MILLIMAN WHITE PAPER

Annuities reinvented

Are annuities the missing asset class for sustainable drawdown solutions?

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Executive Summary

It is a well-established and widespread approach to invest in a diversified range of asset classes when developing a balanced investment fund. Over the last decade or so there has been a profusion of new, increasingly sophisticated portfolio construction techniques aiming to better cater for the needs of a long-term investor. Many of these techniques have merit but when it comes to funding a retirement income, is an important asset class being overlooked?

Understandably, many consumers want flexibility in their retirement and also aspire to leave something significant behind, the previous regime before pensions freedoms facilitated neither of these goals. However, unless people are very wealthy or suffer from particularly poor health, most people will also be looking for a stable, sustainable income over a retirement that could last in excess of 30 years. Could including annuities within the "asset mix" improve the chances of a retirement investment strategy continuing to provide an attractive retirement income over the retiree's lifetime? And, if so, how might this also impact any legacy after the retiree's death?

To help answer these questions we modelled a pure drawdown investment strategy (investing in a mix of equities and bonds) and a strategy based on combining an annuity with a drawdown fund (investing purely in equities). Both strategies also assumed the retiree retained some savings in cash. These two strategies were modelled under a wide range of different economic and market conditions for an extensive set of consumer preferences and circumstances.

For those enjoying a long life in retirement, our analysis revealed clear benefits to annuitising part of the retirement pot. The strategy resulted in a higher likelihood of maintaining a target annual income and also, somewhat surprisingly, a higher average death benefit. In this report you will meet Robin, a 65 year-old who is looking to take an annual income equivalent to 4% of her retirement pot and which moves in line with inflation. By combining a level annuity with an equity drawdown fund, Robin increased the likelihood of maintaining her target income until age 100 from 45% to 55%, compared to a drawdown fund investing in equity and bonds. Where sustainability of income is a priority, these results are significant.

For longer periods of retirement, annuitising part of the retirement pot resulted in a higher likelihood of maintaining a target annual income and a higher average death benefit.

Our modelling indicates that the relative merits of the two strategies vary in line with a whole range of factors: the customer's age and health status, their preference for a fixed or inflation linked income, the ongoing fee level on the drawdown funds, and the allocation to the various asset classes. However, looking across these variables, we found little in our results that could be used to justify not including annuities within the retirement conversation. Furthermore, the benefits they potentially provide to an income in retirement extend beyond the guarantee of "an income for life" that has traditionally been used to sell annuities.

The relative merits vary with a whole range of factors, but a combined annuity-drawdown strategy might provide benefits beyond just guaranteeing an "income for life".

At a time when more complex enhancements to a pure drawdown strategy have struggled to gain traction and the regulator is increasing its focus on consumer outcomes in retirement, we believe this research is important reading for anyone actively engaged with the retirement market.

Introduction

Milliman is among the world's largest providers of actuarial and related products and services. Our consultants in London have for a number of years been engaging with insurers and carrying out our own research to provide insight into the UK retirement market and the challenges faced by retirees.

In 2018, Just Group plc ("Just"), an insurance group offering retirement products in the UK market, commissioned us to explore various different strategies for providing a retirement income. To facilitate our research Just provided us with its annuity rates and consistent longevity assumptions, but all other assumptions are our own.

The new retirement

"Let me be clear. No one will have to buy an annuity" George Osborne, Chancellor of the Exchequer, 19th March 2014

On the 19th March 2014, George Osborne, then Chancellor of the Exchequer, radically changed the UK's retirement landscape with the announcement of 'Freedom and Choice' pension reforms ("pension freedoms"). The combination of this change in legislation and the continued shift from defined benefit to defined contribution pensions, means that an increasing proportion of UK retirees now have significant freedom over how to manage and spend their retirement wealth. This freedom appears to have resonated with consumers, who are taking advantage of the options available to them. Since the new regulation many consumers have accessed their pension pots before age 65 and there has been a significant shift away from annuity purchase. For example, in the first half of 2017, drawdown products outsold annuities by a ratio of three to one[1].

However, the shift from annuity to drawdown products places much greater responsibility on the customer themselves in terms of making their own retirement decisions, including deciding how to invest their money, how much to spend each year, and how long their money needs to last.

The dangers of reckless spending in retirement have been discussed extensively in relation to pension freedoms with fears that retirees could fritter away their pension pots on luxury sports cars or decadent holidays. So far this fear seems unfounded. In its Retirement Outcome Review[2], the FCA stated that it had not yet seen evidence of unsustainable pension spending. The FCA found that whilst 55% of pension pots have been fully withdrawn since the introduction of pension freedoms, this was mainly pots worth less than £30,000 and 94% of consumers who fully withdrew their pots had other sources of retirement income. It should, however, be noted that the current generation of retirees are more likely to have some defined benefit pension entitlement to supplement their defined contribution pot and unfettered drawdown has only been allowed for a few years.

Whilst the image of pensioners blowing all their savings in one go on frivolous purchases captured the media's attention, this seems to us an unlikely course of action for someone who has spent 40 to 50 years saving for retirement. It is not unreasonable to assume that they are far more likely to want to use their savings to enjoy retirement for as long as it lasts. In this case, the more realistic concern is whether consumers will outlive their retirement wealth, ultimately running out of money due to a combination of drawing too high an income, poor investment market performance, or living longer than expected. Of course there is also the contrasting risk that, due to concerns about sustainability, the consumer holds back and takes a lower income than their investments are capable of supporting. In such a scenario, the consumer might live an unnecessarily frugal retirement or leave behind a much larger legacy than planned.

Despite the change to the retirement landscape, the principal financial challenge in retirement remains the same but the key risks associated with that challenge are now increasingly borne by the customer. Pre-pension

[1] https://www.moneymarketing.co.uk/drawdown-sipps-continue-boom-non-advised-sales-growing/

[2] https://www.fca.org.uk/publication/market-studies/ms16-1-3.pdf

freedoms, the risk of running out of money was primarily the insurer's problem and it was their responsibility to consider the impact of an uncertain lifespan combined with uncertain market returns. However, compared to an individual consumer, the insurer is better placed to manage this risk by virtue of being exposed to the average experience across a pool of lives. Even customers who chose drawdown were protected by safeguards, via limits on income withdrawals and the need to effectively annuitise at age 75. Depending on the products used to provide an income in retirement, these risks now rest with the consumer. Furthermore, managing retirement wealth to provide a sustainable income is a somewhat different process to the accumulation phase, where the primary goal is (essentially) to save up as much money as possible. Instead, drawing a desirable but sustainable income from a retirement fund requires consumers to consider a different set of risks and potentially a wider range of asset classes and investment approaches to address these risks.

A further challenge in an unfettered drawdown environment is that the consequences of unsustainable spending may not become apparent for some time. For example, even a particularly aggressive withdrawal rates of say 15% p.a. or more might be sustainable for a number of years and so many consumers might not realise they are in danger of running out of money in the medium-long term.

Unfortunately retirees do not have the luxury of waiting until they become aware of the problem, as at that point it may well be too late to fix. Ideally, consumers need use their retirement pots sustainably from the start. Evidence from overseas would suggest that consumers do not have a great track record of successfully choosing sustainable levels of income, for example[3]:

- 40% of Australians have exhausted their pension savings by age 75; and
- on average, Americans withdraw 8% each year and make their savings last for 17 years - a full 5 years before the average life expectancy for a 65 year old American.

All this raises the key question, what should retirees be doing with their pension pots?

Milliman consultants have worked with a number of UK insurers to investigate the properties of a wide range of retirement products. In a recent previous paper[4] we explored the risks and benefits of pure drawdown funds in comparison to a variety of retirement products that offered varying types of income guarantee. We showed that it was important for consumers not to over-insure themselves by exclusively investing in retirement products which feature guarantees (including annuities), since such products might limit the level of retirement income, reduce flexibility, and the guarantees themselves may not offer good value for money.

However, utilising a pure drawdown product on its own might not be the optimal strategy either. US financial adviser, William Bengen, suggested in 1994 that a 4% annual withdrawal rate, adjusted for inflation each year, could be sustainable for life - the 'Bengen Rule'. Recently, this has been challenged. Morningstar Research[5] suggests that nearer 3% is a more realistic figure for UK retirees.

The caveat with drawdown is that, whilst it offers retirees the potential to benefit from higher returns earned on equity investments (as shown in our previous research), if the priority is to provide a sustainable source of steady income, then consumers would be unwise to select purely high return, high risk assets such as equities. Consumers typically, therefore, choose drawdown funds that invest a portion of their assets in safer instruments[6],

[3] See the Social Market Foundation paper: "*Golden Years? What freedom and choice will mean for UK pensioners*" (http://www.smf.co.uk/wp-content/uploads/2015/11/Social-Market-Foundation-Publication-Golden-Years-What-Freedom-And-Choice-Will-Mean-For-UK-Pensioners.pdf)

[4] http://www.milliman.com/insight/2016/Retirement-guarantees-Are-they-worth-it/

[5] Safe Withdrawal Rates for Retirees in the United Kingdom, Morningstar Research, May 2016

[6] We are aware that the investment strategies followed by an increasing number of drawdown funds, to help manage the risks in the decumulation phase, are more sophisticated than this. A relatively simple bond and equity investment mix is discussed here because it is still relatively commonplace, well understood and (for our purposes) facilitates straightforward analysis and comparison.

such as bonds, since these are (by definition) expected to be less volatile and are only partially correlated with equity markets, but offer a lower expected return over the long term. Therefore, when pursuing an income-focused strategy, the extent to which consumers can use drawdown products to access higher returning assets is typically somewhat constrained. It is also important that consumers are made aware that a partial investment in bond assets will only reduce and not eliminate market risk.

Consumers do not need to think of annuities and drawdown products as being mutually exclusive – they could build their financial strategy in retirement around a combination of the two.

However, as noted earlier there is clear evidence in the market that, since the introduction of pensions freedoms, fewer consumers are choosing to purchase annuities when they reach retirement. Annuities have often been portrayed as offering poor value for money and have been criticised for their lack of flexibility and the absence of a significant death benefit[7]. In addition, George Osborne's announcement that no one would have to buy an annuity was unlikely to inspire consumers to take time to consider the benefits they can potentially offer. Whilst any insurance guarantees come at a cost, annuities do provide the consumer with complete protection from both longevity and investment risks. The partial annuitisation approach may also allow consumers to take on greater levels of market risk with the remainder of their retirement pot. Indirectly, via the annuity provider's own investment strategy, annuities also allow consumers to benefit from assets that have a broadly similar risk profile but higher expected returns than the less risky assets such as government and corporate bonds which are typically included in drawdown funds. So viewed as an asset, annuities may end up providing a better investment return than a direct investment in bonds.

Given the market developments and needs of a typical retiree, could a combination of an equity based drawdown fund and an annuity be a more effective way of providing a sustainable retirement income than a mixed equity and bond drawdown fund?

For our latest research, we decided to explore this very question, by modelling the two different retirement strategies and looking at the income and death benefit provided across a variety of economic and market scenarios for an extensive range of customer profiles.

Annuities as an asset class?

MODELLING APPROACH

Milliman's actuarial and financial risk management teams built and calibrated a stochastic model[8] to compare:

- a strategy which makes use of a level annuity combined with a drawdown fund (investing predominantly in equity) and a cash account, which we will refer to as the 'annuity-equity' strategy; and
- a conventional drawdown only strategy (investing mainly in a mix of equity and bonds) and a cash account, which we will refer to as the 'bond-equity' strategy.

We used this model to project how the value of a customer's investments (i.e. a drawdown fund and cash account) might change over their retirement, given a particular asset allocation and target income requirement, using a forecast of the investment returns on the asset classes in which the drawdown fund invests as well as cash. The model for future investment returns was calibrated with reference to historic performance data for each of the in scope asset classes as well as current market data as at June 2018.

[7] It should be noted that certain annuity products do have attaching death benefits or the option to include them.

[8] A stochastic model explicitly allows for the uncertainty in relation to the future value of certain variables, whereby the final model output is based on a large number of underlying simulations in which key variables are allowed to take any value across a range. Stochastic models contrast with deterministic models, in which the final model output is based on a single set of values for the key variables.

