Vanguard

Vanguard research

April 2025

Does a volatility management fund have a place in a target-date fund?

- Retirement looks very different for each participant in a defined-contribution (DC) plan. Their retirement journey depends on several factors like health status, household structure, financial goals, and plans to work postretirement. In the last two decades, wide-ranging solutions supplementing traditional target-date funds (TDFs) have been introduced to address the heterogenous retirement needs of participants.
- A TDF with a volatility management fund (VMF) could provide another complementary approach in the decumulation ecosystem by helping participants stabilize their retirement savings. A VMF is a multiasset product that uses a structure similar to a stable value fund (SVF) and involves investment in an underlying portfolio of equities and fixed income, along with an insurance contract that provides downside protection against portfolio losses. The insurance contract enables the VMF to utilize accounting techniques and amortize the underlying portfolio's returns over an extended time frame, resulting in reduced volatility exposure for investors.
- We evaluate the investment merits for a VMF-based TDF using the proprietary Vanguard Life-Cycle Investing Model (VLCM). The enhanced balance stability from a VMF can be impactful for participants as they move from their working lives to the retirement phase. The value offered to a participant depends on the design of the investment strategy and is impacted by factors like the timing, amount, and composition of a VMF. But beyond the investment case, there are potential challenges around cost, scale, portability, complexity, suitability, and feasibility that must be addressed to unlock the full benefits of a VMF.

Authors

Vibhor Dave, CFA

Ankul Daga, CFA

Introduction

For over five decades, DC plans have helped participants invest and grow their savings to meet retirement goals. As participants enter the decumulation stage and start using their nest eggs, the investment strategies of DC plans aim to support their goals around retirement income and bequests, while also providing stability for accumulated assets. TDFs have typically dominated as the preferred investment strategy in DC plans, followed by managed accounts. To effectively serve the wide range of DC plan participants, Vanguard constantly researches new themes. The work shared in this paper about the potential use of a multiasset VMF in a participant's investment portfolio is one such idea.

A VMF uses an SVF-like structure and involves investment in an underlying portfolio of equities and fixed income, along with an insurance contract. The insurance contract enables the VMF to amortize the underlying portfolio's returns over a long time period, resulting in reduced volatility exposure for investors. By including equities, a VMF could provide a higher return than a traditional SVF that includes only fixed income securities. When used in an investment strategy, a VMF could help reduce the volatility of accumulated assets without limiting their growth potential. This stability helps participants in financially securing both retirement income and bequest goals. We use the VLCM (Aliaga-Díaz et al., 2021) to evaluate the investment merits of including a VMF in a participant's investment strategy.

Given the ease, reach, and flexibility of TDFs, we have focused our analysis on using a VMF within a TDF.[1] But most of our observations could be extended to other professionally managed solutions like managed accounts. Beyond the investment merit showcased in this paper, there are important questions around product viability, client demand, and participant education that need to be answered. We discuss these considerations along with the key benefits, risks, and hurdles associated with a VMF.

What is a multiasset VMF?

SVFs have been offered in DC plans for over 50 years, with 68% of plans covered in *How America Saves 2024* (Vanguard, 2024) including an SVF in their core menu lineups. SVFs typically invest in a portfolio of short- to intermediate-term fixed income securities. However, unlike traditional fixed income portfolios, SVFs also include an insurance contract ("wrap") issued by a financial institution that provides downside protection against portfolio losses. This insurance contract allows the SVF to utilize accounting techniques to amortize the underlying ("wrapped") portfolio's returns over an extended time frame (typically three to four years), resulting in reduced volatility exposure and a stable return stream for participants. An SVF investor receives this return in the form of the crediting rate. Our crediting rate calculations can be found in the Appendix.

A VMF is a multiasset SVF that works very similarly to a traditional SVF, with the key difference being the underlying portfolio used. Unlike a traditional SVF that includes only fixed income securities, a VMF invests in both equities and fixed income. By including equities in its wrapped portfolio, a VMF can potentially provide a higher return than a traditional SVF. The volatility smoothening offered by a VMF could be helpful for participants during their retirement phase, where the VMF could be included as part of the investment strategy.

Should a VMF be included in a TDF?

Vanguard's *How America Saves 2024* report showed that 96% of plans offered TDFs, with 86% of all participants using TDFs at the end of 2023 (Vanguard, 2024). Mostly used as a qualified default investment alternative (QDIA), TDFs employ a glide-path approach to investing, where allocation to riskier growth-focused assets decreases with a participant's age, while allocation to stability-focused fixed-income-like assets increases.

1 Additionally, just like a traditional SVF, a VMF could only be used in a qualified retirement plan. We focus on TDFs as they represent one of the most widely used investment strategies in qualified retirement plans.

At the beginning of a participant's life, most of their wealth (human capital) is in the form of future earnings. High human capital, along with a long investment horizon, implies younger participants are better able to withstand portfolio risk, thus making a higher allocation to growth-focused equity-like investments appropriate for their portfolios. As participants age, the accumulated wealth (financial capital) increases, shifting the focus to stability. TDFs facilitate this transition by increasing allocation to fixed-income-like assets for participants near or in retirement.

Portfolio stability becomes more important for participants as they move from their working lives to the retirement phase, for a few reasons:

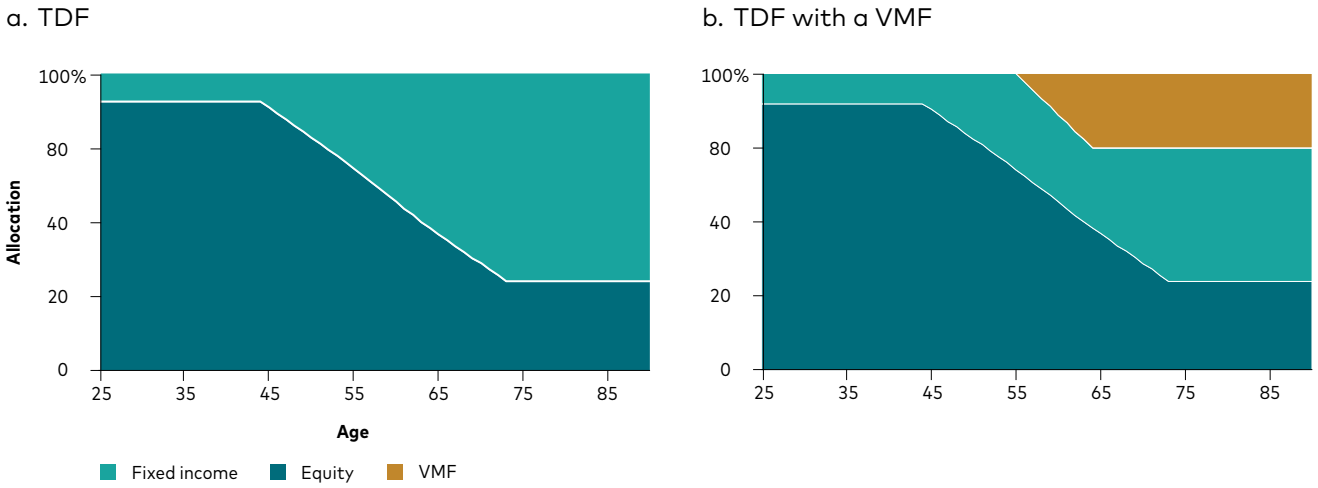
- The time horizon decreases, leaving little room to alter the investment portfolio because of changes in market cycles.
- Participants start withdrawing from the portfolio to cover their retirement lifestyles, meaning any losses due to market movements get locked in as the amount withdrawn from the portfolio never has a chance to benefit from market recovery (commonly known as "sequence-of-returns" risk).
- Older participants have a greater tendency to react to market volatility than younger participants, making them more likely to sell off holdings during market downturns (Shleifer, 2000, and Gamble et al., 2015).

TDFs have done a good job of addressing these concerns by using a fixed-income-heavy allocation during a participant's decumulation stage. There could be an opportunity to further enhance a participant's experience by adjusting the TDF's asset allocation so it reduces portfolio volatility without limiting growth potential. Using a VMF within a TDF is one such alternative that we explore in this paper, although most of our observations could also be applied to other structures like managed accounts.

