

Vanguard's approach to target retirement funds in the UK

Vanguard Research

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- The UK government has announced legislation that will make material changes to the rules governing pensions. Most notably, they removed the requirement for pension savings to be annuitised at retirement, introducing more discretion over how these savings are managed. These changes compel investors to take more personal responsibility, to think long term and seek an enduring solution to meet their retirement goals.
- Previously, UK investors who were required to buy an annuity as they entered retirement would have been well advised to follow a strategy that de-risked the portfolio in the years leading up to retirement. This was intended to maximise the income received from an annuity, while minimising the expected variation in that income. Now that the annuity constraint has been removed, investors can potentially achieve a higher level of income in retirement by exploiting their anticipated long time horizon and staying invested in a multi-asset portfolio whilst in retirement.
- Despite the importance of saving for retirement, research indicates that many investors lack time for or interest in retirement planning.¹ Target retirement funds (TRFs) help to address these challenges by offering an appropriately designed single fund solution that adapts over time to the investor's stage of life, to their retirement date and beyond.
- This paper provides an overview of Vanguard's methodology in designing its TRFs, constructed based on investment best practices, critical in enabling an investor to realise their retirement goals. These include the principles of asset allocation, diversification, transparency and a balance between risk, return and cost. This paper outlines our view of glide path construction, asset-class diversification and the potential benefits of passively managed implementation.

¹ For a more detailed discussion of these issues, see Utkus and Yough (2004, 2009a) and Choi et al. (2006).

In March 2014, the UK government announced legislation that will make material changes to the rules governing pensions. Most notably, it removed the requirement for retirees to annuitise their pension savings at retirement, thereby introducing much more discretion over how these savings are managed. This means that since April 2015, people with defined contribution (DC) savings in the UK have had greater flexibility when they come to access their pension savings after the minimum pension age (currently age 55). Additionally, the UK is currently undergoing the staging-in of automatic enrolment, which requires employers to enrol qualifying employees (meeting particular age and earnings criteria) into a pension scheme.

These changes combined with the ongoing shift away from defined benefit (DB) to DC schemes² compel the investor to take personal responsibility, think long term and seek an enduring solution to meet their retirement goals. To ensure investors have adequate savings for retirement, they should save during their working life and establish clear goals when investing to meet their aspirations for a sufficient standard of living. For those seeking certainty of income in retirement, a guaranteed income product (such as an annuity) will still be relevant.

Both Vanguard research and other studies indicate that many investors lack time for or interest in retirement planning. Even a motivated saver may make errors or fail to manage a portfolio's strategy effectively over time. TRFs address these challenges by offering a convenient single fund solution which adapts over time to the investor's stage of life up to and including retirement. TRFs are designed to address a particular challenge facing many retirement investors: constructing a professionally diversified portfolio. TRFs simplify the investment process over their investment lifecycle inside a convenient single fund. TRFs can also provide a sensible default investment option that plan sponsors can use in conjunction with plan-design strategies to improve member portfolio diversification, enrolment and savings rates.

Most people saving in DC plans in the UK typically default into a lifestyle investment option³, typically run by the administrators of the pension plan. These options aim to maximise the plan member's pension pot as they approach retirement age to secure a good annuity income in retirement. This is achieved by embracing a multi-asset approach targeting growth during most of the accumulation phase and de-risking as the plan member approaches retirement. This de-risking is done to reduce the chances of undesirable falls in the value of the annuity income stream as the retirement date nears.

Without the legal necessity to buy an annuity on retirement⁴, investors are likely to be able to achieve higher expected incomes in retirement by exploiting their anticipated long time horizon and staying invested in a multi-asset portfolio for longer, even in the years beyond their retirement date. Vanguard's TRFs are designed to exploit this preferred approach to retirement saving. This is done by choosing an asset allocation that adapts over time to the investor's stage of life, not only in the years up to retirement, but also while in retirement. This is important because while retirees draw spending from their savings in retirement, those savings still need to sustain through retirement for on average another 20 to 30 years.

Vanguard TRFs also have the advantage of convenience, automatically adjusting the asset mix to ensure that the member remains on track. They automatically rebalance regularly to align the portfolio to the members' established investment objectives. Vanguard does this while being cost effective to ensure that the investor reaps most of the returns generated by their investments.

Of course, even with a simple one-stop lifetime-appropriate investment, it is still necessary for individual investors to assess their personal situation and decide if their chosen TRF continues to be appropriate for their financial goals. In addition to costs, they need to monitor investments from time to time to ensure that the asset allocation is aligned to their specific investment objective, time horizon and risk appetite.

² Annual Survey of Hours and Earnings (ASHE) 2014: Summary of Pension Results released by Office of National Statistics on 26 February 2015.

³ UK Defined Contribution Market Intelligence 2015, Spence Johnson.

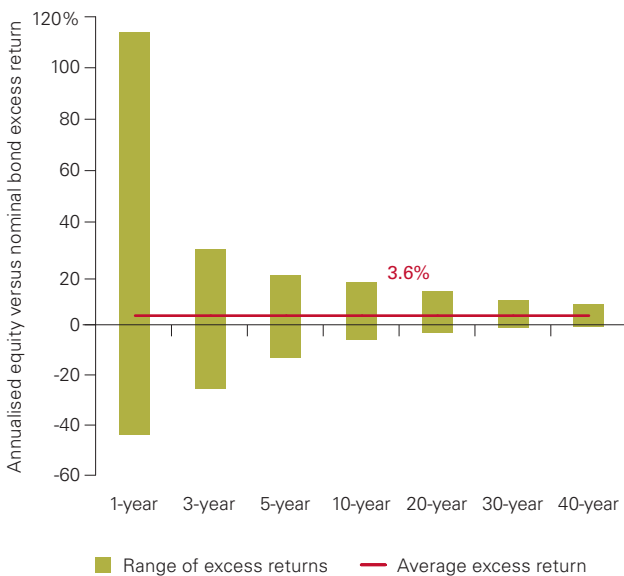
⁴ Announced in the March 2014 budget by the UK government.

Asset-allocation glide path

Fundamentally, the investment case for Vanguard TRFs rests on two key strategic principles: that there are significant potential rewards for taking market risk, and that younger investors are better able to withstand that risk than older investors because a larger percentage of their total wealth is in human capital versus their financial holdings.

Regarding the first of these principles, two important considerations justify an expectation of an equity risk premium. The first is the historical record: in the past, stock market investors in many countries have been rewarded with such a premium. Figure 1 shows historical returns for global equities in excess of returns of global bonds over various time periods from 1900 through 2015.⁵

Figure 1: Historical equity risk premium over different time periods, 1900–2015



Notes: Past performance is no guarantee of future results. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index. From 1900 through 1984, equities are represented by the Barclays Equity Gilt Study from 1900 to 1964, Thomson Reuters Datastream UK Market Index Jan 1965 – Dec 1969; MSCI UK Jan. 1970 – Dec. 1985; Thereafter, equities are represented by MSCI All Country World Index. UK Bonds are represented by Barclays Equity Gilt Study 1900-1976; FTSE UK Government Index Jan. 1977 – Dec 1984, Citigroup World Global Bond Index from 1985 through 1989, Barclays Global Aggregate Index thereafter. Returns are in sterling, with income reinvested, through 2015.

Source: Vanguard

Figure 1 shows that equities have provided higher average returns than bonds over all time horizons analysed from 1900 through 2015 – albeit with a greater propensity to underperform by significant amounts over shorter time frames. Historically, bond returns have lagged equity returns by about 3.5 to 5 percentage points, annualised – amounting to a sizable return differential in most circumstances over longer time periods. Consequently, retirement savers investing only in safe assets must dramatically increase their savings rates to compensate for the lower expected returns of such investments.

The second reason why equities typically outperform bonds is forward-looking and theoretical: despite the long term outlook for global corporate earnings remaining positive, there is uncertainty surrounding equity returns. To compensate equity investors for taking on this uncertainty, they should be rewarded with higher average returns over the long run than investors who choose less volatile investments⁶.