In general the customer's target annual income requirement was also assumed to vary with inflation over the projection period although we did also model the results assuming a fixed target annual income. Because future inflation rates and investment returns are uncertain, we projected the value of the drawdown funds and cash account under 1,000 different economic scenarios calibrated to capture the potential variability of these factors.

For the purpose of these projections, we assumed an overall annual fee of 1.0% on the drawdown funds to cover the fund management and platform charges. The commercial annuity rates used to model the annuity-equity strategy include adviser charges but no allowance for adviser fees are made in the drawdown funds.

For simplicity, the tax situation of the retiree has not been considered, specifically we have not allowed for any potential tax benefits from one strategy over the other.

A wide range of customer circumstances and preferences were modelled for the research, by varying proportions of equity, cash and bonds/annuity, target income requirements, customer age and health.

HOW THE STRATEGIES DIFFER

The main difference between the two strategies is that the bond-equity strategy involves a drawdown fund investing in a mix of equity and bonds together with a cash account whereas in the annuity-equity strategy the retirement pot is split between an equity drawdown fund, a cash account, and an annuity.

The same set of economic scenarios are used to project the retirement income and death benefits in both the bond-equity strategy and the annuity-equity strategy.

Over the course of the projection, the proportion of the consumer's total retirement wealth is rebalanced on an annual basis across the drawdown fund and the cash account so that the relative proportion of these two investments remains the same. Additionally, in the bond-equity strategy, we have assumed that the drawdown fund is itself rebalanced to provide a constant relative exposure to bonds and equities, in line with how typical funds (operating with a consistent investment strategy) would be managed. In the annuity-equity strategy, the equity funds and cash accounts are annually rebalanced relative to each other but the annuity component remains fixed, i.e. we do not assume the customer purchases any future annuities and surrenders (whether partial or full) are not possible on the annuity.

Under both strategies, we have generally assumed that the customer wishes their income to increase with inflation, although we will show some results assuming a level income target over retirement. However, in either case we have used a level annuity in the annuity-equity strategy as this is more reflective of trends in the market. The annuity rates were provided by Just and include a 5-year income guarantee (whereby if the customer dies in the first 5 years of purchasing the product, their beneficiaries receive the remaining annuity payments due over the 5 year period as a lump sum). We have assumed the annuity is sold on an underwritten basis, so that the annuity rate reflects the consumer's health at the point of sale.

MODELLING OUTPUT

Our model was designed to assess whether, in each economic scenario, a customer could afford to withdraw their target level of income, adjusted for inflation (where appropriate), each year. This was done by comparing the total value at the end of each year of their drawdown fund and cash account with their income requirements for that year (less the income received from their annuity in the annuity-equity strategy). For a given retirement term, the overall likelihood of a strategy providing the target annual income in every year of retirement was calculated as the proportion of the 1,000 economic scenarios in which the target level of income was affordable over the retirement term in question.

We also calculated the average death benefit across the 1,000 economic scenarios at the end of the retirement term, where the death benefit was defined as the sum of the value of the drawdown fund, cash account, and (if applicable) any remaining income guarantee payments on the annuity at that point.

Appendix C contains further details of the modelling assumptions used in our research.

Our findings

For the purposes of this paper we illustrate our findings primarily with reference to a single example customer profile. However, we will also show how the results change for other circumstances.

OUR EXAMPLE RETIREE

Robin is 65 years old, in good health and about to retire. She is considering what would be best to do with her £100,000 pension fund. She is hoping to have a steady income that increases with inflation throughout retirement but would like, if possible, to leave something for her children. She decides to target an initial income of £4,000 a year (i.e. a 4% withdrawal rate), to supplement her State Pension. Robin wants to keep a small amount, 5% of her retirement fund, in a cash account for flexibility and easy access. She is trying to decide how to best invest the rest – she will either invest in a mixed bond and equity fund via a drawdown or use part of her fund to purchase an annuity and invest the remainder in equities via a drawdown.

For the purposes of this paper, Robin's underlying investment will be as follows: 5% in cash, 55% in equity and 40% in either bonds or an annuity. Based on currently available market annuity rates, in the annuity-equity scenario, this level of annuity purchase would provide Robin with approximately half of her initial level of target income.

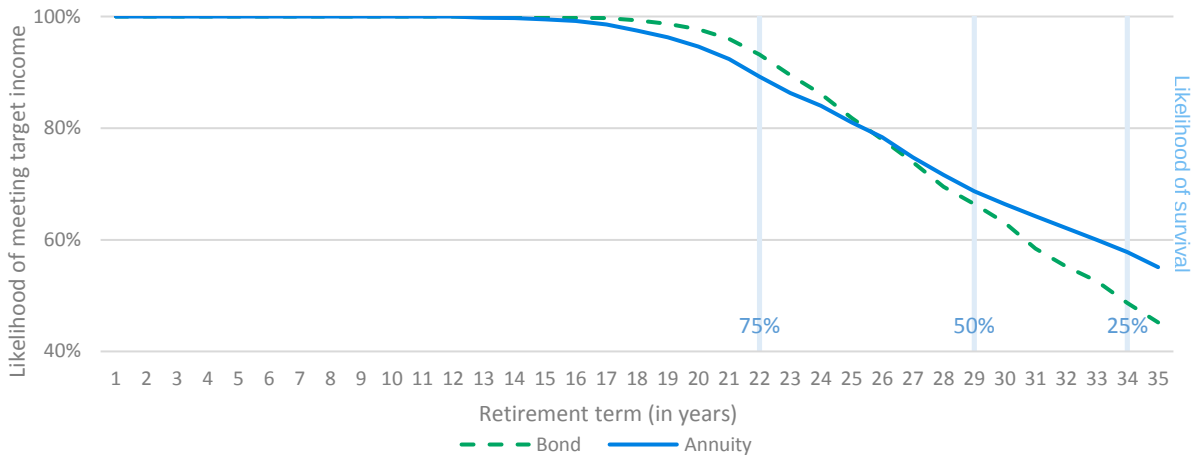
INCOME

For a range of different retirement terms, Figure 1 shows the likelihood of Robin being able to meet her target income for every year of her retirement. For example, if Robin lives to age 95, the annuity-equity strategy offers approximately a 66% chance of meeting her target income in every year of retirement.

Figure 1 also shows how likely it is that Robin, as a 65 year-old healthy female, will survive to various points of retirement, for example there is a 75% chance that she will have 22 years of retirement (i.e. live to age 87) [9].

[9] All the survival statistics used in this paper were provided by Just

FIGURE 1: LIKELIHOOD OF A HEALTHY 65YR OLD MEETING TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY



For both strategies, the likelihood of Robin meeting her target income until age 100 is over 40%, and the likelihood declines fairly linearly with age in later years.

Figure 1 shows that, for the first twelve years of retirement, Robin would be able to withdraw her target income regardless of whether she chooses to invest in bonds or an annuity. In fact, this is the case in every one of the 1,000 economic scenarios we tested.

After twelve years the income likelihoods under the two strategies start to differ. Initially, the bond-equity strategy performs better but after 25 years of retirement, the annuity-equity strategy has a higher likelihood of meeting Robin's target income. The bond-equity strategy offers a higher likelihood of meeting Robin's requirements in the early stages of retirement but this decreases more steeply after 20 years of retirement. The likelihood of the annuity-equity strategy meeting Robin's target income decreases more gradually. So if Robin lives for 25 years or longer, the annuity-equity strategy provides a better chance of Robin being able to meet her target income for the duration of her retirement.

If Robin enjoys a 30 year retirement, the annuity-equity strategy has a 66% chance of providing her with her target level of income throughout retirement whilst the bond-equity strategy has a 63% chance. This could be considered a modest difference, but 3% represents 30 extra economic scenarios where Robin was able to meet her target income requirement with the annuity-equity strategy but at some stage ended up receiving no income under the bond-equity strategy. The difference becomes more pronounced with age, if Robin enjoys 35 years of retirement the annuity-equity has a 55% chance of providing Robin with her target level of income whereas the bond-equity strategy only has a 45% chance.

There is a 67% likelihood that a healthy 65 year-old female, like Robin, would still be alive at 90 (for men there is a 57% chance). So, whilst planning for over 25 years of retirement may seem like a long time, it's more likely than not that Robin will need her retirement pot to last longer than this. Figure 1, shows that over the long term, the annuity-equity strategy is more likely to provide Robin with a sustainable income than the bond-equity strategy.

It is important to note that even in scenarios where the annuity-equity strategy is unable to meet Robin's target income, she will still be receiving some level of income from the annuity were she to choose this strategy. For example, after 25 years, in the economic scenarios where the annuity-equity strategy fails to fully provide Robin with her target income, the annuity is still providing her with 32% (on average) of her target income. By contrast,

in scenarios where the bond-equity strategy is unable to meet Robin's target income, the drawdown fund and cash account are both depleted and she won't receive any further income at all from that point onwards.

There are several factors that explain why the annuity-equity strategy provides a higher likelihood of meeting the target income in later years. Firstly, in the case of the bond-equity strategy, the customer is assumed to be invested in the same equity-bond drawdown fund throughout and so (assuming the fund follows a consistent investment strategy) the balance of equity and bonds is regularly rebalanced. Across the different economic scenarios, the bond exposure has a dampening effect on the overall fund return, tending to reduce the portfolio return when equity returns are high but increasing the returns when equity returns are very low or negative. Under the annuity-equity strategy, there is no rebalancing between the non-annuity and annuity investments (as it would not be possible for a customer to buy and sell annuity holdings). Therefore, the absolute amount of equity (which offers a higher expected investment return) can be higher in the annuity-equity strategy than the bond-equity strategy at later durations.

Over the course of the projection, across all scenarios, the income Robin requires increases steadily with annual inflation. However, the drawdown fund (which supplies either all or some of this income) will in many cases decline in size as money is withdrawn each year. Therefore, under both strategies, the amount of money that is withdrawn from the fund (as a proportion of the remaining fund value) tends to increase over time. Later on in retirement, when the drawdown fund is declining, very high investment returns are therefore required to offset the fund withdrawals and prevent or delay the depletion of the fund. In the subset of economic scenarios where equities perform particularly well in later years, the annuity-equity strategy was able to maintain an income, as the drawdown fund is predominantly invested in equity and so benefits more fully from the investment performance. Whereas, in the same economic scenarios under the bond-equity strategy, the bond exposure constrains the overall investment return such that it is insufficient to offset the fund withdrawal.

Something we have not explored within this paper is what the outcome would be under the annuity-equity strategy, if we did allow the two products to be rebalanced, for example if the retiree increased her level of annuitisation over the course of retirement. Given that annuity rates tend to rise quite materially with age, such a strategy might further improve the sustainability of income, but this might also be expected to reduce the death benefits available.

Another useful perspective is provided by comparing the average investment return on bonds with the implied return on annuities. This can be illustrated by looking at the limiting cases where Robin only invests in either bonds or an annuity. We explored the largest target inflation-linked income, under the two strategies, that Robin could afford to take which would give her a 90% likelihood of meeting that target income for 35 years.

TABLE 1: MAXIMUM SUSTAINABLE TARGET INCOME WITH 100% BOND OR ANNUITY INVESTMENT

	Fund: 100% bonds	Fund 100% annuity[10]
Sustainable income rate	2.90%	3.45%

Table 1 shows that the annuity has almost a 20% higher sustainable income rate than being 100% invested in a bond only drawdown fund. Therefore, in terms of a sustainable income, the annuity should offer a better outcome than the outcome offered by our modelled bond portfolio. Part of the reason that the annuity alone can provide a higher sustainable income rate, than the pure bond drawdown fund, may be that annuities are currently priced

[10] Initially the annuity will provide more than 3.45% as it is assumed to pay a fixed amount rather than being inflation-linked, so we have assumed that any excess income is saved as cash which Robin uses to supplement the increasing income requirements in later years.

based on the insurer achieving a higher investment return than might be expected to be achieved over the long term on a traditional bond focused retail investment fund. It is important to note that the annuity price also benefits from the annuity provider allowing for the average mortality expected on their insured portfolio when pricing annuities, this is not something an individual can benefit from when planning how much to take from their drawdown fund. Beyond any income guarantee period, under the modelled annuity contract if Robin dies earlier than the annuity provider expects then anything remaining from the original premium that Robin paid is retained by the insurer rather than being paid as a death benefit. In contrast, anything remaining in a drawdown fund would be payable to the consumer's beneficiaries. All other things being equal (e.g. the assets underlying the two strategies), this should result in the annuity providing a higher income.

