2022 Capital Market Assumptions

April 2022

Sellwood
CONSULTING LLC

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INTRODUCTION

Sellwood Consulting updates its capital markets assumptions on an annual basis. Our 2022 assumptions reflect information as of December 31, 2021, unless otherwise noted.

This report documents our process for creating these capital markets assumptions, and we provide detailed methodology for each. Several over-arching principles, however, inform all of our analysis:

1. We believe that forward-looking capital market assumptions are an important, but far from the only important, input for properly constructing portfolios. Great care should be taken not to rely only on mean-variance analysis when constructing portfolios. An analysis that relies only on mean-variance analysis will over-allocate to assets with infinitesimally superior risk/return estimates, and assets that are less liquid or less frequently priced, resulting in inferior diversification and the assumption of unintended risks.

2. Our assumptions are forward-looking in nature and reflect a ten-year horizon. They are most appropriate for analysis of portfolios with long-term (10 year or greater) horizons. For portfolios with shorter horizons, alternate methods of analysis should be employed.

3. We deliberately use different methods to separately estimate return and risk. The first part of this paper explains the different methods we employ to estimate the future return of each individual asset class. Later in the paper, we explain a more standardized approach to estimating future risk of the same asset classes.

4. Our return assumptions utilize a build-up approach based on the current values of the individual drivers of expected return that are unique to each asset class.

5. For asset classes where the market provides a current view of forward-looking returns, our assumptions reflect the market view. Additional complexity would be unhelpful.

6. Where possible, all of our return assumptions incorporate current valuations.

7. Our assumptions are for a single-year analysis period. The returns are average one-year returns, and the standard deviation of returns is the standard deviation of one-year returns.

8. Our assumptions are presented in nominal terms. Where we have used historical returns in our input analysis, we have always transformed them to real, after-inflation, returns, to strip out the influence of historical inflation. At the end of the build-up process, where appropriate, we add the market's current measure of forward-looking inflation back to the assumptions to create forward-looking nominal return assumptions.

9. We calculate compound average annual returns. After calculating a compound return and a risk assumption, we combine the two mathematically to calculate an arithmetic average expected return, which is a necessary input for mean-variance analysis.

10. Our assumptions are passive in nature and assume no active management.

11. Our approach to modeling the expected risk of each asset category is multi-faceted and reflects the fact that risky assets exhibit "fat tails" that are not present in normal distributions. First, we examine the historical standard deviation of the returns for a proxy index for the asset category (both the full history and most recent 10 years). Next, we examine the historical worst-case annual return experience (or in the case of asset categories that are not priced to market, the worst two years) for the asset class. If necessary, we adjust our risk estimates upward to ensure that the actual worst-case experience had at least a 1% probability of occurring (once every 100 years) under our assumed return and risk distribution parameters. Finally, for asset classes where our confidence in the data available for examination is limited, we qualitatively adjust our risk assumption to reflect this uncertainty.

12. Our correlation coefficient assumptions are mostly derived from history, with an emphasis on the recent past. We seek a proxy for each asset category we have modeled with as long a history as possible, and then calculate our correlation assumptions using a simple average of the following, for each pair of asset categories:
    - Longest-term correlation
    - 10-year correlation
    - 5-year correlation
    - 3-year correlation

    This approach overweights the recent past, while acknowledging the long-term past. It is also a more conservative measure for diversification benefit to a portfolio, because recent correlations have been higher than they have been historically.

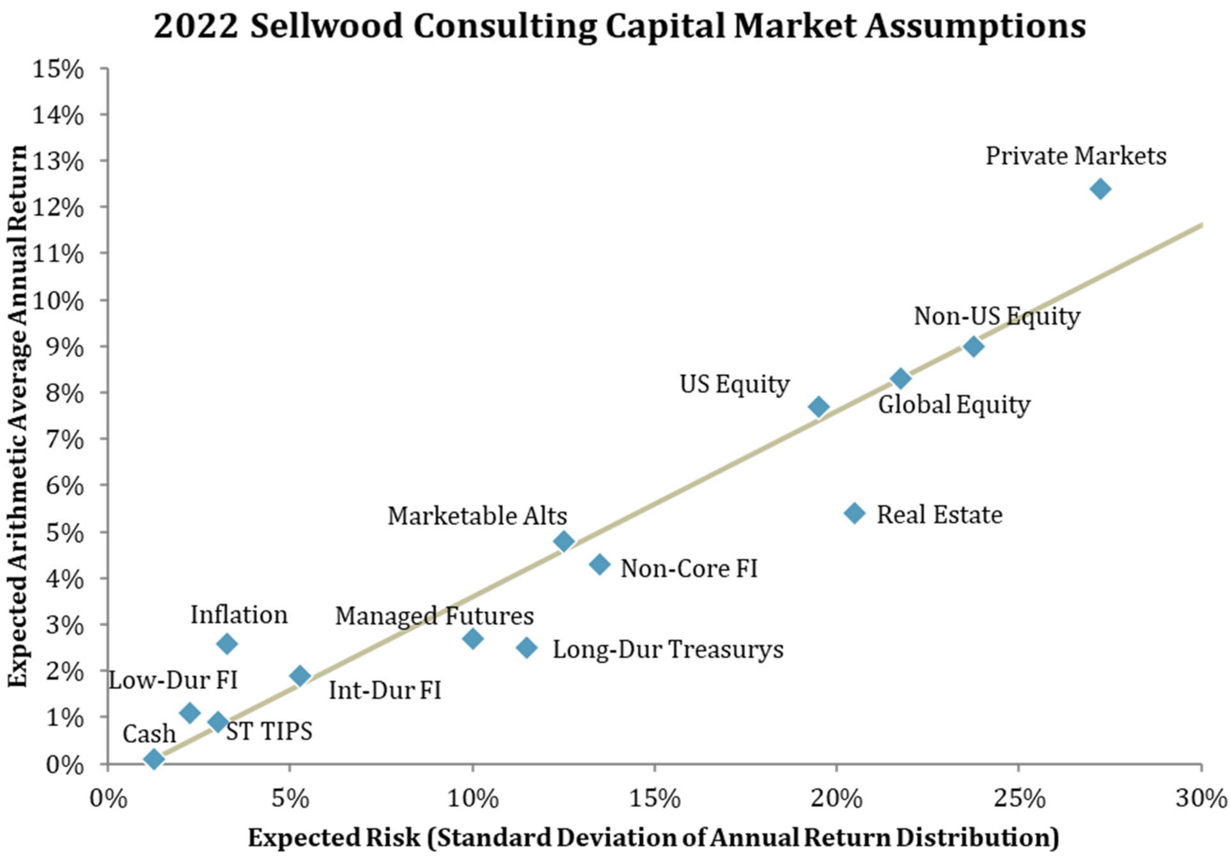
13. We round our assumptions to the nearest 10 basis points, in the case of arithmetic average return, and nearest 25 basis points, in the case of risk.

14. Our assumptions are applicable to US-based, non-taxable investors. For taxable clients located in the United States, we maintain a separate methodology that considers the effects of taxes on expected returns and risk.

15. We purposefully design a limited set of mostly non-overlapping assumptions for major asset categories. By focusing on major asset classes, with the most data available for examination, we can develop the most robust assumptions. Asset allocation analysis is a blunt tool, and we believe that input assumptions should not be more granular than the methodology can support. Using a more limited set of assumptions reduces the risk of false precision when implementing them.

