ECONSTOR
Make Your Publications Visible.

A Service of
ZBW
Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Banks, James; Crawford, Rowena

**Working Paper**

# Managing retirement incomes

IFS Working Paper, No. W22/05

**Provided in Cooperation with:**
Institute for Fiscal Studies (IFS), London

*Suggested Citation:* Banks, James; Crawford, Rowena (2022) : Managing retirement incomes, IFS Working Paper, No. W22/05, Institute for Fiscal Studies (IFS), London, https://doi.org/10.1920/wp.ifs.2022.0522

This Version is available at:
https://hdl.handle.net/10419/254255

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

IFS

Institute for Fiscal Studies

James Banks
Rowena Crawford

Working paper

22/05

# Managing retirement incomes

UKRI Economic and Social Research Council

# Managing Retirement Incomes[1]

James Banks[2]

Rowena Crawford[3]

## Abstract

In this paper we discuss the state of the literature relating to the decumulation of retirement wealth and the management of retirement incomes. On the one hand, life-cycle models which allow for strong bequest motives and the effects of medical expense risks have been shown to be able to rationalise retirees' wealth, income and consumption trajectories. On the other, studies of individual asset choices and portfolio decisions seem to suggest low levels of financial literacy and engagement, and non-negligible consequences of age-related cognitive decline on financial decision making. We argue that future work should try to reconcile these two sets of conflicting findings into a coherent and holistic evidence base to inform policy, since issues around the management of retirement incomes, and insurance against different risks in retirement more generally, will become increasingly important for future cohorts of retirees.

[1] We are grateful to the ESRC Centre for the Microeconomic Analysis of Public Policy (ES/TO14334/1) for financial support.

When citing this paper, please use the following: Banks J, Crawford R, 2022. 'Managing Retirement Incomes', Annu. Rev. Econ. 14, DOI: 10.1146/annurev-economics-051420-014808

[2] Professor of Economics, University of Manchester and Senior Research Fellow, Institute for Fiscal Studies
[3] Associate Director, Institute for Fiscal Studies

## 1. Introduction

A lot of research in macroeconomics, applied microeconomics and finance has looked at the level and determinants of saving for retirement. Within this literature the concept of financial literacy – broadly speaking the capability of individuals to make, and then stick to, good financial decisions and life-cycle savings plans – and its consequences has emerged as an important topic for empirical work. But much of this research has focussed on the accumulation part of the life-cycle, i.e. the decision of how much to save and how to save it. In this paper we review what evidence there is on the decumulation phase of the life cycle, namely the management of retirement resources, and argue that this is becoming an increasingly important issue and hence deserving of more systematic study.

Once individuals retire from the labour market (which for simplicity throughout our review we will treat as a permanent and irreversible event) they face decisions of how much wealth to spend and when. But they also face portfolio decisions such as whether, and if so how, to annuitise any accumulated savings or Defined Contribution pensions, and how to manage their housing consumption and housing equity. And, looked at more broadly, these decisions are an interrelated part of the wider context of managing retirement resources which encompass other insurance-type decisions including healthcare, longterm care, life insurance and bequests, all of which also have implications for the smoothness or otherwise of trajectories of consumption expenditures and marginal utility. Longevity expectations, health and long term care risks, and bequest intentions, will all be a factor in these choices.

There are three (related) reasons why these issues are becoming much more important than they have been in the past. Firstly, individuals are living much longer post-retirement so the complexity of the decisions that need to be made is increasing, and indeed the individual's ability to make them is potentially decreasing, given declining cognition at older ages. Second, the nature of the wealth that individuals are arriving at retirement with has been changing in countries where policy has shifted towards funded Defined Contribution type retirement saving, and hence recent cohorts of retirees in these countries are arriving at retirement with larger fractions of their wealth that requires some kind of active decision and management. Finally, from a policymaking and aggregate economy or market point of view, the ageing of the population means that there are proportionately many more older individuals than there were, and hence the amount of the economies' wealth that is at stake is increasing accordingly.

When combined with worries about poor levels of financial literacy in the population more generally, and the consequences of this for life-cycle savings patterns, these additional

secular trends have potentially serious implications for people's ability to secure their living standards throughout retirement in systems where individual provision is increasingly important. Hence the management of retirement incomes has become a topic of interest for policymakers. This will only increase further in the near future as older voters become an increasingly large proportion of the electorate and issues of poverty and inequality at older ages (which are a potential consequence of systems with less social insurance and more individual provision if there is not good financial management and/or risk pooling) become more politically pressing. Yet there is little consensus over what, if anything, should be done and, unlike in the area of retirement wealth accumulation, it is not the case that countries are all moving in broadly the same direction. The United States and Australia have been discussing using behavioural policies such as defaults and nudges to increase annuitisation for some retirement savings, while at the same time the United Kingdom has been removing mandatory annuitisation. The relative lack of any strong guidance for policymakers regarding how to support the management of retirement incomes in their retired and soon-to-be retired populations is an indication of the lack of concrete research in the area and, in our view, creates perhaps the strongest case for more research to be done, both in terms of data collection and in terms of macroeconomic and microeconomic modelling and empirical analysis.