Maximum sustainable income

Robin is concerned that her initial 4% withdrawal rate might be too high if she wants to be sure she won't run out of money. She wants to know how much she could afford to withdraw each year if she wanted to be confident that she would be able to receive an income that increases with inflation from age 65 to 95. We explored the largest withdrawal rates that Robin could afford to take which would give her a 90% likelihood of meeting this target income for 30 years.

FIGURE 2: SUSTAINABLE WITHDRAWAL RATE (INCREASING WITH INFLATION) FOR HEALTHY 65YR OLD FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY

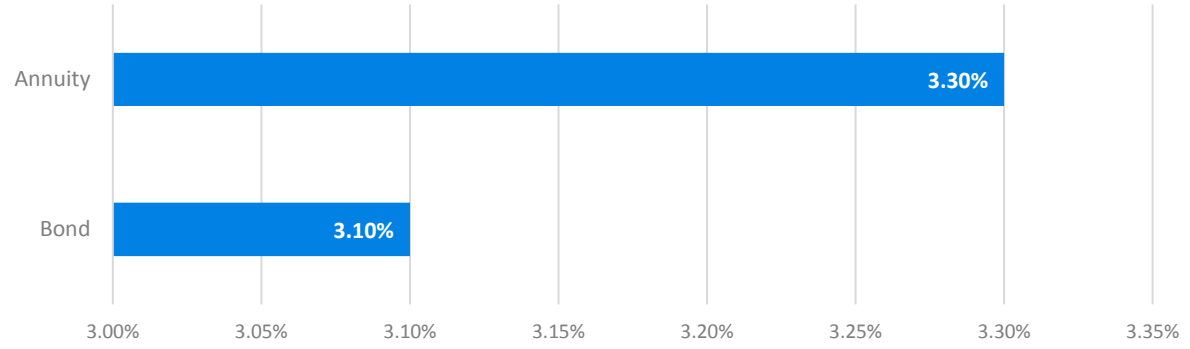


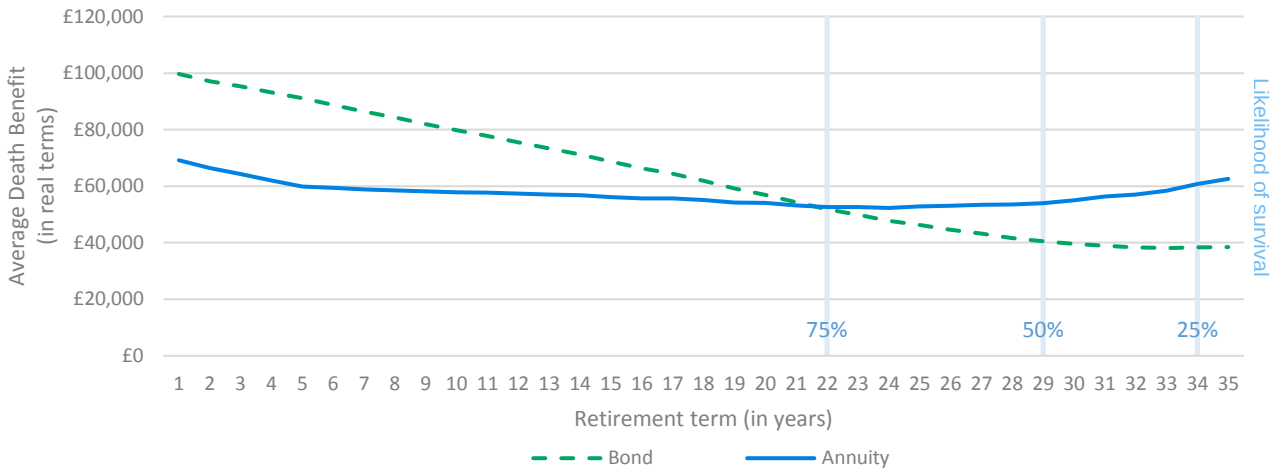
Figure 2 shows that with the annuity-equity strategy Robin could sustainably receive 3.3% (increasing with inflation) of her pension fund until she's 95. Whereas, with the bond-equity strategy the sustainable withdrawal rate would have to be reduced to 3.1%. In other words, Robin would need to withdraw 6% less if she choose the bond-equity strategy.

DEATH BENEFIT

It is also important to consider how the annuity-equity and bond-equity strategy differ in terms of the level of death benefit that they would be expected to provide.

Figure 3 shows the average death benefit (adjusted for inflation) that Robin's beneficiaries could receive in the future if Robin were to pass away. It also shows the likelihood that Robin, as a 65 year-old healthy female, will survive at various points of retirement.

FIGURE 3: AVERAGE DEATH BENEFIT FOR HEALTHY 65YR OLD TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY



Initially, the bond-equity strategy has a higher average death benefit because part of the fund has not been used to purchase an annuity. Therefore, a greater proportion of the initial retirement pot remains available for her beneficiaries. However, at around 21 years into retirement there is a cross-over point where the average of the combined value of Robin's drawdown fund and cash account under the annuity-equity strategy begins to exceed the corresponding value under the bond-equity strategy. This means that the average death benefit is higher for the annuity-equity strategy than for the bond-equity strategy. If Robin survives for 30 years into retirement then the average death benefit under the annuity-equity strategy is approximately £55,000, whereas it is about £40,000 under the bond-equity strategy.

The way the average death benefit varies with time for the two strategies is quite different. Under the annuity-equity strategy, in the first five years the value of the drawdown fund and cash account (which would both be transferred to the Robin's beneficiaries on death) are supplemented by the death benefit available on the annuity over its guaranteed payment period. The value of the guarantee decreases linearly in line with the run-off of the insured annuity payments (i.e. those payable to beneficiaries over the guarantee period). At the beginning of the projection, this leads to a steeper average run-off in the average death benefit compared to later years. After the guaranteed payment period, for about the next 15 years, the average death benefit decreases only very gradually since the fund withdrawals required to meet Robin's target income (together with the fund charges) are, on average, broadly offset by the increase in the value of Robin's investments. By contrast, right from the beginning of the projection, the death benefit under the bond-equity strategy decreases fairly linearly and at a steeper rate, because Robin is drawing down on the fund at a higher rate than the investment returns on the fund can sustainably provide for.

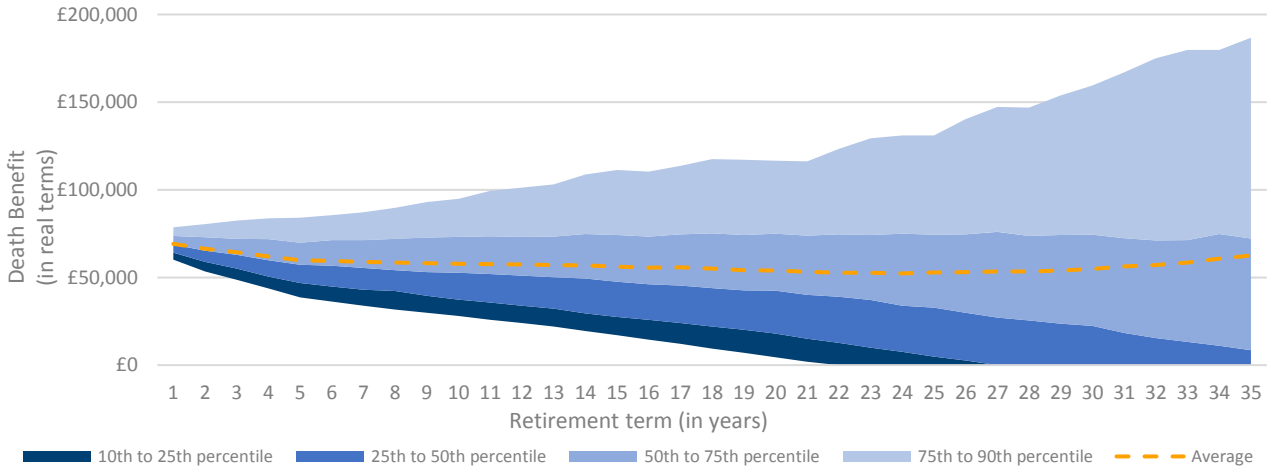
For both strategies, the average death benefit begins to actually increase at the later stages of Robin's retirement. However in Figure 3, it can be seen that the point at which this occurs is much earlier for the annuity-equity strategy. As noted in the context of the income likelihood, the annuity-equity strategy permits Robin to maintain a greater exposure to equity. In the economic scenarios where equity performs well later on in the projection, the drawdown fund in the annuity-equity strategy benefits more significantly from the high equity returns. In these scenarios, the drawdown fund either grows or at least depletes more slowly, allowing Robin to maintain a higher death benefit or a death benefit where there otherwise would not have been one.

Figure 3 shows Robin's average projected death benefit across the 1,000 different economic scenarios, the average provides a useful summary of the analysis and a metric by which to compare the two strategies. However, it is also informative to assess the variability of the death benefit across these scenarios.

Figures 4 and 5 below show the variation in death benefit for the bond-equity and annuity-equity strategies respectively. We have removed the most extreme results (i.e. the top 10% and worst 10% results) as these are unlikely to occur in practice, the graphs therefore show the range of results from the 10th to 90th percentile[11]. The average results from Figure 3 for each of the two strategies are also plotted on the corresponding graphs for comparison.

FIGURE 4: DEATH BENEFIT VARIANCE FOR HEALTHY 65YR OLD (BOND-EQUITY STRATEGY) TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND

FIGURE 5: DEATH BENEFIT VARIANCE FOR HEALTHY 65YR OLD (ANNUITY-EQUITY STRATEGY) TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% ANNUITY



[11] The 10th percentile is the value below which 10% of the results fall or alternatively that 90% of results are above.

Figure 4 shows that there is 10% chance that, under the bond-equity strategy, Robin's death benefit will be zero after 21 years of retirement whereas there will be a 50% chance of it being zero after 33 years of retirement. Under the annuity-equity strategy, there's a 10% chance that Robin's death benefit will be zero after 22 years of retirement (which is marginally better than the bond-equity strategy) but even if Robin's retirement stretched to 35 years there will always be over a 50% chance of receiving some level of death benefit.

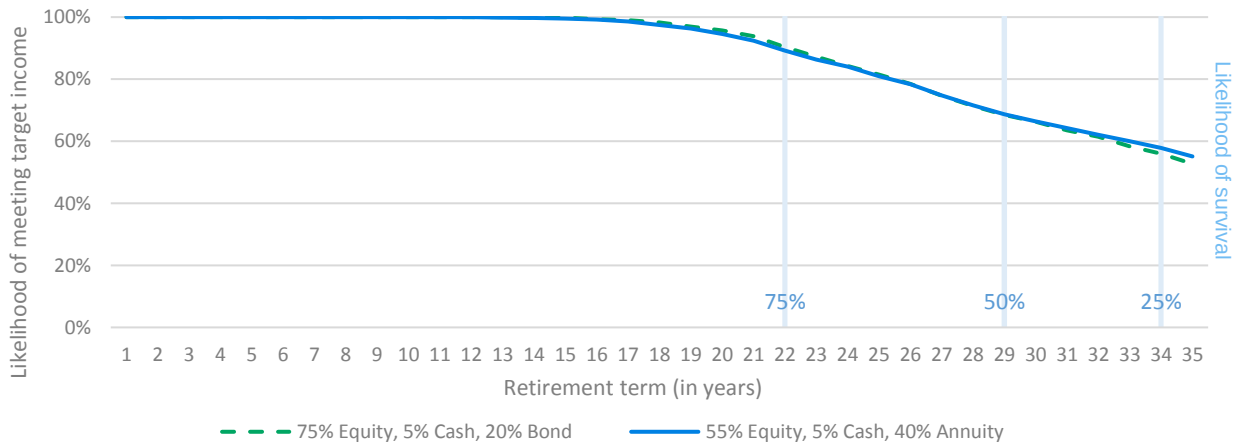
The annuity-equity strategy, therefore, provides a higher average death benefit over the long term but with similar downside risk to the bond-equity strategy. Therefore, if Robin opted for the annuity-equity strategy, in the long-run, she would be taking on no more risk than with the equity-strategy but would expect to achieve a higher death benefit.