In terms of the second strategic principle underlying Vanguard’s glide path construction – that younger investors are better able to withstand risk – this principle recognises that an individual’s total net worth consists of both his or her current financial holdings and future work earnings. For younger individuals, the majority of their ultimate retirement wealth is in the form of what they will earn in the future, or their human capital. Therefore, it may be appropriate for a younger person’s portfolio to have a large commitment to equities, to balance and diversify his or her risk exposure to work-related earnings (Viceira, 2001; Cocco, Gomes, and Maenhout, 2005).⁷

According to the characteristics of the investor, the human capital theory can deliver a range of recommendations on how quickly or in what proportion equity exposure should diminish. But in general, the theoretical prediction that equity allocations should decline with age to help manage risk through time will be robust across a range of assumptions. Widespread debate remains as to what level of equity exposure may be appropriate to diversify investors’ human capital. There is no universally accepted optimal answer; ultimately, this is a fiduciary decision that sponsors offering TRF funds must make for their members and that individual investors must make for themselves.

⁵ The existence of an ex post long-term equity risk premium over the past was also corroborated by Dimson, Marsh, and Staunton (2002), who showed positive historical risk premiums for equities versus bonds in 19 countries since 1900.

⁶ A more rigorous derivation of the equity risk premium relates to the fact that returns on equities are likely to be low during cyclical downturns which is precisely when investors would prefer them to be high, so a premium is required to induce investors to take on that risk.

⁷ For a more detailed discussion of these issues, see Bennyhoff (2008) and Ameriks, Hess, and Donaldson (2008).

Glide path construction approach

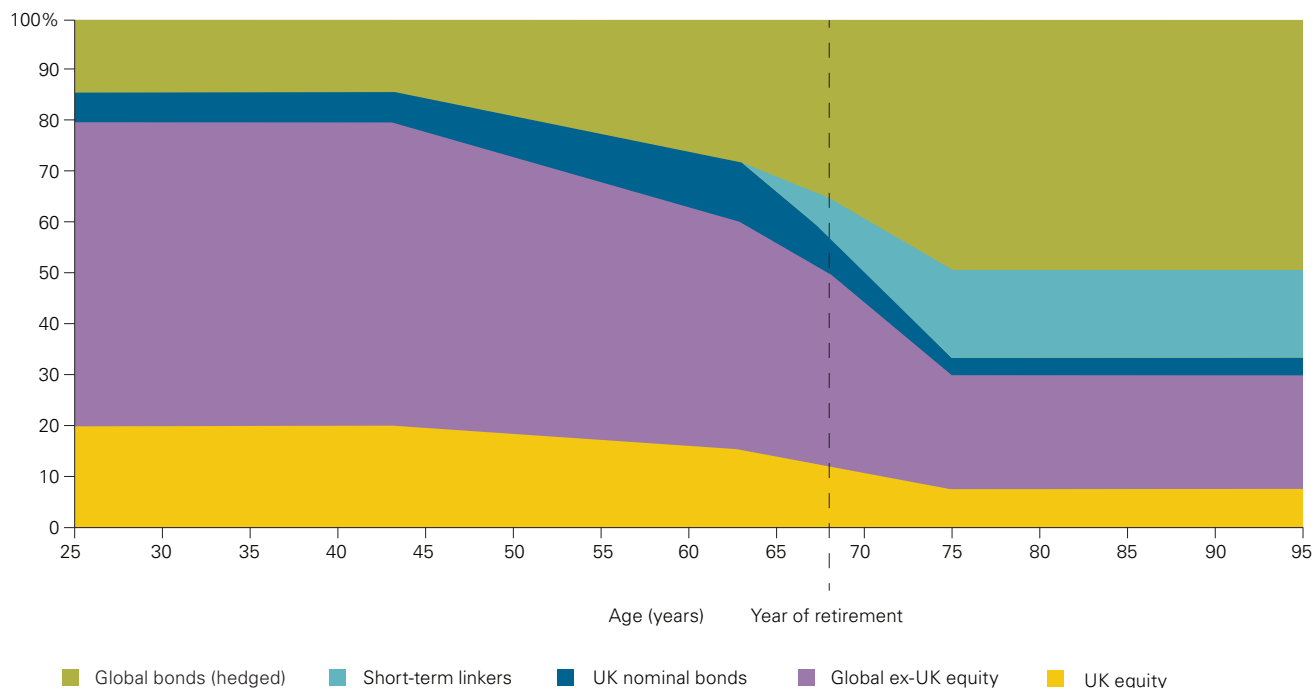
A portfolio's asset allocation – the percentage of a portfolio invested in various asset classes such as equities, bonds and cash investments – is the most important determinant of the return variability and long-term performance of a broadly diversified portfolio that engages in limited market-timing (Brinson, Hood, and Beebower, 1986; Davis, Kinniry, and Sheay, 2007). For that reason, Vanguard's TRF portfolio glide path, illustrated in Figure 2, represents a strategic asset allocation to a broadly diversified set of asset classes – not a tactical asset-allocation philosophy.⁸

Vanguard TRFs take a long-term, strategic approach and are built to be highly diversified and low-cost, both features which have proven to be critical to long-term investing success. The funds' asset-allocation glide path

is designed to help a typical investor who maintains a reasonable savings rate to reach his or her retirement investment goals while bearing what we believe to be an appropriate level of risk at each stage of the life cycle.

As described earlier, the human capital theory supports a significant commitment to equities for young individuals, declining to a more modest allocation as the investor approaches retirement and eventually leaves the workforce. Vanguard TRFs maintain a significant level of equity exposure (80%)⁹ to age 43 because one's human capital remains dominant over the relatively small balances in financial capital during the early stages of asset accumulation. After age 43, the equity allocation continues to decline until age 75 to compensate for the shifting balance between human and financial capital (see Figure 2).

Figure 2: Glide path for Vanguard target retirement funds



Notes: Figure assumes that a particular fund was selected based on a projected target retirement age of 68. Linkers = index-linked gilts (see discussion of linkers later in the text). Source: Vanguard

⁸ Tactical asset allocation is a type of dynamic asset allocation that actively and systematically adjusts the strategic portfolio mix of an entire TRF allocation based on relative short-to-intermediate-term market conditions. Such an approach attempts to add value beyond that of a baseline strategic asset allocation by altering systematic risk factors and overweighting asset classes that are expected to outperform on a relative risk-adjusted basis in the near term. For a more detailed discussion of these issues, see Stockton and Shtekhman (2010).

⁹ The UK target retirement series has been designed with a more conservative asset allocation than similar products offered by Vanguard in other markets. For example, the US series glide path begins with 90% invested in equities. We have decided on the more conservative approach in the early years of the glide path in consultation with the pension industry and drawing on academic literature (Blake and Alistair Haig, 2014) which indicates a high level of risk aversion among UK retirement investors. While the more conservative approach results in a slightly lower level of retirement income, the effect is likely to be marginal and could ultimately benefit the UK investor if it means they are more likely to remain disciplined with the strategy during market downturns.

Once retirement is reached, the retiree will begin to run down the pool of savings by spending, but the remaining savings should ideally grow as fast as is prudent to fund ongoing spending throughout the rest of retirement. To help meet retirees' need for diversification and growth potential for possibly another 20 to 30 years in retirement to offset inflation and longevity risk, Vanguard TRFs still offer significant equity exposure at an investor's designated retirement year – 50% (including both UK and non-UK, as shown in Figure 2). This is gradually reduced over the next seven years to 30% and remains constant thereafter.

