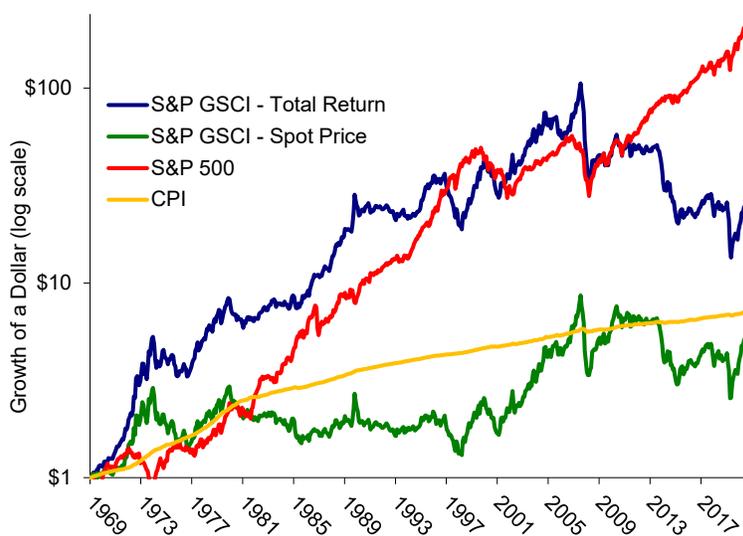
The lack of a long-term real return to oil and gold extends to the broader group of commodities. This is illustrated in Exhibit 37 where the return from the inflation-adjusted S&P GSCI spot price is plotted from inception of the S&P GSCI in 1969. Spot price returns over this entire period have fluctuated greatly in real value and now represent about one-half (\$0.71) of their (\$1.00) real value in December 1969. However, we believe there is no perceptible real return trend to spot commodities and deviations from the 0% real return horizontal line reflect shorter term market supply and demand conditions.

Commodity Futures

An investment in commodity futures can produce returns different from spot commodity returns even though the same commodity is being priced. Commodity futures can produce returns above spot price returns if futures prices are systematically below (expected future) spot prices. Such a condition, referred to as “backwardation,” will create long term real returns as has been exhibited in the performance for the total return of the S&P GSCI.

The total return of the S&P GSCI, which represents an investment in commodity futures, has produced returns well above CPI over its 52-year history and, until the Financial Crisis, equal to the returns achieved by the S&P 500, as Exhibit 38 shows. Because the futures market is a zero-sum market, for such a result to occur there must be a redistribution of wealth from futures sellers (hedgers) to futures buyers (speculators). Historical real returns of 3% for the S&P GSCI suggest commodity futures may earn real returns as well as provide diversification benefits.

Exhibit 38: S&P GSCI Total Return and Spot Price, S&P 500 and CPI, 1969 to 2021

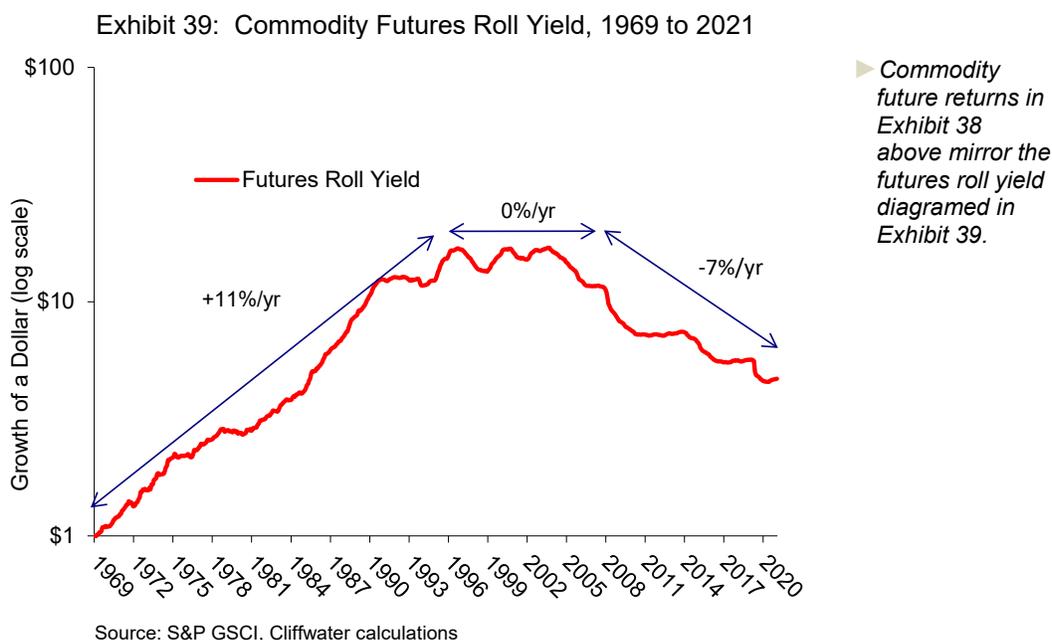


Source: S&P Dow Jones, S&P GSCI, Bureau of Labor Statistics

While some advisors assume significant positive real returns to commodities, we have warned for over 15 years that historical favorable commodity futures returns have been driven by a positive roll yield (from

backwardation in the forward commodity curves) and rebalancing. We said that this condition changed around 1999 and that a systematic real return would be much more difficult to achieve and would depend upon a real return in spot prices. Historically, commodity (spot) returns for most of their history and on a cumulative basis since 1969 failed to keep up with CPI.

Exhibit 39 plots the cumulative return from commodity futures roll, which explains all the past real return to commodity futures. As we described above, the roll yield cumulative return turned negative beginning in 2005 and since that time has been significantly negative, averaging -7% per year, meaning that commodity futures returns trailed spot returns.



Our expected return for commodity futures therefore is a modest 1.50%, which is a combination of our 1.25% expected T-bill return plus our forecast for a +0.25% roll yield, which is roughly what the GSCI roll yield has averaged over the past year. However, roll yield has been volatile in recent years and it would not be surprising to find that it changes in the months ahead. Therefore, we continue to be very cautious on recommending any allocation to commodities. Despite the low expected return, we have shown that commodity futures potentially bring diversification benefits to a portfolio which can be enough to warrant a small allocation to commodities within a portfolio.

Investments in a diversified portfolio of commodity futures such as the S&P GSCI are risky, with standard deviations that are greater than stocks depending on the commodity benchmark. And, as we suggest above, expected returns are likely to be low. Exhibit 40 reports return, risk, and correlations for the S&P GSCI as compared to the S&P 500. For example, over the past 10 years, the standard deviations of the S&P GSCI and S&P 500 returns were 21.60% and 13.04%, respectively. However, in a portfolio context, commodities are not as risky despite their high volatility because of their beneficial correlations with other assets classes. The correlations between the S&P GSCI and the S&P 500 are 0.16 and 0.50 for the 52 year and 10-year periods, respectively.

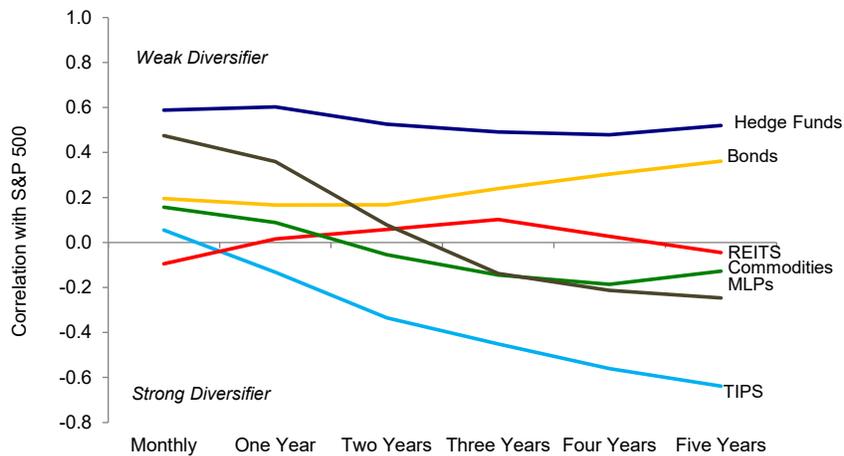
Exhibit 40: Commodity Return, Risk, and Correlations, Dec 1969 to Dec 2021

	Annual Return	Risk	Correlation with S&P 500	Correlation to CPI
<u>Long Term - Jan 1970 to Dec 2021 (52 Yrs)</u>				
S&P GSCI	6.45%	20.42%	0.16	0.19
S&P 500	10.97%	15.23%	1.00	-0.06
CPI Inflation	3.92%	1.15%	-0.06	1.00
<u>Ten Years ending Dec 2021:</u>				
S&P GSCI	-6.39%	21.60%	0.50	0.40
S&P 500	16.16%	13.04%	1.00	0.16
CPI Inflation	2.08%	0.96%	0.16	1.00

Source: S&P Dow Jones, S&P GSCI, Bureau of Labor Statistics, Cliffwater calculations

Commodities possess attractive diversifying characteristics. As “real assets”, they tend to perform well when “financial assets” do not. This tendency is documented in Exhibits 41 and 42 where the correlations for several asset classes are plotted for several time horizons against equities, as measured by the total return of the S&P 500, and inflation, as measured by CPI.

Exhibit 41: Correlation with S&P 500 Index, 1970 to 2021



Source: S&P Dow Jones (S&P 500), HFRI (Hedge Funds), Bloomberg Barclays (Bonds and TIPS), Alerian (MLPs), FTSE/NAREIT (REITs), S&P GSCI (Commodities), Cliffwater calculations. See Exhibit 43 for representative indices.

