Forecast earnings growth (Growth $_{t+1}$) = analysts' long-term forecast of earnings growth obtained from I/B/E/S.

Forecast error (FE_{t+1}) = Realized earnings growth - Forecast earnings growth.

TABLE 7

Results of Nonlinear Weighted and Ordinary Least Squares Regressions Examining the Pricing of the Systematic Bias in Analysts' Forecasts of Long-Term Earnings Growth. Forecast Errors are Conditioned on Proximity to Equity Offerings and the Level of Forecast Earnings Growth.

Panel A: Non-linear weighted least squares

$$FE_{t+1} = \alpha_0 + \alpha_1 Growth_{t+1} + \varepsilon_{t+1}$$

$$AR_{t+1} = \beta_1 [FE_{t+1} - \alpha_0^* - \alpha_1^* Growth_{t+1}] + \upsilon_{t+1}$$

	All deals	All deals with affiliated analysts	All deals with unaffiliated analysts
α_0	-0.058**	-0.018	-0.058**
α_1	-0.329**	-0.621**	-0.325**
α_0^*	-0.054	-0.021	-0.091
α_1^*	0.138	-0.032	0.380
β_1	1.163**	1.257**	1.084**
Tests of the cross-equation restrictions (p-value for likelihood ratio tests)			
Market efficiency ($\alpha_0^* = \alpha_0$ *and* $\alpha_1^* = \alpha_1$)	0.001	0.001	0.001
Naïve expectations ($\alpha_0^* = 0$ *and* $\alpha_1^* = 0$)	0.516	0.894	0.489
Number of observations	1179	440	1070

Panel B: Ordinary least squares

$$AR_{t+1} = \beta_0 + \beta_1 FE_{t+1} + \beta_2 Growth_{t+1} + \upsilon_{t+1}$$

	All deals	*All deals with affiliated analysts*	*All deals with unaffiliated analysts*
β_0	0.063	0.027	0.098
β_1	1.163**	1.257**	1.084**
β_2	-0.161	0.040	-0.412
Adjusted R^2	0.069	0.086	0.066
Number of observations	1179	440	1070

** significant at the one percent level.

Abnormal returns (AR_{t+1}) = cumulative five-year buy and hold market adjusted stock returns beginning three months after the issue date. A value-weighted market index is used to adjust for market performance.

Realized earnings growth = five-year annualized growth rates calculated by fitting a least squares growth line to the logarithms of the six annual observations, beginning with the offer year and ending in the fifth year after the offer year.

Forecast earnings growth (Growth $_{t+1}$) = analysts' long-term forecast of earnings growth obtained from I/B/E/S.

Forecast error (FE_{t+1}) = Realized earnings growth - Forecast earnings growth.

https://www.wsj.com/articles/electricity-deregulation-utility-retail-energy-bills-11615213623

BUSINESS

Deregulation Aimed to Lower Home-Power Bills. For Many, It Didn't.

Retail energy companies compete with local utilities to give consumers more choice. But in nearly every state where they operate, retailers have charged more than regulated incumbents, a Wall Street Journal analysis found.

By Scott Patterson and Tom McGinty | Photographs by Gabriella Demczuk for The Wall Street Journal
March 8, 2021 12:24 pm ET

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Twenty years ago, a new breed of energy companies promised consumers that deregulation of the electricity industry would cut their power bills.

The opposite happened.

U.S. consumers who signed up with retail energy companies that emerged from deregulation paid $19.2 billion more than they would have if they'd stuck with incumbent utilities from 2010 through 2019, a Wall Street Journal analysis of U.S. Energy Information Administration data found.

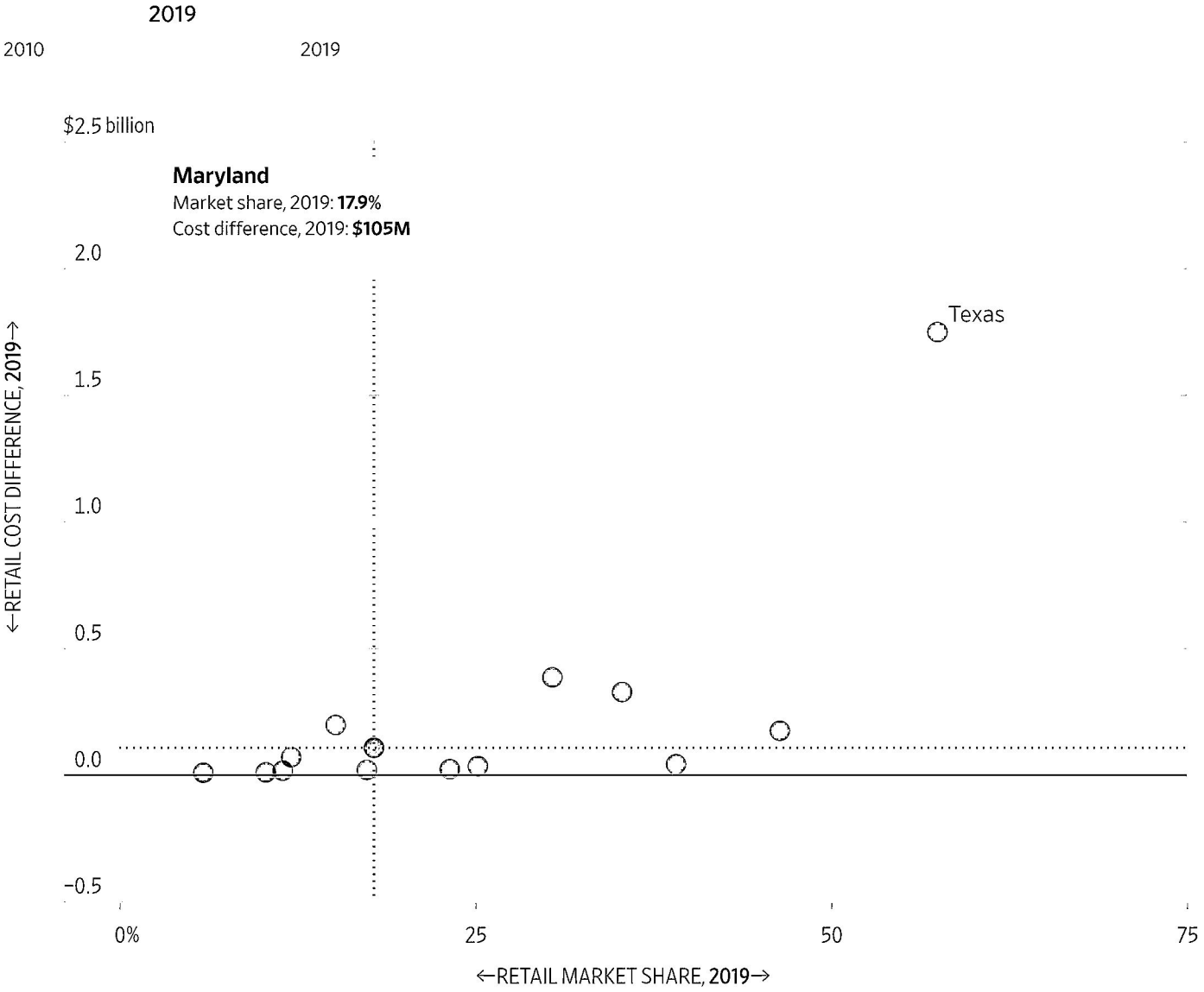
Retail energy companies buy electricity from generators—power-plant operators, wind farms, solar-power firms—and sell it to consumers, usually over the local utilities' wires. Giving consumers a choice between their old utilities and new rivals, the argument for deregulation went, would create competitive pricing.

But in nearly every state, they have charged more than their incumbent utilities in each of the five years from 2015 through 2019, the Journal analysis found. The Journal's analysis of power prices in 13 states and the District of Columbia excluded other states where retail companies supplied less than 1% of residential electricity in 2019.

Consumers on retail plans paid $1.9 billion extra in Pennsylvania and $1.7 billion in New York during the 10-year period examined by the Journal. In 2019, consumers paid $3.1 billion more in D.C. and the 13 states together, the biggest single-year difference ever over what they would have paid their utilities. On average across D.C. and the states, retail electricity cost 14% more than utility power in 2019, an all-time high.

Overcharged

From 2010 to 2019, **retail electricity providers in 13 states and the District of Columbia** charged $19.2 billion more than what regulated utilities would have. Retail providers in Texas have held nearly 60% of the state's electricity market and charged the most in markups over their regulated competitors.



Source: WSJ analysis of U.S. Energy Information Administration data

In Texas, where retail-electricity deregulation has gone furthest, residential consumers who signed up with retailers paid $12.6 billion more in the 10 years through 2019 than if

Texas also deregulated electricity generation—the production of electricity by power plants—and allows the wholesale-market price that power plants charge to go as high as $9,000 a megawatt-hour in times of scarcity, more than 400 times the 2020 average price of $21.18. Prices hit that cap on five days during the February deep freeze, and some retail customers who had opted for variable-rate plans were immediately hit with thousands of dollars of charges.

Retail power providers say their ability to buy and sell power at the best prices allows them to get cheaper energy and curbs the utilities' monopoly power. They also say competitive markets for electricity can spark innovation in the power packages they provide, including the option to purchase plans that include clean-energy supply, giving consumers more choices.

RELATED ARTICLES

- Are You Overpaying for Electricity? Here's How to Find Out
- How We Calculated Electricity-Rate Comparisons

Electricity deregulation worked for business. Federal data show it led to substantial savings for commercial and industrial power customers, whose large-scale electricity use gives them the incentive to shop around and seek expert guidance.

Regulated utilities, while cheaper for consumers, have struggled in many states with issues around reliability and maintenance. Consumers who are paying more for power through retail electricity suppliers still rely on the same power grid and usually the same power plants that customers of the regulated utility use.

Consumers can benefit from the deregulated marketplace by strategically shifting to suppliers with the lowest prices. "People who are effective at shopping are going to get the best price," said Daniel Allegretti, a consultant for the Retail Energy Supply Association, an industry trade group, and a former employee of Enron Corp., which helped spawn the retail energy industry in the 1990s.

Many customers aren't experts at reading the fine print in contracts that let retailers raise rates in ways they don't expect, consumer advocates say. In most deregulated states,

from the retail provider, leaving the perception for some consumers that the regulated provider is still overseeing the contract.

Mr. Allegretti said many retail firms would prefer to send the bills themselves, which he said would help develop their brands with consumers.

Watchdog groups, state attorneys general offices and state consumer advocates have complained about the retail power industry's sales practices for years, saying some use low teaser rates to attract consumers who don't understand that rates could go up eventually or illegally switch people to their service without consent. Big retail companies such as NRG Energy Inc. concede there has been bad behavior by some competitors and say they are working to improve the industry's reputation, such as efforts to make customer bills more transparent.

"After 20 years, I think you'd want to know, has this worked out for residential customers?" said Paula Carmody, who served for 14 years until this January as head of Maryland's Office of People's Counsel, an independent state agency that represents residential utility consumers. "From the information we have, it's not working."

Some retailers have targeted the elderly as well as poor and often heavily minority neighborhoods where electricity bills account for larger shares of income. "Low-income customers are much more receptive to the message, 'Hey you can save some money here,' " said Mr. Allegretti. Rules that encourage retail firms' ability to market their services to low-income communities give customers in those neighborhoods the ability to take advantage of the cost savings they promise, he said.

Mr. Medley's switch

Laurel Peltier, an environmental writer in Baltimore, was helping a local church's parishioners with financial issues in 2016 when she saw some had skyrocketing electricity bills. "I'm looking at these bills, and I'm confused," she said. She realized many—often minorities or cash-strapped elderly consumers—had signed up with retailers and were paying much more than if they had signed up with Baltimore Gas & Electric Co., the incumbent utility for the city of Baltimore.

Jessie Medley, outside his Baltimore home in December, says he didn't realize his power source had been switched to a retail provider.

One she helped recently was retiree Jessie Medley, 76. Ms. Peltier determined that over three years, Mr. Medley had paid retail energy supplier IDT Energy Inc. more than $2,000 in excess of what he would have paid the utility. He said he didn't realize he had been switched to IDT because his bills still said BGE, which was handling collection for the retail energy company.

Mr. Medley, who is on Social Security and frequently gets meals from a local food pantry, said an IDT sales representative told him he would save money if he switched plans. He said he didn't agree to change plans and didn't sign any forms, but he was switched anyway. After a Maryland Public Service Commission investigation determined IDT couldn't verify certain information about Mr. Medley's decision to sign up for their service, the company agreed to repay Mr. Medley $2,635.10.

An IDT spokesman said that the company considered Mr. Medley's enrollment valid and that his monthly bills identified IDT. Mr. Medley's bills, which the Journal reviewed, were delivered by BGE and prominently displayed the name of the utility as well as IDT.

The spokesman said a Maryland Public Service Commission rejection of an enrollment "doesn't necessarily mean fraud was involved" and that the commission rejects enrollments for a variety of reasons, such as incorrect formatting of paperwork.

The retail power industry now ranges from relatively small players like Genie Energy Ltd. , which owns IDT and is publicly traded with a stock-market value of about $200 million, to the nation's biggest players in the electricity industry, such as NRG [illegible] and Exelon

NRG provides power to some six million customers in the U.S. and Canada and has grown sharply in recent years with acquisitions of rival suppliers such as Xoom Energy and Direct Energy Services LLC. Exelon, with a market capitalization of about $40 billion, became a major player in the retail business with its $8 billion purchase of Constellation Energy Group in 2012.

More than 230 retail providers reported selling residential electricity in 2019, with the biggest 20 accounting for 75% of retail sales. Consolidation in the industry means many companies in the market are owned by the same parent. In Texas, marketers owned by NRG and Vistra Corp. accounted for three-quarters of the retail electricity sold in the state in 2019.

Exelon office in Baltimore; the company owns a major retail energy supplier.

Deregulation of retail electricity went further in Texas than any other state. Nearly 60% of residents are required to shop for their electricity on the retail market, with no option of remaining with a traditional utility. Because retailers don't sell in the areas that are served by utilities in Texas, it isn't possible to make direct rate comparisons; the Journal analysis compared Texas' statewide average cost of power sold in the deregulated areas with the statewide average cost of full-service utilities.

In D.C. and the other 12 deregulated states in the Journal's analysis, residents could still opt to stay with their incumbent utilities. In 2010, retailers in D.C. and those states supplied 32 million megawatt-hours of residential power, or about 10% of the total. In 2019, they sold 86 million megawatt-hours, 28% of all residential electricity.

Before deregulation, a consumer usually had one option for electricity: Buy from the regulated-monopoly utility. Government officials let the utilities charge enough to cover costs and make a modest profit.

The retail energy industry began in the 1990s following a wave of deregulation of businesses ranging from railroads to telecommunications to natural gas. Eventually, at least 18 states deregulated retail residential electricity to varying degrees.

The retail power industry largely languished until about a decade ago, when many of those states adopted a regulation called "purchase of receivables," or POR. Under the rule, which regulators implemented as a way to encourage retailers to sell their service to more consumers, utilities became responsible for collecting unpaid residential customer bills. The retail power companies pay a small fee for the service.

Because they were no longer responsible for unpaid bills, retail power companies didn't have to worry about the risks of signing up residential consumers, said Mr. Allegretti, the industry consultant. The POR rule, he said, "makes the retail supplier completely indifferent as to the credit risk of certain customers, and that includes low-income neighborhoods."

James Bride, president of Energy Tariff Experts, an energy-industry consultant, said: "Some of the POR programs were designed without anticipating that some bad actors would charge really high rates."

Many retail energy companies use teaser rates to persuade households to switch to their services. Variable rates often kick in several months after service begins and can change month to month.

They sometimes use deceptive marketing practices—such as promising to deliver long-term cheap power—then raise rates after a few months, according to regulators, customer complaints and multiple lawsuits against some companies in the industry. In online descriptions of their power plans, the companies typically disclose they have the right to raise prices, but the details are often vague and buried in the fine print.

Mr. Allegretti and other industry backers say residential customers need better education from the industry and regulators about how the retail-electricity market works and how it can benefit them. "The more educated the customers are, the better they do," he said.

Some consumers the Journal interviewed said they weren't actively monitoring their month-to-month charges and didn't realize their rates were creeping up.

In Massachusetts, the state attorney general's office in 2019 said residents in the past four years had filed more than 1,000 complaints about retail energy suppliers engaging in "aggressive and deceptive tactics." Retail provider Starion Energy Inc., in response to a complaint by the Massachusetts attorney general's office, agreed in August 2020 to pay up to $10 million for promising big savings while instead raising prices through variable-rate contracts.

According to a script used by telemarketers to sell Starion's services, potential customers were told "starting next month you're able to receive a rate reduction" on an electric bill, according to the complaint. The script didn't disclose that the rate reduction would expire after one or two months, after which charges could more than double.

A Starion representative said it honored its settlement agreement and is focused on serving its current customers with new products.

The Public Utilities Commission of Ohio is investigating whether retail energy providers PALMco Energy and Verde Energy USA, a Spark Energy Inc. affiliate, provided misleading information about variable rates, among other possible violations. The two providers were "very misleading about the nature of the price and the variable nature of it," said Matt Schilling, public-affairs director with the agency, who said the rate they eventually charged was as much as four times the standard utility charge.

PALMco, which has left the Ohio market, declined to comment on any litigation pending before the Ohio commission or on settlement discussions and said it has refunded consumers in the state hundreds of thousands of dollars. Verde didn't respond to requests for comment. Verde didn't dispute the violations detailed in a staff report on its investigation, according to the commission's order on the case.

NRG's Xoom Energy LLC is a defendant in a New York class-action lawsuit over claims it overcharged customers for gas and electricity.

SHARE YOUR THOUGHTS

Have you noticed an increase in the amount you pay for electricity over the past decade? Join the conversation below.

Connecticut's utility regulatory authority in 2019 fined Direct Energy $1.5 million for engaging in unfair and deceptive marketing practices, among other things.

Agents for Direct Energy, also owned by NRG, told consumers that the rate a local utility charged was variable, when it actually was a fixed rate, according to the Connecticut agency's investigation. "Now, if you haven't chosen a supplier, sir, then your rate right now is a variable rate on your bill. It changes month to month," a Direct Energy agent told a consumer, referring to a competing utility company, according to the investigation.

Direct Energy agents would at times describe themselves as "an energy adviser...working with your electric company," rather than saying they worked for a competitor, according to the investigation. The agents would also suggest that the customer isn't switching to a different service provider. In response to a customer stating that "I'm not interested in changing," an agent said: "Well, no, you don't change anything. Everything stays the same."

An NRG spokeswoman said: "We are a fierce advocate for consumer protection, and we support action that holds suppliers accountable. The alleged violations pertaining to Xoom Energy and Direct Energy occurred prior to their acquisition by NRG."

NRG CEO Mauricio Gutierrez said in a written statement to the Journal that while there are some "non-reputable actors" in the retail energy industry, the solution "is not to deprive customers of choices but instead taking meaningful steps to empower and inform customers of their rights and options."

Minority impact

Minorities often represent a disproportionate share of retail energy consumers. About 12% of New York City's households are in ZIP Codes where Black and Hispanic people make up more than half of the population, but those ZIP Codes accounted for 47% of the retail suppliers' electricity customers, according to the Journal's analysis of data from the U.S. Census Bureau and research done in 2016 by the Public Utility Law Project, a consumer advocacy organization.

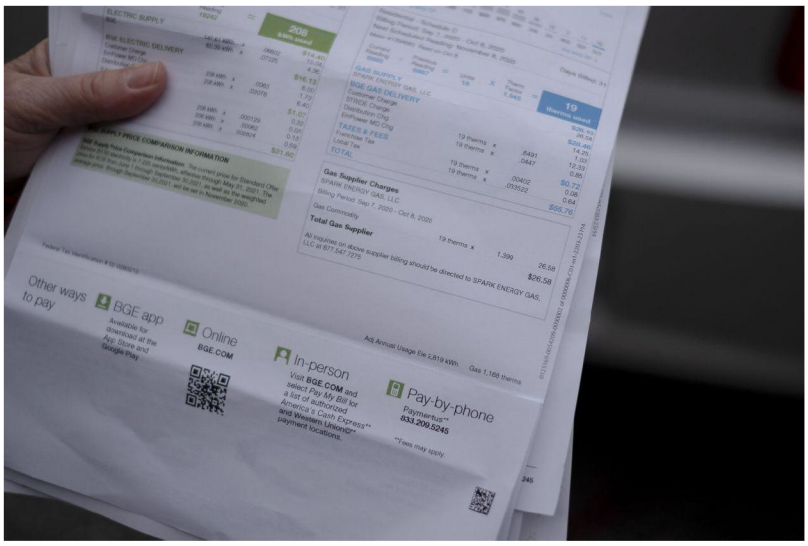
Writer Laurel Peltier, above right at a Baltimore church in December, was helping local parishioners with financial issues in 2016 when she saw some had skyrocketing electricity bills.

Those customers paid $63 million more for their electricity that year than they would have if they had chosen to be served by the regional utility, Consolidated Edison Inc., the analysis shows.

Illinois in a 2018 lawsuit said IDT carried out a "particularly egregious marketing scheme that disproportionately impacted African-American consumers on the South and West sides of Chicago." IDT "bombarded customers with false claims of lower electricity rates and savings," mainly through telephone calls and door-to-door sales, the Illinois attorney general's office said in a news release.

The state's investigation found that nine of 10 ZIP Codes with the highest IDT enrollments were in neighborhoods where the population was more than 90% Black. In a settlement, IDT, which didn't admit wrongdoing, agreed to refund $3 million to more than 176,000 customers.

A 2019 analysis commissioned by the Connecticut Office of Consumer Counsel looked at one month of retail supplier bills in select communities in which people of color made up more than half the population. In those communities, the poorest households—families that got assistance from the state for their electric bills known as "hardship customers"—paid premiums on their bills that were on average nearly 50% higher than other customers for retail providers.



A customer's BGE bill showing the gas supplier charges of Spark Energy in Baltimore in December.

In these communities, 45% of the hardship families got their power from retail energy companies. Statewide, 35% of hardship households got their electricity from these companies, compared with 27% of non-hardship customers that did, the analysis found. None of the communities surveyed saw the poorest families get lower rates than other customers.

Susan Baldwin, an independent consultant and expert in U.S. energy policy who has frequently testified in state regulatory proceedings on behalf of consumer advocates, did the analysis and has done studies of retail energy company practices in several other states. She said billing data shows that people of color tend to use retail energy companies and pay more for their power. "The most vulnerable consumers are harmed the most," she said.

'Sick of it'

Some states, such as New York, Illinois and Ohio, have adopted policies that restrict the ability of retail energy suppliers to sell to consumers who get state aid for their utility bills.

Maryland has considered enacting a similar policy. From 2015 through 2019, residential retail electricity consumers in Maryland paid $399 million more than they would have paid their utility company, according to the Journal's analysis.

Betty Burrows, a 72-year-old retiree in Baltimore, started getting electricity from IDT in

contract in February. IDT complied, and she went back to getting power from her incumbent utility, Baltimore Gas & Electric.

In August, her account illegally switched back to IDT, again without her consent, according to the Maryland Public Service Commission, which investigated the matter. IDT said she had enrolled in August online, but the email address and phone number used for the enrollment weren't hers, according to the commission's investigation. Ms. Burrows said she doesn't own a computer.

Over the course of the year, Ms. Burrows paid $267 more for electricity and natural gas than she would have paid her incumbent utility, the commission found. IDT refunded that amount after the commission's investigation. An IDT spokesman said the retailer terminated the agent who it said had fraudulently signed her up in August.

"It's just hard on some people," Ms. Burrows said, adding that she is concerned she might get switched again. "I'm sick of it."

Ms. Burrows worries her power supplier might get switched again without her consent.

Write to Scott Patterson at scott.patterson@wsj.com and Tom McGinty at tom.mcginty@wsj.com

Appeared in the March 9, 2021, print edition as 'Many Power Bills Rose After Deregulation.'

PGIM QUANTITATIVE SOLUTIONS

2022 Q4 CAPITAL MARKET ASSUMPTIONS

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

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All investments involve risk, including the possible loss of capital.

2022 Q4 Capital Market Assumptions

Summary

Q3 2022 Developments Informing Our Long-Term (10-Year) Forecasts: The most recent estimates of US GDP showed the economy shrank by -0.6% during the second quarter of 2022 amid a continued reduction in inventories and residential investment, marking a second-consecutive quarter of negative growth. Despite the negative reading domestic demand held firm. Labor market strength, driven by ongoing growth in non-farm payrolls in July and August and low unemployment, continued to support consumption spending. Still, other areas of the global economy struggled. This was most evident in Europe where many economies are likely to enter recessions this winter amid a sharp surge in natural gas prices that weighed on households and businesses. Supply shortages, along with higher energy costs, also led to manufacturing shutdowns and deteriorating business confidence. Meanwhile in China, industrial output, retail sales and fixed asset investment improved marginally in the most recent quarter following significant weakness earlier in the year. Federal Reserve (Fed) Chair Powell's speech at the Jackson Hole symposium in August emphasized the importance of doing whatever it takes to bring inflation down, boosting expectations for further Fed rate hikes. Powell argued that bringing inflation back to the 2% target is crucial, even if it causes economic pain or a hard landing. He also warned against prematurely loosening policy. The Bloomberg Commodity Total Return Index declined by 4.1% in the third quarter of 2022, reducing total year-to-date gains to a still impressive 13.6%. Our near-term developed and emerging market economic growth forecasts for the next 10 years have declined slightly, while our inflation forecasts for the same horizon are somewhat higher than those from the previous quarter. Evolving policy rates and a moderation in forecast economic growth and inflation have important implications for our long-term asset class forecasts.

Long-Term Global Economic Outlook: We expect real economic growth in developed economies to continue to moderate over the next decade, as it has for the last 30 years. This is due to the limited growth of the developed labor force, which is constrained by domestic demographics. An assumption of no significant offset from improved productivity growth is an additional constraint on growth. Inflation in developed markets, in contrast, is anticipated to moderate over the next 10 years, relative to the elevated rates of inflation observed in 2021 and the first half of 2022. Nevertheless, inflation is expected to be somewhat higher than that observed in the period following the Global Financial Crisis of 2008, and prior to the COVID-induced recession of 2020. We expect long-run real economic growth and inflation in emerging markets to advance at higher annualized rates. Younger populations and higher rates of return on capital in emerging markets are driving higher rates of nominal economic output compared to developed markets. While our baseline long-term inflation expectations assume a reversion to longer-term trends, the nearer-term outlook for inflation is highly uncertain. The four-decade trend in falling US inflation has at least temporarily paused, with US inflation rising to 7.0% in 2021 and 8.2% through the first three quarters of 2022. While an extreme scenario of 1970s-style, double-digit inflation appears unlikely, the potential for a sustained period of average inflation well above central bank targets is a non-trivial risk for investors. We cover these issues at length in two related white papers[1].

Equities: Our 10-year annualized nominal forecast return for Global Equities is 8.5%, an increase from our forecast of 7.7% for the third quarter of 2022. The forecast increase is primarily attributable to more favorable valuations following a 6.7% decline in Global Equities in the third quarter, taking year-to-date loses to 25.3%. Our long-term return forecast for US Equities is somewhat lower, at 7.8%. Looking at the rest of the world, Developed Market Equities outside the US and Emerging Market Equities are both forecast to return 10% over the long-run. Cheaper valuations, as measured by historical valuation ratios, are driving stronger expected returns for non-US Developed Market Equities versus US Equities. While faster expected economic growth is a positive for Emerging Market Equities versus non-US Developed Market Equities, it is offset by relatively less attractive valuations and income growth.

[1] Tokat-Acikel, Ahmed, Brundage, Campbell, Cummings, & Rengarajan, 2021, "Is Inflation About to Revive?" PGIM Quantitative Solutions White Paper. https://www.pgimquantitativesolutions.com/research/inflation-about-to-revive
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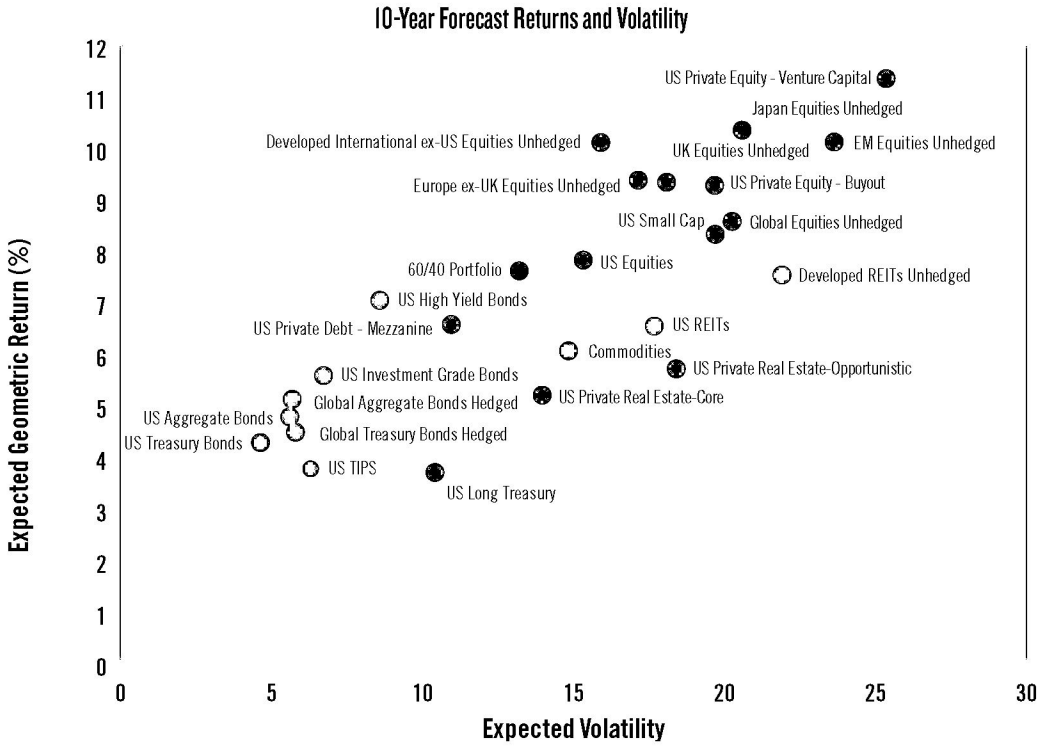


Source: PGIM Quantitative Solutions as of 9/30/2022. Forecasts are not a reliable indicator of future performance.

Fixed Income: Global sovereign interest rates continued to rise markedly in the third quarter of 2022 as inflationary pressures prompted a ratcheting up in expectations for further global central bank interest rate hikes. Our long-run forecast for hedged Global Aggregate Bonds is 5.1%, a material upward revision from the second quarter's forecast of 3.9%, and up from just 1.3% from the first quarter of this year. Our long-run forecast for US Aggregate Bonds is 4.7%, with the lower expected return relative to the Global Aggregate mostly attributable to a positive contribution from hedging foreign currency exposure. At the end of our 10-year forecast horizon, we expect the US Fed's policy rate to be approximately 3.8%, which is about 70 basis points higher than the midpoint of the policy rate target range at the end of the third quarter. Outside the US, developed market central banks are forecast to also increase policy rates from lower levels in many cases, as longer-run policy normalization is expected. In US credit markets, we are forecasting average spreads will decline somewhat over the next 10 years from the elevated levels witnessed at the end of the third quarter following a meaningful rise through the first three quarters of 2022, informing expected returns of 5.5% and 7.0% for US Investment Grade (IG) and High Yield Bonds, respectively.

