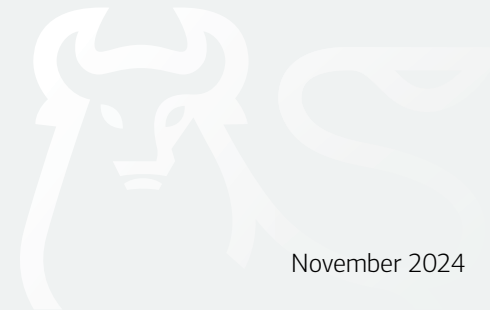


Foundations of Guidance

Capital Market Assumptions and Strategic Asset Allocations

November 2024



Clients often ask how Merrill projects the growth of their investments for planning purposes, and how it arrives at the asset allocation advice it provides. The short answer is that this guidance relies on two methodologies developed by the Chief Investment Office (CIO): the Capital Market Assumptions and the Strategic Asset Allocations. This report explains what these are, how the CIO develops them and their relevance for clients.

WHAT ARE THE CAPITAL MARKET ASSUMPTIONS?

The Capital Market Assumptions are long-term views of major asset classes-including stocks, bonds, cash and alternative investments.¹ More specifically, they are estimates, for a 25-year planning horizon, of the expected returns, volatility and correlations of a set of asset classes that is broadly representative of the investment universe.²

The Capital Market Assumptions are foundational to many parts of our wealth management process, including potential wealth, measurement of progress toward goals, saving and spending guidance, risk management and, most notably, asset allocation. Their development, therefore, requires a thoughtful, rigorous process.

The Capital Market Assumptions do not serve as a crystal ball. Because returns to risky assets are, by their very nature, impossible to forecast precisely, future realized returns will inevitably differ from today’s expected return estimates. The assumptions do, however, offer valuable guidance regarding the central tendency and range of potential returns for each asset class. This equips us to help our clients plan for the future.

¹ An asset class is a group of securities or investments that exhibit similar characteristics, behave similarly in the marketplace and are subject to similar laws and regulations. Each asset class can be divided into sub-asset classes. Alternative investments, for example, can include hedge strategies, private equity & credit, and real assets.

² A correlation is a statistical measure of the extent to which two variables move together.

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WHY ARE THE CAPITAL MARKET ASSUMPTIONS IMPORTANT FOR CLIENTS?

The Capital Market Assumptions have a number of applications. First, there are basic inputs for the future value of a client's potential wealth (Exhibit 1).³ If a potential wealth indicates that a client is not on track to meet his or her goals, the advisor can guide the client to take corrective action, such as saving more, scaling back spending plans or delaying retirement.

One key measure of a client's financial well-being is the funding ratio, defined as the risk-adjusted present value of assets and future income divided by the net present value of future goals and commitments. A client whose funding ratio is 100% is on track to meet goals. A ratio of 125% would indicate ample funding, but a ratio of 75% would signal a meaningful shortfall. The Capital Market Assumptions are key inputs in calculating the funding ratio, which should be monitored regularly by both the client and his or her advisor.

The Capital Market Assumptions form the basis for saving and spending guidance more generally. For example, they help an advisor determine how much a client must save to fund a given goal, or what spending rate will allow a retiree to make use of his or her assets without running the risk of outliving his or her wealth.

The Capital Market Assumptions also support risk management. They do this by supplying key inputs needed to measure and manage downside risk. An advisor can quantify the losses that a client may experience in the future and verify that they are in line with the client's risk capacity and tolerance. The assumptions also help advisors provide clients a picture of how their portfolios might perform under a range of market scenarios. If these prospects are out of line with a client's time horizon and risk tolerance, the advisor can adjust the portfolio allocation to better align with the client's goals and preferences.

All of these applications of the Capital Market Assumptions—potential wealth, measurement of progress to goals, saving and spending guidance, and risk management—are critical links in our wealth management process. But there is one further use of the assumptions, one that warrants particular attention: the development of Strategic Asset Allocations (see section on Strategic Asset Allocations).

HOW DOES THE CIO DEVELOP THE CAPITAL MARKET ASSUMPTIONS?

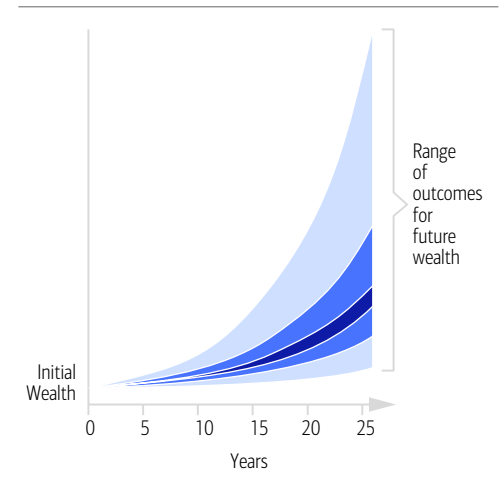
To develop the Capital Market Assumptions, we first identify a market index for each asset class that is broadly representative, is widely accepted and has a long history. The index serves as a proxy for the asset class.

Exhibit 2 presents the 2025 Capital Market Assumptions. The Capital Market Assumptions for U.S. small cap growth stocks, for example, are based on the Russell 2000 Growth Total Return index. They include annual estimates of several measures for a 25-year planning horizon:

- geometric return of 9.6%
- arithmetic return of 12.5%
- volatility of 25.8%
- geometric return of at least 6.7% for unfavorable market scenario estimates
- geometric return of at least 12.7% for favorable market scenario estimates

³ Although the Capital Market Assumptions are stated before expenses and taxes, potential wealth and related measures can nonetheless take these into account.

Exhibit 1: Potential Wealth (Illustrative Only)



Source: Chief Investment Office.
For illustrative purposes only.

Comparing Geometric and Arithmetic Mean Returns

The arithmetic mean, a simple average, provides an unbiased estimate of a variable. If, however, we seek to estimate future compound returns, the more appropriate measure is the geometric mean return. This is the return that, when compounded over the period of time in question, produces the actual realized cumulative return.

To illustrate these concepts, consider the example of a \$100 investment that rises 25% one year (to \$125) and declines 20% the next year (back to \$100). The arithmetic mean return over the two-year period is $[25\% + (-20\%)]/2$, or 2.5%. But the geometric mean return over the period is 0%.

The arithmetic return of a variable will always be greater than or equal to its geometric return. The greater the volatility, the wider the gap between the arithmetic and geometric returns.