We believe this gradual shift is prudent because we view retirement as a transitional period financially, not a one-time event. A reasonable landing point at which the equity allocation remains constant seems to be age 75, because most pre-retirees and recent retirees still have the ability – though far less so than younger investors – to alter their retirement plans if absolutely necessary. The modest exposure to equities can diversify their portfolios and help them realise their long-term goals. In addition, most retirees have a portion of their wealth in the form of relatively safe, inflation-adjusted state pension benefits, which should be diversified with some exposure to the equity markets.¹⁰

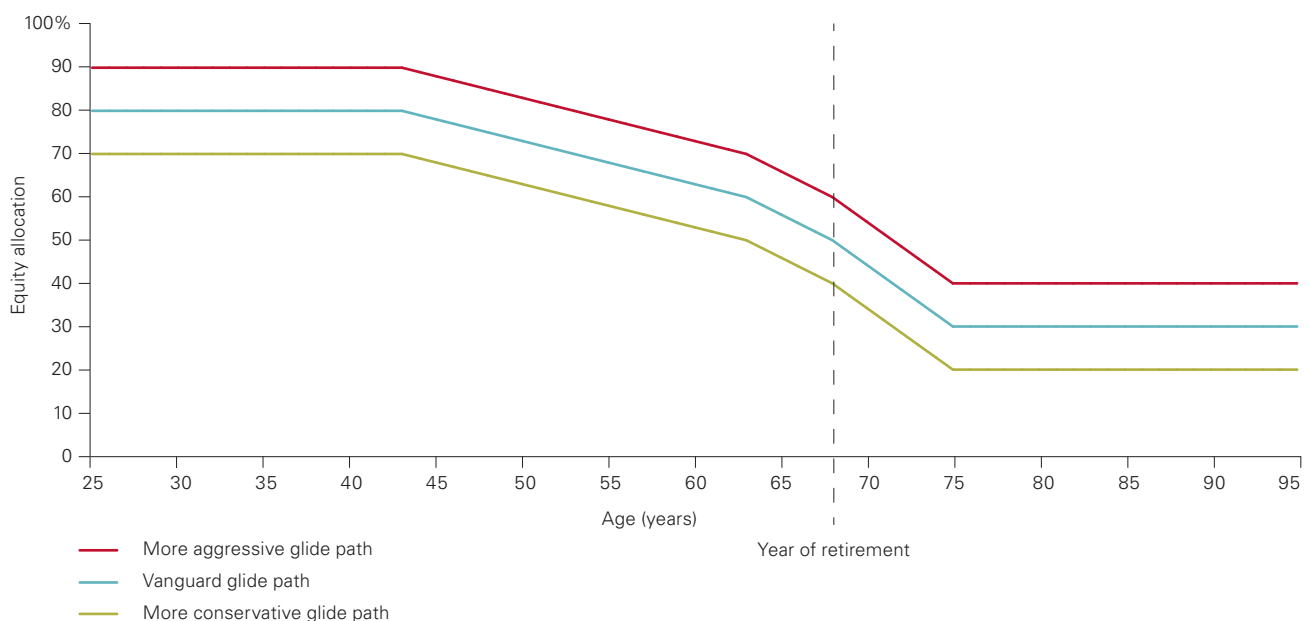
Simulated outcomes and measures of success

As part of the process identifying an appropriate glide path given this theoretical framework, we ran various financial simulations using the Vanguard Capital Markets Model (VCMM). This is a simulation tool that allows different asset allocation strategies to be evaluated by subjecting the portfolio to a range of potential shocks that are likely to occur, thereby allowing us to illustrate a range of possible retirement outcomes that an investor might expect.

We examined alternate risk–reward scenarios and the potential implications of different glide paths and TRF approaches. Figure 3 illustrates three different glide paths, including Vanguard's TRF glide path, beginning with varying levels of significant equity exposure and ending post retirement with ranges of more moderate levels of equity exposure.

These different glide paths will have implications for a range of characteristics of the investor's retirement outcome; for example, they will imply different levels of accumulated wealth at the point when the retiree begins to spend out of the portfolio. This in turn could imply different levels of spending available in retirement. Or alternatively, for a given level of spending, different glide paths will have different implications for the chances that the retiree will exhaust their pool of savings before their death.

Figure 3: Vanguard TRF glide path compared with a more aggressive and a more conservative hypothetical glide path



Notes: This hypothetical illustration does not represent any particular investment. Results may vary with each use and over time. For a detailed description of the assumptions used in the scenario analysis, see Appendix I.

Source: Vanguard.

10 There have also been some academic attempts to determine an appropriate glide path based solely on the specification of investor preferences and a variety of assumptions about capital markets and labour income patterns, using some sophisticated modelling techniques. As a part of its ongoing oversight process, Vanguard has also conducted similar exercises. See, for example, Viceira (2001) and Gomes and Kotlikoff (2008).

Given this additional complexity, we choose to evaluate alternative glide paths by focusing on the following questions;

- How much wealth might investors expect to accumulate at the point when they begin retirement?
- How likely is it that different TRFs will generate enough wealth by retirement date to purchase an annuity that will generate the target level of income in retirement?
- If retirees draw down their TRF savings by spending their target level of income, how likely is it, at different ages, that they will run out of money before they die?
- And how much wealth can retirees expect to leave on their death at different ages?

To begin, we examine how much wealth is accumulated under different scenarios. Figure 4 compares the glide paths shown in Figure 3 under a baseline simulation yielding a predictable outcome. The more aggressive the glide path, the greater the wealth accumulation, on average.

This baseline simulation adopts the following assumptions which are designed to capture the characteristics of an average member in a DC pension savings plan:

- Members enter the work force at age 25 and retire at state pension age of 68. Consequently, their career length is 43 years.
- Total pension contribution is assumed to be 8% of the individual's income at age 25, this gradually increases to 11.5% as they reach retirement (or state pension age).

Further details of these underlying assumptions are provided in Appendix 1.

After contributing over a 43-year period, the median hypothetical investor in the Vanguard glide path retired with 14.8 times his or her ending annual salary. The median investor in the more aggressive glide path accumulated an additional 12% more than those in the

Vanguard glide path, with 16.7 times his or her ending salary; however, this required investors to assume additional risk at all stages of their life cycle, as shown by the 5th-percentile multiple. By contrast, investors in the more conservative glide path accumulated about 12% less than investors in the Vanguard glide path because of the lower equity allocation.

Figure 4: Average wealth accumulated as a multiple of salary at retirement (age 68) under different TRF glide paths

	More conservative glide path	Vanguard glide path	More aggressive glide path
Median	13.1	14.8	16.7
5th percentile (pessimistic scenario)	5.3	5.2	5.0
1st percentile (more pessimistic scenario)	3.8	3.6	3.3

Notes: This hypothetical illustration does not represent any particular investment. Numbers in this chart represent multiples of an investor's ending salary at retirement. For example, an investor in the Vanguard glide path would accumulate assets equal to 14.8 times his or her ending salary, on average, over a 43-year investment period. See Appendix I for additional details on the simulation.

Source: Vanguard.

If we expect the risk–reward relationships of the past to prevail in the future, it makes sense that higher allocations to riskier asset classes will most likely lead to greater wealth accumulation and retirement income over an investor's life cycle. However, in a pessimistic scenario, as represented by the 1st and 5th percentiles, investors in the more aggressive glide path had lower ending wealth than investors in the more conservative glide path. If wealth maximisation is the primary goal, then a higher equity allocation would be an appropriate strategy. It is worth bearing in mind that this does not account for the downside risk that investors would need to withstand (as just mentioned) on a short-term basis to realise the greater wealth accumulation over their entire life cycle. Conversely, if minimisation of risk is the goal, simulation results would lean toward much more conservative allocations along the glide path.

Evaluating retirement income sufficiency

There are a number of ways to evaluate the capability of different TRFs to deliver an appropriate income stream in retirement. In principle, if a given TRF has allowed more wealth to be accumulated, then the retiree can enjoy a higher income in retirement. But the income available in retirement is not uniquely defined since differing rates of spending will have implications for how quickly the retiree runs out of money. To remove this ambiguity, we instead follow the standard industry definition of retirement income sufficiency¹¹ based on a replacement-rate methodology; this assumes that retirees spend exactly enough of their savings to maintain their pre-retirement lifestyle. A replacement ratio of 75% is commonly used to benchmark retirement behaviour in the UK.¹²

As a base-case scenario, we assume an individual earning £24,500 per year¹³ at age 68 will need to replace 75% of that salary at age 68, or roughly £18,400, as an annual spending goal, adjusted for inflation. An amount equal to 31% of the individual's salary at age 68 (£7,700) should come from the state pension¹⁴, so, to get to 75%, an amount equal to 44% of that salary (£10,700) will need to come from private sources, i.e. from the TRF in this context (See Appendix I for additional detail on our use of replacement ratios). From this point on, we will refer to the income needed from private sources as the target level of income.