A TDF with a VMF would combine the asset accumulation offered by a traditional TDF with reduced exposure to market volatility during the decumulation phase. By replacing part of the fixed income allocation with a VMF, a TDF investor could obtain exposure to higher growth potential with the same (or even a lower) level of market risk. A hypothetical TDF with a VMF is illustrated in **Figure 1**, where the allocation to growth-focused equity assets decreases while the allocation to the VMF increases as a participant ages before both level off.

FIGURE 1

Illustrative asset allocation of a traditional TDF versus a TDF with a VMF



Notes: The VMF start age is 55, and the maximum allocation to the VMF is 25%. The VMF composition is 20% U.S. equity and 80% U.S. fixed income.
Source: Vanguard.

Evaluation framework

We evaluate the investment merits of a TDF with a VMF by using the VLCM, a utility-based framework that incorporates participants' goals and preferences while evaluating different investment strategies (see **Figure 2**).[2] Utility is a proven and academically accepted way to quantify human behavior and decision-making. It captures the asymmetric trade-offs between the positive feelings arising from a good outcome and the amplified negative feelings that typically accompany a bad one. We use the Constant Relative Risk Aversion utility function that economists have used to solve life-cycle problems for over 50 years, starting with Merton (1969) and Samuelson (1969).

The VLCM evaluates investment strategies by quantifying the utility derived by the participant from spending and bequests that can be funded from their investment portfolio and other sources over their lifetime in the presence of uncertain asset returns. While evaluating investment strategies, the VLCM also considers the balance stability offered by the investment portfolio.

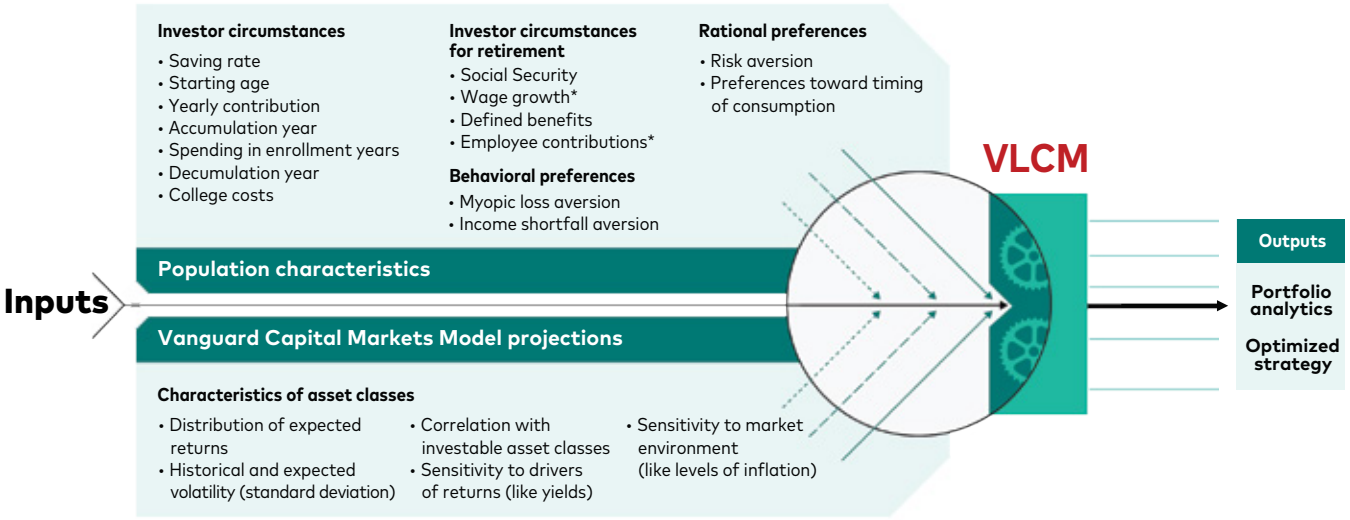
The model leverages long-term asset return expectations derived from the Vanguard Capital Markets Model® (VCMM);[3] incorporates multiple income sources such as defined benefits (DBs), annuities, and Social Security; and accounts for different participant goals like retirement consumption, bequests, and portfolio balance stability.

What is certainty fee equivalent?

Throughout this paper, we use certainty fee equivalent (CFE) as a metric to evaluate TDFs. CFE incorporates a participant's preferences and translates the improvements in consumption, wealth, and portfolio stability into units of returns. It can be thought of as the additional annual fee a participant would be willing to pay for an improved or optimal asset allocation (for example, a TDF with a VMF) relative to a reference asset allocation (for example, a traditional TDF).[4] The higher the CFE, the greater the utility a participant would derive from the optimal TDF compared with the reference TDF.

FIGURE 2

Vanguard Life-Cycle Investing Model



*Data sourced from Vanguard's report, *How America Saves 2024.*

Note: See the "Life-cycle modeling inputs" section in the Appendix for additional details.

Source: Vanguard.

2 See the "Life-cycle modeling inputs" section in the Appendix for additional details on the VLCM.

3 See the Appendix for additional details on the VCMM.

4 To evaluate CFE, we calculate the expected utility *x* of a TDF with a VMF from the full range of market scenarios in our Monte Carlo simulation. With the same participant characteristics (savings, expenses, and preferences), we calculate the expected utility *y* for the reference portfolio, a traditional TDF. CFE is the haircut applied to a full range of uncertain asset returns that makes the utility *x* from the TDF with a VMF the same as the utility *y* from the traditional TDF.

How does a VMF create value for a TDF investor?

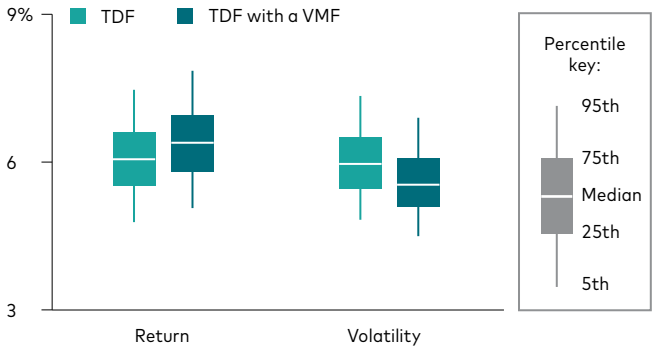
TDFs have played a key role in providing investment strategies for participants saving for retirement. They help participants accumulate and grow assets throughout their working lives. During a participant's retirement, TDFs aim to ensure that accumulated assets remain invested in capital markets while supporting the ability to meet lifestyle goals. By including a VMF in a TDF, participants can enhance the effectiveness of their investment strategies by reducing portfolio volatility without adversely impacting their ability to meet retirement income or bequest goals.

In our analysis, a VMF is introduced in a TDF as the participant approaches retirement, which is often a time of heightened anxiety. In this section, we compare the participant outcomes for a TDF using a VMF with a traditional TDF. The asset allocations used for the two TDFs were previously shown in Figure 1. Both TDFs have similar equity allocations, but the VMF replaces part of the fixed income allocation in the second TDF.

Figure 3 and **Figure 4** show metrics from Monte Carlo simulations where we analyze outcomes from 10,000 different market scenarios. The impact of a VMF on the investment portfolio's return and risk outcomes is shown in Figure 3, where we compare expected return and volatility during a participant's decumulation phase (from age 65 to the end of life). The inclusion of a VMF reduces the expected portfolio volatility, providing stability at a time when it's most critical for the participant. This reduction in expected volatility does not come at the cost of the portfolio's expected return. The combination of these two dynamics leads to an improved portfolio outcome compared with the traditional TDF.

FIGURE 3

Portfolio return and volatility during the decumulation phase



Notes: The VMF start age is 55, and the maximum allocation to the VMF is 25%. The VMF composition is 20% U.S. equity and 80% U.S. fixed income.

Source: Vanguard, with the simulated performance calculated using the VLCM and VCMM.

