



Assessing the inclusion of alternatives in target-date funds

Vanguard Commentary

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- In response to the increasing use of target-date funds (TDFs)—and the consequent surge in their assets—investment managers and defined contribution plan sponsors have begun using alternative investments¹ to differentiate their life-cycle products.
- We evaluate several alternative strategies across broad investment criteria. We then look at two strategies—overweighting real estate investment trusts (REITs) and including a commodities allocation—in terms of TDF-specific portfolio construction considerations, and present further investment analysis centered on their use in a TDF.
- While alternatives have the potential to improve the risk-return profile of a TDF’s glide path, their benefits remain uncertain and typically modest, and their appropriateness in TDFs remains subject to debate. The question that all plan sponsors must address before selecting a TDF is whether any added alternative investments will deliver a benefit over the long term that justifies their higher cost, greater complexity, and more limited transparency and liquidity compared to TDFs that don’t include these strategies.

¹ The terms “alternatives,” “alternative strategies,” “alternative investments,” and “nontraditional investments” are often used interchangeably and their exact definitions remain subject to debate. In this commentary, we will use the term “alternatives” for simplicity and clarity, and consider them to be investments or strategies typically not available and/or included in the retirement portfolios of individual investors.

As investment managers compete for a growing share of TDF assets, some have turned to alternative asset classes and strategies as a way to differentiate their life-cycle offerings.

The asset allocations in TDF glide paths are meticulously constructed to provide asset growth for younger participants and enough income/stability for those nearing or in retirement. Most importantly, they are designed to provide a broad swath of investors with access to a professionally diversified portfolio.²

Investment managers who include alternatives in TDFs typically do so in an effort to improve risk-adjusted returns—but they may also use alternatives to address specific risks (for example, inflation risk) or to enhance the long-term expected return (that is, increase participants’ ending wealth).

Defined contribution (DC) plan sponsors need to be aware that alternative investments, which historically have been used in defined benefit plans or endowments and foundations, can easily increase costs, introduce complexity, lower transparency, and reduce liquidity for both sponsors and participants. And this point is particularly important given that TDFs are designed to simplify the investment process for investors by relying upon time-tested investment principles.

A framework, and a guide

Figure 1 describes the first part of a two-part framework for evaluating the inclusion of alternative investments in TDFs. This framework can serve as a useful guide for plan sponsors assessing the use of alternative investments in TDFs they select, particularly for those that will serve as qualified default investment alternatives (QDIAs).³

Figure 1. Evaluating alternatives in TDFs using broad investment criteria

Broad investment criteria	Commodities	Overweight to REITs	Liquid alternatives	Hedge funds	Private equity	Private real estate
Cost	■	■	■	■	■	■
Simplicity	■	■	■	■	■	■
Transparency	■	■	■	■	■	■
Liquidity	■	■	■	■	■	■

■ Unfavorable quality when compared to broad-based equity and fixed income index funds
 ■ Similar when compared to broad-based equity and fixed income index funds

Notes: For ease of comparison, the categorization used in this framework is relative to broad-based, indexed allocations to traditional assets (i.e., equity and fixed income) that are included in most TDFs. For example, in the “cost” row, the red shading for commodities represents a higher cost relative to broad-based equity and fixed income index funds. In the same row, the yellow shading for REITs represents a similar cost relative to broad-based equity and fixed income index funds. See Appendix A for detailed definitions of these criteria.

Source: Vanguard.

² For a more detailed discussion of these issues, see Donaldson et al. (2015).

³ The Pension Protection Act of 2006 approved the use of target-date funds as QDIAs, protecting plan fiduciaries who choose to use these vehicles as default investment options for participants.

We recognize that there is a subjective component to such an evaluation process and we encourage sponsors to formulate their own weighting schemes in assessing the relative importance of (or ranking against) these criteria.⁴

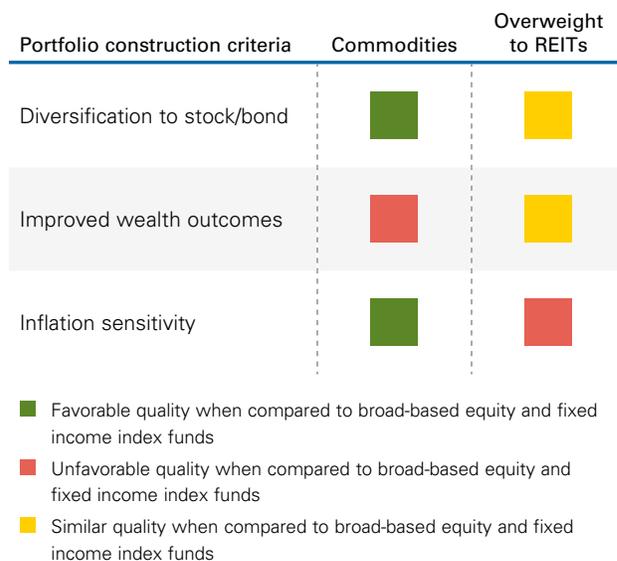
The first part of our framework looks at how well common alternative investments meet four general investment criteria that Vanguard believes are crucial in evaluating investments for use in TDFs, especially for TDFs serving as QDIAs. See **Appendix A** for detailed definitions of these criteria.