Having assumed a given sufficient level of spending in retirement, it is now possible to evaluate different glide paths. One way to perform this evaluation is by calculating the probability of the investor accumulating assets sufficient to purchase an annuity¹⁵ with an annual payout equal to the target level of income from private sources.

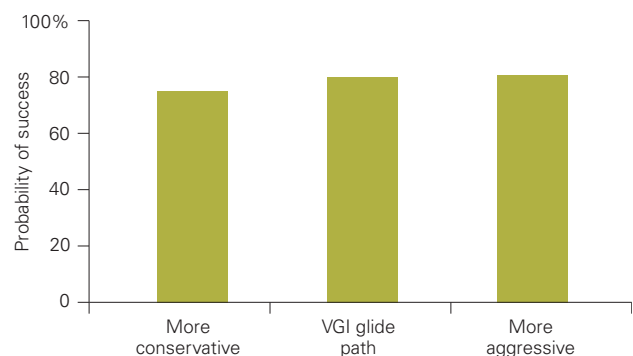
The target level of wealth to purchase an appropriate annuity was identified as approximately £195,000¹⁶, or about 8 times the retiree's £24,500 ending salary. Note that an investor in the Vanguard TRF would have an 80% chance of securing this level of savings. This would allow them to buy an annuity that equalled or

exceeded the target level of income (see Figure 5). When annuity rates are low, the target level of wealth required to purchase an annuity is higher. This is likely to encourage the typical investor to take on more risk by pursuing a more aggressive glide path. Yet, this aggressive glide path produces a similar probability of success to the Vanguard glide path because of the increased likelihood of an investor experiencing a downside event.

In contrast, if an investor requires a higher annual payout¹⁷ or opts for an inflation-adjusted payout, the cost of purchasing the annuity would be higher. As long as this investor is prepared to take on more risk, he or she would have a higher probability of success in one of the more aggressive glide paths, as a result of greater upside potential with higher equity allocations.

If the investor chooses not to purchase an annuity, and decides to systematically draw down from the portfolio in retirement, an additional evaluation is needed to help determine the implications of choosing different glide paths. Now, we are defining the retirement-income objective as having a positive balance at the ages of 85 and 95, essentially the likelihood of accumulating enough assets to last a typical investor through his or her retirement years.

Figure 5: Probability of accumulating assets sufficient to purchase an annuity to meet target level of retirement income



Source: Vanguard

¹¹ This concept of sufficiency is distinct from the idea of having sufficient income to meet some minimum absolute standard of living.

¹² This 75% replacement ratio is adopted from the analysis conducted by the Pensions Commission in 2004. This is commonly used to benchmark retirement behaviour in the UK. Please see figure A2 in Appendix I for more details.

¹³ Simulated median salary at age 68, based on the Annual Survey of Hours and Earnings (ASHE) 2014 released by Office of National Statistics on 16 July 2015.

¹⁴ The full new state pension (as of October 2015) will be £155.65 per week. For more details see: <https://www.gov.uk/new-state-pension>.

¹⁵ Investors intending to buy an annuity in retirement would be better served by a different glide path focusing on maximising the value of their portfolio at retirement. This is typically achieved by de-risking the portfolio and gliding into a complete long bond allocation as the investor approaches retirement.

¹⁶ Note that in the annuity example, we do not assume payments are adjusted for inflation. This is because in most private, corporate pension plans, annuity benefit payments are not typically adjusted for inflation. It has also been Vanguard's experience that among investors who do choose to annuitise retirement assets, the vast majority do not choose inflation-adjusted payout options.

¹⁷ We also evaluated the glide-path success using a significantly more conservative assumption that an investor must replace 64% of ending salary from private sources (annual payout equals £15,600). A comparable annuity in this example would cost approximately £285,000, or about 12 times ending salary. In this scenario, a participant in the Vanguard glide path would have a 75% probability of accumulating sufficient assets to purchase an annuity.

Figure 6: Probability of achieving target level of retirement income under different TRF glide path scenarios

	Systematic Drawdown	
	Positive balance at age 85	Positive balance at age 95
More conservative	93%	83%
VGI glide path	93%	86%
More aggressive	93%	87%

Source: Vanguard.

Figure 6 shows the probability that the chosen TRF will meet this objective when the retiree withdraws the target level of retirement income. On this basis, the Vanguard glide path provides probabilities of at least 86% that the TRF will generate enough funds throughout the retiree’s lifetime to meet the target retirement income to the end of life (age 95) and an even higher probability, 93%, of generating this income to age 85.

Apart from the potential to generate higher income in retirement, there are also additional potential benefits to holding a TRF compared to an annuity because upon early death, the annuity holder will bequeath no assets whereas for the owner of the TRF, the residual pool of assets will still be available to pass on. Figure 7 shows the median level of wealth outstanding for retirees who die at different ages. So using the Vanguard glide path, for a retiree dying at age 68, wealth equal to almost 15 times their ending salary is left in the median outcome; for someone dying at age 95, an even greater sum of wealth (almost 27 times their ending salary) is bequeathed by the median investor. In fact, assuming the long-term growth prospects of the TRF, in the median case, the asset base keeps increasing even in retirement, when the retiree is drawing income from the TRF equivalent to the retirement income paid out by a fixed annuity. Unsurprisingly, these expected bequests

are even higher for the more aggressive asset allocation, and lower for the more conservative one. (See Appendix II for a comparison of the material differences between an income annuity and a systematic withdrawal programme.)

Figure 7: Average wealth accumulated over time using a systematic drawdown equivalent to fixed annuity from the TRF (as a multiple of salary at age 68)

	Systematic Drawdown			Using annuity
	At age 68	At age 85	At age 95	
More conservative	13.1	15.5	16.7	–
VGI glide path	14.8	21.3	26.8	–
More aggressive	16.7	28.3	39.1	–

Source: Vanguard.

Higher replacement rate decreases probability of retirement sufficiency

The investor’s probability of achieving the target level of retirement income is slightly higher in the more aggressive glide paths. For this reason, an investor who decides to draw down his or her portfolio more aggressively would benefit from a more aggressive glide path. For example, if an investor needs to replace 64% (instead of 44%) of his or her ending salary from private sources, he or she would have a 63% probability of still having some money left at age 95 in the more conservative glide path, and a 71% and 75% probability in the Vanguard and the more aggressive glide paths respectively (not detailed in Figure 6). Because many investors have uncertain income requirements in retirement, the Vanguard glide path maintains a moderately higher equity exposure, relative to the more conservative glide path, to counter the uncertainties of retirement spending. The upside potential of a higher equity allocation is evident in the median wealth balance through retirement (see Figure 7).

Higher savings rate increases probability of retirement sufficiency

Given the uncertain nature of the capital markets, investors need to understand what can and cannot be controlled. Equity and bond market returns cannot be controlled; however, the amount an investor saves can be controlled. So here we conduct a robustness check on our conclusions by varying assumptions about individual saving.

Figure 8: Probability of achieving target retirement income from TRF under different savings scenarios

	Probability of having money left	
	At age 85	At age 95
Reduced saving rate	88%	79%
Baseline savings	93%	86%
Increased savings rate	98%	94%

Source: Vanguard.

