

## Strategic Asset Allocation

# A systematic framework for validating TDF glide paths



January 2021

- As target-date funds (TDFs) take a more prominent role in helping investors around the globe accumulate retirement savings, a systematic approach to reviewing their glide paths based on changes in local market assumptions could improve investors' chances of investment success.
- Our proprietary Vanguard Life-Cycle Model (VLCM) compares existing glide paths with optimal glide paths based on changes in user-defined inputs and capital market assumptions.
- The Vanguard Strategic Asset Allocation Committee (SAAC) has approved the existing TDF glide path in the U.S. market as well as a framework for validating it.
- This memo summarizes discussions at the July 2020 SAAC meeting about TDF glide paths based on work done by Vanguard's Investment Strategy Group.

## About the SAAC

The Vanguard Strategic Asset Allocation Committee (SAAC) is a multiasset oversight committee composed of global investment leaders from across the firm.

The members of the SAAC are responsible for the investment methodology behind our single fund solutions, including Vanguard LifeStrategy® Funds, Target Retirement Funds, 529 plans, and model portfolios.

The SAAC meets regularly to review its investment methodology, debate investment strategies, and coordinate any changes with Vanguard's Advice Policy Committee, thereby ensuring a consistent approach in our single fund solutions and advice offers.



**From left to right:** Greg Davis, global chief investment officer; Joseph Davis, committee chair; Roger Aliaga-Díaz, committee vice-chair; Matthew Brancato; Kaitlyn Caughlin; Joel Dickson; Paul Jakubowski; Manish Nagar; Dan Reyes; Qian Wang; Martin Kleppe (non-voting); and Ian Kresnak (non-voting).

**Acknowledgments:** The SAAC acknowledges the contributions of Harshdeep Ahluwalia, Giulio Renzi Ricci, Victor Zhu, Lucas Baynes, Todd Schlanger, and Scott Donaldson, who are all members of the Vanguard Investment Strategy Group.

Since the passage of the Pension Protection Act of 2006, which designated TDFs as a qualified default investment alternative (QDIA) in defined contribution retirement plans, TDFs have experienced remarkable growth, especially in the United States. This growth, combined with the growing role of TDFs in QDIAs, means that the decisions driving TDF outcomes are increasingly influencing retirement outcomes. As more investors use these portfolios to meet their objectives, the SAAC believes a systematic approach to TDF glide-path creation and validation is in the best interest of TDF investors.

The glide path for Vanguard TDFs, which was constructed in 2003 and is reviewed annually by the SAAC, has been adjusted five times over the last 17 years. Because TDFs are used by investors with disparate objectives and varying risk tolerances, the glide path aims to balance risk and reward for a hypothetical investor. Among other things, that investor is assumed to be conservative in terms of risk tolerance, expects to retire at age 65, saves at the average rate for their age cohort, and wants a typical proportion of their ending salary for spending in retirement.

Since 2016, the Vanguard TDF glide path has been assessed using our proprietary Vanguard Life-Cycle Model (VLCM), a utility-based model that optimizes any type of glide path based on certain parameters.<sup>1</sup> Once a year, the SAAC convenes to review TDF glide paths and approve any necessary changes.

In July 2020, the committee met to review and approve a novel framework for consistently assessing glide-path changes across Vanguard's U.S. TDF suite. After applying the framework to the existing TDF glide path in the United States, the committee approved it with no changes and requested further research on global risk aversions and other assumptions.

## A framework for measuring glide-path success

The SAAC considers many qualitative and quantitative metrics when reviewing TDF glide paths. Two considerations particularly relevant to TDF investors are the "certainty fee equivalents" (CFEs) and the probability of success, which together provide relative and client-centric benchmarks.

A CFE is essentially an estimated annual risk-adjusted return differential between the current and alternative glide paths.<sup>2</sup> As part of the annual glide-path validation process, the VLCM is run thousands of times to generate a range of glide paths based on the most recent assumptions about capital market performance, spending, and savings. If the CFEs between the existing glide path and the glide paths generated by the VLCM are sufficiently different, the glide path may require further review.

**Figure 1a** shows a stylized example of CFEs for hypothetical optimal and suboptimal glide paths. In this example, the suboptimal glide paths (dark-blue and light-blue lines) have different risk profiles and returns over an 85-year period, but as shown in **Figure 1b**, they have the same CFE (75 basis points). This is because the wealth and consumption profile generated by the optimal glide path is better suited to the risk profile of the investor than either the riskier or more conservative glide paths shown. The optimal VLCM glide path is the one that is most aligned with the investor's conservative risk preferences and average population inputs.<sup>3</sup> Therefore, the SAAC believes that this optimal glide path would best serve investors given their goals and circumstances.

