for the future rate will not perfectly adjust the assessments and may even overcorrect by introducing larger errors into the assessments than were present in the unadjusted data.

To examine the efficacy of using historical rates of regression to correct one's assessments, the estimated risk coefficients for the individual securities for the period from July 1933 through June 1940 were modified using the first equation in Table 4 to obtain adjusted risk coefficients under the assumption that the future rate of regression will be the same as the past. This process was repeated for each of the next three periods using respectively the next three equations in Table 4 to estimate the rate of regression.

Table 5 compares these adjusted assessments with the unadjusted assessments which were used in Tables 2 and 3. For the portfolios selected previously using the data from July 1933 through June 1940, both the unadjusted

TABLE 5

MEAN SQUARE ERRORS BETWEEN ASSESSMENTS AND FUTURE ESTIMATED VALUES

| | Assessments Based Upon | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Number of Sec./ Port. | 7/33-6/40 unadjusted | 7/33-6/40 adjusted | 7/40-6/47 unadjusted | 7/40-6/47 adjusted | 7/47-6/54 unadjusted | 7/47-6/54 adjusted | 7/54-6/61 unadjusted | 7/54-6/61 adjusted |
| 1 | 0.1929 | 0.1808 | 0.1747 | 0.1261 | 0.1203 | 0.1087 | 0.1305 | 0.1013 |
| 2 | 0.0915 | 0.0813 | 0.1218 | 0.0736 | 0.0729 | 0.0614 | 0.0827 | 0.0535 |
| 4 | 0.0538 | 0.0453 | 0.0958 | 0.0483 | 0.0495 | 0.0381 | 0.0587 | 0.0296 |
| 7 | 0.0323 | 0.0247 | 0.0631 | 0.0276 | 0.0387 | 0.0281 | 0.0523 | 0.0231 |
| 10 | 0.0243 | 0.0174 | 0.0535 | 0.0220 | 0.0305 | 0.0189 | 0.0430 | 0.0169 |
| 20 | 0.0160 | 0.0090 | 0.0328 | 0.0106 | 0.0258 | 0.0139 | 0.0291 | 0.0089 |
| 35 | 0.0120 | 0.0055 | 0.0266 | 0.0080 | 0.0197 | 0.0101 | 0.0302 | 0.0089 |
| 50 | 0.0096 | 0.0046 | 0.0192 | 0.0046 | 0.0122 | 0.0097 | 0.0237 | 0.0064 |
| 75 | 0.0081 | 0.0035 | 0.0269 | 0.0067 | 0.0112 | 0.0078 | 0.0193 | 0.0056 |
| 100 | 0.0084 | 0.0020 | 0.0157 | 0.0035 | 0.0114 | 0.0084 | 0.0195 | 0.0056 |

and adjusted assessments of future risk were obtained. The accuracy of these two alternative methods of assessment were compared through the mean squared errors of the assessments versus the estimated risk coefficients in the next period, July 1940 through June 1947.[23] This process was repeated for each of the next three periods.

For individual securities as well as portfolios of two or more securities, the assessments adjusted for the historical rate of regression are more accurate than the unadjusted or naive assessments. Thus, an improvement in the accuracy of one's assessments of risk can be obtained by adjusting for the historical rate of regression even though the rate of regression over time is not strictly stationary.

23. The mean square error was calculated by $\frac{\Sigma(\beta_1 - \beta_2)^2}{n}$ where $\beta_1$ is the assessed value of the future risk, $\beta_2$ is the estimated value of the risk, and n is the number of portfolios. In using an estimate of beta rather than the actual value, the mean square error will be biased upwards, but the effect of this bias will be the same for both the adjusted and unadjusted assessments.

## V. Conclusion

This paper examined the empirical behavior of one measure of risk over time. There was some tendency for the estimated values of these risk measures to regress towards the mean over time. Correcting for this regression tendency resulted in considerably more accurate assessments of the future values of risk.

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BNY Mellon **Investor Solutions**

### Calendar Year 2023

# 10-Year Capital Market Assumptions

## Key Takeaways

- Volatile markets and asset repricing during 2022 have driven significant changes to our 2023 forecasts relative to our 2022 outlook.
- The majority of our 2023 10-Year Capital Market Assumptions (CMAs) forecast higher expected returns across most asset classes when compared to 2022 assumptions (see Exhibit 1).
- Equity market expected returns have increased due to slightly higher long-term growth rates and upward valuation adjustments (most notably in emerging markets).
- Fixed income asset class expected returns have reverted to levels not seen in many years, significantly higher when compared to 2022 given the dramatic increase in global bond yields.
- Alternative asset class expected returns are generally higher and in line with publicly traded markets on a risk-adjusted basis plus incremental return for alpha and illiquidity.

# Overview

On an annual basis, BNY Mellon Investor Solutions, LLC develops capital market return assumptions (CMAs) for approximately 50 asset classes around the world. The assumptions are based on a 10-year investment time horizon and incorporate the macroeconomic forecasts generated by BNY Mellon Investment Management Global Economic and Investment Analysis Group. The return and risk assumptions are intended to guide investors in the development of long-term strategic asset allocations.

Slowing global economic growth and the persistence of elevated inflation have weighed heavily on market returns in 2022. With limited evidence of victory in their battle against inflation, monetary policymakers have remained resolute in their hawkish view and continue with tightening monetary policy. There have been few “safe-haven” assets in 2022, regardless of asset class, geography, market cap, style, credit quality and/or duration. However, looking forward, the increased market volatility and asset repricing during 2022 have driven notable changes to our 2023 forecasts relative to our forecasts just a year ago.

## Exhibit 1: Snapshot of 2023 vs. 2022 10-Year Capital Market Return Assumptions

| | | 2023 | | 2022 | |
|---|---|---|---|---|---|
| | | **Expected Return** | **Standard Deviation** | **Expected Return** | **Standard Deviation** |
| **Equity Markets** | U.S. Equity | 6.5% | 18.0% | 5.9% | 17.4% |
| | International Developed | 6.9% | 17.1% | 5.8% | 17.4% |
| | Emerging Markets | 9.3% | 20.0% | 7.6% | 21.2% |
| **Fixed Income** | U.S. Aggregate | 4.1% | 4.3% | 1.2% | 3.4% |
| | U.S. High Yield | 6.2% | 9.4% | 1.9% | 9.0% |
| | U.S. Intermediate Municipal | 2.8% | 4.3% | 0.9% | 3.8% |
| | Global Agg. Ex-U.S. | 3.0% | 7.9% | 0.3% | 7.3% |
| | EM Local Currency | 4.0% | 9.5% | 3.8% | 9.8% |
| **Alternatives** | Absolute Return | 4.3% | 5.0% | 3.2% | 5.2% |
| | Hedge Funds | 4.9% | 6.9% | 3.9% | 7.0% |
| | U.S. Private Equity | 8.2% | 21.3% | 7.9% | 20.5% |
| | U.S. Core Real Estate | 6.0% | 8.5% | 4.7% | 8.1% |

Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

## A Time-Tested Approach That Approximates Real-World Results

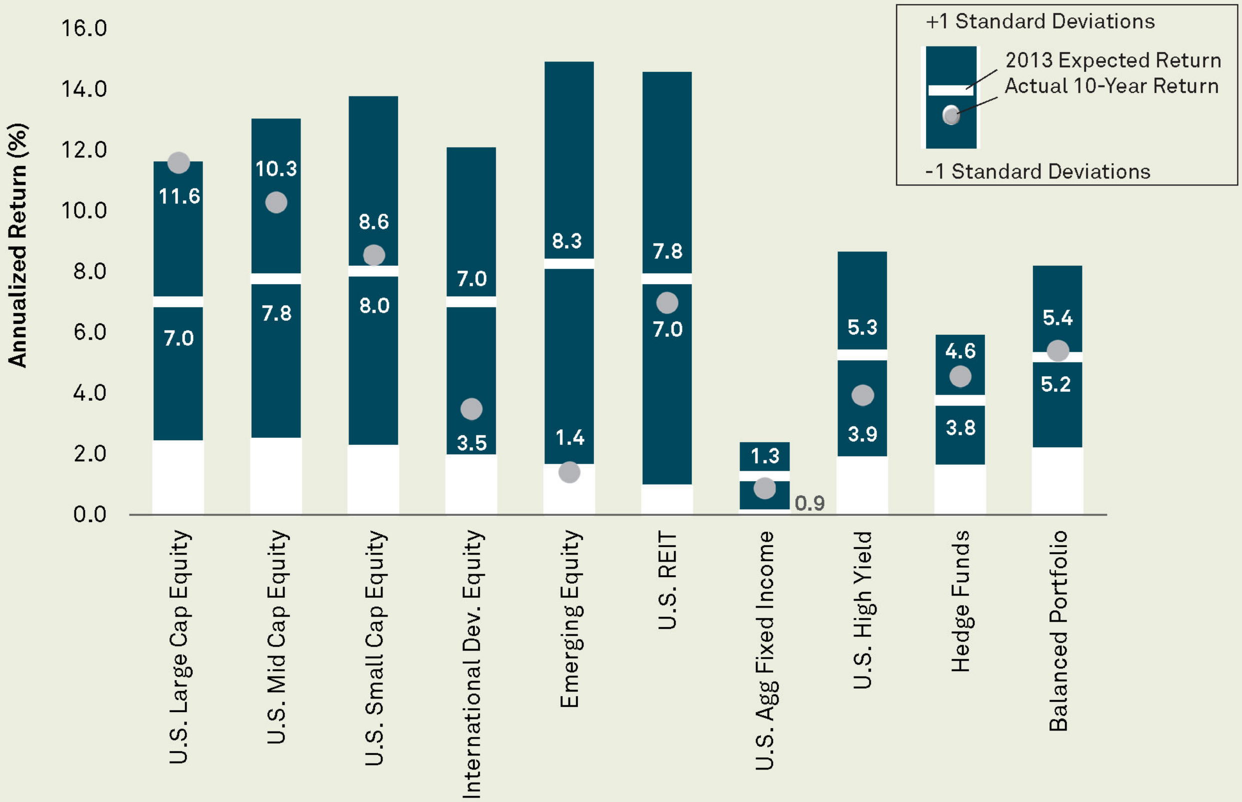
For decades, BNY Mellon has developed capital market assumptions to guide our institutional and high net worth clients in structuring their long-term asset allocations. In our opinion, capital market forward-looking return expectations must be validated against realized market returns. We continually look back and test our assumptions to assess accuracy, and improve our methodology.

Over the past five calendar years, we have back-tested our methodology and found that our 10-year projected returns, with the exception of emerging market equities (where we were too optimistic), were a close representation of actual returns for most asset classes. Exhibit 2 shows a comparison between our published 2013 capital market assumptions and actual returns over the past 10 years. The white lines represent our expected returns from 10 years ago, with the top and bottom of the bars representing plus and minus one standard deviation from the expected return. Actual returns over the past 10 years are represented by the circles. As the chart demonstrates, actual returns for each asset class (except emerging markets equities) and our expected returns fell within the one standard deviation range. Actual returns for U.S. equity were generally higher than expected, and the opposite held true for emerging markets equity. Expected returns for fixed income were extremely close to actual returns. Hedge funds slightly outperformed expectations, although we acknowledge there is significant dispersion with individual hedge fund returns relative to the broad HFRI Index.

Most importantly, the analysis also demonstrates the value of how CMAs are used for the construction of diversified portfolios. A balanced portfolio, based on our estimate of a "typical" institutional investment portfolio comprised of 55% equity, 30% fixed income, and 15% alternatives, had an expected return of 5.2% compared to the actual return of 5.4%. Though certain asset classes – especially those with high volatility – can be challenging to predict individually, a well-diversified portfolio can be relatively predictable over the long term.

The balanced portfolio presented herein is not representative of a specific strategy managed by BNY Mellon Investor Solutions, LLC as of the date of this publication and is not intended to constitute an advertisement of a specific BNY Mellon Investor Solutions, LLC product or service; instead, all information, content, and materials are for general informational purposes only.

Exhibit 2: 2013 Capital Market Return Assumptions vs. Actual 10-Year Returns Ending 9/30/2022




Source: BNY Mellon Investor Solutions, Bloomberg. Data as of September 30, 2022.

The remainder of the document discusses broad market themes/trends to watch, outlines the assumptions in depth and provides supporting details behind the numbers. We hope you find our 2023 10-Year Capital Market Return Assumptions both interesting and insightful.

# Key Themes for the Next Decade

There is a multitude of themes and trends, on both the short and long-term horizon, that may notably impact capital market returns and risk in the years to come. To what degree these themes ultimately shape future asset returns remains to be seen. But this uncertainty further supports the need for investors to consider robust portfolio design to navigate long-term unforeseen circumstances over traditional mean variance-driven outcomes that assume all inputs are known perfectly in advance.

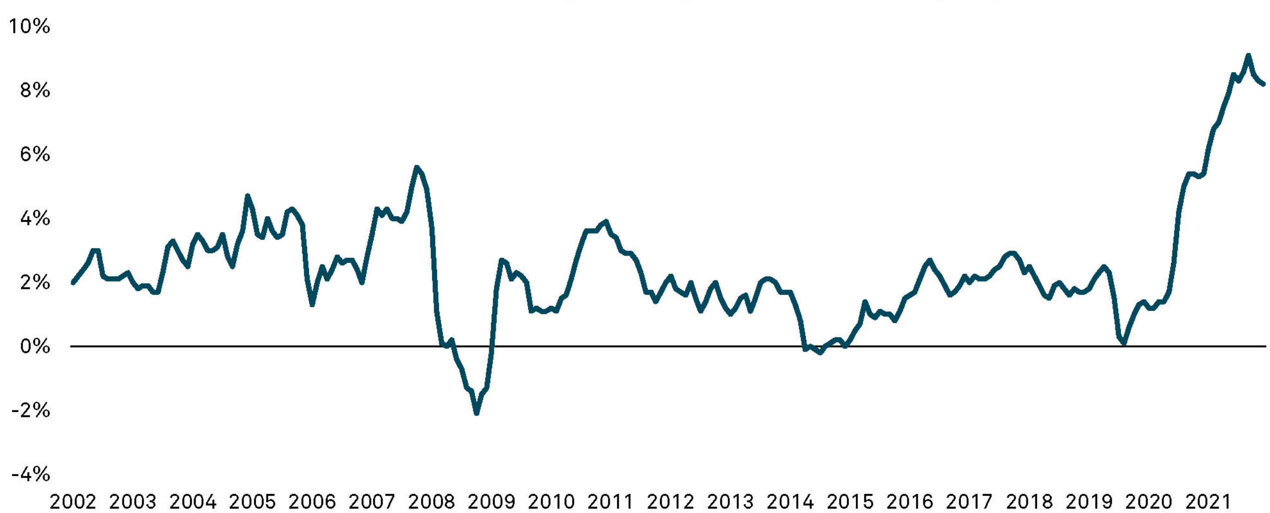
### Key Takeaways

- Continued geopolitical tensions will likely result in further deglobalization and reshoring, impacting variable costs, inflation, corporate margins and investor returns.
- The complex, uncertain and systemic nature of ESG issues makes it challenging to quantify top-down. In short, it is still too early to accurately assess the impact of ESG issues from a top-down strategic asset allocation perspective.
- The long-term impact of these broader themes on asset returns and risk levels will continue to be evaluated by investors and ultimately remains to be seen.

## Geopolitical Tensions and Inflation

The policy shift by the Federal Open Market Committee (FOMC), to average inflation targeting in August 2020, was introduced with the understanding that inflation would likely run above 2% for some time as an offset to lower inflation readings in preceding years. While facing increasing levels of inflation in early through mid-2021, the Fed further asserted in its statements that inflation would be transitory due to the confluence of pent-up demand and supply chains still in recovery from global covid pandemic lockdowns. Early in 2022, major economies began reporting historic levels of year-over-year (YoY) inflation. The U.S. Consumer Price Index (CPI) touched a 40-year high (see Exhibit 3), which was further exacerbated by Russia's invasion of Ukraine.

Exhibit 3: U.S. CPI, 12-Month Percentage Change, Not Seasonally Adjusted



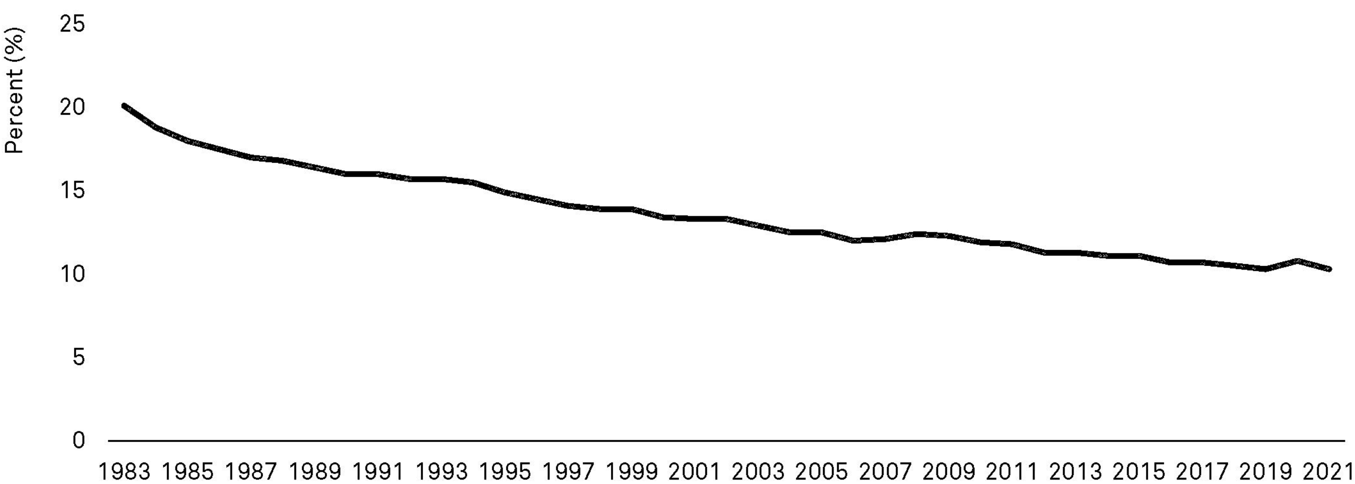

Source: Bureau of Labor Statistics. Data as of September 30, 2022.

The rapid escalation of the Russia/Ukraine war led to immense market volatility following unprecedented sanctions from numerous G7 countries. The United Kingdom and Europe, net importers of energy and heavily dependent on Russian supply, vowed to reduce dependency on Russian exports. These new restrictions and policy shifts resulted in a historic surge in energy and, in turn, consumer prices that were already at multi-decade elevated levels. These supply-driven inflationary pressures from left tail risk events – in the form of geopolitical tensions and supply chain woes – were and continue to be largely out of the control of major central banks.

Tight labor markets have added to the inflationary narrative and monopolized 2022 headlines, becoming the focal point for major central banks seeking to ease demand. Within the U.S., unemployment reached a historic low of 3.5% in tandem with a startling number of job openings that was nearly double the number of unemployed workers.

As central banks continue their tightening cycle, we expect this worker shortage to normalize as the economy slows; however, the labor environment has generally allowed workers more leverage when negotiating compensation and benefits. Among many notable impacts is an increase in unionization efforts for labor forces within multiple large corporations during 2022.[1] Even though the U.S. is far from its peak of employee union membership in the early 1980s (see Exhibit 4), an upward trend of reshoring could see a rise in unionization and increase labor costs.

## Exhibit 4: Share of Wage and Salary Workers (16 and Over) Who Are Members of Unions




Source: Bureau of Labor Statistics. Data as of December 31, 2021.

The tenuous geopolitical environment of 2022 accelerated efforts by international companies to reduce the impact of conflict and political discourse on supply chains. The uncertain risk of importing natural resources from emerging market countries has shifted the need for corporations to reshore production, with agility and reliability among the drivers of change. Consequently, reestablishing manufacturing domestically for international companies will likely lead to higher labor costs and potentially tighter corporate margins. Although the reduced volatility of variable costs may correlate to more predictable costs of goods sold, the increased costs of labor may lead to higher prices for consumers as companies seek to pass through increased input prices to maintain margins.

[1] Harrison, D., Haddon, H. (2022, July 12). Union Organizing Efforts Rise in First Half of Year. Wall Street Journal.

If the trend of deglobalization and reshoring persists, we believe long-term inflation may trend higher than the 2% average the Fed is aiming for. The retreat of corporations and sovereign nations from the reliance of foreign natural resources by the U.S. and other developed market countries may put pressure on emerging market countries once supply chains normalize. This could reduce variable cost volatility and may increase corporate margins.

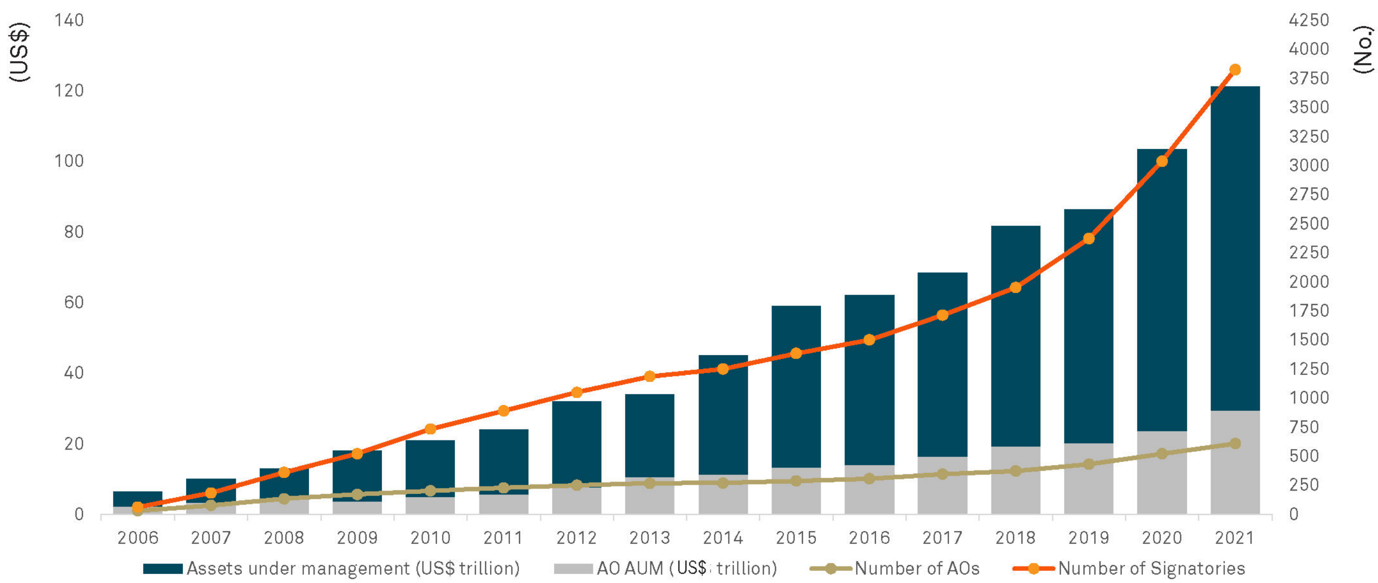
## Responsible Investing[2]

According to the U.S. Forum for Sustainable and Responsible Investing (USSIF), assets under management in the U.S. that incorporate any form of Environmental, Social and Governance (ESG) considerations, grew 42% from 2018 to 2020 to $17.1 trillion.[3]

In addition, the Global Sustainable Investing Alliance (GSIA), an international collaboration of membership-based sustainable investing organizations, reported in its 2020 Global Sustainable Investment Review[4] that sustainable investment assets under management reached USD 35.3 trillion, representing 36% of all professionally managed assets across regions covered by the report.

Since this data was reported, an unprecedented pandemic, heightened social inequity issues and a global geopolitical crisis have all arguably increased the pressure on Corporate America to focus on ESG issues, particularly inclusive work practices and a transition to a low-carbon economy. Governance & Accountability Institute's 2021 Sustainability Reporting in Focus report stated that 92% of S&P 500 companies and 70% of the Russell 1000 companies published a Sustainability report in 2020.[5] Separately, the United Nations backed Principles of Responsible Investing, the world's largest voluntary sustainability initiative, has reached 4000 signatories, including leading asset owners, asset managers and other service providers committed to incorporating an assessment of ESG issues in their investment processes. Over 2021, the number of PRI investor signatories increased by 26%, while the collective AUM represented by both the investor signatories and service providers increased by 17%.[6]

### Exhibit 5: Sustainable Investing Assets Under Management and PRI Signatories




Source: US SIF 2020 Report on U.S. Sustainable, Responsible and Impact Investing Trends.

[2]At BNY Mellon Investor Solutions, we refer to Responsible Investing as an umbrella term encompassing all forms of approaches clients can utilize to evaluate ESG considerations, or their sustainability and/or impact objectives alongside their investment goals.

[3]U.S. SIF Report on U.S. Sustainable and Impact Investing Trends 2020.

[4]Global Sustainable Investment Review 2020.

[5]G&A 10th Anniversary Report Finds All-Time Highs for Sustainability Reporting of Largest U.S. Public Companies November 2021.

[6]PRI Annual Report 2021.

Even with all this momentum, most traditional efforts to incorporate ESG issues in the investment process have been a bottom-up process (e.g., at the security, company or manager level). The efforts to assess ESG from a top-down strategic asset allocation perspective are still nascent, largely due to the limitations and challenges around lack of standard disclosure and poor quality of ESG data.

In the case of climate risks assessment, there have been attempts to assess the impact of climate risks from a top-down perspective. The Task Force on Climate-related Financial Disclosures (TCFD) recommendations also suggests investors undertake climate scenario analysis[7] as one of the key elements. Much of the climate scenario analysis is currently based on specialized third-party data providers that are attempting to assess potential impact of climate risks (e.g., policy changes, stranded assets, extreme weather events, etc.) on asset values both at the asset class and industry/sector levels.

Certain asset classes may be more exposed to physical climate risks (e.g., infrastructure or real estate that is highly exposed to changes in coastal water levels or adverse climate events). Some sectors may be more exposed to regulatory risks, such as energy or utilities, especially if companies in these sectors do not have an adaptation strategy. Adaptation and mitigation strategies may also put inflationary burden on companies and, in some cases, not having these strategies in place could increase the cost of capital for some companies. Physical climate risks could also impact creditworthiness of fixed income issuers, more so in high yield debt or emerging markets. On the other hand, some private asset classes (e.g., private infrastructure) may benefit from increased investment in renewables.

Climate risks also intersect with social inequity issues. Unfortunately, those impacted the most by climate change are typically those with the fewest resources to respond to it (e.g., flooding, drought, etc.). Extreme weather events pose increasing challenges for the most poor and vulnerable communities in terms of health, food, water, livelihood, forced migration, etc.[8]

The complex, uncertain and systemic nature of ESG issues makes it challenging to quantify top-down. In short, it is still too early to accurately assess the impact of ESG issues from a top-down, strategic asset allocation perspective. At BNY Mellon, we continue to be keenly aware of the rapidly evolving Responsible Investing landscape and bring the best thinking to our long-term assessment of risks and opportunities for client portfolios.

[7]The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities. June 2017.

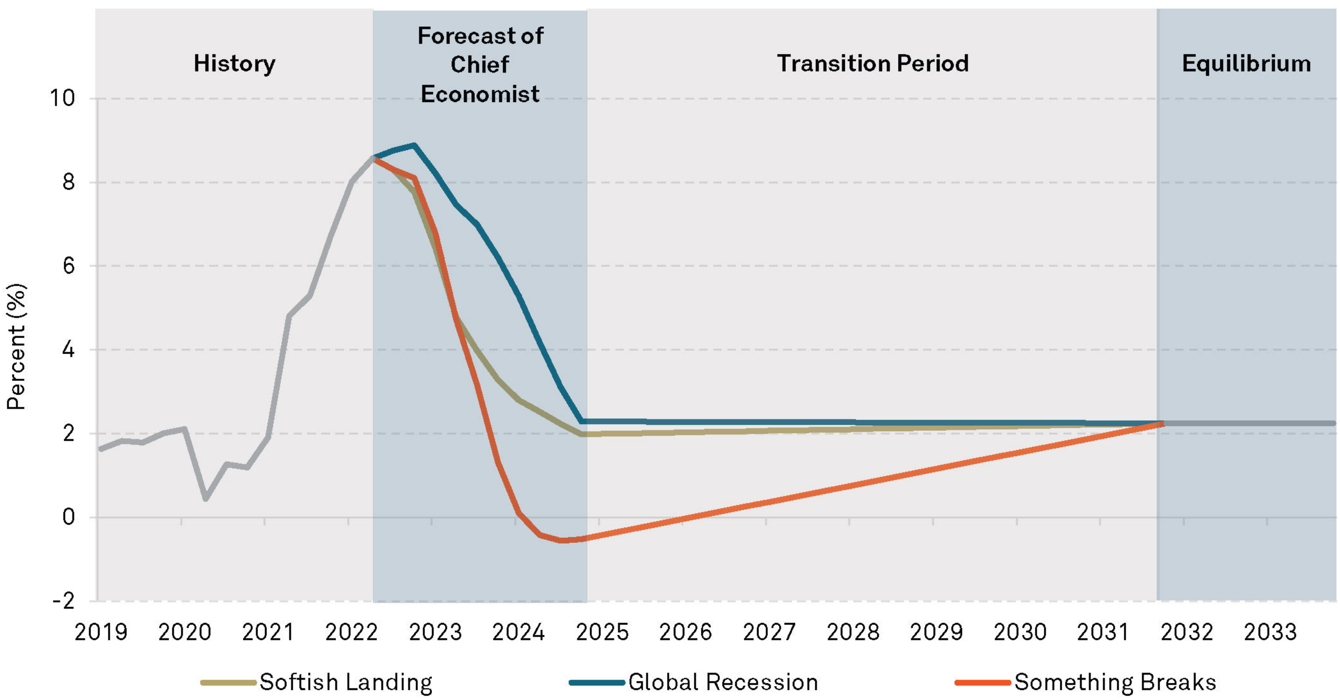
[8]The World Bank: Social Dimensions of Climate Change. Copyright 2022.

# Economic Forecast Methodology for the Capital Market Assumptions

Our macroeconomic projections are central to our building-block approach used for generating expected returns of major asset classes. Our long-term projections for GDP growth, inflation and short-term rates begin with three-year forecasts based on a range of outcomes developed by the BNY Mellon Investment Management Global Economic and Investment Analysis Group. We then assume, as illustrated in Exhibit 6, that the building blocks converge toward a steady-state equilibrium based on long-term market consensus expectations.

Our methodology allows us to generate expected returns under multiple macroeconomic scenarios and time horizons. Though our capital market assumptions are based on a 10-year horizon, the forecast period can be adjusted to generate returns over a shorter horizon, such as five years, or longer-term horizons of 30 years or more.

## Exhibit 6: Historical and Projected U.S. Consumer Price Index (CPI), Four Quarter Percentage Changes




Source: BNY Mellon Investor Solutions, BNY Mellon Investment Management Global Economic and Investment Analysis Group: Vantage Point, Q4 2022.

## Macroeconomic Backdrop

When building capital market assumptions, we start with projections of inflation, real GDP growth, short-term interest rates and currency rates. Inflation and real GDP growth are key drivers of our expected earnings growth for equity. Projections of inflation and real cash rates are extremely influential in projecting fixed income yields and returns.