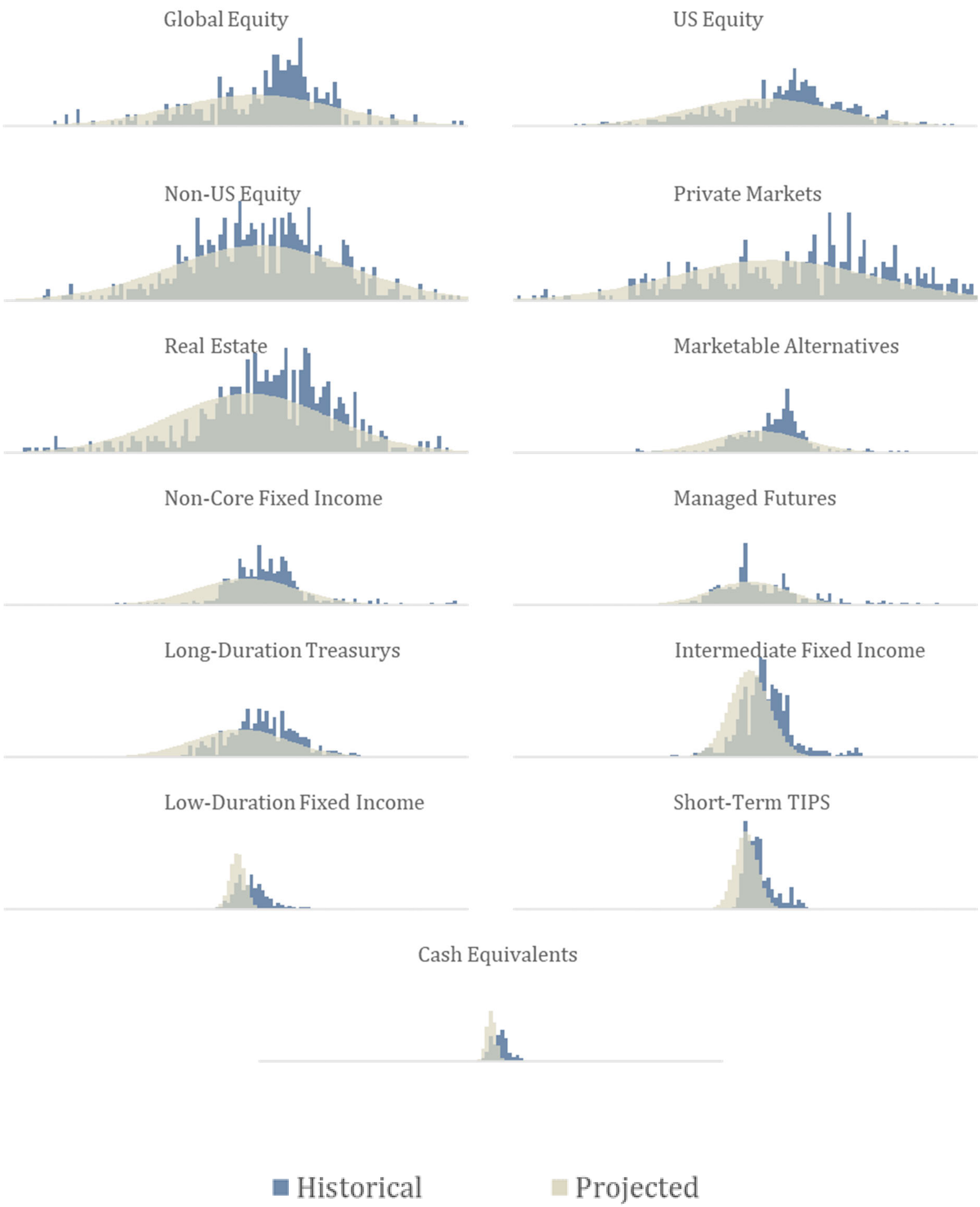
16. We strive to construct a set of assumptions that is straightforward, explainable, fully documented, and replicable by other researchers. Our assumptions are as complex as necessary but no more complex than necessary. They have no hidden constraints. We could make them more complicated, but we do not believe that doing so would make them better.

In summary form, our 2022 capital market assumptions follow on the next page.



	Nominal Compound Return	Risk	Nominal Arithmetic Return	Sharpe Ratio
Inflation	2.56%	3.25%	2.60%	---
Global Equity	6.18%	21.75%	8.30%	0.28
US Equity	5.95%	19.50%	7.70%	0.30
Non-US Equity	6.53%	23.75%	9.00%	0.27
Private Markets	9.23%	27.25%	12.40%	0.34
Real Estate	3.46%	20.50%	5.40%	0.17
Marketable Alternatives	4.05%	12.50%	4.80%	0.32
Non-Core Fixed Income	3.41%	13.50%	4.30%	0.25
Managed Futures	2.26%	10.00%	2.70%	0.22
Long-Duration Treasurys	1.88%	11.50%	2.50%	0.16
Intermediate Fixed Income	1.78%	5.25%	1.90%	0.33
Low-Duration Fixed Income	1.05%	2.25%	1.10%	0.44
Short-Term TIPS	0.84%	3.00%	0.90%	0.26
Cash Equivalents	0.06%	1.25%	0.10%	---

Historical one-year return distributions (historical real returns, plus our current assumed future inflation) are depicted below in blue, and our forward-looking assumed return distributions are shown in tan. We have adopted a philosophy of assuming wide enough normal distributions to capture markets' historical fat tails.



INFLATION

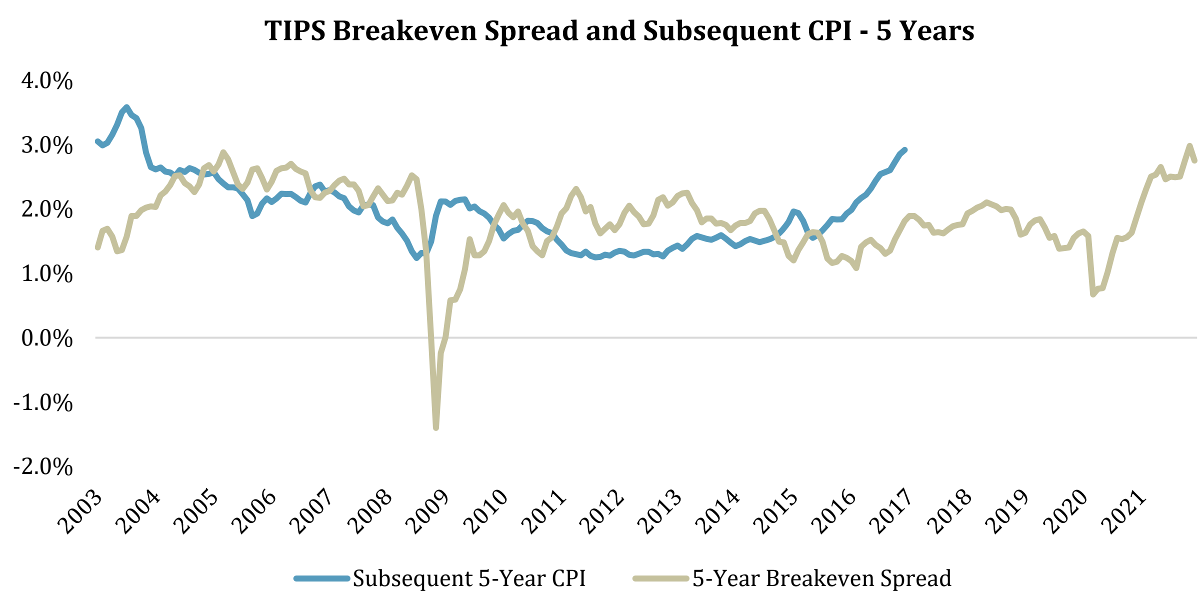
Modeled: US CPI-U Inflation
Compound Return: 2.56%
Arithmetic Average Return: 2.60%
Risk: 3.25%

The market tells us its expectation for forward-looking ten-year inflation, and our assumption reflects that market assumption.

On December 31, 2021, the market's yield for a 10-Year US Treasury Bond was 1.52%, and the real yield for a 10-Year TIPS security was -1.04%. The difference between the two approximates the market's inflation expectation over the next ten years: 2.56%.