Exhibit 2: 2025 Capital Market Assumptions

Asset Class	Proxy	Geometric Return	Arithmetic Return	Volatility	Market Scenarios Unfavorable	Market Scenarios favorable
Inflation	Consumer Price Index (CPI) - All Urban Consumers, not seasonally adjusted	2.29	2.30	1.44	2.09	2.49
U.S. Large Cap Growth	Russell 1000 Growth TR	8.54	10.16	19.09	6.46	10.70
U.S. Large Cap Value	Russell 1000 Value TR	9.35	10.63	16.98	7.45	11.27
U.S. Small Cap Growth	Russell 2000 Growth TR	9.62	12.46	25.78	6.67	12.65
U.S. Small Cap Value	Russell 2000 Value TR	10.04	12.03	21.37	7.53	12.58
International Developed Equity	MSCI Daily TR Net World Ex USA USD	6.68	8.28	18.85	4.50	8.88
Emerging Markets	MSCI Daily TR Net EM USD	6.68	9.13	23.53	3.82	9.67
U.S. Governments	ICE BofA AAA U.S. Treasury/Agency Master	3.61	3.72	4.65	2.78	4.44
U.S. Mortgages	ICE BofA Mortgage Master	3.76	3.91	5.58	2.83	4.70
U.S. Corporates	ICE BofA U.S. Corp Master	4.39	4.59	6.44	3.27	5.53
U.S. High Yield	ICE BofA High Yield Cash Pay	5.65	5.98	8.35	4.53	6.79
International Fixed Income	ICE BofA Global Broad Market TR ex USD (Hedged)	3.88	3.94	3.55	3.19	4.56
Cash	IA SBBI US 30 Day TBill TR USD	2.66	2.67	1.21	2.28	3.04
Hedge Strategies	Hedge Fund Research HFRI Fund Weighted Composite	7.59	7.84	7.28	6.65	8.56
Private Equity & Credit	Cambridge Associates US Private Equity Index (Legacy Version) / US Private Credit Index. The current breakdown weights are 86% Private Equity / 14% Private Credit.	9.65	10.63	14.83	7.87	11.50
Real Assets	50/25/25 BB Commodity / NCREIF Property / NCREIF TBI; After 06/2020: 50/40/10 Commodity / NCREIF Property / FTSE NAREIT Equity REITs Total Return Index	4.25	4.58	8.28	3.07	5.48

Effective January 2025. Source: Chief Investment Office. **FOR INFORMATIONAL PURPOSES ONLY. Performance of CIO Asset Allocation Guidelines is intended to illustrate the effect of asset allocation and diversification. It is not an advertisement or representation of any investment advisory products or services offered by Merrill.**

This exhibit does not reflect the performance of any specific investment. Assumptions are for a 25-year planning horizon. Returns are before fees, taxes and other expenses. Volatility is calculated as a standard deviation. Expected arithmetic return is a simple arithmetic average of periodic returns, calculated by summing returns for all time periods, then dividing by the number of time periods. Expected geometric return is expressed in terms of compounded average annual returns and calculated using geometric mean of periodic returns. Unfavorable scenarios represent our estimate of the 25th percentile of the range of future geometric returns for a 25-year holding period. Favorable scenarios represent our estimate of the 75th percentile of the range of future geometric returns for a 25-year holding period. Actual returns cannot be predicted and will fluctuate. Your returns may be higher or lower. Based on data ending September 30th, 2024. **Please refer to the Index Definitions at the end of this report. Indexes are unmanaged and do not take into account fees or expenses. It is not possible to invest directly in an index.**

To develop the Capital Market Assumptions, the CIO uses a proprietary model that reflects the dynamic interrelationships between asset class returns and a set of investment factors. Research indicates that a model that incorporates factors (a factor model) can forecast returns more accurately than one that simply uses historical average returns.⁴

Our model is guided by economic theory and based on the principle that long-term returns provide compensation for exposure to factors. Risky assets (such as stocks) tend to have higher expected returns than safe assets (such as Treasury bills).

In developing the Capital Market Assumptions, for each asset class we identify factors that help explain returns, which are listed in Exhibit 3. Each of the considered factors:

- has been found in academic research to represent systematic sources of risk
- exhibits a significant risk premium⁵ that is expected to persist in the future
- has extensive historical data available
- is not exclusively tied to a specific asset class.

Exhibit 3: Factors Used To Develop the Capital Market Assumptions

Factor	Market Index	Description
Inflation	Consumer Price Index (CPI) - All Urban Consumers, not seasonally adjusted	The rate of change in consumer prices
Cash	Ibbotson 30-Day T-Bill Return	US 30 day T-Bill Return
Equity Market	Long: S&P 500 TR, Short: Ibbotson 30 Day T Bill	The difference in returns between US large company stock and US 3-Month T-Bill
Equity Size Spread Return	Ibbotson SBBI US Size Premium	The difference in returns between US small cap and large cap stocks.
Equity Value Spread Return	Fama French Value Factor	The difference in returns between US value and growth stocks
Term Spread Return	Long: US 10 year Gov. Bond TR, Short: Ibbotson 30 Day T Bill	The difference in returns between US government bonds and Treasury bills.
Credit Spread Return	Long: US AAA Corp. Bond TR, Short: US 10-Year Gov. Bond TR	The difference in returns between US corporate bonds and government bonds.
Foreign Stock Spread Return	Long: MSCI EAFE Net TR, Short: S&P 500 TR	The difference in returns between foreign stocks and US stocks
Foreign Bond Spread Return	Long: ML Global Govt Bond Ex. US (Hedged), Short: ML US Gov. and Quasi Gov Bond	The difference in returns between foreign bonds hedged for currency risk and US bonds.

Source: Chief Investment Office. **Please refer to the Index Definitions at the end of this report. Indexes are unmanaged and do not take into account fees or expenses. It is not possible to invest directly in an index.**

⁴ The relevant academic research includes: Campbell, John Y., and Robert J. Shiller (1998), "Valuation Ratios and the Long-Run Stock Market Outlook", *The Journal of Portfolio Management* Winter, 11-26; Fama, Eugene F., and Kenneth R. French (1993), "Common Risk Factors in the Returns on Stocks and Bonds", *Journal of Financial Economics* 33(1), 3-56; Ilmanen, A. (1997), "Forecasting U.S. Bond Returns", *The Journal of Fixed Income* 7(1), 22-37; Rapach, David E., Jack K. Strauss, and Guofu Zhou (2010), "Out-of-Sample Equity Premium Prediction: Combination Forecasts and Links to the Real Economy", *The Review of Financial Studies* 23(2), 821-862; Cieslak, Anna, and Pavol Povala (2013), "Expected Returns in Treasury Bonds", *The Review of Financial Studies* 28(10), 2859-2901.

⁵ A risk premium is the incremental return that an investor can expect to earn as compensation for bearing additional risk. The equity risk premium, for example, is the incremental return that an investor can expect to earn by investing in equities as opposed to a risk-free asset. Similarly, the size premium reflects the historical tendency of the stocks of firms with smaller market capitalizations to outperform the stocks of firms with larger market capitalizations.

Exhibit 4 provides an overview of our highly innovative approach to developing Capital Market Assumptions.

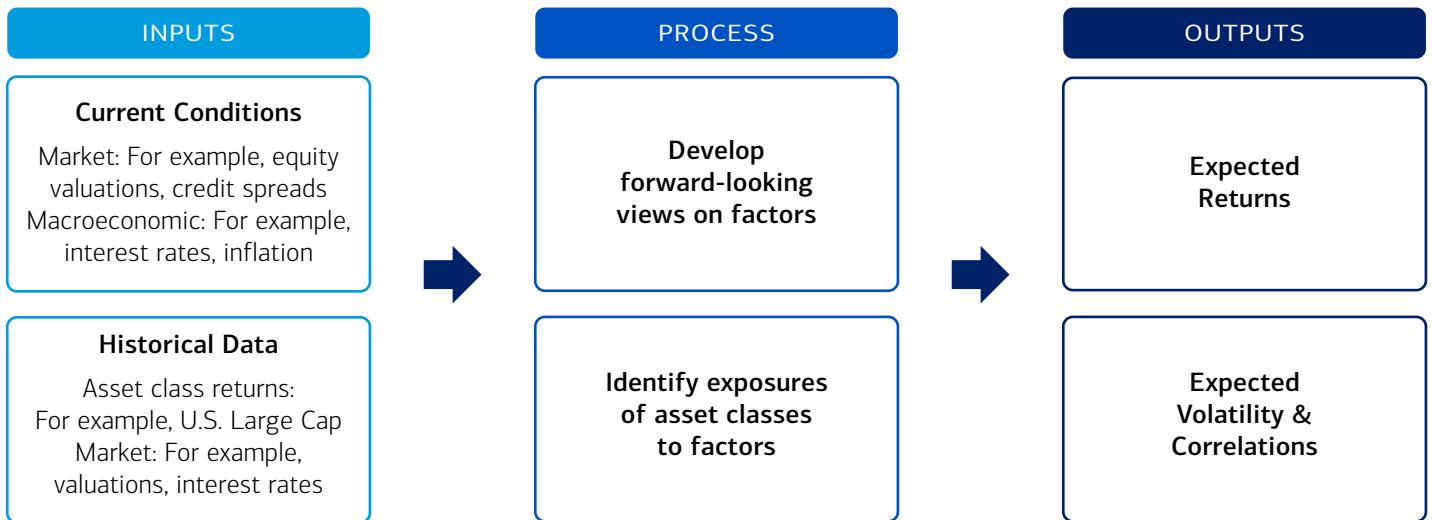
We first forecast returns to the factors using data that gauge current market conditions (e.g., interest rates and equity market valuation levels). For further information, see section on Predictors of Market and Macroeconomic Conditions.