Real Assets: Real Assets are broadly defined to include asset classes that have physical properties or have returns that are highly correlated with inflation. We include Commodities, REITs and TIPS as Real Assets in our Capital Market Assumptions (CMAs). Our forecasts for all these asset classes are expected to outperform our 10-year US inflation forecast of 2.7%.

Private Assets: Given the increasingly important role private asset classes play in a growing number of institutional allocations, beginning in the fourth quarter of 2021 PGIM Quantitative Solutions introduced forecasts for US Buyout Private Equity, US Venture Capital Private Equity and US Mezzanine Private Debt. Our forecasts for US Buyout Private Equity, US Venture Capital Private Equity and US Mezzanine Private Debt are linked to the forecast outcomes of public market assets with a premium consistent with historical empirical outcomes, acknowledging the underlying illiquidity and potential leverage employed in these asset classes relative to public market counterparts. Our forecasts for Core and Opportunistic US Private Real Estate are based on inputs from the NCREIF Property Indexes and linkages to forecast US economic growth and inflation.

Currency and Currency Hedging Returns: Over the next 10 years, we are forecasting mixed returns for the US dollar relative to developed market peers, with outcomes ranging from an annualized loss of 0.6% for the Australian dollar to a gain of 1.2% for the Japanese yen. Forecast outcomes for emerging market currencies range from an expected loss of 2.5% for the South African rand to a gain of 0.7% for the Taiwan dollar. Long-term currency hedging returns against a market-weighted basket of developed market exposures are forecast to be net positives for US investors as short-term interest rates are anticipated to be higher over the long term in the US relative to the Eurozone and Japan.

60/40 Portfolio Return[2]: Based on our long-term forecasts, a balanced portfolio of 60% Global Equities unhedged and 40% Global Aggregate Bonds hedged is forecast to return 7.6% annually over the next 10 years. This forecast represents a material increase of 1.0% from the second quarter, attributable to both the rise in global interest rates to date in 2022 as well as improved equity market valuations.

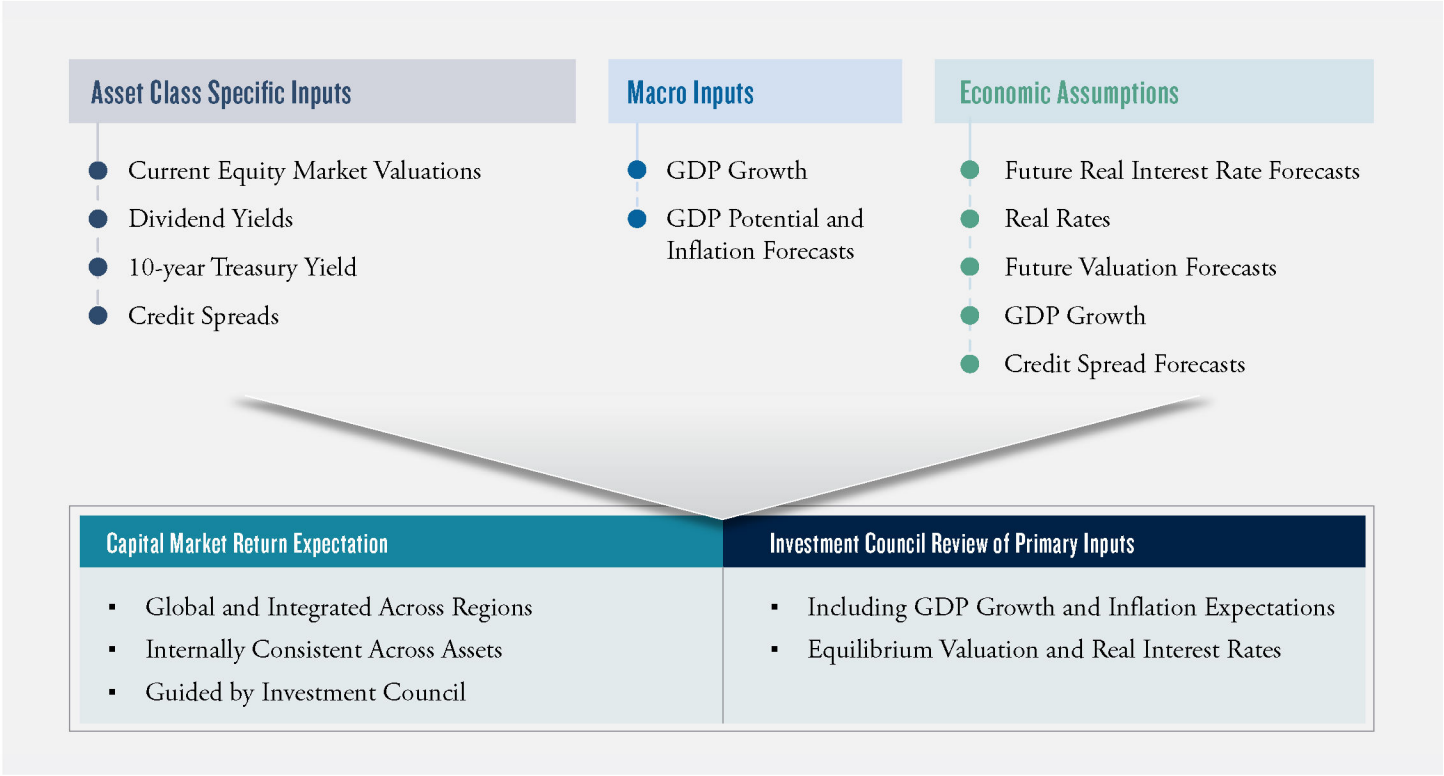
[2] For illustrative purposes only. All model portfolios have significant inherent shortcomings and do not consider many real-world frictions. There is no current PGIM Quantitative Solutions client portfolio with this composition of assets. It does not constitute investment advice and should not be used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

Overview

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

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

Capital Market Assumptions Framework



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

Global Economic Outlook

Forward-looking views for economic growth and inflation are some of the most critical building blocks of our CMAs. We currently compile these for 16 countries. Based on our forecasts, long-term real economic growth in developed economies over the next 10 years is expected to continue to moderate, as it has for the last three decades. This is due to the limited growth of the labor force, which is constrained by domestic demographics, and based on an assumption of no significant offset from improved productivity growth. Our forecasts for near-term economic growth are somewhat lower than last quarter, while our forecasts for inflation edged somewhat higher. We expect longer-term economic growth in developed economies to be led by Australia and other countries with younger populations and more liberal immigration policies. We anticipate growth to be slowest in Japan and parts of Western Europe, where the labor force is expected to contract further over the next decade. Inflation in developed markets is anticipated to moderate over the next 10 years, relative to the elevated rates of inflation observed in 2021 and 2022 but is expected to be somewhat higher than that observed in the period following the Global Financial Crisis of 2008, and prior to the COVID-induced recession of 2020. Our 10-year forecasts for developed market inflation range from a 3.3% annual rate in Australia to a low of 1.5% in Japan. Emerging markets, however, are expected to produce real economic growth and inflation at annualized rates of 3.8% and 3.1%, respectively, driven by younger populations and higher rates of return on capital than in developed markets.

Evolution of Our Market Outlook

Over the last 10 years, coincident with rising valuation ratios and a moderation in expected developed market growth and inflation, our long-term capital market assumptions for global equities trended downwards through 2017 before stabilizing at historically low levels. More recently, declining equity markets in 2022 and an increase to our longer-run inflation expectations have reversed this trend, moving our forecasts higher. Our outlook for returns of global equities over the next 10 years is 8.5%, an increase of 0.8% from our forecast in the third quarter of 2022.

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

Source: PGIM Quantitative Solutions as of 9/30/2022. Forecasts are not a reliable indicator of future performance.

Our capital market assumptions for global fixed income assets have moved materially higher over the past few quarters, coincident with the significant increase in global interest rates. As of September 30, 2022, the amount of negative yielding debt in the Bloomberg Barclays Global Aggregate Index stood at $1.8 trillion, a decline from $11.3 trillion at the end of 2021 and an all-time high of $17.8 trillion at the end of 2020.

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

Source: PGIM Quantitative Solutions as of 9/30/2022. Forecasts are not a reliable indicator of future performance.

Global Fixed Income Markets

Long-term fixed income forecasts begin with our view of 10-year forward policy rates for each of the major developed market central banks. We derive expected policy rates for each central bank jurisdiction as a function of current and future equilibrium real interest rates, the expected GDP output gap over the next 10 years[3] and the expected rate of inflation. Our long-term forecasts for short-term interest rates have edged higher this quarter as global central banks are forecast to pursue more aggressive interest rate hikes in coming quarters as the level of current inflation is well above policy targets. For the US, policy rates in 10 years are expected to be about 70 basis points higher than the 3.1% policy rate midpoint prevailing at the end of the second quarter, given the forward view of inflation and growth relative to potential. Central banks in other developed markets are also expected to raise rates to combat high inflation in coming quarters.

Interest Rates

Country	Current Short-Term Interest Rates (9/30/2022)	Long-Term Forecast of Short Interest Rates
United States	3.25	3.81
United Kingdom	2.58	2.33
Eurozone	0.74	1.54
Japan	-0.25	0.34
Australia	3.52	3.87
Canada	3.79	3.93

Source: Bloomberg, PGIM Quantitative Solutions, as of 9/30/2022. **Forecasts may not be achieved.**

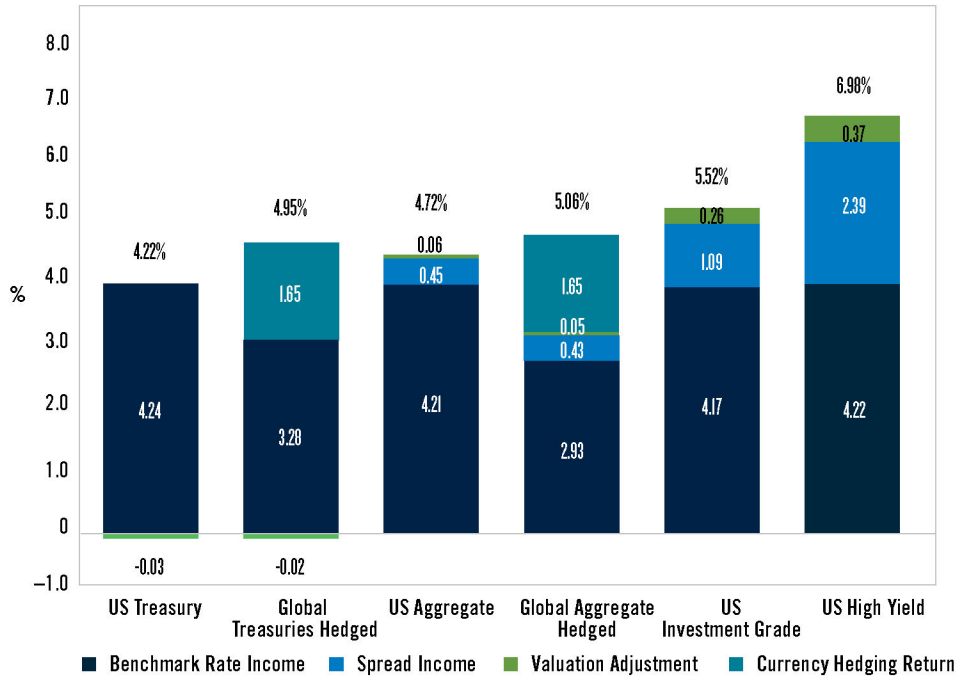
For longer-maturity government bond returns, we forecast[4] each country's expected long-term slope to define a term structure of yields across their respective government yield curves. The forecast slope for each country is a function of forecast and potential real economic growth and will evolve countercyclically.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

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

Year to date through the end of the third quarter, benchmark 10-year US Treasury yields advanced by 230 basis points to a level of 3.8%. Shorter-term 2-year Treasury yields, which better reflect near-term policy expectations, advanced by a much greater 355 basis points year to date, to a level of 4.3%. Looking forward, yields for the Bloomberg US Treasury Index are expected to rise modestly over the next 10 years, resulting in a negative valuation adjustment and an expected return of 4.2%, a rise of 0.7% from last quarter. Unhedged developed market government bonds outside the US are forecast to return less over the next decade given lower initial yields and a negative valuation adjustment, as yields are expected to rise over the forecast horizon. Long-run returns in global developed market government bonds for a US investor are forecast at 3.5% on an unhedged basis and 4.9% on a hedged basis given the differentials in forecast short-term interest rates.

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

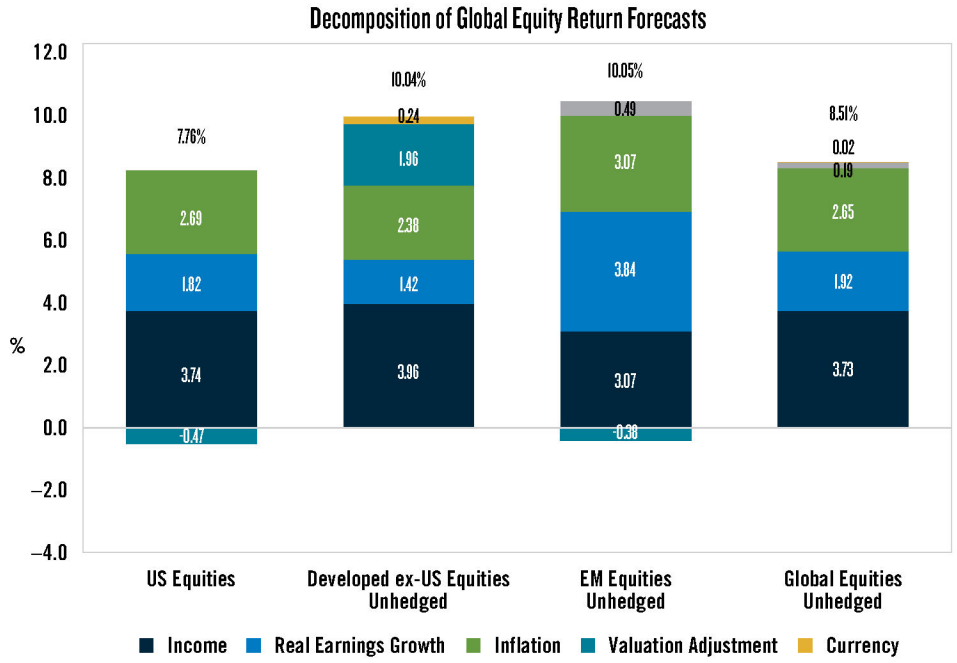
Decomposition of Fixed Income Return Forecasts



Source: PGIM Quantitative Solutions as of 9/30/2022. For illustrative purposes only. Forecasts are not a reliable indicator of future performance.

Our long-term forecast for US Aggregate Bonds is 4.7%, which includes an expected spread return of 0.5%. Our forecast for hedged Global Aggregate Bonds from a US investor perspective is 5.1%, given similar assumptions for credit spreads and defaults, as well as gains from currency hedging, which more than offset lower starting levels for underlying government yields outside the US. For both US Investment Grade and US High Yield Bonds, spreads at the end of the second quarter were somewhat higher than expected averages for the next 10 years.

We calculate the expected returns for fixed income credit indexes to include any additional income expected from an average credit spread yield over comparable government bonds, adjusted for expected default and downgrade losses over the forecast horizon. We then calculate the valuation adjustment for expected changes in spreads. Year to date in 2022, credit spreads have widened substantially following significant narrowing in 2021. Tightening financial conditions in the first three quarters of 2022 have resulted in a modest increase in our forecast for defaults in US High Yield Bonds. Long-run returns for US Investment Grade and US High Yield Bonds are expected to be 5.5% and 7.0%, respectively.



Source: PGIM Quantitative Solutions as of 9/30/2022. For illustrative purposes only. Forecasts are not a reliable indicator of future performance.

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

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

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

For the growth component of our equity return forecasts, long-term nominal earnings growth for each equity market is expected to approximate the growth in nominal GDP for each country. We calculate this as the combined annualized rate of expected inflation plus real GDP growth. As noted earlier, our near-term growth expectations have moderated from last quarter, while our forecasts for inflation have increased somewhat. Our 10-year forecast for US real annualized GDP growth is now 1.8%, with 2.7% for inflation translating to an earnings growth component of 4.5%. We anticipate inflation will remain elevated over the next few quarters before moderating to levels closer to the Fed target rate of 2%. For developed markets outside the US, our 10-year expectation for real GDP growth is 1.4%, while inflation is expected to average 2.4%. This assumption would provide nominal earnings growth of 3.8%, an increase of 0.2% from our forecast from the previous quarter. For emerging markets, higher nominal GDP growth relative to developed markets is expected to result in long-run nominal earnings growth of 6.9%.

Among developed markets, the US maintains a negative expected long-term valuation adjustment of 0.5% annually, attributable to still historically elevated valuation ratios. Developed equities outside the US, in contrast, are expected to have a positive valuation repricing given historical valuation ratios that are below long-run averages. Emerging market equity returns are forecast to be 0.5% higher per year due to what is now a positive valuation adjustment after several quarters of having a negative valuation adjustment.

Private Assets

Given the increasingly important role private asset classes play in a growing number of institutional allocations, beginning in the fourth quarter 2021 PGIM Quantitative Solutions began producing forecasts for US Buyout Private Equity, US Venture Capital Private Equity and US Mezzanine Private Debt. Beginning in the first quarter of 2022 we also began providing forecasts for Core and Opportunistic US Private Real Estate. Our methodology for forecasting Private Assets outside of Real Estate ties the forecast outcomes of Private Assets to those of public market assets and assigns a premium consistent with historical empirical outcomes, acknowledging the underlying illiquidity and potential leverage employed in these asset classes relative to public market counterparts. Our forecasts for private Real Estate incorporate data from the NCRIEF Property Index (NPI) to determine yields and relative valuations in addition to linkages to forecast macroeconomic inputs. Investors in Private Assets must also evaluate cash flow considerations that may impact other liquid allocations in a multi-asset portfolio. For further reference about these considerations please see Shen et al. (2021)[5].

Private equity funds that take a buyout strategy invest in equity ownership in mature companies that result in a change of control. These are typically large transactions that use leverage. Our current 10-year annualized forecast for US Buyout Private Equity is 9.2% versus a forecast of 7.8% for public US Equities.

Venture capital funds seek private equity stakes in startups and small- to medium-sized companies with strong growth potential. Our current annualized 10- year forecast for US Venture Capital Private Equity is 11.3% versus a forecast of 8.3% for public US Small-Cap Equities.

Private mezzanine debt invests in loans that are subordinate to other debt in a firm's capital structure and that are backed by little to no collateral. Our current annualized forecast for US Mezzanine Private Debt is 6.5% versus a forecast of 7.0% for public US High Yield Debt.

Private real estate funds covered in the NPI for our forecasts include properties that have been acquired, at least in part, on behalf of tax-exempt institutional investors and held in a fiduciary environment. The property types allowed into the NPI are hotels, office buildings, industrial properties, apartments and other retail-use properties. Allowed properties can be wholly owned or even jointly owned properties. Returns on investment are required to be reported without leverage. From the unlevered initial forecast, we then calculate a core real estate forecast to represent funds with 20% leverage and an opportunistic real estate forecast to represent funds with 40% leverage. Our forecasts for Core and Opportunistic Private Real Estate this quarter are 5.1% and 5.6%, respectively.

Real Assets

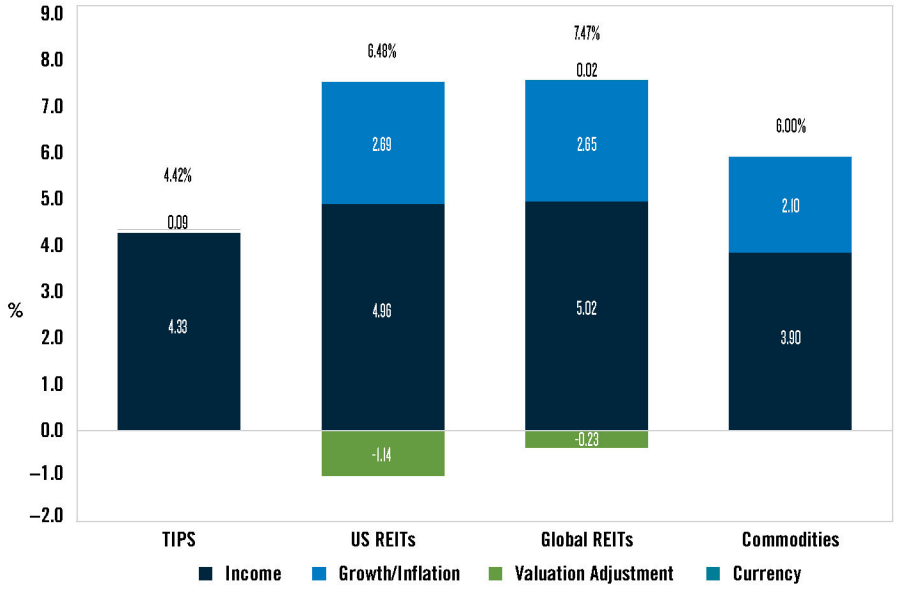
We include Commodities, REITs and TIPS as Real Assets in our Capital Market Assumptions.

For US TIPS, we assume that expected inflation and break-even inflation converge over time, implying that the inflation risk premia and liquidity risk premia in TIPS offset each other. Under these assumptions, we forecast a long-term return from TIPS of 4.4%, which is somewhat above the expected return of US Treasuries given the slightly higher duration of US TIPS. This US TIPS forecast is 0.5% higher than the prior quarter's forecast, attributable to an increase in underlying nominal US TIPS yields.

Our forecast returns for US and Global REITs include current and forecast dividend payments, expected appreciation linked to forecast price level changes, and a valuation adjustment based on current payout ratios. Our long-run forecasts for US and Global REITs are 6.5% and 7.5%, respectively.

Our long-run expected return for Commodities is 6.0%, reflecting a return on cash investment of 3.9%, assuming investment through liquid futures and a growth premium of 2.1%, consistent with historical spot returns over cash and a linkage to forecast inflation. This forecast is 1.3% higher than our forecast from last quarter, largely attributable to the increase in our cash forecast.

Decomposition of Real Asset Return Forecasts



Source: PGIM Quantitative Solutions as of 9/30/2022. For illustrative purposes only. Forecasts are not a reliable indicator of future performance.

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

Currency and Currency Hedging Returns

Our long-term forecasts for currency returns and returns to currency hedging are based on our forward views of local relative price levels and short-term policy rates. These views allow us to provide our long-term forecasts for a range of domiciles outside the US. Over the next 10 years, we are forecasting mixed returns for the US dollar relative to developed market peers, with outcomes ranging from an annualized loss of 0.6% for the Australian dollar to a gain of 1.2% for the Japanese yen. Forecast outcomes for emerging market currencies range from an expected loss of 2.5% for the South African rand to a gain of 0.7% for the Taiwan dollar. Long-term currency hedging returns against a market weighted basket of developed market exposures are forecast to be net positive for US investors as short-term interest rates are anticipated to be higher over the long term in the US relative to the Eurozone and Japan.

PGIM Quantitative Solutions Q4 2022 10-Year Capital Market Assumptions

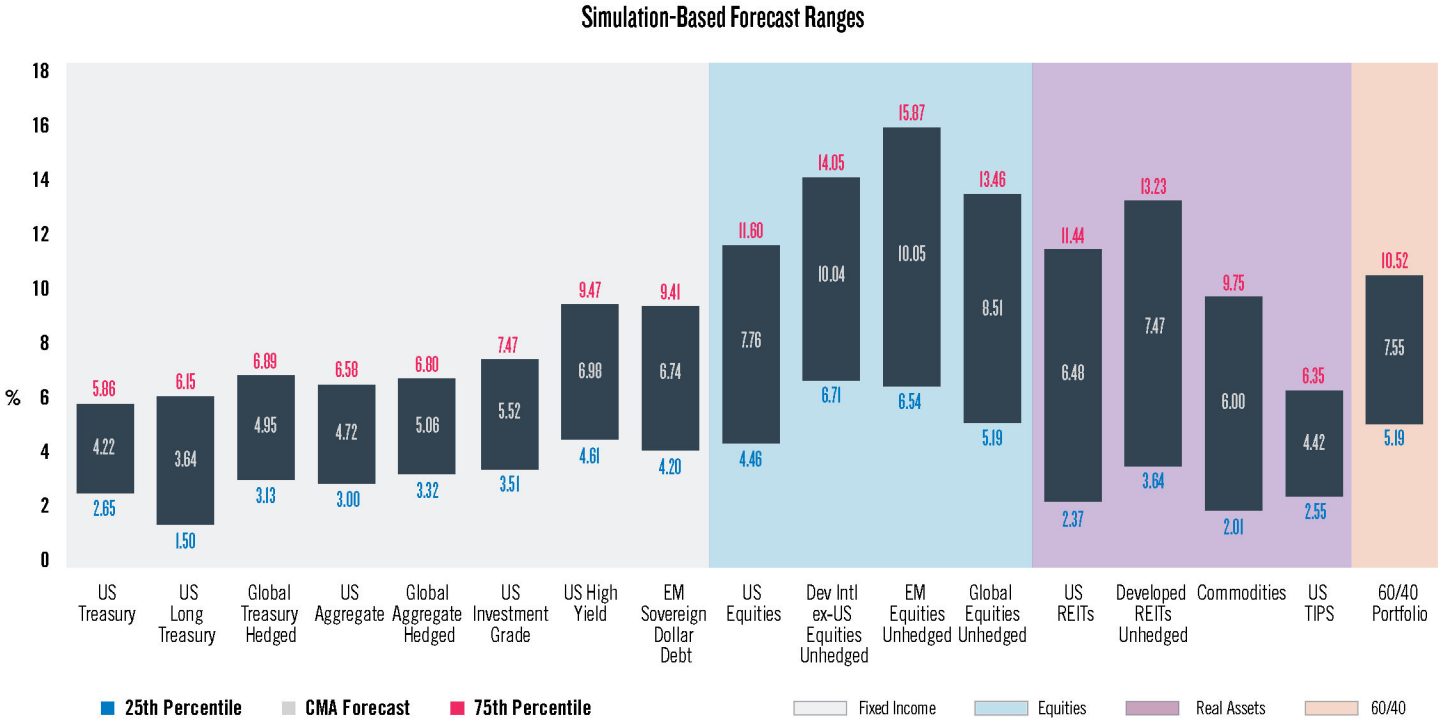
Asset	Expected Geometric Return	Expected Arithmetic Return	Expected Volatility	Expected Sharpe Ratio
Fixed Income				
Cash	3.90	--	--	--
US Treasury Bonds	4.22	4.32	4.63	0.09
US Long Treasury	3.64	4.18	10.41	0.03
Global Treasury Bonds Hedged	4.95	5.17	6.71	0.19
US Aggregate Bonds	4.72	4.88	5.60	0.17
Global Aggregate Bonds Hedged	5.06	5.22	5.68	0.23
US Investment Grade Bonds	5.52	5.74	6.72	0.27
US High Yield Bonds	6.98	7.35	8.58	0.40
US TIPS	4.42	4.59	5.79	0.12
Equities				
US Equities	7.76	8.93	15.32	0.33
US Small Cap	8.26	10.19	19.69	0.32
UK Equities Unhedged	9.27	10.91	18.08	0.39
Europe ex-UK Equities Unhedged	9.31	10.78	17.14	0.40
Japan Equities Unhedged	10.28	12.40	20.58	0.41
Developed International ex-US Equities Unhedged	10.04	11.30	15.90	0.47
EM Equities Unhedged	10.05	12.84	23.63	0.38
Global Equities Unhedged	8.51	10.56	20.25	0.33
Real Assets				
US REITs	6.48	8.04	17.67	0.23
Developed REITs Unhedged	7.47	9.87	21.90	0.27
Commodities	6.00	7.10	14.83	0.22
Private Assets				
US Private Real Estate - Core	5.14	6.12	13.96	0.16
US Private Real Estate - Opportunistic	5.65	7.34	18.40	0.19
US Private Debt - Mezzanine	6.51	7.11	10.95	0.29
US Private Equity - Buyout	9.21	11.14	19.67	0.37
US Private Equity - Venture Capital	11.28	14.49	25.35	0.42
60/40 Portfolio	**7.55**	**8.43**	**13.20**	**0.34**

Source: PGIM Quantitative Solutions as of 9/30/2022. **Forecasts are not a reliable indicator of future performance.**

Incorporating Economic Uncertainty in Our 10-Year Forecasts

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

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



Source: PGIM Quantitative Solutions as of 9/30/2022. **Forecasts and hypothetical performance are not a guarantee or reliable indicator of future results.** PGIM Quantitative Solutions generates 1,000 potential return paths using the simulation methodology described above. The uncertainty bands represent 25th and 75th percentile of potential return paths from the simulation. Returns paths are hypothetical in nature and do not reflect actual investment results. The information is shown for illustrative purposes only, does not constitute investment advice, and is not indicative or a guarantee of future results. Results from the projected simulation may vary over time and with each use.

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

Risk-Based Policy Portfolios[7]

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

For the fourth quarter of 2022, starting from the benchmark policy portfolios, intra-equity allocation changes common to all the policy portfolios were reductions in exposure to US equities and increased allocations to non-US developed and emerging market equities. Within fixed income, allocations to US Aggregate bonds were decreased in the Income portfolio and increased in the Growth portfolio. Across all the portfolios, allocations to US Investment Grade bonds were reduced, while allocations to High Yield bonds were increased. Within Real Assets, allocations to REITs were underweight in the Balanced and Growth portfolios, while allocations to Commodities were increased in all the portfolios. TIPS allocations were overweight in the Balanced portfolio and underweight in the Growth portfolio. Across broad asset class groups, equity allocations were reduced in the Balanced and Growth portfolios, funding overweight allocations to Real Assets in the Balanced portfolio and Fixed Income in the Growth portfolio. Allocations to Real Assets were increased in the Income and Balanced portfolios and decreased in the Growth portfolio.

Q4 Risk-Based Policy Portfolios

	Income Focused	Balanced Income and Growth	Growth Focused
Equities	**30.0%**	**55.0%**	**70.0%**
US Large Cap	20.0%	35.0%	40.0%
US Small Cap	2.0%	3.0%	8.0%
International ex-US	5.0%	12.0%	15.0%
Emerging Markets	3.0%	5.0%	7.0%
Fixed Income	**60.0%**	**35.0%**	**20.0%**
US Aggregate	50.0%	30.0%	10.0%
US Investment Grade	8.0%	3.0%	3.0%
US High Yield	2.0%	2.0%	7.0%
Real Assets	**10.0%**	**10.0%**	**10.0%**
TIPS	6.0%	3.0%	2.0%
US REITs	2.0%	4.0%	5.0%
Commodities	2.0%	3.0%	3.0%
Expected Geometric Return	**6.3%**	**7.4%**	**8.1%**
Expected Standard Deviation	**7.0%**	**10.0%**	**12.4%**
Expected Sharpe Ratio	**0.38**	**0.40**	**0.40**

Q4 Optimized Risk-Based Policy Portfolios

	Income Focused	Balanced Income and Growth	Growth Focused
Equities	**33.0%**	**53.0%**	**68.0%**
US Large Cap	17.0%	30.0%	35.0%
US Small Cap	4.0%	2.0%	7.0%
International ex-US	7.0%	14.0%	17.0%
Emerging Markets	5.0%	7.0%	9.0%
Fixed Income	**55.0%**	**35.0%**	**24.0%**
US Aggregate	45.0%	30.0%	14.0%
US Investment Grade	6.0%	1.0%	1.0%
US High Yield	4.0%	4.0%	9.0%
Real Assets	**12.0%**	**12.0%**	**8.0%**
TIPS	6.0%	5.0%	0.0%
US REITs	2.0%	2.0%	3.0%
Commodities	4.0%	5.0%	5.0%
Expected Geometric Return	**6.6%**	**7.5%**	**8.2%**
Expected Standard Deviation	**7.5%**	**9.8%**	**12.2%**
Expected Sharpe Ratio	**0.40**	**0.41**	**0.41**

Source: PGIM Quantitative Solutions as of 9/30/2022. For illustrative purposes only. The asset allocations are hypothetical and should not be construed as investment advice. No investment strategy or risk management technique can guarantee returns or eliminate risk in any market environment. **There is no guarantee strategies will be successful. Forecasts are not a reliable indicator of future performance.**

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

Innovations in Suggested Allocations from Q3 2022

Changes in our forecasts for the fourth quarter of 2022 have resulted in a number of innovations in our optimized portfolios from the end of the third quarter. In the Income portfolio, increased allocations to US Large and Small Cap equities were funded from a decrease in US Aggregate bond exposure, and a reduction of TIPS exposure within Real Assets funded an increase in the REITs allocation. In the Balanced portfolio, an increased allocation to US Aggregate bonds was funded by a small decrease in the US Small Cap allocation. In the Growth portfolio, US Aggregate bond exposure was increased, funded by reduced exposure in US Small Cap equities and within Real Assets, TIPS exposure was reduced by 4% to fund an equivalent increase in the Commodities allocation.