The Federal Reserve has published this inflation approximation – the so-called "TIPS breakeven spread" – since 2003. The following chart depicts the full history of this measure, laid against the actual subsequent inflation (as measured by the Consumer Price Index, "CPI") that occurred over the following five years. Although we use 10-year values to create our assumptions, our chart depicts the five-year TIPS breakeven spread and subsequent five-year inflation, because the 10-year values do not yet offer sufficient data for evaluation (TIPS have only existed since 1997). With the exception of especially illiquid market periods, which distort the measure because of liquidity differences between TIPS and nominal Treasury Bonds, the measure has done a fair job of predicting subsequent inflation and does not appear to be biased positively or negatively.

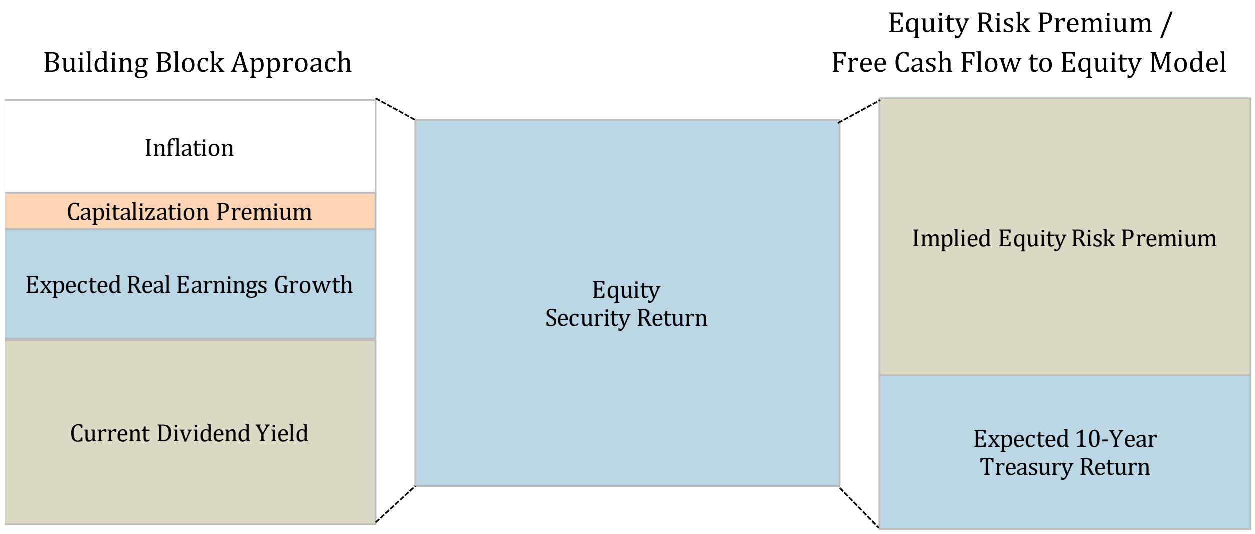
At the same time, it is clear that the market doesn't always get it right, which is why we assume a range of possible outcomes for inflation, defined by the risk assumption.



GROWTH INVESTMENTS

Growth investments primarily consist of equity investments in private and public companies. To derive our equity return assumptions, we use two methodologies:

(i) a building-block approach using the Shiller price-to-earnings (P/E) measure; and
(ii) an equity risk premium estimate that averages the current implied equity risk premium based on a free cash flow to equity model and the historical average equity risk premium.



Our building blocks approach employs "Shiller earnings," which represent a ten-year average of them, adjusted for inflation. We prefer this method because it incorporates a fuller market cycle, aligns with our ten-year forecast period, and has shown a better empirical track record of predicting future return than other approaches. Research shows that of all the varied ways to calculate a P/E ratio, the Shiller P/E measure (Cyclically Adjusted Price to Earnings or "CAPE") has historically shown the highest predictive power over future 10-year returns.[1]

Our building block approach is consistent across equity categories:

Assumed (Expected) US Inflation
+ Current Dividend Yield
+ Expected Real Earnings Growth

[1] Vanguard. Forecasting stock returns: What signals matter, and what do they say now?

US Equity

Modeled: US Equities, All Capitalizations
Compound Return: 5.95%
Arithmetic Average Return: 7.70%
Risk: 19.50%

We create a return assumption for the entire US market by calculating return estimates for large- and small-cap equity and applying those returns to the current market capitalization weights. The current weights, 92% large, and 8% small[2], yield a US Equity assumption of 5.95% in compound terms:

(92% x 5.93%) + (8% x 6.23%) = **5.95%.**

Our calculation methodologies of the US large- and small-cap assumptions are explained below.

US Large-Cap Equity

Our return assumption for the US large-cap equity portion of the US Equity assumption is the average of two separate approaches:

(i) a valuation-sensitive building-block approach, and
(ii) a free cash flow to equity model.

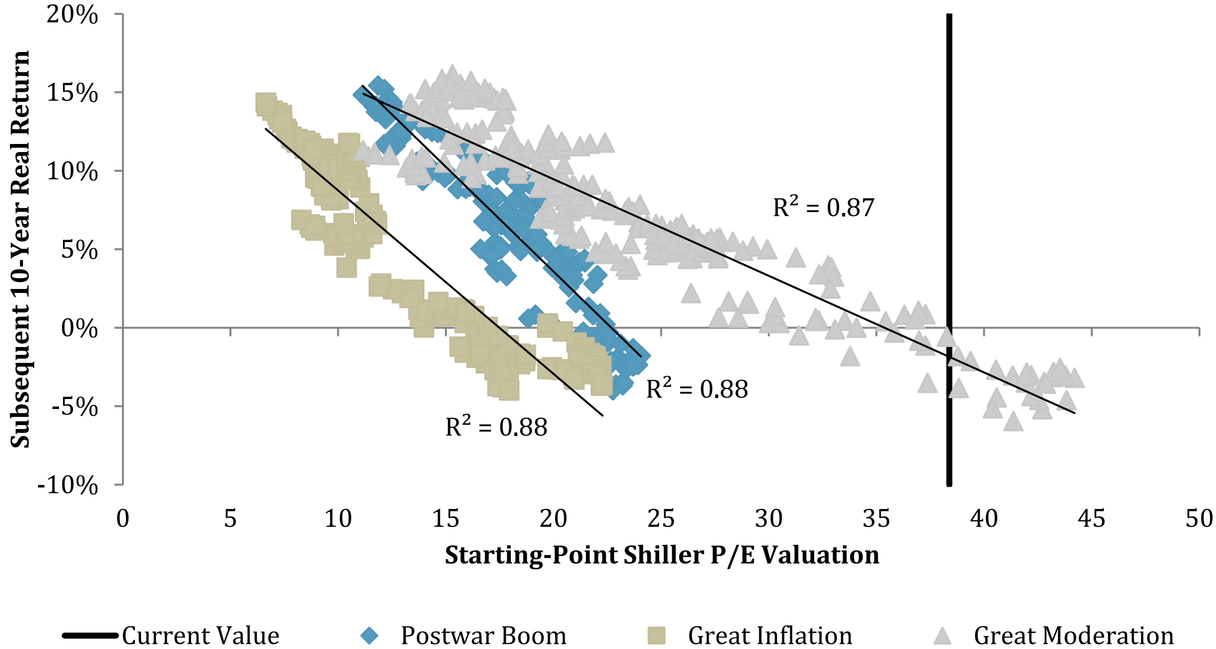
Building Block Approach

Our building block approach considers current valuations and corporate earnings to develop an estimate of future return. Because our return forecasts are long-term in nature, and because we believe in excluding the effects of historical inflation when building a forecast, we prefer to use so-called Shiller earnings as the basis for earnings analysis. Shiller corporate earnings represent the after-inflation US corporate earnings over the last decade.