We can see from this figure that hedge funds, private equity, and private real estate do not warrant further consideration because their notably higher costs (see **Appendix B**), increased complexity, lack of transparency, and limited liquidity prevent them from satisfying our broad investment criteria. It's important to note, however, that each of these alternative investment categories may increase expected returns, improve diversification, and/or provide the opportunity to benefit from skill-based strategies in other portfolio construction settings.⁵

As for liquid alternatives, TDFs that incorporate them may offer access to strategies typically found in a hedge fund structure at a slightly reduced cost and with increased liquidity and transparency (Philips et al., 2014). However, liquid alternatives represent a diverse category of alternative strategies; many of them are highly dependent upon active manager skill, and thus plan sponsors need to consistently select top managers (Kinniry and Philips, 2012). Because of this, we exclude liquid alternatives as a general category from further analysis in this commentary.

The two categories of alternatives that exhibit some positive characteristics across the broad investment criteria, REITs and commodities, warrant further

Figure 2. Portfolio construction criteria for evaluating select alternatives in TDFs



Note: See Appendix A for detailed definitions of these criteria.
Source: Vanguard.

consideration. We evaluated these alternatives in terms of the potential portfolio construction benefits set forth in **Figure 2**.

We believe that, when considering the addition of alternatives in TDF design, the most important portfolio construction criteria are diversification to traditional asset classes, potential return enhancement, and inflation sensitivity. We generally believe that for an alternative investment to merit inclusion within a Vanguard TDF, the magnitude of the improvement it affords, as measured by these criteria, should be notable.

⁴ See Dhillon, Ilmanen, and Liew (2016) for another viewpoint on the use of alternatives in TDFs.

⁵ For more detail regarding the higher costs, increased complexity, lack of transparency and limited liquidity of alternatives in addition to more information about specific categories of alternative investments, refer to Wallick et al. (2015). For a more detailed exploration of the use of alternative investments in institutional portfolio construction, see Wallick et al. (2016).

Both commodities and an overweight to REITs feature positive characteristics as measured by some (though not all) of our portfolio construction criteria. TDFs typically invest in commodities through pooled products that create exposure through derivatives. Commodity-related equities are another means of exposure, though Gorton and Rouwenhorst (2006) find that “commodity company stocks behave more like other equity than their counterparts in the commodity futures market.” Commodities:

- Provide diversification benefits to traditional assets. Over time, commodities have had low to negative correlations with global stocks and bonds.
- Have had limited, though primarily negative, impact on wealth outcomes, both historically and on a forward-looking basis.
- Have shown a relatively high correlation with changes in inflation. This makes them an effective inflation hedge, albeit one with relatively high stand-alone volatility.

REITs are typically used within life-cycle products as a public proxy for a direct allocation to private real estate. It’s important to note that REITs are already represented in a broadly diversified equity allocation—so any additional allocation is beyond what the market consensus believes is their market value. If investors believed more strongly in their merits, their market capitalization would rise (Philips, Walker, and Zilbering, 2011). REITs:

- Have the potential to add long-term portfolio-diversification benefits (in the short term, REITs are more highly correlated with stocks than with private real estate).
- Could improve or detract from wealth outcomes, both historically and on a forward-looking basis.
- Have lacked a high correlation with changes in inflation, limiting their effectiveness as an inflation hedge.

Further commentary on these portfolio construction criteria can be found in **Appendix C**.

Our glide-path analysis

In the section below, we analyze the results of including either commodities or an overweight to REITs in a TDF, first from a historical perspective and then from a forward-looking one. We used the Vanguard Life-Cycle Investing Model (VLCM)⁶ in tandem with the Vanguard Capital Markets Model (VCMM)[®] to conduct the forward-looking analysis.

We used a flat 10% allocation for both REITs (sourced from equities) and commodities (sourced pro-rata from equity and fixed income) across the full glide path to assess the investment merits of including either allocation. In surveying allocations of major target-date funds, we found that explicit allocations to commodities and REITs commonly range between zero and 15%, though the exact figure may fluctuate as the glide path shifts over time.

