Alternative Thinking | Q1 2022

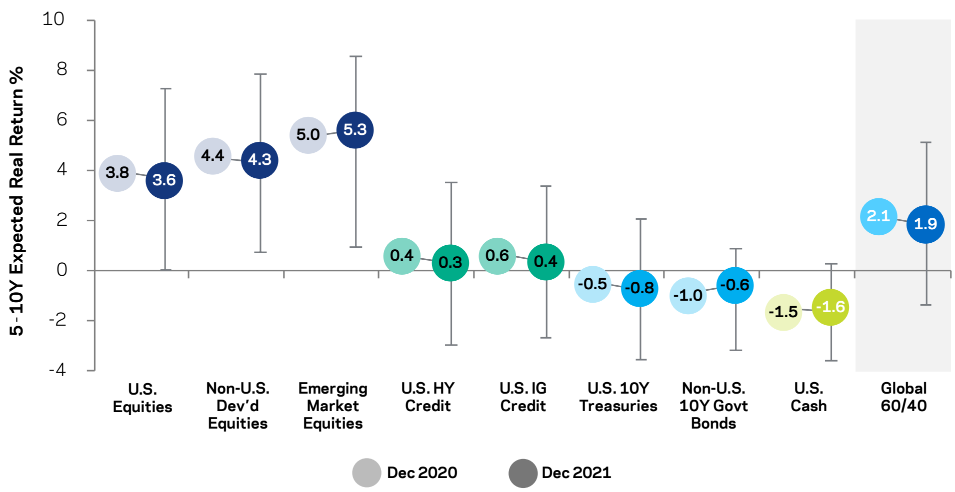
Capital Market Assumptions for Major Asset Classes

Executive Summary

This article updates our estimates of medium-term (5- to 10-year) expected returns for major asset classes. It also includes an analysis that attempts to reconcile ever-lower expected returns with ever-higher realized returns, and suggests practical strategic steps to boost portfolio expected returns.

Selected estimates are summarized in **Exhibit 1**. U.S. equity and bond expected returns both moved lower in 2021, while changes to their global counterparts were mixed. The expected real return of a 60/40 portfolio remains around 2%, less than half its long-term average of nearly 5% (since 1900[1]).

Exhibit 1: Medium-Term Expected Real Returns for Liquid Asset Classes



Source: AQR; see Exhibits 3-5 for details. Estimates as of December 31, 2021. "Non-U.S. developed equities" is cap-weighted average of Euro-5, Japan, U.K., Australia, Canada. "Non-U.S. 10Y govt. bonds" is GDP-weighted average of Germany, Japan, U.K., Australia, Canada. Error bars cover 50% confidence range, based on analysis from the 2018 edition and adjusted for current expected volatilities. These are intended to emphasize the uncertainty around any point estimates. Not only are the return forecasts uncertain, but also any measures of forecast uncertainty are debatable. Forecasting requires humility at many levels. Estimates are for illustrative purposes only, are not a guarantee of performance and are subject to change.

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1 Historical comparison is based on a simpler methodology than main estimates, due to data availability; methodology described in Appendix.

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About the Portfolio Solutions Group

The Portfolio Solutions Group (PSG) provides thought leadership to the broader investment community and custom analyses to help AQR clients achieve better portfolio outcomes.

We thank Alfie Brixton, Pete Hecht, Thomas Maloney and Nick McQuinn for their work on this paper. We also thank Antti Ilmanen for helpful comments.

Introduction and Framework

For the past eight years we have published our capital market assumptions for major asset classes, with a focus on medium-term expected returns (see 2014, 2015, 2016, 2017, 2018, 2019, 2020 and 2021). Each year, as well as the updated estimates, we provide additional analysis in the form of new asset classes or other new material. This year's article includes an application of our CMA framework to understand realized stock and bond returns over the past decade, and suggests several practical steps to raise expected returns over the next ten years.

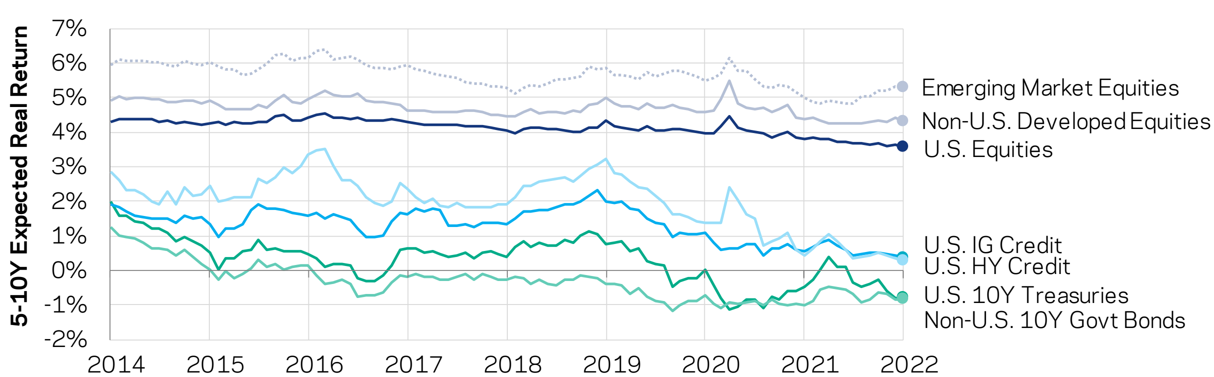
As usual, we present local real (inflation-adjusted) annual compound rates of return[2] for a horizon of 5 to 10 years. Over such intermediate horizons, starting valuations tend to be useful inputs. For multi-decade forecast horizons their impact is diluted, so theory and long-term historical averages may matter more in judging expected returns. At shorter horizons, returns are largely unpredictable and any predictability has tended to mainly reflect momentum and the macro environment.