We use historical data to estimate the empirical relationship between each asset class and relevant factors. For U.S. equity asset classes, we use three well-known factors devised by Fama and French: market, size and value.⁶ For international and emerging market equities, we also include the foreign equity factor. For fixed-income asset classes, we use the following factors: term return spread, credit return spread and foreign bond. For alternative investments, which can have elements of equities and fixed income, we consider all of these factors.

Taking current market conditions such as interest rates and equity market valuation levels as a starting point, the model simulates the future value of the factors. Then, based on these values, it simulates future asset class returns. Finally, it uses these simulation results to forecast the expected returns and the volatility of returns for each asset class, as well as return correlations.

Next, we quantify the statistical effect of these factors on the returns to each asset class (for details, see section on Using a Factor Model).

Exhibit 4: Capital Market Assumptions: Inputs, Outputs and Process Flow



Source: Chief Investment Office.

⁶ Fama, Eugene F., and Kenneth R. French (1993), "Common Risk Factors in the Returns on Stocks and Bonds", Journal of Financial Economics 33(1), 3-56.

Predictors of Market and Macroeconomic Conditions

To estimate the central tendency of future returns for factors, we use information about current market conditions such as equity market valuation levels, interest rates and inflation. Exhibit 5 presents the factor predictors we use along with their descriptions. For example, there is a large body of research showing that the future returns of the Equity Market factor are driven by the dividend yield and the earnings yield, both of which are observable in real-time.⁷

We then apply rigorous statistical techniques to model the dynamics between the factors and their respective predictors shown in Exhibit 5. We use these empirically validated statistical relationships to simulate a range of future returns for these factors.

Exhibit 5: Predictors of Market and Macroeconomic Conditions

Factors	Predictors Used
Inflation	The gap between realized inflation and long-term expected inflation
Cash	Short-term risk-free rate
Equity Market	(1) The deviation of Cyclically Adjusted Price-to-Earnings (CAPE) from its average, (2) US Industrial Production-based Output Gap, and (3) Equity market cap as the percentage of total market cap of equity and fixed incomes
Equity Size	The prevailing long-term average, adjusted down by 50% for a declining trend
Equity Value	The prevailing long-term average, adjusted down by 50% for a declining trend
Term Spread Return	(1) Cyclical component of nominal short-term interest rate, (2) Cyclical component of nominal long-term interest rate, and (3) Inflation-adjusted 10-year Treasury yield
Credit Spread Return	The deviation of Moody's AAA long-term credit spread from its long-term average
Foreign Stock	The prevailing long-term average
Foreign Bond	The prevailing long-term average

Source: Chief Investment Office.

⁷ See, for example, Campbell, John Y., and Robert J. Shiller (1988), "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors", *The Review of Financial Studies* 1(3), 195-228. Also, see Campbell, John Y., and Robert J. Shiller (1988), "Stock Prices, Earnings, and Expected Dividends", *Journal of Finance* 43(3), 661-676.

Using Factor Models

A factor model is a means of estimating the statistical effect of factors on the return of an asset class. More specifically, we regress the excess returns⁸ of each asset class on the factors to measure their sensitivity to the factors.

Exhibit 6 presents an illustrative set of estimates of the relationships between asset class returns and the relevant factors. Exhibit 7 considers a few illustrative examples to demonstrate the use of a factor model.

Exhibit 6: Sensitivity of Returns to Factors for Selected Asset Classes (Illustrative)

Asset Class	Equity Market	Equity Size Spread Return	Equity Value Spread Return	Term Spread Return	Credit Spread Return	Foreign Stock Spread Return	Foreign Bond Spread Return
U.S. Large Cap Growth	1.05	0.05	-0.37	0.00	0.00	0.00	0.00
U.S. Large Cap Value	0.97	0.05	0.35	0.00	0.00	0.00	0.00
U.S. Small Cap Growth	1.14	0.89	-0.45	0.00	0.00	0.00	0.00
U.S. Small Cap Value	1.00	0.69	0.36	0.00	0.00	0.00	0.00
International Developed Equity	1.01	0.04	0.00	0.00	0.00	0.96	0.00
Emerging Markets	0.89	0.18	-0.05	0.00	0.00	0.63	0.00
U.S. Governments	0.00	0.00	0.00	0.62	0.08	0.00	0.00
U.S. Mortgages	0.00	0.00	0.00	0.66	0.17	0.00	0.00
U.S. Corporates	0.00	0.00	0.00	0.85	0.55	0.00	0.00
U.S. High Yield	0.28	0.14	0.08	0.34	0.57	0.00	0.00
International Fixed Income	0.00	0.00	0.00	0.58	0.10	0.00	0.87
Cash	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hedge Strategies	0.33	0.19	-0.06	0.00	0.05	0.10	0.00
Private Equity & Credit	0.66	0.23	0.00	0.00	0.00	0.00	0.00
Real Assets	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Effective January 2025. Source: Chief Investment Office. **Please refer to the Asset Class Proxies & Index Definitions at the end of this report**

⁸ The excess return of an investment or asset class proxy index is defined as the difference between its return and the risk-free rate.

Exhibit 7: Using a Factor Model — Illustrative Examples

To demonstrate the use of factor models, consider a few illustrative examples:

Returns to **U.S. large cap growth stocks** are driven by the market, size and value factors, which have loadings of +1.05, +0.05 and -0.37, respectively. This means that each 1% increase in the broad market's performance will typically be associated with a 1.05% increase in U.S. large cap growth returns, that each 1% increase in the size factor will typically be associated with a 0.05% increase in U.S. large cap growth returns, and that each 1% increase in the value factor will be associated with a 0.37% decrease in U.S. large cap growth returns.

Returns to **corporate bonds** are driven by the term return spread and credit return spread factors, which have loadings of +0.85 and +0.55, respectively. This means that each 1% increase in the performance of term spread factor will typically be associated with a 0.85% increase in corporate bond returns, and that each 1% increase in the performance of AAA corporate bonds relative to treasury bonds will be associated with a 0.55% increase in corporate bond returns.

