

Investment Methodology

A Due Diligence Guide



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Introduction

Edelman Financial Engines is a leading provider of independent portfolio management, investment advice, and retirement help to participants in defined contribution retirement plans. We have been providing advisory services to millions of retirement plan participants as a federally registered investment advisor and fiduciary since 1998.

Financial Engines (later rebranded as Edelman Financial Engines) was cofounded in 1996 by Dr. William F. Sharpe, a recipient of the 1990 Nobel Prize in Economic Sciences for his pioneering work on the theory of financial economics, including how prices of financial assets are determined, and the link between risk and return. The company was founded to address the need for cost-effective, personalized independent investment advice. Dr. Sharpe's vision was to leverage technology to make high-quality independent advice available to millions of participants regardless of their wealth or investment expertise. Since its founding, Edelman Financial Engines has grown to become America's largest independent investment advisor for defined contribution plans as measured by assets under management.¹

A pioneer in the market, Edelman Financial Engines introduced the Online Advice service in 1998. Following the introduction of Online Advice, we focused on expanding our service offerings to provide investors with advice on multiple tax-deferred accounts and taxable investments. Over the next five years, we made significant investments in technology and the usability of our platform that enabled us to expand and enhance our service offerings to include our Retirement Evaluation, a personalized printed retirement assessment. In 2004, we launched our Professional Management service to provide personalized and professional portfolio management to retirement plan participants.

Our disciplined investment process is based on a number of methodologies pioneered by Dr. Sharpe. These methodologies are widely used by large institutional investors, including pension funds and endowments. We have applied and extended this proprietary core methodology to address the needs of a broad range of individual investors.

Our investment philosophy is based on several core principles:

- Advice must be independent and objective.
- Advice should be personalized to each individual's circumstances.
- Informed choice is facilitated by a realistic view of possible future outcomes.
- Advice should be sensitive to individual preferences for risk.



- Market timing should be avoided through the use of consensus market expectations.
- Advice should reflect the impact of expenses, investment constraints, and taxes.

This investment philosophy is expressed through an investment advisory platform that has been developed by a large team of experts in investment management, financial economics, mathematics, and statistics since 1997. With this platform, we are able to systematically apply a disciplined investment process to help improve investor outcomes. Our objective is to provide individual investors with high quality, personalized investment advice that helps them achieve their financial goals regardless of their level of wealth.

This document provides a detailed summary of the investment methodology we use for our Online Advice and Professional Management services. It also provides information on the investment management organization and processes that support our services.



Edelman Financial Engines Investment Committee

The Investment Committee at Edelman Financial Engines has overall responsibility for the fiduciary oversight of advisory and investment management services.² The committee meets regularly (typically weekly) to review and approve methodology and parameter updates, investment policies, new service and participant communications designs, and ongoing monitoring of member portfolio allocations. The committee is comprised exclusively of Edelman Financial Engines employees with a broad range of experience and expertise. Most members of the committee have long tenure with Edelman Financial Engines, and the majority has been integrally involved in the development of our advisory platform for many years.

Chairman: Christopher L. Jones

Title: Executive Vice President, Chief Investment Officer
Education: A.B. Economics, Stanford University
M.S. Engineering – Economic Systems, Stanford University
M.S. Business Technology, Stanford University
Tenure: Since 1996

Mike Agostino

Title: Vice President, Technology
Education: B.S. Computer Science, Cal Poly University
Tenure: Since 2015

Neil Gilfedder

Title: Senior Vice President, Portfolio Management
Education: B.A. Philosophy and Economics, University of York
A.M. Economics, Stanford University
Tenure: Since 2014

Wei-Yin Hu

Title: Vice President, Financial Research
Education: A.B. Economics, Stanford University
Ph.D. Economics, Stanford University
Tenure: Since 2000



Brian Lipps

Title: Regional Director, Financial Planning
Education: B.S. English, Radford University;
M.B.A., University of Southern California
Tenure: Since 2013

Gregory D. Stein

Title: Vice President, Data Science & Engineering
Education: A.B. Economics, Stanford University
A.M. Economics, Stanford University
One year Finance PhD program, Stanford Graduate School of Business
Tenure: Since 1999

Patricia Wang

Title: Director, Portfolio Management
Education: B.A.S. Industrial Engineering and Economics, Stanford University
Tenure: Since 2001

Robert L. Young

Title: Senior Director, Portfolio Management
Education: A.B. Economics, Georgetown University
M.B.A., Stanford University
Tenure: Since 1998

Investment Objectives

At Edelman Financial Engines, our main investment objective is to help individual investors create retirement strategies to reach their financial goals. Investment methodology to achieve this objective is consistent across our two advisory services: Online Advice and Professional Management. Specifically, our investment process is intended to:

- Create personalized, age-appropriate, diversified portfolios for each client selecting from among available investment options
- Maximize the risk-adjusted returns of these portfolios by optimizing asset class exposures, expenses, manager performance, fund-specific risk, and other relevant characteristics from the available investment options
- Prudently manage portfolio risk levels and investment allocations on an ongoing basis as market and personal circumstances change

Our approach to portfolio construction is to recommend a consistent diversified investment strategy that is tailored to the needs and time horizon of each client. We explicitly avoid any form of market timing in our recommendations by using market consensus estimates of asset class expected returns. Broadly speaking, our recommendations assume that asset classes are fairly priced by the market, and that market consensus expectations are the best predictor of future expected returns. We explicitly do not attempt to identify asset classes that may be over- or under-valued.

Rather, we use forward-looking risk premium assumptions that are consistent with the currently observed global market portfolio allocation. As the observed market portfolio allocation changes, the risk premium assumptions are updated. This approach prevents subjective market timing biases from entering into the investment allocation process that otherwise might introduce unwanted volatility. It also ensures that our forward-looking risk premium assumptions are more stable over time and always consistent with current market conditions.

Investment Process

Edelman Financial Engines' investment process for investors accumulating assets for retirement is built around mean-variance portfolio optimization. This portfolio construction process, widely used by institutional investors across the globe, consists of the following elements:

- Estimation of core economic expectations for interest rates, inflation, dividend growth
- Estimation of asset class expected returns, volatilities, and correlations
- Modeling of specific investment alternatives available to the investor
- Simulation of possible investment outcomes for investment strategies
- Generation of personalized portfolio recommendations
- Ongoing monitoring of portfolio efficiency and rebalancing

Estimating Core Economic Expectations

At the core of Edelman Financial Engines' investment process is a pricing kernel, a cohesive asset pricing model that describes the possible evolution of the financial economy based on current market conditions. The pricing kernel is driven by three key underlying variables: inflation, real interest rates, and the dividend growth rate of the U.S. equity market. From these three variables and two additional parameters — the long-term equity risk premium and the slope of the interest rate term structure — the pricing kernel model generates estimates of all asset prices in the economy. The values of these two parameters, and the coefficients governing the processes of the three economic variables, are chosen by the Edelman Financial Engines Investment Committee based upon historical relationships, current market conditions, and financial theory. These moments and parameters are intended to reflect long-term economic behavior and are very stable over time.

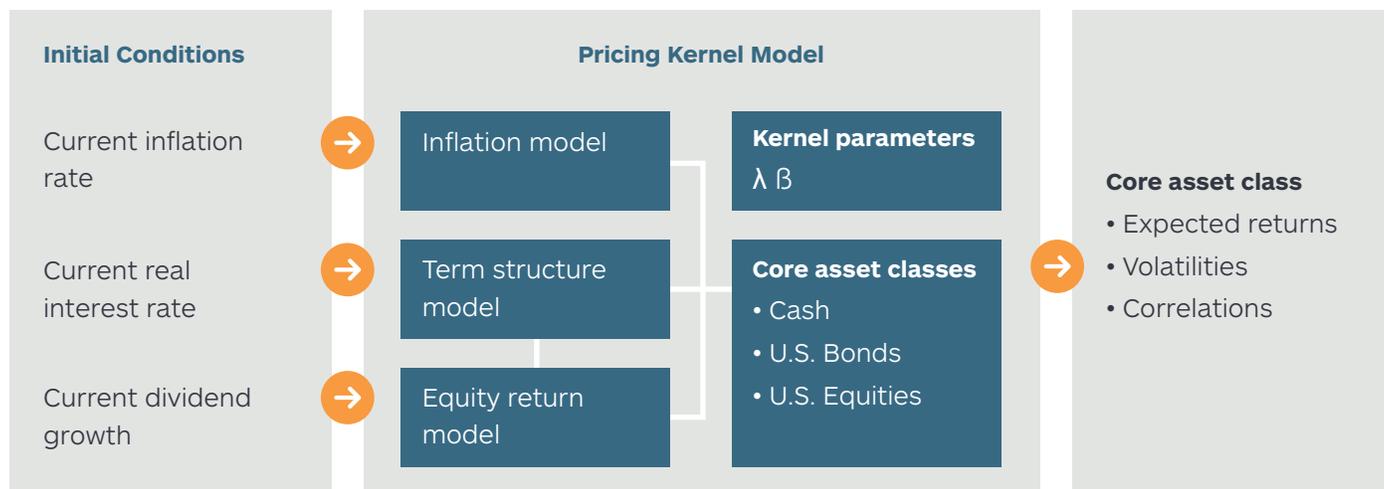
The ultimate objective of the pricing kernel is to provide realistic scenarios of how a portfolio of specific assets may perform over arbitrary investment horizons.