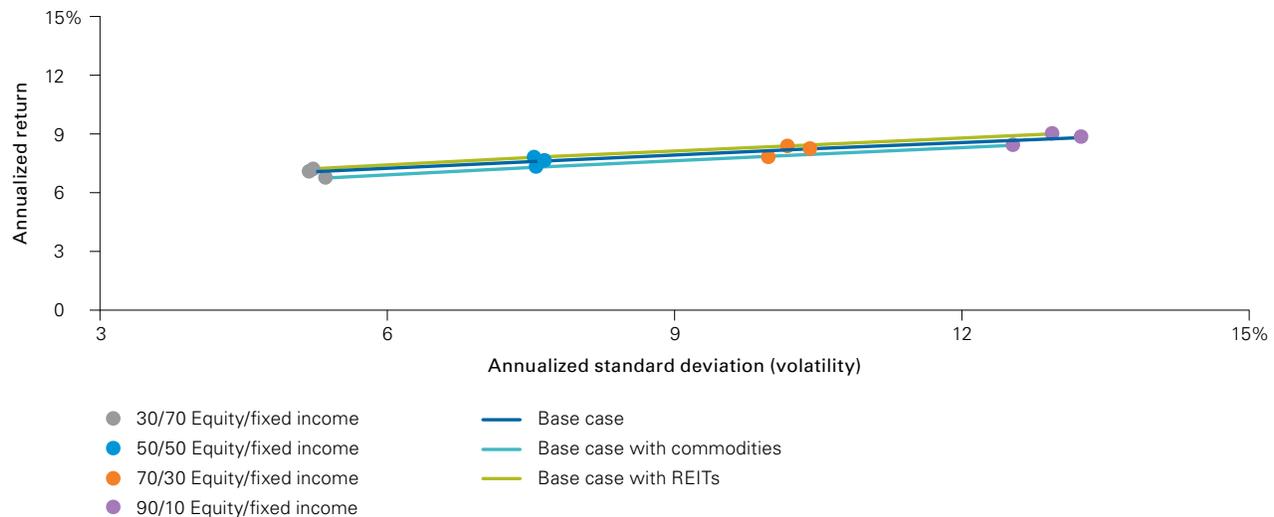
Historical analysis

Figure 3 displays the results of our historical analysis. First we examined the historical annualized risk and return of four portfolios, represented by actual weights taken from a Vanguard TDF glide path; we then added either an overweight to REITs or an allocation to commodities to the four portfolios, and calculated the differences in results. We found that these alternative investments produced marginal differences relative to the base case, with slightly better risk-adjusted performance in some respects and worse in others. For example, including a 10% overweight to REITs yielded a slight improvement compared to the base case in terms of both annualized return and risk-adjusted return, while including a 10% commodities allocation reduced volatility across most portfolios while lowering annualized returns.⁷

⁶ The Vanguard Life-Cycle Model (VLCM) is a proprietary model created by Vanguard’s Investment Strategy Group. Among its practical benefits, the VLCM is a powerful simulation tool for retirement portfolios and quantifies the benefit of glide-path customization based on key metrics of investment success such as diversification properties, wealth outcomes, and retirement income sufficiency. For more information about the VLCM, refer to Aliaga-Diaz et al., 2016.

⁷ We use a longer time series to analyze the return and risk-adjusted return improvements because TDFs are meant to be held by investors over long time periods. It would be possible to find shorter periods within this time series for which a commodity allocation or an overweight to REITs produce better or worse results than those generated by our base case.

Figure 3: Historical risk-return trade-offs when adding commodities and overweighting REITs (1987–2016)



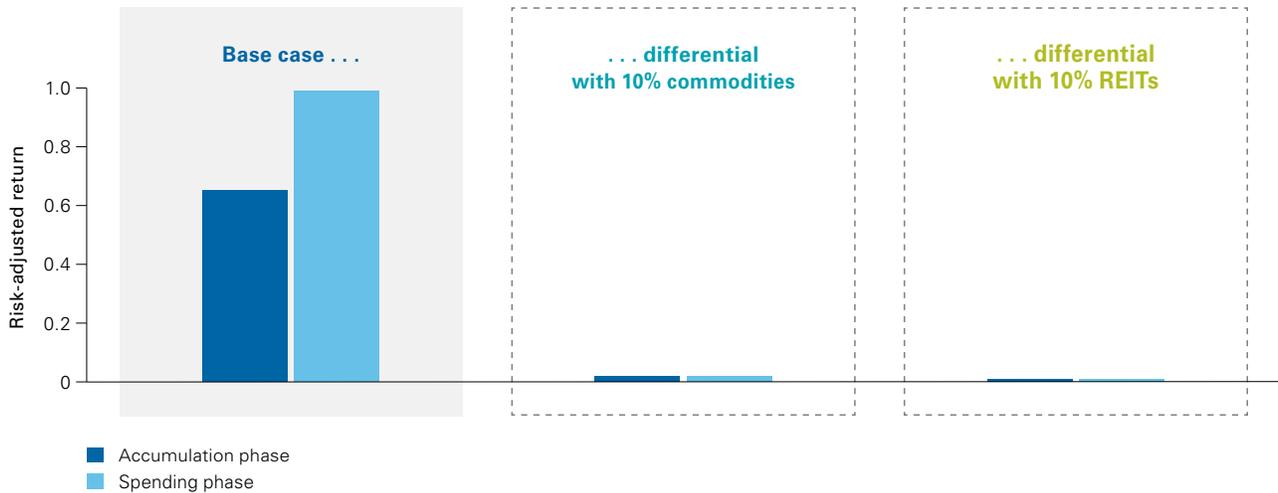
Risk-adjusted return	Equity/fixed income			
	30/70	50/50	70/30	90/10
Base case . . .	1.38	1.00	0.79	0.67
with 10% commodities	1.29 (▼)	0.98 (▼)	0.80 (●)	0.68 (●)
with 10% REIT overweight	1.40 (▲)	1.04 (▲)	0.83 (▲)	0.70 (●)

- ▲ Improved risk-adjusted returns relative to base case
- Similar risk-adjusted returns relative to base case
- ▼ Lower risk-adjusted returns relative to base case

