



Capital Market Assumptions

FIVE-YEAR PERSPECTIVE 2022

Euro





TABLE OF CONTENTS

1	Euro Capital Market Assumptions	4
2	Methodology	11
3	Appendix	19

The T. Rowe Price
Capital Market Assumptions
benefit from the expertise of our
global investment platform.

Capital Market Assumptions Five Year Perspective | 2022

In-depth analysis and insights to inform your decision-making.

We are pleased to present the fourth annual publication of T. Rowe Price's Capital Market Assumptions. Since the onset of the COVID-19 crisis, investors have experienced a wide range of environments over a compressed timeline. At the start of 2021, the global impact of government policies had turned many financial markets skeptics into optimists. But persistent dislocations within regional economies and the shifting positions of central bank policymakers tested the resolve of financial markets throughout the year. Looking ahead, open questions remain about the strength of the cyclical recovery, the speed of normalization for monetary policy, and the durability of recent changes to the global economy brought on by the pandemic.

Our forecasts for most equity markets are comparable to, or slightly more bullish than they were at this time last year, reflecting our continued confidence in the cyclical earnings recovery, which we believe has further room to run. In contrast, we think the same expected economic strength could negatively impact fixed income assets due to an expectation that rates will rise from their current low levels. Lastly, our forecasts for alternative investment strategies generally have improved, driven both by higher risk asset premia forecasts and our expectations for increased return dispersion and greater opportunities for active management to add value across investment universes.

T. Rowe Price's capital market assumptions are best understood as forecasts of the central tendency of forward returns. We do not seek to predict actual or realized returns, as there is bound to be material variation around this central tendency in any given historical or future period. For this reason, our approach to portfolio construction relies on multiple optimization methods and robustness checks.

Our baseline forecasts incorporate the insights of senior portfolio managers and analysts across our equity, fixed income, and multi-asset divisions. We believe this interdisciplinary approach, which seeks to capture both fundamental and quantitative insights, delivers the best thinking of T. Rowe Price.

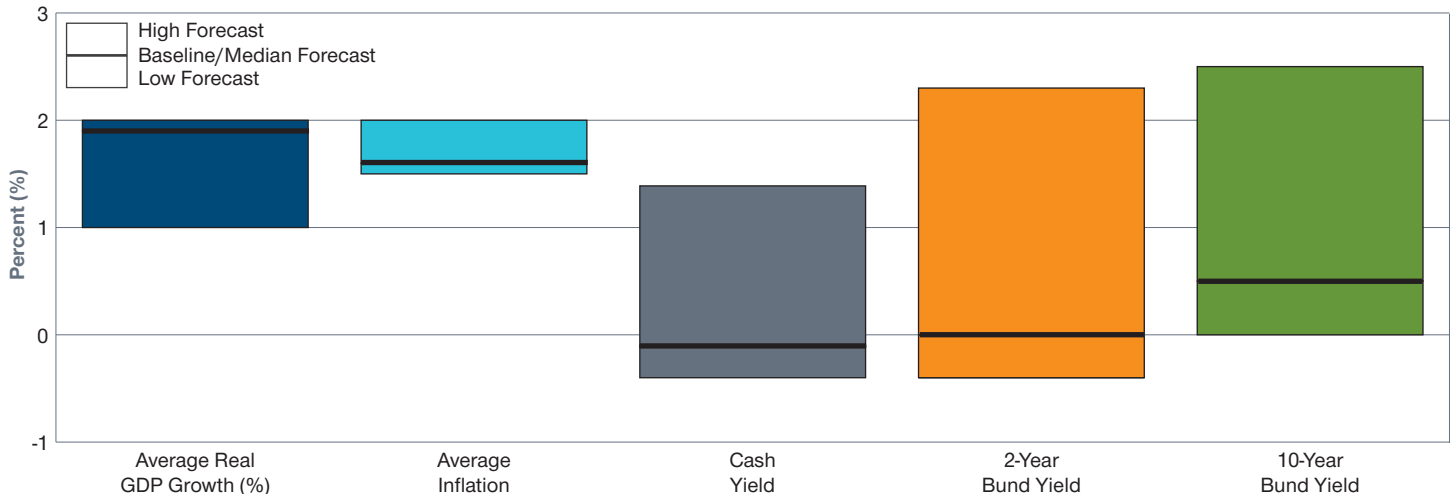
We encourage your questions, comments, and feedback as they truly impact the improvements we make to this publication. Please feel free to contact your T. Rowe Price relationship manager and/or any of the investment professionals who contributed to this effort.

This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance.

EURO



RANGE OF EUROZONE ECONOMIC FORECASTS FOR THE 5-YEAR PERIOD ENDING DECEMBER 31, 2026



Source: T. Rowe Price.

COMMENTARY ON BASELINE FORECASTS

Economies and financial markets saw varying degrees of normalization in 2021, and contrasts across investments were stark, or even paradoxical at times. Vaccine distribution and adoption in developed countries allowed for some return to economic normalcy, while developing countries still had to contend with the lingering virus more so than other countries.

Within financial markets, pockets of euphoria drove cryptocurrencies and meme stocks, as well as some tech giants “to the moon,” while bond markets—aided by central bank accommodation—kept interest rates near rock bottom. These conflicting observations present a greater challenge to our 2022 forecasts and impose wider bands around our confidence levels, but our base case is outlined below.

Investment outlooks are always uncertain, but investment decisions can be made easier by the margin of protection provided by valuations. Heading into 2022, valuations for most asset classes appear full — particularly equity market multiples, but also extending to credit spreads and government bond yields.

Economic

Economic performance since the onset of the pandemic has been driven primarily by government action. The unprecedented fiscal stimulus seen during the pandemic has diminished, and our forecasts for real GDP reflect a muted outlook globally. We expect inflation to meet or exceed 2% in the U.S., Australia, and the UK but to remain well below central bank targets in much of the Eurozone and in Japan.

Notably, the dispersion of GDP growth, inflation expectations, and yield curve views expressed by T. Rowe Price investment professionals has increased from last year, highlighting the extent of uncertainty in the markets. Overall, our economic growth forecast remains positive, but headwinds from fiscal run-off and lingering supply bottlenecks stemming from the pandemic temper our expectations.

Equity

Our five-year expectations for equity returns are generally stable to slightly higher versus last year. Globally, our baseline forecast of modest earnings growth and a slight contraction in valuations,

produces five-year total return expectations that would rank in the bottom third of realized returns historically.

As the comparatively slow recovery of emerging markets (EMs) from the pandemic takes shape, we expect EM equities to outperform their counterparts in the developed markets. In a similar reversal of recent history, our expectations for Eurozone, UK, and Japanese equities generally outpace the U.S. Our change in regional equity market relative performance is primarily driven by valuations, which we view as marginally stretched at present and declining through our forecast horizon.

Fixed Income

Across the government yield curves covered by our publication, we expect interest rates to rise over the next five years. While we recognize the despair of those who have predicted rising rates over the past decade, we believe the combined effects of recent fiscal and monetary policies have created an environment that is unique for the era that has followed the 2008-2009 global financial crisis.

Generally, our investment professionals expect yield curves to flatten as economic recovery prompts central banks to raise short rates. We believe the duration impact will be most sharply felt in government bond indexes, where we expect total returns of less than one percent, with some dipping into negative territory. This should not be surprising given the current negative yields in many Eurozone countries and in Japan.