The pricing kernel links the three economic variables — inflation, interest rates, and the dividend growth rate — to asset class returns in a coherent fashion. The result is a realistic model of the economy with properties that are consistent with the basic tenets of modern economic theory and observed relationships in empirical data. The ultimate objective of the pricing kernel is to provide realistic scenarios of how a portfolio of specific assets may perform over arbitrary investment horizons. These are simulated starting from the most current market conditions. Pricing kernel model inputs and outputs.

Pricing Kernel Model Inputs and Outputs

The inputs to the pricing kernel are three processes that describe the evolution of inflation, real interest rates, and the dividend growth rate of equities; the initial (current) conditions of each of these variables; and two financial market inputs that help define the relationship and correlations between the three variables and returns on cash, bonds, and stocks (“core asset classes”). The outputs of the pricing kernel are expected returns, volatilities, and correlations for three primary asset classes: cash, long-term U.S. bonds, and U.S. equities. (Figure 1)

Figure 1: Illustrates the pricing kernel inputs and outputs



The three input exogenous models were developed using many decades of historical data, as well as empirical research on the statistical properties of these variables, including mean reversion and autoregressive behavior. For example, the model for inflation incorporates observed persistence in future inflation rates based on the current rate, the tendency for inflation rates to revert toward their long-term mean, as well as the property of changes in inflation to become more volatile when inflation rates are high. Each exogenous process also includes a random innovation term that reflects the realistic possibility of unanticipated random shocks.

The output core asset classes form the basis of our generalized asset class model. The expected returns, volatilities, and correlations of the core asset classes are consistent with the calibration of the pricing kernel and with current economic conditions. The model can estimate the full distribution of returns for the core asset classes over arbitrary timeframes.

Two important properties govern the behavior of the pricing kernel model (and hence the expectations for the core asset classes). The first principle is known as “arbitrage-free” pricing. Under an arbitrage-free pricing model, it is not possible to receive a sure payoff without an initial cash outlay. Second, the pricing kernel generates asset returns that are both inter-temporally and cross-sectionally consistent. This means that each variable reflects the appropriate behavior across time, and that the correlations between variables are appropriately modeled at any point in time. Because of the governing properties, the pricing kernel model would be highly unlikely to project high inflation simultaneously with low nominal bond yields, or of projecting double-digit inflation rates one year, followed by a year of deflation, followed again by double-digit inflation rates. Note that Edelman Financial Engines does not simply choose randomly from historical distributions to predict future behavior. This method of forecasting has numerous problems and often results in unrealistic and incoherent scenarios across time and across asset classes.³ Instead, Edelman Financial Engines chooses the governing parameters such that the properties of the resulting process are consistent with what is known historically about cash, bonds, and stocks and their mean reversion, persistence, and volatility characteristics.

Estimating Asset Class Expectations

Overlaying the pricing kernel is the generic asset class (GAC) model, which generates forward-looking returns on 15 different asset classes using the core asset classes as factors. The selection of these particular 15 asset classes was based on providing a spanning set of asset classes for modeling investments while avoiding overspecification of the model. In other words, the generic asset classes were chosen to ensure that the behavior of most financial assets could be adequately described using these classes, while reducing the probability of spurious results due to asset classes being too similar in their economic properties. A key objective in limiting the scope of the asset class model was to include only those asset classes with separately priced risk factors.

The generic asset class model takes as input the core asset class returns and term structure information from the pricing kernel to generate expected returns, correlations, and covariances for 15 generic asset classes (GACs). Cash includes short-term fixed income with maturities of up to one year. Each asset class in the Edelman Financial Engines model is represented by a widely used corresponding market index. The 15 GACs are shown below.

Generic Asset Class (GAC)	Representative index
Cash	U.S. Treasury 1-Yr Yield
Intermediate Government Bonds	Barclays Capital Intermediate Government Bond Index
Long Government Bonds	Barclays Capital Long-term Government Bond Index
Corporate Bonds	Barclays Capital Corporate Bond Index
Mortgage Bonds	Barclays Capital Mortgage Backed Securities Index
Non-U.S. Government Bonds	Salomon Brothers Non-U.S. Government Bond Index
Large Value	S&P/Citi 500 Value Index
Large Growth	S&P/Citi 500 Growth Index
Mid Value	S&P/Citi 400 Value Index
Mid Growth	S&P/Citi 400 Growth Index
Small Value	S&P/Citi 600 Value Index
Small Growth	S&P/Citi 600 Growth Index
European Stocks	MSCI Europe Index
Pacific Stocks	MSCI Pacific Index
Emerging Market Stocks	MSCI Emerging Markets Index

Each asset class in the Edelman Financial Engines model is related to the three core asset classes in the pricing kernel via factor loading coefficients. In addition, Edelman Financial Engines estimates a 15x15 covariance matrix of residuals for each generic asset class. Thus, an asset class can have additional volatility as well as correlations to other asset classes beyond those, due to the factor loadings on the core asset classes. The equation below illustrates the generic asset class model relationship using large cap growth returns as an example:

$$R_{\text{Large Cap Growth}} = \alpha_{\text{Large Cap Growth}} + \beta_{\text{cash}} R_{\text{cash}} + \beta_{\text{bonds}} R_{\text{bonds}} + \beta_{\text{stocks}} R_{\text{stocks}} + \epsilon_{\text{Large Cap Growth}}$$

The factor returns for the core asset classes (R_{cash} , R_{bonds} , R_{stocks}) are outputs from the pricing kernel; the factor loadings (β_i) are estimated from historical relationships between the indices representing the core and generic asset classes. The α represents the forward-looking (not historical) premium or discount relative to the expected return inherited from the core asset class exposures coming from the pricing kernel model. The error term, ϵ , is a random variable estimated using historical relationships between the 15 GACs. The random variables ϵ are correlated in the sense that random shocks to one GAC may be correlated with another, e.g., unexpected shocks to U.S. small cap growth returns are correlated with shocks to U.S. large cap growth returns, etc. The coefficients for each of the generic asset classes are updated monthly.

Asset Class Expected Returns

For the 15 different asset classes in its factor model, Edelman Financial Engines uses historical data to estimate the variances and correlations between core and generic asset classes. These historical estimates are updated on a monthly basis using the most current data available. A procedure called reverse optimization is used to estimate forward-looking expected returns for each asset class. Historical returns provide unreliable estimates of future returns given the limited amount of data available in the historical record.⁴ To address this issue, and derive more robust measures of expected risk premium, the reverse optimization procedure analyzes forward-looking return information embedded in the observed market portfolio.

A traditional mean-variance optimization process takes as inputs expected returns, standard deviations, correlations, and risk tolerance assumptions to generate a portfolio recommendation. The reverse optimization uses a similar framework but takes as inputs standard deviations, correlations, and an observed efficient portfolio to generate a set of expected returns. The efficient portfolio used in this procedure is the global market portfolio adjusted for the preferences of U.S.-based investors.⁵ Based on these inputs, it is possible to derive the set of asset class expected returns that are consistent with the observed market portfolio. These estimates reflect the market consensus expected returns for each asset class.

Edelman Financial Engines evaluates and updates its assessments of the market portfolio proportions and market consensus expected returns on a weekly basis.

There are two primary strengths of the reverse optimization procedure. First, it utilizes the current consensus market assessment of the relative values for the different asset classes (arguably the single best source of information regarding forward-looking returns). Second, it ensures that Edelman Financial Engines' recommendations are free from market timing biases and are "macro-consistent." In this context, macro-consistency means that the aggregate of portfolio recommendations are consistent with the observed market equilibrium (the total recommendations into stocks and fixed income are equal to their supply in the market, resulting in markets that clear). Edelman Financial Engines evaluates and updates its assessments of the market portfolio proportions and market consensus expected returns on a weekly basis. In general, the estimates of market consensus asset class expected returns are quite stable across time periods.

Modeling Alternative Asset Classes

The generalized asset class model described above provides a flexible framework for modeling the behavior of a wide range of investments. However, some investments include exposures to other types of assets that are not directly represented by the 15 asset classes in the Edelman Financial Engines model.

Examples of such investments include real estate, private equity, hedge funds, commodities, and inflation-protected bonds such as TIPS. While these asset types are not directly represented by one of the 15 generalized asset classes, the Edelman Financial Engines model is capable of capturing the economic behavior of such assets within the existing framework. For example, private equity exposures can be captured by levered exposures to the equity asset classes. Real estate exposures including REITs are typically modeled through a combination of exposures to fixed income and small cap value exposure, depending on the specific characteristics of the real estate exposure.

This captures both the impact of potential leverage, interest rate sensitivity, and the correlations with value oriented equities. In general, this modeling approach captures the major sources of risk and correlations of most real estate oriented funds.

TIPS are modeled by projecting the returns of the funds onto the fixed income asset class factors, taking into consideration that TIPS typically offer lower levels of expected volatility in real terms than similar duration nominal bond funds.

Hedge fund securities can be modeled through a combination of asset class exposures that may involve both leverage and short positions. Absolute return products often have similar style exposures. Such assets are typically analyzed on a case-by-case basis. Finally, commodities are modeled through a combination of exposures to fixed income, particularly international bonds, and emerging market exposures. Notably, Edelman Financial Engines does not treat commodities as a separate asset class unto itself. Instead our model attributes expected returns for commodity exposure to the extent that such securities are correlated with the global market portfolio (and its components). Since commodity indices are typically dominated by energy prices and precious metals, they tend to be most correlated with emerging market economies and foreign fixed income. For most commodity products, such exposures will not explain all the variance of the returns, and hence Edelman Financial Engines will also model the non-correlated component of volatility.