Quarter-over-Quarter Changes in Optimized Risk-Based Policy Portfolio Allocations			
	Income Focused	Balanced Income and Growth	Growth Focused
Equities	**3.0%**	**-0.5%**	**-1.5%**
US Large Cap	2.0%	0.0%	0.0%
US Small Cap	1.0%	-0.5%	-1.5%
International ex-US	0.0%	0.0%	0.0%
Emerging Markets	0.0%	0.0%	0.0%
Fixed Income	**-3.0%**	**0.5%**	**1.5%**
US Aggregate	-3.0%	0.5%	1.5%
US Investment Grade	0.0%	0.0%	0.0%
US High Yield	0.0%	0.0%	0.0%
Real Assets	**0.0%**	**0.0%**	**0.0%**
TIPS	-2.0%	0.0%	-4.0%
US REITs	2.0%	0.0%	0.0%
Commodities	0.0%	0.0%	4.0%
Expected Geometric Return	**0.8%**	**0.7%**	**0.7%**
Expected Standard Deviation	**0.6%**	**0.1%**	**0.1%**
Expected Sharpe Ratio	**-0.11**	**-0.07**	**-0.06**

Source: PGIM Quantitative Solutions as of 9/30/2022. Forecasts are not a reliable indicator of future performance. There is no guarantee strategies will be successful. Asset allocations are hypothetical and should not be construed as investment advice For illustrative purposes only.

Policy Portfolio Including Private Assets

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

For the fourth quarter of 2022, the Private Asset policy portfolio allocation changes mirrored those in the Balanced portfolio that included only public markets investments. Specifically, exposure to US equities was reduced in order to fund overweight allocations to International and Emerging Markets equities. Allocations to Fixed Income were reduced in US Aggregate and Investment Grade bonds to finance overweight allocations to Real and Private Assets. Within Real Assets, TIPS and Commodity allocations were increased, while exposure to REITs was decreased. In Private Assets, allocations were increased to Private Equity Buyout, Venture Capital as well as Opportunistic Real Estate. In contrast, the allocations to Private Mezzanine Debt and Core Real Estate were reduced.

Capital Market Assumptions Balanced Portfolio With Private Assets Allocation		
	Benchmark	Optimal
Equities	**28.0%**	**27.5%**
US Large Cap	18.0%	13.0%
US Small Cap	2.0%	0.5%
International ex-US	6.0%	10.0%
Emerging Markets	2.0%	4.0%
Fixed Income	**35.0%**	**32.5%**
US Aggregate	30.0%	27.5%
US Investment Grade	3.0%	1.0%
US High Yield	2.0%	4.0%
Real Assets	**7.0%**	**9.0%**
TIPS	2.0%	4.0%
US REITs	3.0%	1.0%
Commodities	2.0%	4.0%
Private Assets	**30.0%**	**31.0%**
Private Equity Buyout	6.0%	8.0%
Venture Capital	4.0%	6.0%
Private Mezzanine Debt	10.0%	6.5%
Core Real Estate	6.0%	4.5%
Opportunistic Real Estate	4.0%	6.0%
Total	**100%**	**100%**
Expected Geometric Return	**7.2%**	**7.6%**
Expected Standard Deviation	**8.7%**	**9.1%**
Expected Sharpe Ratio	**0.43**	**0.45**

Source: PGIM Quantitative Solutions as of 9/30/2022. Forecasts are not a reliable indicator of future performance.

PGIM Quantitative Solutions' Steady State CMAs

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

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

Long-Term Capital Market Assumptions

Asset	Expected Geometric Return	Expected Arithmetic Return	Expected Volatility	Expected Sharpe Ratio
Fixed Income				
Cash	1.46	1.46	—	—
US Treasury Bonds	4.33	4.54	6.51	0.47
Global Treasury Bonds Hedged	3.56	4.16	10.93	0.25
US Aggregate Bonds	4.66	4.95	7.65	0.46
Global Aggregate Bonds Hedged	3.50	3.88	8.75	0.28
US Investment Grade Bonds	5.47	5.90	9.32	0.48
US High Yield Bonds	6.60	7.31	11.85	0.49
US TIPS	4.34	4.62	7.53	0.42
Equities				
US Equities	8.95	10.95	19.98	0.48
US Small Cap	9.45	12.68	25.39	0.44
UK Equities Unhedged	8.53	10.56	20.18	0.45
Europe ex-UK Equities Unhedged	7.59	9.56	19.88	0.41
Japan Equities Unhedged	6.50	8.36	19.25	0.36
Developed International ex-US Equities Unhedged	7.63	9.08	17.05	0.45
EM Equities Unhedged	10.33	14.08	27.38	0.46
Global Equities Unhedged	8.77	11.83	24.76	0.42
Real Assets				
US REITs	7.94	10.78	23.85	0.39
Developed REITs Unhedged	7.78	11.50	27.27	0.37
Commodities	2.05	2.96	13.46	0.11
60/40 Portfolio	**6.66**	**7.93**	**15.93**	**0.41**

Source: PGIM Quantitative Solutions as of 9/30/2022. **Forecasts are not a reliable indicator of future performance.**

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

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

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Asset allocation is a method of diversification that positions assets among major investment categories. Asset allocation can be used to manage investment risk and potentially enhance returns. However, use of asset allocation does not guarantee a profit or protect against a loss.

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As the quantitative and multi-asset specialist of PGIM, we combine the agility of an independently run boutique with the stability and scale of one of the world's top-15 asset managers. For over 45 years, we have designed proprietary methods to solve beyond alpha by combining the latest technology with scalable, rigorous risk controls to nimbly build and manage diversified and customized solutions that help solve clients' evolving challenges. We manage portfolios across equities, multi asset, liquid alts and retirement for a global client base with $81 billion in assets under management as of 9/30/2022.

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1065573-00001-00 PI8170 ID 06082024

SURVEY OF PROFESSIONAL FORECASTERS

Release Date: February 9, 2024

FIRST QUARTER 2024

Forecasters Predict Higher Output Growth and Brighter Labor Market in 2024

The near-term outlook for the U.S. economy looks better now than it did three months ago, according to 34 forecasters surveyed by the Federal Reserve Bank of Philadelphia. The forecasters predict the economy will expand at an annual rate of 2.1 percent this quarter, up from the prediction of 0.8 percent in the last survey. On an annual-average over annual-average basis, the forecasters expect real GDP to increase 2.4 percent in 2024, up 0.7 percentage point from the estimate in the previous survey.

A downward revision to the path for the unemployment rate accompanies the outlook for growth. The forecasters predict the unemployment rate will increase from 3.8 percent this quarter to 4.0 percent in the fourth quarter of 2024. In the previous survey, the unemployment rate was forecast to rise from 4.0 percent to 4.2 percent over the same period. On an annual-average basis, the forecasters expect the unemployment rate to average 3.9 percent in 2024, marking a downward revision from the previous estimate of 4.1 percent.

On the employment front, the forecasters see job gains in the current quarter at a rate of 235,800 per month. The employment projections for the current quarter and the following three quarters show upward revisions from those of the previous survey. The projections for the annual-average level of nonfarm payroll employment suggest job gains at a monthly rate of 190,000 in 2024, up from the previous estimate of 120,000. (These annual-average projections are computed as the year-to-year change in the annual-average level of nonfarm payroll employment, converted to a monthly rate.)

Median Forecasts for Selected Variables in the Current and Previous Surveys

	Real GDP (%)		Unemployment Rate (%)		Payrolls (000s/month)	
	Previous	New	Previous	New	Previous	New
Quarterly data:						
2024:Q1	0.8	2.1	4.0	3.8	65.7	235.8
2024:Q2	1.3	1.5	4.0	3.9	97.9	119.8
2024:Q3	1.5	1.5	4.2	4.0	81.5	114.6
2024:Q4	1.7	1.7	4.2	4.0	118.8	122.4
2025:Q1	N.A.	1.8	N.A.	4.1	N.A.	133.5
Annual data (projections are based on annual-average levels):						
2024	1.7	2.4	4.1	3.9	120.0	190.0
2025	1.8	1.8	4.2	4.1	N.A.	111.7
2026	2.1	2.2	4.0	4.1	N.A.	N.A.
2027	N.A.	1.7	N.A	4.0	N.A.	N.A.

RESEARCH DEPARTMENT FEDERAL RESERVE BANK OF PHILADELPHIA
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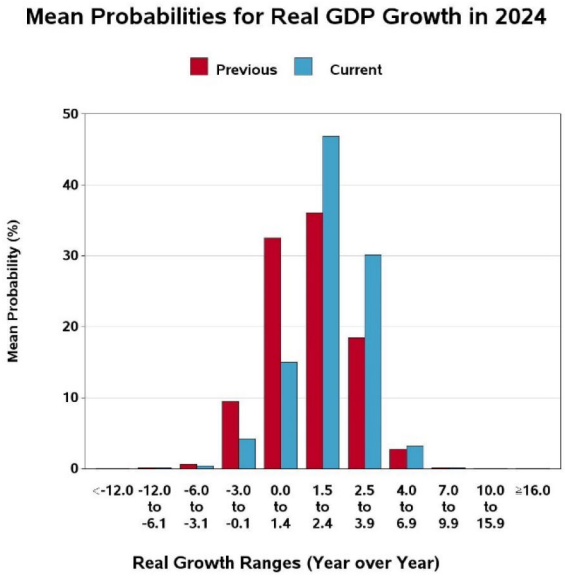
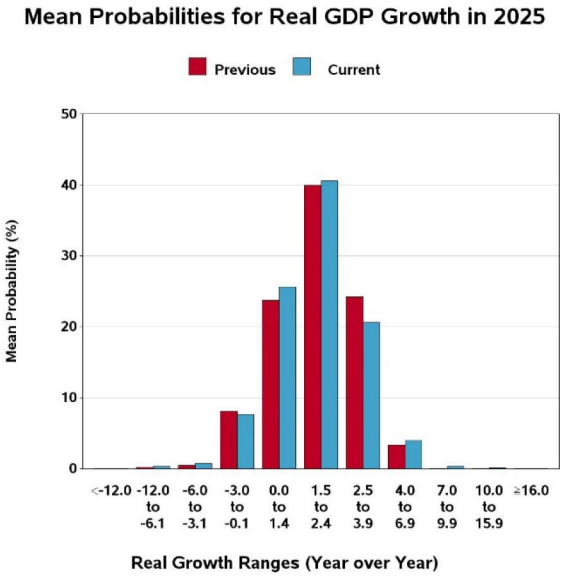
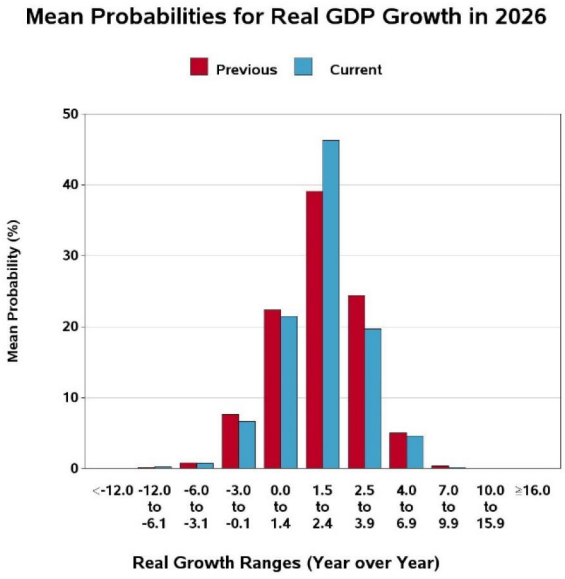
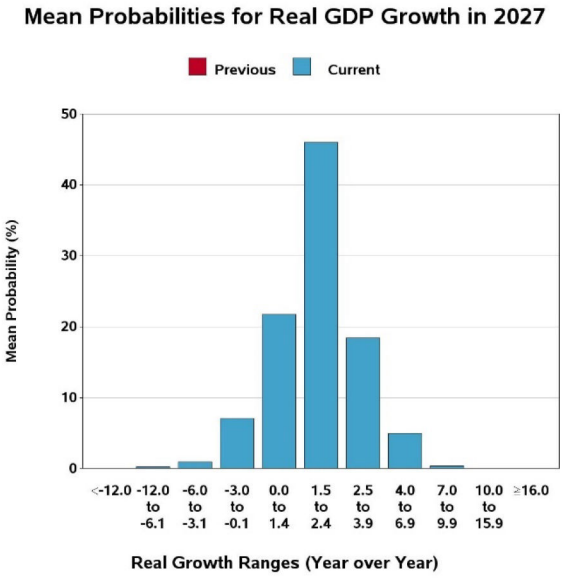
The charts below provide some insight into the degree of uncertainty the forecasters have about their projections for the rate of growth in the annual-average level of real GDP. Each chart presents the forecasters' previous and current estimates of the probability that growth will fall into each of 11 ranges. Notably for 2024, the forecasters are substantially increasing their probability estimates from the previous survey for real GDP growth in the range of 1.5 percent to 3.9 percent.

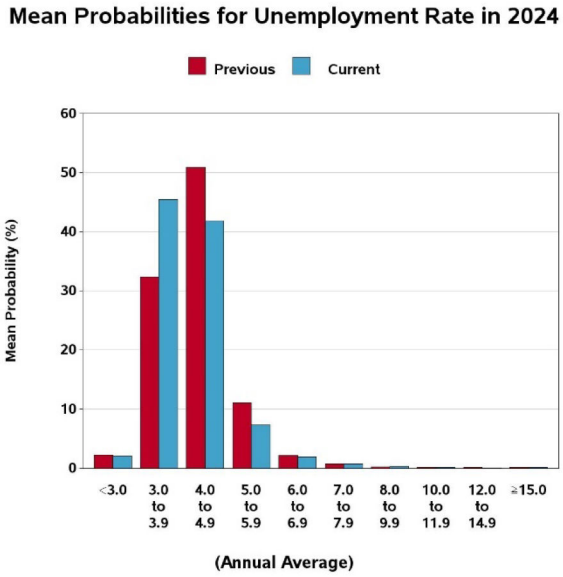


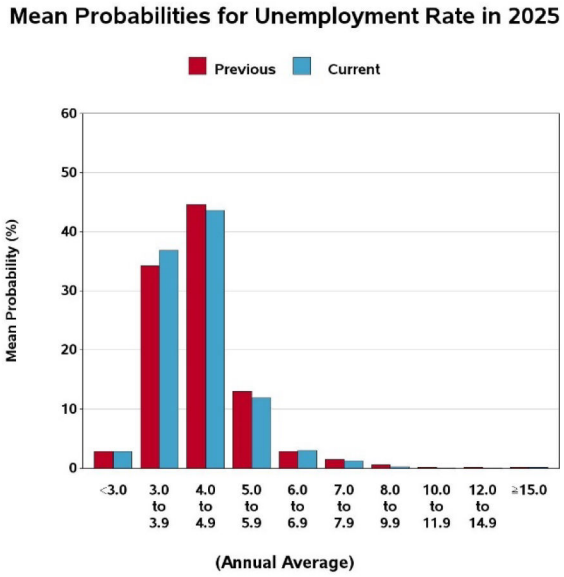


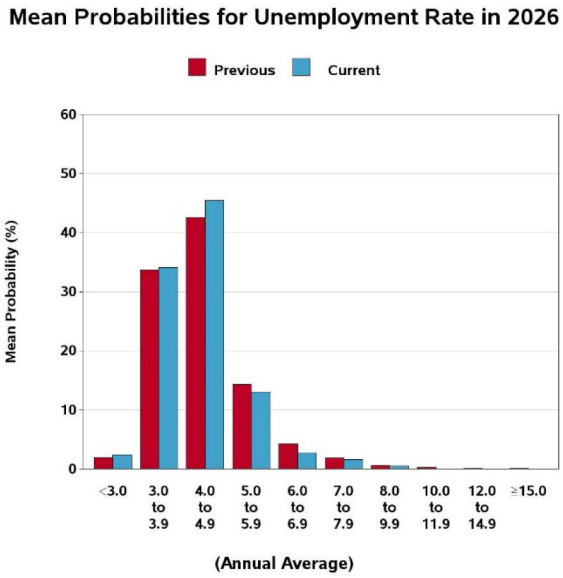


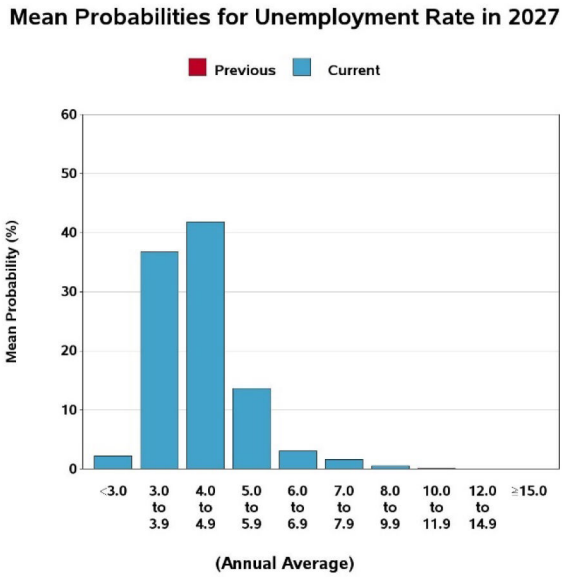


The forecasters' density projections for unemployment, shown below, shed light on uncertainty about the labor market over the next four years. Each chart presents the forecasters' current and previous estimates of the probability that unemployment will fall into each of 10 ranges. For 2024, the forecasters are raising their probability estimates from the previous survey for an unemployment rate in the range of 3.0 percent to 3.9 percent.









Forecasters Project Lower Near-Term Headline Inflation

The forecasters expect current-quarter headline CPI inflation will average 2.5 percent at an annual rate, down from their prediction of 2.8 percent in the previous survey. Headline PCE inflation over the current quarter will also be lower at an annual rate of 1.9 percent, down from the previous estimate of 2.5 percent. The predictions for current-quarter core CPI and core PCE inflation, on the other hand, are mixed. The forecasters predict lower core PCE inflation but higher core CPI inflation over the current quarter, compared with their predictions in the last survey.

Projections for both headline and core PCE inflation in 2024 will be lower at an annual rate of 2.1 percent, down from the previous predictions of 2.4 percent.

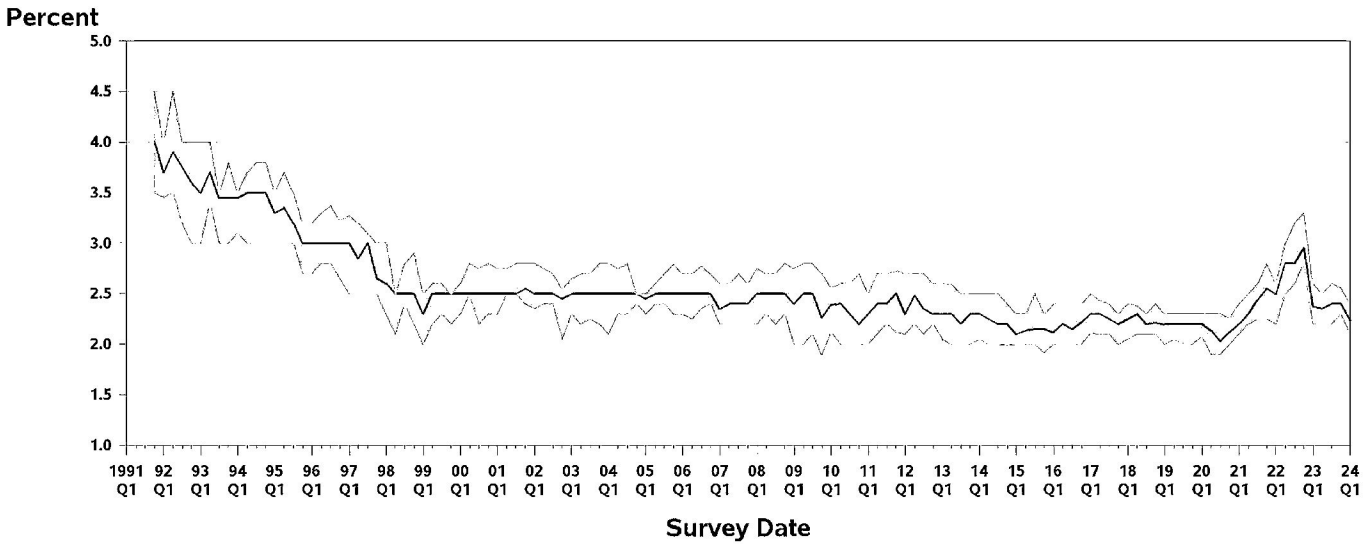
Over the next 10 years, 2024 to 2033, the forecasters predict headline CPI inflation will be an annual-average rate of 2.24 percent. The corresponding estimate for 10-year annual-average PCE inflation is 2.00 percent. These 10-year projections are 0.16 percentage point and 0.22 percentage point lower than those of the previous survey, which covered the 10-year horizon from 2023 to 2032.

Median Short-Run and Long-Run Projections for Inflation (Annualized Percentage Points)

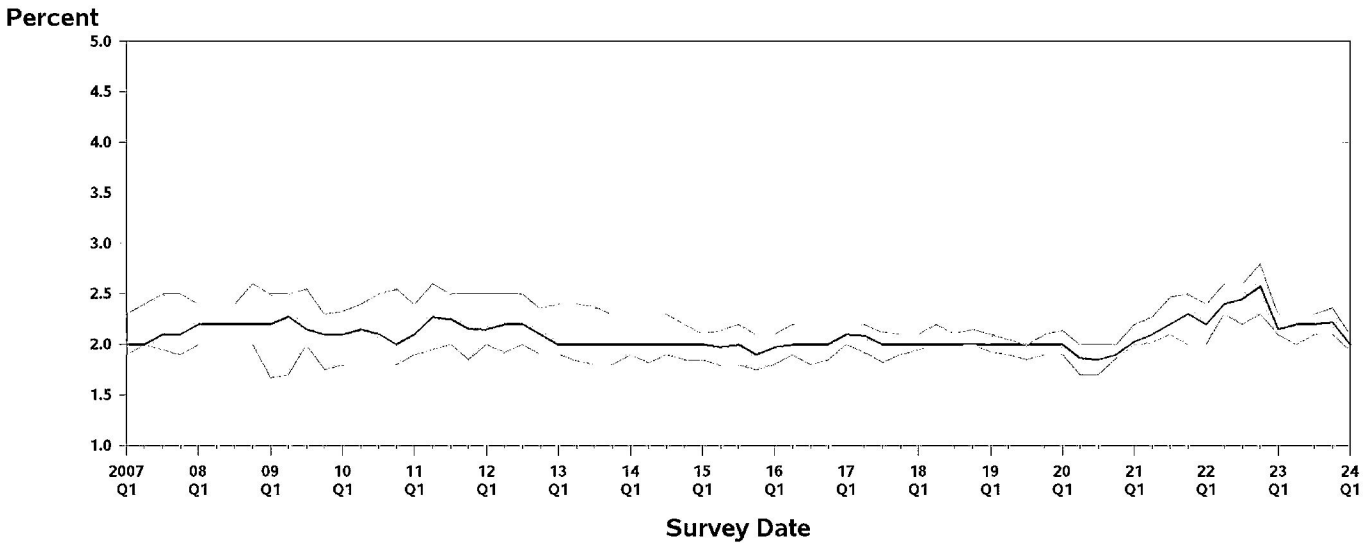
	Headline CPI		Core CPI		Headline PCE		Core PCE	
	Previous	Current	Previous	Current	Previous	Current	Previous	Current
Quarterly								
2024:Q1	2.8	2.5	2.8	3.1	2.5	1.9	2.7	2.1
2024:Q2	2.6	2.5	2.6	2.7	2.5	2.1	2.4	2.1
2024:Q3	2.5	2.4	2.5	2.6	2.3	2.1	2.3	2.1
2024:Q4	2.4	2.4	2.4	2.4	2.3	2.1	2.2	2.1
2025:Q1	N.A.	2.3	N.A.	2.4	N.A.	2.0	N.A.	2.1
Q4/Q4 Annual Averages								
2024	2.5	2.5	2.6	2.7	2.4	2.1	2.4	2.1
2025	2.3	2.2	2.3	2.3	2.1	2.0	2.1	2.0
2026	N.A.	2.3	N.A.	2.3	N.A.	2.0	N.A.	2.0
Long-Term Annual Averages								
2023-2027	2.60	N.A.	N.A.	N.A.	2.46	N.A.	N.A.	N.A.
2024-2028	N.A.	2.30	N.A.	N.A.	N.A.	2.05	N.A.	N.A.
2023-2032	2.40	N.A.	N.A.	N.A.	2.22	N.A.	N.A.	N.A.
2024-2033	N.A.	2.24	N.A.	N.A.	N.A.	2.00	N.A.	N.A.

The charts below show the median projections (the red line) and the associated interquartile ranges (gray areas around the red line) for 10-year annual-average CPI and PCE inflation. The charts provide perspective on the lower 10-year inflation expectations in the current survey.

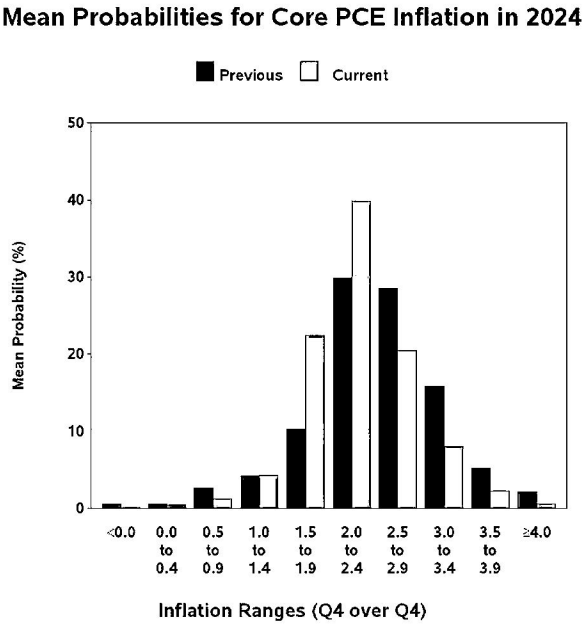
Projections for the 10-Year Annual-Average Rate of CPI Inflation
(Median and Interquartile Range)

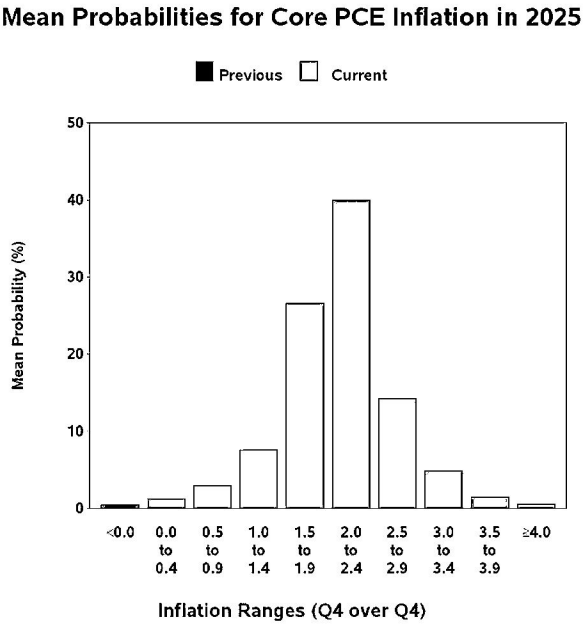


Projections for the 10-Year Annual-Average Rate of PCE Inflation
(Median and Interquartile Range)



The figures below show the probabilities that the forecasters are assigning to each of 10 possible ranges for fourth-quarter over fourth-quarter core PCE inflation in 2024 and 2025. For 2024, the forecasters have significantly raised their estimates for the probability that core PCE inflation will be in the range of 1.5 percent to 2.4 percent, compared with their predictions in the last survey.





Lower Risk of a Contraction in Real GDP in 2024

The forecasters see the risk of a downturn in real GDP this quarter at 17.3 percent, down sharply from the previous estimate of 40.9 percent. Moreover, they have also lowered their probability estimates for negative growth for the following three quarters, compared with their previous estimates. The forecasters now predict a (nearly) one-in-four chance of a contraction in real GDP in each of the remaining three quarters in 2024.

Risk of a Negative Quarter (%)
Survey Means

Quarterly data:	Previous	New
2024:Q1	40.9	17.3
2024:Q2	40.2	23.9
2024:Q3	36.8	25.6
2024:Q4	34.7	25.6
2025:Q1	N.A.	25.2

Forecasters State Their Views on House Price Growth over the Next Two Years

In a special question in this survey, panelists were asked to provide their forecasts for fourth-quarter over fourth-quarter growth in house prices, as measured by several alternative indices. The panelists were allowed to choose their measure from a list of indices or to write in their own index. For each index of their choosing, the panelists provided forecasts for growth in 2024 and 2025.

Seventeen panelists answered the special question. Some panelists provided projections for more than one index. The table below provides a summary of the forecasters' responses. The number of responses (N) is low for each index. The median estimates for the six house price indices listed in the table below range from 1.0 percent to 3.1 percent in 2024 and from -1.1 percent to 2.5 percent in 2025.

Projections for Growth in Various Indices of House Prices
Q4/Q4, Percentage Points

Index	2024 (Q4/Q4 Percent Change)			2025 (Q4/Q4 Percent Change)		
	N	Mean	Median	N	Mean	Median
S&P CoreLogic Case-Shiller: U.S. National	6	1.7	1.5	6	1.8	2.5
S&P CoreLogic Case-Shiller: Composite 10	2	3.1	3.1	2	-0.1	-0.1
S&P CoreLogic Case-Shiller: Composite 20	8	2.9	2.1	8	2.4	2.1
FHFA: Purchase Only (U.S. Total)	10	3.5	2.7	10	2.1	2.5
CoreLogic: National HPI, incl. Distressed Sales (Single Family Combined)	1	2.3	2.3	1	-1.1	-1.1
NAR Median: Total Existing	2	1.0	1.0	2	1.8	1.8

Improved Long-Term Productivity Growth and Higher Returns on Fixed-Income Securities

In our first-quarter surveys, the forecasters provide their 10-year annual-average projections for an expanded set of variables, including growth in output and productivity, as well as returns on financial assets.

As the table below shows, the forecasters expect real GDP to grow at an annual-average rate of 2.00 percent over the next 10 years, unchanged from their projection in the first-quarter survey of 2023. Ten-year annual-average productivity growth is now expected to be 1.50 percent, up from 1.30 percent previously.