Valuation methods based on Shiller earnings have demonstrated predictive power over future long-term returns. The following chart depicts the Shiller price-to-earnings (P/E) metric for the US stock market, since 1951 (the post-WWII period). The Shiller P/E at a given point in time is depicted on the horizontal axis, and the subsequent 10-year inflation-adjusted return is depicted on the vertical axis. We have decomposed the data array into three economic regimes – the post-war boom (in blue; 1951-1965); the great inflationary period (in tan; 1966-1984); and the great moderation (in grey; 1985-2021). Examining the data this way yields useful insights and, importantly, high predictive power for the Shiller P/E metric over subsequent real return. The S&P 500's current position on the chart is indicated by the vertical line.

[2] FTSE/Russell.

Long-Term Shiller P/E versus 10-yr Inflation-Adjusted Returns
By Economic Regime, Since 1951 (Postwar period)



For the valuation-based building block component of the US large-cap return, we create our building blocks from the S&P 500 Index:

2.56%	Inflation
1.43%	Dividend Yield
1.98%	Long-Term Compound Average Real Earnings Growth (Since 1950)

The dividend yield is how current valuations enter our methodology. Because we are forecasting a full market cycle, we prefer to use a more stable input than the market's current dividend yield, which can change at any time. Instead, our approach builds up an assumed dividend yield using Shiller (past 10-year real) earnings as the primary input. We take the inverse of the current Shiller P/E ratio (price / average past 10-year real earnings) in order to determine the long-term Shiller earnings yield. This average earnings yield over the past 10 years is the average earnings yield five years ago and doesn't account for the fact that corporate earnings have grown since then. To bring the analysis current, we then scale the long-term Shiller earnings yield forward 5 years using the experienced real earnings growth rate. We multiply that adjusted earnings yield by the long-term dividend payout ratio of 0.5, which gives us the current dividend yield used above.

Equity Risk Premium / Discounted Free Cash Flow Model

For the implied equity risk premium, we reference and modify a discounted free cash flow model created by Professor Aswath Damodaran of the Stern School of Business[3] that uses a free cash flow to equity approach to account for dividends as well as stock buybacks.

[3] http://pages.stern.nyu.edu/~adamodar/

Our modified free-cash-flow-to-equity model employs several input variables and uses I/B/E/S earnings projections for the next two years. Earnings are then assumed to linearly revert to the long-term risk-free rate in years three to five. We assume the risk-free rate to be the 10-year Treasury bond return.

Beginning (current) S&P 500 level =	$4,766.18
Base year free cash flow to equity, S&P 500 =	$147.2[4]
Expected S&P 500 earnings growth over next 5 years[5] =	8.6% in year 1
	9.9% in year 2
	7.8% in year 3
	5.7% in year 4
	3.6% in year 5
Expected S&P 500 earnings growth past year 5=	1.5%[6]

We apply a standard discounted cash flow methodology to these variables and solve for the rate of growth that makes the discounted forecasted value of the S&P 500 identical to today's value.

$$4{,}766.18 = \frac{147.24(1.074)}{(1+r)^1} + \frac{158.15(1.086)}{(1+r)^2} + \frac{171.76(1.068)}{(1+r)^3} + \frac{192.496(1.050)}{(1+r)^4} + \frac{198.53(1.0031)}{(1+r)^5} + \frac{198.53(1.0031)}{(r-0.0152)(1+r)^5}$$

Solving for *r* yields the expected nominal average annual return for the S&P 500 over the next 10 years, under these assumptions. That rate of return is 5.40%. Subtracting our assumed 10-Year Treasury return of 1.52% results in an expected equity risk premium of 3.88%.

This implied equity risk premium is lower than what history has delivered. To moderate this, we average the current implied forward-looking equity risk premium (3.88%) and the long-term historical geometric average realized equity risk premium (4.84%) to derive an equity risk premium estimate of 4.36% for US large-cap equity. Substituting this assumed equity risk premium into the model results in a return estimate of 5.88%.

Combining the Two Approaches

Averaging the expected returns generated by the building-blocks approach and the discounted free cash flow model yields an expected compound return of 5.93% for US large-cap equity.

[4] 2020 S&P 500 Dividends = $59.20 + buybacks = $88.05

[5] Historically, the I/B/E/S consensus analyst forecast has overstated subsequent actual earnings growth by 15.6%. We reduce our assumption for earnings growth by 13.5% (1-(1/1.156)) accordingly.

[6] Our forecasted return for the 10-year Treasury Bond, as a proxy for the ten-year risk-free rate.

US-Small Cap Equity

Our return assumption for the US small-cap equity portion of the US Equity assumption uses a similar approach as our approach for US large-cap. Because data is much more limited for small-cap equities than for large-cap equities, we evaluate small-cap equities relative to large-cap equities rather than relative to their own history. For US small-cap equity, we compare the Shiller earnings yield for the Russell 2000 Index and S&P 500 Index over the longest common time period for the two indexes (1979-2021). The Shiller-based method is only half of our US large-cap equity assumed return, so we divide the premium in half and add or subtract it from our final US large-cap equity return.

While our assumption models the full universe of small-cap stocks, the data we use excludes companies with negative earnings. Our analysis has shown that, as compared to using the data from the full universe of small-cap stocks, using the dataset that excludes negative earners has yielded higher predictive power over future returns of the full index, which includes the negative earners.

The Shiller earnings yield of +0.65% relative to US large-cap equity over the longest common time period (1988-2021) for which we have reliable data.

US Large-Cap Earnings Yield	2.61%
US Small-Cap Earnings Yield	3.26%
Small-Cap Premium	0.65%

Historically, this method has estimated an average earnings yield premium of 0.53% for US small-cap stocks. We are interested in the current valuation relative to this baseline, so we take the difference between the model's current predicted premium (0.65%) and the long-term average predicted premium (0.53%) and apply only the differential. Then, we add only half of that differential to our assumption for US large-cap equities, because the building-blocks calculation itself represented only half of our calculation of US large-cap equity return.

US Large-Cap Assumed Return:	5.93%
Assumed Small Cap Premium:	0.25%
½ Calculated Small-Cap Premium:	+0.06%
Return Assumption:	6.23%

Non-US Equity

Modeled: Non-US Equities, All Regions & Capitalizations
Compound Return: 6.53%
Arithmetic Average Return: 9.00%
Risk: 23.75%

Our return assumption for Non-US Equity is intended to model the entire non-US equity market. It assumes the current weighting of large-cap and small-cap equities in the international equity market – 86% large-cap and 14% small-cap[7]. These weights are applied to underlying non-US large-cap equity and non-US small-cap equity assumptions. This weighting yields a compound return assumption of 6.53%:

(86% x 6.48%) + (14% x 6.79%) = **6.53%.**

The calculation methodologies of Non-US large- and small-capitalization equities are explained below.

Non-US Large Cap Equity

We build separate assumptions for developed and emerging non-US markets, and then weigh them according to current market weights to construct our non-US large-cap equity assumption, which is intended to model equities of both developed and emerging markets. Just as on the US side, we combine a Shiller-based building block approach with an equity risk premium estimate.

Building Block Approach

Over the longest common period for which we have both US (S&P 500 Index) and non-US developed markets (MSCI EAFE Index – "EAFE") earnings data (since 1977), non-US developed market earnings have grown at only 1.67% versus the rate of 2.21% for US large-capitalization stocks, a difference of 0.54% in real terms. Given the short time frame for EAFE earnings data, we cut that difference in half and apply that number to the US large-capitalization stocks (1.98%) to yield an assumed non-US developed markets earnings growth rate of 1.71%.

Over the longest common period for which we have both US (S&P 500 Index) and emerging (MSCI EM Index – "EM") markets earnings (1995), emerging markets have grown at 4.93% versus the rate of 2.42% for US large-capitalization stocks, a difference 2.51% in real terms. Given the short time frame for EM earnings data, we limit the excess earnings growth rate to 0.50% above the US large-capitalization stock growth rate (1.98%) to yield an assumed emerging markets earnings growth rate of 2.48%.

