PGIM QUANTITATIVE SOLUTIONS

2023 QI CAPITAL MARKET ASSUMPTIONS

Forecasts may not be achieved and are not a guarantee or reliable indicator of future results.

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2023 QI Capital Market Assumptions

Summary

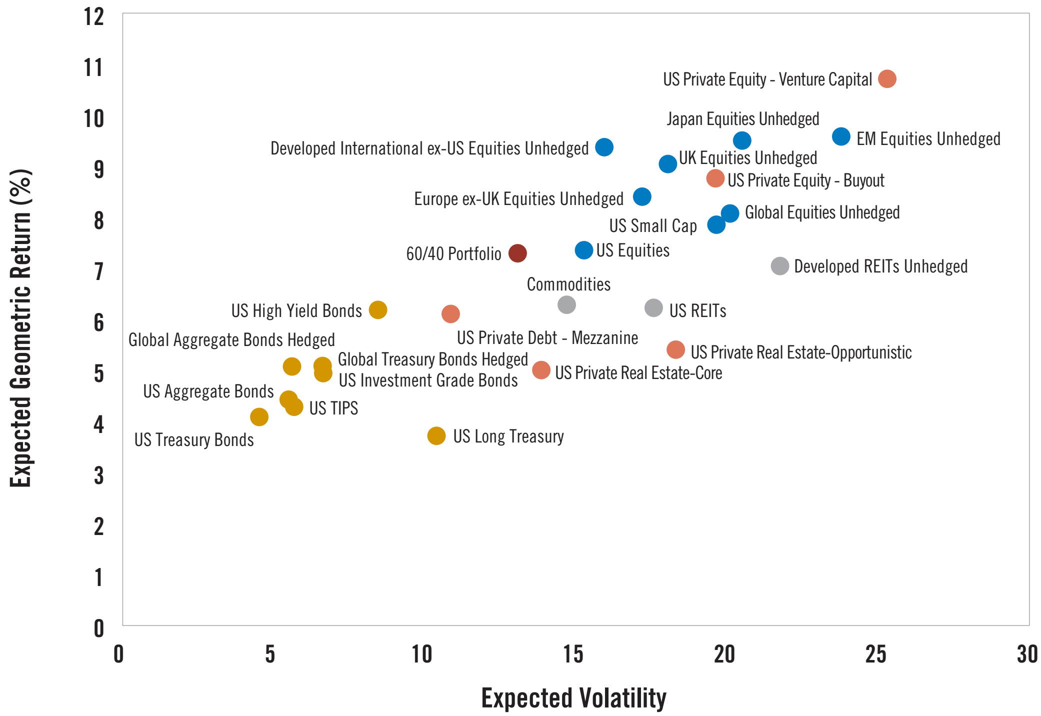
Q4 2022 Developments Informing Our Long-Term (10-Year) Forecasts: The global economy was plagued by persistently high inflation in 2022, prompting dramatic tightening by global central banks in an attempt to bring inflation under control. Russia's invasion of Ukraine led to a surge in energy prices, further exacerbating inflation and making the task of central banks even more difficult. Inflation is likely to have peaked in late 2022 as lower commodity prices and easing supply chain bottlenecks appear to have pushed inflation lower. Although economic and earnings growth stayed positive for the year amid moderating inflation, forecasters expect this to possibly change in 2023, especially in Europe. Nevertheless, GDP and earnings expectations in the US remain positive, albeit with the possibility of a short-lived and minor recession in the latter half of the year. Major central banks retained hawkish positions at the close of the year, and signaled they are unlikely to pivot until there are clear signs that inflation is sustainably slowing toward targets, elevating the risks of policy mistakes among banks in developed markets. Market pricing currently reflects a slower pace of hiking, which will continue to drive short-term interest rates higher. However, on the back of lower inflation expectations, and speculation that the US Federal Reserve (Fed) may pivot, long-term rates trended lower in the latter half of the year, and the Treasury yield curve definitively inverted across various key rates. While an inverted yield curve has long been associated with economic recessions, Fed chair Jerome Powell highlighted that in this case the inversion may represent a successful fight with inflation. For the US, consensus mean forecasts for 2022 and 2023 call for 1.9% and 0.2% real GDP growth and 8.1% and 4.1% CPI inflation, respectively. The Bloomberg Commodity Total Return Index advanced by 2.2% in the fourth quarter of 2022. Gains of 16.4% and 13.3% in Industrial and Precious Metals sub-indexes, respectively, for the quarter were mostly offset by a -9.1% decline in the Energy sub-index. For 2022, the Bloomberg Commodity Index advanced 16.1%. Our near-term developed and emerging market economic growth forecasts for the next 10 years have declined slightly, while our inflation forecasts for the same horizon are similar to those from the previous quarter. Evolving policy rates and forecast economic growth and inflation have important implications for our long-term asset class forecasts.

Long-Term Global Economic Outlook: We expect real economic growth in developed economies to continue to moderate over the next decade, as it has for the last 30 years. This is due to the limited growth of the developed labor force, which is constrained by domestic demographics. An assumption of no significant offset from improved productivity growth is an additional constraint on growth. Inflation in developed markets, in contrast, is anticipated to moderate over the next 10 years, relative to the elevated rates of inflation observed in 2021 and 2022. Nevertheless, inflation is expected to be somewhat higher than that observed in the period following the Global Financial Crisis (GFC) of 2008 and prior to the COVID-induced recession of 2020. We expect long-run real economic growth and inflation in emerging markets to advance at higher annualized rates than in developed markets. Younger populations and higher rates of return on capital in emerging markets are driving higher rates of nominal economic output compared to developed markets. While our baseline long-term inflation expectations assume a reversion to longer-term trends, the nearer-term outlook for inflation is highly uncertain. The four-decade trend in falling US inflation has at least temporarily paused, with US inflation rising to 7.0% in 2021 and 6.5% in 2022. While an extreme scenario of 1970s-style, double-digit inflation appears unlikely, the potential for a sustained period of average inflation well above central bank targets is a non-trivial risk for investors. We cover these issues at length in two related white papers[1].

Equities: Our 10-year annualized nominal forecast return for Global Equities is 8.0%, a decrease from our forecast of 8.5% for the fourth quarter of 2022. The forecast decrease is primarily attributable to more favorable valuations following a 9.9% advance in Global Equities in the fourth quarter, reducing year-to-date losses to a still substantial -18.7%. Our long-term return forecast for US Equities is somewhat lower, at 7.3%. Looking at the rest of the world, Developed Market Equities outside the US are forecast to return 9.3% and Emerging Market Equities are forecast to return 9.5% over the next 10 years. Cheaper valuations, as measured by historical valuation ratios, are driving stronger expected returns for non-US Developed Market Equities versus US Equities. While faster expected economic growth is a positive for Emerging Market Equities versus non-US Developed Market Equities, it is offset by relatively less attractive valuations and income growth.

