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Vanguard economic and market outlook for 2023: Beating back inflation

- Generationally high inflation has led to a marked slowing in global economic activity. Rapid monetary tightening aimed at bringing down inflation will ultimately succeed, but at a cost of a global recession in 2023.
- Current and expected conditions are like those that have signaled past global recessions. Significantly deteriorated financial conditions, increased policy rates, energy concerns, and declining trade volumes indicate the global economy will likely enter a recession in the coming year. Job losses should be most concentrated in the technology and real estate sectors, which were among the strongest beneficiaries of the zero-rate environment.
- Inflation continued to trend higher in 2022 across most economies as supply chains had yet to fully recover from pandemic-related distortions and as demand was buoyed by strong household and business balance sheets. Inflation has likely already peaked in most markets, but reducing price pressures tied to labor markets and wage growth will take longer. As such, central banks may reasonably achieve their 2% inflation targets only in 2024 or 2025.
- Consistent with our investment outlook for 2022, which focused on the need for higher short-term interest rates, central banks will continue their aggressive tightening cycle into early 2023 before pausing as inflation falls and job losses mount. Importantly, we see most central banks reluctant to cut rates in 2023 given the need to cool wage growth.
- Although rising interest rates have created near-term pain for investors, higher starting rates have raised our return expectations for both U.S. and international bonds, which we now expect to return roughly 4%–5% over the next decade.
- Equity markets have yet to drop materially below their fair-value range, which they have historically done during recessions. Longer term, however, our global equity outlook is improving because of lower valuations and higher interest rates. Our return expectations are 2.25 percentage points higher than last year. From a U.S. dollar investor's perspective, our Vanguard Capital Markets Model projects higher 10-year annualized returns for non-U.S. developed markets (7.2%–9.2%) and emerging markets (7%–9%) than for U.S. markets (4.7%–6.7%).

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Notes on asset-return distributions

The asset-return distributions shown here represent Vanguard's view on the potential range of risk premiums that may occur over the next 10 years; such long-term projections are not intended to be extrapolated into a short-term view. These potential outcomes for long-term investment returns are generated by the Vanguard Capital Markets Model® (VCMM) and reflect the collective perspective of our Investment Strategy Group. The expected risk premiums—and the uncertainty surrounding those expectations—are among a number of qualitative and quantitative inputs used in Vanguard's investment methodology and portfolio construction process.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from the VCMM are derived from 10,000 simulations for each modeled asset class. Simulations are as of September 30, 2022. Results from the model may vary with each use and over time. For more information, see the Appendix section "About the Vanguard Capital Markets Model."

Global outlook summary

The global economy in 2023: Beating back inflation

In our 2022 economic and market outlook, we outlined how we believed the removal of policy accommodation would shape the economic and financial market landscape. Policy has in fact driven conditions globally in 2022, one of the most rapidly evolving economic and financial market environments in history. But one fact has been made abundantly clear: So long as financial markets function as intended, policymakers are willing to accept asset price volatility and a deterioration in macroeconomic fundamentals as a consequence of fighting inflation. The normalization of consumer behavior, stabilization of supply pressures, and rapid monetary tightening suggest a more challenging macroeconomic environment in 2023 that, in our view, will help bring down the rate of inflation.

Global inflation: Persistently surprising

Inflation has continued to trend higher across most economies, in many cases setting multidecade highs. The action taken, and likely to be taken in the months ahead, by central banks reflects a promising effort to combat elevated inflation that has proven more persistent and broad-based. Supply-demand imbalances linger in many sectors as global supply chains have yet to fully recover from the COVID-19 pandemic and as demand is supported by strong household and business balance sheets buoyed by pandemic-era stimulus. The war in Ukraine continues, threatening another surge in energy and food commodities prices. Effective monetary policy requires good decision-making, good communication, and good luck. The current backdrop is missing the good-luck component, posing a challenge for policymakers whose fiscal and monetary tools are less effective at combating supply shocks.

A recession by any other name

Global macro and financial market conditions today and those anticipated in the coming months are similar to those that have signaled global recessions in the past. Energy supply-and-demand concerns, diminishing capital flows, declining trade volumes, and falling output per person mean that, in all likelihood, the global economy will enter a recession in the coming year. Central banks generally seek to avoid a recession. Inflation dynamics mean that supply-side price pressures on inflation are likely to reverse in 2023. However, policymakers must tighten financial conditions to stop high inflation from becoming entrenched into the decision-making of households and businesses. That said, households, businesses, and financial institutions are arguably in a better position to handle an eventual downturn, to the extent that they have stronger balance sheets. All recessions are painful, and we expect the length and depth of the recession in 2023 to vary by region.

Our base case is a global recession in 2023 brought about by the efforts to return inflation to target. Whether history views the 2023 recession as mild or significant matters little for those affected by the downturn. But failing to act aggressively to combat inflation risks harming households and businesses through entrenched inflationary pressures that last longer than the pain associated with any one recession.

As the table below highlights, growth is likely to end 2023 flat or slightly negative in most major economies outside of China. Unemployment is likely to rise over the year but nowhere near as high as during the 2008 and 2020 downturns. Through job losses and slowing consumer demand, a downtrend in inflation is likely to persist through 2023. We don't believe that central banks will achieve their targets of 2% inflation in 2023, but they will maintain those targets and look to achieve them through 2024 and into 2025—or reassess them when the time is right. That time isn't now; reassessing inflation targets in a high-inflation environment could have deleterious effects on central bank credibility and inflation expectations.

Vanguard's economic forecasts

	GDP growth*			Unemployment rate			Headline inflation†		Monetary policy		
	2023			2023			2023				
Country/ region	Vanguard	Consensus	Trend	Vanguard	Consensus	NAIRU	Vanguard	Consensus	Year-end 2022	Year-end 2023	Neutral rate
U.S.	0.25%	0.9%	1.8%	5%	4.4%	3.5%–4%	3%	2.4%	4.25%	5%	2.5%
Euro area	0%	0.2%	1.2%	7.4%	7.1%	6.5%–7%	6.0%	5.8%	2%	2.5%	1.5%
U.K.	–1.1%	–0.8%	1.7%	4.7%	4.4%	3.5%–4%	6.3%	6.8%	3.5%	4.5%	2.5%
China‡	4.5%	5%	4.3%	4.7%	N/A	5%	2.2%	2.3%	2.65%	2.6%	4.5%

* For the U.S., GDP growth is defined as the year-over-year change in fourth-quarter gross domestic product. For all other countries/regions, it is defined as the annual change in total GDP in the forecast year compared with the previous year.

† For the U.S., headline inflation is defined as year-over-year changes in this year's fourth-quarter Personal Consumption Expenditures (PCE) Price Index compared with last year. For all other countries/regions, it is defined as the average annual change in headline Consumer Price Index (CPI) inflation in the forecast year compared with the previous year. Consensus for the U.S. is based on Bloomberg ECFC consensus estimates.

‡ China's policy rate is the one-year medium-term lending facility (MLF) rate.

Notes: Forecasts, which may have been updated from earlier outlooks, are as of November 30, 2022. NAIRU stands for non-accelerating inflation rate of unemployment. The neutral rate is the interest rate that would be neither expansionary or contractionary when the economy is at full employment and stable inflation. This table displays our median neutral rate estimates with an effective range of +/- 1 percentage point.

Source: Vanguard.

Global fixed income: Brighter days ahead

The market, which was initially slow to price higher interest rates to fight elevated and persistent inflation, now believes that most central banks will have to go well past their neutral policy rates—the rate at which policy would be considered neither accommodative nor restrictive—to quell inflation. The eventual peak and persistence of policy rates, which will depend heavily on the path of inflation, will determine how high bond yields rise. Rising interest rates and higher interest rate expectations have lowered bond returns in 2022, creating near-term pain for investors. However the bright side of higher rates is higher interest payments. These have led our return expectations for U.S. and international bonds to increase by more than twofold. We now expect U.S. bonds to return 4.1%–5.1% per year over the next decade, compared with the 1.4%–2.4% annual returns we forecast a year ago. For international bonds, we expect returns of 4%–5% per year over the next decade, compared with our year-ago forecast of 1.3%–2.3% per year. This means that for investors with an adequately long investment horizon, we expect their wealth to be higher by the end of the decade than our year-ago forecast would have suggested. In credit, valuations are fair, but the growing likelihood of recession and declining profit margins skew the risks toward higher spreads. Although credit exposure can add volatility, its higher expected return than that of U.S. Treasuries and low correlation with equities validate its inclusion in portfolios.

Global equities: Resetting expectations

Rising interest rates, inflation, and geopolitical risks have forced investors to reassess their rosy expectations for the future. The silver lining is that this year's bear market has improved our outlook for global equities, though our Vanguard Capital Markets Model (VCMM) projections suggest there are greater opportunities outside the United States.

Stretched valuations in the U.S. equity market in 2021 were unsustainable, and our fair-value framework suggests they still don't reflect current economic realities. We also see a high bar for continued above-average earnings growth, especially in the U.S. Although U.S. equities have continued to outperform their international peers, the primary driver of that outperformance has shifted from earnings to currency over the last year. The 30% decline in emerging markets

over the past 12 months has made valuations in those regions more attractive. We now expect similar returns to those of non-U.S. developed markets and view emerging markets as an important diversifier in equity portfolios.

From a U.S. dollar investor's perspective, the VCMM projects higher 10-year annualized returns for non-U.S. developed markets (7.2%–9.2%) and emerging markets (7%–9%) than for U.S. markets (4.7%–6.7%). Globally, our equity return expectations are 2.25 percentage points higher than they were at this time last year. Within the U.S. market, value stocks are fairly valued relative to growth, and small-capitalization stocks are attractive despite our expectations for weaker near-term growth. Our outlook for the global equity risk premium is still positive at 1 to 3 percentage points, but lower than last year because of a faster increase in expected bond returns.

Indexes used in our historical calculations

The long-term returns for our hypothetical portfolios are based on data for the appropriate market indexes through September 30, 2022. We chose these benchmarks to provide the best history possible, and we split the global allocations to align with Vanguard's guidance in constructing diversified portfolios.

U.S. bonds: Standard & Poor's High Grade Corporate Index from 1926 through 1968; Citigroup High Grade Index from 1969 through 1972; Lehman Brothers U.S. Long Credit AA Index from 1973 through 1975; and Bloomberg U.S. Aggregate Bond Index thereafter.

Ex-U.S. bonds: Citigroup World Government Bond Ex-U.S. Index from 1985 through January 1989 and Bloomberg Global Aggregate ex-USD Index thereafter.

Global bonds: Before January 1990, 100% U.S. bonds, as defined above. From January 1990 onward, 70% U.S. bonds and 30% ex-U.S. bonds, rebalanced monthly.

U.S. equities: S&P 90 Index from January 1926 through March 1957; S&P 500 Index from March 1957 through 1974; Dow Jones Wilshire 5000 Index from the beginning of 1975 through April 2005; and MSCI US Broad Market Index thereafter.

Ex-U.S. equities: MSCI World ex USA Index from January 1970 through 1987 and MSCI All Country World ex USA Index thereafter.

Global equities: Before January 1970, 100% U.S. equities, as defined above. From January 1970 onward, 60% U.S. equities and 40% ex-U.S. equities, rebalanced monthly.

Notes on risk

All investing is subject to risk, including the possible loss of the money you invest. Past performance is no guarantee of future returns. Diversification does not ensure a profit or protect against a loss in a declining market. There is no guarantee that any particular asset allocation or mix of funds will meet your investment objectives or provide you with a given level of income. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

Stocks and bonds of companies in emerging markets are generally more risky than stocks of companies in developed countries. U.S. government backing of Treasury or agency securities applies only to the underlying securities and does not prevent price fluctuations. Investments that concentrate on a relatively narrow market sector face the risk of higher price volatility. Investments in stocks issued by non-U.S. companies are subject to risks including country/regional risk and currency risk.

Bond funds are subject to the risk that an issuer will fail to make payments on time, and that bond prices will decline because of rising interest rates or negative perceptions of an issuer's ability to make payments. High-yield bonds generally have medium- and lower-range credit-quality ratings and are therefore subject to a higher level of credit risk than bonds with higher credit-quality ratings. Although the income from U.S. Treasury obligations held in the fund is subject to federal income tax, some or all of that income may be exempt from state and local taxes.

I. Global economic perspectives

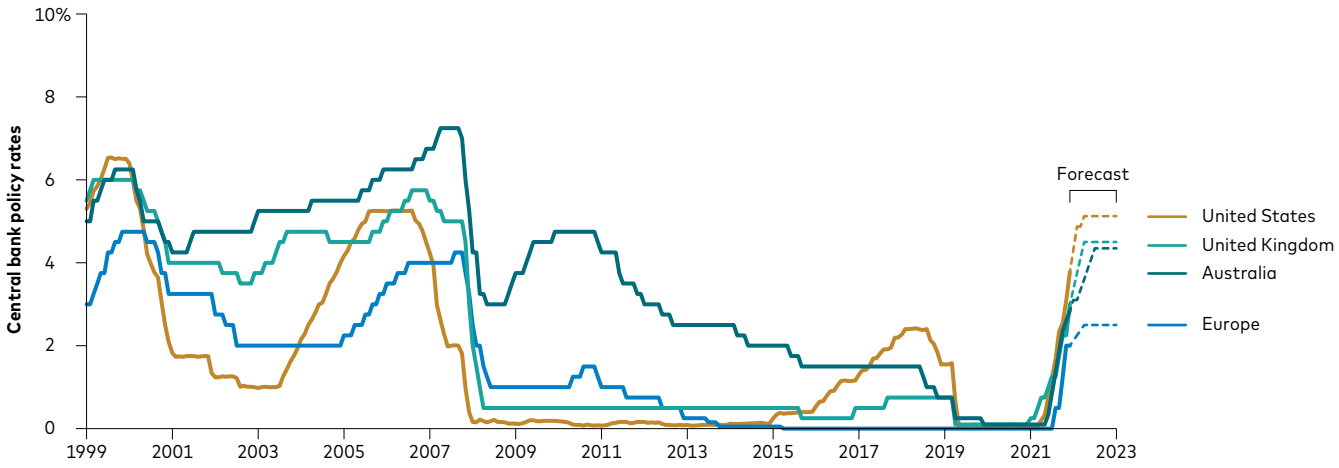
Global economic outlook: Beating back inflation

In our 2022 economic and market outlook, we outlined the reasons why we believed that the removal of policy accommodation would shape the economic and financial market landscape in the year ahead. Policy has in fact been a key driver of conditions globally, as 2022 has proven to be one of the most rapidly evolving economic and financial market environments in recent history. **Figure I-1** shows that the current and expected pace of change in monetary policy is unlike anything we've seen in the last 30 years, particularly on a globally coordinated scale.

The action taken, and likely to be taken in the months ahead, by central banks reflects an effort to combat multidecade high inflation that has proven more persistent and broad-based. Supply-demand imbalances linger in many sectors as global supply chains have yet to fully recover from the COVID-19 pandemic, and as demand is supported by strong household and business balance sheets buoyed by pandemic-era stimulus. The war in Ukraine continues, threatening another surge in energy and food commodities prices. Effective monetary policy requires good decision-making, good communication, and good luck. The Federal Reserve has been behind the curve in hiking rates this year, reflecting imprecise decision-making, but more importantly it is missing the good-luck component, posing a challenge for policymakers whose fiscal and monetary tools are less effective at combating supply shocks.

FIGURE I-1

Globally coordinated monetary tightening



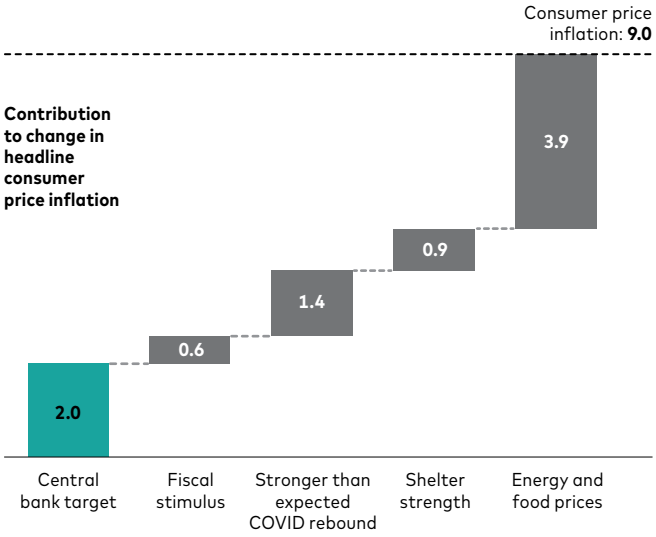
Note: Dotted lines represent Vanguard's forecast for policy rates as of October 31, 2022.

Sources: Vanguard calculations, based on data from Thomson Reuters Datastream and Bloomberg.

Because central banks' tools are most effective in bringing down inflation by tamping down demand, the decomposition of the drivers of inflation is crucial. By our estimates (**Figure I-2**), supply and demand factors are evenly contributing to inflationary pressures. If central banks are to rein in inflation, they will probably have to depress demand to the extent that a recession becomes very likely. **Figure I-3** outlines our projected probabilities of recession along with the likely forces that tip the economy into recession.

FIGURE I-2

Global inflation has been driven by a multitude of factors



Notes: This decomposition of inflation into each of the subcategories is based on subjective analysis of our latest inflation forecast for year-end 2022 compared with expectations at the start of 2021. Shelter inflation is the component that captures the effect of shelter costs in the overall CPI. Shelter includes prices for both renters and homeowners. For renters, shelter inflation measures rent, temporary lodging away from home, and utility payments. For homeowners, the U.S. Bureau of Labor Statistics calculates what it would cost to rent a similar house. Values in the figure reflect rounding.

Sources: Vanguard calculations, based on data from Moody's, Refinitiv, and Bloomberg, as of October 31, 2022.

FIGURE I-3

Near-term recession risk is elevated across major developed markets

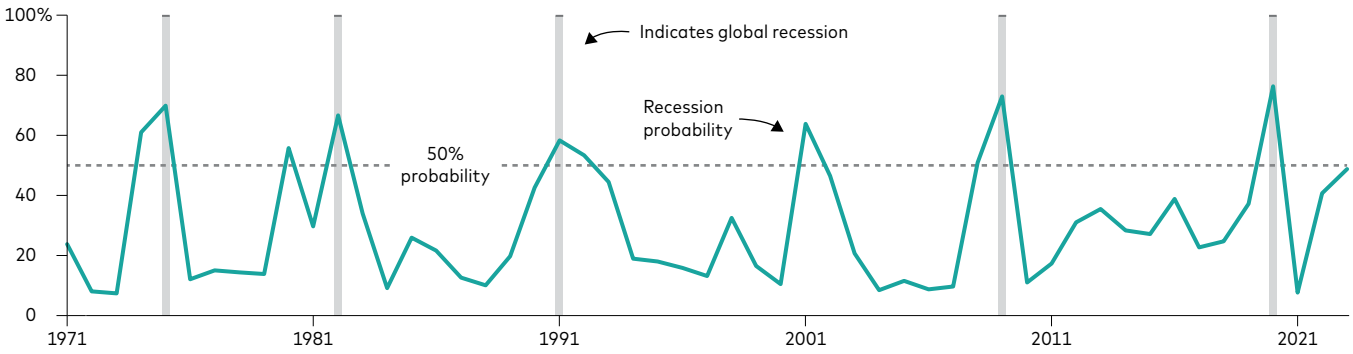
	Probability of recession by end of 2023	Drivers/key risks
United States	90%	• Federal Reserve tightening path • Inflation eroding consumer purchasing power
Euro area	90%	• Ukraine war impact including energy crisis • Inflation eroding consumer purchasing power • European Central Bank tightening path
United Kingdom	90%	• Bank of England tightening path • Inflation eroding consumer purchasing power

Source: Vanguard, as of September 30, 2022.

Global conditions today and those that are expected to materialize in the coming months are similar to conditions that have signaled global recessions in the past. Energy supply-and-demand concerns, decreasing capital flows, declining trade volumes, and falling output per person mean that, in all likelihood, the global economy will enter a recession in the coming year.[1] Borrowing from the World Bank's definition of a global recession, **Figure I-4** assigns a probability that the world is in a state of recession at any given point in time.[2] Only in 2001 was the probability of global recession as high as it is today without an actual recession taking place within the subsequent 12 months.[3] From this we infer that the chances of a global recession in 2023 are very high.

FIGURE I-4

Global recession indicator is at dangerous levels



Note: Probabilities derived from vector similarity matrixes for global unemployment, real per capita GDP, industrial production, foreign direct investment, trade, and global energy demand were used to identify similarities between the period under consideration and other recessionary periods.

Sources: World Bank, British Petroleum Statistical Review of World Energy, OECD, Federal Reserve Bank of St. Louis FRED database, OeNB, CPB Netherlands Bureau for Economic Policy Analysis, and UNCTAD, as of October 31, 2022. Global unemployment data are from Kose, Sugawara, and Terrones (2020).

1 While there is no universal definition of a global recession, the World Bank defines a global recession as a period in which (1) annual global real GDP per capita declines and (2) there is strong evidence for a broad-based decline in multiple global economic activity indicators (Kose, Sugawara, and Terrones, 2020).