The economic projections underpinning our asset class return assumptions are based on three economic scenarios outlined in BNY Mellon Investment Management's *2022 Q4 Vantage Point*. These scenarios are summarized in Exhibit 7. We develop return expectations under each of these scenarios, then probability weight the returns to determine our overall "expected" return. This approach allows us to not only analyze portfolios based on the expected case, but also to shock the portfolio under the various scenarios. We encourage you to read the latest Vantage Point to learn more about our economic projections.

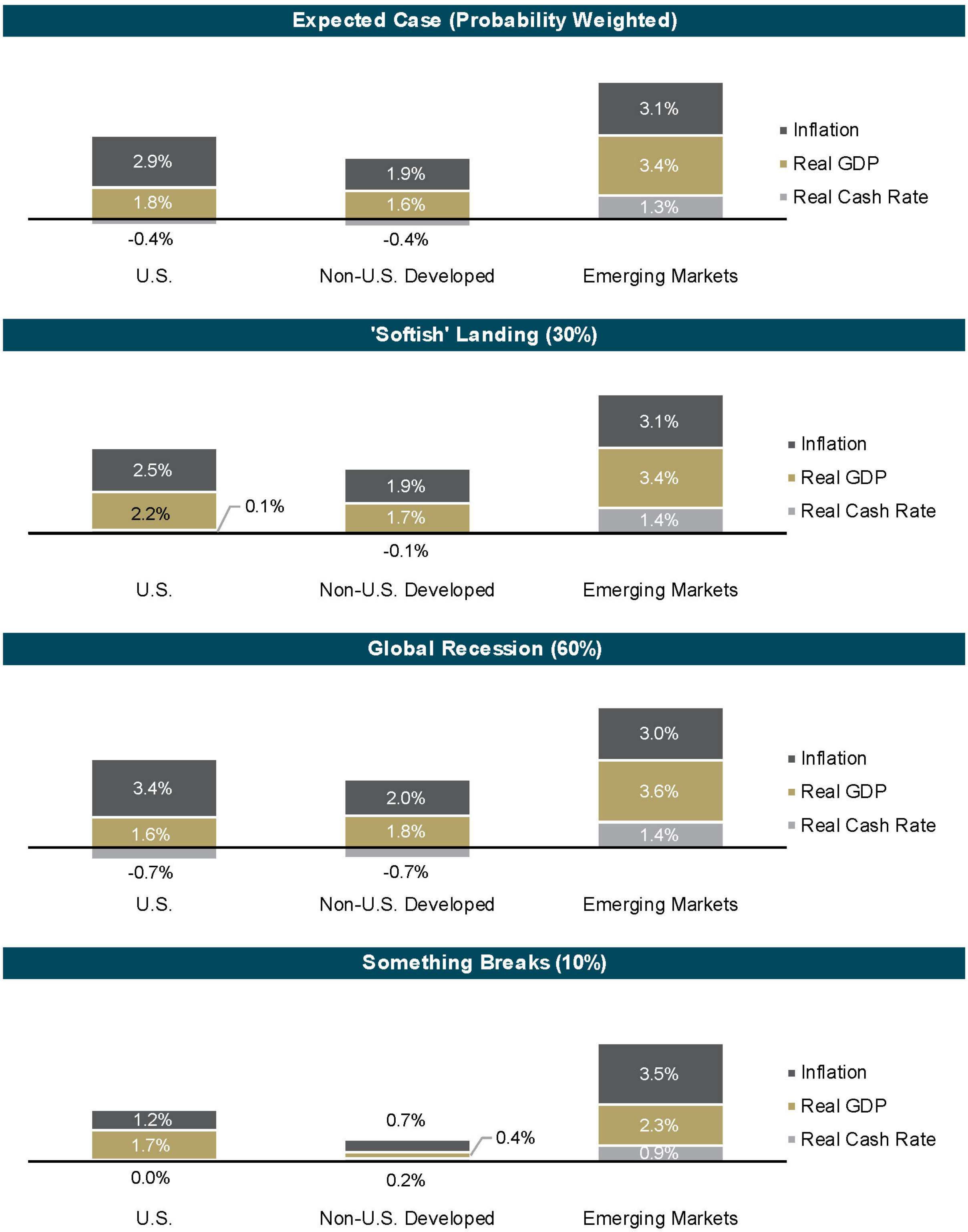
### Exhibit 7: Summary of Macroeconomic Scenarios

| 30% Probability | 60% Probability | 10% Probability |
|---|---|---|
| **'Softish' Landing** | **Global Recession** | **Something Breaks** |
| • Global financial conditions tighten only gradually as rate hikes slow, policy divergence cools, USD strengthening wanes, market liquidity stabilizes<br>• Disinflationary stars align perfectly for major economies, led by supply-side improvements<br>• Tight U.S. labor markets loosen with reduced job offers, but no significant jump in unemployment<br>• Europe imposes price-caps on gas and rapidly substitutes away from Russian energy supply and ECB slows its pace of rate hikes<br>• Wage increases subside, inflation expectations normalize in the U.S. and in Europe<br>• China eases zero-Covid policies<br>• Ukraine conflict is contained, with continuing reduction in food/commodity prices | • Europe slumps into a recession due to deepening energy shock - made worse by a messy energy and fiscal policy response as well as aggressive monetary tightening<br>• U.S. labor markets crack and unemployment rises steeply on more than expected Fed tightening<br>• China's zero-Covid stringency does not ebb and authorities struggle to keep the property sector afloat and domestic demand from crumpling<br>• Interest rates stay higher for longer, and any dovish pivot in monetary policy is pushed out to 2024 or beyond | • Hawkish policy tightening by the Fed materially weakens the U.S. labor market and exposes unforseen vulnerabilities in the U.S. and global economies<br>• Aggressive ECB tightening triggers a European debt crisis<br>• China encounters a banking crisis as domestic demand and confidence is undermined by inadequate countercyclical policies and structural adjustment<br>• Russia-Ukraine war escalates, energy prices spike much higher on threat of nuclear conflict<br>• Aggressive developed market policy-tightening or geopolitical crisis expose global economic and financial vulnerabilities |

Note: Percentages represent projected probabilities of each scenario occurring. The economic scenarios are provided by the BNY Mellon Global Economics and Investment Analysis team. Please refer to the Q4 2022 *Vantage Point* publication for the full analysis behind each economic scenario.

Three of the most critical economic metrics for developing our return assumptions are inflation, real GDP growth and real short-term interest rates/cash rates. Inflation and real GDP growth are key drivers of the expected earnings growth for equity. Projections of inflation and real cash rates are extremely influential in projecting fixed income yields and returns. Exhibit 8 outlines our projections for these primary buildings in the expected case and under the three macroeconomic scenarios outlined above.

## Exhibit 8: 10-Year Annualized Projections of Inflation, Real GDP Growth and Real Cash Rates

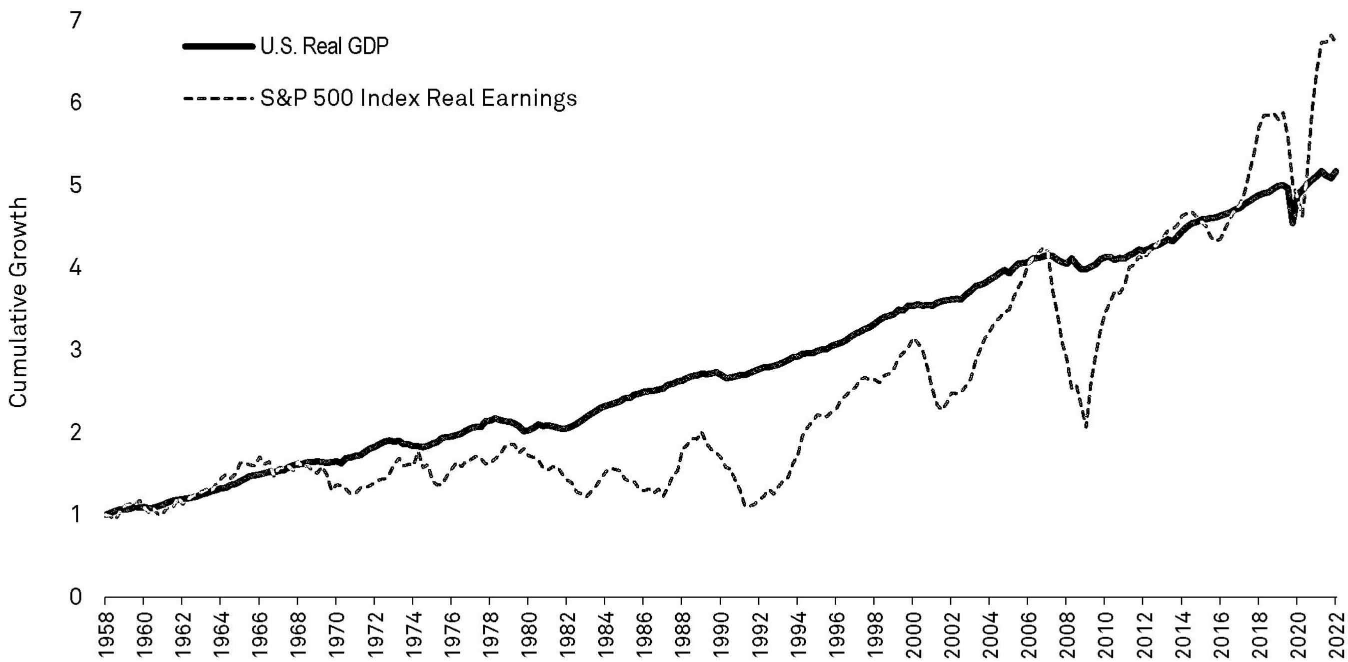



Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

# Equity Markets

Our equity assumptions are developed through a building-block approach consisting of inflation, real earnings growth, income return, valuation and currency adjustments. As a baseline assumption, we assume that real corporate earnings growth will be consistent with our projections for real GDP growth. As Exhibit 9 indicates, there has historically been a reasonably strong relationship between corporate earnings growth and GDP growth over a long-term time horizon.

Exhibit 9: U.S. GDP vs. Cumulative Corporate Earnings Growth



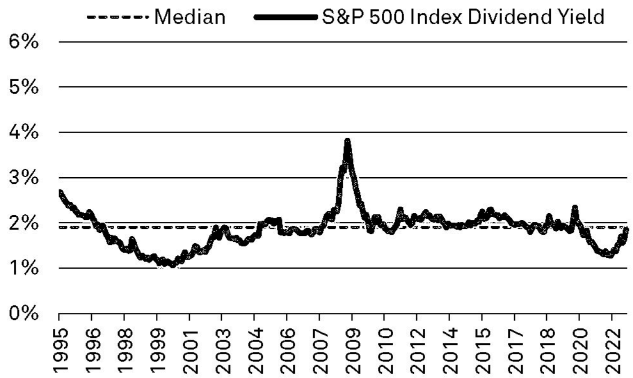

Source: BNY Mellon Investor Solutions, Bloomberg. Data as of September 30, 2022.

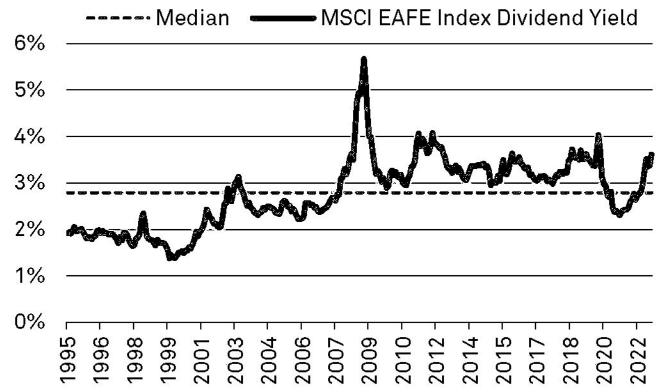
In the U.S., developed markets outside of the U.S. and emerging markets, we anticipate real earnings growth will be in line with our regional real GDP growth expectations. We anticipate real earnings growth of 1.8% in the U.S., 1.6% in the developed markets outside of the U.S. and 3.4% in emerging markets.

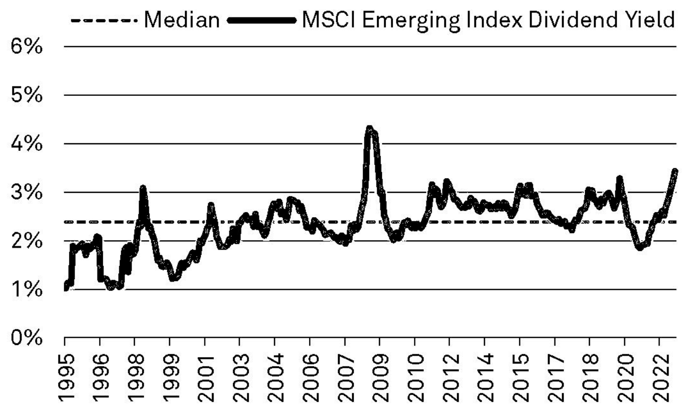
## Dividend Yield

Over the next 10 years, we expect dividend yields to be a blend of historical average yields and current yields in the market. We anticipate dividend yields of 1.8% in the U.S., 2.8% in the developed markets outside of the U.S. and 2.3% in emerging markets. These figures are in line with the long-term average dividend yields as shown in Exhibit 10 and current dividend yields.

## Exhibit 10: Historical Dividend Yield



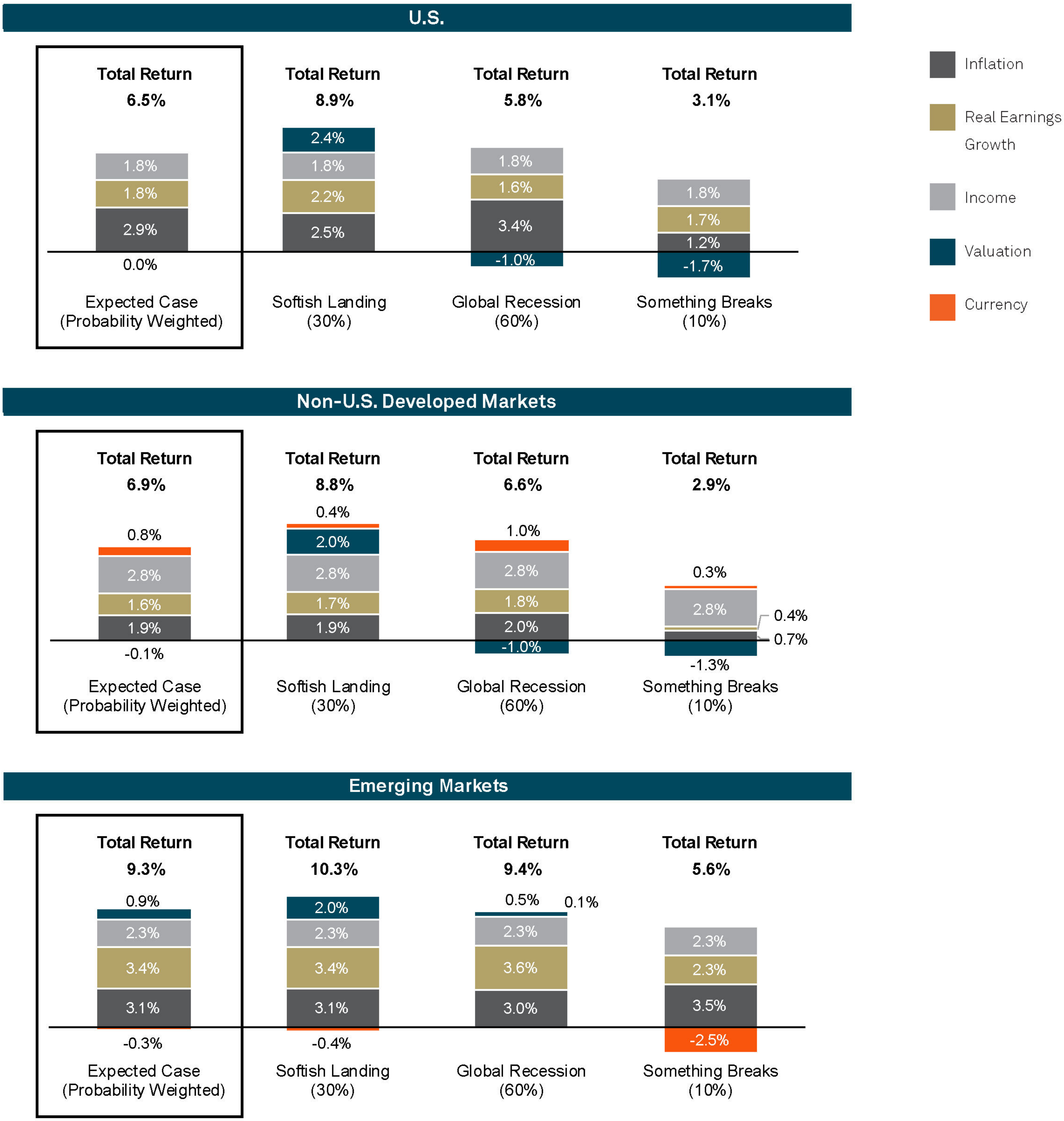




Source: BNY Mellon Investor Solutions, Bloomberg. Data as of September 30, 2022.

Once the primary equity building blocks of inflation, real earnings growth and income are established, we then adjust long-term returns for valuation and currency projections. Based on the three macroeconomic scenarios, we made a moderate adjustment for valuation (emerging markets) and currency shifts (non-U.S.). Exhibit 11 illustrates the equity market building blocks and return expectations under the three macroeconomic scenarios and the probability-weighted expected case.

In the U.S., we see a total expected return of 6.5% consisting of 2.9% inflation, 1.8% real earnings growth, 1.8% income and a negligible valuation component. For developed countries excluding the U.S., we see a total expected return of 6.9% consisting of 1.9% inflation, 1.6% real earnings growth, 2.8% income, negligible valuation adjustment and currency appreciation of 0.8%. For emerging markets, we see a total expected return of 9.3% consisting of 3.1% inflation, 3.4% real earnings growth, 2.3% income, 0.9% valuation adjustment and currency depreciation of -0.3%.

## Exhibit 11: 10-Year Equity Market Expected Returns (in USD)




Source: BNY Mellon Investor Solutions. Data as of September 30, 2022. Numbers may not add up due to rounding.

# Fixed Income Markets

Our fixed income return assumptions are derived from analyzing current yields in the market, projecting yields based on our three macroeconomic scenarios, reducing returns due to anticipated defaults and finally adjusting due to currency fluctuations.

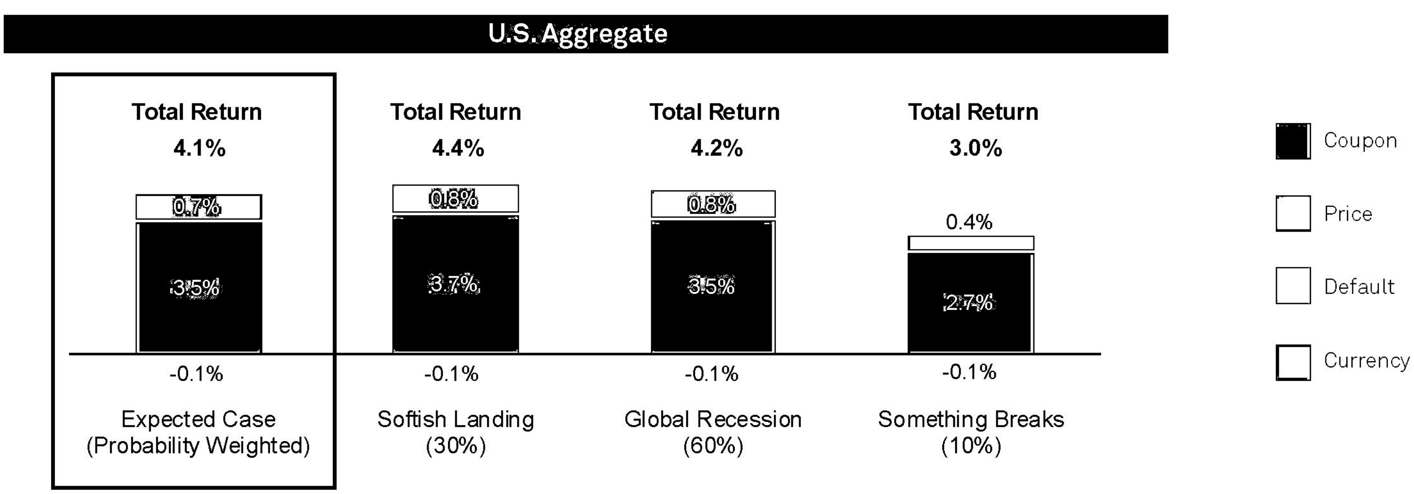
To forecast short-term interest rates, slope of the yield curve and credit spreads in the intermediate term (three years), we rely on the projections of our Chief Economist for several macroeconomic scenarios. Beyond the intermediate term, we assume these factors will migrate to market consensus expectations or to long-term historical averages.

For short-term interest rates in the U.S., we see a range of 0.25% to 4.25% over the next three years depending on the macroeconomic scenario. Beyond three years, we see short-term interest rates gradually migrating to long-term consensus expectations of 2.4%. For the U.S. 10-year Treasury note, we see a range of rates over the next three years of 1.1% to 3.9% with eventual migration to a long-term rate of 3.1% in 10 years.

Regarding credit risk, we see U.S. investment-grade credit spreads in a range of approximately 160 to 310 basis points over the next three years depending on the scenario. Over the long-term, we assume credit spreads migrate to historical long-term averages that are adjusted to eliminate skewing from extreme events such as the global financial crisis. For our baseline economic scenario, we assume default and recovery rates will be in line with historical long-term averages. For our pessimistic economic scenarios, we have increased default rates by as much as 50%.

Summarized in Exhibit 12 are the results of our fixed income return projections along with underlying components of return. In general, we project notably higher fixed income returns for most asset classes primarily due to higher yields in 2022 compared to 2021. In U.S. Aggregate, we expect a return of 4.1% over the next 10 years. For U.S. high yield, we see an expected return of 6.2%. We also see higher returns of 3.0% for Global Aggregate Ex-U.S. There will be some benefit due to an expected weakening U.S. dollar relative to other developed currencies. Emerging markets (EM) local currency is up slightly compared to the capital market assumptions with an expected return of 3.9%.

## Exhibit 12: 10-Year Fixed Income Market Expected Returns (in USD)

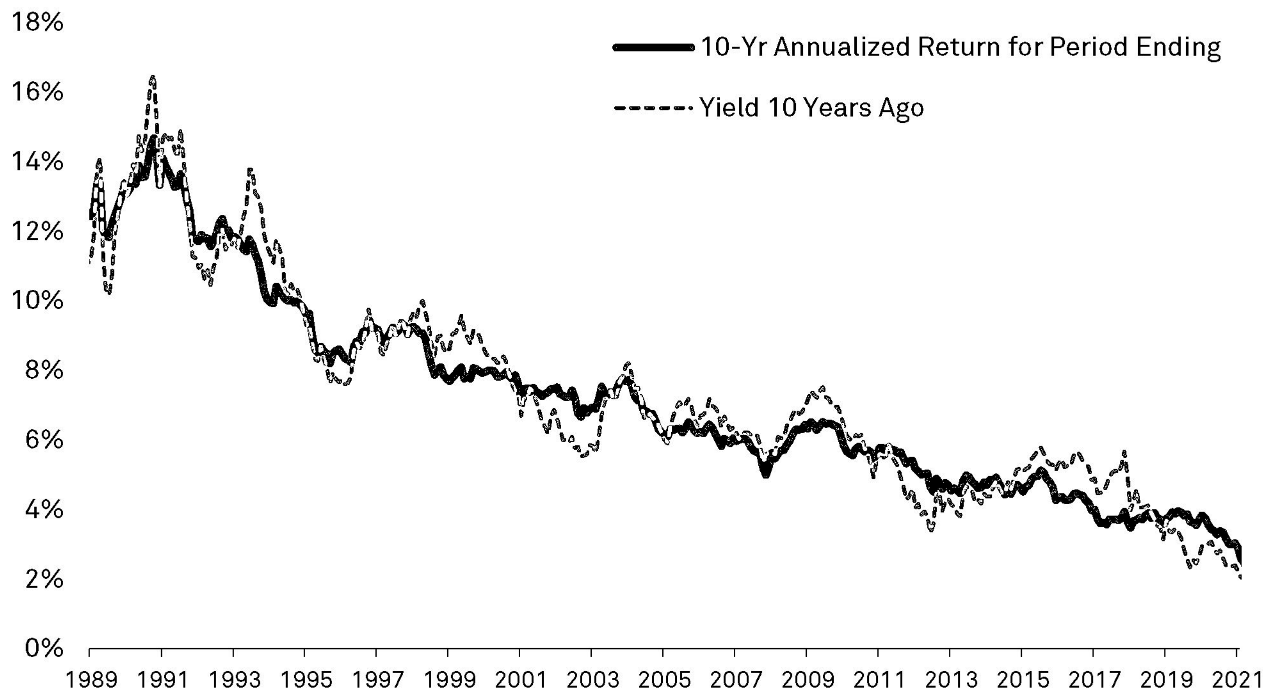



Source: BNY Mellon Investor Solutions. Data as of September 30, 2022. Numbers may not add up due to rounding.

# Comparing Fixed Income Returns to Yields

One technique to affirm our expected return assumptions for fixed income is to compare the returns to current yields in the market. Regardless of where projections indicate yields may go in the future, current yield has historically been a relatively strong indicator of future returns within fixed income. To demonstrate this point, Exhibit 13 shows rolling 10-year annualized returns of the Bloomberg Barclays U.S. Aggregate Index and compares those returns to the yield of the index at the beginning of the 10-year period. We have witnessed significant rate movements over the past 30 years, but the return of the U.S. bond market over 10 years is consistent with the yield of the market at the start of the period. Rarely is the difference more than +/- 1%. With current yields,[9] one should be skeptical of expected returns for U.S. bonds being significantly different than 4% to 5% based on a 10-year horizon. Our expected return for U.S. Aggregate is 4.1% over a 10-year horizon.

## Exhibit 13: U.S. Aggregate Index Returns vs. Starting Yields

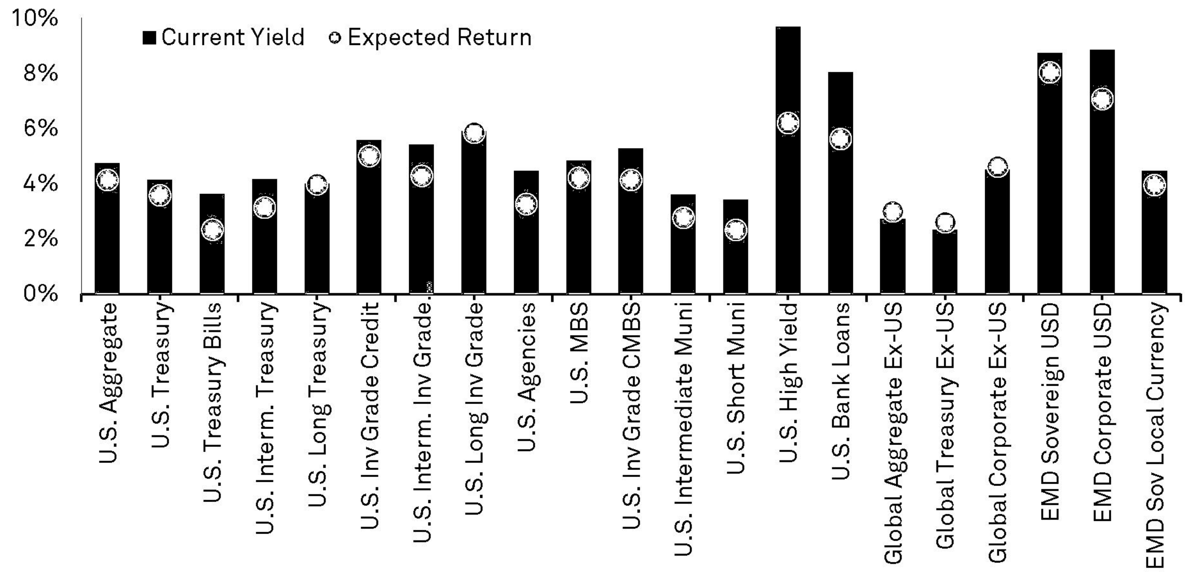



Source: BNY Mellon Investor Solutions, Bloomberg Barclays. Data as of September 30, 2022.

In Exhibit 14, we compare current yields across many fixed income sectors to our expected return assumptions. For most asset classes, the expected return is generally consistent with the current yield. One major exception is high yield fixed income and bank loans, where defaults result in a return less than the current yield.

[9]Current yields were 4.8% as of September 30, 2022.

Exhibit 14: Current Fixed Income Yields vs. Expected Returns




Source: BNY Mellon Investor Solutions, Bloomberg Barclays. Data as of September 30, 2022.

# Alternatives

We believe expected returns for alternative asset classes will generally be in line with publicly traded markets on a risk-adjusted basis, plus incremental return for alpha and liquidity. Manager skill is a critical component in this asset class, so an investor's selection of individual managers is of utmost importance. Our expectations below relate to the asset class in aggregate.

To calculate risk-adjusted returns, we first determine the beta of the asset class relative to public markets based on our expectations of return, standard deviations and correlations. We apply the beta to the public-market expected return to determine the expected return of the alternative asset class. For private markets, we add additional return to account for illiquidity. For hedge funds and other alpha-oriented asset classes, we add additional return to reflect the residual risk not captured by market returns. The additional return assumes an information ratio of 0.3 multiplied by the residual risk.

Exhibit 15 provides a summary of expected real returns (expected return in excess of expected inflation) for primary asset classes. The exhibit also compares how our expected real returns have changed from the 2022 assumptions to the 2023 assumptions. We have seen a substantial shift within fixed income, where an expected flat or positive returns after inflation is nobly different from expectations in 2022.

We point this out in our description of alternative investments because we believe alternatives should continue to play a much greater role going forward for long-term investors. While the traditional risk anchors of fixed income are now expected to generate flat or moderately positive real returns, investors should continue to evaluate additional strategies to complement fixed income. Taking advantage of liquidity premiums in areas such as private equity may be attractive to improve equity diversification and boost long-term potential returns.