Figure 8 examines the impact of changing an investor’s contribution rate. Specifically, we assume that an investor stayed the course in the Vanguard TRF glide path for the full 43-year accumulation horizon, all else being equal, but reduced the savings rate to the auto enrolment¹⁸ minimum of 8%, or alternatively, increased the savings rate by a constant 4% over the baseline contribution rate from age 25 to 68. For example, in the increased saving scenario, someone who had been saving 8% of salary is now saving 12%. At both ages 85 and 95, the additional capital accumulation for the increased savings scenarios provides a higher probability of achieving the retirement-income goal (in Figure 8, 98% and 94%, respectively) than does exposure to a slightly more risky asset allocation by investing the baseline contribution in the more aggressive glide path (in Figure 6, 93% and 87%, respectively). Therefore, to reliably increase the probability of retirement readiness, prudent portfolio construction must be accompanied by a diligent savings programme.

The probability of successfully achieving an appropriate wealth accumulation or systematic withdrawal objective, however, cannot be considered in isolation. To realise the projected outcomes, it is assumed that the investor remains invested in the glide path to retirement or, in the case of a systematic withdrawal programme, beyond the retirement date, regardless of market environment¹⁹. Baseline simulations show that for each glide path, in the 10th percentile observation for a systematic drawdown, investors have a low probability – but a possibility, nonetheless – of depleting their assets before age 85.

Probability of retirement sufficiency for high earners

Another robustness check we can carry out is to examine whether the conclusions derived so far still hold true for investors at different levels of income. Even though savers with lower levels of income will typically have more demanding replacement ratios, the fact that state funding is fixed means that those on lower income don’t rely as heavily on private sources of income as their higher income counterparts. See Appendix 1 Figure A2.

To examine this, we considered a high earner with a high replacement ratio. We analysed the possible outcomes for this high income individual with an ending salary of £70,000 and a replacement rate of 75% using a range of glide paths and saving rates. An amount equal to 11% of the individual’s salary at age 68 (£7,700) should come from the state pension²⁰, and an amount roughly equal to 64% of that salary (£45,000) will need to be funded by private sources. We then compared the probability of having money left while generating the higher target income this investor needs using different glide paths and savings rates. This investor would have a 63% probability of having money left at age 95 in the more conservative glide path, and a 71% and 75% probability in the Vanguard and more aggressive glide paths, respectively (not detailed in Figure 6). Likewise, this investor would have a 62% probability of having money left at age 95 if they saved at a decreased rate (not detailed in figure 8), and a 71% and 84% probability in the baseline and increased saving scenarios, respectively (not detailed in Figure 8). While taking a more aggressive glide path and more saving can both increase the odds of success, it’s worth noting the relative significance of the savings rate over the selection of glide path.

¹⁸ For more details, please see ‘Contribution rates’ in Appendix I.

¹⁹ Vanguard research shows that among plan participants, pure target retirement investors have been historically less likely to abandon equities in times of market volatility relative to non-target retirement investors (Mottola and Utkus, 2009).

²⁰ The full new state pension (as of October 2015) will be £155.65 per week. For more details see: <https://www.gov.uk/new-state-pension>.

Sub-asset allocation of the glide path: Diversifying within major asset classes

Once the broad allocation among equities and bonds across the life of the portfolio has been determined, the focus turns to sub-asset allocation – how to allocate across various types of equities and bonds. For broadly diversified, balanced portfolios such as the Vanguard TRFs, exposure across all key sub-asset classes means the investor will always be able to participate in some of the stronger-performing sectors while also mitigating the negative impact of weaker-performing ones.

The level of equity exposure and the rate of change in that exposure as the investor ages are the most recognisable components of risk in TRFs and the most significant drivers of long-term performance. However, over shorter periods, performance differentials can stem not only from differences in the portfolio's broad asset allocations but also from the portfolio's relative allocation to sub-asset classes within equities and bonds (Cole, Kinniry, and Donaldson, 2009). It is important for plan sponsors and investors to be aware of the trade-offs associated with various sub-allocations within both the more risky asset class (equities) and the less risky asset class (bonds).

Global ex-UK equity allocations

Vanguard research (Westaway et al., 2014) has demonstrated the benefits of diversifying outside the UK within an investor's equity allocation. The advantages of this approach include reducing concentration risk and minimising sector biases, which can provide a more stable return stream over time. Financial theory dictates that an upper limit should be based on the global market capitalisation for global ex-UK equities (currently approximately 92%), our research has shown that diversification benefits can be achieved through less than fully market proportional allocations. Vanguard TRFs seek to offer balance among the benefits of diversification, investor preferences for their domestic market and the risks of currency volatility. Currently, the allocation to global ex-UK equities is 75% of the total equity allocation. Global ex-UK equities are represented by a market-cap-weighted portfolio that seeks to track the performance of equities in the developed and emerging markets, excluding the United Kingdom.

A market-cap-weighted portfolio reflects the consensus estimate of each company's value at any given moment. Because current prices (and, hence, company values) are set based on current and expected events, market-cap-weighted portfolios represent the theoretically expected mean-variance efficient portfolio of securities in a given asset class (Philips, 2012a). Vanguard does not maintain a separate allocation to real estate investment trusts (REITs) within the TRFs. However, to the extent that REITs are part of the global equity portfolio, the Vanguard TRFs include exposure to REITs as part of the UK and global ex-UK equity allocations at their market weights.²¹

UK equity allocations

The UK equity allocation within the Vanguard TRF portfolios is weighted according to prevailing market capitalisation within the UK. This means that the investor will always have exposure to all segments of the broad UK stock market (large-, mid- and small-cap equities; growth and value equities) in the proportion in which they are represented in the market.

Hedged global ex-UK fixed income allocation

Hedged global ex-UK bonds allow an investor to achieve exposure to the interest rate profile, inflation and economic cycles, and political climate of a wide range of markets outside of the United Kingdom within their fixed income allocation. Relative to a more UK-focused bond investment, this can provide a more stable return stream through time. Financial theory dictates that an upper limit should be based on the global market capitalisation for global ex-UK bonds (currently approximately 94%), our research has shown that diversification benefits can be achieved through less than fully market proportional allocations. When constructing the Vanguard TRFs, we aimed to find a reasonable trade-off between the benefits of diversification and investor preferences for the domestic market. Currently, the allocation to global ex-UK hedged bonds is 65% of the total fixed income allocation. Hedged global ex-UK bonds are represented by a market-cap-weighted index that measures the investment return of investment-grade bonds, excluding the United Kingdom.

As with other asset classes, we follow a market-proportional approach within the investment-grade international bond market. Although risk factors such as interest rate fluctuations, inflation, economic cycles and issues associated with changing or unstable political regimes may seem worrisome to UK investors,

21 For an empirical analysis of REITs, see Philips, Walker, and Zilbering (2011).

these should be viewed in the appropriate context. For example, although the bonds of any one country may be more volatile than comparable UK bonds, a portfolio that includes the bonds of many countries and issuers would benefit from imperfect correlations across those issuers. It's also important to note that currency fluctuations account for a significant portion of the volatility in global ex-UK bonds – volatility that is mitigated by Vanguard's decision to hedge this exposure.

UK fixed income allocations

Similar to our market-cap-weighted methodology used elsewhere, Vanguard follows a market-proportional approach within the UK nominal investment-grade bond market to match the market's risk-and-return characteristics as an investor approaches retirement. The key purpose of this allocation to nominal UK investment-grade bonds is to provide diversification to the primary risk of a sizable equity exposure.

Short-term index-linked bonds (linkers)

In a portfolio of traditional fixed-income securities, investors cannot, with certainty, manage inflation risk – the risk that the returns earned across the investor's time horizon will fall short of actual inflation. That is because a bond portfolio's real (inflation-adjusted) value falls when actual inflation exceeds the expected rate of inflation that was built into market interest rates at the time the investor purchased the bond. The advent of index-linked gilts (linkers) over the past few decades – providing inflation-adjusted increases in both principal value and interest payments – has given investors the opportunity to manage the extent to which their fixed-income portfolios are subject to general inflation risk.