[1] Tokat-Acikel, Ahmed, Brundage, Campbell, Cummings, & Rengarajan, 2021, "Is Inflation About to Revive?" PGIM Quantitative Solutions White Paper. https://www.pgimquantitativesolutions.com/research/inflation-about-to-revive
Johnson, Aiolfi, Hall, Patterson, Rengarajan, &Tokat-Acikel, 2022, "Portfolio Implications of a Higher US Inflation Regime" PGIM Quantitative Solutions White Paper. https://www.pgimquantitativesolutions.com/research/portfolio-implications-higher-us-inflation-regime

10-Year Forecast Returns and Volatility



Source: PGIM Quantitative Solutions as of 12/31/2022. **Forecasts are not a reliable indicator of future performance.**

Fixed Income: The rapid rise in global sovereign interest rates in 2022 paused in the fourth quarter as a moderation in inflationary pressures resulted in interest rate markets pricing a less aggressive pace of policy tightening for global central banks in 2023. Our long-run forecast for hedged Global Aggregate Bonds is 5.0%, a modest decrease from the fourth quarter 2022 forecast of 5.1%, but up from just 1.3% from the first quarter of 2022. Our long-run forecast for US Aggregate Bonds is 4.3%, with the lower expected return relative to the Global Aggregate mostly attributable to a positive contribution from hedging foreign currency exposure. At the end of our 10-year forecast horizon, we expect the US Fed's policy rate to be approximately 4.2%, which is about 20 basis points lower than the midpoint of the policy rate target range at the end of 2022. Outside the US, developed market central banks are forecast to continue to increase policy rates, as longer-run policy normalization is expected. In US credit markets, we are forecasting average spreads will be comparable over the next 10 years to those prevailing at the end of 2022, informing expected returns of 4.9% and 6.1% for US Investment Grade (IG) and High Yield Bonds, respectively.

Real Assets: Real Assets are broadly defined to include asset classes that have physical properties or have returns that are highly correlated with inflation. We include Commodities, REITs, and TIPS as Real Assets in our Capital Market Assumptions (CMAs). Our forecasts for all these asset classes are expected to outperform our 10-year US inflation forecast of 2.6%.

Private Assets: Our forecasts for US Buyout Private Equity, US Venture Capital Private Equity, and US Mezzanine Private Debt are linked to the forecast outcomes of public market assets with a premium consistent with historical empirical outcomes, acknowledging the underlying illiquidity and potential leverage employed in these asset classes relative to public market counterparts. Our forecasts for Core and Opportunistic US Private Real Estate are based on inputs from the NCREIF Property Indexes and linkages to forecast US economic growth and inflation**.**

Currency and Currency Hedging Returns: Over the next 10 years, we are forecasting mixed returns for the US dollar relative to developed market peers, with outcomes ranging from an annualized loss of 0.5% for the Australian dollar to a gain of 1.3% for the Japanese yen. Forecast outcomes for emerging market currencies range from an expected loss of 2.6% for the South African rand to a gain of 0.8% for the Taiwan dollar. Long-term currency hedging returns against a market-weighted basket of developed market exposures are forecast to be net positives for US investors as short-term interest rates are anticipated to be higher over the long term in the US relative to the Eurozone and Japan.

60/40 Portfolio Return[2]: Based on our long-term forecasts, a balanced portfolio of 60% Global Equities unhedged and 40% Global Aggregate Bonds hedged is forecast to return 7.2% annually over the next 10 years. This forecast represents a material increase over our forecast of 4.4% from the first quarter of 2022, attributable to both the rise in global interest rates in 2022 as well as improved equity market valuations.

[2] For illustrative purposes only. All model portfolios have significant inherent shortcomings and do not consider many real-world frictions. There is no current PGIM Quantitative Solutions client portfolio with this composition of assets. It does not constitute investment advice and should not be used as the basis for any investment decision.

Overview

PGIM Quantitative Solutions' CMAs underpin the long-run outlook for strategic allocations in our individual strategies and multi-asset portfolios. They are the product of a highly systematic process for generating consistent projections across the capital markets.

CMAs provide 10-year expectations for the most widely held equity, fixed income, and non-traditional asset classes, measuring both return and risk. We update our CMAs each quarter. Our investment professionals begin with evolving asset-class fundamentals and macroeconomic assumptions at the country level. For each asset class, we decompose local return expectations into three broad categories: income, growth, and valuation adjustment. We also forecast relative currency adjustments for investors in different domiciles to allow for conversion to hedged or unhedged returns. Our core building blocks and final forecasts are reviewed at their component levels by an investment council of our most senior investment professionals.

Capital Market Assumptions Framework

Asset Class Specific Inputs

- Current Equity Market Valuations
- Dividend Yields
- 10-year Treasury Yield
- Credit Spreads

Macro Inputs

- GDP Growth
- GDP Potential and Inflation Forecasts

Economic Assumptions

- Future Real Interest Rate Forecasts
- Real Rates
- Future Valuation Forecasts
- GDP Growth
- Credit Spread Forecasts

Capital Market Return Expectation

- Global and Integrated Across Regions
- Internally Consistent Across Assets
- Guided by Investment Council

Investment Council Review of Primary Inputs

- Including GDP Growth and Inflation Expectations
- Equilibrium Valuation and Real Interest Rates

Shown for illustrative purposes only. Source: PGIM Quantitative Solutions.