For developed and emerging markets, our assumed building blocks are as follows:

[7] MSCI, Morningstar Direct

	EAFE	EM
Inflation	2.56%	2.56%
Current Dividend Yield	2.39%	3.83%
Adjusted Compound Average Real Earnings Growth	1.71%	2.48%

This approach yields an expected compound return of 6.66% for developed-markets Non-US Large-Capitalization Equities and 8.87% for Emerging Market Equities using the build-up methodology.

Equity Risk Premium / Discounted Free Cash Flow Model

Our modified free-cash-flow-to-equity model employs several input variables:

		EAFE	EM
Beginning (current) level =		$2,336.07	$1,232.01
Base year free cash flow to equity=		$83.76	$34.50
Expected earnings growth over next 5 years[8] =			
	Year 1	6.3%	5.6%
	Year 2	7.3%	6.5%
	Year 3	5.9%	5.3%
	Year 4	4.4%	4.0%
	Year 5	3.0%	2.8%
Expected earnings growth past year 5=		1.5%	1.5%

Just as before, we solve for the average annual rate of growth to find the equity risk premium. That rate of return is 5.72% for Developed Markets and 4.74% for Emerging Markets. As above, we subtract the ten-year Treasury rate and average with the long-term historical geometric average realized equity risk premium (4.84%).

The result is an estimated equity risk premium of 6.04% for Developed Markets and 5.55% for Emerging Markets using the discounted free cash flow model.

Combining the Two Approaches

	EAFE	EM
Building Block Approach	*6.66%*	*8.87%*
Equity Risk Premium	*6.04%*	*5.55%*
Average	6.35%	7.21%

Developed markets currently comprise 84%, and emerging markets 16%, of the non-US total equity market. Applying those weights to our developed and emerging markets assumptions yields a non-US large-capitalization compound return assumption of 6.53%.

[8] Historically, the I/B/E/S consensus analyst forecast has overstated subsequent actual earnings growth by 15.6%. We reduce our assumption for earnings growth by 13.5% (1-(1/1.156)) accordingly.

Non-US Small Cap Equity

Due to lack of data availability in the non-us small-cap equity space, we assume the same small-cap premium for non-US small cap-equity as our assumption for US small-cap equity. We calculated a US small-cap equity premium of 0.31%, which yields a compound assumption of 6.79%.

Global Equity
Modeled: World Equities, All Capitalizations
Compound Return: 6.18%
Arithmetic Average Return: 8.30%
Risk: 21.75%

We create a return assumption for the global equity market by applying the total world market capitalization weights to our US and Non-US Equity return estimates. The current weights, 60% US, and 40% Non-US, yielding a Global Equity assumption of 6.18% in compound terms:

(60% x 5.95%) + (40% x 6.53%) = **6.18%**

Private Markets
Modeled: Buyouts, Venture Capital, & Distressed Investments, in Lockup Vehicles
Compound Return: 9.23%
Arithmetic Average Return: 12.40%
Risk: 27.25%

We assume a diversified portfolio will tend to approximate the market exposure of US-Small Cap Equity over time, with a multiplication factor to account for the additional leverage, illiquidity, and risk premium:

(US-Small Cap Equity Arithmetic Average) x (1.5 Illiquidity/Leverage/Risk Premium)

Weighting those assumptions accordingly results in a compound return assumption of 9.23%.

Given that our assumption set is intended to be passive in nature and not reflect active management, we are assuming an industry-average active manager or collection of active managers.

DIVERSIFYING INVESTMENTS

Diversifying investments are not easily modeled with public-market index proxies. If the underlying sources of return for each asset class can be identified, we employ a build-up approach to model future projected returns. If a build-up approach is not appropriate, we use historical returns as the basis for our forward projected returns.

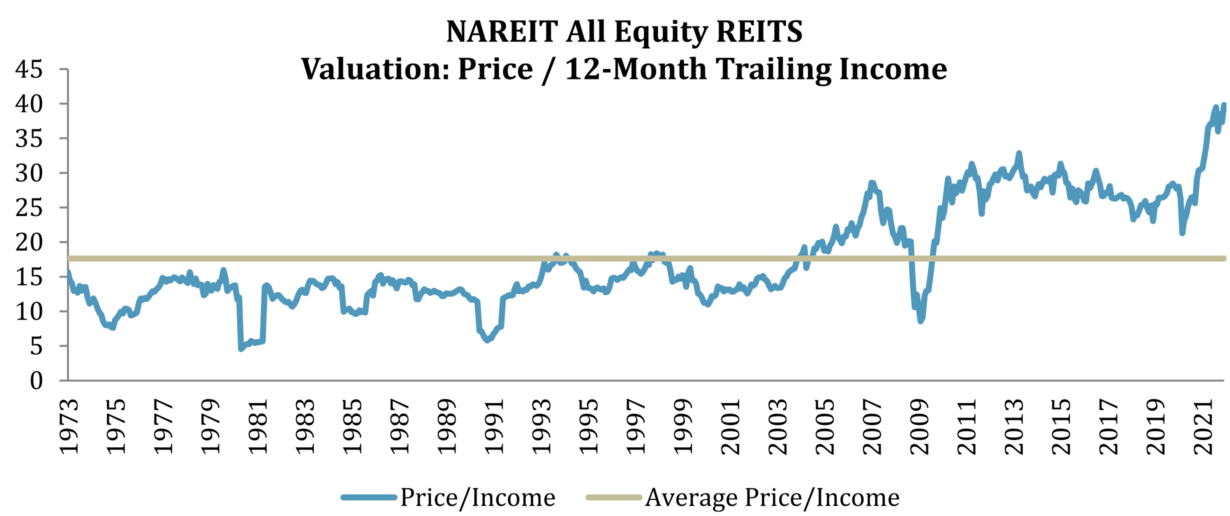
Real Estate

Modeled: Public (US Equity REITs)
Compound Return: 3.46%
Arithmetic Average Return: 5.40%
Risk: 20.50%

Our expected return reflects going-in cap rates for public equity and core private real estate.

For public equity REITs, we calculate the current cap rate, defined as income divided by price, of the FTSE NAREIT All Equity REITS Index: 2.51%.

The following chart depicts the inverse of the cap rate for the equity REIT benchmark: its historical price-to-income ratio. The present low cap rate is explained by high valuations relative to the index's own history.



Our cap rate assumption for core private real estate is based on the Urban Land Institute consensus estimate of the NCREIF capitalization rate as of December 31, 2021: 4.40% in compound terms.[9] This cap rate reflects current income return on an unlevered basis and excludes capital appreciation.

[9] Urban Land Institute. http://uli.org/research/centers-initiatives/center-for-capital-markets/barometers-forecast-and-data/uli-real-estate-consensus-forecast/

Averaging these two cap rates yields a return assumption of 3.46%.

We note that the primary driver of return for core real estate over the long term has been income, not appreciation. For equity REITS, in real terms since 1973, historical price appreciation has averaged 0.80% per year, and income has averaged 3.04% per year. Our compound return assumption is close to the historical income return for the asset class.

Marketable Alternatives

Modeled: Hedge Funds of Funds, Global GTAA, & Multi-Asset Alternative Strategies
Compound Return: 4.05%
Arithmetic Average Return: 4.80%
Risk: 12.50%

We assume a diversified portfolio that will tend to approximate the following market exposures over time:

40% Global Equity
30% Intermediate Fixed Income
30% Non-Core Fixed Income

Weighting those assumptions accordingly results in a compound return assumption of 4.05%.