Notes: We constructed a set of four hypothetical portfolios ranging from 90% equities/10% fixed income to 30% equities/70% fixed income in 20% increments. The set represents the range of allocations along the default Vanguard life-cycle glide path. For example, within the Vanguard TDF line, younger investors would have a higher allocation (90%) to equities, while retired investors would maintain a modest allocation (30%) to equities. We used 1987 as the start date because that is the earliest year for which we have data for all of the sub-asset classes. We calculated the monthly results for each portfolio for the 30-year period (1987–2016), then annualized those results to construct a historical annualized return and volatility. We then compared the performance generated by adding either 10% commodities or a 10% overweight to REITs to the base case. For both the historical and the VLCM analysis, we tested the impact of both alternatives by modifying Vanguard’s default glide path (Donaldson et al., 2015), which on the equity side has a sub-asset class allocation of 60% U.S. equities, 40% non-U.S. equities and on the fixed income side, a sub-asset class allocation of 70% U.S. fixed income, 30% non-U.S. fixed income. We reallocated 10% of equities to REITs and 10% pro-rata from equities/fixed income to commodities, and kept the sub-asset class allocation constant over this scenario analysis time period. Risk-adjusted return is defined as annualized return divided by annualized standard deviation. See box in Appendix B for description of benchmarks.

Sources: Vanguard calculations, using data from MSCI, Bloomberg Barclays, Citigroup, Standard & Poor’s, Goldman Sachs, and Dow Jones.

Figure 4: The potential forward-looking differentials in risk-adjusted return before costs are marginal



Notes: We tested the impact of both alternatives by modifying Vanguard’s default glide path (Donaldson et al., 2015), which has an equity sub-asset class allocation of 60% U.S. equities, 40% non-U.S. equities. On the fixed income side, the allocation is 70% U.S. fixed income, 30% non-U.S. fixed income. We reallocate 10% of equities to REITs and 10% of equities/fixed income to commodities, and the sub-asset class allocation remains constant over this scenario analysis time period. “Risk-adjusted return” is defined as annualized return divided by annualized standard deviation.

Source: Vanguard calculations.

Forward-looking analysis

Figure 4 presents simulation results showing median risk-adjusted returns during the accumulation and decumulation (spending) phases.⁸ We compared a base case with two portfolios that added an alternative strategy to the base case: In one, we overweighted the allocation to REITs, and in the other, we added an allocation to commodities. The higher risk-adjusted returns associated with the inclusion of either an overweight to REITs or an allocation to commodities produces only marginal changes to the risk-return profile of the glide path, which can be seen from the slightly higher calculated risk-adjusted returns differentials.

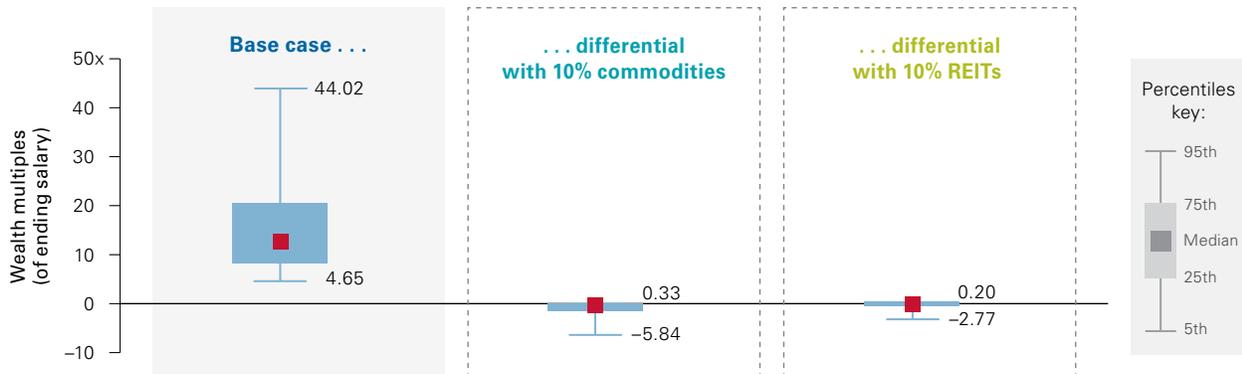
Because TDFs are designed as vehicles to help participants grow their retirement savings, it’s important to look at projected wealth outcomes in addition to risk-adjusted return. Figure 5 compares a participant’s account balance as a multiple of final salary at retirement

(age 65) across our base case glide path and the wealth multiple differentials from the inclusion of commodities or REITs into the glide path. The results suggest that when adding commodities or a REIT overweight relative to the Vanguard glide path, the improvements are minimal at best. Of the outcomes generated by the addition of REITs, for example, those in the 5th percentile see a 0.20 increase in the wealth multiple, while those in the 95th percentile see a 2.77 decrease in it.

In addition to wealth multiples at retirement, we also address wealth multiples through retirement (age 95). Figure 6 shows this median wealth multiple and the wealth multiple differentials from the inclusion of commodities or REITs into the glide path. Again we see that our simulated results show that the inclusion of alternatives does not represent a notable departure from the base case.