The remainder of this paper makes these arguments in more detail and is structured as follows. In Section 2 we discuss the demographic and macroeconomic context and show why the decumulation of retirement wealth is becoming a more important issue, and will continue to be so going forwards. Section 3 discusses the literature on financial literacy and individuals' abilities to take complex financial choices, focusing not just on levels of financial literacy in the population but also on the issue of within-individual declines in cognition and numeracy at older ages. In Section 4 we look at the key existing empirical evidence on retirement incomes more generally, beginning with macroeconomic evidence on wealth trajectories, moving on to more specific evidence on annuitisation and drawdown of retirement savings before turning briefly to broader insurance and consumption smoothing issues. Section 5 concludes and provides some discussion of the nature of future research that is needed in this area.

## 2. Context and background

The ageing of populations around the world is well documented and studied. Individuals are living for much longer and spending longer in retirement and, as a result of this trend coupled

with a decline in fertility rates, an increasing proportion of the population are of older ages. When combined with lower levels of aggregate productivity growth, this population ageing has led to a lack of fiscal sustainability of Pay As You Go retirement saving systems where public pensions are financed out of contemporaneous tax revenues. Hence many countries around the world have moved, or are moving, towards partially 'funded' systems with more reliance on individually provided private pension wealth which can take one of two forms. In the Defined Benefit (DB) case pension incomes are defined as some formula based on career earnings and individuals receive the incomes automatically. In the case of Defined Contribution (DC) pensions, individuals make contributions into a pension pot or other retirement savings vehicle during working life and then have decisions to make over the way in which this fund is withdrawn on retirement. It is this DC retirement wealth that presents most issues for the management of retirement incomes given the need for active portfolio decisions in later life.

Estimates of the size of the private pension market are remarkably difficult to obtain on a reliable basis over time and across countries. Table 1 reports estimates based on a recent OECD analysis for the relatively limited set of countries where they were able to obtain comparable and accurate statistics. A number of things are immediately apparent from this table. First is the substantial variation in the size of private (DC+DB) pension wealth across countries (column 5), and within that the variation in the proportion of that private pension wealth that is held in DC form (column 6), suggesting that the many of the issues we discuss in this paper will be more important in some countries than others, which is a point we will return to a number of times in what follows. Second, however, there is a considerable rise in the importance of private retirement wealth even over the comparatively short period of time between 2009 and 2019 in all countries (columns 2 and 5). These international differences and trends have resulted in widespread variation in the size of the DC pension market in 2019, ranging from over 200% of GDP in Denmark to less than 2% of GDP in Turkey, with the US being an important case where DC pensions are now over 100% of GDP and account for more than two thirds of private retirement wealth.

For the specific case of the US it is possible to document the rise in importance of private pension wealth over a longer period of time, albeit computed with a different methodology to the OECD study. Figure 1 shows the rise in importance of private retirement wealth from 20% of GDP in 1974 to over 140% of GDP in 2019, and within that the gradual

rise of DB pensions up until 1998 and the initially slow but then rapidly increasing importance of DC (401k) pensions and Individual Retirement Accounts since the mid 1980s.

The increasing importance of private retirement savings is not just due to the changing policy and savings environment, however, but also due to the underlying demographic trends that have led to those policy changes. Figure 2 shows how the proportion of the population aged 70 and over has risen – from 6% to 11% in the US over the same 1974 to 2019 period as covered in Figure 1 – and, importantly how this will rise steeply over the next fifteen years leading to even larger fractions of the future population to be observed at the ages with peak retirement wealth. Over the next ten to fifteen years the proportion of the population aged 70 and over is set to increase by almost fifty percent, in the UK, US and for the OECD average as a whole, which is suggestive of large increases in the size of private retirement wealth on the immediate horizon solely due to cohort effects.

These demographic changes are largely the result of changing probabilities of mortality at subsequent ages for the cohorts that are reaching retirement. In Figure 3 we show the distribution of probable ages of death for people reaching age 60 in 1970 and 2020 respectively in the US and the UK, calculated from cohort life tables in each country. The shift to the right of these distributions is marked, and particularly so for men. For women the increase is marked in the UK but, as is well-documented, there has been a stagnation in women's longevity in the US such that the difference, whilst still a shift to the right, is not so immediately apparent. For the purposes of what follows the main conclusion that is important to draw from these figures is not so much the increase in the modal age of death but the substantially reduced chances of dying at ages below age 75 and the considerable increases in the chances of surviving to the much older ages of 95 and over. Additionally, the increased spread of the distribution in the US relative to the UK indicates greater inequality in longevity which may be relevant when thinking about the need to insure longevity risk. Indeed, the degree to which these probabilities represent individual differences versus risk, and the degree to which each component is reflected in individual's subjective probabilities of survival, will be important for us to come back to when thinking of individual's financial choices in later life.