Modeling Specific Investments

Edelman Financial Engines models more than 30,000 securities every month,⁶ including retail mutual funds, individual stocks, institutional funds, exchange-traded funds, guaranteed investment contracts, and stable value funds. The objective of the modeling process is to capture the economic characteristics of each investment including expected returns, covariances with market factors and other securities, and expected volatility. These factors play a key role in all investment recommendations and forward-looking simulations provided to participants. The process includes estimating the underlying exposures to Edelman Financial Engines' 15 generic asset classes and then making adjustments based upon security-specific information such as fees, portfolio turnover, historical manager performance, active risk, and tax-efficiency. By modeling the characteristics of specific investment alternatives, Edelman Financial Engines is able to provide quantitative estimates of possible future outcomes and make robust investment recommendations that incorporate asset-specific information. Edelman Financial Engines provides personalized investment advice to investors that can be efficiently implemented within the limits of a given plan's available options.

Modeling Funds

Edelman Financial Engines analyzes and evaluates more than 19,000 retail mutual funds and several thousand private institutional products on a monthly basis using proprietary techniques. This enables Edelman Financial Engines to consider not only the specific funds available in participant retirement plans but also most funds that are held in non-retirement accounts. Edelman Financial Engines accomplishes this task using a balanced approach that is both qualitative, (in its review of data inputs, due diligence, and oversight of advice delivered), as well as quantitative, in its application of proprietary security analysis models.

Returns-based style analysis

For years, investment professionals noted that asset allocation accounts for a large part of the variability in the returns of an investment portfolio. To estimate the contribution of asset allocation to portfolio performance, Edelman Financial Engines makes use of returns-based style analysis to project the behavior of funds and stocks. This technique, pioneered by Edelman Financial Engines cofounder Dr. William Sharpe, uses a fund's return history to determine its underlying exposure to generic asset classes and hence identify its asset class exposures. For each of the funds tracked by Edelman Financial Engines, a time series of monthly return data is used to identify the specific combination of asset class indices that would have most closely replicated the actual performance of the fund. The result is called a "style benchmark" or style index for the fund.

For example, a large cap growth mutual fund may have exposures of 4% cash, 54% large cap growth stocks, 31% mid cap growth stocks, and 11% in foreign equities. The analysis of this fund reveals not only the anticipated exposures — a significant weighting in large and mid cap growth equities — but also unexpected exposures, such as those to cash and foreign equity. It is these unexpected exposures that are often missed in other approaches that rely on categorization of funds into a limited number of asset class categories. Simply classifying the fund as a “growth” or “domestic equity” fund, and projecting its return based on that classification, would potentially miss a fund’s persistent exposures to other asset classes such as cash and foreign equities and hence the contribution of these exposures to the fund’s overall performance. Edelman Financial Engines estimates a custom style benchmark for each fund in its database of securities. In situations where returns-based techniques are not applicable, Edelman Financial Engines will use holdings-based information to augment its asset class exposure estimates.

Expected returns

Edelman Financial Engines uses both a fund’s style exposure and its specific fund characteristics to calculate its projected return. The contribution from a fund’s investment style is the weighted average of the expected returns from the underlying asset class exposures. While a fund’s style is a critical component of expected return, it is not the only contributor. Funds differ not only by their asset allocation but also in their combination of active management (if any), expenses, costs associated with portfolio turnover, and tax-efficiency. Edelman Financial Engines makes a series of adjustments to the expected returns and fund-specific volatilities of each product to account for these differences. Thus, two funds with the same investment style exposures may have significantly different expected returns and fund-specific volatilities depending on their respective management strategies and associated expenses.

Edelman Financial Engines uses both a fund’s style exposure and its specific fund characteristics to calculate its projected return.

Estimating the expected returns for a given fund involves evaluation of all the factors that contribute to possible future performance. A fund’s baseline expected return is defined by the expected return of its weighted investment style (determined by the asset class model), adjusted for the fund’s expenses and estimated trading costs of the management strategy. The baseline expected return is then the expected return of the underlying asset class exposures for the fund, less the drag due to management expenses and trading costs. For a passively managed product, the baseline estimate is a very good predictor of future expected returns, since the tracking error of the fund relative to its target index is generally very low. However, the calculation is more complex when the fund is actively managed.

Actively managed products may outperform or underperform their investment style benchmark due to the management strategy employed by the fund manager. To measure manager performance, it is critical to compare the performance of the fund to an appropriate benchmark. Edelman Financial Engines estimates a custom investment style benchmark for each fund in our database. Manager performance can then be evaluated by measuring the alpha of the fund's performance relative to the returns of a zero-cost index fund with the same investment style. A positive alpha indicates outperformance of the investment style; a negative alpha, underperformance. Edelman Financial Engines has researched the performance of thousands of funds over several decades to estimate the predictive power of historical alpha estimates. To properly weight the historical alpha estimate in projections of a fund's expected returns, Edelman Financial Engines uses a Bayesian statistical model that takes into consideration not only the magnitude of the alpha estimate (positive or negative) but also the volatility of that estimate and the length of time over which the performance was observed. Managers that generate positive alpha with greater consistency over longer time periods are judged to be more likely to repeat good performance than those with more erratic and shorter track records. The same is true for managers that consistently underperform their investment style benchmark. The statistical reliability of historical alpha as a predictor for the future is greater if the observed alpha is more stable over time. Edelman Financial Engines evaluates thousands of funds over long time periods to periodically calibrate its mutual fund alpha model.

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In addition, some funds are more tax-efficient than others due to their propensity to distribute dividends and short and long-term capital gains. For funds held in taxable accounts, the tax efficiency of the fund will impact expected returns. Thus, the return projection for any given mutual fund is a function of its style, the projected return for the underlying indexes, with an adjustment for manager performance, expense ratio, tax-efficiency (where applicable), and portfolio turnover.

Projected fund volatility

A fund's projected volatility is a function of its underlying style exposures plus any fund-specific risk factors. This implies that different funds within the same category (such as small cap growth) may have different projected volatilities. For example, a small cap growth fund that routinely holds 10% of its assets in cash (a low-risk asset) will likely have lower volatility than a small cap growth fund that holds only a minimal amount of cash. As another example, active management can increase the volatility of a fund relative to an equivalent index fund with the same investment style. Some fund managers may concentrate their holdings in only a few stocks or choose to rotate among several styles over time. Such funds can be expected to incur more volatility than funds that are more

diversified or pursue a more consistent strategy over time. Edelman Financial Engines models this additional volatility with a parameter for fund-specific risk. This additional risk is incorporated into both the simulation of fund returns and the portfolio optimization model.

Qualitative due diligence and oversight

Edelman Financial Engines' quantitative analysis ensures that funds are evaluated in a systematic, consistent, and rigorous manner. In addition, Edelman Financial Engines also engages in qualitative review of funds likely to be recommended by our advisory services. These periodic reviews explore the following issues:

- Analysis of fund company service providers (administrator, fund accountant, transfer agent, custodian, independent auditor, legal counsel)
- Regulatory compliance history of the fund company, portfolio managers, and principals of the advisor and subadvisor (if any)
- A review of any legal proceedings involving the fund
- An assessment of the accounting procedures in place at the fund
- Review of the fund prospectus to ensure the accuracy of the underlying fund data. Information on such issues is culled from a combination of sources that can include interviews with fund managers, the fund prospectus, the ADV, and other sources such as FINRA and LexisNexis

Stable value funds

Stable value funds offer participants fixed income returns with a nominal guarantee against loss of principal and accumulated interest. The guarantee of principal and accumulated interest is provided by a wrapper contract issued either by the issuer of the security or by an independent party, usually an insurance company or investment institution. Stable value funds typically hold a combination of cash and other short to intermediate-term fixed income investment contracts.

The economic behavior of stable value investments creates unique modeling challenges. First, stable value funds use book value accounting, which allows the interest rate received by investors ("the crediting rate") to differ from the market returns of the underlying assets. This property effectively dampens short-term, period-to-period market volatility relative to that of the underlying assets and results in serial correlation (i.e., persistence) of returns. This feature is often highlighted to appeal to more conservative investors. Second, a smoothing mechanism is used to bring the book value of the investments back in line with the market value of the underlying portfolio over time. This is necessary because the stable value fund must ultimately fund liabilities from the returns of the underlying assets. To accomplish this, the fund's crediting rate is set such that higher rates may be credited if the market value of the underlying portfolio is above book value, and lower rates are credited if the market value is below book value. Edelman Financial Engines' objective in developing its approach to modeling stable value funds is to capture the economic properties likely to be experienced by stable value investors and to assist them in making informed and intelligent investment decisions.

Specifically, Edelman Financial Engines' stable value methodology aims to:

- Accurately model the risk and expected returns of stable value investments
- Accurately model the distribution of real portfolio wealth over a given investment horizon
- Capture the special properties of stable value funds (such as serial correlation in the crediting rate) in forecast simulations
- Provide advice that is consistent and actionable for all stable value investors

Modeling stable value funds is more complex than modeling standard fixed income mutual funds because the return on the underlying portfolio and the return paid to the investors are often different at a given point in time. Edelman Financial Engines models both the characteristics of the portfolio underlying the stable value fund and the payout process (the crediting rate) of the stable value fund. The return on the underlying portfolio is modeled based on compositional analysis and the payout process is modeled using Edelman Financial Engines' generalized crediting rate algorithm. The simulated crediting rate is a function of the fund's duration and the difference between the portfolio's market value and book value and is smoothed over time such that it exhibits positive serial correlation.