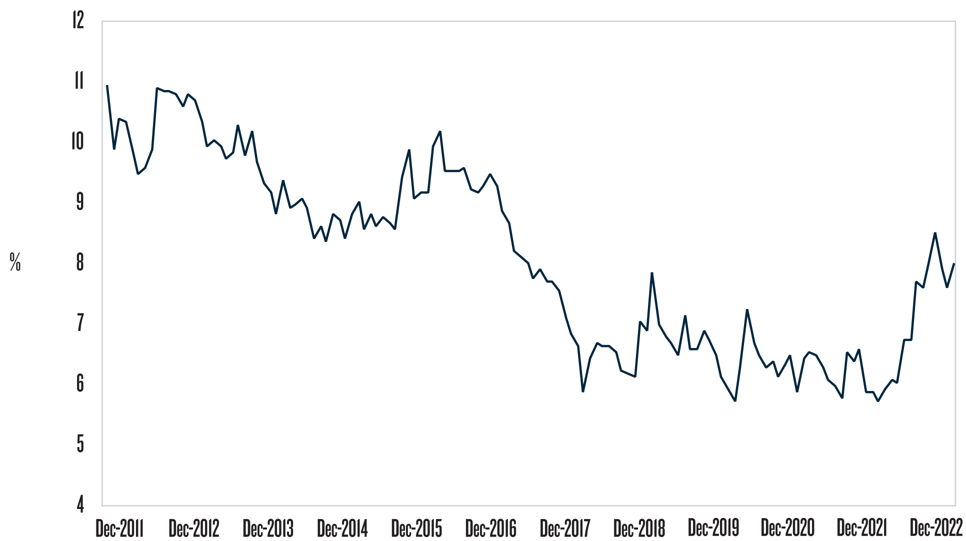
Global Economic Outlook

Forward-looking views for economic growth and inflation are some of the most critical building blocks of our CMAs. We currently compile these for 16 countries. Based on our forecasts, long-term real economic growth in developed economies over the next 10 years is expected to continue to moderate, as it has for the last three decades. This is due to the limited growth of the labor force, which is constrained by domestic demographics and based on an assumption of no significant offset from improved productivity growth. Our forecasts for near-term economic growth are somewhat lower than last quarter, while our forecasts for inflation edged somewhat higher. We expect longer-term economic growth in developed economies to be led by Australia and other countries with younger populations and more liberal immigration policies. We anticipate growth to be slowest in Japan and parts of Western Europe, where the labor force is expected to contract further over the next decade. Inflation in developed markets is anticipated to moderate over the next 10 years relative to the elevated rates of inflation observed in 2021 and 2022, but is expected to be somewhat higher than the pace observed in the period covering the GFC to the COVID-induced recession of 2020. Our 10-year forecasts for developed market inflation range from a 3.2% annual rate in Australia to a low of 1.3% in Japan. Emerging markets, however, are expected to produce real economic growth and inflation at annualized rates of 3.8% and 3.1%, respectively, driven by younger populations and higher rates of return on capital than in developed markets.

Evolution of Our Market Outlook

Over the last 10 years, coincident with rising valuation ratios and a moderation in expected developed market growth and inflation, our long-term Capital Market Assumptions for global equities trended downward through 2017 before stabilizing at historically low levels. More recently, declining equity markets in 2022 and an increase to our longer-run inflation expectations have reversed this trend, moving our forecasts higher. Our outlook for returns of global equities over the next 10 years is 8.0%, a slight decrease of 0.5% from our forecast in the fourth quarter of 2022.

PGIM Quantitative Solutions' Expected 10-Year Return for Global Equities



Source: PGIM Quantitative Solutions as of 12/31/2022. **Forecasts are not a reliable indicator of future performance.**

Our Capital Market Assumptions for global fixed income assets have moved materially higher over the past two years, coincident with the significant increase in global interest rates. As of December 31, 2022, the amount of negative-yielding debt in the Bloomberg Barclays Global Aggregate Index stood at $1.4 trillion, a decline from $11.3 trillion at the end of 2021 and an all-time high of $17.8 trillion at the end of 2020.

PGIM Quantitative Solutions' Expected 10-Year Return for Hedged Global Aggregate Bonds

Source: PGIM Quantitative Solutions as of 12/31/2022. **Forecasts are not a reliable indicator of future performance.**

Global Fixed Income Markets

Long-term fixed income forecasts begin with our view of 10-year forward policy rates for each of the major developed market central banks. We derive expected policy rates for each central bank jurisdiction as a function of current and future equilibrium real interest rates, the expected GDP output gap over the next 10 years,[3] and the expected rate of inflation. Our long-term forecasts for short-term interest rates have edged higher this quarter as global central banks are forecast to pursue more aggressive interest rate hikes in coming quarters as the level of current inflation is well above policy targets. For the US, policy rates in 10 years are expected to be roughly 20 basis points lower than the 4.4% policy rate midpoint that prevailed at the end of 2022, given the forward view of inflation and growth relative to potential. Central banks in other developed markets are also expected to raise rates to combat high inflation in coming quarters.

Interest Rates

Country	Current Short-Term Interest Rates (12/31/2022)	Long-Term Forecast of Short Interest Rates
United States	4.34	4.18
United Kingdom	3.50	3.75
Eurozone	1.61	2.18
Japan	-0.18	0.30
Australia	3.50	3.70
Canada	4.26	4.33

Source: Bloomberg, PGIM Quantitative Solutions, as of 12/31/2022. **Forecasts may not be achieved.**

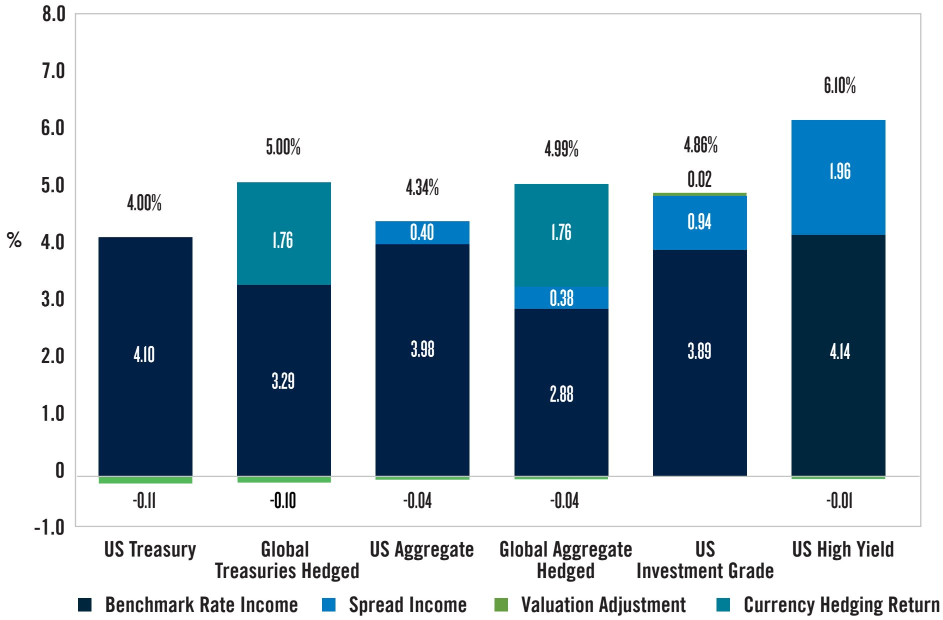
For longer-maturity government bond returns, we forecast[4] each country's expected long-term slope to define a term structure of yields across their respective government yield curves. The forecast slope for each country is a function of forecast and potential real economic growth and will evolve countercyclically. When economic growth is forecast below potential, the slope of the yield curve is expected to be steeper (early cycle), whereas if growth is forecast to be closer to, or above, potential (late cycle), the yield curve is forecast to be flatter.