The reason the above trends are important is not just because individual's wealth decumulation and annuitisation decisions will now have consequences over a longer fraction of people's life-cycles, but that these decisions will increasingly be made at ages when cognition is declining. Much medical literature is now being devoted to documenting

cognition at older ages, both in terms of natural age-related decline and of any changes in the prevalence of dementia and Alzheimer's disease across cohorts. Both aspects of cognition change have consequences for decision making but for our purposes the former is more relevant. Harada et al (2013) present a good overview of the normal cognitive changes associated with ageing and discuss how these might affect functioning. Whilst some decline in verbal and mathematical reasoning has been found from ages 45 onwards, many more changes have been documented beginning from age 70. These include white matter volume decreases, verbal fluency and recall, and most importantly executive functioning – defined as the capacities allowing people to engage in independent, purposive behaviour including a range of cognitive abilities such as the ability to self-monitor, plan, organize and problem-solve. The UK's Cognitive Function and Ageing Study (CFAS, see Matthews et al 2013)) is one of the longest running cross-cohort cognition studies and has shown that, whilst the prevalence of the more severely impaired groups was broadly constant or in some cases even declined between 1991 and 2011, and the proportion with no limitations has increased, the proportion with Other Cognitive Impairment no Dementia (broadly speaking, the normal cognitive ageing defined by Harada et al) has increased from 36.8% to 40.4% (Richardson et al 2019). This is in keeping with a story of the onset of Dementia occurring later for more recent cohorts as life expectancy has increased, but with the additional years of good cognition being split between years with no cognitive limitation and years experiencing normal age-related cognitive decline. Hence it seems natural to expect that, as the proportion of the population aged over 70 increases (Figure 2) and the chance of dying before 75 falls rapidly (Figure 3) there will be increasing numbers of older adults taking financial choices when their cognition is declining, even if there might not be more severe cognitive limitation and increased functional dependence until older ages.

## 3. Financial literacy and financial decision making at older ages

Many of the financial choices that individuals will face in managing their retirement incomes and resources at older ages are becoming increasing complex. This is true for issues such as pension wealth drawdown options, annuitisation, healthcare and long-term care insurance even before one considers possible interactions between them, and interactions with publicly provided programs. And, as we have argued above, at the same time the stakes are becoming higher for future cohorts of retirees in many countries due to the increasing proportion of their wealth held in DC pensions that will require some active choices at old ages.

A large literature has documented the fact that in order to make good financial decisions households need to be financially literate. As defined by the OECD (2012), financial literacy is "a combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and ultimately achieve individual financial well-being". In other words, people do not just need knowledge and understanding of financial concepts and risks, but also the skills, motivation and confidence to apply that understanding in decision making. However, there is substantial evidence that levels of financial literacy in the general population are poor. We do not review the general evidence in detail here but instead note that Lusardi and Mitchell (2014) provide a comprehensive review of the international evidence on individuals' numeracy and lack of understanding of key concepts such as inflation and risk diversification. Of particular relevance to what we discuss here is that individuals have been shown to have biased expectations, information and knowledge in many contexts that directly matter for the decisions involved with managing retirement incomes. Numerous papers (for example Hurd and McGarry (1995), Elder (2013), Wu et al (2015), Sturrock and O'Dea (2021)) have pointed out disparities between subjective expectations of longevity and objective longevity risks. There is also ample evidence that individuals lack knowledge relating to private or public pension arrangements and entitlements (Mitchell (1988), Gustman and Steinmeier (2005), Bottazzi et al. (2006), Crawford and Karjalainen (2020)). In terms of the drawdown phase of pensions, Bateman et al (2018) find that less than one-third of 50-74 year olds they surveyed understand the basic features of standard decumulation products like lifetime annuities, while Brown et al (2017) find that a substantial fraction of Individual Retirement Account (IRA) holders misunderstand or were unaware of the rules around Required Minimum Distributions which govern the rate at which they need to decumulate their fund. Fong et al. (2021) examine a range of financial behaviours, including paying off credit cards, and age-related asset diversification, among older people, and find that the more financially literate are more likely to do what would be thought of as 'recommended behaviours'. Cognitive abilities, and numerical ability in particular, have been found to affect portfolio choices, with more able individuals more likely to hold stocks and DC pensions in many different countries (Banks and Oldfield 2007, Christelis, Jappelli and Padula 2010; Fong et al. 2021) and differences in cognitive abilities and numeracy are also associated with different wealth accumulation and decumulation trajectories (Banks, O'Dea and Oldfield 2010). Banks, Crawford and Tetlow (2015) examined annuitisation choices in the UK and found that numeracy was associated with whether an individual shopped around for an annuity as opposed to taking the easier

path of purchasing an annuity from their original pension fund provider, where the former would provide significant financial benefits for most people.