Our estimates are intended to assist investors with setting medium-term expectations. They are highly uncertain, and not intended for market timing. The frameworks we present may be more informative than the numbers themselves. As one cautionary example, the error ranges shown in **Exhibit 1**, based on historical analysis in the 2018 edition, suggest there is a 50% chance that realized equity market returns over the next 10 years will under- or overshoot our estimates by more than 3% *per annum*.

Since we started publishing our CMAs in 2014, estimates for both stocks and bonds have moved lower due to richening valuations (see **Exhibit 2**). All assets' expected real returns remain depressed by exceptionally low real cash rates, but expected premia over cash are nearer normal levels.[3]

Exhibit 2: Expected Real Returns for Liquid Asset Classes

Dec-2013 to Dec-2021



Source: AQR; see Exhibits 3-5 for details. "Non-U.S. developed equities" is cap-weighted average of Euro-5, Japan, U.K., Australia, Canada. "Non-U.S. 10Y govt. bonds" is GDP-weighted average of Germany, Japan, U.K., Australia, Canada. Estimates are based on current methodologies, are for illustrative purposes only, are not a guarantee of performance and are subject to change.

2 For a discussion of expected arithmetic (or simple) vs. geometric (or logarithmic, or compound) rates of return, see the 2018 edition. 3 We calculate the excess-of-cash return by subtracting an estimate of real cash return; this is effectively the return accessed by

hedged investors irrespective of their base currency. Unhedged USD estimates are shown in the Appendix; other currencies available on request.

Equity Markets

Our starting point for equities is the dividend discount model, under which expected real return is approximately the sum of dividend yield (DY), expected trend growth (g) in real dividends or earnings per share (EPS), and expected change in valuation (Δv), that is: E(r) ≈ DY+g+Δv. We take the average of two approaches,[4] described below. We assume no mean reversion in valuations.[5]

1. **Earnings-based:** We start from the inverse of the CAPE ratio (cyclically-adjusted P/E), which is 10-year average inflation-adjusted earnings divided by today's price. We multiply by 0.5 (roughly the U.S. long-run dividend payout ratio), and add real earnings growth of 1.5% (roughly the U.S. long-run average). So earnings-based expected return[6] is: $E(r) \approx 0.5$* *Adjusted Shiller E/P* + g_{EPS}

2. **Payout-based:** We estimate net total payout yield (NTY) as the sum of current dividend yield and smoothed net buyback yield. To this we add an estimate of long-term real growth of aggregate payouts that includes net issuance. This growth estimate, g_{TPagg}, is an average of smoothed historical aggregate earnings growth and forecast GDP growth. So our payout-based expected return is: $E(r) \approx NTY + g_{TPagg}$, *where NTY = DY + net buyback yield (NBY)*

Our estimates saw mixed changes in 2021 (see **Exhibit 3**), with U.S. and global real return estimates falling slightly as markets richened. The U.S. estimate is very low by historical standards.

Exhibit 3: Expected Local Returns for Equities

December 2021

	1. Earnings-Based		2. Payout-Based				Combined		
	Adjusted Shiller EP	0.5 * EP + g_{EPS}	Dividend Yield	NBY	g_{TPagg}	DY+NBY + g_{TPagg}	Real Return	*1yr Change*	Excess-of-Cash Return
U.S.	2.8%	**2.9%**	1.3%	0.2%	2.7%	**4.2%**	**3.6%**	*-0.2%*	**5.1%**
Eurozone	4.0%	**3.5%**	2.2%	-0.3%	2.5%	**4.4%**	**3.9%**	*-0.2%*	**5.8%**
Japan	4.6%	**3.8%**	2.1%	0.2%	2.3%	**4.6%**	**4.2%**	*+0.0%*	**5.1%**
U.K.	5.6%	**4.3%**	3.6%	-0.2%	2.4%	**5.8%**	**5.1%**	*-0.1%*	**6.9%**
Australia	4.4%	**3.7%**	4.0%	-0.4%	2.8%	**6.4%**	**5.1%**	*+0.5%*	**6.3%**
Canada	4.1%	**3.6%**	2.7%	-0.9%	2.7%	**4.4%**	**4.0%**	*-0.2%*	**5.2%**
Global Developed	3.2%	**3.1%**	1.6%	0.1%	2.7%	**4.4%**	**3.7%**	*-0.2%*	**5.3%**
Global Dev. ex U.S.	4.5%	**3.7%**	2.6%	-0.2%	2.5%	**4.9%**	**4.3%**	*-0.1%*	**5.8%**
Emerging Markets	6.6%	**5.3%**	2.4%	--	2.9%	**5.3%**	**5.3%**	*+0.3%*	**4.4%**

Source: AQR, Consensus Economics and Bloomberg. Estimates and methodology subject to change and based on data as of December 31, 2021. See main text above for methodology. For earnings yield, U.S. is based on S&P 500; U.K. on FTSE 100 Index; Eurozone is a cap-weighted average of large-cap indices in Germany, France, Italy, Netherlands and Spain; Japan is Topix Index; and "Emerging Markets" is MSCI Emerging Markets Index. Net buyback yield is past 10-year average. For payout-based estimates, all countries are based on corresponding MSCI indices. "Global Developed" is a cap-weighted average. For emerging markets, payout-based estimate is dividend yield + forecast GDP per capita growth. Excess-of-cash return is calculated by subtracting real cash return estimates described later in the article. Hypothetical performance results have certain inherent limitations, some of which are disclosed in the back. Estimates are for illustrative purposes only, are not a guarantee of performance and are subject to change.

4 See the 2017 edition and its online appendix for details and discussion of the methodology.

5 See the 2015 edition for a discussion of mean reversion in stock and bond valuations, and our decision to exclude it. Our analysis suggests the timing of any mean reversion is difficult to forecast, and there are plausible arguments for yields remaining below historical levels.