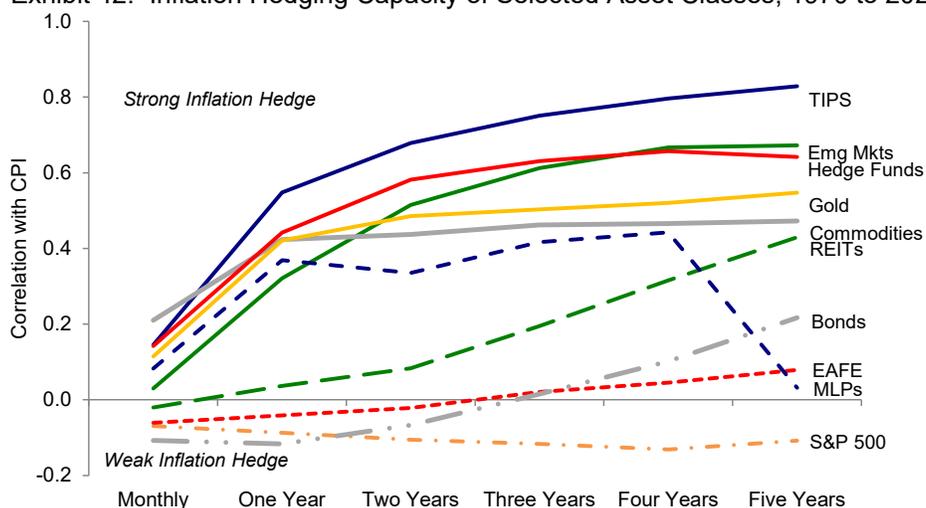
Exhibit 41 demonstrates which asset classes are effective equity diversifiers by displaying correlations with the S&P 500 over varying time horizons. The full time period examined is 1970 to 2021. Note that as the horizon increases from one month to three and five years, the correlation of commodity returns with the S&P 500 falls from slightly positive for one month to negative for three and five years. These low correlations provide effective long-term diversification, particularly when compared to bonds, hedge funds, MLPs, and REITs, which are the other major diversifying asset classes. The graph also illustrates how TIPS are the most effective diversifier against equity exposure.

One reason commodities have a low correlation with equities is their tendency to correlate positively with inflation. This trait is shown in Exhibit 42 where asset class return correlations are measured directly against CPI.

Exhibit 42 reveals which asset classes are “real” and which are not. TIPS, emerging markets, hedge funds, REITs, and commodities (S&P GSCI) are inflation hedges. Stock and bond returns do not hedge inflation and show negative correlations with inflation over most time horizons. MLPs fall somewhere in the middle.

REITs behave more like stocks over short and intermediate time periods but exhibit improved inflation hedging characteristics over long time periods.

Exhibit 42: Inflation Hedging Capacity of Selected Asset Classes, 1970 to 2021



Source: Bureau of Labor Statistics (CPI), Bloomberg Barclays (TIPS, Bonds), MSCI (Emg Mkts, EAFE), HFRI (Hedge Funds), Bloomberg (Gold), S&P Dow Jones (S&P 500, Commodities), FTSE/NAREIT (REITs), Alerian (MLPs), Cliffwater calculations. See Exhibit 43 for representative indices.

Exhibit 43 reports inflation hedging values for the asset classes depicted in Exhibit 42, including a calculation of “inflation beta”, the sensitivity of return to changes in CPI.

Exhibit 43: Calculation of Inflation Beta

Period	S&P 500	MSCI EAFE	MSCI Emerging Markets	Bloomberg	FTSE/ NAREIT	S&P	HFRI Fund	Alerian	Gold	
				U.S. Aggregate Bond						Bloomberg Barclays U.S. All Equity TIPS
Correlation with CPI Inflation										
Monthly	-0.07	-0.06	0.03	-0.11	0.14	-0.02	0.21	0.14	0.08	0.11
One Year	-0.09	-0.04	0.32	-0.12	0.55	0.04	0.42	0.44	0.37	0.42
Two Years	-0.11	-0.02	0.51	-0.07	0.68	0.08	0.44	0.58	0.34	0.49
Three Years	-0.12	0.02	0.61	0.02	0.75	0.19	0.46	0.63	0.42	0.50
Four Years	-0.13	0.05	0.67	0.10	0.80	0.32	0.47	0.66	0.44	0.52
Five Years	-0.11	0.08	0.67	0.22	0.83	0.43	0.47	0.64	0.03	0.55
Ratio of Standard Deviation to CPI Standard Deviation										
Monthly	11.80	13.02	17.24	4.04	3.48	13.28	15.87	4.36	17.31	15.30
One Year	5.62	7.23	9.36	2.27	1.77	6.40	8.70	2.88	8.60	9.10
Two Years	4.33	6.57	6.80	1.89	1.47	4.98	7.22	2.14	6.03	8.87
Three Years	3.89	6.24	6.41	1.76	1.39	4.34	6.50	1.83	5.13	8.71
Four Years	3.83	6.33	6.29	1.78	1.38	4.07	5.83	1.69	5.00	7.96
Five Years	3.87	6.15	6.38	1.80	1.37	3.97	4.87	1.70	0.43	6.15
CPI Inflation Beta (=correlation x ratio of standard deviations)										
Monthly	-0.82	-0.79	0.52	-0.43	0.50	-0.27	3.33	0.62	1.43	1.75
One Year	-0.49	-0.30	3.00	-0.26	0.97	0.23	3.68	1.27	3.17	3.83
Two Years	-0.46	-0.14	3.50	-0.13	0.99	0.41	3.16	1.24	2.02	4.30
Three Years	-0.45	0.13	3.92	0.03	1.05	0.84	3.00	1.16	2.14	4.38
Four Years	-0.50	0.29	4.19	0.18	1.10	1.29	2.72	1.11	2.21	4.15
Five Years	-0.42	0.49	4.29	0.39	1.14	1.71	2.30	1.09	0.01	3.37

Source: S&P Dow Jones, MSCI, Bloomberg, FTSE NAREIT, S&P GSCI, HFRI, Alerian, Bloomberg, Bureau of Labor Statistics, Cliffwater calculations

In summary, despite Cliffwater’s low return expectations for commodities, their high correlation to inflation and low correlation to equities make them a potentially useful diversifying asset class that investors with inflation sensitive payouts may choose to consider for a modest portfolio allocation.

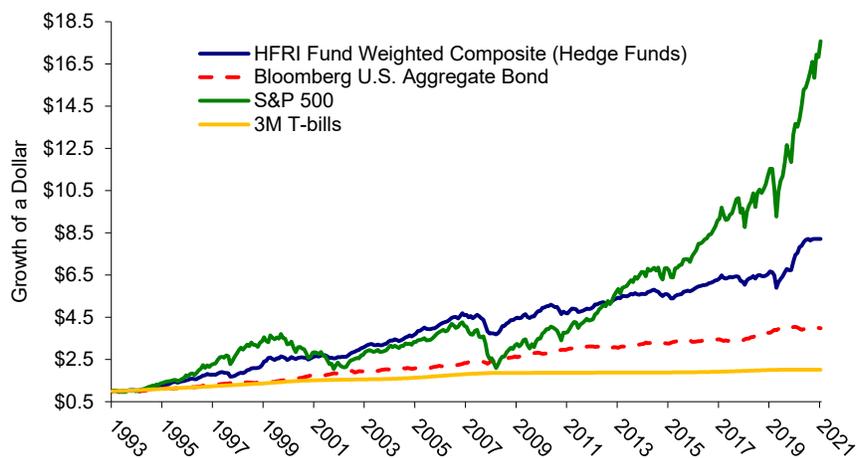
Hedge Funds¹⁷

Traditional asset classes like stocks and bonds derive most, if not all, of their returns from the types of security they represent. Buy and hold returns generated by these traditional asset classes are referred to as “beta.” Hedge funds, on the other hand, derive most of their return from “alpha” which is generated by active management employing investment strategies that are very different from traditional long only investment approaches. Examples of hedge fund investment strategies include convertible arbitrage, merger arbitrage, long-short equity and tactical asset allocation. Aside from investment strategy, hedge funds are unique from the other asset classes presented in our report in two respects: (1) flexibility to invest in a broad range of securities and (2) the ability to short securities.

The unique features of hedge funds make forecasting their return and risk more challenging because it requires making assumptions about the ability of hedge fund managers to produce alpha return. While we also forecast alpha for private equity and opportunistic real estate, alpha represents a smaller proportion of return compared to hedge funds.

Our hedge fund forecasting process begins with examining historical hedge fund returns. Hedge Fund Research, Inc. (“HFRI”) is a well-known firm that tracks hedge fund performance. Exhibit 44 shows net-of-fee returns for their hedge fund index for the period 1993 through 2021. While returns for the HFRI Fund Weighted Composite Index¹⁸ go back to 1990, it was only in 1994 that “survivorship bias” was minimized by retaining performance of funds that stopped reporting to the Index. While academics still question the integrity of these published hedge fund index returns, we believe that the returns reported by HFRI are generally representative of hedge fund portfolio returns found in practice.

Exhibit 44: Hedge Fund Performance, 1993 to 2021



Source: HFRI, Bloomberg, S&P Dow Jones, Bank of America Merrill Lynch

We believe the investment attractiveness of hedge funds is apparent from Exhibits 44 and 45. Over the past 28 years the HFRI Fund Weighted Composite Index produced returns between stocks and bonds but with a level of volatility that is much closer to bonds. As a result, the HFRI Fund Weighted Composite Index has produced a return-to-risk ratio equal to 1.15, about 50% higher than the 0.73 ratio for the S&P 500.

¹⁷ See Cliffwater’s research report “Constructing a Portfolio of Hedge Funds: April 2011” for a more complete discussion of hedge fund investing.

¹⁸ The HFRI Fund Weighted Composite Index is an equal weighting of approximately 3,000 hedge funds. Many users misinterpret the term “Fund Weighted” to mean asset weighted.

