MILLIMAN REPORT

Retirement income in a Defined Contribution pensions world

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Neil Dissanayake, FIA, FRM, GSFP
Charlie Howell, FIA, CERA
Russell Ward, FIA

Milliman

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Introduction

Soon, many individuals in the UK will reach retirement with accumulated pension savings solely in defined contribution (DC) form. The "freedom and choice" reforms to the UK pension system introduced back in April 2015 (yes, it was eight years ago) offered individuals greater flexibility in how they structure and manage the provision of their retirement income but did not deliver the supporting tools in terms of products, advice and services, to help them navigate the new world. The working assumption has been that the insurance and pension industry would address this and fill the gap over time. Indeed, progress has been made though we believe many would agree it has been slower than envisaged back in 2015. To be fair to the industry, the scale of the challenge is huge and there have been some significant headwinds to deal with over this period in terms of economic conditions, regulation, changes to state benefits and technology.

This is a potentially vast topic and in writing this paper we have concentrated on the following important question: When individuals reach retirement with an accumulated pot of DC pension savings, how can we help them achieve a sustainable pension income, balancing aspiration (what they would like) with financial reality (what they can get)?

For some, the gap between the income desired and that which can be achieved with the accumulated pension fund may be small or zero. For others the gap will be significant, but in all cases our aim is to offer approaches that can help retirees make the most of available funds, thus reducing any deficiency. We are aware that a great deal has already been written on this topic and we will refer to a number of previous papers on our journey through the pages of this report, while aiming to make our own contribution to this crucial debate.

We note that the UK Department for Work and Pensions (DWP) consultation issued in July 2023, "Helping savers understand their pension choices,"[1] sets out clear proposals that DC schemes will soon be required to provide some level of decumulation framework for members. The consultation notes:

"Our aim, through the proposals presented in this consultation, is to establish a broad alignment in the service offer among different providers where every pension scheme, either directly or through a partnering arrangement, provide decumulation solutions for their members.

"The intention is to place a duty on trustees to offer decumulation services, which are suitable for their members and consistent with pension freedoms."

We hope the analysis in this paper is both interesting and helpful.

The remainder of this report is structured as follows:

- Tools and techniques to help manage retirement income that we expect will form part of future decumulation frameworks—in this section we discuss the use of two approaches that can be used to manage income:
  - Dynamic income management: Varying income taken in response to retiree needs and emerging experience in terms of fund returns.
  - Smoothing and dynamic asset management: Varying the shape and timing of expected fund returns themselves.
- Overview of research on expected desired income paths over retirement.
- Current market developments—this section comments on developments in decumulation across several markets, namely:
  - Australia
  - US
  - Netherlands
- Illustrative case study: Here we lay out the details of a simplified though realistic example. The example contemplates a couple retiring with a target level of income needs based on the Pensions and Lifetime Savings Association (PLSA) retirement living standards, taking into account current UK State Pension entitlements. The analysis considers the ability of various configurations of dynamic income and dynamic asset management to enhance outcomes across a range of metrics tailored to decumulation.
- Summary and conclusions.

1 DWP (July 2023). Helping Savers Understand Their Pension Choices. Retrieved 19 October 2023 from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1168926/helping-savers-understand-their-pension-choices-consultation.pdf.

Tools and techniques to help manage retirement income

Frameworks to manage the translation of accumulated retirement savings into sustainable pension incomes (decumulation) will involve elements such as:

1. Setting and balancing retiree objectives and priorities (cash withdrawals, initial income level and subsequent profile, inflation protection, legacy benefits, risk appetite)
2. Selecting products (annuities, income drawdown, hybrid)
3. Setting investment strategy (risk-return balance)
4. Providing access to advice and guidance

The outcome of considering areas 1 to 4 above is the establishment of an initial decumulation plan.

Once the decumulation process is underway, there will be a need to monitor progress and potentially adjust some aspects of the approach to recognise actual experience, particularly in relation to investment returns, and any significant changes to retiree circumstances that may shift objectives and priorities. Development and delivery of robust and cost-effective ongoing review and management processes represents a significant challenge, but we envisage these actions blending automated and more manual processes to keep down costs. For example, we might have:

- **Periodic health check:** A less frequent process (e.g., every three or five years) to review the areas 1 to 4 described above, revisit the decumulation plan and make any required adjustments.

  The following capabilities would then be used to help keep things on track between periodic health checks.
- **Dynamic income management:** A frequently applied (e.g., annual) but largely automated process to review planned income versus available funds and propose adjusted income levels. The retiree may need to actively opt into the adjustment, or the adjustment could be applied as a default but with the retiree having the right to override it.
- **Dynamic investment risk management:** A frequently applied (e.g., daily) but automated approach to adjust asset risk exposures in light of market conditions (in simple terms the mix between equities and cash or fixed income) in order to target certain objectives such as a particular level of return volatility and/or maximum drawdown.[2]

The focus of the remainder of this paper is on the above automated dynamic management processes.

Dynamic income management

How to appropriately manage income levels through retirement is a complex question whose answer will vary to a degree with individual circumstances. Nevertheless, we can articulate some broad principles that can act as a guide.

INCOME TO COVER ESSENTIAL SPENDING NEEDS

We expect individuals to show the greatest concern over the certainty with which they expect to be able to meet essential spending around, for example: food, utilities, basic clothing and travel. Logically, their appetites for risk in relation to being able to meet (or not) these requirements is extremely low. Such arguments are often used to support an approach of accessing income covering these needs in as secure a form as possible, e.g., using an inflation-linked annuity. We note this is a perfectly reasonable approach, though it is important to consider access to any state benefits when considering the level of annuity required.

Taking a UK example, consider a couple, John who is aged 66 and Sarah who is 63 in January 2023, both wishing to retire. In this case, the State Pension age (SPA) is 66 for them both and so £10,600 per annum (p.a.)—indexed, for now at least, in line with the "triple lock"[3]—is immediately payable to John. However, we note it will be three years hence before Sarah becomes eligible to claim her State Pension. If we assume the couple requires income at least equal to the PLSA minimum level[4] to cover their essential spending, then Figure 1 illustrates their position.

2 Maximum drawdown represents the highest peak-to-trough fall in value of an investment over a specified exposure period.

3 Under the triple lock, the UK State Pension increases each year by the greater of: consumer price inflation, national average earnings and a floor of 2.5%.

4 See: https://www.retirementlivingstandards.org.uk/ for further details on the PLSA retirement living standards.

FIGURE 1: ESSENTIAL SPENDING NEEDS VS. STATE PENSION (UK)

YEARS POST-RETIREMENT	ESSENTIAL SPENDING NEED (£ P.A.)	STATE PENSION5 (£ P.A.)	SHORTFALL (£ P.A.)
1	19,900	10,600	9,300
2	19,900	10,600	9,300
3	19,900	10,600	9,300
4	19,900	21,200	-
5+	19,900	21,200	-

In Figure 1, we have ignored inflation for simplicity. In reality both the essential spending requirement and the State Pension will increase with inflation, though it is unlikely that they will increase at the same rate. A basket of goods that is reflective of essential spending for the average retiree may will differ markedly from the basket of goods that is used to define the general consumer price index used to measure price levels within the whole economy (which the State Pension references).

The results show clearly that our couple has an initial shortfall of guaranteed income to meet essential spending. However, the shortfall is temporary and disappears once Sarah's State Pension becomes payable. Faced with this our couple has some options:

1. **Secure additional guaranteed income:** One approach would be to purchase a lifetime annuity to provide an initial income of £9,300 p.a. This certainly covers the shortfall but beyond year 3 may result in the couple having more guarantees around their income than they really need, with an associated loss of control and flexibility. A more targeted alternative, if available, would be to purchase a temporary annuity for a three-year term to cover the shortfall period.
2. **Accept some risk:** At the other end of the spectrum, they could remain entirely invested via an income drawdown product and accept that this does present some risk. Specifically, the relatively large income withdrawals required during the first three years make them vulnerable to adverse investment returns during that period in particular—an example of so-called sequencing risk, which we return to later. However, we note there are techniques such as return smoothing and investment risk management that enable sequencing risk to be reduced.

INCOME TO COVER LIFESTYLE SPENDING

Once essential spending requirements are satisfied, residual funds can be applied to deliver incremental income to enhance John's and Sarah's lifestyle in retirement. This additional spending is likely to have both a broadly regular element (e.g., club memberships, entertainment subscriptions and day trips) alongside a lumpier element (e.g., holidays, home improvements, car replacement).

The desire to retain some flexibility around the level and timing of income to meet lifestyle requirements[6] can be addressed by keeping part of their pension fund invested and using an income drawdown product to take income as it is needed. This approach however exposes our couple to several risks:

- **Investment risk:** Essentially the risk that the assets constituting their pension fund fall in value.
- **Sequencing risk:** The risk of the timing of commencing income drawdown relative to the market cycle. If investment markets fall rapidly at the same time as commencing an income drawdown, then this can have an adverse impact on the level of income that can be supported later in retirement. This impact of a severe market downturn is less significant if markets are in a period of growth to begin, and the downturn instead happens later in retirement.
- **Inflation risk:** The risk that, even if the income available is adequate to meet needs initially, it fails to keep pace with inflation over time, resulting in a gradual fall in the couple's living standards in real (inflation-adjusted) terms.
- **Longevity risk:** The risk that the initial pension fund and subsequent investment returns are inadequate to sustain income throughout the entire retirement period.

5 Note that we assume both John and Sarah are eligible for the full State Pension benefit.

6 Note that another driver can be the desire to pass on any residual pension fund to their chosen beneficiaries on death.

As a result of these risks, the income delivered from a drawdown product cannot be guaranteed, and it is possible that income may cease altogether should the investment fund be fully exhausted, leaving John and Sarah reliant on the State Pension.

To reduce the risk that our couple exhaust their retirement fund and suffer a consequent material decline in their living standards it is important that the income taken is set considering:

1. The level realistically sustainable given the size of the retirement fund and the planned investment strategy.
2. The implications of realised investment market returns and changes in expected future returns.

At the most fundamental level, the sustainability of a retirees' income is undermined when income is set at a level that is simply too ambitious in relation to the funds available and/or when income is delivered by selling retirement fund assets at depressed prices. Nevertheless, to the above technical conditions, we would add a third practical one in that the actual level of income desired by John and Sarah should also be recognised even if it cannot always be delivered.