Although the risk of inflation is prevalent throughout an investor's life cycle, it's primarily in the later stages that investors must focus on investment tools to provide some protection. This is because for investors in the accumulation stage, inflation protection can be effectively provided from salaries and higher real returning assets, such as equities. But once in retirement, it is much more difficult to add to a portfolio through additional earnings; shorter-term changes in inflation thus become a concern. As a result, investors must balance the need to preserve capital through bonds and cash with the need to preserve their purchasing power. Given that index-linked gilts adjust to changes in inflation quickly, linkers are an appropriate substitute for a portion of the portfolio's equity allocation during retirement. Vanguard research shows that shorter-term linkers have historically

displayed a higher correlation to realised inflation with less duration risk than longer-term linkers. This can provide investors with a stronger inflation hedge and less duration risk – albeit at the cost of somewhat lower expected total returns. The primary purpose of linkers in the near-dated funds is to provide inflation protection for investors, not to boost returns.

Vanguard thus dedicates a portion of each TRF's total fixed income allocation to short-term UK linkers as a diversifier, beginning five years before retirement and representing 30% of UK fixed income, reaching a maximum allocation of 17.5% of the total portfolio at age 75. As a result, for later stage portfolios, the fixed income allocation combines a market-proportional allocation to nominal UK investment-grade bonds and a meaningful allocation to linkers.

Since TRF portfolios use bonds as the primary diversifier for equities, it is important to recognise that some components of the bond allocation can contribute to the portfolio's overall risk level and to its return variability, particularly over shorter periods. Historically, the correlation between equity and bond returns has been low; however, in extreme market conditions, the correlation between equities and higher-risk, more aggressive bonds (i.e., corporate bonds) is much higher, which can diminish the diversification benefit of holding bonds as a general asset class. In an extreme down market, an explicit allocation to linkers in the more conservative portfolios also provides a potentially beneficial relative overweight to high-quality government bonds at a time when the investor can least afford the possibility that the bond allocation might react similarly to the portfolio's equity allocation.

Role of non-traditional asset classes

Non-traditional asset classes and alternative investment strategies could be considered for use in shaping the risk-return profiles of some TRFs. These non-traditional asset classes can include REITs, commodities, private equity, emerging market bonds, and high-yield bonds. Among other alternative investment strategies are long/short and market neutral approaches. These asset classes and strategies can offer potential advantages compared with investing in traditional equities, bonds, and cash, including:

- Potentially higher expected returns.
- Lower expected correlation and volatility vis-à-vis traditional market forces.
- The opportunity to benefit from market inefficiencies through skill-based strategies.

Although these potential advantages are often debated, it can be difficult to assess the degree to which they can be relied upon. This is even more evident for those strategies in which investable beta is not available.²² Strategies such as long/short, market neutral and private equity largely depend on manager skill; investors will therefore be subject to the distribution of manager skill, with success dependent upon consistently selecting top managers.²³

Non-traditional bond strategies, such as high-yield and emerging market are not included in the bond allocation, since they represent a small portion of the global bond markets and, at market weight, would not significantly alter the risk-and-return makeup of a broadly diversified portfolio. If, on the other hand, non-traditional bonds are over-weighted to the market, Vanguard analysis has shown that these bonds have not historically provided meaningful diversification to a balanced portfolio, but instead have increased average volatility and downside risk (if replacing investment-grade bond positions) (Schlanger, Jaconetti, Westaway, Daga, 2016). Vanguard has thus concluded that adding this exposure to the TRFs does not warrant the additional complexity without providing meaningful benefits.

Commodities provide another example of complexity introduced with allocations to non-traditional assets. While recognising the historical portfolio diversification benefit of including commodities (specifically, commodities futures), we caution against making such an allocation solely on the basis of an extrapolation of historical commodity returns. The long-term economic justification for expecting significant, positive returns from a static, long-only commodities futures exposure is subject to ongoing debate.

Given our current assessment of the risks, costs and the additional complexities involved, Vanguard TRF portfolios do not explicitly include an allocation to non-traditional and alternative asset classes.

Key implementation considerations

Active versus indexing

Discussions regarding the active/passive decision have recently become more commonplace among investors and investment professionals. Indexing offers broad diversification, low costs, market like returns and transparency. Indexing has been instrumental in reducing surprises in investment performance and controlling risk. Costs are one of the few variables investors can control, and that cost advantage is particularly important for TRFs (especially given recent regulatory developments such as the retail distribution review [RDR]). Compared with index funds, actively managed mutual funds typically have higher management fees coupled with higher transaction costs: the higher fees often result from a portion of the management fee that must cover the research process; higher transaction costs are attributable to the generally higher turnover associated with active management's attempt to outperform the market.

While active management does offer the opportunity to outperform the market, it may involve higher costs and additional risks, including manager risk, security selection and underperformance. Ongoing oversight of active managers may also be a more complex task from a fiduciary viewpoint because of these risks.

Active management can play an important role for investors willing to accept the risks of active investing in exchange for potential outperformance. Since, in aggregate, active managers can't all add value, indexed investing makes sense as a starting point for many investors. While low-cost active management can be a good choice for some, taking on active manager risk is a decision that we believe investors should make on their own.

²² Investable beta in this instance is a publicly available index which can be wholly invested.

²³ For a more detailed discussion of the use of alternatives, see Kinniry and Philips (2007), and for additional details and empirical analysis of commodities as investments, see the Vanguard publication *Investment case for commodities? Myths and reality* on <https://advisors.vanguard.com/iam/pdf/ICRMR.pdf>.

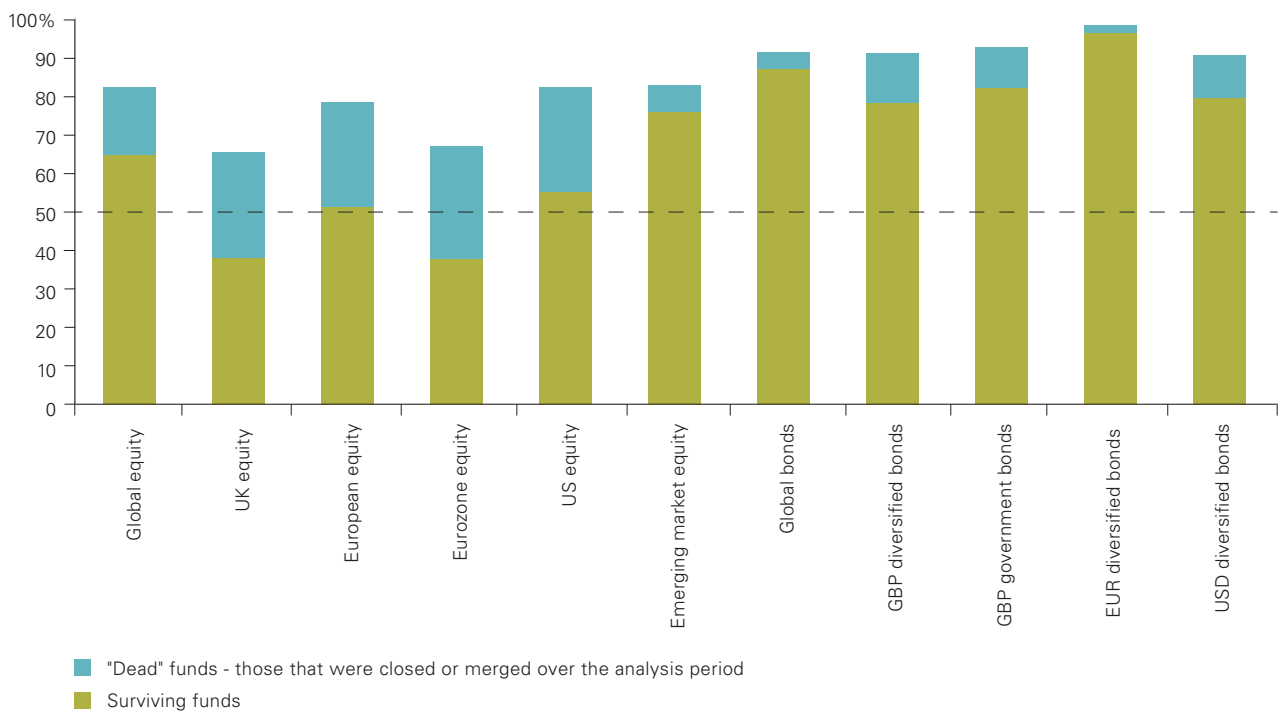
In constructing the Vanguard TRFs, we strongly believe that any risks investors bear should be expected to produce a compensating return through time. Modern portfolio theory and years of financial practice lead us to conclude that diversified, broad-based index exposures are precisely this kind of compensated risk. While some active managers can add value at least some of the time, outperformance cannot be guaranteed.