Our bond return forecasts are largely predicated on income and valuation factors. At a given maturity point, the forecast income return for a government bond will consist of the average expected coupon yield over the forecast horizon, as well as proceeds from bonds maturing to lower yields. Changes in yield at a given maturity point over the forecast horizon will determine the necessary valuation adjustment. If yields are forecast to rise (fall) over the next 10 years, the valuation adjustment will be negative (positive).

During 2022, benchmark 10-year US Treasury yields advanced by 240 basis points to a level of 3.9%. Shorter-term 2-year Treasury yields, which better reflect near-term policy expectations, advanced by a much greater 370 basis points in 2022, to a level of 4.4%. Looking forward, yields for the Bloomberg US Treasury Index are expected to rise modestly over the next 10 years, resulting in a negative valuation adjustment and an expected return of 4.0%, a rise of 2% from our forecast in the first quarter of 2022. Unhedged developed market government bonds outside the US are forecast to return less over the next decade given lower initial yields and a negative valuation adjustment, as yields are expected to continue to rise over the forecast horizon. Long-run returns in global developed market government bonds for a US investor are forecast at 3.6% on an unhedged basis and 5.0% on a hedged basis given the differentials in forecast short-term interest rates.

[3] GDP-weighted Eurozone country average for European Central Bank.
[4] There can be no assurance these forecasts will be achieved.

Decomposition of Fixed Income Return Forecasts

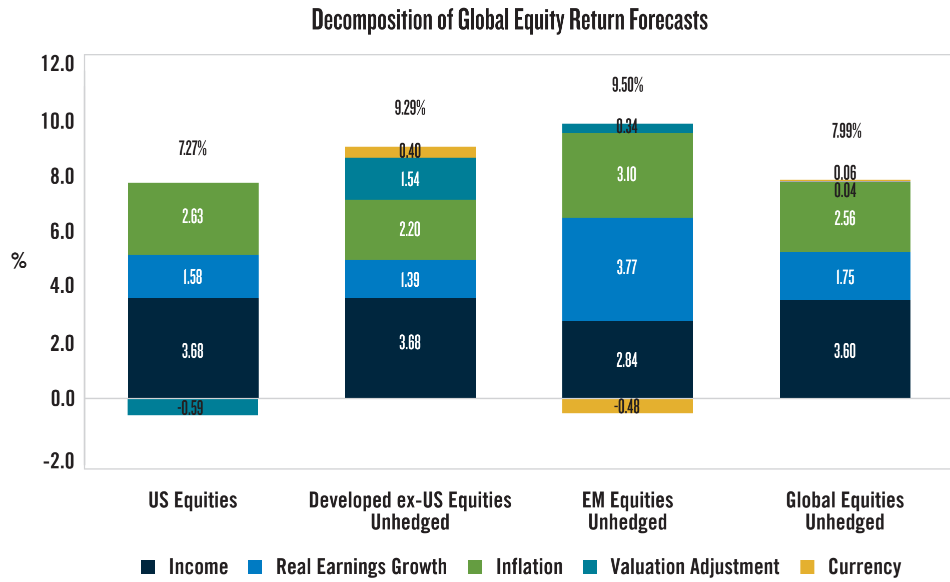


Source: PGIM Quantitative Solutions as of 12/31/2022. For illustrative purposes only. **Forecasts are not a reliable indicator of future performance.**

Our long-term forecast for US Aggregate Bonds is 4.3%, which includes an expected spread return of 0.5%. Our forecast for hedged Global Aggregate Bonds from a US investor perspective is 5.0%, given similar assumptions for credit spreads and defaults, as well as gains from currency hedging, which more than offset lower starting levels for underlying government yields outside the US. For both US Investment Grade and US High Yield Bonds, spreads at the end of 2022 were in line with expected averages for the next 10 years.

We calculate the expected returns for fixed income credit indexes to include any additional income expected from an average credit spread yield over comparable government bonds, adjusted for expected default and downgrade losses over the forecast horizon. We then calculate the valuation adjustment for expected changes in spreads. Credit spreads widened substantially in the first half of 2022, following significant narrowing in 2021. Tightening financial conditions in 2022 resulted in a modest increase in our forecast for defaults in US High Yield Bonds. Long-run returns for US Investment Grade and US High Yield Bonds are expected to be 4.9% and 6.1%, respectively.

Global Equity Markets



Source: PGIM Quantitative Solutions as of 12/31/2022. For illustrative purposes only. **Forecasts are not a reliable indicator of future performance.**

All of our long-term asset class forecasts, including equities, are based on income, growth, and valuation considerations.

Consistent with historical precedent, and assuming the continuation of current dividend taxation regimes, the US equity market has a large share of expected income returns coming from share buybacks, equal to about 1.9% in our long-term forecasts. Outside the US, the expected impact of net buybacks in developed economies on long-term income returns is anticipated to be a much more modest 0.3%. For emerging markets, an expected drag on income returns from net share issuance is forecast at 0.5%.

To build the income component of our long-term equity forecasts, we calculate each country's expected income contribution based on current and anticipated levels of dividend yield as well as the expected returns attributable to buyback activity (positive) or net positive share issuance (negative).

For the growth component of our equity return forecasts, long-term nominal earnings growth for each equity market is expected to approximate the growth in nominal GDP for each country. We calculate this as the combined annualized rate of expected inflation plus real GDP growth. As noted earlier, our near-term growth expectations have moderated from last quarter, while our forecasts for inflation have increased somewhat. Our 10-year forecast for US real annualized GDP growth is now 1.6%, with 2.6% for inflation translating to an earnings growth component of 4.2%. We anticipate inflation will remain elevated over the next few quarters before moderating to levels closer to the Fed target rate of 2%. For developed markets outside the US, our 10-year expectation for real GDP growth is 1.4%, while inflation is expected to average 2.2%. This assumption would provide nominal earnings growth of 3.6%, a decrease of 0.2% from our forecast from the previous quarter. For emerging markets, higher nominal GDP growth relative to developed markets is expected to result in long-run nominal earnings growth of 6.9%.

Among developed markets, the US maintains a negative expected long-term valuation adjustment of 0.6% annually, attributable to still historically elevated valuation ratios. Developed equities outside the US, in contrast, are expected to have a positive valuation repricing given historical valuation ratios that are below long-run averages. Emerging market equity returns are forecast to be 0.3% higher per year due to what is now a positive valuation adjustment after several quarters of having a negative valuation adjustment.