Probability of success is the other key metric that the committee's framework considers.<sup>4</sup> All else equal, a higher probability of success is driven by the glide path's riskiness. If the probability of success is too low, then the glide path needs to increase its equity allocation. Likewise,

<sup>1</sup> For more information on the VLCM, see the forthcoming Vanguard research paper *Vanguard Life-Cycle Investing Model: A Framework for Building Target-Date Portfolios*.

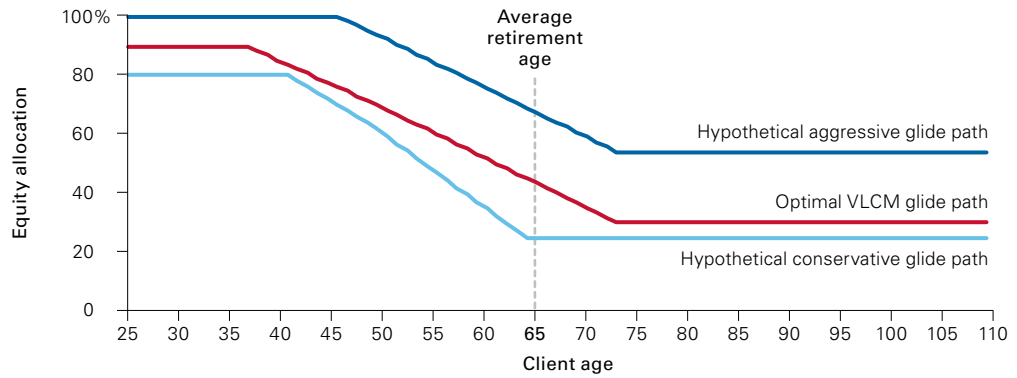
<sup>2</sup> CFE is calculated as the difference between an existing glide path and a VLCM-derived "optimal" glide path based on the latest inputs and capital market assumptions. It can be taken as the additional fee (in basis points) that an investor is willing to pay in order to access the optimal glide path compared with staying in the current glide path. The CFE calculation is derived from the utility value attached to a certain portfolio risk-return trade-off, as expressed through the coefficient of risk aversion in utility functions.

<sup>3</sup> Examples of these inputs are highlighted in Figure 2.

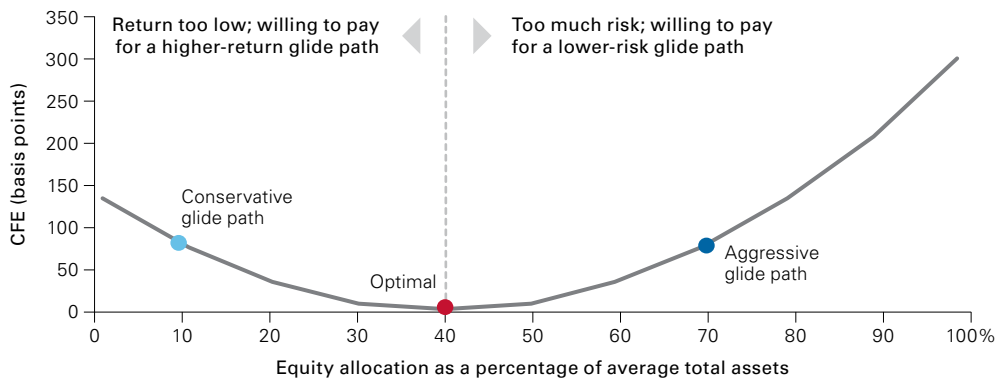
<sup>4</sup> Success is defined as when the median income from the portfolio at age 95 at least covers the replacement ratio (which in the United States is calculated as 86% of an individual's final salary).

Figure 1. Suboptimal glide paths with similar CFEs can be high or low risk

a. The VLCM optimizes glide paths based on a range of inputs



b. The CFE calculation does not depend on how aggressive or conservative the glide path is



Source: Vanguard.  
These illustrations are hypothetical in nature.

if the probability of success is too high, meaning the investor has taken on unnecessary risk, the glide path can be made more conservative. The SAAC aims to maintain consistency with Vanguard’s retail and institutional advice offers and targets a 70% or higher probability of success, all else equal.