Mixed returns on financial assets over the next 10 years accompany the current long-term outlook for real GDP and productivity. The forecasters predict the S&P 500 returning an annual-average 7.00 percent over the next 10 years, down from the previous estimate of 7.50 percent in the first-quarter survey of 2023. The forecasters see the rate on 10-year Treasuries averaging 3.60 percent over the next 10 years, up from 3.35 percent in last year's first-quarter survey. Three-month Treasury bills will return an annual-average 2.78 percent over the next 10 years, up from 2.65 percent previously.

Median Long-Term (10-Year) Forecasts (%)

	First Quarter 2023	*Current Survey*
Real GDP Growth	2.00	2.00
Productivity Growth	1.30	1.50
Stock Returns (S&P 500)	7.50	7.00
Rate on 10-Year Treasury Bonds	3.35	3.60
Bill Returns (3-Month)	2.65	2.78

Technical Notes

Moody's Aaa and Baa Historical Rates
The historical values of Moody's Aaa and Baa rates are proprietary and, therefore, not available in the data files on the Bank's website or on the tables that accompany the survey's complete write-up in the PDF.

The Federal Reserve Bank of Philadelphia thanks the following forecasters for their participation in recent surveys:

William Adams, Comerica Bank; **Ed Al-Hussainy** and **Alexander Spitz**, Columbia Threadneedle Investments; **Scott Anderson** and **Doug Porter,** Bank of Montreal-BMO; **Robert J. Barbera**, Johns Hopkins University Center for Financial Economics; **Peter Bernstein**, RCF Economic and Financial Consulting, Inc.; **Wayne Best** and **Michael Brown**, Visa, Inc.; **Jay Bryson**, Wells Fargo; **Christine Chmura, Ph.D.**, and **Xiaobing Shuai, Ph.D.**, Chmura Economics & Analytics; **Gary Ciminero**, **CFA**, GLC Financial Economics; **Grant Collins**, AIM Research, LLC; **Rajeev Dhawan**, Georgia State University; **Bill Diviney**, ABN AMRO Bank NV; **Gabriel Ehrlich**, **Daniil Manaenkov**, and **Yinuo Zhang**, RSQE, University of Michigan; **Michael R. Englund**, Action Economics, LLC; **Michael Feroli**, J.P. Morgan; **Tani Fukui** and **Shan Ahmed**, MetLife Investment Management; **Sacha Gelfer**, Bentley University; **James Glassman**, Independent Economist; **Jan Hatzius**, Goldman Sachs; **Steve Kihm**, Citizens Utility Board of Wisconsin; **Yaniv Konchitchki**, University of California, Berkeley; **Thomas Lam**, Independent Economist (Singapore); **Brian Martin**, Australia New Zealand Bank (ANZ); **Robert McNab**, Old Dominion University; **R. Anthony Metz**, Pareto Optimal Economics; **R. M. Monaco**, TitanRM; **Joel L. Naroff**, Naroff Economics, LLC; **Nomura Securities International**; **Brendon Ogmundson**, BC Real Estate Association; **Perc Pineda, Ph.D.**, Plastics Industry Association; **Joel Prakken** and **Chris Varvares**, S&P Global Market Intelligence; **Jason Prole**, Capital Risk Management; **Michael Roberts**, **Dan Roberts**, and **Jeffrey Baldwin**, Roberts Capital Advisors, LLC; **Parker Ross**, Arch Capital Group; **Philip Rothman**, East Carolina University; **Allen Sinai** and **Lu Yu**, Decision Economics, Inc.; **Sean Snaith**, University of Central Florida; **Stephen Stanley**, Santander US Capital Markets; **Charles Steindel**, Editor, NABE *Business Economics*; **Susan M. Sterne**, Economic Analysis Associates, Inc.; **Edward Sullivan**, Portland Cement Association; **Ryan Sweet**, Oxford Economics USA, Inc.; **Jordan Vickers** and **Maira Trimble**, Eaton Corporation; **Lawrence Werther**, Daiwa Capital Markets America; **Mark Zandi**, Moody's Analytics; **Ellen Zentner**, Morgan Stanley.

This is a partial list of participants. We also thank those who wish to remain anonymous.

SUMMARY TABLE
SURVEY OF PROFESSIONAL FORECASTERS
MAJOR MACROECONOMIC INDICATORS

	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2024	2025	2026	2027
						(YEAR-OVER-YEAR)			
PERCENT GROWTH AT ANNUAL RATES									
1. REAL GDP (BILLIONS, CHAIN WEIGHTED)	2.1	1.5	1.5	1.7	1.8	2.4	1.8	2.2	1.7
2. GDP PRICE INDEX (PERCENT CHANGE)	2.0	2.0	2.1	2.1	2.2	2.1	2.1	N.A.	N.A.
3. NOMINAL GDP ($ BILLIONS)	4.3	3.5	3.6	4.1	4.2	4.6	3.9	N.A.	N.A.
4. NONFARM PAYROLL EMPLOYMENT									
(PERCENT CHANGE)	1.8	0.9	0.9	0.9	1.0	1.5	0.8	N.A.	N.A.
(AVG MONTHLY CHANGE)	235.8	119.8	114.6	122.4	133.5	190.0	111.7	N.A.	N.A.
VARIABLES IN LEVELS									
5. UNEMPLOYMENT RATE (PERCENT)	3.8	3.9	4.0	4.0	4.1	3.9	4.1	4.1	4.0
6. 3-MONTH TREASURY BILL (PERCENT)	5.3	5.2	4.8	4.6	4.2	5.0	3.8	3.0	2.8
7. 10-YEAR TREASURY BOND (PERCENT)	4.1	4.0	3.9	3.8	3.8	3.9	3.7	3.7	3.7

	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2024	2025	2026
						(Q4-OVER-Q4)		
INFLATION INDICATORS								
8. CPI (ANNUAL RATE)	2.5	2.5	2.4	2.4	2.3	2.5	2.2	2.3
9. CORE CPI (ANNUAL RATE)	3.1	2.7	2.6	2.4	2.4	2.7	2.3	2.3
10. PCE (ANNUAL RATE)	1.9	2.1	2.1	2.1	2.0	2.1	2.0	2.0
11. CORE PCE (ANNUAL RATE)	2.1	2.1	2.1	2.1	2.1	2.1	2.0	2.0

Note: The figures on each line are medians of 34 forecasters.

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2024.

SURVEY OF PROFESSIONAL FORECASTERS

First Quarter 2024

Tables

Note: Data in these tables listed as "actual" are the data that were available to the forecasters when they were sent the survey questionnaire on January 25, 2024; the tables do not reflect subsequent revisions to the data. All forecasts were received on or before February 6, 2024.

TABLE ONE
MAJOR MACROECONOMIC INDICATORS
MEDIANS OF FORECASTER PREDICTIONS

	NUMBER OF FORECASTERS	ACTUAL	FORECAST					ACTUAL	FORECAST			
		2023 Q4	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2023 ANNUAL	2024 ANNUAL	2025 ANNUAL	2026 ANNUAL	2027 ANNUAL
1. GROSS DOMESTIC PRODUCT (GDP) ($ BILLIONS)	31	27939	28232	28473	28725	29013	29313	27356	28604	29719	N.A.	N.A.
2. GDP PRICE INDEX (2017=100)	30	123.24	123.85	124.47	125.13	125.78	126.46	122.27	124.81	127.46	N.A.	N.A.
3. CORPORATE PROFITS AFTER TAXES ($ BILLIONS)	16	N.A.	2738.5	2768.6	2779.7	2786.7	2797.3	N.A.	2768.4	2860.9	N.A.	N.A.
4. UNEMPLOYMENT RATE (PERCENT)	33	3.7	3.8	3.9	4.0	4.0	4.1	3.6	3.9	4.1	4.1	4.0
5. NONFARM PAYROLL EMPLOYMENT (THOUSANDS)	28	157030	157738	158097	158441	158808	159209	156174	158454	159795	N.A.	N.A.
6. INDUSTRIAL PRODUCTION (2017=100)	25	102.5	102.7	102.9	103.2	103.6	103.8	102.8	103.1	104.5	N.A.	N.A.
7. NEW PRIVATE HOUSING STARTS (ANNUAL RATE, MILLIONS)	29	1.45	1.42	1.43	1.45	1.46	1.45	1.41	1.45	1.48	N.A.	N.A.
8. 3-MONTH TREASURY BILL RATE (PERCENT)	32	5.28	5.34	5.18	4.84	4.60	4.17	5.07	5.00	3.78	3.03	2.82
9. MOODY'S AAA CORP BOND YIELD * (PERCENT)	20	N.A.	4.89	4.86	4.85	4.81	4.78	N.A.	4.87	4.70	N.A.	N.A.
10. MOODY'S BAA CORP BOND YIELD * (PERCENT)	19	N.A.	5.80	5.85	5.73	5.74	5.75	N.A.	5.78	5.70	N.A.	N.A.
11. 10-YEAR TREASURY BOND YIELD (PERCENT)	31	4.44	4.07	4.00	3.85	3.80	3.77	3.96	3.93	3.70	3.70	3.70
12. REAL GDP (BILLIONS, CHAIN WEIGHTED)	34	22673	22793	22878	22964	23063	23166	22375	22922	23329	23833	24242
13. TOTAL CONSUMPTION EXPENDITURE (BILLIONS, CHAIN WEIGHTED)	29	15569.8	15665.2	15722.7	15793.1	15858.6	15934.7	15421.9	15760.6	16078.2	N.A.	N.A.
14. NONRESIDENTIAL FIXED INVESTMENT (BILLIONS, CHAIN WEIGHTED)	28	3300.3	3318.5	3333.1	3351.1	3363.7	3382.2	3268.0	3341.2	3416.7	N.A.	N.A.
15. RESIDENTIAL FIXED INVESTMENT (BILLIONS, CHAIN WEIGHTED)	28	740.8	744.5	747.8	752.7	758.4	763.3	734.5	750.0	772.1	N.A.	N.A.
16. FEDERAL GOVERNMENT C & I (BILLIONS, CHAIN WEIGHTED)	29	1501.6	1507.6	1514.3	1518.2	1521.7	1522.7	1480.9	1516.1	1527.2	N.A.	N.A.
17. STATE AND LOCAL GOVT C & I (BILLIONS, CHAIN WEIGHTED)	29	2373.0	2384.8	2394.2	2404.4	2412.4	2419.5	2336.0	2397.4	2429.8	N.A.	N.A.
18. CHANGE IN PRIVATE INVENTORIES (BILLIONS, CHAIN WEIGHTED)	27	82.7	57.3	47.7	44.8	49.0	49.8	50.7	48.9	52.7	N.A.	N.A.
19. NET EXPORTS (BILLIONS, CHAIN WEIGHTED)	27	-908.2	-914.7	-917.0	-923.9	-928.0	-942.4	-925.6	-921.1	-957.3	N.A.	N.A.

* The historical values of Moody's Aaa and Baa rates are proprietary and therefore not available to the general public.

Source: Research Department, Federal Reserve Bank of Philadelphia. Survey of Professional Forecasters, First Quarter 2024.

TABLE TWO
MAJOR MACROECONOMIC INDICATORS
PERCENTAGE CHANGES AT ANNUAL RATES

	NUMBER OF FORECASTERS	Q4 2023 TO Q1 2024	Q1 2024 TO Q2 2024	Q2 2024 TO Q3 2024	Q3 2024 TO Q4 2024	Q4 2024 TO Q1 2025	2023 TO 2024	2024 TO 2025	2025 TO 2026	2026 TO 2027
1. GROSS DOMESTIC PRODUCT (GDP) ($ BILLIONS)	31	4.3	3.5	3.6	4.1	4.2	4.6	3.9	N.A.	N.A.
2. GDP PRICE INDEX (2017=100)	30	2.0	2.0	2.1	2.1	2.2	2.1	2.1	N.A.	N.A.
3. CORPORATE PROFITS AFTER TAXES ($ BILLIONS)	16	2.6	4.5	1.6	1.0	1.5	4.4	3.3	N.A.	N.A.
4. UNEMPLOYMENT RATE (PERCENT)	33	0.1	0.1	0.1	0.0	0.1	0.3	0.2	0.0	-0.1
5. NONFARM PAYROLL EMPLOYMENT										
(PERCENT CHANGE)	28	1.8	0.9	0.9	0.9	1.0	1.5	0.8	N.A.	N.A.
(AVG MONTHLY CHANGE)	28	235.8	119.8	114.6	122.4	133.5	190.0	111.7	N.A.	N.A.
6. INDUSTRIAL PRODUCTION (2017=100)	25	0.8	0.7	1.1	1.7	0.9	0.3	1.4	N.A.	N.A.
7. NEW PRIVATE HOUSING STARTS (ANNUAL RATE, MILLIONS)	29	-8.6	0.9	7.3	1.4	-1.2	2.1	2.2	N.A.	N.A.
8. 3-MONTH TREASURY BILL RATE (PERCENT)	32	0.06	-0.16	-0.34	-0.24	-0.43	-0.07	-1.22	-0.75	-0.21
9. MOODY'S AAA CORP BOND YIELD * (PERCENT)	20	N.A.	-0.03	-0.01	-0.04	-0.04	N.A.	-0.17	N.A.	N.A.
10. MOODY'S BAA CORP BOND YIELD * (PERCENT)	19	N.A.	0.05	-0.12	0.02	0.01	N.A.	-0.08	N.A.	N.A.
11. 10-YEAR TREASURY BOND YIELD (PERCENT)	31	-0.37	-0.07	-0.15	-0.05	-0.03	-0.03	-0.24	0.00	-0.00
12. REAL GDP (BILLIONS, CHAIN WEIGHTED)	34	2.1	1.5	1.5	1.7	1.8	2.4	1.8	2.2	1.7
13. TOTAL CONSUMPTION EXPENDITURE (BILLIONS, CHAIN WEIGHTED)	29	2.5	1.5	1.8	1.7	1.9	2.2	2.0	N.A.	N.A.
14. NONRESIDENTIAL FIXED INVESTMENT (BILLIONS, CHAIN WEIGHTED)	28	2.2	1.8	2.2	1.5	2.2	2.2	2.3	N.A.	N.A.
15. RESIDENTIAL FIXED INVESTMENT (BILLIONS, CHAIN WEIGHTED)	28	2.0	1.8	2.7	3.1	2.6	2.1	2.9	N.A.	N.A.
16. FEDERAL GOVERNMENT C & I (BILLIONS, CHAIN WEIGHTED)	29	1.6	1.8	1.0	0.9	0.3	2.4	0.7	N.A.	N.A.
17. STATE AND LOCAL GOVT C & I (BILLIONS, CHAIN WEIGHTED)	29	2.0	1.6	1.7	1.3	1.2	2.6	1.4	N.A.	N.A.
18. CHANGE IN PRIVATE INVENTORIES (BILLIONS, CHAIN WEIGHTED)	27	-25.4	-9.6	-2.9	4.2	0.8	-1.8	3.8	N.A.	N.A.
19. NET EXPORTS (BILLIONS, CHAIN WEIGHTED)	27	-6.5	-2.3	-6.9	-4.1	-14.3	4.5	-36.3	N.A.	N.A.

* The historical values of Moody's Aaa and Baa rates are proprietary and therefore not available to the general public.

Note: Figures for unemployment rate, 3-month Treasury bill rate, Moody's Aaa corporate bond yield, Moody's Baa corporate bond yield, and 10-year Treasury bond yield are changes in these rates, in percentage points. Figures for change in private inventories and net exports are changes in billions of chain-weighted dollars. All others are percentage changes at annual rates.

Source: Research Department, Federal Reserve Bank of Philadelphia. Survey of Professional Forecasters, First Quarter 2024.

TABLE THREE
MAJOR PRICE INDICATORS
MEDIANS OF FORECASTER PREDICTIONS

	NUMBER OF FORECASTERS	ACTUAL	FORECAST(Q/Q)					ACTUAL	FORECAST(Q4/Q4)		
		2023 Q4	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2023 ANNUAL	2024 ANNUAL	2025 ANNUAL	2026 ANNUAL
1. CONSUMER PRICE INDEX (ANNUAL RATE)	32	2.8	2.5	2.5	2.4	2.4	2.3	3.2	2.5	2.2	2.3
2. CORE CONSUMER PRICE INDEX (ANNUAL RATE)	32	3.4	3.1	2.7	2.6	2.4	2.4	4.0	2.7	2.3	2.3
3. PCE PRICE INDEX (ANNUAL RATE)	32	1.7	1.9	2.1	2.1	2.1	2.0	2.7	2.1	2.0	2.0
4. CORE PCE PRICE INDEX (ANNUAL RATE)	32	2.0	2.1	2.1	2.1	2.1	2.1	3.2	2.1	2.0	2.0

Source: Research Department, Federal Reserve Bank of Philadelphia. Survey of Professional Forecasters, First Quarter 2024.

TABLE FOUR
YIELD SPREADS
MEDIANS OF FORECASTER PREDICTIONS

	NUMBER OF FORECASTERS	ACTUAL	FORECAST					ACTUAL	FORECAST			
		2023 Q4	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2023 ANNUAL	2024 ANNUAL	2025 ANNUAL	2026 ANNUAL	2027 ANNUAL
1. TBOND MINUS TBILL (PERCENTAGE POINTS)	30	-0.84	-1.27	-1.13	-0.94	-0.72	-0.43	-1.11	-1.00	-0.06	0.80	0.91
2. AAA MINUS TBOND (PERCENTAGE POINTS)	20	N.A.	0.79	0.82	0.86	0.90	0.95	N.A.	0.86	1.01	N.A.	N.A.
3. BAA MINUS TBOND (PERCENTAGE POINTS)	19	N.A.	1.67	1.78	1.80	1.80	1.88	N.A.	1.78	1.91	N.A.	N.A.
4. BAA MINUS AAA (PERCENTAGE POINTS)	19	N.A.	0.89	0.90	0.92	0.90	0.95	N.A.	0.91	0.98	N.A.	N.A.

Notes:

TBOND is the rate on 10-year Treasury bonds.
TBILL is the rate on 3-month Treasury bills.
AAA is the rate on Moody's Aaa corporate bonds.
BAA is the rate on Moody's Baa corporate bonds.

The historical values for interest rate spreads for Moody's Aaa and Baa rates are proprietary and therefore not available to the general public.

Each interest rate spread is computed as the median value of the forecasters' spreads. These median values may differ from those computed as the difference between the median values of each interest rate in the spread.

Source: Research Department, Federal Reserve Bank of Philadelphia. Survey of Professional Forecasters, First Quarter 2024.

TABLE FIVE
ESTIMATED PROBABILITY OF DECLINE IN REAL GDP

ESTIMATED PROBABILITY (CHANCES IN 100)	Q4 2023 TO Q1 2024	Q1 2024 TO Q2 2024	Q2 2024 TO Q3 2024	Q3 2024 TO Q4 2024	Q4 2024 TO Q1 2025
			NUMBER OF FORECASTERS		
10 OR LESS	12	7	4	5	5
11 TO 20	5	7	9	5	5
21 TO 30	5	6	7	10	11
31 TO 40	3	4	5	4	3
41 TO 50	0	1	0	1	0
51 TO 60	0	0	0	1	2
61 TO 70	1	0	0	0	0
71 TO 80	0	1	1	0	0
81 TO 90	0	0	0	0	0
91 AND OVER	0	0	0	0	0
NOT REPORTING	8	8	8	8	8
MEAN AND MEDIAN					
MEDIAN PROBABILITY	17.50	20.00	22.50	25.00	25.00
MEAN PROBABILITY	17.30	23.94	25.57	25.57	25.18

Note: Total number of forecasters reporting is 26.

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2024.

TABLE SIX
MEAN PROBABILITIES

MEAN PROBABILITY ATTACHED TO POSSIBLE
CIVILIAN UNEMPLOYMENT RATES:
(ANNUAL AVERAGE)

	2024	2025	2026	2027
15.0 PERCENT OR MORE	0.13	0.12	0.00	0.00
12.0 TO 14.9 PERCENT	0.08	0.07	0.00	0.00
10.0 TO 11.9 PERCENT	0.10	0.07	0.00	0.15
8.0 TO 9.9 PERCENT	0.30	0.25	0.52	0.57
7.0 TO 7.9 PERCENT	0.73	1.24	1.69	1.68
6.0 TO 6.9 PERCENT	1.93	3.02	2.75	3.11
5.0 TO 5.9 PERCENT	7.29	11.92	13.03	13.66
4.0 TO 4.9 PERCENT	41.84	43.62	45.47	41.88
3.0 TO 3.9 PERCENT	45.50	36.83	34.11	36.74
LESS THAN 3.0 PERCENT	2.09	2.87	2.42	2.22

MEAN PROBABILITY ATTACHED TO POSSIBLE
PERCENT CHANGES IN REAL GDP:
(ANNUAL-AVERAGE OVER ANNUAL-AVERAGE)

	2023-2024	2024-2025	2025-2026	2026-2027
16.0 PERCENT OR MORE	0.02	0.02	0.02	0.02
10.0 TO 15.9 PERCENT	0.04	0.08	0.04	0.07
7.0 TO 9.9 PERCENT	0.11	0.33	0.16	0.42
4.0 TO 6.9 PERCENT	3.22	3.96	4.65	4.94
2.5 TO 3.9 PERCENT	30.13	20.62	19.68	18.42
1.5 TO 2.4 PERCENT	46.85	40.59	46.31	46.02
0.0 TO 1.4 PERCENT	14.96	25.60	21.49	21.75
-3.0 TO -0.1 PERCENT	4.16	7.67	6.69	7.12
-6.0 TO -3.1 PERCENT	0.40	0.76	0.72	0.96
-12.0 TO -6.1 PERCENT	0.08	0.31	0.22	0.25
LESS THAN -12.0 PERCENT	0.02	0.06	0.02	0.02

MEAN PROBABILITY ATTACHED TO POSSIBLE
PERCENT CHANGES IN GDP PRICE INDEX:
(ANNUAL-AVERAGE OVER ANNUAL-AVERAGE)

	2023-2024	2024-2025
4.0 PERCENT OR MORE	0.80	2.77
3.5 TO 3.9 PERCENT	1.35	2.37
3.0 TO 3.4 PERCENT	5.78	7.06
2.5 TO 2.9 PERCENT	21.63	17.54
2.0 TO 2.4 PERCENT	35.61	30.73
1.5 TO 1.9 PERCENT	24.11	27.27
1.0 TO 1.4 PERCENT	7.46	8.04
0.5 TO 0.9 PERCENT	2.03	2.56
0.0 TO 0.4 PERCENT	0.66	1.13
LESS THAN 0.0 PERCENT	0.57	0.53

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2024.

TABLE SEVEN
MEAN PROBABILITY OF CORE CPI AND CORE PCE INFLATION (Q4/Q4)

MEAN PROBABILITY ATTACHED TO CORE CPI INFLATION:

	23Q4 TO 24Q4	24Q4 TO 25Q4
4.0 PERCENT OR MORE	1.79	2.46
3.5 TO 3.9 PERCENT	6.18	4.07
3.0 TO 3.4 PERCENT	20.61	9.93
2.5 TO 2.9 PERCENT	31.30	20.60
2.0 TO 2.4 PERCENT	24.19	35.68
1.5 TO 1.9 PERCENT	11.57	18.46
1.0 TO 1.4 PERCENT	3.22	5.23
0.5 TO 0.9 PERCENT	0.60	1.83
0.0 TO 0.4 PERCENT	0.43	0.93
LESS THAN 0.0 PERCENT	0.13	0.82

MEAN PROBABILITY ATTACHED TO CORE PCE INFLATION:

	23Q4 TO 24Q4	24Q4 TO 25Q4
4.0 PERCENT OR MORE	0.61	0.56
3.5 TO 3.9 PERCENT	2.29	1.45
3.0 TO 3.4 PERCENT	8.10	4.87
2.5 TO 2.9 PERCENT	20.49	14.28
2.0 TO 2.4 PERCENT	39.82	39.97
1.5 TO 1.9 PERCENT	22.48	26.61
1.0 TO 1.4 PERCENT	4.35	7.57
0.5 TO 0.9 PERCENT	1.25	2.94
0.0 TO 0.4 PERCENT	0.48	1.28
LESS THAN 0.0 PERCENT	0.14	0.47

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2024.

TABLE EIGHT
LONG-TERM (5-YEAR AND 10-YEAR) INFLATION FORECASTS

ANNUAL AVERAGE OVER THE NEXT 5 YEARS: 2024-2028

CPI INFLATION RATE		PCE INFLATION RATE	
MINIMUM	1.75	MINIMUM	1.59
LOWER QUARTILE	2.10	LOWER QUARTILE	1.97
MEDIAN	2.30	MEDIAN	2.05
UPPER QUARTILE	2.50	UPPER QUARTILE	2.30
MAXIMUM	3.07	MAXIMUM	2.79
MEAN	2.33	MEAN	2.10
STD. DEVIATION	0.27	STD. DEVIATION	0.23
N	27	N	27
MISSING	7	MISSING	7

ANNUAL AVERAGE OVER THE FOLLOWING 5 YEARS: 2029-2033

CPI INFLATION RATE		PCE INFLATION RATE	
MINIMUM	1.70	MINIMUM	1.41
LOWER QUARTILE	2.10	LOWER QUARTILE	1.85
MEDIAN	2.15	MEDIAN	2.00
UPPER QUARTILE	2.30	UPPER QUARTILE	2.10
MAXIMUM	2.70	MAXIMUM	2.42
MEAN	2.18	MEAN	1.97
STD. DEVIATION	0.22	STD. DEVIATION	0.22
N	27	N	27
MISSING	7	MISSING	7

ANNUAL AVERAGE OVER THE NEXT 10 YEARS: 2024-2033

CPI INFLATION RATE		PCE INFLATION RATE	
MINIMUM	1.93	MINIMUM	1.69
LOWER QUARTILE	2.10	LOWER QUARTILE	1.94
MEDIAN	2.24	MEDIAN	2.00
UPPER QUARTILE	2.40	UPPER QUARTILE	2.10
MAXIMUM	2.60	MAXIMUM	2.40
MEAN	2.26	MEAN	2.03
STD. DEVIATION	0.19	STD. DEVIATION	0.15
N	27	N	27
MISSING	7	MISSING	7

Note: The summary statistics for each forecast horizon are computed on a sample of panelists that may differ from one horizon to the next. The usual identity linking the 10-year horizon to the two underlying five-year horizons may not hold in the results.

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2024.

TABLE NINE
ADDITIONAL LONG-TERM (10-YEAR) FORECASTS

ANNUAL AVERAGE OVER THE NEXT 10 YEARS: 2024-2033

REAL GDP GROWTH RATE	
MINIMUM	1.50
LOWER QUARTILE	1.73
MEDIAN	2.00
UPPER QUARTILE	2.20
MAXIMUM	2.50
MEAN	1.98
STD. DEVIATION	0.30
N	24
MISSING	10

PRODUCTIVITY GROWTH RATE	
MINIMUM	0.90
LOWER QUARTILE	1.20
MEDIAN	1.50
UPPER QUARTILE	1.70
MAXIMUM	3.00
MEAN	1.55
STD. DEVIATION	0.47
N	19
MISSING	15

STOCK RETURNS (S&P 500)	
MINIMUM	2.10
LOWER QUARTILE	6.00
MEDIAN	7.00
UPPER QUARTILE	8.00
MAXIMUM	15.00
MEAN	7.15
STD. DEVIATION	2.59
N	19
MISSING	15

BOND RATE (10-YEAR)	
MINIMUM	2.20
LOWER QUARTILE	3.30
MEDIAN	3.60
UPPER QUARTILE	3.90
MAXIMUM	4.60
MEAN	3.55
STD. DEVIATION	0.57
N	22
MISSING	12

BILL RETURNS (3-MONTH)	
MINIMUM	2.00
LOWER QUARTILE	2.60
MEDIAN	2.78
UPPER QUARTILE	3.30
MAXIMUM	3.70
MEAN	2.84
STD. DEVIATION	0.48
N	22
MISSING	12

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2024.

SURVEY OF PROFESSIONAL FORECASTERS

Release Date: February 10, 2023

FIRST QUARTER 2023

Forecasters See Higher Growth and Stronger Labor Market in 2023

The outlook for the U.S. economy in 2023 looks somewhat better now than it did three months ago, according to 37 forecasters surveyed by the Federal Reserve Bank of Philadelphia. The forecasters predict the economy will expand at an annual rate of 0.6 percent this quarter and 1.0 percent in the second quarter of 2023, up from the previous predictions of 0.2 percent in each quarter. On an annual-average over annual-average basis, the forecasters expect real GDP to increase 1.3 percent in 2023, up from the projection of 0.7 percent in the survey of three months ago.

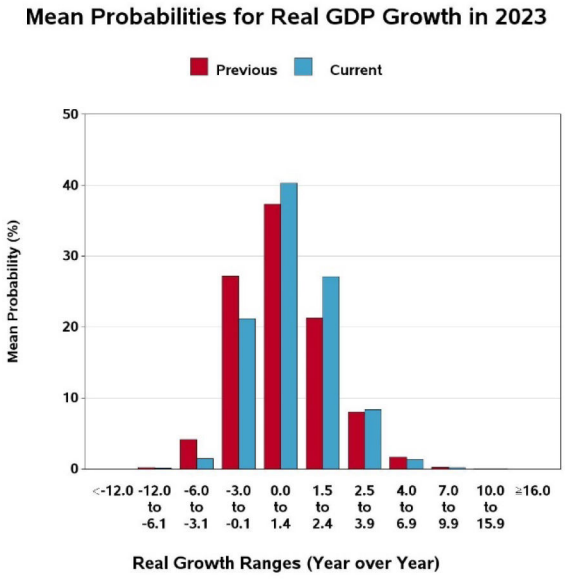
A downward revision to the path for the unemployment rate accompanies the outlook for growth. The forecasters predict the unemployment rate will increase from 3.5 percent this quarter to 4.1 percent in the fourth quarter of 2023. In the previous survey, the unemployment rate was forecast to rise from 3.8 percent to 4.4 percent over the same period. On an annual-average basis, the forecasters expect the unemployment rate to average 3.8 percent this year, marking a downward revision from the previous estimate of 4.2 percent.

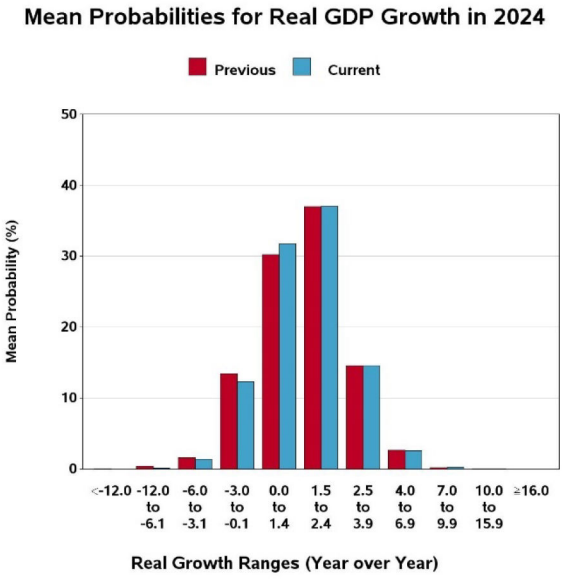
On the employment front, the panelists have revised upward their estimates for job gains in 2023. The projections for the annual-average level of nonfarm payroll employment suggest job gains at a monthly rate of 217,800 in 2023, up from 143,600 projected three months ago.