Because of the serial correlation, the volatility of wealth resulting from investment in a stable value fund is less than the volatility of wealth resulting from investment in the underlying assets over short investment horizons. For instance, an intermediate bond fund could lose money over the next 12 months if interest rates were to suddenly shift upwards. However, in general, a stable value fund with the same underlying assets would not be expected to see a loss in the short run if interest rates spike upwards. Instead, the shock to the market value of the assets would be spread out over many months via the crediting rate algorithm. Because of this feature, the Edelman Financial Engines Simulation Engine ("Simulation Engine") properly characterizes the very low possibility of loss in the short run.

Edelman Financial Engines' investment team determines the duration parameter based on qualitative and quantitative analysis, which includes analysis of the duration of the assets that comprise the underlying portfolio.

Over intermediate and long horizons (e.g., more than five years), the volatility of wealth for the stable value fund converges to the volatility of wealth for the marked-to-market underlying assets. The underlying portfolio of a typical stable value fund has an investment style comprised of cash and fixed income asset classes. The risk and return characteristics of these assets are adjusted to account for fund-specific characteristics such as credit quality, diversification, expenses, fund composition, liquidity restrictions, wrappers and contractual guarantees, and predicted manager performance. The duration of the underlying portfolio is an important parameter in the stable value model because it enters directly into the crediting rate algorithm and affects the extent to which the crediting rate is smoothed over time. Edelman Financial Engines' investment team determines the duration parameter based on qualitative and quantitative analysis, which includes analysis of the duration of the assets that comprise the underlying portfolio.

In determining portfolio allocations, Edelman Financial Engines generates recommendations that are consistent and actionable for all stable value shareholders. Portfolio allocation recommendations are based on the long-run distributional characteristics of the underlying assets. In addition, allocations to stable value funds do not depend upon the gap between the book value and market value of assets. The primary factor driving stable value allocations in the Edelman Financial Engines framework is the risk tolerance of the investor and the availability of other competitive fixed income options.

Target date funds

Target date funds are diversified funds designed to become more conservative as the investor approaches retirement. Edelman Financial Engines models target date funds in a similar way as other funds in the plan lineup. Target date funds can have asset class exposures of up to 15 different asset classes.

One notable difference in the modeling of target date funds compared to traditional funds is that target date funds change their allocations over time in predictable ways. For instance, a 2030 target date fund will typically become more conservative over time as the fund ages. Because of this characteristic, Edelman Financial Engines models the changes in investment style over time as part of its simulation methodology. Each target date fund family is associated with a customized assumed glidepath for changes in investment style as the funds age. The family's glidepath is estimated using data on the investment style of each retirement date fund in the family.

For instance, a fund family might include target date funds spanning the years 2020 to 2050. For each of the target retirement dates, Edelman Financial Engines constructs an assumed glidepath that determines how the asset allocation of the fund is likely to change as the fund matures. As an example, the 2040 fund would be expected to change its allocation over time consistent with the asset allocation of the 2030, 2025, and 2020 funds in the same fund family. Note that the modeling process captures both the differences in asset allocation policies across target date fund families, as well as the differences in assumed glidepaths. It also makes adjustments for differences in expected expense ratios as the assets in the fund change over time.

By incorporating this family-specific glidepath information into the simulation model, Edelman Financial Engines can provide a more realistic estimate of investment outcomes for participants who choose to invest in target date funds during their accumulation period. In particular, the simulation reflects the expected decrease in equity exposure over time as participants reach their retirement horizon.

Modeling Company Stock and Other Individual Equities

Edelman Financial Engines models individual equities, including company stock, using a similar methodology as that used in modeling funds. Individual equities are modeled through a multistage process that involves modeling the asset-class exposure of industry sector groupings and then modeling each stock's covariance with the respective sector groupings. In this case, asset-class exposures of ten industry sectors are estimated using returns-based style analysis. The ten sectors are energy, materials, industrials, consumer discretionary, consumer staples, health care, financials, information technology, telecommunications, and utilities. Edelman Financial Engines estimates style exposures for each of these industry sectors, including breaking down the exposures into growth and value, large, mid, and small cap subsectors. Stocks may have exposures to more than one subsector.

Edelman Financial Engines models individual equities, including company stock, using a similar methodology as that used in modeling funds.

In the first stage, using a time series of returns from each subsector, the exposures to a combination of up to eight domestic asset classes are estimated: cash; long-term bonds; large cap growth and value; medium cap growth and value; and small cap growth and value. In the second stage, monthly returns of individual stocks are decomposed into co-movements with sector-level returns with an allowance for company-specific leverage (if any) and company-specific volatility. The estimate of stock-specific risk (idiosyncratic volatility) comes from the variability that is not explained by underlying asset class and industry subsector exposures. Stocks inherit their expected returns from their (levered) exposures to the underlying asset classes. Edelman Financial Engines assumes that all individual stocks are appropriately priced by the market, and hence the alpha component of expected returns is zero.

Combining these estimated stock parameters with expected returns at the asset-class level allows a computation of each stock's expected return and risk. An important feature of the stock-specific component of volatility is the tendency for high volatility stocks to gradually converge (conditional on survival) to lower long run volatility consistent with their peer group. This mean reversion property is built into Edelman Financial Engines' model of stock volatility for both forecasting and portfolio optimization. Incorporating mean reversion in company-specific risk is particularly important in the case of stocks with recent IPOs. Such young stocks may have an initial period of very high volatility, but on a forward-looking basis, one can expect their volatility to decrease, if the stocks survive over the long term.

In making investment recommendations, Edelman Financial Engines incorporates the specific characteristics of the company stock available in the plan (if any). In general, it will be inefficient for investors to hold a significant proportion of their assets in a single security, given the greatly increased risk associated with company-specific volatility. Edelman Financial Engines will recommend an efficient allocation of company stock for each participant, which depends on the risk tolerance of the investor, other retirement assets, investment horizon, and the parameters of the specific company stock. For most participants holding company stock, this will result in a recommendation to diversify out of concentrated positions. Edelman Financial Engines will generally not recommend that participants increase their level of company stock exposure. Online Advice users have the ability to override the recommendation and lock their company stock allocation to a level of their choosing. Edelman Financial Engines will then update the advice on the remaining portion of plan assets to best mitigate the risk of the company stock as best possible. For instance, an employee wishing to hold 15% of their assets in a growth-oriented company stock would generally see recommendations to hold a greater proportion of their remaining assets in fixed income or value-oriented equity to complement the higher exposure to risky growth assets.

Employee Stock Options

The employee stock option (ESO) modeling in the simulation engine demonstrates the effects of owning, exercising, and reinvesting the proceeds from employee stock options. Employee stock options can be entered by participants using the Online Advice service. The tax treatment of different types of employee stock options is modeled in a realistic manner while requiring as few tax-related inputs as possible.

Employee stock options can be entered by participants using the Online Advice service.

Employee stock options are essentially nontransferable American-style call options granted to employees as compensation. That is, the owner of the option is granted the right to purchase employer stock for a specified price, the “exercise price,” at or before the expiration date of the option. Employee stock option grants are often accompanied by a vesting schedule specifying how many of the options can be exercised at various points in time before expiration. A typical vesting schedule would stipulate that no options may be exercised until one year after the date of the grant (this is known as a “cliff” period), at which time 25% of the options granted may be exercised. Thereafter, an additional 1/48 of the option grant may be granted each month until the entire amount is vested after four years. Edelman Financial Engines allows the modeling of various assumptions for vesting and exercise strategies.

There are two different types of employee stock options modeled by Edelman Financial Engines:

- **Incentive Stock Options (ISOs):** ISOs are sometimes referred to as “qualified” stock options because they qualify for favorable tax treatment. At exercise, the difference between the market price of the stock and the option exercise price (sometimes called the option “spread”) is not taxed as ordinary income. Instead, the spread becomes an item of adjustment for Alternative Minimum Tax calculations and possibly triggers an AMT liability.⁷
- **Nonqualified Stock Options (NSOs):** NSOs have simpler, though less advantageous tax treatment. At exercise, the difference between the market price of the stock and the exercise price is taxable as ordinary income. Furthermore, because the exercise of NSOs counts as compensation from the employer, the option owner (that is, the employee) owes FICA payroll taxes on the spread. FICA taxes include Social Security taxes and Medicare taxes.

There are two common types of exercise methods for ESOs. The first, often referred to as a “cash” exercise, requires the owner to pay cash for the exercise price of the optioned stock as well as any taxes owed on the exercise. A “cashless” exercise (also referred to as “sell-to-cover”) is for the ESO owner who is either short on cash or short on tolerance for downside exposure. Under this method, the owner exercises and simultaneously liquidates enough of the optioned stock to pay for the costs of exercise. The owners are left with a reduced portion of optioned stock but effectively have invested nothing from their own pocket for that portion. Edelman Financial Engines allows the modeling of various exercise strategies and accommodates various assumptions on how the proceeds should be invested within the Online Advice service.

Defined Benefit and Cash Balance Plans

Edelman Financial Engines methodology allows participants with defined benefit plans to receive personalized forecasts and recommendations reflecting the impact of these benefits.

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For both traditional (e.g., final average pay) plans and cash balance plans, projected benefits are included in a participant's retirement income forecast. In addition, the existence of the guaranteed income stream from a traditional defined benefit might alter a participant's risk tolerance, resulting in a change in the portfolio allocation from Edelman Financial Engines.

Academic research shows the impact of a pension may affect investors' risk preferences, but the overall effect is uncertain due to a combination of opposing influences. On one hand, having a pension may allow for greater risk and therefore higher equity allocations. Conversely, having a pension may allow some investors to "lock in" their goals with less risk. Our proprietary research on investor behavior suggests that the net effect of these and other factors is that investors expecting traditional defined benefit pensions generally take moderately higher risk in their retirement portfolios than those without a traditional defined benefit.