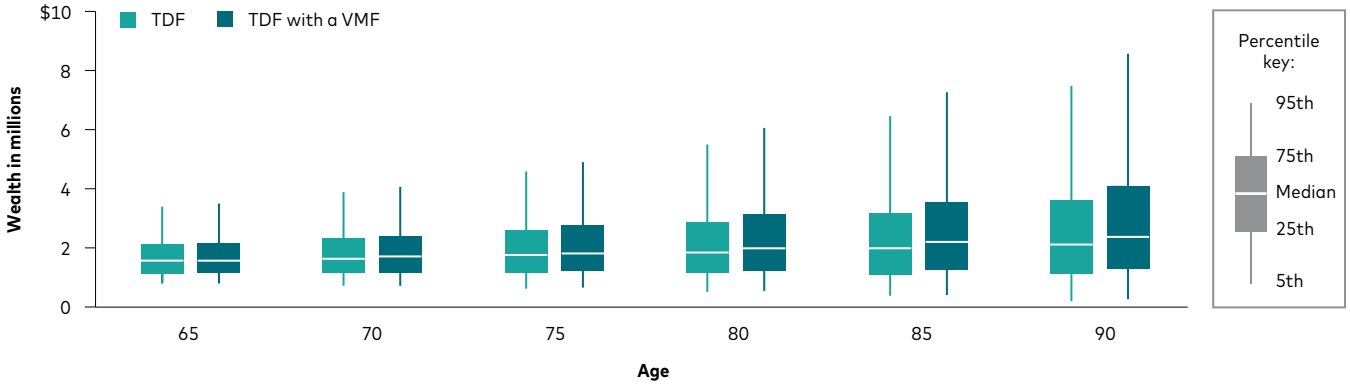
IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from the VCMM are derived from 10,000 simulations for each modeled asset class. Simulations are as of December 2024. Results from the model may vary with each use and over time. For more information, please see the Appendix.

By using a TDF with a VMF, a participant could achieve improved balance stability while experiencing similar (or better) outcomes for income and bequest goals compared with a traditional TDF. As shown in Figure 4, the TDF with a VMF increases accumulated wealth during the later years of retirement (the median wealth increase is around 13% by age 90) compared with a traditional TDF. At the same time, a lower-volatility portfolio doesn't compromise a participant's retirement income goal, as total retirement income remains comparable when using a VMF.

To holistically accommodate the impact of balance stability, wealth, and retirement income, we use the VLCM to evaluate the two TDFs discussed above. With the VLCM, we can use the CFE (utility metric) to measure the degree of improvement in a participant's ability to meet retirement expenses, the reduction in the risk of outliving one's wealth, and the mitigation of market risk when using a TDF with a VMF versus a traditional TDF. Driven primarily by better balance stability during retirement, the TDF with a VMF provides a CFE value of 0.24% compared with a traditional TDF.

FIGURE 4

Accumulated wealth: TDF versus a TDF with a VMF



Notes: The VMF start age is 55, and the maximum allocation to the VMF is 25%. The VMF composition is 20% U.S. equity and 80% U.S. fixed income.
Source: Vanguard, with the simulated performance calculated using the VLCM and VCMM.

How does asset allocation impact the investment merits of a TDF with a VMF?

To analyze the investment merits of a TDF with a VMF, we evaluate its performance under different design elements. The timing, amount, and composition of a VMF could impact the investment value a participant receives in a TDF that uses a VMF. We evaluate each of these design parameters by using the VLCM and compare the utility (CFE) a participant experiences in a TDF with a VMF versus a traditional TDF. We analyze the potential value offered by different VMF-based TDFs in consideration of the three key design elements shown in **Figure 5**—VMF start age, VMF maximum allocation, and VMF composition.

Key observations from our analysis of the investment merits of a TDF with a VMF include:

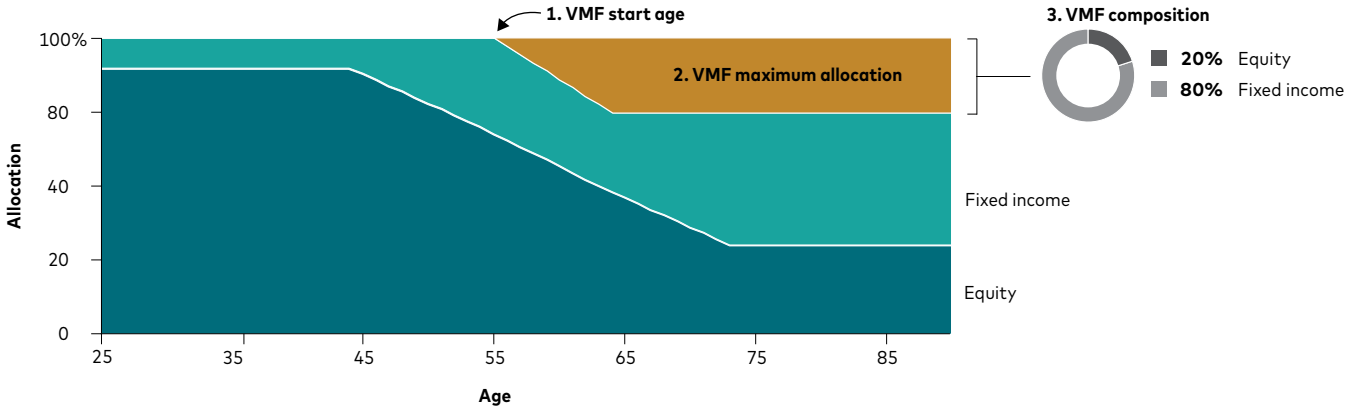
- A VMF would be most effective when used in the decumulation stage. Our analysis suggests the VMF allocation should be built gradually by starting 5–10 years before retirement.
- Increasing the allocation to a VMF improves the balance stability of a TDF.
- Theoretically, a higher equity allocation within a VMF increases its value to the participant. The actual equity allocation that can be realistically included within a VMF depends on several provider-specific factors like capacity, demand, and the economic feasibility of the VMF.

Optimal allocation for a TDF with a VMF

All CFEs shown in this section are for optimized TDFs. We identify the optimal TDF allocation based on three VMF variables: start age, maximum allocation, and composition. These variables determine the overall exposure to a VMF in a TDF. For the remaining TDF allocation, there could be numerous choices in the form of equity-bond glide paths. We evaluate multiple potential glide paths and select the one that provides the highest utility to a TDF participant.

FIGURE 5

Design elements of a TDF with a VMF

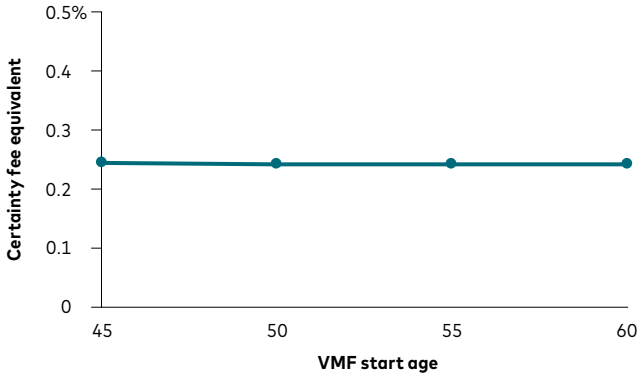


Source: Vanguard.

VMF start age is the age when a TDF starts allocation to a VMF. As most of the value is driven by the balance stability offered by a VMF during the decumulation stage, changing the VMF start age (and hence the overall exposure to a VMF during the accumulation stage) has marginal impact on the CFE. **Figure 6** shows the impact of different VMF start ages on optimal TDF CFEs. As CFEs don't change much with VMF start age, the participants will be better served by using an equity-bond portfolio during the accumulation stage and including a VMF only during the decumulation stage for improved balance stability. This VMF allocation needs to be developed gradually, so it could be helpful to start VMF exposure 5–10 years before retirement and then build it slowly.[5]

FIGURE 6

Impact of VMF start age on TDF value



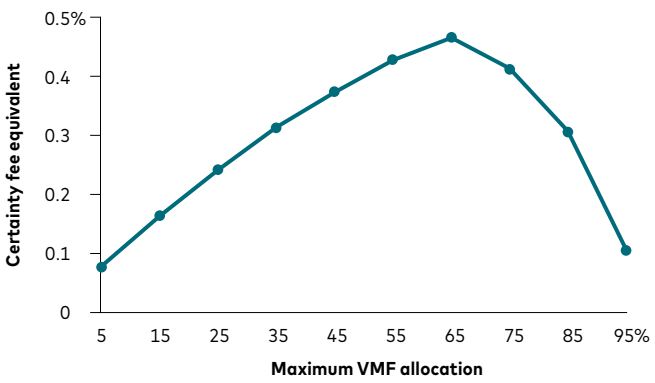
Notes: The VMF start age is 45–60, and the maximum allocation to the VMF is 25%. The VMF composition is 20% U.S. equity and 80% U.S. fixed income.