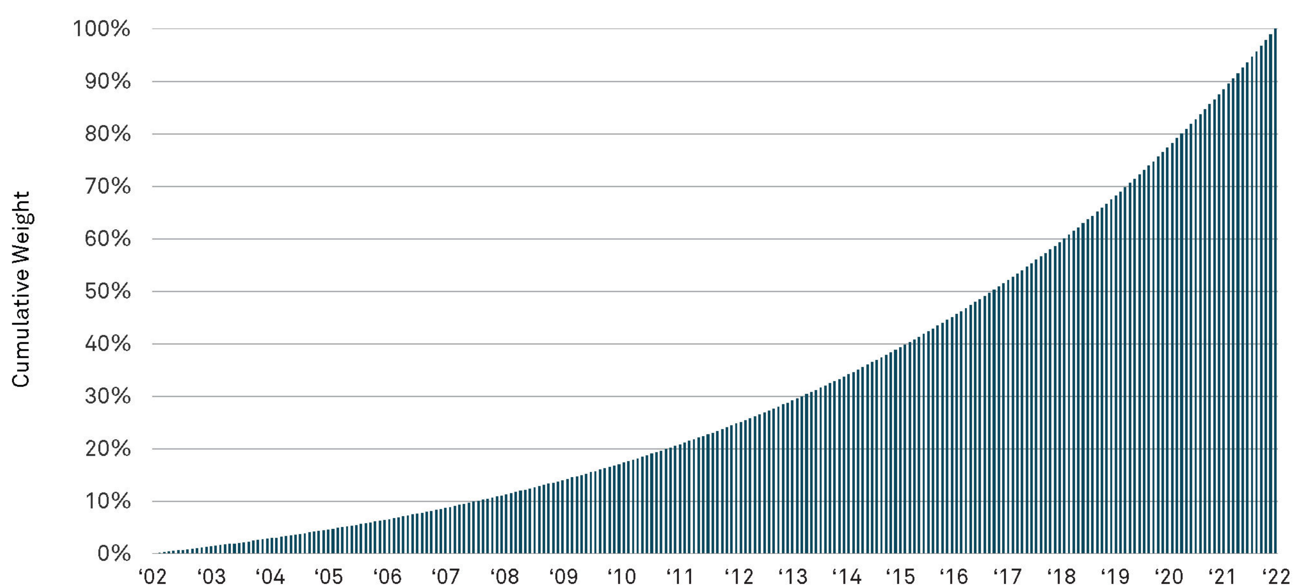
Exhibit 15: Asset Class Expected Real Return


Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

# Standard Deviations and Correlations

At a high level, our standard deviations and correlations are based on long-term historical returns with additional emphasis on near-term history. Especially with illiquid asset classes, we adjust for serial correlation and smoothing of historical asset returns. To determine standard deviations and correlations, we utilized exponential weighting of the last 20 years of monthly returns (see Exhibit 16). This approach ensures an appropriate covariance matrix and smooths out results on a year-by-year basis.

Exhibit 16: Historical Weighting for Standard Deviations and Correlations




Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

# Expected 10-Year Returns and Standard Deviations

| | Asset Class | Representative Index | Expected Return | Standard Deviation |
|---|---|---|---|---|
| Equity | U.S. Equity | Russell 3000 | 6.5% | 18.0% |
| | U.S. Large Cap Equity | Russell 1000 | 6.4% | 17.8% |
| | U.S. Mid Cap Equity | Russell Midcap | 6.8% | 19.7% |
| | U.S. Small Cap Equity | Russell 2000 | 7.1% | 22.3% |
| | U.S. Micro Cap Equity | Dow Jones Wilshire U.S. Micro-Cap | 6.9% | 23.8% |
| | Global Equity | MSCI ACWI | 6.9% | 17.1% |
| | International Developed Equity | MSCI World Ex-U.S. | 6.9% | 17.1% |
| | International Small Cap Equity | MSCI World Ex-U.S. Small Cap | 7.3% | 19.5% |
| | Global Emerging Markets Equity | MSCI Emerging | 9.3% | 20.0% |
| | U.S. REIT | FTSE NAREIT Equity | 6.2% | 21.8% |
| | Global REIT | FTSE EPRA/NAREIT Developed Index | 6.8% | 19.6% |
| Fixed Income | U.S. Aggregate | Bloomberg Barclays U.S. Aggregate | 4.1% | 4.3% |
| | U.S. Treasury | Bloomberg Barclays U.S. Treasury | 3.6% | 4.6% |
| | U.S. Treasury Bills | Bloomberg Barclays U.S. Treasury Bills 3-6 Months | 2.3% | 0.4% |
| | U.S. Intermediate Treasury | Bloomberg Barclays U.S. Intermediate Treasury | 3.1% | 3.1% |
| | U.S. Long Treasury | Bloomberg Barclays U.S. Long Treasury | 4.0% | 12.4% |
| | U.S. Investment Grade Credit | Bloomberg Barclays U.S. Credit | 5.0% | 6.4% |
| | U.S. Intermediate Inv Grade Credit | Bloomberg Barclays U.S. Intermediate Credit | 4.3% | 4.4% |
| | U.S. Long Investment Grade Credit | Bloomberg Barclays U.S. Long Credit | 5.9% | 11.3% |
| | U.S. TIPS | Bloomberg Barclays U.S. Govt Inflation-Linked | 4.4% | 6.2% |
| | U.S. Agencies | Bloomberg Barclays U.S. Agencies | 3.3% | 3.1% |
| | U.S. MBS | Bloomberg Barclays U.S. MBS | 4.2% | 3.9% |
| | U.S. Investment Grade CMBS | Bloomberg Barclays CMBS Investment Grade | 4.1% | 6.6% |
| | U.S. Intermediate Municipal | Bloomberg Barclays Municipal Bond Intermediate (5-10) | 2.8% | 4.3% |
| | U.S. Short Municipal | Bloomberg Barclays Municipal Bond Short (1-5) | 2.3% | 2.0% |
| | U.S. High Yield | Bloomberg Barclays U.S. Corporate High Yield | 6.2% | 9.4% |
| | U.S. Bank Loans | S&P/LSTA Leveraged Loan | 5.6% | 6.9% |
| | Global Aggregate Ex-US | Bloomberg Barclays Global Aggregate ex-USD | 3.0% | 7.9% |
| | Global Treasury Ex-US | Bloomberg Barclays Global Treasury ex-U.S. | 2.6% | 8.0% |
| | Global Corporate Ex-US | Bloomberg Barclays Global Agg ex USD: Corporate | 4.6% | 9.6% |
| | Emerging Mkts Sovereign USD | Bloomberg Barclays EM USD Aggregate: Sovereign | 8.0% | 9.7% |
| | Emerging Mkts Corporate USD | Bloomberg Barclays: EM USD Aggregate: Corporate | 7.1% | 9.2% |
| | Emerging Mkts Sovereign Local | Bloomberg Barclays EM Local Currency Government | 4.0% | 9.5% |
| Alternatives | Absolute Return[1,2] | HFRX Global Hedge Fund | 4.3% | 5.0% |
| | Hedge Funds[1,2] | HFRI Fund Weighted Composite | 4.9% | 6.9% |
| | Hedge Funds - Equity Hedge[1,2] | HFRI Equity Hedge | 5.8% | 9.6% |
| | Hedge Funds - Event Driven[1,2] | HFRI Event-Driven | 5.4% | 7.8% |
| | Hedge Funds - Macro[1,2] | HFRI Macro | 4.2% | 5.1% |
| | Hedge Funds - Relative Value[1,2] | HFRI Relative Value | 4.4% | 5.1% |
| | Hedge Funds - Managed Futures[1,2] | Credit Suisse Managed Futures Liquid Index | 5.1% | 10.8% |
| | Commodities | Bloomberg Commodity Index | 2.9% | 16.6% |
| | Global Natural Resources Equity | S&P Global Natural Resources | 6.4% | 22.9% |
| | Energy Infrastructure | Alerian MLP | 7.2% | 34.0% |
| | U.S. Private Equity[1,2] | Cambridge Associates LLC U.S. Private Equity | 8.2% | 21.3% |
| | U.S. Core Real Estate[2] | NCREIF ODCE Index | 6.0% | 8.5% |
| | Real Assets[3] | Blended Benchmark | 4.8% | 12.4% |

Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.
[1] Consistent with the Representative Index, returns are net of management fees.
[2] The Representative Index is not investable. Returns are based on manager averages. Actual results may vary significantly.
[3] Represents a weighted average of 1/3 U.S. TIPS, 1/3 Commodities, 1/9 Global REIT, 1/9 Natural Resources, 1/9 Infrastructure.

# Expected Correlations

| | | Equity | | | | Fixed Income | | | | | | | | | | | Alternatives | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | U.S. Equity | International Developed Equity | Emerging Equity | Global REIT | U.S. Aggregate | U.S. Treasury | U.S. Treasury Bills | U.S. Investment Grade Credit | U.S. TIPS | U.S. MBS | U.S. Intermediate Municipal | U.S. High Yield | Global Aggregate Ex-US | Emerging Markets Sovereign USD | Emerging Markets Sovereign LC | Absolute Return | Commodities | Energy Infrastructure | U.S. Private Equity | U.S. Core Real Estate |
| Equity | U.S. Equity | 1.00 | 0.88 | 0.74 | 0.83 | 0.28 | -0.05 | -0.19 | 0.52 | 0.39 | 0.24 | 0.26 | 0.78 | 0.44 | 0.64 | 0.53 | 0.79 | 0.47 | 0.62 | 0.91 | 0.39 |
| | International Developed Equity | 0.88 | 1.00 | 0.92 | 0.84 | 0.28 | -0.06 | -0.13 | 0.53 | 0.39 | 0.22 | 0.27 | 0.80 | 0.57 | 0.72 | 0.72 | 0.82 | 0.58 | 0.59 | 0.81 | 0.39 |
| | Emerging Equity | 0.74 | 0.92 | 1.00 | 0.72 | 0.26 | -0.05 | -0.08 | 0.50 | 0.37 | 0.19 | 0.23 | 0.73 | 0.56 | 0.69 | 0.76 | 0.76 | 0.56 | 0.52 | 0.69 | 0.34 |
| | Global REIT | 0.83 | 0.84 | 0.72 | 1.00 | 0.41 | 0.10 | -0.15 | 0.63 | 0.52 | 0.31 | 0.39 | 0.79 | 0.56 | 0.72 | 0.66 | 0.70 | 0.48 | 0.56 | 0.73 | 0.45 |
| Fixed Income | U.S. Aggregate | 0.28 | 0.28 | 0.26 | 0.41 | 1.00 | 0.90 | 0.17 | 0.89 | 0.83 | 0.91 | 0.79 | 0.43 | 0.71 | 0.64 | 0.46 | 0.13 | -0.04 | 0.09 | 0.24 | 0.21 |
| | U.S. Treasury | -0.05 | -0.06 | -0.05 | 0.10 | 0.90 | 1.00 | 0.29 | 0.64 | 0.71 | 0.82 | 0.64 | 0.05 | 0.56 | 0.33 | 0.24 | -0.18 | -0.25 | -0.21 | -0.06 | 0.10 |
| | U.S. Treasury Bills | -0.19 | -0.13 | -0.08 | -0.15 | 0.17 | 0.29 | 1.00 | -0.01 | 0.03 | 0.21 | 0.04 | -0.16 | 0.11 | -0.05 | 0.01 | -0.19 | -0.16 | -0.24 | -0.11 | -0.04 |
| | U.S. Investment Grade Credit | 0.52 | 0.53 | 0.50 | 0.63 | 0.89 | 0.64 | -0.01 | 1.00 | 0.79 | 0.71 | 0.77 | 0.70 | 0.72 | 0.82 | 0.59 | 0.45 | 0.16 | 0.38 | 0.45 | 0.25 |
| | U.S. TIPS | 0.39 | 0.39 | 0.37 | 0.52 | 0.83 | 0.71 | 0.03 | 0.79 | 1.00 | 0.74 | 0.68 | 0.52 | 0.69 | 0.64 | 0.54 | 0.29 | 0.24 | 0.22 | 0.30 | 0.22 |
| | U.S. MBS | 0.24 | 0.22 | 0.19 | 0.31 | 0.91 | 0.82 | 0.21 | 0.71 | 0.74 | 1.00 | 0.71 | 0.33 | 0.64 | 0.51 | 0.36 | 0.01 | -0.03 | 0.03 | 0.21 | 0.18 |
| | U.S. Intermediate Municipal | 0.26 | 0.27 | 0.23 | 0.39 | 0.79 | 0.64 | 0.04 | 0.77 | 0.68 | 0.71 | 1.00 | 0.47 | 0.57 | 0.64 | 0.41 | 0.17 | -0.01 | 0.17 | 0.20 | 0.18 |
| | U.S. High Yield | 0.78 | 0.80 | 0.73 | 0.79 | 0.43 | 0.05 | -0.16 | 0.70 | 0.52 | 0.33 | 0.47 | 1.00 | 0.54 | 0.81 | 0.62 | 0.74 | 0.50 | 0.62 | 0.71 | 0.40 |
| | Global Aggregate Ex-US | 0.44 | 0.57 | 0.56 | 0.56 | 0.71 | 0.56 | 0.11 | 0.72 | 0.69 | 0.64 | 0.57 | 0.54 | 1.00 | 0.68 | 0.80 | 0.34 | 0.32 | 0.23 | 0.37 | 0.24 |
| | Emerging Markets Sovereign USD | 0.64 | 0.72 | 0.69 | 0.72 | 0.64 | 0.33 | -0.05 | 0.82 | 0.64 | 0.51 | 0.64 | 0.81 | 0.68 | 1.00 | 0.73 | 0.60 | 0.38 | 0.44 | 0.58 | 0.32 |
| | Emerging Markets Sovereign LC | 0.53 | 0.72 | 0.76 | 0.66 | 0.46 | 0.24 | 0.01 | 0.59 | 0.54 | 0.36 | 0.41 | 0.62 | 0.80 | 0.73 | 1.00 | 0.48 | 0.45 | 0.38 | 0.46 | 0.26 |
| Alternatives | Absolute Return[1,2] | 0.79 | 0.82 | 0.76 | 0.70 | 0.13 | -0.18 | -0.19 | 0.45 | 0.29 | 0.01 | 0.17 | 0.74 | 0.34 | 0.60 | 0.48 | 1.00 | 0.56 | 0.61 | 0.73 | 0.28 |
| | Commodities | 0.47 | 0.58 | 0.56 | 0.48 | -0.04 | -0.25 | -0.16 | 0.16 | 0.24 | -0.03 | -0.01 | 0.50 | 0.32 | 0.38 | 0.45 | 0.56 | 1.00 | 0.49 | 0.40 | 0.18 |
| | Energy Infrastructure | 0.62 | 0.59 | 0.52 | 0.56 | 0.09 | -0.21 | -0.24 | 0.38 | 0.22 | 0.03 | 0.17 | 0.62 | 0.23 | 0.44 | 0.38 | 0.61 | 0.49 | 1.00 | 0.56 | 0.09 |
| | U.S. Private Equity[1,2] | 0.91 | 0.81 | 0.69 | 0.73 | 0.24 | -0.06 | -0.11 | 0.45 | 0.30 | 0.21 | 0.20 | 0.71 | 0.37 | 0.58 | 0.46 | 0.73 | 0.40 | 0.56 | 1.00 | 0.42 |
| | U.S. Core Real Estate[2] | 0.39 | 0.39 | 0.34 | 0.45 | 0.21 | 0.10 | -0.04 | 0.25 | 0.22 | 0.18 | 0.18 | 0.40 | 0.24 | 0.32 | 0.26 | 0.28 | 0.18 | 0.09 | 0.42 | 1.00 |

Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

[1] Consistent with the Representative Index, returns are net of management fees.

[2] The Representative Index is not investable. Returns are based on manager averages. Actual results may vary significantly.

Only a subset of the asset classes is shown in the matrix above. A full correlation matrix is available upon request.

For illustrative purposes only. There can be no assurance that the expected returns listed above will be achieved.

# Importance of Capital Market Assumptions

Capital market assumptions are the initial building block for the development of an investor's strategic asset allocation (SAA). SAA, or policy portfolio design, serves a central role as the touchstone of multi-asset investment, transforming long-term, forward-looking market forecasts into enduring portfolio allocations. However, forecasting is an inherently error-prone endeavor because financial market performance exhibits a high degree of uncertainty. These forecast errors become even more protracted as time horizons extend.

Thus, when designing a policy portfolio to weather the highs and lows of the coming market cycle, we propose investors consider a "robust" portfolio, rather than an "optimal" one. By building a portfolio that is intended to withstand the test of time, while being robust to forecast error and intertemporal forecast noise, we seek to ensure that investors have the highest probability of achieving their objectives. To learn more about how BNY Mellon utilizes our capital market assumptions and robust strategic asset allocation process to help our clients solve their investment challenges, please contact a BNY Mellon Investor Solutions representative.

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## Calendar Year 2023

# 10-Year Capital Market Assumptions

## Key Takeaways

- Volatile markets and asset repricing during 2022 have driven significant changes to our 2023 forecasts relative to our 2022 outlook.
- The majority of our 2023 10-Year Capital Market Assumptions (CMAs) forecast higher expected returns across most asset classes when compared to 2022 assumptions (see Exhibit 1).
- Equity market expected returns have increased due to slightly higher long-term growth rates and upward valuation adjustments (most notably in emerging markets).
- Fixed income asset class expected returns have reverted to levels not seen in many years, significantly higher when compared to 2022 given the dramatic increase in global bond yields.
- Alternative asset class expected returns are generally higher and in line with publicly traded markets on a risk-adjusted basis plus incremental return for alpha and illiquidity.

# Overview

On an annual basis, BNY Mellon Investor Solutions, LLC develops capital market return assumptions (CMAs) for approximately 50 asset classes around the world. The assumptions are based on a 10-year investment time horizon and incorporate the macroeconomic forecasts generated by BNY Mellon Investment Management Global Economic and Investment Analysis Group. The return and risk assumptions are intended to guide investors in the development of long-term strategic asset allocations.

Slowing global economic growth and the persistence of elevated inflation have weighed heavily on market returns in 2022. With limited evidence of victory in their battle against inflation, monetary policymakers have remained resolute in their hawkish view and continue with tightening monetary policy. There have been few "safe-haven" assets in 2022, regardless of asset class, geography, market cap, style, credit quality and/or duration. However, looking forward, the increased market volatility and asset repricing during 2022 have driven notable changes to our 2023 forecasts relative to our forecasts just a year ago.

## Exhibit 1: Snapshot of 2023 vs. 2022 10-Year Capital Market Return Assumptions

| | | 2023 | | 2022 | |
|---|---|---|---|---|---|
| | | Expected Return | Standard Deviation | Expected Return | Standard Deviation |
| Equity Markets | U.S. Equity | 6.5% | 18.0% | 5.9% | 17.4% |
| | International Developed | 6.9% | 17.1% | 5.8% | 17.4% |
| | Emerging Markets | 9.3% | 20.0% | 7.6% | 21.2% |
| Fixed Income | U.S. Aggregate | 4.1% | 4.3% | 1.2% | 3.4% |
| | U.S. High Yield | 6.2% | 9.4% | 1.9% | 9.0% |
| | U.S. Intermediate Municipal | 2.8% | 4.3% | 0.9% | 3.8% |
| | Global Agg. Ex-U.S. | 3.0% | 7.9% | 0.3% | 7.3% |
| | EM Local Currency | 4.0% | 9.5% | 3.8% | 9.8% |
| Alternatives | Absolute Return | 4.3% | 5.0% | 3.2% | 5.2% |
| | Hedge Funds | 4.9% | 6.9% | 3.9% | 7.0% |
| | U.S. Private Equity | 8.2% | 21.3% | 7.9% | 20.5% |
| | U.S. Core Real Estate | 6.0% | 8.5% | 4.7% | 8.1% |

Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

## A Time-Tested Approach That Approximates Real-World Results

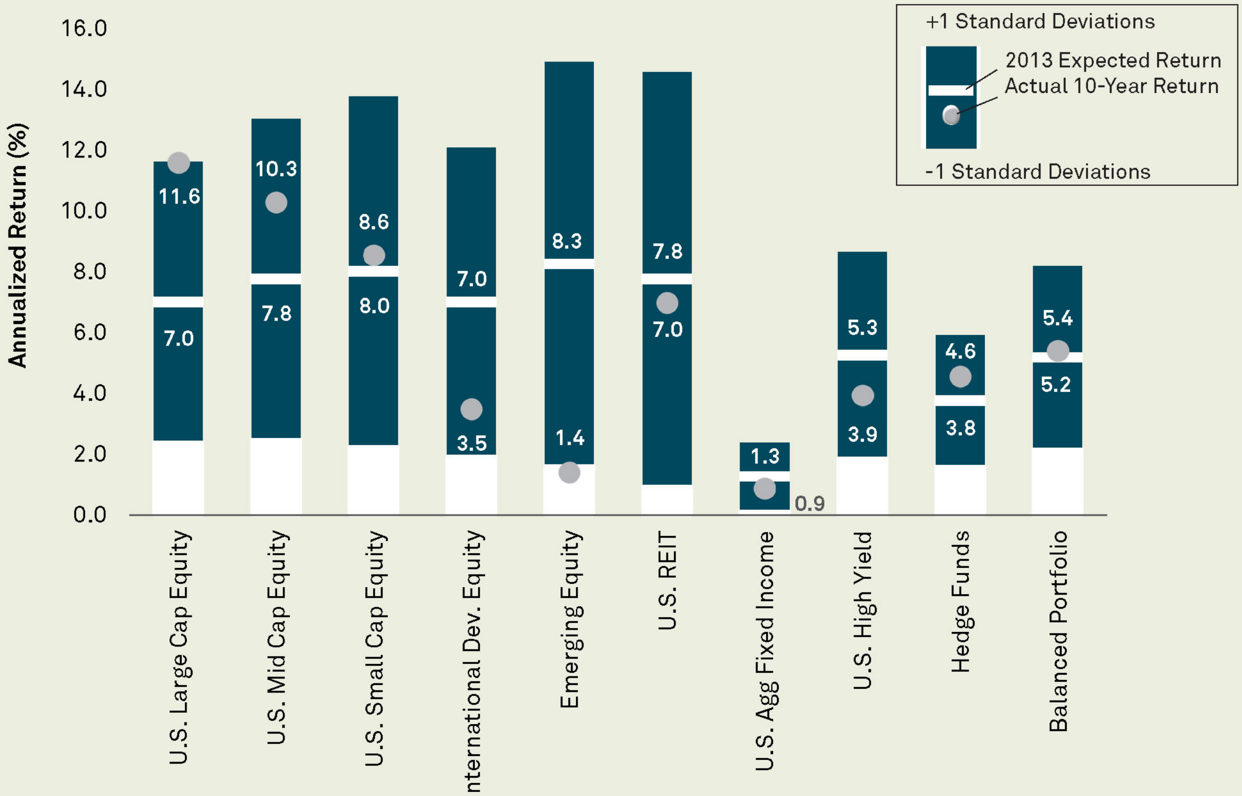
For decades, BNY Mellon has developed capital market assumptions to guide our institutional and high net worth clients in structuring their long-term asset allocations. In our opinion, capital market forward-looking return expectations must be validated against realized market returns. We continually look back and test our assumptions to assess accuracy, and improve our methodology.

Over the past five calendar years, we have back-tested our methodology and found that our 10-year projected returns, with the exception of emerging market equities (where we were too optimistic), were a close representation of actual returns for most asset classes. Exhibit 2 shows a comparison between our published 2013 capital market assumptions and actual returns over the past 10 years. The white lines represent our expected returns from 10 years ago, with the top and bottom of the bars representing plus and minus one standard deviation from the expected return. Actual returns over the past 10 years are represented by the circles. As the chart demonstrates, actual returns for each asset class (except emerging markets equities) and our expected returns fell within the one standard deviation range. Actual returns for U.S. equity were generally higher than expected, and the opposite held true for emerging markets equity. Expected returns for fixed income were extremely close to actual returns. Hedge funds slightly outperformed expectations, although we acknowledge there is significant dispersion with individual hedge fund returns relative to the broad HFRI Index.

Most importantly, the analysis also demonstrates the value of how CMAs are used for the construction of diversified portfolios. A balanced portfolio, based on our estimate of a "typical" institutional investment portfolio comprised of 55% equity, 30% fixed income, and 15% alternatives, had an expected return of 5.2% compared to the actual return of 5.4%. Though certain asset classes – especially those with high volatility – can be challenging to predict individually, a well-diversified portfolio can be relatively predictable over the long term.

The balanced portfolio presented herein is not representative of a specific strategy managed by BNY Mellon Investor Solutions, LLC as of the date of this publication and is not intended to constitute an advertisement of a specific BNY Mellon Investor Solutions, LLC product or service; instead, all information, content, and materials are for general informational purposes only.

Exhibit 2: 2013 Capital Market Return Assumptions vs. Actual 10-Year Returns Ending 9/30/2022




Source: BNY Mellon Investor Solutions, Bloomberg. Data as of September 30, 2022.

The remainder of the document discusses broad market themes/trends to watch, outlines the assumptions in depth and provides supporting details behind the numbers. We hope you find our 2023 10-Year Capital Market Return Assumptions both interesting and insightful.

# Key Themes for the Next Decade

There is a multitude of themes and trends, on both the short and long-term horizon, that may notably impact capital market returns and risk in the years to come. To what degree these themes ultimately shape future asset returns remains to be seen. But this uncertainty further supports the need for investors to consider robust portfolio design to navigate long-term unforeseen circumstances over traditional mean variance-driven outcomes that assume all inputs are known perfectly in advance.

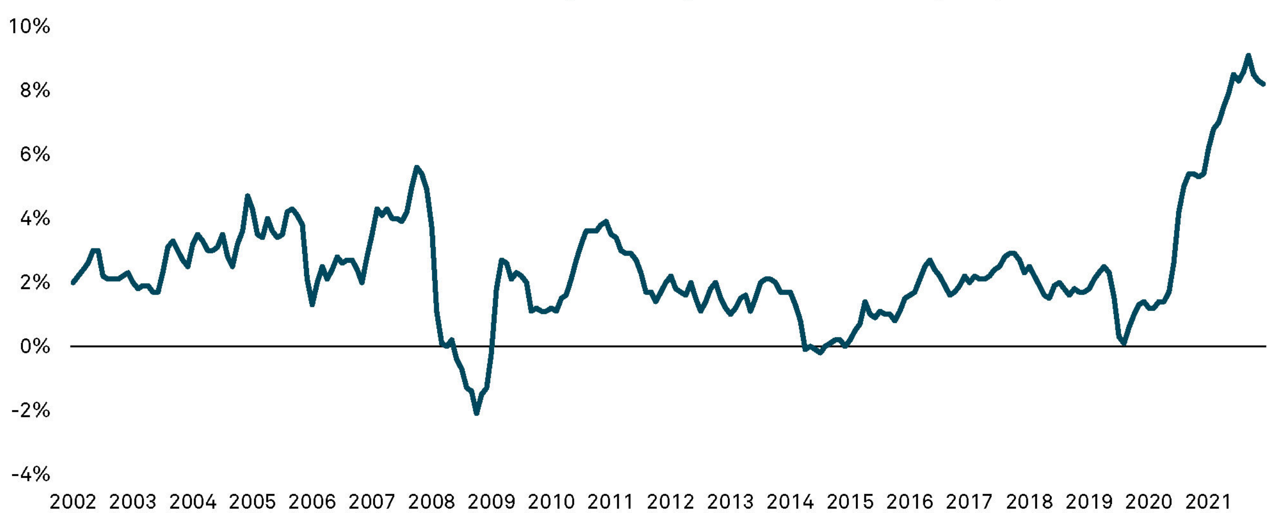
**Key Takeaways**

- Continued geopolitical tensions will likely result in further deglobalization and reshoring, impacting variable costs, inflation, corporate margins and investor returns.
- The complex, uncertain and systemic nature of ESG issues makes it challenging to quantify top-down. In short, it is still too early to accurately assess the impact of ESG issues from a top-down strategic asset allocation perspective.
- The long-term impact of these broader themes on asset returns and risk levels will continue to be evaluated by investors and ultimately remains to be seen.

## Geopolitical Tensions and Inflation

The policy shift by the Federal Open Market Committee (FOMC), to average inflation targeting in August 2020, was introduced with the understanding that inflation would likely run above 2% for some time as an offset to lower inflation readings in preceding years. While facing increasing levels of inflation in early through mid-2021, the Fed further asserted in its statements that inflation would be transitory due to the confluence of pent-up demand and supply chains still in recovery from global covid pandemic lockdowns. Early in 2022, major economies began reporting historic levels of year-over-year (YoY) inflation. The U.S. Consumer Price Index (CPI) touched a 40-year high (see Exhibit 3), which was further exacerbated by Russia's invasion of Ukraine.

Exhibit 3: U.S. CPI, 12-Month Percentage Change, Not Seasonally Adjusted



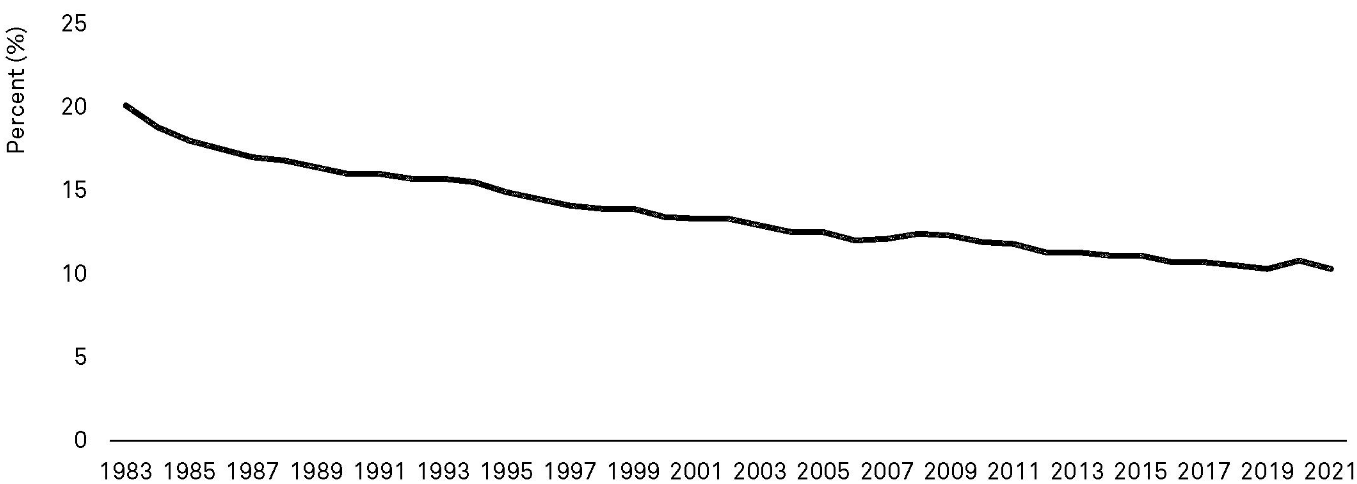

Source: Bureau of Labor Statistics. Data as of September 30, 2022.

The rapid escalation of the Russia/Ukraine war led to immense market volatility following unprecedented sanctions from numerous G7 countries. The United Kingdom and Europe, net importers of energy and heavily dependent on Russian supply, vowed to reduce dependency on Russian exports. These new restrictions and policy shifts resulted in a historic surge in energy and, in turn, consumer prices that were already at multi-decade elevated levels. These supply-driven inflationary pressures from left tail risk events – in the form of geopolitical tensions and supply chain woes – were and continue to be largely out of the control of major central banks.

Tight labor markets have added to the inflationary narrative and monopolized 2022 headlines, becoming the focal point for major central banks seeking to ease demand. Within the U.S., unemployment reached a historic low of 3.5% in tandem with a startling number of job openings that was nearly double the number of unemployed workers.

As central banks continue their tightening cycle, we expect this worker shortage to normalize as the economy slows; however, the labor environment has generally allowed workers more leverage when negotiating compensation and benefits. Among many notable impacts is an increase in unionization efforts for labor forces within multiple large corporations during 2022.[1] Even though the U.S. is far from its peak of employee union membership in the early 1980s (see Exhibit 4), an upward trend of reshoring could see a rise in unionization and increase labor costs.

## Exhibit 4: Share of Wage and Salary Workers (16 and Over) Who Are Members of Unions




Source: Bureau of Labor Statistics. Data as of December 31, 2021.