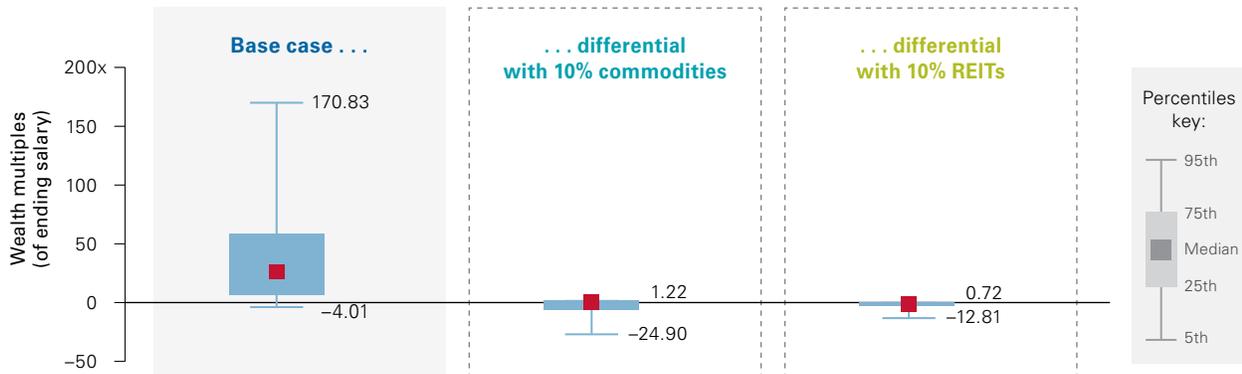
⁸ In Vanguard TDFs, the accumulation phase is defined as the 40 years between ages 25 and 64 and the decumulation phase is defined as the 30 years between ages 65 and 95.

Figure 5: Range of forward-looking wealth multiples at age 65, and potential differentials before costs



Notes: This chart shows the range of outcomes for a base case, a base case with a 10% allocation to commodities, and a base case with a 10% overweight to REITs. Plot values represent the 95th, 75th, 50th, 25th, and 5th percentile values. The median value is represented by the red square. The base case represents multiples of an investor's ending salary at retirement; the median investor (red square) on the default glide path would accumulate assets equal to 12.7 times his or her ending salary at age 65. The 10% commodities and 10% REITs plots represent the differentials with their inclusion into portfolio. Of the outcomes generated by the addition of REITs, for example, those in the 95th percentile would see a 0.20 increase in the wealth multiple compared to the base case, while those in the 5th percentile would see a 2.77 decrease in it. VCMM simulations are as of March 31, 2017.

Figure 6. Range of forward-looking wealth multiples at age 95, and potential differentials before costs



Notes: This chart shows the range of outcomes for a base case, a base case with a 10% allocation to commodities, and a base case with a 10% overweight to REITs. Plot values represent the 95th, 75th, 50th, 25th, and 5th percentile values. The median value is represented by the red square. The base case represents multiples of an investor's ending salary at retirement; the median investor (red square) on the default glide path would accumulate assets equal to 25.31 times his or her ending salary at age 95. The 10% commodities and 10% REITs plots represent the differentials with their inclusion into portfolio. Of the outcomes generated by the addition of commodities, for example, those in the 95th percentile would see an increase in the wealth multiple compared to the base case of 1.22 compared to the base case, while those in the 5th percentile would see a 24.90 decrease in it. VCMM simulations are as of March 31, 2017.

The primary takeaway from both our historical and forward-looking analyses is that—before costs and relative to a baseline glide path containing purely traditional asset classes—there is a chance of slight improvement in risk-adjusted returns and wealth outcomes when a TDF includes an overweight to REITs or an allocation to commodities.

The big picture

TDFs are designed to provide a simplified structure to put investors in a suitable asset allocation leading up to and through retirement. Though we note that the use of alternatives has the potential to improve retirement outcomes for participants, the merits of these uncertain benefits remain subject to intense debate, as it can be difficult to assess the degree to which they may persist over long-term horizons. Assessing the benefits is also particularly difficult given both the higher costs of alternatives and the relatively small allocation they typically maintain across many life-cycle products.

The added complexity that alternative investments bring to a TDF means that participants may require significant and ongoing education. Plan sponsors should consider the extent to which they are able to provide such education, and how willing they are to provide or oversee it. As for liquidity, because DC plans are benefit-responsive, TDFs should contain asset classes that are readily convertible to cash with minimal disruption to the strategy and loss of value for the participant. Participants can decide to change either their investments or their employer, and so plan balances must be valued at fair market prices that are equitable to both the departing participants and remaining investors.

The final, and arguably the most important, consideration is cost. Alternative investments generally have greater explicit costs in the form of higher fees, and studies that highlight their benefits without taking cost into account can be misleading. And—though admittedly more challenging to measure—there are additional implicit costs for sponsors, such as the time, energy, and resources required to ensure due diligence, manager oversight, and additional participant education. These added costs, as well as the increased level of participant confusion, can offset any potential risk-return improvements in a glide path created by an alternative allocation.

