



Institute
and Faculty
of Actuaries

Pension Decumulation Pathways

A proposed approach

Pension Decumulation Pathways Working Party

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Summary

1. The introduction of Pension Decumulation Pathways can help improve outcomes in retirement for those with Defined Contribution (**DC**) pensions.
2. Decumulation Pathways is where the consumer determines how their DC fund should be split to cover the main competing objectives in retirement. Firstly, what percentage of the fund should be invested in the 'Flexible Fund' (**FlexFund**) for flexible access and/or legacy provision, and secondly what percentage should be invested in the 'Pension Fund' (**PenFund**), which is used to provide a lifetime income.
3. Suitable high-quality products can then be offered for each of these two Funds, along with associated information and guidance.

Decumulation Pathway product choices

4. Flexi-access drawdown is a suitable product for the FlexFund, but not for the PenFund as it does not adequately manage longevity risk. Decumulation Pathways can help emphasise this point, and promote the use and development of alternative products for the PenFund.
5. At present the guaranteed annuity, is the only mainstream product that manages longevity risk, but is unpopular for a variety of reasons.
6. Two potential alternatives to the guaranteed annuity are considered which provide a variable, but potentially higher income:
 - Collective Defined Contribution (**CDC**) schemes, which are trust-based arrangement where members' assets are pooled.
 - An arrangement with no universally accepted name but which will be referred to as a 'Pooled Pension Fund' (**Pooled PenFund**), with the following key features:
 - Maintenance of individual DC funds, with some limited choice in how the arrangement is managed, such as in choosing the investment strategy and the extent to which the income increases each year to reflect the impact of inflation.
 - Longevity risk is either pooled between the participants or is insured. Pooling is a mutual arrangement, where monies from those who die are transferred to the collective longevity pool, and then reallocated as 'longevity credits' to survivors; loss of legacy on death is the price paid for the longevity protection.

Decumulation Pathway design

7. An illustrative '**standard**' Decumulation Pathway has been designed, which might be suitable for the typical consumer, perhaps employed as a default. The main objective set for this standard is to provide a reasonably stable and sustainable lifetime income, for those consumers who do not wish to purchase an annuity. It provides for:
 - A 10% allocation to the FlexFund, invested in drawdown
 - The remaining 90% is allocated to the PenFund having the following features:
 - Initially invested in drawdown, followed by a phased transfer to a Pooled

PenFund over the age range 75-79 in order to manage longevity risk in the longer term, while maintaining some flexibility and legacy potential in the shorter-term

- Provision of an income which aims to increase in line with inflation, but is automatically evaluated at the outset and each year thereafter based on what is affordable. This is achieved by reference to the fund value and a single life, inflation-linked annuity rate applicable at each review date, where the annuity is calculated using an interest rate which closely reflects the expected return from the investment strategy adopted
 - An investment strategy which might be typically described as ‘medium risk’.
8. Modelling suggests that the standard PenFund is likely to substantially outperform the immediate purchase of an index-linked annuity over a 30-year period, underperforming only in the worst economic scenarios. Superior performance is as result of the greater investment freedom, possible in absence of a guarantee on the level of income, but at the expense of a modest degree of income volatility.
 9. The standard PenFund also outperforms drawdown, mainly due to the introduction of longevity risk management. This results in a higher initial withdrawal rate being supportable for a given investment strategy; 4% in the example modelled.
 10. For DC funds of £150,000 or more, the standard Decumulation Pathway has a good chance of providing an income, along with the State pension, that is sufficient to meet basic needs in retirement, while retaining some flexibility and legacy potential through the 10% FlexFund allocation.
 11. A range of alternative Decumulation Pathway designs are modelled for comparison. For the PenFund, this includes variation in the means and timing of longevity risk management, the impact of taking a higher initial income on the sustainability of the income in the longer term, and alternative means of improving income stability. Various FlexFund allocations were also explored across different DC fund sizes.

Product development

12. Market development is needed to enable Decumulation Pathways to be effective. In particular, two alternative products to the guaranteed annuity are considered:
 - CDC schemes require minimal decision making by the consumer. Recently introduced in the UK for single employer purposes, there are ongoing discussions to increase their scope to permit multi-employer arrangements.
 - The Pooled PenFund can offer the consumer more personal choice in how decumulation is managed, with individual DC funds being maintained. A key distinction is that it decouples the management of longevity risk from the ability to set investment strategy. A product operating in this manner is already established in The Netherlands, and there is growing interest elsewhere, for example, Canada. Market research can help evaluate the potential interest in the UK.
13. Products which permit the PenFund and FlexFund to work interactively would be advantageous; for example, to permit the exchange of monies between them or to use the FlexFund to smooth out any volatility in income available from the PenFund. This will be facilitated if both funds reside under the same trust or product, and are invested in the same way.

14. Annuity innovations might include purchases under trust, to permit the income to remain within the trust, and to secure lower annuity prices than are available to the individual consumer.

Consumer decision making

15. Quality information and guidance are essential to enable consumers to make informed decisions at retirement. A particular concern is the challenge of explaining the key financial risks of decumulation; longevity, inflation and investment. A focus on average outcomes is deceptive in that it hides the range of uncertainty and so undervalues the benefits of risk mitigation strategies, such as smoothing or insurance. More work on communicating these issues is desirable.
16. It is also important that consumers make decisions about their DC pensions by reference to their wider financial resources, in order to make informed decisions. The Pensions Dashboard will be important in that regard.
17. The standard Decumulation Pathway offers a default approach deemed suitable for the typical consumer, while there could be the option to vary some of the features, such as the choice of investment strategy or FlexFund allocation, and the extent to which the initial income is increased in the future to reflect inflation.
18. Decumulation Pathways can help overcome the challenge of providing ongoing support in retirement, by offering solutions which require minimal consumer decision making once established.

1. Introduction

- 1.1. This paper has been prepared by the Pension Decumulation Pathways Working Party of the Institute & Faculty of Actuaries (IFoA).
- 1.2. The Taxation of Pensions Act 2014 introduced so-called ‘Pension Freedoms’ from April 2015, offering flexibility as to how people access their defined contribution (DC) pension funds. This has proved popular, with many people choosing flexi-access drawdown instead of a guaranteed annuity, as discussed further in Appendix A.
- 1.3. However, there has been limited innovation in the pensions industry to help support DC consumers in this new and more complex environment, especially those with small to medium size DC funds¹. The number of people in non-advised drawdown has been a particular cause for concern. Drawdown requires good ongoing decision making to manage the complex risks, which may be undermined by a lack of financial awareness or understanding of pensions, or of cognitive decline with advancing age.
- 1.4. Pension Wise, a free and impartial government service for people planning their retirement, offers free guidance to those aged 50 or more on the available choices, but only a small proportion of people currently choose to access that service².
- 1.5. A Decumulation Pathway is a broad concept which aims to help DC consumers meet their financial needs in retirement. An effective Decumulation Pathway would provide suitable high quality, value for money products, along with associated information and guidance. This is the idea behind the Retirement Income Covenant³ in Australia being introduced in July 2022, while in the UK NEST’s Retirement Income Blueprint⁴ set out a framework with a similar purpose.
- 1.6. The introduction of Investment Pathways is a closely related concept, but covering only the management of investment risk.
- 1.7. Section 2 sets out a proposed framework for a Decumulation Pathway, whereby the bulk of the DC pot is set aside to provide a lifetime income and the rest is retained in a separate fund to provide flexible access and/or legacy.
- 1.8. In section 3 the risks underlying the achievement of a sustainable lifetime income are explored (longevity, inflation and investment risks), and alternative product types (both existing and potential new ones to the UK) are compared in terms of how they manage these risks.
- 1.9. Modelling is used in sections 4-6 to design a proposed standard Decumulation Pathway aimed at the typical consumer, which might be used as a default. The performance of this standard is compared with the existing mainstream options of drawdown and an annuity. Alternative design features are also explored for comparison.

¹ Lindley, D. (2019) *Fixing the Freedoms: Helping smaller savers get the most out of the pension reforms* Age UK

² Financial Conduct Authority (2021) *The stronger nudge to pensions guidance: feedback on CP21/11 and final rules and guidance* Policy Statement PS 21/21

³ OBPR (2021) Retirement Income Covenant: Regulatory Impact Statement – Department of the Treasury

⁴ NEST (2015) *The Future of Retirement A Retirement Income Blueprint for NEST members*

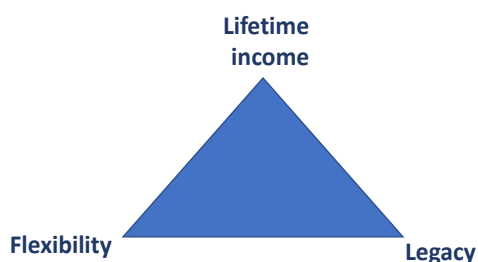
- 1.10. Sections 7 and 8 explore the practical aspects of Decumulation Pathways; product development and how to support good consumer decision making. Finally, conclusions are set out in section 9.

2. Decumulation Pathway design principles

Consumer objectives

- 2.1. The construction of a Decumulation Pathway requires a consideration of the consumer objectives it seeks to satisfy. These objectives can be grouped into three broad categories as shown in Figure 1. To a degree, they are in conflict, as assets used for one purpose are then no longer available for the other purposes.

Figure 1: Conflicting consumer objectives

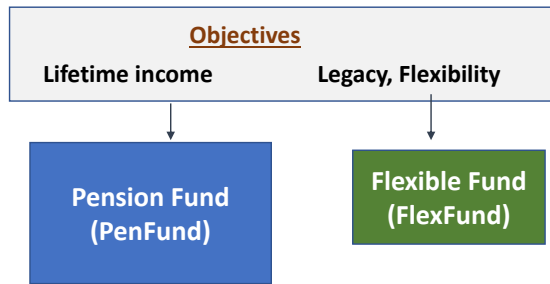


- 2.2. A consumer's DC pension will not usually be their only source of retirement income; there will also be the State pension, and there may also be defined benefit pensions. The Pensions Dashboard will be especially important in helping to collate total pension savings, which may derive from multiple DC funds from different employments. There may also be other forms of savings such as Individual Savings Accounts (ISAs), and potential for equity release from residential homes, as well as support from the wider family. The consumer's attitude to risk in respect of their DC pensions will therefore be influenced by their significance relative to total available income and realisable assets.
- 2.3. Flexibility lies at the heart of Pension Freedoms and allows consumers to have some control over how their DC pensions are managed in retirement, both at the outset and on an ongoing basis. For example, the ability to determine investment strategy, or to choose the amount of income drawn each year to meet immediate needs and/or for legacy planning purposes. This flexibility is likely to be a significant reason for the greater popularity of drawdown compared with annuities.
- 2.4. While an ability to exercise control may seem attractive, it does place a significant burden on the consumer to manage the risks associated with maintaining a lifetime income. Furthermore, flexibility can also be in conflict with the management of longevity risk, as explained in section 3, which is why drawdown is not a suitable product for providing a lifetime income.