Exhibit 45: Hedge Fund Return and Risk, 1993 to 2021

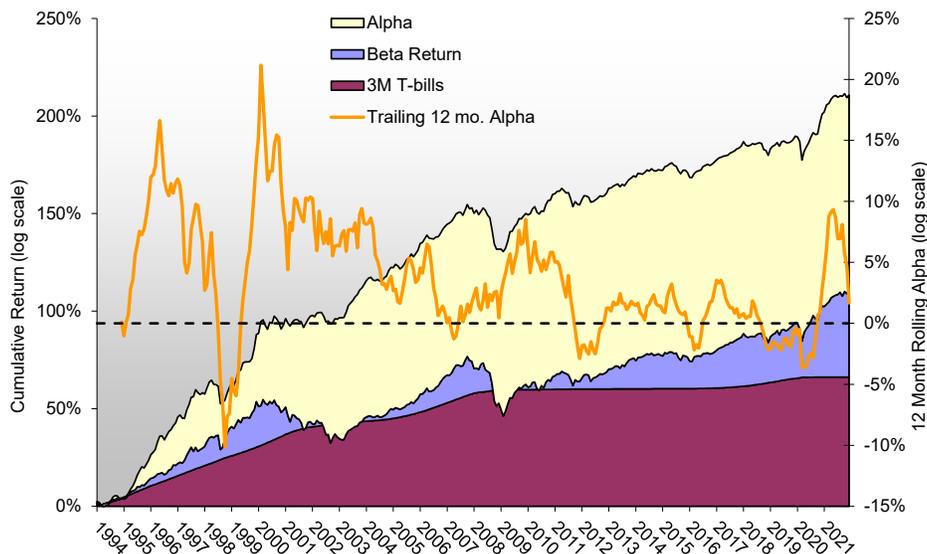
Index	Annual Return	Risk	Return/ Risk
Hedge Funds (HFRI Fund Weighted Composite)	7.81%	6.78%	1.15
S&P 500	10.78%	14.83%	0.73
Bloomberg U.S. Aggregate Bond	5.06%	3.52%	1.44
3M T-bills	2.53%	0.64%	

Source: HFRI, Bloomberg, S&P Dow Jones, Bank of America Merrill Lynch

In Exhibit 46, we divide the HFRI Fund Weighted Composite Index cumulative return, shown in Exhibit 44, into its three component returns: T-bills (cash), beta, and alpha. T-bills (red area) represents the risk-free return that is a component of all asset classes. The beta return (blue area) is estimated monthly by multiplying the trailing 36-month equity beta for the HFRI Fund Weighted Composite Index by the difference between MSCI ACWI and T-bill returns. Equity beta as calculated for the HFRI Fund Weighted Composite Index over the 27 years averages 0.36 and varies from a low of 0.17 to a high of 0.50.

While the HFRI Fund Weighted Composite Index returns are the same in Exhibits 44 and 46, they are expressed in log form (continuously compounded) in Exhibit 46, causing the vertical axis scales to be different though the cumulative returns look the same in both graphs. The change to log returns in Exhibit 46 makes it easier to conduct our return attribution.

Exhibit 46: Sources of Hedge Fund Returns – Alpha, Beta, and T-bills, 1994 to 2021



Source: HFRI, MSCI, Bank of America Merrill Lynch, Cliffwater calculations

The top line in Exhibit 46 shows cumulative percentage return for the HFRI Fund Weighted Composite Index, which is the combination of the alpha, beta, and T-bills area segments. In combination, the three return segments grew 210% over the entire 28-year period, the cumulative (log) return of the HFRI Fund Weighted Composite Index. Visual inspection shows that the two largest components of the HFRI Fund Weighted Composite Index return were alpha, the top segment, and T-bills, the bottom segment, with returns from beta being the smallest component. Annualized, the component returns for the 28-year period are shown in Exhibit 47, where they are again converted back to the more familiar compound annual return form.

Exhibit 47: Sources of HFRI Fund Weighted Composite Index Return

Hedge Fund Return Attribution				
Periods ending December 2021				
Return Source	28 Years	10 Years	5 Years	1 Year
Alpha	3.75%	0.97%	0.54%	1.77%
Beta*	1.67%	4.20%	5.42%	8.49%
T-bills	2.39%	0.62%	1.14%	0.05%
Total	7.82%	5.79%	7.10%	10.30%
Alpha Risk	3.51%	2.32%	2.85%	4.12%
Inf Ratio	1.07	0.42	0.19	0.43

* Beta measured relative to MSCI ACWI Index

Source: Bank of America Merrill Lynch, MSCI, HFRI, Cliffwater calculations

Note: Amounts may not sum due to rounding

Our analysis shows that alpha and T-bills have been the two dominant contributors to long-term hedge fund returns. Beta contributed a smallish 1.67% to the 7.82% annual hedge fund return since December 31, 1993.

Alpha contributed 3.75% annually to hedge fund returns over the last 28 years. To better understand the consistency of alpha generation by hedge funds and the degree of accuracy with which we can forecast its level, we also plot a line in Exhibit 46 showing the trailing 12-month alpha whose values are represented in the right-hand scale.

Alpha turned negative in 2008 but recovered sharply in 2009 and found roughly its long-term average in 2010. This pattern is not unique and mirrors the Asian/Russian Debt Crisis in 1997-99 which produced even greater losses for hedge fund alpha followed by a rapid recovery in 2000-01. The European sovereign crisis hit in 2011 and again hedge fund performance weakened, and returns were negative for all of 2011. Hedge fund returns bounced back in 2012 but alpha has been generally modest and below historical averages over the last four years. Most recently, hedge fund alpha returns have turned strongly positive, particularly over the last two years.

Investors do not always hold a diversified cross section of hedge fund strategies as represented by the HFRI or other composite indices, but instead may utilize one hedge fund strategy such as equity long/short. Therefore, we provide forecasts for seven commonly used hedge fund strategies and use industry-like weights to roll up into one overall hedge fund return and risk forecast.

Our seven hedge fund strategies are:

1. *Market Neutral*. These include convertible arbitrage, fixed income arbitrage, and equity market neutral strategies that are intended to earn positive returns regardless of market direction by hedging away all stock or bond market risk.
2. *Credit/Distressed*. These hedge funds invest long and short in higher risk debt securities (corporate, mortgage, asset-backed, and other) and sometimes equity in troubled and/or post-bankruptcy companies.
3. *Event Driven*. These are generally equity but sometimes debt securities of companies undergoing some corporate action such as a spinoff, merger, or other short-term event.
4. *Equity Long/Short*. These are equity managers that invest long and short in common stocks.
5. *Macro-Discretionary*. These are managers that engage in tactical allocations driven by fundamental relative value analysis in currencies, commodities, and stock and bond indices.
6. *Macro-Systematic (CTA)*. These are trend following managers who display strong performance during periods of high market stress or when markets make major moves up or down.

7. *Multistrategy*. Hedge funds that employ several hedge fund strategies and opportunistically move capital among strategies as they perceive relative opportunity.

Exhibit 48 provides a detailed accounting of Cliffwater’s forecasts for hedge fund return and risk by strategy and by return component (T-bill, beta, and alpha).

Exhibit 48: Expected Sources of Hedge Fund Return and Risk as of January 1, 2022

	1	2	Beta				Alpha			T-bill+Beta+Alpha	
	Model	3M T-bill	Equity	Credit	Beta	Beta	Alpha	Alpha	Info	Total	Total
Hedge Fund Strategy	Weights	return	Beta*	Beta**	Return	Risk	Return	Risk	Ratio	Return	Risk
Market Neutral	20.0%	1.25%	-0.05	0.00	-0.27%	0.90%	1.58%	3.52%	0.45	2.55%	3.63%
Credit/Distressed	15.0%	1.25%	0.10	0.40	1.77%	4.96%	1.35%	3.11%	0.43	4.37%	5.86%
Event Driven	12.5%	1.25%	0.25	0.15	1.82%	5.47%	2.13%	4.91%	0.43	5.20%	7.35%
Equity Long/Short	25.0%	1.25%	0.35	0.00	1.91%	6.30%	2.15%	4.50%	0.48	5.31%	7.74%
Macro-Discretionary	7.5%	1.25%	0.10	0.00	0.55%	1.80%	2.10%	4.70%	0.45	3.90%	5.03%
Macro-Systematic	5.0%	1.25%	0.05	0.00	0.27%	0.90%	1.24%	8.25%	0.15	2.76%	8.30%
Multistrategy	15.0%	1.25%	0.10	0.15	1.00%	2.87%	1.50%	3.46%	0.43	3.75%	4.49%
Hedge Fund Portfolio	100.0%	1.25%	0.15	0.10	1.12%	3.34%	1.77%	2.95%	0.60	4.14%	4.49%

* MSCI All Country World Index (MSCI ACWI) expected return equal to 6.70%

** S&P/LSTA Leveraged Loan Index expected return equal to 4.30%

Individual hedge fund strategy weights are contained in column 1. These weights are set by Cliffwater generally annually to represent optimal allocations for a diversified hedge fund portfolio. They are not index weights, per se, but will generally be similar to weightings found in commercial hedge fund indices.

Column 2 contains our expected 1.25% cash (T-bill) return. This is the same return across all strategies. Columns 3 and 4 show our equity and credit beta forecasts which are based upon historical analysis of strategy returns. For example, we expect equity long/short hedge funds to have an equity beta equal to 0.35 and credit beta equal to 0.00. The overall hedge fund portfolio beta values are a weighted average of strategy betas where the weights are those in column 1.

Column 5 shows our expected beta returns for strategies and the overall hedge fund portfolio. These return components are calculated by multiplying the beta values in columns 3 and 4 times our expected equity and bank loan excess returns. For example, the 1.91% expected beta return for equity long/short equals the 0.35 expected equity beta multiplied by 5.55%, the expected excess return on global stocks (6.70% minus 1.25%). The beta risk values in column 6 are derived from the expected beta values in columns 3 and 4 and the risk forecasts for equities and bank loans.

Columns 7, 8 and 9 provide our alpha return and risk forecasts. These are based upon a detailed historical analysis of our internal hedge fund strategy returns. Combining all strategies in the bottom row shows that our alpha forecast for a diversified hedge fund portfolio is 1.77%. Alpha risk for the combined hedge fund portfolio, shown in the bottom row in column 8, equals 2.95%. A key performance metric is information ratio, shown in column 9. It measures risk-adjusted alpha and equals alpha return divided by alpha risk. Our expected hedge fund portfolio information ratio equals 0.60, which we believe should be considered attractive relative to most other asset classes.

Finally, columns 10 and 11 provide total return and risk forecasts, by combining returns and risks for cash (T-bill), beta, and alpha. Risk forecasts also combine the three components and incorporate correlation assumptions which are not shown in Exhibit 48 but available upon request. We forecast a 10-year return equal to 4.14% for a diversified hedge fund portfolio with an expected risk equal to 4.49%. We round values to a 4.15% hedge fund expected return.