We anticipate that credit spreads for investment grade and high yield corporate debt will widen slightly in developed markets but expect this to have a relatively muted impact on returns. While this forecast may seem inconsistent with our generally positive outlook for risk assets, we believe a stronger economic backdrop and higher interest rates may relieve some of the downward pressure on spreads.

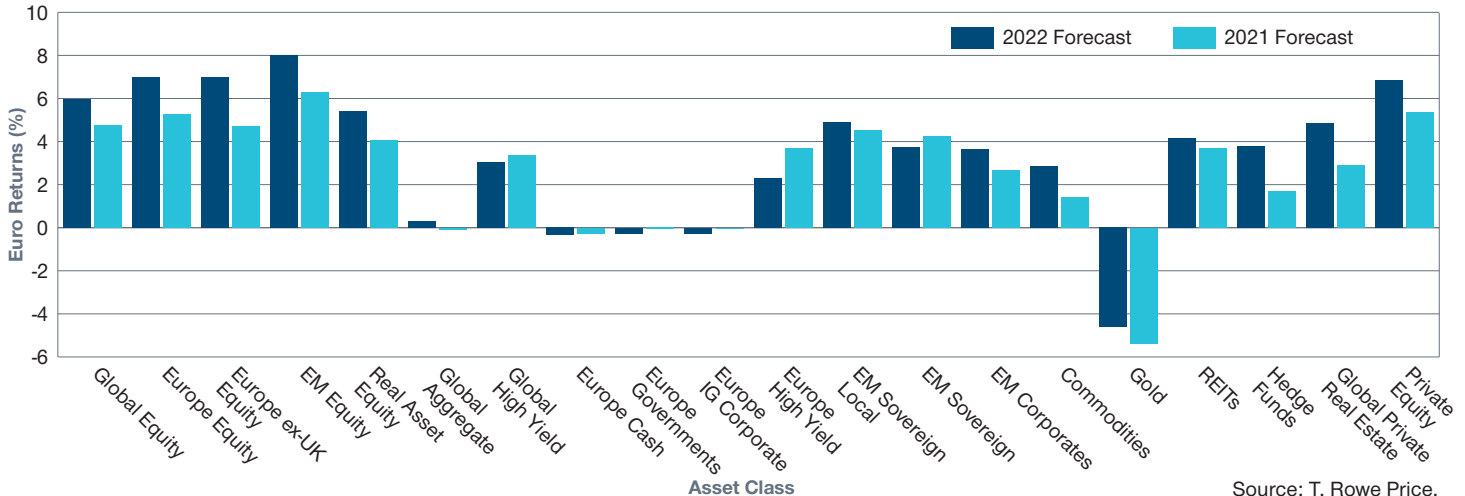
Alternatives

Our slightly more bullish expectations for public equity markets relative to our 2021 outlook carries through to forecasts of alternative asset classes which have some structural equity beta. We also believe the



(Figures in Euros)

COMPARISON OF 2022 AND 2021 RETURN FORECASTS



Source: T. Rowe Price.

The forecasts contained herein are for illustrative purposes only and are not indicative of future results.

backdrop for active management will be more favorable, leading to higher return expectations for asset classes like hedge funds and private equity which rely on active management for a significant amount of their value proposition.

Our higher return expectations for commodities logically follow from our inflation forecasts. Our expectations for private assets continue to include a slight liquidity premium, but we believe they will not offer dramatically higher returns than their public market equivalents. We continue to expect negative total returns from gold, continuing 2021's momentum.

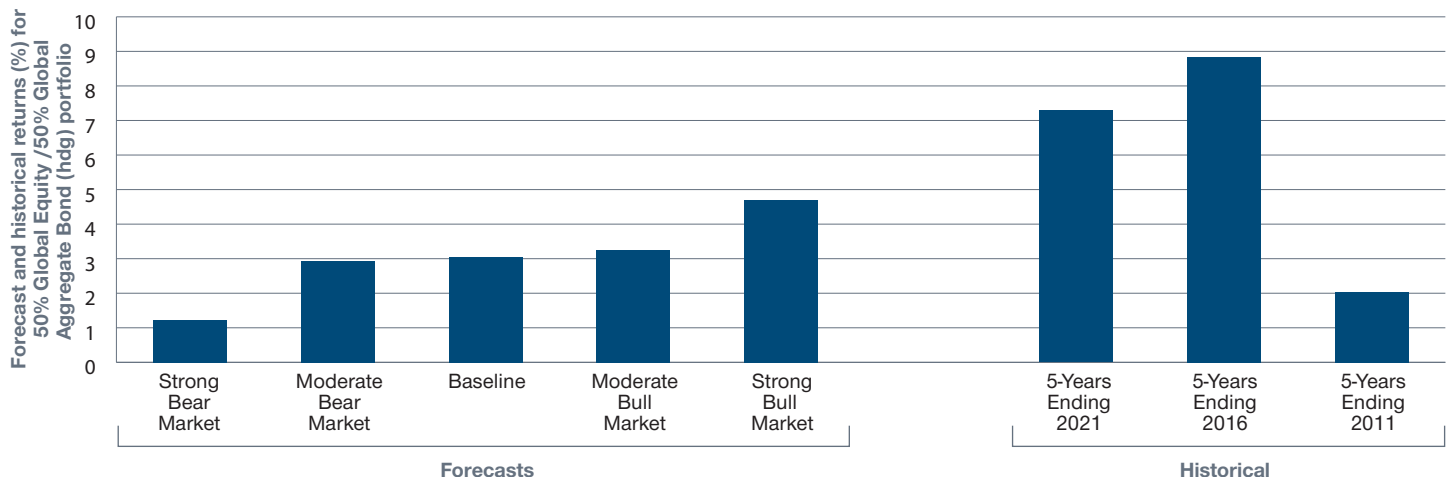
Eurozone

Our forecast for the Eurozone reflects a continuation of strong 2021 earnings growth and the critical role that European banks have in financing investments related to renewable energy. As the globe transitions from carbon fuels to cleaner sources of energy, we see sectors within Europe equities poised to benefit. Shorter term,

lockdowns and continued Coronavirus uncertainty may way on the region. The European Central Bank (ECB) has also signaled any exit from ultra-easy monetary policy will be slow, leading to less yield curve movement in the Eurozone than our investors expect in other developed markets.

Given our expectation for slightly improved economic conditions for the region, our forecasts see the German bund curve shift up approximately 70 bps by the end of 2026. This nearly parallel curve movement contributes to relatively muted multi-asset portfolio return expectations relative to recent history. We present 5 forecast scenarios of returns for a 50% global equity and 50% global fixed income hedged portfolio and the historical returns for 5-year periods ended on December 31, 2021, 2016, and 2011, respectively. Our bullish forecasts are less optimistic than recent historical returns have been and much of that is due to low and negative levels of fixed income yield and stretched equity valuations globally at the beginning of the forecast period.

IMPACT OF LOW EXPECTED RETURNS ON MULTI-ASSET PORTFOLIOS



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Representative indexes are MSCI ACWI (EUR) and Bloomberg Global Aggregate Bond (Hdg EUR) Index.