By and large the majority of empirical evidence treats financial literacy as a fixed individual characteristic and does not deal with the additional issues that come into play with older decision makers due to the changing cognition that occurs with age. This can be stark after age 70, and particularly so in areas of executive function such as numeracy. Table 2 documents the distribution of numerical ability by age band in the English Longitudinal Study of Ageing. For the purposes of this table numeracy levels are divided into four groups, with the worst group unable to correctly answer any questions involving fractions or percentages, and the best group correctly answering all questions including those involving compound interest. In keeping with previous finding, older adults with DC pensions are more numerate than average. That said, even within the group of DC pension holders the proportion in the highest numeracy group is still relatively low (21%) and declines steeply with age, such that only 10% of those aged 70-79 and 5% of those aged over 80 are in the highest numeracy group.[4]

Keane and Thorp (2016) provide a comprehensive survey of the key literature on age related cognitive decline as it might pertain to financial choices in later life and show how, when combined with low levels of cognition and financial literacy more generally, it might affect complex economic decision making and life-cycle planning. Amongst the empirical findings are those of Agarwal et al (2009), who show that financial mistakes (paying substantially higher than market interest rates, not optimising credit card transfers, making mistakes in home equity loans, incurring fees) display a U-shaped pattern with age, and suggest this is due to cognitive decline. Korniotis and Kumar (2011) argue that investor performance is hump shaped, and that at older ages (particularly 70 and over) the negative effects of cognitive decline outweigh the positive effects of experience.

More recent contributions have exploited panel data to provide new empirical evidence on observed changes in cognition over time and how these correlate with financial outcomes at older ages. Angrisani and Lee (2019) and Mazzonna and Peracchi (2020) both find that cognitive decline is associated with reductions in wealth (which are shown not to be due to greater medical expenses). Importantly, Angrisani and Lee (2019) find that the

[4] Whilst, for simplicity and for reasons of sample size, these are cross-sectional age profiles rather than genuine longitudinal changes with age we can be relatively confident they reflect declines with age since the strongest and most obvious cohort effect – due to differential survival of the wealthiest and highest educated households – would be operating in the opposite direction which would, if anything, mean that this cross-sectional profile might be underestimating the decline with age.

associated wealth reductions are lower for those who rely on pension or annuity income rather than distributions from retirement accounts, and lower for those who have help with their finances from children or other family members. These results lend support to the concern that the impact of cognitive decline on household financial decisions may be of rising importance, as successive generations become more reliant on financing their retirements from accumulated defined contribution savings.

Whilst cognitive decline is defined at the individual level, older couples will presumably take joint financial decisions, meaning that the cognitive decline of one member of the couple may be less consequential for outcomes in couples than for singles or couples who keep their financial choices entirely separate. Indeed, Banks and Oldfield (2007) show that the maximum level of numeracy within a couple is more predictive of portfolio choices and behaviour than an individual's own level of numeracy, which is suggestive of some sharing of skills and decision making even before cognitive decline sets in. But even in married couples there will be some cognitive decline for both spouses so a key issue when thinking about choices at older ages is how individuals may be aware of such decline and take actions accordingly, such as seeking financial advice. Angrisani and Lee (2019) and highlight the importance of self-awareness of cognitive decline for its effects on financial outcomes empirically.

The lack of awareness of cognitive decline is perhaps one of the reasons why the empirical evidence is of lower use of financial advice at older ages than might be expected. For example, Kim, Maurer and Mitchell (2020) show that only one-third of the 50+ population in the US reported that they have ever sought financial advice. This is also a topic of particular concern in the UK, where only half of individuals accessing a pension fund for the first time in 2019-20 used either regulated advice or the free government-provided guidance service (see Figure 4). Whilst the proportion taking advice is greater for those accessing the largest funds, even at relatively large fund values such as £50,000-£100,000 and £100,000-250,000 it is still the case that one third and one quarter, respectively, of decisions are taken without any advice.

Furthermore, while the potential gains from seeking assistance with or delegating financial decisions are greater for those with lower cognitive ability, cognitive ability can also affect the decision of whether or not to hire advisors. Kim, Maurer and Mitchell (2020) find that cognitive ability and financial literacy affect the quality of financial advice sought at older ages, with the more able and more literate more likely to seek financial advice from professional advisors. In England also the use of financial advice is negatively associated

with numeracy. Table 3a presents the estimated association between numeracy and reported sources of information on pensions, for ELSA respondents with Defined Contribution pension wealth. The least numerate are more than one and a half times more likely to report having no information on their pensions than the most numerate group (20% compared with 12%) and most numerate groups are four times more likely to take formal advice than their least numerate counterparts. Of course, part of these effects can be driven by the fact that the less numerate have lower wealth levels in general and smaller DC fund values, and therefore lower net returns to the use of advice. Table 3b shows that there is a large negative correlation between wealth levels and the use of formal financial advice in particular. However, differences in the proportion reporting having no information are much smaller across individuals with different levels of DC pension wealth than they are across individuals with different levels of numeracy.