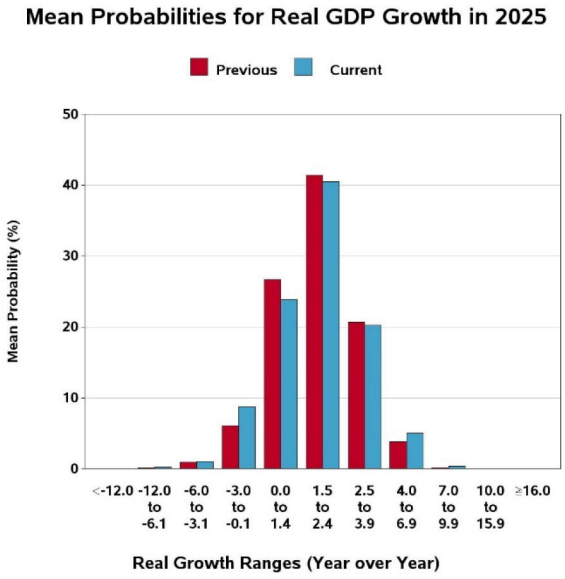
Median Forecasts for Selected Variables in the Current and Previous Surveys

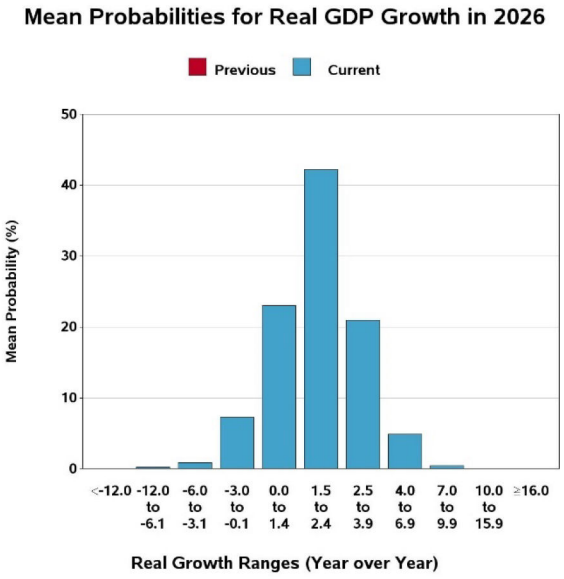
	Real GDP (%)		Unemployment Rate (%)		Payrolls (000s/month)	
	Previous	New	Previous	New	Previous	New
Quarterly data:						
2023:Q1	0.2	0.6	3.8	3.5	79.0	281.9
2023:Q2	0.2	1.0	4.0	3.7	35.8	0.5
2023:Q3	0.9	-0.1	4.3	3.9	41.8	47.5
2023:Q4	2.1	1.2	4.4	4.1	-14.5	62.7
2024:Q1	N.A.	1.3	N.A.	4.2	N.A.	60.8
Annual data (projections are based on annual-average levels):						
2023	0.7	1.3	4.2	3.8	143.6	217.8
2024	1.8	1.4	4.3	4.2	N.A.	43.3
2025	2.2	2.2	4.2	4.2	N.A.	N.A.
2026	N.A.	1.5	N.A.	4.1	N.A.	N.A.

The charts below provide some insight into the degree of uncertainty the forecasters have about their projections for the rate of growth in the annual-average level of real GDP. Each chart presents the forecasters' previous and current estimates of the probability that growth will fall into each of 11 ranges. For 2023, the forecasters see a higher probability that growth will fall into the positive ranges than they did in the previous survey. For 2024 and 2025, the forecasters see few changes to the probability estimates they projected in the survey of three months ago.

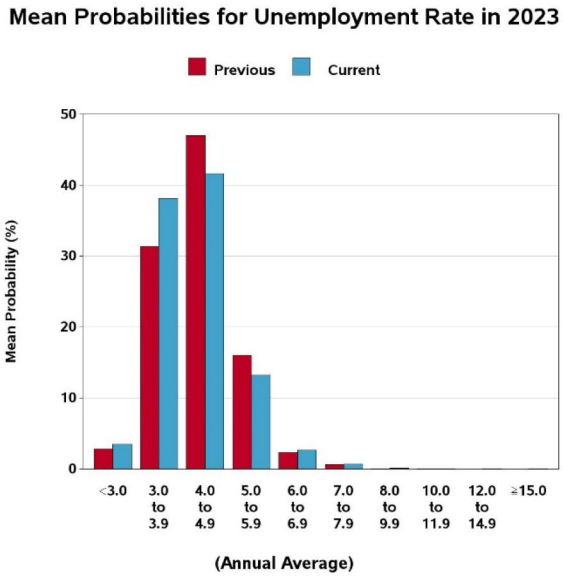


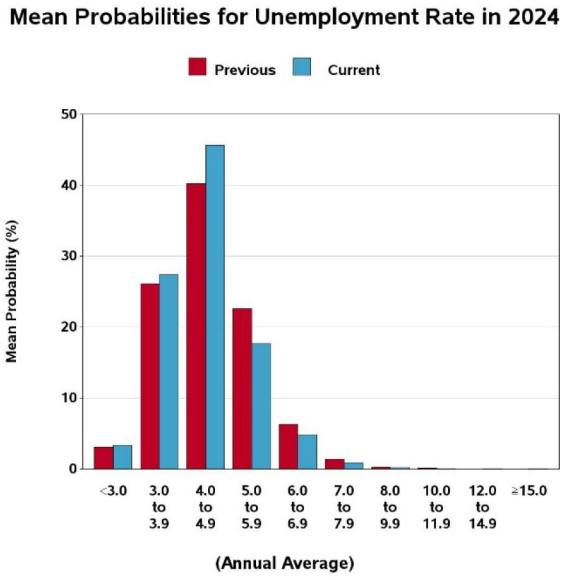


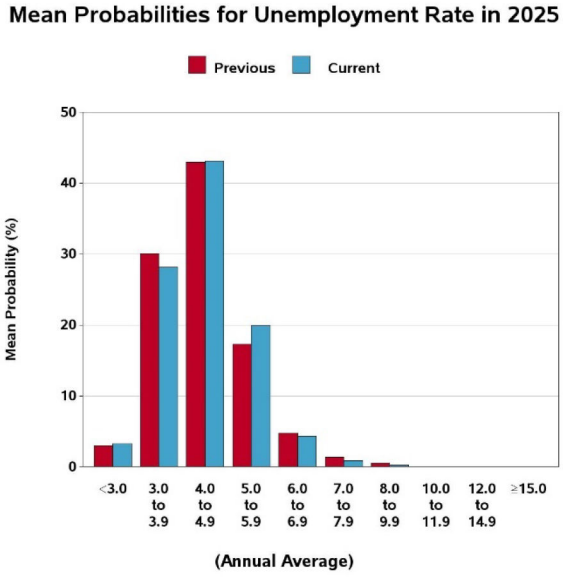


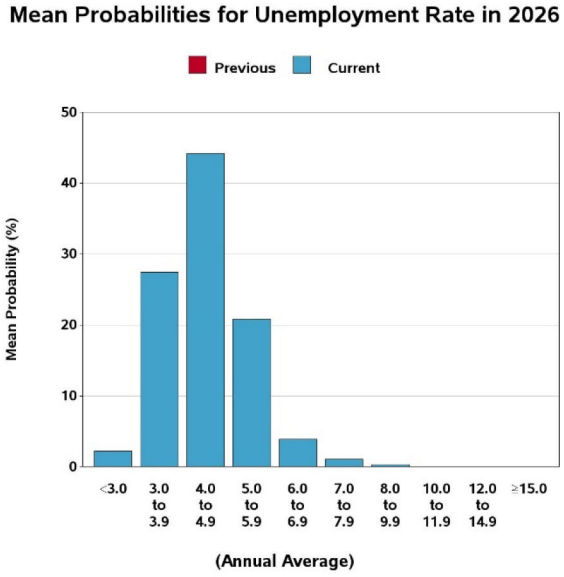


The forecasters' density projections for unemployment, shown below, shed light on uncertainty about the labor market over the next four years. Each chart presents the forecasters' current and previous estimates of the probability that unemployment will fall into each of 10 ranges. For 2023 and 2024, the forecasters are raising their probability estimates from the previous survey for an unemployment rate below 4.0 percent.









Forecasters Predict Lower Inflation

The forecasters expect current-quarter headline CPI inflation will average 3.3 percent at an annual rate, down from the prediction of 4.5 percent in the survey of three months ago. Headline PCE inflation over the current quarter will also be lower at an annual rate of 3.2 percent, down from the previous estimate of 3.8 percent.

Projections for headline and core CPI and PCE inflation at all other forecast horizons have also been revised downward or remain unchanged, compared with those of the previous survey.

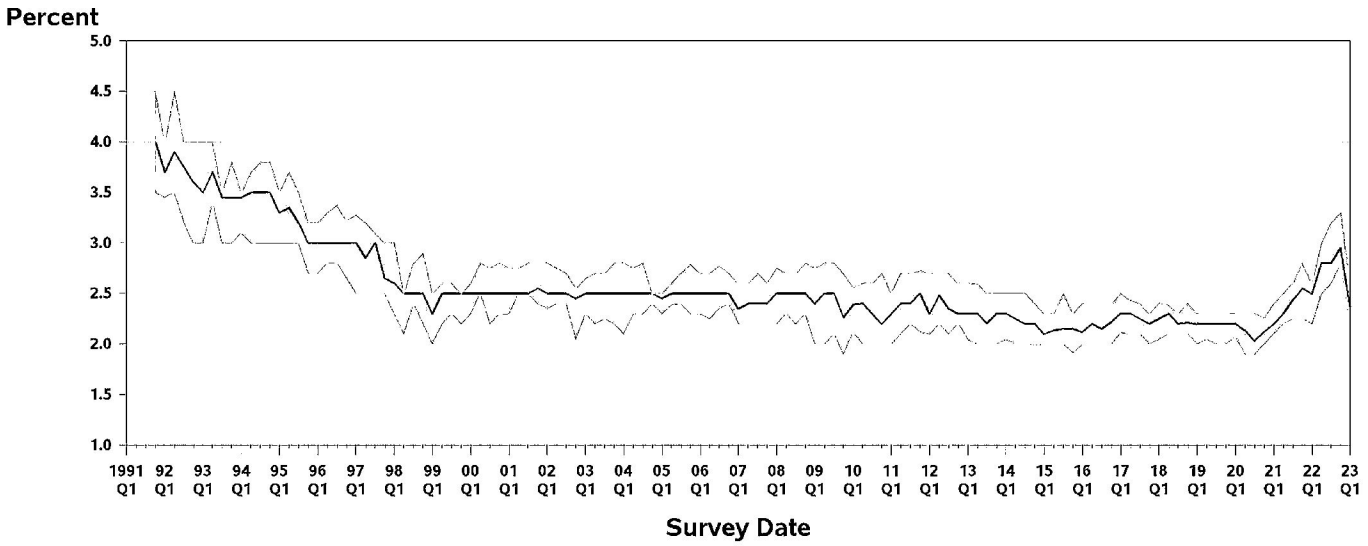
Over the next 10 years, 2023 to 2032, the forecasters predict headline CPI inflation will be at an annual-average rate of 2.37 percent. The corresponding estimate for 10-year annual-average PCE inflation is 2.15 percent. Notably, these 10-year projections are 0.58 percentage point and 0.43 percentage point lower than those of the previous survey, which covered the 10-year horizon from 2022 to 2031.

Median Short-Run and Long-Run Projections for Inflation (Annualized Percentage Points)

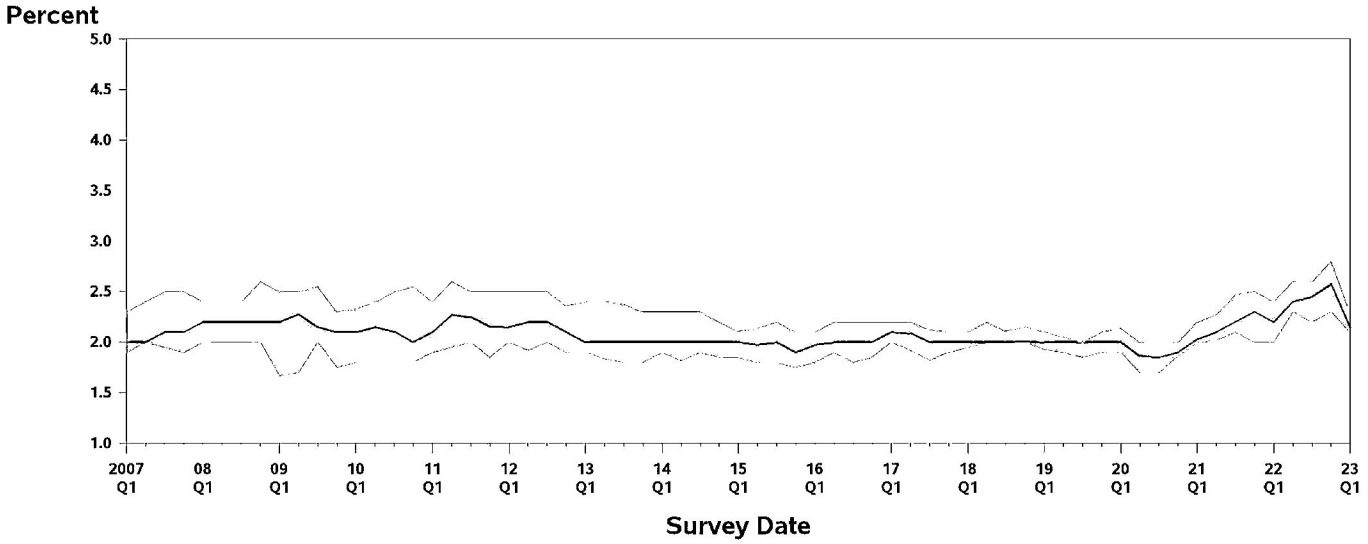
	Headline CPI		Core CPI		Headline PCE		Core PCE	
	Previous	Current	Previous	Current	Previous	Current	Previous	Current
Quarterly								
2023:Q1	4.5	3.3	4.5	3.8	3.8	3.2	3.8	3.6
2023:Q2	3.5	3.4	3.7	3.6	3.1	3.0	3.2	3.1
2023:Q3	3.1	3.1	3.2	3.1	2.7	2.6	2.8	2.7
2023:Q4	2.9	2.8	2.9	2.9	2.7	2.6	2.7	2.5
2024:Q1	N.A.	2.6	N.A.	2.8	N.A.	2.3	N.A.	2.5
Q4/Q4 Annual Averages								
2023	3.4	3.1	3.5	3.4	2.9	2.8	3.0	3.0
2024	2.5	2.5	2.6	2.6	2.3	2.2	2.4	2.3
2025	N.A.	2.4	N.A.	2.4	N.A.	2.2	N.A.	2.1
Long-Term Annual Averages								
2022-2026	3.75	N.A.	N.A.	N.A.	3.23	N.A.	N.A.	N.A.
2023-2027	N.A.	2.50	N.A.	N.A.	N.A.	2.30	N.A.	N.A.
2022-2031	2.95	N.A.	N.A.	N.A.	2.58	N.A.	N.A.	N.A.
2023-2032	N.A.	2.37	N.A.	N.A.	N.A.	2.15	N.A.	N.A.

The charts below show the median projections (the red line) and the associated interquartile ranges (gray areas around the red line) for 10-year annual-average CPI and PCE inflation. The charts provide perspective on the lower 10-year inflation expectations in the current survey.

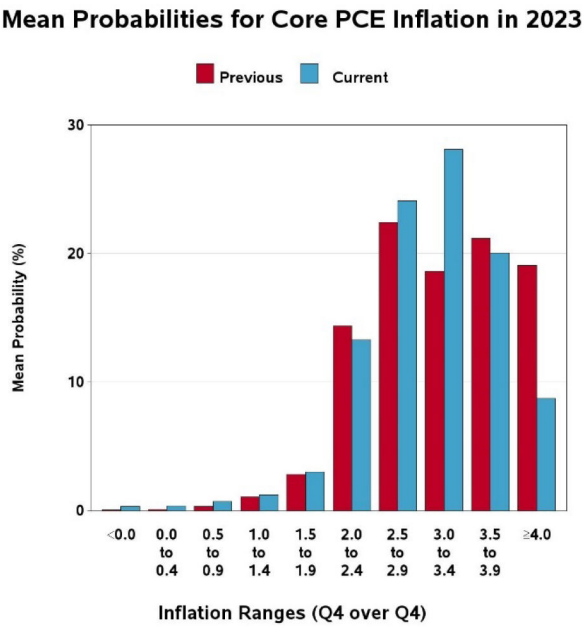
Projections for the 10-Year Annual-Average Rate of CPI Inflation
(Median and Interquartile Range)

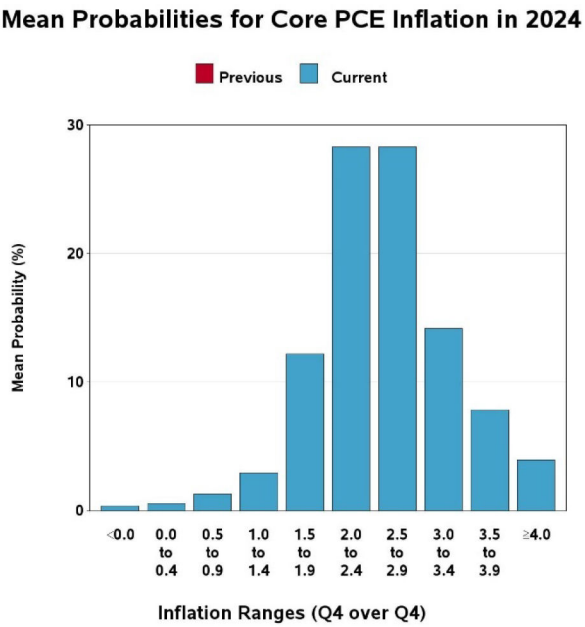


Projections for the 10-Year Annual-Average Rate of PCE Inflation
(Median and Interquartile Range)



The figures below show the probabilities that the forecasters are assigning to each of 10 possible ranges for fourth-quarter over fourth-quarter core PCE inflation in 2023 and 2024. The forecasters have reduced their estimates for the probability that core PCE inflation in 2023 will be 3.5 percent or higher compared with their prediction in the last survey.





Lower (but Significant) Risk of Negative Real GDP Growth in 2023

The forecasters have revised downward the chance of a contraction in real GDP in any of the next four quarters. For the current quarter, the forecasters predict a 40.4 percent chance of negative growth, down from 47.2 percent in the previous survey. The forecasters have also made downward revisions to their probability estimates for the following three quarters.

Risk of a Negative Quarter (%)
Survey Means

Quarterly data:	Previous	New
2023:Q1	47.2	40.4
2023:Q2	49.4	42.4
2023:Q3	46.1	44.9
2023:Q4	43.5	40.6
2024:Q1	N.A.	31.8

Forecasters State Their Views on House Price Growth over the Next Two Years

In a special question in this survey, panelists were asked to provide their forecasts for fourth-quarter over fourth-quarter growth in house prices, as measured by a number of alternative indices. The panelists were allowed to choose their measure from a list of indices or to write in their own index. For each index of their choosing, the panelists provided forecasts for growth in 2023 and 2024.

Fourteen panelists answered the special question. Some panelists provided projections for more than one index. The table below provides a summary of the forecasters' responses. The number of responses (N) is low for each index. The median estimates for the six house price indices listed in the table below range from -4.4 percent to 0.0 percent in 2023 and from -3.0 percent to 4.0 percent in 2024.

Projections for Growth in Various Indices of House Prices
Q4/Q4, Percentage Points

Index	2023 (Q4/Q4 Percent Change)			2024 (Q4/Q4 Percent Change)		
	N	Mean	Median	N	Mean	Median
S&P CoreLogic Case-Shiller: U.S. National	5	-4.0	-4.2	5	-1.1	0.6
S&P CoreLogic Case-Shiller: Composite 10	1	0.0	0.0	1	4.0	4.0
S&P CoreLogic Case-Shiller: Composite 20	4	-3.6	-4.4	4	1.0	1.7
FHFA: Purchase Only (U.S. Total)	8	0.3	-1.5	8	2.0	2.2
CoreLogic: National HPI, incl. Distressed Sales (Single Family Combined)	2	-3.6	-3.6	1	-3.0	-3.0
NAR Median: Total Existing	2	-2.3	-2.3	2	1.4	1.4

Lower Long-Term Output and Productivity Growth but Higher Returns on Financial Assets

In our first-quarter surveys, the forecasters provide their 10-year annual-average projections for an expanded set of variables, including growth in output and productivity, as well as returns on financial assets.

As the table below shows, the forecasters expect real GDP to grow at an annual-average rate of 2.00 percent over the next 10 years, lower than their projection of 2.28 percent in the first-quarter survey of 2022. Ten-year annual-average productivity growth is now expected to be 1.30 percent, down from 1.60 percent previously.

Higher returns on financial assets over the next 10 years accompany the current long-term outlook for real GDP and productivity. The forecasters predict the S&P 500 returning an annual-average 7.50 percent over the next 10 years, up from the previous estimate of 6.73 percent in the first-quarter survey of 2022. The forecasters see the rate on 10-year Treasuries averaging 3.35 percent over the next 10 years, up from 3.07 percent in last year's first-quarter survey. Three-month Treasury bills will return an annual-average 2.65 percent over the next 10 years, up from 2.25 percent previously.

Median Long-Term (10-Year) Forecasts (%)

	First Quarter 2022	*Current Survey*
Real GDP Growth	2.28	2.00
Productivity Growth	1.60	1.30
Stock Returns (S&P 500)	6.73	7.50
Rate on 10-Year Treasury Bonds	3.07	3.35
Bill Returns (3-Month)	2.25	2.65

Technical Notes

Moody's Aaa and Baa Historical Rates
The historical values of Moody's Aaa and Baa rates are proprietary and, therefore, not available in the data files on the Bank's website or on the tables that accompany the survey's complete write-up in the PDF.

The Federal Reserve Bank of Philadelphia thanks the following forecasters for their participation in recent surveys:

Scott Anderson, Bank of the West (BNP Paribas Group); **Anwiti Bahuguna** and **Ed Al-Hussainy**, Columbia Threadneedle Investments; **Robert J. Barbera**, Johns Hopkins University Center for Financial Economics; **Peter Bernstein**, RCF Economic and Financial Consulting, Inc.; **Wayne Best** and **Michael Brown**, Visa, Inc.; **Jay Bryson**, Wells Fargo; **Christine Chmura, Ph.D.**, and **Xiaobing Shuai, Ph.D.**, Chmura Economics & Analytics; **Gary Ciminero, CFA**, GLC Financial Economics; **Grant Collins**, AIM Research, LLC; **Rajeev Dhawan**, Georgia State University; **Bill Diviney**, ABN AMRO Bank NV; **Gabriel Ehrlich**, **Daniil Manaenkov**, and **Tereza Ranosova**, RSQE, University of Michigan; **Michael R. Englund**, Action Economics, LLC; **Sacha Gelfer**, Bentley University; **James Glassman**, JPMorgan Chase & Co.; **Jan Hatzius**, Goldman Sachs; **Steve Kihm**, Citizens Utility Board of Wisconsin; **Oren Klachkin** and **Ryan Sweet**, Oxford Economics USA, Inc.; **Jack Kleinhenz**, Kleinhenz & Associates, Inc.; **Yaniv Konchitchki**, University of California, Berkeley; **Thomas Lam**, Sim Kee Boon Institute, Singapore Management University; **Brian Martin**, Australia New Zealand Bank (ANZ); **Robert McNab**, Old Dominion University; **R. Anthony Metz**, Pareto Optimal Economics; **R. M. Monaco**, TitanRM; **Joel L. Naroff**, Naroff Economic Advisors; **Nomura Securities International**; **Brendon Ogmundson**, BC Real Estate Association; **Perc Pineda, Ph.D.**, Plastics Industry Association; **Joel Prakken** and **Chris Varvares**, S&P Global Market Intelligence; **Jason Prole**, Capital Risk Management; **Michael Roberts**, Roberts Capital Advisors, LLC; **Alfredo A. Romero**, North Carolina A&T State University; **Philip Rothman**, East Carolina University; **Allen Sinai** and **Lu Yu**, Decision Economics, Inc.; **Sean Snaith**, University of Central Florida; **Stephen Stanley**, Santander Capital Markets; **Charles Steindel**, Editor, NABE *Business Economics*; **Susan M. Sterne**, Economic Analysis Associates, Inc.; **Edward Sullivan**, Portland Cement Association; **James Sweeney**, Credit Suisse; **Jordan Vickers** and **Marie Dempsey**, Eaton Corporation; **Lawrence Werther**, Daiwa Capital Markets America; **Mark Zandi**, Moody's Analytics; **Ellen Zentner**, Morgan Stanley.

This is a partial list of participants. We also thank those who wish to remain anonymous.

SUMMARY TABLE
SURVEY OF PROFESSIONAL FORECASTERS
MAJOR MACROECONOMIC INDICATORS

	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2023	2024	2025	2026
						(YEAR-OVER-YEAR)			
PERCENT GROWTH AT ANNUAL RATES									
1. REAL GDP (BILLIONS, CHAIN WEIGHTED)	0.6	1.0	-0.1	1.2	1.3	1.3	1.4	2.2	1.5
2. GDP PRICE INDEX (PERCENT CHANGE)	3.2	2.9	2.8	2.6	2.4	3.6	2.3	N.A.	N.A.
3. NOMINAL GDP ($ BILLIONS)	4.0	3.4	3.5	3.9	4.2	5.0	3.8	N.A.	N.A.
4. NONFARM PAYROLL EMPLOYMENT									
(PERCENT CHANGE)	2.2	0.0	0.4	0.5	0.5	1.7	0.3	N.A.	N.A.
(AVG MONTHLY CHANGE)	281.9	0.5	47.5	62.7	60.8	217.8	43.3	N.A.	N.A.
VARIABLES IN LEVELS									
5. UNEMPLOYMENT RATE (PERCENT)	3.5	3.7	3.9	4.1	4.2	3.8	4.2	4.2	4.1
6. 3-MONTH TREASURY BILL (PERCENT)	4.7	5.0	4.9	4.9	4.5	4.9	4.1	3.1	2.8
7. 10-YEAR TREASURY BOND (PERCENT)	3.6	3.8	3.9	3.7	3.6	3.8	3.5	3.5	3.3

	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2023	2024	2025
						(Q4-OVER-Q4)		
INFLATION INDICATORS								
8. CPI (ANNUAL RATE)	3.3	3.4	3.1	2.8	2.6	3.1	2.5	2.4
9. CORE CPI (ANNUAL RATE)	3.8	3.6	3.1	2.9	2.8	3.4	2.6	2.4
10. PCE (ANNUAL RATE)	3.2	3.0	2.6	2.6	2.3	2.8	2.2	2.2
11. CORE PCE (ANNUAL RATE)	3.6	3.1	2.7	2.5	2.5	3.0	2.3	2.1

Note: The figures on each line are medians of 37 forecasters.

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2023.

SURVEY OF PROFESSIONAL FORECASTERS

First Quarter 2023

Tables

Note: Data in these tables listed as "actual" are the data that were available to the forecasters when they were sent the survey questionnaire on January 26, 2023; the tables do not reflect subsequent revisions to the data. All forecasts were received on or before February 7, 2023.

TABLE ONE
MAJOR MACROECONOMIC INDICATORS
MEDIANS OF FORECASTER PREDICTIONS

	NUMBER OF FORECASTERS	ACTUAL	FORECAST					ACTUAL	FORECAST			
		2022 Q4	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2022 ANNUAL	2023 ANNUAL	2024 ANNUAL	2025 ANNUAL	2026 ANNUAL
1. GROSS DOMESTIC PRODUCT (GDP) ($ BILLIONS)	33	26133	26391	26612	26839	27094	27375	25461	26723	27752	N.A.	N.A.
2. GDP PRICE INDEX (2012=100)	33	129.37	130.40	131.34	132.25	133.10	133.90	127.19	131.81	134.79	N.A.	N.A.
3. CORPORATE PROFITS AFTER TAXES ($ BILLIONS)	15	N.A.	2550.7	2519.9	2516.9	2520.9	2550.4	N.A.	2520.2	2612.6	N.A.	N.A.
4. UNEMPLOYMENT RATE (PERCENT)	36	3.6	3.5	3.7	3.9	4.1	4.2	3.6	3.8	4.2	4.2	4.1
5. NONFARM PAYROLL EMPLOYMENT (THOUSANDS)	30	153509	154355	154356	154499	154687	154869	152041	154655	155174	N.A.	N.A.
6. INDUSTRIAL PRODUCTION (2017=100)	27	104.1	104.0	103.7	103.8	104.1	104.1	103.9	103.9	104.2	N.A.	N.A.
7. NEW PRIVATE HOUSING STARTS (ANNUAL RATE, MILLIONS)	30	1.40	1.38	1.35	1.33	1.35	1.37	1.56	1.35	1.40	N.A.	N.A.
8. 3-MONTH TREASURY BILL RATE (PERCENT)	36	4.04	4.70	4.95	4.92	4.89	4.52	2.02	4.87	4.07	3.10	2.80
9. MOODY'S AAA CORP BOND YIELD * (PERCENT)	23	N.A.	4.55	4.90	4.89	5.05	4.94	N.A.	4.74	4.84	N.A.	N.A.
10. MOODY'S BAA CORP BOND YIELD * (PERCENT)	21	N.A.	5.69	6.06	6.25	6.25	6.12	N.A.	6.09	5.95	N.A.	N.A.
11. 10-YEAR TREASURY BOND YIELD (PERCENT)	34	3.83	3.64	3.78	3.86	3.69	3.55	2.95	3.76	3.52	3.45	3.32
12. REAL GDP (BILLIONS, CHAIN WEIGHTED)	37	20198	20227	20279	20273	20331	20395	20018	20277	20561	21004	21316
13. TOTAL CONSUMPTION EXPENDITURE (BILLIONS, CHAIN WEIGHTED)	31	14252.2	14295.4	14331.9	14390.9	14437.5	14473.4	14139.7	14371.3	14548.2	N.A.	N.A.
14. NONRESIDENTIAL FIXED INVESTMENT (BILLIONS, CHAIN WEIGHTED)	29	2964.7	2975.0	2985.8	2995.0	3004.6	3021.6	2938.7	2992.2	3047.6	N.A.	N.A.
15. RESIDENTIAL FIXED INVESTMENT (BILLIONS, CHAIN WEIGHTED)	30	573.6	558.7	551.2	544.5	544.5	551.3	642.3	549.5	563.6	N.A.	N.A.
16. FEDERAL GOVERNMENT C & I (BILLIONS, CHAIN WEIGHTED)	29	1374.1	1382.6	1391.2	1396.3	1396.8	1398.2	1355.5	1391.3	1404.3	N.A.	N.A.
17. STATE AND LOCAL GOVT C & I (BILLIONS, CHAIN WEIGHTED)	30	2068.3	2076.0	2084.5	2092.0	2098.8	2104.2	2050.8	2088.1	2110.6	N.A.	N.A.
18. CHANGE IN PRIVATE INVENTORIES (BILLIONS, CHAIN WEIGHTED)	30	129.9	76.0	49.1	37.7	42.1	43.1	123.3	46.6	42.9	N.A.	N.A.
19. NET EXPORTS (BILLIONS, CHAIN WEIGHTED)	30	-1232.4	-1233.4	-1234.7	-1229.6	-1224.5	-1224.8	-1355.1	-1228.2	-1216.0	N.A.	N.A.

* The historical values of Moody's Aaa and Baa rates are proprietary and therefore not available to the general public.

Source: Research Department, Federal Reserve Bank of Philadelphia. Survey of Professional Forecasters, First Quarter 2023.