6 For our earnings-based estimate, we apply a 50% payout ratio to all countries, and use g = 1.5% for all countries except for emerging markets, where we use a higher growth rate of 2%. *Adjusted Shiller EP* is Shiller EP * 1.075 where the scalar accounts for average earnings growth during the 10-year earnings window of the Shiller EP.

Government Bonds

Government bonds' prospective medium-term nominal total returns are strongly anchored by their yields. The so-called *rolling yield* measures the expected return of a constant-maturity bond allocation assuming an unchanged yield curve.[7] For example, a strategy of holding constant-maturity 10-year Treasuries has an expected annual (nominal) return of 1.8%, given the starting yield of 1.5% and expected capital gains of 0.3% from rolldown as the bonds age. **Exhibit 4** shows current local rolling yields for six countries, converted to local real returns by subtracting a survey-based forecast of long-term inflation.

We also show expected excess-of-cash returns, which are effectively the expected returns accessed by hedged investors irrespective of their base currency. While real returns are often the appropriate unit for assessing expectations versus investment objectives, excess-of-cash returns are more relevant for making international allocation decisions, and for investors with access to leverage.

During 2021, our U.S. estimate fell as higher yields were offset by a flatter curve and higher expected inflation. Most other countries' estimates increased slightly, but remain in negative territory. Low bond yields should be considered in the context of exceptionally low cash rates – indeed, all excess-of-cash returns are positive. Any adjustment to these expected returns boils down to expected future changes in the yield curve level or shape. Capital gains/losses due to falling/rising yields dominate returns over short horizons but are highly uncertain, and matter less over longer horizons.

Exhibit 4: Expected Local Returns for Government Bonds

December 2021

	Y	RR	I	Y + RR - I		
	10-Year Nominal Bond Yield	Rolldown Return	10-Year Forecast Inflation	Expected Real Return	*1yr Change*	Excess-of-Cash Return
U.S.	1.5%	0.3%	2.6%	**-0.8%**	*-0.3%*	**0.8%**
Japan	0.1%	0.4%	0.8%	**-0.3%**	*+0.0%*	**0.5%**
Germany	-0.2%	0.5%	2.0%	**-1.7%**	*+0.2%*	**0.7%**
U.K.	1.0%	0.4%	2.5%	**-1.2%**	*+0.2%*	**0.7%**
Canada	1.4%	0.3%	2.2%	**-0.4%**	*+0.3%*	**0.8%**
Australia	1.7%	0.7%	2.3%	**0.0%**	*+0.3%*	**1.2%**
Global Developed	1.1%	0.4%	2.2%	**-0.7%**	*-0.1%*	**0.8%**
Global Developed ex U.S.	0.5%	0.6%	1.7%	**-0.6%**	*+0.4%*	**0.9%**

Source: Bloomberg, Consensus Economics and AQR. Estimates as of December 31, 2021. "Global Developed" and "Global Developed ex US" are GDP-weighted averages. Rolldown return is estimated from fitted yield curves and based on annual rebalance. Excess-of-cash return is calculated by subtracting real cash return estimates described later in the article. Estimates are for illustrative purposes only, are not a guarantee of performance and are subject to change.

7 If we assumed a more realistic random-walk (rather than unchanged) yield curve, our estimate would theoretically need to include convexity and variance drag components (see footnote 9). However, since these terms are small and mostly offsetting for concentrated bond portfolios, we ignore them here.

Credit Indices

To estimate expected real returns for credit indices, we first apply a haircut of 50% to both IG and HY spreads to represent the combined effects of expected default losses, downgrading bias and bad selling practices.[8] We assume no change in the spread curve, say, through mean reversion. We add the expected real yield of a duration-matched Treasury, and rolldown from both Treasury and spread curves. Finally, we include corrections for convexity and variance drag.[9] **Exhibit 5** shows our updated estimates for U.S. credit indices[10] and hard-currency emerging market sovereign debt. Estimates for U.S. credit fell slightly in 2021, with higher Treasury yields offset by narrower spreads. The HY-IG spread remains narrow (HY's modest spread advantage over IG is offset by its lower Treasury yield, rolldown and convexity).

Exhibit 5: Expected Returns for Credit Indices

December 2021

	A. Spread Return	B. Treasury Real Yield	C. Rolldown Return	D. Convexity & Variance			
	OAS * 0.5	Y - I	R_T+R_C	C - V	Expected Real Return A+B+C+D	*1yr Change*	Excess-of-Cash Return
U.S. IG	0.5%	-1.2%	0.6%	0.5%	**0.4%**	-0.2%	**1.9%**
U.S. HY	1.4%	-1.2%	0.2%	-0.1%	**0.3%**	-0.2%	**1.8%**
EM HC Debt	1.7%	-1.1%	0.4%	0.5%	**1.4%**	+0.2%	**3.0%**

Source: Bloomberg, AQR. Estimates as of December 31, 2021. OAS and duration data are for Bloomberg Barclays U.S. Corporate Investment Grade (IG), U.S. Corporate High Yield (HY) and Emerging USD Sovereign (EM HC Debt) Indices. Index durations are 8.7 years, 3.9 years and 8.8 years respectively. Excess-of-cash return is calculated by subtracting real cash return estimates described later in the article. Estimates are for illustrative purposes only, are not a guarantee of performance and are subject to change.

Commodities

Commodities do not have obvious yield measures, and we find no statistically significant predictability in medium-term returns (see the 2016 edition). Our estimate of 5- to 10-year expected return is therefore simply the long-run average return of an equal-weighted portfolio of commodity futures. This portfolio has earned about 3% geometric average excess return over cash since 1877, and a similar return if measured since 1951.[11] We add a (negative) U.S. real cash return to give our expected real return of 1.4%.