Returns to **hedge strategies** are driven by the market, size, value, term spread, credit spread, foreign equity, and foreign bond factors, which have loadings of +0.33, +0.19, -0.06, 0, +0.05, +0.1, and 0, respectively. This means that each 1% increase in the broad market's performance will typically be associated with a 0.33% increase in hedge strategies returns and that each 1% increase in the size factor will be associated with a 0.19% increase in hedge strategies returns. Similarly, each 1% increase in the value factor will typically be associated with a 0.06% decrease in hedge strategies returns, etc.

Returns to **private equity & credit** are driven by the market and size factors, which have, respectively, loadings of +0.66 and +0.23. This means that each 1% increase in the broad market's performance will typically be associated with a 0.66% increase in private equity & credit returns, and that each 1% increase in the size factor will be associated with a 0.23% increase in private equity & credit returns.

Next, taking current market conditions (such as interest rates and equity market valuation levels) as a starting point, the model simulates a large number of possible scenarios for future market conditions and factor returns. Then, based on these values, it simulates future asset class returns. Finally, to produce the Capital Market Assumptions, we use these simulated time series to forecast expected returns, volatilities and correlations over a 25-year planning horizon.

The Capital Market Assumptions provide views of future asset class returns. These expected returns, volatilities and correlations are directly estimated from the simulated return scenarios generated by our proprietary model. Expected return, which is computed as a simple arithmetic mean, reflects the average annual return the asset class is expected to provide over the planning horizon. (For a discussion of volatility and correlation measures, see next page).

Projecting Future Return Volatility and Correlations

Expected Volatility, which reflects future return expectations, is measured as the standard deviation of annual returns. Standard deviation is a common statistical measure that conveys the deviation of a variable (such as asset returns) around its mean. Two useful rules of thumb are that:

- approximately two-thirds of observations of a variable are within one standard deviation of the mean, and
- approximately 95% of observations are within two standard deviations of the mean.

Thus, if an asset class has an expected annual return of 10% and volatility (standard deviation) of 23%, in approximately two-thirds of the years in our planning horizon, returns to the asset class will be between -13% (i.e., $10\% - 23\%$) and 33% ($= 10\% + 23\%$). Similarly, in approximately 95% of the years, these returns will be between -36% ($= 10\% - 2 \times 23\%$) and 56% ($= 10\% + 2 \times 23\%$).

Expected correlation also reflect future return prospects. The correlation between each pair of asset classes is quantified using the correlation coefficient, another standard statistical measure. By definition, the correlation between two variables can be between -1 and +1. Two asset classes with a correlation of +1 move in perfect lockstep. If they have a correlation of -1, they move synchronously, but in opposite directions. Two asset classes whose correlation is zero are uncorrelated. Most pairs of asset classes are positively correlated, with correlation less than +1.

This simulation-based approach captures several important aspects of returns. In particular, the Capital Market Assumptions:

- may deviate from historical averages
- capture current market conditions as they evolve in simulations
- allow for factors that vary over the planning horizon

Market conditions change - sometimes quite rapidly. Because of this, we review the Capital Market Assumptions every year. In our reviews, we first update the historical data to reflect the financial and economic developments of the past year. Then, we generate updated Capital Market Assumptions using our proprietary model and the Global Wealth & Investment Management Investment Strategy Committee (GWIM ISC) reviews and votes on them. Once finalized, the assumptions are published and disseminated to advisors and clients.

WHAT ARE THE STRATEGIC ASSET ALLOCATIONS?

The Strategic Asset Allocations are a disciplined approach to long-term investing that entails diversifying across asset classes to help clients achieve their financial goals in a manner consistent with their time horizon and risk tolerance.

There is ample evidence that asset allocation has a major impact on investment performance. While researchers differ as to the precise magnitude of this impact, there is general consensus that it matters greatly.⁹

⁹ See Roger Ibbotson (2010), "The Importance of Asset Allocation", *Financial Analysts Journal*, 66(2), 18-20.

WHY ARE STRATEGIC ASSET ALLOCATIONS IMPORTANT FOR CLIENTS?

The Strategic Asset Allocations are used extensively in providing guidance to clients. In particular, they are a critical input to Merrill's:

- asset allocation guidance
- supervision process
- financial planning tools
- performance review tools
- centrally managed portfolios

Asset allocation guidance. As noted, strategic asset allocation is a critical determinant of portfolio performance and clients' success in achieving their goals. Thus, identifying which allocation best suits each client is an important step in our advice and guidance process. To do so, we take into account the client's risk tolerance, as well as the time horizon of the client's goals. After identifying an appropriate allocation for a client, the advisor periodically reviews the client's personal situation and goals to verify that this allocation is still a good fit. In addition, we provide tactical asset allocation guidance, which seeks to enhance investment performance by taking advantage of short-term market opportunities.

Supervision process. To help assure that we accurately implement the asset allocation guidance, we regularly review client portfolios to verify that they remain within an acceptable range of the client's target Strategic Asset Allocation.

Financial planning tools. The Strategic Asset Allocations serve as inputs to Merrill's proprietary financial planning tools. In particular, the Strategic Asset Allocations are the building blocks that help identify an asset allocation appropriate for each client's goals.

Performance review tools. The Strategic Asset Allocations also serve as inputs to tools that monitor how well our clients' investments are faring, providing a benchmark for making that determination.

Centrally managed portfolios. Merrill makes its disciplined investment process available to clients through centrally managed portfolios that are benchmarked to the Strategic Asset Allocations. This helps ensure that these portfolios are broadly diversified over a range of asset classes, consistent with the guidance of the CIO.

HOW DOES THE CIO DEVELOP THE STRATEGIC ASSET ALLOCATIONS?

To develop the Strategic Asset Allocations, the CIO implements an enhanced version of the mean-variance optimization approach pioneered by Nobel laureates Harry Markowitz, William Sharpe and James Tobin, among others.¹⁰ The enhancement we use in implementing this approach is known as **robust optimization**.

¹⁰ The seminal paper in this literature is Harry Markowitz (1952), "Portfolio Selection", Journal of Finance, 7, 77-91.

Robust optimization

Traditional mean-variance optimization begins with capital market assumptions regarding expected returns, volatility and correlations. If these measures were known with certainty, the approach would work as intended. A challenge that practitioners face is that capital market assumptions are just that - assumptions. The true expected returns, volatility and correlations can be estimated, but not known with certainty. Yet, traditional mean-variance optimization treats estimates of expected returns as if they were the true values of these parameters and takes no account of the impact of estimation error.

Through decades of experience implementing mean-variance optimization, practitioners have identified two shortcomings to the approach. First, the asset allocations it produces are highly sensitive to the Capital Market Assumptions used. Second, these allocations can sometimes be concentrated in relatively few asset classes.

To overcome these limitations, we implement mean-variance optimization using an approach known as **robust optimization**.¹¹ Robust optimization explicitly takes into account the uncertainty inherent in Capital Market Assumptions. The approach generates allocations that are satisfactory, even if the input parameters on which they are based are imprecise. Thus, the approach builds on the strength of traditional mean-variance optimization while acknowledging that the inputs it uses cannot be known with certainty.

In our own work, we have compared mean-variance optimization with robust optimization in a variety of contexts. We find that robust optimization generally outperforms mean-variance optimization with respect to risk-adjusted returns and that robust optimization typically produces allocations that are more diversified than does mean-variance optimization.