Source: Vanguard, with the simulated performance calculated using the VLCM and VCMM.

VMF maximum allocation is the highest VMF exposure that a participant receives over their lifetime. In our analysis, the allocation to the VMF increases with a participant's age and reaches its highest value near retirement. There is an inherent trade-off between the growth offered by equities and the balance stability provided by a VMF. Due to this trade-off, the value offered by a TDF with a VMF initially increases with VMF allocation and then starts decreasing. This is shown in **Figure 7**, where the enhanced balance stability provided by a VMF leads to an initial increase in CFE as the VMF allocation is increased. As the VMF allocation increases to a level where it starts crowding out the growth from equities, however, the investment value begins to decrease.

FIGURE 7

Impact of maximum allocation to a VMF on TDF value



Notes: The VMF start age is 55, and the maximum allocation to the VMF is 5%–95%. The VMF composition is 20% U.S. equity and 80% U.S. fixed income.

Source: Vanguard, with the simulated performance calculated using the VLCM and VCMM.

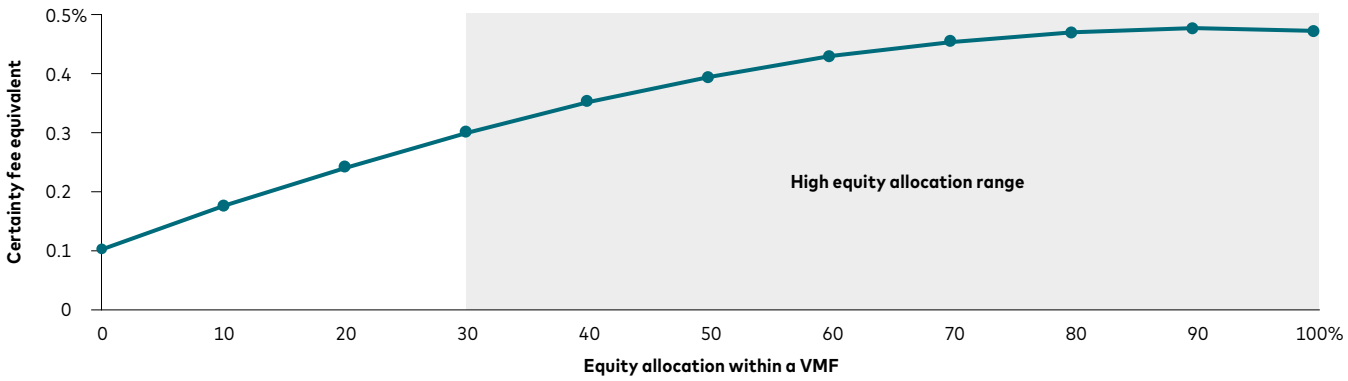
5 Introducing significant changes in a portfolio at or near retirement could expose participants to sequence-of-returns risk. During retirement, the participants start withdrawing from the portfolio to cover their retirement lifestyles, meaning that any losses due to market movements or allocation changes become locked in, as the amount withdrawn from the portfolio never gets a chance to benefit from market recovery.

VMF composition is the allocation of the portfolio included inside a VMF. In our analysis, we have assumed that a VMF holds a portfolio of U.S. equities and fixed income. This portfolio is then wrapped under an insurance product and offers amortized returns to the participant. The impact of changing the mix of equity and fixed income within a VMF is illustrated in **Figure 8**. As shown, a higher equity allocation inside the VMF generally leads to greater potential growth for the TDF and potential value for the participant.

It's worth noting that the allocations shown here are hypothetical. It might not be economically feasible for a VMF provider to offer a product that includes a very high equity allocation within a VMF (represented by the shaded area in Figure 8). Using a higher equity allocation within a VMF would increase the risk for the insurer, as it would have to amortize a return stream with higher volatility. This would not only increase the cost of a VMF but could also make it unfeasible for an insurer to support the product beyond a certain equity-bond mix.

FIGURE 8

Impact of VMF composition on TDF value



Notes: The VMF start age is 55, and the maximum allocation to the VMF is 25%. The VMF composition is 0%–100% U.S. equity and 100%–0% U.S. fixed income.
Source: Vanguard, with the simulated performance calculated using the VLCM and VCMM.

Does a VMF provide value under stressed conditions?

The analysis shared up to this point shows that a VMF could improve participant outcomes when included in a TDF. To evaluate if a VMF continues to provide value even in stressed scenarios, we tested its performance in incrementally adverse conditions. There are several factors that could impact the VMF performance, but those with the most prominent effect are market drawdowns, participant-directed outflows, and a default by the insurance provider. Under all these conditions, a TDF with a VMF continued to perform well compared with a traditional TDF.

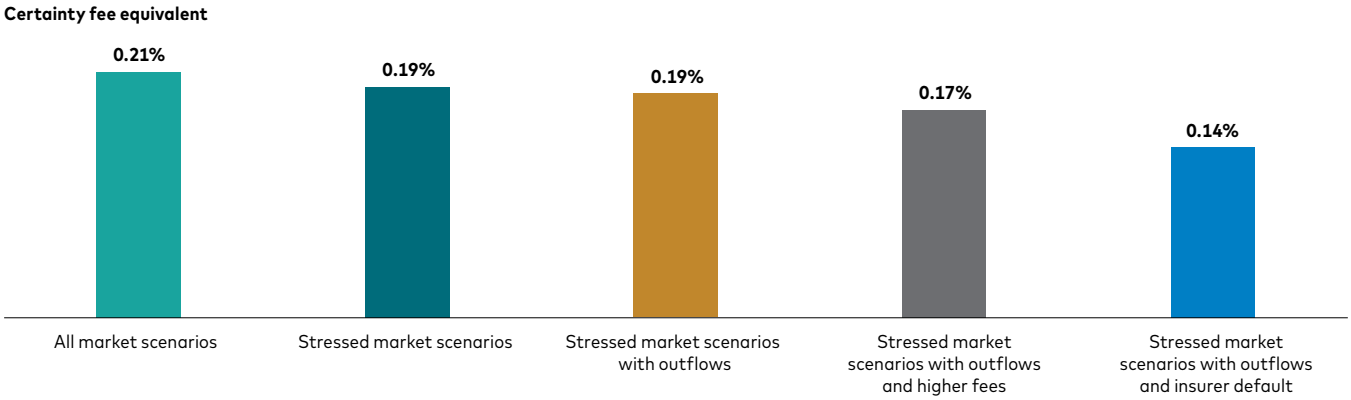
The results of stress tests are shown in **Figure 9**, where we used the VLCM to evaluate a VMF-based TDF[6] under the following conditions:

- Stressed market scenarios where the underlying portfolio provides negative returns for three or more consecutive years during the retirement phase.
- Stressed market scenarios that include high outflows from the VMF.[7]
- Stressed market scenarios that include high outflows from the VMF and an increase in VMF fees.[8]
- Stressed market scenarios that include high outflows from the VMF and a default by the insurance provider.

We started with the market-driven stressed scenario where the VMF's underlying portfolio underperforms. Given that the VMF amortizes portfolio returns over a long time period, the participant experiences these market drawdowns over a much longer time compared with what they would have experienced without the VMF. This leads to better performance of the TDF with a VMF versus a traditional TDF.

FIGURE 9

Performance of a TDF with a VMF under different market scenarios



Notes: The VMF start age is 55, and the maximum allocation to the VMF is 25%. The VMF composition is 20% U.S. equity and 80% U.S. fixed income.
Source: Vanguard, with the simulated performance calculated using the VLCM and VCMM.

6 For stress testing, we evaluated TDF performance in Monte Carlo simulation paths that reflect the scenarios being tested.

7 For stress testing, we assumed that participants withdraw 15% of the VMF investment annually.

8 For stress testing, we assumed that VMF annual fees increase by 30 basis points. (A basis point is one-hundredth of a percentage point.)