Decumulation Pathways

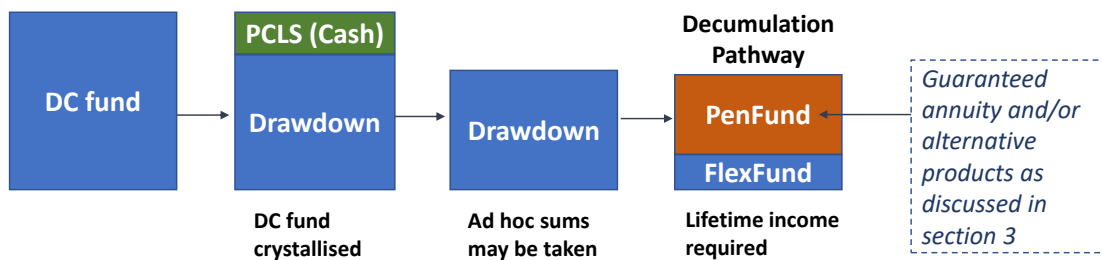
- 2.5. Decumulation Pathways would be aimed at the consumer whose main priority is to provide a regular lifetime income, but who wish to put aside some monies for other purposes. When a consumer joins a Decumulation Pathway, the DC fund is split into two components, as illustrated in Figure 2. The majority of the fund is allocated to the Pension Fund (**PenFund**) to support the lifetime income, with the balance invested in the Flexible Fund (**FlexFund**) to provide flexible access and/or to be preserved for legacy purposes.

Figure 2: The purpose of a Decumulation Pathway



- 2.6. The transition into a Decumulation Pathway is illustrated in Figure 3. When a DC fund is crystallised, the consumer may withdraw a Pension Commencement Lump Sum (PCLS), and the remainder will be invested in a drawdown product until a lifetime income is required, at which point a Decumulation Pathway should be considered. Ad hoc withdrawals might be made in the meantime.
- 2.7. Alternatively, after taking the PCLS, if a lifetime income is required the consumer might wish to join a Decumulation Pathway straightaway, missing out the middle step.

Figure 3: The role of Decumulation Pathways



- 2.8. It is envisaged that the FlexFund will be invested in drawdown. The PenFund will start as drawdown until longevity risk management is introduced, at which point one or more suitable products will be used, discussed further in section 3.
- 2.9. A Decumulation Pathway will not be applicable if the consumer wishes to a) withdraw the entire DC fund, b) leave the DC fund untouched, for the time being at least, or c) have flexible access only.

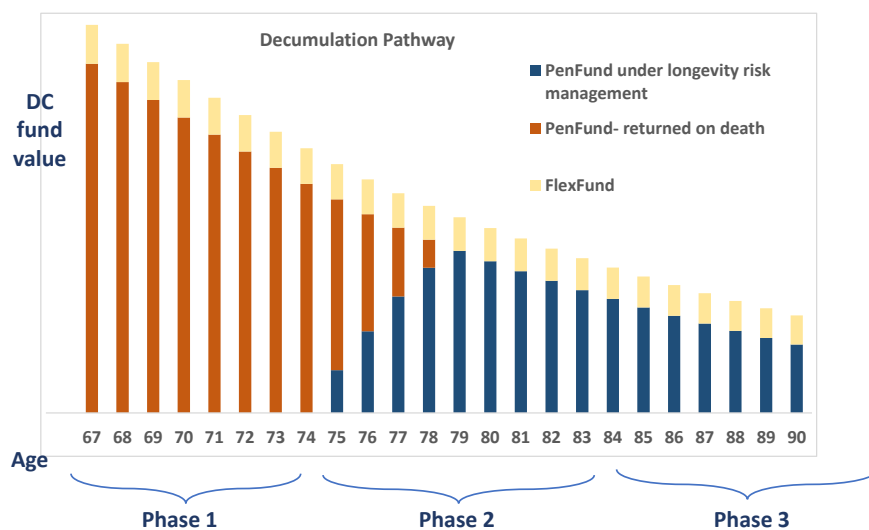
Decumulation Pathway design

- 2.10. Since it is assumed that the consumer will have already taken any tax-free cash required, the extent to which flexibility is needed is expected to be limited, so only a relatively small element would normally be set aside in the FlexFund for this purpose.
- 2.11. A separate legacy fund has not been included in the design, for simplicity and because legacy can be seen as one aspect of flexibility, in that the consumer can either withdraw monies or leave them as a legacy. The choice of investment strategy in the FlexFund may be different to that in the PenFund, reflecting the consumer’s balance of priorities between the two objectives of flexibility and legacy (with the implied shorter- or longer-term investment horizons).
- 2.12. While it has been assumed that the PenFund is not required for any legacy purposes once longevity risk sharing has commenced, it would be possible to include options

such as a dependant’s pension within the PenFund design.

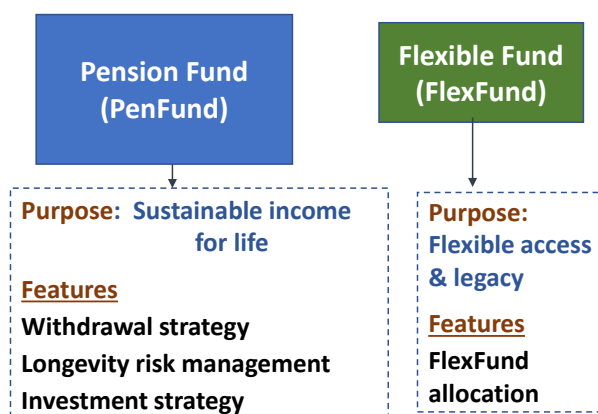
- 2.13. It is convenient to divide the drawdown period into phases^{5,4}, to recognise that consumer objectives may change over time. Figure 4 illustrates a Decumulation Pathway with three phases, where longevity risk management is introduced in a phased manner over the age range 75-79 for reasons discussed in section 4. In this example, it has been assumed that the FlexFund is retained for legacy purposes, but in practice some or all of it could be used for ad hoc withdrawals to supplement the income from the PenFund.
- 2.14. The investment strategy might also vary in each phase, to reflect changing tolerance for taking investment risk.

Figure 4: Illustrative Decumulation Pathway design



- 2.15. The design features of a Decumulation Pathway are shown in Figure 5. The FlexFund is considered further in section 6. For the PenFund, longevity risk management and investment strategy are discussed in section 3, while withdrawal strategy is discussed below.

Figure 5: Design features of a Decumulation Pathway



⁵ Dytchwald, K. & Morison, M. (2020) *What Retirees Want: A Holistic View of Life’s Third Age* Published by John Wiley & Sons

Withdrawal strategy

- 2.16. One of the most challenging aspects of decumulation is to decide how much money to withdraw over time. This is taken care of automatically with an annuity and managed collectively under CDC, but with drawdown the consumer must decide.
- 2.17. An ideal withdrawal strategy should spread the income in an optimal manner, seeking to prevent running out of money before death while avoiding unnecessary frugality by drawing too little. This is a very difficult balance to achieve in drawdown (and is not possible without longevity risk management).
- 2.18. Generic guidance about the level of income to draw can be helpful, such as the set of rules of thumb⁶ proposed by the New Zealand Society of Actuaries. These are designed for a set of alternative objectives, and bear similarity to the famous 4% 'safe withdrawal rate' devised by Bengen. However, such rules do not take into account changing financial conditions or personal circumstances.
- 2.19. Various 'dynamic' withdrawal strategies have been developed⁷ whereby the income drawn each year varies in response to investment markets according to a set of rules. Such an approach helps to use the DC fund in a more optimal manner, but introduces some volatility in annual income and is more complex to implement.
- 2.20. One such dynamic approach will be referred to as '**notional annuitisation**', where the lifetime income is calculated as the amount having equal actuarial value to the DC fund. This is achieved by applying an annuity rate, but a notional one as an annuity is not actually purchased and the rate used need not be a market one.
- 2.21. Income in each subsequent period is re-evaluated in the same way, based on the value of the DC fund at the start of the period and reflecting annuity rates at the time. The period between re-evaluations will normally be no less frequent than annual. This approach ensures that the money never runs out, as the remaining fund balance at the end of each year is repeatedly re-spread into the future.
- 2.22. The notional annuitisation approach has been adopted for the modelling in sections 4 and 5.

⁶ Retirement Income Interest Group of the New Zealand Society of Actuaries (2017) *Decumulation Options in the New Zealand Market: How Rules of Thumb can help*

⁷ Pfau, W. (2015) *Making sense out of variable spending strategies for Retirees*

3. Pension Fund: products for managing the risks

- 3.1. Consumer surveys such as one by NEST⁴ unsurprisingly confirm provision of a lifetime income to be their top decumulation priority, and this is the role of the PenFund within a Decumulation Pathway.
- 3.2. The key financial risks underlying the provision of a lifetime income are as follows:
- **Longevity:** the risk of outliving the supply of required income
 - **Inflation:** the risk that the purchasing power of the available income declines over time
 - **Investment:** the risk that adverse investment experience results in less income being available than had been expected
- 3.3. Figure 6 summarises five types of products that can be used for decumulation and how they manage these three risks (highlighted in blue shading).

Figure 6: Types of products available for decumulation

Feature	Guaranteed annuity	Variable income annuity	Drawdown - individual DC (IDC)	Pooled Pension Fund	Collective DC (CDC)
UK current availability	Insurer	Insurer, limited market	Pension provider or trust	Not available	Trust, single employer arrangement
Available in accumulation phase	No ¹	No ¹	Yes	Not required; IDC suffices	Yes
Income	Guaranteed	Variable	Variable	Variable	Variable
Individual member fund identified	No (money passed to insurer)	No (money passed to insurer)	Yes	Yes	No, assets are pooled
Longevity risk	Assumed by insurer	Assumed by insurer	Borne by individual	Pooled or insured	Pooled between members
Inflation risk	Can fully protect	Can partially protect	Can partially protect	Can partially protect	Trustees can partially protect
Investment risk	Borne by insurer	Largely borne by individual	Borne by individual ²	Borne by individual ²	Pooled ⁵
Withdrawal strategy/ flexible access	Income pre-determined	Income varies under pre-determined rules	Income under individual control	Income varies under pre-determined rules	Income decided by trustees
Legacy provision	Defined at outset	Defined at outset	Residual fund paid out on death	None, residual fund lost on death ⁴	Set by rules of trust
Surrender terms	None normally ³	None normally ³	Fund value	May be possible	May be possible

1 In principle, deferred annuities could also be used for accumulation purposes, but providers no longer offer such products