Several dynamic income rules have been proposed over time from a simple aim to maintain a particular income level in real (inflation-adjusted) terms. Here, an initial income level might be set either as percentage of preretirement income or as a percentage of the retirement fund and then adjusted in line with inflation. An example would be the so-called Bengen 4% rule.[7] Some approaches extend the above by adding a periodic affordability test, for example by considering whether the remaining fund could purchase the current level of income as a level or inflation-linked annuity and adjusting the income downwards if the test is failed. Going further, some approaches embed assumptions about the economic utility function of retirees[8]—typically some degree of risk aversion such that avoiding falls in income below a target level are more important than achieving increases in income above the target.

A review of a wide range of proposed rules was undertaken in a paper by W. Pfau, "Making Sense Out of Variable Spending Strategies for Retirees."[9] The analysis shows that the choice of spending rule can have a marked impact on customer outcomes. However, some have cautioned against the use of highly complex rules given that they may be challenging operationally and difficult to explain.[10]

Our view is that the principle of parsimony should apply and thus spending rules should be no more complex than they absolutely need to be to deliver real benefits in customer outcomes. Later in this paper we explore the impact of some dynamic spending rules on the income available to John and Sarah.

Smoothing and dynamic investment risk management

Dynamic income management, as described above, can help improve the sustainability of income by essentially making asset realisations more sympathetic to the underlying investment performance of the fund, resulting in assets being realised at a higher average price over time and benefiting the total amount of income that can be provided. However, to be clear, this approach does not change the underlying investment returns of the fund and an unconstrained application could result in significant income volatility unlikely to be attractive to many retirees. To address this, we now consider two additional and potentially complementary techniques.

Smoothing and dynamic investment risk management techniques aim to adjust the profile of underlying fund returns to one that is more favourable to individuals drawing a regular income.

Firstly, we consider smoothing, which is a technique whereby the recognition of raw underlying fund returns is modified to generate a smoother profile. It is important to note that this process does not change the underlying fund returns, only the timing of their recognition, but this can nevertheless be helpful.

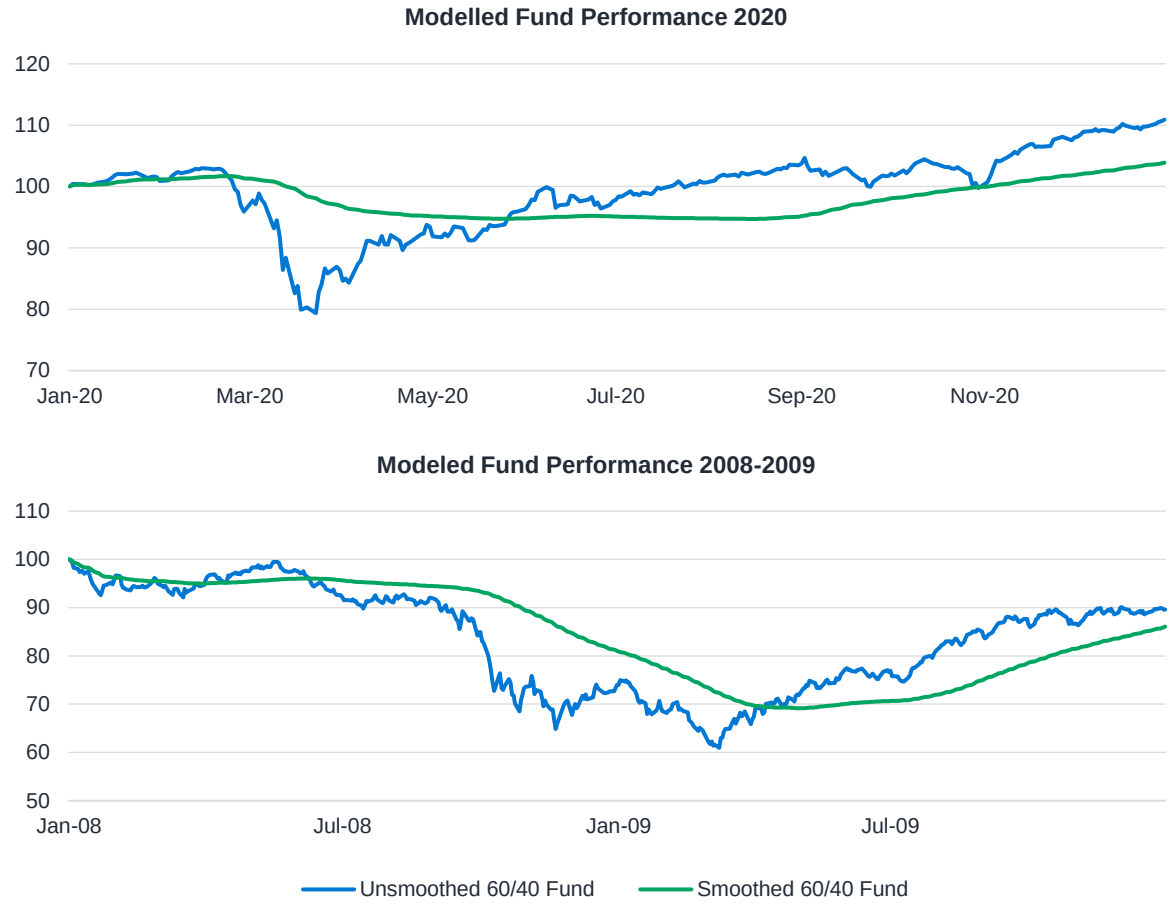
7 Bengen, W. P. (October 1994). Determining Withdrawal Rates Using Historical Data. FPA Journal. Retrieved 20 October 2023 from https://www.financialplanningassociation.org/sites/default/files/2021-04/MAR04%20Determining%20Withdrawal%20Rates%20Using%20Historical%20Data.pdf.

8 See for example: "Redefining Optimal Retirement Income Strategy" (Blanchett) at https://www.tandfonline.com/doi/full/10.1080/0015198X.2022.2129947.

9 See https://www.financialplanningassociation.org/article/journal/OCT15-making-sense-out-variable-spending-strategies-retirees.

10 See for example: "Redefining Optimal Retirement Income Strategy" (Blanchett) at https://www.tandfonline.com/doi/full/10.1080/0015198X.2022.2129947 and "Decumulation, Sequencing Risk and the Safe Withdrawal Rate" (Clare, A. et al., 2017) at https://www.york.ac.uk/media/economics/documents/discussionpapers/2017/1706.pdf.

FIGURE 2: IMPACT OF SMOOTHING



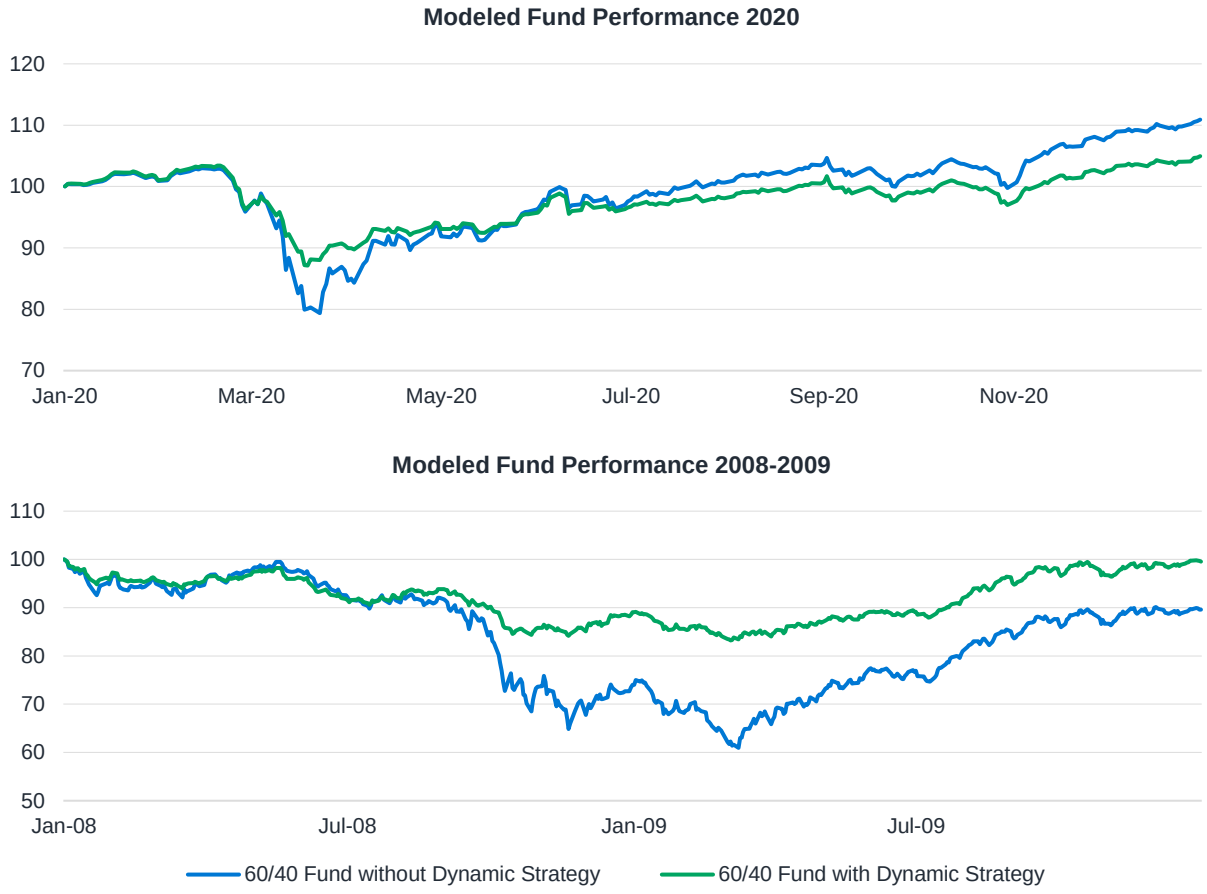
For illustrative purposes only, does not represent the performance of any actual investment or portfolio, and should not be viewed as a recommendation to buy/sell.

Results based on simulated or hypothetical performance results have certain inherent limitations. Unlike the results shown in an actual performance record, these results do not represent actual trading. Also, because these trades have not actually been executed, these results may have under-or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated or hypothetical trading programs in general 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. Milliman does not manage the underlying fund.