Private Assets

Our methodology for forecasting Private Assets outside of Real Estate ties the forecast outcomes of Private Assets to those of public market assets and assigns a premium consistent with historical empirical outcomes, acknowledging the underlying illiquidity and potential leverage employed in these asset classes relative to public market counterparts. Our forecasts for private Real Estate incorporate data from the NCRIEF Property Index (NPI) to determine yields and relative valuations in addition to linkages to forecast macroeconomic inputs. Investors in Private Assets must also evaluate cash flow considerations that may impact other liquid allocations in a multi-asset portfolio. For further reference about these considerations please see Shen et al. (2021)[5].

Private equity funds that take a buyout strategy invest in equity ownership in mature companies, resulting in a change of control. These are typically large transactions that use leverage. Our current 10-year annualized forecast for US Buyout Private Equity is 8.7% versus a forecast of 7.3% for public US Equities.

Venture capital funds seek private equity stakes in startups and small- to medium-sized companies with strong growth potential. Our current annualized 10-year forecast for US Venture Capital Private Equity is 10.6% versus a forecast of 7.8% for public US Small Cap Equities.

Private mezzanine debt invests in loans that are subordinate to other debt in a firm's capital structure and that are backed by little to no collateral. Our current annualized forecast for US Mezzanine Private Debt is 6.0% versus a forecast of 6.1% for public US High Yield Debt.

Private real estate funds covered in the NPI for our forecasts include properties that have been acquired, at least in part, on behalf of tax-exempt institutional investors and held in a fiduciary environment. The property types allowed into the NPI are hotels, office buildings, industrial properties, apartments, and other retail-use properties. Allowed properties can be wholly owned or even jointly owned properties. Returns on investment are required to be reported without leverage. From the unlevered initial forecast, we then calculate a core real estate forecast to represent funds with 20% leverage and an opportunistic real estate forecast to represent funds with 40% leverage. Our forecasts for Core and Opportunistic Private Real Estate this quarter are 4.9% and 5.3%, respectively.

Real Assets

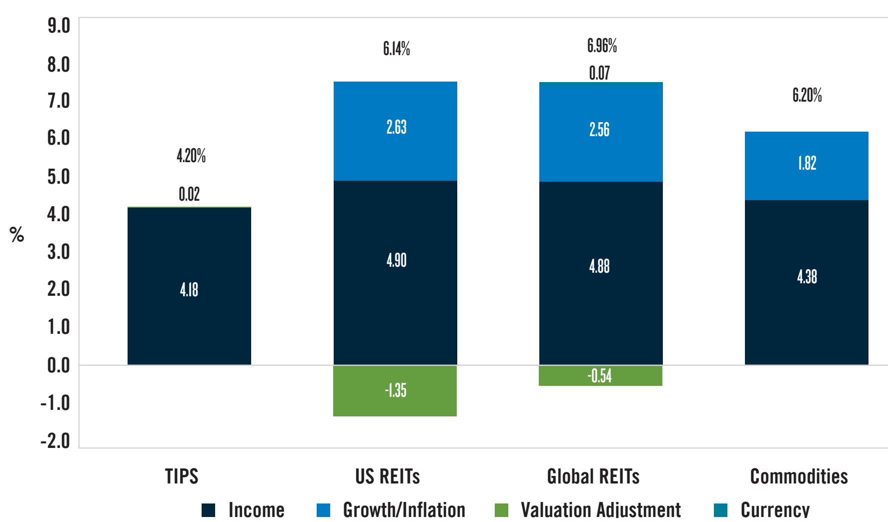
We group together Commodities, REITs, and TIPS as Real Assets in our Capital Market Assumptions.

For US TIPS, we assume that expected inflation and break-even inflation converge over time, implying that the inflation risk premia and liquidity risk premia in TIPS offset one another. Under these assumptions, we forecast a long-term return from TIPS of 4.2%, which is somewhat above the expected return of US Treasuries given the slightly higher duration of US TIPS. This US TIPS forecast is 0.2% lower than the prior quarter's forecast, attributable to a decrease in the underlying expected roll down return for US TIPS.

Our forecast returns for US and Global REITs include current and forecast dividend payments, expected appreciation linked to forecast price level changes, and a valuation adjustment based on current payout ratios. Our long-run forecasts for US and Global REITs are 6.1% and 7.0%, respectively.

Our long-run expected return for Commodities is 6.2%, reflecting a return on cash investment of 4.4%, assuming investment through liquid futures and a growth premium of 1.8%, consistent with historical spot returns over cash and a linkage to forecast inflation. This forecast is 0.2% higher than our forecast from last quarter, largely attributable to the increase in our cash forecast.

Decomposition of Real Asset Return Forecasts



Source: PGIM Quantitative Solutions as of 12/31/2022. For illustrative purposes only. **Forecasts are not a reliable indicator of future performance.**

[5] Shen et al. (2021), "Harnessing the Potential of Private Assets: A Framework for Institutional Portfolio Construction", PGIM Institutional and Advisory Solutions.

Currency and Currency Hedging Returns

Our long-term forecasts for currency returns and returns to currency hedging are based on our forward views of local relative price levels and short-term policy rates. These views allow us to provide our long-term forecasts for a range of domiciles outside the US. Over the next 10 years, we are forecasting mixed returns for the US dollar relative to developed market peers, with outcomes ranging from an annualized loss of 0.5% for the Australian dollar to a gain of 1.3% for the Japanese yen. Forecast outcomes for emerging market currencies range from an expected loss of 2.6% for the South African rand to a gain of 0.8% for the Taiwan dollar. Long-term currency hedging returns against a market-weighted basket of developed market exposures are forecast to be net positive for US investors as short-term interest rates are anticipated to be higher over the long term in the US relative to the Eurozone and Japan.