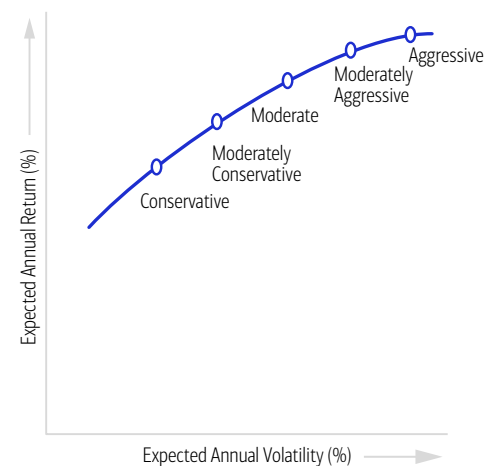
- Asset allocation and diversification do not assure a profit or protect against a loss.

Mean-variance optimization begins with Capital Market Assumptions. Taking the Capital Market Assumptions as inputs, we identify the efficient frontier, which represents a set of allocations that provide an optimal trade-offs between risk and return. Exhibit 8 shows the efficient frontier for sample Strategic Asset Allocations including stocks, bonds and cash.

We identify a set of five Strategic Asset Allocations that run the gamut of client risk preferences. These range from conservative to aggressive and include three intermediate allocations.

It should be noted that, in both developing and implementing the Strategic Asset Allocations, we impose constraints on the asset class weights (for more details, see next section on Guardrails placed on the Strategic Asset Allocations).

Exhibit 8: Merrill Strategic Asset Allocations Including Stocks, Bonds and Cash: Trade-Off between Risk and Return along the Efficient Frontier



Source: Chief Investment Office.
For illustrative purposes only.

¹¹ For more on this, see Richard Michaud (1989), "The Markowitz Optimization Enigma: Is 'Optimized' Optimal?", *Financial Analysts Journal*, 45(1), 31-42; and Donald Goldfarb and Garud Iyengar (2003), "Robust Portfolio Selection Problems", *Mathematics of Operations Research*, 28(1), 1-38.

Guardrails placed on the Strategic Asset Allocations

To help ensure that the Strategic Asset Allocations are feasible, broadly diversified and consistently followed, we apply guardrails to their development and implementation.

Development Guardrails

The CIO recommends neither short selling, nor leverage in the Strategic Asset Allocations. Consistent with this, the allocation weight of each asset class is restricted to between 0% and 100%. Also, as a practical matter, the Strategic Asset Allocations must offer some liquidity. We therefore require a minimum allocation to cash of 1%

Another consideration is that the allocations should bear some relationship to the relative market capitalizations of the underlying asset classes. An extremely large allocation to a small asset class may prove impossible to implement. We also want to ensure that large asset classes are meaningfully represented in the Strategic Asset Allocations.

Exhibit 9 presents Strategic Asset Allocations with varying allocations to stocks, bonds and cash that reflect a range of investor preferences. The Conservative portfolio has a large allocation to bonds and cash, while the Aggressive portfolio has a substantial allocation to stocks. As one would expect, there is a trade-off between risk and return. The higher the expected return one seeks from a Strategic Asset Allocation, the greater the resulting risk. In identifying the most appropriate Strategic Asset Allocation for a client, it is important to consider the client's goals, investment time horizon and risk tolerance.

It is possible to perform mean-variance optimization with just a few high-level asset classes (e.g., stocks, bonds and cash). But this would not provide sufficient asset allocation guidance to advisors and clients. Conversely, if we use sub-asset classes that are too specialized, there will not be enough historical data to allow us to develop Capital Market Assumptions. Another key decision in developing a Strategic Asset Allocation is whether or not to include alternative investments (for more on this, see next section on Strategic Asset Allocations Including Alternative Investments.)

Exhibit 9: Strategic Asset Allocations Including Stocks, Bonds and Cash — Low Tax Sensitivity

Asset Class	All Fixed Income	Conservative	Moderately Conservative	Moderate	Moderately Aggressive	Aggressive	All Equity
Equity	0%	24%	40%	58%	75%	91%	99%
U.S. Large Cap Growth	0%	7%	12%	17%	22%	27%	29%
U.S. Large Cap Value	0%	8%	14%	20%	26%	31%	34%
U.S. Small Cap Growth	0%	1%	1%	2%	3%	4%	4%
U.S. Small Cap Value	0%	1%	1%	2%	3%	4%	4%
International Developed Equity	0%	5%	8%	11%	14%	16%	18%
Emerging Markets	0%	2%	4%	6%	7%	9%	10%
Fixed Income	99%	71%	59%	41%	24%	8%	0%
U.S. Governments	28%	17%	17%	13%	8%	3%	0%
U.S. Mortgages	24%	12%	13%	10%	3%	0%	0%
U.S. Corporates	26%	17%	16%	13%	11%	5%	0%
U.S. High Yield	5%	3%	3%	2%	1%	0%	0%
International Fixed Income	16%	22%	10%	3%	1%	0%	0%
Cash	1%	5%	1%	1%	1%	1%	1%
Expected Return (Arithmetic)	4.1%	5.5%	6.5%	7.5%	8.6%	9.5%	10.0%
Expected Risk	4.3%	5.3%	7.5%	10.1%	12.8%	15.4%	16.7%
Expected Sharpe Ratio	0.34	0.53	0.51	0.48	0.46	0.44	0.44
Expected Yield	3.8%	3.1%	3.0%	2.7%	2.3%	2.0%	1.8%
Expected Return (Geometric)	4.0%	5.3%	6.2%	7.1%	7.8%	8.5%	8.7%

Effective January 2025. Source: Chief Investment Office. **FOR INFORMATIONAL PURPOSES ONLY. Performance of CIO Asset Allocation Guidelines is intended to illustrate the effect of asset allocation and diversification. It is not an advertisement or representation of any investment advisory products or services offered by Merrill.**

Note: Based on data ending September 30, 2024. Figures may not sum due to rounding. Actual returns cannot be predicted and will fluctuate. Your returns may be higher or lower.

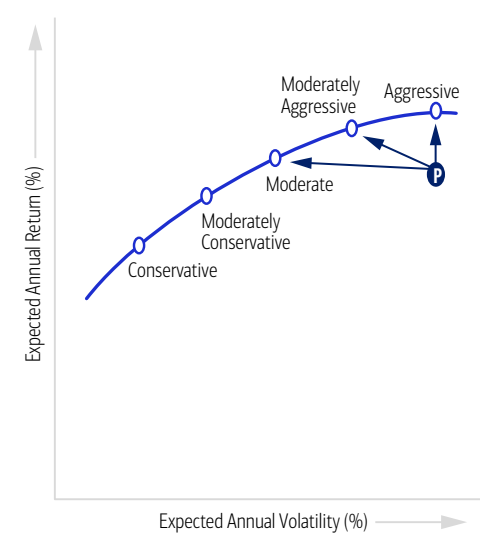
Please refer to the Glossary, Asset Class Proxies & Index Definitions at the end of this report.

The use of Strategic Asset Allocations can help improve allocation performance relative to what one might achieve through a less disciplined approach. An investor who does not deliberately select an allocation on the efficient frontier will typically end up with an allocation that offers substantial room for improvement.

Consider, for example, Portfolio P, which lies under the efficient frontier (Exhibit 10). The portfolio could achieve a higher expected return with the same amount of risk by aligning to an aggressive Strategic Asset Allocation. Alternatively, shifting from Allocation P to a moderate Strategic Asset Allocation, could achieve a similar or higher level of expected return but meaningfully less expected risk. Or, the portfolio could shift to a moderately aggressive Strategic Asset Allocation, which would produce a higher expected return with less risk than Allocation P.