Furthermore, Figures 4 and 5 show that there is potential for much higher levels of death benefit under the annuity-equity strategy. For example after 35 years of retirement, the 75th percentile result for Robin's death benefit is £72,000 under the annuity-equity strategy i.e. there is a 25% chance her dependants could receive more than £72,000. For the bond-equity strategy, the 75th percentile is a little over half the annuity-equity amount, with her dependants having a 25% chance of receiving more than £39,000.

ALTERNATIVE INVESTMENT ALLOCATIONS

Figure 1 shows that the annuity-equity strategy provides a higher likelihood of meeting Robin's target income in retirement over the long term. It is important to explore whether this increased likelihood can be replicated under the bond-equity strategy using an alternative asset allocation. We investigated how much higher the equity content of the bond-equity strategy would need to be in order to achieve the same results as the annuity-equity strategy. We choose to vary the equity content because the equities are the highest returning asset class in our study. Based on targeting the same likelihood of meeting income for thirty years of retirement, the bond-equity strategy would need 75% of the fund to be invested in equity to provide the same results as the original annuity-equity strategy which had a 55% equity allocation. Although we choose the equity content of the bond-equity strategy based on achieving the same likelihood after thirty years, as Figure 6 shows, the results are actually very similar across all the potential retirement terms.

FIGURE 6: LIKELIHOOD OF A HEALTHY 65YR OLD MEETING TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION).



This demonstrates that Robin would need to invest a significantly higher proportion of her fund in equity under the bond-equity strategy to achieve the same results as Robin's original annuity-equity strategy. Moving from 55% to 75% equity allocation is a significant increase in the equity content.

Although Figure 6 appears to suggest that the two strategies are returning similar likelihoods of meeting income, this does not mean that the two strategies provide Robin with the same amount of income. It is important to remember that where the annuity-equity strategy is unable to meet Robin's target income, she will receive some level of income from the annuity. By contrast, in scenarios where the bond-equity strategy is unable to meet Robin's target income, this means the fund has been exhausted and she won't be receiving any income from that point onwards. Our 'likelihood of meeting target income' graphs do not recognise this – the likelihood of meeting target income is based on the number of scenarios where Robin would be able to achieve her target income. Therefore, the fact that an annuity is providing Robin with some level of income for her entire life is not reflected in the results unless she is able to meet her target income level each year. For example, Robin missing her annual target income by £500 or by £5,000 does not make a difference – either way it is recorded as the strategy failing to provide her with her target income.

WHAT ABOUT OTHER CONSUMERS?

The results we have presented so far are based on assuming Robin's particular circumstances. However retirement age, health, income requirements and attitude to risk varies from person to person. Therefore, in this section, we explore how the annuity-equity strategy compares to the bond-equity strategy if Robin was in a different situation.

Age

We have previously assumed Robin is 65, but how would the results change if she were older or younger at the point of retirement?

Figure 7 shows which strategy provides Robin with the greatest likelihood of meeting her target income (which is unchanged as 4% of her £100,000 pension pot increasing with inflation) at different points of retirement if she was retiring at age 60, 65 and 70. The graph below shows the results from Robin's retirement age until she turns 100. Therefore there are 40 years of results for the case that Robin retires at 60 but 30 years of results for the case where she retire at 70.

FIGURE 7: STRATEGY WHICH PROVIDES THE HIGHEST LIKELIHOOD OF MEETING TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION).

FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY

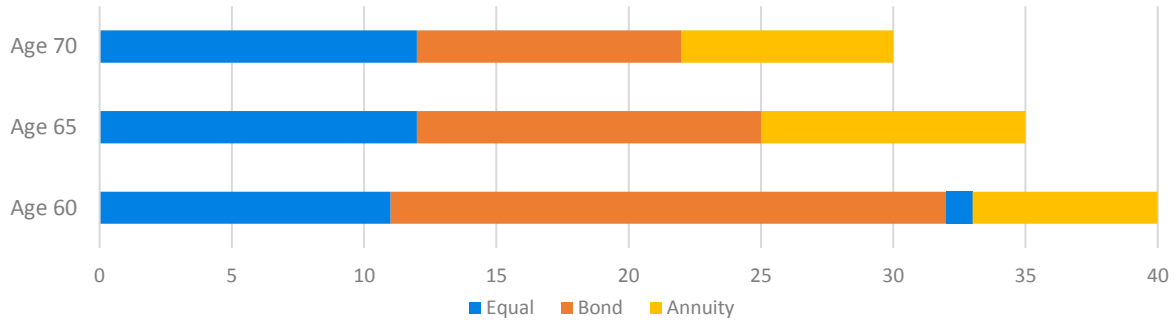


Figure 7 shows that the point at which the annuity-equity strategy outperforms the bond-equity strategy, decreases with age. We see that, if Robin was 65 when she retired, the annuity-equity strategy would be the best

strategy after 25 years of retirement whereas if she were 70, then she would wait 22 years for the annuity-equity strategy to outperform the bond-equity strategy.

This is because the bond-equity performs the same regardless of Robin's age and so the difference in results are a function of the annuity rates offered at different ages. A 70 year-old will receive a higher annuity rate than a 60 year-old and therefore, the annuity-equity strategy for a 70 year-old will outperform the bond-equity strategy more quickly than the annuity-equity strategy for a 60 year-old.

Health

We have assumed that Robin is healthy when she retires, however not all consumers will be fortunate enough to be in good health when they retire.

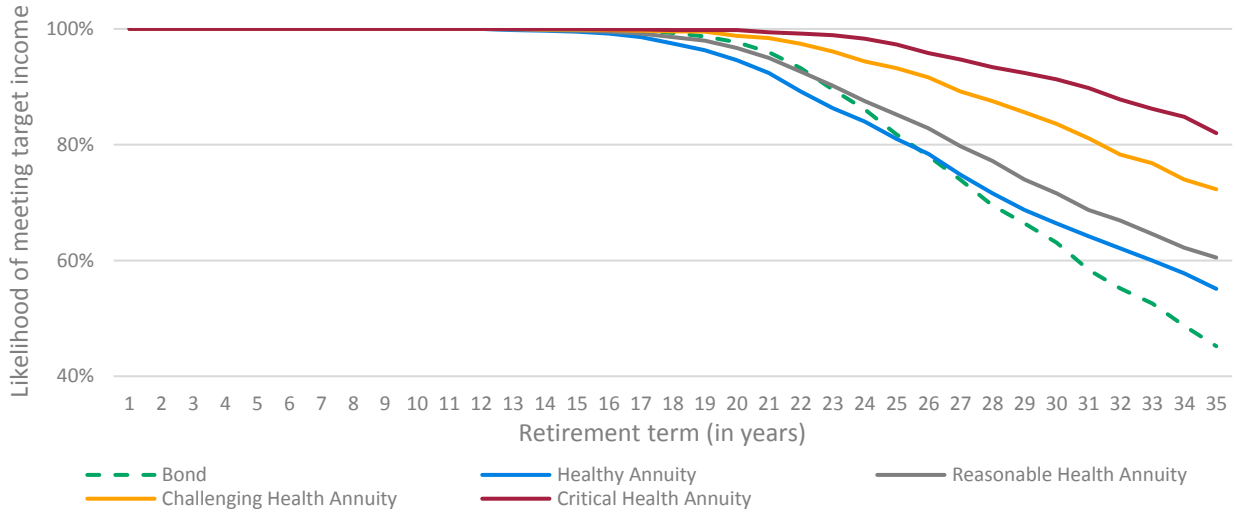
Annuity rates tend to rise with deteriorating health and this is reflected in the annuity rates we used in our study. Table 2 below shows how the annuity rates vary depending on health status.

TABLE 2: ANNUITY RATES FOR DIFFERENT HEALTH STATUSES

Health Status	Annuity Rate	Description
Healthy	5.2%	Feeling well. Height and weight fine. No medication for long term conditions
Reasonable	5.7%	Feeling okay. Might be on medication for cholesterol/high blood pressure.
Challenging	6.8%	Struggling. May have high blood pressure/cholesterol and other long term conditions.
Critical	7.8%	Suffering from a serious medical condition such as cancer and undergoing treatment for it.

Figure 8 shows the likelihood of a 65 year-old meeting their target income for a variety annuities that correspond to different health ratings.

FIGURE 8: LIKELIHOOD OF A 65YR OLD MEETING TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY



Given the increased annuity rates, it is unsurprising that the annuity-equity strategies for a customer in poorer health provides a higher likelihood of meeting target income than the 'healthy' annuity we examined earlier in the paper.

Therefore, the poorer health a customer has, the less time they will have to wait for the annuity-equity strategy to provide a better likelihood of meeting target income. In addition, for customers with the poorer health statuses, the annuity-equity strategy will always provide a higher likelihood of meeting target income than the bond-equity strategy.

However, it is important to view this in the context of the customer's life expectancy. For example, the critical health annuity-equity strategy provides a 90% likelihood of receiving the target income for the first thirty years of retirement. However, a customer with this health rating has a 20% chance of being alive at age 90 if they are female or 14.3% chance if they are male. By contrast, a healthy customer has 67% change of being alive at 90 if they are female and 57% if they are male.

Figure 9 shows the death benefit for these different annuity-equity strategies.

FIGURE 9: AVERAGE DEATH BENEFIT FOR 65 YR OLD TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY

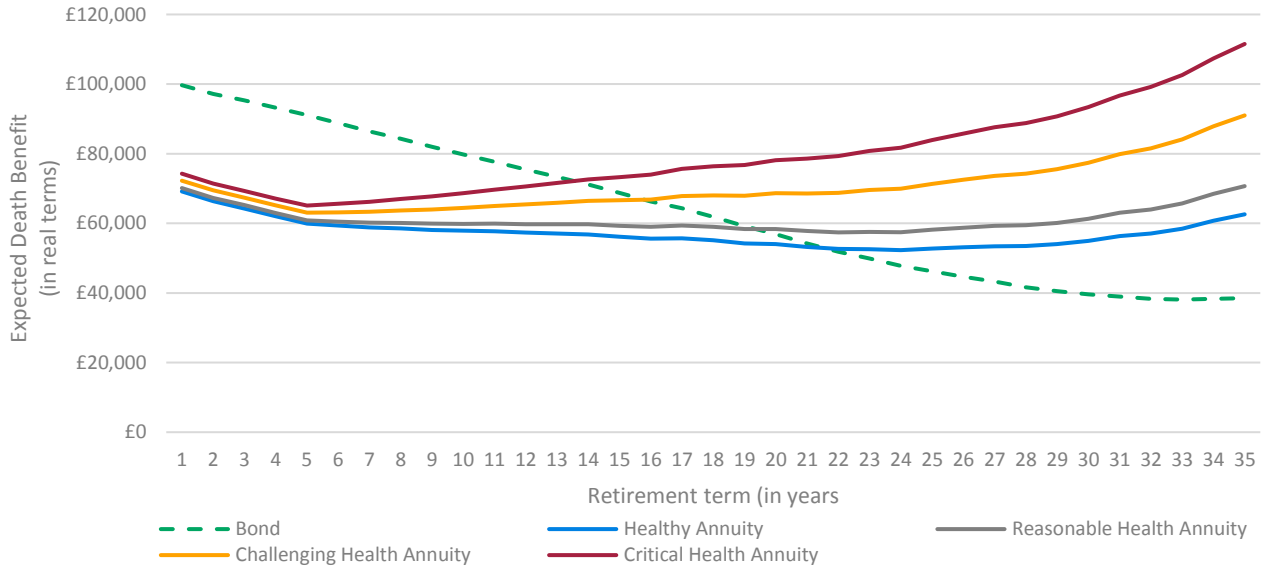


Figure 9 shows that the death benefit for poorer health annuity-equity strategies increases over time (except in the first 5 years as a result of the guaranteed payment period), which suggests that the drawdown fund is growing over time. This is because the annuity rates offered by these products exceed the target level of income and so the excess income is being reinvested into the drawdown fund[12]. However, this needs to be considered in the context of a customer's life expectancy. For example, whilst the critical health annuity-equity strategy provides a higher average death benefit than the bond-equity portfolio after 14 years of retirement, a female aged 65 only has a 34% chance of being alive 15 years into their retirement (a 65 year-old male has 30% chance).