In Figure 2, we illustrate the impact of smoothing underlying investment fund returns using a six-month moving average approach and a fund invested 60% in risk assets (equity, property) and 40% in bonds. The chart on the left shows the return profile with and without smoothing during 2020, which exhibited a very deep but relatively short-lived market stress. In this case, we can see that the smoothing has been effective at mitigating the price fall with the smoothed price remaining broadly stable and providing a more supportive return profile for taking income. Turning to the chart on the right, we consider the 2008-2009 period of the global financial crisis (GFC), which resulted in a significantly more protracted fall in investment markets. In this scenario, smoothing offers some mitigation of the price fall but given the length of the market decline, smoothed prices are also pulled down eventually.

Next, we consider the impact of a dynamic investment risk management approach specifically designed to reshape the profile of fund investment returns to significantly reduce downside risk whilst preserving the ability to participate in positive returns. There is, as they say, no such thing as a free lunch, and so this approach will lead to lower returns in bull markets, but the overall balance of upside and downside exposure is likely to produce a better alignment of portfolio returns with the need of retirees to withdraw a regular income.

FIGURE 3: IMPACT OF DYNAMIC INVESTMENT RISK MANAGEMENT



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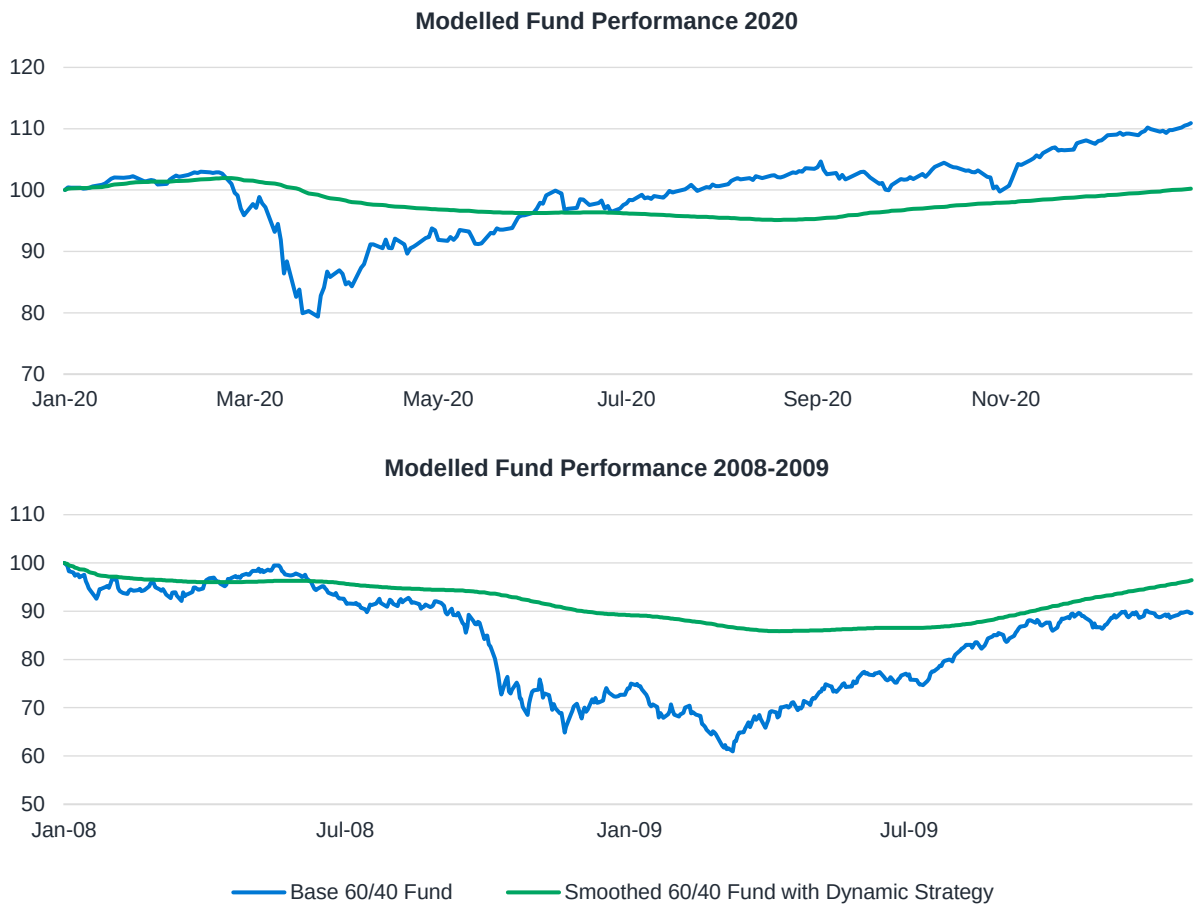
In Figure 3, we illustrate the same historical scenarios we considered earlier, but this time using an investment risk management strategy that rebalances the level of equity exposure within the fund in response to the level of prevailing risk. In markets when near-term equity risk is forecast as sufficiently low, 60% equity exposure is retained. In markets where near-term equity risk is expected to be high, the equity exposure in the fund is reduced—in an extreme case this could be completely replaced with a 60% cash exposure. There are various quantitative, rules-based techniques that can be used to achieve this. In this example, we illustrate a strategy which combines two techniques—volatility management and option replication.[11] From a practical perspective, this could be implemented either by using liquid futures to synthetically adjust net equity exposure, or alternatively the equity exposure could be delivered through a basket of equity and cash exchange-traded funds.

In the 2008-2009 example, where the market crisis involved a severe fall unfolding over several months, such dynamic investment risk management techniques work well in being able to "put the brakes on" and cushion the fund from the worst of the market decline. In the 2020 example, given the comparatively quick drop in the markets, dynamic investment risk management techniques have less impact as they take some time to adjust the exposure of the fund.

11 For more information, see Milliman Managed Risk Strategy | Milliman | Worldwide at https://www.milliman.com/en/services/milliman-managed-risk-strategy.

Finally, noting that the relative strengths of the smoothing and dynamic investment risk management are complementary—smoothing being more effective in short, sharp stress scenarios and dynamic investment risk management in more persistent stresses—there is a clear indication that combining the two approaches may offer further improvements in retiree outcomes.

FIGURE 4: IMPACT OF COMBINED SMOOTHING PLUS DYNAMIC INVESTMENT RISK MANAGEMENT



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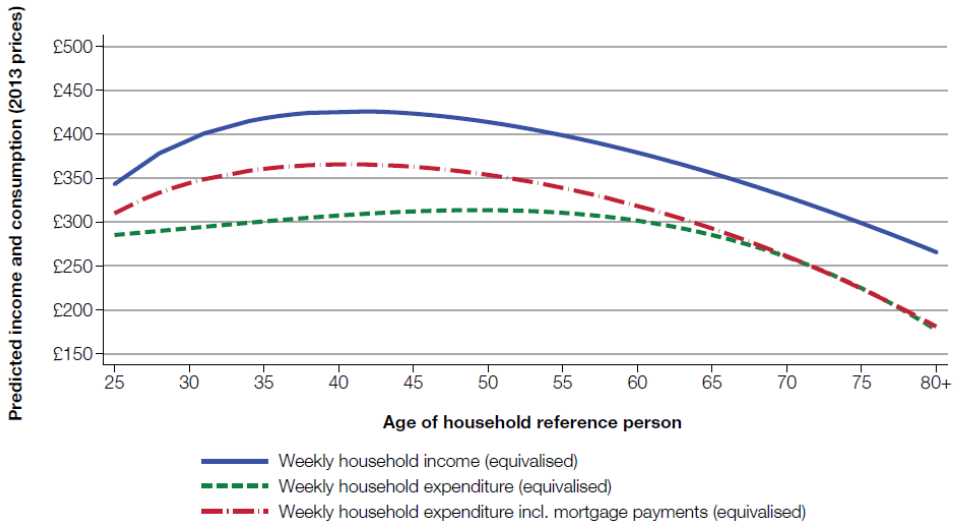
In Figure 4, we see that, when combining both techniques, we preserve the benefits of both and therefore have a more robust overall risk management strategy. In the 2020 example, the smoothing helps to ensure that the ”risk-managed” fund keeps a price level higher than 95, compared to a price level that drops to below 80 otherwise. In the 2008-2009 example, the dynamic investment risk management helps to ensure that the risk managed fund keeps a price level higher than 85, compared to a price level that drops to close to 60 in the absence of protection.

Desired income profiles

When assessing possible options for taking retirement income, consideration is needed for what represents a reasonable desired income profile. Setting this is nontrivial given that it is unlikely that many retirees will have a firm view of their likely spending five, 10 or 20 years hence. Fortunately, a considerable body of research is building around the spending profiles of retirees and the results emerging provide helpful insights and point to features that should be considered as part of decumulation solutions.

A report produced in 2015 titled "Understanding Retirement Journeys: Expectations vs. Reality" (Brancati et al.) [12] showed the results illustrated in Figure 5 of an analysis of income and spending by age.

FIGURE 5: INCOME AND CONSUMPTION EXPENDITURE AT DIFFERENT AGES



Source: author's calculations from Living Costs and Food Survey / Expenditure and Food Survey (years 2003 to 2013)
Consumption expenditure and household income deflated by RPI index at 2013 prices; OECD equivalence scale used to account for household composition; top and bottom 1% of the distribution of consumption expenditure and household income have been trimmed to exclude outliers; data are weighted using annual weights.

The report noted:

"This report finds evidence of something akin to a default consumption path in retirement, with consumption falling during retirement leading to savings in later life."

In terms of implications for retirement income provision, the report said:

"Given the reality of retirement journeys, it may make sense for financial products and services to facilitate relatively high initial income before guaranteeing a base level of income in later life as people reduce expenditure on non-essential items but maintain spending on essential every-day items."