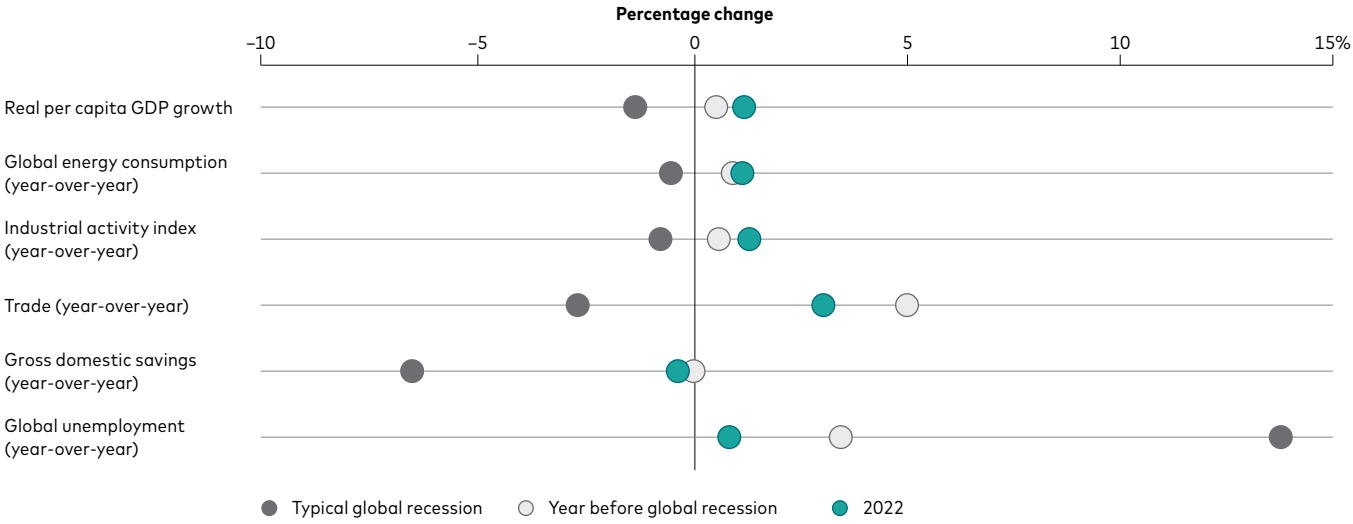
2 See World Bank, 2022, *Risk of Global Recession in 2023 Rises Amid Simultaneous Rate Hikes*, press release issued September 15, 2022, available at www.worldbank.org/en/news/press-release/2022/09/15/risk-of-global-recession-in-2023-rises-amid-simultaneous-rate-hikes.

3 A recession did occur in the United States from March to November 2001, though a global recession as defined by the World Bank was avoided.

Periods of global recession tend to be associated with considerable economic and financial market pain (**Figure I-5**). This is in part because, rather than simply a drop in demand or an increase in supply constraints, there is typically broader dislocation in macroeconomic fundamentals or the functioning of financial markets. In 1974 and 1981, global economies were locked in a stagflationary environment brought about by oil supply shocks and an unhinging of inflation expectations; that led to wages and prices moving ever higher in a vicious cycle broken only by substantial monetary policy tightening and ensuing recessions. In 2007, the global financial system nearly came to a halt as liquidity constraints led to solvency concerns at systemically important financial institutions exposed to securities tied to U.S. mortgage debt. And in 2020, large portions of the global economy essentially shut down in efforts to stem the health risks of the COVID-19 pandemic. The starting point for the global economy in 2022 was stronger than in a typical year before a global recession (Figure I-5): output and industrial activity were a little stronger and unemployment significantly lower. Taken at face value, a stronger footing into the recession could result in a milder downturn supported by strong balance sheets.

FIGURE I-5

Comparison: Global recessions versus now



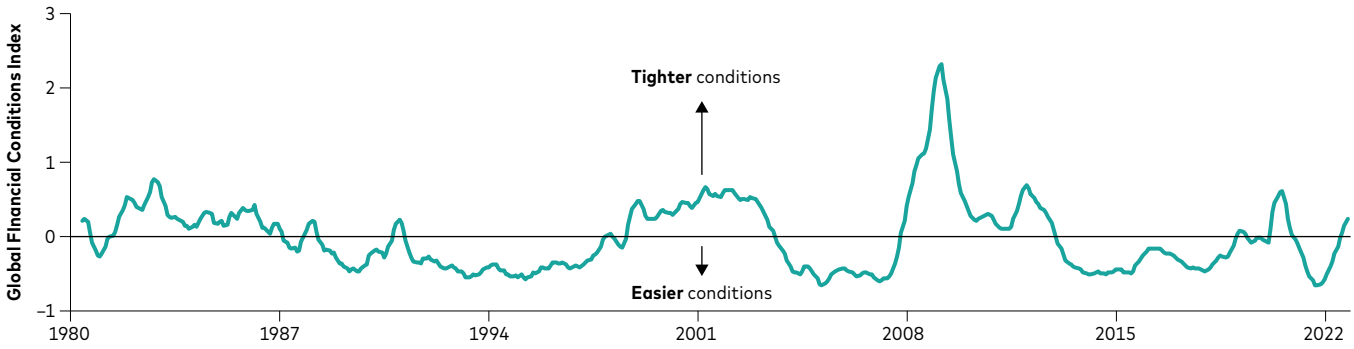
Notes: Global recession years were 1975, 1982, 1991, 2009, and 2020. Year before includes the year before each, excluding 2019. Vanguard calculations are as of October 31, 2022. The typical global recession reflects the median result for each category in the global recession years.

Sources: World Bank, British Petroleum Statistical Review of World Energy, OECD, Federal Reserve Bank of St. Louis FRED database, OeNB, CPB Netherlands Bureau for Economic Policy Analysis, UNCTAD, and Our World in Data, as of October 31, 2022. Global unemployment data and years of global recession are from Kose, Sugawara, and Terrones (2020).

Today, policymakers face a threat from global inflation brought on by a combination of a strong post-COVID recovery, lingering supply-chain disruptions, the war in Ukraine, and overly accommodative fiscal and monetary policy. In response, monetary policy has begun to swing toward restrictive conditions, much as it did during the 1980s (**Figure I-6**), though on a more coordinated scale. There are similarities between the global recessions of the 1970s and what may transpire in coming months, such as relatively tight labor markets (**Figure I-7**) and the presence of supply-side shocks, but there are also key differences. First, rather than double-digit inflation rising ever higher and on the back of rising inflation expectations and wages, inflation expectations have largely stayed contained, particularly those that look out over longer periods (**Figure I-8**). Should that change, central banks will increase the urgency of their tightening processes. Second, central banks have built up credibility regarding their resolve and ability to keep inflation at their target rates. This is mainly due to successful efforts to bring inflation down in the 1980s and maintain it at around 2% over the past 30 years. The credibility gained by central banks is what has helped anchor inflation expectations today. This is the key reason why the likelihood of central banks changing their inflation targets amid a high-inflation environment remains low for now, as doing so could hurt their credibility and thus their ability to address inflation in future episodes. That said, a change in the inflation target at some future date cannot be ruled out should it be supported by changes in policy preferences or the structure of the economy (Gagnon and Collins, 2019).

FIGURE I-6

Global financial conditions continue to tighten

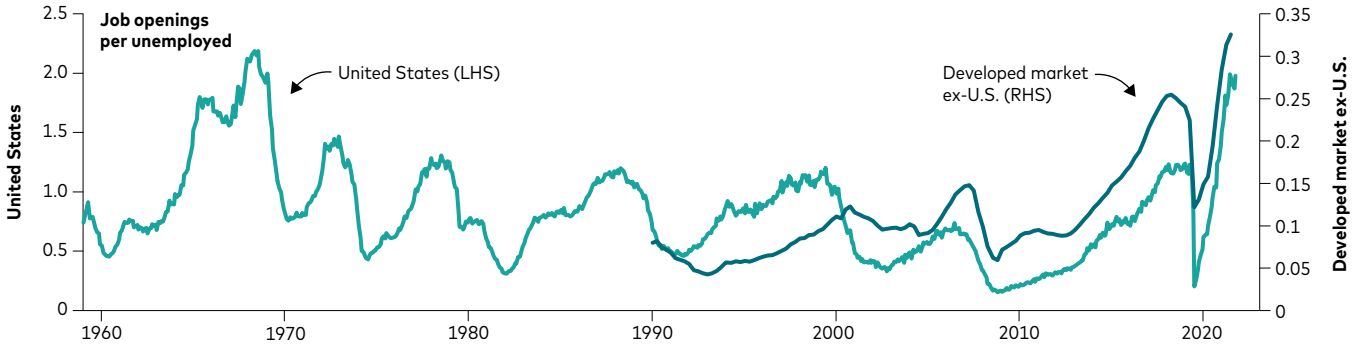


Note: The global index is a GDP-weighted average of the Vanguard U.S., Bloomberg U.K., Vanguard euro zone, and Goldman Sachs Japan financial conditions indexes.

Sources: Vanguard calculations, based on data from Thomson Reuters Datastream, Bloomberg, and Goldman Sachs, as of October 31, 2022.

FIGURE I-7

Employers having trouble filling vacant jobs

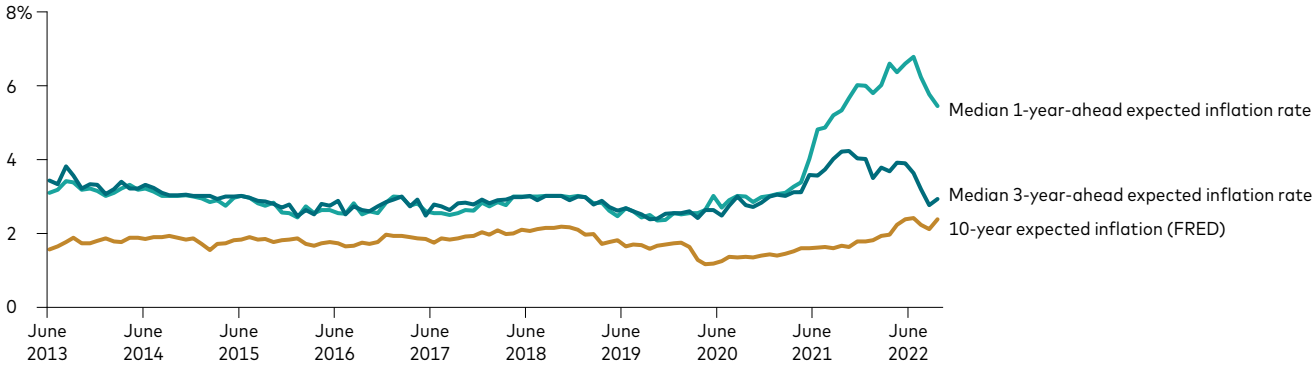


Note: Data include Australia, Austria, Belgium, the Czech Republic, Finland, Germany, Japan, Norway, Portugal, Spain, Sweden, the United Kingdom, and the United States.

Sources: Vanguard calculations, based on data from Thomson Reuters Datastream, as of October 31, 2022.

FIGURE I-8

Long-term inflation expectations have remained anchored



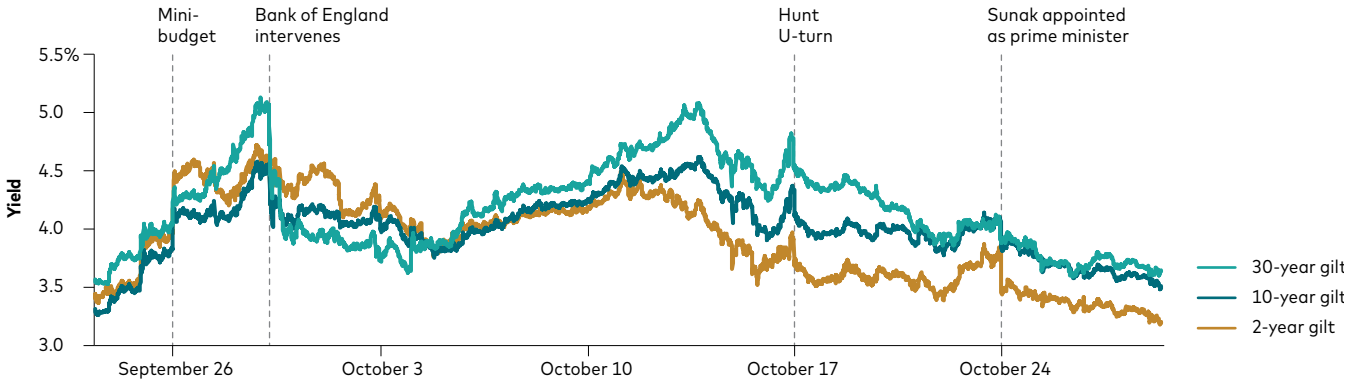
Notes: Global inflation expectations were calculated for G7 countries based on GDP weights. Subcomponent contributions were calculated on a GDP-weighted basis. For CPI subcomponent weights at the country level, 2021 weights were used for the U.S., the U.K., the European Union, and Canada; 2020 weights were used for Japan. West Texas Intermediate (WTI) spot data were used for oil prices, and WTI forward prices were used for forecast estimates.

Sources: Survey of Consumer Expectations, Federal Reserve Bank of New York, and Federal Reserve Bank of St. Louis FRED database.

Credibility can affect fiscal policy as well. The market response to the United Kingdom's "mini-budget" was swift and harsh (**Figure I-9**), a clear signal that the proposed tax and spending changes negatively affected the perceived willingness and ability of the U.K. government to service its debts. This should serve as a stark reminder that markets will not tolerate unfunded expenditures (tax cuts or spending increases) beyond a certain level. Following the appointment of Jeremy Hunt as chancellor and Rishi Sunak as prime minister, the U.K. has seen a return of fiscal orthodoxy. Tax rises and spending cuts worth 2.5% of GDP over the next five years have placated markets. The U.K. fiscal watchdog—the Office for Budget Responsibility (OBR)—has affirmed that the latest fiscal plans put public sector net debt to GDP on a sustainable path. Gilt yields have returned to levels seen prior to the mini-budget, and the sterling has recovered against the dollar and euro.

FIGURE I-9

U.K. gilt yields have declined to pre-mini-budget levels



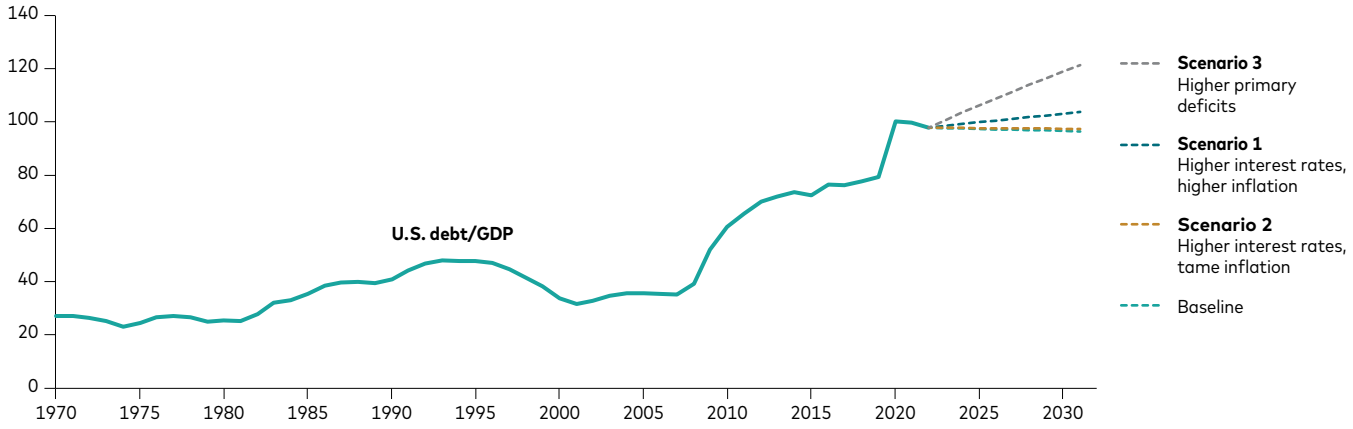
Notes: Intraday data from September 22, 2022, to October 27, 2022. "Mini-budget" refers to the growth plan announced by Chancellor of the Exchequer Kwasi Kwarteng on September 23, 2022. The Bank of England intervened on September 28 to restore financial stability, announcing it would buy an unlimited amount of long-term gilts. On October 17, new Chancellor of the Exchequer Jeremy Hunt reversed almost all the measures of the mini-budget. On October 24, Rishi Sunak was announced as the new U.K. prime minister.

Source: Bloomberg, as of October 31, 2022.

Last year, we introduced the theory of fiscal space as one approach to estimating how much debt countries can maintain without risking sustainability and likely interest rate increases (Ostry et al., 2010, and Zandi, Cheng, and Packard, 2011). Taking the U.S. situation as an example, **Figure I-10** shows that the current high-inflation, high-interest-rate environment does little to affect the sustainability of current debt levels, as the two forces offset each other, but if deficits are to average 5% as the Congressional Budget Office expects under current U.S. tax and spending policies, the upward trajectory of debt quickly becomes unsustainable. Although the debts taken on during the pandemic were necessary to prevent suffering on a global scale, something needs to be done going forward to start reining in gaps between taxes and spending before financial markets begin to take action themselves. The time is not now, but it is approaching.

FIGURE I-10

U.S. debt ratio is expected to remain flat even in a higher-rate, higher-inflation environment



Notes: Debt-to-GDP ratios were forecasted according to a standard debt accumulation equation. We used real GDP growth taken from July 2022 Congressional Budget Office (CBO) extended baseline projections. The other variables are defined as follows (based on 2022–2032 averages): In the base case, nominal interest rates were assumed to be 1.6%, inflation was assumed to be 2%, and the primary deficit was assumed to be 2%. We modifed those assumptions as indicated by the labels in the figure. For Scenario 1, we used 2.5% for the nominal interest rate. For Scenario 2, we used 2.5% for the nominal interest rate and 2.8% for inflation. For Scenario 3, we used 5% for the primary deficit.

Sources: CBO July 2022 extended baseline projections and Vanguard, as of November 4, 2022.

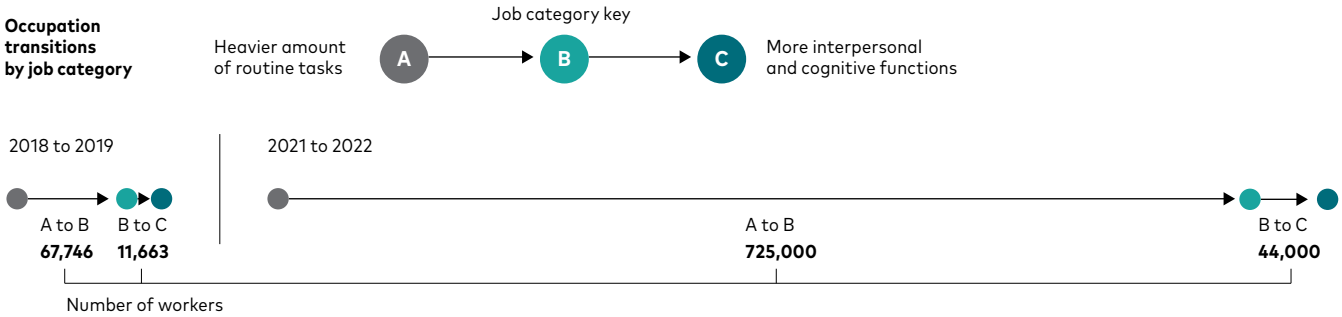
In addition to previously mentioned goods and energy supply shocks and accommodative policy considerations, labor market dislocations have played a role in shaping our current environment. Our research has shown that, as with the other factors, this is in part due to the pandemic and its lingering impacts (Clarke, Tan, and Schickling, 2022). That said, the factors driving labor market frictions over the last few years (slowing population growth, increasing retirements, and changing skill supply-and-demand dynamics) are likely an acceleration of labor market trends that had been in place well before COVID-19 and the policy responses to it that threw economic and financial markets into turmoil.

In 2018, we presented a more optimistic perspective on automation's impact on labor markets, outlining why automation and broader trends in the skills required of jobs meant that labor demand, rather than declining, was likely to shift to incorporate different skill sets (Tufano et al., 2018). Mirroring what has been the case during most economic downturns (Kopytov, Roussanov, and Tashereau-Dumouchel, 2018), increasing numbers of studies and our analysis in **Figure I-11** highlight how people took the time to upskill during the pandemic (Ganguli et al., 2022), because of more time spent at home, concern about the viability or safety of their current industry, and/or their increased ability to spend time and money acquiring those additional skills. In Figure I-11, the one-third of jobs with the least amount of interpersonal or cognitive capabilities fall into Category A, the middle one-third into Category B, and the one-third with the highest requirement of interpersonal and cognitive capabilities into Category C. As individuals move from a Category A role to a Category C role, they typically require increasing amounts of training to allow them to develop the interpersonal and cognitive capabilities required of that type of role. Our work shows that the movement from A to B to C roles from 2021 to 2022 is substantially greater than that which occurred in 2018 to 2019, before the pandemic.

In addition to the movement of workers between types of jobs, this upskilling also implies future productivity increases over time that would in part offset any inflationary pressures associated with higher wages. But the road to that point will be painful. Staffing shortages (**Figure I-12**) are likely in the near term, meaning that wage pressures and the risks they pose to inflation are likely to persist absent the intervention of central banks and the impacts outlined earlier.

FIGURE I-11

Job upskilling is a tailwind for potential economic growth



Notes: Occupations categorized as A entail more routine tasks, while B and C occupations entail more cognitive and interpersonal job functions. Average 2021 pay levels for each category in our sample data were $37,200, $51,800, and $60,500.

Sources: Vanguard calculations, based on data from the Bureau of Labor Statistics Current Population Survey, as of September 30, 2022.

FIGURE I-12

A global recession will offer only temporary relief from a tight U.S. labor market

Labor supply-demand balance	2022	2025
Supply: Expected civilian labor force	165 million	165.5 million
Demand: Employment + job openings	170 million	174 million
Current shortfall	**5 million**	**8.5 million**

Labor shortfalls likely offset

Labor shortfalls		2025
1	**Non-uniquely human to uniquely human job transitions**	+ 1.5 million
2	**Legal migration returns to pre-COVID rate**	+ 3 million
3	**a. Work-from-anywhere dividend**	+ 600 thousand
	b. Demographic dividend	+ 1.8 million
Implied 2025 shortfall		**1.6 million**

A milder, but still tight, labor market

Implied	2022	2025
Vacancy/Unemployment (V/U)	2.0	1.2
Wage growth	6%	4%
Inflation (CPI)	5%–6%	2%–3%

Notes: Non-uniquely human to uniquely human job transitions reduce the labor shortfall since the workers' output per hour increases after the transition. The work-from-anywhere dividend is an estimate of the increase in labor force participation brought on by increased remote work opportunities. The demographic dividend refers to the sizable percentage of nonworking individuals ages 60 to 75 who report a desire to return to the labor force if conditions are right.

Sources: Vanguard calculations, based on data from the Bureau of Labor Statistics, as of September 30, 2022.

From an economic, financial market, and social perspective, the last few years have left us with no shortage of volatility and pain. That is, unfortunately, likely to persist in the near term as we work through the lasting impacts of the pandemic and subsequent policy reactions. A recession, probably global in nature, seems likely in the next year and, with it, job and output losses that hopefully lead to declines in inflation. That said, households, businesses, and financial institutions are in a much better position to handle the eventual downturn, such that drawing parallels with the 1970s, 1980s, 2008, or 2020 seems misplaced.