MLPs (Master Limited Partnerships)

Created by Congress in the 1980s, these publicly traded partnership interests are tax free at the entity level provided that 90% of their income comes from natural resources such as oil, natural gas, coal, timber. Income generating MLP activities include exploration & production and mining as well as midstream services such as gathering & processing, transportation, storage, and distribution, but exclude most downstream services such as gas stations and utilities.

There are approximately 110 MLPs in the market, traded primarily on the New York and NASDAQ exchanges. The most referenced MLP index is the Alerian MLP Index, a float-adjusted capitalization weighted index of the 28 largest MLPs with a total capitalization of \$206 billion as of December 2021 and a December 1995 start date.

MLPs show strong equity-like performance over their entire history but, as shown in Exhibits 49 and 50, MLPs have experienced a sharp drawdown beginning in 2014 which has continued through 2021.

Exhibit 49: MLP Performance versus Other Asset Classes, Dec 1995 to Dec 2021

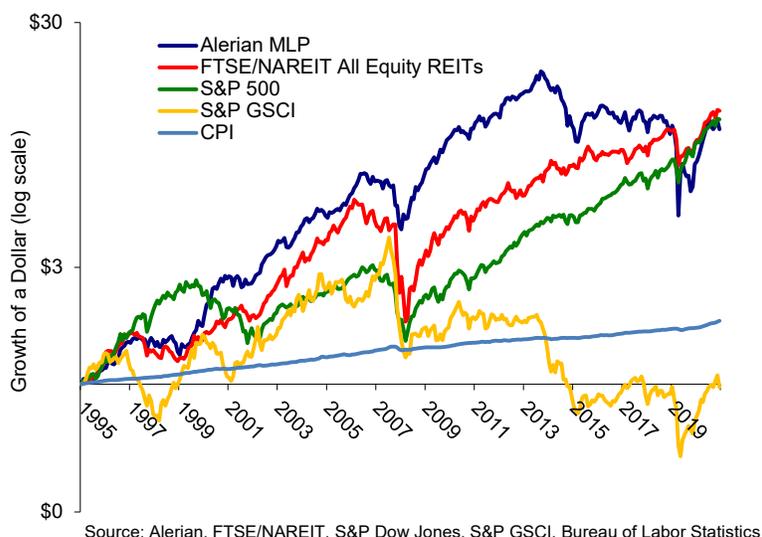


Exhibit 50 shows return, risk, and correlation for MLPs compared to other asset classes beginning in 1995 when the Alerian MLP was created.

MLP risk, measured by standard deviation, equals 22.28% over the entire period. This is greater than the volatility of REITs, and S&P 500.

An important question is the sensitivity of MLP earnings and returns to commodity prices, particularly oil and natural gas. This touches on the commodity risk imbedded in MLPs and whether they can be a reliable inflation hedge. The conventional wisdom is that most MLPs follow a “toll-road” business model where revenues are more sensitive to the volume of oil & gas put through pipes and other transport assets and less sensitive to oil & gas prices.

While we find that MLP returns are modestly sensitive to changes in oil prices over their entire history, MLP returns have moved together with energy prices in recent years. Oil betas for the four asset classes and CPI are reported in section (c) of Exhibit 50. Betas are shown because they include both correlation and volatility. The S&P GSCI, as expected, has the highest oil beta, equal to 0.51. The betas drop off significantly for the S&P 500, REIT, and MLP indices, though the Alerian MLP Index would rank second in beta sensitivity to oil with a beta equal to 0.22.

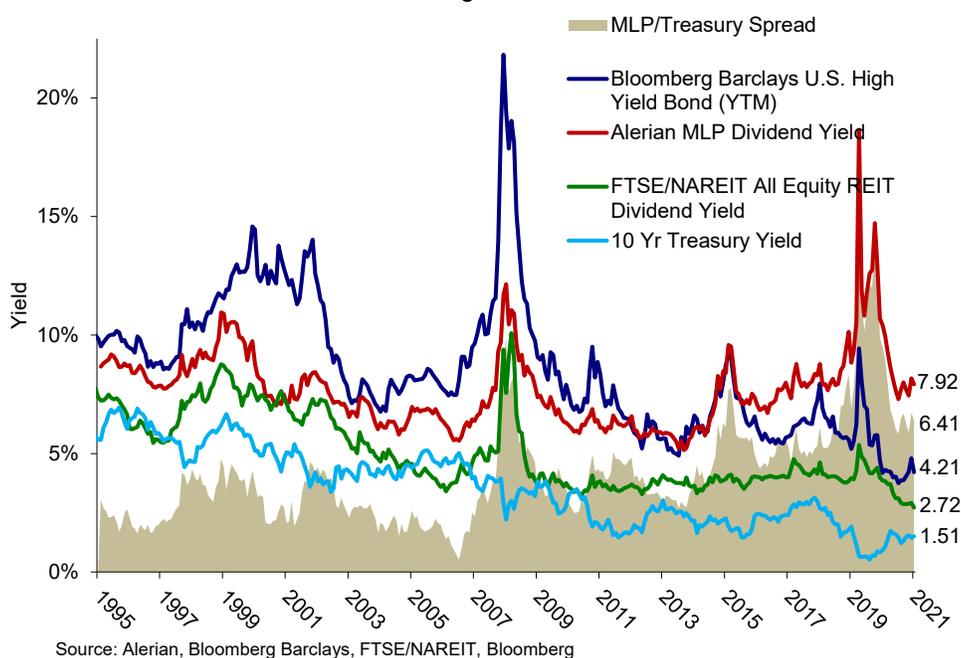
Exhibit 50: MLP Return and Risk versus Other Asset Classes (periods ending Dec 2021)

	FTSE/NAREIT				
	Alerian MLP	All Equity REITs	S&P 500	CPI	S&P GSCI
(a) Returns ending December 2021					
1 Year	38.75%	35.94%	27.92%	6.88%	38.24%
3 Years	-2.31%	11.87%	20.38%	3.33%	2.59%
5 Years	-2.55%	9.80%	17.90%	2.89%	2.24%
10 Years	-0.05%	10.90%	16.16%	2.08%	-6.39%
Since Jan 1996 (26 Yrs)	9.66%	10.40%	10.05%	2.31%	-0.12%
Year 2008	-36.93%	-37.74%	-37.01%	-0.04%	-46.49%
(b) Risk and Correlation since Jan 1996					
Risk	22.28%	19.64%	15.18%	1.01%	22.81%
Correlations:					
MLPs	1	0.40	0.47	0.08	0.38
REITs	0.40	1	0.59	0.08	0.22
S&P 500	0.47	0.59	1	0.05	0.32
CPI	0.08	0.08	0.05	1	0.35
S&P GSCI	0.38	0.22	0.32	0.35	1

The primary interest in MLPs is their high current yield. A high yield appeals to investors who want liquidity and/or current income and also provides some inflation protection as cash flow can be reinvested at higher rates during periods of rising inflation.

In Exhibit 51 we compare cash yields for MLPs, REITs, Treasuries, and high yield bonds. The MLP yield is for the Alerian MLP Index, the REIT yield is for the FTSE/NAREIT All Equity REITs Index and yields on high yield bonds are measured by the yield-to-maturity on the Bloomberg U.S. High Yield Bond Index.

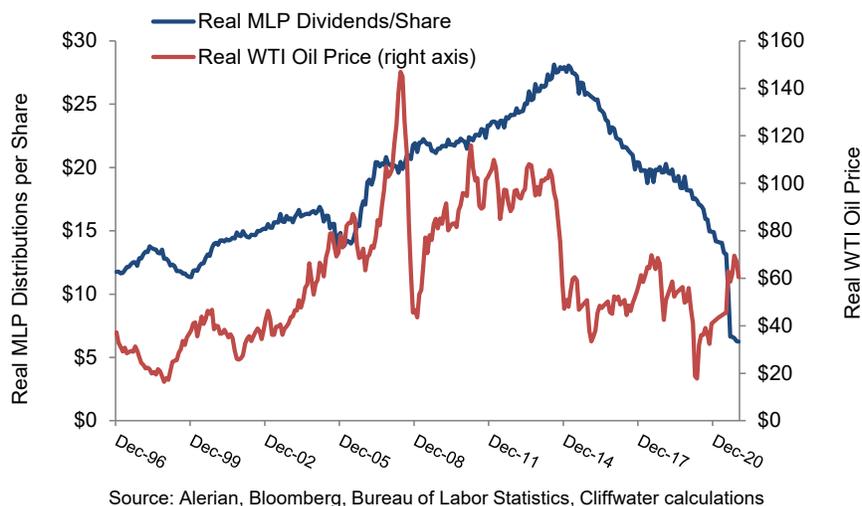
Exhibit 51: Yield across MLPs, REITs, High Yield Bonds and Treasuries, 1996 to 2021



MLP yields are consistently high and exceed most other yield-oriented asset classes, even high yield bonds over the last three years.

In Exhibit 52 we show MLP earnings per share history from 1996 to 2021 and compare them with oil prices. There is some similarity in the progression of both. MLP earnings increased, as did oil prices, from 1996 to 2014. Then both fell.

Exhibit 52: Alerian MLP Index Dividend per Share History, 1996 to 2021



MLP earnings/dividends have fallen roughly 50% from their highs of three years ago, roughly matching the 56% drop in MLP prices for the same period. Exhibit 52 shows that MLP dividends have fallen before, in 2005 and 1997, but never of the current magnitude. The Exhibit also shows that MLP dividends are not a direct reflection of energy prices as dividends have risen and fallen in the past irrespective of energy prices. Where MLP earnings go from here is uncertain and further damage may be forthcoming.

Our expected return for MLPs is 6.45%, equal to the 7.70% current yield minus a 1.25% estimate for administrative costs and management fees associated with MLP accounts. We are assuming no pass-through of expected inflation.