By investing according to a Strategic Asset Allocation, portfolios are positioned to earn the highest possible expected return for a given level of expected risk (or, equivalently, have the lowest expected risk exposure for a given expected return). It is this efficiency that has prompted economists to call the mean-variance optimization used to construct Strategic Asset Allocations one of the rare “free lunches” that financial markets offer investors. Investors who do not pursue this approach might leave money on the table.

Exhibit 10: Strategic Asset Allocations Including Stocks, Bonds and Cash: Trade-Off between Risk and Return within the Efficient Frontier



Source: Chief Investment Office. For illustrative purposes only.

Strategic Asset Allocations Including Alternative Investments

A basic decision that investors face is whether or not to include alternative investments—such as hedge funds, private equity and real assets—in their portfolios. Investors who do not qualify to hold alternative investments, or who choose not to, will have Strategic Asset Allocations such as those shown in Exhibits 9 and 10, which have no allocations to alternative investments. Investors who qualify to hold alternative investments and wish to do so will allocate some of their assets to these investments (Exhibit 11). Including alternative investments has the potential to enhance the trade-off between risk and return, as depicted by an upward shift in the efficient frontier (Exhibit 12).

Exhibit 11: Strategic Asset Allocations Including Stocks, Bonds, Cash and Alternative Investments — Low Tax Sensitivity

Asset Class	All Fixed Income	Conservative	Moderately Conservative	Moderate	Moderately Aggressive	Aggressive	All Equity
Equity	0%	17%	34%	49%	60%	75%	99%
U.S. Large Cap Growth	0%	6%	11%	14%	18%	22%	29%
U.S. Large Cap Value	0%	7%	12%	16%	21%	26%	34%
U.S. Small Cap Growth	0%	0%	1%	2%	2%	3%	4%
U.S. Small Cap Value	0%	0%	1%	2%	2%	3%	4%
International Developed Equity	0%	3%	6%	10%	11%	14%	18%
Emerging Markets	0%	1%	3%	5%	6%	7%	10%
Fixed Income	99%	59%	41%	23%	7%	0%	0%
U.S. Governments	28%	18%	13%	8%	3%	0%	0%
U.S. Mortgages	24%	11%	9%	4%	0%	0%	0%
U.S. Corporates	26%	15%	14%	9%	4%	0%	0%
U.S. High Yield	5%	3%	2%	1%	0%	0%	0%
International Fixed Income	16%	12%	3%	1%	0%	0%	0%
Cash	1%	5%	1%	1%	1%	1%	1%
Alternatives	0%	19%	24%	27%	32%	24%	0%
Hedge Strategies	0%	11%	14%	16%	19%	11%	0%
Private Equity & Credit	0%	4%	6%	7%	9%	9%	0%
Real Assets	0%	4%	4%	4%	4%	4%	0%
Expected Return (Arithmetic)	4.1%	5.7%	7.1%	8.1%	9.0%	9.6%	10.0%
Expected Risk	4.3%	5.0%	7.7%	10.2%	12.4%	14.4%	16.7%
Expected Sharpe Ratio	0.34	0.62	0.57	0.53	0.51	0.48	0.44
Expected Yield	3.8%	2.7%	2.3%	1.9%	1.5%	1.5%	1.8%
Expected Return (Geometric)	4.0%	5.6%	6.8%	7.6%	8.3%	8.6%	8.7%

Effective January 2025. Source: Chief Investment Office. **FOR INFORMATIONAL PURPOSES ONLY. Performance of CIO Asset Allocation Guidelines is intended to illustrate the effect of asset allocation and diversification. It is not an advertisement or representation of any investment advisory products or services offered by Merrill.**

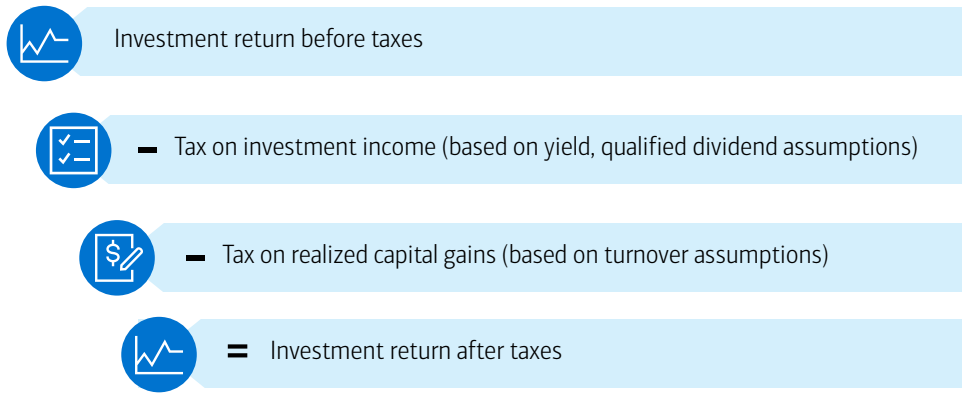
Note: Based on data ending September 30, 2024. Figures may not sum due to rounding. Actual returns cannot be predicted and will fluctuate. Your returns may be higher or lower.

Please refer to the Glossary, Asset Class Proxies & Index Definitions at the end of this report.

Strategic Asset Allocations for Clients with High Tax-Sensitivity

The CIO approach to developing Strategic Asset Allocations for clients with High Tax-Sensitivity considers the effect of taxes on investment returns arising from the distribution of income and capital gains, as well as from the typical turnover observed in each asset class considered (Exhibit 13). We systematically evaluate the impact of taxes on the expected returns and expected risk of each asset class, and then make what we believe to be prudent and robust trade-offs to develop our High Tax-Sensitivity Strategic Asset Allocation guidance.

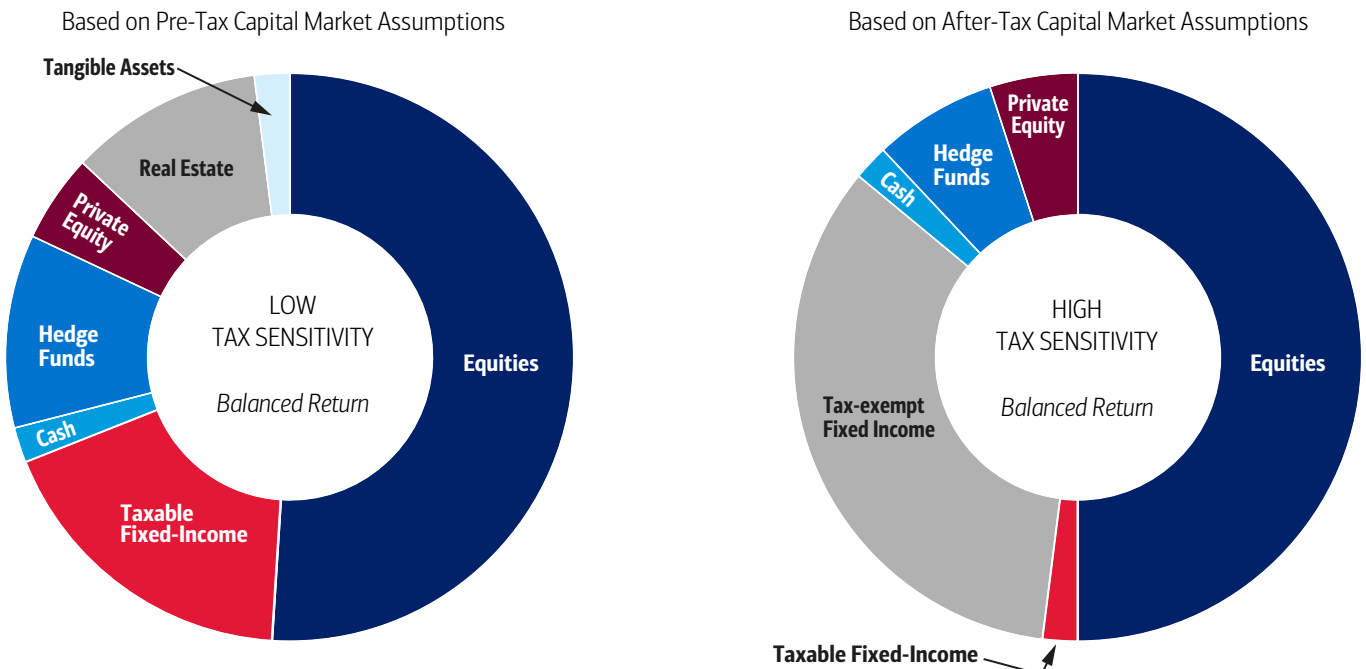
Exhibit 13: Our Approach Accounts for Impact of Taxes on Investment Income and Realized Capital Gains



Source: Chief Investment Office. For illustrative purposes only.