As a result, the initial portfolio recommendation for a participant with a traditional defined benefit may have a slightly higher equity allocation, depending on the size of the pension relative to the retirement portfolio and the amount of time left until retirement. This initial suggested allocation reflects a more personalized estimate of risk tolerance for each participant.

Participants may further personalize their risk preference. By incorporating how a defined benefit pension helps participants achieve their goals, our services help each individual assess whether they can either "lock in" their goal by taking less risk or tolerate higher risk given the safety of their Social Security and pension income.

In addition, some participants may choose to adjust their savings rate or planned retirement age. There is no single best combination of risk, savings, and retirement age that is suitable for all participants. Edelman Financial Engines' services help participants make informed retirement decisions while considering the impact of traditional defined benefit income.

Edelman Financial Engines models cash balance plans in the same manner as other defined contribution assets. That is, it includes the projection of future employer contributions (known as “pay credits” or “compensation credits”) based on the specific contribution formula and modeling of the cash balance plan assets. Since cash balance plan crediting rates are sensitive to interest rates, the investment risk of the cash balance instrument is included when determining a participant’s total portfolio risk. In this way, the cash balance plan directly impacts the advice provided on the participant’s advisable portfolio. Edelman Financial Engines’ modeling accounts for the uncertainty of future interest rates and, therefore, the range of projected future values of a participant’s cash balance account. Unlike a future income stream from a traditional defined benefit plan, the expected performance of the interest-crediting instrument has some correlation to the expected performance of a participant’s other investments.

Portfolio Simulation

Edelman Financial Engines uses a sophisticated Monte Carlo simulation engine to help investors understand the range of possible investment outcomes that may occur for a given investment strategy. The simulation engine helps plan participants reach informed decisions about the appropriate level of risk, savings, and time horizon to improve the likelihood of achieving financial goals. Our simulation engine is capable of:

- Simulating more than 38,000 securities, including retail mutual funds, stocks, employee stock options, institutional funds, guaranteed investment contracts, and stable value funds while considering tax implications, expenses, loads, and distributions
- Considering security-specific characteristics such as investment style, expenses, turnover, manager performance, security-specific and industry risk
- Forecasting the total household portfolio, including tax-deferred and taxable accounts
- Incorporating Social Security, pension income, and other retirement benefits
- Presenting outcomes in terms of portfolio value or retirement income

The goal of the simulation process is to create feasible scenarios for how a portfolio of assets may perform through a wide variety of market conditions.

The goal of the simulation process is to create feasible scenarios for how a portfolio of assets may perform through a wide variety of market conditions. Simulation consists of the following steps:

- Start with current values of economic state variables (interest rates, inflation, etc.).
- Using the pricing kernel model, generate possible paths for core asset classes (cash, bonds, stocks). This process yields arbitrage-free, coherent scenarios for the core asset classes.
- Map each generic asset class onto a combination of the core asset scenarios while drawing random innovation terms from an estimated residual covariance matrix for each of the 15 generic asset classes. This creates scenarios for each of the 15 asset classes.
- Map each fund or stock onto the 15 asset classes using the estimated investment styles, with adjustments made to the returns to account for expenses, portfolio turnover, and predicted alpha (if any).
- For each scenario, calculate the value of the portfolio at each time step.

- Estimate the future distribution of portfolio values by aggregating across thousands of scenarios over the modeled time period.

From the pricing kernel to portfolio projections, each step in the Edelman Financial Engines simulation model has been carefully constructed to ensure a high level of consistency and coherence among key economic variables and asset class returns. The result is the ability to create realistic forward-looking scenarios for a wide range of financial assets and user portfolios.

In addition, the simulation model takes into consideration growth in projected salaries, future contributions reflecting plan-specific and statutory contribution limits, and taxes (including taxes on dividends, capital gains, and income). The incorporation of these complexities ensures that simulation forecasts of participant balances are as realistic as possible.

To convert portfolio balances into representative estimates of retirement income, Edelman Financial Engines' simulation engine converts various sources of retirement income into a comparable basis. Since most investors will receive some form of Social Security income, Edelman Financial Engines converts all financial balances and other sources of retirement income into an equivalent basis to Social Security — namely an inflation-adjusted income stream that lasts for life (also known as a real annuity value). The goal of this approach is to help investors understand the standard of living they could afford in today's dollars, assuming that the income lasts for life.

Since Social Security is already represented as a real annuity value, no further adjustment is needed. For financial assets that have a balance at retirement, Edelman Financial Engines calculates the real annuity value of the assets at that point in time.⁸ For other sources of income (for example a defined benefit pension), we calculate the real annuity value of the income stream starting at retirement. This allows the investor to see all their sources of retirement income on an apples-to-apples basis. While most investors are unlikely to fully annuitize their financial assets at retirement, this methodology allows them to understand the level of inflation-adjusted income they could lock in for life if they desired. As such, it is a useful benchmark for understanding their retirement standard of living under different investment strategies.

Generating Portfolio Recommendations

In generating portfolio recommendations, Edelman Financial Engines relies on two sets of inputs: information about the preferences of the investor and information about future market expectations given the lineup of investments available. This section details the process used to provide investors with personalized portfolio recommendations.

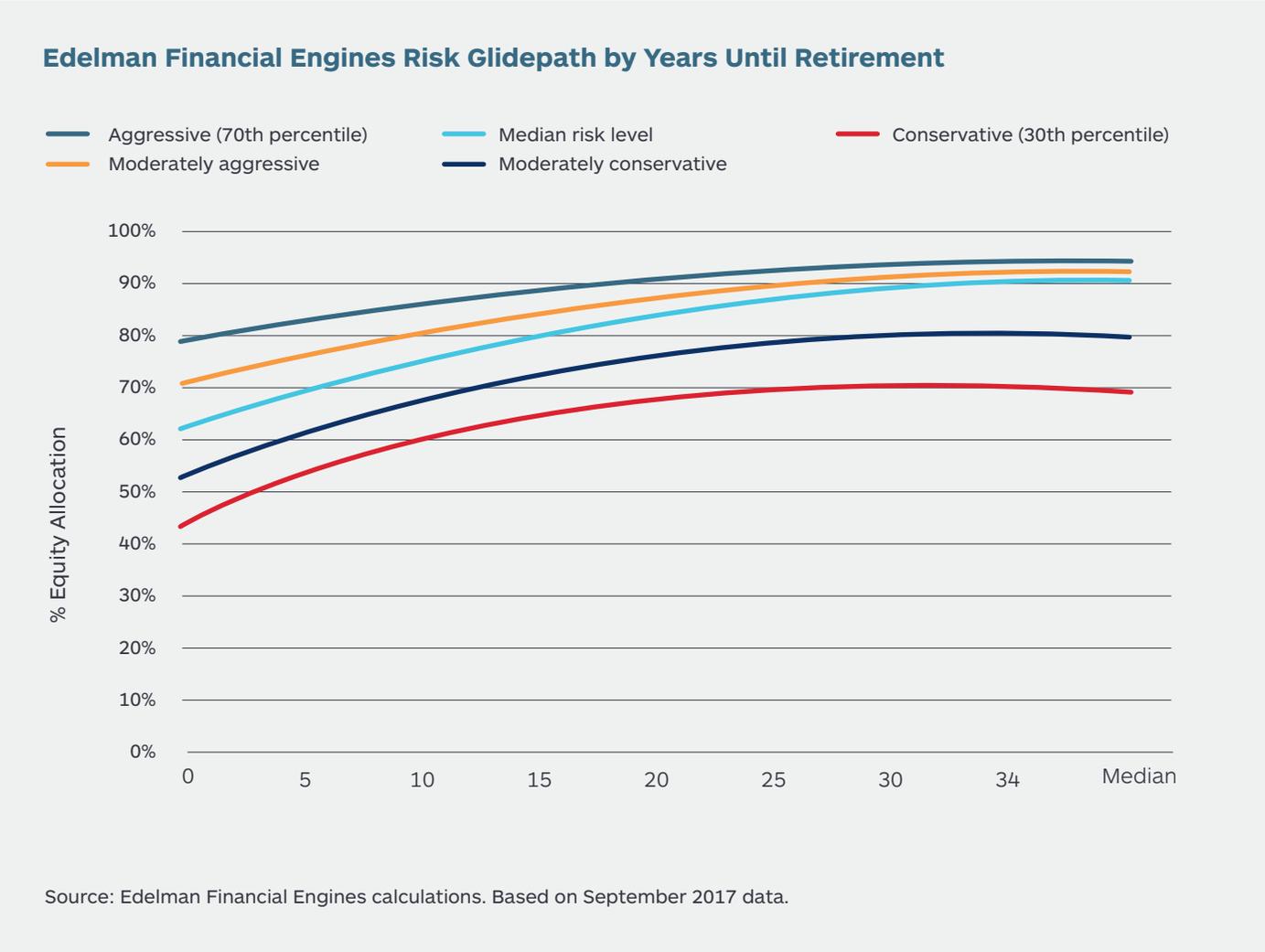
Modeling Investor Risk Tolerance

A key input in the portfolio optimization process is the risk tolerance assumption for the investor. Risk tolerance assumptions govern where on the efficient frontier the investor would be most comfortable. They can also affect the tradeoff between current consumption and saving for future income.