Gold has attracted attention recently, as it is often viewed as an inflation hedge. We do not have medium-term return estimates for individual commodities but would expect gold to have a substantially lower risk-adjusted return than a diversified basket over the long term.[12] A gold investment has indeed exhibited useful tail-hedging properties, but arguably it lacks the premium associated with growth-sensitive commodities, and it forgoes the considerable diversification found within the broader asset class.

8 Consistent with Giesecke et al. (2011) and Ben Dor et al. (2021), who find that over the long term, the average credit risk premium is roughly half the spread. 'Bad selling' refers to the practice of selling bonds that no longer meet the rating or maturity criteria of the index.
9 These terms, both related to volatility, are not as closely offsetting for broad indices as they are for single bonds, due to diversification effects. Briefly, the convexity term estimates the impact of non-linearities assuming yields will change, while the variance drag term estimates the impact of compounding effects assuming return volatility will be non-zero.
10 Exhibit 5 shows spreads for Bloomberg Barclays cash bond indices. Synthetic indices (Markit North America CDX) have tended to have somewhat tighter spreads (but during 2021 this basis was near zero). For EM debt we use US HY OAS rolldown due to data limitations.
11 For more details see the 2016 edition, Levine, Ooi, Richardson and Sasseville (2018), and the AQR data library.
12 From February 1975 to December 2021, an investment in gold futures delivered around 1% real return, approximately the same as cash.

Alternative Risk Premia

Style-Tilted Long-Only Portfolios

We believe a hypothetical value-tilted, diversified long-only equity portfolio that is carefully implemented and reasonably priced may be assumed to have an expected real return 0.5% higher than the cap-weighted index, after fees, with 2-3% tracking error. An integrated multi-style strategy — which we assume to include balanced allocations to value, momentum and defensive styles — may achieve a higher expected net active return of around 1% at a similar tracking error. Finally, we think a defensive or low-risk equity portfolio may be assumed to have an expected return similar to that of the relevant cap-weighted index, but may achieve this with lower volatility.[13] These are long-term estimates – we discuss tactical considerations below.

Long/Short Style Premia

Alternative risk premia strategies apply similar tilts as long-only smart beta strategies, but in a market-neutral fashion and often in multiple asset classes. Because long/short strategies can be invested at any volatility level, it makes sense to focus on expected Sharpe ratios. The degree of diversification is essential. A single long/short style applied in a single asset class might have an expected Sharpe ratio of only 0.2-0.3. For a diversified composite, we believe an expected Sharpe ratio of 0.7-0.8, net of trading costs and fees, can be feasible when multiple styles are applied in multiple asset classes. At a target volatility of 10%, such a hypothetical portfolio would have an expected return of 7-8% over cash.[14] We stress that this requires careful craftsmanship in portfolio construction as well as great efficiency in controlling trading, financing and shorting costs.[15] Strategies that are less well-designed or poorly implemented may have much lower expected returns.

Current valuations

Aggregate valuations across multiple styles are near long-term averages. Among individual styles, the equity defensive style has cheapened after appearing rich for many years, while the equity value style continues to look extremely cheap, despite a performance rebound in 2021. Indeed, spreads between value and growth stocks are now comparable to their previous peak during the Dotcom Bubble. Our research suggests there is quite a weak link between the value spreads of style factors and their future returns, making it difficult to use tactical timing based on valuations to outperform a strategic multi-style portfolio.[16] However, we believe the current extreme cheapness of value warrants an overweight to that style in multi-factor strategies.[17]

13 Style-tilted strategies exhibit many design variations. Our estimates are purely illustrative and
14 Consistent with historical data, we assume low correlations between the styles to produce our Sharpe ratio range for a diversified

composite of long/short styles. As transaction costs depend on implementation and both transaction costs and fees vary with target volatility, our estimates are based on a transaction-cost-optimized strategy targeting 10% volatility with fees of 1 to 1.5%. Refer to the 2015 edition for details of our style premia assumptions, which we believe are plausible and conservative. All assumptions are purely illustrative
15 See Israel, Jiang and Ross (2017), "Craftsmanship Alpha: An Application to Style Investing".
16 See Asness, Chandra, Ilmanen and Israel (2017), "Contrarian Factor Timing Is Deceptively Difficult".
17 See *Cliff's Perspective* blog, "That's It, That's the Blog", December 2021.

Private Equity and Real Estate

Illiquid assets are inherently harder to model than public markets, and this is exacerbated by a lack of good quality data. Nevertheless, in recent years we extended our discounted-cashflow-based approach into the illiquid realm and we update these estimates below. For private equity (PE) our estimate is for U.S. buyout funds. We present net-of-fee expected returns, as fees are a substantial component of returns for illiquid assets. Each of our inputs is debatable, as data limitations necessitate lots of simplifying assumptions, and each input can substantially affect the final estimate. **Exhibit 6** illustrates our framework and current inputs.[18] First, we estimate unlevered ER using the DDM: $E(r) \approx y_U + g_U$, where y_U = unlevered payout yield and g_U = real earnings-per-share growth rate. Then, we estimate the levered return by applying leverage and the cost of debt, and finally we add expected multiple expansion and subtract fees.

Our yield-based real return estimate is 5.9% net of fees, higher than last year due to higher leverage and lower cost of debt. An alternative approach, which applies simple size and leverage adjustments to a public proxy and assuming zero net alpha, generates a lower estimate of 5.5%.[19] Taking a simple average of the two approaches gives a final estimate of **5.7%**, compared to our U.S. large cap equity estimate of 3.6%.