2 Can be pooled, e.g., as in with-profits, but this is very rare nowadays

3 Surrender is possible, subject to a penalty, if the annuity is set up under trust

4 Some provision for dependant's pension may be possible

5 Under trustees' control, subject to any restrictions that may be imposed by the Rules

Longevity risk

- 3.4. The importance of longevity risk management during decumulation has been highlighted in a recent OECD report⁸.
- 3.5. The only satisfactory solution to managing longevity risk is to share it with others or via insurance, as explained in Appendix B. This is an automatic feature of an annuity, CDC scheme and Pooled Pension Fund (**Pooled PenFund**), but not with drawdown.
- 3.6. The guaranteed annuity has not proved to be a popular option, even though it is the only mainstream product able to offer an entirely predictable lifetime income. This has been termed the ‘annuity puzzle’ and is discussed at the end of Appendix A. Variable income annuities used to be popular in the form of with-profits, but the market is now very limited in the UK.
- 3.7. For drawdown, longevity risk can be managed to some extent through the withdrawal strategy, as discussed in section 2. By reducing the income in response to adverse market movements, the risk of running out of money is reduced, but this may result in the anticipated income proving to be unsustainable in the long-term.
- 3.8. The Pooled PenFund is a type of arrangement which comes under a variety of different names and is discussed further in section 7. It can be regarded as a variant of individual DC (IDC) where longevity risk is shared between the participants or is insured. When the risk is shared, this is achieved by means of periodic reviews (at least annually), when monies from DC funds of those who have died since the last review are gathered into a collective mortality pool, and redistributed as ‘longevity credits’ to the DC funds of surviving members of the arrangement. The loss of the DC fund on death is the price paid for the longevity credits in the event of survival.
- 3.9. A fair system would imply actuarial neutrality, such that the expected gain on survival (the longevity credit, LC) equals the expected loss in the event of death (forfeiture of the accumulated DC fund, F). For a probability of death of q , this translates into the equation:
$$(1-q) \times LC = q \times F, \text{ or } LC = q \times F / (1-q)$$
- 3.10. In practice, LC will be dependent on the actual number of deaths in the period and the size of the deceased members’ funds, as well as the method used to allocate the funds of deceased members between the survivors. Administrative practicalities will inevitably mean some departure from pure actuarial ‘fairness’.
- 3.11. Appendix B provides further commentary on how longevity credits can be calculated, how they support the level of income in later life, and the options for insuring the longevity risk as an alternative to the mutual pooling outlined above. A useful overview is provided by Fullmer⁹.
- 3.12. In a Pooled PenFund, flexibility to manage the arrangement is much reduced, as a consequence of the pooling of longevity risk. This is in order to protect the pool from adverse selection, e.g., if a participant wanted to withdraw monies more quickly on

⁸ OECD (2022) *Recommendation of the Council for the Good Design of Defined Contribution Pension Plans* OECD Legal Instrument 0467

⁹ Fullmer, R.K. (2019) *Tontines: A Practitioner’s Guide to Mortality Pooled Investments* CFA Institute Research Foundation

experiencing poor health, in order to avoid losing them to the pool on death.

- 3.13. The Pooled PenFund discussed in this paper incorporates an automated withdrawal strategy to determine the (variable) income payable each year. This is using the notional annuitisation approach explained in section 2.

Inflation risk

- 3.14. Full protection against inflation risk is possible only through the purchase of a guaranteed index-linked annuity.
- 3.15. Where full inflation protection is not required or is considered too expensive, some allowance for expected future inflation can be achieved by purchasing a guaranteed annuity with fixed annual increases, such as 2.5% or an index-linked annuity with capped increases.
- 3.16. Making provision for expected future inflation means taking a lower initial income than if a level pension is taken. This is because providing an income which increases each year is more expensive than one which doesn't and so, for a given DC fund, the initial income will have to be lowered to compensate. In practice, the relative value of these alternative income streams will depend on the future rate of inflation and how long the consumer lives.
- 3.17. The natural desire to maximise income, coupled with the challenge of fully appreciating the potential long-term impact of inflation, partially explains why flat annuities are far more popular than index-linked ones. For example, over the period 2019-21 over 85% of annuities sold in the UK were level¹⁰. Consumer choice regarding inflation protection is further discussed in section 8.
- 3.18. Another consideration is the extent to which people actually need a fully index-linked DC income. This is because there is evidence that suggests consumer expenditure typically falls in real terms in retirement, while the State pension currently increases faster than inflation. These issues are discussed further in Appendix A.

Investment risk

- 3.19. Assistance in managing investment risk in the run up to decumulation is available in the following ways:
- Default investment strategies are required during the accumulation phase, designed to provide a suitable investment strategy during the period up to the selected retirement age. Default strategies are very popular among DC participants
 - Before a DC fund is accessed, FCA-regulated pension providers are required to ensure non-advised customers are offered a suitable '**Investment Pathway**' for those who, over a 5-year time horizon, wish to a) leave the money untouched; b) purchase a guaranteed annuity; c) withdraw income under flexi-access drawdown; d) withdraw money over a short period.
- 3.20. Managing **sequence of return risk**¹¹ is a particularly important consideration towards the end of the accumulation phase and during the early years of decumulation. This is

¹⁰ Financial Conduct Authority (2020) *Retirement Income Market Data 2020/21*

¹¹ Clare, A. et al, (2017) *Decumulation, Sequencing risk and the Safe withdrawal rate: Why the 4% withdrawal rules leaves money on the table*, University of York and Cass Business School

where poor investment returns are not fully compensated later because of the money withdrawn in the meantime. One solution is to adopt an investment strategy with a lower sequence of return risk, such as by smoothing returns over time (e.g., see comments on CDC below).

- 3.21. Limiting withdrawals to the ‘natural yield’ (income generated each year) is another method of managing the risk, but is unlikely to generate adequate income in the long-term. Another approach is to retain a cash balance that can be drawn on when markets fall, for a sufficient period until the markets recover¹².
- 3.22. The use of derivatives and other strategies to provide downside protection to market movements is discussed in Appendix C.
- 3.23. With collective DC approaches, the consumer is not required to manage investment risk, as it is either transferred to an insurer (where an annuity is purchased) or is managed by trustees (in the case of CDC).
- 3.24. While CDC pools investments, the way in which it manages investment risk can vary:
 - There is a degree of smoothing of investment experience over the long-term as a result of the way in which changes in income are typically smoothed over time (as discussed in 5.15 and 5.16). This leads to some cross subsidies between generations.
 - Where a financial buffer is used to further smooth investment returns, consumers are no longer directly exposed to market performance and investment outcomes will deviate from the individual approach. This leads to further cross-subsidies between generations, which needs careful management to avoid becoming unfair. CDC as recently introduced in the UK does not allow this.

¹² Kitces, M. (2014) *Managing Sequence of return risk with bucket strategies vs total return rebalancing*

4. Standard Decumulation Pathway design

- 4.1. A standard Decumulation Pathway has been designed, as one which might be suitable for the typical consumer, based on an appropriate and sensible set of objectives for the purpose¹³. The main objective assumed for this standard is to provide a reasonably stable and sustainable lifetime income, for those consumers who do not wish to purchase an annuity. The standard might be adopted for default purposes.
- 4.2. The standard was derived after exploring a range of alternative features which are detailed in sections 5 and 6. It is intended to be illustrative, and in practice would need to be tailored to meet the needs of the consumers to whom it is being offered.
- 4.3. The standard Decumulation Pathway provides for:
- A 10% allocation to the FlexFund
 - The remaining 90% invested in a PenFund with the features set out in Figure 7.

Figure 7: Standard PenFund design features

Feature	Standard design
Longevity risk management	Drawdown initially, followed by a phased transfer to a Pooled PenFund in order to manage longevity risk in the longer term, while maintaining some flexibility and legacy potential in the shorter-term (as illustrated in Figure 4)
Withdrawal strategy	Index-linked income, calculated using notional annuitisation (see section 2), with single life annuities adjusted from market rates to reflect the expected return from the investment strategy
Investment strategy	'Moderate' risk, with a 50% equity allocation (further detail is provided in Appendix D)

PenFund design metrics

- 4.4. In order to evaluate a PenFund design, stochastic modelling has been employed, in conjunction with the metrics described below. A retirement age of 67 was assumed. The methodology and other assumptions adopted are set out in Appendix D, including an explanation of the suitability of the approach adopted.
- 4.5. A range of metrics has been developed to evaluate the effectiveness of different PenFund designs. Whereas during accumulation the key risk is investment, in decumulation risk needs to be viewed differently¹⁴, in terms of the impact on the level and stability of the income.
- 4.6. **Average Income** is the average inflation-adjusted DC income in the first 30 years, expressed as a % of the initial PenFund size.
- 4.7. It is also instructive to compare the PenFund design with a guaranteed index-linked annuity using the same initial fund size. The metric **Exceeds Annuity** is the percentage by which Average Income (as defined above) from the PenFund exceeds

¹³ Bell, Shao and Liu (2018) *An Introduction to the Member's Default Utility Function*

¹⁴ EV (2021) *Drawdown: The Mirror Image of Accumulation*

that from the index-linked annuity, along with the probability that the PenFund will provide a higher Average Income than the annuity.

- 4.8. It is relatively easy to ensure an income lasts a full lifetime, by reducing it, if necessary, in response to adverse investment performance. Where such a dynamic withdrawal strategy is adopted, a more meaningful test is one of **Sustainability** of the initial income in real terms. This has been defined as the level of income in the 26th year of retirement divided by the initial income adjusted for inflation over the period. 26 years was chosen as being a sufficiently long period to assess sustainability, while there is a significant chance a consumer will survive to the end of that period (34% for retirement at age 67, based on the mortality assumptions described in Appendix D).
- 4.9. The extent to which the income varies each year is also a significant factor, in particular when the income falls. The metric **Income Stability** measures the likelihood that the income over the first 30 years will not fall by more than 5% compared with the prior year's income. This is shown in nominal terms, as that is what people notice in the short-term, as opposed to the longer-term impact of inflation.
- 4.10. Finally, **Basic Income Buffer** is the amount by which the total 'inflation' adjusted income (DC plus State pension) over the first 30 years exceeds basic income needs, which are defined as £12,000, 'inflation' adjusted. Basic Income Buffer is relevant to a consumer's individual circumstances and is discussed in section 6.

Standard PenFund design: how it performs

- 4.11. Figure 8 shows the calculated metrics for the standard PenFund design.

Figure 8. Standard PenFund performance

Approach	Initial income %	Average Income (30-year inflation adjusted)										
		Amount (%), percentile					Exceeds Annuity (%), percentile					Prob %
		5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	
Standard	4.0	2.4	3.3	4.1	5.1	7.3	(20)	10	37	70	143	82

Approach	Sustainability (%), percentile					Income Stability (%), percentile				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
	Standard	45	74	108	156	250	63	73	80	86

- 4.12. The initial income is 4.0% of the fund size, but 30-year inflation adjusted Average Income varies considerably according to future investment performance. The results are shown in percentiles; e.g., 4.1% for the 50% (median) Average Income, 5.1% for 75% (upper quartile) and 3.3% for 25% (lower quartile).
- 4.13. Exceeds Annuity shows how Average Income compares with the immediate purchase of an index-linked annuity. For example, the median Average Income of 4.1% is 37% better than the 3.0% from an annuity. Overall, the standard design has an 82% chance of outperforming the annuity, with a good chance of substantially outperforming. Average Income is only 20% less than the annuity for the worst (5th percentile) outcome shown.
- 4.14. Sustainability measures the ratio of actual versus expected income in the 26th year, where the level of expected income is the initial income of 4.0% increased by inflation. The median outcome shows that the income in that year is 8% higher than expected. The lower quartile income is 26% below expected (74% ratio). The rationale for the choice of approach is discussed in section 5.

- 4.15. Income Stability shows the proportion of years in the first 30 where the income does **not** fall by more than 5% compared with the prior year’s income. It should be noted that there are ways of improving income stability in practice, as discussed in section 5.