**Input changes for the U.S. glide path**

The VLCM relies on a series of nine key user inputs along with a client risk-aversion assumption and Vanguard Capital Markets Model® (VCMM) return projections to determine the optimal glide path.<sup>5</sup> These inputs are sourced from national statistics and reports as

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

<sup>5</sup> The VCMM long-term return projections are in the local market currency. More information was presented in the Vanguard research paper by Davis et al. (2014), *Vanguard Global Capital Markets Model*. See the Appendix for VCMM steady-state returns used in the model.

well as Vanguard studies to ensure that assumptions are empirically driven, consistent with the local market, and defensible. For particular institutional clients (such as plan sponsors), custom glide paths can also be derived based on the specific characteristics of their participants.

**Figure 2** shows the nine key values and the old and new assumptions for the fields that were updated based on new U.S. data.

Notable changes for the July 2020 glide-path review were SAAC updates to the replacement ratio and the spending-rule assumption. The new replacement ratio incorporates the findings of a Vanguard publication that uses more recent and granular data for retiree spending and discretionary spending.<sup>6</sup> The spending rule transitioned from a required minimum distribution (RMD) assumption to a fixed, real-dollar hybrid spending assumption that the SAAC believes is more appropriate.

Another critical input in the validation of the TDF glide path—investors’ risk aversion—is accounted for through a coefficient of risk aversion that is part of the VLCM’s utility-based portfolio framework. Because TDF investors are assumed to be highly conservative in their tolerance toward investment risk, the coefficient of risk aversion in the VLCM was calibrated to the highest available setting.<sup>7</sup> In the current TDF due diligence review, this conservative default setting was not revised. As a result, potential changes to the TDF glide path, if any, would arise only from changes in the other investor characteristics, as described in Figure 2.

**Figure 2. Key assumptions for VLCM inputs**

Input variable	United States	
	Old assumption	New assumption
Starting age	25	25
Starting salary	\$26,600	\$26,600
Contribution rate	10%	10%
Social Security benefit (salary replacement percentage)	46%	47%
Spending rule	Percentage of portfolio/RMD	Fixed real-dollar hybrid rule
Defined benefits	0	0
Retirement age	65	65
Replacement ratio	78%	86%
Initial savings	0	0

**Notes:** Salaries are based on data from the U.S. Social Security Administration with a 1.1% real (inflation-adjusted) wage-growth assumption. The contribution rate is the average rate over an investor’s life from Vanguard’s *How America Saves 2020* report. Contribution rates typically increase as an investor ages from 25 to 65; the VLCM takes this into account. U.S. Social Security and replacement ratio data are from the Vanguard research paper by Lobel, Jaconetti, and Cuff (2019), *The Replacement Ratio: Making it Personal*. The fixed real-dollar spending rule means an inflation-adjusted fixed amount is assumed to be spent from the portfolio each year; the hybrid rule assumes a transition to a percentage of the portfolio as wealth breaches a minimum threshold and is more representative of how clients actually behave.

**Sources:** Vanguard and the U.S. Social Security Administration.

<sup>6</sup> For more details, please see the Vanguard research paper by Lobel, Jaconetti, and Cuff (2019), *The Replacement Ratio: Making it Personal*.

<sup>7</sup> The default assumption of TDF investors being highly conservative is reasonable, given the lack of detailed and individualized information about investors in these funds. However, because of the high sensitivity of VLCM results to this assumption, the SAAC has asked the Investment Strategy Group to undertake further research in order to develop a consistent global framework for risk-aversion coefficients that is based on actual TDF client data for different countries in 2021.

### The VLCM outputs and recommendation

Using the assumptions described on the previous page and a risk-aversion assumption centered on the implied risk aversion in the glide path, the SAAC generated the charts in **Figure 3** for the United States.

**Figure 3a** shows that the existing glide path (the blue line) is most consistent with high risk aversion (the red line). As shown in **Figure 3b**, the probability of success is 81% (acceptable), and the CFE benefit of change is 0 basis points; therefore, no change was recommended.

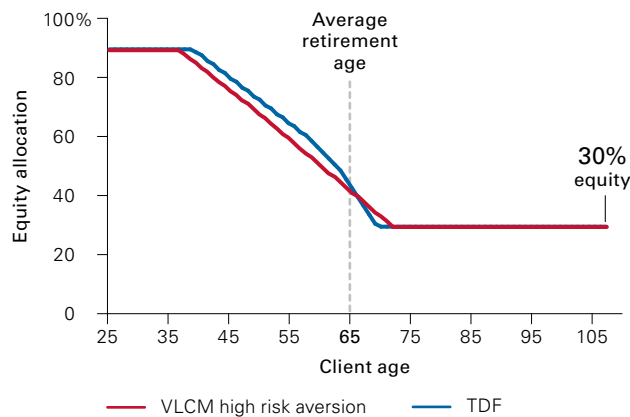
### Conclusion

The last two decades have solidified the important role TDFs play in improving retirement outcomes for investors. As these funds continue to grow and become even more widely available, a systematic, empirical approach to validating their glide paths is vital. The SAAC is confident that its current framework provides a rigorous validation methodology for Vanguard TDF glide paths.