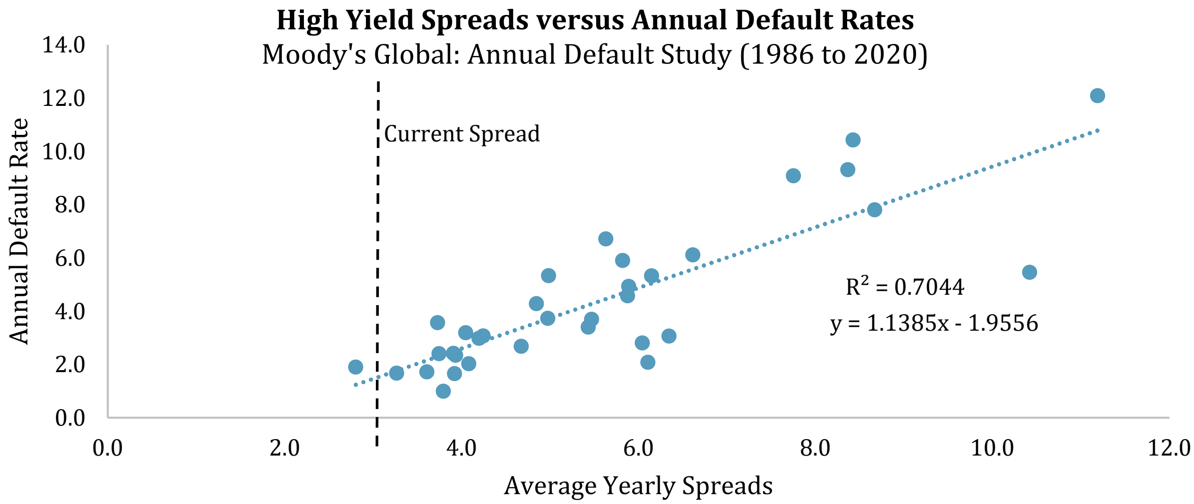
Non-Core Fixed Income

Modeled: US and Non-US Below-Investment-Grade & Emerging Markets Fixed Income
Compound Return: 3.41%
Arithmetic Average Return: 4.30%
Risk: 13.50%

We use the same analytical framework for estimating future return for bonds, detailed below, for Non-Core Fixed Income. The framework starts with current market yield and subtracts an estimate of unrecovered defaults.

For our Non-Core Fixed Income assumption, we model the Bloomberg Global High Yield Index. The return is calculated using the current yield, adjusted by a default and recovery rate for high yield debt. High-yield debt offers a higher yield, or "yield spread" relative to investment-grade bonds, to offer compensation for the risk of default. Our process considers that current spread and adjusts it downward to account for default probability.

As shown below, higher-than-average yield spreads relative to investment-grade bonds have historically corresponded to higher-than-average default rates.



Current spread:	3.1%
Projected Default Rate:	*1.6%*
Historical Default Rate:	*4.4%*
Assumed Default Rate:	3.0%

Given current spreads, the predicted model default rate for high-yield default is 1.6%. We average that predicted number with the long-term average high-yield default rate since 1983, which is 4.4%, to come up with the combined default assumption of 3.0%.

Starting Yield:	5.24%
Expected Default Rate:	*2.97%*
Expected Default Recovery Rate:	*38%*
Default Effect:	(1.83%)
Return Assumption:	**3.41%**

Managed Futures

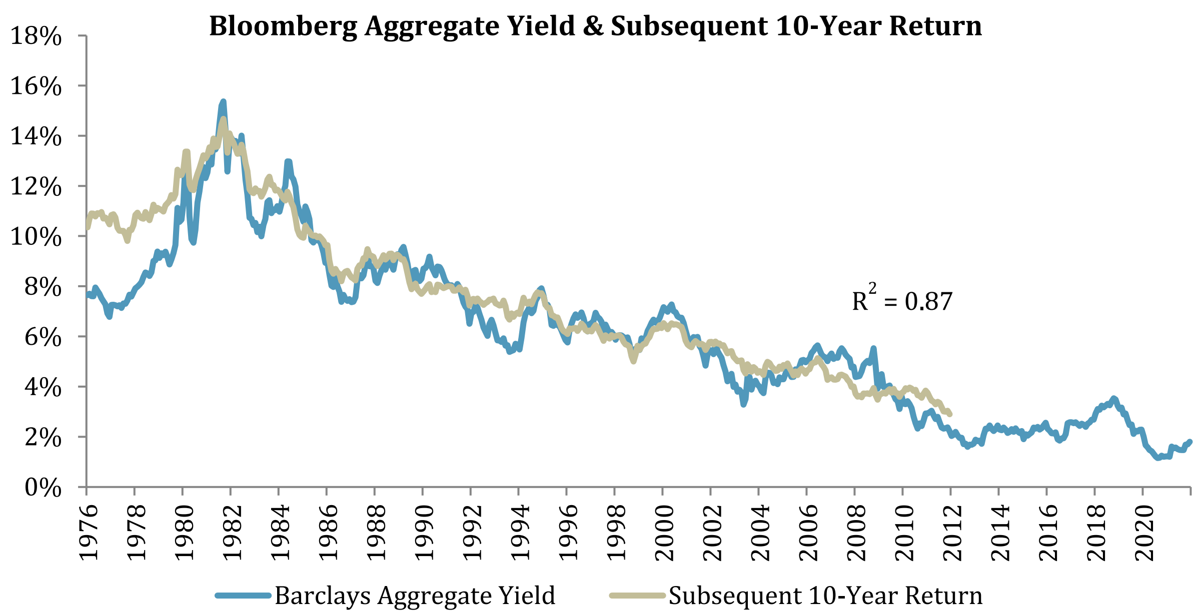
Modeled: Managed Futures Strategies Targeting 10% Volatility
Compound Return: 2.26%
Arithmetic Average Return: 2.70%
Risk: 10.00%

Using the SG Trend Index, an index of actual, "live" managed futures strategies, we calculate the excess return to cash that managed futures strategies have returned since January 1, 2000 (the index's inception date). We scale that premium based on a targeted 10% volatility level and arrive at a historical annualized arithmetic annual average premium over cash of 2.20%. We then add back our Cash Equivalent return assumption of 0.06% to come up with a 2.26% return assumption for Managed Futures.

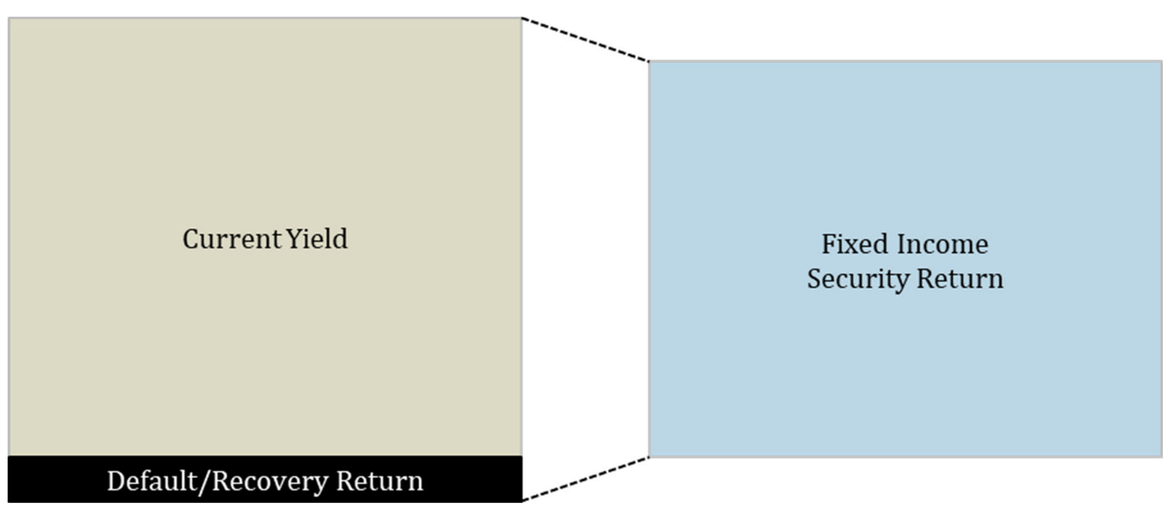
2.20% + 0.06% = **2.26%**

RISK MITIGATION

Risk mitigation assets primarily consist of high-quality fixed income of various durations. Fixed income returns are highly dependent on entry yields. For the Bloomberg Aggregate Index, since 1976, going-in yields have explained 87% of subsequent 10-year returns:



Given the high degree of certainty of future returns stemming from the entry yield, our fixed income process lets the market be our guide. For each fixed income assumption, the return is simply the current yield, adjusted by a default and recovery rate depending on the quality of the asset class. One reason why current yields do not predict 100% of future returns is that some of the bonds in the index default. Our assumption reflects this reality.