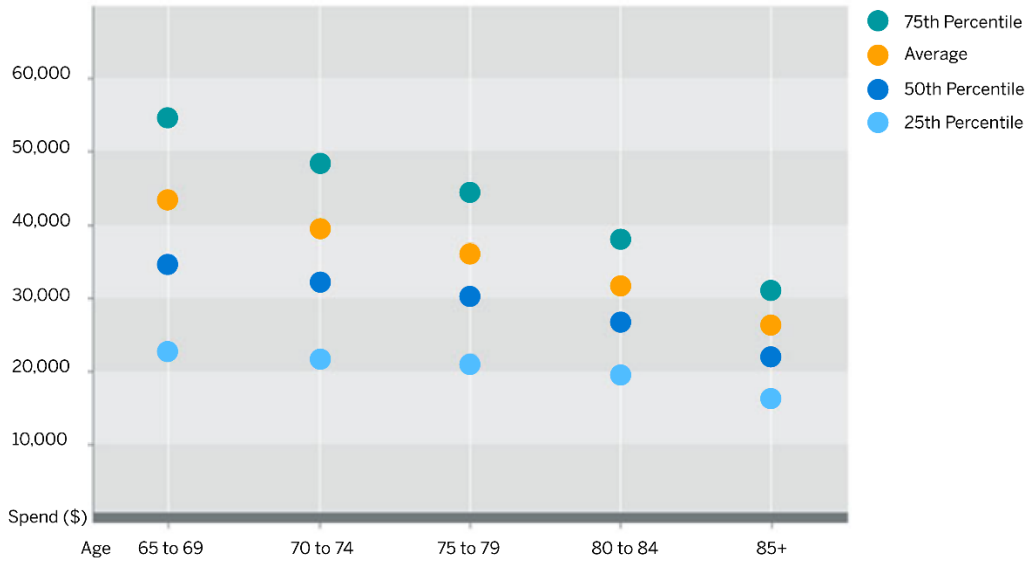
Considering a different market, but one with a well-established DC retirement framework, our colleagues in Australia undertook research into the spending patterns of retirees there split by wealth band.[13] The Milliman Retirement Expectations and Spending Profiles (ESP) analysis is based on the actual spending of more than 300,000 Australian retirees and notes:

"The decline in expenditure for couples is relatively stable in the early years of retirement at about 6% to 8% across each four-year age band, but then rapidly accelerates once retirees pass 80 years of age."

12 Brancati, C.U. et al. (1 December 2015). Understanding Retirement Journeys: Expectations vs. Reality. Retrieved 20 October 2023 from https://www.bl.uk/collection-items/understanding-retirement-journeys-expectations-vs-reality.

13 Gebler, J. (23 April 2018). Analysis: Retirees' Spending Falls Faster Than Expected Into Old Age. Milliman Insight. Retrieved 20 October 2023 from https://au.milliman.com/en/insight/analysis-retirees-spending-falls-faster-than-expected-into-old-age.

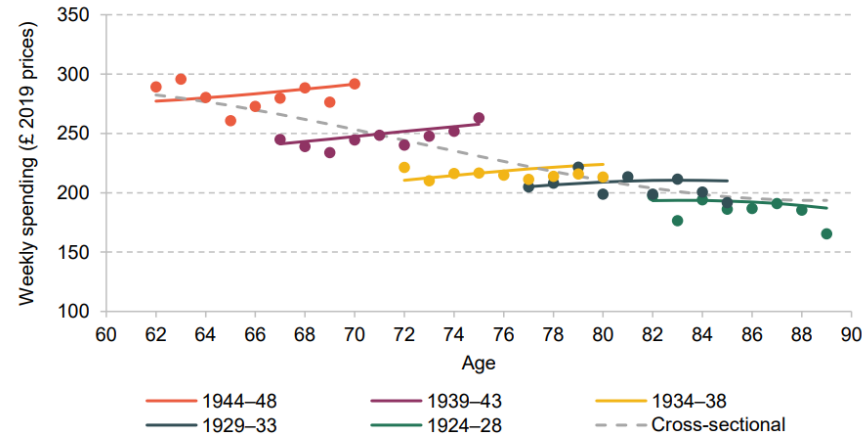
FIGURE 6: MILLIMAN ESP ANALYSIS OF SPENDING BY WEALTH BAND



The Australian study uses shows a similar pattern of spending declining in real terms with advancing age during retirement.

Both the papers referred to above use cross-sectional data. An alternative approach was taken by Crawford et al. in a 2022 paper for the Institute of Fiscal Studies (IFS) entitled "How Does Spending Change Through Retirement?"[14] This paper considered UK data and divided individuals into several birth cohorts and considered the spending profile of each cohort over several years, providing a longitudinal perspective.

FIGURE 7: MEAN AND FITTED AGE PROFILES OF TOTAL HOUSEHOLD EXPENDITURE BY BIRTH COHORT



Note: CPI used for inflation adjustment. Average weekly per-person spending in £ 2019 prices. Solid lines: estimated age profiles from a regression of spending on a cubic in age, and year and cohort dummies, drawn separately for each cohort. Dots: average spending among the given cohort and age. Dashed grey line: the cross-sectional profile derived from a regression of spending on a cubic in age, and year dummies, but no cohort controls.

Source: Authors' calculations using LCFS 2006–18 and ELSA waves 2–9.

The paper notes:

"These results suggest that, on average, in order to have an income profile that would match the age profile of spending through retirement seen among earlier cohorts, people should aim for a total income profile that is roughly constant in real (CPI-adjusted) terms through retirement."

14 Crawford, R. et al. (10 May 2022). How Does Spending Change Through Retirement? IFS. Retrieved 20 October 2023 from https://ifs.org.uk/publications/how-does-spending-change-through-retirement-0.

Clearly these results differ from those in the earlier studies, and it will be interesting to follow the progress of the cohort analysis as additional years of data are added.

A 2021 paper by Chen and Munnell entitled "Do Retirees Want to Consume More, Less, or the Same as They Age?"[15] also considers longitudinal data from two consumption surveys in the US. The paper considers the overall profile of consumption but then also considers the impact of wealth and health on consumption patterns over time. Considering retirees as an aggregate group, the authors found consumption falling at a rate of about 0.75% p.a. through retirement. However, when the data was split by wealth the observed fall in spending was only 0.35% p.a. for the top wealth tercile but it increased to 1.0% p.a. for the bottom tercile, indicating that part of the fall seen in the aggregate data may be due partly to financial constraints.

Given the uncertainty, an important consideration is the consequence of making an inaccurate assumption regarding the spending profile. This will vary with product selection depending on the extent to which there is flexibility to adjust income levels over time as a retiree's actual profile reveals itself. Examples include:

- **Inflation-linked annuity:** Offers a level income profile in real terms.[16] However, if an individual's actual profile of required spending exhibited a fall with advancing age, then the annuity income will be unnecessarily reduced in early retirement and may then be higher than required in the later years.
- **Level annuity:** Offers a reducing income profile in real terms (ignoring the possibility of deflation). The issue then is simply the mirror image of the previous product. If the true profile of required spending was level or increasing in real terms, then the annuity income will be elevated during the early years but will fail to offset the impact of inflation and be potentially inadequate in later retirement.
- **Income drawdown:** To the extent that the initial level of income reflects a sustainable withdrawal rate calculation, then the potential inaccuracies are similar to those for the annuity. However, a difference arises in that income from the drawdown product can be adjusted subsequently to reflect emerging information about spending patterns. Where an annuity is purchased in later life, there is at least the opportunity for individuals and/or their advisors to reflect on accumulated experience in setting the chosen income profile to lock into.

Current market developments outside the UK

We have examined the product landscape in three other markets—Australia and the USA, where there is a predominance of individualised savings products, and the Netherlands, where there has been a greater emphasis on collective pensions savings.

AUSTRALIA

In the Australian market, there are some innovative products that include mechanisms aimed at addressing some key retirement risks. Two examples are as follows:

- **QSuper Lifetime Pension:** This product delivers a target (although not a guaranteed) lifetime income, which is expected to increase over time. However, it can also vary with inflation, investment returns and the collective mortality experience of its members. It protects members against idiosyncratic longevity through use of a pooling mechanism. It also simultaneously offers a death benefit (equal to initial payment less income received) through a group life insurance policy. More information can be found here: Lifetime Pension | QSuper at https://qsuper.qld.gov.au/our-products/superannuation/lifetime-pension.
- **SpiritSuper Managed Pension:** This product automatically distributes income at a sustainable level that is suitable for providing an income with a high degree of confidence until age 90, including allowing for inflationary increases. This sustainable income level is recalculated each year to help protect against the risk of members taking an excessive level of income that could lead to a higher probability of running out of money. Conversely, it also helps protect against underutilisation of savings, from members being overly cautious as they look to protect themselves against that risk. The use of a conservative sustainable level of income in this product is likely to lead to a gradually increasing level of income beyond the inflationary increases over time. More information can be found here: Pension account options | Spirit Super at https://www.spiritsuper.com/au/Retirement/Account-options.

15 See https://crr.bc.edu/wp-content/uploads/2021/12/IB_21-21.pdf.

16 Strictly speaking, ignoring the basis risk between the general inflation index, e.g., consumer price index (CPI), used to index annuity income versus the actual rate pertaining to the basket of goods purchased by a retired individual.

US

In contrast to Europe, where guaranteed products have declined as interest rates have fallen, in the US the market for guaranteed products or products with embedded protection has instead evolved to respond to changing market conditions. Many of these products will include a choice of either a capital benefit or an income benefit. The income benefit is most commonly a lifetime income guarantee—e.g., guaranteed minimum withdrawal benefits for life, or deferred annuities. They therefore offer the ability to either be used as a pure accumulation product, or a combined accumulation and decumulation product.

There are the following main types of products:

- **Variable annuities (VAs):** Investments with attaching guaranteed payments, such as capital guarantees, lifetime income (or withdrawal) guarantees or guaranteed rates of capital to income conversion.
- **Fixed indexed annuities (FIAs):** Investment accounts, where annual investment return is floored at zero, and for any positive investment return only an initial specified proportion is credited to the investment account. Typically, nearly all products offer either a capital benefit or a lifetime income benefit at the end of the savings period.
- **Registered index-linked annuities (RILAs):** Similar to fixed indexed annuities, except that the investment return may be floored at a negative return, rather than zero. Not all these products necessarily offer a lifetime income benefit. Some of the products on the market only offer a capital sum at the end of the savings period.
- **Fixed deferred annuities (FAs):** A more traditional insurance product, where future income is defined and paid for through premiums that are paid over a period leading up to the first income payment.
- **Multiyear guarantee annuities (MYGAs):** A more generic definition of fixed deferred annuities, where guarantees of investment performance, to meet a future capital amount or income stream, are spread over a multiyear investment period.