A final aspect worthy of note is the issue of those who seek or respond to unregulated and unscrupulous advice, making potentially catastrophic financial mistakes, or falling victim to fraud. There are concerns this is on the rise, with older people targeted due to their relatively easy access to large amounts of funds, low financial literacy and declining cognition. This is a particular issue in the UK, where the new institutional environment in which retirees can flexibly access their retirement funds makes distinguishing fraud from new product innovations harder. The current literature, however, is unclear on the importance of financial literacy for fraud victimisation. Gamble, Boyle, Yu and Bennett (2014) find that decreasing cognition and overconfidence in financial knowledge are indeed associated with fraud victimisation, whilst DeLiema, Deevy, Lusardi and Mitchell (2020) find that empirical patterns of fraud are complex and there are few strong predictors of victimization, even when only looking at investment fraud.

Our takeaway from this more recent literature on advice and fraud is that, whilst much of the work on financial literacy and cognitive decline at older ages has focused on individual choices and outcomes, there is still more that could usefully be done on issues surrounding the nature of delegated or at least supported choices. Given the increased likelihood of future cohorts living to ages where cognitive decline is significant, empirical work in a greater number of international contexts and situations is needed to look into the nature of individuals awareness of their decision making capabilities and how this relates to their propensity to seek advice from different sources and to their vulnerability and exposure to extreme financial risk. Not unrelated to this are issues surrounding decision making in the

case of mental incapacity due to the onset of Dementia when decisions are more explicitly being supported by other household or family members.

## 4. Evidence on the management of retirement resources

We turn now to a review of some of the empirical evidence related to the management of financial resources in retirement. While much of the rising interest in this topic is driven by the shift towards DC saving, combined with concerns about the ability of those with low levels of financial literacy and declining cognition to make appropriate choices about drawing down those savings, it is important not to focus on the use of DC resources alone. First, DC savings are virtually always only one part of the household's portfolio, and the appropriateness of choices made with respect to the investment or drawdown of DC wealth will depend on what other resources the household has and how those are being used. For example, holding DC savings in cash and spending them all over the first ten years of retirement might be optimising behaviour for someone with owner occupied housing and a large (annuitised) income from a DB pension, but might be much less appropriate for someone in rented accommodation with little social security income and no other assets. Second, those with no DC assets still face many of the same choices and difficulties – how to spend their accumulated wealth and how to manage their portfolio composition through retirement in the presence of uncertainties around longevity and health. Evidence on how such individuals cope with these decisions is therefore still important for policy makers concerned with supporting their retired populations, and would be more relevant for countries that have not seen the same growth in private DC provision. We therefore start with a discussion of the literature on overall wealth trajectories in retirement which arguably capture a more overarching view of how individuals are managing their retirement resources. We then turn to the evidence on how DC savings specifically are being managed, discussing the annuitisation decision first, before the drawdown of unannuitised DC assets. We finish with a brief discussion of broader issues around insurance choices at older ages and putting this into the context of the trajectory of spending patterns in retirement.

### 4.1 Overall wealth trajectories in retirement

There is an extensive literature that has examined overall wealth trajectories in retirement. In contrast to what would be predicted by the simplest life cycle model, households typically use their accumulated resources slowly in retirement and hold large amounts of wealth into very old age (Love et al, 2009; Poterba et al 2011; De Nardi, French and Jones (2010),

Blundell et al 2016; De Nardi et al (2021)). Figure 5 illustrates this for the US and England. Retirement resources declined with age in the US over the 2000s, but only by around two-thirds on average between age 70 and 95. In England the decline with age is even less marked, as age profiles of total wealth are dominated by the equity effects of rapid increases in house prices over this period that were not consumed.

An extensive literature has sought to expand life cycle models to understand the drivers of slow wealth decumulation, using retirement wealth trajectories to estimate or infer preference parameters. These models have emphasised the role of uncertain life expectancies, medical expense risk and bequest motives (Love, Palumbo, Smith (2009), DeNardi et al. (2010), De Nardi et al 2021, Lockwood (2018) McGee (2019). However, separating the relative importance of these motivations is made challenging by the fact that they have similar implications for wealth in retirement (De Nardi et al 2016). Some analyses have attempted to unpick this by developing models that simultaneously match both empirical wealth measures and other empirical data, such as purchases of long term care insurance (Lockwood 2018) or self-reported preferences (Ameriks et al 2011, 2015). Others have taken the approach of comparing wealth trajectories between countries with different institutional settings – in particular comparing countries that have social insurance systems that cover medical and long term care costs with those that do not (Blundell et al 2016, Nakajima and Telyukova 2016, 2018; Van Ooijen, Alessie and Kalwij 2015). These latter papers all find that, even in settings where there is extensive or complete social insurance coverage of medical expense risk, retirees still hold large amounts into old age. There remains little consensus over the relative importance of bequest motives and precautionary saving motives, and indeed Dynan et al 2002 argued the motives themselves are overlapping and therefore not truly separable.