In general, the appropriate risk tolerance for individual investors is an empirical question. Despite the concerted efforts of financial economists, there are no reliable ways of determining the appropriate risk tolerance of an individual investor based on first principles. Instead, risk tolerance must be assessed through an interactive exploration of the consequences of different levels of investment risk, or it must be inferred from the choices of similar investors with similar time horizons and financial circumstances.

A key question for many inexperienced investors is where to start when evaluating their tolerance for risk. Most investors have higher levels of risk tolerance when they are younger and their investment horizon is longer. Since younger investors generally have a lower proportion of wealth in financial assets, and more of their net worth in the form of their future income capacity (human capital), it is intuitive that younger investors would prefer to hold a higher proportion of riskier assets like equities. However, not all people of the same age have similar tolerance for risk. Some investors are inherently more aggressive or conservative relative to other investors of their age group. Many factors can influence an individual's risk tolerance, including their general appetite for risk, age, job security, health, the presence or absence of a working spouse, other sources of income such as Social Security and defined benefit plans, and other household assets. Edelman Financial Engines' advisory services are designed to allow for these differences in personal risk preferences.

Edelman Financial Engines provides a starting point for the risk tolerance of individual investors based on evaluating the behavior of other similar investors. The philosophy behind this approach is that many investors desire to start with a reasonable default for the risk of their portfolio, and then make modifications if needed. To create a default starting point for risk tolerance, Edelman Financial Engines periodically evaluates the risk tolerance of a large population of individual investors segmented by investment horizon (based on their age and assumed retirement date). For each horizon cohort, we calculate the empirical distribution of risk tolerance. If we do not have additional information about participant specific preferences, we will recommend the median risk tolerance from this distribution for investors with the same horizon. Users of the Online Advice service can modify this starting risk tolerance assumption as much as desired. For members of the Professional Management program, we allow them to choose higher or lower levels of risk tolerance for their horizon between the 30th and 70th percentiles of the risk tolerance distribution for their horizon cohort. As expected, the risk tolerance of investors trends down as they approach their retirement horizon. The chart below shows an example of the empirical distribution of risk tolerances based on data.



As noted above, Edelman Financial Engines relies on market consensus expectations in estimating asset class returns. We also take into consideration changes in the empirical distribution of risk tolerance as market conditions change. As the overall global market proportions of equities and fixed income change, the average investor becomes more or less risk tolerant. For example, during the financial crises of 2008 and 2009, investors, particularly those with shorter horizons, became less risk tolerant.

Edelman Financial Engines updates its risk distribution estimates monthly to assess changes in aggregate preferences. In most market conditions, the estimated glidepath for investors of different horizons is quite stable. However, there can be changes observed when markets move dramatically. Notably, Edelman Financial Engines does not automatically rebalance individual portfolios to fixed proportions. Instead, our equity proportions and glidepaths take into consideration changes in both the market consensus expectations, and in the changes observed in empirical risk choices.

Portfolio Optimization

Portfolio optimization has the objective of providing investors with the highest expected return portfolio for a given level of volatility. Edelman Financial Engines has developed proprietary robust mean-variance optimization techniques with the objectives of:

- Creating personalized, age-appropriate diversified portfolios for participants (no model portfolios)
- Maximizing portfolio expected returns by balancing asset class diversification, fees, manager performance, and other fund-specific characteristics
- Considering the initial portfolio allocation, other sponsored plans, outside assets, and investment constraints

Specifically, Edelman Financial Engines' investment recommendations take into consideration for each investment option the mix of asset class exposures, fund expenses, turnover, fund-specific risk due to active management, manager performance and consistency, user-imposed constraints, and tax-efficiency, where applicable, to construct a personalized portfolio recommendation for each participant.

Key characteristics of Edelman Financial Engines' optimization engine include:

- Supports product-level buy and sell recommendations that can be readily executed through Online Advice and automated transactions for the Professional Management program
- Supports recommendations across retail mutual funds, institutional funds, and employer stock

- Provides recommendations across multiple taxable and tax-deferred accounts
- Takes into consideration investor risk preferences, restricted positions, redemption fees, investor constraints, and outside account information to create personalized investment recommendations

In optimizing portfolios, Edelman Financial Engines employs an approach that takes into consideration the specific characteristics of each investment option available in the account — fund level optimization. This is in contrast to the traditional approach of hierarchical optimization, a commonly employed two-stage process that generates a target asset allocation under the assumption that you can invest directly in the asset classes, followed by a fund selection process to pick investments that will achieve the target asset allocation. The problem with hierarchical optimization is that it makes strong assumptions about the available investment options that may not be realized in a defined contribution plan. Such problems with hierarchical optimization include:

- The target asset allocation decision assumes that the available investments behave like zero-cost index funds. Instead, most plans offer a mix of active and passive investments at varying levels of management fees.
- The process assumes that one can get exposures to all the asset classes in the target allocation.
- The process assumes that the target asset allocation applies to all household assets.
- The process assumes that funds can be categorized into a single asset class.
- The hierarchical process makes the strong assumption that asset class diversification is more valuable than any fund-specific characteristic. For instance, it would assume that getting small and mid cap exposure is important, even if the only small and mid cap option were vastly more expensive than the available large cap equity exposure.

Edelman Financial Engines developed a more robust optimization approach that takes into consideration the fund-specific characteristics of the available investments.

Since many of these assumptions break down in defined contribution plans, Edelman Financial Engines developed a more robust optimization approach that takes into consideration the fund-specific characteristics of the available investments.

Fund level optimization used by Edelman Financial Engines avoids these problems by basing the optimization on the specific funds available to the participant in their plan. This implies that the benefits of asset class diversification can be evaluated in the context of the investment style, manager performance, fees, active risk, and other fund-specific factors. By combining the target

asset allocation decision and the fund selection process into a single integrated optimization, Edelman Financial Engines can provide more efficient portfolio recommendations for a wider range of plan lineups. Moreover, the portfolio optimization process is able to account for multi-asset class funds, differences in expenses and manager performance, as well as any outside assets held by the investor. In addition, by incorporating fund-level information into the optimization, it is possible to account for plan complexities including restricted balances, redemption fees, and stable value equity wash provisions. The final result of this optimization process is actionable, efficient portfolio recommendations.

Advice Palatability

It is a well-known result in mean-variance optimization that portfolio recommendations can be very sensitive to changes in the inputs to the model, particularly with respect to expected returns. This observation results from the fact that there are typically a variety of portfolios that are very nearly efficient for a level of desired risk. While the portfolios may differ in allocations, they are immaterially different in terms of expected return and volatility. In other words, in real world optimization problems the efficient frontier is not a line, but instead is a thin cloud of portfolios with varying allocations. Given that there are a number of portfolio allocations to choose from with nearly identical risk and return properties, how do we choose an answer when it is known that the inputs to the optimization model are estimated with some amount of noise?

Advice palatability is a collection of optimization enhancements developed by Edelman Financial Engines designed to make the recommendations more intuitive and credible to an investor. Optimizing assuming an efficient band instead of an efficient frontier allows the optimization model to formally bring palatability considerations into the equation without sacrificing portfolio quality. The palatability features built into the Edelman Financial Engines optimization process take into account the following factors:

- **Turnover:** All else being equal, minimizing turnover from the current portfolio is desirable. Reducing turnover focuses the participant on the few things that are required to improve the risk or return of their portfolio. Avoiding turnover also has a very important benefit of creating stability over time.
- **Concentration:** Research conducted by Edelman Financial Engines shows that investors are generally uncomfortable with concentrating a large portion of their assets into a single fund, unless the account size is small. Our experience shows that this concern starts at around 35% of the portfolio and increases substantially for values above 50%.

- **Number of positions and transactions:** Edelman Financial Engines tries to avoid recommending a large number of individual positions. Edelman Financial Engines also tries to reduce the number of overall transactions. A portfolio that requires two transactions to achieve its targets is better than one that requires three. The net result of avoiding large numbers of positions and of avoiding a large number of transactions is to significantly reduce the incidence of trace allocations (very small positions) in the portfolio recommendation.

Plan and Fund Restrictions

Many defined contribution plans have restrictions on participants' ability to buy or sell certain mutual funds or stocks. In order to provide a robust service that can accommodate the complexities of larger plans, Edelman Financial Engines' portfolio optimization technology is capable of respecting a number of plan and fund restrictions. These include restricted balances, discontinued funds, redemption fees, stable value equity wash restrictions, and Qualified Default Investment Alternative (QDIA) requirements.

- **Restricted balances:** Some assets in a plan may have restricted balances; that is, a portion or all of the holdings in these assets cannot be bought or sold in certain time periods. The optimization model will take restricted balances into account when giving recommendations on the unrestricted portion of the account. Restricted balances will also be represented in simulated forecasts of the portfolio.
- **Redemption fees:** A redemption fee is a fee that is charged by a mutual fund when shares are sold during a specified time period after the shares' purchase. The sale of funds that incur redemption fees is generally unfavorable as it results in additional costs to the investor. There is a general exception to this rule. If a member has more than 20% of an account invested in a fund subject to a redemption fee, and that fund contributes significantly to an inefficient portfolio, a partial sale of the fund is allowed, because the portfolio may be extremely undiversified and subject to significant volatility. However, to mitigate costs, the maximum amount sold is constrained to be no more than the excess above 20% of the position subject to redemption fee holdings.⁹
- **Short-term trading restrictions:** Some funds in a plan may have short-term trading restrictions to avoid frequent purchases and sales of shares. Depending on the nature and type of trading restrictions, Edelman Financial Engines' optimization model may be able to honor these constraints.
- **Stable value equity wash:** Many defined contribution plans contain stable value funds. Stable value funds often come with a restriction that the proceeds from selling a stable value fund cannot be used to buy competing short-term investments within the plan for a specified number of days. Edelman Financial Engines' portfolio optimization process can accommodate this constraint by specifying transactions in the form of constrained fund-to-fund exchanges.¹⁰

Professional Management (Managed Account Program)

The Professional Management program provides defined contribution participants with personalized, discretionary account management. Members of the Professional Management program are typically sent a personalized Retirement Plan that reviews and explains the proposed portfolio allocations. It generally includes a comparison of the current allocations with the target portfolio, the asset-class breakdown of the target portfolio, the median and downside forecasts, and the potential short-term investment loss associated with the proposed portfolio. It also provides suggestions on recommended savings rates.