TABLE TWO
MAJOR MACROECONOMIC INDICATORS
PERCENTAGE CHANGES AT ANNUAL RATES

	NUMBER OF FORECASTERS	Q4 2022 TO Q1 2023	Q1 2023 TO Q2 2023	Q2 2023 TO Q3 2023	Q3 2023 TO Q4 2023	Q4 2023 TO Q1 2024	2022 TO 2023	2023 TO 2024	2024 TO 2025	2025 TO 2026
1. GROSS DOMESTIC PRODUCT (GDP) ($ BILLIONS)	33	4.0	3.4	3.5	3.9	4.2	5.0	3.8	N.A.	N.A.
2. GDP PRICE INDEX (2012=100)	33	3.2	2.9	2.8	2.6	2.4	3.6	2.3	N.A.	N.A.
3. CORPORATE PROFITS AFTER TAXES ($ BILLIONS)	15	-0.4	-4.7	-0.5	0.6	4.8	0.9	3.7	N.A.	N.A.
4. UNEMPLOYMENT RATE (PERCENT)	36	-0.1	0.2	0.2	0.1	0.2	0.2	0.4	0.0	-0.1
5. NONFARM PAYROLL EMPLOYMENT										
(PERCENT CHANGE)	30	2.2	0.0	0.4	0.5	0.5	1.7	0.3	N.A.	N.A.
(AVG MONTHLY CHANGE)	30	281.9	0.5	47.5	62.7	60.8	217.8	43.3	N.A.	N.A.
6. INDUSTRIAL PRODUCTION (2017=100)	27	-0.2	-1.3	0.5	0.8	0.2	-0.0	0.3	N.A.	N.A.
7. NEW PRIVATE HOUSING STARTS (ANNUAL RATE, MILLIONS)	30	-7.3	-7.5	-4.9	4.1	6.5	-13.2	3.7	N.A.	N.A.
8. 3-MONTH TREASURY BILL RATE (PERCENT)	36	0.66	0.25	-0.03	-0.04	-0.37	2.85	-0.80	-0.97	-0.30
9. MOODY'S AAA CORP BOND YIELD * (PERCENT)	23	N.A.	0.35	-0.01	0.16	-0.11	N.A.	0.10	N.A.	N.A.
10. MOODY'S BAA CORP BOND YIELD * (PERCENT)	21	N.A.	0.37	0.19	0.00	-0.13	N.A.	-0.14	N.A.	N.A.
11. 10-YEAR TREASURY BOND YIELD (PERCENT)	34	-0.19	0.13	0.09	-0.18	-0.14	0.81	-0.24	-0.07	-0.13
12. REAL GDP (BILLIONS, CHAIN WEIGHTED)	37	0.6	1.0	-0.1	1.2	1.3	1.3	1.4	2.2	1.5
13. TOTAL CONSUMPTION EXPENDITURE (BILLIONS, CHAIN WEIGHTED)	31	1.2	1.0	1.7	1.3	1.0	1.6	1.2	N.A.	N.A.
14. NONRESIDENTIAL FIXED INVESTMENT (BILLIONS, CHAIN WEIGHTED)	29	1.4	1.5	1.2	1.3	2.3	1.8	1.8	N.A.	N.A.
15. RESIDENTIAL FIXED INVESTMENT (BILLIONS, CHAIN WEIGHTED)	30	-10.0	-5.3	-4.7	0.0	5.1	-14.4	2.6	N.A.	N.A.
16. FEDERAL GOVERNMENT C & I (BILLIONS, CHAIN WEIGHTED)	29	2.5	2.5	1.5	0.1	0.4	2.6	0.9	N.A.	N.A.
17. STATE AND LOCAL GOVT C & I (BILLIONS, CHAIN WEIGHTED)	30	1.5	1.6	1.4	1.3	1.0	1.8	1.1	N.A.	N.A.
18. CHANGE IN PRIVATE INVENTORIES (BILLIONS, CHAIN WEIGHTED)	30	-54.0	-26.8	-11.4	4.4	1.0	-76.7	-3.8	N.A.	N.A.
19. NET EXPORTS (BILLIONS, CHAIN WEIGHTED)	30	-1.0	-1.3	5.1	5.1	-0.3	126.9	12.2	N.A.	N.A.

* The historical values of Moody's Aaa and Baa rates are proprietary and therefore not available to the general public.

Note: Figures for unemployment rate, 3-month Treasury bill rate, Moody's Aaa corporate bond yield, Moody's Baa corporate bond yield, and 10-year Treasury bond yield are changes in these rates, in percentage points. Figures for change in private inventories and net exports are changes in billions of chain-weighted dollars. All others are percentage changes at annual rates.

Source: Research Department, Federal Reserve Bank of Philadelphia. Survey of Professional Forecasters, First Quarter 2023.

TABLE THREE
MAJOR PRICE INDICATORS
MEDIANS OF FORECASTER PREDICTIONS

	NUMBER OF FORECASTERS	ACTUAL	FORECAST(Q/Q)					ACTUAL	FORECAST(Q4/Q4)		
		2022 Q4	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2022 ANNUAL	2023 ANNUAL	2024 ANNUAL	2025 ANNUAL
1. CONSUMER PRICE INDEX (ANNUAL RATE)	36	3.1	3.3	3.4	3.1	2.8	2.6	7.1	3.1	2.5	2.4
2. CORE CONSUMER PRICE INDEX (ANNUAL RATE)	34	4.4	3.8	3.6	3.1	2.9	2.8	6.0	3.4	2.6	2.4
3. PCE PRICE INDEX (ANNUAL RATE)	35	3.2	3.2	3.0	2.6	2.6	2.3	5.5	2.8	2.2	2.2
4. CORE PCE PRICE INDEX (ANNUAL RATE)	34	3.9	3.6	3.1	2.7	2.5	2.5	4.7	3.0	2.3	2.1

Source: Research Department, Federal Reserve Bank of Philadelphia. Survey of Professional Forecasters, First Quarter 2023.

TABLE FOUR
YIELD SPREADS
MEDIANS OF FORECASTER PREDICTIONS

	NUMBER OF FORECASTERS	ACTUAL 2022 Q4	FORECAST 2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	ACTUAL 2022 ANNUAL	FORECAST 2023 ANNUAL	2024 ANNUAL	2025 ANNUAL	2026 ANNUAL
1. TBOND MINUS TBILL (PERCENTAGE POINTS)	34	-0.21	-1.09	-0.98	-0.87	-0.82	-0.65	0.93	-0.95	-0.43	0.25	0.50
2. AAA MINUS TBOND (PERCENTAGE POINTS)	23	N.A.	0.92	1.00	1.04	1.09	1.09	N.A.	1.00	1.02	N.A.	N.A.
3. BAA MINUS TBOND (PERCENTAGE POINTS)	21	N.A.	2.00	2.20	2.28	2.28	2.25	N.A.	2.20	2.21	N.A.	N.A.
4. BAA MINUS AAA (PERCENTAGE POINTS)	21	N.A.	1.07	1.10	1.10	1.10	1.00	N.A.	1.09	1.07	N.A.	N.A.

Notes:

TBOND is the rate on 10-year Treasury bonds.
TBILL is the rate on 3-month Treasury bills.
AAA is the rate on Moody's Aaa corporate bonds.
BAA is the rate on Moody's Baa corporate bonds.

The historical values for interest rate spreads for Moody's Aaa and Baa rates are proprietary and therefore not available to the general public.

Each interest rate spread is computed as the median value of the forecasters' spreads. These median values may differ from those computed as the difference between the median values of each interest rate in the spread.

Source: Research Department, Federal Reserve Bank of Philadelphia. Survey of Professional Forecasters, First Quarter 2023.

TABLE FIVE
ESTIMATED PROBABILITY OF DECLINE IN REAL GDP

ESTIMATED PROBABILITY (CHANCES IN 100)	Q4 2022 TO Q1 2023	Q1 2023 TO Q2 2023	Q2 2023 TO Q3 2023	Q3 2023 TO Q4 2023	Q4 2023 TO Q1 2024
			NUMBER OF FORECASTERS		
10 OR LESS	3	1	0	2	3
11 TO 20	5	4	5	3	7
21 TO 30	2	7	3	6	8
31 TO 40	7	6	9	5	3
41 TO 50	4	2	1	4	2
51 TO 60	2	2	3	2	4
61 TO 70	1	2	3	5	0
71 TO 80	3	2	3	1	1
81 TO 90	0	2	1	0	0
91 AND OVER	1	0	0	0	0
NOT REPORTING	9	9	9	9	9
MEAN AND MEDIAN					
MEDIAN PROBABILITY	40.00	36.25	39.00	35.00	30.00
MEAN PROBABILITY	40.39	42.41	44.85	40.61	31.78

Note: Total number of forecasters reporting is 28.

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2023.

TABLE SIX
MEAN PROBABILITIES

MEAN PROBABILITY ATTACHED TO POSSIBLE
CIVILIAN UNEMPLOYMENT RATES:
(ANNUAL AVERAGE)

	2023	2024	2025	2026
15.0 PERCENT OR MORE	0.03	0.04	0.00	0.00
12.0 TO 14.9 PERCENT	0.03	0.04	0.00	0.00
10.0 TO 11.9 PERCENT	0.03	0.04	0.00	0.00
8.0 TO 9.9 PERCENT	0.14	0.21	0.23	0.34
7.0 TO 7.9 PERCENT	0.69	0.89	0.88	1.10
6.0 TO 6.9 PERCENT	2.64	4.86	4.37	3.92
5.0 TO 5.9 PERCENT	13.19	17.63	19.91	20.83
4.0 TO 4.9 PERCENT	41.66	45.63	43.13	44.16
3.0 TO 3.9 PERCENT	38.09	27.36	28.17	27.45
LESS THAN 3.0 PERCENT	3.48	3.32	3.31	2.22

MEAN PROBABILITY ATTACHED TO POSSIBLE
PERCENT CHANGES IN REAL GDP:
(ANNUAL-AVERAGE OVER ANNUAL-AVERAGE)

	2022-2023	2023-2024	2024-2025	2025-2026
16.0 PERCENT OR MORE	0.00	0.00	0.00	0.00
10.0 TO 15.9 PERCENT	0.03	0.04	0.00	0.00
7.0 TO 9.9 PERCENT	0.17	0.23	0.38	0.43
4.0 TO 6.9 PERCENT	1.33	2.55	5.01	4.93
2.5 TO 3.9 PERCENT	8.32	14.55	20.29	20.97
1.5 TO 2.4 PERCENT	27.14	37.06	40.48	42.20
0.0 TO 1.4 PERCENT	40.28	31.79	23.85	23.05
-3.0 TO -0.1 PERCENT	21.20	12.28	8.77	7.33
-6.0 TO -3.1 PERCENT	1.42	1.39	1.00	0.85
-12.0 TO -6.1 PERCENT	0.10	0.11	0.23	0.25
LESS THAN -12.0 PERCENT	0.00	0.00	0.00	0.00

MEAN PROBABILITY ATTACHED TO POSSIBLE
PERCENT CHANGES IN GDP PRICE INDEX:
(ANNUAL-AVERAGE OVER ANNUAL-AVERAGE)

	2022-2023	2023-2024
4.0 PERCENT OR MORE	19.94	4.09
3.5 TO 3.9 PERCENT	26.79	8.77
3.0 TO 3.4 PERCENT	22.96	16.64
2.5 TO 2.9 PERCENT	12.36	22.17
2.0 TO 2.4 PERCENT	7.33	26.54
1.5 TO 1.9 PERCENT	6.55	13.42
1.0 TO 1.4 PERCENT	2.45	5.92
0.5 TO 0.9 PERCENT	0.97	1.42
0.0 TO 0.4 PERCENT	0.43	0.66
LESS THAN 0.0 PERCENT	0.21	0.36

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2023.

TABLE SEVEN
MEAN PROBABILITY OF CORE CPI AND CORE PCE INFLATION (Q4/Q4)

MEAN PROBABILITY ATTACHED TO CORE CPI INFLATION:

	22Q4 TO 23Q4	23Q4 TO 24Q4
4.0 PERCENT OR MORE	18.22	6.07
3.5 TO 3.9 PERCENT	26.19	10.77
3.0 TO 3.4 PERCENT	22.64	16.82
2.5 TO 2.9 PERCENT	18.23	25.84
2.0 TO 2.4 PERCENT	7.27	25.54
1.5 TO 1.9 PERCENT	1.66	7.70
1.0 TO 1.4 PERCENT	0.90	1.94
0.5 TO 0.9 PERCENT	0.86	0.83
0.0 TO 0.4 PERCENT	0.74	1.16
LESS THAN 0.0 PERCENT	3.30	3.34

MEAN PROBABILITY ATTACHED TO CORE PCE INFLATION:

	22Q4 TO 23Q4	23Q4 TO 24Q4
4.0 PERCENT OR MORE	8.73	3.96
3.5 TO 3.9 PERCENT	20.08	7.85
3.0 TO 3.4 PERCENT	28.11	14.18
2.5 TO 2.9 PERCENT	24.12	28.30
2.0 TO 2.4 PERCENT	13.30	28.31
1.5 TO 1.9 PERCENT	3.02	12.20
1.0 TO 1.4 PERCENT	1.21	2.94
0.5 TO 0.9 PERCENT	0.70	1.31
0.0 TO 0.4 PERCENT	0.38	0.57
LESS THAN 0.0 PERCENT	0.35	0.38

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2023.

TABLE EIGHT
LONG-TERM (5-YEAR AND 10-YEAR) INFLATION FORECASTS

ANNUAL AVERAGE OVER THE NEXT 5 YEARS: 2023-2027

CPI INFLATION RATE		PCE INFLATION RATE	
MINIMUM	2.14	MINIMUM	1.59
LOWER QUARTILE	2.40	LOWER QUARTILE	2.20
MEDIAN	2.50	MEDIAN	2.30
UPPER QUARTILE	2.80	UPPER QUARTILE	2.50
MAXIMUM	3.75	MAXIMUM	3.25
MEAN	2.65	MEAN	2.37
STD. DEVIATION	0.43	STD. DEVIATION	0.36
N	29	N	28
MISSING	8	MISSING	9

ANNUAL AVERAGE OVER THE FOLLOWING 5 YEARS: 2028-2032

CPI INFLATION RATE		PCE INFLATION RATE	
MINIMUM	1.70	MINIMUM	1.26
LOWER QUARTILE	2.00	LOWER QUARTILE	1.90
MEDIAN	2.20	MEDIAN	2.00
UPPER QUARTILE	2.33	UPPER QUARTILE	2.25
MAXIMUM	3.70	MAXIMUM	3.29
MEAN	2.21	MEAN	2.07
STD. DEVIATION	0.38	STD. DEVIATION	0.39
N	28	N	27
MISSING	9	MISSING	10

ANNUAL AVERAGE OVER THE NEXT 10 YEARS: 2023-2032

CPI INFLATION RATE		PCE INFLATION RATE	
MINIMUM	1.96	MINIMUM	1.79
LOWER QUARTILE	2.20	LOWER QUARTILE	2.09
MEDIAN	2.37	MEDIAN	2.15
UPPER QUARTILE	2.60	UPPER QUARTILE	2.30
MAXIMUM	3.70	MAXIMUM	3.00
MEAN	2.44	MEAN	2.23
STD. DEVIATION	0.35	STD. DEVIATION	0.30
N	28	N	27
MISSING	9	MISSING	10

Note: The summary statistics for each forecast horizon are computed on a sample of panelists that may differ from one horizon to the next. The usual identity linking the 10-year horizon to the two underlying five-year horizons may not hold in the results.

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2023.

TABLE NINE
ADDITIONAL LONG-TERM (10-YEAR) FORECASTS

ANNUAL AVERAGE OVER THE NEXT 10 YEARS: 2023-2032

REAL GDP GROWTH RATE	
MINIMUM	1.50
LOWER QUARTILE	1.75
MEDIAN	2.00
UPPER QUARTILE	2.16
MAXIMUM	2.80
MEAN	1.96
STD. DEVIATION	0.33
N	25
MISSING	12

PRODUCTIVITY GROWTH RATE	
MINIMUM	0.50
LOWER QUARTILE	1.00
MEDIAN	1.30
UPPER QUARTILE	1.40
MAXIMUM	3.00
MEAN	1.33
STD. DEVIATION	0.58
N	17
MISSING	20

STOCK RETURNS (S&P 500)	
MINIMUM	1.80
LOWER QUARTILE	5.00
MEDIAN	7.50
UPPER QUARTILE	8.00
MAXIMUM	10.50
MEAN	6.82
STD. DEVIATION	2.31
N	13
MISSING	24

BOND RATE (10-YEAR)	
MINIMUM	2.40
LOWER QUARTILE	2.80
MEDIAN	3.35
UPPER QUARTILE	3.51
MAXIMUM	4.25
MEAN	3.28
STD. DEVIATION	0.51
N	22
MISSING	15

BILL RETURNS (3-MONTH)	
MINIMUM	1.10
LOWER QUARTILE	2.40
MEDIAN	2.65
UPPER QUARTILE	3.23
MAXIMUM	4.00
MEAN	2.75
STD. DEVIATION	0.66
N	22
MISSING	15

Source: Research Department, Federal Reserve Bank of Philadelphia.
Survey of Professional Forecasters, First Quarter 2023.

RBC Global Asset Management

RBC GAM long-term capital market assumptions

2023 update

JANUARY 2023

Eric Savoie, MBA, CFA
Investment Strategist
RBC Global Asset Management Inc.

Financial markets were ravaged in 2022 as valuations suddenly retraced from extremes, setting up the conditions for improved return potential for a wide range of asset classes going forward.

Last year marked one of the worst periods on record for financial markets in terms of the depth and breadth of declines in asset prices globally. The rapid and coordinated tightening of monetary conditions everywhere hurt an unusually broad range of investments, with the biggest declines occurring in segments of the market most sensitive to changes in interest rates. Government bonds suffered their biggest drop since the 1980s and the world's major equity-market indices fell precipitously into bear markets (Exhibit 1). Although last year was painful for investors and a variety of near-term risks remain, the scale of adjustment that we've seen in interest rates and asset prices last year erased much of the overvaluation that existed at the beginning of 2022 and reset interest rates to levels not seen since before the 2008 global financial crisis. With that re-pricing now behind, financial markets today are meaningfully more appealing to investors and, as forecasters looking forward, we find ourselves more constructive on the outlook for investment returns across a broad range of asset classes over a time horizon measured in decades.

Exhibit 1: Asset performance

Calendar year total returns

2014	2015	2016	2017	2018	2019	2020	2021	2022
30% REITS	5% Growth	25% Small Cap	31% Emerging Markets	0% Aggregate Bonds	31% Value	32% Growth	40% REITS	23% Commodities
13% Large Cap	2% REITS	18% Mid Cap	26% Developed Markets	-1% Growth	31% Large Cap	25% Gold	39% Commodities	0% Gold
13% Value	1% Large Cap	17% Value	26% Growth	-1% TIPS	30% Growth	18% Large Cap	31% Growth	-5% Value
12% Growth	0% Aggregate Bonds	12% Emerging Markets	21% Large Cap	-2% Gold	29% REITS	15% Emerging Markets	29% Large Cap	-12% TIPS
8% Mid Cap	0% Developed Markets	11% Commodities	15% Value	-4% Large Cap	24% Mid Cap	12% Mid Cap	27% Small Cap	-13% Aggregate Bonds
6% Aggregate Bonds	-2% TIPS	11% Large Cap	14% Mid Cap	-6% REITS	23% Small Cap	11% Small Cap	25% Value	-14% Mid Cap
6% Small Cap	-2% Small Cap	8% Gold	13% Small Cap	-8% Small Cap	22% Developed Markets	11% TIPS	23% Mid Cap	-15% Developed Markets
4% TIPS	-4% Mid Cap	8% REITS	12% Gold	-9% Value	20% Emerging Markets	9% Developed Markets	12% Developed Markets	-16% Small Cap
0% Emerging Markets	-4% Value	6% Growth	6% REITS	-12% Mid Cap	18% Gold	7% Aggregate Bonds	6% TIPS	-18% Emerging Markets
-2% Gold	-11% Gold	5% TIPS	4% Commodities	-14% Commodities	16% Commodities	1% Value	1% Emerging Markets	-18% Large Cap
-6% Developed Markets	-16% Emerging Markets	3% Aggregate Bonds	4% Aggregate Bonds	-15% Developed Markets	8% Aggregate Bonds	-5% REITS	-2% Aggregate Bonds	-26% REITS
-33% Commodities	-34% Commodities	1% Developed Markets	3% TIPS	-15% Emerging Markets	8% TIPS	-24% Commodities	-4% Gold	-29% Growth

Note: as of December 2022. Performance shown in U.S. dollars based on the following ETF tickers: large cap (SPY), mid cap (MID), small cap (IJR), growth (IUSG), value (IUSV), emerging markets (VWO), developed markets (VEA), aggregate bonds (AGG), REITS (VNQ), commodities (GSG), TIPS (TIP), gold (GLD).
Source: Piper Sandler

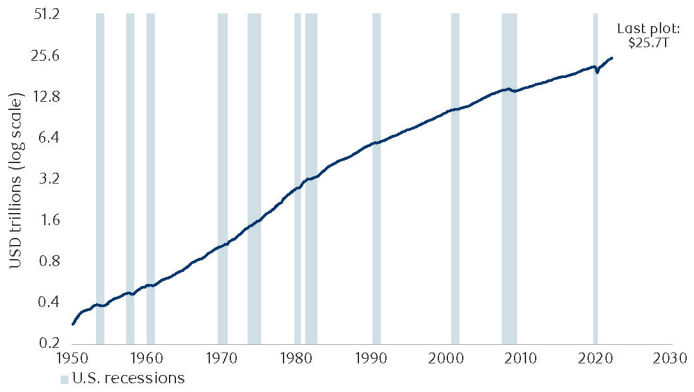
Highly volatile financial markets make forecasting a difficult exercise, particularly in the near-term, but taking a step back and looking at the bigger picture we observe durable and consistent longer term trends that provide comfort in making predictions over longer horizons. Although there have been 15 recessions in the last 70 years, U.S. nominal GDP has risen in what seems a nearly uninterrupted fashion and the downturns barely register on a multi-decade time frame (Exhibit 2). The stock market is much more volatile than the economy, but here too we observe similar long-lasting trends. Exhibit 3 plots the S&P 500 Index alongside its earnings per share dating back to 1950. Over this period there have been 8 bear markets defined by peak-to-trough declines exceeding 20% and yet the stock market has still managed to deliver impressive gains of around 10% annualized on a total return basis. To be clear, every single recession and bear market in history has been followed by a recovery that more than restored any losses through those downturns. Over very long horizons, it should be no surprise that the economy will from time to time encounter recessions and that financial assets will suffer losses. In the context of a longer term view, we think little importance should be placed on trying to time these precisely.

With these long-term trends in mind, and using a collection of four distinct models, RBC GAM's Long-Term Expected Returns Committee (LTERC) generates capital market assumptions spanning the next 10, 20 and 30 year periods (Exhibit 4). Each of the four models in our framework takes a different approach, using their own inputs and methodologies but with a common goal of arriving at multi-decade return forecasts for various asset classes. Details of these models are beyond the scope of this paper, but one point of common ground across the models is that the starting point of the forecast is critical to ultimate returns. While long-term trends and predictions about the future tend to move glacially, financial markets can swing wildly from year to year or even month to month. The massive moves we have seen in many markets over the past year have had meaningfully positive impact on our return forecasts for the decades ahead.

Last year's financial market turmoil stemmed from the sudden and substantial increase in interest rates on the back of unacceptably high inflation. Consumer prices rose at their fastest pace in four decades, in part due to pandemic-related challenges, and also due to Russia's

Exhibit 2: U.S. nominal GDP

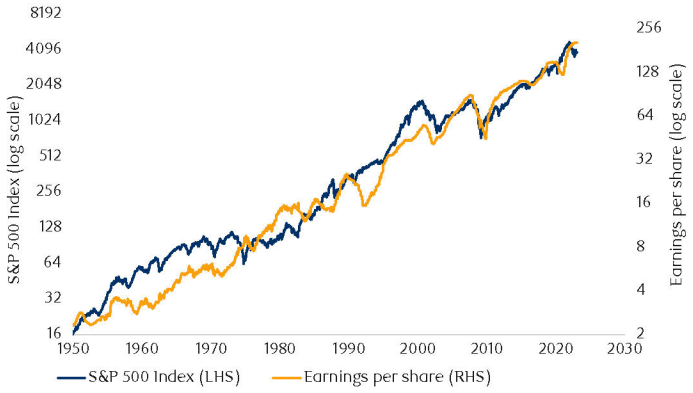
U.S. dollars, seasonally adjusted annual rate (SAAR)



Note: as of September 30, 2022. Source: Bureau of Economic Analysis

Exhibit 3: S&P 500 Index

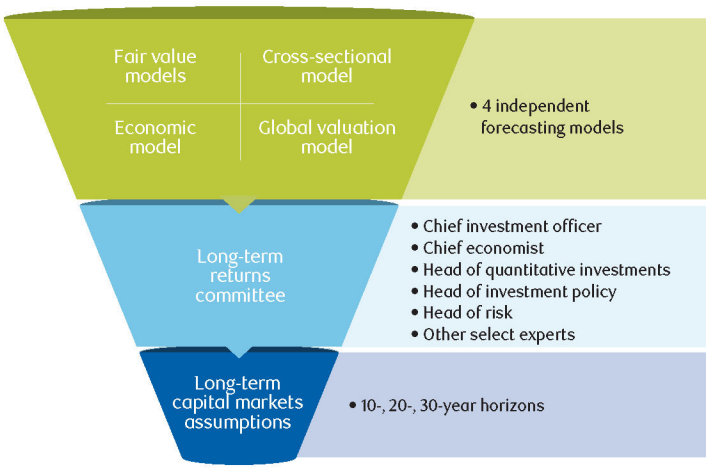
Monthly data



Note: as of January 18, 2022. Source: Bloomberg

Exhibit 4: Long-term expected returns committee

Multi-model comprehensive approach



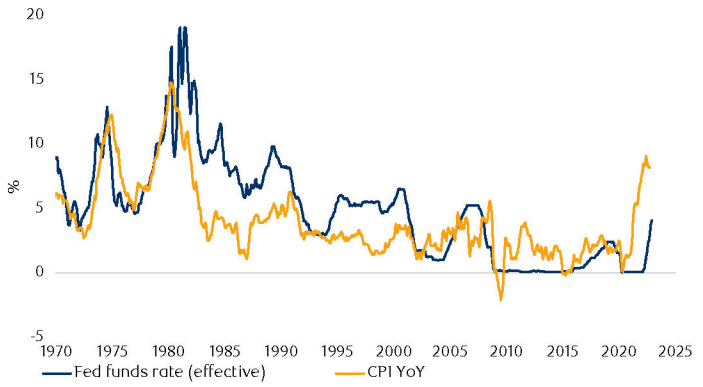
Source: RBC GAM

invasion of Ukraine which further disrupted supply chains and energy prices in particular. In response, central banks around the world simultaneously embarked on their most aggressive tightening cycle since the 1970s, featuring several jumbo-sized interest rate hikes in quick succession (Exhibit 5). In the U.S., the fed funds rate soared 425 basis points in less than a year and interest rates are now situated at their highest level since the onset of the 2008/2009 Global Financial Crisis.

The massive surge in interest rates has fundamentally altered the investing landscape for all asset classes, and especially for fixed-income investors. At the start of 2022, fixed-income investors were being offered 0% on cash, 1.5% on U.S. 10-year Treasuries, 2.4% on investment grade bonds and 4.5% on high-yield bonds (Exhibit 6). These yields were at or near historic lows due to a combination of extremely accommodative central bank policy and heightened complacency among the investors. Roll forward to early 2023 and these numbers have leaped to 4.3%, 3.5%, 5.1% and 8.2%, respectively. Yields are much more appealing and, interestingly, are now right in line with their average levels of the past 30 years.

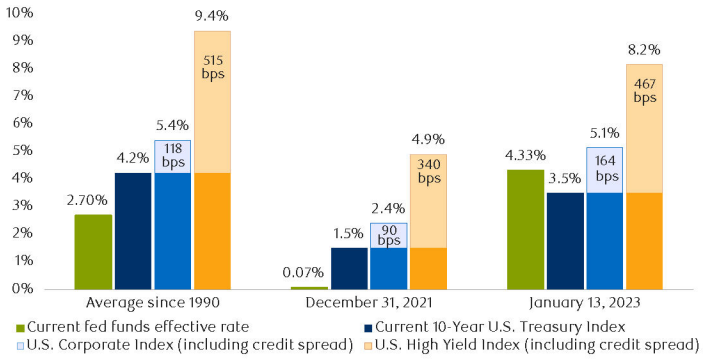
This improved starting point for interest rates is critical in establishing a forecast over the very long term. A quick rule of thumb to formulating a simple yet fairly effective forecast is to use the current yield-to-maturity of a bond. Exhibit 7 plots the relationship between 10-year Treasury yields and actual realized returns over the subsequent 10 years dating all the way back to 1910. The correlation between the two lines is almost perfect, suggesting that today's yield-to-maturity on 10-year Treasuries is a good approximation for what investors will receive by buying and holding 10-year bonds for the next decade. Last year, this forecast would have been 1.5% annualized, meaning a $10,000 investment in 10-year Treasuries at the beginning of 2022 would have grown to $11,605 by 2032. But fast forward one year, and the listed yield of 3.5% would mean a $10,000 investment could stand to turn into $14,105 by 2033, a marked boost. Although this example is highly simplified, it illustrates the importance of the current yield in generating a forecast. This notion extends, with a variety of nuances, to other areas of fixed income including investment grade and high-yield bonds, where return potential has also improved.

Exhibit 5: Inflation and Fed funds rate history



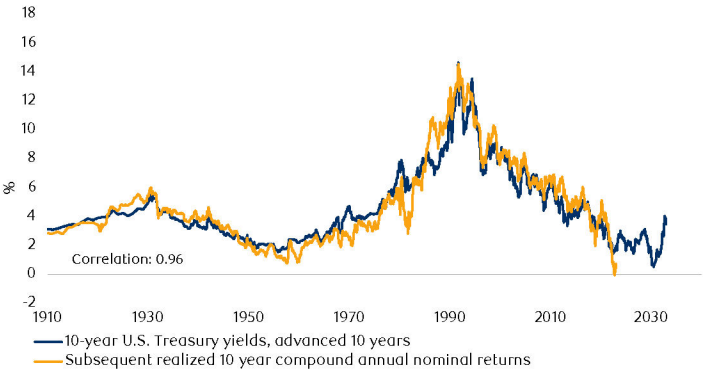
Note: as of December 31, 2022. Source: Bloomberg, RBC GAM

Exhibit 6: Yield to maturity



Note: current spread as of January 13, 2023. Shaded areas within the bars indicate the yield spread versus the U.S. 10-year Treasury bond yield.
Source: ICE BofA, RBC GAM

Exhibit 7: U.S. 10-year Treasury note and returns



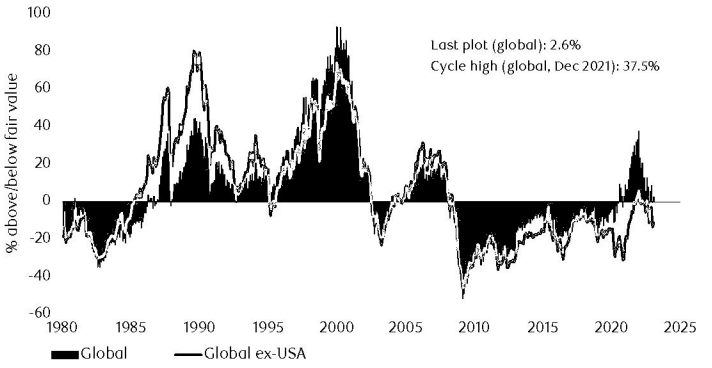
Note: as of January 13, 2023. Source: Deutsche Bank, Haver Analytics, RBC CM, RBC GAM

Equities, too, have undergone a massive valuation adjustment and expected returns have increased as a result. Global equities began 2022 at nearly 40% above our modelled estimate of fair value, but last year's plunge in the world's major stock markets pulled that measure down close to 0% – i.e. stocks are now trading in line with fair value (Exhibit 8). Furthermore, if we exclude the U.S. equity market, which remains one of the more expensive markets in the world, stocks are trading a 10% *discount* to fair value. As a result, the extreme overvaluation in stocks that existed at the start of last year has been erased and stocks outside the U.S. have become especially appealing on this basis.