Private Debt and BDCs

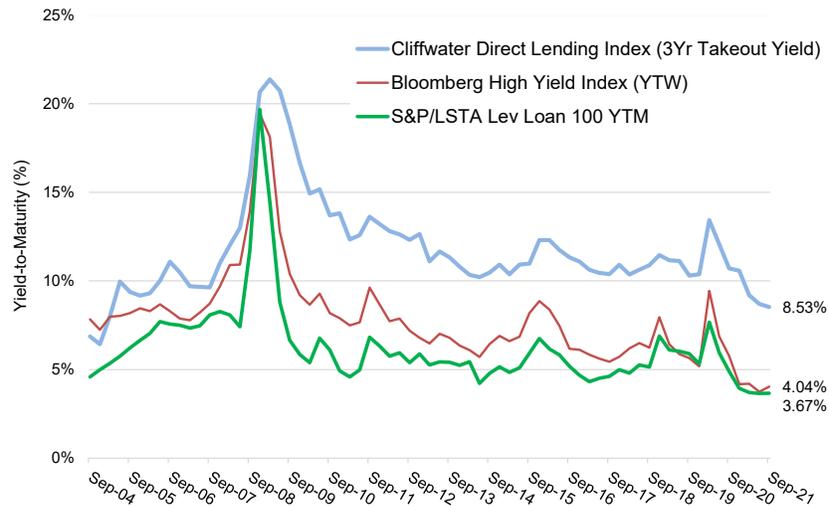
U.S. Middle Market Corporate Lending (Direct Lending)

Private middle market lending (private debt) has been a fast-growing asset class in recent years for four reasons: expected returns are high single digit, volatility is low relative to other asset classes with similar expected returns, cash returns are almost immediate in the form of current yield with mitigated J-curve effects versus typical private equity investments, and yields increase with interest rates due to floating rate structures. This last reason means that private debt should perform well in a rising interest rate environment, unlike traded credit like investment grade bonds and high yield bonds.

Exhibit 53 reports yields for unlevered private debt, represented by the Cliffwater Direct Lending Index, together with high yield bonds.¹⁹ The Cliffwater Direct Lending Index is comprised of over 8,000 corporate loans representing over \$177 billion in asset value at September 30, 2021. The Index is unlevered and gross of fees. Further information on the CDLI can be found at www.CliffwaterDirectLendingIndex.com.

¹⁹ See *Private Debt, Opportunities in Corporate Direct Lending*, Stephen L. Nesbitt, (John Wiley & Sons, 2019), for an extensive discussion on private debt and the Cliffwater Direct Lending Index.

Exhibit 53: Yield Comparison of Direct Lending and High Yield Bonds, Sept 2004 to Sept 2021²⁰



► Gross yields for direct lending have averaged 4 percentage points above traded high yield bonds over the last 15 years.

Exhibit 53 shows direct lending yields, measured by the CDLI, that have been consistently higher than yields for broadly syndicated (traded) high yield bonds and bank loans, with gross yield spreads averaging 4.58% and 5.81%, respectively, over the 10 years ending September 30, 2021.

Direct lending, like private equity, is an actively managed asset class with fees and expenses that will lower return. On the other hand, direct lending managers often finance some of their loan portfolio (use leverage) to enhance return. Exhibit 54 illustrates the expected return from an actively managed direct lending portfolio that uses some leverage (1.0 times net assets) and where typical fees and expenses are netted from interest income.

²⁰ Cliffwater research, as of September 30, 2021. The Cliffwater Direct Lending Index (the “CDLI”) seeks to measure the unlevered, gross of fees performance of U.S. middle market corporate loans, as represented by the underlying assets of public and private Business Development Companies, subject to certain eligibility requirements. The CDLI is asset-weighted by reported fair value. Any information presented prior to the Launch Date (September 30, 2015) of the CDLI is back-tested. The CDLI performance has been prepared for informational purposes only. Past performance is not indicative of future returns. “3Yr Takeout Yield” is calculated by assuming that all loans will be repaid at par in three years, which represents the average life of direct loans. The index returns are provided for information only. Reference to an index does not imply that a portfolio will achieve returns, volatility or other results similar to the index. Please see additional disclosures at the end of the report.

Exhibit 54: Calculations underlying Cliffwater Direct Lending Expected Return²¹

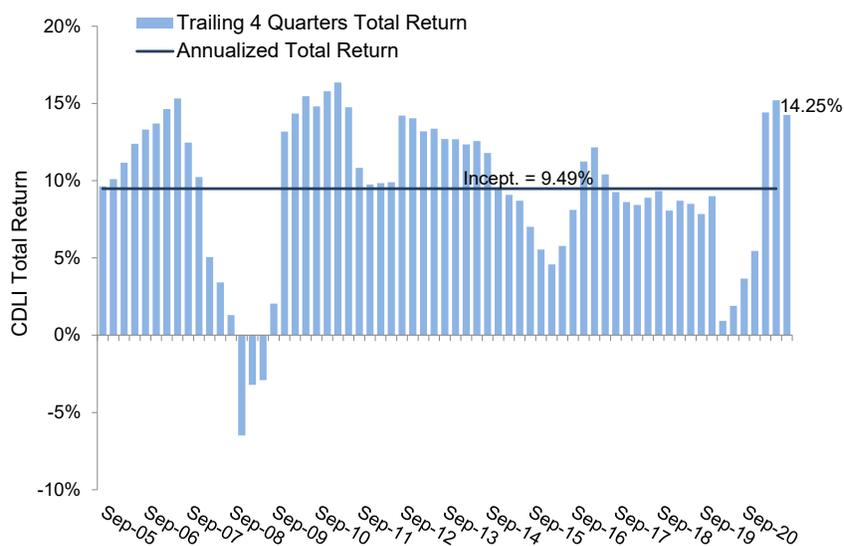
(1) Loan Assumptions		
Loan Interest Income	7.50%	
Fee Income (OID)	0.67%	
Credit Losses	0.50%	
(2) Leverage Assumptions		
Cost of Debt	2.75%	2.75%
Leverage Amount	0.00x	1.00x
(3) Fee Assumptions		
Mgmt Fees (Gross Assets)	1.00%	1.00%
Operating Expenses (NAV)	0.20%	0.20%
Incentive Fee	0%	15%
Preferred Return	0%	6%
(4) Expected Return Calculation		
	<u>Unlevered</u>	<u>Levered</u>
<i>Unlevered Portfolio Yield</i>	7.50%	7.50%
+ Loan Origination Income	0.67%	0.67%
+ Effect of Leverage	0.00%	8.17%
- Interest Cost of Leverage	<u>0.00%</u>	<u>-2.75%</u>
= Gross Levered Yield	8.17%	13.59%
- Expected Credit Losses	-0.50%	-1.00%
- Estimated Mgmt Fees	-1.00%	-2.00%
- Other Expenses	-0.20%	-0.20%
- Estimated Incentive Fee	<u>0.00%</u>	<u>-1.56%</u>
= Net Expected Return	6.47%	8.83%

Expected returns for unlevered and levered direct lending equal 6.45% and 8.85%, respectively, after rounding.

Exhibit 55 shows past performance for the CDLI from its inception. The CDLI has an inception annualized return equal to 9.49% with modest volatility.

²¹ The Cliffwater return forecast shown is calculated by applying the current Cliffwater return forecast methodology to currently available market information and the use of Cliffwater's professional judgment. Due to the forward-looking nature of the forecast, it is necessarily speculative and may prove to be inaccurate. The return forecast reflects expected returns for the entire direct lending asset class and not for specific investments within the asset class. Specific investments within the asset class will perform differently and may underperform the forecasted returns. The forecasted returns do not reflect actual performance of any account(s) managed by Cliffwater. Cliffwater may change its return forecast methodology at any time and the Cliffwater return forecast should not be used to predict the actual future performance of any Cliffwater account.

Exhibit 55: Cliffwater Direct Lending Index Performance, Rolling Four Quarter, Sept 2005 to Sept 2021²²



Business Development Companies

Publicly traded Business Development Companies (or “BDCs”) are exchange traded companies that invest in middle market private debt and can be accessed as a complement to or substitute for private debt. BDCs are very much like REITs and MLPs, though their assets are private debt instead of real estate and midstream energy, respectively. BDCs were created by Congress in 1980, under Section 54 of the Investment Company Act of 1940, to stimulate private investment in middle market U.S. companies. Congress gave the BDC structure the advantage of electing to be exchange-traded with a tax-free pass-through of investment income, but with some restrictions, including:

- SEC registration and oversight
- At least 70% of assets limited to non-public debt and equity in U.S. corporations
- Maximum leverage equal to net asset value (NAV)
- Annual distribution of at least 90% of income to shareholders
- Certain portfolio diversification constraints

BDCs, therefore, are in many ways like REITs and MLPs in their cash generating, tax-preference investment characteristics that originally appealed to yield-hungry retail investors but have since found institutional interest as the number and size of offerings grew.

There are 36 publicly traded BDCs with a combined market capitalization equal to \$56 billion in the Cliffwater BDC Index as of December 31, 2021, representing a small fraction of the \$1 trillion direct lending market. By market capitalization, BDC size is well behind other publicly traded yield-oriented instruments. However, we expect the BDC market to grow, both from investor demand for yield, the growth of non-bank middle market financing, and the general trend toward securitization of private assets.

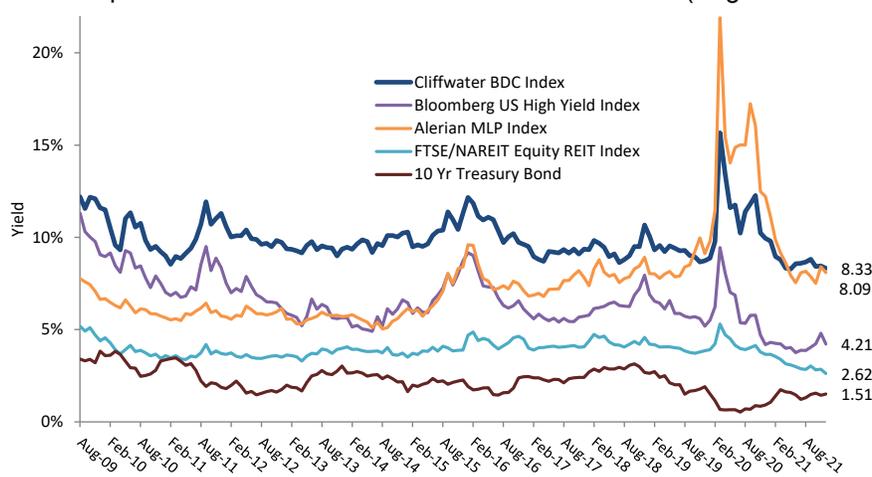
As illustrated in Exhibit 56, BDCs were priced attractively at year-end, with an 8.33% dividend yield.