The tenuous geopolitical environment of 2022 accelerated efforts by international companies to reduce the impact of conflict and political discourse on supply chains. The uncertain risk of importing natural resources from emerging market countries has shifted the need for corporations to reshore production, with agility and reliability among the drivers of change. Consequently, reestablishing manufacturing domestically for international companies will likely lead to higher labor costs and potentially tighter corporate margins. Although the reduced volatility of variable costs may correlate to more predictable costs of goods sold, the increased costs of labor may lead to higher prices for consumers as companies seek to pass through increased input prices to maintain margins.

[1] Harrison, D., Haddon, H. (2022, July 12). Union Organizing Efforts Rise in First Half of Year. Wall Street Journal.

If the trend of deglobalization and reshoring persists, we believe long-term inflation may trend higher than the 2% average the Fed is aiming for. The retreat of corporations and sovereign nations from the reliance of foreign natural resources by the U.S. and other developed market countries may put pressure on emerging market countries once supply chains normalize. This could reduce variable cost volatility and may increase corporate margins.

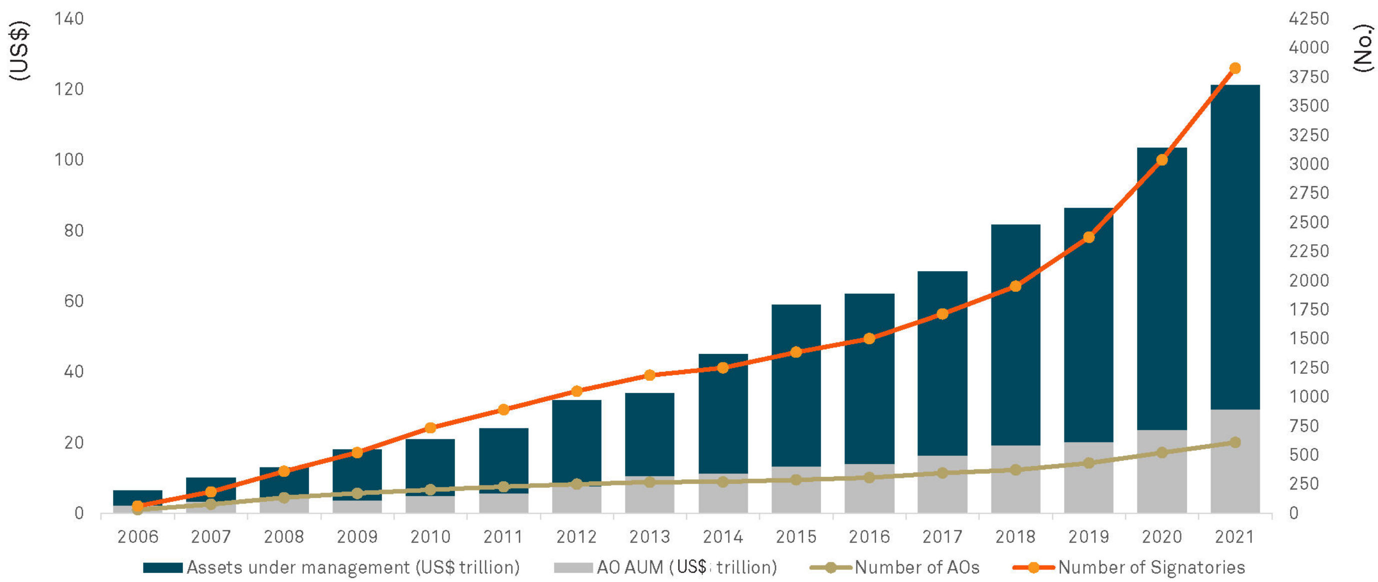
## Responsible Investing[2]

According to the U.S. Forum for Sustainable and Responsible Investing (USSIF), assets under management in the U.S. that incorporate any form of Environmental, Social and Governance (ESG) considerations, grew 42% from 2018 to 2020 to $17.1 trillion.[3]

In addition, the Global Sustainable Investing Alliance (GSIA), an international collaboration of membership-based sustainable investing organizations, reported in its 2020 Global Sustainable Investment Review[4] that sustainable investment assets under management reached USD 35.3 trillion, representing 36% of all professionally managed assets across regions covered by the report.

Since this data was reported, an unprecedented pandemic, heightened social inequity issues and a global geopolitical crisis have all arguably increased the pressure on Corporate America to focus on ESG issues, particularly inclusive work practices and a transition to a low-carbon economy. Governance & Accountability Institute's 2021 Sustainability Reporting in Focus report stated that 92% of S&P 500 companies and 70% of the Russell 1000 companies published a Sustainability report in 2020.[5] Separately, the United Nations backed Principles of Responsible Investing, the world's largest voluntary sustainability initiative, has reached 4000 signatories, including leading asset owners, asset managers and other service providers committed to incorporating an assessment of ESG issues in their investment processes. Over 2021, the number of PRI investor signatories increased by 26%, while the collective AUM represented by both the investor signatories and service providers increased by 17%.[6]

### Exhibit 5: Sustainable Investing Assets Under Management and PRI Signatories




Source: US SIF 2020 Report on U.S. Sustainable, Responsible and Impact Investing Trends.

[2]At BNY Mellon Investor Solutions, we refer to Responsible Investing as an umbrella term encompassing all forms of approaches clients can utilize to evaluate ESG considerations, or their sustainability and/or impact objectives alongside their investment goals.

[3]U.S. SIF Report on U.S. Sustainable and Impact Investing Trends 2020.

[4]Global Sustainable Investment Review 2020.

[5]G&A 10th Anniversary Report Finds All-Time Highs for Sustainability Reporting of Largest U.S. Public Companies November 2021.

[6]PRI Annual Report 2021.

Even with all this momentum, most traditional efforts to incorporate ESG issues in the investment process have been a bottom-up process (e.g., at the security, company or manager level). The efforts to assess ESG from a top-down strategic asset allocation perspective are still nascent, largely due to the limitations and challenges around lack of standard disclosure and poor quality of ESG data.

In the case of climate risks assessment, there have been attempts to assess the impact of climate risks from a top-down perspective. The Task Force on Climate-related Financial Disclosures (TCFD) recommendations also suggests investors undertake climate scenario analysis[7] as one of the key elements. Much of the climate scenario analysis is currently based on specialized third-party data providers that are attempting to assess potential impact of climate risks (e.g., policy changes, stranded assets, extreme weather events, etc.) on asset values both at the asset class and industry/sector levels.

Certain asset classes may be more exposed to physical climate risks (e.g., infrastructure or real estate that is highly exposed to changes in coastal water levels or adverse climate events). Some sectors may be more exposed to regulatory risks, such as energy or utilities, especially if companies in these sectors do not have an adaptation strategy. Adaptation and mitigation strategies may also put inflationary burden on companies and, in some cases, not having these strategies in place could increase the cost of capital for some companies. Physical climate risks could also impact creditworthiness of fixed income issuers, more so in high yield debt or emerging markets. On the other hand, some private asset classes (e.g., private infrastructure) may benefit from increased investment in renewables.

Climate risks also intersect with social inequity issues. Unfortunately, those impacted the most by climate change are typically those with the fewest resources to respond to it (e.g., flooding, drought, etc.). Extreme weather events pose increasing challenges for the most poor and vulnerable communities in terms of health, food, water, livelihood, forced migration, etc.[8]

The complex, uncertain and systemic nature of ESG issues makes it challenging to quantify top-down. In short, it is still too early to accurately assess the impact of ESG issues from a top-down, strategic asset allocation perspective. At BNY Mellon, we continue to be keenly aware of the rapidly evolving Responsible Investing landscape and bring the best thinking to our long-term assessment of risks and opportunities for client portfolios.

[7]The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities. June 2017.

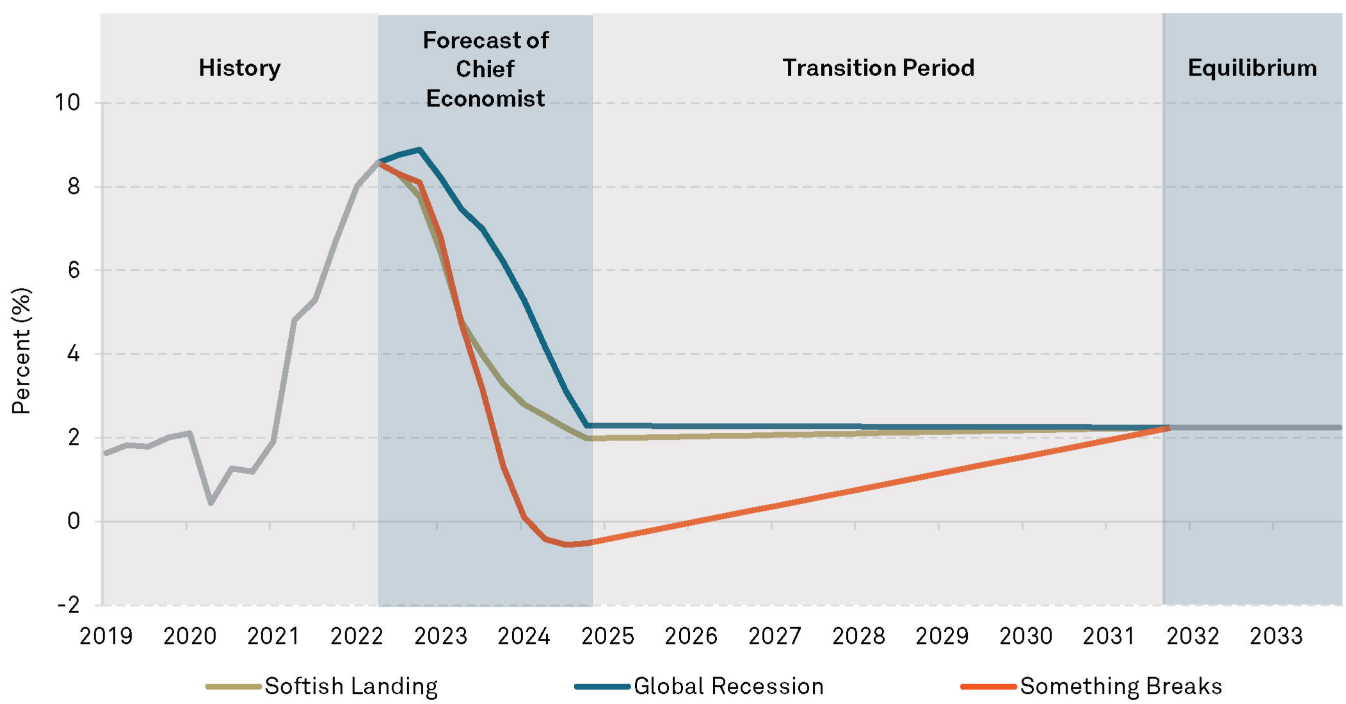
[8]The World Bank: Social Dimensions of Climate Change. Copyright 2022.

# Economic Forecast Methodology for the Capital Market Assumptions

Our macroeconomic projections are central to our building-block approach used for generating expected returns of major asset classes. Our long-term projections for GDP growth, inflation and short-term rates begin with three-year forecasts based on a range of outcomes developed by the BNY Mellon Investment Management Global Economic and Investment Analysis Group. We then assume, as illustrated in Exhibit 6, that the building blocks converge toward a steady-state equilibrium based on long-term market consensus expectations.

Our methodology allows us to generate expected returns under multiple macroeconomic scenarios and time horizons. Though our capital market assumptions are based on a 10-year horizon, the forecast period can be adjusted to generate returns over a shorter horizon, such as five years, or longer-term horizons of 30 years or more.

## Exhibit 6: Historical and Projected U.S. Consumer Price Index (CPI), Four Quarter Percentage Changes




Source: BNY Mellon Investor Solutions, BNY Mellon Investment Management Global Economic and Investment Analysis Group: Vantage Point, Q4 2022.

# Macroeconomic Backdrop

When building capital market assumptions, we start with projections of inflation, real GDP growth, short-term interest rates and currency rates. Inflation and real GDP growth are key drivers of our expected earnings growth for equity. Projections of inflation and real cash rates are extremely influential in projecting fixed income yields and returns.

The economic projections underpinning our asset class return assumptions are based on three economic scenarios outlined in BNY Mellon Investment Management's *2022 Q4 Vantage Point*. These scenarios are summarized in Exhibit 7. We develop return expectations under each of these scenarios, then probability weight the returns to determine our overall "expected" return. This approach allows us to not only analyze portfolios based on the expected case, but also to shock the portfolio under the various scenarios. We encourage you to read the latest Vantage Point to learn more about our economic projections.

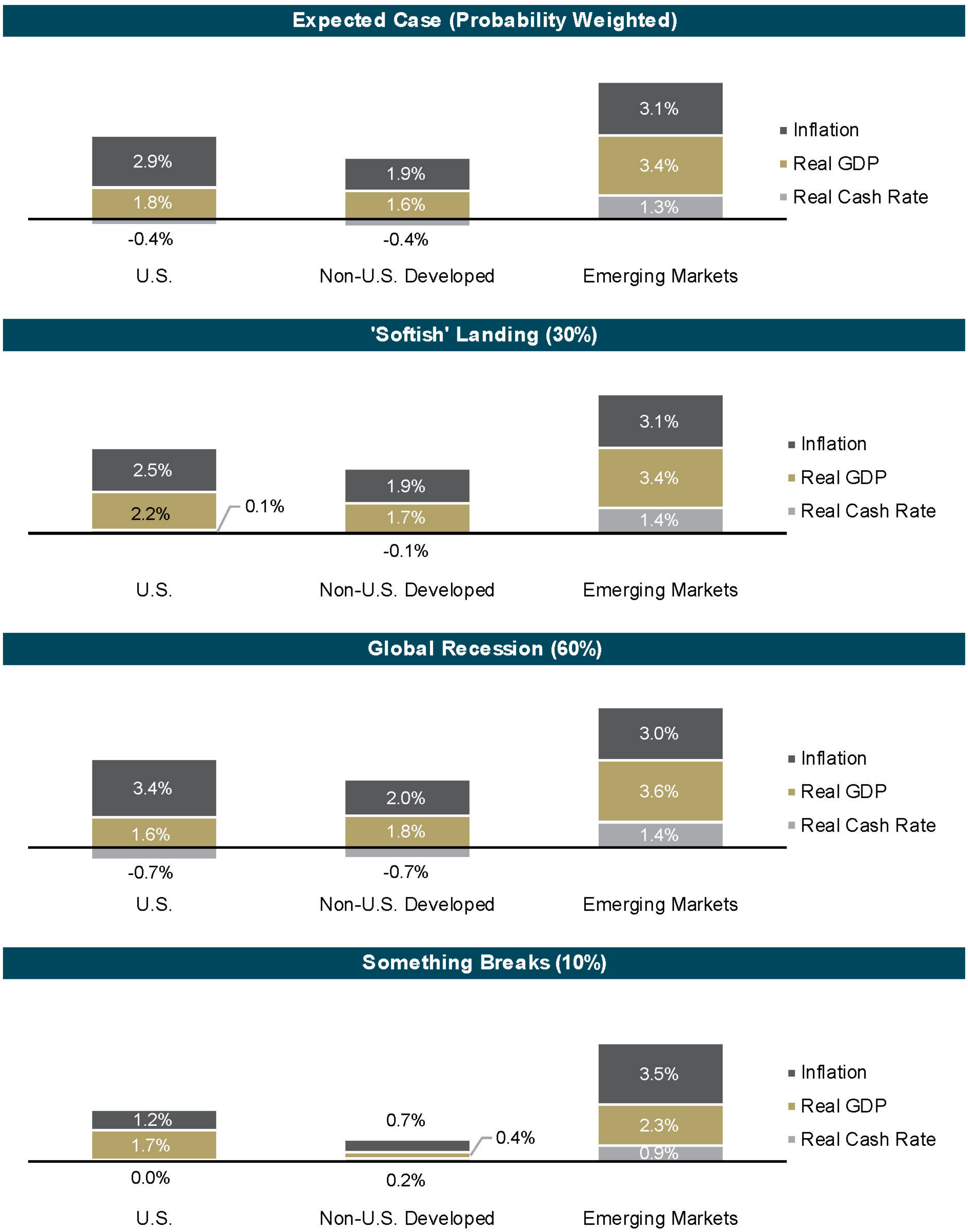
## Exhibit 7: Summary of Macroeconomic Scenarios

| 30% Probability | 60% Probability | 10% Probability |
|---|---|---|
| **'Softish' Landing** | **Global Recession** | **Something Breaks** |
| • Global financial conditions tighten only gradually as rate hikes slow, policy divergence cools, USD strengthening wanes, market liquidity stabilizes<br>• Disinflationary stars align perfectly for major economies, led by supply-side improvements<br>• Tight U.S. labor markets loosen with reduced job offers, but no significant jump in unemployment<br>• Europe imposes price-caps on gas and rapidly substitutes away from Russian energy supply and ECB slows its pace of rate hikes<br>• Wage increases subside, inflation expectations normalize in the U.S. and in Europe<br>• China eases zero-Covid policies<br>• Ukraine conflict is contained, with continuing reduction in food/commodity prices | • Europe slumps into a recession due to deepening energy shock - made worse by a messy energy and fiscal policy response as well as aggressive monetary tightening<br>• U.S. labor markets crack and unemployment rises steeply on more than expected Fed tightening<br>• China's zero-Covid stringency does not ebb and authorities struggle to keep the property sector afloat and domestic demand from crumpling<br>• Interest rates stay higher for longer, and any dovish pivot in monetary policy is pushed out to 2024 or beyond | • Hawkish policy tightening by the Fed materially weakens the U.S. labor market and exposes unforseen vulnerabilities in the U.S. and global economies<br>• Aggressive ECB tightening triggers a European debt crisis<br>• China encounters a banking crisis as domestic demand and confidence is undermined by inadequate countercyclical policies and structural adjustment<br>• Russia-Ukraine war escalates, energy prices spike much higher on threat of nuclear conflict<br>• Aggressive developed market policy-tightening or geopolitical crisis expose global economic and financial vulnerabilities |

Note: Percentages represent projected probabilities of each scenario occurring. The economic scenarios are provided by the BNY Mellon Global Economics and Investment Analysis team. Please refer to the Q4 2022 *Vantage Point* publication for the full analysis behind each economic scenario.

Three of the most critical economic metrics for developing our return assumptions are inflation, real GDP growth and real short-term interest rates/cash rates. Inflation and real GDP growth are key drivers of the expected earnings growth for equity. Projections of inflation and real cash rates are extremely influential in projecting fixed income yields and returns. Exhibit 8 outlines our projections for these primary buildings in the expected case and under the three macroeconomic scenarios outlined above.

## Exhibit 8: 10-Year Annualized Projections of Inflation, Real GDP Growth and Real Cash Rates

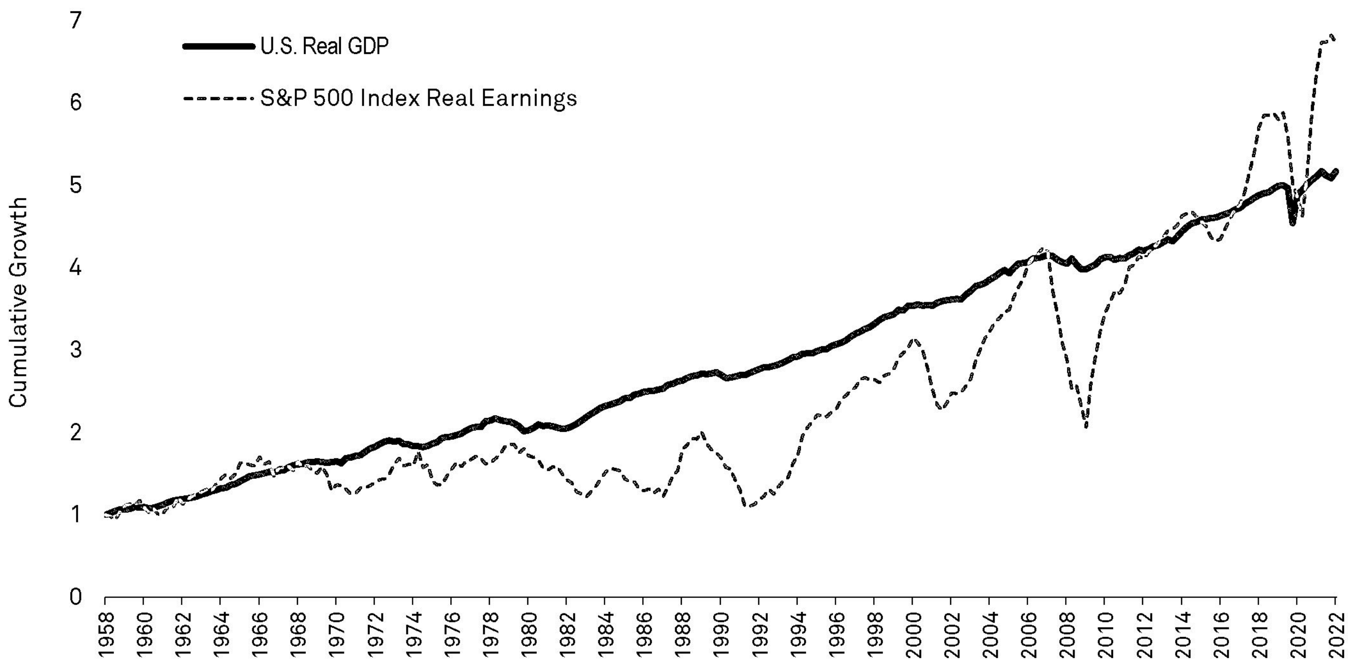



Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

# Equity Markets

Our equity assumptions are developed through a building-block approach consisting of inflation, real earnings growth, income return, valuation and currency adjustments. As a baseline assumption, we assume that real corporate earnings growth will be consistent with our projections for real GDP growth. As Exhibit 9 indicates, there has historically been a reasonably strong relationship between corporate earnings growth and GDP growth over a long-term time horizon.

Exhibit 9: U.S. GDP vs. Cumulative Corporate Earnings Growth



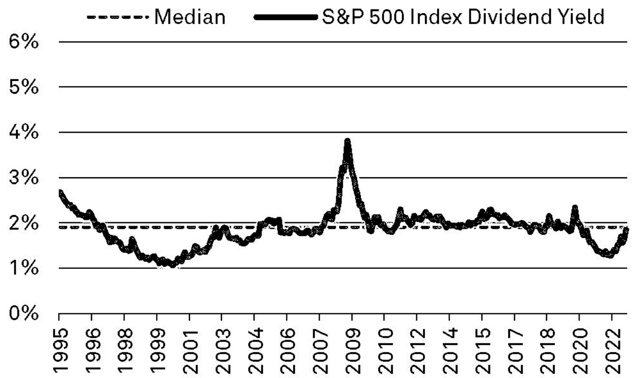

Source: BNY Mellon Investor Solutions, Bloomberg. Data as of September 30, 2022.

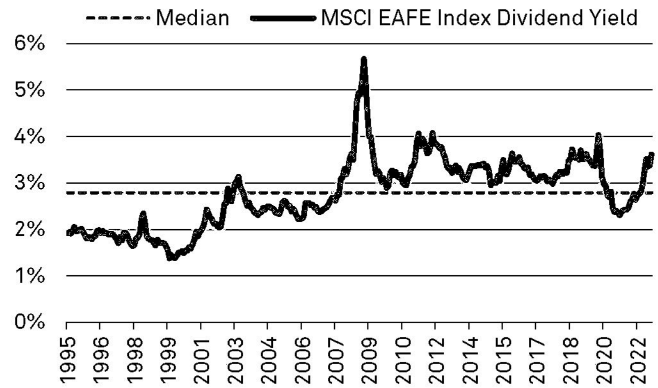
In the U.S., developed markets outside of the U.S. and emerging markets, we anticipate real earnings growth will be in line with our regional real GDP growth expectations. We anticipate real earnings growth of 1.8% in the U.S., 1.6% in the developed markets outside of the U.S. and 3.4% in emerging markets.

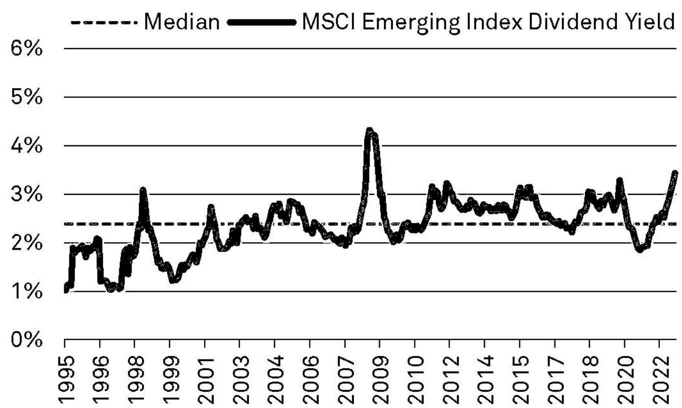
## Dividend Yield

Over the next 10 years, we expect dividend yields to be a blend of historical average yields and current yields in the market. We anticipate dividend yields of 1.8% in the U.S., 2.8% in the developed markets outside of the U.S. and 2.3% in emerging markets. These figures are in line with the long-term average dividend yields as shown in Exhibit 10 and current dividend yields.

## Exhibit 10: Historical Dividend Yield



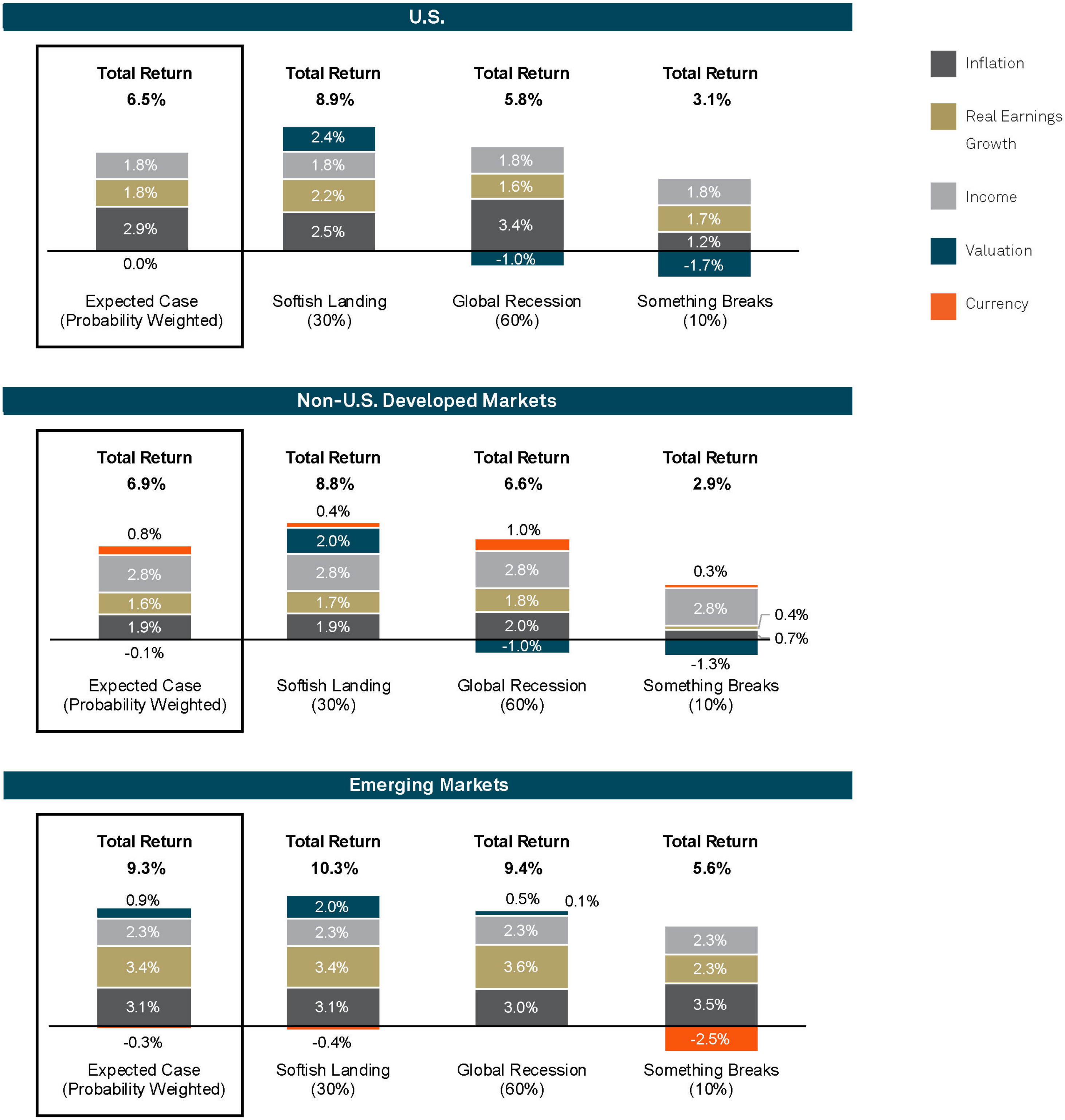




Source: BNY Mellon Investor Solutions, Bloomberg. Data as of September 30, 2022.

Once the primary equity building blocks of inflation, real earnings growth and income are established, we then adjust long-term returns for valuation and currency projections. Based on the three macroeconomic scenarios, we made a moderate adjustment for valuation (emerging markets) and currency shifts (non-U.S.). Exhibit 11 illustrates the equity market building blocks and return expectations under the three macroeconomic scenarios and the probability-weighted expected case.

In the U.S., we see a total expected return of 6.5% consisting of 2.9% inflation, 1.8% real earnings growth, 1.8% income and a negligible valuation component. For developed countries excluding the U.S., we see a total expected return of 6.9% consisting of 1.9% inflation, 1.6% real earnings growth, 2.8% income, negligible valuation adjustment and currency appreciation of 0.8%. For emerging markets, we see a total expected return of 9.3% consisting of 3.1% inflation, 3.4% real earnings growth, 2.3% income, 0.9% valuation adjustment and currency depreciation of -0.3%.

## Exhibit 11: 10-Year Equity Market Expected Returns (in USD)




Source: BNY Mellon Investor Solutions. Data as of September 30, 2022. Numbers may not add up due to rounding.

# Fixed Income Markets

Our fixed income return assumptions are derived from analyzing current yields in the market, projecting yields based on our three macroeconomic scenarios, reducing returns due to anticipated defaults and finally adjusting due to currency fluctuations.