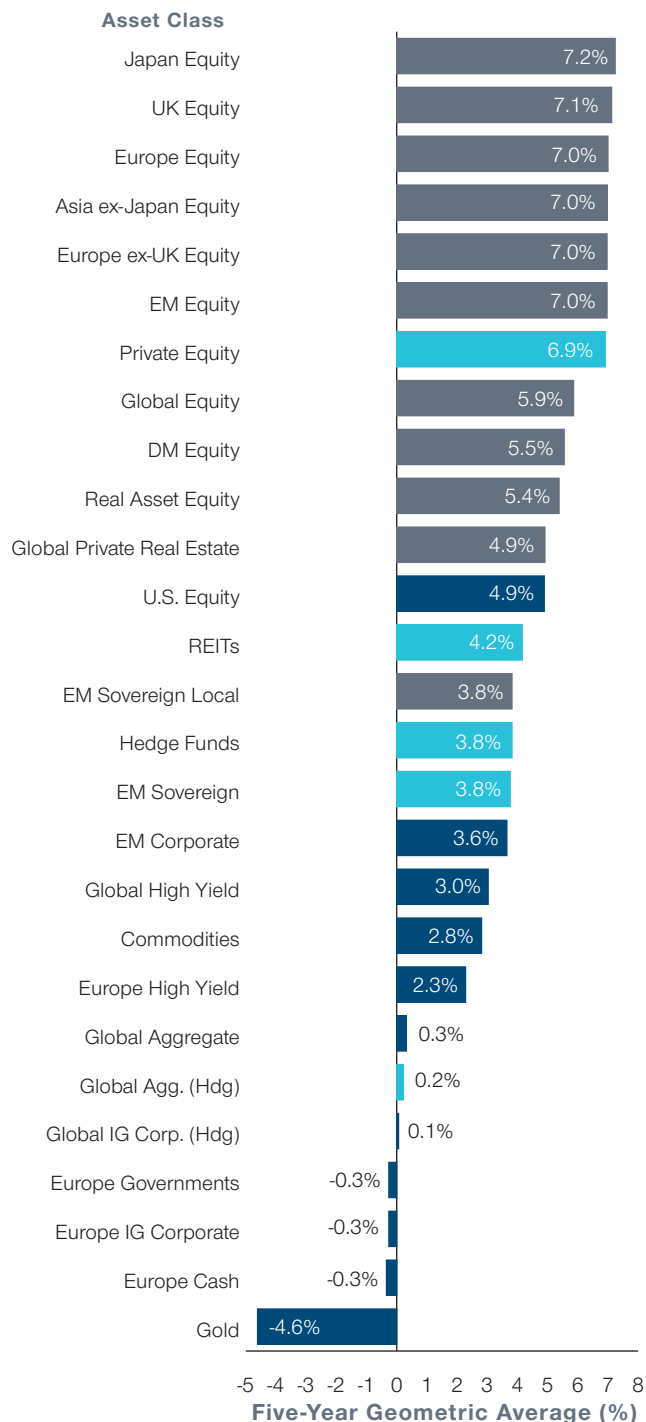
Refer to page 18, "Methodology – Scenarios" for definition of Bear and Bull Markets.



ANNUALIZED FORECAST AND HISTORICAL NOMINAL RETURNS

ASSET CLASS	2022 5-YEAR RETURN FORECAST	HISTORICAL 5-YEAR RETURNS, ENDED 31 DECEMBER		
		2021	2016	2011
EQUITY	Global Equity	5.9%	13.2%	14.5%
	DM Equity	5.5	13.9	15.7
	U.S. Equity	4.9	16.7	19.5
	Europe Equity	7.0	9.1	11.3
	Europe ex-UK Equity	7.0	10.6	12.8
	UK Equity	7.1	5.0	8.6
	Asia ex-Japan Equity	7.0	9.9	9.5
	Japan Equity	7.2	6.8	13.4
	EM Equity	7.0	8.5	5.8
	Real Asset Equity	5.4	5.8	8.9
FIXED INCOME	Global Aggregate	0.3	1.8	4.5
	Global Aggregate (Hdg)	0.2	1.4	3.1
	Global IG Corporate (Hdg)	0.1	2.7	4.3
	Global High Yield	3.0	4.3	11.5
	Europe Cash	-0.3	-0.4	0.3
	Europe Governments	-0.3	1.7	5.8
	Europe IG Corporate	-0.3	1.8	5.6
	Europe High Yield	2.3	4.1	10.6
	EM Sovereign Local	3.8	1.3	2.9
	EM Sovereign	3.8	3.1	10.4
	EM Corporate	3.6	3.7	10.4
ALTERNATIVES	Commodities	2.8	2.1	-5.1
	Gold	-4.6	6.8	-2.6
	REITs	4.2	10.7	16.7
	Hedge Funds	3.8	6.7	3.9
	Global Private Real Estate	4.9	4.7	15.6
	Private Equity	6.9	16.5	17.8

FIVE-YEAR ANNUALIZED EXPECTED RETURNS



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Hdg = Hedged currency treatment. EM = Emerging Markets. DM = Developed Markets.

Sources: MSCI, Bloomberg Index Services Limited, S&P, J.P. Morgan Chase & Co., HFR, Cambridge Associates, NCREIF, and FTSE/Russell. Analysis: T. Rowe Price. See Additional Disclosures in Appendix for further source information. January 2022. See Appendix for a representative list of indexes. This information is not intended to be investment advice or a recommendation to take any particular investment action.

Forecasts are based on subjective estimates about market environments that may never occur. See the Methodology section for additional information.



FIVE-YEAR SCENARIO ANNUALIZED RETURNS

	ASSET CLASS	BASELINE	STRONG BEAR MARKET	MODERATE BEAR MARKET	MODERATE BULL MARKET	STRONG BULL MARKET
	Global Equity	7.4	3.5	6.8	7.6	9.3
	DM Equity	5.5	1.7	5.1	5.8	8.3
	U.S. Equity	7.1	3.4	6.4	7.3	9.1
	Europe Equity	4.9	1.0	4.5	5.1	8.0
	Europe ex-UK Equity	5.8	0.1	5.2	6.0	9.9
	UK Equity	7.0	3.2	6.8	7.3	9.5
	Asia ex-Japan Equity	7.0	3.0	6.6	7.3	8.5
	Japan Equity	7.2	3.7	5.6	7.4	8.5
	EM Equity	8.3	3.8	7.7	8.5	10.0
	Real Asset Equity	5.4	2.2	5.0	5.6	7.5
	Global Aggregate	0.3	0.5	0.4	0.3	0.6
FIXED INCOME	Global Aggregate (Hdg)	0.5	0.5	0.4	0.3	0.6
	Global IG Corporate (Hdg)	0.4	0.6	0.5	0.3	0.4
	Global High Yield	0.4	0.6	0.5	0.3	0.4
	Europe Cash	0.3	0.1	0.2	0.3	1.3
	Europe Governments	3.0	-0.4	3.0	3.1	4.6
	Europe IG Corporate	1.0	0.5	0.7	0.9	1.0
	Europe High Yield	0.0	0.7	0.0	0.0	0.0
	EM Sovereign Local	0.0	-0.3	0.0	0.0	0.6
	EM Sovereign	0.8	0.4	0.9	0.8	1.2
	EM Corporate	3.6	1.7	2.8	3.7	4.9
ALTERNATIVES	Commodities	2.8	1.7	2.4	2.7	2.6
	Gold	-4.6	-2.1	-2.8	-4.8	-5.1
	REITs	4.2	0.2	3.9	4.4	8.7
	Hedge Funds	3.8	3.1	3.5	3.7	3.5
	Global Private Real Estate	4.9	3.5	4.6	4.9	5.5
	Private Equity	6.9	5.5	6.6	6.9	7.5

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Hdg = Hedged currency treatment. EM = Emerging Markets. DM = Developed Markets.