Equity-market valuation is highly useful in predicting returns over extended time horizons. Shiller's Cyclically-Adjusted P/E ratio (CAPE) is one such valuation measure that was popularized for its strong relationship with S&P 500 returns over 10-year periods (Exhibit 9). The chart, which plots Shiller's CAPE in blue alongside 10-year returns for the S&P 500 in orange (on an inverted scale), clearly demonstrates the benefit of purchasing stocks at attractive valuations. Returns tend to be higher when stocks were cheaper (i.e. lower CAPE) at the date of the initial investment, and returns tend to be lower for positions established at points when stocks were more expensive (i.e. higher CAPE). In fact, at the start of 2022 when the CAPE was near 35x, this measure would have suggested paltry returns for the S&P 500 of just 2% per year over the subsequent decade. While we won't be able to verify the accuracy of that forecast for another 9 years, the bear market of 2022 significantly altered the prediction. At the time of this writing, the CAPE at around 25x would be consistent with an 8% per year return forecast for the S&P 500 over the next 10 years.

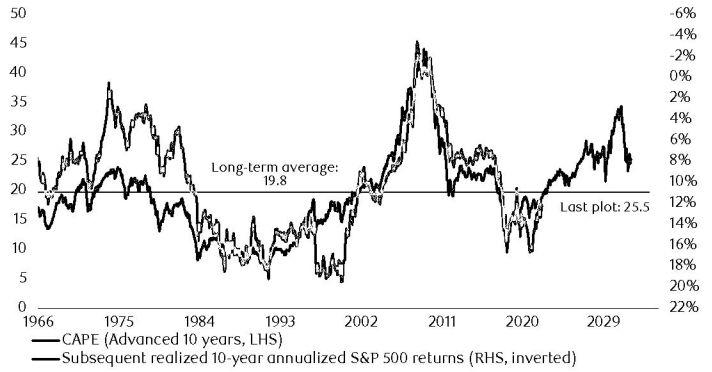
To further stress the importance of valuations on return forecasts, our own fair value models combine valuations and earnings predictions to generate an expected level for equity markets far into the future. Here, too, we have seen large swings in forecasts, not because the final expected ending point for the market changed a lot, but because the starting point changed materially. Exhibits 10 and 11 plot our fair value models for the S&P 500 and the MSCI Europe. Two arrows are plotted on each chart, one beginning at September 2021 and one beginning at September 2022 and ending at the mid-point of the fair value channel in 20 years' time. The S&P 500 was more than one standard deviation above fair value in late 2021, reducing the scope of investment gains available to investors, but by late 2022

Exhibit 8: Global stock market composite
Equity market indexes relative to equilibrium



Note: as of January 18, 2023. Source: RBC GAM

Exhibit 9: Shiller's CAPE
Real S&P 500 Index / 10-year average of real EPS



Note: as of January 18, 2023. Source: Macrobond, Bloomberg, RBC GAM

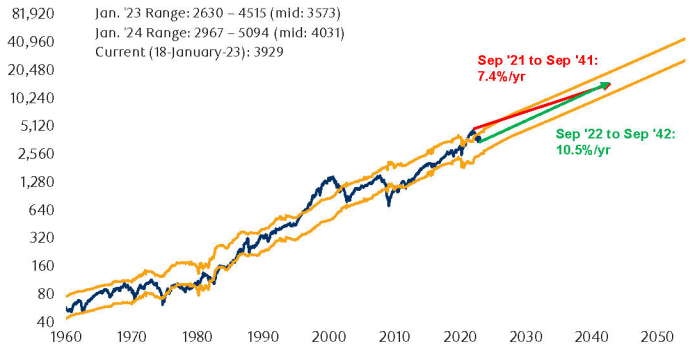
"We encourage investors to revisit their plans on a regular basis to ensure that they remain on track to meet their long-term financial objectives."

and after more than a 20% drop in the S&P 500, stocks were trading closer to fair value and the slope of the expected path for the market steepened. Where markets trade at discounts to their fair values, such as Europe and other international markets, valuations end up being a tailwind, boosting returns given our expectation that markets ultimately will end up at their fair values over the very long term. For these reasons, our return forecasts tend to be higher in markets outside of the most expensive U.S. large-cap space.

Taken together, our capital market assumptions have been refreshed to reflect current and expected market conditions over the longer term. Exhibit 12 lists our latest forecasts for 10, 20, and 30 year horizons across a variety of asset classes. Compared to a year earlier, these return expectations have improved anywhere from 100 bps to 300 bps and in some cases even a bit more. We now look for low single digit returns for cash, mid-single digit returns on government and investment grade bonds, mid- to high-single-digit returns on high-yield bonds, and high-single-digit to low-double-digit returns for stocks. While we recognize that uncertainty is high and a wide range of outcomes is possible in the near-term, these forecasts are meant to be used as building blocks useful in long-term financial planning. We encourage investors to revisit their plans on a regular basis to ensure that they remain on track to meet their long-term financial objectives. While 2022 was difficult year for many investors, we are of the view that markets endured a painful yet welcome transition, shifting the financial landscape away from extreme valuations and low-return potential toward a more normal and encouraging environment on a go-forward basis.

Exhibit 10: S&P 500 equilibrium

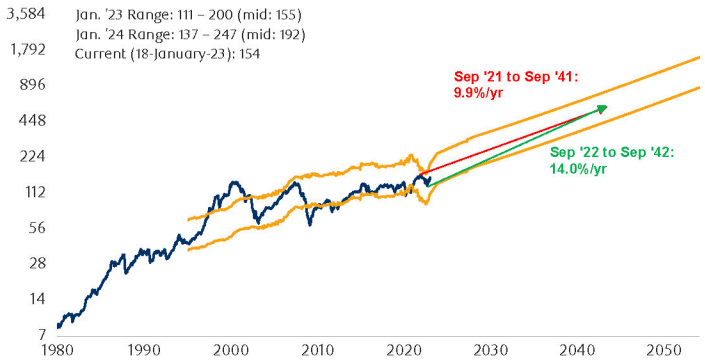
Normalized earnings & valuations



Source: RBC GAM

Exhibit 11: MSCI Europe equilibrium

Normalized earnings & valuations



Source: RBC GAM

Exhibit 12: Asset assumptions

Annualized return expectation

		As of Sept. 2021	As of Sept. 2022		As of Sept. 2021	As of Sept. 2022		As of Sept. 2021	As of Sept. 2022	
Fixed Income	Reference Index	10-year ER (%)	10-year ER (%)	Change	20-year ER (%)	20-year ER (%)	Change	30-year ER (%)	30-year ER (%)	Change
US Cash	Citigroup (1 M) Treasury Bill (LOC)	1.80	3.10	▲ 1.30	2.05	3.05	▲ 1.00	2.15	3.05	▲ 0.90
CDN Cash	DEX 30 Day T-Bill	1.35	2.75	▲ 1.40	1.55	2.65	▲ 1.10	1.60	2.65	▲ 1.05
GBP Cash	United Kingdom 1-Month Bond Yield	1.85	3.10	▲ 1.25	2.00	2.95	▲ 0.95	2.05	2.90	▲ 0.85
Euro Cash	BBG Barclays Euro T-Bills 0-3 Months TR	0.80	1.65	▲ 0.85	1.00	1.65	▲ 0.65	1.10	1.70	▲ 0.60
Japan Cash	FTSE Japanese Yen Euro Deposit (1 M) (LOC)	0.35	0.30	▼ -0.05	0.25	0.20	▼ -0.05	0.40	0.35	▼ -0.05
EM Cash	JP Morgan ELMI+ USD	2.80	4.00	▲ 1.20	2.80	3.95	▲ 1.15	2.75	3.95	▲ 1.20
CDN Provincial Bonds	FTSE Canada Universe Provincial Bond (CAD)	2.30	4.60	▲ 2.30	2.65	4.25	▲ 1.60	2.80	4.20	▲ 1.40
CDN Federal Bonds	FTSE Canada Federal Bond Index	1.75	3.75	▲ 2.00	2.10	3.60	▲ 1.50	2.25	3.60	▲ 1.35
CDN Government Bonds	DEX Government Bonds	2.05	4.20	▲ 2.15	2.40	3.90	▲ 1.50	2.55	3.90	▲ 1.35
CDN Corporate Bonds	DEX Corporate Bonds	3.10	5.15	▲ 2.05	3.40	4.85	▲ 1.45	3.50	4.80	▲ 1.30
CDN Universe Bonds	DEX Universe	2.35	4.45	▲ 2.10	2.65	4.20	▲ 1.55	2.80	4.15	▲ 1.35
US Government Bonds	BofAML US Gov 1-10 Yr USD	2.00	4.35	▲ 2.35	2.45	4.15	▲ 1.70	2.65	4.15	▲ 1.50
US Corporate Bonds	BofAML US Corp 1-10 Yr USD	3.25	5.80	▲ 2.55	3.75	5.50	▲ 1.75	3.95	5.45	▲ 1.50
UK Government Bonds	BofAML 1-10 Yr Gilts GBP	1.50	4.30	▲ 2.80	2.20	4.00	▲ 1.80	2.45	3.90	▲ 1.45
UK Corporate Bonds	BofAML 1-10 year Corp GBP	2.90	6.15	▲ 3.25	3.35	5.80	▲ 2.45	3.50	5.75	▲ 2.25
Euro Government Bonds	Iboxx Eurozone Sovereigns EUR	1.20	3.55	▲ 2.35	1.70	3.15	▲ 1.45	1.90	3.10	▲ 1.20
Euro Corporate Bonds	Iboxx Eurozone Corporates EUR	2.25	5.05	▲ 2.80	2.60	4.65	▲ 2.05	2.70	4.60	▲ 1.90
HSBC Asian Local Bond Index LCL	HSBC Asian Local Bond Index LCL	0.00	0.80	▲ 0.80	0.00	0.80	▲ 0.80	0.00	0.80	▲ 0.80
Citi WGBI	Citi WGBI LCL	1.50	4.10	▲ 2.60	1.80	3.35	▲ 1.55	1.95	3.30	▲ 1.35
HY Bonds	BofAML HY Master II USD	4.45	7.35	▲ 2.90	4.95	7.10	▲ 2.15	5.15	7.05	▲ 1.90
EM Bonds	JPM EMBI Global Diversified TR USD	4.25	6.70	▲ 2.45	4.50	6.00	▲ 1.50	4.65	5.85	▲ 1.20
Global Bonds	Barcap Global Agg Bond Index (USD)	2.25	4.80	▲ 2.55	2.70	4.45	▲ 1.75	2.90	4.40	▲ 1.50
Equities		10-year ER (%)	10-year ER (%)		20-year ER (%)	20-year ER (%)		30-year ER (%)	30-year ER (%)	
CDN Equities	TSX Composite	6.70	9.40	▲ 2.70	7.25	8.70	▲ 1.45	7.20	8.45	▲ 1.25
US Equities	S&P 500 TR USD	4.75	7.85	▲ 3.10	6.55	8.00	▲ 1.45	7.15	8.10	▲ 0.95
US Mid Caps	S&P 400 TR USD	7.20	11.55	▲ 4.35	7.75	9.90	▲ 2.15	7.60	9.15	▲ 1.55
US Small Caps	S&P 600 TR USD	6.80	11.90	▲ 5.10	8.40	10.55	▲ 2.15	8.50	10.00	▲ 1.50
UK Equities	FTSE AllSh TR GBP	8.75	11.25	▲ 2.50	8.25	9.60	▲ 1.35	7.75	8.75	▲ 1.00
Europe Equities ex UK	MSCI Europe ex UK LCL	7.20	9.85	▲ 2.65	7.55	9.05	▲ 1.50	7.25	8.25	▲ 1.00
Asian Equities	MSCI AC Asia Pac LCL	4.70	7.75	▲ 3.05	5.40	6.45	▲ 1.05	5.60	6.20	▲ 0.60
Japan Equities	Nikkei 225 Average PR JPY	5.75	7.60	▲ 1.85	4.95	6.10	▲ 1.15	4.65	5.45	▲ 0.80
Australian Equities	S&P/ASX 200 TR AUD	5.25	8.35	▲ 3.10	6.35	8.10	▲ 1.75	6.65	8.00	▲ 1.35
Developed Markets (World)	MSCI World LCL	5.55	8.30	▲ 2.75	6.65	8.00	▲ 1.35	6.90	7.85	▲ 0.95
EM equities	MSCI EM USD	8.80	11.50	▲ 2.70	9.70	10.55	▲ 0.85	7.50	8.70	▲ 1.20
EAFE Equities	MSCI EAFE LCL	6.45	9.00	▲ 2.55	6.70	7.95	▲ 1.25	6.55	7.40	▲ 0.85

Notes: asset assumptions as of September 30, 2022.

1. Fixed income indices may have compositional differences which could impact the comparability of return expectations between regions.
2. Fewer of our models contribute to forecasts for U.S. small cap and U.S. mid cap equities and, as a result, less breadth of information is contained in these figures as compared to other asset classes.
3. History suggests that asset valuations at the onset of an investment holding period have a meaningful impact to subsequent realized returns over long horizons. The sharp decline in global stock markets and the surge in bond yields in 2022 significantly reduced valuations and boosted return potential on a go-forward basis. As a result, our long-term return expectations for fixed income and equities have increased from a year ago.

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Publication date: January 2023

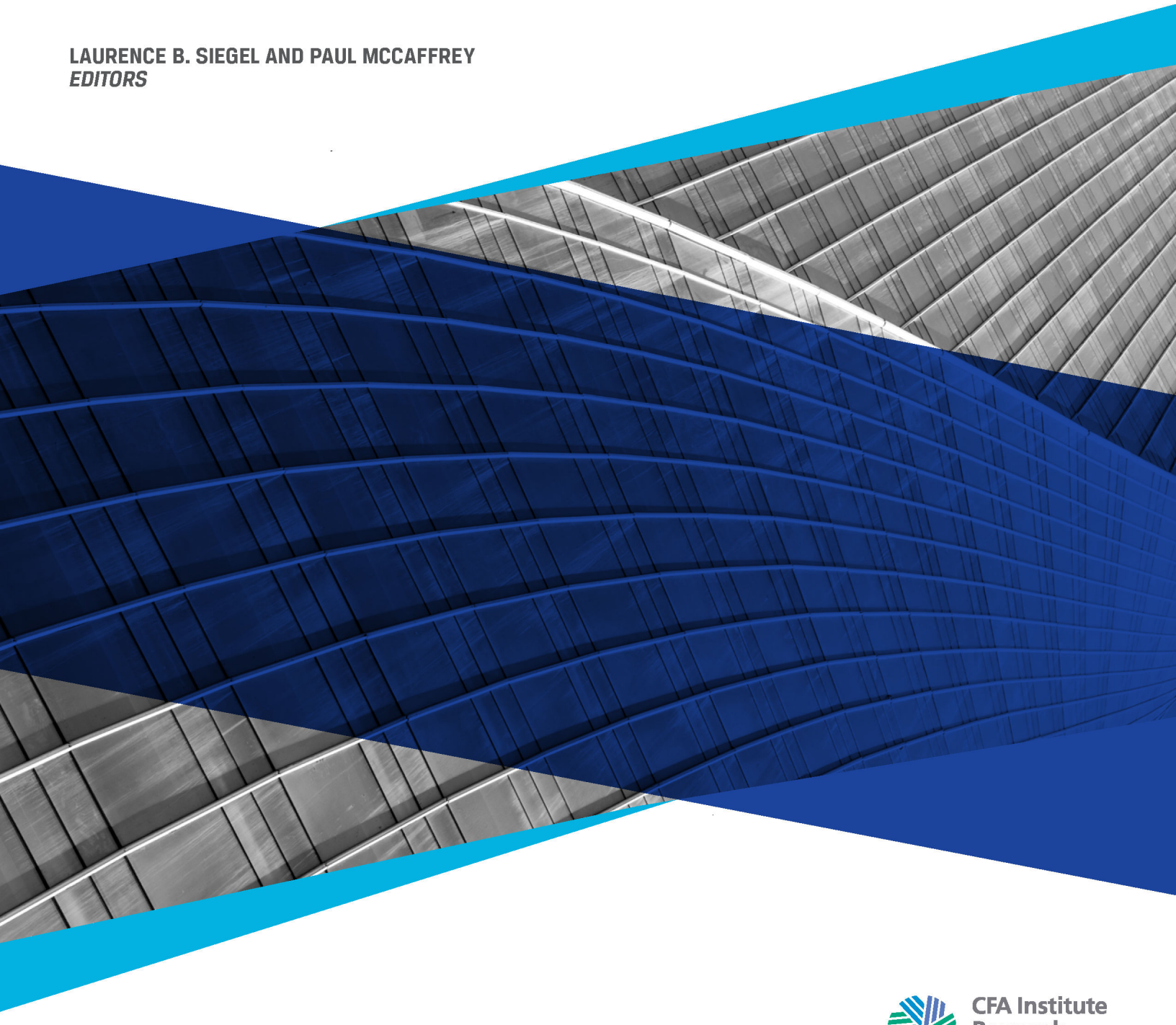
(01/2023)

RBC GAM LONG-TERM CAPITAL MARKET ASSUMPTIONS-E 02/09/2023

CFA INSTITUTE RESEARCH FOUNDATION / **MONOGRAPH**

REVISITING THE EQUITY RISK PREMIUM

LAURENCE B. SIEGEL AND PAUL MCCAFFREY
EDITORS



CFA Institute Research Foundation

REVISITING THE EQUITY RISK PREMIUM

LAURENCE B. SIEGEL AND PAUL MCCAFFREY, EDITORS

CFA Institute
Research
Foundation

Statement of Purpose

The CFA Institute Research Foundation is a not-for-profit organization established to promote the development and dissemination of relevant research for investment practitioners worldwide.

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ISBN: 978-1-952927-35-5

CONTENTS

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PREFACE

Because it is not directly observable, the equity risk premium (ERP) is one of the great mysteries of finance.

Whatever the risk-free rate happens to be, depending on the time horizon, stocks tend to generate annual returns that are 3% to 7% higher. What accounts for such a premium? What mechanism explains it? Is it really all about the excess risk? Or, as Rob Arnott posits later in this book, is it more of a fear premium?

These questions seek to uncover the elemental forces that drive the markets. To decipher the answers would, with only slight exaggeration, be the equivalent of discovering finance's philosopher's stone.

For this very reason, three times in the past 20 years, CFA Institute and CFA Institute Research Foundation have assembled a roundtable of distinguished investors, other financial practitioners, and academics to explore these questions. The panel has featured an evolving cast of luminaries. Those who have participated in the roundtable on all three occasions are Arnott, Cliff Asness, Roger Ibbotson, Martin Leibowitz, and Rajnish Mehra. Meanwhile, new names have been added, and their contributions are at the same level of quality as the perennials.

As these pages demonstrate, rarely have so many of finance's top thinkers been gathered in one place, and rarer still is their dialogue so compelling, forthright, and incisive.

The research and discussion that follow may not offer a single *Eureka!* moment that solves the mystery once and for all, but they do shed considerable light on the ERP while also offering a fascinating window into some of the greatest minds in finance today. Taken together, they provide a holistic model of how inquiries into the internal workings of the financial markets should be conducted.

In other words, the exercise encapsulates the mission of CFA Institute: "To lead the investment profession globally by promoting the highest standards of ethics, education, and professional excellence for the ultimate benefit of society."

I plan on returning to this text often in the months and years ahead, not only for its insights into the equity premium but also for its ample doses of wit, wisdom, and inspiration. I know that countless readers will do so as well. I also expect that, like me, they will be looking forward to the next Equity Risk Premium Forum in 2031.

In closing, this project would not have been possible without the singular contributions of the many roundtable participants who generously donated their time and effort as well as contributed their original research to this endeavor. Special thanks are due to both Laurence B. Siegel and Bud Haslett, CFA, who are respectively the Gary P. Brinson Director of Research and the executive director of CFA Institute Research Foundation. They shepherded this project from conception to completion. Their diligence, commitment, and passion truly represent the best in finance and demonstrate why CFA Institute Research Foundation is such an essential pillar of modern financial scholarship.

Paul McCaffrey
Editor, Enterprising Investor
CFA Institute

EDITOR'S NOTE

In 2001, Marty Leibowitz organized the first Equity Risk Premium Forum, published online by AIMR, a predecessor organization of CFA Institute. Ten years later, Brett Hammond, Marty Leibowitz, and I convened a similar group. We reflected on the changes that had occurred in the previous 10 years and made new forecasts. CFA Institute Research Foundation published this work as a research monograph, entitled *Rethinking the Equity Risk Premium*.

Then, in late 2021, at the suggestion of our executive director Bud Haslett, I organized the third decennial conversation, which resulted in the *Revisiting the Equity Risk Premium* book that you are now reading. I chose the speakers, led the discussion, and edited the part of the book consisting of the presentations and short discussions of each presentation. Our distinguished speakers—many of the same ones we had 10 and 20 years ago—each had 10 minutes to present, and then we all had 5 minutes to talk about the presentation. We began with Roger Ibbotson, because he started the investigation of the equity risk premium back in the 1970s when I was a student at the University of Chicago and he was my professor. I am very thankful he was able to attend.

Paul McCaffrey edited the remainder of this book, consisting of the roundtable discussion that followed the presentations.

That is enough of me. I therefore asked Brett Hammond and Marty Leibowitz to write the introduction to this book, a task that would more typically fall to the editor. Their wonderful introduction comes next, followed by the 11 direct presentations, discussions of the presentations, and the roundtable.

Happy reading, and see you again in 2031!

Laurence B. Siegel
Gary P. Brinson Director of Research
CFA Institute Research Foundation

INTRODUCTION: THREE DECADES OF EQUITY RISK PREMIUM FORUMS

P. Brett Hammond
Martin L. Leibowitz

In 2001, just after the dot-com crash, a group of academics and market professionals came together under the sponsorship of CFA Institute (known at that time as AIMR) to provide estimates of the equity risk premium (ERP) over the next 10 years. Most participants also provided essays describing the analyses that underpinned their forecasts.[1] The meeting was held at the offices of TIAA-CREF (as it was then known), where both of us were employed at the time.

In late 2011, following the Global Financial Crisis, CFA Institute Research Foundation convened a second risk premium forum. The forum participants, perhaps understandably, did not all give numerical estimates (and there is no record of the individual estimates provided by those who did). Instead, or in addition, they contributed essays on the multiple factors that should form the *theoretical basis* for risk premiums.[2]

At a subsequent Q Group conference in October 2012, Brett Hammond was invited to present a summary of the earlier meetings.[3] He began his presentation with the slide shown as **Exhibit 1**.

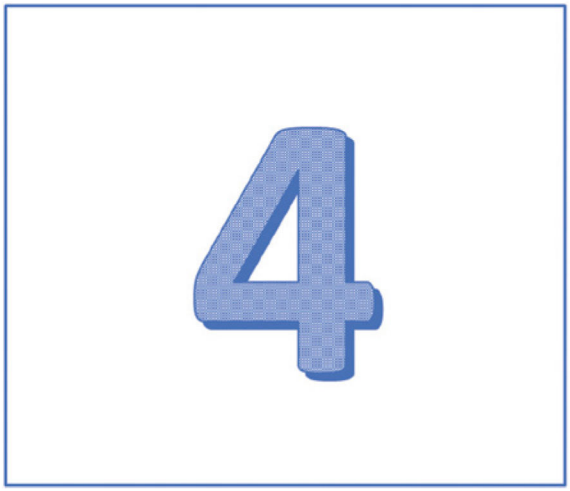
Some attendees said this parsimonious slide was the most memorable one ever presented at the Q Group. For the 2001 data, the slide relied on both a literature survey and the following distribution of participants' estimates, shown in **Exhibit 2**.

In the decade following the 2001 forum, equity returns were terrible. The average annualized real price return was −1.1%. Although those forecasting a zero premium came closest, none of the estimates anticipated negative premiums, much less negative total returns.

In contrast, in the decade following the 2011 forum, the market turned in terrific returns, with annualized real price returns of around 11%.

After the first and second forum, CFA Institute Research Foundation bowed to the inevitable and sponsored a third forum in late 2021, under the leadership of Larry Siegel.

Exhibit 1. Most Frequent Estimate of the 10-Year Equity Risk Premium



Source: Authors' calculations based on a literature survey and estimates from participants in the 2001 Equity Risk Premium Forum (AIMR 2002) and Hammond (2012).

The proceedings of this third forum make up the book that you are now holding in your hands. The distribution of this forum's estimates is shown in **Exhibit 3**.

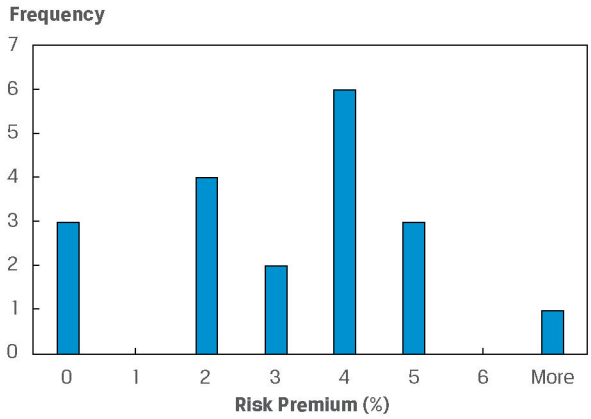
Despite radically different market environments, it is striking that the estimates in all three forums were so similar. They tended to be in the 3%–5% range, and notably, in comparison to historical returns, none of them included estimates above 7% or below zero. Moreover, in the first two cases, participants were free to choose their own (relatively) risk-free asset benchmark, which ranged from 3-month Treasury bills to 10-year Treasury bonds or TIPS (inflation-indexed Treasury bonds). (In the third forum, Larry asked all of us to use the 10-year nominal Treasury bond as

[1]See AIMR (2002).

[2]See Hammond, Leibowitz, and Siegel (2011).

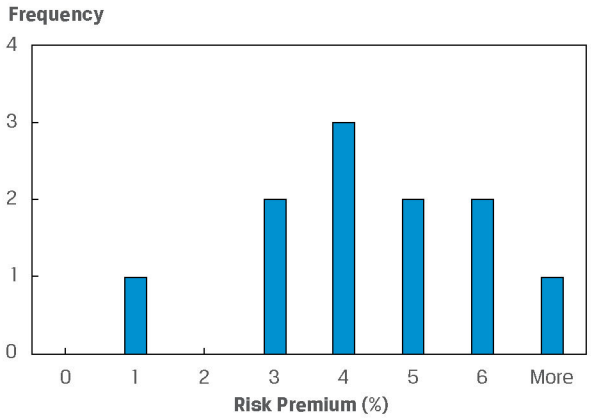
[3]The formal name of the Q Group is the Institute for Quantitative Research in Finance.

Exhibit 2. Distribution of 10-Year Equity Risk Premium Estimates, 2001



Source: AIMR (2002).

Exhibit 3. Distribution of 10-Year Equity Risk Premium Estimates, 2021



Source: Authors' calculations based on survey of participants in the third Equity Risk Premium Forum, held in 2021.

the risk-free asset.[4]) It almost seems as though a 4% value is the financial equivalent of a cosmological constant.

The question is: Why are all three sets of estimates so similar? One answer might be that powerful investor biases tend to compress the range of estimates.

On the one hand, belief in very low estimates might compel investors to feel that prospective returns do not justify significant equity positions. Consequently, subsequent selling to reduce positions would (presumably quickly) bring valuations back to reasonable risk-adjusted returns. In other words, a belief in a very low estimate would be inconsistent with a stable valuation.

On the other hand, a very high risk-premium estimate might be interpreted as implying unrealistic or unsustainable valuation levels, or as a call for investors to move toward risk levels that far exceed their strategic risk limit.

In addition to investors' valuation-based biases, estimates may also be influenced by looking back through a historical lens. For example, an admittedly simplistic analysis of rolling 40-year periods beginning in 1925 reveals that the realized median (50th percentile) return of US equities relative to US bonds was 3.6%. At the 90th percentile, the realized return was 3.95%.

(Note how close together the median and 90th percentile rates of return are, indicating a tight distribution of 40-year returns. This is something one might expect because of the nature of rolling 40-year returns, refreshed annually, in a less than 100-year time period.)

These unintended consequences of extremely high or low forecasts and the influence of historical averages might all lead to a more compressed range of estimates. It is hardly surprising that the combination of compression effects and high equity volatility would lead to estimates that turn out to be wrong—often by a lot!

It also might be argued that participants knowingly or unknowingly intended the estimates to be for horizons much longer than 10 years and that they really represent mean returns for a distribution of future decades. For example, additional work using shorter-term valuations and market-cycle theory might have been needed to convert truly long-term estimates to 10-year estimates. This view clearly represents a departure from the stated 10-year ground rule, however, and fails to provide practitioners with practical and useful information.

These considerations lead to a somewhat different view of the ERP that focuses on the hierarchy of non-cash assets against which equity returns could be measured. All non-cash assets have risk; and, in real terms, so does cash. Of course, when comparing the return patterns of two risky assets, it is the volatility of the difference between their prospective returns that matters. This volatility difference depends on both the volatilities of the two assets and the correlation between them and is a key determinant of the

[4]Purchased once at the beginning of the forecast period and held through the end of it (maturity). In other words, the rate deemed to be riskless was the yield on that bond at the beginning of the period. Another convention (the one we did not use) would be to use a hypothetical constant-maturity portfolio of 10-year Treasury bonds as the reference ("riskless") asset.

risk premium needed to justify an allocation to the more volatile asset.

For example, the equity premium resulting from a comparison against the mythical riskless asset, which has zero volatility and correlation, would be misleadingly simple. That would involve, however, a likely fruitless effort to identify a truly nonvolatile, riskless asset while ignoring signals contained in other risky assets that can inform comparisons with equities. To that end, 10-year Treasury bonds, which have a relatively long duration, are often considered to be a more proper base for computing a risk premium. The spread of equity returns relative to a diversified portfolio of corporate bonds also might be a viable alternative.

More generally, a spectrum of both individual asset types and well-constructed portfolios could serve as points of comparison for incremental equity-like investments. One implication is that the choice of a comparison asset or portfolio is not straightforward and may depend on an individual's investment goals. Another implication is that because the available comparison assets are themselves risky, they may necessitate even higher risk-adjusted premiums.

Another problem has to do with the leverage inherent in the stock market, which in the aggregate varies considerably over time. Based on the well-known work of Modigliani and Miller,[5] expected returns from equities should be higher when companies are more leveraged (all other things being equal).

In addition, the typical equity premium estimation process considers a range of influences, such as real GDP, as well as factors that affect all assets, such as interest rates and inflation. In particular, the earnings yield is often taken as a proxy for prospective real total return. This procedure ignores consideration of the prospects for earnings growth (which in many circumstances has been shown to be the dominant total return factor). Moreover, without an adjustment for the "retention effect" (earnings versus dividends and share buybacks) and for new equity issuance, any simple add-on of a raw growth number also can lead to misleading risk premium values.

The effects of increased investor access to private markets of all kinds have not escaped analysts' attention. With private markets growing in size, different payoff structures, and more limited reporting, how should we consider private asset returns when estimating an equity premium?