Next, we tested VMF performance under adverse participant behavior. Following a market drawdown, if there are large outflows from a VMF, the portfolio losses would be allocated among participants who stay invested in the VMF. This could lead to lower VMF returns compared with the case where such outflows don't occur. Looking at a participant's entire life cycle, we still saw positive value from a TDF with a VMF, driven primarily by the volatility smoothening from the VMF in the years leading up to and after the market drawdown events.

Finally, we added adverse actions from a VMF provider that could impact VMF performance. For such scenarios, we assumed that along with the market underperformance and significant participant outflows, the VMF insurance provider either increases VMF fees or, in the worst case, defaults on its obligations. An insurer default has the most prominent impact on VMF performance, as the loss of insurance coverage causes the VMF to lose the return-amortization benefit, and participants start receiving market returns from the VMF portfolio rather than the smoothed return they received before the default.[9]

Potential appeal of a TDF with a VMF

Retirement looks very different for each participant. Their retirement journey depends on several factors like health status, household structure, financial goals, and plans to work postretirement. In the last two decades, wide-ranging solutions supplementing traditional TDFs have been introduced to help participants create effective decumulation strategies. Through products such as annuities and hybrid annuity TDFs (Dave et al., 2024), services such as withdrawal guidance and paycheck services, or hybrid offerings such as dynamic QDIAs, these solutions help participants draw income from their accumulated nest eggs. A TDF with a VMF could provide another complementary approach in the decumulation ecosystem by helping participants keep their retirement savings stable and providing them with more time to firm up their decumulation strategies.

A VMF combines the balance stability offered by an SVF with the growth potential of equities. A VMF could be used in a TDF to either decrease portfolio volatility for a return level similar to that of a traditional TDF, or to increase portfolio return for a volatility level similar to that of a traditional TDF. When a VMF is included in a TDF, the portfolio volatility is likely to improve in the short term without decreasing growth potential in the long term.

The balance stability is more important for participants in the retirement phase due to a shorter time horizon, higher sequence-of-returns risk, and age-specific behavioral biases, as discussed earlier in the section, "Should a VMF be included in a TDF?" All these factors make a VMF an appealing option for participants transitioning from the accumulation phase to the decumulation phase. Whether such an alternative is feasible would depend on a host of implementation and operational factors like participant population characteristics, complexity, cost, and adoption.

VMFs are liquid instruments, just like fixed-income-based SVFs. Participants could get in and out of a VMF contract while remaining in a qualified retirement plan. Compared to some other products where participants might feel like they lose control of assets after starting a guaranteed income stream, a VMF could offer an alternative solution where participants benefit from stabilizing their accumulated assets while retaining control of them. Participants who value such control could find more value in a VMF, although another key consideration is the portability to IRAs or other plans, which we discuss in the next section.

9 As observed in the previous scenario, there is a decrease in the VMF-based TDF value, but it remains positive because of the volatility smoothening from the VMF in the years leading up to and after the hypothetical developments used for the stress test.

Limitations and considerations for a TDF with a VMF

Either through a TDF or as part of advice, using a VMF could help certain participants. The main value provided by a VMF is an improvement in balance stability without limiting a portfolio's potential growth. But beyond the investment case is the question of whether such a product could be viable for participants, plan sponsors, and providers. Here, we list some of the challenges that must be tackled before participants could effectively realize the investment value offered by a VMF.

Costs: With the additional expenses of a stable value wrap and provider-specific fund fees, a TDF with a VMF would cost more than a traditional TDF. That cost remains one of the significant considerations for many participants and plan sponsors. Adoption of a VMF would require transparent expense information and a meaningful focus on product evaluation by considering both the benefits and associated costs.

Scale and cashflows: One of the requirements for a VMF provider to support such a product is a regular stream of cash inflows to balance outflows. Given that a VMF is an insurance product, the insurer would need to step in and support the product if there are withdrawals following a market downturn. During such a market event, supporting a VMF could be challenging for an insurer if outflows are significantly higher than cash inflows.[10]

Portability: Although a VMF has been used by some plan sponsors as a menu item in their 401(k) plans, it remains a fairly new product. Portability at the participant level (from the employer's plan to an IRA) or the plan sponsor level (related to a change in the provider or recordkeeper) could be challenging. A lack of portability might deter plan participants from opting for VMF investments, as they fear losing flexibility in managing their retirement funds. This might also present an obstacle to plan sponsor adoption of VMF-based products. Portability could potentially be supported by middleware providers, but that would require broader demand for such a product in the retirement industry.

Complexity: Although a VMF works like an SVF, a product that has been used extensively in retirement plans, the complex product structure of a VMF could make it difficult for participants to effectively evaluate the trade-offs involved. Plan sponsors and participants would need considerable support and education to adopt a TDF with a VMF.

Suitability: The VMF component may not be optimal for everyone. Given that retirement income needs are quite heterogeneous across the participant population, the required timing, amount, and composition of a VMF could vary significantly.

Feasibility: The stable value industry has grown to over $882 billion in retirement plan assets (MetLife, 2024), with the majority of SVFs today using a fixed income portfolio. Offering a VMF would require SVF providers to evaluate capacity and tolerance for the additional risk associated with the inclusion of equity investments in a VMF.

10 This is mainly due to the dynamic between the book value and market value of a VMF. Following a market downturn, the market value of a VMF could drop substantially below its book value. To support the product, the insurer provides the difference between the book value and market value whenever there are outflows from a VMF. When the market value is significantly lower than the book value, increased support is required from the insurer for any cash outflows. However, this risk can be effectively managed by the VMF investment manager through stringent insurer selection criteria and rigorous ongoing due-diligence review of the wrap providers.

Conclusion

Wide-ranging new products and services have been introduced in the market as the retirement industry tries to address the decumulation challenge for participants. Most of these solutions aim to provide a form of either guaranteed or nonguaranteed income stream. A VMF offers an alternative solution that could stabilize the accumulated assets when used in an investment portfolio. We analyzed a range of strategies that could be created by combining a TDF with a VMF. The value offered to a participant depends on the design of the investment strategy and is impacted by factors like the timing, amount, and composition of the VMF. Our analysis shows that a TDF with a VMF could provide investment merit for some participants, especially those looking for balance stability during retirement.

While this innovative solution appears promising, there are questions around product viability, client demand, and participant education that must be answered. We have discussed some of the considerations related to cost, scale, portability, complexity, suitability, and feasibility that need addressing. Participants seeking a simple and transparent solution are generally well served by traditional TDFs. That said, a VMF represents another tool for participants to potentially improve retirement security if the challenges discussed here could be effectively addressed.

References

Aliaga-Díaz, Roger, Harshdeep Ahluwalia, Victor Zhu, Scott Donaldson, Ankul Daga, and David Pakula, 2021. *Vanguard's Life-Cycle Investing Model (VLCM): A General Portfolio Framework for Goals-Based Investing*. Vanguard. corporate.vanguard.com/content/dam/corp/research/pdf/Vanguards-Life-Cycle-Investing-Model-VLCM-A-general-portfolio-framework-US-ISGVLCM_032021_online.pdf.

Dave, Vibhor, Ankul Daga, Kimberly A. Stockton, Brian Miller, and Joseph Schisselbauer, 2024. *From Theory to Practice: Guaranteed Income and Hybrid Annuity Target-Date Funds*. Vanguard. corporate.vanguard.com/content/dam/corp/research/pdf/from_theory_to_practice_guaranteed_income_and_hybrid_annuity_target_date_funds.pdf.

Gamble, Keith Jacks, Patricia Boyle, Lei Yu, and David Bennett, 2015. *Aging and Financial Decision Making*. Management Science. papers.ssrn.com/sol3/papers.cfm?abstract_id=2165564.

Lobel, Hank, Colleen Jaconetti, and Rebecca Cuff, 2019. *The Replacement Ratio: Making It Personal*. Vanguard.

Merton, Robert C., 1969. *Lifetime Portfolio Selection Under Uncertainty: The Continuous-Time Case*. The Review of Economics and Statistics. jstor.org/stable/1926560.

MetLife, 2024. *2024 Stable Value Study*. metlife.com/content/dam/metlifecom/us/homepage/institutionalRetirement/insights/StableValue/2024-stable-value-study.pdf.