Sources: MSCI, Bloomberg Index Services Limited, S&P, J.P. Morgan Chase & Co., HFR, Cambridge Associates, NCREIF, and FTSE/Russell. Analysis: T. Rowe Price. See Additional Disclosures in Appendix for further source information. January 2022. See Appendix for a representative list of indexes. This information is not intended to be investment advice or a recommendation to take any particular investment action.

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EXPECTED VOLATILITIES AND CORRELATIONS

Volatility and Correlation Matrix		EQUITY										FIXED INCOME			
		Global Equity	DM Equity	U.S. Equity	Europe Equity	Europe ex-UK Equity	UK Equity	Asia ex-Japan Equity	Japan Equity	EM Equity	Real Asset Equity	Global Aggregate	Global Aggregate (Hdg)	Global IG Corporate (Hdg)	Global High Yield
EQUITY	Global Equity	1.0													
	DM Equity	1.0	1.0												
	U.S. Equity	0.9	0.8	1.0											
	Europe Equity	0.9	0.8	1.0	1.0										
	Europe ex-UK Equity	0.9	0.8	1.0	0.9	1.0									
	UK Equity	0.9	0.7	0.8	0.8	0.8	1.0								
	Asia ex-Japan Equity	0.8	0.7	0.7	0.7	0.7	0.6	1.0							
	Japan Equity	0.9	0.7	0.9	0.8	0.8	1.0	0.6	1.0						
	EM Equity	0.9	0.9	0.8	0.7	0.9	0.7	0.6	0.8	1.0					
	Real Asset Equity	0.0	0.1	-0.1	-0.2	-0.1	0.0	0.2	-0.1	0.3	1.0				
FIXED INCOME	Global Aggregate	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1	0.1	0.5	1.0			
	Global Aggregate (Hdg)	0.5	0.4	0.5	0.5	0.5	0.5	0.3	0.5	0.5	0.1	0.6	1.0		
	Global IG Corporate (Hdg)	0.8	0.7	0.7	0.6	0.7	0.7	0.6	0.7	0.9	0.2	0.0	0.5	1.0	
	Global High Yield	-0.1	-0.1	0.0	0.0	0.0	0.1	-0.1	0.0	0.0	0.2	0.0	-0.2	-0.1	1.0
	Europe Cash	-0.2	-0.1	-0.2	-0.1	-0.2	-0.1	-0.1	-0.2	0.0	0.5	0.9	0.4	0.0	0.0
	Europe Governments	0.6	0.5	0.6	0.6	0.5	0.6	0.3	0.6	0.5	0.0	0.5	0.9	0.6	-0.1
	Europe IG Corporate	0.7	0.6	0.8	0.8	0.8	0.7	0.4	0.8	0.7	-0.2	0.0	0.7	0.8	0.0
	Europe High Yield	0.6	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.7	0.4	0.3	0.5	0.6	0.1
	EM Sovereign Local	0.5	0.6	0.4	0.4	0.4	0.5	0.5	0.5	0.7	0.6	0.4	0.5	0.8	-0.1
	EM Sovereign	0.6	0.6	0.4	0.4	0.5	0.5	0.5	0.5	0.7	0.6	0.3	0.4	0.9	-0.1
	EM Corporate	0.6	0.5	0.5	0.5	0.6	0.5	0.4	0.6	0.7	-0.1	-0.2	0.2	0.5	0.0
	Commodities	0.0	0.0	-0.1	-0.1	-0.1	0.1	0.0	0.1	0.2	0.6	0.4	0.1	0.1	0.2
	Gold	0.7	0.8	0.6	0.6	0.7	0.5	0.5	0.5	0.8	0.2	0.1	0.5	0.7	-0.2
ALTERNATIVES	REITs	0.7	0.8	0.7	0.6	0.7	0.5	0.5	0.5	0.8	0.3	0.1	0.4	0.7	0.0
	Hedge Funds	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.1	0.2	0.1
	Global Private Real Estate	0.2	0.3	0.0	-0.1	0.1	0.0	0.3	-0.1	0.3	0.7	-0.1	-0.3	0.3	-0.1
	Private Equity	0.7	0.8	0.6	0.6	0.7	0.6	0.6	0.6	0.8	0.3	-0.3	0.1	0.7	0.0

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EXPECTED VOLATILITIES AND CORRELATIONS (CONTINUED)

Volatility and Correlation Matrix				FIXED INCOME					ALTERNATIVES						VOLATILITY (%)
		Europe Cash	Europe Governments	Europe IG Corporate	Europe High Yield	EM Sovereign Local	EM Sovereign	EM Corporate	Commodities	Gold	REITs	Hedge Funds	Global Private Real Estate	Private Equity	
EQUITY	Global Equity														15.6
	DM Equity														15.5
	U.S. Equity														15.8
	Europe Equity														16.7
	Europe ex-UK Equity														17.2
	UK Equity														16.6
	Asia ex-Japan Equity														18.5
	Japan Equity														16.3
	EM Equity														19.8
	Real Asset Equity														18.5
FIXED INCOME	Global Aggregate														6.9
	Global Aggregate (Hdg)														3.0
	Global IG Corporate (Hdg)														4.9
	Global High Yield														11.4
	Europe Cash	1.0													0.8
	Europe Governments	0.5	1.0												4.2
	Europe IG Corporate	-0.1	0.7	1.0											4.3
	Europe High Yield	0.2	0.5	0.5	1.0										14.3
	EM Sovereign Local	0.3	0.5	0.4	0.7	1.0									9.7
	EM Sovereign	0.2	0.4	0.5	0.7	0.9	1.0								10.1
EM Corporate	-0.3	0.2	0.4	0.3	0.3	0.4	1.0							10.0	
ALTERNATIVES	Commodities	0.2	0.0	-0.1	0.4	0.4	0.4	0.2	1.0						17.4
	Gold	0.1	0.5	0.6	0.6	0.6	0.6	0.4	0.1	1.0					14.7
	REITs	0.1	0.5	0.5	0.6	0.6	0.5	0.4	0.1	1.0	1.0				22.8
	Hedge Funds	0.0	0.1	0.1	0.3	0.2	0.2	0.2	0.0	0.2	0.2	1.0			8.7
	Global Private Real Estate	0.0	-0.3	-0.3	0.2	0.5	0.5	0.1	0.3	0.3	0.3	0.1	1.0		10.5
	Private Equity	-0.2	0.1	0.4	0.4	0.6	0.6	0.6	0.2	0.5	0.6	0.3	0.6	1.0	21.4

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METHODOLOGY

METHODOLOGY

Fixed Income



Basic Model

We decompose fixed income sector returns into three components: the average yield over the five-year period, the average roll-down yield over the five-year period, and the average annual return due to changes in valuation over the five-year period:

$$\text{Return} = \text{average yield} + \text{roll-down} + \text{valuation change}$$

These three components are calculated from the following inputs: current yield, forecast yield, and current duration for a given asset class.