Prior to 2008, when interest rates were comparatively high and equity market volatility fairly benign, variable annuity guarantees could be manufactured at a reasonably attractive cost. Low volatility means a low cost of hedging for guarantees against investment falls, and high interest rates help to mean discounted long-term guarantee liabilities are low. After 2008, declining interest rates led to FIAs becoming a comparatively more attractive way to offer similar benefits, given the comparatively less favourable pricing conditions for VAs, as well as other regulatory drivers.

In recent years, where volatility has been on the increase, option derivative instruments which are needed to support both these product types (both put and call options) have also become expensive. This has led to FIAs adapting into RILAs (with negative floors). With the rise of interest rates, MYGAs have now also started to find traction.

Insurance guarantees have evolved to respond to falling interest rates, but we have also seen the evolution of investment products to “mimic” these benefits, at a more attractive cost. Firstly, funds with downside risk protection that sit somewhere between a guarantee and no protection—when markets fall they cushion against investment losses, to ensure fund values remain higher than without any protection. However, they do not guarantee that investment losses will be capped. Secondly, funds that invest in options, and so provide a payout similar to FIA or RILA products but again without the absolute guarantee—residual risk may be small if invested on the start date for these products, but higher if invested at other points. Such soft protection approaches introduce some more risk due to a lack of guarantee, in exchange for a cheaper cost of manufacture. As the extreme tail risk protection of a guarantee is typically the most costly to hedge, these strategies are typically expected to have higher expected benefits per unit of cost.

In contrast to the split between accumulation and decumulation we see in the UK DC pensions market, these products (when a lifetime income guarantee benefit is selected) essentially combine both savings and decumulation periods together in one product—i.e., a “to and through” approach. Through offering guarantees (or softer protection, in the case of pure investment products) they aim to offer protection from both investment risk and longevity risk. This is manufactured through sophisticated derivatives-based strategies, a commonly utilised approach in this market.

For more information on these products the following is a useful article: The Rise of Registered Index Linked Annuity (RILA) products | SOA at https://www.soa.org/sections/product-dev/product-dev-newsletter/2022/august/pm-2022-08-carbo/.

NETHERLANDS

In the Netherlands, many rely substantially on workplace pensions, in addition to the state pension, to fund retirement. The provision of workplace pensions has evolved over the years, in accordance with market regulation.

Firstly, there was the move away from defined benefit (DB) plans, either to collective defined contribution (CDC) plans (starting around 2010), or International Financial Reporting Standard (IFRS)-proof plans offered by insurance companies (starting around 2012). These changes were largely in response to a desire to remove pension-related corporate balance sheet risks. Another benefit, but less of a driver, was the cost and return benefits from pooling assets into larger funds.

CDC plans collectively invested assets and pooled benefits. They aimed to target specific benefit levels, but these levels were not guaranteed. If investment or longevity experience was sufficiently adverse, CDC plan rules enabled benefits to be reduced to improve scheme funding levels.

Given the nature of how these CDC and IFRS-proof plans were structured and administered, and the resulting risks, they typically followed a relatively conservative investment policy. Even with such a conservative investment policy, there were periods of investment performance that resulted in many schemes reducing benefits to scheme members. Scheme rules set out that investment risk was to be borne by the collective participants, but the expectations of plan participants had historically not been effectively managed. Along with a lack of transparency, this led to a lack of trust in the current system, and a perception that the existing system was unable to provide for benefits as promised.

Consequently, there has recently been a change in pension legislation (as of 1 July 2023). This new legislation in effect converts all pension funds into collectively managed but individually allocated assets. This new framework also potentially opens up greater scope for product innovation, both from an investment perspective and an income benefit management perspective.

Illustrative case study

We have already introduced our case study couple, John and Sarah, but in this section, we add further details necessary to develop the illustrations which follow.

JOHN AND SARAH

- John: Retires aged 66 in January 2023 with immediate full entitlement to the new UK State Pension.
- Sarah: Retires aged 63 in January 2023 with full entitlement to the new UK State Pension but must wait three years until it becomes payable from age 66.
- John and Sarah have an accumulated DC pension fund of £275,000 at retirement.
- The UK State Pension is £10,600 p.a. in 2023 and, given that the long-term future of the triple lock is uncertain, we assume future increases in line with inflation only.
- Finally, we assume that John and Sarah have no other savings or forms of income and we ignore the equity they have in their home as this is earmarked to provide an inheritance for their children.

OBJECTIVES

- They aim for a very high degree of security in relation to income covering their basic needs (PLSA minimum level of £19,900 p.a. initially but increasing with inflation).
- However, they aspire to a better retirement standard of living than this and anticipate additional income being available to provide for some lifestyle-enhancing spending in line with the PLSA moderate income level. This additional income amounts to £14,100 p.a., initially also increasing with inflation. They are comfortable in taking some risk with their lifestyle income to retain flexibility and preserve scope for an additional legacy for their children.
- Thus, their overall income target is £34,000 p.a.[17] at outset, increasing with inflation.

17 Equivalent to the PLSA Moderate level for a couple.

PRODUCTS

- **Annuity (immediate purchase):** John and Sarah decide against purchasing an annuity immediately as the deficiency of the State Pension to cover their essential spending needs lasts only for three years.
- **Income drawdown:** The couple decide to invest their £275,000 retirement fund into an income drawdown product with the following features:
  - Investment mix:
    - 50% international equity
    - 10% property
    - 17.5% UK gilts (all durations)
    - 17.5% UK corporate bonds
    - 5% cash
  - Option to add smoothing of investment returns
  - Option to add investment risk management
  - Charges: We assume a product charge of 0.50% p.a. during the drawdown phase, with a 0.30% p.a. fund management charge.
- **Annuity (later life):** John and Sarah understand that in later life there are circumstances where the purchase of an annuity may be appropriate. For example, when one of them dies, State Pension income will be reduced by 50% and may therefore be less than the essential spending needs of the survivor—using part of the remaining retirement fund to purchase guaranteed income to cover any deficiency may provide peace of mind. Furthermore, at advanced ages investment horizons become shorter (making risk management more difficult). The relative importance of income flexibility versus income security tends to tilt in favour of the latter as activity levels decline and individuals become less able or willing to engage in managing their retirement income—this may occur for example due to cognitive decline.

  To recognise this, our examples assume that the residual fund within the income drawdown product is automatically applied to purchase an inflation-linked annuity once John reaches age 80.

DYNAMIC INCOME RULES

The management of retirement income has several elements:

1. Setting an initial level of income and a planned trajectory for this—the two are of course interrelated.
2. Devising and applying a set of rules to determine a suggested income adjustment for a retiree at each review point. As described earlier, these adjustments help reflect accumulated investment return experience with the objective of maintaining income at a sustainable level. Broadly speaking, if investment returns have exceeded expectations, then we expect an upward adjustment to income (other things equal) and vice versa if investment returns have been poorer than those expected.
3. Recognising input from the retiree and/or their advisor provides an important additional element of variation to recognise changes in current and possibly future planned spending needs.

Taking each of these elements in turn:

INITIAL INCOME LEVEL AND PROFILE

In our example, we know John and Sarah have an initial target income of £34,000 p.a. and, allowing for their State Pension entitlement (John only initially), the minimum income required from their accumulated retirement fund is £23,400 p.a. (£34,000 - £10,600). This is what they would like to have.

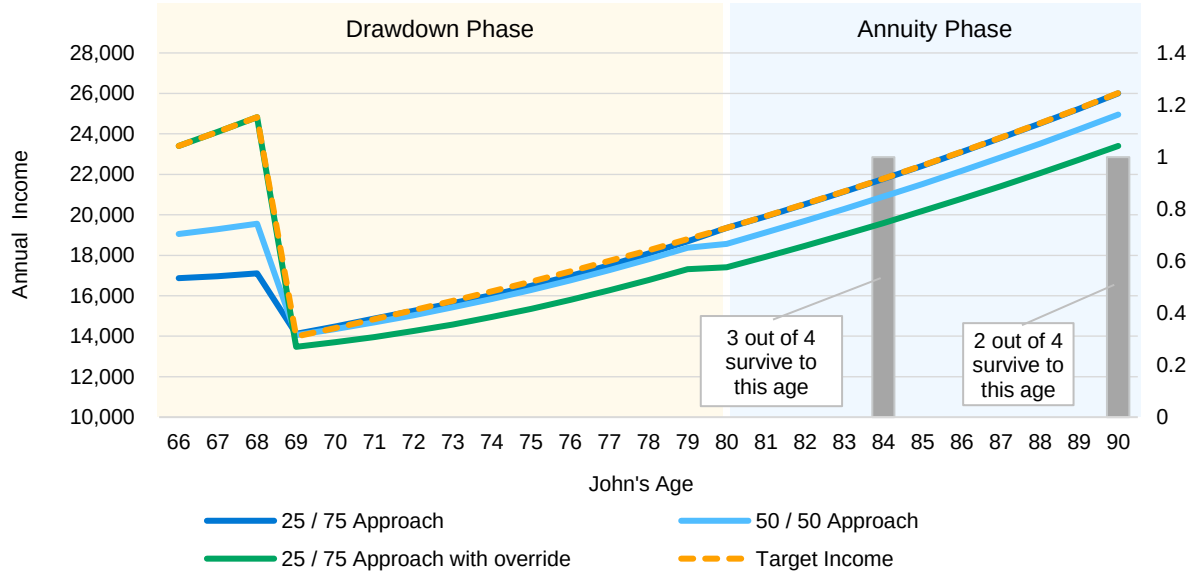
The next step is to determine a sustainable withdrawal rate given assumptions around aspects such as future investment returns and mortality rates. Approaches here can vary in sophistication. For example, a relatively simple approach would contemplate an annuity rate but one where the assumed investment return made some allowance for the risk premium expected to be earned on any exposure to real assets, e.g., equities. This approach can also make an approximate allowance for the anticipated future profile of income required in real (inflation-adjusted) terms by making a full or partial allowance for inflation—as discussed earlier, this is tricky to predict and to balance correctly.

An alternative approach would use a stochastic projection to evaluate the outcome of a large number and range of possible future paths for key variables such as investment returns and inflation. The stochastic approach is more complex but can allow more readily for variations in expected income profile and investment asset allocation over time whilst also allowing the definition of "sustainable" to be made explicit in probabilistic terms.