These life cycle papers, however, typically assume that individuals make rational and fully informed choices. Despite the plethora of evidence previously discussed that individuals have limited financial acuity and declining cognition with age, and that this affects economic decision making, few papers have incorporated such frictions into their models. Two recent exceptions include Gan et al (2015), who incorporate subjective survival expectations into a lifecycle model and find that this performs better in terms of predicting wealth holdings at older ages than using life-table survival probabilities, and Lusardi et al (2017) who endogenize financial wealth accumulation in a stochastic lifecycle model and argue that 30-40% of retirement wealth inequality could be accounted for by financial knowledge. Keane and Thorp (2016) provide a review of models of choice behaviour that incorporate irrational

behaviour and confusion, and point to some possible approaches for future work on modelling retirement wealth accumulation and decumulation. These include allowing perceived attributes to differ from actual attributes, allowing individuals to use heuristics to solve optimisation problems, and allowing individuals to be inattentive or to procrastinate. We believe this to be a valuable direction for future work. In countries where retirement assets are shifting towards DC, and individuals are becoming more responsible for managing their own longevity risk and the rate of drawdown from their pensions assets, viewing observed wealth trajectories as the outcome of fully informed rational behaviour and standard preferences will become increasingly unattractive.

One branch of the literature on wealth trajectories in retirement that has considered optimisation frictions – albeit not ones driven by financial literacy or cognitive capacity – is that which has examined the use of housing wealth in retirement. Housing is an important asset in the portfolio for most households in many countries including the US and UK (Christelis et al 2013, Crawford and O'Dea 2020), and therefore choices with respect to the use of housing wealth in retirement have an important bearing on both retirement resources, overall wealth trajectories and retirees' welfare.

Housing wealth can be used to fund non-housing consumption, with wealth being accessed either in conjunction with a change in the value of housing consumption, such as by moving (downsizing) or by reducing maintenance and housing quality, or in isolation without a change in housing consumption by unlocking the financial value of the property through an equity release product. In practice many papers have shown that housing wealth is not drawn down rapidly in retirement across different countries with different institutional settings (for example, Nakajima and Telyukova 2016, Blundell et al 2016). In part this could be because many motives for saving in retirement discussed above (precautionary saving, bequest motives) in theory apply to housing wealth as to other assets. In addition, housing specific factors have also been found to be important. Sinai and Souleles (2005) argue owner-occupied housing has a role as a hedge against rent risk, and some have argued that housing is a particularly good asset to hold as insurance against health and long-term care shocks in later life (Skinner 1996, Davidoff 2014). Venti and Wise (1991) and Hancock (1998) find the income gains from equity release would be small for most households, and therefore may not be worth transaction costs involved. Nakajima and Telyukova (2020) estimate a lifecycle model of retirement saving and housing choice, and find that the slow decumulation of housing is largely driven by the utility benefits of homeownership and the illiquidity of housing. In their model reductions in maintenance and therefore depreciation of housing

wealth are an important channel of asset decumulation that increases with age, with nearly one-third of the oldest individuals in their model choosing not to maintain their house. However this decumulation may often not be observed in empirical analyses of wealth trajectories, as it may not be factored into individuals' self-reported house values on which measures of wealth are normally based.

In summary then, a large literature has examined patterns of overall wealth trajectories in retirement, and found that in general retired households do not spend down their wealth rapidly, and that this is particularly true of housing wealth. We have already made the point that the role of financial literacy and the effect of this on economic decisions is understudied as a potential driver of some of these patterns, and of rising importance in countries that are experiencing a shift towards private DC pension assets. There are two other limitations of this literature that are worth highlighting, from the perspective of policy makers seeking to understand how retirees are faring with managing their resources. First, attention is often on trajectories of average wealth, rather than the behaviour of individuals across the whole distribution and particularly at the tails – i.e. those spending down private wealth particularly rapidly or particularly slowly – and the drivers of this behaviour. The latter is less important when the object of interest is estimating average preference parameters, but is crucial when the question is about the capacity of all households to make appropriate financial decisions. Second, the empirical literature to date has largely studied households with relatively little DC wealth that can be flexibly accessed (for example, retired cohorts in the US who so far have relatively little in DC assets). The existing literature on overall wealth trajectories therefore may be limited in what it can tell us about the wealth trajectories of retirees more reliant on accumulated DC assets. Given this, a natural place to turn our attention is to the evidence that exists on how DC assets specifically are drawn on in retirement.