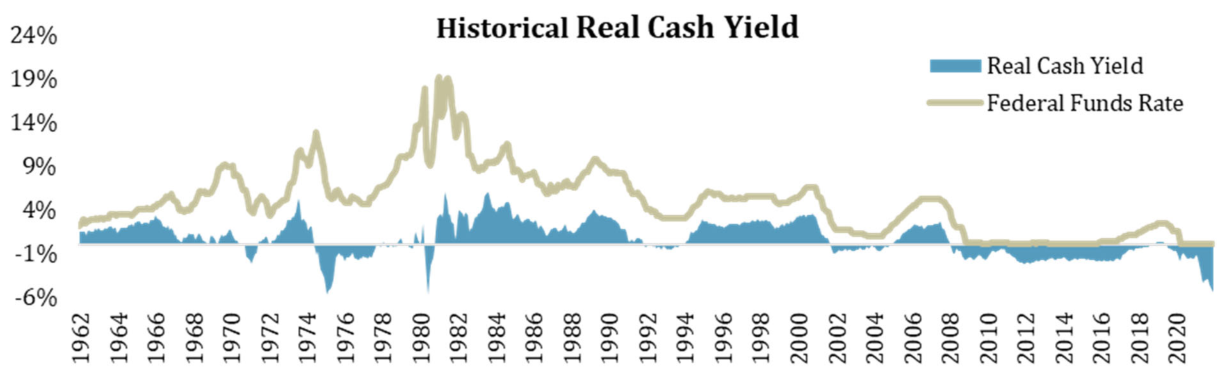


Cash Equivalents

Modeled: 91-Day T-Bills
Compound Return: 0.06%
Arithmetic Average Return: 0.10%
Risk: 1.25%

We use the 91-Day T-Bill yield as the basis of our assumption. As of December 31, 2021, the yield was 0.06%.

We caution that there is an inherent problem with forecasting a 10-year return for an asset that matures every 91 days. Nominal cash returns are highly sensitive to nominal short-term interest rates, which we expect to be as variable over the next decade as they have been historically. As illustrated in the chart below, while investors typically demand a positive real yield from cash, periods of negative real return to cash have existed for considerable periods of time – including most of the time since February 2008. Our risk assumption reflects an appropriate range of uncertainty around our return projection for cash equivalents.



Short-Term US Treasury Inflation Protected Securities (TIPS)

Modeled: Short-Term US TIPS
Compound Return: 0.84%
Arithmetic Average Return: 0.90%
Risk: 3.00%

For our Short-Term TIPS assumption, we model a proxy for the Bloomberg US 0-5 Year TIPS Index, which currently has a maturity of 2.5 years. A portfolio of 80% 2-year Treasury Bonds and 20% 5-year Treasury bonds results in a synthetic Treasury bond with 2.5-year maturity. The expected Short-Term TIPS return is simply a weighted average of our return expectations for the nominal 2-year and 5-year Treasury bonds.

Applying these weights to our return projections for those bonds results in a Short-Term TIPS nominal return assumption of 0.84%:

(80% x 0.73%) + (20% x 1.26%) = **0.84%.**

Low-Duration Fixed Income

Modeled: 1-5 Year Aggregate Fixed Income
Compound Return: 1.05%
Arithmetic Average Return: 1.10%
Risk: 2.25%

For our Low-Duration Fixed Income assumption, we model the Bloomberg US 1-5 Year Government/Credit Index, which currently has a maturity of 2.9 years and is comprised of 74% short-term government bonds and 26% corporate bonds. We adjust the current yield with expected default rate and recovery rates for non-Treasury securities using historical averages for them.

Starting Yield:	1.06%
Expected Default Rate:	*0.08%*
Expected Default Recovery Rate:	*45%*
Default Effect (26% Corporates):	(0.01%)
Return Assumption:	**1.05%**

Intermediate Fixed Income

Modeled: US Investment-Grade Aggregate and Hedged Non-US Aggregate Fixed Income
Compound Return: 1.78%
Arithmetic Average Return: 1.90%
Risk: 5.25%

For our Intermediate Fixed Income assumption, we model the Bloomberg US Aggregate Bond Index, which currently has a duration of 6.6 years and is comprised of 50% US Treasury Bonds, 28% corporate bonds, and 22% securitized bonds. We adjust the current yield with expected default rate and recovery rates for non-Treasury securities using historical averages.

Starting Yield:	1.80%
Expected Default Rate:	*0.08%*
Expected Default Recovery Rate:	*45%*
Default Effect (50% Corp & Securitized):	(0.02%)
Return Assumption:	**1.78%**

We believe that this approach works equally well for US Aggregate fixed income and for Non-US Aggregate fixed income where the currency exposure is hedged back to the US dollar. By stripping out currency exposure, the non-US fixed income investor is left with a portfolio of fixed income securities expecting similar underlying characteristics to the US fixed income portfolio.

Long-Duration Treasury Bonds

Modeled: US Long-Term Treasury Bonds
Compound Return: 1.88%
Arithmetic Average Return: 2.50%
Risk: 11.50%

For the Long-Duration Treasury assumption, we model the Bloomberg US Long Treasury Index, which currently has a duration of 17.9 years and a yield and current yield (return expectation) of 1.88%.

RISK

Our risk assumptions are mostly derived from history, but we have enhanced historical metrics with qualitative overlays in several asset categories.

For each asset category, we began by examining the following historical annual returns:

Inflation	US CPI
Global Equity	MSCI ACWI IMI back to 1994; MSCI ACWI before 1994
US Equity	Russell 3000 back to 1979; S&P 500 before 1979
Non-US Equity	MSCI ACWI ex US IMI back to 1994; MSCI EAFE before 1994
Private Markets	1.5x Russell 2000 back to 1979
Real Estate	FTSE NAREIT
Marketable Alternatives	40% our Global Equity series, 30% our Intermediate Fixed Income series, and 30% our Non-Core Fixed Income series
Non-Core Fixed Income	Bloomberg Global High Yield back to 1988; ICE BofA High Yield Master II before 1998
Managed Futures	SG Trend Index
Cash Equivalents	91-Day T-Bills
Short-Term TIPS	Bloomberg US 0-5 Year TIPS
Low-Duration Fixed Income	Bloomberg 1-5 Year Government/Credit
Intermediate Fixed Income	Bloomberg US Aggregate
Long-Duration Treasurys	Bloomberg US Long Treasurys

In each case, we calculated the longest-term standard deviation of returns possible for the category. Then, we calculated the standard deviation of annual returns over the last ten years. The average of these two figures represents our base-case risk assumption.

Next, we examined the worst annual return for each proxy index, going back as far as possible into history. We assumed this return as the worst-case scenario. In some cases, the normal return distribution implied by our return and risk assumptions suggested that the actual worst-case scenario had less than a 1% probability (1 in 100 years) of occurring. Because we are uncomfortable assuming that observed reality – what has actually happened in the real world – is extremely unlikely, we adjusted our risk assumption upward until the actual, real-world worst-case scenario had at least a 1% probability of occurring under our assumed normal return distribution.

Finally, based on this analysis and our qualitative assessment of the quality and longevity of our return data, we made several qualitative adjustments, where noted. The results of this risk analysis follow.

The following table depicts actual standard deviations of annual return, measured in the long term (as far back as history will allow), for the last ten years, and the average of those two figures.

Adding or subtracting our qualitative adjustment results in the Risk Assumption at the far right.