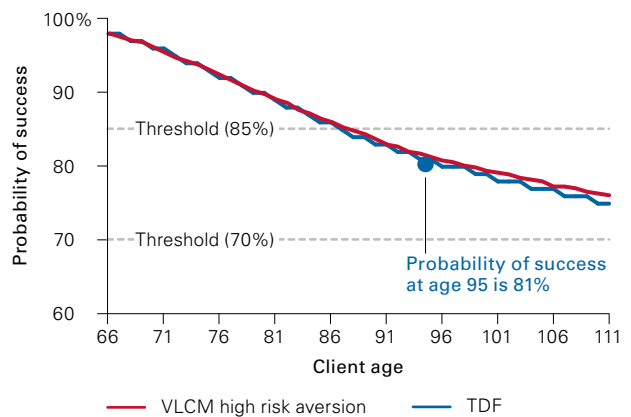
Our TDF-related research in 2021 will focus on a deeper assessment of our assumptions involving risk aversion and explore retirement income solutions. As new information becomes available, the SAAC will consider it within the proposed framework and adjust our glide-path recommendation accordingly.

**Figure 3. The existing U.S. glide path is sufficiently close to optimal in terms of CFE and probability of success**

a. U.S. glide path



b. Probability of success for the U.S.



Source: Vanguard.

## Appendix

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

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

The Vanguard Capital Markets Model is a proprietary financial simulation tool developed and maintained by Vanguard’s primary investment research and advice teams. The model forecasts distributions of future returns for a wide array of broad asset classes. Those asset classes

include U.S. and international equity markets, several maturities of the U.S. Treasury and corporate fixed income markets, international fixed income markets, U.S. money markets, commodities, and certain alternative investment strategies. The theoretical and empirical foundation for the Vanguard Capital Markets Model is that the returns of various asset classes reflect the compensation investors require for bearing different types of systematic risk (beta).

At the core of the model are estimates of the dynamic statistical relationship between risk factors and asset returns, obtained from statistical analysis based on available monthly financial and economic data from as early as 1960. Using a system of estimated equations, the model then applies a Monte Carlo simulation method to project the estimated interrelationships among risk factors and asset classes as well as uncertainty and randomness over time. The model generates a large set of simulated outcomes for each asset class over several time horizons. Forecasts are obtained by computing measures of central tendency in these simulations. Results produced by the tool will vary with each use and over time.

### Appendix 1. VCMM steady-state return assumptions for U.S. TDF glide paths

	5th percentile	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile	95th percentile	Median volatility
U.S. equity	-0.74%	1.19%	4.47%	8.23%	12.20%	15.96%	18.39%	17.42%
International equity	1.44%	3.11%	5.84%	8.88%	12.06%	15.06%	16.73%	18.83%
U.S. bond	1.40%	2.04%	3.16%	4.45%	5.77%	7.03%	7.82%	4.92%
International bond	1.61%	2.15%	3.14%	4.34%	5.63%	6.83%	7.56%	4.19%

Source: Vanguard calculations, as of January 5, 2021.

See the section titled “Index simulations” for further details on the asset classes shown. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of June 30, 2020.

The Vanguard Lifecycle Model (VLCM) is designed to identify the product design that represents the best investment solution for a theoretical, representative investor who uses the target-date funds to accumulate wealth for retirement. The VLCM generates an optimal custom glide path for a participant population by assessing the trade-offs between the expected (median) wealth accumulation and the uncertainty about that wealth outcome, for thousands of potential glide paths. The VLCM does this by combining two set of inputs: the asset class return projections from the VCMM and the average characteristics of the participant population. Along with the optimal custom glide path, the VLCM generates a wide range of portfolio metrics such as a distribution of potential wealth accumulation outcomes, risk and return distributions for the asset allocation, and probability of ruin, such as the odds of participants depleting their wealth by age 95.

The VLCM inherits the distributional forecasting framework of the VCMM and applies to it the calculation of wealth outcomes from any given portfolio.

The most impactful drivers of glide path changes within the VLCM tend to be risk aversion, the presence of a defined benefit plan, retirement age, savings rate and starting compensation. The VLCM chooses among glide paths by scoring them according to the utility function described and choosing the one with the highest score. The VLCM does not optimize the levels of spending and contribution rates. Rather, the VLCM optimizes the glide path for a given customizable level of spending, growth rate of contributions, and other plan sponsor characteristics.