Vanguard and alternatives

Vanguard continually evaluates both traditional asset classes and alternative investments and strategies for use in Vanguard TDFs. We first evaluate alternatives relative to our criteria for suitability in a TDF. For those that meet these criteria, including REITs and commodities, we then evaluate their potential portfolio construction benefits. We also weigh any benefits against the costs—both explicit and implicit—of including alternatives in an easy-to-understand, low-cost, transparent vehicle.

Vanguard TDFs do not currently contain an explicit REIT or commodities allocation. With regard to REITs, we believe that the allocation achieved through an equity market capitalization-weighting scheme provides sufficient exposure to the sector. And while the inflation-sensitivity and diversification properties of commodities are notable, we believe that the associated increased cost, lack of a market capitalization-weighting scheme for providing consistent exposure to their systematic risk,⁹ and increased complexity for participants outweigh their benefits.

Ultimately, perspective is important. Our analysis suggests that even if alternatives can be used at a low cost and with limited administrative complexity (and participant confusion), these strategies are likely to deliver modest benefits at best. Our conclusions are consistent with earlier Vanguard research, which finds that any improvement in participant outcomes produced by changes in sub-asset class allocation is likely to be small compared with what can be achieved through other strategies such as reducing investment costs, increasing savings amounts, adjusting retirement age, and managing the desired replacement ratio (Aliaga-Díaz et al., 2016). Instead, we urge sponsors to spend the necessary time educating their participant base on the importance of these other factors, which may play a larger role in helping them achieve investment success.

⁹ For example, the Standard & Poor's Goldman Sachs Commodity Index is a world-production weighted index, while the Bloomberg Barclays Commodity Index uses a rules-based approach under which, per the 2017 target-weighting scheme, no group of commodities (for example, precious metals) may constitute more than 33% of the index.

Conclusion

Target-date funds play a prominent role in retirement plans, providing participants with professionally managed, diversified portfolios linked to their expected retirement dates. As a way of differentiating themselves, some investment managers have begun to supplement their TDFs' allocation to traditional asset classes with investments in alternatives. This has prompted plan sponsors to consider using such augmented TDFs as QDIAs.

After evaluating various alternative investments within a general framework to think through target-date portfolio construction, we further investigated the benefits of a REIT overweight and commodities allocation in glide paths. We found that these alternative allocations delivered some portfolio construction benefits and some drawbacks. The question that all plan sponsors must address, of course, is whether these alternatives will deliver a benefit going forward. If the answer is yes, the question becomes whether that benefit will be enough to justify potential trade-offs against the cost, transparency, simplicity, and liquidity of their life-cycle products.

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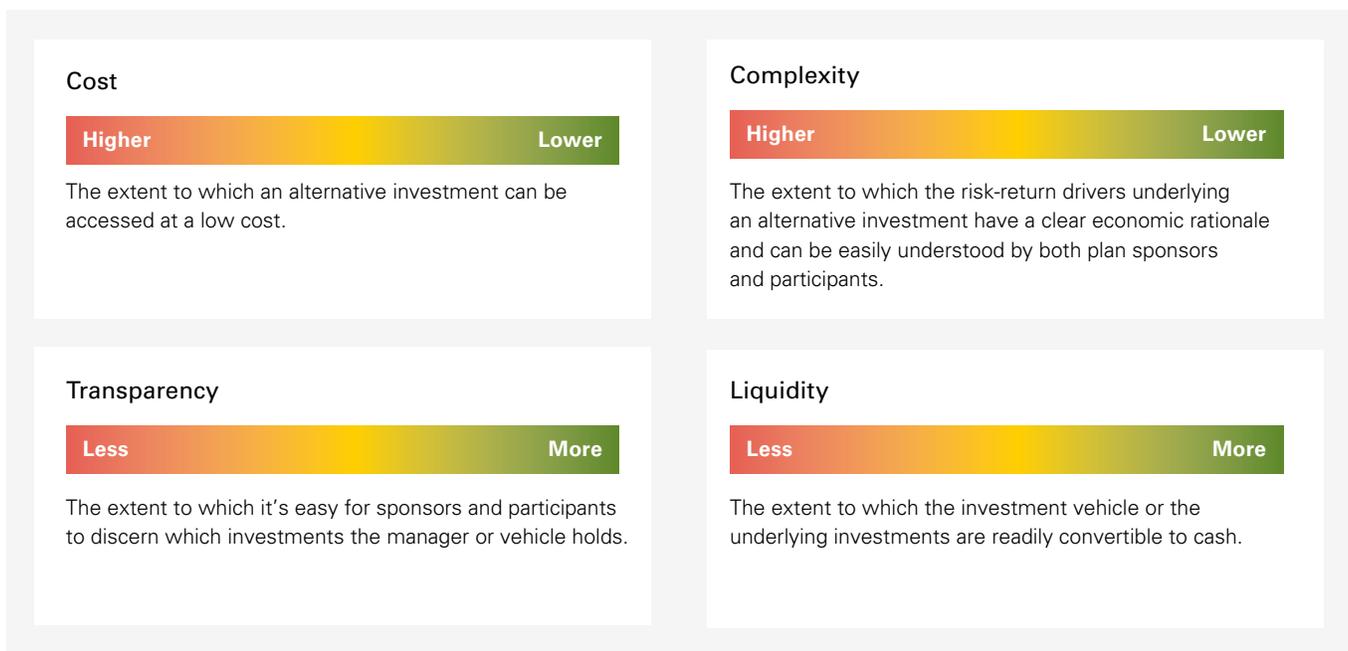
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Appendix A: Criteria used to assess alternatives in target-date funds