Samuelson, Paul A., 1969. *Lifetime Portfolio Selection by Dynamic Stochastic Programming*. The Review of Economics and Statistics. jstor.org/stable/1926559.

Shleifer, Andrei, 2000. *Inefficient Markets: An Introduction to Behavioral Finance*. Oxford University Press.

Vanguard, 2024. *How America Saves 2024*. corporate.vanguard.com/content/dam/corp/research/pdf/how_america_saves_report_2024.pdf.

Appendix

Vanguard Capital Markets Model (VCMM)

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. 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 importantly, the VCMM may be underestimating extreme negative scenarios unobserved in the historical period on which the model estimation is based.

The VCMM is a proprietary financial simulation tool developed and maintained by Vanguard's Investment Strategy Group. 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 VCMM is that the returns of various asset classes reflect the compensation participants 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. 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. The asset-return distributions used in this paper are drawn from 10,000 VCMM simulations based on market data and other information available. The model uses index returns, without any fees or expenses, to represent asset classes. Taxes are not factored into the analysis.

We implement the framework using five assets. We have assumed a 60/40 home bias within equities and a 70/30 home bias within fixed income toward the U.S. International fixed income is assumed to be currency hedged back to U.S. dollars. We refer to the combined allocation toward U.S. and international (or world ex-U.S.) equities as the overall equity allocation. Equity is the more risky asset and fixed income is the less risky asset. We assume that asset returns follow a vector autoregression (VAR) with one lag. VAR is a statistical model used to capture the relationship between multiple quantities as they change over time. VAR(1) means that the probability of achieving each equity and fixed income state in the next period is conditional on the current state of equities and fixed income.

$$\begin{bmatrix} r^e_t \\ r^b_t \end{bmatrix} = \begin{bmatrix} c^e \\ c^b \end{bmatrix} + \begin{bmatrix} \beta^{t-1}_{1,1} & \beta^{t-1}_{1,2} \\ \beta^{t-1}_{2,1} & \beta^{t-1}_{2,2} \end{bmatrix} \begin{bmatrix} r^e_{t-1} \\ r^b_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon^e_t \\ \varepsilon^b_t \end{bmatrix}$$

$$\begin{bmatrix} \varepsilon^e_t \\ \varepsilon^b_t \end{bmatrix} \sim N \left(0, \begin{bmatrix} \sigma^2_{et} & \sigma_{e,bt} \\ \sigma_{e,bt} & \sigma^2_{bt} \end{bmatrix} \right)$$

In the formula above:

- r^e_t and r^b_t are the returns for equity ("e") and fixed income or bonds ("b") for year t.
- c^e and c^b are the returns realized if prior returns are zero.
- β is the coefficient relating prior returns to current returns.
- ε^e and ε^b are the error terms that are normally distributed with a mean of 0 and covariance matrix (σ).

Indexes for VCMM simulations

The long-term returns of our hypothetical portfolios are based on data for the appropriate market indexes. 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.
- **Global ex-U.S. developed market equities:** MSCI World ex USA Index.
- **Emerging markets equities:** MSCI Emerging Markets Index.
- **U.S. REITs:** FTSE Nareit U.S. Real Estate Index.
- **U.S. Treasury bonds:** Bloomberg U.S. Treasury Index.
- **U.S. short-term Treasury bonds:** Bloomberg U.S. 1–5 Year Treasury Bond Index.
- **U.S. intermediate-term Treasury bonds:** Bloomberg U.S. 5–10 Year Treasury Bond Index.
- **U.S. long-term Treasury bonds:** Bloomberg U.S. Long Treasury Bond Index.
- **U.S. intermediate credit bonds:** Bloomberg U.S. Credit Bond Index.
- **U.S. high-yield corporate bonds:** Bloomberg U.S. Corporate High Yield Bond Index.
- **U.S. bonds:** Bloomberg U.S. Aggregate Bond Index.
- **Global ex-U.S. bonds:** Bloomberg Global Aggregate ex-USD Index USD Hedged.
- **U.S. Treasury Inflation-Protected Securities (TIPS):** Bloomberg U.S. Treasury Inflation Protected Securities Index.
- **Emerging markets sovereign bonds:** Bloomberg Emerging Markets USD Sovereign Bond Index—10% Country Capped.
- **Mortgage-backed securities:** Bloomberg U.S. Mortgage Backed Securities Index.

All equity indexes below are weighted by market capitalization:

- **Small-cap equities:** Stocks with a market cap in the lowest two-thirds of the Russell 3000 Index.
- **Large-cap equities:** Stocks with a market cap in the highest one-third of the Russell 1000 Index.
- **Growth equities:** Stocks with a price/book ratio in the highest one-third of the Russell 1000 Index.
- **Value equities:** Stocks with a price/book ratio in the lowest one-third of the Russell 1000 Index.

FIGURE 10

Forward-looking long-run correlation expectations

	U.S. cash	U.S. equities	U.S. nominal bonds	International equities	International bonds	Short-term TIPS
U.S. cash	1.0	—	—	—	—	—
U.S. equities	0.0	1.0	—	—	—	—
U.S. nominal bonds	0.2	–0.1	1.0	—	—	—
International equities	0.0	0.8	–0.1	1.0	—	—
International bonds	0.4	–0.1	0.7	–0.2	1.0	—
Short-term TIPS	0.5	–0.3	0.6	–0.2	0.5	1.0

Source: Vanguard, as of December 2024.

FIGURE 11

Annualized forward-looking long-run return and volatility expectations

	Median return	Volatility
U.S. cash	3.5%	1.9%
U.S. equities	5.7%	17.9%
U.S. nominal bonds	5.0%	6.1%
International equities	8.5%	18.9%
International bonds	4.6%	4.7%
Short-term TIPS	3.8%	3.9%

Source: Vanguard, as of December 2024.

TDF with VMF assumptions

The VMF is represented by an SVF that wraps U.S. equities and U.S. nominal bonds. The SVF is an insurance product that utilizes accounting techniques to amortize the underlying portfolio's returns over a long time period, resulting in reduced volatility exposure for the participant. In an SVF, the crediting rate is used to determine the returns experienced by the participant.

For each of the 10,000 market scenarios, we compute the crediting rate using the formula:

$$CR_t(i) = max\left[0, \left(\frac{MV_t(i)}{BV_t(i)}\right)^{1/Duration_t(i)} * \left(1 + Yield_t(i)\right) - Fee - 1\right]$$

$$MV_t(i) = MV_{t-1}(i) * \left(1 + PR_t(i)\right)$$

$$BV_t(i) = BV_{t-1}(i) * \left(1 + CR_{t-1}(i)\right)$$

In the formula above:

- i is the market scenario.
- t is the participant age.
- $CR_t(i)$ is the crediting rate (return) from the SVF for age t and market scenario i.
- Fee is the wrap fee for the SVF. We use an annual fee of 0.20%.
- $MV_t(i)$ and $BV_t(i)$ are the market value and book value of the SVF for age t and market scenario i.
- $PR_t(i)$ is the return on the wrapped portfolio in the SVF for age t and market scenario i.
- $Duration_t(i)$ and $Yield_t(i)$ are the duration and yield of the wrapped portfolio in the SVF for age t and market scenario i.

Life-cycle modeling inputs

FIGURE 12

Inputs to the Vanguard Life-Cycle Investing Model

Input	Assumption	Notes
Starting age	25	—
Horizon age	111	—
Retirement age	65	—
Social Security withdrawal age	65	—
Savings rate (as % of salary)	8.8%–12.0%	The savings rate increases over time because of the expectation of savings escalation for retirement plan enrollees as the participant approaches their retirement date.
Starting real salary	$52,000	For a participant in the workforce at age 25.
Ending real salary	$75,000	For a participant starting at age 25 and retiring at age 65. We add productivity growth and inflation to this over time.
Wage scale	Wage Index	Based on the U.S. Social Security Administration National Average Wage Index.
Total replacement ratio	79%	This represents the percentage of preretirement income needed in retirement. It is based on real replacement rate estimates for an ending salary of about $75,000 and a savings rate of 15% (Lobel, Jaconetti, and Cuff, 2019).
Social Security replacement ratio	37%	This is based on real monthly Social Security benefit estimates for an ending salary of about $75,000 and savings rate of 15%.
DB replacement ratio	None (0%)	—
TDF replacement ratio	42%	This represents retirement expenses that need to be funded by the investment portfolio. It is calculated as: Total replacement ratio – Social Security replacement ratio – DB replacement ratio.
Spending rule	Hybrid spending*	Withdrawal amounts target a specified replacement ratio aimed at maintaining lifestyle in retirement. When wealth balances run low, spending reduces to a sustainable withdrawal amount that is dependent on the years of spending the portfolio is expected to support.