To illustrate these points and introduce our modelling we consider some very simplified examples below where inflation is a constant 3% p.a. (the authors remain sceptical over a return to central bank targets but would be happy to be proved wrong) and a constant fund return of 6.2% p.a.[18] Furthermore, we use a simple dynamic income rule, as follows, applying to income in excess of the State Pension:

- Income delivered in each year of retirement is a weighted average of our couple's target income in that year and an affordable income calculation.
- The affordable income calculation is based on a joint life last survivor annuity for life with inflation-linked payments. The annuity cost is calculated at each review point using the 10-year gilt rate plus an allowance for the incremental expected return on growth assets (risk premium) during the period up to assumed annuitisation at age 80. Finally, we deduct a charge to reflect an insurer's expenses and cost of capital to provide the guaranteed benefits.
- Where the affordable income level exceeds the target then the income delivered is increased by a percentage (x%) of the difference.
- Where the affordable income level is below the target then the income delivered is reduced by a percentage (y%) of the difference.
- In descriptions, different parameterisations are simply shown as x/y so "25/75" would provide 25% of any upside difference and 75% of any downside difference. In this configuration, downside differences are recognised more quickly to mitigate the risk that the deficiency becomes more acute over time.
- Finally, the affordability test can be overridden in any year in which case the income paid is the couple's target level.[19] For example, this facility might be applied during the first three years to permit a temporarily higher income, above the affordable level, to be paid before Sarah's State Pension commences.

FIGURE 8: EXAMPLE INCOME PROFILES FROM DC POT[20] VS. TARGETED REQUIREMENT (LEVEL IN REAL TERMS)



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18 Fund return composed of 3.5% return on the fixed income portfolio (40%) and 7.7% on growth assets (60%).

19 Provided the target income can be supported by the fund.

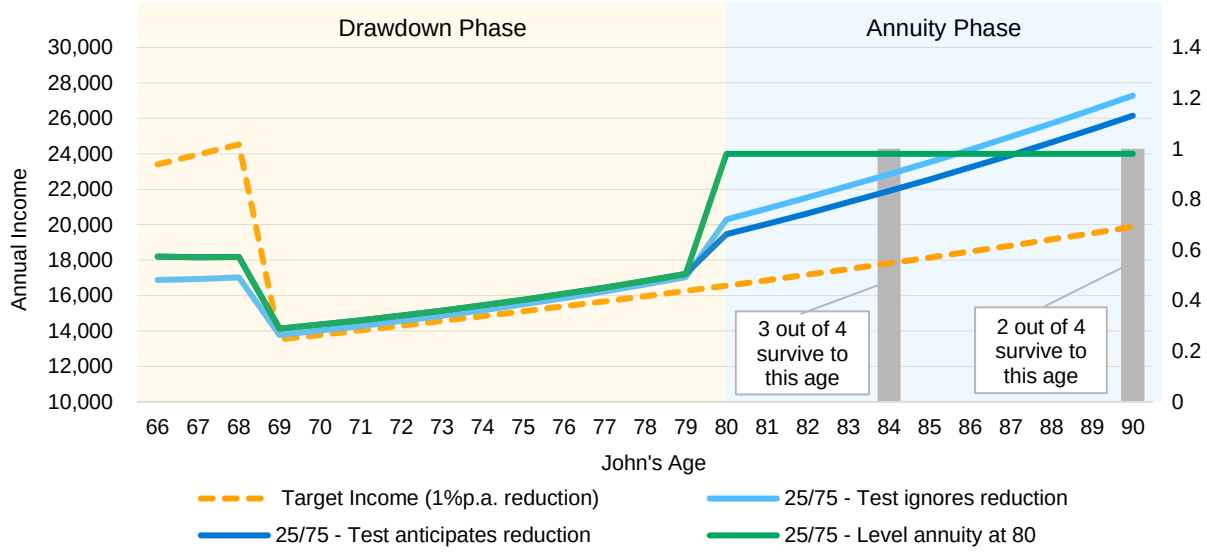
20 The couple will also receive State Pension income, which is not included in Figure 8.

From Figure 8, we can see that our couple's income requirements from their pension pot are broadly consistent with their financial resources in this simple deterministic scenario. In particular:

- Not surprisingly, without an explicit override, the rules do not fully provide for John and Sarah's significantly higher income requirement in the very early years of retirement, as that level of income is unsustainable over the longer term. However, from John's age 69 onwards, the 25/75 approach (light blue line) offers an income that follows closely the target level required.
- The 50/50 approach allows for higher income in the early years (closer to the target) but a lower income later that falls short of the target (dark blue line).
- Finally, we see that fully meeting our couple's income aspirations in the early years results in more significant under-provision later (green line).

In Figure 9, we consider the position if our couple's target income had, rather than aiming to match inflation, instead anticipated a fall of 1% p.a. in real terms.

FIGURE 9: EXAMPLE INCOME PROFILES FROM DC POT ASSUMING A DECLINING REQUIREMENT IN REAL TERMS



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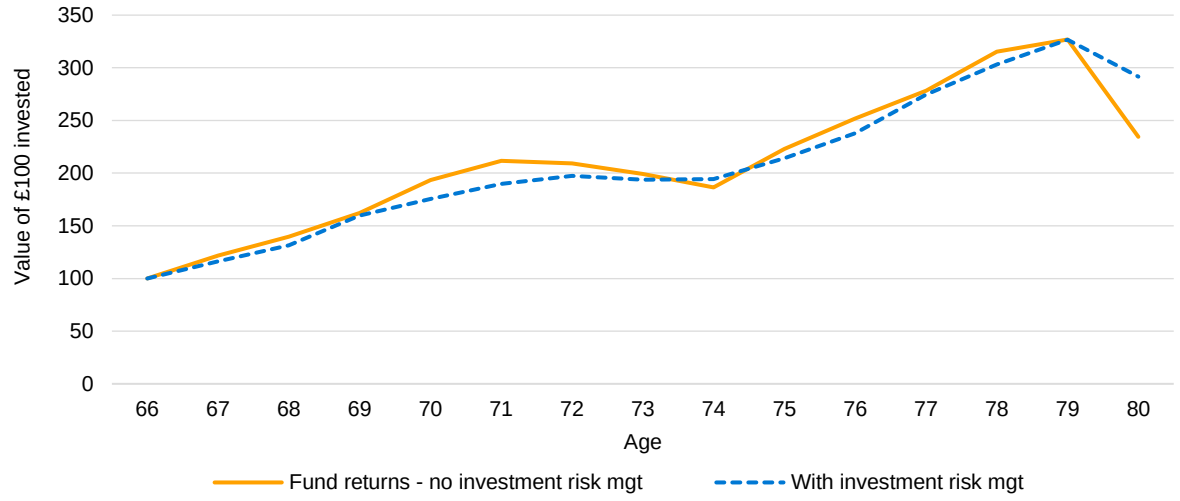
The lower income target now means that our couple's financial resources are more than adequate to deliver the required income. During the drawdown phase, income is managed explicitly with their target in mind, although with a cautious allowance for income to exceed this, as is evident from Figure 9 during the period from age 69 to 80. However, the cautious approach results in a significant surplus being accumulated and crystallised upon annuitisation, at which point none of the income profiles align closely to what is required. We might argue this is not a significant issue, as our couple can simply save the excess income that is not needed. However, our couple may well have appreciated the surplus position being recognised earlier in their retirement with the chance then to reassess their income target and potentially enjoy a higher income while they are younger and probably more active—this more fundamental review is the role of the periodic health check we referred to earlier.

Historical scenarios

In this section, we make our illustrations more realistic by using actual historical experience for investment returns and inflation whose variability over time allows us to also show the impact of dynamic investment risk management techniques.

FIGURE 10: FUND PERFORMANCE IN SCENARIO A – MARKET CRASH IMMEDIATELY PRIOR TO ANNUITISATION



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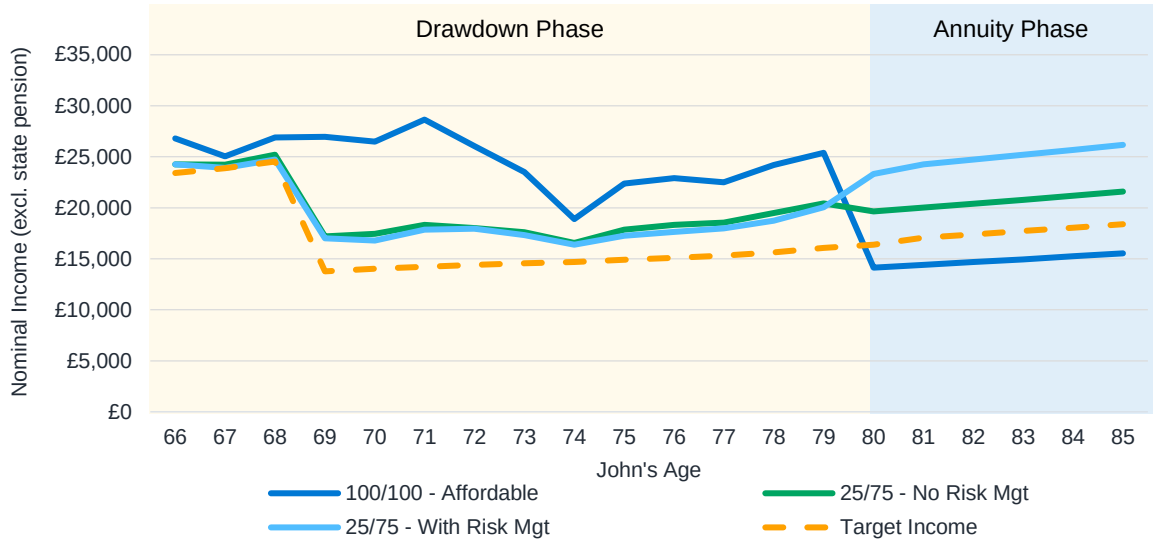
In this first scenario, based on the 1995-2008 period, the couple experience a long run of sustained gains, until just before John turns 80, and the couple are just ready to convert their pot to an annuity, when the 2008 market crash occurs. The dashed line in Figure 10 shows the position where there is smoothing and dynamic investment risk management applied to the fund, which mitigates the crash at the end of the period. The smoothing assumes a simple six-monthly rolling average.[21] The dynamic investment risk management is modelled using the volatility management and downside risk protection techniques described earlier in this paper.[22] In this instance, it is assumed the dynamic investment risk management is applied to all investments within the fund. One advantage of applying the investment risk management technique to the entire fund[23] is that it is only needed to step in where diversification between assets within the fund (i.e., equities and bonds) fails to deliver sufficient protection. This helps to bring down the cost of delivering the protection.