Figure 9 provides a sense of how active management has performed across common asset classes and sub-asset classes, compared with the benchmark indices they have specified in their own prospectus. The chart shows how difficult it can be for active managers to outperform their indexed peers, especially when accounting for funds

that were closed or merged during the ten years ended December 31, 2014. Once the effects of survivorship bias were taken into account by including merged and closed funds, more than 50% of funds underperformed their benchmark across all 11 fund categories.

If we look at the issue from a structural standpoint, index funds provide transparent investment options that result in a more efficient portfolio and broad diversification. Index funds can also offer plan sponsors and investors investments that can deliver over the long term, without the need of a fund manager to continually monitor performance and make changes because of capacity constraints, manager turnover or loss of confidence in a manager.

Figure 9: Percentage of active funds underperforming average return of low-cost index funds



Notes: Data are for the ten years ended December 31, 2014.

Fund universe includes funds available for sale in the UK, filtered according to the description above, from the following Morningstar categories: UK equity – flex cap, large-cap blend, large-cap growth, large-cap value, mid-cap, small-cap; Europe equity – Europe OE: flex-cap, large-cap blend, large-cap growth, large-cap value, mid-cap, small-cap; Euro zone equity – flex-cap, large-cap, mid-cap, small-cap; Global – flex-cap, large-cap blend, large-cap growth, large-cap value, mid-cap, small-cap; US equity – flex-cap, large-cap blend, large-cap growth, large-cap value, mid-cap, small-cap; Emerging markets equity – emerging markets; Europe bond – EUR diversified; US bond – USD diversified; Global bond – global un-hedged bond; UK bonds – UK diversified, UK government. Performance is for periods ending on 31 December 2014. Performance is calculated relative to prospectus benchmark. Fund performance is shown in GBP terms, net of fees, gross of withholding tax, with income reinvested, based on closing NAV prices.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

Conclusion

Vanguard target retirement funds are constructed based on investment best practice, critical in enabling an investor to realise their retirement goals. Vanguard TRFs have been designed by combining capital markets and portfolio construction research with Vanguard's vast global practical experience to offer a diversified portfolio, professional portfolio management, and automatic rebalancing at a low cost. TRFs adapt over time to the investor's stage of life to their retirement date and beyond. Vanguard TRFs are straightforward and transparent by design and implemented with broad-based exposure to major asset classes. This low cost approach is designed to maximise the impact of these funds for investors.

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Appendix I. About the Vanguard Capital Markets Model and study assumptions

Vanguard Capital Markets Model

The Vanguard Capital Markets Model (VCMM) is a proprietary financial simulation tool developed and maintained by Vanguard’s Investment Strategy Group. The VCMM uses statistical analysis of historical data for interest rates, inflation and other risk factors for global equities, fixed income and commodity markets to generate forward-looking distributions of expected long-term returns. The asset-return distributions shown in this paper are drawn from 10,000 VCMM simulations based on market data and other information available as of June 30, 2015. Our simulations do not incorporate the impact of costs and expenses.

The VCMM is grounded in the empirical view that the returns of various asset classes reflect the compensation investors receive for bearing different types of systematic risk (or beta). Using a long span of historical monthly data, the VCMM estimates a dynamic statistical relationship among global risk factors and asset returns. Based on these calculations, the model uses regression-based Monte Carlo simulation methods to project relationships in the future. By explicitly accounting for important initial market conditions when generating its return distributions, the VCMM framework departs fundamentally from more basic Monte Carlo simulation techniques found in certain financial software. Readers are directed to the research paper titled Vanguard Capital Markets Model (Davis, Aliaga-Díaz, Ahluwalia, Polanco, and Tasopoulos, 2015) for further details.

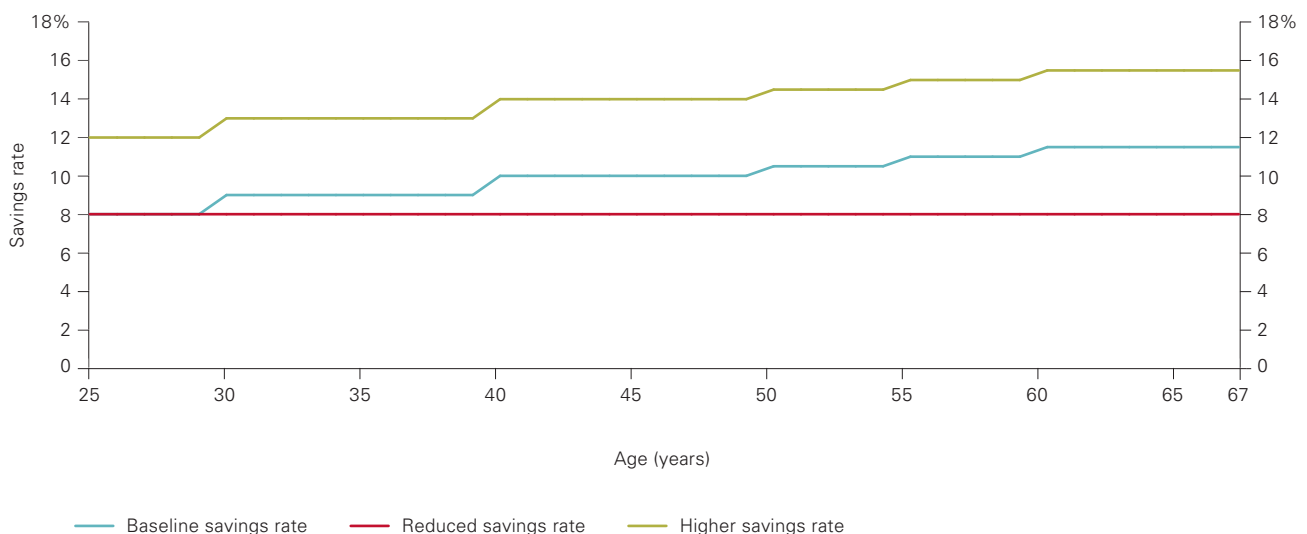
Wage scale

Investor salary growth is modelled based on the Annual Survey of Hours and Earnings (ASHE) 2014 released by Office of National Statistics on 19 November 2014. The wage index used in our analysis is based on reported median wages of full time workers across an age spectrum of 16 to 60 and beyond. This wage scale allows us to trace the earnings progression of an average earner over a 43-year working career, from age 25 to 68, accounting for factors such as career development. Therefore, as modelled, the average member reaches a peak salary at age 45 (in real terms) and experiences a decline in real salary as they approach the state pension age of 68²⁴. In our life cycle simulations, we assume a 1.5% annual salary growth, on a real basis, in addition to the cross-sectional increase in the wage scale, which reflects the forecasted average productivity growth of the UK economy.

Glide path allocations

The simulations use three different TRF glide path allocations: the Vanguard glide path, the more conservative glide path and the more aggressive glide path. The Vanguard glide path reflects Vanguard’s current allocations; the more conservative glide path reallocates 10% of the Vanguard glide path’s equity exposure proportionately across all other asset classes; and the more aggressive glide path increases Vanguard’s glide path’s equity allocation by 10%, which is taken proportionately from the other asset classes.

Figure A1: Pension contribution scenarios



Source: Annual Survey of Hours and Earnings (ASHE) 2014 by Office of National Statistics, Vanguard calculations

²⁴ While the current state pension age is 65, we have observed a consistent extension of the state pension age (SPA) stipulated by the Pensions Acts. To reflect the long term equilibrium we assume the SPA to be 68 years for both men and women in the UK.