However, the reasonable annuity-equity strategy has a higher average death benefit after 19 years. There is an 84% chance of a female 65 year-old customer being alive after 20 years of retirement with this health rating (61% for a male).

Target income rates

[12] In practice, Robin's ability to reinvest this tax efficiently would depend on the structure of the drawdown product.

So far we have assumed that Robin wants an annual income equivalent to 4% of her initial retirement pot. But what if Robin's income requirements were different?

We also investigated how the two strategies performed at different levels of target income.

Initial annual target income of £3,000

Figure 10 shows that, if Robin chooses to lower her target income to 3% or £3,000 a year (increasing with inflation), she would have a 90% chance of receiving her target income in every year until she was 100 with the annuity-equity strategy. This is a higher likelihood of meeting her target income than we have seen previously for a 4% target income - this reflects the fact that the annuity is providing Robin with a larger proportion of her desired income and so she doesn't need to withdraw as much from her drawdown fund. Whilst both strategies, provide Robin with at least an 80% likelihood of meeting her retirement income, the bond-equity strategy doesn't outperform the annuity-equity strategy at any point in Robin's retirement.

FIGURE 10: LIKELIHOOD OF A HEALTHY 65YR OLD MEETING TARGET INCOME OF £3,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY

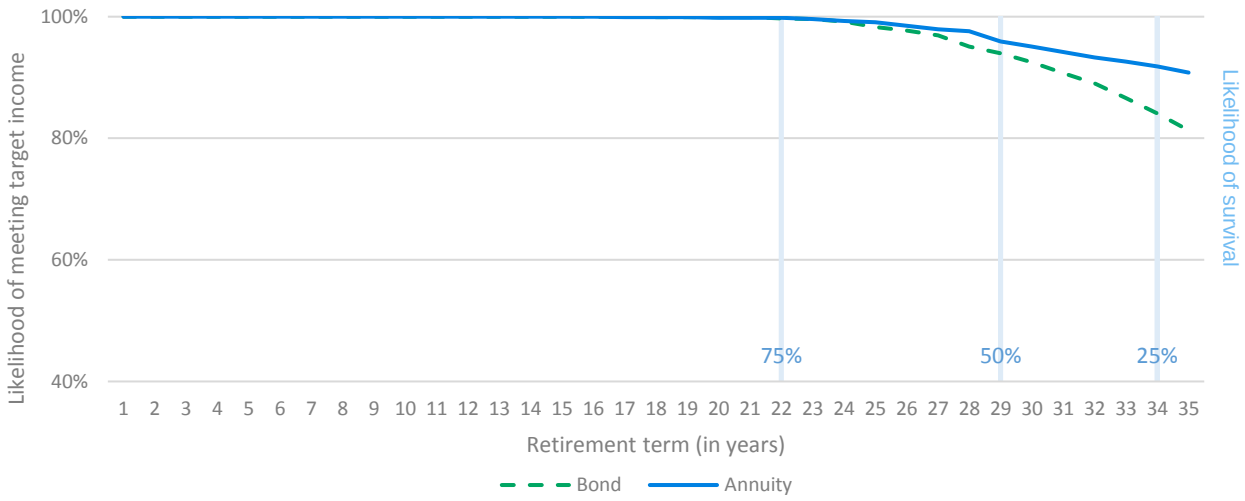
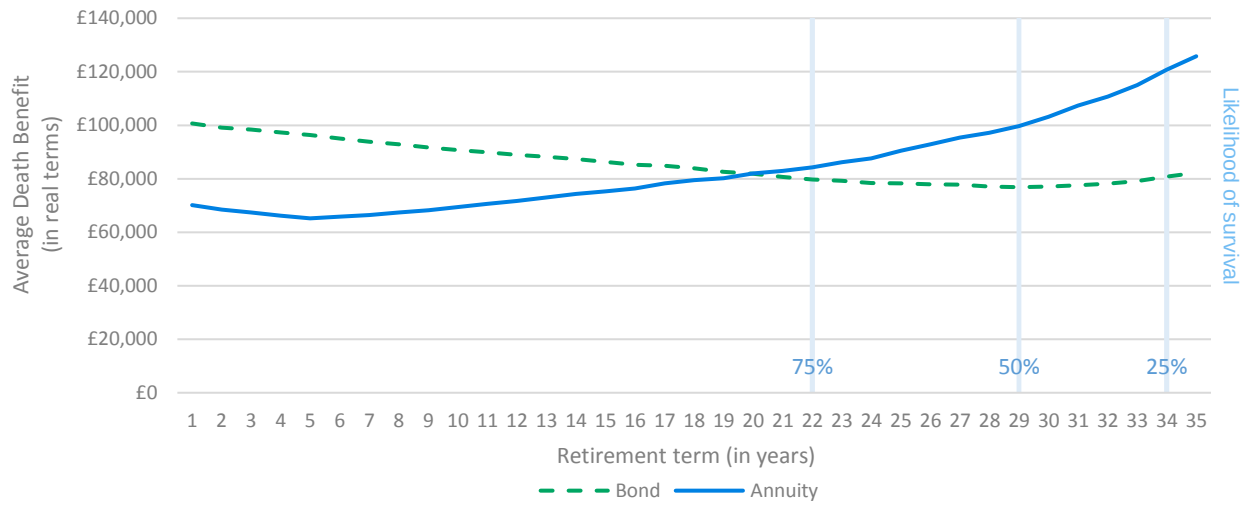


Figure 11 shows that the average death benefit for the annuity-equity income increases over time (except in the guaranteed payment period) which means that the average value of Robin's fund increases over time. Therefore, based on likely mortality rates, Robin is likely to receive a higher death benefit.

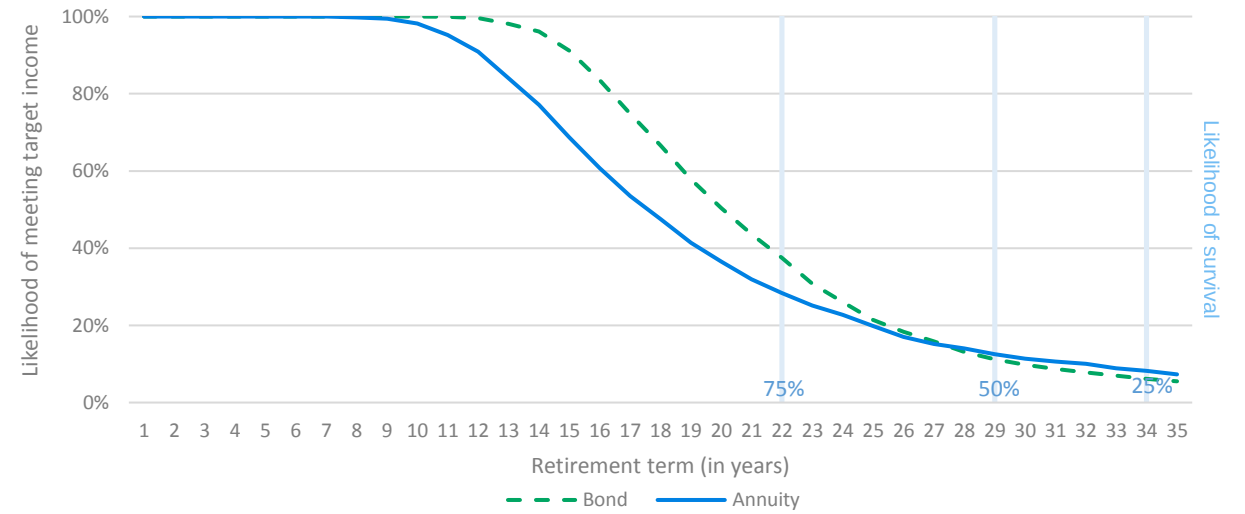
FIGURE 11: AVERAGE DEATH BENEFIT FOR HEALTHY 65YR OLD TARGET INCOME OF £3,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY



Initial annual target income of £6,000 and £8,000

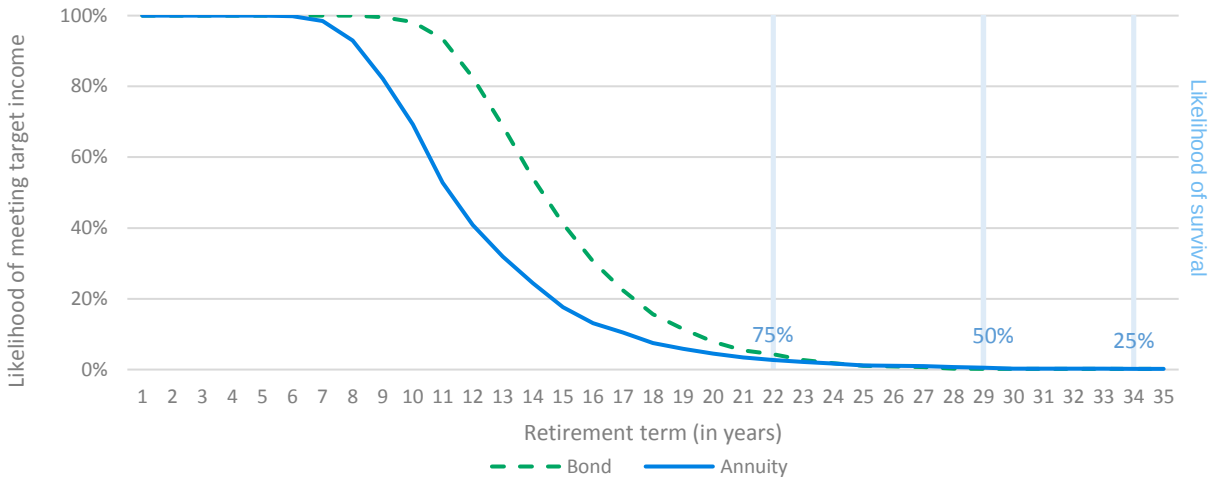
According to the latest FCA findings[13], the average withdrawal rate across all drawdown funds where a regular payment has been set up is just under 6%, whilst the most popular withdrawal rate for drawdown funds worth less than £249,000 is above 8%. Both of these rates are significantly higher than typically recommended sustainable drawdown rates, and although this may not be representative of long-term behaviour, it's interesting to look at how Robin's results would change if she was behaving like an 'average' customer.

FIGURE 12: LIKELIHOOD OF A HEALTHY 65YR OLD MEETING TARGET INCOME OF £6,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY



[13] https://www.fca.org.uk/data/data-bulletin-issue-14

FIGURE 13: LIKELIHOOD OF A HEALTHY 65YR OLD MEETING TARGET INCOME OF £8,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY



Figures 12 and 13 show the likelihood of Robin meeting her target income if she choose to take 6% and 8% of her pension fund as income (increasing with inflation).

These graphs show that for higher withdrawal rates both strategies offer a much shorter period of certainty of meeting Robin's target income. At both withdrawal rates, in either strategy there is less than a 50% chance of meeting her target income after 20 years. This is worrying as Robin is likely to still be alive at this age[14].

The bond-equity strategy does perform the best of the two strategies. It provides certainty for a longer period of Robin's retirement and under both withdrawal rates, and the bond-equity strategy has a higher or similar likelihood of meeting Robin's needs than the annuity-equity strategy. For the 8% target income, the annuity-bond strategy doesn't beat the bond-equity strategy at any point in Robin's retirement and for the 6% target income, the annuity-bond strategy only beats it marginally and after almost 30 years of retirement.