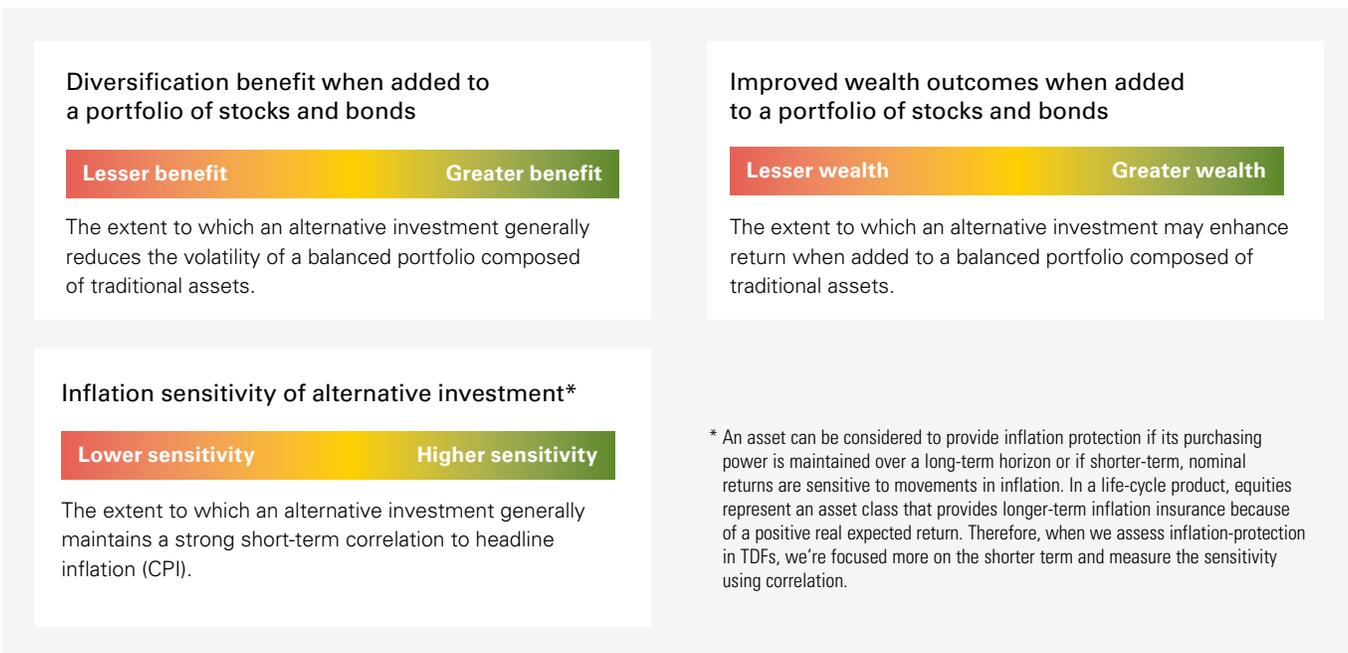
It's important to note that the definitions set forth below represent one specific way to define each of these terms. Sponsors and other investment managers may choose a different way to define each term, and this difference may affect the relative scoring and results of any overall assessment. The investment criteria used in the framework to assess alternative investments are relative to broad-based, indexed allocations to traditional assets (equity and fixed income).

Figure A-1. Definitions of investment and portfolio criteria

Broad investment criterion

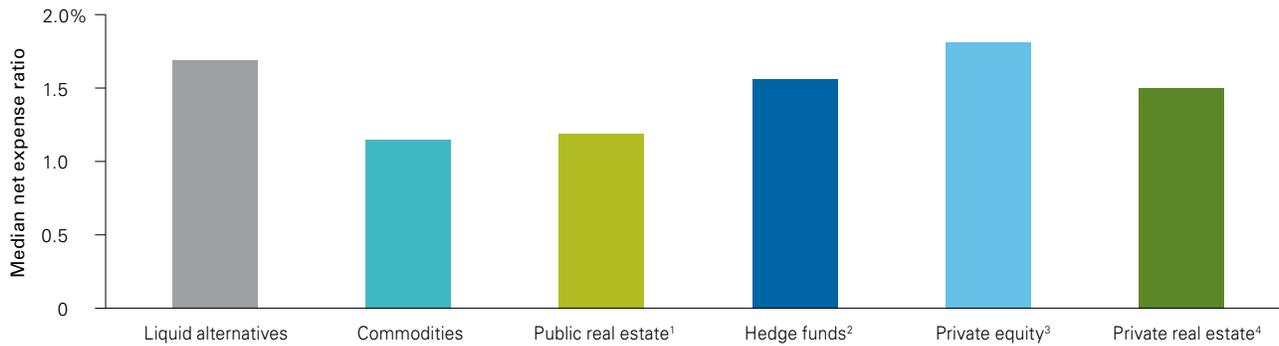


Portfolio construction criteria



Appendix B: Comparing the cost of selected alternatives

Figure B-1. The cost of various alternatives



1 Though real estate funds invest substantially in equity REITs, they also invest in other real-estate related investments. The sample includes funds that invest in both local and global real estate.