Current Yield

The current yield is calculated using linear interpolation—matching the yield on the appropriate sovereign yield curve for the maturity that matches the current duration of the sector. For spread sectors, the current option-adjusted spread is added to the yield of the sovereign maturity that matches the duration of the spread sector.

Forecast Yield

The forecast yield is calculated similar to the current yield, with the inputs provided by the survey results. For a non-government index (e.g., credit), the five-year spread forecast from our survey is then added to the forecast sovereign yield.

Current Duration

The current duration is used in two ways. First, to find current yield through duration matching to the sovereign curve, as discussed above. Second, it is used to calculate the average annual roll-down yield and return due to valuation change. These calculations assume the sector will maintain a constant duration throughout the subsequent five-year period. Our research shows that this assumption, while not perfect, is reasonable since modified durations typically vary within +/- one year over rolling five-year windows.

Average Yield

The average yield is the simple average of the current yield and the forecast yield five years forward, incorporating expectations for spread capture ratios in non-Treasury asset classes:

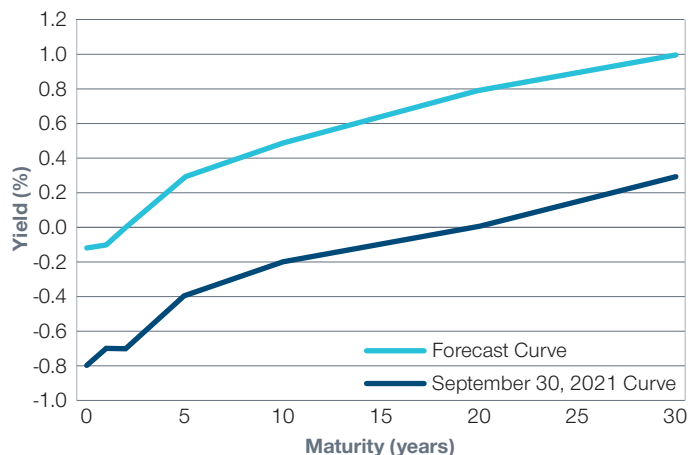
$$\text{Average yield} = (\text{current yield} + \text{forecast yield}) / 2$$

Change in Yield

The change in yield is the annual average change from the current yield to the five-year forecast yield:

$$\text{Yield change} = (\text{forecast yield} - \text{current yield}) / 5$$

FORECAST GERMAN BUND CURVE



Source: T. Rowe Price.

Roll-Down Return

The roll-down return is earned through rebalancing each year to maintain a constant duration. The return is due to the convergence of a bond's end-of-period yield to the beginning-of-period yield of an equivalent bond with a one-year shorter maturity. Thus, we estimate the roll-down return as follows:

1. First, we use the same estimation methods as for the current and forecast rolled-down yields, except that we interpolate to the maturity points on the current and future yield curves that are one year less than the current average maturity of the index.
2. Second, we estimate the average rolled-down yield over the five-year period as the simple average of the current and forecast rolled-down yields from step 1:

$$\text{Average rolled-down yield} = (\text{current rolled-down yield} + \text{forecast rolled-down yield}) / 2$$

3. Third, we calculate the average annual change in yield due to rolling down the curve (roll-down change):

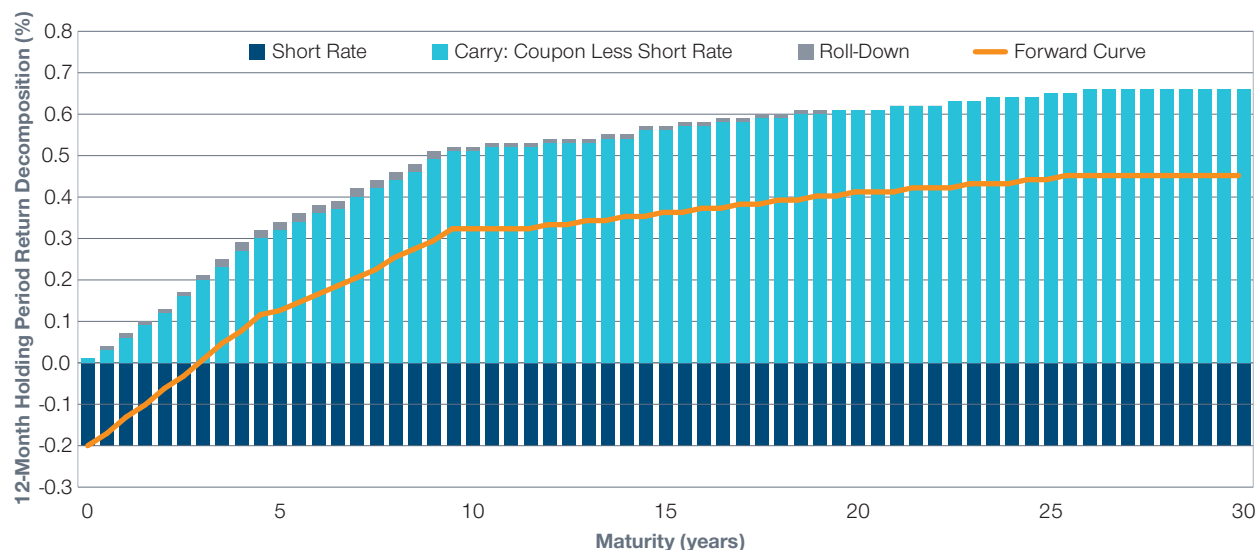
$$\text{Average roll-down change} = (\text{average rolled-down yield} - \text{average yield}) / 5$$

4. Last, we multiply the current duration by the roll-down change to get the average annual return to the index from rolling down the yield curve:

$$\text{Average roll-down return} = \text{current duration} \times \text{average roll-down change}$$



CARRY AND ROLL-DOWN FOR GOVERNMENT BONDS



Valuation Change

Valuation change has two components: the return due to changes in the level of the underlying sovereign curve and the return due to changes in the spread over the sovereign curve.