## Index simulations

The long-term returns of our hypothetical portfolios are based on data for the appropriate market indexes through June 2020. We chose these benchmarks to provide the most complete history possible, and we apportioned the global allocations to align with Vanguard's guidance in constructing diversified portfolios. Asset classes and their representative forecast indexes are as follows:

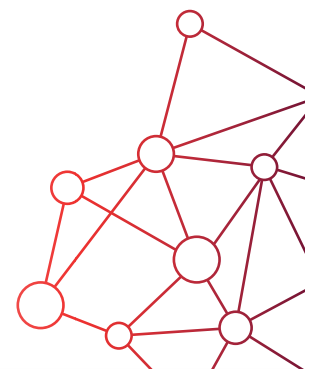
- **U.S. equities:** MSCI US Broad Market Index.
- **Global ex-U.S. equities:** MSCI All Country World ex USA Index.
- **U.S. bonds:** Bloomberg Barclays U.S. Aggregate Bond Index.
- **Global ex-U.S. bonds:** Bloomberg Barclays Global Aggregate ex-USD Index.

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## Additional perspectives from the SAAC

A primary responsibility of the SAAC is to oversee the policy allocation of Vanguard's suite of multiasset portfolios, including a formal annual review. The SAAC has also been tasked with establishing the investment methodology and portfolio construction approaches that are most appropriate for various objectives. Since its founding in 2013, the SAAC has held research meetings to discuss investment topics, seeking the best outcomes for our clients through constant debate. These meetings, often showcasing the latest research by Vanguard's Investment Strategy Group, have centered on a wide range of subjects. A summary of past topics is provided below.

<b>2013</b>	<ul style="list-style-type: none"><li>Hedging currency exposure in a multiasset portfolio</li><li>Role of commodity futures</li><li>Minimum-volatility equity strategies</li></ul>	<b>2018</b>	<ul style="list-style-type: none"><li>Role of private real estate in portfolios</li><li>Vanguard Life-Cycle Model (VLCM) and glide-path outcomes</li><li>Inflation protection in a 529 college savings plan</li></ul>
<b>2014</b>	<ul style="list-style-type: none"><li>Equity home bias by country</li><li>Glide-path construction methodology</li><li>Inflation protection</li></ul>	<b>2019</b>	<ul style="list-style-type: none"><li>Vanguard Asset Allocation Model (VAAM) and optimal allocations to active and passive strategies</li><li>VAAM-based investment methodology for ETF-model portfolios</li><li>Return-targeting and time-varying asset allocation</li></ul>
<b>2015</b>	<ul style="list-style-type: none"><li>Approaches to retirement income</li><li>Factors and strategic asset allocation</li><li>Fixed income glide-path allocations</li></ul>	<b>2020</b>	<ul style="list-style-type: none"><li>VLCM-derived glide paths for 529 college savings plans</li><li>Role of private equity in multiasset portfolios</li></ul>
<b>2016</b>	<ul style="list-style-type: none"><li>Time-varying risk premia and asset allocation</li><li>Expansion of the Vanguard Capital Markets Model</li><li>Inflation-hedging strategies over multiyear horizons</li></ul>	<b>2021</b>	<ul style="list-style-type: none"><li>A systematic framework for validating TDF glide paths (<i>more details in this memo</i>)</li></ul>
<b>2017</b>	<ul style="list-style-type: none"><li>Long-run equilibrium risk-free rates and the equity risk premia</li><li>Diversified versus concentrated active equity portfolios</li><li>Global methodology for non-market-cap-weighted ETF model portfolios</li></ul>		





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Investments in Target Retirement Funds are subject to the risks of their underlying funds. The year in the fund name refers to the approximate year (the target date) when an investor in the fund would retire and leave the workforce. The fund will gradually shift its emphasis from more aggressive investments to more conservative ones based on its target date. An investment in a Target Retirement Fund is not guaranteed at any time, including on or after the target date.

All investing is subject to risk, including the possible loss of the money you invest. There is no guarantee that any particular asset allocation or mix of funds will meet your investment objectives or provide you with a given level of income. Diversification does not ensure a profit or protect against a loss.

Private investments involve a high degree of risk and therefore should be undertaken only by prospective investors capable of evaluating and bearing the risks such an investment represents. Investors in private equity generally must meet certain minimum financial qualifications that may make it unsuitable for specific market participants.

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