Exhibit 6: Expected Real Returns for U.S. Private Equity

	Unlevered			Leverage		Levered					
	y_u	g_u	$r_u = y_u + g_u$	D/E	k_d	$r_l = r_u + (D/E) * (r_u - k_d)$	m	$r_g = r_l + m$	f	$r_n = r_g - f$	
	Income Yield	Real Growth Rate	Real Return	Debt to Equity	Real Cost of Debt	Levered Real Return	Multiple Expansion	Gross Real ER	Fees	Net Exp. Real Return	*1yr Change*
U.S. PE	2.0%	+ 3.0%	= 5.0%	103%	0.0%	10.1%	+ 0.8%	= 10.9%	5.0%	= **5.9%**	*+1.2%*

Source: AQR, Pitchbook, Bloomberg, CEM Benchmarking. Estimates as of September 30, 2021. Strictly speaking, our inputs are log returns and should be converted to simple returns before leverage is applied, then converted back to log returns. This 'round-trip' has only a small impact, so we omit it here. For real cost of debt we apply a floor at 0%. Estimates are for illustrative purposes only, are not a guarantee of performance and are subject to change.

We estimate expected returns for unlevered U.S. direct real estate (RE) as represented by the NCREIF indices. We caveat that returns for individual RE funds can vary vastly from the industry average (this is also true of PE). As with our DDM-based approach for equities, we sum payout yield and expected long-term growth rate.[20] **Exhibit 7** shows a slight rise in our expected real return for RE (unlevered to make it comparable to the unlevered returns reported by NCREIF) to 2.6%.

18 See Ilmanen, Chandra and McQuinn (2020) for a detailed discussion of the framework, our input choices, and the sources, as well as a literature review. Strictly speaking, the framework applies to the current vintage rather than the entire PE market. This paper also discusses the theoretical rationales and historical average returns to assess expected PE returns.
19 See the 2019 edition for details of this alternative method.
20 See Ilmanen, Chandra and McQuinn (2019) for full details of our methodology and assumptions.

Exhibit 7: Expected Real Returns for U.S. Private Real Estate

	NOI	C ≈ NOI / 3	CF ≈ NOI - C	g	ER = CF + g	
	NOI Yield	Capital Expenditure	Cashflow Yield	Real Growth	Unlevered Real Return	*1yr Change*
U.S. Real Estate	3.9%	1.3%	2.6%	0.0%	**2.6%**	*+0.1%*

Source: AQR, NCREIF Webinar Q3 2021. Estimates as of September 30, 2021. Estimates are for illustrative purposes only, are not a guarantee of performance and are subject to change. Not representative of any AQR product or strategy.

Cash

As discussed in the 2020 edition, our yield-based cash return assumption is a weighted average of current short-term and long-term yields. We are effectively averaging between the pure expectations and pure risk premium hypotheses. Giving a larger weight to the 10-year yield implies market rate expectations explain a larger portion of the yield curve slope than the required term premium, a conjecture arguably justified by relatively low inflation uncertainty and the role of forward guidance from central banks.

Exhibit 8 shows real cash return estimates were little changed during 2021 (after sharp falls in 2020), remaining negative for all major markets. If expected returns for equities and bonds are low, they are even lower for cash – and this important fact will be true for almost any methodology.[21]

Exhibit 8: Expected Local Real Returns for Cash

December 2021

	S	L	I	(L*2/3 + S*1/3) - I	
	3-Month Yield	10-Year Yield	10Y Forecast Inflation	Expected Real Cash Return	*1yr Change*
U.S.	0.0%	1.5%	2.6%	**-1.6%**	*-0.1%*
Japan	-0.1%	0.1%	0.8%	**-0.8%**	*+0.0%*
Germany	-0.7%	-0.2%	2.0%	**-2.4%**	*+0.0%*
U.K.	0.1%	1.0%	2.5%	**-1.8%**	*+0.2%*
Australia	0.0%	1.7%	2.3%	**-1.2%**	*+0.4%*
Canada	0.2%	1.4%	2.2%	**-1.2%**	*+0.3%*

Source: Bloomberg, Consensus Economics and AQR. Estimates as of December 31, 2021. Estimates are for illustrative purposes only, are not a guarantee of performance and are subject to change.

21 Survey-based forecasts from Consensus Economics point to cash rates 50-100bps higher than our market-based estimates, as well as higher bond yields, as they have for many years. But we find no evidence that estimates based on survey data have been more accurate than our market-based assumptions.

Revisiting "The 5% Solution" – and practical strategic steps to boost portfolio expected returns

Mea culpa – dusting off a decade-old paper

Ten years ago we published an article titled *The Five Percent Solution*[22] that lamented the impact of low yields on expected real returns, and proposed unconventional solutions. We wrote: "Current market yields and valuations make it very unlikely that traditional allocations will achieve 5 percent real return in the next five to ten years." Using simpler versions of the measures presented in these pages, we said the expected real return for a U.S. 60/40 portfolio was 2.4%. How did that prediction work out?

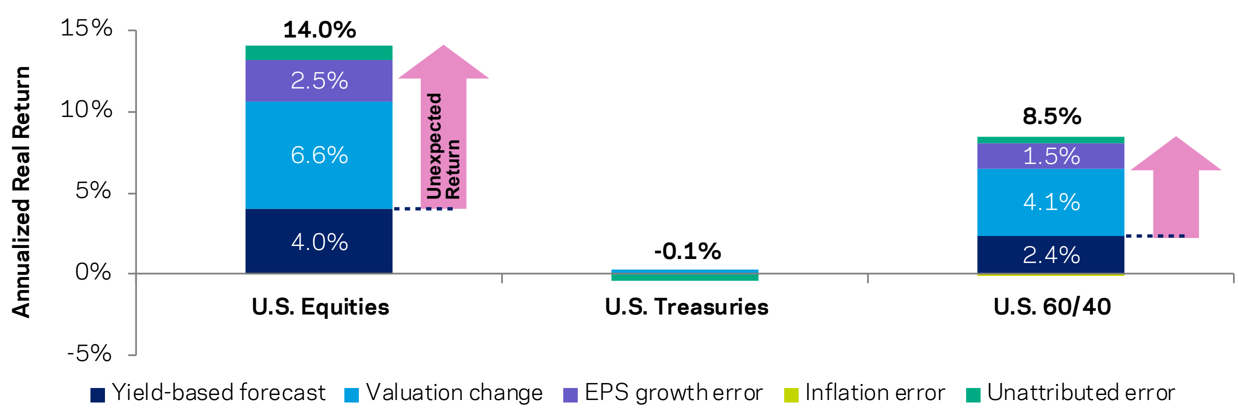
During the decade from January 2012 to December 2021, that U.S. 60/40 portfolio delivered not 5% but a stunning **8.5% annual real return** (6.8% for a global equivalent). How did that happen, and does it invalidate our yield-based approach to estimating medium-term returns?