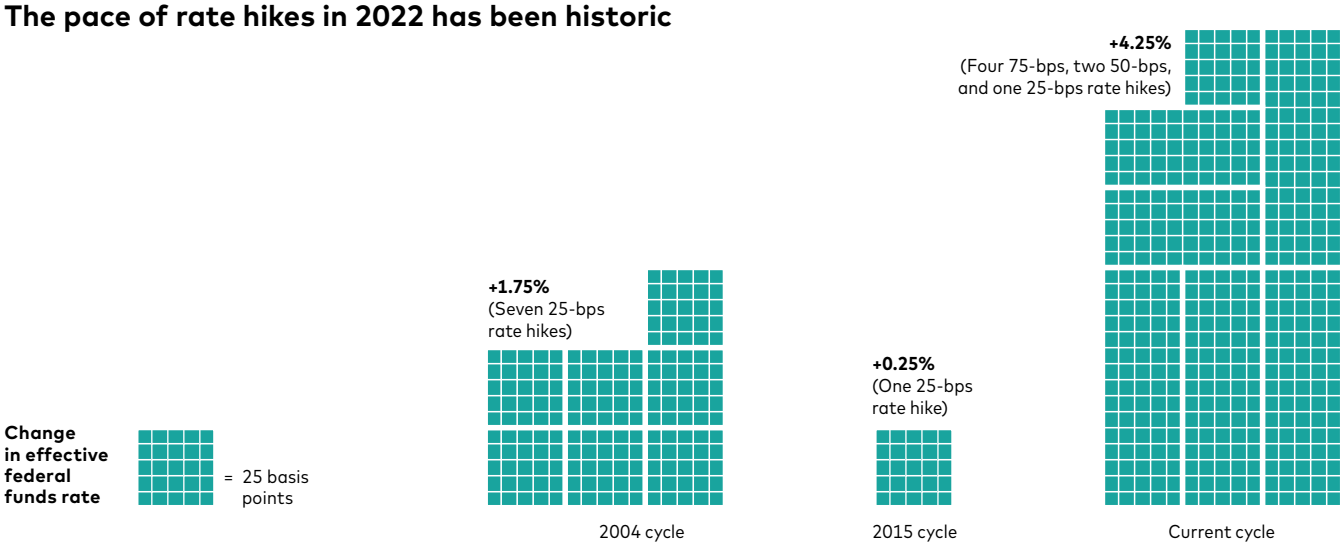
United States: A narrow path gets narrower

Economic outcomes in the U.S. for 2023—much like in the rest of the developed world—will be dominated by monetary policy efforts to accelerate the path of inflation back to target. Growth slowed materially in 2022, but inflation has remained stubbornly elevated and the labor market strong. Further slowdowns in growth and a weakening of the labor market are necessary conditions for disinflation.

Compared with recent history, the current monetary tightening cycle is historic and leaves the narrowest of paths for the economy to escape without a period of recession. **Figure I-13** illustrates the rapid rise in the policy rate over the last four quarters and relative to previous cycles.

FIGURE I-13

The pace of rate hikes in 2022 has been historic



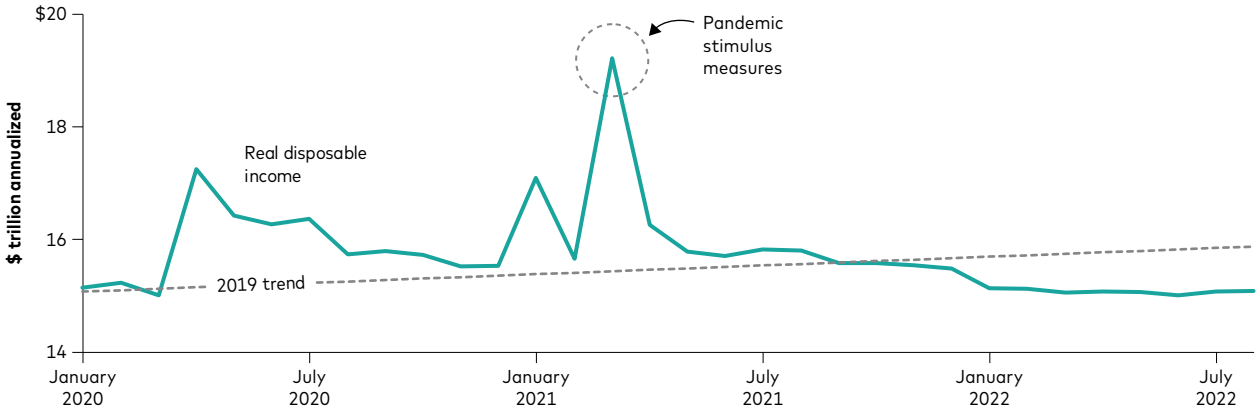
Notes: The figure shows changes in the effective federal funds rate during the first four quarters of each hiking cycle. The current cycle assumes an additional 50 bps of tightening will occur at the December 2022 Federal Open Market Committee meeting. A basis point equals one-hundredth of a percentage point.

Sources: Vanguard and the Federal Reserve Bank of St. Louis, as of October 31, 2022.

Overall, we expect GDP growth of around 0.25% over the course of 2023. Key interest-rate-sensitive sectors of the economy such as housing have already abruptly slowed, and consumers are facing wage gains that, while nominally strong, have turned sharply negative in real terms. We estimate that given the pace of inflation relative to wages, the average household experienced a $400 shortfall per month in its standard of living relative to before the pandemic. **Figure I-14** shows the current severity of real income shortfall compared with the pre-COVID income trend. Households in aggregate have thus far absorbed rising prices by relying on a strong labor market and a remaining savings buffer built up during the pandemic, but inflation has depressed sentiment, and overall growth activity has slowed below trend as we head into 2023.

FIGURE I-14

Real purchasing power is a key headwind to growth

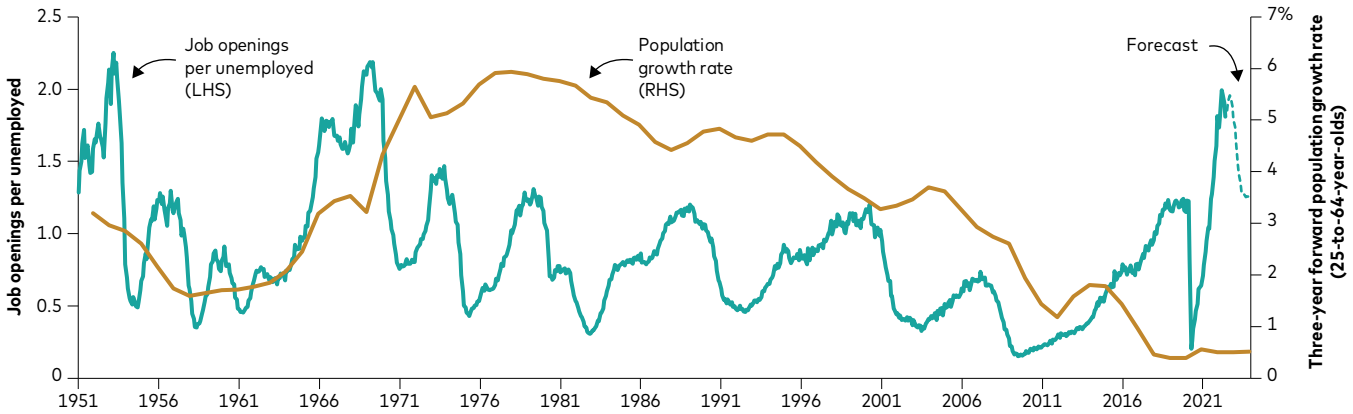


Sources: Vanguard and Refinitiv, as of October 31, 2022.

Although the U.S. labor market has been surprisingly resilient to these mounting economic challenges, aided by structural labor-supply constraints, we expect that demand for labor will moderate as consumers and companies brace for a recession. But considering how tight the labor market is entering this recession—as shown in **Figure I-15** in job openings per unemployed, and the slower pace of new labor force entrants as a result of slower population growth—unemployment may peak around 5%, a historically low rate for a recession. Furthermore, as a result of the moderation in labor demand and declining consumer confidence, job turnover rates are likely to return to more normal levels, which will help reduce wage inflation to a more sustainable 4% nominal growth rate. We expect a weaker labor market on a number of fronts as outlined above, which will hopefully put downward pressure on inflation.

FIGURE I-15

Tepid working-age population growth limits the downside for the U.S. labor market

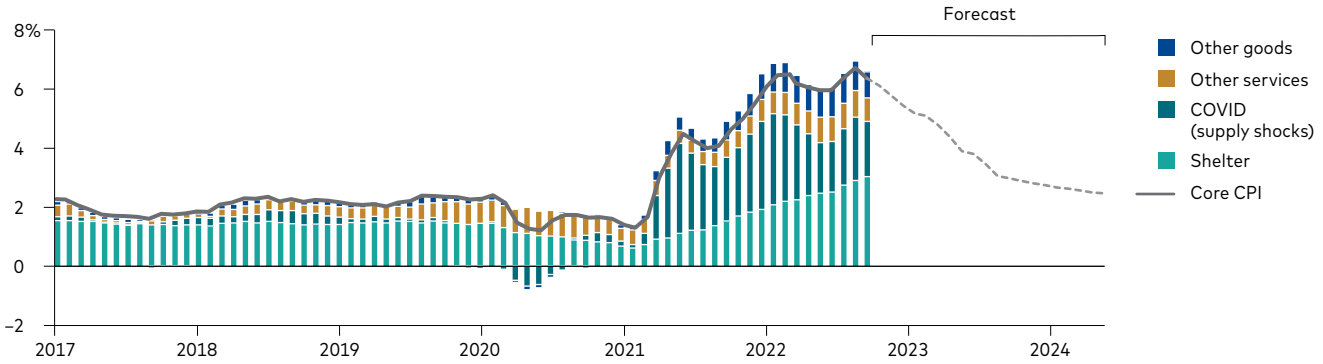


Sources: Vanguard calculations, based on data from Datastream, DataBuffet, and the Bureau of Labor Statistics, as of October 31, 2022.

Among the drivers of U.S. inflation, in addition to a tight labor market, 2022 saw the lagged impact of supply constraints resulting from pandemic-era dynamics pushing inflation higher (**Figure I-16**). As we step into 2023, early signs of a recovery in goods supply and softening demand could help balance supply and demand for consumption goods and bring prices lower. But expectations of a stronger pickup in services—especially the stickier component of shelter inflation—will keep inflation from falling back quickly. We see inflation by the end of 2023 settling at 3%, which is higher than the Federal Reserve's inflation target of 2%. In other words, we do not see inflation returning to target next year.

FIGURE I-16

Inflation has proved more persistent because of COVID-related shocks and the shelter component



Notes: The COVID supply shocks component includes subcomponents that faced extreme supply bottlenecks and demand shocks during peak COVID, namely transportation services and vehicles. Other goods includes apparel, household furnishings, and recreational goods. Other services includes health care, education and communication, recreational services, and other services. Energy price shocks are not directly included in transportation services but are indirectly included through higher airfares. Shelter inflation is the component that captures the effect of shelter costs in the overall CPI. Shelter includes prices for both renters and homeowners. For renters, shelter inflation measures both rent and utility payments. For homeowners, the BLS calculates what it would cost to rent a similar house.

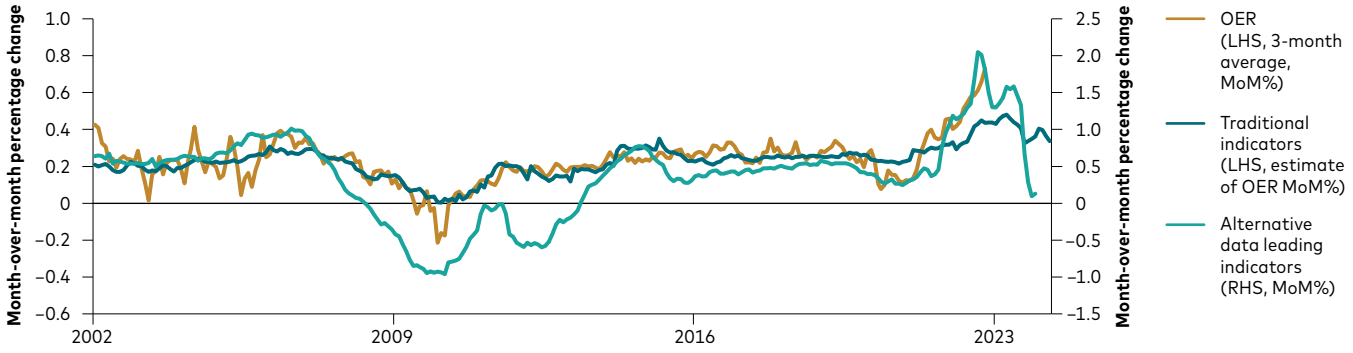
Sources: Vanguard calculations, based on data from the Bureau of Labor Statistics, as of October 31, 2022.

As we discussed earlier, monetary policy and the communications from policymakers have squarely focused on inflation, and policy rates are currently at levels broadly considered restrictive for economic activity, with more likely in coming quarters. That said, we're starting to see signs of progress in the fight against inflation. Prime among these is housing activity, where signs of slowing momentum are already evident. Given the lag with which housing activity filters into inflation, this will eventually result in a slower pace of shelter inflation sometime in the second half of 2023. In early 2023, shelter inflation will remain strong, reflecting the still-robust housing market momentum of early 2022 (**Figure I-17**). The stronger gains in shelter inflation, in our view, will be offset by a faster deceleration in goods inflation and a slowdown in wages as a tighter policy rate environment begins showing its full effect on the economy in 2023.

Given such price and labor dynamics of late, our monetary policy outlook has become more hawkish, and we expect a "higher for longer" policy rate environment ahead. Our baseline outlook envisions the policy rate tightening to reach a peak of 5% by early 2023 and remaining at similar levels throughout the year. Given the uncertainty that the inflation path has posed thus far, we expect the Fed to favor a pace of tightening based strongly on data dependence, with wage and inflation expectations being key watch variables that will influence the Fed's ultimate path.

FIGURE I-17

Both traditional and alternative data suggest a slowdown in shelter inflation only after mid- to late 2023, keeping core inflation elevated at year-end 2023



Notes: Owners' equivalent rent (OER) represents the CPI subcomponent of owner-imputed rent, which holds the highest weight in core CPI. Traditional indicator estimates of OER MoM% are based on a Vanguard proprietary model used to forecast OER MoM gains. Alternative data indicators contain publicly provided data from private rental and housing firms. Weighted average of MoM changes in alternative data has been a relatively good signal of turning points in the monthly pace of shelter inflation.

Sources: Vanguard calculations, based on data from Zillow, Apartment List, the Bureau of Labor Statistics, the U.S. Bureau of Economic Analysis, Refinitiv, and Moody's, as of October 31, 2022.

Euro area: The European Central Bank (ECB) will continue to tighten despite recession

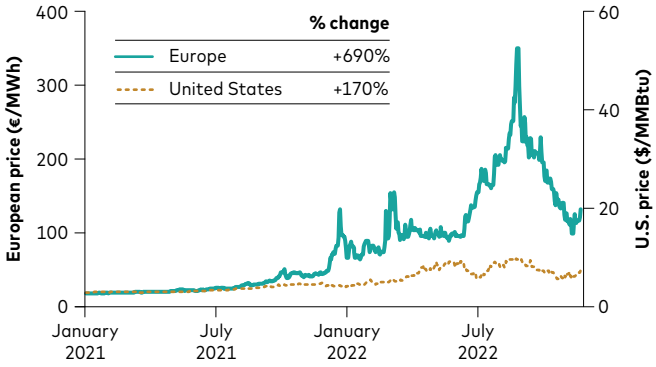
Inflation and the policies enacted to address it have played a large role in shaping the economic conditions in the euro area. The war in Ukraine added another layer of uncertainty, volatility, and price pressures in 2022. Activity held up well in the first half of the year, supported by a strong post-pandemic recovery. Growth momentum, though, slowed sharply in the second half as higher energy prices (**Figure I-18a**), tighter financial conditions, depressed sentiment, and weakening global growth all weighed on the economy. We expect euro-area GDP growth to slow from around 3% in 2022 to 0% in 2023.

Looking ahead, we are encouraged by Europe's flexibility in adapting to the sharp reduction in Russian gas imports. Over 90% of its gas storage capacity has been filled, helped by additional imports from other pipeline and liquefied natural gas suppliers, and efforts have been made to use alternative energy sources in some industries. This should help soften the blow. That said, we still expect gas demand to contract by about 15% this winter relative to last year (**Figure I-18b**) given the war-related supply constraints.

FIGURE I-18

A European energy crisis

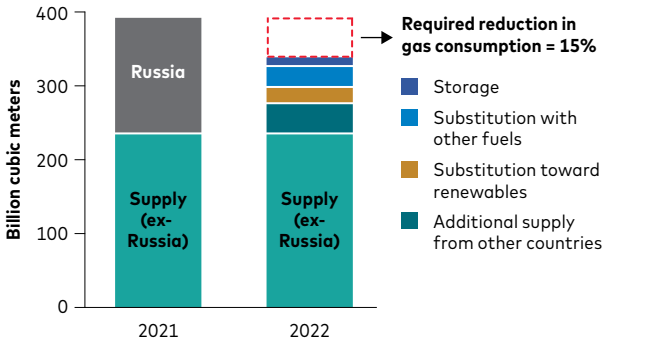
a. European natural gas prices remain elevated



Notes: Increase since December 31, 2020. ICE Dutch TTF natural gas price for Europe, and Henry Hub natural gas price for the the U.S. Daily data from January 1, 2021, to November 23, 2022.

Source: Bloomberg, as of November 23, 2022.

b. European gas imports: How the gap will be plugged

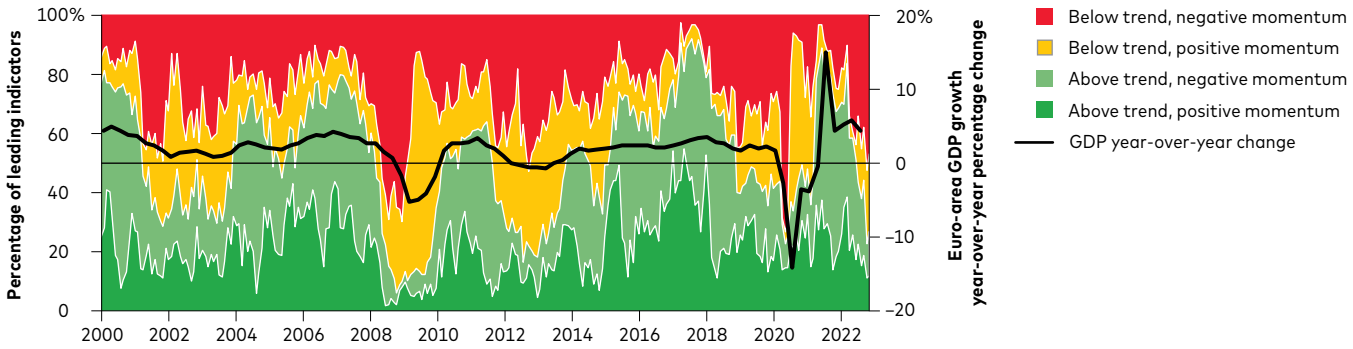


Sources: International Energy Agency, European Commission, and Vanguard estimates, as of October 31, 2022.

Forward-looking data, including Vanguard's leading economic indicator, point to continued weakness ahead (**Figure I-19**). In our base case, we expect that the euro-area economy will have entered recession from the fourth quarter of 2022, with growth turning positive only in the second half of 2023. We anticipate that Germany and Italy will underperform, given their relatively large energy-intensive industrial sectors. The risks to this view are skewed to the downside; We do not rule out the prospect of a double-dip recession in the second half of 2023 given that European gas supply will be starting from a much lower base than in 2022 and financial conditions will be tighter. Upside risks include milder-than-expected weather or an earlier-than-expected resolution to the war. As with the U.S., many of the risks come down to luck.

FIGURE I-19

Vanguard leading economic indicator points to further deterioration in economic growth



Notes: Monthly data from January 2000 to October 2022. The Vanguard leading economic indicator (VLEI) dashboard considers a range of leading indicators, sorted based on current levels relative to trend and underlying momentum. Indicators include consumer confidence, industrial production, retail sales, trade-weighted euro, factory orders, and stock market indexes.

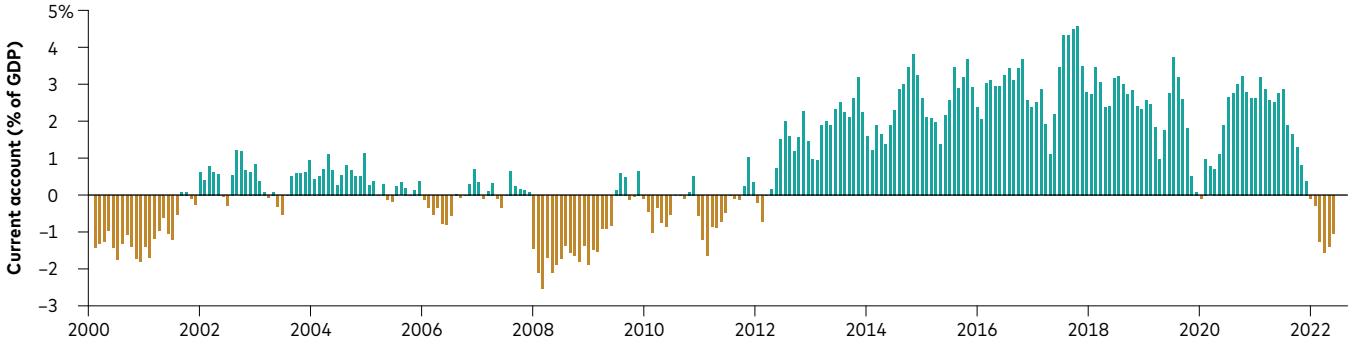
Source: Vanguard, as of October 31, 2022.