Average level change return = current duration x yield change

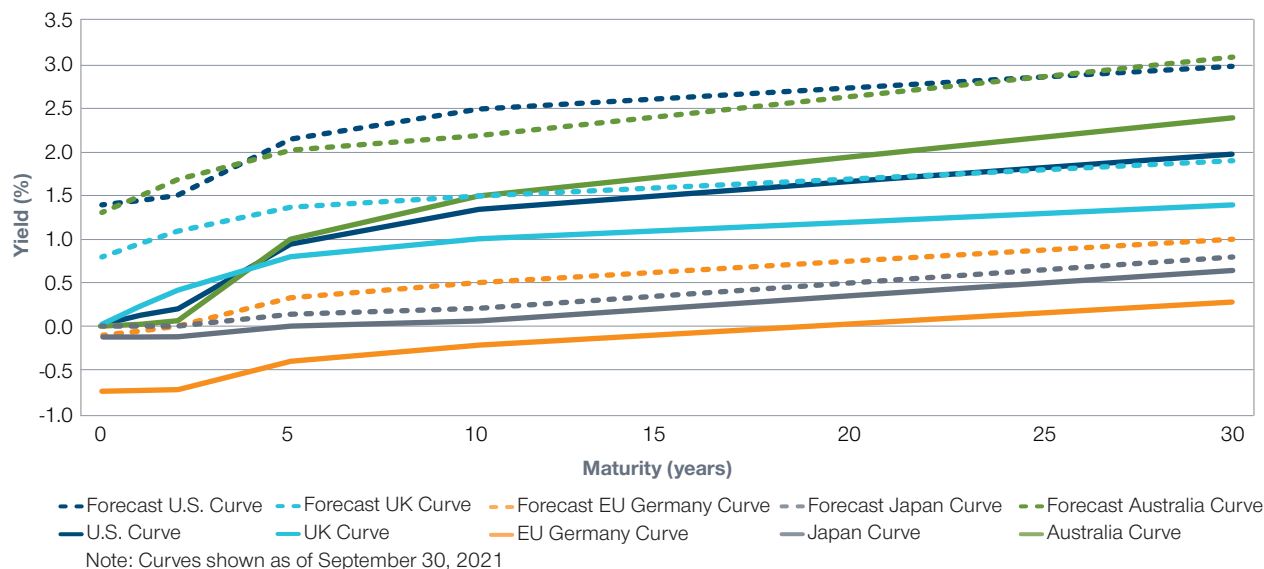
Comment on Durations

We use analytical modified adjusted durations to ascertain the correct point on the yield curve for interpolation. However, we use empirical durations for estimating the returns from valuation changes so that we can ensure we cleanly separate the duration due purely to level changes in the underlying sovereign curve and changes in spread levels for a sector.

Inflation-Linked Bonds

We decompose inflation-linked bond returns into two components: the portion of return due to underlying changes in the nominal sovereign curve and the portion attributable to unexpected changes in inflation. The nominal government bond return is developed using the same process as described previously. The unexpected inflation return is computed by subtracting the current five-year consensus inflation estimate from our inflation forecast and then multiplying by the current duration of the index.

GLOBAL YIELD CURVES





METHODOLOGY

Equities

The capital market assumptions for equities provide return forecasts for the U.S., the UK, Europe, Japan, Australia, and emerging markets. U.S. returns are further broken out by large-cap and small-cap returns. Our survey process leverages the knowledge and expertise of our global equity portfolio manager and analyst teams via forecasts for each market that are combined to arrive at a global equity forecast. We blend the survey results with market data to develop our equity market assumptions.

Survey Data:

1. Expected Inflation—headline consumer price index annualized over the next five years
2. Real earnings per share (EPS) growth—arithmetic average over the next five years

3. Future price/earnings ratio (P/E)—multiple in five years' time

Market Data:

1. Dividend yield—historical average percentage yield
2. Current P/E—Last 12-month P/E

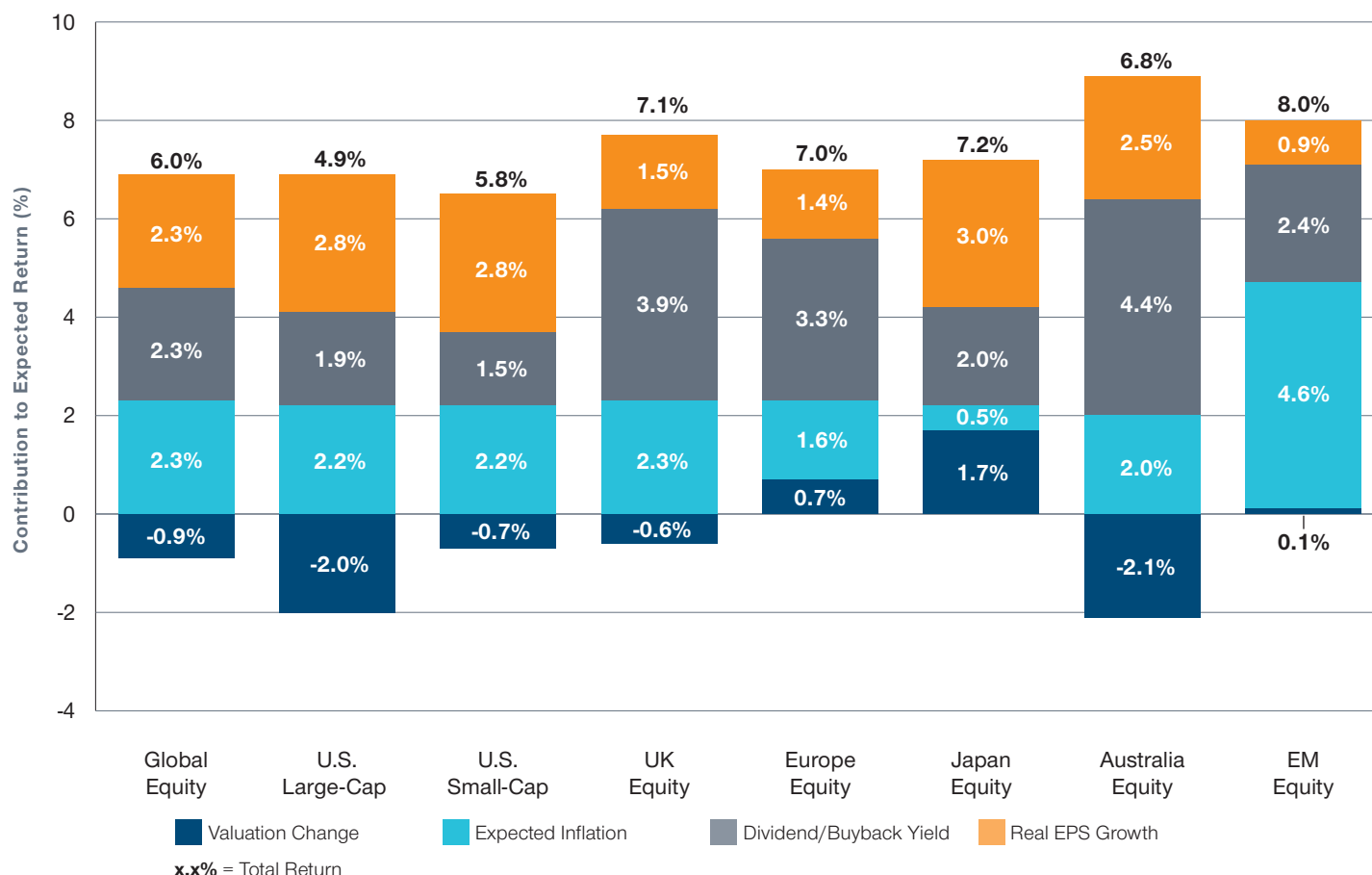
For each equity asset class, the above inputs are used to calculate expected average annual returns, according to the equation:

$$\text{Expected Inflation} + \text{Real EPS Growth} + \text{Dividend Yield} + \Delta\text{Valuation}$$

Where annual $\Delta\text{Valuation}$ for each of the next five years is given by:

$$\left(\frac{\text{Future P/E}}{\text{Current P/E}} \right) \times \frac{1}{5}$$

EQUITY MARKET EXPECTED RETURNS FROM 2022 TO 2026 (IN LOCAL CURRENCY)



The forecasts contained herein are for illustrative purposes only and are not indicative of future results.

Analysis: T. Rowe Price, January 2022. This information is not intended to be investment advice or a recommendation to take any particular investment action. Forecasts are based on subjective estimates about market environments that may never occur.