### 4.2 Annuitisation choices

An important reason why managing retirement incomes is such a complex problem is that there is uncertainty over future mortality. For example, using the cohort life expectancies presented in Figure 2, US males reaching age 60 in 2020 have, on average, a 15% chance of dying by the age of 70, yet a 23% chance of surviving beyond age 90. For any given individual, private information such as current health, lifestyle factors and the survival of parents is likely to tighten this distribution. Many studies (see, for example Hurd and McGarry 1995 for the US or Sturrock and O'Dea 2021 for England) have shown that when

data on subjective survival probabilities are collected then such individual specific health and lifestyle factors are correlated with both self-reported and actual survival probabilities. However, significant uncertainty remains, and this makes it difficult for individuals to decide how rapidly to spend down retirement resources. In particular, while public pension systems and private DB pension arrangements insure against longevity risk, the same is not normally true by default of savings in DC pensions. To obtain longevity insurance people need to use their accumulated savings to purchase an annuity.

Despite theory predicting that risk-averse individuals would purchase fairly priced insurance against longevity risk**,** in practice voluntary annuity demand is extremely low – the so called 'annuity puzzle' (Davidoff et al. 2005, Mitchell et al. 1999). This is true internationally, across many different institutional settings. In the UK, the announcement in 2014 of the removal of the effectively mandatory requirement to use accumulated DC pension wealth to purchase an annuity led to a collapse in annuity purchases – with the number of new contracts falling by 70% and the total value of premiums falling by 60% (Cannon, Tonks, Yuile 2016).

Were the lack of longevity insurance being bought by those with defined contribution assets to be due to suboptimal decision making this would be a cause for concern, particularly as this becomes the dominant form of private pension saving in countries such as the US, UK, Denmark and Australia. There is a relatively large literature that has explored aspects of financial literacy and found a relationship with annuitisation demand. Sturrock and O'Dea (2021) examine mis-perceptions of mortality risk, and find that the difference between objective and subjective survival expectations is large enough, for many individuals, to outweigh the insurance value of annuitizing much of their wealth. Brown et al (2017) highlight the difficulties consumers have in valuing annuities, and that those with less education and lower numerical abilities struggle more. Bateman et al (2018) highlight the importance of information, and its interaction with financial literacy, for annuity demand. The framing of retirement income choices, and the arrangement that is the default, have also been shown to be important (Brown et al (2008), Benartzi, Previtero and Thaler (2011), Hu and Scott (2007), Butler and Teppa (2007)).

However, other rational explanations have also been argued to explain low voluntary annuity demand. Finkelstein and Poterba (2004, 2014) point to adverse selection in the annuity market, and it is easy to see why this is a concern, given the asymmetry of information available to retirees about their future life expectancy (including their current health, life history of behaviours and the mortality of their parents) as compared to what is

available to the insurer. On the demand side, Inkman, Lopes and Michaelides, 2011, Peijnenburg et al (2017) and Lockwood (2012, 2018) have argued that factors such as health expense risk, bequest motives, and the extent to which the household wealth portfolio is already annuitised can all explain observed levels of annuity purchases.

Despite the abundance of literature on the annuity puzzle, there remains little consensus as to the extent to which the lack of annuitisation is welfare reducing. Indeed, this will vary across institutional settings and individuals, depending on the characteristics of the rest of the household portfolio and the nature of state-provided retirement resources. The welfare costs of not annuitizing will also depend on individuals' subsequent drawdown of their DC assets. For example, if limited financial literacy means that individuals end up investing poorly or spending their DC wealth very rapidly or very slowly then the welfare costs of not annuitizing will be greater than if individuals draw down their DC wealth at the optimal rate given their preferences and the nature of the risks they face. We therefore turn to the relatively recent but growing literature on the drawdown of DC assets in retirement.

### 4.3. Drawdown of DC assets

If individuals are not annuitizing defined contribution pension assets in institutional settings where that is not mandated, then how are they then drawing on these assets through retirement? Is there any evidence that individuals are drawing down their wealth too quickly or too slowly, and does financial literacy have an important bearing on the quality of decisions? These are important questions for policy makers grappling with the issue of how best to support retirees with their financial decisions in systems with large values of DC wealth.

Unfortunately they are difficult questions to answer. As already stressed, to assess the appropriateness of drawdown decisions (let alone heterogeneity in that across individuals) one needs to examine these in the context of households' total wealth portfolio and their wider situation. This creates a data problem – it is challenging to obtain panel data on both the retirement accounts and the household's wider wealth portfolio for a large representative sample of people. Surveys like the Health and Retirement Study and its equivalents around the world have the necessary breadth of panel data, but limited sample size for examining the behaviour of those with defined contribution pension savings, and the data quality is subject to reporting errors. On the other hand, administrative data from financial institutions or tax records have high quality data on aspects of pension holdings or withdrawals, but often only that narrow perspective. Furthermore, the institutional context – particularly the structure and

generosity of public pension systems, the incentives created by the tax treatment of private pension saving vehicles both in the accumulation and decumulation phases, and rules around the timing and allowed rates of withdrawal from private pension saving – will have a crucial bearing on individuals' behaviour and the appropriateness or optimality of different types of decisions and behaviours.[5] Empirical evidence from other institutional settings must therefore be interpreted with caution and the development of new data resources, such as linked administrative data or administrative data linked to survey data, should be a high priority among researchers and policy makers in many countries in order to expand the institution-specific evidence available.