Also similar to the U.S. situation is that the central challenge for European policymakers remains rising inflation. To be successful in guiding inflation back down to target, the European Central Bank will need a combination of good decision-making, good communication, and good luck. The headline Consumer Price Index (CPI) rate doubled, from 5% at the start of 2022 to 10% in November, predominantly because of accelerating energy and food prices. A weakening of the euro, partly driven by the war-induced negative terms-of-trade shock (**Figure I-20**), has amplified this inflationary pressure, as it raised the cost of imports priced in foreign currencies, putting downward pressure on growth.[4]

The breadth of inflation has also increased throughout 2022. Eighty percent of the CPI is now tracking at an annual rate above 3%, and core inflation accelerated from 2.6% at the start of the year to 5% as of November. We expect both headline and core inflation to peak in December 2022 and then fall gradually in 2023 as energy and food price base effects unwind and demand softens. We still, though, expect inflation to average 5.5%–6% in 2023, well above the ECB's target of around 2%, as services inflation persists and core goods pressures dissipate only gradually (**Figure I-21a**).

FIGURE I-20

The current account has switched from surplus to deficit



Note: Monthly data from January 2000 to August 2022.
Sources: Vanguard calculations, based on data from Bloomberg, as of October 24, 2022.

4 A country's terms of trade refers to the relative price of exports compared with imports.

The ECB will be concerned about the stickiness of inflation, particularly in the services component, amid a still-tight labor market. Indeed, the unemployment rate is at a record low 6.5% (as of October 2022), wage growth has increased to 4% year-over-year compared with a pre-pandemic average of 2%,[5] and there is tentative evidence that high inflation is now flowing through to longer-term inflation expectations (**Figure I-21b**).

We therefore expect the ECB to build on the 200 basis points' worth of rate increases it has already delivered, with the deposit rate having risen from –0.5% at the start of 2022 to 1.5% at the October 2022 meeting. (A basis point is one-hundredth of a percentage point.) Our base case is for the deposit rate to reach at least 2% by year-end and to peak at 2.5% in early 2023. We expect this restrictive policy stance to be maintained through 2023, with risks to our terminal rate view skewed to the upside given the underlying strength of the labor market..

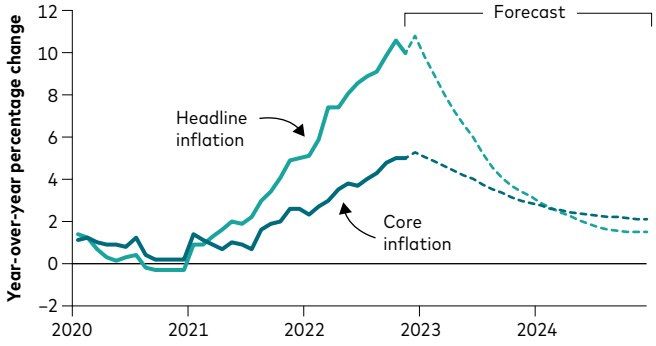
As policymakers continue to raise rates, they will need to be mindful of the risk of euro-area fragmentation, which would impair the proper functioning of monetary policy. The introduction of the Transmission Protection Instrument will help allay concerns here. In our central scenario, the presence of this tool, coupled with a delay of quantitative tightening until the second half of 2023, will limit any material blowout in peripheral spreads.

Finally, given our central scenario of recession, we expect euro-area governments to keep energy-related fiscal measures for at least the first half of 2023 in order to cushion demand, which we estimate will average between 2% and 3% of GDP. This will delay any plans for fiscal consolidation until the latter part of 2023 at the earliest. Given weak growth, continued energy support, and rising interest costs, euro-area debt-to-GDP ratios are unlikely to fall meaningfully in the near term. Italy will be under the most scrutiny because of its relatively high debt burden and the election of a new government. Debts will remain sustainable in the near term, but solutions to growing debt burdens must be discussed going forward.

FIGURE I-21

Inflation is a challenge for policymakers

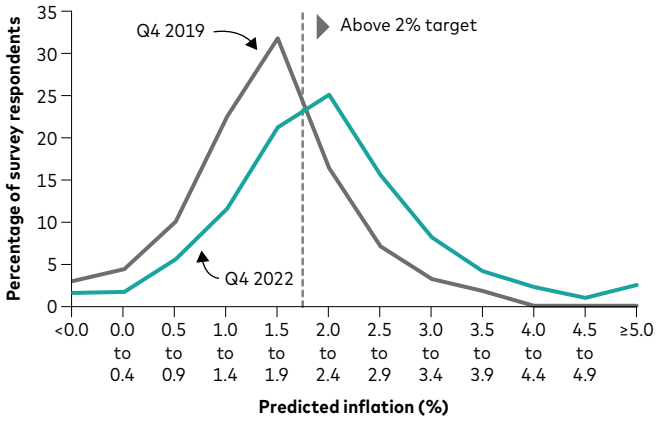
a. Peak in inflation is yet to come



Note: Monthly data from January 2020 to November 2022 and Vanguard forecasts thereafter.

Sources: Vanguard calculations, based on data from Bloomberg, as of November 22, 2022.

b. Long-term inflation expectations have become stickier



Note: Longer-term expectations refer to 2027 in Q4 2022 and to 2024 in Q4 2019.

Sources: ECB and Survey of Professional Forecasters, as of October 28, 2022.

5 As measured by the euro-area employment cost index.

United Kingdom: Recession looms large as cost-of-living crisis intensifies

The war in Ukraine, the unique structure of the U.K. energy market, and domestic political instability posed challenges to the U.K. economy in 2022. Activity slowed consistently throughout the year as higher commodity prices, tighter financial conditions, very low confidence, and a weak global growth backdrop all dragged on demand. This was before the mini-budget was announced and then renounced weeks later in an effort to appease financial markets. We expect 2022 U.K. GDP growth of about 4%, coming from a low 2021 base, but—as with other major developed markets—slowing to –1% to –1.5% in 2023.

We expect the economy to have entered recession in the third quarter of 2022. Business surveys are now consistent with a sharp contraction in output, and consumer confidence metrics are at historical lows. Forward-looking indicators, including Vanguard's leading economic indicator, suggest further weakness ahead. We expect the recession to last at least six quarters and to be deeper than in the euro area.

The U.K.'s annual rate of CPI inflation doubled in 2022, from 5.4% at the start of the year to 11.1% as of October 2022. The acceleration was primarily driven by higher energy and food prices, though the core goods and services components also rose significantly. The government's Energy Price Guarantee (EPG) policy, which caps unit energy prices, should keep a lid on inflation in the near term.

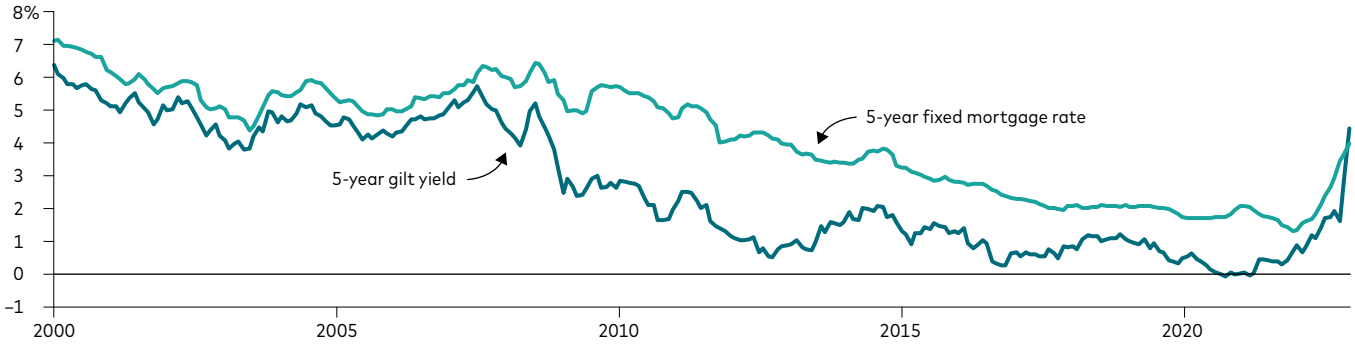
In our base case, we expect inflation to fall gradually from a peak of above 11% in the last quarter of 2022 and to average 6% to 6.5% in 2023, well above the Bank of England's 2% target.

Aside from energy prices, the Bank of England will be closely monitoring developments in the labor market to calibrate its appropriate policy response. As in the U.S., job vacancies in the U.K. remain close to record highs, and wage pressures have intensified, with wages rising roughly 6% year-over-year. The latter issue is of particular concern as strong wage growth will lead to more persistent inflationary pressure, predominantly through the stickier services component. In our central scenario, we expect the Bank of England to raise interest rates to around 3.5% by the end of 2022 and to a peak rate of 4.5% in early 2023. We expect this restrictive policy stance to persist through 2023.

With the implementation of the EPG and higher interest rates, we expect the narrative of the U.K.'s "cost-of-living" crisis to shift away from higher energy prices and toward higher mortgage interest payments. If the Bank Rate does reach 4.5%, this would imply new mortgage rates of at least 5.5% for the average borrower—a near-quadrupling of interest costs (**Figure I-22**). As a large proportion of U.K. mortgagers are on fixed rates, it will take time for this effect to feed through to the economy. That said, we estimate that 35% to 45% of the total stock of U.K. mortgages will be repriced to newer rates over the course of 2023. This will further weaken the outlook for the consumer and exert downward pressure on housing valuations.

FIGURE I-22

New mortgage rates have moved in line with higher U.K. bond yields



Note: Monthly data from January 31, 2000, to September 30, 2022.
Source: Bloomberg, as of October 21, 2022.

The year 2022 was also one of political instability for the U.K. Disagreements within the Conservative Party led to three different prime ministers (and four different Chancellors of the Exchequer). Despite the aggregate fiscal consolidation of the Autumn Statement, policy is actually set to ease in the next two financial years to protect the economy during recession, with the expected tightening occurring thereafter (**Figure I-23**).

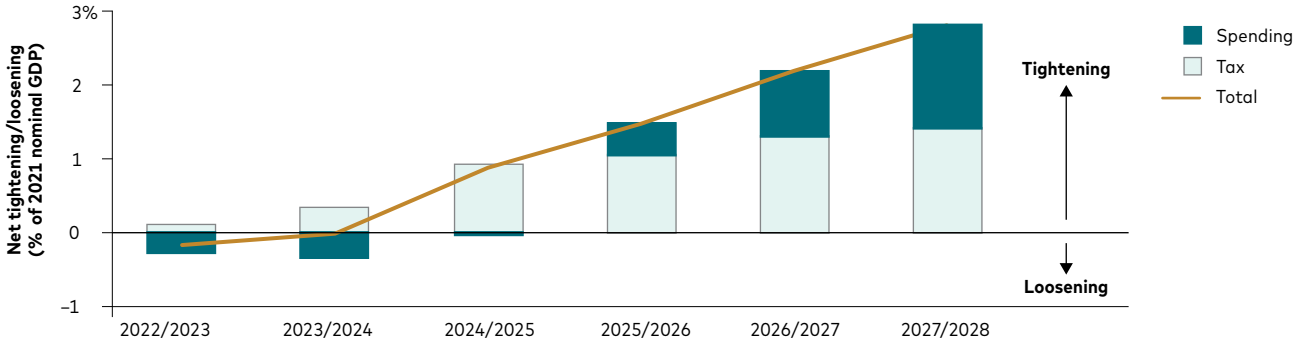
Concerns remain over the sustainability of the U.K.'s debt profile. Although the debt-to-GDP ratio, at below 100%, is lower than in many other developed economies, substantial fiscal consolidation was penciled in the Autumn Statement to prevent it from rising significantly in the next five years (Figure I-23).

The U.K. is arguably in a more fragile situation than other developed economies. Growth is already weak and global inflation shocks are amplified given that it is a small, open economy. To bring inflation back down to target, the economic sacrifice—ultimately through higher unemployment—could be larger.

Raising interest rates sharply to address this heightened inflation challenge may also unveil hidden risks, particularly given the U.K.'s relatively large financial sector. The stress experienced by some domestic pension funds amid volatility in the gilt market earlier this year is one example of this risk to financial stability.

FIGURE I-23

A modest loosening in fiscal policy until 2024



Sources: Vanguard and the OBR, as of November 21, 2022.

China: A cyclical bounce meets a structural downturn

As in major developed economies, policy has played and will play a large role in economic outcomes in China, but for different reasons. China's economic fortunes are governed by what we have termed an "impossible trilemma," in which policymakers must balance three competing priorities: maintaining a zero-COVID policy (ZCP), ensuring financial stability, and sustaining strong levels of economic growth. In 2022, policymakers focused on upholding ZCP and ensuring financial stability at the cost of growth. As a result, we forecast GDP growth to end 2022 at around 3%, well below the historical average and official targets of 5.5%. In 2023, we expect that policymakers' focus is likely to gradually shift away from maintaining a strict ZCP toward achieving slightly stronger economic growth levels.

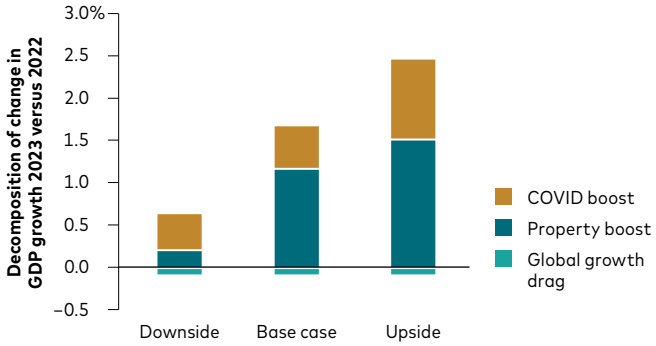
This will most likely result in a cyclical bounce in 2023 of 4.5% GDP growth with risks skewed to the upside on that view, driven by gradual loosening of COVID controls and a stabilizing real estate sector (**Figure I-24**). Nonetheless, we believe that the cyclical bounce will be modest compared with those that followed the global financial crisis in 2009 and the 2020 Wuhan lockdown, given the expected global recession, uncertainty around the exit path from COVID-19, the lack of willingness and capacity to overstimulate the economy, and a structural slowdown of growth potential in the long run.

Policymakers have announced that they plan to prepare for reopening the economy by relaxing COVID controls, promoting vaccine and drug development, and improving hospital facilities. This could engineer a long-awaited recovery in consumption and service activities. Crucially, however, we think the exit from COVID-19 is unlikely to be smooth, as China's health care system remains vulnerable to large outbreaks. A gradual reopening is more likely in our view as booster vaccination rates for the older population improve and an mRNA vaccine and/or effective treatment becomes widely available, which should lead to a more evident rebound in the economy following the National People's Congress (NPC) next March.

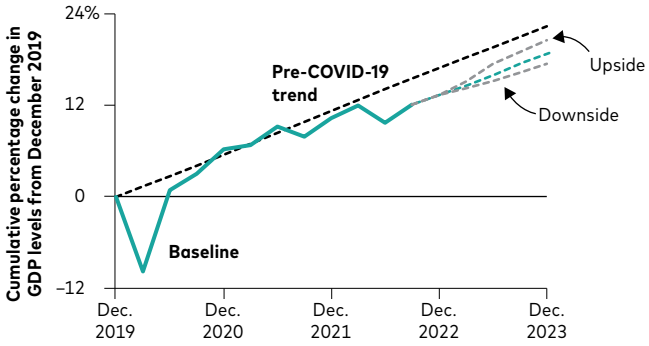
FIGURE I-24

Cyclical bounce expected in 2023 as the zero-COVID policy is unwound and the real estate sector stabilizes

a. 2023 cyclical GDP bounce decomposed into drivers



b. Chinese GDP unlikely to fully recover to pre-COVID levels



Sources: Vanguard calculations, based on data from Bloomberg, as of October 31, 2022.

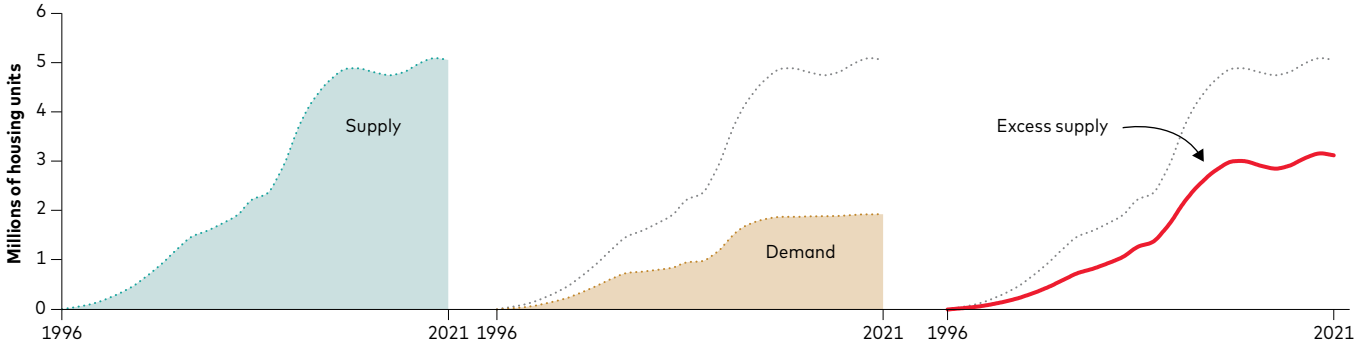
Notes: The baseline assumes a gradual decline in COVID restrictions with the pace accelerating after the March NPC meetings, but no complete abolishment. It also assumes that real estate investment stabilizes but does not rebound. The downside scenario assumes COVID restrictions remain at pandemic highs by the March leadership meetings and decline gradually through year-end, plateauing at a high level. It also assumes real estate investment continues to fall but at a slower pace than in 2022. The upside scenario assumes COVID restrictions are largely abolished after the March NPC meetings while real estate investment has a modest recovery.

Along with ZCP, China's real estate sector was a major drag on headline growth in 2022, subtracting around 2%. In 2023, we expect a cyclical rebound in the sector, which may boost growth by slightly more than 1 percentage point relative to 2022. This rebound is driven by supportive fiscal and monetary policy, stabilizing sentiment and real estate investment, and reopening of the economy, which will help boost demand at a low level following a nearly 10% contraction in 2022. We believe the rebound will be restrained by the significant structural challenges facing China's real estate sector, including oversupply, poor affordability, and worsening demographic trends (**Figure I-25**).

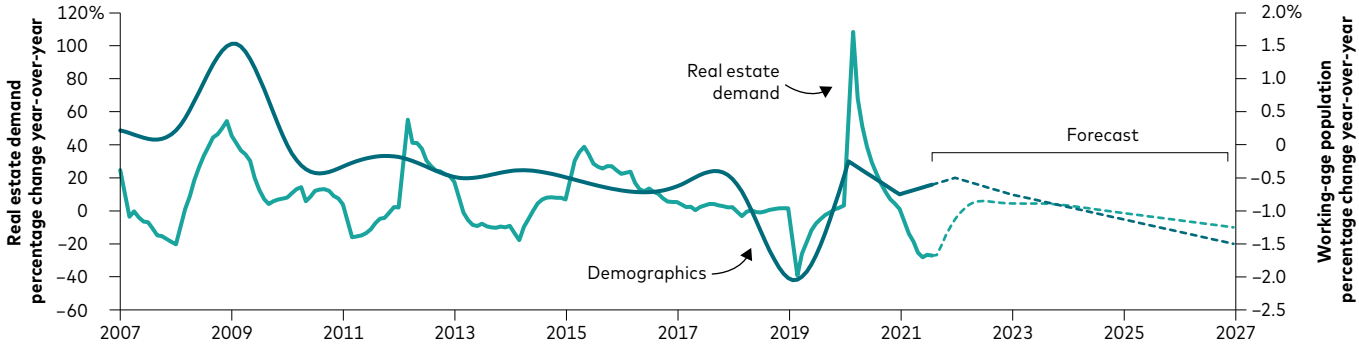
FIGURE I-25

Despite easing regulation, the housing market is unlikely to rebound because of a structural downturn

a. Housing remains oversupplied in China, with increased demand providing only a slight offset to supply growth



b. Cyclical factors will provide near-term support to housing, but structural factors will lower demand over the next five years

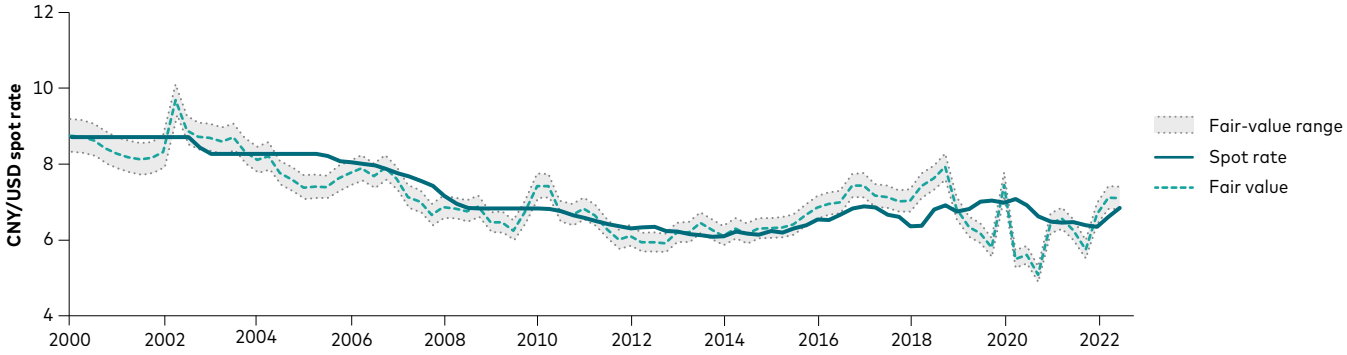


Sources: Vanguard calculations, based on data from Bloomberg, as of October 31, 2022.

A modest cyclical bounce, following the deep downturn in 2022, suggests that a negative output gap is likely to persist toward the end of next year even in our upside scenario, with the normalization in consumption and services continuing to lag behind that of production. Such an incomplete and uneven recovery of the economy would keep consumer inflation subdued. We expect headline CPI to average 2.2% in 2023, with core inflation below 1%. As such, the People's Bank of China is likely to continue with modest liquidity easing and interest rate cuts in the near term, bucking the global trend. Nonetheless, we also believe that policymakers will refrain from overstimulating the housing market and the broader economy in 2023, given concerns about ever-rising leverage and financial stability risks. In fact, once the economy starts to rebound in the second quarter, we expect policy to switch to a more neutral stance. In addition, the depreciation in the renminbi in the second half of 2022 is a reminder that Chinese policymakers have limited space to stimulate, as further and more aggressive easing may lead to capital outflows and higher inflation. The currency is likely to remain under pressure in 2023 as developed-market central banks continue raising interest rates in efforts to curb inflation, though the improved growth outlook in China and the interventions by the People's Bank of China to prevent panic about financial stability could help stabilize the renminbi down the road. Our fair-value model (**Figure I-26**) suggests that the renminbi is now close to fair value based on fundamentals.