Standard PenFund: comparison with other options

- 4.16. Figure 9 compares the standard PenFund against three alternatives:

- Drawdown using the well-known ‘4% rule’, where the income is 4% of the initial fund, subsequently index-linked, with no longevity risk management but the same investment strategy as the standard PenFund.
- The immediate purchase of an index-linked guaranteed annuity
- The immediate purchase of a flat (non-increasing) guaranteed annuity

Figure 9. Standard PenFund versus drawdown and annuity

Approach	Initial income %	Average Income (30-year inflation adjusted)					Exceeds Annuity (%), percentile					Prob %
		Amount (%), percentile										
		5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	
Standard	4.0	2.4	3.3	4.1	5.1	7.3	(20)	10	37	70	143	82
Drawdown	4.0	2.0	2.6	3.1	4.0	4.0	(33)	(13)	3	33	33	53
Indexed annuity	3.0	3.0	3.0	3.0	3.0	3.0	-	-	-	-	-	-
Flat annuity	4.9	2.0	2.6	3.2	3.9	5.0	(33)	(13)	7	30	67	56

Approach	Sustainability (%), percentile					Income Stability (%), percentile				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
Standard	45	74	108	156	250	63	73	80	86	93
Drawdown	-	-	-	100	100	90	93	93	96	100
Indexed annuity	100	100	100	100	100	100	100	100	100	100
Flat annuity	12	28	45	71	123	100	100	100	100	100

- 4.17. The metrics for the standard PenFund are highlighted in red and the best results are highlighted in grey text. The same applies to the Figures in section 5.
- 4.18. The standard PenFund scores highest in terms of Average Income and Exceeds Annuity, except for the worst (5th percentile) outcomes where the index-linked annuity performs best.
- 4.19. The drawdown strategy assumes an initial withdrawal rate of 4%, which in current economic conditions is now widely recognised to be too high, although many consumers continue to draw income at that rate, or even higher (see Appendix A). In practice, consumers are likely to adjust the level of income drawn to reflect what they deem to be affordable, but it is hard to optimise the affordable income over the full period of retirement in this way. In contrast, the standard PenFund is better able to support a 4% initial withdrawal rate through the use of longevity risk management and an automated withdrawal strategy.
- 4.20. An index-linked annuity scores best in terms of Sustainability and Income Stability. Comparison between the flat and index-linked annuities shows the impact of inflation on Average Income and Sustainability; the flat annuity has a much higher initial income and performs better in low inflationary scenarios, while the index-linked annuity is superior when inflation is high.

5. Alternative Pension Fund design features

- 5.1. The standard PenFund was formulated after exploring the alternative features discussed in this section. Some of these might be offered to consumers who wish to deviate from the standard approach.

Figure 10. Alternative PenFund design features

Feature	Standard design	Alternative features explored
Longevity risk management	Pooled PenFund, phased in over 5 years from age 75	<ul style="list-style-type: none"> - Annuity instead of Pooled PenFund - Alternative timing/phasing options
Withdrawal strategy	Index-linked income, calculated using the notional annuitisation (see section 2), using single life annuities adjusted from market rates to reflect the investment strategy	<ul style="list-style-type: none"> - Static strategy (not responding to market conditions) - Annuities based on alternative interest rates - Allowance for inflation: flat versus index-linked - Various means of improving Income Stability
Investment strategy ¹	'Moderate' risk	- 'Cautious' and 'Bold' strategies (with 20% and 80% equity allocations respectively)

¹ These strategies are defined in Appendix D

Longevity risk management

- 5.2. Figure 11 illustrates how pooling longevity risk greatly improves the projected outcomes compared with pure drawdown (having no longevity risk management), as measured across all metrics. A significantly higher, more sustainable and more stable income can be expected; a good illustration of the inadequacies of drawdown to provide a sustainable lifetime income.

Figure 11. Longevity risk management

Longevity risk management	Initial income %	Average Income (30-year inflation adjusted)										
		Amount (%), percentile					Exceeds Annuity (%), percentile					Prob %
		5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	
None	4.0	2.0	2.6	3.2	3.9	5.4	(33)	(13)	7	30	80	57
Pool, 75-79	4.0	2.4	3.3	4.1	5.1	7.3	(20)	10	37	70	143	82
Pool, 75	4.0	2.5	3.4	4.2	5.2	7.4	(17)	13	40	73	147	84
Pool, 80	4.0	2.4	3.2	4.0	4.9	6.9	(20)	7	33	63	130	79
Annuity, 75-79	4.0	2.2	2.9	3.5	4.1	5.5	(27)	(3)	17	37	83	68

Longevity risk management	Sustainability (%), percentile					Income Stability (%), percentile				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
None	21	34	49	71	115	43	53	60	66	76
Pool, 75-79	45	74	108	156	250	63	73	80	86	93
Pool, 75	47	77	112	162	263	63	73	80	86	93
Pool, 80	42	70	102	147	239	63	73	80	86	93
Annuity, 75-79	46	65	81	101	144	76	86	90	93	96

- 5.3. Introducing mortality pooling immediately at age 75 generates slightly better outcomes than when spread over ages 75-79. However, it involves a step change in

terms of flexibility and legacy potential.

- 5.4. It can be seen that introducing mortality pooling at age 80 is less optimal than at age 75, due to the increasing impact of mortality drag with age (see Appendix B). Finally, a phased annuitisation over the age range 75-79 instead of mortality pooling generates inferior outcomes, mainly because of the more adventurous investment strategy retained with mortality pooling, but is still superior to pure drawdown¹⁵.

Withdrawal strategy – static versus dynamic

- 5.5. Figure 12 illustrates the limitations of a static withdrawal strategy, i.e., where the income remains unchanged, irrespective of market movements. While it naturally scores well on Income Stability, it fails to take advantage of favourable investment returns (although it leaves greater residual funds as a legacy) and carries the risk of running out of money. In other words, it is the wrong sort of low volatility; stable until bust. A dynamic withdrawal strategy alleviates these issues.

Figure 12. Withdrawal strategy: static versus dynamic

Withdrawal strategy	Initial income %	Average Income (30-year inflation adjusted)										
		Amount (%), percentile					Exceeds Annuity (%), percentile					Prob %
		5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	
Static	4.0	2.1	2.7	4.0	4.0	4.0	(30)	(10)	33	33	33	66
Dynamic	4.0	2.4	3.3	4.1	5.1	7.3	(20)	10	37	70	143	82

Withdrawal strategy	Sustainability (%), percentile					Income Stability (%), percentile				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
Static	-	-	100	100	100	86	93	93	100	100
Dynamic	45	74	108	156	250	63	73	80	86	93

Withdrawal strategy – interest rates adjustment to market annuities

- 5.6. The standard design employs a dynamic withdrawal strategy; the notional annuitisation approach described in section 2, using an interest rate 2.0% p.a. above market rates. This is compared, in Figure 13, with alternative interest rate adjustments.

Figure 13. Dynamic withdrawal strategy: notional annuitisation

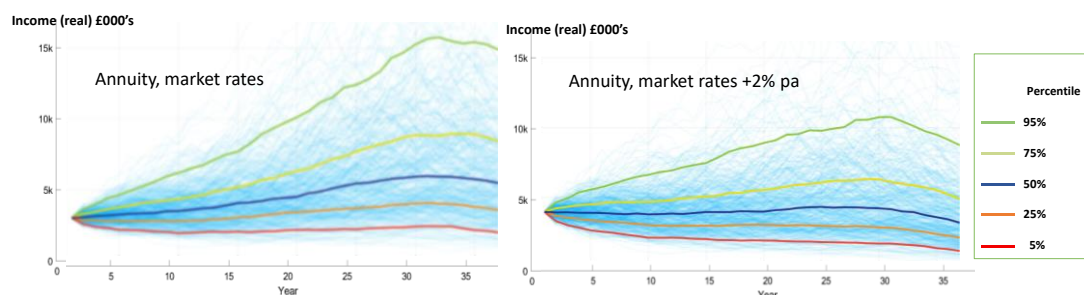
Market annuity interest adjust	Initial income %	Average Income (30-year inflation adjusted)										
		Amount (%), percentile					Exceeds Annuity (%), percentile					Prob %
		5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	
Nil	3.0	2.5	3.4	4.3	5.5	8.0	(17)	13	43	83	167	84
+ 1.0%	3.5	2.5	3.3	4.2	5.3	7.6	(17)	10	40	77	153	83
+1.5%	3.7	2.4	3.3	4.1	5.2	7.4	(20)	10	37	73	147	83
+2.0%	4.0	2.4	3.3	4.1	5.1	7.3	(20)	10	37	70	143	82
+2.5%	4.2	2.4	3.2	4.0	5.0	7.1	(20)	7	33	67	137	82

Market annuity interest adjust	Sustainability (%), percentile					Income Stability (%), percentile				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
Nil	76	125	182	263	420	73	80	86	90	96
+ 1.0%	59	96	140	202	324	66	76	83	86	93
+1.5%	51	84	123	178	284	66	76	83	86	93
+2.0%	45	74	108	156	250	63	73	80	86	93
+2.5%	40	65	95	137	219	63	70	76	83	90

¹⁵ Institute & Faculty of Actuaries (2018) *How can we help consumers avoid running out of money in retirement?* Policy briefing

- 5.7. Under the standard approach, the median Average Income of 4.1 is similar to the initial income of 4.0, implying it is close to a best estimate based on the investment strategy being assumed. This is further evidenced by a median Sustainability of 108%, implying an income in the 26th year that is only modestly above the expected level.
- 5.8. This is analogous to how UK CDC schemes operate, which by law are required to use a ‘central’ (best) estimate discount rate.
- 5.9. Average Income is fairly similar for all the interest rate adjustments. This is because, in the long term, total available income is largely dependent on investment performance, so that taking more income in early years results in less being available later, although slightly better outcomes arise by taking a lower initial income (as explained in 5.12). Income Stability is also fairly similar in all these examples.
- 5.10. The key difference lies in the expected shape of income, as indicated by Sustainability. The most cautious approach, using market annuity rates, provides the best downside protection (Sustainability of 76% at the 5th percentile), but there is a high chance of the income rising substantially in real terms. This is contrary to the evidence that there is a tendency for expenditure to fall in real terms in retirement. Such a tendency also provides some comfort that the worst scenarios under the standard approach are less problematic, as a fall in real income may be tolerable to some extent.
- 5.11. The difference between the standard approach and using market annuity rates is illustrated in Figure 14, which plots all 1,000 simulations and highlights the same percentiles shown in Figure 13. The standard approach has a much narrower range of outcomes, owing to the initial income being set close to a best estimate. Furthermore, the market rate approach may seem unattractive to consumers in providing an initial income no greater than that available from an annuity, albeit there is a strong chance that the income will increase over time in real terms.

Figure 14. Distribution of inflation-adjusted income



- 5.12. The standard approach does mean that, should the consumer wish (and be permitted) to purchase an annuity at a later date, there will be some reduction in income when market rates are applied. However, the difference between market and adjusted annuity rates declines with advancing years, and there is also the option of further mitigating the reduction by purchasing a flat annuity rather than index-linked. Furthermore, it might be considered relatively unlikely that a consumer would choose to purchase an annuity after entering into a Decumulation Pathway.

Withdrawal strategy – allowance for inflation

- 5.13. Figure 15 demonstrates how an index-linked income performs better than a level income, partly due the lower income in early years providing greater protection

against sequence of return risk. On the other hand, the initial income is much lower.