BDCs have consistently yielded well above other yield-oriented asset classes over the last nine years. Particularly relevant is the comparison to high yield bonds as both are credit driven asset classes. BDCs have historically offered significant additional cash yield compared to high yield bonds. The BDC yield

²² Any information presented prior to the Launch Date (September 30, 2015) of the CDLI is back-tested. The performance of the CDLI has been prepared for informational purposes only. Past performance is not indicative of future returns.

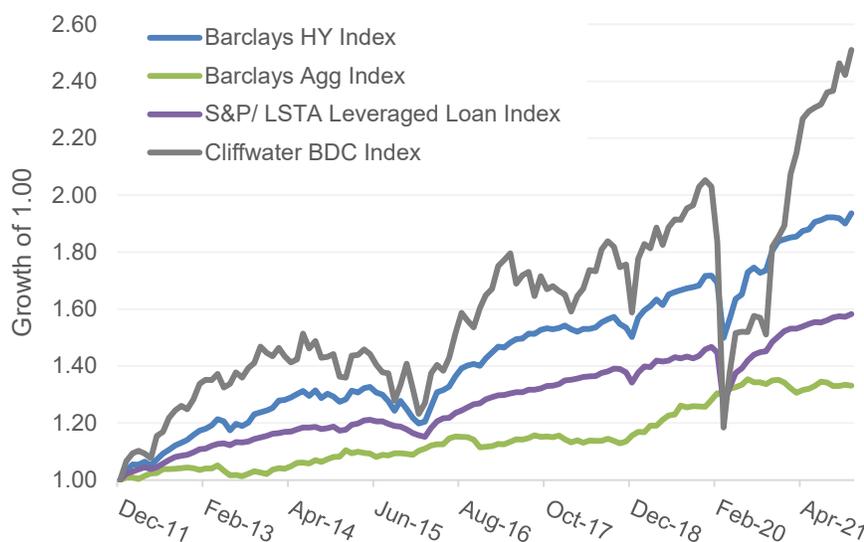
spread to high yield bonds equaled 4.21% on December 31, 2021. Cliffwater is forecasting a 7.05% long-term return for a portfolio of public BDCs, which is 2.95% above the 4.10% high yield bond forecast.

Exhibit 56: Comparison of Yields across Selected Asset Classes (Aug 2009 to Dec 2021)²³



Performance for the Cliffwater BDC Index over the last nine years is shown in Exhibit 57 along with two credit-oriented indices (Bloomberg U.S. High Yield Bond Index and S&P/LSTA U.S. Leveraged Loan Index) and the Bloomberg U.S. Aggregate Bond Index, as a measure of investment grade bond performance.

Exhibit 57: Return Comparison of BDC, High Yield, Levered Loan, and Investment Grade Bonds, Dec 2009 to Dec 2021



BDCs performed better than the other bond indices over the last 10 years, earning a 9.64% annualized return. By comparison, the Bloomberg U.S. High Yield Bond, S&P/LSTA U.S. Leveraged Loan, and Bloomberg U.S. Aggregate Bond indices returned 6.83%, 4.70%, and 2.90%, respectively.

²³ The Cliffwater BDC Index (the “CWBD”) measures the performance of lending-oriented, exchange-traded Business Development Companies, subject to certain eligibility criteria. The CWBD is a capitalization-weighted index calculated daily using publicly-available closing share prices and reported dividend payouts. Any information presented prior to the Launch Date (January 1, 2015) of the CWBD is back-tested. The performance of the CWBD has been prepared for informational purposes only. Past performance is not indicative of future returns.

Exhibit 56 also illustrates the higher volatility found with BDCs compared to high yield bonds and bank loans. For example, the annualized return standard deviation equaled 18.75% for the Cliffwater BDC Index over the 10-year period as compared to 6.48%, 5.14%, and 2.98% for the Bloomberg U.S. High Yield Bond Index, the S&P LSTA Levered Loan Index, and the Bloomberg Aggregate Bond Index, respectively. We believe the higher BDC risk level is likely to gradually decline as the BDC market grows in market capitalization and institutional participation.

Infrastructure

Like real estate, we divide institutional infrastructure investments into three categories:

1. Core – These are brownfield assets with current contracted cash flows which are inflation linked, GDP insensitive, or Public Private Partnerships (“PPP”). Investment in core infrastructure assets is highly competitive with lower targeted returns and limited growth characteristics. Core infrastructure investments have traditionally been in OECD countries. Leverage and efficient operation are the primary levers used to support performance.

PPPs are investment structures that allow a government entity to partner with a private contractor and investor to build and manage infrastructure assets deemed essential to a community. The structure provides for an arms-length negotiation of the private investment required return. The contract will also provide for an efficient and privately constructed turnkey operating asset with underwriting guarantees by the construction company. The ownership of the asset remains with the government entity with the private investor and operator retaining the right to operate the asset over a pre-determined period. PPPs have long durations ranging from 20 to 100 years that are well matched to the long-term liabilities of pension funds. The private partners of the PPP will collect the cash flows from the operation of the asset and will be held to operating standards. PPPs will have varying levels of risk including construction and in some cases a level of demand risk through user pay systems.

2. Core Plus – These include mostly brownfield assets plus some greenfield opportunities which together provide a mix of current and future cash flows which are inflation-linked and GDP insensitive. Core Plus infrastructure assets allow institutional investors to target higher total returns by risking capital on new or additional development of existing brownfield infrastructure assets. Direct investors are less likely to target core plus assets due to the additional skill sets required to develop greenfield assets. Some investors may also venture into non-OECD countries where major infrastructure assets can be acquired and efficiently managed. Investors have recently allocated substantial capital to core plus strategies where there is a larger universe of investment opportunities that includes both public and private assets. Core plus assets will have a substantial amount of contracted revenues.
3. Value Add – These may include non-operating properties, properties in development, and properties with shorter or no contracts. Consequently, they have little or no correlation to inflation, high GDP risk, and greater operational risk. Value Add infrastructure includes the broadest set of investment opportunities and has included non-traditional infrastructure assets that may be considered traditional private equity assets. Value Add investors are willing to acquire uncontracted assets and transform the businesses into core and core plus assets by establishing growth initiatives and executing long term client contracts.

Expected return and risk on a portfolio of infrastructure assets depends largely upon the mix of property categories. Cliffwater forecasts a 7.25% expected return for infrastructure, up from one year ago due to higher expected inflation.

Short-Term Tactical Considerations

The primary purpose for this report is to assist investors in constructing portfolios that meet long term return and risk objectives. Our expected asset class returns should be used as inputs in asset allocation studies that formulate portfolios that optimize return and risk to best meet investor objectives. The outcome is generally targeted asset class weights that are intended to be followed for extended periods of time.

While our long-term asset class return assumptions may prove accurate, the path to achieving a return outcome is never a straight line, which creates short term added return opportunities for investors willing to take (benchmark and absolute) risk for being wrong. This is the second tactical component to return identified in our expected return methodology.

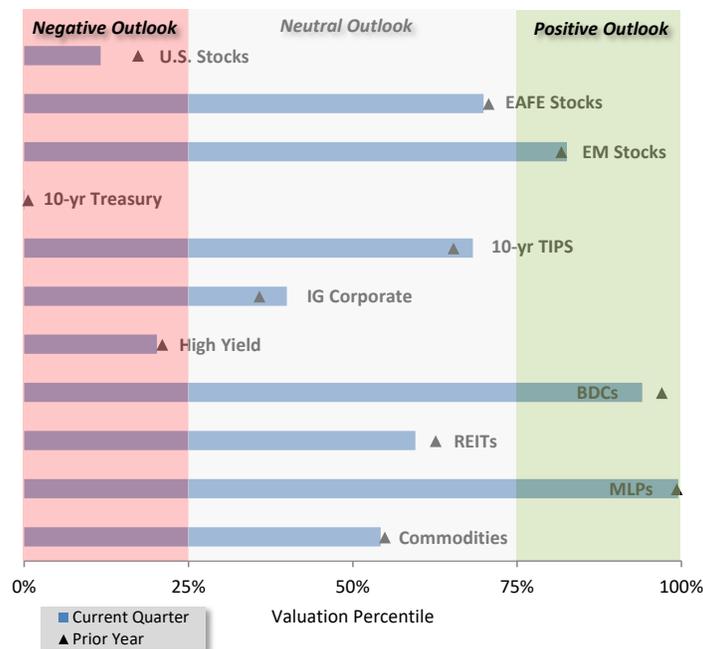
Cliffwater maintains tactical models for most of the liquid asset classes covered in this report. These tactical models are broadly based upon the thesis that riskier assets are owed higher expected returns. Those higher expected returns, or risk premiums, are discoverable by examining historical data. When actual expected returns divert from historical norms, we believe they will eventually (we don't know when) revert to our expectations. Reversion generally proceeds through abnormal price change which can potentially be captured as a tactical return.

Exhibit 58 shows our tactical outlook for selected asset classes as of January 1, 2022 and compares it to the prior year. Asset classes whose current values (blue bar) plot in the green (top quartile) region to the right are undervalued and given a *Positive Outlook*. Asset classes whose current values plot in the red (bottom quartile) region to the left are overvalued and given a *Negative Outlook*. Asset classes whose current values plot in the middle two quartiles are neither overvalued (<50%) nor undervalued (>50%) and given a *Neutral Outlook* because their values are not sufficiently different from fair value (=50%) to warrant an over- or underweight.

The blue bars measure current values as of January 1, 2022 while the dark triangles show values from one year earlier. High yield saw the largest change in valuation outlook, from a valuation near the Negative Outlook to a valuation close to a Positive Outlook. U.S. stocks showed a similar shift in attractiveness.