FIGURE I-26

Our fair-value model is showing the renminbi fairly valued at current levels

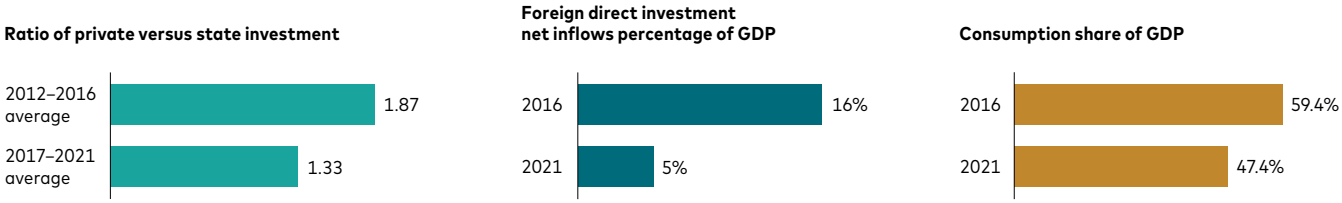


Sources: Vanguard calculations, based on data from DataStream, as of October 31, 2022.

In addition to policymakers' reluctance to overstimulate, a worsening structural growth outlook is expected to restrain the recovery in 2023 and the growth outlook in the years ahead. Foreign direct investment flows into China over 2017–2021 were significantly lower than they had been in the prior five years, amid a slowing globalization trend and rising geopolitical tension, while the pace of private sector investment slowed notably over the same time frame (**Figure I-27**). These developments will weigh on productivity growth, a key determinant of potential growth rates. Also concerning is that progress has reversed during the pandemic on the shift from an investment-led economy to a consumption-led one, exacerbating concerns about growth sustainability in the medium term.

FIGURE I-27

Japanification warning signs, with rising concerns about long-term growth sustainability



Sources: Vanguard calculations, based on data from Bloomberg and the CEIC, as of October 31, 2022.

Emerging markets: Headline growth resilience meets underlying economic divergence

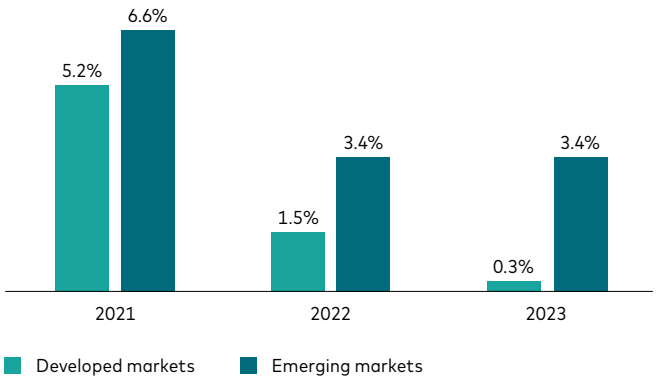
The story of emerging markets (EM) in 2022 has been one of remarkable resilience (**Figure I-28a**) despite myriad macroeconomic shocks. Although food and energy prices rose, financial conditions tightened significantly, and Chinese growth disappointed, EM growth, foreign exchange, and inflation have not underperformed developed markets. However, the relative headline resilience masks the regional divergence (**Figure I-28b**).

We expect EM growth of 3.4% in 2023 to significantly outperform developed-market growth of 0.3%, but we are likely to see notable divergence once again across regions. While Asia will benefit from a cyclical bounce in China and falling inflation, EM Europe will continue to face inflation pressures from uncertain energy supply and a weak European growth backdrop. In Latin America, growth is likely to disappoint consensus as U.S. growth slows materially in 2023, prompting central banks to adjust policy rates down from very high levels.

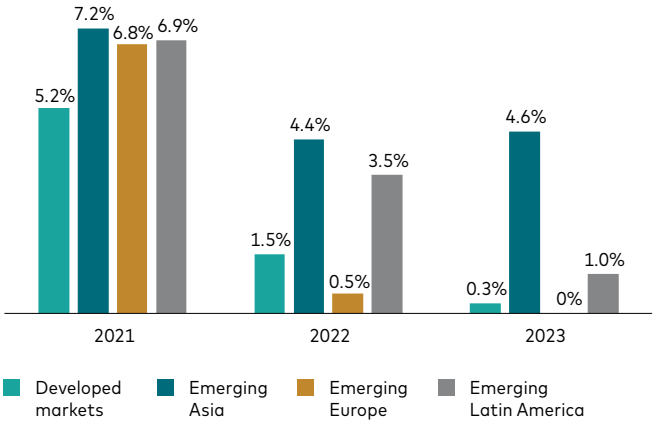
FIGURE I-28

Diverging fortunes for emerging-market economies

a. Emerging markets GDP growth will remain resilient relative to developed markets growth in 2023



b. But we expect significant divergence among regions to continue in 2023



Note: Vanguard forecasts for 2022 and 2023.

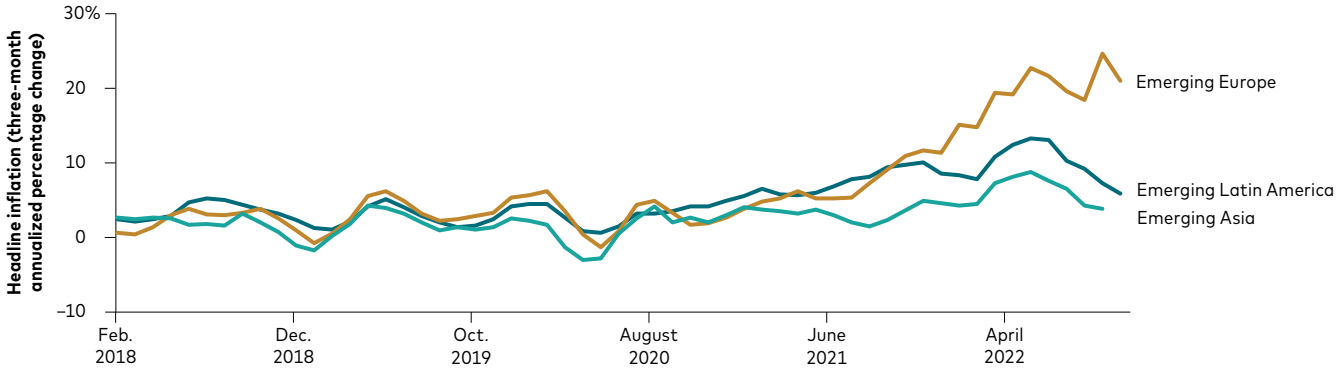
Sources: Vanguard calculations, based on data from Thomson Reuters Datastream, as of October 31, 2022.

Our below-consensus outlook for the Latin American region is driven by a few factors. First is our below-consensus U.S. growth outlook. Seventy percent of Mexican exports go to the U.S., and Mexican exports are highly correlated with the U.S. inventory cycle (excluding autos). After a strong build over the last year, we expect inventory growth to slow along with the slowing U.S. economy. This will put downside pressure on both Mexican growth and the Mexican current account. Second, Latin America is the only EM region with central bank interest rates above inflation. However, inflation is falling quickly across many Latin American economies (**Figure I-29**). This means interest rates will be even more restrictive at current levels, further slowing economic growth.

In EM Asia, we are expecting 2023 GDP growth of 4.6%, broadly in line with consensus. Our view is driven by two countervailing forces. Our forecast for a cyclical growth rebound in China supports a positive EM Asian growth outlook. Additionally, as inflation in EM Asia falls, we expect central banks to end their hiking cycle, which will support growth. EM Asian export growth has been a major growth support during the recovery from the pandemic. We believe that consensus expectations for a mix of modest rate hikes and cuts and broadly flat inflation are fair.

FIGURE I-29

Inflation in emerging Europe is mainly energy-driven at this point, while inflation in both emerging Latin America and emerging Asia looks more persistent

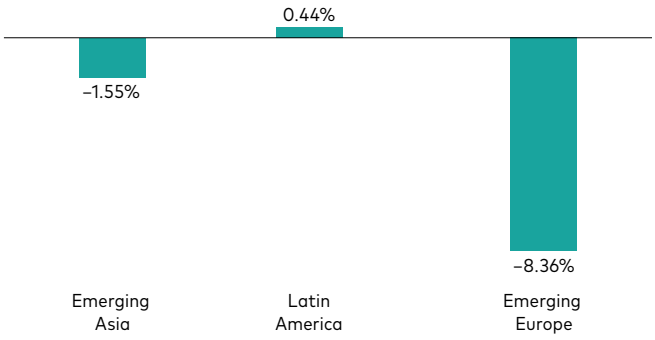


Sources: Vanguard calculations, based on data from Refinitiv, as of October 31, 2022.

In EM Europe, we expect 2023 GDP growth to be flat at 0%, below consensus of 0.6%. Our below-consensus view is driven by our below-consensus developed-market European outlook as well as an inflation outlook that we expect to remain precarious throughout 2023. EM European inflation continues to accelerate, though a recent reprieve has come in the form of energy price subsidies. These expensive subsidies can lead to widening fiscal deficits, which lead to tighter financial conditions and lower growth. Should governments try to limit deficit expansion, the energy price subsidy would likely crowd out other government spending priorities, possibly limiting potential growth. The big risk for Europe is that, should inflation remain stubbornly high because of a structural energy shortage, central banks would likely need to continue hiking interest rates to get them to restrictive territory. **Figure I-30** shows that EM European interest rates are a long way from being positive on a real basis, in contrast to their EM peers.

FIGURE I-30

European real spot rates remain deeply negative, while Latin American rates look as though they have room to come down



Sources: Vanguard calculations, based on data from Refinitiv, as of October 31, 2022.

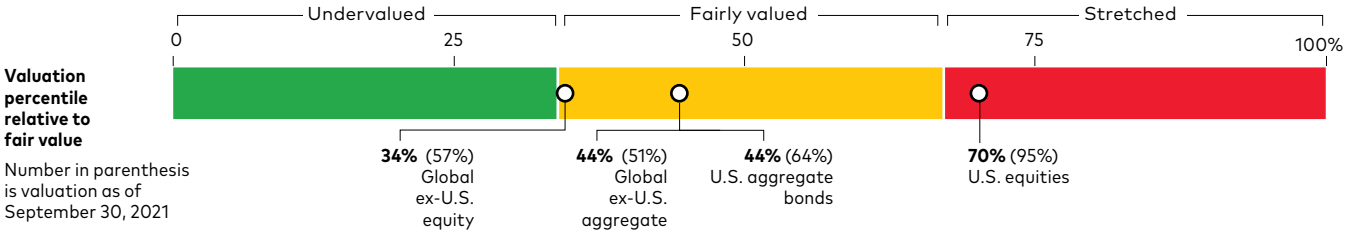
II. Global capital markets outlook

In our economic and market outlook for 2022, we highlighted the risks global capital markets faced from the dual pressures of high equity valuations and interest rates that did not reflect the seriousness of inflation pressures. As the year started, markets began to price this shift, and discount rates rose. Rising discount rates, coupled with geopolitical shocks and slowing growth, led to a sell-off that was notable not only for its depth but also for its breadth and persistence. Although it is impossible to say with confidence when equity and bond markets will bottom, valuations and yields are clearly more attractive than they were a year ago.

Looking ahead, our return outlook—which has been on a steady downward trajectory since 2009—is ticking up. This is especially true in fixed income, where our U.S. and international bond forecasts are more than two times higher than they were a year ago. In equities, U.S. valuations are more attractive than they were last year but are still above our estimate of fair value. International equities, however, are at the low end of our fair-value estimates (**Figure II-1**).

FIGURE II-1

Equity and bond valuations are attractive



Notes: The U.S. valuation measure is the current cyclically adjusted price/earnings ratio (CAPE) percentile relative to fair-value CAPE for the Standard & Poor's Composite Index from 1940 to 1957 and the S&P 500 Index from 1957 through September 30, 2022. Global ex-U.S. equity is a 70% developed markets/30% emerging markets blend. Developed-market equity valuation measures are the current CAPE percentile relative to the fair-value CAPE for the local MSCI index. The ex-U.S. developed markets valuation measure is the market-weighted average of each region's (Australia, U.K., euro area, Japan, and Canada) valuation percentile. Emerging markets is based on the percentile rank based on our fair-value model relative to the market. U.S. aggregate bonds are the weighted average between intermediate-term credit and Treasury valuation percentiles. The global ex-U.S. aggregate valuation measure is the market-weighted average of each region's (Australia, U.K., euro area, Japan, and Canada) valuation percentile. The valuation percentiles in parenthesis are as of one year prior.

Sources: Vanguard calculations, based on Robert Shiller's website, at aida.wss.yale.edu/~shiller/data.htm, the U.S. Bureau of Labor Statistics, the Federal Reserve Board, and Refinitiv, as of September 30, 2022, and September 30, 2021.

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Vanguard's distinct approach to forecasting

To treat the future with the deference it deserves, Vanguard has long believed that market forecasts are best viewed in a probabilistic framework. This annual publication's primary objectives are to describe the projected long-term return distributions that contribute to strategic asset allocation decisions and to present the rationale for the ranges and probabilities of potential outcomes. This analysis discusses our global outlook from the perspective of a U.S. investor with a dollar-denominated portfolio.

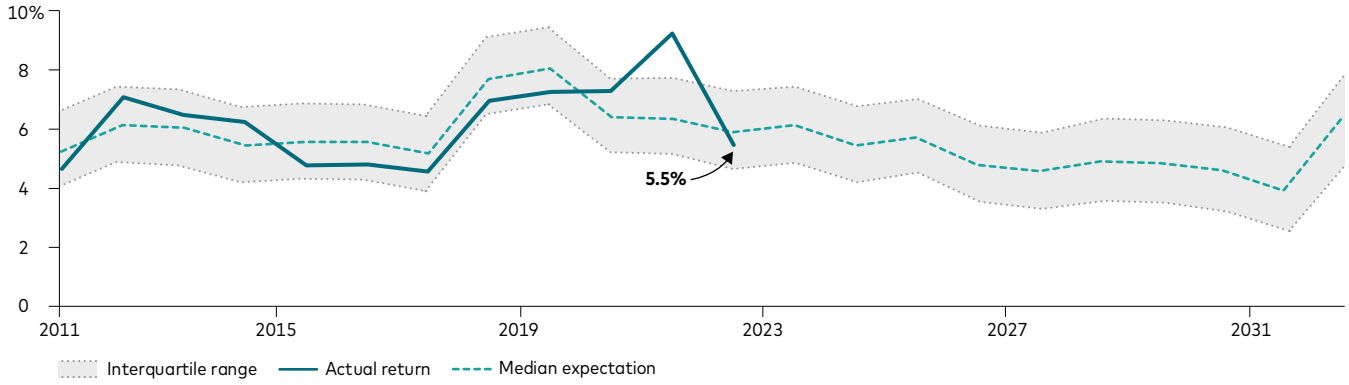
A notable characteristic of the sell-off in global stocks and bonds in 2022 was the degree to which both fell together.[6] **Figure II-2** shows our 10-year outlook and realized returns for a globally diversified, 60% stock/40% bond portfolio since 2001. Rising equity valuations in 2021 pushed realized returns above our forecasted range from 10 years prior, but large losses in both equity and fixed income over the last 12 months have brought those returns within the range.

The figure also shows that our outlook for global stocks and bonds has reversed its downward trend in the last decade. This higher return outlook is in large part because of higher interest rates to fight inflation, which caused asset price declines through the equity valuation and bond yield channels. These forces also raised expectations for the next decade, because yields on developed-market sovereign debt are the foundation on which other risky returns are built.

FIGURE II-2

Returns on a 60/40 balanced portfolio are now more in line with our view from 10 years ago

10-year annualized returns



Notes: The chart shows the actual 10-year annualized return of a 60/40 stock/bond portfolio compared with the VCMM forecast for the same portfolio made 10 years earlier. For example, the 2011 data point at the beginning of the chart shows the actual return for the 10-year period 2001–2011 (solid line) compared with the 10-year return forecast made in 2001 (dotted line). After 2022, the dotted line is extended to show how our forecasts made between 2013 and 2022 (ending between 2023 and 2032) are evolving. The interquartile range represents the area between the 25th and 75th percentile of the return distribution. The portfolio is 36% U.S. stocks, 24% international stocks, 28% U.S. bonds, and 12% international bonds. See the Appendix section titled "Indexes for VCMM simulations" for further details on asset classes.

Source: Vanguard calculations, as of September 30, 2022.

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Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

6 This breakdown in correlation was disconcerting for many investors and led some to question whether the 60% stock/40% bond portfolio still had merit as an investment tool. Our research finds that correlations can move aggressively over shorter investment horizons but that it would take long periods of consistently high inflation for long-term correlation measures—those that more meaningfully affect portfolio outcomes—to turn positive (Wu et al., 2021).

Global fixed income markets: Sowing the seeds for brighter days ahead

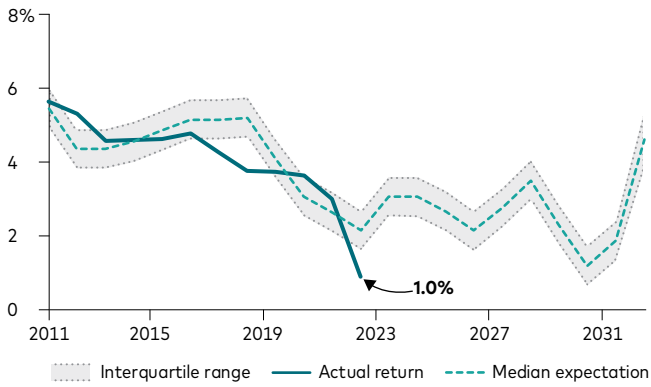
The pain of rising interest rates has been felt most acutely in global fixed income markets. Both the Bloomberg U.S. Aggregate Bond Index and the Bloomberg Global Aggregate ex-USD Index (Hedged) have declined more than in any 12-month period in their histories, down 14.6% and 9.9%, for the year ended September 30, 2022, respectively.[7] As shown in **Figure II-3a**, the steep decline in U.S. bonds—along with the 12-month return that rolled off—reduced 10-year annualized returns by 2 percentage points. **Figure II-3b** shows a similar story for international bonds. However, losses there offset previous higher-than-expected returns from lower relative interest rates and brought actual results more in line with our expectations from a decade ago.

FIGURE II-3

Rising interest rates created near-term pain, but have raised our long-term forecast

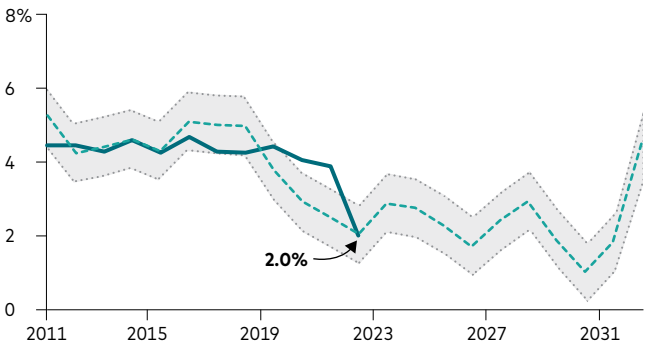
a. Fastest policy tightening in 40 years led to unprecedented losses for U.S. bonds

10-year annualized returns



b. Currency hedging offset similarly large losses on international bonds for U.S. investors

10-year annualized returns



Notes: Figure II-3a shows the actual 10-year annualized return of U.S. bonds compared with the VCMM forecast of 10 years earlier. Figure II-3b shows the actual 10-year annualized return of U.S. dollar-hedged international bonds compared with the VCMM forecast of 10 years earlier. For example, the 2011 data point at the beginning of each chart shows the actual return for the 10-year period 2001–2011 (solid line) compared with the 10-year return forecast made in 2001 (dotted line). After 2022, the dotted line is extended to show how our forecasts made between 2013 and 2022 (ending between 2023 and 2032) are evolving. The interquartile range represents the area between the 25th and 75th percentile of the return distribution. See the Appendix section titled "Indexes for VCMM simulations" for further details on asset classes.

Source: Vanguard calculations, as of September 30, 2022.

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7 Return data begin in 1975 for the Bloomberg U.S. Aggregate Bond Index and 2000 for the Bloomberg Global Aggregate ex-USD Index Hedged.

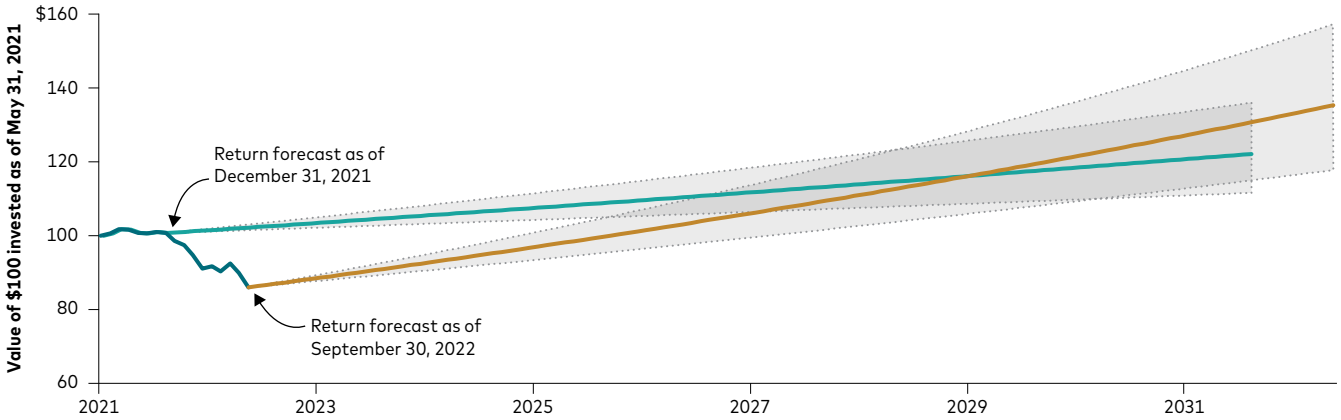
Although rising interest rates have created near-term pain for fixed income investors, we expect that those with sufficiently long investment horizons will be better off in end-of-period wealth terms by the end of the decade than if they had just realized our return forecast from the end of last year (**Figure II-4**). This is because of the effect of duration. When interest rates rise, bonds reprice lower immediately. However, cash flows can then be reinvested at higher rates. Given enough time, the increased income from higher coupon payments will offset the price decline, and an investor's total return should increase.