Figure 15. Allowance for inflation

Income shape	Initial income %	Average Income (30-year inflation adjusted)										
		Amount (%), percentile					Exceeds Annuity (%), percentile					Prob %
		5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	
Indexed	4.0	2.4	3.3	4.1	5.1	7.3	(20)	10	37	70	143	82
Flat	6.1	2.4	3.0	3.7	4.5	6.3	(20)	-	23	50	110	75

Income shape	Sustainability (%), percentile					Income Stability (%), percentile				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
Indexed	45	74	108	156	250	63	73	80	86	93
Flat	11	22	37	61	120	53	60	66	73	80

Withdrawal strategy - improving Income Stability

- 5.14. Figure 15 also illustrates how an index-linked income provides better Income Stability than a level income.
- 5.15. There are various other ways of improving Income Stability, such as smoothing the changes in income over a period. Care needs to be taken that the smoothing period is not too long though, as that increases the chance of not paying out an appropriate total income in the event the member dies at a point where the smoothing has not fully worked its way through. A smoothing period of up to 3 years say, will reduce such risk. This is less of an issue with IDC, where the balance on death is paid to beneficiaries, but is much more significant in a Pooled PenFund, where the balance on death is redistributed to surviving members.
- 5.16. An alternative approach to improving Income Stability is one where the level of future indexation expectations, rather than the current level of income, is varied in the first instance. For example, with an index-linked income, if investments perform poorly the current and anticipated future indexation might be reduced to 50% of inflation, say. With further deterioration, future indexation might be removed entirely, before the level of pension is cut. A similar approach would be adopted when investments perform favourably.
- 5.17. This approach is analogous to how CDC operates in the UK. While Income Stability can be improved, the consumer does not keep their original level of pension increases. For example, a consumer expecting an index-linked pension may end up with a level pension if markets perform poorly and don't recover; an outcome which might be preferred in the circumstances, but possibly not.
- 5.18. A further way of achieving a more stable income is to utilise the FlexFund. If the income falls, the FlexFund can be used to make up the shortfall, while if the income is more than required then the balance can be paid into the FlexFund. This is explored further in section 7.
- 5.19. Finally, income stability can be controlled through the investment strategy.

Investment strategy

- 5.20. Setting investment strategy is a trade-off between seeking upside potential and managing the downside risk. The strategies mentioned in Figure 16 are described in terms of the extent to which they deviate from the 'least risk' approach (whereby investments are fully matched with the cost of providing the pension). Cautious is the

closest to the least risk approach (with a 20% equity allocation) and Bold involves the largest departure (having an 80% equity allocation).

Figure 16. Investment strategy

Investment strategy	Initial income %	Average Income (30-year inflation adjusted)										
		Amount (%), percentile					Exceeds Annuity (%), percentile					Prob %
		5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	
Cautious	4.0	2.5	3.2	3.9	4.7	6.4	(17)	7	30	57	113	80
Moderate	4.0	2.4	3.3	4.1	5.1	7.3	(20)	10	37	70	143	82
Bold	4.0	2.4	3.3	4.2	5.4	7.9	(20)	10	40	80	163	83

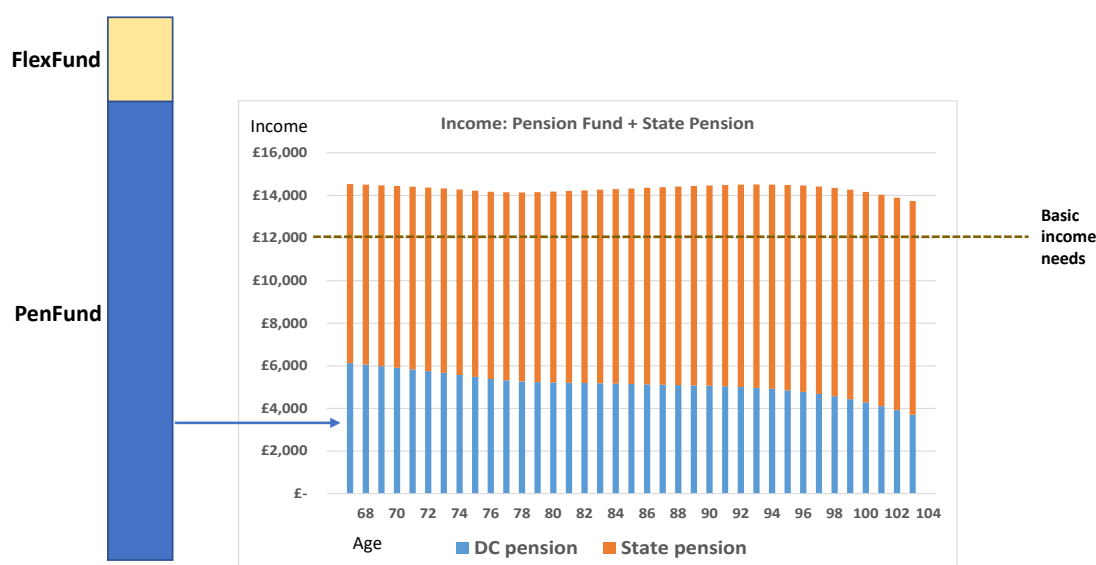
Investment strategy	Sustainability (%), percentile					Income Stability (%), percentile				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
Cautious	47	70	100	137	209	66	76	83	86	93
Moderate	45	74	108	156	250	63	73	80	86	93
Bold	45	77	114	168	277	63	73	80	83	93

- 5.21. The modelling results present a good case for the Bold strategy, given the extra upside potential and no detriment to the downside risk when compared with Moderate. This demonstrates the potential to take very significant investment risk in the standard PenFund, supported by the allocation of longevity credits (resulting in a longer investment horizon) and the drawing of a reasonably stable income.
- 5.22. However, the 80% equity allocation for Bold can result in substantial short-term volatility in fund value, which will be of concern to some consumers when individual funds are identified as in the Pooled PenFund (perhaps less of an issue for CDC where the focus is on the level of income). The standard approach has therefore been based on the Moderate investment strategy, in an acknowledgement that perhaps the metrics adopted need further refinement to adequately deal with this aspect of design.
- 5.23. An investment approach which varies over time could be adopted, such as based on the three retirement phases described in section 2. There are various arguments about how this variation might be structured, which are beyond the scope of this paper.
- 5.24. There is the related consideration of how the FlexFund is invested, noting there may be administrative convenience in adopting the same strategy as for the PenFund. If the FlexFund is intended primarily for flexible access, this would suggest a more cautious approach than if intended for legacy purposes due to the shorter investment horizon.

6. Flexible Fund allocation

- 6.1. A decision is needed as to how much of the DC fund to allocate to the FlexFund to meet flexibility and legacy requirements within the standard Decumulation Pathway. This is distinct from the PenFund which provides a lifetime income for the consumer only, although it would be possible to also build provision within the PenFund for a dependant's pension following the death of the consumer.
- 6.2. A FlexFund allocation of **10%** has been chosen for the standard, reflecting the following:
- It is sufficiently modest such that the bulk of monies are targeted at providing a lifetime income, while offering some flexibility and legacy potential
 - The consumer may still have access to part of the PCLS (tax-free cash) taken, which may help support a smaller allocation to the FlexFund
 - For DC funds of £150,000 or more, the remaining 90% allocation to the PenFund has a good chance of providing an income, along with the State pension, that is sufficient to meet basic needs in retirement (assumed to be £12,000 p.a.). This is illustrated in Figure 17 and evaluated more fully below.

Figure 17: Meeting basic income needs¹



¹ Initial DC fund size £150,000, 10% FlexFund allocation, State pension of £8,400

- 6.3. The methodology employed to determine basic income needs and the assumed State pension is explained at the end of Appendix D.
- 6.4. **Basic Income Buffer** has been defined as the extent to which the inflation-adjusted 30-year average income (DC plus State) exceeds basic income needs as defined above. Figure 18 shows the results for this metric for various FlexFund (FF) allocations.

Figure 18: Flexible Fund and Basic Income Buffer by fund size (in £000's)

Initial DC fund size	Basic Income Buffer (£000's) by percentile											
	FlexFund allocation 0%						FlexFund allocation 10%					
	5%	25%	50%	75%	95%	FF	5%	25%	50%	75%	95%	FF
£50,000	(3.2)	(2.9)	(2.8)	(2.6)	(2.2)	-	(3.4)	(3.1)	(3.0)	(2.8)	(2.6)	5
£100,000	(2.0)	(1.3)	(0.7)	(0.0)	1.4	-	(2.3)	(1.6)	(1.1)	(0.5)	0.7	10
£150,000	(0.8)	0.4	1.3	2.5	5.1	-	(1.2)	(0.1)	0.7	1.8	4.0	15
£200,000	0.4	2.0	3.4	5.1	8.7	-	(0.1)	1.3	2.6	4.1	7.3	20

Initial DC fund size	Basic Income Buffer (£000's) by percentile											
	FlexFund allocation 20%						FlexFund allocation 30%					
	5%	25%	50%	75%	95%	FF	5%	25%	50%	75%	95%	FF
£50,000	(3.5)	(3.3)	(3.2)	(3.1)	(2.9)	10	(3.6)	(3.4)	(3.4)	(3.3)	(3.3)	15
£100,000	(2.5)	(2.0)	(1.5)	(1.0)	(0.0)	20	(2.8)	(2.3)	(1.9)	(1.6)	(0.8)	30
£150,000	(1.6)	(0.6)	0.1	1.0	2.9	30	(1.9)	(1.1)	(0.5)	0.2	1.8	45
£200,000	(0.6)	0.7	1.8	3.0	5.8	40	(1.1)	0.0	0.9	2.0	4.4	60

- 6.5. The modelling results support the earlier comment that, for a DC fund size of £150,000 or more, there is good chance of meeting basic income needs, based on a 10% FlexFund allocation. There may also be scope to increase this up to a 20% allocation.
- 6.6. For fund sizes of £100,000 or less, basic income needs are unlikely to be met even with no FlexFund allocation, based on the assumptions adopted. However, adopting a 10% FlexFund allocation provides some flexibility and legacy potential.
- 6.7. For fund sizes of £200,000 or more, there is more significant scope to increase the FlexFund allocation from the 10% standard allocation, while retaining a good chance of meeting basic income needs.
- 6.8. Of course, the extent to which a consumer is concerned about the DC pension being used to meet basic income needs will depend on individual circumstances.

7. Product development

- 7.1. A number of product initiatives have been mentioned in this paper that are of potential relevance to the pension decumulation market. These are explored further below.

PenFund & FlexFund in combination

- 7.2. The PenFund and FlexFund could work together effectively in various ways, such as the following:
- Money could be moved from one Fund to the other as required (to the extent permitted), either to rebalance them or to reflect revised circumstances or objectives
 - The FlexFund could be used to top up income from the PenFund when it has fallen due to adverse investment performance, or some of the income from the PenFund could be diverted into the FlexFund if not required
 - A very different approach might see all income from the PenFund paid into the FlexFund, leaving the consumer free to draw the amount required
- 7.3. The ability to operate in any of these ways will depend on how the PenFund and FlexFund are constructed. Where they both reside within the same trust or product, the flows between the two funds would be treated as internal transfers rather than income distributions. Transfers would be easy to manage where the PenFund and FlexFund both retain individual member funds, and especially if they both invest in the same pooled assets.

Annuity innovations

- 7.4. Similarly, if an annuity is purchased as a trust asset, annuity payments will constitute a source of income rather than a distribution, and so can be kept within the trust. It would also be possible to permit the surrender of the annuity, albeit at a discount. One such product is offered by Just¹⁶.
- 7.5. Trustees of defined benefit schemes can typically obtain better annuity pricing for buy-ins or buy-outs than individuals purchasing annuities themselves, due to their bulk purchasing power. In a similar manner, a Master Trust, say, might be able to enter into an arrangement with a preferred provider to provide cheaper annuity terms than would be available to individuals. Naturally this would require careful management to ensure good value against the market.