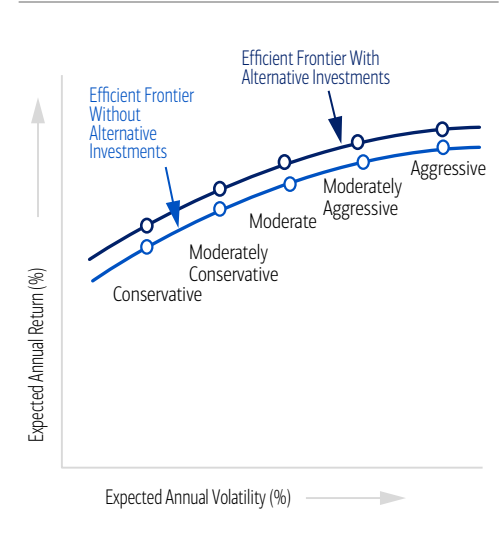
In general, our approach results in higher allocations to tax-efficient asset classes and lower allocations to tax-inefficient asset classes within each allocation profile. The fixed income allocations in these tax-sensitive profiles is heavily tilted towards tax exempt bonds. However, some allocation to taxable bonds is still present, more so at a lower risk tolerance, to provide additional diversification (Exhibit 14).

Exhibit 14: Impact of Taxes on Strategic Asset Allocations



Source: Chief Investment Office. For illustrative purposes only. This may not reflect any specific investor's facts and circumstances.

Exhibit 12: Strategic Asset Allocations with and without Alternative Investments



Source: Chief Investment Office. For illustrative purposes only.

Tactical Asset Allocations

Tactical asset allocation (TAA) is designed to complement a long-term investment strategy, allowing pursuit of short-term opportunities in the market, potentially enhancing overall portfolio performance.

The CIO Tactical Asset Allocation TAA targets are guidance that is informed by the GWIM ISC's 12-36 month outlook on asset classes, and is reviewed monthly. The ISC reviews indicators such as economic growth, inflation, earnings and liquidity in the markets and takes a stand on whether there are opportunities to rebalance allocations to either reduce risk or take it on. The goal of TAA is to potentially add value to SAA, while TAA targets remain prudently anchored to the longer-term SAA targets.

The GWIM ISC has the option to review and make changes to the TAA targets at any time and these can change over time. It is important to note that the TAA target for any specific asset class is provided in the context of overall asset allocation guidance.

CONCLUSION

The CIO provides investment strategies, due diligence, portfolio construction guidance and wealth management solutions to help our advisors address their clients' goals. Underlying these offerings are:

- the Capital Market Assumptions, thoughtfully developed long-term views on various asset classes
- the Strategic Asset Allocations, the basis for diversified allocations designed to help clients achieve their financial goals in a manner consistent with their investment time horizon and risk tolerance.

The CIO reviews both the assumptions and the allocations annually, and updates them as needed, in the context of the latest economic and financial developments. These methodologies have served our advisors and their clients well and will remain foundations of CIO guidance for years to come.

Asset Class Proxies & Index Definitions

Asset Class	Index	Description
U.S. Large Cap Growth	Russell 1000 Growth TR	Russell 1000 Growth Total Return measures the performance of the large-cap growth segment of the U.S. equity universe. It includes those Russell 1000 companies with higher price-to-book ratios and higher forecasted growth values.
U.S. Large Cap Value	Russell 1000 Value TR	Russell 1000 Value Total Return measures the performance of the large-cap value segment of the U.S. equity universe. It includes those Russell 1000 companies with lower price-to-book ratios and lower expected growth values.
U.S. Small Cap Growth	Russell 2000 Growth TR	Russell 2000 Growth Total Return measures the performance of the broad growth segment of the U.S. equity universe. It includes those Russell 2000 companies with higher price-to-book ratios and higher forecasted growth values.
U.S. Small Cap Value	Russell 2000 Value TR	Russell 2000 Value Total Return measures the performance of the large-cap value segment of the U.S. equity universe. It includes those Russell 2000 companies with lower price-to-book ratios and lower expected growth values.
International Developed Equity	MSCI Daily TR Net World Ex USA USD	The MSCI World ex USA Index captures large and mid cap representation across 22 of 23 Developed Markets (DM) countries – excluding the United States. The index covers approximately 85% of the free float-adjusted market capitalization in each country.
Emerging Markets	MSCI Daily TR Net EM USD	The MSCI Emerging Markets (EM) Index captures large and mid cap representation across 23 Emerging Markets countries and targets coverage of approximately 85% of the free float adjusted market capitalization in each country.
U.S. Government	ICE BofA AAA U.S. Treasury/Agency Master	The ICE BofA US Treasury & Agency Index tracks the performance of US dollar denominated Treasury and non-subordinated US agency debt issued in the US domestic market. Qualifying securities must have an investment grade rating (based on an average of Moody's, S&P and Fitch). In addition, qualifying securities must have at least one year remaining term to final maturity, at least 18 months to maturity at time of issuance, a fixed coupon schedule and a minimum amount outstanding of \$1 billion for sovereigns and \$250 million for agencies.
U.S. Mortgages	ICE BofA Mortgage Master	The ICE BofA US Mortgage Backed Securities Index tracks the performance of US dollar denominated fixed rate and hybrid residential mortgage pass-through securities publicly issued by US agencies in the US domestic market. 30-year, 20-year, 15-year and interest-only fixed rate mortgage pools are included in the Index provided they have at least one year remaining term to final maturity and a minimum amount outstanding of at least \$5 billion per generic coupon and \$250 million per production year within each generic coupon.
U.S. Corporates	ICE BofA U.S. Corp Master	The ICE BofA US Corporate Index tracks the performance of US dollar denominated investment grade corporate debt publicly issued in the US domestic market. Qualifying securities must have an investment grade rating (based on an average of Moody's, S&P and Fitch), at least 18 months to final maturity at the time of issuance, at least one year remaining term to final maturity as of the rebalancing date, a fixed coupon schedule and a minimum amount outstanding of \$250 million.
U.S. High Yield	ICE BofA US Cash Pay High Yield	The ICE BofA US Cash Pay High Yield Index tracks the performance of US dollar denominated below investment grade corporate debt, currently in a coupon paying period, that is publicly issued in the US domestic market.
International Fixed Income	ICE BofA Global Broad Market TR ex USD (Hedged)	The ICE BofA Global Broad Market Excluding US Dollar Index tracks the performance of investment grade debt publicly issued in the major domestic and Eurobond markets, including sovereign, quasi-government, corporate, securitized and collateralized securities, excluding all securities denominated in US dollars.
Cash	IA SBBI U.S. 30-Day T-Bill TR USD	For the IA SBBI U.S. Treasury Bill Index, the CRSP U.S. Government Bond File is the source from 1926 to 1976. Each month a one-bill portfolio containing the shortest-term bill having not less than one month to maturity is constructed. (The bill's original term to maturity is not relevant).
Hedge Strategies	Hedge Fund Research HFRI Fund Weighted Composite	The HFRI Fund Weighted Composite Index is a global, equal-weighted index of over 2,000 single-manager funds that report to HFR Database. Constituent funds report monthly net of all fees performance in US Dollar and have a minimum of \$50 Million under management or a twelve (12) month track record of active performance. The HFRI Fund Weighted Composite Index does not include Funds of Hedge Funds.
Private Equity & Credit	CA U.S. Private Equity Index (Legacy Version) & CA U.S. Private Credit Index	The Cambridge Associates U.S. Private Equity benchmark statistics are based on data compiled from more than 1,400 institutional-quality buyout, growth equity, private equity energy, and subordinated capital funds. The Cambridge Associates U.S. Private Credit benchmark is home to all strategies classified by Cambridge Associates as private credit, which includes more than 200 funds in each of credit opportunities and subordinated capital categories. The AUM weighted return of private equity and private credit benchmarks reflects the overall performance of private assets.
Real Assets	Pre-06/2020: 50/25/25 BB Commodity / NCREIF Property / NCREIF TBI; Post-06/2020: 50/40/10 Commodity / NCREIF Property / FTSE NAREIT	(i) The Bloomberg Commodity Index is designed to be a highly liquid and diversified benchmark for commodities as an asset class. The index is composed of futures contracts on 22 physical commodities. (ii) Produced quarterly, the NCREIF Property Index (NPI) shows real estate performance returns using data submitted by its Data Contributing Members. The NPI is used as an industry benchmark to compare an investor's own returns against the industry average. (iii) The NCREIF Transaction-Based Index (TBI) is an index based on properties that were in the NCREIF Property Index and were sold that quarter. The index does not replace the NPI. It is a complementary index to the appraisal-based NPI. A transaction-based index is often considered to be more comparable to stock and bond indexes that are transaction-based (iv) The FTSE Nareit US Real Estate Index Series is designed to present investors with a comprehensive family of REIT performance indexes that spans the commercial real estate space across the U.S. economy. The index series provides investors with exposure to all investment and property sectors. The FTSE Nareit Equity REITs index contains all Equity REITs not designated as Timber REITs or Infrastructure REITs.