Of course, higher returns are not guaranteed. The median of this analysis is informed by the trajectory of yields implied by the forward yield curve. Figure II-4 shows that there is a possibility that investors may not have higher wealth at the end of the decade because interest rates continue to rise throughout the next decade. But this analysis should give long-term investors reasons to be optimistic about the prospects of their fixed income portfolios.

Against a backdrop of rapidly rising rates, our fixed income return outlook for the next decade (**Figure II-5a**) is significantly better than last year's projections, at 4.1%–5.1%, based on more attractive valuations (**Figure II-5b**). Expected returns for non-U.S. bonds in local currency are lower than those of U.S. bonds in light of the relatively lower yields in non-U.S. developed markets, but the differences are negligible once we account for currency impacts. Further, the diversification through exposure to hedged non-U.S. bonds should help offset some risk specific to the U.S. fixed income markets (Philips et al., 2014). Broad U.S. investment-grade bonds should outperform U.S. Treasury bonds by 1.1 percentage points on an annualized basis. Importantly, while recent returns have called into question fixed income's role in portfolios, we continue to believe its inclusion is warranted as a portfolio stabilizer and a long-term diversifier.[8]

FIGURE II-4

We expect investors to be better off because, not in spite, of the sell-off



Notes: The chart shows actual returns for the Bloomberg U.S. Aggregate Bond Index along with Vanguard's forecast for cumulative returns over the subsequent 10 years as of December 31, 2021, and September 30, 2022. The dotted lines represent the 10th and 90th percentiles of the forecasted distribution. Data are as of September 30, 2022.

Sources: Vanguard calculations and Bloomberg, as of September 30, 2022.

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8 Despite the historic sell-off of fixed income in 2022, its inclusion in the portfolio still improved results, because bonds are a lower-volatility asset. Our research (Wu et al., 2021) finds that asset allocation matters more than correlation regime when estimating outcomes over a long-term horizon.

FIGURE II-5

The green shoots of higher bond returns

a. Higher rates have pushed expected bond returns higher

	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile	Median volatility
U.S. high-yield corporate bonds	4.5%	6.1%	7.1%	8.2%	9.8%	10.4%
Emerging sovereign bonds	4.2	6.0	6.9	7.9	9.2	11.0
U.S. Treasury bonds	2.4	3.4	4.2	4.9	6.1	5.8
U.S. intermediate TIPS	1.4	2.6	3.7	4.8	6.6	5.0
U.S. bonds	2.9	3.9	4.6	5.3	6.5	5.6
U.S. mortgage-backed securities	2.7	4.0	4.8	5.5	6.4	4.7
Global ex-U.S. bonds (hedged)	2.4	3.6	4.5	5.4	6.9	4.4
U.S. inflation	0.3	1.6	2.5	3.3	4.6	2.3
U.S. cash	1.7%	2.9	3.9	4.9	6.4	1.4

Notes: The forecast corresponds to the distribution of 10,000 VCMM simulations for 10-year annualized nominal returns in USD for asset classes highlighted here. Median volatility is the 50th percentile of an asset class's distribution of annualized standard deviation of returns. Asset class returns do not take into account management fees and expenses, nor do they reflect the effect of taxes. Returns do reflect reinvestment of dividends and capital gains. Indexes are unmanaged; therefore, direct investment is not possible. See the Appendix section titled "Indexes for VCMM simulations" for further details on asset classes. U.S. inflation is the 10-year average of year-over-year U.S. headline CPI.

Source: Vanguard calculations, as of September 30, 2022.

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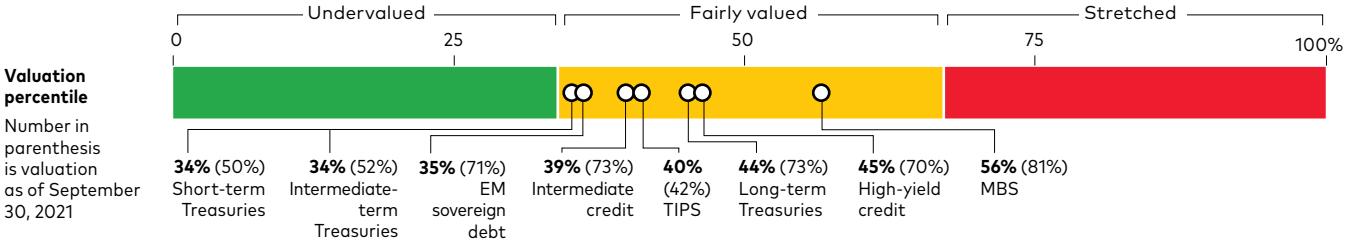
b. Fixed income is fairly valued



Notes: Credit (emerging sovereign, high-yield and intermediate) and mortgage-backed securities (MBS) valuations are based on current spreads relative to year 30. Treasury valuation is the key rate duration-weighted average of our proprietary fundamental fair-value model. TIPS are calculated using 10-year-ahead annualized inflation expectation relative to years 21–30. The valuation percentiles in parenthesis are as of one year prior.

Source: Vanguard calculations, as of September 30, 2022, and September 30, 2021.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of September 30, 2022, and September 30, 2021. Results from the model may vary with each use and over time.

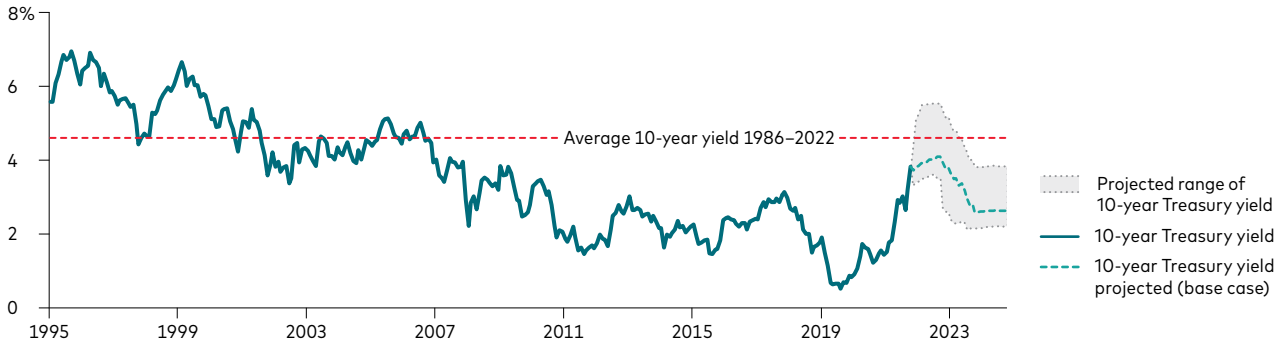
U.S. interest rates: Valuations are attractive

After rising by as much as 260 basis points in 2022, the 10-year U.S. Treasury yield has traded in a range of 3.7%–4.3% as the market tries to ascertain the direction of Fed policy. But we believe that the terminal rate and the amount of time policy is held at that level will be what ultimately matters for U.S. Treasury returns. Based on current economic conditions and Fed policy guidance, our Treasury fair-value model suggests that the yield curve is within our fair-value range.[9]

The evolution of fair value will depend heavily on the direction of inflation, the Fed's response, and the market's expectations for future policy rates. **Figure II-6** shows the expected impact of our economics team's inflation and federal funds rate forecast on the 10-year Treasury yield over the next three years.

FIGURE II-6

Higher long-term yields are possible, but any trip above historical averages is likely to be brief



Notes: The chart shows the actual 10-year Treasury yield quoted on a constant maturity basis since 1995 and Vanguard's forecast based on a range of economic scenarios. The forecasts are derived from a statistical model specification that is a five-variable vector error correction model, including the 10-year Treasury yield, first three principal components of covariance matrix for 10-year trailing inflation, 10-year trailing food inflation, the 10-year trailing hourly earnings growth, effective federal funds rate, and 5-year trailing real GDP estimated over the period January 1979–September 30, 2022.

Sources: Vanguard calculations, based on data from FactSet, the U.S. Bureau of Labor Statistics, the Federal Reserve Board, Refinitiv, and Global Financial Data.

9 For more details on our Treasury attribution model, see Davis et al., 2021.

In our baseline scenario—in which inflation falls throughout 2023 but remains above the Fed's 2% target and the federal funds rate rises to 4.5% and stays there for the next 12 months before gradually falling to 2.5%—we expect the 10-year yield to peak around its recent highs (4%–4.3%). In a more pessimistic scenario—shown by the top of the gray band in Figure II-6—the Fed's fight against inflation forces it to raise rates as high as 5.7%. In this scenario, the 10-year yield could peak as high as 5.5%. If the fight against inflation requires less action from the Fed, the 10-year yield has likely already peaked, and we would expect lower 10-year yields as policy rates normalize more quickly. No matter the scenario, our view that the Fed will ultimately be successful in bringing down inflation means that it will be difficult for long-term yields to remain above their historical average from the past 35 years.

Expected long-term inflation rates implied by Treasury Inflation-Protected Securities (TIPS) also support this view. Breakeven inflation rates peaked in the first half of 2022, as energy prices reached record highs, at 2.98% annually over the next decade. These expectations have since moderated to 2.15% as of September 30, 2022. This is below our median VCMM 10-year annualized inflation forecast of 2.5% (see Figure II-5a), which leads us to view longer-term inflation protection as cheaper than last year but within our fair-value range (see Figure II-5b). Higher TIPS returns are a result of inflation exceeding market expectations. To that end, only upside inflation surprises will create excess return opportunities. Regardless of their attractiveness from a valuation perspective at any point in time, TIPS offer some benefit to long-term investors who are sensitive to inflation risk.

Corporate bonds: Cheaper valuations, but downside risks remain

Despite a record pace of Fed tightening and a historic rise in Treasury yields in 2022, credit spreads have remained remarkably resilient. Our fair-value framework, shown in **Figures II-7a and II-7b**, uses the same four variables to model investment-grade and high-yield spreads but finds that these variables differ in their importance. For instance, both investment-grade and high-yield spreads are most sensitive to economic conditions, but the slope of the yield curve matters more for investment-grade than for high-yield. Conversely, high-yield is more sensitive to corporate debt fundamentals given its riskier credit profile.

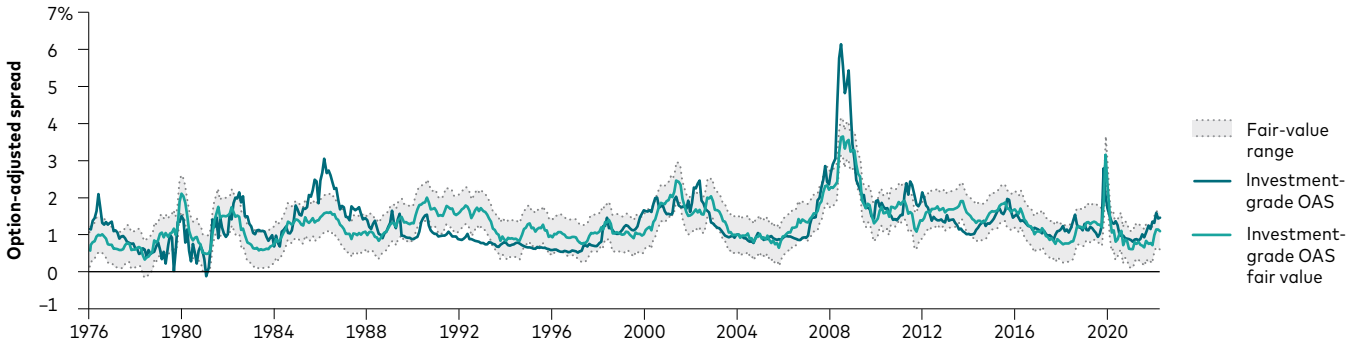
Over the last 12 months, worsening economic conditions from inflation and the Fed's fight to contain it have been the main factors pushing credit spreads higher. Tighter policy is also raising the risk of a recession, which leads the yield curve to invert and could put downward pressure on profits and debt sustainability metrics. Strong balance sheets, however, have prevented spreads (especially high-yield ones) from widening further. Although both investment-grade and high-yield bond spreads are within our fair-value range, it is reasonable to expect that they could widen more given our outlook for weaker economic conditions, high short-term interest rates to fight inflation, and slower corporate profit growth.

Over the next decade, we expect investment-grade bonds to return 4.8%–5.8% and high-yield bonds to return 6.6%–7.6% per year. These returns are not dissimilar from our forecasted equity returns for the next decade, but they also come with equity-like volatility. Although this volatility may be concerning for investors with shorter investment horizons, our research finds that for investors with a sufficiently long investment horizon who are looking to maximize their end-of-period wealth, credit can improve portfolio outcomes. This improvement comes from credit's premium over Treasuries and its low correlation with equity.[10]

FIGURE II-7

Credit spreads are near fair value, but risks are elevated because of the macro environment

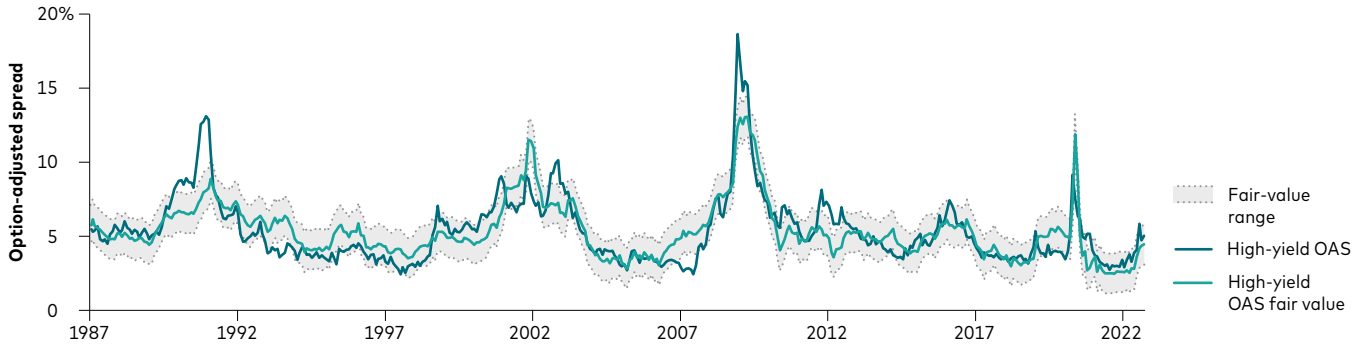
a. Investment-grade



Notes: Investment-grade credit spreads are yields on bonds characterized by their low default risk (credit rating above BBB–) above the yield on a Treasury security of the same duration. Data are from July 1976 to June 2022. Fair value is specified by an Ordinary Least Squares (OLS) regression model where the dependent variable is the investment-grade option-adjusted spread (OAS) of the Bloomberg U.S Corporate Investment Grade Index and the explanatory variables (all one month lagged) are our proprietary Vanguard leading economic indicator (VLEI), the 10-year Treasury yield minus the 2-year Treasury yield (yield curve slope), the debt-to-profit ratio (ratio of U.S. debt outstanding of nonfinancial corporations to U.S. nonfinancial corporate business profits before tax), and year-on-year change in quarterly corporate profits.

Sources: Vanguard calculations, based on data from Bloomberg, Refinitiv Datastream, and Barclays Live, as of September 30, 2022.

b. High-yield



Notes: High-yield credit spreads are yields on bonds characterized by their elevated default risk (credit rating BB+ or lower) above the yield on a Treasury security of the same duration. Data are from January 1987 to June 2022. Fair value is specified by an Ordinary Least Squares (OLS) regression model where the dependent variable is the high-yield option-adjusted spread (OAS) of the Bloomberg U.S. Corporate High Yield Index and the explanatory variables (all one month lagged) are our proprietary Vanguard leading economic indicator (VLEI), the 10-year Treasury yield minus the 2-year Treasury yield (yield curve slope), the debt-to-profit ratio (ratio of U.S. debt outstanding of nonfinancial corporations to U.S. nonfinancial corporate business profits before tax), and year-on-year change in quarterly corporate profits.

Sources: Vanguard calculations, based on data from Bloomberg, Refinitiv Datastream, and Barclays Live, as of September 30, 2022.

10 Our VCMM forecast suggests that median correlations between U.S. equities and investment-grade and high-yield bonds will be 0.22 and 0.31, respectively.

Global equity markets: Normalizing return outlook

The sell-off in equity markets this year has been indiscriminate. U.S., developed ex-U.S., and emerging-market equity indexes have all posted losses greater than 20% in the last nine months. Valuation declines were more pronounced in U.S. markets, but a strengthening dollar meant U.S.-based investors realized larger losses on their unhedged international equity exposures than on their local ones. Even though this is negative from a short-term, realized-return perspective, it means that the global opportunity set is now more attractive than it was a year ago.

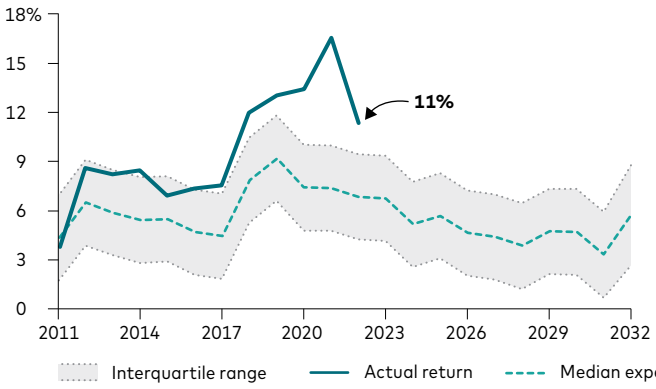
Figures II-8a and II-8b show that the global sell-off is bringing U.S. returns closer to our forecasts from 10 years ago but that international equities have continued to underperform our expectations. Although discrepancies exist at the regional level, our forecast 10 years ago for global equities has proved accurate.[11] This underscores the challenges investors face when tilting their portfolio heavily in one direction, and it highlights the benefits of global diversification.

FIGURE II-8

Investors are reassessing their rosy view of equities, which is pushing our return outlook higher

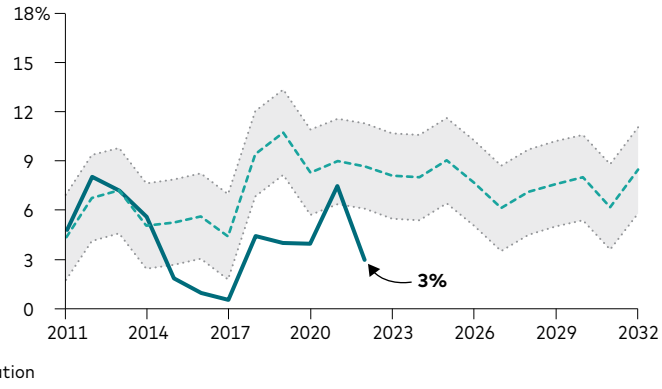
a. U.S. equities are falling back toward our forecast from a decade ago

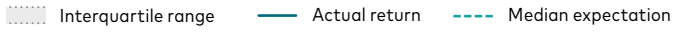
10-year annualized returns



b. International equities have continued to lag expectations from a decade prior

10-year annualized returns





Notes: Figure II-8a shows the actual 10-year annualized return for U.S. equities compared with the VCMM forecast made 10 years earlier. Figure II-8b shows the actual 10-year annualized return for international equities compared with the VCMM forecast made 10 years earlier. For example, the 2011 data point at the beginning of each chart shows the actual return for the 10-year period 2001–2011 (solid line) compared with the 10-year return forecast made in 2001 (dotted line). After 2022, the dotted line is extended to show how our forecasts made between 2013 and 2022 (ending between 2023 and 2032) are evolving. The interquartile range represents the area between the 25th and 75th percentile of the return distribution. See the Appendix section titled "Indexes for VCMM simulations" for further details on asset classes.

Source: Vanguard calculations, as of September 30, 2022.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of September 30, 2022. Results from the model may vary with each use and over time.

Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

11 Our median forecast for a market-cap-weighted portfolio of U.S. and international equities for the 10-year period from September 30, 2012, to September 30, 2022, was 7.6% per year, and the same portfolio returned 8% over that period.

Figures II-9a and II-9b show our expectations for U.S.-based investor equity returns and our view of valuations across developed and emerging markets and factors. Our valuations and forecasting frameworks are intended to set long-term expectations. Therefore, overvaluation (or undervaluation) should not, in itself, suggest a short-term action by investors. Time-varying portfolio construction should balance risk and return in a utility-based framework and requires acceptance of model and active risk (Aliaga-Díaz et al., 2022).

FIGURE II-9

Expected returns are higher, but we still see more opportunities internationally

a. Equity market 10-year outlook: Setting reasonable expectations

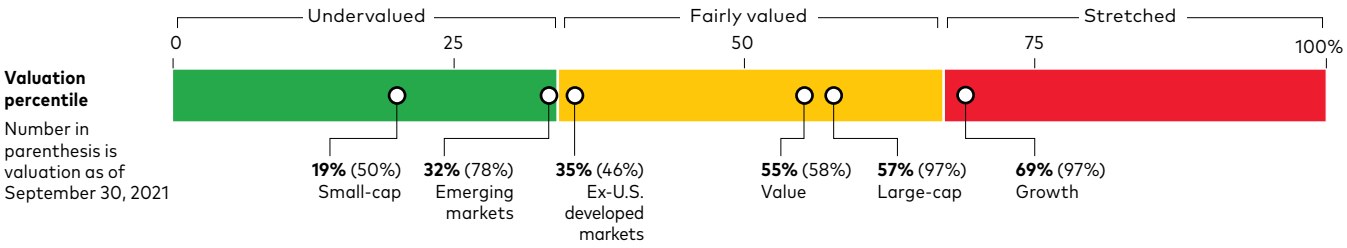
	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile	Median volatility
U.S. small-cap	–2.6%	2.5%	6.1%	9.7%	15.1%	22.9%
U.S. value	–2.7	2.2	5.7	9.1	14.2	19.8
U.S. REITs	–2.6	2.4	5.9	9.4	14.4	20.1
Global ex-U.S. equities	2.2	5.8	8.4	11.0	14.9	18.8
U.S. growth	–3.4	1.0	4.1	7.1	11.6	18.6
U.S. equity	–1.3	2.8	5.7	8.6	12.9	17.4
U.S. large-cap	–1.5	2.7	5.6	8.5	12.8	17.1
Commodities	–13.0	–2.9	4.3	11.8	23.4	16.6

Notes: The forecast corresponds to the distribution of 10,000 VCMM simulations for 10-year annualized nominal returns in USD for asset classes highlighted here. Median volatility is the 50th percentile of an asset class's distribution of annualized standard deviation of returns. Asset class returns do not take into account management fees and expenses, nor do they reflect the effect of taxes. Returns do reflect reinvestment of dividends and capital gains. Indexes are unmanaged; therefore, direct investment is not possible. See the Appendix section titled "Indexes for VCMM simulations" for further details on asset classes.