Pooling longevity risk

- 7.6. Products which provide longevity risk management other than the guaranteed annuity are not currently widely available in the UK. Two potential alternative products have been considered in this paper; the Pooled PenFund and CDC, which are compared in Figure 19. These products offer the potential for significantly higher income than from a guaranteed annuity due to their greater investment freedom, albeit with a variable income.

¹⁶ Just (2021) *Secure Lifetime Income: Adviser Guide*

Figure 19: Comparison of the Pooled Pension Fund and CDC for Decumulation

Feature	Pooled Pension Fund	Collective Defined Contribution
Accumulation also	Yes ¹	Yes
Income	Variable	Variable
Member fund identified	Yes	No, assets are pooled
Risk pooling	Longevity risk only ²	Longevity and investment risks
Cross-subsidies between participants/ members	Minimal other than longevity cross-subsidies, as individual funds are maintained. Underwriting could help to reduce the longevity cross-subsidies	Other than longevity cross-subsidies, relatively low (especially where there is no financial buffer). Underwriting could be used for commercial Master Trusts
Individual choice	Limited in order to avoid selection against the pool, but some pre-determined choice can be offered, such as income shape (e.g., index-linked or flat), investment strategy options, legacy provision and some variation in income taken each year.	None, or likely to be very limited
Surrender option	Determined by pension provider ³	Unlikely to be available in retirement. Before retirement, a “central estimate” share of Fund

1 In the accumulation stage, this is normal individual defined contribution (IDC), in absence of any mortality pooling

2 Investment risk can also be pooled, e.g., as in with-profits, but this is very rare nowadays

3 This will be less than the full fund value for Pooled Pension Fund, and may also be discounted in CDC

- 7.7. CDC offers a straightforward solution for the consumer, especially when also adopted during the accumulation phase. With assets being pooled, and no, or very limited choices to consider, the consumer receives a lifetime income, albeit one that is variable.
- 7.8. The Pooled PenFund is not a new concept; for example, Blake¹⁷ referred to it as CIDD (collective individual defined contribution) and it is given various other names in the references mentioned below and in Appendix B. A key distinction is the identification of individual funds, along with the decoupling of the management of longevity risk from the ability to set investment strategy. Furthermore, there is the possibility of offering some choices, which most likely need to be pre-determined, in order to minimise the risk of adverse selection against the pool. Some potential choices are shown in Figure 19.
- 7.9. Underwriting is mentioned in Figure 19. This is more naturally undertaken where an insurance company is involved, and has a cost implication. **Impaired lives** need particular consideration if they are not to be disadvantaged, in terms of the distribution of longevity credits and calculating the affordable income each year. When making decumulation decisions, consumers need to consider if this aspect is relevant to their circumstances.
- 7.10. The Pooled PenFund has not yet been adopted widely around the world, although

¹⁷ Blake (2016) *We Need a National Narrative: Building A Consensus around Retirement Income Independent Review of Retirement Income*

there is growing interest and some innovative products are reaching the market such as offered by Nuovallo and Tontine Trust. In Canada, MacDonald et al¹⁸ discuss the potential of such products, while Purpose Investments Inc¹⁹ have recently introduced one. Mercer²⁰ has operated a similar product in Australia for some time.

- 7.11. The Dutch variable DC pension²¹ has been in existence since 2016 and is expected to play a prominent role in the planned new pension arrangements. It has a strong resemblance to the Pooled PenFund modelled in this paper. Market research could help determine the potential demand for the Pooled PenFund in the UK.
- 7.12. Both the Pooled PenFund and CDC would require legislative change to make them suitable as alternative decumulation options. For the Pooled PenFund this might be based on existing provisions for individual DC, while ensuring that longevity credits do not count towards the Annual Allowance. For CDC, it would build on existing CDC legislation which is for single employer arrangements only, which the Government has expressed a willingness to do in conjunction with the pensions industry.
- 7.13. Collective products such as the Pooled PenFund and CDC need scale to make them cost effective. The increasing consolidation in the UK DC market is helpful in this regard.

Quality assurance

- 7.14. Products need to be of high quality and offer value for money. A quality assurance (or safe harbour¹⁷) scheme might be introduced, to certify a product as being Decumulation Pathway approved, and thereby provide comfort and protection to consumers. There would need to be consensus on what the key attributes of such a product should comprise.

¹⁸ MacDonald, B-J., Sanders, B., Strachan, L., Frazer, M. (2021) *Affordable Lifetime Pension Income for a Better Tomorrow* National Institute on Aging & Global Risk Institute

¹⁹ Purpose Investments Inc (2022) *Longevity Pension Fund Brochure*

²⁰ Mercer LifetimePlus (2016) *Adviser Toolkit, Conversation Guide*

²¹ Warren, O. and Irwin, M. (2021) *Going Dutch: What are variable DC pensions?* The Actuary November 2021

8. Consumer decision making

- 8.1. The Working Party's brief was to consider how consumers can be automatically protected against making bad decisions regarding their pension decumulation.
- 8.2. Clearly the preferred outcome is that the consumer will make good, well-informed decisions. Decumulation Pathways can help in this regard, with the consumer being encouraged to weigh up the relative importance of competing objectives in order to allocate monies between the PenFund and FlexFund.
- 8.3. It is also important that suitable products are available to implement the consumer's preference, which was explored in section 7.

Consumer choice and guidance

- 8.4. Successfully navigating the available choices requires the provision of high-quality information and guidance. Lindley¹ suggests that, before accessing their DC funds, all consumers should be required to take regulated advice, use the Pension Wise guidance service, or go through an opt-out service managed by Money & Pension Service. The new stronger nudge to pensions guidance requirement² will help address this point.
- 8.5. One possible approach might be an automated decision-making pathway, which could pose a series of questions and offer guidance based on the responses given.
- 8.6. It is also important that consumers make decisions about their DC pensions by reference to their wider financial resources, in order to make informed decisions, and the Pensions Dashboard will be crucial in this regard. This should reduce the number of cases where the consumer regards the DC fund as being too small to use for a lifetime income. It might also impact people's decisions about how much tax-free cash to draw, given that it will leave them with less income for the future.
- 8.7. While guidance and advice at retirement has rightly been given a lot of focus, take up of ongoing support in retirement is less common, and is unlikely to extend beyond investment advice. Decumulation Pathways can help overcome this challenge, by offering solutions which require minimal consumer decision making once established.

Understanding risk

- 8.8. One of the biggest challenges is helping consumers understand the key decumulation financial risks of longevity, inflation and investment. Developing more guidance on these matters would be highly desirable.
- 8.9. A key concern is the natural tendency for consumers to focus on the expected, median or average outcome, however it may be termed. Such a simple approach has obvious merit in being engagingly straightforward, but does not reveal the range of uncertainty that exists, and which could impact a consumer's decision making.
- 8.10. One important example is life expectancy, which is often underestimated by people. As Appendix B illustrates, people also underestimate the wide distribution of age at death around the average, which highlights why the pooling of longevity risk is so important. By definition, there is a 50% chance of living longer than the median expected lifetime, which makes this a material matter in terms of financial planning. Furthermore, the most likely (modal) date of death is typically a few years later than

the median.

- 8.11. A similar issue arises when considering expected investment returns. For example, while a Pooled PenFund is expected to deliver a higher income than an annuity, there is a range of uncertainty as illustrated in the modelling from sections 4 and 5. Stochastic modelling can be used to explain this uncertainty, but is not straightforward to present.
- 8.12. A related point is that it is sometimes argued less money is needed in drawdown to provide a specified level of income than if a guaranteed annuity is purchased. Again, this notion ignores the range of uncertainty in outcomes. Such analysis could also adversely impact retirement planning, with lower contributions being deemed necessary if drawdown is anticipated rather than income being provided by an annuity²². The current Statutory Money Purchase Illustrations (SMPI) assumptions for DC projections assume the purchase of an annuity, which is therefore prudent in being less likely to underestimate the cost of providing a given level of income.
- 8.13. In principle of course, in absence of cross-subsidies, the total income achievable over a given period will depend on actual investment performance. Taking a higher initial income will mean less being available at a later date, as discussed in section 5.
- 8.14. An awareness of inflation risk may also have been undermined by the low inflationary environment experienced for many years, although that has now changed. There is still a danger that the cumulative impact of inflation is underestimated, partially linked to the tendency to underestimate longevity and because it is seen as a more distant problem. This is likely to contribute towards the popularity of level pensions as opposed to index-linked (in addition to the other points made in Appendix A).

Consumer protection

- 8.15. Ideally people will make well-judged, informed decisions based on quality information and guidance, but it is worth reflecting on how to minimise the risk of poor decision making.
- 8.16. The standard Decumulation Pathway can provide a degree of protection by offering a default solution deemed suitable for the typical consumer, with a range of options available for those who wish to tailor the product to suit their personal circumstances. Guidance will be important though the help consumers determine if the standard is appropriate for them, or how to modify it if not, within the range of options offered. Providing a standard which varies according to certain criteria, such as fund size, has merit in principle, but introduces additional complexity and could lead to more sub-optimal consumer choices.
- 8.17. Making the transition from accumulation to decumulation as seamless as possible is convenient for the consumer. This is easily achieved where the consumer is in a CDC scheme and remains so in retirement. A transfer from drawdown to Pooled PenFund can also be relatively straightforward if there is no change in provider, as the individual DC fund is retained. On the other hand, such convenience might not result in the optimal solution for the consumer, who could be better served by re-evaluating objectives and choosing a decumulation approach accordingly.

²² Hyams, S.D. et al (2019) *Saving for Retirement Rules of Thumb*. Saving for Retirement Working Party of the Institute & Faculty of Actuaries

- 8.18. Some commentators have suggested making longevity risk management compulsory on reaching a certain age, but this would be very problematic.
- 8.19. Reintroducing capped drawdown rules and required proof of a secure income before accessing drawdown, would reduce scope for poor consumer choices, but such a reversal seems unlikely and is contrary to the concept of Pension Freedoms.

9. Conclusions

- 9.1. Many DC consumers currently choose drawdown rather than a guaranteed annuity. While drawdown offers flexibility, it does not provide a reliable lifetime income, mainly due to the absence of longevity risk management. This gives rise to a danger that some consumers will achieve poor outcomes in retirement relative to their expectations.
- 9.2. Decumulation Pathways can help address this issue by:
 - Providing a framework for consumers to determine the relative weight they attach to competing objectives, and apply these weightings to their decumulation strategies
 - Encouraging the development of alternative products for the PenFund, in addition to the guaranteed annuity
 - Providing information and guidance to support consumers in understanding the risks in decumulation.
- 9.3. A standard Decumulation Pathway suitable for the typical consumer, with some options to tailor it, can help consumer decision making.
- 9.4. The proposed illustrative standard Decumulation Pathway utilises the Pooled PenFund, a product which is not currently available in the UK but exists elsewhere. It offers the prospect of an income which is variable, but is significantly higher than that available from a guaranteed annuity. Market research can help evaluate consumer appetite for the Pooled PenFund.
- 9.5. CDC offers an alternative approach to the Pooled PenFund, also with potential to significantly outperform the guaranteed annuity. It generates a lifetime income with minimal decision making required by the consumer, while the Pooled PenFund can offer the consumer more personal choice in how decumulation is managed, with individual DC funds being maintained.