After reviewing these materials, the members can tailor the program even further to fit their own situation by providing additional personal information through a phone conversation with a registered investment advisor representative or via a dedicated member website.

Personalization options

The Professional Management program allows additional personalization related to risk tolerance, expected retirement age, company stock preference (if applicable), and assets held outside the retirement account.

- **Risk preference:** Based on Edelman Financial Engines research and in accordance with standard practice in investment management, the default level of portfolio risk in the program depends on the number of years until retirement and declines as the retirement date approaches. In the absence of personalization, the member is assigned the median risk level of a large sample of investors with the same number of years until retirement. If members feel they are more or less risk tolerant than a typical investor with a similar investment horizon, they can select risk levels associated with the 30th or 70th percentile of their cohort based on years to retirement.
- **Retirement age:** The program assumes that a member intends to retire at 65. Members can personalize their anticipated retirement age based on their current expectations. Since the risk level is based on the number of years until retirement, this estimate of the retirement age helps to determine the appropriate portfolio risk level for the member.
- **Company stock:** The default behavior for the Professional Management program is to reduce company stock exposure to an efficient level, given the facts and circumstances of the investor and specific parameters of the stock. Recognizing that some investors may have strong opinions regarding their employer stock, the Professional Management program allows members to hold up to 20% of their account in company stock and maintain membership in the program. By design, the maximum cannot be greater than 20% of the unrestricted account balance as company stock is typically a more volatile asset and allocations exceeding 20% would limit Edelman Financial Engines' ability to appropriately diversify and manage the portfolio. For example, if a member personalizes the company stock allocation to 10% and market movements cause the stock allocation to rise above 10%, Edelman Financial Engines will rebalance the stock allocation down to 10% at the next transaction. If market fluctuations cause the stock allocation to fall below 10%, the stock allocation is left at its current level.

- **Outside accounts:** Members may have assets outside their sponsored accounts set aside for retirement. The program uses information on these non-managed assets in order to model correlations between managed and non-managed assets. Outside accounts may include sponsored accounts such as cash balance accounts or ESOPs, other holdings in employer-sponsored accounts, spouse/partner employer-sponsored accounts, and retail accounts (e.g., tax-deferred and/or taxable accounts). The optimized managed allocation will then take into account the other household assets. For example, if the member reports aggressive growth holdings in a taxable account, the managed retirement account portfolio will be more conservative, with less exposure to growth assets.

Transition period

The Professional Management program includes a transition period over which a member's current portfolio is transitioned to the target portfolio. During the transition period, Edelman Financial Engines typically makes gradual adjustments to the member's holdings toward a portfolio target over a period of up to six months. For the typical plan, the member's portfolio is adjusted monthly, with a maximum allowable turnover of 20% imposed in each transaction. Transactions are generated to produce the greatest efficiency gain while respecting the turnover limit. For member portfolios that initially include concentrated positions in company stock, the early transition period trades will typically focus on adjusting the company stock positions.

The purpose of the transition period is twofold:

- To increase the member's comfort level with the transactions required to reach the portfolio target
- To reduce the potential market impact of sales of company stock, stable value, or other securities with limitations on liquidity

The target portfolio may be updated during the transition period to reflect plan changes, new member personalizations, or changes in the estimated risk or return of plan assets. Typically, the transition period ends before the full six month period, as many portfolios require less than 100% turnover to reach their target allocation.

The Professional Management program offers two additional temporary personalizations to accommodate participant preferences regarding their investment allocations.

Asset class personalization

During times of market volatility, Edelman Financial Engines' advisors receive thousands of calls from program members concerned about the market. Examples include worries about international stock markets and the potential impact of rising interest rates on bond investments. Advisors consistently educate such individuals about the benefits of maintaining a long-term focus with a

diversified portfolio and the pitfalls of attempting to time the market. In a fraction of cases, members may be so worried that they cancel from the program with the intention of changing their allocations to lower-risk investments on their own. Empirical research on investor behavior reveals that, left to their own devices, many individuals sell out of stocks in a panic but fail to reinvest for lengthy periods of time, often missing out on a market recovery.

Edelman Financial Engines believes that participant outcomes can be improved by offering greater short-term flexibility for those concerned about market volatility combined with a disciplined process to return to a more fully diversified allocation in the medium term.

Edelman Financial Engines believes that participant outcomes can be improved by offering greater short-term flexibility for those concerned about market volatility combined with a disciplined process to return to a more fully diversified allocation in the medium term. The added flexibility is offered in the following manner:

- Program members may, in consultation with an advisor request that Edelman Financial Engines minimize their managed account's exposure to a single asset class.¹¹ Advisors will clearly remind each member of the potential consequences for their investment returns and of our philosophy to achieve diversified portfolios. Edelman Financial Engines will adjust its allocation to exclude funds with material exposure to that asset class.
- This asset class personalization automatically expires after 12 months. At that time, the managed account portfolio is reallocated and will likely move some portion of the account into the asset class that had been minimized.

This personalization capability is not designed to facilitate "market timing." For example, members will not be able to achieve portfolio allocations that entirely lack stock market exposure. Instead, this feature is intended to accommodate concerns about certain portions of the investable universe, while preserving a balance between low-risk and higher-risk investment categories. The economic consequences of removing a single asset class for a short period of time are relatively modest in expectation. This is because most asset classes are highly correlated with other asset classes, and hence reasonable substitutes can be found to preserve portfolio diversification and efficiency. Over the intermediate term, the portfolio will automatically return to a fully diversified allocation unless the participant intervenes.

Deferred stock transition

Company stock is the single investment that participants care the most about. At the same time, company stock is usually the riskiest investment in an employer-sponsored plan, so concentrated allocations should be avoided. Many participants would rather not accept a diversified portfolio if it means selling a large part of their company stock holdings today. As an unfortunate consequence of this short-term focus, most of these participants may never diversify their concentrated positions, placing their retirement balances at unnecessary risk of large losses.

We believe that more participants can be helped by offering greater short-term flexibility combined with a pre-commitment to achieve a more fully diversified allocation in the medium and long term. The added flexibility is offered in the following manner:

Program members may, in consultation with an advisor express their desire to transition their stock holding to a long-term target more gradually. An interim cap of up to 50 percent of the account can be specified. Advisors clearly remind each member of the risks of concentrated stock holdings and of our philosophy to achieve diversified portfolios after a gradual transition.

- For the first 12 months after this feature is chosen by the member, the program will sell company stock only if the allocation exceeds the interim cap.
- Any participant contributions will not be directed to company stock until the cap is reduced to the long-term target (e.g., 20 percent). This provides for a natural reduction in stock concentrations over time, even without explicit trades out of stock.

After 12 months, the program will reduce the cap on stock holdings by 2 percentage points per month until the long-term personalized level (or the program's non-personalized target) is achieved. For members wishing to maintain a long-term level of 20 percent stock, their stock transition will be completed no later than 27 months following enrollment. Members who are making ongoing contributions will likely reach their long-term targets earlier, since those contributions will not be allocated to company stock. Contributions to company stock resume once the long-term target for stock is reached.

This additional stock flexibility offers help to those participants who have concentrated holdings in company stock but also a strong aversion to immediately selling their stock holdings. Individuals' fears about selling at what could turn out to be the "wrong" time (should the stock price outperform the market after selling) can be overcome by a commitment to diversifying gradually and in the future. This enhanced flexibility follows Edelman Financial Engines' philosophy to limit concentrated risk with a focus on long-term retirement outcomes.

Ongoing portfolio management

As many factors change over time, ongoing portfolio management is important in helping program members achieve their specific retirement goals. Edelman Financial Engines regularly updates the target allocation for each member of its Professional Management program.

In general, Edelman Financial Engines reviews member portfolios at least once every month for potential adjustments. In addition to monthly reviews, off-cycle reviews may be performed at the individual, company, or aggregate level. Off-cycle reviews can be triggered by changes in a member's personalization options, changes in the investment options within a plan, and unusual market events or volatility. Prudent management implies that rebalancing should only occur in response to material changes in key economic and financial factors. Edelman Financial Engines will typically not execute transactions for portfolios within 5% turnover of their target allocation, unless there has not been a completed transaction within the last six months. While differences under 5% will typically be economically immaterial, even small allocation differences in certain investments (e.g., company stock), can result in more significant deviations from a risk or return standpoint. The six month policy ensures that the length of time over which such deviations can exist are minimized. This policy applies to both the transition period and ongoing management.

To maintain the quality of our investment recommendations, our investment process incorporates a wide variety of automated checks and validation procedures. These processes are overseen by multiple groups within our Investment Management and Service Delivery organizations. Such processes help verify that the data inputs into our systems are timely and accurate, and that the resulting investment recommendations reflect the correct application of our investment methodology.

Investment Performance Measurement

Historical investment performance is one factor that plan sponsors evaluate when deciding whether to offer Professional Management services to their employees and when monitoring the investment manager selected. Because each Professional Management portfolio is personalized to the member's specific financial circumstances, there is no one representative portfolio from which to calculate investment performance.