Real Asset Equity

The returns for real asset equities reflect the three components that make up the underlying benchmark: inflation-sensitive equities, real estate investment trusts (REITs), and physical commodities. Returns for the asset class reflect a 50% MSCI ACWI ex-USA equity, 25% REITs, and 25% commodities weighting. MSCI ACWI ex-USA Index returns were selected to give higher notional weight to commodities-producing countries at the expense of the U.S.

Impacts of Buybacks and New Issuance

Two components purposefully absent from our equity-return model are share buybacks and net issuance. When companies buy their own stock, the remaining outstanding shares each represent a larger ownership percentage and should, therefore, appreciate in price. However, the positive effects of share buybacks may be offset by initial and secondary stock offerings. Published academic literature has been inconclusive on the net effect at the market level.

In favor of a negative buyback effect, on the order of -2% per year, William Bernstein and Rob Arnott argue that share issuances and initial public offerings have consistently outpaced buybacks. Their observation that the market capitalizations of global stock markets consistently grow faster than the price level of indexes that follow the same markets supports this argument. On the other side of the debate, Philip Straehl and Roger Ibbotson have argued for a positive buyback effect on the order of +1.5%, based on aggregating net issuance at the individual company level divided by beginning market capitalization for all stocks in the S&P 500 Index from 1970–2014.

Rather than align directly with either side of the debate, we have chosen a middle ground by assuming no net change in return due to buybacks and new issuance.



METHODOLOGY

Alternatives

To forecast the returns of the alternative investments, we use a factor regression model with the following premia used as the predictive variables:

- Equity risk premium (Equity return in excess of cash)
- Small-cap premium (Small-cap return in excess of large-cap)
- EM premium (EM equity return in excess of DM equity)
- Investment-grade credit premium (Investment grade credit return in excess of duration matched government bonds)
- Duration premium (Government bonds return in excess of cash)

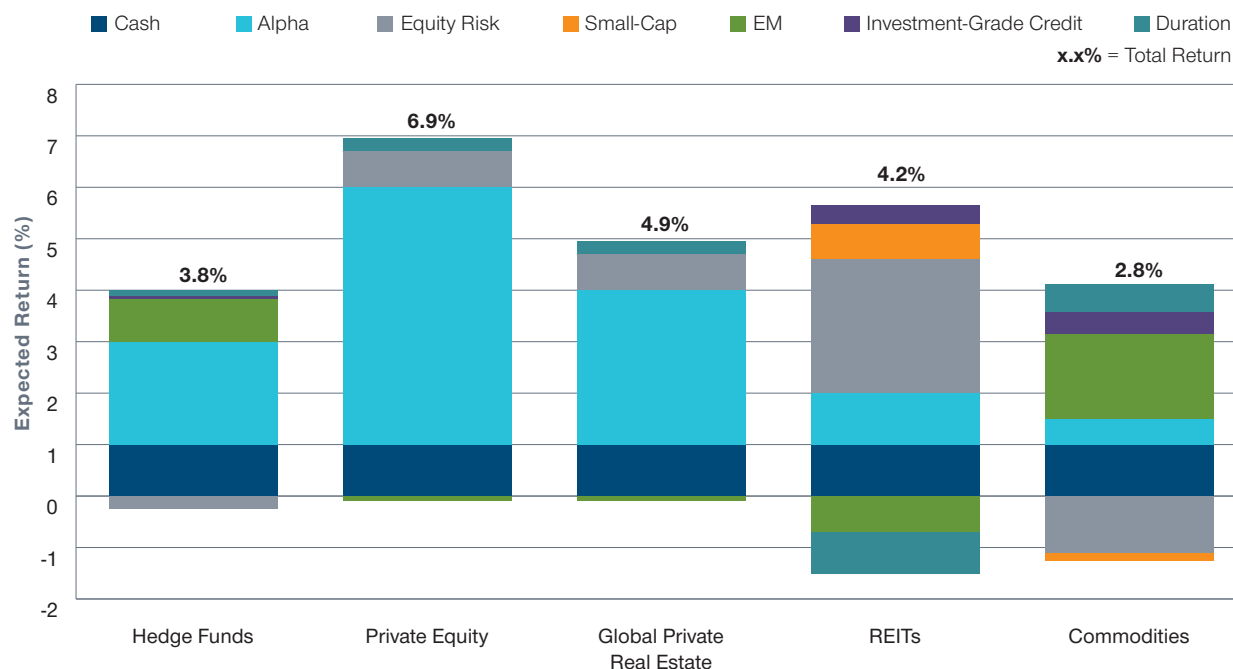
We use data starting in 2002 to help estimate the exposure of each asset class to the premia. Additionally, investments such as hedge funds and private equity/real estate have a

non-negligible active management component that is a foundational portion of the value proposition.

Based on our survey results, we quantify each premium as shown below and apply investments's historical beta to the premia to calculate an expected return.

Premia	Forecasted Value Over Next 5 Years (Arithmetic Averages)
Equity Risk	3.9%
Small-Cap	0.9%
EM	3.4%
Investment-Grade Credit	0.3%
Duration	-1.0%

COMPONENT OF EXPECTED RETURN



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Commodities

In addition to the factor model described above, for commodities we also use gold and oil forecasts from our sector specialists as inputs into our estimates. Generally, we are bearish on commodities, as supply/demand imbalances in oil have continued to place downward pressure on the asset class.

Our investment professionals forecast the average spot price in five years for a barrel of Brent crude oil and an ounce of gold as \$60 and \$1,388 USD, respectively.

EM =Emerging Markets. DM = Developed Markets.

METHODOLOGY



Survey

The foundation of our CMAs is a survey provided to a wide range of senior T. Rowe Price portfolio managers, economists, and analysts across our equity, fixed income, and multi-asset divisions. The survey requests forecasts for many inputs: GDP growth, inflation, commodity prices, equity valuations, earnings growth, fixed income yields, slopes of yield curves, and spread levels. Respondents are asked to offer insights for their respective areas of expertise and are invited to add thoughts for other categories. After all surveys are collected, baseline forecasts are developed for each asset class. The Capital Market Assumptions Governance and Investment Committee then reviews the results for internal consistency and reasonableness.

Correlations and Volatility

Empirical research has shown that over short time horizons (days and months), volatility regimes tend to cluster—i.e., today's volatility environment is highly correlated to that which investors are likely to experience in the near future. However, these results are less conclusive over longer time horizons. Similarly, certain asset classes, like EM debt, have experienced significant structural declines in volatility over the past decades, while others, like developed market investment-grade debt, recently have increased in volatility as the duration of the asset class has extended in a low interest rate environment.

The volatility and correlation matrix shown is based on approximately 15 years of historical data, making adjustments as necessary to reflect recent developments within each asset class. We “unsmooth” return histories of alternative investments, which have significant auto-correlation, to better reflect the economic volatility of the underlying assets.

Currency Treatment

Estimating returns for assets domiciled in a different currency than the base currency invites several questions:

- Should currency movements be hedged and does that view change by asset class?
- What is a reasonable approach for estimating currency return?

For the 2022 assumptions, we presume that developed market currencies contribute no return relative to each other. This approach contrasts with uncovered interest rate parity — essentially the difference in nominal interest rates between two countries is equal to the expected depreciation of one currency relative to the other. Although intuitive, empirically uncovered interest-rate parity does not hold well, so our

2022 currency approach reflects this evidence. We do expect slight depreciation in emerging market currencies, reflecting the higher economic growth, inflation expectations, and cash yields available in those markets.