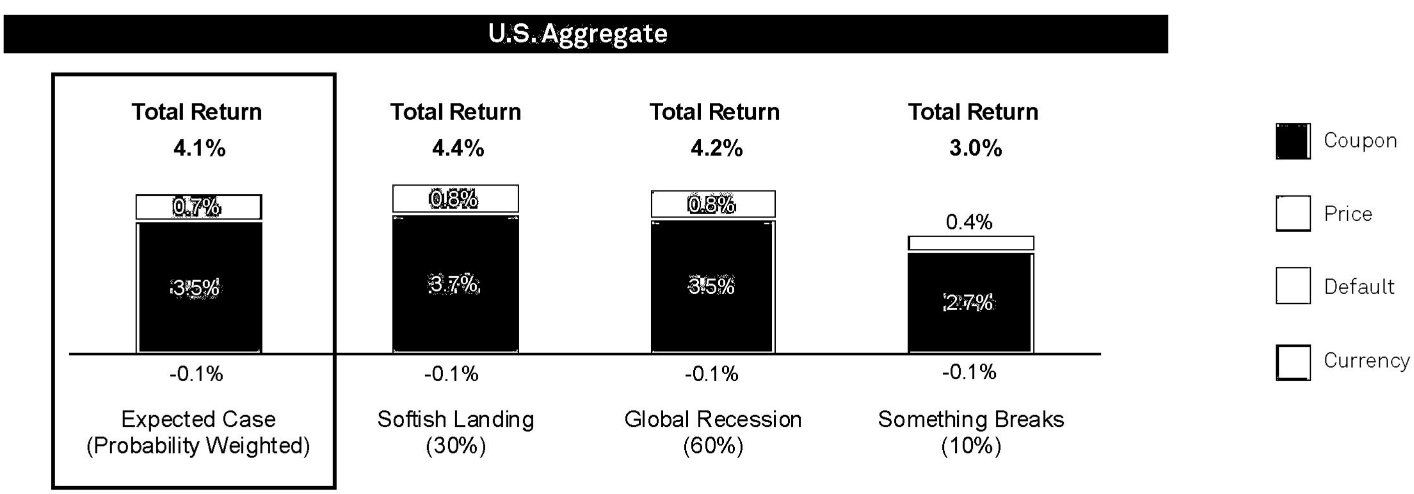
To forecast short-term interest rates, slope of the yield curve and credit spreads in the intermediate term (three years), we rely on the projections of our Chief Economist for several macroeconomic scenarios. Beyond the intermediate term, we assume these factors will migrate to market consensus expectations or to long-term historical averages.

For short-term interest rates in the U.S., we see a range of 0.25% to 4.25% over the next three years depending on the macroeconomic scenario. Beyond three years, we see short-term interest rates gradually migrating to long-term consensus expectations of 2.4%. For the U.S. 10-year Treasury note, we see a range of rates over the next three years of 1.1% to 3.9% with eventual migration to a long-term rate of 3.1% in 10 years.

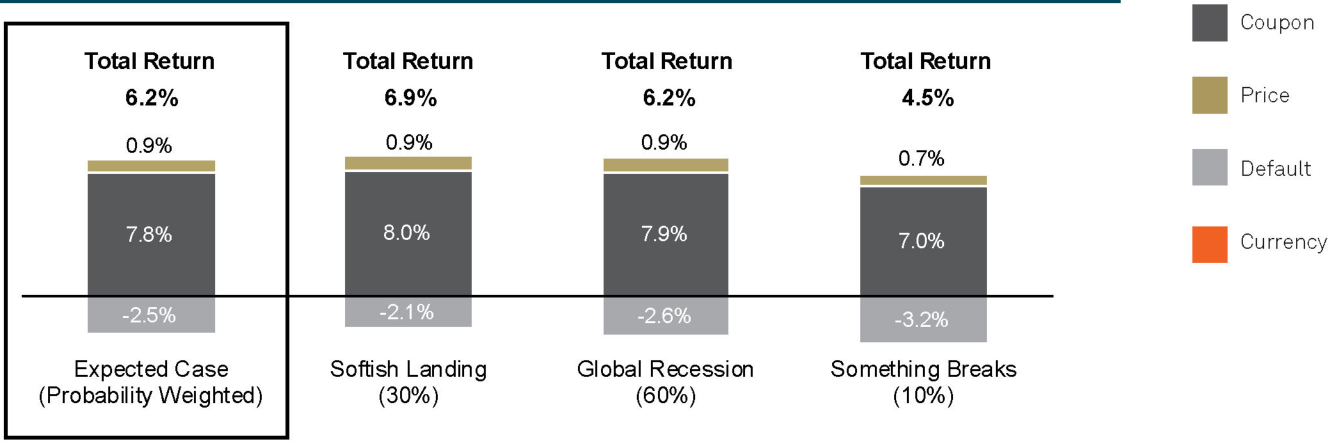
Regarding credit risk, we see U.S. investment-grade credit spreads in a range of approximately 160 to 310 basis points over the next three years depending on the scenario. Over the long-term, we assume credit spreads migrate to historical long-term averages that are adjusted to eliminate skewing from extreme events such as the global financial crisis. For our baseline economic scenario, we assume default and recovery rates will be in line with historical long-term averages. For our pessimistic economic scenarios, we have increased default rates by as much as 50%.

Summarized in Exhibit 12 are the results of our fixed income return projections along with underlying components of return. In general, we project notably higher fixed income returns for most asset classes primarily due to higher yields in 2022 compared to 2021. In U.S. Aggregate, we expect a return of 4.1% over the next 10 years. For U.S. high yield, we see an expected return of 6.2%. We also see higher returns of 3.0% for Global Aggregate Ex-U.S. There will be some benefit due to an expected weakening U.S. dollar relative to other developed currencies. Emerging markets (EM) local currency is up slightly compared to the capital market assumptions with an expected return of 3.9%.

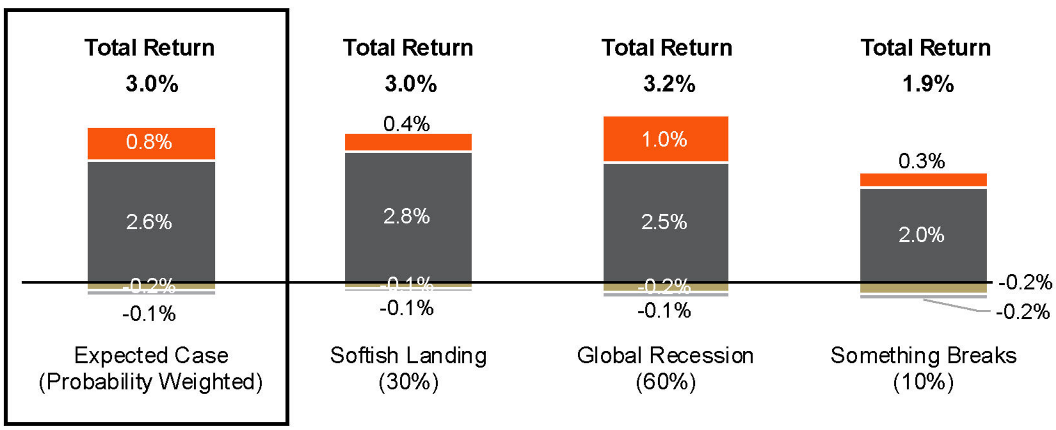
## Exhibit 12: 10-Year Fixed Income Market Expected Returns (in USD)



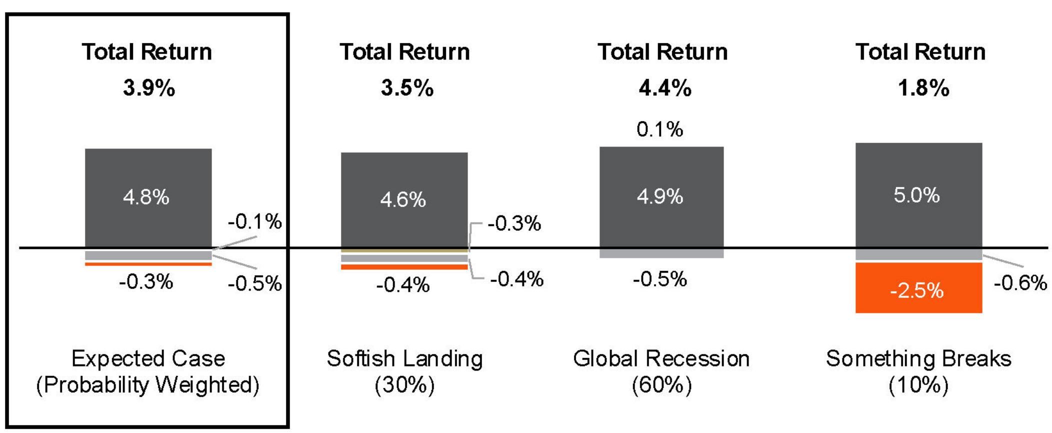
## U.S. High Yield




## Global Aggregate Ex-U.S.




## Emerging Markets Local Currency

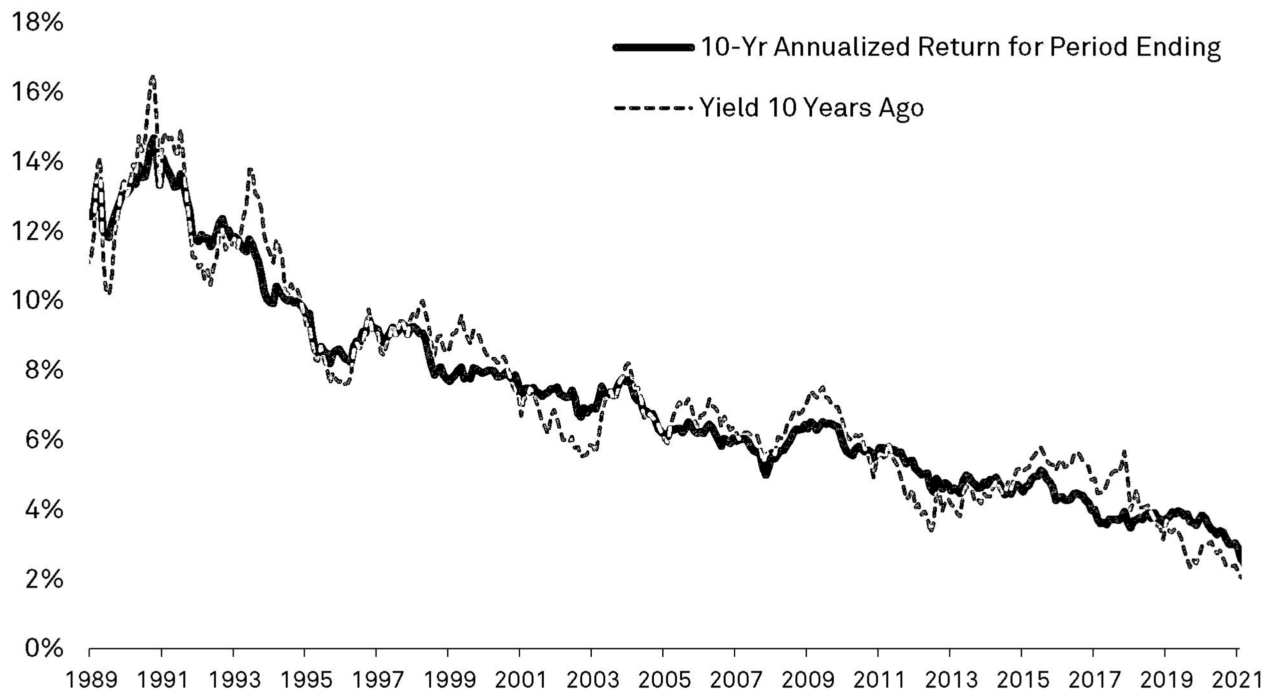



Source: BNY Mellon Investor Solutions. Data as of September 30, 2022. Numbers may not add up due to rounding.

# Comparing Fixed Income Returns to Yields

One technique to affirm our expected return assumptions for fixed income is to compare the returns to current yields in the market. Regardless of where projections indicate yields may go in the future, current yield has historically been a relatively strong indicator of future returns within fixed income. To demonstrate this point, Exhibit 13 shows rolling 10-year annualized returns of the Bloomberg Barclays U.S. Aggregate Index and compares those returns to the yield of the index at the beginning of the 10-year period. We have witnessed significant rate movements over the past 30 years, but the return of the U.S. bond market over 10 years is consistent with the yield of the market at the start of the period. Rarely is the difference more than +/- 1%. With current yields,[9] one should be skeptical of expected returns for U.S. bonds being significantly different than 4% to 5% based on a 10-year horizon. Our expected return for U.S. Aggregate is 4.1% over a 10-year horizon.

## Exhibit 13: U.S. Aggregate Index Returns vs. Starting Yields

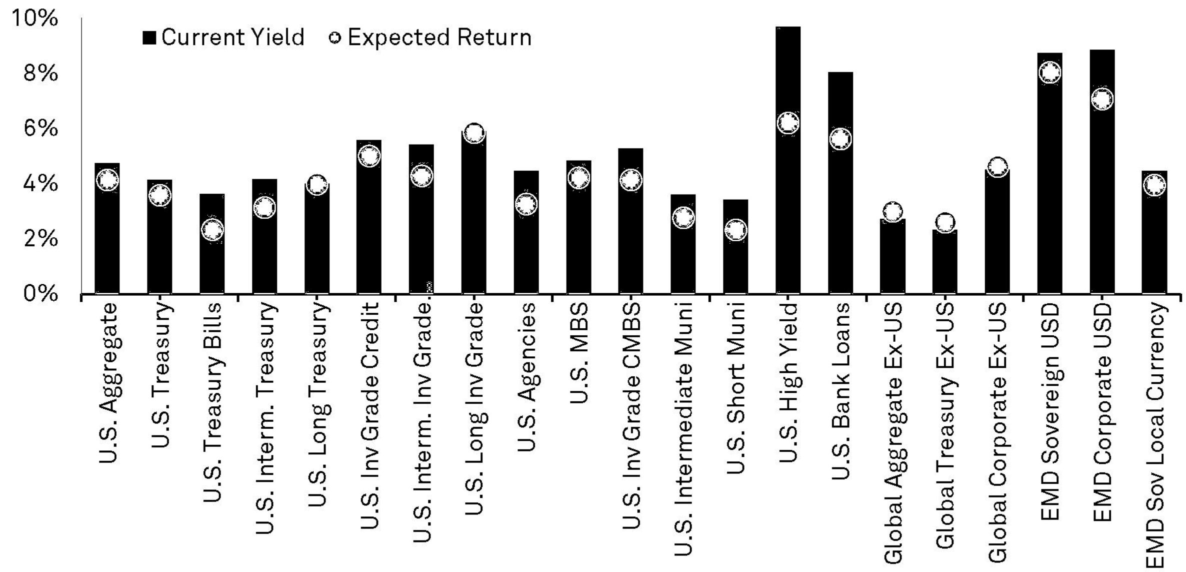



Source: BNY Mellon Investor Solutions, Bloomberg Barclays. Data as of September 30, 2022.

In Exhibit 14, we compare current yields across many fixed income sectors to our expected return assumptions. For most asset classes, the expected return is generally consistent with the current yield. One major exception is high yield fixed income and bank loans, where defaults result in a return less than the current yield.

[9] Current yields were 4.8% as of September 30, 2022.

Exhibit 14: Current Fixed Income Yields vs. Expected Returns




Source: BNY Mellon Investor Solutions, Bloomberg Barclays. Data as of September 30, 2022.

# Alternatives

We believe expected returns for alternative asset classes will generally be in line with publicly traded markets on a risk-adjusted basis, plus incremental return for alpha and liquidity. Manager skill is a critical component in this asset class, so an investor's selection of individual managers is of utmost importance. Our expectations below relate to the asset class in aggregate.

To calculate risk-adjusted returns, we first determine the beta of the asset class relative to public markets based on our expectations of return, standard deviations and correlations. We apply the beta to the public-market expected return to determine the expected return of the alternative asset class. For private markets, we add additional return to account for illiquidity. For hedge funds and other alpha-oriented asset classes, we add additional return to reflect the residual risk not captured by market returns. The additional return assumes an information ratio of 0.3 multiplied by the residual risk.

Exhibit 15 provides a summary of expected real returns (expected return in excess of expected inflation) for primary asset classes. The exhibit also compares how our expected real returns have changed from the 2022 assumptions to the 2023 assumptions. We have seen a substantial shift within fixed income, where an expected flat or positive returns after inflation is nobly different from expectations in 2022.

We point this out in our description of alternative investments because we believe alternatives should continue to play a much greater role going forward for long-term investors. While the traditional risk anchors of fixed income are now expected to generate flat or moderately positive real returns, investors should continue to evaluate additional strategies to complement fixed income. Taking advantage of liquidity premiums in areas such as private equity may be attractive to improve equity diversification and boost long-term potential returns.

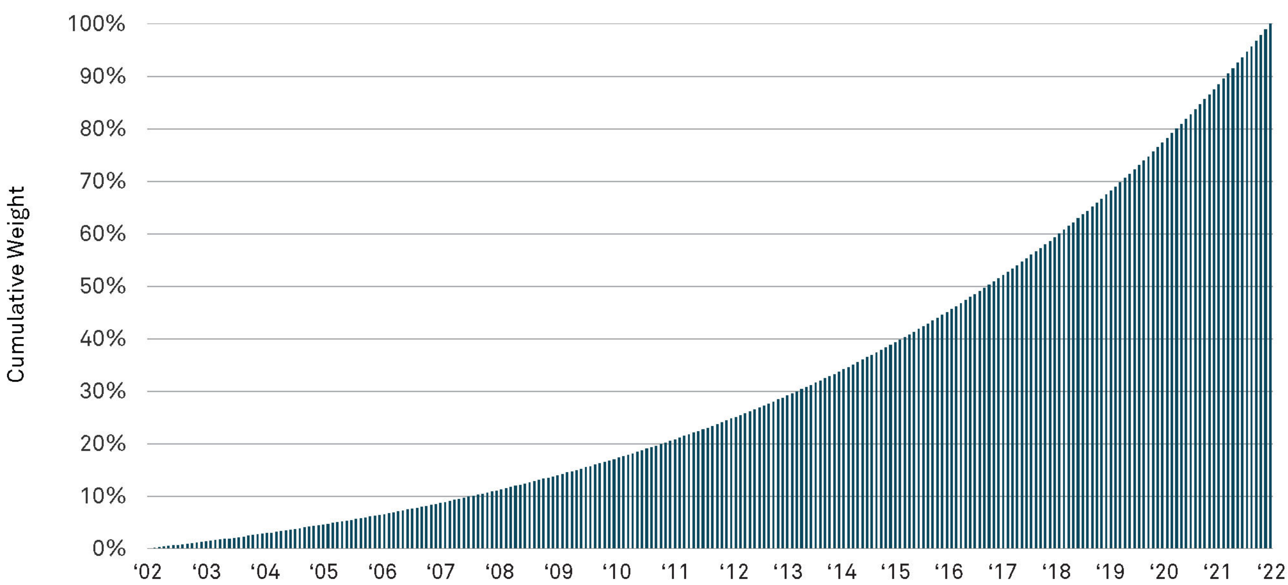
Exhibit 15: Asset Class Expected Real Return


Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

# Standard Deviations and Correlations

At a high level, our standard deviations and correlations are based on long-term historical returns with additional emphasis on near-term history. Especially with illiquid asset classes, we adjust for serial correlation and smoothing of historical asset returns. To determine standard deviations and correlations, we utilized exponential weighting of the last 20 years of monthly returns (see Exhibit 16). This approach ensures an appropriate covariance matrix and smooths out results on a year-by-year basis.

Exhibit 16: Historical Weighting for Standard Deviations and Correlations




Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

# Expected 10-Year Returns and Standard Deviations

| | Asset Class | Representative Index | Expected Return | Standard Deviation |
|---|---|---|---|---|
| Equity | U.S. Equity | Russell 3000 | 6.5% | 18.0% |
| | U.S. Large Cap Equity | Russell 1000 | 6.4% | 17.8% |
| | U.S. Mid Cap Equity | Russell Midcap | 6.8% | 19.7% |
| | U.S. Small Cap Equity | Russell 2000 | 7.1% | 22.3% |
| | U.S. Micro Cap Equity | Dow Jones Wilshire U.S. Micro-Cap | 6.9% | 23.8% |
| | Global Equity | MSCI ACWI | 6.9% | 17.1% |
| | International Developed Equity | MSCI World Ex-U.S. | 6.9% | 17.1% |
| | International Small Cap Equity | MSCI World Ex-U.S. Small Cap | 7.3% | 19.5% |
| | Global Emerging Markets Equity | MSCI Emerging | 9.3% | 20.0% |
| | U.S. REIT | FTSE NAREIT Equity | 6.2% | 21.8% |
| | Global REIT | FTSE EPRA/NAREIT Developed Index | 6.8% | 19.6% |
| Fixed Income | U.S. Aggregate | Bloomberg Barclays U.S. Aggregate | 4.1% | 4.3% |
| | U.S. Treasury | Bloomberg Barclays U.S. Treasury | 3.6% | 4.6% |
| | U.S. Treasury Bills | Bloomberg Barclays U.S. Treasury Bills 3-6 Months | 2.3% | 0.4% |
| | U.S. Intermediate Treasury | Bloomberg Barclays U.S. Intermediate Treasury | 3.1% | 3.1% |
| | U.S. Long Treasury | Bloomberg Barclays U.S. Long Treasury | 4.0% | 12.4% |
| | U.S. Investment Grade Credit | Bloomberg Barclays U.S. Credit | 5.0% | 6.4% |
| | U.S. Intermediate Inv Grade Credit | Bloomberg Barclays U.S. Intermediate Credit | 4.3% | 4.4% |
| | U.S. Long Investment Grade Credit | Bloomberg Barclays U.S. Long Credit | 5.9% | 11.3% |
| | U.S. TIPS | Bloomberg Barclays U.S. Govt Inflation-Linked | 4.4% | 6.2% |
| | U.S. Agencies | Bloomberg Barclays U.S. Agencies | 3.3% | 3.1% |
| | U.S. MBS | Bloomberg Barclays U.S. MBS | 4.2% | 3.9% |
| | U.S. Investment Grade CMBS | Bloomberg Barclays CMBS Investment Grade | 4.1% | 6.6% |
| | U.S. Intermediate Municipal | Bloomberg Barclays Municipal Bond Intermediate (5-10) | 2.8% | 4.3% |
| | U.S. Short Municipal | Bloomberg Barclays Municipal Bond Short (1-5) | 2.3% | 2.0% |
| | U.S. High Yield | Bloomberg Barclays U.S. Corporate High Yield | 6.2% | 9.4% |
| | U.S. Bank Loans | S&P/LSTA Leveraged Loan | 5.6% | 6.9% |
| | Global Aggregate Ex-US | Bloomberg Barclays Global Aggregate ex-USD | 3.0% | 7.9% |
| | Global Treasury Ex-US | Bloomberg Barclays Global Treasury ex-U.S. | 2.6% | 8.0% |
| | Global Corporate Ex-US | Bloomberg Barclays Global Agg ex USD: Corporate | 4.6% | 9.6% |
| | Emerging Mkts Sovereign USD | Bloomberg Barclays EM USD Aggregate: Sovereign | 8.0% | 9.7% |
| | Emerging Mkts Corporate USD | Bloomberg Barclays: EM USD Aggregate: Corporate | 7.1% | 9.2% |
| | Emerging Mkts Sovereign Local | Bloomberg Barclays EM Local Currency Government | 4.0% | 9.5% |
| Alternatives | Absolute Return[1,2] | HFRX Global Hedge Fund | 4.3% | 5.0% |
| | Hedge Funds[1,2] | HFRI Fund Weighted Composite | 4.9% | 6.9% |
| | Hedge Funds - Equity Hedge[1,2] | HFRI Equity Hedge | 5.8% | 9.6% |
| | Hedge Funds - Event Driven[1,2] | HFRI Event-Driven | 5.4% | 7.8% |
| | Hedge Funds - Macro[1,2] | HFRI Macro | 4.2% | 5.1% |
| | Hedge Funds - Relative Value[1,2] | HFRI Relative Value | 4.4% | 5.1% |
| | Hedge Funds - Managed Futures[1,2] | Credit Suisse Managed Futures Liquid Index | 5.1% | 10.8% |
| | Commodities | Bloomberg Commodity Index | 2.9% | 16.6% |
| | Global Natural Resources Equity | S&P Global Natural Resources | 6.4% | 22.9% |
| | Energy Infrastructure | Alerian MLP | 7.2% | 34.0% |
| | U.S. Private Equity[1,2] | Cambridge Associates LLC U.S. Private Equity | 8.2% | 21.3% |
| | U.S. Core Real Estate[2] | NCREIF ODCE Index | 6.0% | 8.5% |
| | Real Assets[3] | Blended Benchmark | 4.8% | 12.4% |

Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

[1] Consistent with the Representative Index, returns are net of management fees.

[2] The Representative Index is not investable. Returns are based on manager averages. Actual results may vary significantly.

[3] Represents a weighted average of 1/3 U.S. TIPS, 1/3 Commodities, 1/9 Global REIT, 1/9 Natural Resources, 1/9 Infrastructure.

# Expected Correlations

| | | Equity | | | | Fixed Income | | | | | | | | | | | Alternatives | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | U.S. Equity | International Developed Equity | Emerging Equity | Global REIT | U.S. Aggregate | U.S. Treasury | U.S. Treasury Bills | U.S. Investment Grade Credit | U.S. TIPS | U.S. MBS | U.S. Intermediate Municipal | U.S. High Yield | Global Aggregate Ex-US | Emerging Markets Sovereign USD | Emerging Markets Sovereign LC | Absolute Return | Commodities | Energy Infrastructure | U.S. Private Equity | U.S. Core Real Estate |
| Equity | U.S. Equity | 1.00 | 0.88 | 0.74 | 0.83 | 0.28 | -0.05 | -0.19 | 0.52 | 0.39 | 0.24 | 0.26 | 0.78 | 0.44 | 0.64 | 0.53 | 0.79 | 0.47 | 0.62 | 0.91 | 0.39 |
| | International Developed Equity | 0.88 | 1.00 | 0.92 | 0.84 | 0.28 | -0.06 | -0.13 | 0.53 | 0.39 | 0.22 | 0.27 | 0.80 | 0.57 | 0.72 | 0.72 | 0.82 | 0.58 | 0.59 | 0.81 | 0.39 |
| | Emerging Equity | 0.74 | 0.92 | 1.00 | 0.72 | 0.26 | -0.05 | -0.08 | 0.50 | 0.37 | 0.19 | 0.23 | 0.73 | 0.56 | 0.69 | 0.76 | 0.76 | 0.56 | 0.52 | 0.69 | 0.34 |
| | Global REIT | 0.83 | 0.84 | 0.72 | 1.00 | 0.41 | 0.10 | -0.15 | 0.63 | 0.52 | 0.31 | 0.39 | 0.79 | 0.56 | 0.72 | 0.66 | 0.70 | 0.48 | 0.56 | 0.73 | 0.45 |
| Fixed Income | U.S. Aggregate | 0.28 | 0.28 | 0.26 | 0.41 | 1.00 | 0.90 | 0.17 | 0.89 | 0.83 | 0.91 | 0.79 | 0.43 | 0.71 | 0.64 | 0.46 | 0.13 | -0.04 | 0.09 | 0.24 | 0.21 |
| | U.S. Treasury | -0.05 | -0.06 | -0.05 | 0.10 | 0.90 | 1.00 | 0.29 | 0.64 | 0.71 | 0.82 | 0.64 | 0.05 | 0.56 | 0.33 | 0.24 | -0.18 | -0.25 | -0.21 | -0.06 | 0.10 |
| | U.S. Treasury Bills | -0.19 | -0.13 | -0.08 | -0.15 | 0.17 | 0.29 | 1.00 | -0.01 | 0.03 | 0.21 | 0.04 | -0.16 | 0.11 | -0.05 | 0.01 | -0.19 | -0.16 | -0.24 | -0.11 | -0.04 |
| | U.S. Investment Grade Credit | 0.52 | 0.53 | 0.50 | 0.63 | 0.89 | 0.64 | -0.01 | 1.00 | 0.79 | 0.71 | 0.77 | 0.70 | 0.72 | 0.82 | 0.59 | 0.45 | 0.16 | 0.38 | 0.45 | 0.25 |
| | U.S. TIPS | 0.39 | 0.39 | 0.37 | 0.52 | 0.83 | 0.71 | 0.03 | 0.79 | 1.00 | 0.74 | 0.68 | 0.52 | 0.69 | 0.64 | 0.54 | 0.29 | 0.24 | 0.22 | 0.30 | 0.22 |
| | U.S. MBS | 0.24 | 0.22 | 0.19 | 0.31 | 0.91 | 0.82 | 0.21 | 0.71 | 0.74 | 1.00 | 0.71 | 0.33 | 0.64 | 0.51 | 0.36 | 0.01 | -0.03 | 0.03 | 0.21 | 0.18 |
| | U.S. Intermediate Municipal | 0.26 | 0.27 | 0.23 | 0.39 | 0.79 | 0.64 | 0.04 | 0.77 | 0.68 | 0.71 | 1.00 | 0.47 | 0.57 | 0.64 | 0.41 | 0.17 | -0.01 | 0.17 | 0.20 | 0.18 |
| | U.S. High Yield | 0.78 | 0.80 | 0.73 | 0.79 | 0.43 | 0.05 | -0.16 | 0.70 | 0.52 | 0.33 | 0.47 | 1.00 | 0.54 | 0.81 | 0.62 | 0.74 | 0.50 | 0.62 | 0.71 | 0.40 |
| | Global Aggregate Ex-US | 0.44 | 0.57 | 0.56 | 0.56 | 0.71 | 0.56 | 0.11 | 0.72 | 0.69 | 0.64 | 0.57 | 0.54 | 1.00 | 0.68 | 0.80 | 0.34 | 0.32 | 0.23 | 0.37 | 0.24 |
| | Emerging Markets Sovereign USD | 0.64 | 0.72 | 0.69 | 0.72 | 0.64 | 0.33 | -0.05 | 0.82 | 0.64 | 0.51 | 0.64 | 0.81 | 0.68 | 1.00 | 0.73 | 0.60 | 0.38 | 0.44 | 0.58 | 0.32 |
| | Emerging Markets Sovereign LC | 0.53 | 0.72 | 0.76 | 0.66 | 0.46 | 0.24 | 0.01 | 0.59 | 0.54 | 0.36 | 0.41 | 0.62 | 0.80 | 0.73 | 1.00 | 0.48 | 0.45 | 0.38 | 0.46 | 0.26 |
| Alternatives | Absolute Return[1,2] | 0.79 | 0.82 | 0.76 | 0.70 | 0.13 | -0.18 | -0.19 | 0.45 | 0.29 | 0.01 | 0.17 | 0.74 | 0.34 | 0.60 | 0.48 | 1.00 | 0.56 | 0.61 | 0.73 | 0.28 |
| | Commodities | 0.47 | 0.58 | 0.56 | 0.48 | -0.04 | -0.25 | -0.16 | 0.16 | 0.24 | -0.03 | -0.01 | 0.50 | 0.32 | 0.38 | 0.45 | 0.56 | 1.00 | 0.49 | 0.40 | 0.18 |
| | Energy Infrastructure | 0.62 | 0.59 | 0.52 | 0.56 | 0.09 | -0.21 | -0.24 | 0.38 | 0.22 | 0.03 | 0.17 | 0.62 | 0.23 | 0.44 | 0.38 | 0.61 | 0.49 | 1.00 | 0.56 | 0.09 |
| | U.S. Private Equity[1,2] | 0.91 | 0.81 | 0.69 | 0.73 | 0.24 | -0.06 | -0.11 | 0.45 | 0.30 | 0.21 | 0.20 | 0.71 | 0.37 | 0.58 | 0.46 | 0.73 | 0.40 | 0.56 | 1.00 | 0.42 |
| | U.S. Core Real Estate[2] | 0.39 | 0.39 | 0.34 | 0.45 | 0.21 | 0.10 | -0.04 | 0.25 | 0.22 | 0.18 | 0.18 | 0.40 | 0.24 | 0.32 | 0.26 | 0.28 | 0.18 | 0.09 | 0.42 | 1.00 |

Source: BNY Mellon Investor Solutions. Data as of September 30, 2022.