Reconciling ever-lower expected returns to ever-higher realized returns

The main story is that rich markets got richer. The U.S. Shiller CAPE started the period at 20.5 (already the 79th percentile historically) and almost doubled to 39 by the end of it (99th percentile). The 10-year Treasury yield started at 1.9% – its lowest ever at the time – and defied many confident predictions of rises to end the period slightly lower. Global bond yields saw more substantial falls.

Exhibit 9 shows how the 60/40 portfolio delivered that 8.5% return given its 2.4% starting yield. The largest contributor to the 'unexpected return' or forecast error was equity richening (4.1%), followed by faster than expected EPS growth (1.5%). Realized inflation matched the 2.2% forecast.

Exhibit 9: Forecasts as of December 2011 vs. Subsequent Realized 10-Year Returns



Source: AQR. Realized returns are calculated for period January 1, 2012 to December 31, 2021. Yield-based forecasts are based on simple methodology as described in the Appendix. Valuation change is annualized change in CAPE ratio for equities and annualized return impact of yield change for Treasuries. EPS growth error is realized annualized real EPS growth minus starting assumption of 1.5%. Inflation error is average realized inflation minus forecast. Unattributed error is error not accounted for by these components. For illustrative purposes only.

22 Asness and Ilmanen, *Institutional Investor* May 2012.

As we emphasized in another paper a few years later, *Market Timing: Sin a Little*, market valuations can drift for long periods, and it's hard to judge fair value in real time. This is why we assume no mean reversion in our estimates (forecasts that do assume mean reversion have suffered even larger errors). Even so, any richening or cheapening will tend to send expected returns (informed by starting valuations) and realized returns in opposite directions.

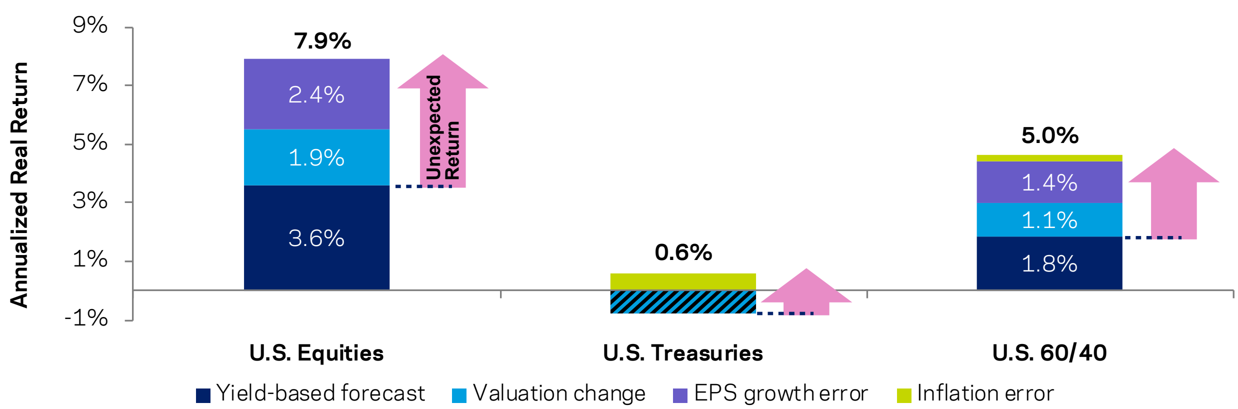
What would have to happen for 60/40 to deliver 5% real over the *next* 10 years?

Our CMA framework allows us to break down and quantify what needs to happen for markets to defy "low expected returns" gloomsters like us yet again. Here is one possible (if unlikely) scenario:

- Equities deliver 7.9% real return, instead of our forecast 3.6%
  - — Market richens another 20%, Shiller CAPE exceeding Tech bubble peak (worth 1.9% pa)
  - — Real EPS growth is 3.9% instead of assumed 1.5% (worth 2.4% pa)
- Bonds deliver 0.6% real return instead of our forecast -0.8%
  - — Yields fall 100bps from current levels, with U.S. 10-year yield at 0.5% (worth 0.8% pa)
  - — Inflation averages 2% instead of the forecast 2.6% (worth 0.6% pa)

Exhibit 10 illustrates this rosy scenario. Some investors may plausibly believe the 2020s will be a decade of ever-rising valuations, strong growth and low inflation. If so, traditional portfolios could perform strongly again. If not – and of course the pink arrows in the chart can also go in the other direction – what changes to strategic asset allocation could improve portfolio expected returns in the current yield environment? We turn to this question in our final section.

Exhibit 10: Possible Scenario for Unexpected Returns, Delivering 5% Real in the Next 10 Years



Source: AQR. Yield-based forecasts are as described earlier in this article. For illustrative purposes only – this scenario is not a forecast. Striped fill indicates positive valuation change fully offsets negative forecast.