Standard Deviation of Returns

	10 Years	Longest-Term	Average	Qualitative Adjustment	Risk Assumption (Rounded)
Global Equity	12.19%	17.86%	15.02%	6.75%	21.75%
US Equity	12.39%	16.96%	14.67%	4.75%	19.50%
Non-US Equity	13.17%	22.08%	17.63%	6.00%	23.75%
Private Markets	21.75%	27.74%	24.74%	2.50%	27.25%
Real Estate	15.23%	20.16%	17.69%	2.75%	20.50%
Marketable Alternatives	7.11%	10.91%	9.01%	3.45%	12.50%
Non-Core Fixed Income	7.85%	14.22%	11.04%	2.50%	13.50%
Managed Futures	8.33%	9.37%	8.85%	1.15%	10.00%
Cash Equivalents	0.83%	3.31%	2.07%	-0.75%	1.25%
Short-Term TIPS	2.57%	3.47%	3.02%		3.00%
Low-Duration Fixed Income	1.34%	4.59%	2.96%	-0.75%	2.25%
Intermediate Fixed Income	3.72%	6.72%	5.22%		5.25%
Long-Duration Treasurys	11.45%	11.37%	11.41%		11.50%

The following table examines the probability of the actual experienced worst case occurring under our assumed normal distribution of returns, as implied by our expected return and standard deviation of returns, after accounting for qualitative adjustments to risk.

We measure the actual worst-case scenario in "sigmas," or standard deviations from our assumed mean return. Measuring this way, we ask, "How likely was the actual experienced worst case, according to the distribution parameters we have assumed?" We have qualitatively adjusted several asset classes to ensure that the probability of the actually experienced worst case is always greater than 1%, meaning we assume that the experienced worst case has at least a one-in-a-hundred-year chance of happening under our assumptions.

	Worst Year		Actual Worst Case, in Sigmas from Assumption	Implied Probability of Actual Worst Case Occurring
Global Equity	-42.01%	2008	2.31	1.0%
US Equity	-37.31%	2008	2.32	1.0%
Non-US Equity	-45.99%	2008	2.33	1.0%
Private Markets	-50.68%	2008	2.32	1.0%
Real Estate	-42.24%	1974	2.33	1.0%
Marketable Alternatives	-23.30%	2008	2.26	1.2%
Non-Core Fixed Income	-26.89%	2008	2.30	1.1%
Managed Futures	-8.11%	2018	1.08	14.0%
Cash Equivalents	0.02%	2014	0.06	47.7%
Short-Term TIPS	-2.03%	2008	0.97	16.6%
Low-Duration Fixed Income	0.55%	1994	0.25	40.2%
Intermediate Fixed Income	-2.92%	1994	0.92	17.8%
Long-Duration Treasurys	-12.92%	2009	1.35	8.8%

Our qualitative adjustments to Risk were as follows:

Cash Equivalents (-0.75%) and Low-Duration Fixed Income (-0.75%)

While the long-term standard deviation of returns to cash and short-term bonds have been greater than 3%, that volatility was experienced at higher levels of cash return. We believe it is unlikely for the distribution of returns to these assets to be as wide as historically observed, given its current low level of return. We qualitatively adjust their risk downward by 75 basis points.

Global Equity (+6.75%), US Equity (+4.75%), Non-US Equity (+6.00%), Private Markets (+2.50%), Real Estate (+2.75%), Non-Core Fixed Income (+2.50%)

These categories were adjusted upward to make their actual worst-case experience greater than a 1% probability of occurring under the assumed return distribution.

Marketable Alternatives (+3.45%)

We apply the same adjustments from above at the target underlying asset class weights.

Managed Futures (+1.15%)

This adjustment adds or subtracts to achieve a 10.00% target volatility target.

CORRELATION COEFFICIENTS

Our forward-looking correlation assumptions are mostly derived from long-term history but emphasize the recent past. The indexes used for each asset class match what has been used above for our risk analysis.

Using those streams, we constructed a correlation matrix that takes the simple average of four other correlation matrices – constructed with 3 years, 5 years, and 10 years of data, and one with as much data as possible going back to each series' inception. Averaging these four measures gives acknowledgement to the long-term history while emphasizing the recent past, when correlations have been higher than long-term history has delivered. This approach is therefore conservative in assuming the diversification benefit that will appear from correlation in our modeling.

Our assumed return correlation matrix follows:

Sellwood Consulting 2022 Correlation Coefficient Assumptions

	Inflation	Global Equity	US Equity	Non-US Equity	Private Markets	Real Estate	Marketable Alternatives	Non-Core Fixed Income	Managed Futures	Cash Equivalents	Short-Term TIPS	Low-Duration Fixed Income	Intermediate Fixed Income	Long-Duration Treasurys
Inflation	**1.00**	0.04	0.04	0.03	0.00	0.12	0.03	0.07	-0.05	-0.16	0.22	-0.24	-0.15	-0.13
Global Equity	0.04	**1.00**	0.97	0.97	0.91	0.72	0.97	0.82	0.07	-0.27	0.44	-0.15	0.02	-0.32
US Equity	0.04	0.97	**1.00**	0.89	0.91	0.73	0.93	0.75	0.08	-0.26	0.41	-0.17	0.01	-0.30
Non-US Equity	0.03	0.97	0.89	**1.00**	0.85	0.67	0.95	0.84	0.06	-0.26	0.44	-0.11	0.03	-0.33
Private Markets	0.00	0.91	0.91	0.85	**1.00**	0.70	0.87	0.76	0.01	-0.28	0.36	-0.19	-0.06	-0.39
Real Estate	0.12	0.72	0.73	0.67	0.70	**1.00**	0.76	0.69	0.10	-0.25	0.52	0.01	0.28	0.00
Marketable Alternatives	0.03	0.97	0.93	0.95	0.87	0.76	**1.00**	0.92	0.07	-0.26	0.54	0.00	0.20	-0.20
Non-Core Fixed Income	0.07	0.82	0.75	0.84	0.76	0.69	0.92	**1.00**	-0.02	-0.29	0.58	0.04	0.22	-0.22
Managed Futures	-0.05	0.07	0.08	0.06	0.01	0.10	0.07	-0.02	**1.00**	0.04	0.17	0.16	0.23	0.25
Cash Equivalents	-0.16	-0.27	-0.26	-0.26	-0.28	-0.25	-0.26	-0.29	0.04	**1.00**	-0.16	0.45	0.18	0.23
Short-Term TIPS	0.22	0.44	0.41	0.44	0.36	0.52	0.54	0.58	0.17	-0.16	**1.00**	0.41	0.49	0.16
Low-Duration Fixed Income	-0.24	-0.15	-0.17	-0.11	-0.19	0.01	0.00	0.04	0.16	0.45	0.41	**1.00**	0.78	0.61
Intermediate Fixed Income	-0.15	0.02	0.01	0.03	-0.06	0.28	0.20	0.22	0.23	0.18	0.49	0.78	**1.00**	0.86
Long-Duration Treasurys	-0.13	-0.32	-0.30	-0.33	-0.39	0.00	-0.20	-0.22	0.25	0.23	0.16	0.61	0.86	**1.00**

APPENDIX: SOURCES

We are grateful to several data sources for our analysis. They were:

FRED, The St. Louis Fed Federal Reserve Economic Data

https://fred.stlouisfed.org/

FTSE NAREIT

https://www.reit.com/data-research/reit-indexes/ftse-nareit-us-real-estate-index-historical-values-returns
http://www.ftse.com/products/indices/russell-us

Professor Aswath Damodaran, Stern School of Business

http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/implpr.html
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2581517

Research Affiliates

http://www.researchaffiliates.com

Blackrock

http://www.blackrock.com

Standard & Poors

http://www.standardandpoors.com

Morgan Stanley Capital International

http://www.msci.com/

Moodys

https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_151031
https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_154805

Professor Robert Shiller

http://www.econ.yale.edu/~shiller/data.htm

Vanguard

https://personal.vanguard.com/pdf/s338.pdf