21 No additional fees for the cost of smoothing are assumed.

22 The strategies are assumed to be delivered using futures contracts. These contracts are assumed to have transaction costs of 3 basis points per annum. The management fee is assumed to be an additional 10 basis points per annum.

23 It is assumed that all asset exposures can be hedged using futures contracts that act as suitable match or proxy match to the risk.

FIGURE 11: INCOME PATHS IN SCENARIO A – MARKET CRASH IMMEDIATELY PRIOR TO ANNUITISATION



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Turning to the results in Figure 11, we note:

- **100/100 affordable:** In the period before the crash, the strong investment returns mean the affordable level of income (the 100/100 approach) is much higher than the couple's target level of income. However, when the crash occurs there is no buffer or protection, the residual fund is much reduced and along with it the annuity income that can be purchased for the remainder of the couple's retirement.
- **25/75 no risk management:** This approach produces a lower income (though still higher than the target) but with greater stability compared with the 100/100 approach. The cautious approach of holding back some of the potential upside provides a buffer such that, even after the crash, the annuity purchased only results in a small fall in our couple's income.
- **25/75 with risk management:** The addition of smoothing and investment risk management produces an even more stable but very slightly lower income during the drawdown phase. However, when the crash occurs, as we can see from Figure 10, the impact on the residual fund is greatly reduced and consequently the annuity income that can be purchased is increased.

In the following scenario, based on the 2008-2021 period, the couple retire at the start of the 2008 crash and see their fund lose over a quarter of its value in their first year of retirement. The subsequent years, before taking their annuity, see strong growth. Where they have dynamic investment risk management and smoothing in place, their fund is largely sheltered from the initial drop and later wobbles, though the cost of the protection reduces returns by the later years. Around five years after the initial shock, the funds are about equal again, and by the time the couple are ready to take an annuity, the unprotected fund has surpassed the protected fund.

FIGURE 12: FUND PERFORMANCE IN SCENARIO B – MARKET CRASH JUST AFTER RETIREMENT

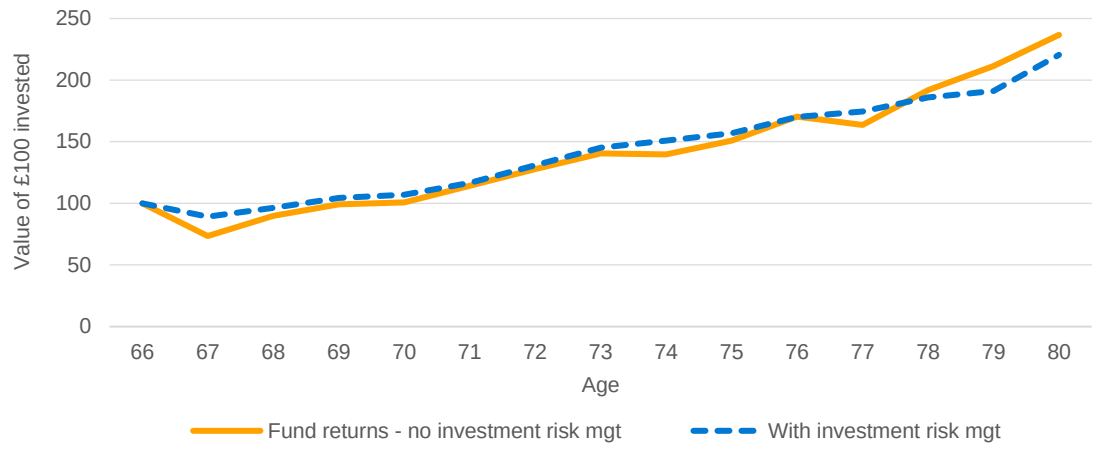

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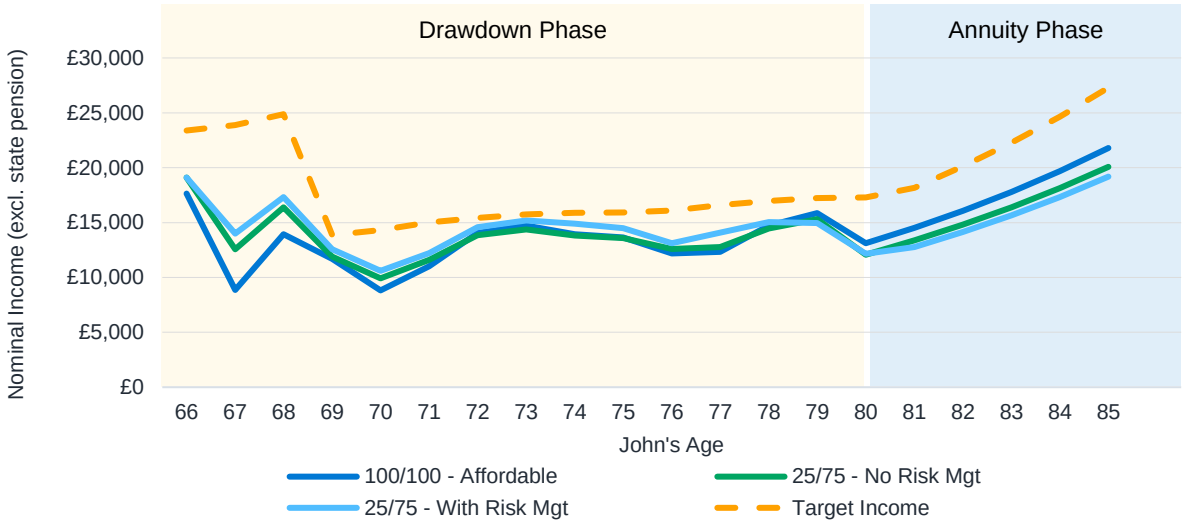
FIGURE 13: INCOME PATHS IN SCENARIO B – MARKET CRASH JUST AFTER RETIREMENT



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From the results in Figure 13, we see:

- **100/100 affordable:** The early market crash is particularly damaging, significantly reducing the retirement fund and its ability to benefit from the positive returns which occur later. The couple's affordable income falls significantly to only £8,900 when John is 67. Positive returns later and the lower target income from age 69 bring the affordable income and target much closer together but the target remains out of reach throughout retirement.
- **25/75 no risk management:** Dynamic income management reduces income in response to the crash but not fully to the affordable level. Income under this approach is more stable but the higher initial income results in a lower fund available to purchase the annuity income and thus a lower income from age 80.

- **25/75 with risk management:** With smoothing and investment risk management in place, the drop in the fund value seen over the couple's first year of retirement is much less and so, when John is 67, a higher income of almost £14,000 is available. Income throughout the drawdown phase is generally highest under this approach and is more stable. However, from Figure 13 we can see that, following the early crash, the remainder of the period shows a sustained investment bull market. Under such conditions, a fund including risk management is expected to underperform one without, causing the unprotected fund to surpass the protected fund by the point of annuitisation. Combined with the higher income paid out during the drawdown phase, the result is a lower income annuity income available from age 80 compared with the other approaches.

Stochastic scenarios

Assessing income and investment risk management options against a broader set of stochastic scenarios illustrates their likely impact more clearly.

We will compare:

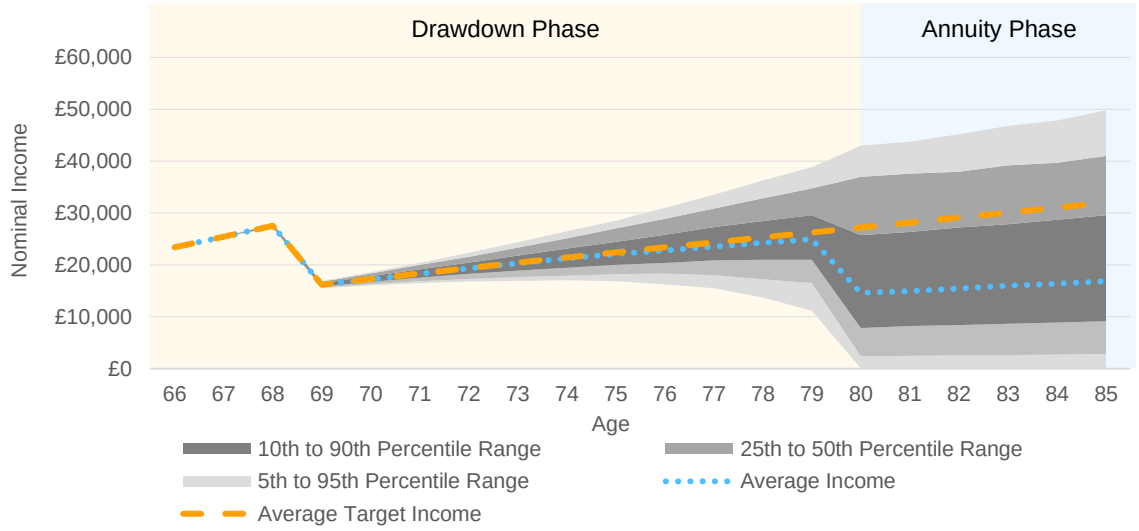
1. Taking the couple's desired level of income each year irrespective of market conditions (0/0 approach).
2. Applying dynamic income management (25/75 approach).
3. Applying dynamic income management (25/75 approach) and investment risk management combining smoothing and a managed risk strategy applied to the whole fund.

DESIRED INCOME APPROACH

As a base case, we examine the range of outcomes where the couple do not apply any risk management to their fund and make withdrawals based on their desired income with no consideration of affordability.

In this case, we see a very tight set of initial income paths, varying only in that desired nominal income moves with inflation. At annuitisation, the paths then vary drastically, depending on what the economic circumstances have meant for the pension pot in the background. In some cases, strong economic growth means the couple have underspent in the early years of retirement, and they are able to afford an annuity higher than their target income. However, there are more cases where the reverse applies, as the target income taken during drawdown has not been sustainable, resulting in a fall in income upon annuitisation. In the worst 4.8% of scenarios, the fund runs out entirely before the couple are ready to take an annuity.