[1] Consistent with the Representative Index, returns are net of management fees.

[2] The Representative Index is not investable. Returns are based on manager averages. Actual results may vary significantly.

Only a subset of the asset classes is shown in the matrix above. A full correlation matrix is available upon request.

For illustrative purposes only. There can be no assurance that the expected returns listed above will be achieved.

# Importance of Capital Market Assumptions

Capital market assumptions are the initial building block for the development of an investor's strategic asset allocation (SAA). SAA, or policy portfolio design, serves a central role as the touchstone of multi-asset investment, transforming long-term, forward-looking market forecasts into enduring portfolio allocations. However, forecasting is an inherently error-prone endeavor because financial market performance exhibits a high degree of uncertainty. These forecast errors become even more protracted as time horizons extend.

Thus, when designing a policy portfolio to weather the highs and lows of the coming market cycle, we propose investors consider a "robust" portfolio, rather than an "optimal" one. By building a portfolio that is intended to withstand the test of time, while being robust to forecast error and intertemporal forecast noise, we seek to ensure that investors have the highest probability of achieving their objectives. To learn more about how BNY Mellon utilizes our capital market assumptions and robust strategic asset allocation process to help our clients solve their investment challenges, please contact a BNY Mellon Investor Solutions representative.

# BofA Now Has One Of The Most Bullish Stock Market Forecasts On Wall Street

Matthew Boesler
Jul. 15, 2013, 11:26 AM

Bloomberg TV

Savita Subramanian

In a note to clients today, BofA Merrill Lynch Head of U.S. Equity Strategy Savita Subramanian ups her year-end target for the S&P 500 to 1750 from 1600 – making hers the second-most bullish forecast on the Street, behind Cannacord's Tony Dwyer, who sees the index finishing 2013 at 1760.

Subramanian's 1750 target implies around 4.2% upside from today's levels at 1680 by the end of 2013.

(Before today, only two Wall Street equity strategists had lower S&P 500 price targets than Subramanian: Gina Martin Adams at Wells Fargo, with a target of 1440 by year-end, and Barry Knapp at Barclays, with a target of 1525.)

"Our new 2013 year-end target of 1750 implies modest upside from current levels, attributable to expected earnings growth, contrasting with returns so far this year driven by multiple expansion," says Subramanian. "While the decline in the equity risk premium (ERP) has been more than twice what we expected, we think it is justified by diminished tail risks, positive surprises in the US economy, and, as expected, a continued decline in earnings volatility."

## Table 3: 2013 year-end S&P 500 fair value model

| | |
|---|---|
| BofAML 2014 Pro Forma EPS Forecast | $115 |
| **Normalized 2014 EPS** | **$107.50** |
| Normalized % of Proforma EPS | 93% |
| Nominal Long-Term Risk-Free Rate | 3.50% |
| - Assumed Long-Term Inflation | 2.00% |
| = Normalized Real Risk-Free Rate | 1.50% |
| **+ Equity Risk Premium** | **475bp** |
| = Fair Real Cost of Equity Capital (Ke) | 6.25% |
| **Fair Forward PE (1 ÷ Fair Ke)** | **16.0x** |
| **2013 Year-End Target (Fair PE × Normalized 2014 EPS)** | **1,720** |

BofA Merrill Lynch US Equity and US Quant Strategy

The biggest input into Subramanian's new S&P 500 price target forecast is the BAML Fair Value model, which assumes a forward price-to-earnings ratio unchanged from current levels at 16 and full-year S&P 500 earnings of $107.50 per share in 2014.

The assumption of a 16x price-to-earnings ratio rests heavily on Subramanian's forecast for the equity risk premium.

Below, Subramanian gives her thoughts on the ERP:

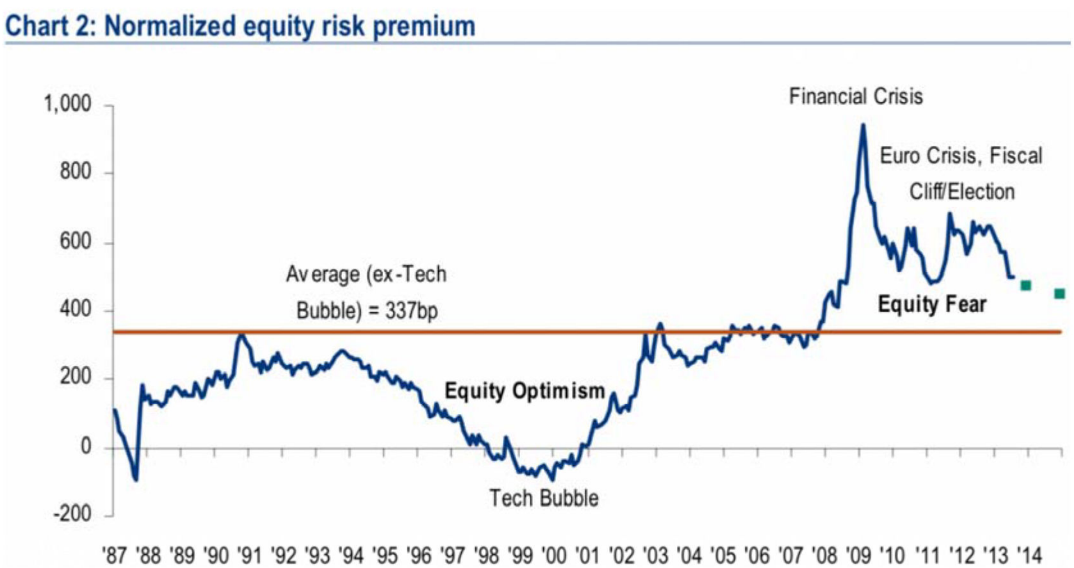
The equity rally over the last eight months has been primarily driven by multiple expansion, with the forward PE multiple on the S&P 500 expanding from 12x to 14x (18%). In our fair value model, we focus on the normalized forward PE multiple, which has also risen from 13.5x to 16.0x (18%). This multiple expansion has predominantly been a function of the significant decline in the equity risk premium (ERP), partially offset by a modest rise in real normalized interest rates.

While current real normalized rates are only modestly higher than our previous year-end assumption of 1.0% (now forecasting 1.5%), the 135bp drop in the ERP is more than double the 50bp that we had originally assumed going into the year. This rapid ERP compression reflects the reality that many of the major uncertainties overhanging the market have been removed or significantly diminished (US election, fiscal cliff, sequestration, Eurozone collapse, China hard landing).

But at 500bp, the ERP is currently still well above the sub-400bp levels preceding the financial crisis, and we think it should continue to decline over the next several years as the memory of the Financial Crisis fades, corporate profits continue to make new highs and some of the macro risks abate. We expect the “wall of worry” to persist as new concerns emerge, but visibility is clearly improving and we still expect global growth to pick up as the year progresses.

As such, we have lowered our normalized risk premium assumption in our fair value model for the end of 2013 from 600bp to 475bp, which assumes roughly another 25bp of ERP contraction by year-end. We have also raised our normalized real risk-free rate assumption for year-end from 1.0% to 1.5%. Not only have current and future inflation expectations declined since last fall, but long-term interest rates have also begun to rise recently. Meanwhile, our Rates Strategist Priya Misra also recently raised her interest rate forecasts.

The chart below shows BAML's ERP forecast.




BofAML US Equity & Quant Strategy, Federal Reserve Board, Standard & Poor’s, BLS

# What Does Capital Really Cost a Utility?

*A new study suggests excess compensation to shareholders is costing ratepayers billions.*

Regulating an electric or gas utility is a tough job. You want utilities to have the funding they need to serve the public reliably and safely while also keeping rates under control and distributing the revenue burden fairly among customers. Setting rates and monitoring the service performance of utilities gets a lot of attention. What gets much less attention is one of the biggest challenges the regulator faces: figuring out a utility’s costs.

For many costs this seems trivial – the regulator can see what the company paid for everything from fuel to software to the CEO simply by looking at the utility’s books. There is, of course, still the question of whether the utility is overpaying or is using too much (or too little) of an input.

But when it comes to the cost of capital things get murkier. Determining the interest rate the utility must pay lenders or the rate of return it must pay shareholders when they finance investment by issuing stock has been a constant challenge since utility regulation began about a century ago. Unlike most other inputs to utility operations, the cost of capital depends very much on the utility itself, in particular on its finances and risk.

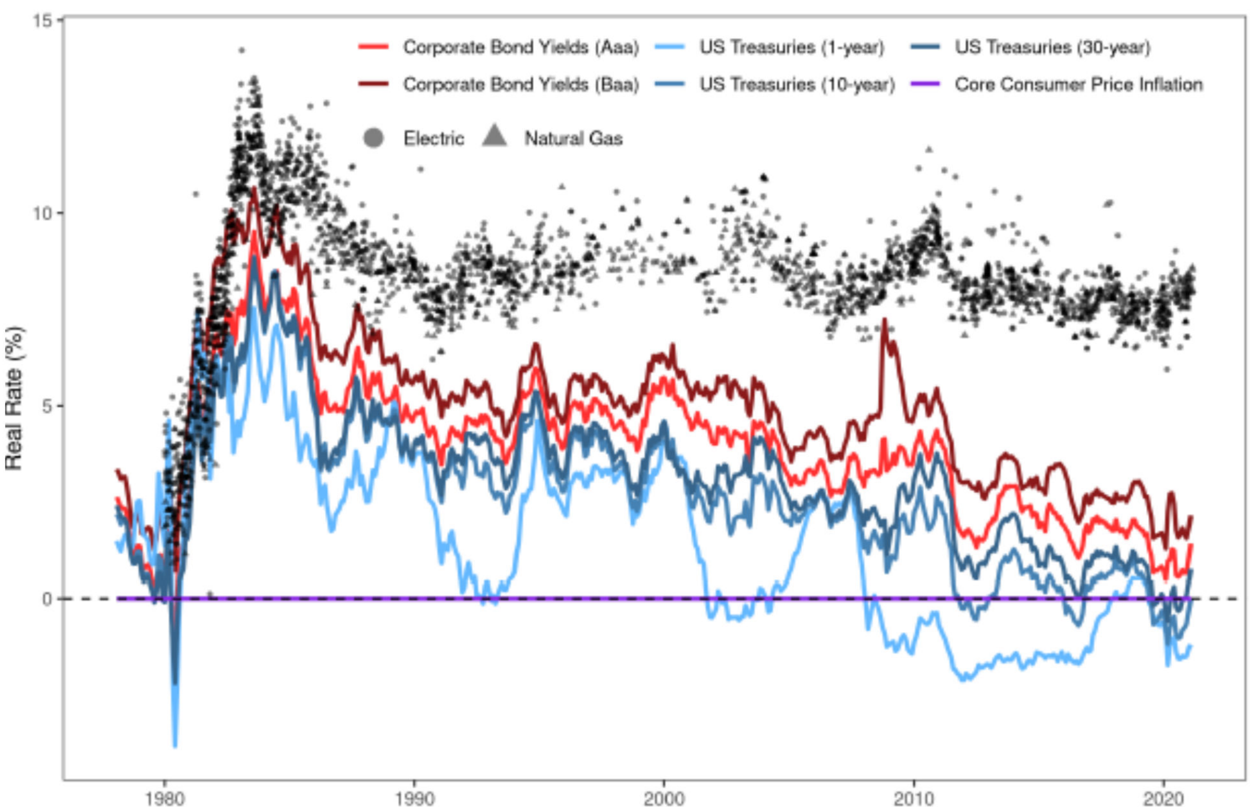

(Source)

A regulator can see the interest rate the utility pays to a lender or bond purchaser, though there is always concern that the utility isn't getting the best deal it could in those thin markets. The much bigger problem, however, is how much to compensate shareholders who own a piece of the firm. Those costs don't appear anywhere on the books and are not straightforward to estimate.

These numbers really matter. US investor-owned electric utilities had assets of [nearly $1.4 trillion] when 2022 started, and about half of that is financed with shareholder equity. That's why a lot of time in utility rate cases is spent fighting over the relatively obscure technical question of how much return investors require in order to buy the utility's stock.

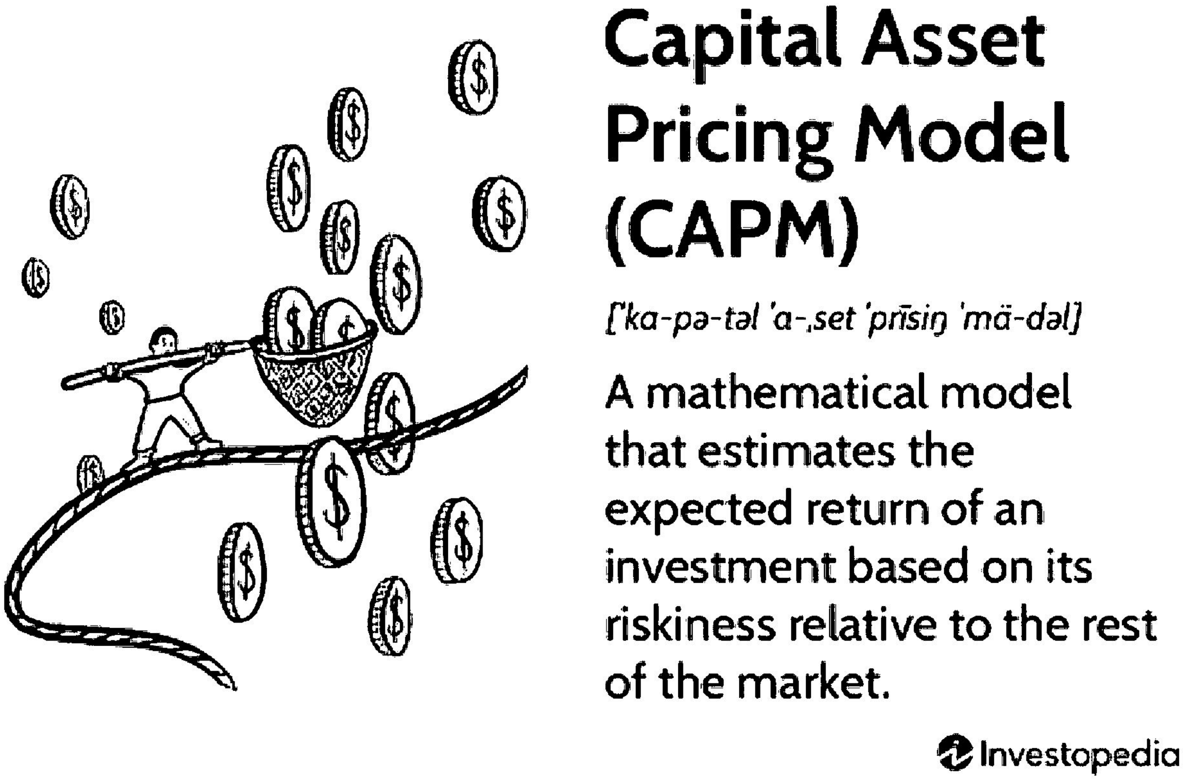
A new Energy Institute [working paper] by recently-graduated EI alumni, [Karl Dunkle Werner] and [Stephen Jarvis], takes a deep dive into this question and suggests that U.S. regulators are not doing a great job overseeing these costs.

Karl and Stephen (K&S) do this by collecting data on over 3500 regulatory rate cases for electricity and natural gas utilities between 1980 and 2021. They then compare the allowed rate of return on equity to a variety of capital cost indexes, including government and corporate bonds. As the figure below shows, the real (inflation-adjusted) return regulators allow equity investors to earn has been pretty steady over the last 40 years, while many different measures of the actual cost of capital have been declining.




These trends could be explained if utilities have gotten riskier over the last 40 years. But if that were the case it would affect bond ratings, as well as the cost of equity. Increased industry risk would be borne more by equity than debtholders, but it would still be hard to explain a substantial change in the riskiness of utility equity while their debt remained rock-solid. As the paper shows, utility debt ratings have barely budged. That may be a surprise to some folks in California – it's easy to think of particular utilities that may face more risk today than in past decades – but overall the folks who rate the riskiness of US utilities' don't see a systematic trend in recent decades.

All these different benchmarks yield different estimates of the gap in allowed equity returns compared to 25 years ago, but the median is around 2 percentage points, which is real money when it is multiplied by about $700 billion in equity financing of electric utilities alone. Still, there is a valid question of whether utilities are being over-compensated today or were being under-compensated 25 years ago.




(Source)

But K&S don't just compare to debt ratings. They also look at the direct economic models of what equity should actually cost, built around what's known as the Capital Asset Pricing Model (CAPM), the workhorse finance model for asset valuation that is frequently referenced in regulatory hearings. This approach accounts for how risky a company is and the market compensation for taking on extra risk. Consistent with earlier research on utility equity returns, they find that there is also a significant and growing gap between the return regulators allow shareholders and what the CAPM would say they need to be paid to attract investment. They also show just how sensitive this approach is to the underlying assumptions, a fact that utilities are no doubt aware of and that should make regulators wary.

Along the way, the study finds an interesting empirical pattern that suggests what might be going on with these regulatory decisions. Both the return on equity requested by utilities and the return granted by regulators respond more quickly to rises in market measures of capital cost than to declines. In other words, utilities get in there quickly and demand higher returns when they can make the case shareholders are being under-compensated, and regulators respond to those demands. But when shareholders are being over-compensated, the adjustment tends to take longer (consistent with research that Paul Joskow did nearly 50 years ago), about twice as long, K&S estimate. Combining this slow response to over-compensation with the declining cost of capital over most of the last four decades (at least until 2022 came along) would explain why the gap in equity returns has widened on average.


(Source)

We worry about regulators over-compensating shareholders because the costs are paid through higher utility rates, which disproportionately hurt the poor, as Jim Sallee blogged about last week. And higher electric rates undermine building and transportation decarbonization

But utilities also have an incentive to overinvest in capital projects if they are earning an outsized return on those investments. Sure enough, the paper finds that every extra percentage point of allowed return on equity causes a utility's capital rate base to expand by an extra 5% on average. Overall the paper estimates excess costs to consumers could range from $2 billion to $20 billion per year, with the most likely number in the middle of that range. That doesn't mean all of that extra investment is wasted – the capital is still doing something that is presumably useful unless it's being spent on gold-plated coffee mugs – but it should make regulators think carefully about utilities' motivations when they argue for particular new capital expenditures.

Obviously, we need electric utilities, and we even need gas utilities for at least a while. Some people may argue K&S's results make the case for government-owned utilities so there are no shareholders to compensate, but to anyone who has studied the alternatives carefully, it's clear that each model is subject to abundant inefficiencies. I think this study should be another reminder not just that regulating utilities is a tough job, but also that investing in high-quality regulation – hiring adequate numbers of highly-skilled staff, paying well enough to retain the best of them, and giving them the resources to do their jobs – is likely to have enormous payback.

*Find me @BorensteinS most days tweeting energy news/research/blogs.*

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*Suggested citation: Borenstein, Severin. "*What Does Capital Really Cost a Utility?*" Energy Institute Blog, UC Berkeley, October 3, 2022,* https://energyathaas.wordpress.com/2022/10/03/what-does-capital-really-cost-a-utility/

**CATEGORIES**

Uncategorized

**TAGS**

# The Equity Premium

*Paul Bostock*. **Journal of Portfolio Management**. New York: Winter 2004. Vol. 30, Iss. 2; pg. 104, 8 pgs

**Abstract (Summary)**
Investors require additional expected returns for bearing costs and risks. The equity premium is the compensation investors require for bearing the additional costs and risks of equity investment compared with government bonds (or cash). In this framework, the equity premium is constructed by assembling the premiums paid for each source of cost and risk. The results appeal to intuition and are closer to theoretical expectations than historical equity and bond return comparisons. [PUBLICATION ABSTRACT]

**Full Text** (2957 words)



**[Headnote]**
What level should investors require?

The equity premium relates required returns for equities to returns for cash and bonds. The equity premium is the compensation investors require for bearing the additional costs and risks of equity investment.

Understanding the equity premium is largely a matter of using clear terms. Arnott in "Proceedings" [2002] suggests equity risk premium for the forward-looking expected or required returns and equity excess return for historical performance numbers. It is also useful to refer to the total equity premium, which is the compensation investors require for risk and for non-risk items such as term structure expectations, trading costs, and taxes.

There is a substantial literature on the equity premium. Kocherlakota [1996], Cornell [1999], "Proceedings of Equity Risk Premium Forum" [2002], and Ilmanen [2003] provide excellent reviews with comprehensive references.

Mehra and Prescott [1985] demonstrate theoretically that under standard finance models the equity risk premium should be very low: "The largest premium obtainable with the Model is 0.35%, which is not close to the observed value" (p. 156). Observing that equities had outperformed cash by some 6 percentage points per year over a period of almost 90 years, Mehra and Prescott realized there is a puzzle.

The risk premium is all about expectations and requirements. If assets return their expected rates, there is little dispersion among them. Actual historical returns vary enormously because historical returns also predominantly reflect surprises (departures from, or changes in, expectations.) It is therefore extremely difficult to infer a risk premium from historical returns.

The great 20th century surprise was inflation. In the 19th century, there was no inflation, while the 20th century saw an inflation explosion. Much of the 20th century equity-bond return difference is the effect of unanticipated inflation on cash and bond performance. Wilkie [1995], Arnott and Bernstein [2002], and Hunt and Hoisington [2003] discuss inflation further.

## COMPARING REQUIRED RETURNS ACROSS ASSET CLASSES

We develop an intuitive framework for construction of the total equity premium, piece by piece. We do not use historical returns or valuation indicators to assess the equity risk premium, but rather assess how high it j/zowM be, using information from other asset classes whose premiums are arguably more transparent. The approach is neither rigorous nor unique.

As a starting point, equities, bonds, and cash have one important general characteristic in common: Each provides a stream of income over time. For any income-producing asset, we can calculate a fair value by discounting the future expected cash flows at an appropriate rate-one that takes into account all relevant information: credit rating of the issuer, interest rate risk (or duration), discretionary variability of dividend income, trading, and tax costs.

Taking into account the full set of characteristics that investors would use to compare assets leads to a straightforward framework of analysis, illustrated in Exhibit 1. Note that discount rates and required rates of return are the same thing; the price now is the future value discounted back, while the future value is the price now plus its appreciation at the required rate. Required return is a natural characterization of how investors compare assets.

Cash is considered the risk-free asset, and its required return $R_0$ is known. The required return on fowg government bonds, over the shorter time horizon, is denoted $R_L$. This is not the same as the long yield $Y_L$ because the yield curve reflects expectations about interest rates in later periods as well as an interest rate risk premium.

For the long rate:

$R_L = R_0$, + fn[Duration(Bonds)l (1)

For long corporate bonds, the required return RH differs from the government bond rate solely because of issuer risk (normally expressed as a function of credit rating) . Smithers and Wright [2000] note that issuer differences can be used to refine risk premium measurements (although they do not pursue this). Corporate bonds are included to provide a yardstick for the issuer risk premium:

$R_B = R_0$ + fn[Duration(Bonds)] + fn[Issuer(Bonds)] (2)

The required return for equities, $R_E$, differs from the long corporate rate because of additional uncertainty in the payout, additional duration, and additional costs. There is no term for price volatility. In the discounted income valuation, a change in the value of equities is either a change in the expected income stream or a change in the discount rate, and the framework includes both these terms:

$R_E = R_0$ + fn[Duration(Equity)] + fn[Issuer(Equity)] + fn(Income Risk) + fn(Tax)+ fn(Trading Costs) (3)

Putting these pieces together, we can construct the equity premium by measuring and extrapolating the duration premium from the yield curve, providing the details for Equation (1); inferring an appropriate issuer premium from corporate bond data [Equation (2)]; calculating tax and trading costs from known rates; and measuring the effect of income volatility in cross-sectional studies of equities, for Equation (3).

ASSIGNING REQUIRED RETURNS TO ASSET CHARACTERISTICS

We use the framework in Exhibit 1 to assign required returns to the various asset characteristics.

Term Structure and Interest Rate Risk

Required returns cannot be taken directly from the yield curve, which shows return expectations over lengthening time horizons. Here we need to compare required returns for different assets over the same time horizon.

Over the longer term, the average yield curve shape should reflect expected interest rate changes split evenly between rises and falls. The yield curve shape is then a measure of the interest rate risk premium. For equities, we must include interest rate risk over and above long bonds.

The going concern equity duration is the reciprocal of the dividend yield, a result implied by the Gordon [1962] model. At a typical U.S. equity market yield of 4%, duration is 25 years. We use this figure to capture the essential property that growth of equity income over time makes equities more interest rate-sensitive than bonds. The duration figure may be model-dependent and may shorten because of buy-backs.

The data in Exhibit 2 show that ten-year bonds have had an average premium of 1.6 percentage points per year over cash. The equity interest rate risk premium is estimated by fitting the yield curve (an exponential shape fits well) and extrapolating it to the equity time horizon (Exhibit 3). The best estimate for the additional annual equity premium is about 3 to 4 percentage points, the error attributable to analysis of the time series volatility of the yield curve slope.

The high differential between long-term and short rates as of December 2002 surely reflects expectations, since the cash rate of 1.2 percentage point is very low relative to its history. To isolate expectations, it is reasonable to assume there is no further interest rate forecasting beyond five years (the yield curve may continue to slope upward as it is the mean value or integral of the forward short rate curve). The choice of five years for the limit of interest rate forecasting is not precise, so we include an error term for this.

According to the best fit, the ten-year yield is explained by term structure alone. This attribution has an indicative error of 0.3%, the interest rate risk premium on the next-higher maturity. Extrapolating to the long duration limit for the currently low equity yield (the analysis is not sensitive to the long duration number) gives an additional interest rate risk premium for equities of 0.8%. The additional equity premium has an error of 1.0%, reflecting the difficulty (and the model-dependence) of separating term structure and interest rate risk in this case.

Issuer Risk

Equities are issued by corporations, and corporations have a risk of default. The total equity premium and the equity risk premium must therefore include some compensation for issuer risk. Issuer risk is readily measurable in the bond markets. We use gross redemption yields on Lehman Corporate Aggregate bond indexes for four credit rating classes of U.S. corporate bonds (AAA, AA, A, BAA) as well as a government bond series (Exhibit 4).

Issuer risk must be aggregated over all companies in the equity market. While not all listed equities have credit-rated debt, it is possible to make reasonable estimates. Equities rank below debt, and companies can cut dividends more readily than they can suspend bond repayments. The larger companies that dominate the equity indexes in capitalization terms are typically rated A or AA. These considerations suggest an average rating of between A and BAA and, for an indicative range for errors, AA to BAA.

Transaction costs are higher for corporate bonds than governments, and an estimated liquidity premium for corporate bonds of 0.5% has been subtracted from yield spreads. Using a series from January 1973, the issuer risk premium is estimated at around 0.9% ± 0.4%. As of the end of 2002, similar analysis produces an estimated issuer premium of 1.4% ± 0.8%.

For an alternative approach that estimates premiums directly using option-based models, see Cooper and Davydenko [2003].

Income Risk

Equities have income risk that government bonds and T-bills do not have, in the sense that dividend payments are not fixed or contractual. This element of unpredictability should require an additional premium in required return. If this income volatility requires additional return, then the more volatile the income, the greater the required return.

The cross-sectional relationship between income volatility and required return may be isolated by grouping equities according to income volatility. From all S&P 500 constituents, over the period January 1960-January 2003, we select companies with a known market value and a dividend record. The five-year dividend volatility is evaluated from quarterly data for each company each year, and companies are assigned to slots of zero to 4% annual dividend volatility, over 4% to under 8%, and so on.

Average dividend yields for these volatility groups are calculated over the entire period. Here, incremental dividend yield is used as a proxy for an incremental discount rate; the steady-state discount rate is dividend yield plus long-term growth, and it is reasonable to assume over so many company-years that average expected growth would not be a function of historical dividend volatility.

Dividend yields are flat to slightly negative across these groups, implying that there is no additional premium for additional volatility (see Exhibits 5 and 6). Running the analysis as of the end of 2002 yields similar results.

This result suggests that investors in equities are not sensitive to dividend variability, and that there should be no additional premium required for the equity market over cash. Variations of the methodology indicate that the result is not explained by the variation of average market yield over the period, or by historical earnings growth, or by recent buybacks. Price volatility gives an even more negative slope. These results are supported by a similar study in the U.K.

Note that we have treated dividend variability and issuer risk separately for convenience. Part of income uncertainty is priced in issuer risk, but since equity income is discretionary and equity ranks below debt, a firm's shares carry more income risk than its corporate bonds.

Transaction Costs

Equities cost significantly more to trade than government bonds. One would expect the rational investor to price securities on the basis of after-cost returns. It is more realistic, however, to look at actual investor holding periods to calculate an appropriate liquidity premium.

Jones [2002] gives a highly informative account of U.S. equity trading volumes and costs over the 20th century. Jones's detailed analysis produces an estimated premium effect of 50 basis points per year, which we use for the long-term adjustment.

For end-2002 costs, we take a simpler approach. Consider a trading time horizon, which is the time it takes for the dollar value of trading in the market to equal the total market capitalization. The liquidity premium is the average round-trip cost taken over the trading time horizon. Using recent trading times (under a year) with current commissions and spreads produces a current U.S. equity liquidity premium of 20 ± 20 basis points.

Tax Costs

Investors should demand a higher return rate from securities that are more highly taxed, because realized net-of-tax returns are what investors actually receive. Government issues are not treated specially in the U.S. In the U.K., for example, government bonds are offered with tax advantages over equities, so in the general case a tax cost term is required.

Assembling the Risk Premium

Estimates of the total equity premium and the equity risk premium are summarized in detail in Exhibit 7. On average, equities should have offered a total premium over government bonds of 1.7% ± 0.6% and a risk premium of 1.2% ± 0.6%.

These results appeal to intuition and are consistent with an increasingly accepted view that the true risk premium is considerably lower than the historical return differential (see, for example, a thorough review in Ilmanen [2003]). We have already shown why historical returns give unreliable results.

The December 2002 total premium is 2.6% ± 1.3% over bonds, reflecting mainly additional issuer risk. The result is very interesting. It means a higher return is required if equities are to be fairly valued against bonds. This premium taken over current long government bond rates of 4.8% gives a total required return over the ten years of 7.4%.

The required long-term growth (with a yield of 1.8% and using the Gordon model again) is 5.6%. In current conditions (a bear market, an economy facing difficulties, and very low inflation), this outcome seems implausible. The analysis quite strongly suggests that the U.S. equity market remained overvalued at the end of 2002.

ESTIMATING THE MEHRA AND PRESCOTT THEORETICAL PREMIUM

Mehra and Prescott's [1985] theory shows how a premium is required for assets that offer uncertain delivery of marginal utility. In terms of securities, this relates both to the volatility of returns and to the timing (in simple terms, the same payment is more valuable in bad times than in good). Measurements or estimates of this premium require us to identify and price only the corresponding characteristics.

An important question arises as to whether issuer risk is part of the theoretical risk premium. Over the very short term (the time horizon for the theoretical risk premium), we would not expect default to be a significant risk other than for already distressed, very low-grade issuers. Equity default is certainly rare (or, at least, it has been). If the Mehra and Prescott theoretical result is strictly a short-term only result, issuer risk should not be included in the premium estimate, which would then be low.