Exhibit 58: Cliffwater Tactical Outlook for Selected Asset Classes

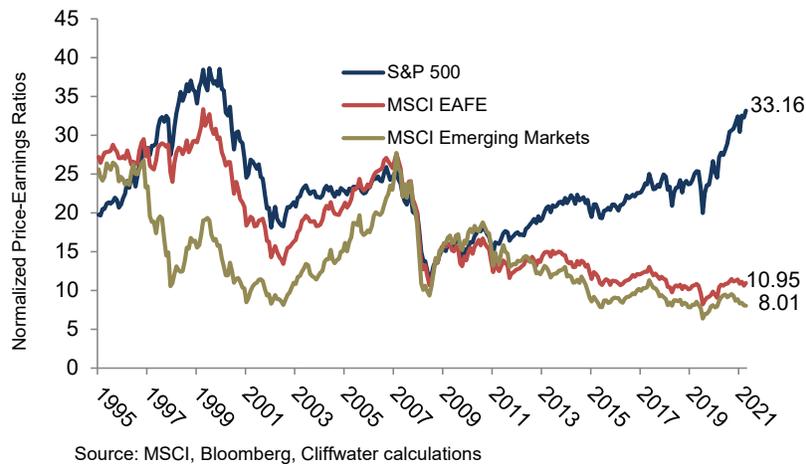
Cliffwater Tactical Asset Class Outlook (Jan 1, 2022)



Many institutional investors are currently evaluating their allocations to non-U.S. stocks, both developed and emerging, due to their low returns over multiple years when compared to U.S. stocks. In 2015, our tactical models gave emerging markets a Positive Outlook and did the same for non-U.S. developed markets in 2016.

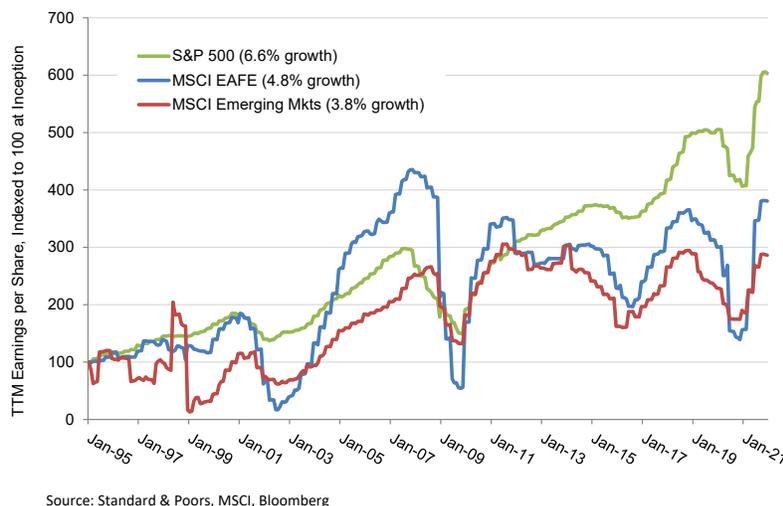
Exhibit 59 provides price-earnings ratios over time for U.S. and non-U.S. stocks. After 2008, U.S. price-earnings ratios climbed considerably relative to price-earnings ratios for non-U.S. stocks. Current differences in price-earnings multiples point to more attractive valuations for non-U.S. stocks compared to U.S. stocks.

Exhibit 59: Price-Earnings Ratios for U.S. and non-U.S. Stocks (Sept 1995 to Dec 2020)



Despite the attractive valuations for non-US stocks, we continue to depart from our tactical valuation indicator because earnings per share growth have been much higher in the US compared to the developed markets and emerging markets, as displayed in Exhibit 60. Viewed with Exhibit 59, the price-earnings separation among regions can be explained by the growth differentials after 2008. Consequently, we believe that looking at price-earnings ratios only has been a multi-year “value trap” that so far has led to underperformance from overweighting non-US stocks. As a result we continue to recommend overweight to US stocks.

Exhibit 60: Earnings per Share Growth for U.S. and non-U.S. Stocks (Jan 1995 to Dec 2020)



Asset Class	Index	Benchmark
Stocks	U.S. Stocks	Russell 3000
	Non-US Developed	MSCI EAFE
	Emerging Markets	MSCI EM
	Global Equity	MSCI ACWI
Fixed Income	Core U.S. Bonds	Bloomberg Barclays U.S. Aggregate Bond
	IG Corporate	Bloomberg Barclays U.S. Corporate Bond
	10-yr Treasury	Bloomberg Barclays 10y U.S. Treasury
	3M LIBOR (Cash)	Bloomberg
	10-yr TIPS	Bloomberg Barclays 5-10y U.S. TIPS
	High Yield Bonds	Bloomberg Barclays U.S. High Yield S&P/LSSTA U.S. Leveraged Loan
	Bank Loans	JPMorgan EMBI Global Diversified
	Emerging Market Debt	NCREIF Property
	Private Real Estate (UL)	FTSE/NAREIT All Equity REITs
	Public REITs	Cambridge Opportunistic RE
	Private RE Partnerships	Cambridge Global PE & VC
	Diversified Private Equity	HFRI FOF Composite
	Diversified Hedge Funds	Cambridge Global Energy
	Energy Funds	NCREIF Farmland Property
	Farmland	Bloomberg Commodity
Alternatives	Farmland	Cambridge Infrastructure
	Commodity Futures	Alerian MLP
	Infrastructure	Cliffwater Direct Lending
	MLPs	Cliffwater Estimates
	Private Debt (UL)	Cliffwater U.S. Buyout
	Private Debt (L:1.0)	Cambridge U.S. Buyout
	Public BDCs	Cambridge Global Venture
	Buyouts	HFRI FOF Strategic
	Venture Capital	HFRI FOF Conservative
	Directional HFs	na
	Absolute Return HFs	na
	Market Neutral HFs	na
	Credit/ Distressed HFs	na
	Event Driven HFs	na
	Equity L/S HFs	na
	Macro (Discretionary) HFs	na
	Macro (Trend) HFs	na
	Multi Strat HFs	na
	CPI	Bureau of Labor Statistics

Disclosures

The views expressed herein are the view of Cliffwater LLC (“Cliffwater”) only through the date of this report and are subject to change based on market or other conditions. All information has been obtained from sources believed to be reliable but its accuracy is not guaranteed. Cliffwater has not conducted an independent verification of the information. The information herein may include inaccuracies or typographical errors. Due to various factors, including the inherent possibility of human or mechanical error, the accuracy, completeness, timeliness and correct sequencing of such information and the results obtained from its use are not guaranteed by Cliffwater. No representation, warranty, or undertaking, express or implied, is given as to the accuracy or completeness of the information or opinions contained in this report. This report is not an advertisement, is being distributed for informational and discussion purposes only, should not be considered investment advice, and should not be construed as an offer or solicitation of an offer for the purchase or sale of any security. The information herein does not take into account any investor’s particular investment objectives, strategies, tax status or investment horizon. Cliffwater shall not be responsible for investment decisions, damages, or other losses resulting from the use of the information. This report is not intended for public use or distribution. The information contained herein is confidential commercial or financial information, the disclosure of which would cause substantial competitive harm to you, Cliffwater, or the person or entity from whom the information was obtained, and may not be disclosed except as required by applicable law.

The information in this report is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance. Note that these asset class and strategy assumptions are passive only, and they do not consider the impact of active management. References to future returns are not promises or even estimates of actual returns a client portfolio may achieve.

Statements that are nonfactual in nature, including opinions, projections and estimates, assume certain economic conditions and industry developments and constitute only current opinions that are subject to change without notice. Further, all information, including opinions and facts expressed herein are current as of the date appearing in this report and is subject to change without notice. Unless otherwise indicated, dates indicated by the name of a month and a year are end of month.

There can be no assurance that any expected rates of return or risk will be achieved. Expected rates of return and risk are subjective determinations by the Cliffwater based on a variety of factors, including, among other things, investment strategy, prior performance of similar strategies, and market conditions. Expected rates of return may be based upon assumptions regarding future events and conditions that prove to be inaccurate. Expected rates of return and risk should not be relied upon as an indication of future performance and should not form the primary basis for an investment decision. No representation or assurance is made that the expected rates of return or risk will be achieved.

This report may include sample or pro forma performance. Such information is presented for illustrative purposes only and is based on various assumptions, not all of which are described herein. Such assumptions, data, or projections may have a material impact on the returns shown. Nothing contained in this report is, or shall be relied upon as, a representation as to past or future performance, and no assurance, promise, or representation can be made as to actual returns. Past performance is not indicative of future returns, which may vary. Future returns are not guaranteed, and a loss of principal may occur.

Cliffwater is a service mark of Cliffwater LLC.

Cliffwater Index Disclosures

The Cliffwater Direct Lending Index (the “CDLI”) seeks to measure the unlevered, gross of fees performance of U.S. middle market corporate loans, as represented by the underlying assets of Business Development Companies (“BDCs”), including both exchange-traded and unlisted BDCs, subject to certain eligibility requirements. The CDLI is asset-weighted index that is calculated on a quarterly basis using financial statements and other information contained in the U.S. Securities and Exchange Commission (“SEC”) filings of all eligible BDCs. Cliffwater believes that the CDLI is representative of the direct lending asset class.

The Cliffwater BDC Index (the “CWBDC” and, together with the CDLI, each an “Index”) measures the performance of lending-oriented, exchange-traded BDCs, subject to certain eligibility criteria. The CWBDC is a capitalization-weighted index that is calculated on a daily basis using publicly-available closing share prices and reported dividend payouts. Cliffwater believes that the CWBDC is representative of the BDC asset class.

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Benchmark Index Definitions

For each asset class, Cliffwater has selected a benchmark index that it believes is representative of the asset class based on various considerations, including the return/risk characteristics. Below is information regarding the benchmark index that was selected for each asset class.

Stocks – U.S. Stocks: The Russell 3000 Index is a capitalization-weighted stock market index that seeks to track the entire U.S. stock market. It measures the performance of the 3,000 largest publicly held companies incorporated in the United States based on market capitalization.