FIGURE 14: INCOME DISTRIBUTION WHEN FULL TARGET INCOME TAKEN



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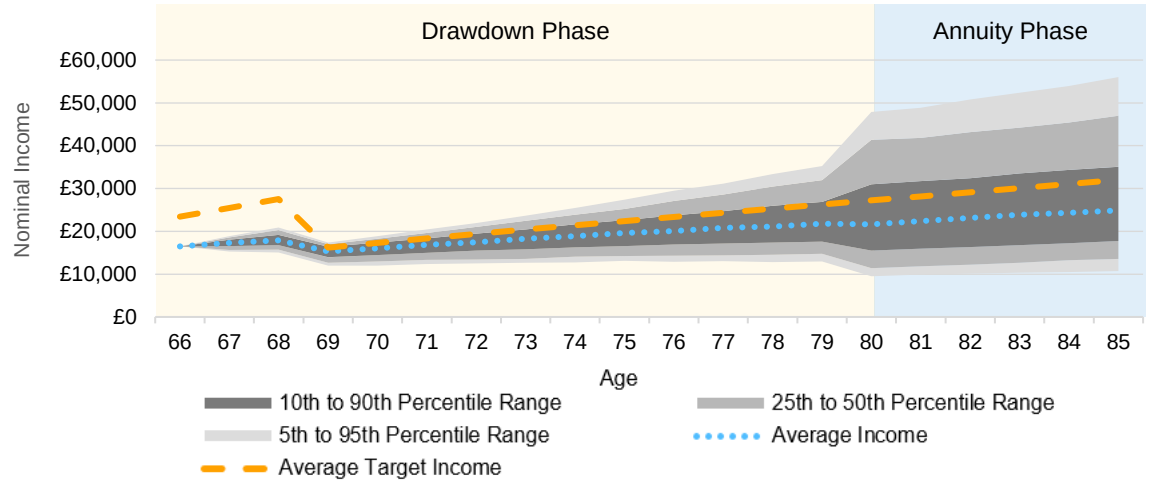
25/75 INCOME MANAGEMENT APPROACH

We next consider the case where an income management approach is applied, reducing income when the affordable level is below the target and vice versa when it is above. As Figure 15 shows, this approach significantly improves the sustainability of income, removing the marked fall in average income at annuitisation and in particular those scenarios which previously resulted in a complete exhaustion of the fund and cessation of income.

FIGURE 15: INCOME DISTRIBUTION WITH A 25/75 INCOME APPROACH



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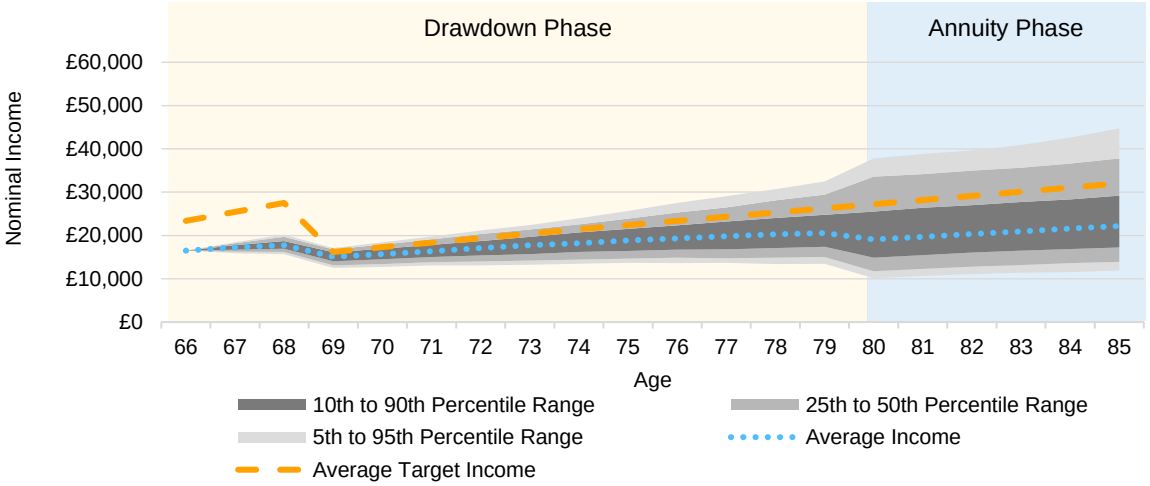
INVESTMENT RISK MANAGEMENT AND 25/75 INCOME MANAGEMENT APPROACH

Finally, we consider the impact of adding dynamic investment risk management to the couple's fund.

This further narrows the range of outcomes, adding protection against the most adverse investment scenarios at the cost of losing some of the potential upside. How attractive this cost-benefit trade-off is will depend on individual risk preferences.

FIGURE 16: INCOME DISTRIBUTION WITH A 25/75 INCOME APPROACH, DYNAMIC INVESTMENT RISK MANAGEMENT APPLIED



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The charts above are useful to visualise the distribution of income results over time, but they do not convey the full story of how the income and investment risk management approaches can alter the outcomes for John and Sarah. To do that, we include some additional metrics which we illustrate in the next section.

MEASURING SUCCESS

There are several features of the income profile that we expect to be of interest to our couple. The overall level of income will clearly be important but so will its sustainability over time—retirement for John and Sarah is hopefully a marathon not a sprint. Finally, we expect a more stable income to be preferred, making planning and budgeting easier and less stressful.

In Figure 17, we set out a range of metrics that cover the features of level, sustainability and stability and compare results for the income options illustrated in the charts above together with an additional approach ("100/100 Unprotected") where the "affordable" level of income is taken each year without regard to the extent of variation that introduces.

FIGURE 17: COMPARISON OF INCOME LEVEL METRICS

METRIC	0/0 UNPROTECTED	100/100 UNPROTECTED	25/75 UNPROTECTED	25/75 + INVESTMENT RISK MGMT.
INCOME LEVEL				
Average[24] annual drawdown income (real value)	£15,071[25]	£12,107	£12,476	£12,158
INCOME SUSTAINABILITY				
Median annuity at age 80 (real value)	£7,264	£10,899	£10,492	£9,364
5th percentile annuity at age 80 (real value)	£21	£4,936	£4,083	£4,240
Probability the fund is exhausted by age 80	4.8%	0%	0%	0%
INCOME STABILITY				
Mean number of years where drawdown income falls by more than 5%		4.3	3.1	3.3
Mean number of years where drawdown income falls by more than 10%		2.6	1.3	0.9
Median size of fall in drawdown income (where a fall occurs)		8%	5%	4%
95th percentile size of fall in drawdown income (where a fall occurs)		24%	16%	12%
% of scenarios experiencing at least one drop in drawdown income of at least 20% by age 80		51%	9%	1%

For illustrative purposes only, does not represent the performance of any actual investment or portfolio, and should not be viewed as a recommendation to buy/sell.

Results based on simulated or hypothetical performance results have certain inherent limitations. Unlike the results shown in an actual performance record, these results do not represent actual trading. Also, because these trades have not actually been executed, these results may have under-or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated or hypothetical trading programs in general 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. Milliman does not manage the underlying fund.

From Figure 17 we note the following key points:

1. **Income level:** Our stochastic analysis clearly indicates that taking the full amount of target income ("0/0 Unprotected") during drawdown is unsustainable with a significant income fall upon annuitisation and about a 5% probability of complete fund exhaustion before age 80.

   We note that all the other approaches, which recognise affordability to some extent, deliver a broadly similar average income level.

24 We calculate the mean annual drawdown income taken for each scenario and take the median across all scenarios. The median across all years and scenarios would be misrepresentative of the average received, as all 0/0 and 25/75 scenarios have high withdrawals for the three years before the second State Pension is received.

25 This is the average withdrawing £23,400 for three years while Sarah does not receive her State Pension and withdrawing £12,800 in the remaining years of drawdown.

2. **Income sustainability:** We note that the three managed approaches all eliminate the risk of complete fund exhaustion. Of the three, the "100/100 Unprotected" approach delivers slightly better results in terms of the annuity income available. This is consistent with taking a more aggressive approach to income management, with affordability-based increases and decreases being fully reflected in the income taken. The "25/75 Unprotected" method takes a more measured approach to income revisions, which slightly reduces its effectiveness from a sustainability perspective. Finally, the investment risk management included in the "25/75 + Investment Risk Mgmt." approach mitigates the poorest outcome—worst-case annuity income increased from £956 p.a. to £1,331 p.a. However, there is a cost to the protection, with a lower median annuity amount of £9,364 p.a. compared with £10, 492 p.a.
3. **Income stability:** In the final section of the table in Figure 17 we see the impact of the different managed approaches on income stability.[26] Moving from the "100/100 Unprotected" to the "25/75 Unprotected" approach illustrates that the number of occasions on which the couple's income is materially cut back is reduced significantly. Furthermore, the size of income cuts is also reduced. These are the benefits of the more measured income management approach adopted using the 25/75 method. Finally, considering the approach which includes investment risk management, we see benefits in terms of further marked improvements in income stability regarding both the incidence and size of income cuts that our couple might experience.

Conclusions

At the beginning of this paper, we proposed the question, "When individuals reach retirement with an accumulated pot of DC pension savings, how can we help them achieve a sustainable pension income balancing aspiration (what they would like) with financial reality (what they can get)?"

Many individuals in this position will seek the freedom and flexibility of drawdown but be unprepared to assess the various factors in managing it: what investment return they might see, how long they might live and how their spending might change over a retirement which could last decades.

We have explored the possible use of dynamic income management and dynamic investment risk management as tools to approach this. Starting without these tools, individuals run the risk of being too optimistic, withdrawing too much and either exhausting their pot or seeing a large income drop should they wish to convert their pot to an annuity later in retirement. Alternatively, some will recognise this risk and veer too far in the other direction to compensate, withdrawing too little in the early years of retirement when they are most likely to value the opportunities a higher income could provide. Neither result is desirable.

We believe that the tools of dynamic income and investment risk management outlined in this paper, operating as part of a broader income management framework for drawdown, can play a significant role in helping retirees balance the level, sustainability and stability of their income.

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26 Note: We do not compare against the "0/0 Unprotected" option where the couple simply take their desired income, as the only variation in income in this case is if the fund is exhausted.

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milliman.com

CONTACT

Charlie Howell
charlie.howell@milliman.com

Russell Ward
russell.ward@milliman.com

Neil Dissanayake
neil.dissanayake@milliman.com