In terms of hedging considerations, historical data demonstrates that better risk-adjusted returns potentially can be earned by investors hedging high-quality fixed income versus leaving investment-grade foreign bond exposures unhedged. This is generally true for investors domiciled across the globe. The data is less conclusive for equities and the results are more country specific. We have elected to forecast returns for global aggregate bonds and global investment-grade corporates with hedging, while leaving all other foreign currency exposures unhedged. The difference between our hedged and unhedged return expectations are driven by differences between our interest-rate views and the five-year forward cash rate implied by the market.

Longer-Term Expectations

Many, if not most, investors have a time horizon longer than the five-year forecasts included in this document. As examples, the T. Rowe Price Target Date and Target Allocation franchises offer strategies targeted to investors with 40+ year accumulation and 30+ year retirement cycles. We are often asked for the forecasts we use to inform the construction and design of those portfolios. While we strongly advise against using any single set of assumptions for portfolio construction, investors with a longer-term or perpetual time horizon should consider market conditions beyond the current market environment, which, admittedly, heavily influences many of the forecasts we share here. Included below are several of the risk premia we believe the markets tend to reward over long investment horizons, along with estimates of their average magnitudes over multiple market cycles. By definition, these are long term and relatively stable over time, but they are subject to revisions and revalidation as necessary. The table below includes the same premia we use for estimating alternative asset class returns, but are just a subset of the premia potentially available over long investment horizons.

Premia	Forecasted Value Over Market Cycles (Arithmetic Averages)
Equity Risk	5.5%
Small-Cap	1.0%
EM	1.0%
Investment-Grade Credit	0.5%
Duration	1.0%



METHODOLOGY

Scenarios

Point estimates of future returns are implicitly accompanied by some level of uncertainty. For that reason, we have constructed four additional sets of capital market assumptions that represent strong bear, moderate bear, moderate bull, and strong bull outlooks. These scenarios are intended to bookend our baseline scenarios, allowing for consideration of a range of economic and return scenarios.

The scenarios are underpinned by the belief that the level of aggregate investor risk appetite is the primary driver of investment returns over short- to medium-term horizons. With this in mind, our scenario generation process begins by analyzing historical periods of differing investor sentiment towards risk. Using global equity returns as a proxy for risk, we divide the past 15 years of common asset class performance into quartiles and estimate the volatility of each asset class and its correlation to global equities during those periods. This approach

explicitly acknowledges that average correlations and volatilities do not adequately represent asset class behaviors during all risk regimes. We then divide the past 30 years of rolling 5-year periods into quartiles and reconstruct the broader set of asset class returns using their previously estimated volatilities and correlations. These quartiles correspond to the strong bear, moderate bear, moderate bull, and strong bull market scenarios.

The resulting asset class returns from this quantitative process form the starting point for the Capital Market Assumptions Governance and Investment Committee's oversight. The Committee makes adjustments to returns, often due to structural changes of an asset class that are not reflected through a solely backwards-looking quantitative lens. These qualitative insights are important in assessing the forward-looking potential behavior of investments.

We believe that considering portfolio designs across multiple regimes is necessary for aligning investor objectives and asset allocation.

APPENDIX



APPENDIX

Acknowledgments

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APPENDIX



REFERENCE INDEXES

	ASSET CLASS	REPRESENTATIVE INDEX
EQUITY	Global Equity	MSCI ACWI
	Global ex-U.S. Equity	MSCI ACWI ex-USA
	Global ex-Japan Equity	MSCI Kokusai
	Global ex-Australia Equity	MSCI ACWI ex-Australia
	DM Equity	MSCI World
	DM ex-U.S. Equity	MSCI World ex-USA
	U.S. Equity	Russell 3000
	Europe ex-UK Equity	MSCI Europe ex-UK
	UK Equity	FTSE 100
	U.S. Large-Cap Equity	Russell 1000
	U.S. Small-Cap Equity	Russell 2000
	Europe Equity	MSCI Europe
	Asia ex-Japan Equity	MSCI Asia ex-Japan
	Japan Equity	MSCI Japan
	Australia Equity	S&P/ASX 200
	EM Equity	MSCI Emerging Markets
FIXED INCOME	Real Asset Equity	S&P Real Assets Index
	Global Aggregate	Bloomberg Global Aggregate
	Global Aggregate (Hdg)	Bloomberg Global Aggregate (Hdg)
	Global Agg ex-U.S. (Hdg)	Bloomberg Global Aggregate ex-U.S. (Hdg)
	Global Agg ex-U.S.	Bloomberg Global Aggregate ex-U.S.
	Global IG Corporate (Hdg)	Bloomberg Global-Aggregate Corporate (Hdg)
	Global High Yield	Bloomberg Corporate High Yield
	U.S. Cash	Bloomberg 1–3M Treasury Bills
	U.S. TIPS	Bloomberg Global Inflation-Linked U.S. TIPS
	U.S. Short TIPS	Bloomberg Global Inflation-Linked 1-5 Year U.S. TIPS
	U.S. Treasury	Bloomberg U.S. Treasury
	U.S. IG Corporate	Bloomberg U.S. Aggregate Corporate
	U.S. IG Coporate (Hdg)	Bloomberg U.S. Aggregate Corporate (Hdg)
	U.S. Long Credit	Bloomberg U.S. Long Credit
	U.S. Long Treasury	Bloomberg U.S. Long Treasury
	U.S. Aggregate	Bloomberg U.S. Aggregate Bond
	U.S. High Yield	Bloomberg U.S. Corporate High Yield
	U.S. Bank Loans	S&P/LSTA Leveraged Performing Loan
	U.S. Securitized	Bloomberg U.S. Securitized
	UK Cash	Bloomberg Sterling Treasury Bills 0-3 Month
	UK Gilts	Bloomberg UK Gilts
	UK IG Corporate	Bloomberg UK Aggregate Corporate
	Europe Cash	Bloomberg EUR Treasury Bills 0-3 Month
	Europe Treasury	Bloomberg EUR Treasury
	Europe IG Corporate	Bloomberg EUR Aggregate Corporate
	Europe IG Corporate (Hdg)	Bloomberg EUR Aggregate Corporate (Hdg)
	Europe High Yield	Bloomberg EUR High Yield
	Japan Cash	Bloomberg Japan Treasury Bills 1-3 Months
	Japan Treasury	Bloomberg Japan Treasury
	Japan IG Corporate	Bloomberg Japan Aggregate Corporate
	Australia Cash	Bloomberg Ausbond Bank Bill
	Australia Bonds	Bloomberg Ausbond 0+ Composite
	EM Sovereign Local	JP Morgan GBI – EM Global Diversified
	EM Sovereign	JP Morgan EMBI Global Diversified
	EM Corporate	JP Morgan CEMBI
ALTERNATIVES	Hedge Funds	HFRI Fund of Funds Composite
	Private Equity	Cambridge Associates LLC Global Private Equity
	Commodities	Bloomberg Commodity
	Gold	S&P GSCI Gold Total Return
	Global Private Real Estate	NCREIF Property
	REITs	FTSE EPRA/NAREIT Developed

Hdg = Hedged currency treatment. EM =Emerging Markets. DM = Developed Markets.

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