PGIM Quantitative Solutions QI 2023 10-Year Capital Market Assumptions

Asset	Expected Geometric Return	Expected Arithmetic Return	Expected Volatility	Expected Sharpe Ratio
Fixed Income				
Cash	4.38	--	--	--
US Treasury Bonds	4.00	4.10	4.64	-0.06
US Long Treasury	3.63	4.18	10.49	-0.02
Global Treasury Bonds Hedged	5.00	5.22	6.73	0.12
US Aggregate Bonds	4.34	4.50	5.61	0.02
Global Aggregate Bonds Hedged	4.99	5.15	5.72	0.13
US Investment Grade Bonds	4.86	5.09	6.75	0.10
US High Yield Bonds	6.10	6.46	8.56	0.24
US TIPS	4.20	4.37	5.79	0.00
Equities				
US Equities	7.27	8.45	15.36	0.26
US Small Cap	7.77	9.71	19.73	0.27
UK Equities Unhedged	8.96	10.60	18.13	0.34
Europe ex-UK Equities Unhedged	8.32	9.81	17.28	0.31
Japan Equities Unhedged	9.42	11.54	20.58	0.35
Developed International ex-US Equities Unhedged	9.29	10.58	16.03	0.39
EM Equities Unhedged	9.50	12.34	23.85	0.33
Global Equities Unhedged	7.99	10.03	20.18	0.28
Real Assets				
US REITs	6.14	7.70	17.66	0.19
Developed REITs Unhedged	6.96	9.34	21.83	0.23
Commodities	6.20	7.30	14.79	0.20
Private Assets				
US Private Real Estate - Core	4.92	5.89	13.95	0.11
US Private Real Estate - Opportunistic	5.32	7.01	18.39	0.14
US Private Debt - Mezzanine	6.02	6.62	10.96	0.20
US Private Equity - Buyout	8.68	10.62	19.70	0.32
US Private Equity - Venture Capital	10.63	13.85	25.37	0.37
60/40 Portfolio	**7.21**	**8.08**	**13.17**	**0.28**

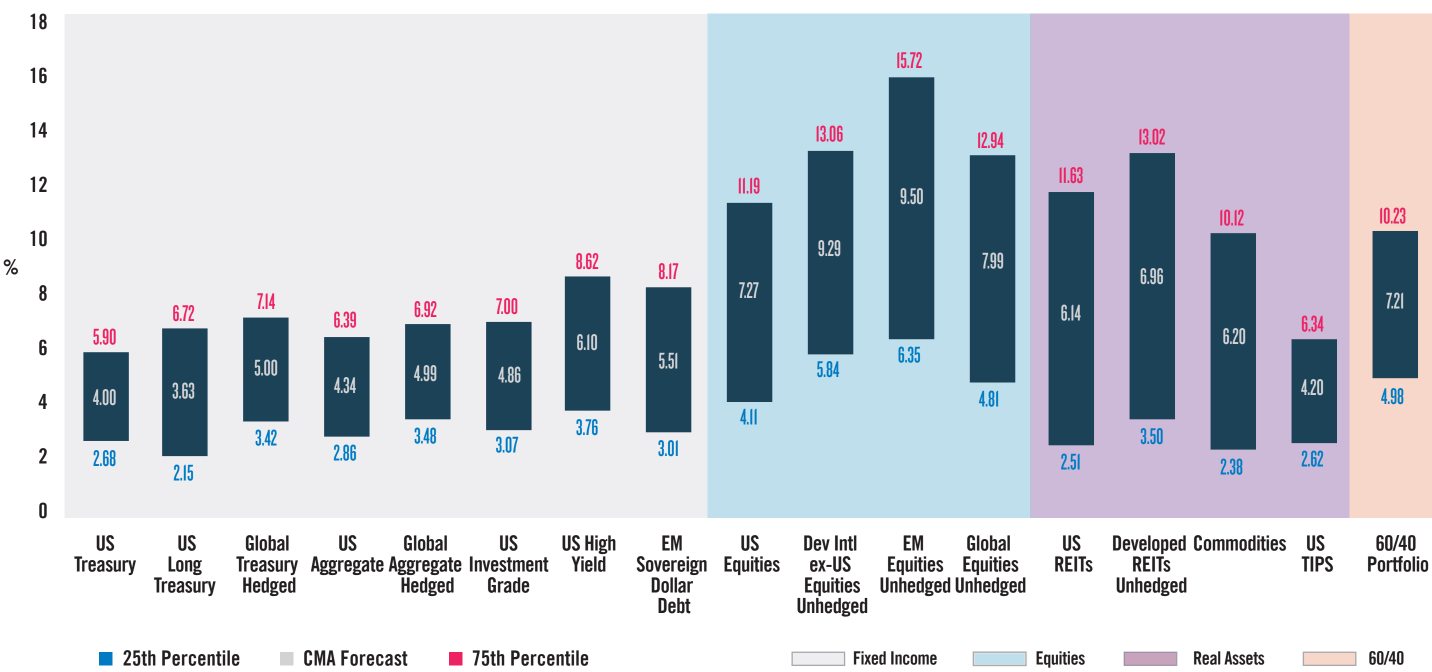
Source: PGIM Quantitative Solutions as of 12/31/2022. **Forecasts are not a reliable indicator of future performance.**

Incorporating Economic Uncertainty in Our 10-Year Forecasts

PGIM Quantitative Solutions' 10-year forecasts are based on building blocks with inherent uncertainty, particularly uncertainty as to the economic environment that will prevail over the next 10 years. To model this economic uncertainty, we conduct forward-looking simulations incorporating joint distributions of expansionary and recessionary investment environments. In contrast to simulations assuming a single multivariate normal distribution of asset class returns that are inconsistent with observed historical outcomes, our robust simulations consider periods of crisis that result in more pronounced drawdowns than would be captured in static average expected return and covariance forecasts.

Through these simulations we generate a distribution of return outcomes centered on our Capital Market Assumptions. Presented in the following chart are the 25th and 75th percentile ranges for the primary asset classes we forecast.[6]

Simulation-Based Forecast Ranges



Source: PGIM Quantitative Solutions as of 12/31/2022. **Forecasts and hypothetical performance are not a guarantee or reliable indicator of future results.** PGIM Quantitative Solutions generates 1,000 potential return paths using the simulation methodology described above. The uncertainty bands represent 25th and 75th percentile of potential return paths from the simulation. Returns paths are hypothetical in nature and do not reflect actual investment results. The information is shown for illustrative purposes only, does not constitute investment advice, and is not indicative or a guarantee of future results. Results from the projected simulation may vary over time and with each use.

[6] Beginning in Q1 2022, PGIM Quantitative Solutions introduced a methodology change in the Economic Uncertainty Simulations that removed the quarterly modeling of deviations from expected economic growth and inflation. The updated monthly asset-class-based simulations result in wider uncertainty bands than the previous methodology.

Risk-Based Policy Portfolios[7]

To provide insight into how our evolving CMAs can be used to inform multi-asset portfolios, PGIM Quantitative Solutions produces three representative risk-based policy portfolios every quarter. These policy portfolios are based on public market assets only and are meant to mimic three distinct liability profiles from a US investor perspective. Each quarter suggested portfolios are constructed through constrained optimization based on our evolving risk and return forecasts. Suggested portfolios selected along the efficient frontier will be those with the highest Sharpe ratios and with at least the same expected return as the respective policy portfolio to which they are benchmarked.