***** We use a hybrid spending rule to reflect a participant aiming to maintain their lifestyle while moving into retirement. We achieve this by using a replacement ratio, which is a conventional practice in the financial planning industry. The VLCM does allow for other spending rules like required minimum distributions, fixed percentage withdrawals, etc.

Source: Vanguard.

Wage scale

Participant salary growth is modeled after the U.S. Social Security Administration's National Average Wage Index. The index is based on reported wages across workers' age spectrum of 25–65 for low-, medium-, and high-income earners. This allows us to trace the earnings progression of an average earner over a 40-year working career, accounting for factors such as career development. As modeled, the average participant reaches a peak salary at age 55 (in real terms) and experiences a decline in real salary through age 65. In our life-cycle simulations, we also allow for 1.1% annual salary growth, on a real basis, in addition to the cross-sectional increase in the wage scale, which reflects the historical average productivity growth of the U.S. economy.

Contribution rates

Age-specific contribution rates are derived from *How America Saves 2024* (Vanguard, 2024), a report surveying the approximately 5 million participants served by Vanguard's recordkeeping business. Contribution patterns account for the likelihood that participants will start with a lower savings rate in their early working years and increase their contributions as retirement approaches. Contributions start at approximately 5% at age 25 and increase to approximately 10% by age 65. In addition, the simulations include a company match of $0.50 per dollar up to 3% of salary, which is consistent with industry averages.

Replacement ratios and drawdown scenarios

We follow industry convention in assuming that retirees will spend a percentage of their age-65 salary every year in retirement from a combination of Social Security benefits and investment income from private sources. In our baseline analysis, the replacement ratio assumption (as a percentage of the age-65 salary) is consistent with retirees maintaining the same standard of living enjoyed during their final working years. Replacement ratios vary by income level, as Social Security makes up a smaller percentage at larger salaries.

Survival probability

Participant survival probabilities are calculated using the U.S. Social Security Administration's actuarial life tables. We use gender-neutral survival probabilities in this paper.

Taxes

For simplicity, we ignore the impact of taxes in our model.

Connect with Vanguard®

vanguard.com

The Vanguard Life-Cycle Investing 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 sets of inputs: the asset class return projections from the Vanguard Capital Markets Model (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.

A full dynamic stochastic life-cycle model, including optimization of a savings strategy and dynamic spending in retirement, is beyond the scope of this framework.

All investing is subject to risk, including the possible loss of the money you invest.

Diversification does not ensure a profit or protect against a loss.

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.

A stable value investment is neither insured nor guaranteed by the U.S. government. There is no assurance that the investment will be able to maintain a stable net asset value, and it is possible to lose money in such an investment.

Investments in target-date 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 target-date funds is not guaranteed at any time, including on or after the target date.

CFA® is a registered trademark owned by CFA Institute.

Vanguard®

ISGMASVF 042025

Important Information

VIGM, S.A. de C.V. Asesor en Inversiones Independiente ("Vanguard Mexico") registration number: 30119-001-(14831)-19/09/2018. The registration of Vanguard Mexico before the Comisión Nacional Bancaria y de Valores ("CNBV") as an Asesor en Inversiones Independiente is not a certification of Vanguard Mexico's compliance with regulation applicable to Advisory Investment Services (Servicios de Inversión Asesorados) nor a certification on the accuracy of the information provided herein. The supervision scope of the CNBV is limited to Advisory Investment Services only and not all services provided by Vanguard Mexico.

This material is solely for informational purposes and does not constitute an offer or solicitation to sell or a solicitation of an offer to buy any security, nor shall any such securities be offered or sold to any person, in any jurisdiction in which an offer, solicitation, purchase or sale would be unlawful under the securities law of that jurisdiction. Reliance upon information in this material is at the sole discretion of the recipient.

Securities information provided in this document must be reviewed together with the offering information of each of the securities which may be found on Vanguard's website: https://www.vanguardmexico.com/institutional/products/en/list/overview or www.vanguard.com

Vanguard Mexico may recommend products of The Vanguard Group Inc. and its affiliates and such affiliates and their clients may maintain positions in the securities recommended by Vanguard Mexico.

ETFs can be bought and sold only through a broker and cannot be redeemed with the issuing fund other than in very large aggregations. Investing in ETFs entails stockbroker commission and a bid-offer spread which should be considered fully before investing. The market price of ETF Shares may be more or less than net asset value.

All investments are subject to risk, including the possible loss of the money you invest. Investments in bond funds are subject to interest rate, credit, and inflation risk. Governmental backing of securities applies only to the underlying securities and does not prevent share-price fluctuations. High-yield bonds generally have medium- and lower-range credit quality ratings and are therefore subject to a higher level of credit risk than bonds with higher credit quality ratings.

There is no guarantee that any forecasts made will come to pass. Past performance is no guarantee of future results.

Prices of mid- and small-cap stocks often fluctuate more than those of large-company stocks. Funds that concentrate on a relatively narrow market sector face the risk of higher share-price volatility. Stocks of companies are subject to national and regional political and economic risks and to the risk of currency fluctuations, these risks are especially high in emerging markets. Changes in exchange rates may have an adverse effect on the value, price or income of a fund.

The information contained in this material derived from third-party sources is deemed reliable, however Vanguard Mexico and The Vanguard Group Inc. are not responsible and do not guarantee the completeness or accuracy of such information.

This document should not be considered as an investment recommendation, a recommendation can only be provided by Vanguard Mexico upon completion of the relevant profiling and legal processes.

This document is for educational purposes only and does not take into consideration your background and specific circumstances nor any other investment profiling circumstances that could be material for taking an investment decision. We recommend getting professional advice based on your individual circumstances before taking an investment decision.

These materials are intended for institutional and sophisticated investors use only and not for public distribution.

Materials are provided only for the recipient's exclusive use and shall not be distributed to any other individual or entity. Broker-dealers, advisers, and other intermediaries must determine whether their clients are eligible for investment in the products discussed herein.

The information contained herein does not constitute an offer or solicitation and may not be treated as such in any jurisdiction where such an offer or solicitation is against the law, or to anyone for whom it is unlawful to make such an offer or solicitation, or if the person making the offer or solicitation is not qualified to do so.

THESE MATERIALS ARE PROVIDED FOR THE EXCLUSIVE USE OF RECIPIENT AND CONTAIN HIGHLY CONFIDENTIAL INFORMATION, WHICH SHALL NOT BE REPRODUCED OR TRANSMITTED TO ANY THIRD PARTIES WITHOUT VANGUARD'S PRIOR WRITTEN CONSENT. THE CONTENTS OF THESE MATERIALS SHALL NOT BE UNDERSTOOD AS AN OFFER OR SOLICITATION TO BUY OR SELL SECURITIES IN BRAZIL AND VANGUARD IS NOT MAKING ANY REPRESENTATION WITH RESPECT TO THE ELIGIBILITY OF ANY RECIPIENT OF THESE MATERIALS TO ACQUIRE THE INTERESTS IN THE SECURITIES DESCRIBED HEREIN UNDER THE LAWS OF BRAZIL. SUCH SECURITIES HAVE NOT BEEN REGISTERED IN BRAZIL AND NONE OF THE INTERESTS IN SUCH SECURITIES MAY BE OFFERED, SOLD, OR DELIVERED, DIRECTLY OR INDIRECTLY, IN BRAZIL OR TO ANY RESIDENT OF BRAZIL EXCEPT PURSUANT TO THE APPLICABLE LAWS AND REGULATIONS OF BRAZIL.