Appendix A: Consumer behaviour

Consumer spending habits and legacy intentions

- A.1. A lot of research has been carried out to investigate the spending patterns of people in retirement. Timeline has summarised the findings of a number of studies²³ which show that retirement spending tends to reduce in real terms with advancing age, the results being fairly consistent across a wide range of lifestyles. This reveals a persistent and increasing underspending of available income and consequential increasing in savings over time.
- A.2. In one such study, Brancati et al²⁴ found that a household headed by someone aged 80 or more spends, on average, 43% less than a household headed by a 50-year-old, with the over 80's saving an average of around £5,900 per year. What is perhaps surprising is that the same trend is seen in low-earning households, who start saving in later life as consumption falls but incomes remain flat; on average, they consume around 114% of their income at age 50 and 76% at age 80.
- A.3. They also found no evidence of a U-shaped pattern of expenditure; that is, no increased expenditure early in retirement and no sharp increase later in life to cover the cost of care.
- A.4. Their conclusions were that the reduced consumption appears to be mainly driven by less spending on non-essential items, as a result of poorer health, as well as changing personal preferences for goods and services in old age.
- A.5. Another factor in choosing to reduce expenditure is a desire to provide bequests, i.e., legacy intentions. On average, they found that retirees think they have a 70% chance of leaving an inheritance of £50,000 or more. Legacy intentions also ranked quite high in the NEST survey⁴ mentioned earlier. In addition to planned legacies, there is a tendency to worry about getting value for money on early death, whereby residual monies are distributed as legacies rather than being 'lost'.
- A.6. These findings raise some interesting questions. Are retirees spending their money in an optimal manner, balancing the conflicting objectives of enjoying the best possible standard of living they can afford (avoiding unnecessary frugality), while ensuring they do not run out of money and provide for any legacy intentions?
- A.7. Blake & Boardman²⁵ proposed the use of behavioural economics to improve the spending decisions of retirees. This involves the retiree making a plan to feel in control, encouraging annuitisation to provide comfort of not running out of money, and a campaign which plays on the natural desire to seek instant reward, thereby encouraging spending to combat the tendency to overcaution.

²³ Timeline (2020) *Retirement Spending Pattern - Implications for Retirement Income Sustainability*

²⁴ Brancati, C., Beach, B., Franklin, B. & Jones, M. (2015) *Understanding Retirement Journeys: Expectations Reality*

²⁵ Blake, D. & Boardman, B. (2010) *Spend More Today Safely: Using Behavioural Economics to Improve Retirement Expenditure Decisions with Speedometer Plans* Risk Management and Insurance Review, 2013, Vol. 17, No.1, 83-112

Inflation linking requirements

- A.8. If retirees are spending their money optimally, then the findings are important in terms of planning how much needs to be saved to achieve a given standard of living in retirement, as well as in the design of a Decumulation Pathway.
- A.9. The Pension & Lifetime Savings Association (PLSA) Retirement Living Standards (RLS)²⁶ set out the required incomes to achieve ‘Minimum’, ‘Moderate’ and ‘Comfortable’ lifestyles in retirement, based on consumer research into their expenditure requirements. The RLSs would need to be increased over time to offset rises in the cost of living, either as measured against price inflation or against earnings inflation (if the retiree is to enjoy the same increases in living standards as the working population).
- A.10. Another consideration is that the State pension is currently subject to the triple lock (although not applied in 2022); the higher of price inflation, earnings growth and 2.5% p.a. This means it is expected to increase faster than price inflation, which arguably reduces the extent to which the DC pension needs to be inflation proofed.

Use of Pension Freedoms

- A.11. FCA market data¹⁰ provides a detailed analysis of the 1.9m DC funds accessed for the first time in the three-year period to March 2021. This data shows that consumer choice varies significantly by fund size.
- A.12. About 40% of the funds were less than £10,000, and it is not surprising that almost 90% of these were fully withdrawn. 35% of the funds were between £10,000 and £50,000 and about half were fully withdrawn, most of the rest choosing flexible income rather than an annuity.
- A.13. 20% of the funds were between £50,000 and £250,000. About two-thirds of these elected for flexible income, of which approaching two-thirds took just a tax-free lump sum in the first instance, leaving the rest in drawdown. Only 19% elected to purchase an annuity.
- A.14. For the 5% of funds worth over £250,000, 92% elected for flexible income, of which approaching two-thirds took just a tax-free lump sum in the first instance, leaving the rest in drawdown.
- A.15. Over half of those entering drawdown took regulated advice, the proportion increasing with fund size; for example, 78% where the fund size is £100,000 or more. The take-up of Pension Wise is very low; an average of 10% across all fund sizes.
- A.16. It is interesting to note the much lower proportion of consumers with DC fund sizes of more than £250,000 who purchased annuities compared with those with fund sizes in the range £50,000 to £250,000. This may indicate their willingness to take more investment risk, given the larger fund size.
- A.17. 43% of regular withdrawals were at an annual rate of 8% or more of the pot value, which is not sustainable. There is further evidence that few consumers know how much to draw from their funds to ensure that they do not run out of money in later life.

²⁶ Pension & Lifetime Savings Association (2018) *Hitting the Target, A Vision for Retirement Income Adequacy, Final Recommendations*

In a 2020²⁷ survey Pensions Bee concluded that only a relative minority of consumers had a clear idea of what represents a sustainable withdrawal rate. Around a third of respondents gave withdrawal rates of 8% of their fund, or higher and around one in seven said that they didn't know.

The annuity puzzle

- A.18. Annuities are the traditional means of achieving longevity protection, but since Pension Freedoms in 2015 their popularity has declined markedly. The same FCA data revealed that annuities were purchased in only 11% of cases.
- A.19. Since an annuity is a ready-made solution to meeting the important consumer objective of achieving a lifetime income, the lack of take-up has been termed the 'annuity puzzle'²⁸. A number of factors may be at play:
- An aversion to handing over a large sum of money and thereby losing control of it, e.g., an ability to vary the income or cash it in
 - The perception that annuities are poor value because of the conservative investment policy backing them, compounded by the current very low interest rates
 - Underestimating life expectancy and the likelihood of living even longer
 - Placing more weight on the near-term risk of losing value in the event of dying early than on the longer-term risk of outliving pension savings
 - An aversion to buy what is perceived as insurance and to navigate the range of options requiring consideration

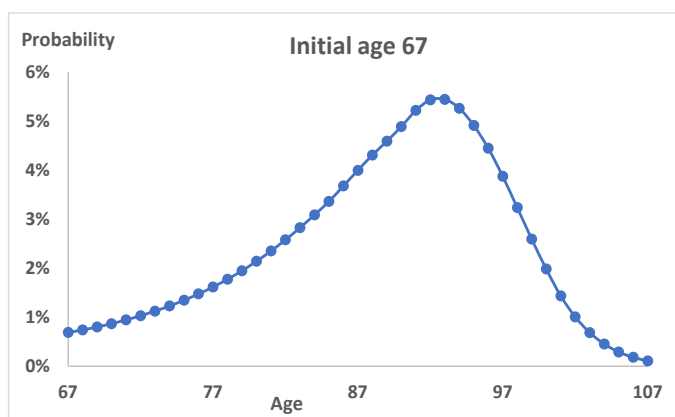
²⁷ Pension Bee (2020) *Drawdown Doldrums: Barriers and challenges faced by people accessing their defined contribution pensions*

²⁸ Silvestrini, E. (2019), *The Annuity Puzzle: What is It and Why Should You Care?* Annuity.org

Appendix B: Longevity risk management

- B.1. Longevity risk management is an essential feature in delivering a reliable lifetime income, in view of the uncertain period until death as illustrated in Figure 20.

Figure 20: Probability distribution of age at death



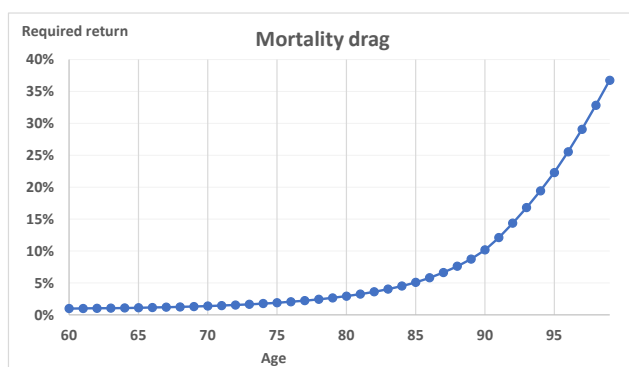
Based on SMPI mortality assumptions - see Appendix D

- B.2. With a 50% chance of surviving more than the median life expectancy, the initial DC fund needed to target a given level of lifetime income is highly uncertain. It should also be noted that the most likely (modal) date of death is typically a few years later than the median.
- B.3. The underlying principle of longevity risk management is that funds from those who die early are used to subsidise those who live relatively long. This can be achieved either through insurance or by a mutual pooling arrangement, as discuss later.

Mortality drag

- B.4. For the most risk averse consumers seeking a sustainable lifetime income, the immediate purchase of a guaranteed annuity is optimal. This provides insurance against longevity risk as well as removing the investment risk.
- B.5. For the less risk averse who choose to delay the purchase of an annuity, there is a cost of delay, which is commonly expressed as '**mortality drag**', calculated as the investment return required each year to enable the purchase of an annuity at the start of the following year, as illustrated in Figure 21.

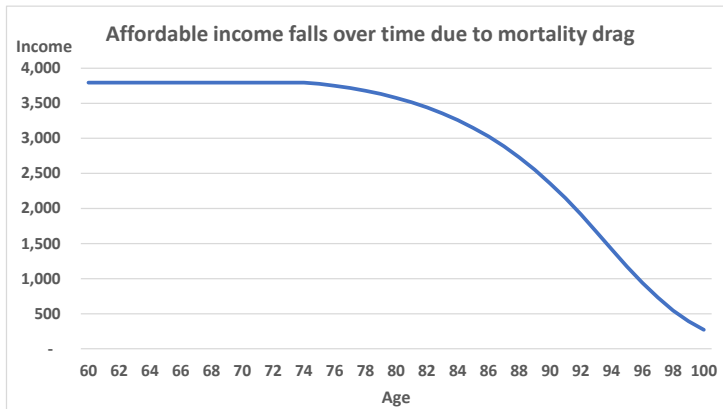
Figure 21: Mortality drag



Assumes retirement at 60, level income, SMPI mortality assumptions and an annuity interest rate of 1.2% p.a.

- B.6. It can be seen that mortality drag rises sharply with age from around the mid-70s as mortality rates increase, so that the required investment return to make up for mortality drag starts to become very high. Conversely, Figure 22 illustrates (using the same example as above) how the affordable income (based on purchasing an annuity at each age with the fund available at the time) falls over time as a result of mortality drag.

Figure 22: Impact of mortality drag on the affordable income



- B.7. While mortality drag applies to annuity purchases, a similar concept is relevant for the other forms of longevity risk management discussed below.