FURTHER WORK

It would be most interesting to explore a framework with a long time horizon and to include the impact of inflation. High and unexpected 20th century inflation explains much of the low real return to cash and bonds. In a real and long-term framework, cash and bonds would be seen as more risky and equities less so, so a smaller risk premium would very probably result.

The analysis here also raises interesting questions of how each premium component should be priced, in theory. In other words, is there a theoretically correct interest rate risk premium, a correct issuer premium, and so on? Mehra [2003] looks at pricing influences including costs and taxes, making modifications to the theory rather than to the measurements.

Refining both the theory and the measurement for each risk premium component will be an interesting task. In other words, our work raises as many new issues as it solves, and it will continue to be interesting to see the subject evolve.

SUMMARY

We have described a procedure for constructing the equity premium by assembling premiums paid for each source of cost and risk. According to historical average data, equities should offer a total premium over government bonds of 1.7% ± 0.6% and a risk premium of 1.2% ± 0.6%.

Investors do not all have the same time horizon and the same inflation risks. For long-term real investors, equities are the natural home, and it does seem that equity buyers accept short-term volatility as part of the package. These results appeal to intuition and are closer to theoretical expectations than historical equity and bond return comparisons.

ENDNOTE

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# The N-Stage Discount Model and Required Return: A Comment

*Richard S. Bower**

**Abstract**

A number of financial economists have observed that estimates of the market discount rate have a downward bias when dividend timing is ignored. They have done so in academic and utility industry journals as well as in testimony. Most conclude or imply that such a downward bias carries over to the calculation of a regulated utility's required rate of return. This paper demonstrates that in fact the conventional cost of equity calculation, ignoring quarterly compounding and even without adjustment for fractional periods, serves very well as a measure of required return.

## Introduction

In a recent issue of *The Financial Review*, Brooks and Helms presented an N-stage dividend discount model [1]. The model is a welcome addition to the analytic tool kit available for estimation of market discount rates.

Nevertheless, I think they make an unwarranted leap from the model to the conclusion that failure to consider quarterly compounding and fractional periods introduces a downward bias in rate of return calculation, and that theirs is "an efficient procedure . . . for estimating the required rate of return" ([1], p. 656). That this presumption may mislead analysts involved in public utility rate proceedings is likely because their illustration involves a regulated electric utility, Commonwealth Edison Company, and their point seems to have relevance for regulatory proceedings.

Brooks and Helms are not alone in their observation. A number of financial economists note that market discount rate estimates are biased downward when div-

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idend timing is ignored. These findings have appeared in academic and utility industry journals as well as in testimony. Academic articles include [1, 2, 7, 8, 12], and examples in the utility literature are [3, 14]. For recent testimony that makes the point, see [9]. The same point is made in Morin's *Utilities' Cost of Capital* [10, pp. 141–142]. Most authors have concluded or implied that such a downward bias carries over to the calculation of the required rate of return.

Linke and Zumwalt [2, 7, 8] are the exceptions. They made it clear that there is a distinction between a utility's market discount rate ($k$ in my notation) and the rate year required return ($r$) that regulators should allow, and that reconciling the two necessitates a calculation.

I do not dispute the observation that an estimate of the market discount rate has a downward bias when dividend timing is ignored, nor do I find fault with the Linke and Zumwalt market rate to rate year required return adjustment calculations. My intention here is to point out that the conventional cost of equity calculation used in utility rate cases ($k^*$ in my notation), which ignores timing, is (or is easily transformed into) an unbiased estimate of rate year required return ($k^{**}$ in my notation), while the correct market discount rate, if unadjusted, has an upward bias when used to represent required utility return.

## Base Case

The market discount rate annually compounded for the year ahead is the rate $k$ that satisfies the equation

$$P_0 = \frac{d1}{(1+k)^{t1}} + \frac{d2}{(1+k)^{t2}} + \frac{d3}{(1+k)^{t3}} + \frac{d4}{(1+k)^{t4}} + \frac{P_0(1+\hat{g})}{(1+k)}, \quad (1)$$

where $P_0$ is the market price of a stock at time 0; $dn$ is the first, second, third, or fourth dividend expected in the year ahead (quarterly dividends are assumed but the assumption is unimportant); $\hat{g}$ is the expected annual growth rate in stock price; and $tn$ is the fraction of a 365-day year before dividend $n$ is to be received. I consider the ex-dividend date to be the date the dividend is received because it is the date on which the dividend becomes the investor's property, a property that remains the investor's even if the stock is sold prior to the payment date. Brooks and Helms used the actual dividend payment date, which I follow when I use their illustration in this note.

The total dividend expected in the year is $D = d1 + d2 + d3 + d4$, and the conventional cost of equity calculation used in utility rate cases is

$$k^* = (D/P_0) + \hat{g}. \tag{2}$$

If market price ($P_0$) and book value ($B_0$) are equal at time 0, and the rate year begins at time 0, then, using $k^*$ as allowed return ($r$), regulators would approve prices for utility services that provide expected earnings ($E$):

$$E = k^* P_0. \tag{3}$$

Combining equations (2) and (3),

$$\hat{g} = E - D/P_0. \tag{4}$$

Regulators using this approach will provide an expected cash flow that just satisfies equation (1):

$$P_0 = \frac{d1}{(1+k)^{t1}} + \frac{d2}{(1+k)^{t2}} + \frac{d3}{(1+k)^{t3}} + \frac{d4}{(1+k)^{t4}} + \frac{P_0 + E - D}{(1+k)}. \tag{1a}$$

If regulators set allowed return equal to $k$ (the market discount rate) rather than the smaller $k^*$, expected cash flow would discount to a current price greater than $P_0$. The market discount rate ($k$), when used directly in this way, would produce a required return ($r$) with an upward bias.

The conventional estimate of cost of equity ($k^*$) is also the correct estimate of required return ($r$) when price and book values are not equal. To see that it is, consider a payout rate $\text{PAY}_m$. Set it equal to $d_m/k^*P_0$ at each dividend date $n$. Then use this payout with the earnings indicated by applying the same required return rate to book value, $k^*B_0$.

The result is that each term in equation (1) or (1a) is multiplied by the ratio $B_0/P_0$ so that the dividends and final book value that could be provided and are expected discount to initial book value at the market discount rate, $k$.

If the rate year does not begin at the same time that the market price is observed, an adjustment in the calculation of $k^*$ (to $k^{**}$) is required. Because $P$ rises as the time ($t1$) to the first dividend ($d1$) falls, the calculation of $k^{**}$ will vary from $k^*$ with $t1$. The market discount rate ($k$) will not change.

To get a correct conventional measure of required return, prices must be adjusted to reflect any time difference from $d1$ in market price and rate year book value. For example, if the market price used is the price 30 days before a dividend date, and initial book value for the rate year is 90 days before a dividend date, then the proper price to use in the conventional but adjusted cost of equity calculation, $k^{**}$, is $P_0/(1 + k)^{60/365}$, and

$$k^{**} = (D/[P_0/(1 + k)^{(60/365)}]) + \hat{g} \qquad (5)$$

is the right measure of required return ($r$). This adjustment is one that staff witnesses for the New York Public Service Commission appear to make in calculating $k^*$ (see [13]). If the market price is 90 days before and the rate year book value 30 days before the dividend date, then $(1 + k)^{-60/365}$ would be used to adjust $P_0$.

Because the timing difference from dividend dates for market price and rate year book value may result in either an upward or downward adjustment of the same magnitude in the conventional estimate of cost of equity ($k^*$), omitting the adjustment—failing to use $k^{**}$—introduces error but not bias. The conventional measure of cost of equity ($k^*$), a measure that does not consider quarterly compounding and usually fails to consider fractional periods, has no downward bias as an estimate of required return ($r$). It is, as the Federal Energy Regulatory Commission (FERC) and other regulatory bodies have concluded, a fair measure to use in calculating the allowed return for a utility. The FERC, in its *Generic Determination of Rate of Return on Common Equity for Public Utilities*, embraces the Linke and Zumwalt analysis in Order No. 442 [4], reconsiders it in Order No. 442-A [5], and settles on the required return I develop here in Order No. 461 [6].

### First Illustration

For illustration, consider the Brooks and Helms no-growth case for Commonwealth Edison. That this is an illustration simplifying most of the very difficult problems of estimation facing a cost of equity analyst is particularly clear in the case of Commonwealth Edison. Its very complicated situation is described in a November 1990 Salomon Brothers report [11]. On June 9, 1989, Commonwealth Edison stock closed at 37 5/8; the next dividend date is 52 days away on August 1, 1989; the expected dividend on that date is \$0.75, and assumed and expected growth is zero. With this information, $k$ = 8.287 percent, and equation (1) yields

$$37.625 = \frac{0.75}{1.08287^{(54/365)}} + \frac{0.75}{1.08287^{(146/365)}} + \frac{0.75}{1.08287^{(238/365)}} + \frac{0.75}{1.08287^{(327/365)}} + \frac{37.625(1 + 0)}{1.08287},$$

and $k^* = 7.973$ percent or \$37.625.

If market and book values were equal and the rate year began on June 9, 1989, then setting allowed and required return ($r$) equal to $k^*$ would provide earnings of $k^*P(0.07973 \times 37.625)$, or \$3.00. Because rate case earnings reflect cash flow timing, including dividend payments, as well as short-term interest expense and revenue, the \$3.00 covers the \$0.75 dividends received by investors on May, August, November, and February 1st and maintains book and market value at \$37.625.

Suppose, however, that the rate year begins on January 1, 1990. The book value estimated for that date is \$32.68, according to Value Line, and the next dividend is 31 rather than 52 days away. Adjusting price for the difference in dividend timing and calculating a conventional but adjusted required return

$$\begin{aligned} k^{**} &= (D/[P_0/(1 + k)^{(-21/365)}]) + \hat{g} \\ &= (3/[37.625/1.08287^{(-21/365)}]) + 0 \\ &= 7.9370\%. \end{aligned}$$

Earnings based on an allowed and required return ($k^{**}$) of 7.9370 percent and a book value ($32.68) would be set at $2.594 and, with payout at 25 percent of earnings each quarter ($d_1/k^{**}P_0$), would be associated with a $0.6485 dividend on February 1, 1990 and on subsequent dividend dates.

The present value of the expected dividend flow and the unchanged or zero growth end-of-year 1990 book value is the January 1, 1990 book value:

$$B_0 = \frac{0.6485}{(1.08287)^{(31/365)}} + \frac{0.6485}{(1.08287)^{(120/365)}} + \frac{0.6485}{(1.08287)^{(212/365)}} + \frac{0.6485}{(1.08287)^{(304/365)}} + \frac{32.68(1 + 0)}{(1.08287)}.$$

$$B_0 = 32.68.$$

In other words, the allowed return set equal to the conventional but adjusted cost of equity estimate ($k^{**}$) provides earnings and dividends sufficient to support book value at the market discount rate. In this illustration, the conventional but adjusted cost of equity calculation ($k^{**}$) provides the correct estimate of the required rate of return.

## Second Illustration

My first illustration has assumed no growth and full payout of dividends. A second illustration with dividend growth and fractional payout may be more useful. Linke and Zumwalt [7, pp. 16–17] provided the material for that illustration. A stock with dividend due one quarter away is now selling at $8.2294, which is also its book value. The dividend expected is $0.25 at the end of the current and the following quarter and $0.265 in each of the four following quarters. Price, like dividends, is expected to increase 6 percent from one year to the next, so that one year from now price is expected to be 8.2294 × 1.06, or $8.7232. The rate year begins with the first dividend one quarter away, so $k^*$ and $k^{**}$ are equal.

The market discount rate ($k$) is 19.375:

$$8.2294 = \frac{0.25}{1.19375^{0.25}} + \frac{0.25}{1.19375^{0.50}} + \frac{0.265}{1.19375^{0.75}} + \frac{0.265}{1.19375} + \frac{8.7232}{1.19375}.$$

The conventional cost of equity ($k^*$) is

$$k^* = D/P_0 + \hat{g}$$
$$= 1.03/8.2294 + 0.06$$
$$= 18.516\%.$$

The conventional cost of equity ($k^*$) is less than the market discount rate ($k$), but as a measure of required return ($r$), it is still correct. The earnings it provides, $k^*P_0 = 0.18516 \times 8.2294 = 1.524$, are just sufficient to cover dividends and support book and market value growth of 6 percent:

| | Q1 | Q2 | Q3 | Q4 | Year |
|---|---|---|---|---|---|
| Book, Start of Q | 8.2294 | 8.3604 | 8.4914 | 8.6074 | |
| Earnings | 0.381 | 0.381 | 0.381 | 0.381 | 1.524 |
| Dividend | 0.25 | 0.25 | 0.265 | 0.265 | 1.03 |
| Book, End of Q | 8.3604 | 8.4914 | 8.6074 | 8.7234 | |

This illustration is obvious. The point may be less clear, but more interesting, if book value varies from market price, and rate year timing differs from market timing. The results remain the same, however: While the conventional cost of equity may have a downward bias as an estimate of the market discount rate, it is a correct and unbiased estimate of a utility's required return.

## Conclusion

Although many analysts have concluded that required return has a downward bias if it is calculated ignoring quarterly compounding and fractional periods, it would be surprising if they were correct. Too many rate cases have come and gone, and too many utilities have survived and sustained market prices above book, to make downward bias in the conventional calculation of required return a likely reality.

Brooks and Helms and the other authors are correct when they say that the conventional cost of equity calculation is a downward-biased estimate of the market discount rate. They are not correct, however, in concluding that it has a bias as a measure of required return. As a measure of required return, the conventional cost of equity calculation ($k^*$), ignoring quarterly compounding and even without adjustment for fractional periods, serves very well.

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# *A re-examination of analysts' superiority over time-series forecasts*

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CARE Conference
April 10, 2010

# Summary of slides from the Inaugural CARE Conference

- #1 "Analysts' forecasts are optimistic"
- #2 "Analysts are better than time-series models"
- #3 We think we know how analysts forecast
- #4 "Analysts' forecasts are inefficient"
- #5 Limited evidence on what analysts do with forecasts
- #6 Most research ignores analysts' multi-tasking
- *#7 Analyst data are helpful for capital markets literature*
- #8 "Analysts are dominated by conflicts of interest"
- #9 We may be focusing on their least important activities
- #10 Researchers eschew alternative methodologies

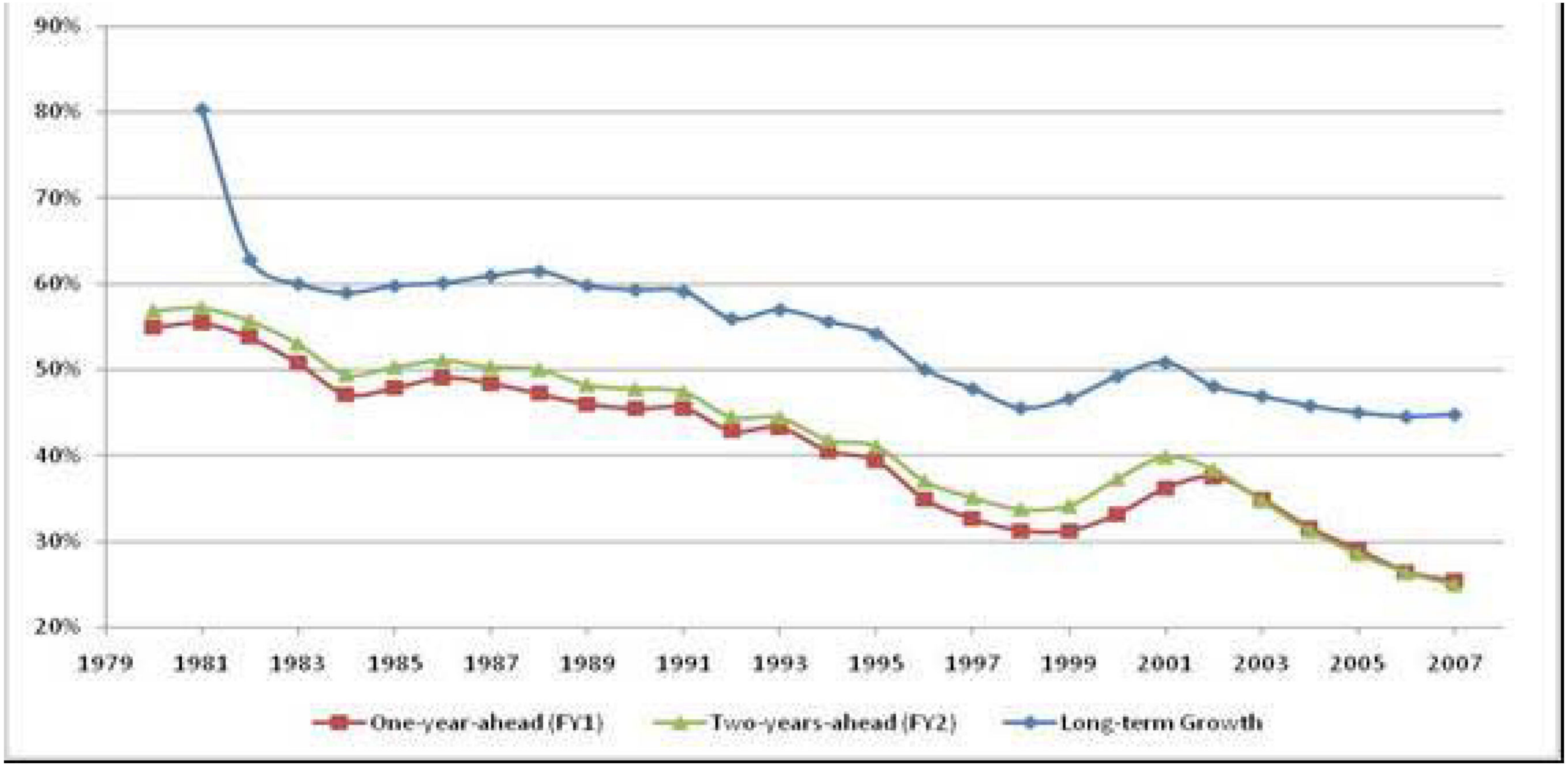
# Summary motivation

- Analysts >> Time-series models is widely accepted

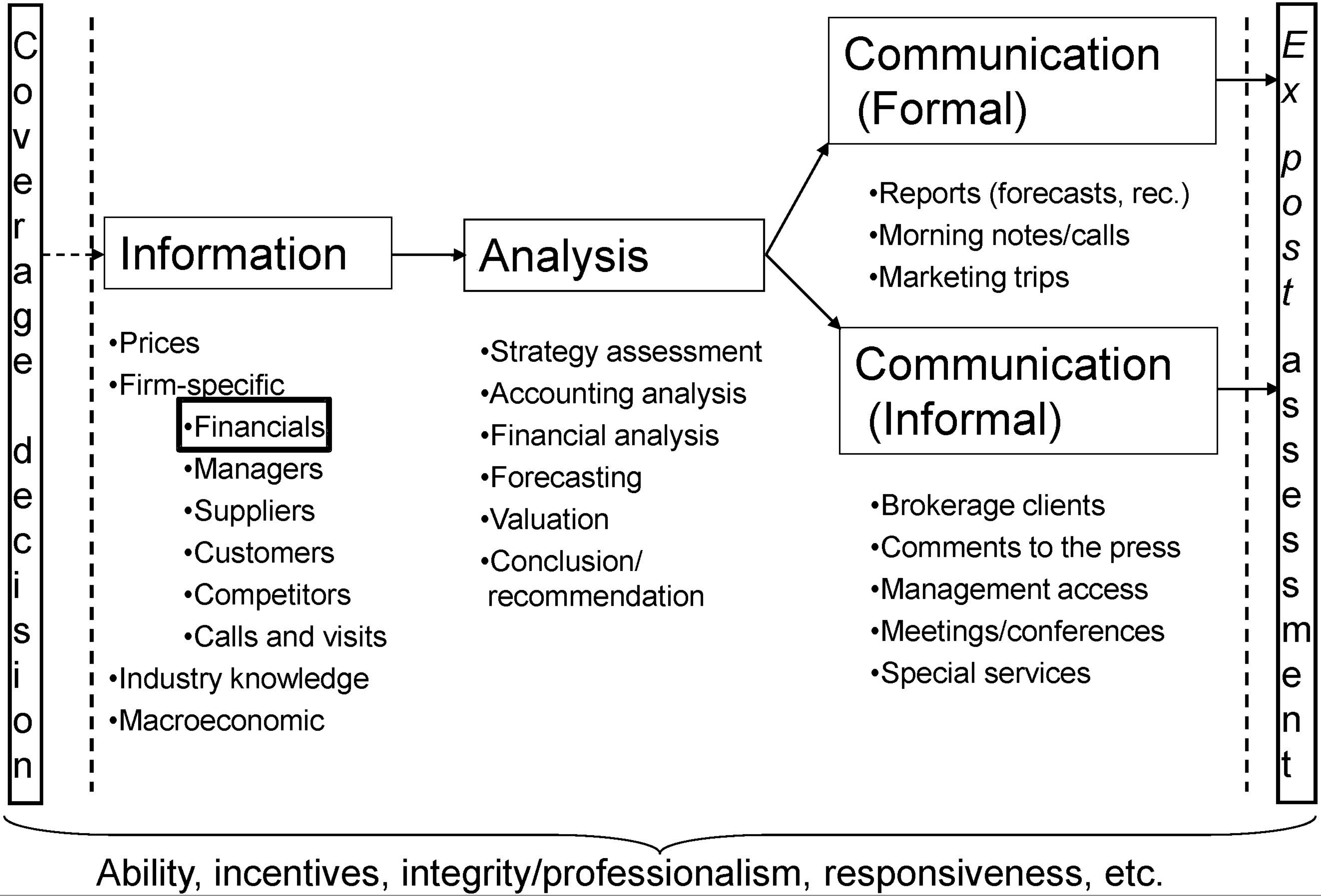
- However, research supporting this view is characterized by:
  - **Tiny samples** relative to current research standards (in capital mkts.)
    - e.g., 50 to a few hundred firms
  - Data demands ⇒ **bias towards large, mature firms**
    - e.g., some studies restrict sample to NYSE, or numerous analysts
    - Analyst following correlated with institutional investment
    - e.g., AF and II interact with firms ⇒ richer information environment (more severe in earlier years)
  - **Economic significance** of differences seems small
    - Collins & Hopwood (1980): 31.7% vs. 32.9%
    - Fried & Givoly (1982): 16 vs. 19%

- Current-day incorporation of analysts' forecasts into research studies
  - Goes beyond **generalizability** of earlier studies
    - e.g., smaller firms underrepresented in early research,
      longer forecast horizons underrepresented
    - ala Bamber, Christensen & Gaver (AOS2000)

# Figure 1: Percentage of firms on Compustat/CRSP *without* analyst coverage



# Analysts


Coverage decision
Information
•Prices
•Firm-specific
•Financials
•Managers
•Suppliers
•Customers
•Competitors
•Calls and visits
•Industry knowledge
•Macroeconomic
Analysis
•Strategy assessment
•Accounting analysis
•Financial analysis
•Forecasting
•Valuation
•Conclusion/ recommendation
Communication (Formal)
•Reports (forecasts, rec.)
•Morning notes/calls
•Marketing trips
Communication (Informal)
•Brokerage clients
•Comments to the press
•Management access
•Meetings/conferences
•Special services
Ex post assessment
Ability, incentives, integrity/professionalism, responsiveness, etc.

# Research question

- Do analysts' forecasts *really* dominate time-series forecasts?
  - When and when not?
    - Covariate 1: Forecast horizon (timing advantage)
    - Covariate 2: Firm age (information advantage)
    - Covariate 3: Firm size " "
    - Covariate 4: Analyst following " "
    - Covariate 5: Magnitude of changes (when analysts stand to add most value)

- Implicit Null: We should see NO significant results

- Conditional on differences in forecast accuracy (in favor of time-series models), do market returns reinforce the primary results?

# Observation: Other Evidence re: Experts vs. Time-Series

- Interest rates (Belongia 1987)
- GDP (Loungani 2000)
- Recessions (Fintzen and Stekler 1999)
- Turning points of business cycles (Zarnowitz 1991)
- …

# Landscape – 1970s

- Much capital markets research was aimed at understanding the time-series properties of earnings.
    - Ball and Watts 1972, Brooks and Buckmaster 1976, Albrecht et al. 1977, Salamon and Smith 1977, and Watts and Leftwich 1977.

- General Conclusion: Earnings approximate a random walk. Sophisticated time-series models rarely provide an economically significant improvement, and even when they do it comes at high cost.

- *"The ability of random walk models to "outpredict" the identified Box-Jenkins models suggests that the random walk is still a good description of the process generating annual earnings in general, and for individual firms."* Watts and Leftwich (1977, 269)

- Brown (1993, 295) declares the issue of whether annual earnings follow a random walk as "*pretty much resolved by the late 1970s.*"

# Landscape – 1980s

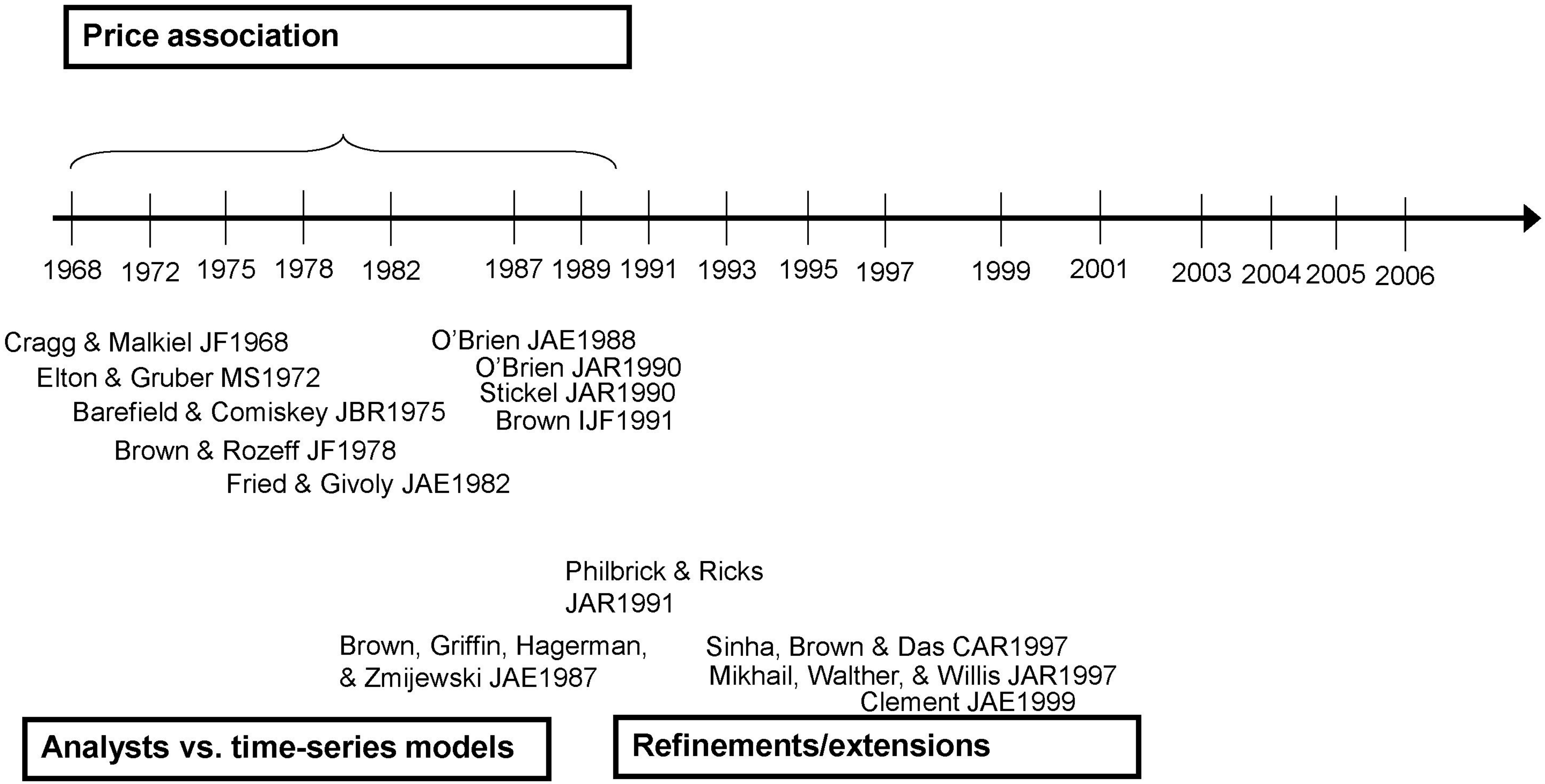
- Newly available analyst data becomes available
  (i.e., Value-Line, I/B/E/S).

- "Horse-race studies" comparing time-series and analyst forecasts.

- Brown and Rozeff 1978, Fried and Givoly 1982, and Brown et al. 1987a,b

- General Conclusion: Analyst forecasts generally dominate time-series forecasts of earnings. Analyst superiority is attributed to:
  - **<u>Information Advantage</u>**
    - They know all information in TS and more
  - **<u>Timing Advantage</u>**
    - They issue forecasts after the end of the lagged TS

# Timeline of Analysts vs. Time-Series Research



# Landscape – Today

- Researchers generally regard this literature as having conclusively shown that analysts' forecasts are a superior proxy for earnings expectations.

- Kothari (JAE2001) concludes that
  - The time-series properties of earnings literature is fast becoming extinct because of "the easy availability of a better substitute" which is "available at a low cost in machine-readable form for a large fraction of publicly traded firms." (p. 145)
  - "[C]onflicting evidence notwithstanding, in recent years it is common practice to (implicitly) assume that analysts' forecasts are a better surrogate for market's expectations than time-series forecasts." (p. 153)

# Landscape – Today (cont.)

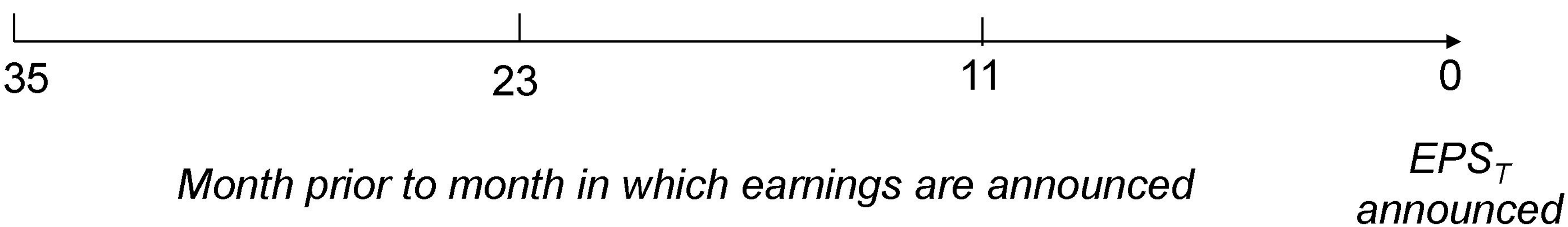
- Random Walk
  - Still descriptive (Lorek, Willinger & Bathke RQFA2008)

- Valuation and cost of capital literature:
  - Researchers use analyst forecasts over some short horizon and then extrapolate to value a perpetuity.
  - Example: Dhaliwal et al. (JAE 2007), Frankel & Lee (JAE1998), etc.
    - One-year-ahead: FY1 (I/B/E/S Consensus forecast )
    - Two-years-ahead: FY2
    - Three-years-ahead: FY3 = FY2 x (1+LTG)
    - Four-years-ahead: FY4 = FY3 x (1+LTG)
    - Five-years-ahead: FY5 = FY4 x (1+LTG)
  - Exceptions: Allee (2009); Hou, Van Dijk and Zhang (2010)

# Data

- 1983-2007 (25 years)
- Minimal constraints on data
  - Biggest constraint is presence on *I/B/E/S*
    - EPS forecast, actual EPS, stock price
  - Sales on *Compustat* in year t-1
  - Earnings in year t-1 > 0
    - Hayn (1995): losses less persistent than profits
      ⇒ bias results in favor of random walk (but not really)
  - *CRSP* returns for last analysis

- Consensus forecasts in months 0 to -35



# Forecast errors

- Random Walk
  - Minimizes data demands
  - Performs as well or better than higher order models (consistent w/ Lorek, WIllinger & Bathke RQFA2008)
  - *We aim to do nothing to "help" RW forecasts"*

- Forecast of EPS for year T as of t months prior to the month $EPS_T$ announced
  - Analysts: $|(FEPS_{T,t} – EPS_T)| / Price_t$
  - Time-series: $|(EPS_{T-1} – EPS_T)| / Price_t$

| | #Forecasts | #Firm-years | #Firms |
|---|---|---|---|
| FY1: | 740,070 | 69,483 | 10,140 |
| FY2: | 611,132 | 60,170 | 9,037 |
| FY3: | 468,777 | 46,226 | 7,070 |

- Analyst superiority = RWFE – AFE
  - >0 $\Rightarrow$ analysts more accurate than random walk
  - <0 $\Rightarrow$ random walk more accurate than analysts

# Table 2 Descriptive Statistics

| | Mean | Q1 | Median | Q3 |
|---|---|---|---|---|
| Sales | >374 | 110 | 374 | 1,384 |
| BTM | 0.58 | 0.31 | 0.50 | 0.75 |
| Age | 8.2 | 4 | 7 | 12 |
| # Analysts | 7.6 | 2 | 5 | 10 |

* A hypothetical data requirement of 10 years (as in Fried and Givoly 1982) would eliminate 70% of the observations in our sample).