For the first quarter of 2023, starting from the benchmark policy portfolios, intra-equity allocation changes common to all the policy portfolios were reductions in exposure to US Large Cap equities and increased allocations to US Small Cap equities, International ex-US, and Emerging Markets equities. Within Fixed Income, allocations to both US Aggregate bonds and US Investment Grade bonds were decreased in all the portfolios, while allocations to US High Yield bonds were increased across the portfolios. Within Real Assets, allocations to TIPS were underweight, while allocations to REITs were increased in all the portfolios. Allocations to Commodities were increased in the Balanced and Growth portfolios. Across broad asset class groups, fixed income allocations were reduced, funding overweight allocations to equities in all portfolios and overweight allocations to Real Assets in the Growth and Balanced portfolios.

Q1 Risk-Based Policy Portfolios			
	Income Focused	Balanced Income and Growth	Growth Focused
Equities	**30.0%**	**55.0%**	**70.0%**
US Large Cap	20.0%	35.0%	40.0%
US Small Cap	2.0%	3.0%	8.0%
International ex-US	5.0%	12.0%	15.0%
Emerging Markets	3.0%	5.0%	7.0%
Fixed Income	**60.0%**	**35.0%**	**20.0%**
US Aggregate	50.0%	30.0%	10.0%
US Investment Grade	8.0%	3.0%	3.0%
US High Yield	2.0%	2.0%	7.0%
Real Assets	**10.0%**	**10.0%**	**10.0%**
TIPS	6.0%	3.0%	2.0%
US REITs	2.0%	4.0%	5.0%
Commodities	2.0%	3.0%	3.0%
Expected Geometric Return	**5.9%**	**6.9%**	**7.6%**
Expected Standard Deviation	**7.0%**	**10.0%**	**12.4%**
Expected Sharpe Ratio	**0.25**	**0.30**	**0.32**

Q1 Optimized Risk-Based Policy Portfolios			
	Income Focused	Balanced Income and Growth	Growth Focused
Equities	**35.0%**	**56.0%**	**71.0%**
US Large Cap	19.0%	30.0%	35.0%
US Small Cap	4.0%	5.0%	10.0%
International ex-US	7.0%	14.0%	17.0%
Emerging Markets	5.0%	7.0%	9.0%
Fixed Income	**55.0%**	**32.0%**	**17.0%**
US Aggregate	45.0%	27.0%	7.0%
US Investment Grade	6.0%	1.0%	1.0%
US High Yield	4.0%	4.0%	9.0%
Real Assets	**10.0%**	**12.0%**	**12.0%**
TIPS	4.0%	1.0%	0.0%
US REITs	4.0%	6.0%	7.0%
Commodities	2.0%	5.0%	5.0%
Expected Geometric Return	**6.3%**	**7.2%**	**7.8%**
Expected Standard Deviation	**7.8%**	**10.6%**	**13.1%**
Expected Sharpe Ratio	**0.28**	**0.32**	**0.33**

Source: PGIM Quantitative Solutions as of 12/31/2022. For illustrative purposes only. The asset allocations are hypothetical and should not be construed as investment advice. No investment strategy or risk management technique can guarantee returns or eliminate risk in any market environment. **There is no guarantee strategies will be successful. Forecasts are not a reliable indicator of future performance.**

[7] For illustrative purposes only. All risk-based policy portfolios have significant inherent shortcomings and do not consider many real-world frictions. There is no current PGIM Quantitative Solutions client portfolio with this composition of assets. Does not constitute investment advice and should not be used as the basis for any investment decision.

Innovations in Suggested Allocations from Q4 2022

Changes in our forecasts for the first quarter of 2023 have resulted in a number of innovations in our optimized portfolios from the end of 2022. In the Income portfolio, increased allocations to US equities and US REITs were funded by a decrease in TIPS and Commodities exposure. In the Balanced portfolio, an increased allocation to US Small Cap equities was funded by a decrease in the US Aggregate bond allocation. In the Growth portfolio, increased allocations to US Small Cap equities and REITs were funded through a meaningful 7% reduction in US Aggregate bond exposure.

Quarter-over-Quarter Changes in Optimized Risk-Based Policy Portfolio Allocations

	Income Focused	Balanced Income and Growth	Growth Focused
Equities	**2.0%**	**3.0%**	**3.0%**
US Large Cap	2.0%	0.0%	0.0%
US Small Cap	0.0%	3.0%	3.0%
International ex-US	0.0%	0.0%	0.0%
Emerging Markets	0.0%	0.0%	0.0%
Fixed Income	**0.0%**	**-3.0%**	**-7.0%**
US Aggregate	0.0%	-3.0%	-7.0%
US Investment Grade	0.0%	0.0%	0.0%
US High Yield	0.0%	0.0%	0.0%
Real Assets	**-2.0%**	**0.0%**	**4.0%**
TIPS	-2.0%	-4.0%	0.0%
US REITs	2.0%	4.0%	4.0%
Commodities	-2.0%	0.0%	0.0%
Expected Geometric Return	**-0.4%**	**-0.3%**	**-0.3%**
Expected Standard Deviation	**0.3%**	**0.9%**	**0.9%**
Expected Sharpe Ratio	**-0.12**	**-0.10**	**-0.08**

Source: PGIM Quantitative Solutions as of 12/31/2022. **Forecasts are not a reliable indicator of future performance. There is no guarantee strategies will be successful.** Asset allocations are hypothetical and should not be construed as investment advice For illustrative purposes only.

Policy Portfolio Including Private Assets

Given the increasingly important role private asset classes play in a growing number of institutional allocations, beginning in the second quarter of 2022, we introduced an additional policy portfolio that includes allocations to a number of private asset classes. The allocations are designed to approximate the risk profile of the Balanced policy portfolio, while providing diversifying exposure to private equity, private debt, and private real estate allocations. As in the policy portfolios including only public markets, suggested portfolios are constructed through constrained optimization based on our evolving risk and return forecasts. Suggested portfolios selected along the efficient frontier will be those with the highest Sharpe ratios and with at least the same expected return as the benchmark policy portfolio.

For the first quarter of 2023, the Private Assets policy portfolio allocation changes mirrored those in the Balanced portfolio that included only public markets investments. Specifically, exposure to US Large Cap equities was reduced in order to fund overweight allocations to US Small Cap, International ex-US, and Emerging Markets equities. Allocations to Fixed Income were reduced in US Aggregate and US Investment Grade bonds to finance overweight allocations to US High Yield bonds, and cross-asset-class allocations to Equities and Real and Private Assets. Within Real Assets, TIPS and Commodities allocations were increased, while exposure to REITs was decreased. In Private Assets, allocations were increased to Private Equity Buyout, Venture Capital, as well as Opportunistic Real Estate. In contrast, the allocations to Private Mezzanine Debt and Core Real Estate were reduced.