Pooled Pension Funds

- B.8. In a Pooled Pension Fund, individual DC funds are maintained and longevity risk is shared with other participants using a mortality pool, whereby the funds of those who die are placed in the pool and redistributed to surviving participants in the form of **longevity credits**. This process will be carried out at regular intervals, normally at least annually. The impact is to substantially mitigate the fall in affordable income illustrated in Figure 22.
- B.9. A fair system would imply actuarial neutrality, such that the expected gain on survival (the longevity credit, LC) equals the expected loss in the event of death (forfeiture of the accumulated DC fund, F). For a probability of death of q, this translates into the equation⁹:

$$(1-q) \times LC = q \times F, \text{ or } LC = q \times F / (1-q)$$

- B.10. In practice, LC will be dependent on the actual number of deaths in the period and the size of the deceased members' funds, as well as the method used to allocate the funds of deceased members between the survivors.
- B.11. Various approaches to allocate the longevity credits can be adopted. A simple and transparently fair one is the **'nominal-gain' method**. Under this approach, at the end of each period the ratio A/E is calculated, where A and E are respectively the actual and expected total funds of deceased members in the period. The longevity credit for each surviving member is then calculated as LC x A/E, where LC is as defined above. In this way, each surviving member's longevity credit is adjusted upwards or downwards in the same proportion to reflect deviations in experience from that expected.

- B.12. A Pooled Pension Fund will provide a variable, non-guaranteed single life income, responsive to investment performance and market conditions. It is possible to provide for a dependant's benefit on death, whereby the calculated income would be reduced to allow for the cost of the dependant's pension, and the member would receive correspondingly lower longevity credits.

Fairness

- B.13. Some methods of allocating longevity credits are intrinsically fairer than others (as defined in B.9). Another aspect of fairness is the extent to which qx is accurate at an individual level. In principle, it is possible to perform underwriting (akin to an annuity purchase) whereby qx for each participant takes into account individual rating factors, such as postcode and state of health. This has a cost of course, and is more naturally undertaken where an insurance company is involved.
- B.14. A published mortality table is likely to be used, suitably adjusted to reflect the collective characteristics of the participants. If underwriting were carried out, this might result in an individual rating relative to the published table.
- B.15. On a practical level, it is likely that any departure from actuarial fairness will have a minor impact on an individual's income compared with the variation due to investment performance and market movements.

Insuring longevity risk

- B.16. Until a Pooled Pension Fund acquires a sufficient number of participants, the variation in mortality experience around the expected level may be unacceptably high. Some research indicates that the required number of participants is not that high²⁹. It is not just a case of numbers though, as variability will be impacted by the degree of heterogeneity among the participants; a wide spread of ages and fund sizes will increase the degree of variation in experience over time.
- B.17. If such variability is a concern, one solution is insurance. A contract would be arranged with an insurer whereby it undertakes to pay pre-determined longevity credits in return for receiving the funds of members who have died. This has the further advantage that the longevity credits can be communicated to give participants comfort as to what they will receive. It also removes the risk that short-term experience of the whole group of participants deviates from what is expected.
- B.18. Insurance comes at a cost of course, but this is very modest compared with the cost of longevity protection under an annuity, as the insurer has no reserving requirements.
- B.19. The variability in mortality experience referred to above is on account of idiosyncratic mortality risk; the random fluctuations around an expected mean. Systematic longevity risk is where the mortality experience of the entire pool differs from what was expected. This risk can be mitigated by regular updates to the mortality tables used, in light of known experience, and by ensuring the tables take into account expected future improvements in mortality.

²⁹ Bernhardt, T and Donnelly, C. (2021) *Staying the course: how pooled annuity funds are proving an attractive alternative* The Actuary, May 2021

Appendix C: Investment risk management

- C.1. Under the notional annuitisation withdrawal strategy discussed in section 2, income is re-evaluated each year using annuity rates. This creates a potential mismatch between the DC fund value (invested across a range of asset classes) and the annuity rate (reflecting current interest rates). It is possible to hedge this **interest rate risk**, for example by the use of swaps. These are inexpensive when operated across assets of at least £200m, say, such as would be expected in a future world of large consolidated DC pension providers.
- C.2. There are also a variety of investment solutions which can be used to protect against downside risk. One well-known and straightforward example is **put options**; for example, to protect against losses arising from a fall in equity markets of more than 10% or 20%.
- C.3. Constant Proportion Portfolio Insurance (**CPPI**) is another technique that can be used to protect against downside risk and splits investments into matching assets (such as government bonds) and risky assets (e.g., equities), then dynamically adjusting the mix between the two in order to protect against large falls.
- C.4. Protection is also available on multi-asset portfolios (i.e., not limited to equities) via structured products arranged through counterparty banks.
- C.5. All such products come at a cost, which will impact future investment returns. This cost might be via a premium payable e.g., for put options, or incurred through the protection mechanism whereby, whilst being protected during a market fall, there is less exposure to asset price recoveries. Where relevant, there is also the risk of counterparties failing.
- C.6. There are also complexity and practical hurdles involved in creating a single packaged protected fund in which multiple investors can be protected in the same manner while being able to trade when they wish. This becomes even more complex if it is the pension income which needs to be protected rather than the capital value.
- C.7. In a decumulation context, the level of protection required should be viewed relative to total income (DC and State pension). For example, protecting against a 20% fall in DC income might be equivalent to protecting a 10% fall in total income (noting the State pension is not subject to market movements).

Appendix D: Modelling methodology and assumptions

Stochastic modelling

- D.1. The modelling results set out in this paper are based on 1,000 stochastic simulations, using an economic scenario generator supplied by EV. Within each individual investment scenario, there are consistent relationships between the movements of different asset classes. This provides projections of investment returns on various asset classes, yields on nominal and index-linked gilts, Consumer Price Index (CPI) inflation and average earnings growth.
- D.2. The EV Asset Model is a state-space asset model of markets and economies that describes in probabilistic terms how states of the economy evolve. Underlying all asset class and economic forecasts is an interest rate model capable of handling the whole range of historical rates and the current low-rate environment. The returns used are those from October 2021, as illustrated in Figure 23.

Figure 23. EV Asset Model

Time horizon (years)	Statistic	Cash	Gilts	Corps	Equities	Property	CPI	Gilts for level annuities	Gilts for index-linked annuities
5	MAR	0.18%	0.49%	1.18%	4.17%	-2.02%	3.73%	1.82%	-1.92%
	SDAR	1.42%	3.21%	4.56%	7.22%	6.56%	2.00%	0.99%	0.48%
	AASD	1.85%	9.17%	11.57%	16.26%	13.57%	2.73%	1.38%	0.68%
15	MAR	1.11%	1.67%	2.79%	4.89%	1.00%	3.34%	2.74%	-1.14%
	SDAR	2.03%	1.41%	2.30%	4.73%	4.18%	2.63%	1.80%	0.79%
	AASD	2.93%	10.48%	12.41%	16.84%	14.83%	3.81%	2.56%	1.22%
25	MAR	1.87%	2.60%	3.86%	5.47%	2.55%	3.23%	3.46%	-0.57%
	SDAR	2.36%	1.47%	2.06%	4.11%	3.51%	2.89%	2.18%	0.90%
	AASD	3.65%	11.24%	12.92%	17.04%	15.33%	4.34%	3.26%	1.50%

All asset classes are UK. **Gilts** means Government bonds and **Corps** means investment grade corporate bonds.

Median annualised return (**MAR**) is calculated as the median of the annualised cumulative returns over the specified period.

Standard deviation of annualised return (**SDAR**) is calculated as the standard deviation of the annualised cumulative returns over the specified period.

Average annual standard deviation (**AASD**) is calculated as the standard deviation of the annual returns over the specified period.

- D.3. A stochastic model was required in order to capture variability in outcomes with probabilities. Mean-variance-covariance stochastic models were rejected on the grounds that they lack time-dependency and also fail to take into account the effects of sequencing risk and pound-cost ravaging, which means that they would systematically overstate sustainability of income. An economic scenario generator can overcome these issues.
- D.4. As well as the ability to model asset returns with time-dependency and individually plausible scenarios, it is also necessary to model inflation and long-term yields required to calculate level and increasing annuities. The model selected is believed to satisfy all these requirements.

Consumer details

- D.5. It has been assumed that the consumer is aged 67 on entering the Decumulation Pathway and starts drawing State pension at the earliest opportunity.

Investment strategies

- D.6. The investment strategies Cautious, Moderate and Bold referred to in sections 4 and 5 are shown in Figure 24. The Moderate strategy has been used, unless stated otherwise, which is representative of the typical range offered under Investment Pathways to meet the objective of withdrawing income under flexi-access drawdown over a 5-year time horizon. Cautious and Bold strategies are included for comparison purposes.

Figure 24. Illustrative investment strategies

Asset class	Cautious	Moderate	Bold
Cash	15%	5%	0%
UK Government bonds ¹	40%	20%	0%
Corporate bonds	25%	20%	15%
Equities	20%	50%	80%
Property	0%	5%	5%

¹ Comprising equal proportions of nominal and index linked gilts

Mortality assumption

- D.7. Mortality assumptions used are those currently specified for Statutory Money Purchase Illustrations (SMPI).

Annuity rates

- D.8. Market annuity rates are based on the projected gilt yields from the economic scenario generator, with a 0.5% deduction to the interest rate as specified for SMPI. The interest rate applied under the notional annuitisation methodology is then adjusted from the market rate as specified in the paper. In all cases, an annuity expense allowance is applied as specified for SMPI.

Expenses

- D.9. An allowance is made for expenses by way of an annual management charge of 0.75% of the DC fund value, to cover both investment and administration costs.

Index-linked annuities

- D.10. In anticipation of the phasing out of the Retail Prices Index (RPI) by 2030, CPI has been used as the index for determining pension increases (very similar to CPIH which is the anticipated replacement for RPI).

Mortality pooling

- D.11. When participating in mortality pooling, the member is assumed to receive a longevity credit at the end of each year equal to $F \times q / (1 - q)$, where F is the DC fund that is within the mortality pool at the start of the year and q is the probability that the member will die over the course of the year. Longevity credits are added to the member's DC fund and thereby count towards future such allocations. This is further discussed in Appendix B.

Basic income needs

- D.12. Various studies have investigated the income required for a basic lifestyle in retirement. One such study is that carried out by the PLSA with their Retirement Living Standards (RLSs)⁸. A key factor is whether the person lives alone or in a household of two, the latter requiring significantly less than twice the income of the former.
- D.13. Taking into account these various studies, a figure of £12,000 has been adopted as the required annual income per person to provide for basic needs. This is intended as a broad-brush view, reflecting the needs of a single person (a household income requirement is less than twice that for a single person, but an individual contribution towards this will depend on how much the other partner can provide).
- D.14. In the longer-term, living standards are expected to increase in line with earnings growth. Accordingly, it has been assumed that the £12,000 will increase in line with earnings growth, but subject to not growing by less than CPI inflation. This has been referred to as ‘double lock’, analogous to the triple lock referred to below.
- D.15. A substantial part of the income needed to cover basic needs will be provided by the State pension, which has been assumed to continue increasing according to the ‘triple lock’, i.e., the greater of the double lock and 2.5%. Under these assumptions the State pension is likely to gradually increase faster than basic income needs, thereby reducing the amount required from the DC fund. In practice, the future level of the State pension will depend on political and economic factors, and so is highly uncertain.
- D.16. The consumer is assumed to have 90% of the full State pension (around £8,400 p.a.), which is approximately the average amount currently payable³⁰, and no other sources of retirement income. This is a broad-brush assumption, and in practice there will clearly be a wide range of individual circumstances.

³⁰ Department of Work & Pensions (2021) Benefit Statistics: August 2021

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