# Scaling and winsorizing

$$Error = \left| \frac{(\text{Actual} - \text{Predicted})}{|\text{Actual}|} \right|$$

% > 1.00

| Months Prior to RDQE | Analysts Forecasts Errors | Random Walk Errors |
|---|---|---|
| 1 Month (Mature Firms) | 2.90% | 10.50% |
| | | |
| 1 Month | 5.20% | 14.20% |
| 11 Months | 16.50% | 14.60% |
| 23 Months | 22.60% | 19.70% |
| 35 Months | 29.50% | 26.20% |

**The 1.00 cut-off was reasonable in earlier studies. Fried and Givoly (1982) report that only 0.5% of their observations have scaled forecast errors that are greater than 1.00.

# Table 2 Descriptive Statistics (i.e., Forecast– Actual)

**Panel C: Signed Forecast Errors**

| | **Mean** | **Median** | **Q1** | **Q3** |
|---|---|---|---|---|
| *Signed Random Walk Errors* | | | | |
| 11 Months | 0.0086 | -0.0055 | -0.0153 | 0.0108 |
| 23 Months | 0.0033 | -0.0091 | -0.0260 | 0.0150 |
| 35 Months | -0.0038 | -0.0124 | -0.0363 | 0.0166 |
| *Signed Analysts' Forecasts Errors* | | | | |
| 11 Months | 0.0194 | 0.0028 | -0.0041 | 0.0209 |
| 23 Months | 0.0272 | 0.0090 | -0.0049 | 0.0391 |
| 35 Months | 0.0332 | 0.0162 | -0.0047 | 0.0541 |

# Table 3 – Main Results
# Analysts' forecast superiority, Full sample

| FY1 | | | FY2 | | | FY3 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Months Prior | Firm-years | Analyst Superiority | Months Prior | Firm-years | Analyst Superiority | Months Prior | Firm-years | Analyst Superiority | |
| 0 | 32,723 | 0.0245 | 12 | 29,072 | 0.0120 | 24 | 21,944 | 0.0072 | |
| 1 | 66,224 | 0.0236 | 13 | 55,447 | 0.0106 | 25 | 41,766 | 0.0055 | |
| 2 | 66,104 | 0.0227 | 14 | 56,659 | 0.0095 | 26 | 42,827 | 0.0044 | |
| 3 | 65,794 | 0.0212 | 15 | 56,575 | 0.0081 | 27 | 42,941 | 0.0033 | |
| 4 | 65,458 | 0.0182 | 16 | 56,023 | 0.0063 | 28 | 42,588 | 0.0019 | |
| 5 | 65,158 | 0.0155 | 17 | 55,360 | 0.0049 | 29 | 42,272 | 0.0007 | |
| 6 | 64,787 | 0.0131 | 18 | 54,458 | 0.0037 | 30 | 41,753 | (0.0000) | NS |
| 7 | 64,361 | 0.0102 | 19 | 53,195 | 0.0022 | 31 | 40,952 | (0.0012) | |
| 8 | 63,869 | 0.0081 | 20 | 51,832 | 0.0012 | 32 | 40,137 | (0.0020) | |
| 9 | 63,200 | 0.0064 | 21 | 49,745 | 0.0004 | 33 | 38,925 | (0.0027) | |
| 10 | 62,103 | 0.0041 | 22 | 46,501 | (0.0006) | 34 | 36,836 | (0.0035) | |
| 11 | 60,289 | 0.0025 | 23 | 42,124 | (0.0011) | 35 | 33,789 | (0.0040) | |

Analyst are more accurate than RW by 25 basis-pts

RW is more accurate than Analysts by 40 basis-pts

# Table 4 – Analysts' forecast superiority and firm age

**Panel A: FY1 – 11 months prior to RDQE**

| Firm Age | Firm-years | Analysts'Superiority | RW Forecast Error | Analysts' Forecast Error |
|---|---|---|---|---|
| 1 | 2,534 | 0.0007 | 0.0534 | 0.0527 |
| 2 | 6,321 | 0.0015 | 0.0405 | 0.0391 |
| 3 | 5,867 | 0.0005 | 0.0382 | 0.0378 |
| 4 | 5,109 | 0.0005 | 0.0379 | 0.0374 |
| 5+ | 40,335 | 0.0033 | 0.0301 | 0.0268 |

**Panel B: FY2 – 23 months prior to RDQE**

| Firm Age | Firm Years | Analysts' Superiority | RW Forecast Error | Analysts' Forecast Error |
|---|---|---|---|---|
| 1 | 1,413 | (0.0102) | 0.0628 | 0.0730 |
| 2 | 3,969 | (0.0072) | 0.0528 | 0.0599 |
| 3 | 3,810 | (0.0048) | 0.0511 | 0.0559 |
| 4 | 3,404 | (0.0028) | 0.0472 | 0.0500 |
| 5+ | 29,447 | 0.0008 | 0.0396 | 0.0388 |

**Panel C: FY3 – 35 months prior to RDQE**

| Firm Age | Firm Years | Analysts' Superiority | RW Forecast Error | Analysts' Forecast Error |
|---|---|---|---|---|
| 1 | 1,119 | (0.0186) | 0.0735 | 0.0871 |
| 2 | 2,954 | (0.0147) | 0.0647 | 0.0785 |
| 3 | 3,011 | (0.0084) | 0.0604 | 0.0670 |
| 4 | 2,794 | (0.0060) | 0.0584 | 0.0618 |
| 5+ | 23,868 | (0.0012) | 0.0498 | 0.0488 |

# Table 5: Partitions for size and analyst following

**Panel A: Small Firms**

| FY1 | | | FY2 | | | | FY3 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Months Prior** | **Firm-years** | **Analysts' Superiority** | **Months Prior** | **Firm-years** | **Analysts' Superiority** | | **Months Prior** | **Firm-years** | **Analysts' Superiority** |
| 0 | 6,897 | 0.0256 | 12 | 5,786 | 0.0085 | | 24 | 3,067 | 0.0007 |
| 1 | 13,845 | 0.0252 | 13 | 10,871 | 0.0074 | | 25 | 6,006 | (0.0023) |
| 2 | 13,737 | 0.0242 | 14 | 11,087 | 0.0060 | | 26 | 6,192 | (0.0040) |
| 3 | 13,535 | 0.0225 | 15 | 10,885 | 0.0045 | | 27 | 6,114 | (0.0054) |
| 4 | 13,396 | 0.0191 | 16 | 10,574 | 0.0020 | | 28 | 5,968 | (0.0074) |
| 5 | 13,175 | 0.0162 | 17 | 10,204 | 0.0004 | NS | 29 | 5,836 | (0.0086) |
| 6 | 13,009 | 0.0132 | 18 | 9,799 | (0.0012) | | 30 | 5,626 | (0.0096) |
| 7 | 12,815 | 0.0098 | 19 | 9,299 | (0.0026) | | 31 | 5,366 | (0.0106) |
| 8 | 12,607 | 0.0071 | 20 | 8,759 | (0.0040) | | 32 | 5,055 | (0.0119) |
| 9 | 12,341 | 0.0052 | 21 | 8,023 | (0.0055) | | 33 | 4,707 | (0.0131) |
| 10 | 11,906 | 0.0023 | 22 | 6,987 | (0.0066) | | 34 | 4,152 | (0.0151) |
| 11 | 11,314 | (0.0003) | 23 | 5,804 | (0.0078) | | 35 | 3,521 | (0.0167) |

# Table 5: Partitions for size and analyst following

**Panel B: Low Analyst Following**

| FY1 | | | | FY2 | | | | FY3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Months Prior | Firm-years | Analysts' Superiority | | Months Prior | Firm-years | Analysts' Superiority | | Months Prior | Firm-years | Analysts' Superiority | |
| 0 | 9,089 | 0.0314 | | 12 | 8,001 | 0.0110 | | 24 | 8,634 | 0.0063 | |
| 1 | 18,744 | 0.0311 | | 13 | 14,945 | 0.0102 | | 25 | 16,197 | 0.0036 | |
| 2 | 18,704 | 0.0289 | | 14 | 15,648 | 0.0085 | | 26 | 16,784 | 0.0022 | |
| 3 | 18,557 | 0.0267 | | 15 | 15,890 | 0.0066 | | 27 | 16,848 | 0.0005 | NS |
| 4 | 18,422 | 0.0224 | | 16 | 16,055 | 0.0043 | | 28 | 16,672 | (0.0014) | |
| 5 | 18,265 | 0.0185 | | 17 | 16,138 | 0.0027 | | 29 | 16,489 | (0.0030) | |
| 6 | 18,104 | 0.0151 | | 18 | 16,319 | 0.0008 | NS | 30 | 16,180 | (0.0035) | |
| 7 | 18,062 | 0.0109 | | 19 | 16,646 | (0.0009) | | 31 | 15,556 | (0.0051) | |
| 8 | 17,880 | 0.0080 | | 20 | 16,901 | (0.0022) | | 32 | 14,941 | (0.0063) | |
| 9 | 17,636 | 0.0058 | | 21 | 17,310 | (0.0032) | | 33 | 13,992 | (0.0074) | |
| 10 | 17,113 | 0.0026 | | 22 | 17,924 | (0.0041) | | 34 | 12,501 | (0.0087) | |
| 11 | 16,264 | 0.0000 | NS | 23 | 18,185 | (0.0045) | | 35 | 10,544 | (0.0099) | |

# Table 6: Partitions by magnitude of change in EPS

**Panel A: The 33% of Forecasts with the Least Extreme Forecasted Change in EPS**

| FY1 | | | FY2 | | | FY3 | | |
|---|---|---|---|---|---|---|---|---|
| **Months Prior** | **Firm-years** | **Analysts' Superiority** | **Months Prior** | **Firm-years** | **Analysts' Superiority** | **Months Prior** | **Firm-years** | **Analysts' Superiority** |
| 0 | 10,915 | 0.0025 | 12 | 9,679 | 0.0174 | 24 | 7,305 | 0.0140 |
| 1 | 22,093 | 0.0026 | 13 | 18,472 | 0.0156 | 25 | 13,910 | 0.0124 |
| 2 | 22,053 | 0.0025 | 14 | 18,881 | 0.0143 | 26 | 14,268 | 0.0115 |
| 3 | 21,954 | 0.0023 | 15 | 18,845 | 0.0125 | 27 | 14,300 | 0.0106 |
| 4 | 21,842 | 0.0020 | 16 | 18,654 | 0.0106 | 28 | 14,185 | 0.0097 |
| 5 | 21,743 | 0.0018 | 17 | 18,439 | 0.0087 | 29 | 14,075 | 0.0085 |
| 6 | 21,620 | 0.0016 | 18 | 18,139 | 0.0074 | 30 | 13,907 | 0.0078 |
| 7 | 21,481 | 0.0014 | 19 | 17,721 | 0.0058 | 31 | 13,645 | 0.0071 |
| 8 | 21,324 | 0.0013 | 20 | 17,260 | 0.0051 | 32 | 13,382 | 0.0065 |
| 9 | 21,110 | 0.0012 | 21 | 16,561 | 0.0041 | 33 | 12,968 | 0.0061 |
| 10 | 20,731 | 0.0012 | 22 | 15,488 | 0.0034 | 34 | 12,277 | 0.0057 |
| 11 | 20,117 | 0.0012 | 23 | 14,023 | 0.0029 | 35 | 11,263 | 0.0053 |

# Table 6: Partitions by magnitude of change in EPS

**Panel B: The 33% of Forecasts with the Most Extreme Forecasted Change in EPS**

| FY1 | | | FY2 | | | FY3 | | |
|---|---|---|---|---|---|---|---|---|
| **Months Prior** | **Firm-years** | **Analysts' Superiority** | **Months Prior** | **Firm-years** | **Analysts' Superiority** | **Months Prior** | **Firm-years** | **Analysts' Superiority** |
| 0 | 20,131 | 0.0025 | 12 | 9,695 | 0.0090 | 24 | 7,319 | 0.0018 |
| 1 | 10,881 | 0.0616 | 13 | 18,483 | 0.0077 | 25 | 13,924 | 0.0005 NS |
| 2 | 22,029 | 0.0591 | 14 | 18,885 | 0.0067 | 26 | 14,272 | (0.0007) NS |
| 3 | 21,988 | 0.0566 | 15 | 18,865 | 0.0057 | 27 | 14,316 | (0.0021) |
| 4 | 21,881 | 0.0530 | 16 | 18,684 | 0.0042 | 28 | 14,196 | (0.0037) |
| 5 | 21,761 | 0.0453 | 17 | 18,463 | 0.0028 | 29 | 14,088 | (0.0049) |
| 6 | 21,657 | 0.0381 | 18 | 18,157 | 0.0014 | 30 | 13,908 | (0.0058) |
| 7 | 21,530 | 0.0320 | 19 | 17,728 | 0.0000 NS | 31 | 13,639 | (0.0076) |
| 8 | 21,385 | 0.0244 | 20 | 17,276 | (0.0012) | 32 | 13,360 | (0.0087) |
| 9 | 21,217 | 0.0190 | 21 | 16,584 | (0.0025) | 33 | 12,964 | (0.0095) |
| 10 | 20,993 | 0.0143 | 22 | 15,498 | (0.0035) | 34 | 12,267 | (0.0109) |
| 11 | 20,635 | 0.0083 | 23 | 14,042 | (0.0040) | 35 | 11,256 | (0.0115) |

## Market expectation tests

- We estimate:

$$\text{Return} = \alpha + \beta \ \text{RWFE} + \epsilon_{it}$$
$$\text{Return} = a + b \ \text{AFE} + e_{it}$$

where the return accumulation period is equaled to forecast horizon.

- Market Expectation Proxy Ratio = $\beta$ / b

# Table 7: Associations with market returns

$$Return_{T,M} = \alpha + \beta\,(EPS_{T-1} - EPS_T) + \varepsilon_T$$

$$Return_{T,M} = \alpha + b\,(Forecasted\ EPS_{T,M} - EPS_T) + e_T$$

| FY1 | | | FY2 | | | | FY3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Months Prior | Firm-years | $\beta/b$ | Months Prior | Firm-years | $\beta/b$ | | Months Prior | Firm-years | $\beta/b$ | |
| 0 | 30,411 | 0.345 | 12 | 28,003 | 0.602 | | 24 | 21,097 | 0.784 | |
| 1 | 62,355 | 0.395 | 13 | 53,654 | 0.678 | | 25 | 40,377 | 0.831 | |
| 2 | 63,455 | 0.342 | 14 | 54,664 | 0.707 | | 26 | 41,336 | 0.843 | |
| 3 | 63,419 | 0.396 | 15 | 54,473 | 0.742 | | 27 | 41,369 | 0.874 | |
| 4 | 63,101 | 0.540 | 16 | 53,882 | 0.798 | | 28 | 40,992 | 0.908 | |
| 5 | 62,790 | 0.632 | 17 | 53,196 | 0.833 | | 29 | 40,674 | 0.928 | |
| 6 | 62,441 | 0.685 | 18 | 52,319 | 0.888 | | 30 | 40,151 | 0.962 | |
| 7 | 62,016 | 0.735 | 19 | 51,113 | 0.912 | | 31 | 39,409 | 1.001 | |
| 8 | 61,540 | 0.795 | 20 | 49,789 | 0.953 | | 32 | 38,624 | 1.017 | NS |
| 9 | 60,915 | 0.838 | 21 | 47,783 | 1.007 | NS | 33 | 37,455 | 1.057 | NS |
| 10 | 59,936 | 0.905 | 22 | 44,672 | 1.008 | NS | 34 | 35,435 | 1.081 | |
| 11 | 58,261 | 0.939 | 23 | 40,500 | 1.032 | | 35 | 32,530 | 1.099 | |

The association between returns and RW is 94% of the association between returns and analyst forecast errors.

# Table 8: Market returns, by size & analyst following

$$Return_{T,M} = \alpha + \beta\,(EPS_{T-1} - EPS_T) + \varepsilon_T$$

$$Return_{T,M} = \alpha + b\,\left(Forecasted\ EPS_{T,M} - EPS_T\right) + e_T$$

**Panel A: Small Firms**

| FY1 | | | | FY2 | | | | FY3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Months Prior | Firm-years | $\beta/b$ | | Months Prior | Firm-years | $\beta/b$ | | Months Prior | Firm-years | $\beta/b$ | |
| 0 | 6,558 | 0.1813 | | 12 | 7,275 | 0.6957 | | 24 | 3,396 | 0.9083 | |
| 1 | 13,382 | 0.3422 | | 13 | 13,711 | 0.7238 | | 25 | 6,575 | 0.8822 | |
| 2 | 13,474 | 0.4286 | | 14 | 14,068 | 0.7550 | | 26 | 6,814 | 0.9084 | |
| 3 | 13,364 | 0.4433 | | 15 | 13,887 | 0.7793 | | 27 | 6,757 | 0.9330 | |
| 4 | 13,227 | 0.5309 | | 16 | 13,468 | 0.8111 | | 28 | 6,552 | 0.9392 | NS |
| 5 | 13,001 | 0.6186 | | 17 | 12,974 | 0.8496 | | 29 | 6,422 | 0.9495 | NS |
| 6 | 12,838 | 0.6610 | | 18 | 12,424 | 0.9076 | | 30 | 6,173 | 0.9550 | NS |
| 7 | 12,643 | 0.7170 | | 19 | 11,713 | 0.8973 | | 31 | 5,844 | 0.9762 | NS |
| 8 | 12,431 | 0.8323 | | 20 | 10,906 | 0.9676 | NS | 32 | 5,491 | 1.0016 | NS |
| 9 | 12,176 | 0.8551 | | 21 | 9,808 | 1.0151 | NS | 33 | 5,028 | 1.0965 | |
| 10 | 11,750 | 0.9273 | NS | 22 | 8,168 | 1.0043 | NS | 34 | 4,258 | 1.1229 | |
| 11 | 11,167 | 0.9431 | NS | 23 | 6,392 | 1.0277 | NS | 35 | 3,431 | 1.1230 | |

# Table 8: Market returns, by size & analyst following

**Panel B: Low analyst following**

| FY1 | | | | FY2 | | | | FY3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Months Prior | Firm-years | $\beta/b$ | | Months Prior | Firm-years | $\beta/b$ | | Months Prior | Firm-years | $\beta/b$ | |
| 0 | 8,522 | 0.4728 | | 12 | 5,691 | 0.6681 | | 24 | 3,010 | 0.9507 | NS |
| 1 | 17,567 | 0.5084 | | 13 | 10,710 | 0.6871 | | 25 | 5,901 | 0.9674 | NS |
| 2 | 17,746 | 0.4986 | | 14 | 10,912 | 0.7337 | | 26 | 6,077 | 0.9682 | NS |
| 3 | 17,688 | 0.5739 | | 15 | 10,706 | 0.7421 | | 27 | 5,993 | 0.9786 | NS |
| 4 | 17,582 | 0.6328 | | 16 | 10,395 | 0.8069 | | 28 | 5,842 | 1.0100 | NS |
| 5 | 17,437 | 0.7040 | | 17 | 10,026 | 0.8506 | | 29 | 5,706 | 1.0230 | NS |
| 6 | 17,289 | 0.7165 | | 18 | 9,631 | 0.9414 | NS | 30 | 5,502 | 1.0464 | NS |
| 7 | 17,220 | 0.7617 | | 19 | 9,140 | 0.9273 | NS | 31 | 5,247 | 1.0736 | NS |
| 8 | 17,039 | 0.8377 | | 20 | 8,606 | 0.9721 | NS | 32 | 4,941 | 1.0892 | NS |
| 9 | 16,825 | 0.9025 | | 21 | 7,878 | 1.0209 | NS | 33 | 4,596 | 1.1288 | |
| 10 | 16,383 | 0.9530 | NS | 22 | 6,849 | 1.0100 | NS | 34 | 4,045 | 1.2025 | |
| 11 | 15,615 | 0.9823 | NS | 23 | 5,687 | 1.0570 | NS | 35 | 3,426 | 1.1849 | |

# Table 9: Market returns, by magnitude of change in EPS

$$Return_{T,M} = \alpha + \beta\,(EPS_{T-1} - EPS_T) + \varepsilon_T$$

$$Return_{T,M} = \alpha + b\,(Forecasted\ EPS_{T,M} - EPS_T) + e_T$$

**Panel A: The 33% of Forecasts with the Least Extreme Forecasted Change in EPS**

| FY1 | | | | FY2 | | | | FY3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Months Prior | Firm-Years | *β/b* | | Months Prior | Firm-years | *β/b* | | Months Prior | Firm-years | *β/b* | |
| 0 | 9,023 | 0.9388 | NS | 12 | 7,763 | 0.6330 | | 24 | 5,840 | 0.7597 | |
| 1 | 18,254 | 0.9280 | NS | 13 | 14,935 | 0.7053 | | 25 | 11,227 | 0.7974 | |
| 2 | 18,188 | 0.9300 | NS | 14 | 15,145 | 0.7316 | | 26 | 11,462 | 0.8336 | |
| 3 | 18,083 | 0.9620 | NS | 15 | 15,057 | 0.7808 | | 27 | 11,466 | 0.8514 | |
| 4 | 18,018 | 0.9882 | NS | 16 | 14,865 | 0.8222 | | 28 | 11,356 | 0.8433 | |
| 5 | 17,921 | 0.9764 | NS | 17 | 14,697 | 0.8603 | | 29 | 11,264 | 0.8631 | |
| 6 | 17,807 | 0.9807 | NS | 18 | 14,479 | 0.8661 | | 30 | 11,101 | 0.9067 | |
| 7 | 17,710 | 0.9866 | NS | 19 | 14,147 | 0.9241 | | 31 | 10,891 | 0.9716 | NS |
| 8 | 17,566 | 0.9767 | NS | 20 | 13,783 | 0.9412 | | 32 | 10,696 | 0.9870 | NS |
| 9 | 17,398 | 0.9794 | NS | 21 | 13,218 | 0.9643 | NS | 33 | 10,337 | 1.0165 | NS |
| 10 | 17,143 | 0.9772 | NS | 22 | 12,365 | 0.9747 | NS | 34 | 9,777 | 1.0334 | NS |
| 11 | 16,646 | 0.9791 | NS | 23 | 11,269 | 0.9930 | NS | 35 | 9,034 | 1.0473 | NS |

**Panel B: The 33% of Forecasts with the Most Extreme Forecasted Change in EPS**

| FY1 | | | FY2 | | | FY3 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Months Prior | Firm-Years | *β/b* | Months Prior | Firm-years | *β/b* | Months Prior | Firm-years | *β/b* | |
| 0 | 8,795 | 0.2981 | 12 | 7,575 | 0.5937 | 24 | 5,566 | 0.8875 | |
| 1 | 17,647 | 0.3710 | 13 | 14,701 | 0.6814 | 25 | 10,831 | 0.8781 | |
| 2 | 17,619 | 0.3270 | 14 | 14,892 | 0.7739 | 26 | 10,975 | 0.8875 | |
| 3 | 17,498 | 0.3560 | 15 | 14,823 | 0.7831 | 27 | 10,950 | 0.9032 | |
| 4 | 17,319 | 0.5213 | 16 | 14,617 | 0.7384 | 28 | 10,811 | 0.9513 | NS |
| 5 | 17,210 | 0.6093 | 17 | 14,426 | 0.8124 | 29 | 10,741 | 0.9741 | NS |
| 6 | 17,103 | 0.6808 | 18 | 14,171 | 0.9003 | 30 | 10,587 | 0.9953 | NS |
| 7 | 16,903 | 0.7110 | 19 | 13,800 | 0.9175 | 31 | 10,376 | 1.0477 | |
| 8 | 16,709 | 0.7550 | 20 | 13,433 | 1.0186 | 32 | 10,130 | 1.0967 | |
| 9 | 16,438 | 0.7822 | 21 | 12,856 | 1.0476 | 33 | 9,823 | 1.0626 | |
| 10 | 16,084 | 0.8471 | 22 | 11,983 | 1.0304 | 34 | 9,269 | 1.1096 | |
| 11 | 15,650 | 0.8717 | 23 | 10,852 | 1.0735 | 35 | 8,493 | 1.1257 | |

# Table 10: Panel multivariate regression

$$Analysts'Superiority_{T,M} = \gamma_0 + \gamma_1\ \#Analysts_T + \gamma_2\ STD_{T,M} + \gamma_3\ BTM_{T-1} + \gamma_4\ Sales_{\ T-1} + \gamma_5\ Forecast\Delta_{T,M} + \varepsilon_T$$

| Months Prior RDQE | Intercept | #Analysts | STD | BTM | Sales | Forecasted Δ |
|---|---|---|---|---|---|---|
| 0 | -0.0083 | -0.0021 | 0.0055 | 0.0035 | 0.0015 NS | 0.0279 |
| 1 | -0.0072 | -0.0022 | 0.0052 | 0.0028 | 0.0017 | 0.0262 |
| 2 | -0.0079 | -0.0013 | 0.0043 | 0.0030 | 0.0017 | 0.0253 |
| 3 | -0.0079 | -0.0013 | 0.0047 | 0.0029 | 0.0012 | 0.0238 |
| 4 | -0.0071 | -0.0005 | 0.0039 | 0.0024 | 0.0005 NS | 0.0206 |
| 5 | -0.0055 | 0.0003 NS | 0.0027 | 0.0025 | -0.0002 NS | 0.0175 |
| 6 | -0.0054 | 0.0006 | 0.0025 | 0.0022 | 0.0001 NS | 0.0148 |
| 7 | -0.0050 | 0.0011 | 0.0015 | 0.0019 | 0.0004 NS | 0.0115 |
| 8 | -0.0047 | 0.0015 | 0.0009 | 0.0017 | 0.0007 NS | 0.0092 |
| 9 | -0.0041 | 0.0016 | 0.0004 | 0.0015 | 0.0010 | 0.0069 |
| 10 | -0.0026 | 0.0015 | -0.0003 | 0.0010 | 0.0012 | 0.0043 |
| 11 | -0.0017 | 0.0018 | -0.0011 | 0.0008 | 0.0012 | 0.0025 |
| 12 | 0.0076 | -0.0002 NS | 0.0050 | 0.0045 | 0.0058 | -0.0064 |
| 13 | 0.0070 | 0.0003 NS | 0.0031 | 0.0041 | 0.0055 | -0.0057 |
| 14 | 0.0056 | 0.0008 | 0.0031 | 0.0042 | 0.0053 | -0.0057 |
| 15 | 0.0046 | 0.0011 | 0.0020 | 0.0042 | 0.0049 | -0.0050 |
| 16 | 0.0028 | 0.0017 | 0.0010 | 0.0037 | 0.0052 | -0.0048 |
| 17 | 0.0012 | 0.0022 | 0.0000 NS | 0.0036 | 0.0054 | -0.0043 |
| 18 | 0.0005 NS | 0.0028 | -0.0007 | 0.0036 | 0.0048 | -0.0043 |
| 19 | -0.0015 | 0.0031 | -0.0014 | 0.0033 | 0.0049 | -0.0037 |
| 20 | -0.0023 | 0.0037 | -0.0019 | 0.0030 | 0.0048 | -0.0035 |
| 21 | -0.0029 | 0.0038 | -0.0023 | 0.0026 | 0.0054 | -0.0036 |
| 22 | -0.0036 | 0.0038 | -0.0028 | 0.0024 | 0.0057 | -0.0035 |
| 23 | -0.0079 | 0.0057 | -0.0027 | 0.0019 | 0.0062 | -0.0035 |
| 24 | 0.0048 | 0.0009 | -0.0005 NS | 0.0051 | 0.0094 | -0.0074 |
| 25 | 0.0026 | 0.0023 | -0.0016 | 0.0059 | 0.0090 | -0.0074 |
| 26 | 0.0026 | 0.0025 | -0.0023 | 0.0056 | 0.0093 | -0.0078 |
| 27 | 0.0019 | 0.0029 | -0.0026 | 0.0053 | 0.0094 | -0.0083 |
| 28 | 0.0007 NS | 0.0035 | -0.0028 | 0.0052 | 0.0096 | -0.0089 |
| 29 | -0.0007 NS | 0.0039 | -0.0028 | 0.0047 | 0.0096 | -0.0090 |
| 30 | -0.0020 | 0.0042 | -0.0033 | 0.0046 | 0.0106 | -0.0093 |
| 31 | -0.0027 | 0.0046 | -0.0035 | 0.0042 | 0.0104 | -0.0097 |
| 32 | -0.0036 | 0.0049 | -0.0038 | 0.0038 | 0.0108 | -0.0099 |
| 33 | -0.0040 | 0.0051 | -0.0040 | 0.0035 | 0.0111 | -0.0103 |
| 34 | -0.0060 | 0.0054 | -0.0044 | 0.0030 | 0.0133 | -0.0108 |
| 35 | -0.0062 | 0.0058 | -0.0048 | 0.0019 | 0.0127 | -0.0108 |

# Conclusion

- DISCLAIMER: Prior research was appropriately deliberate in its sample selection and other research design choices, and the conclusions drawn are warranted.
  - However, as is common in our field, it is the subsequent researcher who over-generalizes findings from prior studies.

- **Analysts** only appear persistently superior to a simple earnings extrapolation for **short horizons for large firms**.
- Equivalently, **time-series** forecasts perform as well or better than analysts over **moderate-to-long forecast horizons, and especially for smaller, younger firms**.