Source: Vanguard calculations, as of September 30, 2022.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of September 30, 2022. Results from the model may vary with each use and over time.

b. Valuations are more attractive than a year ago



Notes: With the exception of emerging markets and ex-U.S. developed markets, valuations are relative to U.S. equities as the base at the 50th percentile. Growth, value, and small-cap are all based on the percentile rank based on our fair-value model relative to the market. Large-cap valuations are composite valuation measures of the style factor to U.S. relative valuations and the current U.S. cyclically adjusted price/earnings ratio (CAPE) percentile relative to its fair-value CAPE. The ex-U.S. developed markets valuation measure is the market-weighted average of each region's (Australia, U.K., euro area, Japan, and Canada) valuation percentile. Emerging markets are based on the percentile rank based on our fair-value model relative to the market. Valuation percentiles in parenthesis are as of one year prior.

Sources: Vanguard calculations, based on Robert Shiller's website, at aida.wss.yale.edu/~shiller/data.htm, the U.S. Bureau of Labor Statistics, the Federal Reserve Board, and Refinitiv, as of September 30, 2022, and September 30, 2021.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of September 30, 2022 , and September 30, 2021. Results from the model may vary with each use and over time.

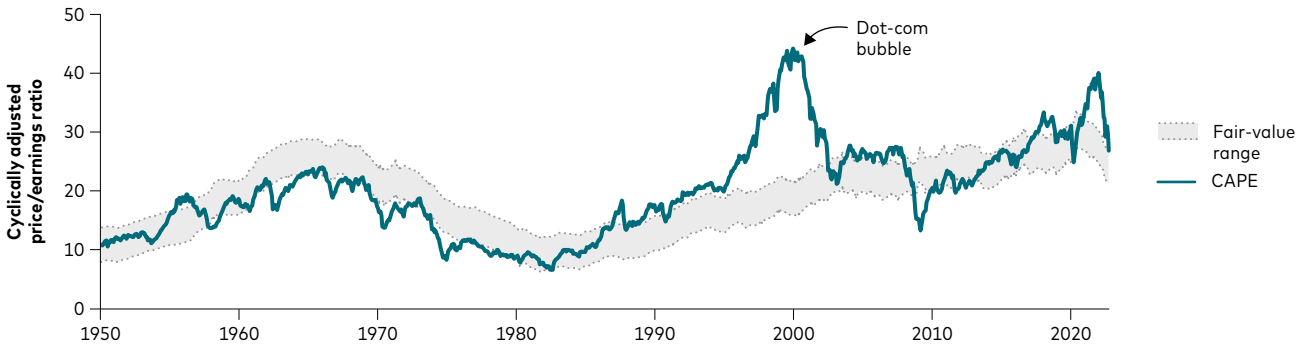
Valuations are more favorable, but the opportunity set is still limited

High inflation and rising real interest rates have caused Robert Shiller's cyclically adjusted price/earnings (CAPE) ratio for the Standard & Poor's 500 Index and our estimate of fair value to decline. **Figure II-10** shows our model estimate and suggests that although equity valuations have improved, they are still overvalued.

Our median fair-value estimate sits at 23.7 times the trailing 10-year average of real earnings. Higher (lower) inflation and a more (less) aggressive Fed could cause our fair value to settle lower (higher). Our analysis indicates that much larger, more persistent shifts in the inflation and interest rate environments are needed to move valuations meaningfully beyond the standard error of our fair-value estimate.

FIGURE II-10

U.S. equity valuations are more attractive than they were a year ago



Notes: The U.S. fair-value cyclically adjusted price/earnings ratio (CAPE) is based on a statistical model that corrects CAPE measures for the level of inflation and interest rates. The statistical model specification is a three-variable vector error correction model including equity-earnings yields, 10-year trailing inflation, and 10-year U.S. Treasury yields estimated from January 1940 to September 30, 2022. Details were published in Davis (2017). A declining fair-value CAPE suggests that higher equity-risk premium (ERP) compensation is required, whereas a rising fair-value CAPE suggests that the ERP is compressing.

Sources: Vanguard calculations, based on data from Robert Shiller's website, at aida.wss.yale.edu/~shiller/data.htm, the U.S. Bureau of Labor Statistics, the Federal Reserve Board, Refinitiv, FTSE Russell, FactSet, Barclays Live, and Global Financial Data, as of September 30, 2022.

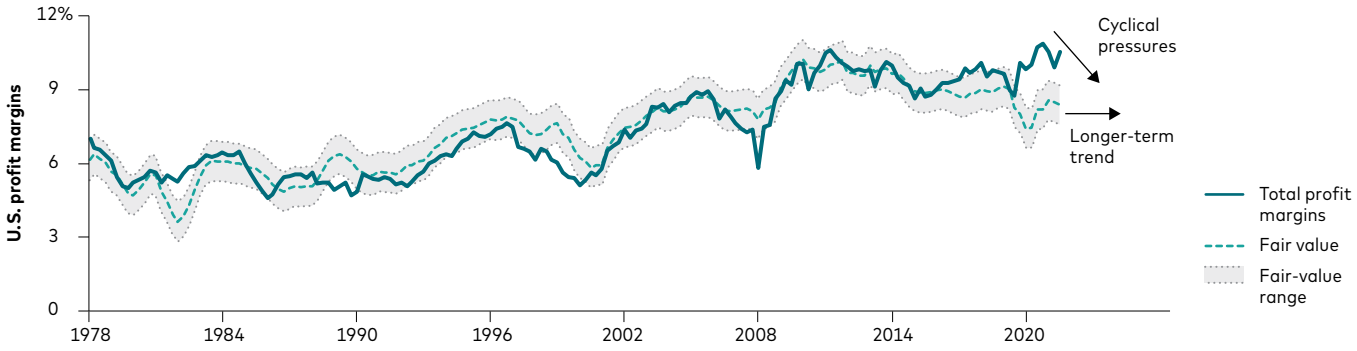
Profit margins are unlikely to continue powering U.S. earnings

In addition to stretched valuations, the risks posed to earnings by high inflation and the growing likelihood of recession underscore our cautious stance on U.S. equities. Our framework for assessing U.S. earnings growth breaks it down into revenue growth and profit margins. We find that revenue growth is a function of global GDP growth and that profit margins are determined by global trade intensity and labor costs. **Figure II-11** shows our model for U.S. profit margins compared with actuals. Profit margins are currently at a cyclical high, and we expect them to decline toward our estimates in the coming years, mostly because of higher labor costs. Longer term, we expect a modest decline in margins as a slower pace in the trend of globalization is partially offset by higher productivity because of idea sharing.[12]

We expect U.S. earnings growth to average 5% per year over the next decade, which is below the 6.4% that investors experienced over the last decade. Although this information is useful in informing our forecast, long-term investors must remember that what matters most for equity returns is the price paid for earnings, not the earnings themselves. Our research finds that GDP growth explains some of revenue growth, which in addition to profit margins explains earnings growth. But earnings growth explains only about 15% of the variation in equity returns; valuations matter more.

FIGURE II-11

U.S. profit margins may face cyclical pressure in the near term, but should remain above long-term averages



Notes: Profit margins are broken into their cyclical and trend components and forecasted using an Ordinary Least Squares (OLS) regression model with trade intensity (sum of imports and exports) and labor costs as the independent variables. We expect higher productivity to drive higher profit margins given the linear relationship between productivity and profit margins and our view for higher productivity based on our proprietary Idea Multiplier. For more information on the Idea Multiplier, see *The Idea Multiplier: An Acceleration in Innovation Is Coming* (Davis et al., 2019).

Sources: Vanguard calculations, based on data from Refinitiv, as of June 30, 2022.

12 For more information on Vanguard's view on these two "megatrends," see Lemco et al., 2021, and Davis et al., 2019.

After value's resurrection, the risks are more balanced

In the U.S. market, the return of value investing has been a notable narrative that has continued in 2022. Unlike in the first quarter of 2021, value's outperformance over the last 12 months has had more to do with growth's relative weakness than value's relative strength. Our "fair value of value" framework (**Figure II-12a**) shows how interest rates and inflation have driven value's secular decline over the last 40 years. As we highlighted in our economic and market outlook for 2021, however, by the end of 2020, the value trade had been oversold (Davis et al., 2020). This led us to believe that even if the macroeconomic conditions that supported growth persisted, value was likely to outperform in the coming years.

Value's outperformance now means that the risks are more symmetrical.[13] On one hand, recession dynamics historically have helped growth. On the other hand, there's reason to believe that this recession might not look exactly like the past and that higher interest rates and inflation could continue supporting value.

The one part of the U.S. market where our fair-value frameworks see some opportunity is in small-caps, albeit to a much smaller degree than we saw in value last year. We find that similar drivers—interest rates, inflation, volatility, and corporate profits—explain 72% of the variations in small-cap versus large-cap price/book ratios (**Figure II-12b**). Currently small-caps sit below our estimate of fair value, even when we account for the mounting inflation pressures and rising interest rates experienced in the last year. Our excess return projections for small-caps, however, are de minimis (20 basis points per year over the next decade)—especially when compared with the 160 basis points of annualized excess return for value over growth.

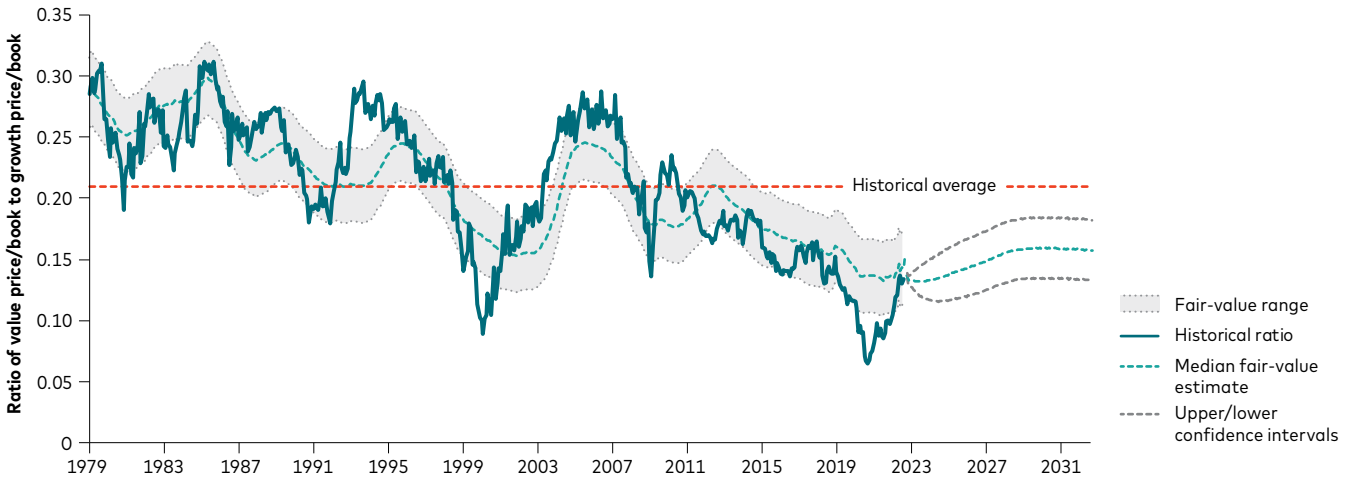
Although more favorable valuations have improved our outlook for U.S. equities compared with last year, we still caution investors against expecting returns similar to the 11.3% per year they experienced in the last decade. In addition to our expected 5% annualized earnings growth, we expect dividend yields to average 1.9% per year (in line with the last decade) but valuations to contract 1.2% annually. All told, these factors underpin our forecast for U.S. equities to return 4.7%–6.7% annually.

13 We still expect value to outperform over the next decade, but this outperformance has less to do with relative valuations and more to do with the "value premium" that our research, along with that of academic and other practitioners, finds.

FIGURE II-12

Some parts of the U.S. market are still attractively valued

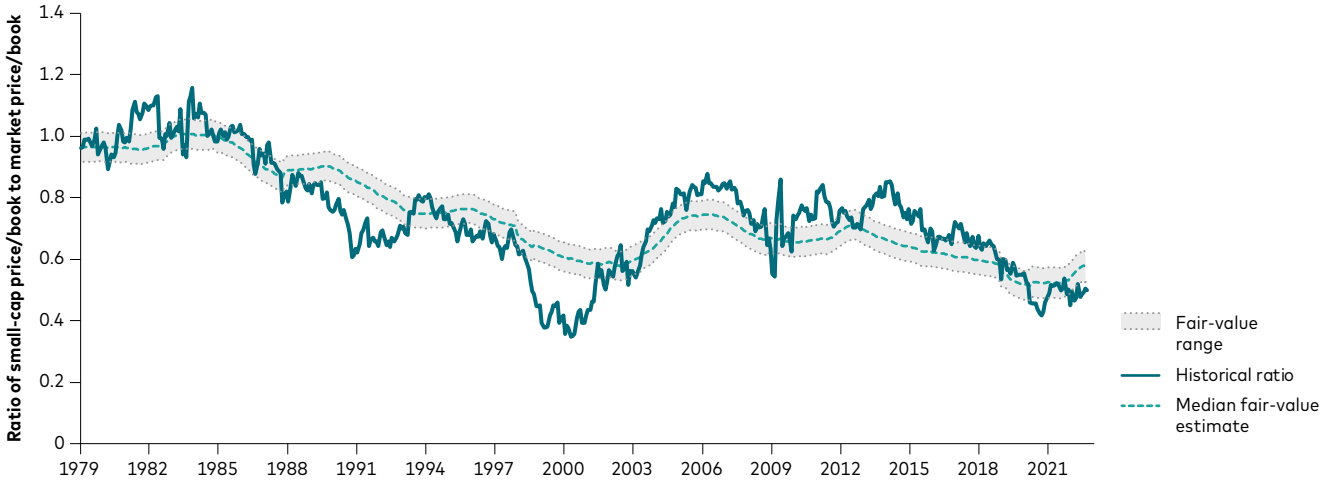
a. With value/growth valuations at fair value, the risks are more symmetrical



Notes: The valuation ratio is projected based on a vector error correction model and using a five-lag vector autoregression model to project the systematic drivers.

Sources: Vanguard calculations, based on data from FactSet, the U.S. Bureau of Labor Statistics, the Federal Reserve Board, Refinitiv, and Global Financial Data, as of September 30, 2022.

b. There may still be opportunity in small-caps



Note: The statistical model specification is a five-variable vector error correction model, including a respective ratio of price to book, 10-year trailing inflation, 10-year real Treasury yield, equity volatility, and growth of corporate profits, estimated over the period January 1979–September 2022.

Sources: Vanguard calculations, based on data from FactSet, the U.S. Bureau of Labor Statistics, the Federal Reserve Board, Thomson Reuters, and Global Financial Data, as of September 30, 2022.

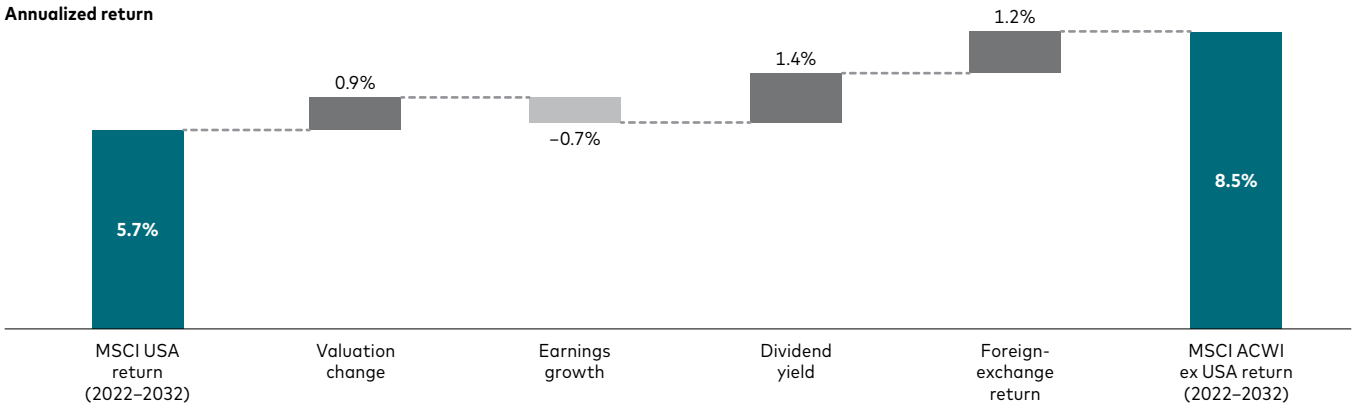
International equities: More value with less growth

U.S. equities have outperformed their global peers by a very wide margin over the last decade. On a cumulative return basis, a portfolio of U.S. stocks bought in 2012 is worth twice as much as a portfolio of international stocks bought in the same period. Although many reasons have been cited for this outperformance—stronger U.S. growth, a less uncertain economic environment, and the sector composition of the U.S. market—our framework focuses on the durable sources of outperformance. To that end, we believe that the valuation-based expansion in U.S. equities is sowing the seeds for lower returns in the decade ahead. Our outlook is positive for international equities despite our view that the U.S. will have higher earnings growth, though we may need to see a weaker dollar for international outperformance to be sustained.

Figure II-13 shows our outlook for U.S. and international equities and a breakdown of the expected total return difference for the decade ahead. Although the valuations gap has narrowed since last year, we expect more favorable international valuations, higher dividend payout ratios, and a weaker dollar to drive international outperformance.

FIGURE II-13

Since relative valuations have improved, a weaker dollar is becoming a more important driver of expected international outperformance



	Valuation change	Earnings growth	Dividend yield	Foreign-exchange return	Total return
MSCI USA Index	−1.18%	5.0%	1.9%	—	5.7%
MSCI ACWI ex USA Index	−0.27%	4.3%	3.3%	1.2%	8.5%

Notes: Forward-looking return estimates are from the VCMM, as of September 30, 2022, for the period October 1, 2022, through September 30, 2032. The U.S. equity return is represented by the MSCI USA Index return; the international equity return is represented by the MSCI ACWI ex USA Index return. Returns do not take into account management fees and expenses, nor do they reflect the effect of taxes. Returns do reflect reinvestment of dividends and capital gains. The two end bars representing U.S. and international expected returns are median expectations. As a result, this comparison does not account for the correlation between U.S. and international equities. The sum of the individual bars in the middle may not equal the difference between the two end bars because of rounding.

Sources: Vanguard calculations, based on data from Refinitiv and Global Financial Data, as of September 30, 2022.

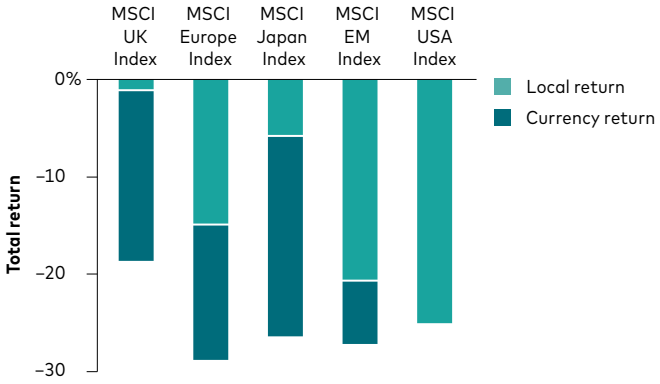
IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of September 30, 2022. Results from the model may vary with each use and over time.

More favorable valuations internationally, however, are not a new story. Nevertheless, international has been unable to generate any significant outperformance relative to the U.S. This is in large part because of the dollar's strength, which has reduced an unhedged U.S.-based investor's return on international equities this year. As of September 30, 2022, our capital markets model suggests that the U.S. dollar is 13% above what the fundamental, long-term drivers of currency value suggest. This leads us to project a 1.2% annualized decline in the dollar relative to a basket of international currencies over the next decade.

Figure II-14 shows how a strong dollar has amplified losses in international equities for unhedged U.S.-based investors. This effect has been particularly acute in developed markets where returns have held up much better in local currency terms because of less-stretched valuations. Currency returns are notoriously difficult to forecast over short investment horizons, and many factors can cause them to deviate from their fundamentals.[14] However, over a sufficiently long investment horizon, we expect global inflation and policy convergence to lead to exchange-rate normalization.

FIGURE II-14

Dollar strength has held back international performance for U.S. investors this year



Notes: The chart breaks down the unhedged USD return from December 31, 2021, to September 30, 2022, into the local and exchange rate return components. The indexes used are the MSCI UK Net Total Return Index, the MSCI Europe Net Total Return Index, the MSCI Japan Net Total Return Index, the MSCI Emerging Market Net Total Return Index, and the MSCI USA Net Total Return Index. The currency exchange rates are the EUR/USD, GBP/USD, and JPY/USD cross-rates. The MSCI Emerging Markets currency return is derived using the local currency index, which accounts for exchange rate differences based on each country's weight in the index.

Sources: Vanguard calculations, based on data from Bloomberg and Global Financial Data, as of September 30, 2022.

14 Because all currencies are relative pairs, it is possible that the headwinds the U.S. dollar faces will be even stronger for international currencies, which would cause the U.S. dollar to strengthen, all else equal.