The 4% solution? Practical strategic steps to boost portfolio expected returns

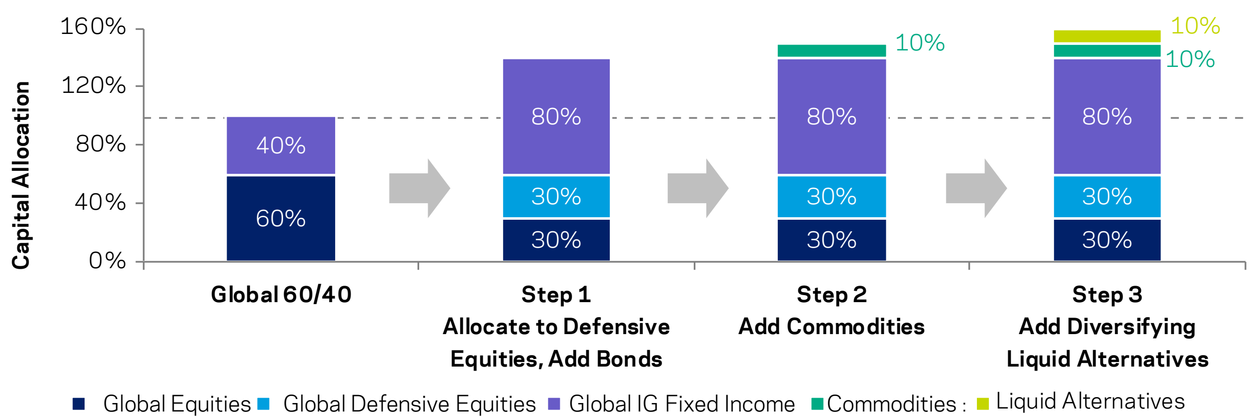
We now consider several incremental changes that could, according to the assumptions presented in these pages, raise the expected return of a traditional portfolio without a material impact on portfolio risk. The three steps are illustrated in **Exhibit 11.**

Step 1 begins with a factor tilt. Specifically, we reallocate half of the 60% (cap-weighted) equity allocation to defensive equities. According to our assumptions (and supported by a raft of evidence) this may be expected to maintain the expected return while reducing portfolio risk, providing a risk budget for our other enhancements. At the same time, we apply modest leverage to the bond allocation, adding another 40% of NAV to our bond exposure. This takes advantage of positive risk premia and improves the portfolio's risk balance.

Step 2 adds a 10% commodity allocation in the form of a derivatives overlay. This brings portfolio risk back up to where it started, and adds another positive risk premium that has tended to be especially diversifying in inflationary scenarios.

Finally, **Step 3** adds an allocation to diversifying dynamic strategies. These could include alternative risk premia (ARP), trend following, global macro and others. We use our ARP assumption as a proxy.

Exhibit 11: Practical Steps That May Increase Portfolio Expected Return



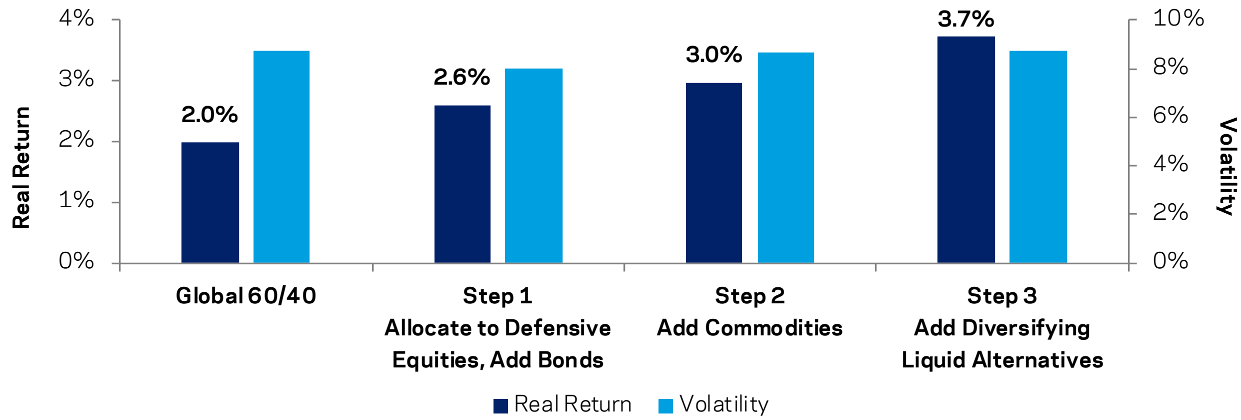
AQR. For illustrative purposes only.

The role of leverage: These steps are designed to combine better diversification with the use of moderate leverage to convert that diversification into higher expected returns. For investors unable or unwilling to use direct leverage in this way (even via derivatives), a similar effect can be achieved using delegated leverage in strategies such as risk parity.[23] Some investors pursue higher returns via levered equity exposure (private equity). This approach *can* also help improve diversification if it is combined with a dollar tilt away from equities to fund diversifying strategies. We believe investors should be wary of raising expected returns simply by adding to their portfolio's dominant risk.

23 For example, the bond and commodity additions described above can be approximately replicated without any direct leverage, using a 35% allocation to a risk parity strategy targeting 10% volatility, funded mainly from bonds and partly from equities.

Exhibit 12 shows the impact on expected real return and risk. According to our assumptions, these diversifying steps raise the expected real return from 2% to almost 4%, at a similar level of risk. To achieve 5% real return in this environment, investors may have to accept a higher level of risk. The alternative is to increase savings and accept lower returns for their investments. These unpalatable choices may be an unavoidable consequence of pervasive low riskless real rates.

Exhibit 12: Impact of Proposed Steps, According to Our Assumptions



Source: AQR. Real returns are based on assumptions described herein. Volatilities are based on monthly historical data since January 1990. For illustrative purposes only.