Capital Market Assumptions Balanced Portfolio With Private Assets Allocation		
	Benchmark	Optimal
Equities	**28.0%**	**31.0%**
US Large Cap	18.0%	13.0%
US Small Cap	2.0%	4.0%
International ex-US	6.0%	10.0%
Emerging Markets	2.0%	4.0%
Fixed Income	**35.0%**	**30.0%**
US Aggregate	30.0%	25.0%
US Investment Grade	3.0%	1.0%
US High Yield	2.0%	4.0%
Real Assets	**7.0%**	**8.5%**
TIPS	2.0%	3.5%
US REITs	3.0%	1.0%
Commodities	2.0%	4.0%
Private Assets	**30.0%**	**30.5%**
Private Equity Buyout	6.0%	8.0%
Venture Capital	4.0%	6.0%
Private Mezzanine Debt	10.0%	5.0%
Core Real Estate	6.0%	5.5%
Opportunistic Real Estate	4.0%	6.0%
Total	**100%**	**100%**
Expected Geometric Return	**6.8%**	**7.3%**
Expected Standard Deviation	**8.7%**	**9.6%**
Expected Sharpe Ratio	**0.32**	**0.35**

Source: PGIM Quantitative Solutions as of 12/31/2022. **Forecasts are not a reliable indicator of future performance.**

PGIM Quantitative Solutions' Steady State CMAs

PGIM Quantitative Solutions is now providing a longer-term forecast view beyond a 10-year horizon based on our 'steady state' views for asset classes. We construct long-term CMAs by combining 10-year CMAs and steady state CMAs. Returns are expected to follow the 10-year CMA scenario for the first segment of history and then follow the steady state CMAs thereafter. One motivation for this structure is that assets that are cheap (rich) on a valuation basis might have better (worse) returns over the near-term horizon. However, the longer an investor's time horizon, the less weight they should place on an asset class being cheap or rich today, and the more weight they should place on what happens in the steady state. Steady state CMAs are intended to answer the question of "what will asset returns be after prices have returned to equilibrium and economies grow at their long-run pace?" To accomplish this, we remove valuation components and cyclical terms in our existing model, anchoring them to an equilibrium level.

CMA volatility estimates are constructed based on historical standard deviations over the long term. To construct steady state volatility, we rely on the methodology by Cox, Ingersoll, and Ross (1985)[8], whose model links the volatility of interest rates to the square root of interest rates. Higher interest rates are associated with greater volatility in interest rates, just not linearly. In our case, we have volatility estimates over the subsequent 10 years, and want to model how those values would change if the return estimates change. The steady state volatility is calculated by scaling the 10-year volatility by the square root of the ratio of the steady state return to the 10-year return expectation. This approach ensures that if an asset class has a higher return in the steady state, such as would occur due to interest rates rising beyond our typical 10-year horizon, then the volatility is also scaled higher. However, since the scaling uses a square root instead of a linear adjustment, volatility will not increase as much as returns in the steady state. This means that the Sharpe ratio will also increase (see Tokat-Acikel et al. 2021 for details).[9]

Long-Term Capital Market Assumptions				
Asset	Expected Geometric Return	Expected Arithmetic Return	Expected Volatility	Expected Sharpe Ratio
Fixed Income				
Cash	3.86	3.86	—	—
US Treasury Bonds	4.02	4.13	4.66	0.06
Global Treasury Bonds Hedged	4.75	4.97	6.57	0.17
US Aggregate Bonds	4.42	4.58	5.66	0.13
Global Aggregate Bonds Hedged	4.71	4.87	5.56	0.18
US Investment Grade Bonds	4.93	5.16	6.79	0.19
US High Yield Bonds	6.55	6.94	8.87	0.34
US TIPS	3.98	4.13	5.63	0.05
Equities				
US Equities	8.62	10.01	16.73	0.35
US Small Cap	9.12	11.40	21.37	0.34
UK Equities Unhedged	8.25	9.76	17.39	0.35
Europe ex-UK Equities Unhedged	7.65	9.02	16.56	0.32
Japan Equities Unhedged	6.51	7.98	17.11	0.28
Developed International ex-US Equities Unhedged	7.67	8.73	14.56	0.35
EM Equities Unhedged	10.19	13.25	24.71	0.37
Global Equities Unhedged	8.53	10.70	20.84	0.32
Real Assets				
US REITs	8.23	10.32	20.45	0.29
Developed REITs Unhedged	8.06	10.82	23.48	0.28
Commodities	4.52	5.31	12.62	0.14
60/40 Portfolio	**7.43**	**8.32**	**13.37**	**0.33**

Source: PGIM Quantitative Solutions as of 12/31/2022. **Forecasts are not a reliable indicator of future performance.**

[8] Cox, Ingersoll, & Ross. 1985. "A Theory of the Term Structure of Interest Rates." Econometrica, 53 (2): 385-407. https://doi.org/10.2307/1911242.

[9] Tokat-Acikel, Aiolfi, Hall, Jin, & Johnson. 2021. "Top-Down Portfolio Implications of Climate Change" PGIM Quantitative Solutions White Paper. https://www.pgimquantitativesolutions.com/white-paper/top-down-portfolio-implications-climate-change

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About PGIM Quantitative Solutions

As the quantitative and multi-asset specialist of PGIM, we combine the agility of an independently run boutique with the stability and scale of one of the world's top-15 asset managers.* For over 45 years, we have designed proprietary methods that seek to solve beyond alpha by combining the latest technology with scalable, rigorous risk controls to nimbly build and manage diversified and customized solutions that help solve clients' evolving challenges. We manage portfolios across equities, multi asset, liquid alts and retirement for a global client base with $86 billion in assets under management as of 12/31/2022.

*PGIM is the investment management business of Prudential Financial, Inc. (PFI). PFI is the 11th largest investment manager (out of 431 firms surveyed) in terms of worldwide institutional assets under management based on Pensions & Investments' Top Money Managers list published June 2022. This ranking represents institutional client assets under management by PFI as of December 31, 2021. Participation in the P&I ranking is voluntary and open to managers that have any kind of U.S. institutional tax-exempt AUM. Managers self-report their data via a survey. P&I sends the survey to previously identified managers and to any new managers asking to participate in the survey/ranking. No compensation is required to participate in the ranking.