2 Hedge fund cost is represented by the mean management fee for all hedge funds that reported data to Preqin for the first quarter of 2017. Data were sourced from Preqin Hedge Fund Online.

3 Private equity cost is represented by the mean management fee for buyout funds during the investment period for vintage 2015 or 2016 funds. Data were sourced from the 2016 Preqin Private Capital Fund Terms Advisor.

4 Private real estate cost is represented by the mean management fee for private real estate funds during the investment period for vintage 2015 or 2016 funds. Data were sourced from the 2016 Preqin Private Capital Fund Terms Advisor.

Notes: Liquid alternatives, commodities, and public real estate include open-ended U.S. mutual funds that reported an annual report net expense ratio for 2016; all share classes were used in our calculations. Certain types of liquid alternative funds as categorized by Morningstar were removed from the sample, including funds using “trading” and “bear market” strategies. We acknowledge that the costs depicted above may not be truly representative of the cost of these types of allocations if wrapped within a TDF structure. The figure is meant to provide an illustrative example of cost differences across various alternatives.

Sources: Vanguard calculations, using data from Morningstar and Preqin.

Benchmarks used in historical analysis

Domestic equity: MSCI USA Index.

International equity: MSCI World ex USA Index.

Domestic fixed income: Bloomberg Barclays U.S. Aggregate Float Adjusted Index (USD-Hedged).

International fixed income: Citi World Government Bond Index ex US (hedged to USD), from January 1987 through December 1998; Bloomberg Barclays Global Aggregate ex-USD Float Adjusted Index thereafter.

Commodities: Standard & Poor’s Goldman Sachs Commodity Index.

REITs: Dow Jones U.S. Select REIT Index.

Appendix C: Further commentary on portfolio construction criteria

Commodities	Commentary
Diversification benefit when added to a portfolio of stocks and bonds	Bhardwaj, Gorton, and Rouwenhorst (2015) found that fully collateralized commodity futures were negatively correlated with stocks and bonds, but correlations increased during the financial crisis.
Improved wealth outcomes when added to a portfolio of stocks and bonds	The economic justification for expecting persistent, positive returns from a commodity futures allocation is subject to ongoing debate in the investment management community. Erb and Harvey (2006) describe a few frameworks to explain expected returns for commodity futures. For example, several theories have emerged as to what drives returns: insurance provided to commodity producers (i.e., bearing future spot price risk), the convenience yield (commodity inventory levels), or a diversification return (rebalancing a portfolio of commodity futures). Academic economic research has also explored the degree to which the growing use of commodity futures as a strategic portfolio allocation for investors may continue to affect commodity markets (and in turn, investment returns). See, for example, Cheng and Xiong (2013).
Inflation sensitivity of alternative investment	Bhardwaj, Hamilton, and Ameriks (2011) note that commodity futures can provide “an effective partial hedge against inflation, particularly in the near term.” Additionally, Bhardwaj, Gorton, and Rouwenhorst (2015) find that “correlations between commodities and inflation have been positive in the past decade, albeit in a low inflation environment.” Ultimately, inflation sensitivity can be measured in a few different ways; therefore, conclusions from academic studies are dependent upon assumptions used (see Appendix A for the definitions we use in our framework).
REITs	Commentary
Diversification benefit when added to a portfolio of stocks and bonds	For the most part, studies have shown long-term historical diversification benefits of real estate relative to a traditional equity/fixed income portfolio. REITs have had a high correlation to equities over the shorter term and higher correlation to private real estate over the longer term. Cotter, Gabriel, and Roll (2016) show that the diversification benefit of REITs appears to have been decreasing since the late 1990s.
Inflation sensitivity of alternative investment	Studies have generally shown that direct investment in real estate is at least a partial hedge against both unexpected and expected inflation. However, studies on REITs’ inflation-hedging properties are diverse and inconclusive. Kloosterman (2009) provides a thorough review of academic literature on these points.

Appendix D: About the Vanguard Capital Markets Model

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 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 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. 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 primary value of the VCMM is in its application to analyzing potential client portfolios including ones with glide paths. VCMM asset-class forecasts—comprising distributions of expected returns, volatilities, and correlations—are key to the evaluation of potential downside risks, various risk–return trade-offs, and the diversification benefits of various asset classes. Although central tendencies are generated in any return distribution, Vanguard stresses that focusing on the full range of potential outcomes for the assets considered, such as the data presented in this paper, is the most effective way to use VCMM output. We encourage readers interested in more details to read Davis et al. (2014). The VCMM seeks to represent the uncertainty in the forecast by generating a wide range of potential outcomes. It is important to recognize that the VCMM does not impose “normality” on the return distributions, but rather is influenced by the so-called fat tails and skewness in the empirical distribution of modeled asset class returns. Within the range of outcomes, individual experiences can be quite different, underscoring the varied nature of potential future paths. Indeed, this is a key reason why we approach asset-return outlooks in a distributional framework.

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