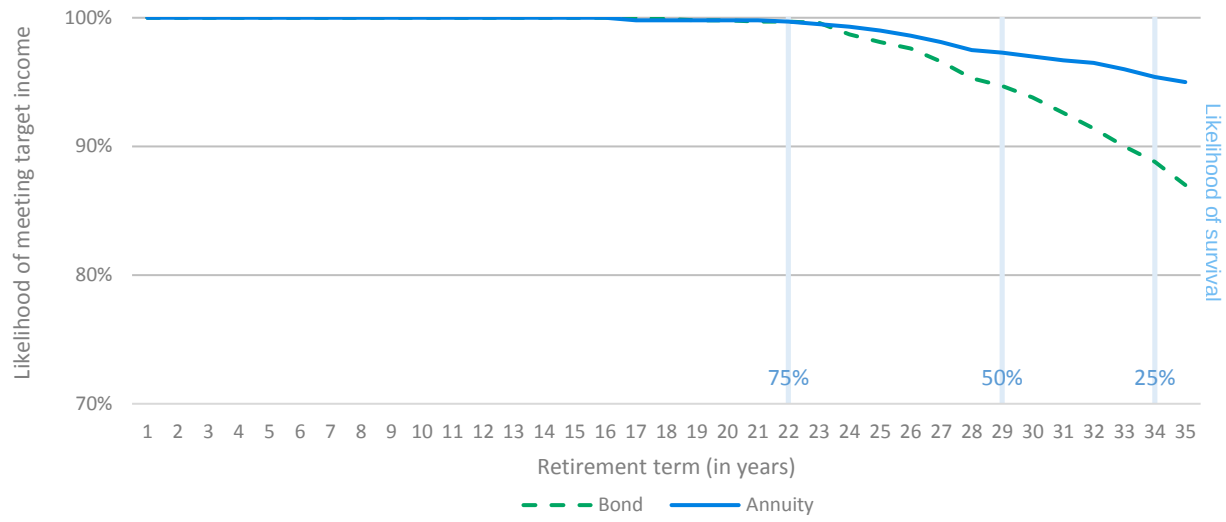
The annuity-equity strategy is designed to provide a sustainable income for retirement, therefore it performs less well in cases where the withdrawal rates are high. Whereas under the bond-equity strategy, there is a greater amount of money available to make withdrawal from. However, as mentioned earlier it is important to remember that in the case where the annuity-equity strategy doesn't meet the target income, Robin will still benefit from some level of income for the rest of her life. Where the bond-equity strategy doesn't meet the target income, this means that Robin's retirement fund is completely depleted and she will not receive any more income from her retirement fund.

Inflation

So far we have assumed that Robin would want her income to increase with inflation. However, many customers do not consider the impact of inflation when making financial decisions or believe that they will need to spend less in later stages of retirement. Therefore, we thought it would be interesting to see how the results change if Robin were to target a fixed level of income.

[14] 82% chance of a 65 year-old female being alive at 85

FIGURE 14: LIKELIHOOD OF A HEALTHY 65YR OLD MEETING TARGET INCOME OF £4,000 A YEAR (FIXED)
FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY



Unsurprisingly, choosing a level target income means that Robin has a higher likelihood of meeting her target income level under both strategies because she will be drawing down less money each year (as the desire for an inflation-linked income increases Robin's target income requirements over time). In fact, under both strategies, Robin has over a 90% chance of receiving her targeted income until she turns 95, however there is no point where the bond-equity strategy provides a higher likelihood than the annuity-equity strategy.

We investigated how much more Robin could afford to take annually to maintain a 90% change of meeting her target income until she turns 95.

FIGURE 15: SUSTAINABLE LEVEL WITHDRAWAL RATE FOR FIXED TARGET INCOME
FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY

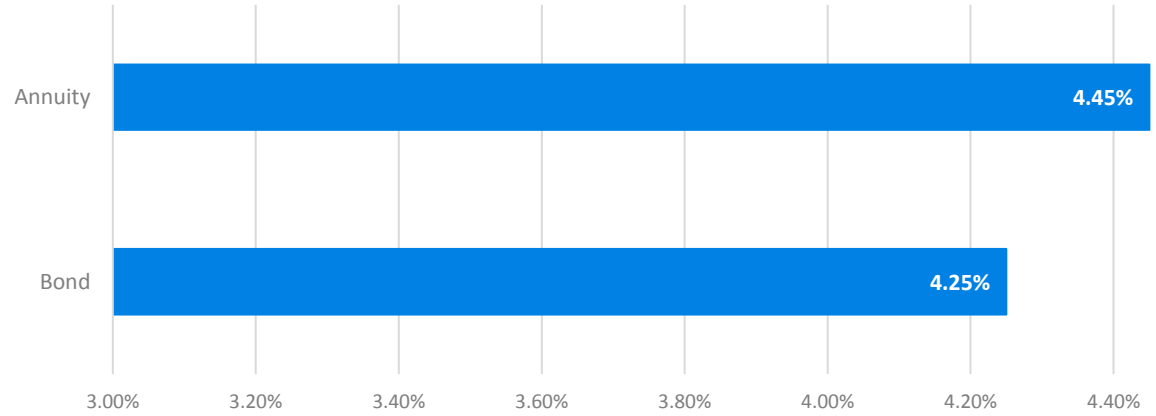


Figure 15 shows that Robin has a 90% likelihood of being able to take 4.45% of her fund, or £4,450 a year until she turns 95 under the annuity-equity strategy. To achieve the same result with the bond-equity strategy, Robin would have to reduce her target income from 4.45% to 4.25%.

Other variables

We have also looked at the impact of varying the equity content and the fees applied to the drawdown funds. At a high level, increasing the proportion of Robin's fund invested in equities reduces the differences between the two

strategies because the bonds or annuity make up a smaller proportion of the total fund and therefore the distinguishing features of the strategies have a smaller impact on the results.

Varying the fees affects the bond-strategy to a greater extent than the annuity-equity strategy. This is because fees are only applied to the drawdown funds and so a smaller proportion of Robin's retirement pot attracts fees under the annuity-equity strategy.

These results are included in Appendix A and B.

Conclusions

Our research shows that including annuities within the "asset mix" that is used to provide a retirement income can have a meaningful impact on both the sustainability of that income and the death benefits that are available. Our analysis indicates that, for longer periods of retirement, a combination of an annuity income and drawing down from an equity investment fund could lead to a higher likelihood of achieving a person's target income and a higher death benefit compared to drawing down from a mixed bond and equity investment fund.

The degree to which an annuity-equity strategy could be considered better (using these metrics) will vary according to a wide range of factors, not all of which have been explored in this research. A partial investment in an annuity will not be right for everyone. For example, our modelling indicates that someone who prioritises taking a high proportion of their initial retirement pot each year and is less concerned about maintaining an income throughout their retirement would be better served by drawdown alone. However, for a consumer who anticipates a long life in retirement and wants their pension pot to provide an income throughout, then the annuity-equity strategy showed promising results.

For consumers that are discussing their options with an adviser, our analysis supports the view that this discussion should not discount annuities as a potential part of the retirement solution. Furthermore, the relative merits of the two strategies varied noticeably based on the initial health of the retiree, so the analysis also highlights the importance of considering an underwritten annuity[15].

For those who cannot or who choose not to access advice, then the findings are just as applicable. In fact, these consumers may be less aware of what level of income is sustainable. The FCA has recently suggested that non-advised consumers might benefit from being allocated to one of a number of default investment pathways that align with their objectives[16]. Our research shows that designing a default pathway for those seeking a sustainable retirement income might not be optimally achieved by just focusing on the asset mix in a drawdown fund, annuities could also be an important component of such a pathway.

During the run up to, and in the aftermath of, pensions freedoms, the reputation of annuities has undoubtedly suffered. We started this report with a quote: "no one will need to buy an annuity" and whilst annuities are no longer mandatory that doesn't mean they shouldn't be considered and perhaps included as part of a range of products that collectively help a consumer to meet their retirement goals.

The results presented in this paper are a tiny fraction of the results produced as part of this research. Just has taken our modelling work and developed an interactive tool where you can investigate the effects of changing age, health, inflation protection, withdrawal rates, term and asset allocation for yourself.

"…a combination of an annuity income and drawing down from an equity investment fund could lead to a higher likelihood of achieving a person's target income and a higher death benefit.."

[15] An underwritten annuity is one in which the annuity rate offered to the customer is influenced by one or more rating factors such as their health, lifestyle, or postcode.

[16] https://www.fca.org.uk/publications/consultation-papers/cp18-17-retirement-outcomes-review

Appendices

APPENDIX A - VARYING PROPORTION OF RETIREMENT FUND INVESTED IN EQUITY

The results below show how the likelihood of meeting target income and average death benefit for a higher and lower equity investment.

FIGURE 16: LIKELIHOOD OF A HEALTHY 65YR OLD MEETING TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 75% EQUITY, 5 % CASH, 20% BOND OR ANNUITY

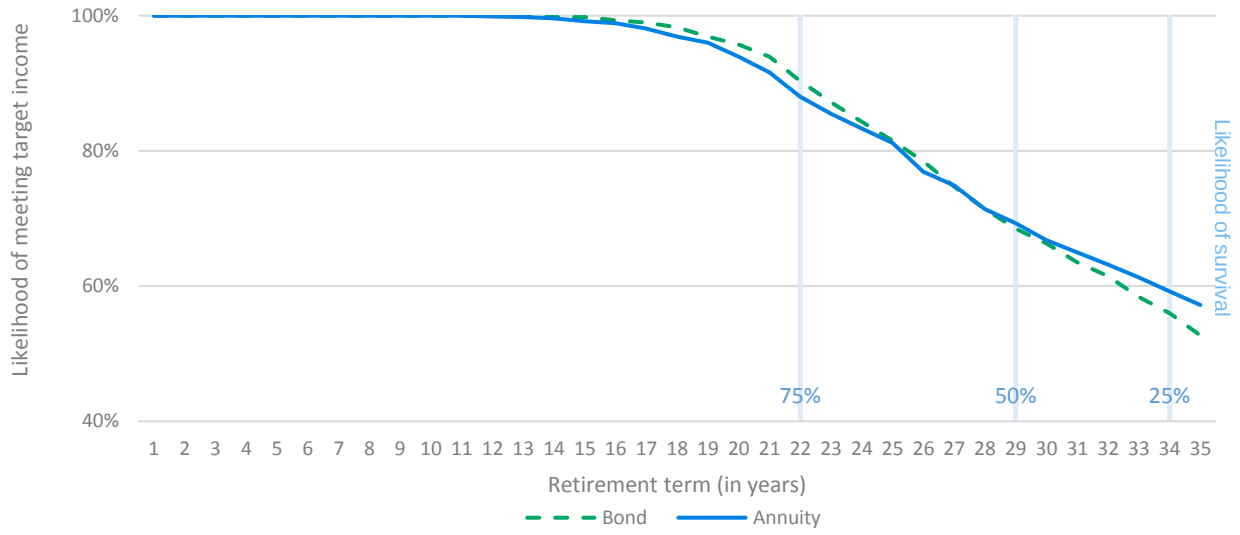


FIGURE 17: AVERAGE DEATH BENEFIT FOR HEALTHY 65YR OLD TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 75% EQUITY, 5 % CASH, 20% BOND OR ANNUITY

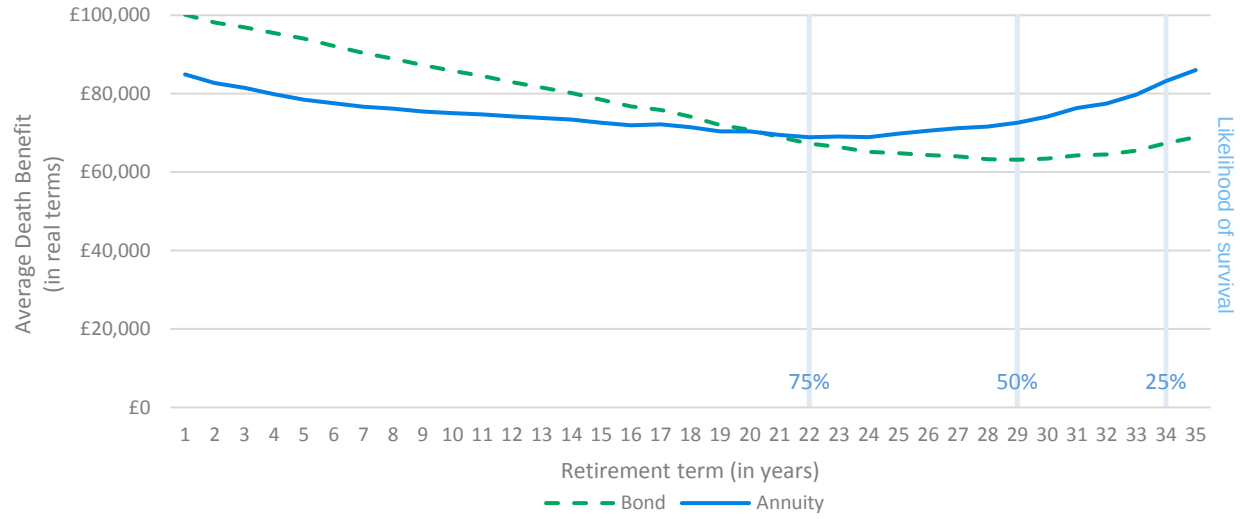


FIGURE 18: LIKELIHOOD OF A HEALTHY 65YR OLD MEETING TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 25% EQUITY, 5 % CASH, 70% BOND OR ANNUITY