Unlike a traditional investment fund, there is no single benchmark or index that would be appropriate to measure the relative performance of member portfolios. In order to provide investment performance with a realistic point of reference to plan sponsors, Edelman Financial Engines aggregates members into "cohort portfolios" corresponding to specific anticipated retirement dates plus or minus two years (e.g., 2025 member cohort). While the member allocations within these cohort portfolios differ according to the specific financial circumstances of each individual member, they share a common investment horizon and typically have similar risk levels.

For example, the 2025 Portfolio includes members expecting to retire in years 2023, 2024, 2025, 2026, and 2027. The results are calculated net of fees, using the maximum fee schedule applicable to any cohort member. Returns are calculated for members who completed the transition period either before or during the measured time period and who had account balances at some point during the period. A near-retiree cohort portfolio consists of all members in plans either retired or expected to retire within the next calendar year. For example, in 2015, the near-retiree member cohort portfolio consisted of members expected to retire in 2016 and currently retired members.

The specific horizon target years are chosen for each sponsor based upon the time of program implementation and following criteria:

- All target horizon years are a multiple of 5 (e.g., 2020, 2025, etc.) to be consistent with retail target date funds. In addition, the five-year span between horizons allows for sufficient distinctions between portfolios and investment performance.
- The earliest horizon year is selected to be the earliest available target horizon greater than or equal to one year. The one-year minimum was chosen to measure the performance of members who are at least one year from retirement.

Grouping members into cohorts with similar risk levels makes it possible to compare member investment performance to other investments with similar characteristics, such as target date funds with similar horizons, or a passive index strategy with similar asset allocation exposures.

Edelman Financial Engines' investment philosophy is not based on trying to beat the market through tactical market timing decisions. Our process relies on market consensus expectations which we believe reduces investment volatility in the long run. Our investment process is designed to create additional value through the effective selection of available investment options. The results of this methodology create investment portfolios that are transparent, consistent with global market conditions, offer predictable performance relative to market movements, and are free from subjective biases.

Frequently Asked Questions

How does company stock fit into the overall portfolio recommendation?

Edelman Financial Engines explicitly accounts for company stock, if available, into our investment recommendations. Each company stock is modeled uniquely in the Edelman Financial Engines platform. We take into consideration the stock's asset exposures, its industry exposures, leverage, and company-specific volatility. Based on this analysis, we recommend a prudent level of stock, given the investment horizon, risk tolerance, and other household assets of each participant. For most participants, it will be prudent to limit their stock exposure to a small proportion of their total portfolio. However, in the Online Advice service, participants can customize their level of company stock exposure to any percentage desired, and see a realistic forecast of the implications of their decision. In the Professional Management program, members are allowed to personalize their level of company stock exposure to hold up to 20% of their managed account in company stock.

Would you ever recommend target date funds? Do you ever sell participants out of them?

Yes, Edelman Financial Engines can use target date funds as appropriate building blocks for constructing personalized portfolios. In some cases, our advice will be to sell positions in target date funds if a portfolio with better expected performance can be constructed from the other core options in the plan.

Do you ever recommend funds that are not in the fund lineup?

Edelman Financial Engines provides recommendations across only those investment options available in each participant account. We do not recommend funds outside of the plan for advice on the primary defined contribution account. For the Online Advice service, it is possible to get advice on other household accounts such as IRAs or brokerage accounts, which may offer additional fund options.

What do you recommend when there is a poorly performing fund lineup or asset class representation?

Edelman Financial Engines does not provide formal plan or investment consulting services to plan sponsors in order to avoid any potential for conflicts of interest. However, as part of our ongoing reporting to plan sponsors, we provide information on how our services evaluate each option in the plan, including options not selected for participant portfolios. This information may be helpful to sponsors in making decisions about their investment lineup.

What do you do when a participant has balances in the brokerage window?

Edelman Financial Engines advisory services are capable of providing recommendations on the full spectrum of investment funds available, including brokerage windows consisting of thousands of investment options. Depending on the limitations of the recordkeeping connections for the plan, brokerage window holdings may be automatically recognized as part of the participant's portfolio. For the Professional Management program, these assets are treated as outside holdings that can influence the selection of an appropriate portfolio for the participant's defined contribution plan.

How does Edelman Financial Engines evaluate active versus passive investments?

Active and passive investment options are treated with the same analysis and methodology. Funds, whether they are actively or passively managed, can have multiple asset class exposures, along with adjustments for expenses, fund-specific risk, and manager performance. In general, actively managed funds will have higher levels of expenses (both in terms of management fees and implied trading costs due to turnover) and higher levels of fund-specific risk. Actively managed funds will have more volatile manager performance, which can be positive or negative relative to their estimated average investment style exposures. Edelman Financial Engines takes into consideration all of these fund characteristics in making its investment recommendations.

How often does Edelman Financial Engines review its strategic asset allocation process?

The Edelman Financial Engines investment model is designed to adapt to current market conditions including current inflation, interest rates, dividend growth rates, asset class returns, volatilities, correlations, and the allocation of the global market portfolio. Our investment philosophy is based on reliance on consensus market expectations for asset class returns. As such, our strategic allocation policies have remained consistent with the observed market portfolio. Our estimate for the long-range risk premium of stocks over bonds has been very stable over the history of our business, and is expected to remain so in the foreseeable future.

Does Edelman Financial Engines require a minimum set of asset classes to provide advice?

The Edelman Financial Engines model is capable of providing recommendations over any set of investment options, including plans that are missing certain asset classes. However, to provide a well-diversified portfolio, it is desirable to have a spectrum of fixed income and equity asset classes available, including international equity. The vast majority of defined contribution plans have adequate asset class coverage to build quality participant portfolios.

How does Edelman Financial Engines model funds with limited or no trading histories?

Typically, Edelman Financial Engines requires at least 18 months of trading history for a fund in order to apply returns-based style analysis. When modeling funds with limited or no performance histories, our fund analysts rely on holdings-based information, or the declared investment objectives of the funds, to infer estimates of the forward-looking investment style. The objective of this analysis is to properly characterize the economic characteristics of the fund, including expected returns, volatility, and correlations with other assets. For index funds, Edelman Financial Engines may use the target index with appropriate adjustments for fund-specific expenses, and other characteristics.

- ¹ InvestmentNews ranking and status as of June 5, 2019. For independence methodology and ranking, see <https://data.investmentnews.com/ria/>.
- ² All advisory services provided through Financial Engines Advisors L.L.C. (FEA), a federally registered investment advisor and wholly owned subsidiary of Edelman Financial Engines, LLC. Results are not guaranteed.
- ³ See “On the Use and Abuse of History: Examining the Pitfalls of Using Historical Data for Financial and Investment Planning”, Financial Engines, 2001.
- ⁴ For a more detailed discussion of this issue, see “On the Use and Abuse of History: Examining the Pitfalls of Using Historical Data for Financial and Investment Planning”, Financial Engines, 2001.
- ⁵ The market portfolio proportions are determined by the global market capitalization of all 15 asset classes. To adjust for the home bias of U.S.-based investors, Edelman Financial Engines adjusts the proportions between foreign and domestic holdings to match those of the top 200 U.S. corporate defined benefit plans. Over time the home bias adjustment is becoming smaller as the proportion of foreign assets held by sophisticated U.S. investors increases.
- ⁶ As of December 31, 2011. The specific number of securities will vary over time with the market entry and exit of stocks, funds, and private (non-registered) instruments.
- ⁷ This is advantageous for the option owner in that the AMT liability from the exercise of ISOs may often be credited back over time. When the owner sells the stock at least one year after exercise, the difference between the stock price at disposition and the exercise price of the ISO is taxable as capital gains (or qualifies as a capital loss). However, if the stock acquired through the exercise of the ISO is sold either (a) within a year of exercise or (b) within two years of the ISO grant, then it becomes a “disqualifying disposition,” the AMT liability is reversed and the owner must pay ordinary income taxes (though not payroll taxes) on the spread that existed at exercise. Any difference between the stock price at disposition and the stock price at exercise is then taxable as capital gains (or qualifies as a capital loss).
- ⁸ In calculating the real annuity value of a portfolio balance, Edelman Financial Engines incorporates estimates of typical fees associated with annuity products offered by insurance companies. Furthermore, in order to reflect the fact that most annuities that are purchased come with some form of period certain or death benefits, we annuitize portfolio balances using an “age-85 certain” annuity. This form of annuity provides income through life, or through the year at which the participant would have reached age 85, whichever is later. This age-certain annuity assumption is applied to income sources that are not lifetime incomes, such as portfolio balances, lump sum pensions, and fixed-duration pensions. Lifetime income sources such as Social Security and defined benefit pensions that are life annuities are adjusted through a simple life annuity calculation assuming no death benefits.
- ⁹ Taking into consideration redemption fees requires additional data on balances subject to redemption fees from the plan provider. Online Advice optimization will consider restricted balances, and highlights funds subject to stable value equity wash constraints or redemption fees.
- ¹⁰ Note that from-to transaction capability may not be available in all provider channels.
- ¹¹ The five asset classes available for this setting are Cash, Bonds, Large Cap Stocks, Mid & Small Cap Stocks, and International Stocks. If a member chooses to minimize exposure to Bonds, the Program will maintain an ability to invest in the most conservative fund in the lineup, which will typically be a capital preservation fund (money market or stable value fund). This design accommodates an often-expressed concern that rising interest rates may hurt bond fund values; such concerns do not apply to capital preservation funds.

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