Contribution rates

Age-specific contribution rates are derived from the Annual Survey of Hours and Earnings (ASHE) 2014, which was released by the Office of National Statistics on 16 July 2015. Contribution patterns account for the likelihood that investors will start with a lower savings rate in their early working years and increase their contributions as their retirement date approaches. In the baseline scenario, we assume that a saver makes a total contribution of 8% of their income at age 25. This gradually increases to 11.5% as they approach retirement. Employer contributions start at approximately 4% at age 25 and increase to approximately 7.5% at age 68. In addition, the simulations include a consistent employee contribution of 4%, which is consistent with the observed average over the last decade (from 2005 to 2014).

The reduced savings rate scenario assumes a flat 8% total contribution rate reflecting the mandatory auto-enrolment²⁵, which comes into effect in the UK in April 2018. The higher savings rate scenario assumes an additional 4% contribution over the baseline savings scenario.

Replacement ratios and drawdown scenarios

We follow industry convention in assuming that retirees will spend a percentage of their salary at age 68 every year in retirement from a combination of the state pension²⁶ and investment income from private sources. The replacement ratio is consistent with retirees maintaining the same standard of living enjoyed during their final working years.

Vanguard draws on the work of the Department of Work and Pensions documented in the *Framework for the analysis of future pension incomes, September 2013* to assign appropriate replacement ratios based on retirees' ending salary. The replacement ratio benchmarks for different income levels is taken from the first report published by the UK Pension Commission in 2004 and expressed in 2013 earnings terms as a percentage of gross earnings. It's worth noting that the replacement ratios used by the Department of Work and Pensions are based on average salary from age 50 to state pension age (currently 65, but gradually increasing to 68 by 2046), rather than the ending salary at age 68. In the interest of clarity, we have converted the replacement ratio and based it over the ending salary, without disturbing the post retirement income. In practice, this can be illustrated by considering the retirement income need of an individual on median income. The average salary from age 50 to the state pension age in the UK is £27,000 per annum, whereas the average ending salary (at age 68) is £24,500. This means that the annual spending goal²⁷ of 67% of £27,000, the average earnings from year 50 to the state pension age in retirement, would amount to £18,400, which is equivalent to 75% of the ending salary of £24,500 at age 68.

Even though savers with lower levels of income will typically have more demanding replacement ratios, the fact that state funding is fixed means that those on lower income don't rely as heavily on private sources of income as their higher income counterparts. See Figure A2 for more details on replacement ratios across various income brackets in the UK.

Figure A2: Replacement ratio benchmarks for different income levels as used by the UK Pensions Commission 2004, expressed in 2012 earning terms

Income bands in 2012 earning terms	Target replacement rate (% of salary)		Retirement income (% of salary at age 68)	
	Age 50 to SPA	At age 68	State pension	Private sources
Up to £12,000	80%	90%	86%	3%
£12,000–£22,100	70%	79%	51%	28%
£22,100–£31,600	67%	75%	31%	44%
£31,600–£50,500	60%	67%	21%	46%
Over £50,500	50%	56%	12%	44%

Notes: Retirement income from the state pension and private sources may not add up to the target replacement rate at age 68, due to rounding.

Source: UK Pensions Commission 2004 (p.143), Vanguard calculations

²⁵ For more details please see www.gov.uk/workplace-pensions.

²⁶ The new state pension comes into force from 6 April 2016. For details see: <https://www.gov.uk/plan-retirement-income/your-pension-options>.

²⁷ For a further breakdown of replacement ratios at various preretirement salary levels, see DWP, July 2012, Estimates of the numbers of people facing inadequate retirement incomes.

Annuity examples

Annuity rates are for an immediate joint annuity for a 68-year-old male and female couple with an annual payout equal to the required replacement ratio and a 50% benefit to the survivor. These rates were estimated by Vanguard using the Money Advice service²⁸ set up by the UK government to offer free and impartial money advice. In settling for an annuity rate of 5.5% we considered a range of postcodes and health circumstances (from good to moderate health) as of 9 October 2015. Additionally, we assumed no guarantee period and a fixed annuity amount where the retiree does not withdraw a tax-free cash lump sum from his or her retirement savings. Even though life expectancy in the UK is anticipated to rise over time, the time in retirement stays stable as the state pension age is increased at a pace similar to the increase in life expectancy. To estimate future annuity prices, we looked at annuity rates available to someone retiring today at the age of 65. See Appendix II, which compares an annuity with a systematic withdrawal plan.

Asset returns

The asset-return distributions are based on 10,000 simulations from the VCMM. The VCMM uses a statistical analysis of historical data to create forward-looking expectations for the UK and international capital markets. The model uses index returns, without any fees or expenses, to represent asset classes. Taxes are not factored into the analysis. Inflation is modelled based on historical data from the Consumer Price Index and simulated going forward with the median and volatility

and correlation displayed in Figure A3 and Figure A4.

UK equities are represented by the MSCI UK Index; International (ex-UK) equities are represented by MSCI All Country World ex-UK Index. UK Bonds are represented by Barclays Sterling Aggregate Gilts Index; International (ex-UK) bonds are represented by Barclays Global Aggregate ex-GBP Bond Index; short-term inflation-linked gilts (or linkers) and cash are derived from underlying UK inflation linked gilt data from the Bank of England.

Figure A3: Annualised 75-year asset return distributions based on forward looking simulations

	Median annualised return	Median annualised standard deviation
Domestic equity	9.2%	19.9%
International equity	9.6%	21.5%
Sterling bonds	4.3%	9.4%
Inflation	2.1%	3.0%
International bonds	4.4%	4.8%
Cash	3.4%	2.1%
Short-term linkers	3.7%	7.0%

Note: Short-term linkers = Short-term inflation-linked gilts

Source: Vanguard.

Figure A4: Asset-class correlations based on forward looking simulations

	Domestic equity	International equity	Sterling bonds	Inflation	International bonds	Cash	Short-term linkers
Domestic equity	1.0						
International equity	0.6	1.0					
Sterling bonds	-0.1	0.0	1.0				
Inflation	0.1	0.2	-0.1	1.0			
International bonds	0.0	-0.1	0.5	0.1	1.0		
Cash	0.0	0.0	0.2	0.1	0.5	1.0	
Short-term linkers	0.0	0.0	0.7	0.5	0.5	0.4	1.0

Note: Short-term linkers = Short-term inflation-linked gilts

Source: Vanguard.

28 <https://www.moneyadvice.service.org.uk/en>

Appendix II. Comparing an annuity and a systematic withdrawal plan

	Immediate – income annuity	Systematic withdrawal plan
Objective	To provide a fixed, guaranteed monthly payment for the life of the annuitant.	To gradually spend down a diversified portfolio that is managed for total return, rather than income. The goal is to provide some reasonable level of income over time.
Payments	Monthly; fixed, unless the annuitant chooses annual adjustments according to an inflation-based index or a fixed increment selected at the time of purchase.	Payments are usually made monthly. Strategies vary from simple percentage spending rules to more complicated market-dependent and tax-sensitive withdrawals. Investors' spendable income is not limited to portfolio yield, but can be based on initial capital and a portfolio's total return.
Costs and expenses	No initial sales loads, charges or surrender fees. Fees are incorporated into the rate quoted at the time of purchase. Also, see "Taxes" below.	Expenses vary depending on the underlying assets involved. The analysis of TRF in this paper does not include the impact of costs and expenses.
Liquidity	None. The annuitant surrenders any claim to principal in exchange for the annuity.	Depends on the assets involved. In most cases, shares can be redeemed at any time.
Guarantees and safety	Payments are guaranteed based on the claims paying ability of the insurance company that issues the annuity.	The investor receives no guarantees; payments and principal can go up or down significantly.
Fluctuation of principal	Not applicable, because the annuitant surrenders the principal.	Portfolio value can fluctuate significantly over time.
Taxes	Payments are generally treated as ordinary income.	Distributions may comprise any combination of income, capital gains, and return of capital.

Note: There may be other material differences to consider.

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