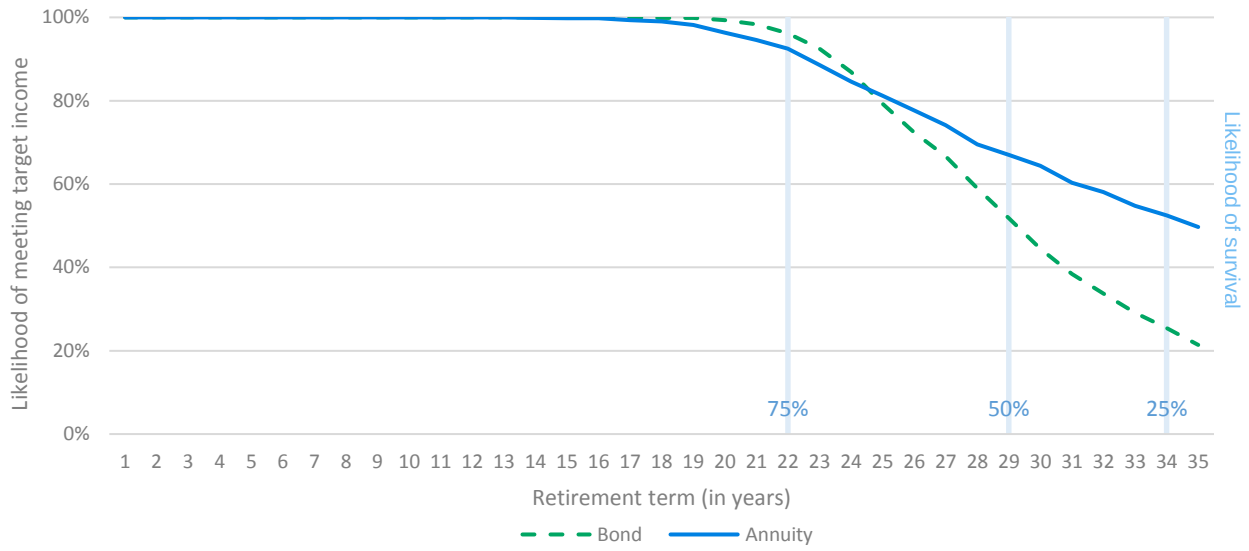


FIGURE 19: AVERAGE DEATH BENEFIT FOR HEALTHY 65YR OLD TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 25% EQUITY, 5 % CASH, 70% BOND OR ANNUITY

APPENDIX B - VARYING THE LEVEL OF DRAWDOWN FEES

The results below show how the likelihood of meeting target income and average death benefit for higher and lower levels of drawdown fees based on our economic scenario modelling.

FIGURE 20: LIKELIHOOD OF A HEALTHY 65YR OLD MEETING TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY, FEES: 1.5%

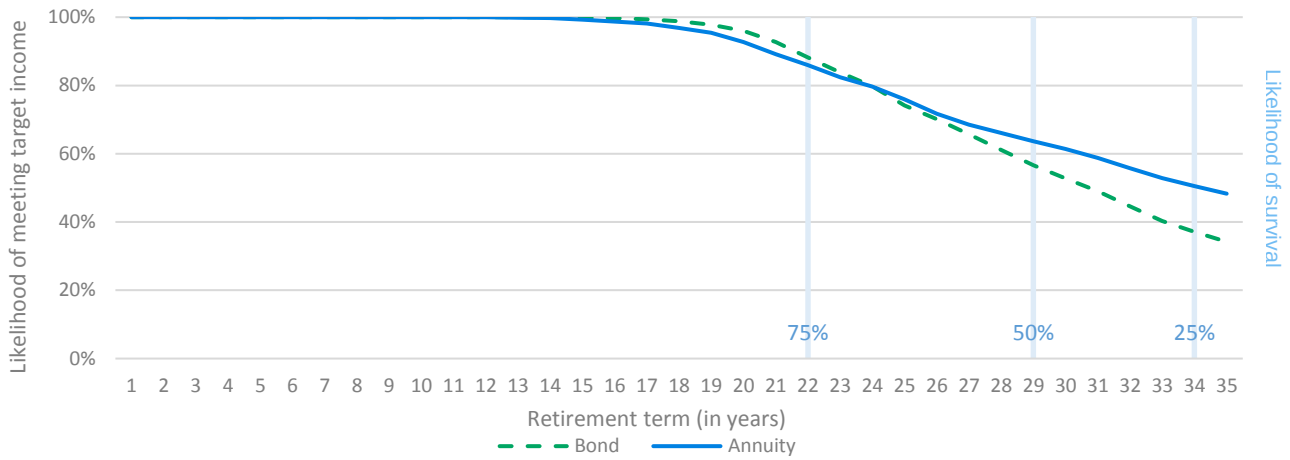


FIGURE 21: AVERAGE DEATH BENEFIT FOR HEALTHY 70YR OLD TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY, FEES: 1.5%

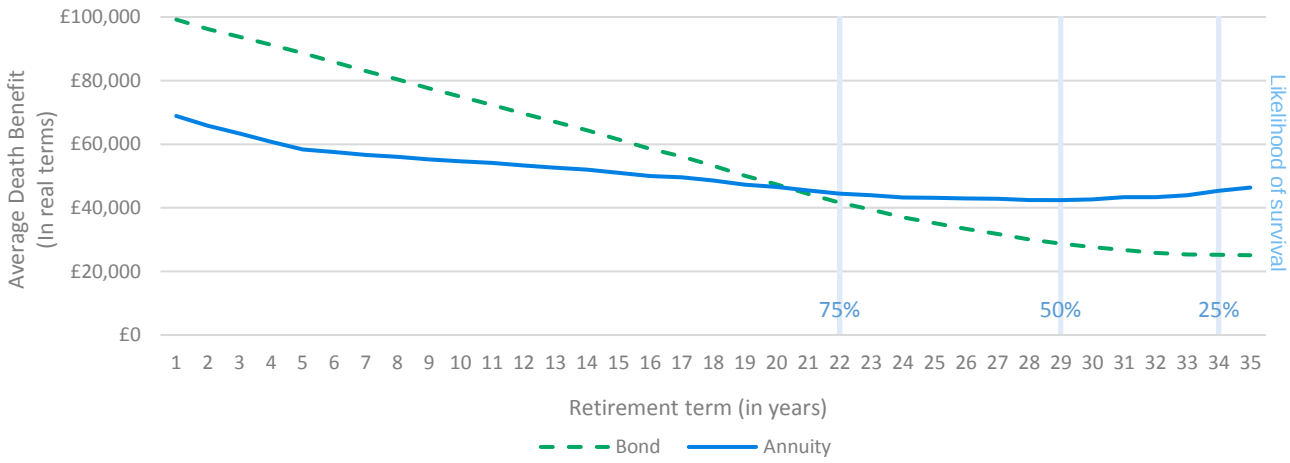


FIGURE 22: LIKELIHOOD OF A HEALTHY 70YR OLD MEETING TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY, FEES: 0.5%

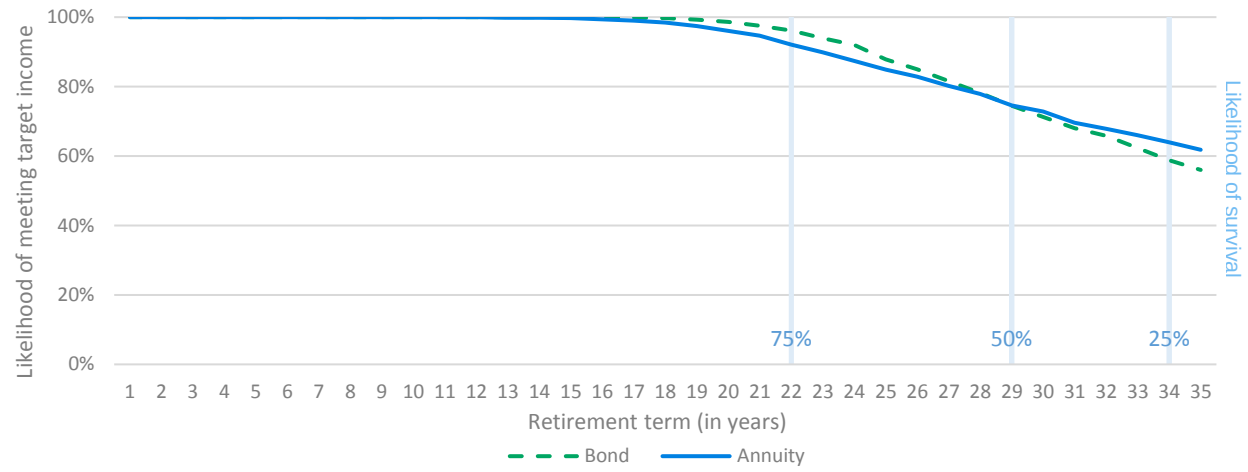
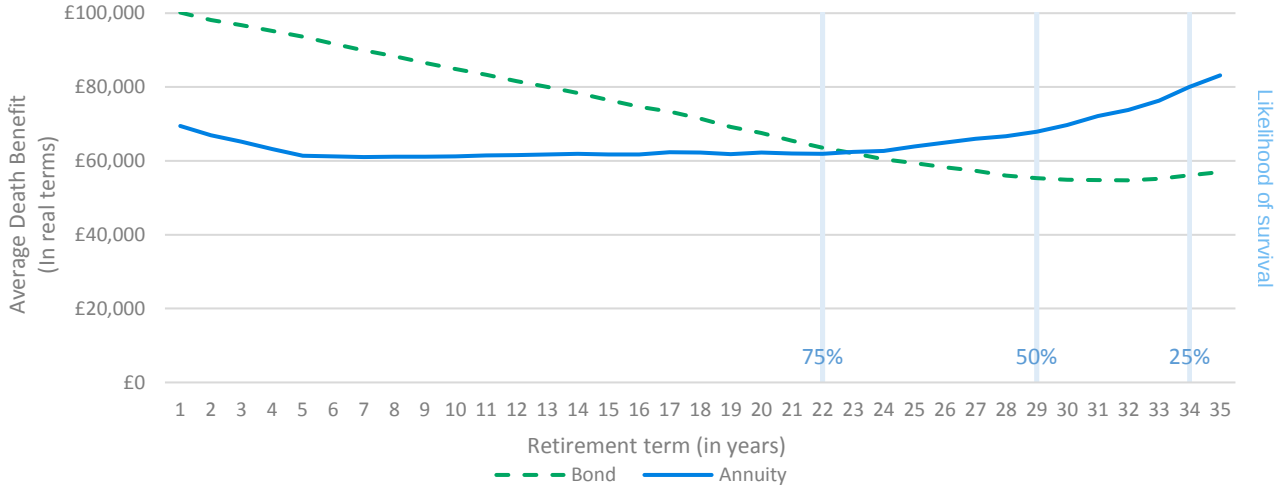


FIGURE 23: AVERAGE DEATH BENEFIT FOR HEALTHY 70YR OLD TARGET INCOME OF £4,000 A YEAR (INCREASING WITH INFLATION). FUND: 55% EQUITY, 5 % CASH, 40% BOND OR ANNUITY, FEES: 0.5%



APPENDIX C - KEY ASSUMPTIONS AND METHODOLOGY

This appendix explains our approach to the research featured in the paper in further detail. **For further information on and detail on the model methodology and parameters, please contact Milliman.**

Overview of calculations

The model used to determine the income likelihood and average death benefit results is driven by an underlying stochastic forecast of the annual investment returns on a number of asset classes: cash, UK government bonds, UK corporate bonds, UK listed equity, global listed equity, and UK property.