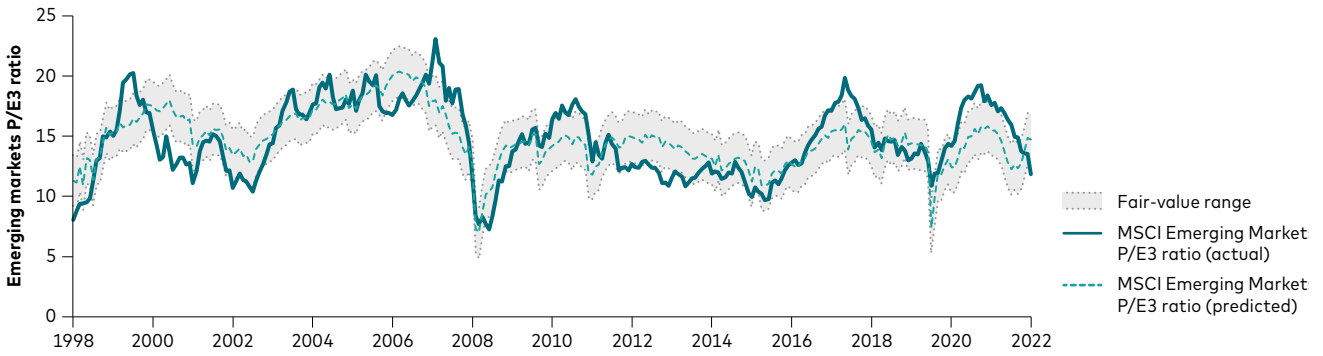
An improved return outlook and consistent diversification benefits from emerging markets

Within international markets, our fair-value framework shown in **Figure II-15** suggests that emerging markets are attractively valued for the first time since the pandemic.[15] Steep sell-offs in 2021 and 2022 stemming from elevated inflation, aggressive policy tightening, slowing growth, and political risks have increased the emerging-market risk premium. Although near-term risks in the form of a strong dollar, global recession, and geopolitical tensions remain, the narrative appears oversold. Faster policy normalization in emerging markets than in the U.S. and slowing economic conditions were the main drivers behind the decline in our fair-value estimate from September 2021 to June 2022. Rate hikes in emerging markets, however, have broadly slowed, and U.S. rates are rising faster. Higher interest rates in the U.S. relative to emerging markets raise fair value because they lead the dollar to trade at a forward discount to emerging-market currencies, which (according to uncovered interest rate parity) should raise expected returns for a U.S.-based investor.

Our outlook suggests that emerging markets should return between 7% and 9% (2.3 percentage points higher than U.S. equities) over the next decade. Further, emerging-market equities still have a lower correlation with U.S. equities than developed ex-U.S. markets and a higher inflation beta to U.S. inflation.[16] For these reasons, we believe that a balanced allocation to emerging-market equities plays an important role in investors' portfolios.

FIGURE II-15

Emerging-market valuations are attractive



Notes: The statistical model specification is a five-variable Ordinary Least Squares regression that uses the following variables: inflation for six major emerging markets countries (Brazil, China, India, South Korea, Mexico, and Taiwan) weighted by MSCI monthly index weights; monthly average of daily real 2-year U.S. Treasury yield; emerging markets central bank policy rates weighted by GDP in U.S. dollars, minus the federal funds rate; Vanguard's leading economic indicators (VLEI) for China, Brazil, and Mexico (weighted average based on country GDP in U.S. dollars); and monthly average of daily U.S. equity market volatility, as measured by the CBOE Volatility Index (VIX). P/E3 is the price divided by trailing 3-year average earnings.

Sources: Vanguard calculations, based on data from the Federal Reserve Bank of St. Louis FRED database and Bloomberg, as of September 30, 2022.

15 See Davis et al. (2021) for more details on our fair-value model.

16 The predicted median correlations for emerging-market equities are 0.70 with U.S. equities and 0.74 with developed ex-U.S. equities. The inflation beta—the linear regression coefficient between the 30-year U.S. inflation forecast and the 30-year asset return forecast—is 0.71 for emerging markets versus –0.44 for developed-market ex-U.S. equities.

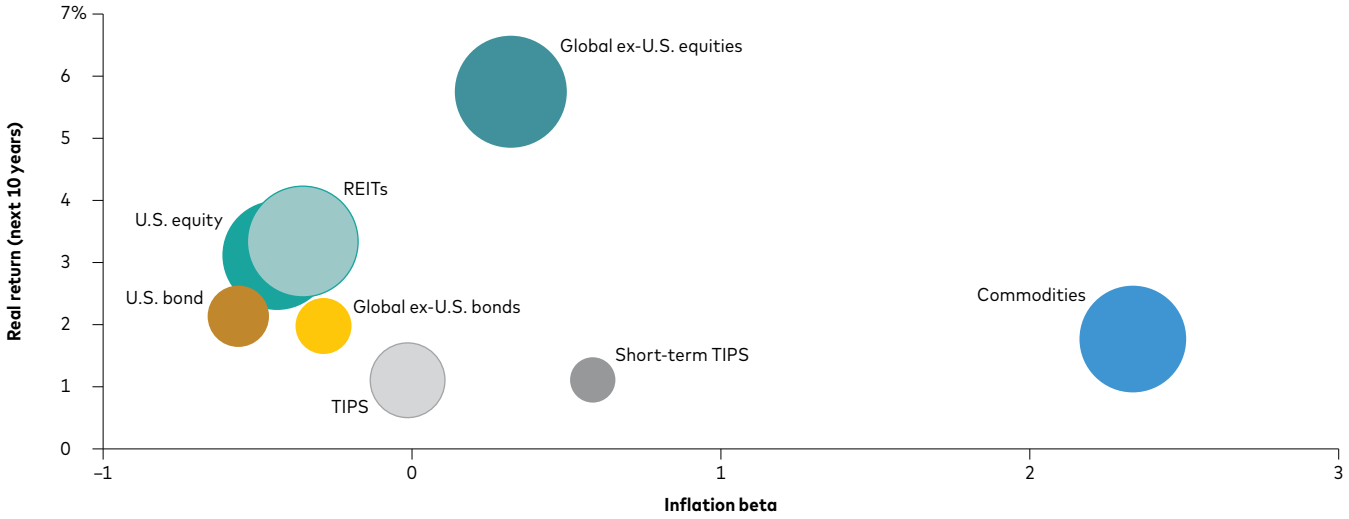
Inflation hedging is a multidimensional problem

There is no one-size-fits-all solution to inflation hedging—it depends on an investor's objectives, investment horizon, and risk tolerance. **Figure II-16a** breaks down the inflation-hedging properties of major asset classes across these three dimensions. For investors looking to generate a positive real return over a very long horizon, equities—especially nonlocal ones—provide the best probability of beating inflation.[17] Investors with a shorter investment horizon may prefer to maintain their purchasing power by matching inflation. To this end, traditional inflation hedges such as TIPS and commodities are useful. These securities, however, can introduce a real-return drag on the portfolio if they are held for extended periods. Commodities can also introduce high volatility, which could be incongruent with a shorter investment horizon.

FIGURE II-16

Commodities are not an investor's only tool to fight inflation

a. There is no one-size-fits-all solution to inflation hedging



Notes: The chart compares real (inflation-adjusted) annualized return projections over the next 10 years to the inflation beta for various asset classes. Inflation beta is the slope coefficient of a linear regression of the year 30 return forecast on a constant and the year 30 inflation forecast. The size of each bubble represents the forecasted median annualized volatility over the next 10 years. See the Appendix section titled "Indexes for VCMM simulations" for further details on asset classes.

Source: Vanguard calculations, as of September 30, 2022.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of September 30, 2022. Results from the model may vary with each use and over time.

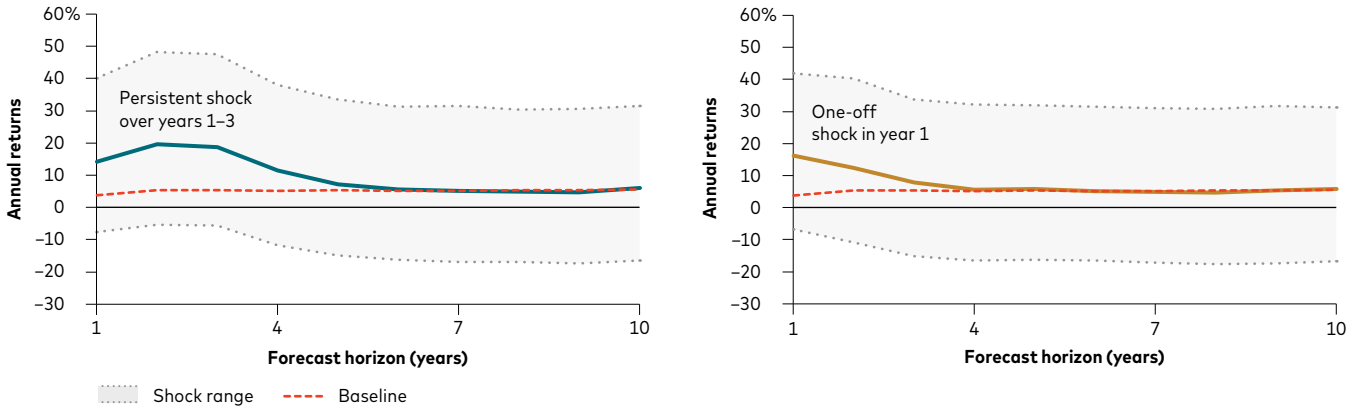
17 As long as local and nonlocal inflation correlation is less than 1, nonlocal equities will serve as an effective inflation hedge. This is because higher local inflation should cause the local currency to depreciate, which would raise nonlocal equity returns, all else equal (Rodel, 2014).

Given the similar energy supply dynamics driving current inflation, it is easy to draw parallels to the 1970s, when oil embargos in the Middle East contributed to inflation pressures in the U.S. and commodity returns provided a useful hedge. Our research indicates that commodity returns are a function of realized inflation and the economic growth environment. We also find that shocks to these drivers are both quickly reflected in commodity prices and short-lived. **Figure II-16b** shows that a shock to inflation and growth is reflected in commodity prices only for as long as the inflation/growth pressures remain. This means that to realize the full benefit of commodities as an inflation hedge, investors must be able to time their entry into and exit from the position or accept a persistent return drag because of a lower Sharpe ratio for commodities than for U.S. and international equities.[18]

FIGURE II-16 (CONTINUED)

Commodities are not an investor's only tool to fight inflation

b. Commodity returns are sensitive to growth and inflation but can decay quickly after a shock



Notes: The figure shows the impact of a shock to inflation and the Vanguard leading economic indicator (VLEI) on nominal commodity returns over time, based on the distribution of return outcomes from the VCMM derived from 10,000 simulations. The solid lines correspond to the median forecast and the shaded area highlights the range from the 25th to the 75th percentile after a shock of the given persistence. The turquoise line and area show the impact of a persistent shock increasing annualized inflation over years 1–3 by one standard deviation and increasing VLEI in years 1–3 by 0.5 standard deviation. The yellow line and area show the impact of a temporary shock increasing inflation in year 1 by one standard deviation and increasing VLEI in year 1 by 0.5 standard deviation. The red dotted line shows the baseline forecast without any additional shocks. See the Appendix section titled "Indexes for VCMM simulations" for further details on asset classes.

Source: Vanguard calculations, as of September 30, 2022.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of September 30, 2022. Results from the model may vary with each use and over time.

18 The Sharpe ratio is a measure of return above the risk-free rate that adjusts for volatility. A higher Sharpe ratio indicates a higher expected risk-adjusted return. Based on the VCMM median return and volatility forecasts for U.S. and global ex-U.S. equities, cash, and commodities in Figure II-5a and Figure II-9a, global ex-U.S. equities have the highest expected Sharpe ratio (0.24), followed by U.S. equities (0.10) and commodities (0.02).

A balanced portfolio still offers the best chance of success

The policy response to higher and more persistent inflation and the subsequent repricing of risk in global capital markets has led to a dramatic shift in our time-varying asset allocation (TVAA) outlook. The TVAA looks to harvest the risk premia for which we think there is modest return predictability based on the VCMM. It leverages the Vanguard Asset Allocation Model (VAAM) to optimize a portfolio that maximizes end-of-period wealth with a penalty for dispersion of outcomes based on our 10-year return forecasts (Aliaga-Díaz et al., 2022). **Figure II-17** shows the optimal TVAA portfolio, based on our current outlook, versus its policy benchmark, which is a 60% stock/40% bond portfolio.

TVAA methodology is appropriate for investors who are willing to take on active risk in the form of "model forecast risk." For investors whose objectives and risk tolerances make it prudent to consider adjusting their asset allocations when market conditions materially change, the VAAM, combined with time-varying VCMM asset returns, provides a consistent and holistic way to analyze the trade-offs in time-varying portfolio solutions.

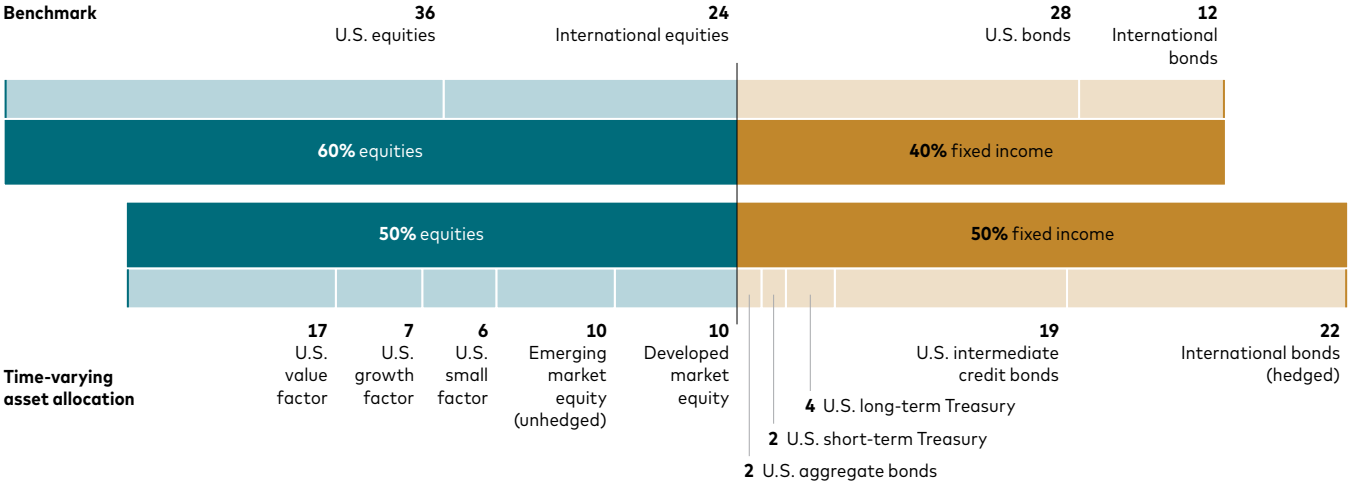
The TVAA portfolio targets the same risk profile as the traditional benchmark portfolio, with the flexibility to deviate from the benchmark based on the Vanguard projected outlook. The global interest rate tightening cycle in 2022 has raised our expected bond return forecasts by more than the equity market sell-off has raised expected equity returns. Higher bond returns and lower equity returns have reduced the equity risk premium. This is reflected in the TVAA portfolio with a 10-percentage-point decrease in the equity allocation, which is a meaningful derisking move.

This TVAA strategy breaks down the major asset class into smaller sub-assets to provide additional portfolio tilt benefits. On the domestic equity front, we see a tilt toward the value factor given favorable risk and return characteristics. Within international equities, there is an equal allocation to emerging markets and developed (ex-U.S.) markets given emerging markets' lower correlation with U.S. equities. On the domestic fixed income side, the portfolio is tilted toward credit given the time diversification benefits we outlined earlier in this section and the higher expected returns in Figures II-5a and II-9a.

In short, the TVAA portfolio is inclined toward reducing equity risk because of the compressed equity risk premium and reallocating it toward fixed income with a credit tilt. This results in a lower volatility for the TVAA portfolio while producing expected returns similar to those of the 60/40 benchmark (**Figure II-18**). Although the expected Sharpe ratio and maximum drawdown of the time-varying portfolio are better than that of the benchmark 60/40 portfolio, this comes at the expense of active risk (that is, tracking error to the benchmark) of 2.3%, which translates to a 51% probability of underperforming the benchmark in any given year.

FIGURE II-17

A more attractive risk/return trade-off means our time-varying asset allocation framework favors bonds and emerging markets



Notes: Time-varying portfolio allocations were determined by the VAAM. The assets under consideration were U.S. and non-U.S. equities and fixed income, in addition to real estate investment trusts (REITs), U.S. high-yield corporate bonds, and emerging-market equity, which were used to illustrate time-varying allocation not only within equities versus fixed income but also within sub-asset classes. See "Indexes for VCMM simulations" in the Appendix for additional details on asset class indexes. Maximum home-bias constraint of 60% was applied for U.S. equities, and 70% was applied for U.S. fixed income. Allocation to non-U.S. equities would have been higher had there been no home-bias constraint, given its higher expected return. VCMM 10-year projections as of September 2022 were used. The sum of individual sub-asset class allocations may not total 100% because of rounding.

Source: Vanguard calculations, as of September 30, 2022.

FIGURE II-18

We expect a similar return with lower volatility from our time-varying portfolio

	September 2022	
	TVAA	**Benchmark**
Equity allocation	50%	60%
10-year expected annualized total return	6.4%	6.4%
10-year expected annualized volatility	9.4%	10.3%
10-year expected Sharpe ratio	0.25	0.24
10-year expected maximum drawdown	–7.7%	–9.2%
Excess return to the benchmark	0%	—
Tracking error to the benchmark	2.3%	—
Probability of underperformance relative to benchmark in any given year	51.0%	—

Notes: Vanguard calculations are based on portfolios optimized by the VAAM, using return projections from the VCMM. The Sharpe ratio is a measure of return above the risk-free rate that adjusts for volatility. A higher Sharpe ratio indicates a higher expected risk-adjusted return.

Source: Vanguard calculations, as of September 30, 2022.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of September 30, 2022. Results from the model may vary with each use and over time.

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III. Appendix

About the Vanguard Capital Markets Model

IMPORTANT: The projections and other information generated by the Vanguard Capital Markets Model regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. VCMM results will vary with each use and over time.

The VCMM projections are based on a statistical analysis of historical data. Future returns may behave differently from the historical patterns captured in the VCMM. More important, the VCMM may be underestimating extreme negative scenarios unobserved in the historical period on which the model estimation is based.

The VCMM is a proprietary financial simulation tool developed and maintained by Vanguard's Investment Strategy Group. The model forecasts distributions of future returns for a wide array of broad asset classes. Those asset classes include U.S. and international equity markets, several maturities of the U.S. Treasury and corporate fixed income markets, international fixed income markets, U.S. money markets, commodities, and certain alternative investment strategies. The theoretical and empirical foundation for the Vanguard Capital Markets Model is that the returns of various asset classes reflect the compensation investors require for bearing different types of systematic risk (beta). At the core of the model are estimates of the dynamic statistical relationship between risk factors and asset returns, obtained from statistical analysis based on available monthly financial and economic data. Using a system of estimated equations, the model then applies a Monte Carlo simulation method to project the estimated interrelationships among risk factors and asset classes as well as uncertainty and randomness over time. The model generates a large set of simulated outcomes for each asset class over several time horizons. Forecasts are obtained by computing measures of central tendency in these simulations. Results produced by the tool will vary with each use and over time.

The primary value of the VCMM is in its application to analyzing potential client portfolios. VCMM asset-class forecasts—comprising distributions of expected returns, volatilities, and correlations—are key to the evaluation of potential downside risks, various risk–return trade-offs, and the diversification benefits of various asset classes. Although central tendencies are generated in any return distribution, Vanguard stresses that focusing on the full range of potential outcomes for the assets considered, such as the data presented in this paper, is the most effective way to use VCMM output. We encourage readers interested in more details of the VCMM to read Vanguard's white paper (Davis et al., 2014).

The VCMM seeks to represent the uncertainty in the forecast by generating a wide range of potential outcomes. It is important to recognize that the VCMM does not impose "normality" on the return distributions, but rather is influenced by the so-called fat tails and skewness in the empirical distribution of modeled asset-class returns. Within the range of outcomes, individual experiences can be quite different, underscoring the varied nature of potential future paths. Indeed, this is a key reason why we approach asset-return outlooks in a distributional framework.

Indexes for VCMM simulations

The long-term returns of our hypothetical portfolios are based on data for the appropriate market indexes through September 30, 2022. We chose these benchmarks to provide the most complete history possible, and we apportioned the global allocations to align with Vanguard's guidance in constructing diversified portfolios. Asset classes and their representative forecast indexes are as follows:

- **U.S. equities:** MSCI US Broad Market Index.
- **Global ex-U.S. equities:** MSCI All Country World ex USA Index.
- **U.S. REITs:** FTSE/NAREIT US Real Estate Index.
- **U.S. cash:** U.S. 3-Month Treasury—constant maturity.
- **U.S. Treasury bonds:** Bloomberg U.S. Treasury Index.
- **U.S. short-term Treasury bonds:** Bloomberg U.S. 1–5 Year Treasury Bond Index.
- **U.S. long-term Treasury bonds:** Bloomberg U.S. Long Treasury Bond Index.
- **U.S. credit bonds:** Bloomberg U.S. Credit Bond Index.
- **U.S. short-term credit bonds:** Bloomberg U.S. 1–3 Year Credit Bond Index.
- **U.S. high-yield corporate bonds:** Bloomberg U.S. High Yield Corporate Bond Index.
- **U.S. bonds:** Bloomberg U.S. Aggregate Bond Index.
- **Global ex-U.S. bonds:** Bloomberg Global Aggregate ex-USD Index.
- **U.S. TIPS:** Bloomberg U.S. Treasury Inflation Protected Securities Index.
- **U.S. short-term TIPS:** Bloomberg U.S. 1–5 Year Treasury Inflation Protected Securities Index.
- **Emerging-market sovereign bonds:** Bloomberg Emerging Markets USD Aggregate Bond Index.
- **Commodities:** Bloomberg Commodity Index.
- **Mortgage-backed securities (MBS):** Bloomberg U.S. Mortgage Backed Securities Index.

All equity indexes below are weighted by market capitalization:

- **Small-cap equities:** Stocks with a market cap in the lowest two-thirds of the Russell 3000 Index.
- **Large-cap equities:** Stocks with a market cap in the highest one-third of the Russell 1000 Index.
- **Growth equities:** Stocks with a price/book ratio in the highest one-third of the Russell 1000 Index.
- **Value equities:** Stocks with a price/book ratio in the lowest one-third of the Russell 1000 Index.

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