Stocks – Non-U.S. Developed: The MSCI EAFE Index is an equity index which captures large and mid cap representation across developed markets countries around the world, excluding the United States and Canada. With over 900 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in each country.

Stocks – Emerging Markets: The MSCI Emerging Markets Index (MSCI EM) captures large and mid cap representation across 23 Emerging Markets (EM) countries. With over 800 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in each country.

Stocks – Global Equity: The MSCI All Country World Index (MSCI ACWI) captures large and mid cap representation across 23 developed markets and 23 emerging markets countries. With over 2,400 constituents, the index covers approximately 85% of the global investable equity opportunity set.

Rates – Core U.S. Bonds: The Bloomberg U.S. Aggregate Bond Index represents securities that are SEC-registered, taxable, and dollar denominated. The index covers the U.S. investment grade fixed rate bond market, with index components for government and corporate securities, mortgage pass-through securities, and asset-backed securities.

Rates – IG Corporate: The Bloomberg U.S. Corporate Index represents publicly issued U.S. corporate and specified foreign debentures and secured notes. Securities must be rated investment-grade (Baa3/BBB- or higher) by at least two of the following ratings agencies: Moody’s, S&P, Fitch, have at least one year to final maturity regardless of call features and have at least \$250 million par amount outstanding.

Rates – 10-yr Treasury: The Bloomberg 10y U.S. Treasury Bellwether Index is a universe of 10-Year U.S. Treasury bonds. The index assumes reinvestment of all distributions and interest payments.

Rates – 10-yr TIPS: The Bloomberg 5-10y U.S. TIPS Index is a universe of 5-10-Year U.S. Treasury Inflation Protected Securities (“TIPS”).

Credit – High Yield Bonds: The Bloomberg U.S. Corporate High Yield Index (Bloomberg Barclays High Yield) measures the USD-denominated, high yield, fixed-rate corporate bond market. Securities are classified as high yield if the middle rating of Moody’s, Fitch and S&P is Ba1/BB+/BB+ or below. Bonds from issuers with an emerging markets country of risk, based on the indices’ EM country definition are excluded.

Credit – Bank Loans: The S&P/LSTA U.S. Leveraged Loan Index is a market value-weighted index designed to measure the performance of the institutional leveraged loan market in the United States based upon market weightings, spreads and interest payments, including Term Loan A, Term Loan B and Second Lien tranches.

Credit – Emerging Market Debt: The J.P. Morgan EMBI Global Diversified Index is a market-capitalization weighted, total-return index tracking the traded market for U.S.-dollar-denominated Brady bonds, Eurobonds, traded loans, and local market debt instruments issued by sovereign and quasi-sovereign entities. It covers more of the eligible instruments than the EMBI limits on secondary market trading liquidity and limits the weights of those index countries with larger debt stocks by only including a specified portion of these countries eligible current face amounts of debt outstanding.

Credit – Public BDCs: The Cliffwater BDC Index measures the performance of lending-oriented, exchange-traded Business Development Companies, subject to certain eligibility criteria. The index is a capitalization-weighted index that is calculated on a daily basis using publicly-available closing share prices and reported dividend payouts.

Real Estate – Public REITs: The FTSE/NAREIT All Equity REITs Index is a free-float adjusted, market capitalization-weighted index of U.S. Equity REITs. Constituents of the Index include all tax-qualified REITs with more than 50 percent of total assets in qualifying real estate assets other than mortgages secured by real property.

Real Estate – Private RE (Unlevered): The NCREIF Property Index is a quarterly time series composite total rate of return measure of investment performance of a very large pool of individual commercial real estate properties acquired in the private market for investment purposes only. All properties in the index have been acquired, at least in part, on behalf of tax-exempt institutional investors.

Real Estate – Private Partnerships: The Cambridge Opportunistic Real Estate Index is based on data compiled from global institutional-quality opportunistic real estate funds, including fully liquidated partnerships, formed between 1988 and 2017.

Private Equity – Diversified: The Cambridge Global Private Equity and Venture Capital Index is based on horizon returns data compiled from global institutional-quality buyout, growth equity, private equity energy, venture capital and mezzanine funds, including fully liquidated partnerships, formed between 1986 and 2017.

Private Equity – Buyout: The Cambridge U.S. Buyout Index is based on horizon returns data compiled from U.S. institutional-quality buyout funds, including fully liquidated partnerships, formed between 1986 and 2017.

Private Equity – Venture Capital: The Cambridge Global Venture Capital Index is based on horizon returns data compiled from global institutional-quality venture capital funds, including fully liquidated partnerships, formed between 1981 and 2017.

Private Equity – Energy: The Cambridge Global Energy Index is based on horizon returns data compiled from global institutional-quality venture capital funds, including fully liquidated partnerships, formed between 1981 and 2017.

Private Debt – Unlevered: The Cliffwater Direct Lending Index (CDLI) seeks to measure the unlevered, gross of fees performance of U.S. middle market corporate loans, as represented by the underlying assets of public and private Business Development Companies, subject to certain eligibility requirements. The index is asset-weighted by reported fair value.

Hedge Funds – Diversified: The HFRI FOF Composite Index tracks the performance of Fund of Funds that invest with multiple managers through funds or managed accounts. The strategy designs a diversified portfolio of managers with the objective of significantly lowering the risk (volatility) of investing with an individual manager.

Hedge Funds – Absolute Return: The HFRI FOF Conservative Index tracks the performance of ‘Conservative’ Fund of Funds that invest with multiple managers through funds or managed accounts. FOFs classified as ‘Conservative’ exhibit one or more of the following characteristics: seeks consistent returns by primarily investing in funds that generally engage in more ‘conservative’ strategies such as Equity Market Neutral, Fixed Income Arbitrage, and Convertible Arbitrage; exhibits a lower historical annual standard deviation than the HFRI Fund of Funds Composite Index.

Hedge Funds – Directional: The HFRI FOF Strategic Index tracks the performance of ‘Strategic’ Fund of Funds that invest with multiple managers through funds or managed accounts. FOFs classified as ‘Strategic’ exhibit one or more of the following characteristics: seeks superior returns by primarily investing in funds that generally engage in more opportunistic strategies such as Emerging Markets, Sector specific, and Equity Hedge; exhibits a greater dispersion of returns and higher volatility compared to the HFRI Fund of Funds Composite Index.

Other Real Assets – Commodity Futures: The Bloomberg Commodity Index (BCOM) is calculated on an excess return basis and reflects commodity futures price movements. The index rebalances annually weighted 2/3 by trading volume and 1/3 by world production and weight-caps are applied at the commodity, sector and group level for diversification.

Other Real Assets – MLPs: The Alerian MLP Index is a float-adjusted, capitalization-weighted index, whose constituents represent approximately 85% of total float-adjusted market capitalization of publicly traded Master Limited Partnerships.

Other Real Assets – Farmland: The NCREIF Farmland Property Index is a quarterly time series composite return measure of investment performance of a large pool of individual farmland properties acquired in the private market for investment purposes only. All properties in the Farmland Index have been acquired, at least in part, on behalf of tax-exempt institutional investors.

Other Real Assets – Timber: The NCREIF Timberland Index is a quarterly time series composite return measure of investment performance of a large pool of individual timber properties acquired in the private market for investment purposes only. All properties in the Timberland Index have been acquired, at least in part, on behalf of tax-exempt institutional investors.

Other Real Assets – Infrastructure: The Cambridge Infrastructure Index is based on horizon returns data compiled from institutional-quality infrastructure funds, including fully liquidated partnerships, formed between 1993 and 2017.

Cash – 3M T-bill: The BofA Merrill Lynch U.S. 0-3M Treasury Bill Index tracks the performance of the U.S. dollar denominated U.S. Treasury bills publicly issued in the U.S. domestic market with a remaining term to final maturity of less than 3 months.

Cash – 3M Libor: The Bloomberg 3M Libor tracks the total return performance of a theoretical security continuously reinvested daily at the prevailing 3M Libor rate.

Inflation: The CPI-U produced by the Bureau of Labor Statistics tracks monthly changes in the prices paid by urban consumers for a representative basket of goods and services.

Other Indices:

S&P 500: The Standard and Poor's 500 Index is a capitalization-weighted index of 500 stocks. The index is designed to measure performance of the broad domestic economy through changes in the aggregate market value of 500 stocks representing all major industries.

Russell 2000: The Russell 2000 Index is a capitalization-weighted stock market index that seeks to track U.S. small-cap companies. It measures the performance of approximately the 2,000 smallest publicly held companies within the Russell 3000 Index (see above for definition).

HFRI Fund Weighted Composite: The HFRI Fund Weighted Composite Index is a global, equal-weighted index of over 2,000 single-manager funds that report to HFR Database. Constituent funds report monthly net of all fees performance in U.S. Dollars and have a minimum of \$50 million under management or a 12-month track record of active performance. The index does not include funds of hedge funds.

S&P GSCI Commodities: The S&P GSCI Index is a tradable, world-production weighted index that is based on the average quantity of production of each commodity in the index, over the last five years of available data that tracks the performance of front-month commodity futures.

Citi WGBI Non-USD: The Citi World Government Bond Index (WGBI) Non-USD Index measures the performance of fixed-rate, local currency, investment grade sovereign bonds, excluding USD denominated securities.

Bloomberg EM USD: The Bloomberg EM USD Index is a hard currency Emerging Markets debt index that includes USD denominated debt from sovereign, quasi-sovereign, and corporate EM issuers. The index is broad-based in its coverage by sector and by country, and reflects the evolution of EM benchmarking from traditional sovereign bond indices to Aggregate-style benchmarks that are more representative of the EM investment choice set.

Bloomberg U.S. TIPS: The Bloomberg U.S. TIPS index consists of Inflation-Protection securities issued by the U.S. Treasury with at least one year to final maturity and at least \$250 million par amount outstanding.

Gold: The Bloomberg XAU ticker serves as our data source for historical spot gold prices.

U.S. Dollar: The U.S. Dollar Index (DXY) is an index of the value of the United States dollar relative to a basket of foreign currencies.