Glossary

Expected Return: The average annual total return the strategic target can be expected to generate over a 15-year horizon. Expected arithmetic return is the simple arithmetic average of periodic returns, calculated by summing returns for all time periods, then dividing the number of time periods. Expected geometric return is expressed in terms of compounded average annual returns and calculated using geometric mean of periodic returns.

Expected Volatility: A measure of the dispersion of a set of data from their mean. Also known as standard deviation. Applied to the periodic rate of return of an investment to measure its volatility. The more spread apart the data are, the higher the volatility of that investment.

Expected Yield: The average annual income the strategic target can be expected to generate over a 15-year horizon.

Expected Sharpe Ratio: A risk-adjusted measure calculated using standard deviation and excess return (above cash) to determine reward per unit of risk. High Sharpe Ratios translate into better risk-adjusted performance.

Simulated Time Series: The CIO uses market valuation levels as a starting point, the model simulates a large number of possible scenarios for future market conditions and factor returns. Then, based on these values, it simulates future asset class returns. Finally, to produce the Capital forecast expected returns, the model uses these simulated expected return time series to forecast volatilities and correlations over a 15-year planning horizon.

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All recommendations must be considered in the context of an individual investor's goals, time horizon, liquidity needs and risk tolerance. Not all recommendations will be in the best interest of all investors. Asset allocation, diversification and rebalancing do not ensure a profit or protect against loss in declining markets.

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Dividend payments are not guaranteed, and are paid only when declared by an issuer's board of directors. The amount of a dividend payment, if any, can vary over time.

Investments discussed have varying degrees of risk. Some of the risks involved with equities include the possibility that the value of the stocks may fluctuate in response to events specific to the companies or markets, as well as economic, political or social events in the U.S. or abroad. Stocks of small-and mid-cap companies pose special risks, including possible illiquidity and greater price volatility than stocks of larger, more established companies. Investing in fixed-income securities may involve certain risks, including the credit quality of individual issuers, possible prepayments, market or economic developments and yields and share price fluctuations due to changes in interest rates. When interest rates go up, bond prices typically drop, and vice versa. Bonds are subject to interest rate, inflation and credit risks. Investments in high yield bonds may be subject to greater market fluctuations and risk of loss of income and principal than securities in higher rated categories. Investments in foreign securities involve specific risks, including foreign currency risk and the possibility of substantial volatility due to adverse political, economic or other developments. These risks are magnified for investments made in emerging markets. Investments in a certain industry or sector may pose additional risk due to lack of diversification and sector concentration. Investments in real estate securities can be subject to fluctuations in the value of underlying properties, the effect of economic conditions on real estate values, changes in interest rates, and risk related to renting properties, such as rental defaults. There are special risks associated with an investment in commodities, including market price fluctuations, regulatory changes, interest rate changes, credit risk, economic changes and the impact of adverse political or financial factors.

Tax-exempt investing offers current tax-exempt income, but it also involves special risks. Single-state municipal bonds pose additional risks due to limited geographical diversification. Interest income from certain tax-exempt bonds may be subject to certain state and local taxes and, if applicable, the alternative minimum tax. Any capital gains distributed are taxable to the investor.

For investments in ABS and MBS, generally, when interest rates decline, prepayments accelerate beyond the initial pricing assumptions, which could cause the average life and expected maturity of the securities to shorten. Conversely, when interest rates rise, prepayments slow down beyond the initial pricing assumptions, and could cause the average life and expected maturity of the securities to extend, and the market value to decline.

Treasury bills are less volatile than longer-term fixed income securities and are guaranteed as to timely payment of principal and interest by the U.S. government.

Dividend payments are not guaranteed. The amount of a dividend payment, if any, can vary over time.

Alternative investments are speculative and involve a high degree of risk.

Alternative investments are intended for qualified investors only. Alternative Investments such as derivatives, hedge funds, private equity funds, and funds of funds can result in higher return potential but also higher loss potential. Changes in economic conditions or other circumstances may adversely affect your investments. Before you invest in alternative investments, you should consider your overall financial situation, how much money you have to invest, your need for liquidity, and your tolerance for risk.

Nonfinancial assets, such as closely-held businesses, real estate, fine art, oil, gas and mineral properties, and timber, farm and ranch land, are complex in nature and involve risks including total loss of value. Special risk considerations include natural events (for example, earthquakes or fires), complex tax considerations, and lack of liquidity. Nonfinancial assets are not in the best interest of all investors. Always consult with your independent attorney, tax advisor, investment manager, and insurance agent for final recommendations and before changing or implementing any financial, tax, or estate planning strategy.

We assume top federal tax bracket to be appropriate for Global Wealth & Investment Management clients with high tax sensitivity. State taxes & Medicare taxes are not included due to their variability and complexity. The SAA for high tax-sensitive clients is meaningfully robust vis-à-vis change in tax assumptions.

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