Despite these issues and concerns, many institutional funds continue to base their allocation strategies on the "building blocks" of assumed risk premiums. For institutional policy-making purposes, the net result is a portfolio whose *expected* return may provide a possibly false reassurance that the fund's key objectives will be achieved. If so, should the causality be reversed? That is, do the implicit slow-changing estimates justify the preexisting (and also slow-changing) allocations?

In other words, could it be that this 4% "cosmological constant" is not really derived solely from actual forecasts but rather ends up being somewhat of a "goldilocks" number that comfortably fits with a variety of investor hopes and institutional structures?

Of course, one of the most valuable benefits of the risk premium concept is that it encourages us to contemplate the range of scenarios facing us at a given time and to consider whether the offered return represents sufficient reward. To that end, we would like to draw readers' attention not only to the most frequent risk premium estimate but also to the full range of estimates from previous forums. In Exhibit 2, these range from zero to more than 6%, and in Exhibit 3, they range from 1% to more than 6%.

At first glance, we might simply conclude that these ranges reflect a lack of full consensus among the expert forum participants as well as possible methodological and definitional differences in arriving at each estimate. For example, note that for those experts who provided estimates in both 2001 and 2021, those offering lower versus higher estimates in the first instance also did so in the second instance. (The identity of the participant making each forecast is not revealed here, but we had that information when preparing this introduction.)

Looking a little deeper, we can also see at least two more interesting implications for asset analysis and allocation.

First, asset allocation analysis benefits from sensitivity analysis that reflects uncertainty regarding asset return, volatility, and correlation estimates. Keeping in mind that actual returns over the past two decades have departed significantly from the most frequent risk premium estimate, rather than relying on one future scenario (that is, one risk premium estimate), analysts should test a compact set of plausible higher and lower premium estimates, such as those suggested by Exhibits 2 and 3, as well as covariance estimates. Modern modeling tools and computing power easily support such an exercise.

Second, although the third Equity Risk Premium Forum required participants to use a 10-year horizon, most institutions and individual retirement savers are in it for the longer haul, in many cases multiple decades. We noted that the implicit, even unconscious, influence of the long view may bias estimates toward 4%. We could add that one of the most difficult practical problems in estimating returns is to link the short term with the long term. Specifically, if our shorter-term risk premium estimate differs significantly

[5]See Modigliani and Miller (1958).

from a long-term equilibrium estimate, it raises the question of how to model the time-varying nature of the premium. Of course, this concern applies to all asset classes, not just equities.

To illustrate, our 10-year risk premium estimates might imply projected equity returns ranging anywhere from 0 to 7% with a central tendency of 4% (as Exhibit 1 strongly suggested). Our long-term risk premium estimate, however, might be the same or different—say 4%, 6%, or another estimate. For asset allocation, should we redo the premium estimates each year and remodel allocations accordingly? Or should we ignore short-term estimates for any portfolios with multidecade horizons and use our preferred long-term risk premium estimate for modeling purposes all the time?

Or should we model allocations dynamically by assuming 11% or –1% equity returns for the next few years, whichever seems appropriate at the time, but reallocate as we approach year 10? If the latter, it isn't obvious how we should model the transition from short- to long-term estimates. One approach would be to introduce a small weight for the long-term estimate at some point and gradually increase the weight. Another would be to assume that a period of returns below the long-term estimate will be followed by a period of returns above the estimate to avoid violating the long-term equilibrium assumption. Perhaps a more satisfying approach would be simply to look at different risk premium scenarios as described.

Whichever approach the analyst chooses, the results will be influenced by estimates and methods. In an era in which we observe macro forces acting on asset markets and changing premia regimes, it might behoove the analyst not only to use the consensus equity premium number as an asset allocation anchor but also to test allocation sensitivity to different estimates and methods.

REVISITING THE EQUITY RISK PREMIUM

EQUITY RISK PREMIUM FORUM 2021: PRESENTATIONS AND DISCUSSIONS

LAURENCE B. SIEGEL, EDITOR

PRESENTATION BY ROGER IBBOTSON: HISTORICAL RETURNS, PREMIUMS, AND POPULARITY

Roger Ibbotson: Thank you, Larry. It's a wonderful group you put together here.

A lot of my old friends, but also a really accomplished group.

My work was probably the earliest here, but it didn't come out of a vacuum. I was at the University of Chicago, and Larry Fisher and James Lorie had put together the Center for Research in Security Prices (CRSP). All the data were available there. So, by writing some code, I had a great opportunity to put together the kind of data that are in *Stocks, Bonds, Bills, and Inflation*. Fisher and Lorie's stock market data actually mentioned total returns, which was pretty unusual at the time because most people worked on price indices, not total returns that included dividends.

Even with dividends available on the CRSP tapes, most researchers treated dividends separately. You might think it's a trivial thing to add dividends and capital gains together, but that wasn't done at the time. When investment managers reported their results, they basically reported capital gains and dividends separately as well.

We also had some data on the bond side. We have Marty Leibowitz here today, and working with Sidney Homer, he did a lot on bond data at the time.

What motivated me most was the capital asset pricing model (CAPM), because the equity risk premium came out of that. At the time, in the early 1970s, the CAPM was the dominant model of security prices—and to implement that model, you had to have a measure of the equity risk premium. All of the researchers were talking about equity risk premiums and other risk premiums—everything was all about risk at the time. And we didn't have any real measures of any of these premiums. We had some data on stocks—the Fisher and Lorie data—which were not up to date. We had some data on bonds and other assets, but they weren't brought together in a form where you could look at risk premiums.

Comparative Returns on Stocks, Bonds, Bills, and Inflation

Please refer to **Exhibit 4**. Many of you have seen it—the "Stocks, Bonds, Bills, and Inflation" chart. This is Morningstar data at this point, because I sold Ibbotson Associates to Morningstar back in 2006.

The whole purpose of this study was to look at premiums, which Exhibit 4 displays as the differences between the rates of return. This dataset is available now from CFA Institute Research Foundation. It's updated monthly and is available to any CFA Institute member,[1] so it's being circulated again.

What you see in these data most vividly, though, are the different premiums. The dark blue line is the stock market's total return, which shows the explosive growth of the markets. Over 95 years, $1 in the US stock market total return index has grown to almost $11,000. People are always astonished to see the amount of growth you get if you can compound the annual rates of return over long periods of time.

These are nominal indexes. The inflation index grew by a factor of 15, so you can divide the nominal indexes by 15 to get real (inflation-adjusted) indexes, but the real returns are still very large numbers. The real return on equities is the premium of equities over inflation.

You can see the other premiums: bonds versus bills, bills versus inflation, and small-cap stocks versus large-cap stocks. We didn't have small stocks in the original study.

The first release of these data came out in two *Journal of Business* articles in 1976.[2] At that time, we used the data not only to show historical performance but also to make a forecast for the next 25 years—to the year 2000. We took 50 years of historical data and then made 25-year future projections. Looking back from 2000, those forecasts turned out to be pretty close to correct.

Arithmetic versus Geometric Mean Returns

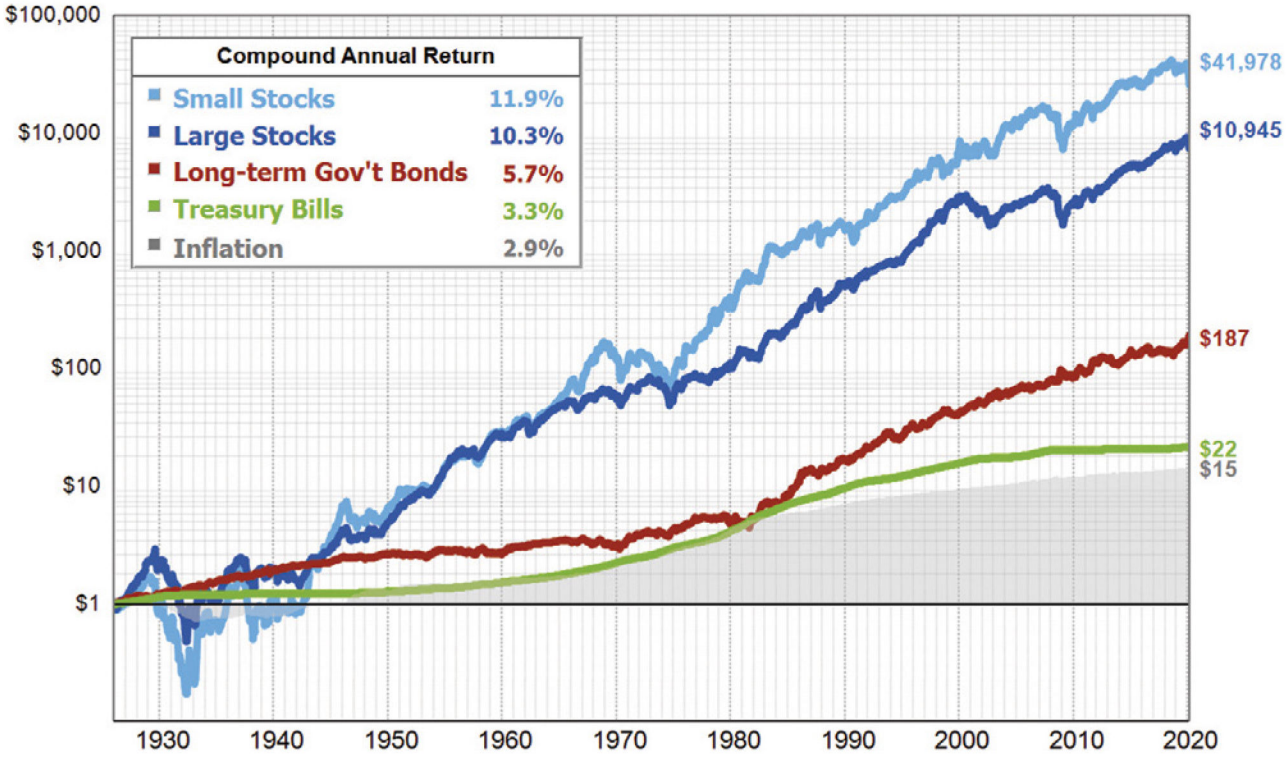
Exhibit 5 shows the summary statistics of the data in Exhibit 4. Over the years, people have been confused between geometric mean (compound annual) returns and arithmetic mean returns.

Premiums can be measured in either arithmetic or geometric mean terms, and the two can be very different. The difference relates to the standard deviation—the bigger the standard deviation of the series, the bigger the difference between the arithmetic and geometric mean. This relationship has become a key element in understanding asset returns.

[1]In the mainland of China, CFA Institute accepts CFA® charterholders only.

[2]See Ibbotson and Sinquefield (1976a, 1976b).

Exhibit 4. Ibbotson SBBI: Stocks, Bonds, Bills, and Inflation, 1926–2020



Source: Data from Stocks, Bonds, Bills, and Inflation (SBBI) and Morningstar, Inc.

With highly volatile series, there can be huge differences. The premium between small caps and large caps or, for that matter, between stocks and riskless assets—the equity risk premium itself—differs greatly depending on whether it is measured arithmetically or geometrically. We tend to talk about it both ways.

Long-Term versus Short-Term Riskless Assets

We also get very different numbers for the equity risk premium depending on whether we are comparing stocks to long-term or short-term riskless assets. All these estimates of the equity risk premium are useful—if I were making a long-term forecast, I would want an equity risk premium that was measured relative to long-term Treasury bonds, and if I were making a short-term forecast, I would use the equity risk premium relative to Treasury bills.

So, in making the choice of arithmetic versus geometric and long versus short-term horizon equity risk premiums, there are a lot of issues to address. For now, I am just defining the terms. Another issue is the starting date, which at the time I started the study was 1926 because those were the available data.

Components of Returns: The Riskless Rate and Risk Premiums

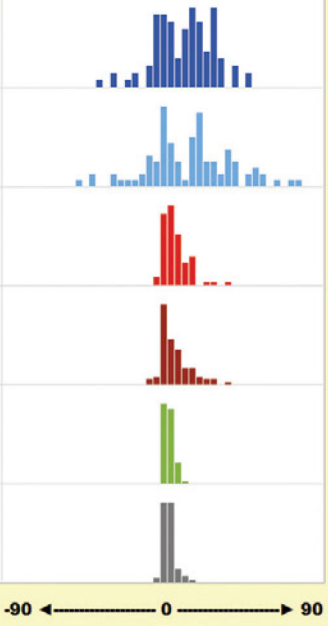
In **Exhibit 6** and **Exhibit 7**, we break the returns on each asset class into their component parts. In doing so, we identify different types of premiums by taking either arithmetic or geometric differences between one asset class series and another. The premiums include a small-cap premium, a corporate bond default risk premium, a bond horizon premium, and a real riskless rate of interest.

All these premiums, plus the real riskless rate, come out of this analysis. To make the analysis visually clear, I sometimes stack the components as in Exhibit 6. Look, for example, at "cash" (Treasury bills), where the Treasury bill return itself has two pieces: inflation and the real interest rate. For premiums, we can talk about either the realizations (past returns) or the expectations. The current discussion is mostly about the expected, or future, equity risk premium.

The second column or "tower" in Exhibit 6 includes the equity risk premium. This premium can be measured relative to long-term bonds, or it can be measured relative to Treasury bills. We can put the small-cap premium or value premium on top of that. Today, of course, there is a lot of

Exhibit 5. Summary Statistics of Returns on Stocks, Bonds, Bills, and Inflation, 1926–2020

	Compound annual return	Arithmetic annual return	Risk (standard deviation)	
Large Stocks	**10.3%**	**12.2%**	**19.7%**	
Small Stocks	**11.9%**	**16.2%**	**31.3%**	
Long-term Corporate Bonds	**6.2%**	**6.5%**	**8.5%**	
Long-term Government Bonds	**5.7%**	**6.1%**	**9.8%**	
Treasury Bills	**3.3%**	**3.3%**	**3.1%**	
Inflation	**2.9%**	**2.9%**	**4.0%**	



Source: Data from SBBI, Morningstar, Inc.

debate about whether those premiums even exist or what other premiums might exist, with many opinions on what these premiums should be. I think there's little doubt that there's a liquidity premium, though, in all asset classes and situations.

On the bond side, you can use the same sort of stacking methods. The Treasury bond has a premium relative to "cash" (Treasury bills), and I call that the horizon premium, referring to the time horizon of the bond. I took out the word "risk" in some of the boxes. I think it was Rajnish Mehra who said, "that's not necessarily a *risk* premium." It really has to do with matching the time horizons of investors and issuers, so the difference in yields or returns between short- and long-term bonds isn't necessarily a premium for risk specifically.

When you move to the right in Exhibit 7 to consider a bond that can default, you have a default risk premium. The risk premium that you expect to realize is only part of the yield spread between the corporate and Treasury bonds—you don't get the whole yield spread because you'll have some defaults along the way.

Summary

Let me wrap up by summarizing where I think we are going today.

There are different methods of estimating the equity risk premium. The historical method basically asks, "What do historical returns tell us about the future?" That's the approach in *Stocks, Bonds, Bills, and Inflation*. Next, you'll hear from Elroy Dimson with the Dimson–Marsh–Staunton research on many different countries. In a related area, Will Goetzmann and I are currently working on some more data back to 1815 for the New York Stock Exchange. Jeremy Siegel has also done a lot of work on historical returns. Many of us who are here today are working in this area.

The demand side is a different approach. What returns do investors demand for taking on the risk and other characteristics of securities? The CAPM addresses that question because it says that people are risk-averse and therefore demand an equity risk premium. Some of Rajnish's major work is on this topic—looking at utility curves and asking, "What are investors demanding here?"

Exhibit 6. Stacking Equity Premiums

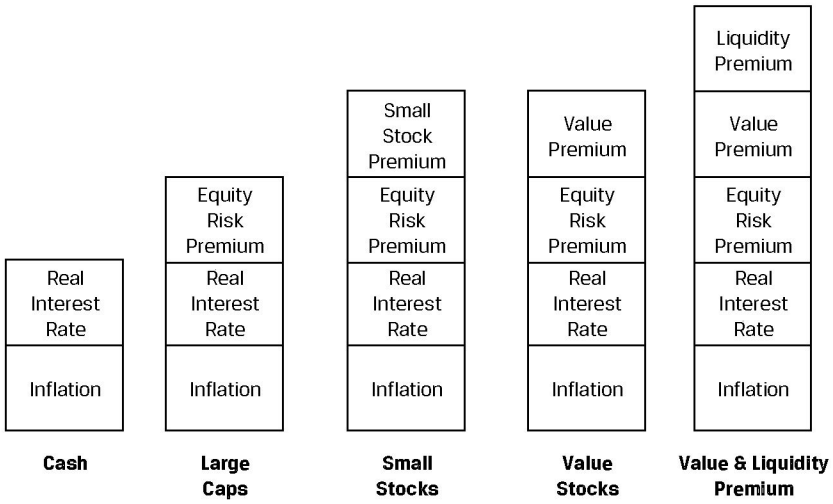
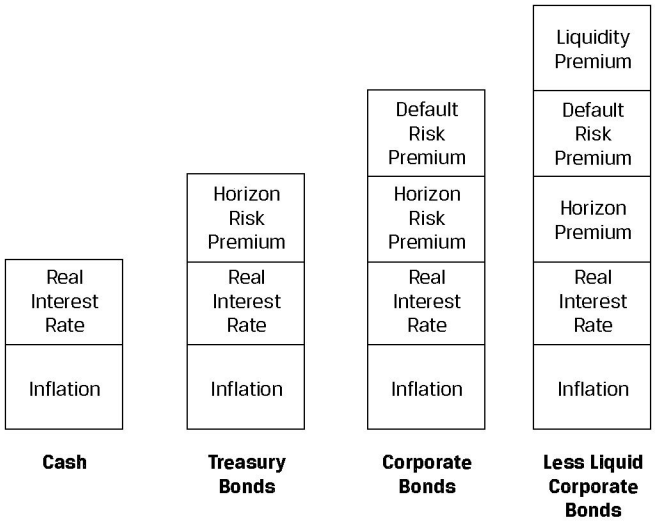


Exhibit 7. Stacking Fixed-Income Premiums



I've been working on the demand side with a set of papers and a CFA Institute Research Foundation Monograph called *Popularity: A Bridge between Classical and Behavioral Finance*.[3] My co-authors are Tom Idzorek, Paul Kaplan, and James Xiong. They're all from Morningstar. It says that if you have a preference for an asset characteristic—if you really like it—you're going to raise the valuation of assets with that characteristic. The same future cash flows will have a higher valuation or price in the present; that means the asset will have a *lower* expected return. If we don't like a characteristic, assets with that characteristic will have *higher* expected returns.

From the supply side, the question is: What cash flows does the economy supply to investors? I recently published some work on this with Philip Straehl, looking at buybacks, because buybacks are now actually a bigger part of cash flow to investors than dividends.[4] We definitely want to correct dividend discount models (DDMs) for buybacks. DDM models are in the supply realm. Marty Leibowitz is going to talk about growth estimates, so his work would fit into the supply category.

The last approach to estimating the equity risk premium is surveys, in which you might simply ask people what

[3]See Ibbotson, Idzorek, Kaplan, and Xiong (2018).

[4]See Straehl and Ibbotson (2017).

returns they expect or think they should earn. Conceptually, this idea is good, but the questions in the surveys tend to be ambiguous. When people ask me what return I expect, I don't know if they're talking about the arithmetic mean, the geometric mean, the long term, or the short term. I would give very different answers depending on these conditions, and usually these surveys are not designed well enough for you to know which question you're answering.

Discussion of Roger Ibbotson's Presentation

Robert Arnott: It will come as no surprise to you, Roger, that I view buybacks as partly real and partly mirage. So, I'd push back on the arithmetic of suggesting that buybacks are, sustainably on a long-term basis, larger than dividends. You and I have already had that back-and-forth discussion in the Letters section of the *Financial Analysts Journal*,[5] so I'll let it go with that.

Laurence Siegel: Rob, can you summarize what you mean by "mirage"?

Robert Arnott: Buybacks are often done to facilitate management stock option redemption. So you noisily announce you're buying back 10 million shares of stock. Roughly concurrent with that announcement, management redeems 10 million shares of stock options. The aggregate float doesn't change. So, what we found historically is that float for the aggregate market tends to go up, not down. A buyback isn't a buyback if the float doesn't go down.

And if you go through the arithmetic on market aggregates, as reported by CRSP, you find that dilution of shareholders collectively across the index is the overwhelming norm for the S&P 500, with occasional bouts of net buybacks.

The net buybacks are also usually overwhelmed by net new share issuance, if only by the index changing its composition. If you kick out AIG and put in Tesla, for example, you're forcing everyone holding the index to sell 1.5% of every stock they already have in order to bring in this giant new company—so the aggregate float goes up, not down. Taking that into account, you find that indexes are diluted by an average of 2% a year historically. There have been bouts in the 1980s and in the mid-aughts and mid-teens (of the current century) where buybacks for the S&P exceeded new share issuance and other forms of dilution, but…

Roger Ibbotson: I don't think that Rob is right on this, but this discussion has been in the *Financial Analysts Journal*. I don't think buybacks are going away, because they're a much more flexible way of paying out cash flows. There is no signaling with buybacks: You don't have the problem of cutting dividends and having investors interpret that as bad news. You can buy back or not buy back stock whenever you want.

Jeremy Siegel: Buybacks are also tax efficient.

Roger Ibbotson: They are. We are out of time, but that's a great discussion.

Laurence Siegel: Depending on what everyone wants to talk about in the afternoon, we might be able to bring this topic back.

Appendix to Roger Ibbotson's Presentation: Further Reading

Historical: What do historical returns tell us about the future? See:

Dimson, Elroy, Paul Marsh, and Mike Staunton. 2021. *Credit Suisse Global Investment Returns Yearbook 2021 Summary Edition.* Credit Suisse Research Institute. https://www.credit-suisse.com/media/assets/corporate/docs/about-us/research/publications/credit-suisse-global-investment-returns-yearbook-2021-summary-edition.pdf.

Ibbotson, Roger G., and James P. Harrington. 2021. *Stocks, Bonds, Bills, and Inflation® (SBBI®): 2021 Summary Edition*. Charlottesville, VA: CFA Institute Research Foundation. https://www.cfainstitute.org/-/media/documents/book/rf-publication/2021/sbbi-summary-edition-2021.ashx.

Demand Methods: What do investors demand? See:

Ibbotson, Roger G., Thomas Idzorek, Paul Kaplan, and James Xiong. 2018. *Popularity: A Bridge between Classical and Behavioral Finance*. Charlottesville, VA: CFA Institute Research Foundation. https://www.cfainstitute.org/research/foundation/2018/popularity-bridge-between-classical-and-behavioral-finance.

Supply Methods: What does the economy supply? See:

Straehl, Philip U., and Roger G. Ibbotson. 2017. "The Long-Run Drivers of Stock Returns: Total Payouts and the Real Economy." *Financial Analysts Journal* 73 (3): 32–52.

Surveys: What do investors and economists anticipate? See:

Fernandez, Pablo, Alberto Ortiz, and Isabel Fernandez Acín. 2017. "Market Risk Premium Used in 71 Countries in 2016: A Survey with 6,932 Answers." *Journal of International Business Research and Marketing* 2 (6): 23–31. Updated at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3861152.

[5]See Arnott and Bernstein (2018); Straehl and Ibbotson (2018).

PRESENTATION BY ELROY DIMSON: A GLOBAL VIEW AND AMERICAN EXCEPTIONALISM

Elroy Dimson: As a doctoral student at London Business School (LBS), I was strongly influenced by Roger Ibbotson, even though I never met him during my student days. I discussed thesis ideas with Professor Bob Hamada, who was visiting for a year from the University of Chicago. He suggested I look at Roger's Chicago proposal to study IPOs on the NYSE. Roger's ideas intrigued me so much that I selected IPOs as my topic. My dissertation was on the pricing of new flotations on the London Stock Exchange.

Meanwhile, Professor Dick Brealey, head of the finance group at LBS, convinced faculty and funders that the school should follow Chicago's lead by creating a research database for financial research. That was the origin of the London Share Price Database, which fellow student Paul Marsh and I used for estimating long-term stock market returns for the United Kingdom. We published our findings in the *Journal of Business*,[6] the same outlet as Roger's seminal study on the returns from US stocks, bonds, bills, and inflation.[7]

Returns on Many Markets around the World

After several years, Mike Staunton joined us, and we extended the research to a series of reports and articles. Our book, *Triumph of the Optimists*, published in 2002 by Princeton University Press, presented over a century of capital market history for the main asset categories.[8] Since 2002, we have published an annual volume—the *Global Investment Returns Yearbook*—which is an annual study of risk and return since 1900 on worldwide asset classes and factors.

The breadth of our dataset has expanded over time. As **Exhibit 8** shows, there are now 23 stock markets for which we have return histories beginning in 1900. For all these markets, we have not only a price index but also a measure of income (dividend yield).

The United States was already one of the largest markets in the world by market capitalization in 1900. It rapidly became the biggest soon after that and, except for one brief period, remained as such through to the present. For a short interval around 1990, Japan was bigger, but that did not last. Today, the US market has become larger than every other stock market put together. For Paul Marsh, Mike Staunton, and me, this was the motivation for remarking that there must be something exceptional about the United States.

We now have data on 90 markets, and of those, the 23 shown in Exhibit 8 started in 1900. For those, we have an index series that spans 121 years, except for two markets that terminated and then restarted—namely, China and Russia. We incorporate the latter two markets into our global index returns, so total wipeouts are still reflected in the worldwide index series.

More recently, we've added nine more markets where we have 50 years or more of data. So, rather than 23 markets from 1900, we now have a total of 32 markets with a history spanning at least a half-century. Then there are another 58 countries—nearly all of them emerging markets—where we have data for shorter periods. We remove the ones with less than 10 years of data, so we have excess returns or realized equity risk premiums in 90 markets. **Exhibit 9** depicts our global returns dataset. To conserve space, we omit markets with a relatively short history from this chart.

Exhibit 10 shows the markets where we have a complete history with all asset return series starting at the same time. They are shown with the usual country abbreviations for countries except for two: WXU is the world ex–United States, and WLD just to the right of the center is the world, both measured in common currency (US dollars). Returns are in local currency and are real (i.e., adjusted for local inflation). Equities beat inflation everywhere.

The exhibit also shows bonds. We used long-term government bonds where available. As you go back in time, some governments didn't issue very long bonds. And some governments, such as the United Kingdom, issued bonds with a maturity of infinity ("consol bonds"). So, there is substantial variation between countries in the maturity of the bond series. Bonds produced, on balance, a positive real return in local currency adjusted by local inflation. Bonds also beat cash with one minor exception, which is Portugal, where cash did better than bonds.

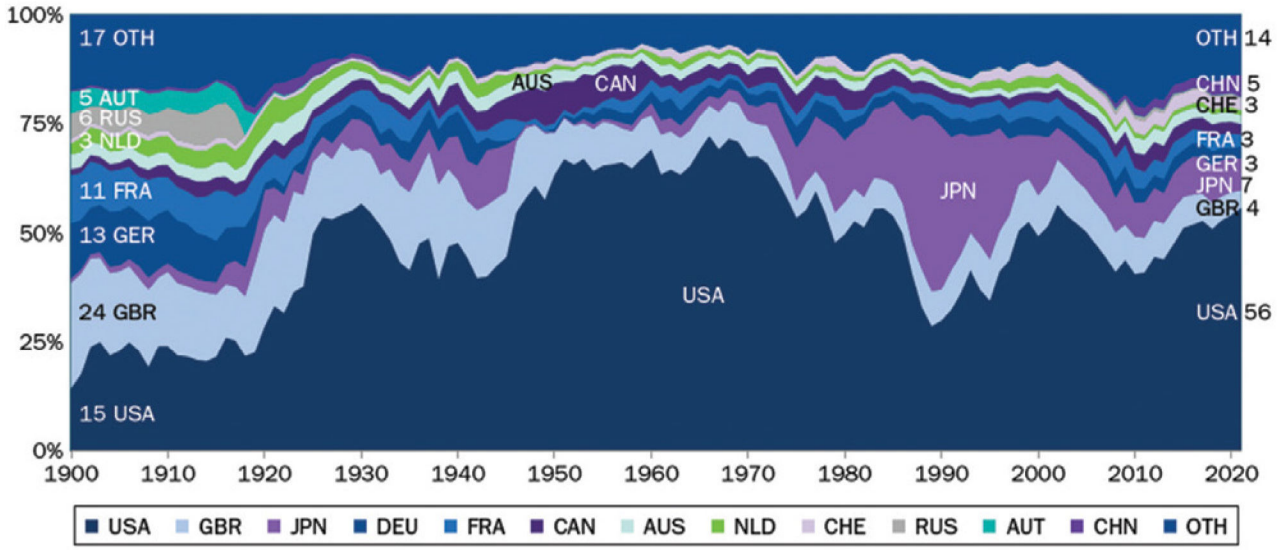
These differences in rates of return, or premiums, are all geometric differences, so they measure how much wealthier you would be in equities versus government bonds, for example. These premiums have no numeraire, so they

[6]See Dimson and Marsh (2001).

[7]See Ibbotson and Sinquefield (1976a).

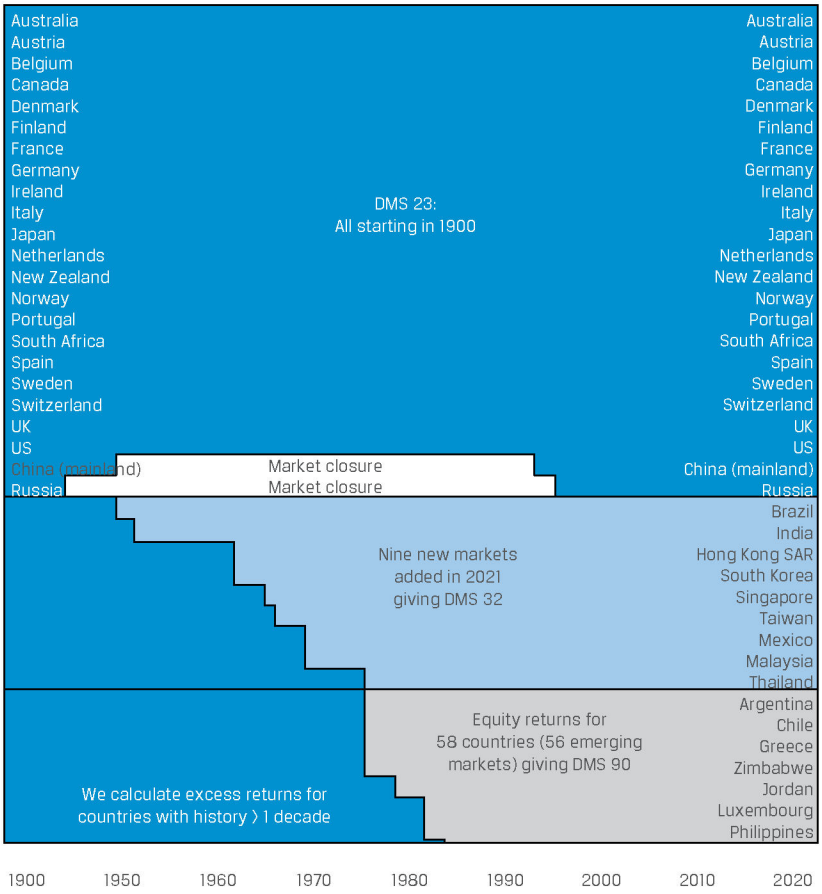
[8]See Dimson, Marsh, and Staunton (2002).

Exhibit 8. Evolution of Equity Markets since 1900



Source: Dimson, Marsh, and Staunton (2021).

Exhibit 9. The DMS Long-Term Dataset: 90 Markets, 1900–2020



Source: Dimson et al. (2021).