THIS DOCUMENT WAS SENT BY VANGUARD SPECIFICALLY TO ITS RECIPIENT AND CONTAINS HIGHLY CONFIDENTIAL INFORMATION, WHICH SHALL NOT BE REPRODUCED OR TRANSMITTED TO ANY THIRD PARTIES WITHOUT VANGUARD'S PRIOR AND WRITTEN CONSENT. THE CONTENTS OF THIS MESSAGE SHALL NOT BE UNDERSTOOD AS AN OFFER OR SOLICITATION TO BUY OR SELL SECURITIES IN BRAZIL.

This document is provided at the request of and for the exclusive use of the recipient and does not constitute, and is not intended to constitute, a public offer in the Republic of Colombia, or an unlawful promotion of financial/capital market products. The offer of the financial products described herein is addressed to fewer than one hundred specifically identified investors. The financial products described herein may not be promoted or marketed in Colombia or to Colombian residents, unless such promotion and marketing is made in compliance with Decree 2555/2010 and other applicable rules and regulations related to the promotion of foreign financial/capital market products in Colombia.

The financial products described herein are not and will not be registered before the Colombian National Registry of Securities and Issuers (Registro Nacional de Valores y Emisores - RNVE) maintained by the Colombian Financial Superintendency, or before the Colombian Stock Exchange. Accordingly, the distribution of any documentation in regard to the financial products described here in will not constitute a public offering of securities in Colombia.

The financial products described herein may not be offered, sold or negotiated in Colombia, except under circumstances which do not constitute a public offering of securities under applicable Colombian securities laws and regulations; provided that, any authorized person of a firm authorized to offer foreign securities in Colombia must abide by the terms of Decree 2555/2010 to offer such products privately to its Colombian clients.

The distribution of this material and the offering of securities may be restricted in certain jurisdictions. The information contained in this material is for general guidance only, and it is the responsibility of any person or persons in possession of this material and wishing to make application for securities to inform themselves of, and to observe, all applicable laws and regulations of any relevant jurisdiction. Prospective applicants for securities should inform themselves of any applicable legal requirements, exchange control regulations and applicable taxes in the countries of their respective citizenship, residence or domicile.

This document and its content should not be considered as an offer, if it were the case the offer of the securities described herein would be made in accordance with general rule No. 336 of the Financial Market Commission (Comisión para el Mercado Financiero). The securities described herein are not registered under Securities Market Law, nor in the Securities Registry nor in the Foreign Securities Registry of the Chilean Financial Market Commission, and therefore such securities are not subject to its oversight. Since such securities are not registered in Chile, the issuer is not obligated to provide public information in Chile regarding the securities. The securities shall not be subject to public offering unless they are duly registered in the corresponding Securities Registry in Chile. The issuer of the securities is not registered in the Registries maintained by the Chilean Financial Market Commission, therefore it is not subject to the supervision of the Chilean Financial Market Commission or the obligations of continuous information.

El presente documento y su contenido no deberá considerarse como una oferta, en su caso la oferta de los valores aquí descritos se realizaría conforme a la norma de carácter general No. 336 de la Comisión para el Mercado Financiero. Los valores aquí descritos, al ser valores no inscritos bajo la Ley de Mercado de Valores en el Registro de Valores o en el Registro de Valores extranjeros que lleva la Comisión para el Mercado Financiero, no están sujetos a la fiscalización de ésta. Por tratarse de valores no inscritos, no existe la obligación por parte del emisor de entregar en Chile información pública respecto de esos valores. Los valores no podrán ser objeto de oferta pública mientras no sean inscritos en el Registro de Valores correspondiente. El emisor de los valores no se encuentra inscrito en los Registros que mantiene la Comisión para el Mercado Financiero, por lo que no se encuentra sometido a la fiscalización de la Comisión para el Mercado financiero ni a las obligaciones de información continua.

The securities described herein have not been registered under the Peruvian Securities Market Law (Decreto Supremo No 093-2002-EF) or before the Superintendencia del Mercado de Valores (the "SMV"). There will be no public offering of the securities in Peru and the securities may only be offered or sold to institutional investors (as defined in Appendix I of the Institutional Investors Market Regulation) in Peru by means of a private placement. The securities offered and sold in Peru may not be sold or transferred to any person other than an institutional investor unless such securities have been registered with the Registro Público del Mercado de Valores kept by the SMV. The SMV has not reviewed the information provided to the investor. This material is for the exclusive use of institutional investors in Peru and is not for public distribution.

The financial products described herein may be offered or sold in Bermuda only in compliance with the provisions of the Investment Business Act 2003 of Bermuda. Additionally, non-Bermudian persons may not carry on or engage in any trade or business in Bermuda unless such persons are authorized to do so under applicable Bermuda legislation. Engaging in the activity of offering or marketing the financial products described herein in Bermuda to persons in Bermuda may be deemed to be carrying on business in Bermuda.

Vanguard Mexico does not intend, and is not licensed or registered, to conduct business in, from or within the Cayman Islands, and the interests in the financial products described herein shall not be offered to members of the public in the Cayman Islands.

The financial products described herein have not been and will not be registered with the Securities Commission of The Bahamas. The financial products described herein are offered to persons who are non-resident or otherwise deemed non-resident for Bahamian Exchange Control purposes. The financial products described herein are not intended for persons (natural persons or legal entities) for which an offer or purchase would contravene the laws of their state (on account of nationality or domicile/registered office of the person concerned or for other reasons). Further, the offer constitutes an exempt distribution for the purposes of the Securities Industry Act, 2011 and the Securities Industry Regulations, 2012 of the Commonwealth of The Bahamas.

This document is not, and is not intended as, a public offer or advertisement of, or solicitation in respect of, securities, investments, or other investment business in the British Virgin Islands ("BVI"), and is not an offer to sell, or a solicitation or invitation to make offers to purchase or subscribe for, any securities, other investments, or services constituting investment business in BVI. Neither the securities mentioned in this document nor any prospectus or other document relating to them have been or are intended to be registered or filed with the Financial Services Commission of BVI or any department thereof.

This document is not intended to be distributed to individuals that are members of the public in the BVI or otherwise to individuals in the BVI. The funds are only available to, and any invitation or offer to subscribe, purchase, or otherwise acquire such funds will be made only to, persons outside the BVI, with the exception of persons resident in the BVI solely by virtue of being a company incorporated in the BVI or persons who are not considered to be "members of the public" under the Securities and Investment Business Act, 2010 ("SIBA").

Any person who receives this document in the BVI (other than a person who is not considered a member of the public in the BVI for purposes of SIBA, or a person resident in the BVI solely by virtue of being a company incorporated in the BVI and this document is received at its registered office in the BVI) should not act or rely on this document or any of its contents.

Vanguard represents and agrees that it has not offered or sold, and will not offer or sell, any ETFs or Mutual Funds to the public in Uruguay, except in circumstances which do not constitute a public offering or distribution under Uruguayan laws and regulations. Neither Vanguard ETFs or Mutual Funds nor issuer are or will be registered with the Superintendency of Financial Services of the Central Bank of Uruguay to be publicly offered in Uruguay.

This document is not intended to provide tax advice or make and exhaustive analysis of the tax regime of the securities described herein. We strongly recommend seeking professional tax advice from a tax specialist.

Bloomberg® and Bloomberg Indexes mentioned herein are service marks of Bloomberg Finance LP and its affiliates, including Bloomberg Index Services Limited ("BISL"), the administrator of the index (collectively, "Bloomberg") and have been licensed for use for certain purposes by Vanguard. Bloomberg is not affiliated with Vanguard and Bloomberg does not approve, endorse, review, or recommend the Financial Products included in this document. Bloomberg does not guarantee the timeliness, accurateness or completeness of any data or information related to the Financial Products included in this document.

Vanguard Mexico is not responsible for and does not prepare, edit, or endorse the content, advertising, products, or other materials on or available from any website owned or operated by a third party that may be linked to this email/document via hyperlink. The fact that Vanguard Mexico has provided a link to a third party's website does not constitute an implicit or explicit endorsement, authorization, sponsorship, or affiliation by Vanguard with respect to such website, its content, its owners, providers, or services. You shall use any such third-party content at your own risk and Vanguard Mexico is not liable for any loss or damage that you may suffer by using third party websites or any content, advertising, products, or other materials in connection therewith.

Connect with Vanguard®

Vanguard®