The solutions outlined above are very similar to those prescribed in our paper a decade ago: use financial tools to embrace and monetize diversification across many sources of returns. Back then, we added recommendations for careful portfolio construction and risk management, and rigorous cost control. Those also apply today.

Maybe the next 10 years will see a continuation of the recent golden era for traditional portfolios, with all the inputs to our return estimates once again surprising on the upside, and we'll be writing another *mea culpa* in 2032. But we wouldn't bet on it.

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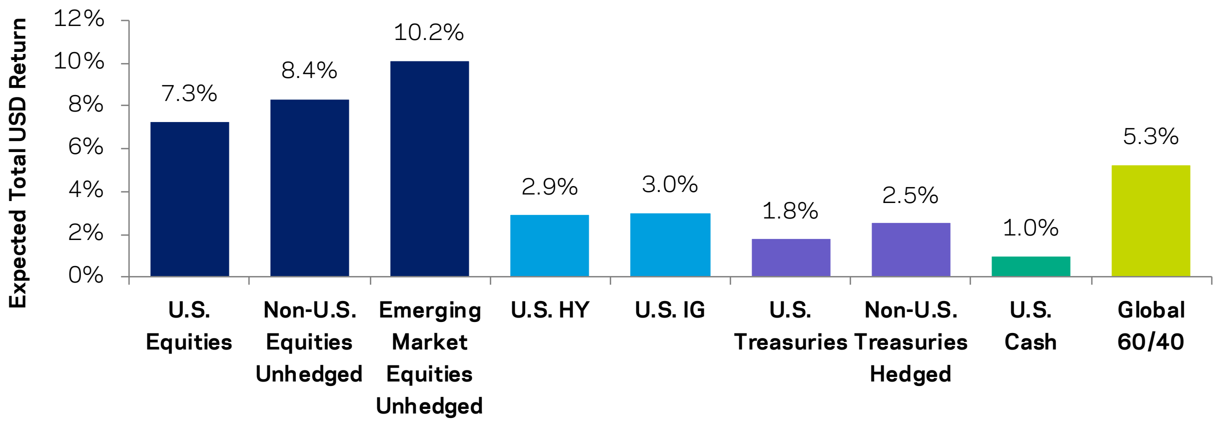
Appendix

Translating Local Real Returns to Expected Total Returns for a Given Base Currency

In the rest of this paper we report local real and excess-of-cash returns. In **Exhibit A1** we translate these into *nominal arithmetic* returns by adding local expected inflation and variance drag terms. We also quote *unhedged* U.S. dollar estimates for non-U.S. equities, in line with common investing practice. Currency return assumptions are based on expected inflation differentials. Expected returns for other base currencies are available on request.

Exhibit A1: Expected Total Nominal Arithmetic Returns for a U.S. Dollar Investor



Source: AQR. Estimates as of December 31, 2021 are USD-denominated total nominal annual arithmetic rates of return. "Non-U.S. developed equities" is cap-weighted average of Euro-5, Japan, U.K., Australia and Canada, unhedged. U.S. and Non-U.S. Treasuries are represented by the respective Bloomberg Barclays indices. Global 60/40 is a 60%/40% weighted average of the developed equities listed above and developed government bonds listed above, respectively. Estimates are for illustrative purposes only, are not a guarantee of performance and are subject to change.

Sources and Methodology for Long-Term Historical Expected Returns

Sources for historical equity and bond expected returns are AQR, Robert Shiller's data library, Kozicki-Tinsley (2006), Federal Reserve Bank of Philadelphia, Blue Chip Economic Indicators, Consensus Economics and Morningstar. Prior to 1926, stocks are represented by a reconstruction of the S&P 500 available on Robert Shiller's website which uses dividends and earnings data from Cowles and associates, interpolated from annual data. After that, stocks are the S&P 500. Bonds are represented by long-dated Treasuries. The equity yield is a 50/50 mix of two measures: 50% Shiller E/P * 1.075 and 50% Dividend/Price + 1.5%. Scalars are used to account for long term real Earnings Per Share (EPS) Growth. Bond yield is 10-year real Treasury yield minus 10-year inflation forecast as in *Expected Returns* (Ilmanen, 2011), with no rolldown added.

Methodology for Forecast Error Analysis (Exhibit 1)

We first produce historical time series of yield-based estimates for U.S. equities and U.S. Treasuries using the method described in the previous paragraph (analysis starts in 1900, but we use data from 1870s onwards). We test their predictive power using quarterly overlapping 10-year periods since 1900 and measure the distribution of errors. See the 2018 edition for more details. Error ranges in **Exhibit 1** are based on interquartile ranges of these distributions, adjusted for current volatility estimates.

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Index Definitions:

The **S&P 500 Index** is the Standard & Poor's composite index of 500 stocks, a widely recognized, unmanaged index of common stock prices.

The **FTSE 100 Index** is an index composed of the 100 largest companies by market capitalization listed on the London Stock Exchange.

The **TOPIX Index** is a free-float adjusted market capitalization-weighted index that is calculated based on all the domestic common stocks listed on the TSE First Section.

The **MSCI Emerging Markets Index** is a free float-adjusted market capitalization index that is designed to measure equity market performance of emerging markets.

The **Bloomberg Barclays U.S.Corporate Bond Index** measures the USD-denominated, investment-grade, fixed-rate, taxable corporate bond market.

The **Bloomberg Barclays U.S.Corporate High Yield Index** 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.

The **Bloomberg Barclays Emerging Markets Hard Currency (USD) Sovereign Index** is an Emerging Markets debt benchmark that includes USD-denominated debt from sovereign EM issuers.

The **NCREIF Property Index** measures the performance of real estate investments on a quarterly basis and evaluates the rate of returns in the market. The NPI covers properties that are acquired in place of institutional investors that are exempted from taxes in the fiduciary environment.

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