In an individual scenario, the forecast investment returns on these asset classes are used to project the annual growth in the value of the corresponding drawdown funds. The customer's retirement fund is subject to a withdrawal in line with the customer's income requirement. In addition, the drawdown funds (investing in bonds and/or equity) are subject to a fixed annual management charge of 1% p.a. (which is the same for every year of the projection and across the different scenarios).

Under the pure drawdown strategy, the customer's annual income needs are met entirely from the drawdown fund (until the fund is projected to be exhausted). Under the annuity-equity strategy, if necessary, the drawdown fund (until it is projected to be exhausted) is used to supplement the income provided by the level annuity so that the customer receives their target level of income.

Where selected, the model also allows for the projected income requirements to vary with future inflation.

Accordingly, for a given set of initial parameters (e.g. age, term, target annual income, etc.), the key variables influencing whether or not the customer receives their target level of income in a particular scenario are the forecast investment returns and forecast inflation in that scenario.

The death benefit available at any particular time point in the projection is the value of the drawdown fund at that point. In addition, during the first five years of the projection, the death benefit under the annuity-equity strategy also includes the value of the remaining income from the annuity's guaranteed period. All of the annuities modelled have a five year guaranteed period and so if the customer were to die in the first 5 years of purchasing the product, their beneficiaries would receive the remaining undiscounted value of the annuity payments due over the 5 year period as a lump sum.

The model assumes that the consumer survives for the entire of the projection period (50 years), i.e. the model does not allow for mortality. The model also assumes that the customer remains invested in the drawdown fund over the projection period, i.e. the model does not allow for surrenders.

Likelihood of meeting target income

For each term, the estimated likelihood of meeting the customer's income requirements over the duration of that term is calculated as the number of individual scenarios in which the target income is met in each year during the term, divided by the total number of modelled scenarios. The customer's target income requirements are deemed to be met in a given year if they receive or are able to withdraw at least 99% of their target income level that year, on the basis that we would expect a typical customer to consider anything within this threshold as successfully meeting their requirements. For this modelling exercise, we have used 1,000 different scenarios which were randomly generated by Milliman's proprietary Economic Scenario Generator. So, for example, if the product strategy is able to provide the target income in 500 scenarios at a given term, then the income likelihood at that term is 50%.

All of the likelihoods (i.e. probabilities) in relation to maintaining the target level of income over a given retirement term that are quoted in this report are based on the modelling work described in this appendix. Actuarial estimates and assumptions are subject to uncertainty and, for this exercise, not all risk factors which could

potentially affect the level of retirement income have been allowed for. The actual likelihood of a particular retiree receiving a target level of income may therefore differ from that suggested by our analysis.

Average death benefit

The average death benefit at each year of the projection is calculated as the average value of the drawdown fund (plus any guaranteed benefit on the annuity) at the end of that year assessed across the 1,000 different economic scenarios. The results are presented as the average death benefit in real terms as a proportion of the unit investment.

Bond-Equity Strategy

At the beginning of the projection, the initial unit investment is allocated between 2 different investments:

- a drawdown fund investing in a mix of bonds and equities:
  - the bond portfolio is 50% in UK corporate bonds with an average duration of 5 years and 50% in UK government bonds with an average duration of 10 years; and
  - the "equity" portfolio is 45% in UK listed equity, 45% in Global listed equity, and 10% in UK property; and
- a cash account.

The UK corporate bonds in the drawdown fund are split across 15% AA rated, 40% A rated and 45% BBB rated assets.

The drawdown fund is assumed to attract an annual management charge of 1% p.a. The cash account is assumed not to attract a charge.

The annual management charge applied to the drawdown fund represents the drawdown product charges and fund management fees.

At the end of each year of the projection, the asset class exposure is rebalanced to the initial level. For example, if the initial investment is allocated 90% to the drawdown fund and 10% to cash. The model will invest / disinvest at the end of each time step such that the portfolio remains at this investment allocation over the duration of the projection. Additionally, the investment mix of the drawdown fund is also rebalanced to reflect a consistent investment strategy. As such, under the pure drawdown strategy, the customer's exposure to the underlying asset classes remains constant over the projection (relative to the total asset value).

Annuity-Equity Strategy

At the beginning of the projection, a proportion of the initial unit investment is used to purchase an annuity.

The annuity rates (i.e. the annual income provided by the annuity per unit of premium), which vary by age, were provided by Just. Just currently carries out individual underwriting on all annuity sales such that the annuity rate offered reflects the customer's personal health. For the purpose of the modelling exercise, Just provided annuity rates at 4 materially different "hazard levels" which were (in order of deteriorating health) referred to as: healthy, reasonable, challenging and critical.

The rates provided are for a level annuity and were the current set of annuity rates used by Just as at 5 June 2018. The annuity rates used were those for a 5-year income guarantee product, where if the customer dies in the first 5 years of purchasing the annuity, the customer's beneficiaries would receive the remaining annuity payments due over the 5 year period as a lump sum.

The remainder of the unit investment is allocated to an equity drawdown fund and a cash account. The equity drawdown fund is invested 45% in UK listed equity, 45% in Global listed equity, and 10% in UK property. For the avoidance of doubt, in the annuity-equity strategy, the modelling does not allow for any exposure to fixed income bonds.

Unlike the pure drawdown strategy (where all assets and investments are rebalanced), for the annuity-equity strategy there is no annual rebalancing of the annuity investment, i.e. there are no future purchases (or partial sales) of the annuity. However, the relative level of the investments in the equity drawdown fund and the cash account are assumed to be rebalanced on an annual basis.

As with pure drawdown strategy, the equity drawdown fund is assumed to attract an annual management charge of 1% p.a. and the cash account is assumed not to attract a charge. The annuity rates include an adviser charge but no other adviser fees are allowed for within the projections.

If in any year of the projection, the level annuity produces an annual income which exceeds the target income level then the excess of the income provided by the annuity is invested in the equity drawdown fund and cash account in proportion to the initial allocation.

Investment and product assumptions

Results were produced for both consumers that would want a flat income or an inflation linked income. In the case of the inflation-linked income, the customer is still assumed to purchase a level annuity and therefore the amount of additional income taken out of their drawdown varies with inflation.

A table below shows the average annual return and standard deviation over the 50 year period for each of the asset classes.

	AVERAGE	STD DEV
BLENDED BOND	3.5%	4.8%
BLENDED EQUITY	6.3%	12.9%
CASH	1.3%	2.2%
INFLATION	2.1%	1.2%

Future portfolio returns

To capture the uncertainty of future portfolio returns in the stochastic model the model was set up as follows:

- The investment performance of the drawdown funds and the cash account were modelled under 1,000 potential future economic scenarios to capture the uncertainty regarding future investment returns on assets and interest rates.
- Risk-free interest rates were implied from the UK government bond yield curve as at 6 June 2018. Variability in interest rates was allowed for using an internally developed stochastic model (based upon 3 factors). Interest rates are assumed to revert, over 30 years, to a long-term level on average as implied by the bond curve at the calibration date, and are assumed non-negative implicitly.
- The risk premiums, above risk-free, earned by each of the UK equity, Global equity, UK property, and UK corporate bond asset classes were derived following an objective approach by using the longest historical periods, where all asset classes have available data. For UK property some further adjustment needed to be made, given that the benchmark data was smoothed, and so was likely to understate the true risk profile. The property calibration was adjusted so the future return and risk profile of UK property is more consistent with other equity type assets.
- This information was used to project investment returns on each specific fund modelled. Variability in the projected investment returns comes from both the variability in the excess return, and in variability in the 1-year risk free rate.

Future inflation-linked income

In addition to the asset class returns, the future annual rate of UK inflation has also been modelled stochastically. This variable is used in the model to project future retirement income requirements for the set of results where the income is allowed to vary with inflation. The principal assumptions underlying the stochastic inflation model are that the Bank of England maintains its current policy towards managing inflation (started in 1997) and that it is successful in meeting the policy objectives. Accordingly, the model assumes that over the long term, inflation rates will revert to a rate consistent with that policy. The model for annual UK inflation has been calibrated using historical Consumer Price Index ("CPI") data.

All of the assumptions are intended to be purely illustrative. All of the results presented throughout this paper are based on simulated or hypothetical performance results that have certain inherent limitations. Unlike the results shown in an actual performance record, these results do not represent actual products. Also, because trades for these products have not actually been executed, these results may have under-or over-compensated for the impact, if any, of certain market factors. Simulated programs are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to these being shown.

APPENDIX D - IMPORTANT INFORMATION

This paper has been commissioned by Just Group. Milliman provides general actuarial services for compensation to Just Group – specifically, Milliman received compensation for this research.

This paper is intended solely for educational purposes and presents information of a general nature.

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Differences between our projections and actual amounts depend on the extent to which future experience conforms to the assumptions made for this analysis. The assumptions we have used have, in our view, been made on the basis of reasonable hypotheses. It is certain, however, that actual experience will not conform exactly to the assumptions used in this analysis. Actual amounts will differ from projected amounts to the extent that actual experience deviates from expected experience. Such variations in experience could have a significant effect on the results and conclusions of this report. No warranty is given that the assumptions made in this report will be reflected in actual future experience.

The information, products, or services described or referenced in this report are intended to be for informational purposes only. This report is not intended to be a recommendation, offer, solicitation or advertisement to buy or sell any annuities, securities, securities or annuities related product or service, or investment strategy, nor is it intended to be to be relied upon as a forecast, research or investment advice.

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The economic scenarios referred to herein may potentially not accurately replicate the prices of all the target calibration assets considered in the calibration and, moreover, may be subject to sampling errors. Other risk-neutral economic scenarios, including those developed by other Milliman consultants or other Milliman offices, could lead to different results and may not be appropriate for a particular financial product or specified set of

assets. The risk-neutral product scenarios are only appropriate for performing valuations and not for risk calculations such as an economic capital analysis. Certain valuations may require different numbers of scenarios in order for such scenarios to be sufficiently accurate. It is up to the user to evaluate whether the scenario-based results are adequately converged. Risk-neutral tables may not reflect or even take into account all potentially significant factors such as certain market risks, liquidity risks and credit risks.

APPENDIX E - ABOUT MILLIMAN

Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in healthcare, property & casualty insurance, life insurance and financial services and employee benefits.

Our Life Insurance and Financial Risk Management practices provide consulting, advisory, risk management and investment advisory services to a large range of clients from insurance companies and investment banks to governments, regulators and ratings bureaus. In particular, we are a global leader in advising retirement product providers and have provided assistance across the industry in terms of developing, managing and optimising the types of products featured in this analysis. We regularly produce insights and research in this area.

In addition, Milliman has a number of innovative risk management strategies, offered through its partners, which allow customers to keep growing their retirement savings while limiting their investment risk.

Founded in 1947, Milliman is an independent firm with offices in major cities around the globe. We are owned and managed by our principals—senior consultants whose selection is based on their technical, professional and business achievements.

Despite our impressive growth over the past six decades, we still operate according to the guiding principles of our founders, Wendell Milliman and Stuart Robertson. We retain their rigorous standards of professional excellence, peer review and objectivity. We remain committed to developing innovative tools and products and providing expert solutions. And we continue to earn our clients' trust by keeping our focus fixed on their business objectives.

Experts: One of the leading life actuarial practice in Europe and Asia and the largest life actuarial practice in the United States. Our financial risk management practice is a global leader in the retirement savings industry. Established in 1998, it pioneered hedging and risk management techniques for the US life insurance industry, and now provides investment advisory, hedging and consulting services on more than $164 billion in global assets (as of March 31, 2016), through its hedging operations in Chicago, London and Sydney. The majority of our clients use these services to support the types of retirement guarantee products discussed in this paper.

Trusted: Advisers to over 80% of the world's leading insurers and engaged by 44 of the top 50 insurers globally. Milliman are well established (founded in 1947) and the majority of our clients are long-term (some clients having engaged with us for over 35 years).

Independent: Owned and managed by our principals, meaning we are committed and independent. We are beholden to no corporate parent or point of view.

Everywhere: With more than 62 offices and 3,000 employees worldwide, we have a strong presence throughout North America, Latin America, Europe, Asia Pacific, Middle East and Africa. Full geographical coverage available by drawing upon our worldwide pool of consultants.

For more information about Milliman's retirement research or experience in managing retirement risks please visit us at:

uk.milliman.com/solutions/services/managing-retirement-risks

Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in life insurance and financial services, property & casualty insurance, healthcare, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

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