The country that has perhaps the best evidence on individuals' DC withdrawal decisions is Australia. DC pension saving has been mandatory for employees since 1992, and so these assets are relatively widely held, though amounts accumulated are still increasing for each subsequent generation reaching retirement. Despite concerns about Australian retirees drawing down their assets too rapidly and moving onto the means tested public pension during retirement, the empirical literature suggests that households are typically prudent and cautious in their drawdown behaviour. Fewer than 30% of funds are taken as lump sum withdrawals, and those lump sums that are taken are typically small (Productivity Commission 2015). In terms of funds that are taken through phased withdrawal (known as 'account based pensions' in the Australian context) Rothman and Wang (2013) find that many simply withdraw the minimum amount permitted each year: around 50% of those aged under 79, rising to 70% of those aged 85-89. Using alternative data the Productivity Commission 2015 estimate somewhat lower proportions: closer to 30% of those aged 65-79 and 50% of those aged 90 and over. Asher et al 2017 examine administrative panel data on the whole portfolio over an eight year period, and find that on average households are cautious: while younger retired households draw down their non-housing assets, older

[5] As an example, two of the most studied countries – the UK and US – have similar tax systems for most DC pensions with contributions and accumulation within the fund being exempt from tax and withdrawals being subject to income tax and only accessible without a tax penalty after a certain age. However in the US DC pensions represent additional saving over and above earnings related social security, whereas in the UK DC pensions will for many be the only form of earnings related pension saving (since social security now only consists of a redistributive component to ensure basic retirement income adequacy). The Australian system is different again, with some DC contributions being tax advantaged (although not exempt) at the contribution stage and exempt at the withdrawal stage and the remainder of contributions made from post-tax earnings and with no tax on withdrawals or any requirement to start drawing by a particular age. The Australian public pension is means tested, with DC pension saving counted against both the income and asset tests. Such differences in tax treatments and public pension provision will clearly be expected to affect the optimal management of retirement incomes, and particularly so when interactions with other retirement resources are taken into account.

households actually accumulate wealth. Pensioners, particularly those who are single, typically hold on to their relatively small pots of retirement savings throughout retirement. Spicer et al 2016 also find, using representative survey data, that the average retired household maintained or accumulated wealth over the period before the financial crisis. That said, Asher et al 2017 find considerable heterogeneity in drawdown patterns: 10% experienced a decline in asset values of more than 50% over the 8 year period. This tail is worthy of further examination as, while there may be innocuous explanations, this could be indicative of poor financial management, fraud, or unsustainable spending behaviour due to some individuals struggling with the complex financial decisions they are having to make.

There is a growing US literature that has examined withdrawals from personal pension accounts. The US context is somewhat different in that while, in common with most countries, there is a minimum age at which personal pension accounts can be accessed without a tax penalty the tax law also specifies that once individuals reach a certain age (70 ½ until 2020 and now 72) they must start taking Required Minimum Distributions (RMDs) from their retirement accounts. Empirical evidence to date has exploited tax return data (Sabelhaus (2000); Bershadker and Smith (2006); and Mortenson et al. (2019)), fund administrative data (Holden and Bass (2012), Brown et al (2016)) and survey data (Poterba et al (2013)) to study withdrawal behaviour. These papers have found that in fact the majority of individuals do not currently withdraw anything until they reach the age at which RMDs are required. Above that age most do make withdrawals (as would be expected given the tax penalty from not doing so), but there is significant clustering around the RMD amounts. For example, Mortenson et al. (2019) using nationally representative tax data on IRA holders find that the proportion of IRA holders with any distributions jumps from around 35% to around 90% at the RMD age of 70½, while the proportion of those withdrawing the RMD amount is around 50-70% (depending on age and fund size). Much of this bunching has been shown to be driven by individuals being constrained by the RMD rules (Mortenson et al (2019), Brown et al (2017)), and Horneff, Maurer and Mitchell (2021) attribute this to bequest motives. However, there is also evidence of optimisation frictions. Mortenson et al (2019) find evidence of significant bunching at the RMD levels in 2009, even when minimum distributions were not required. This could be due to inattention (not realising the rules had been suspended), hassle costs (associated with changing withdrawals for just one year), or an interpretation of the RMD rules as implicit guidance as to the appropriate rate at which to withdraw assets.

The latter is important, as it highlights the difficulty that individuals face with trying to calculate appropriate withdrawal rates. While individuals may interpret the RMD rules as implicit guidance, the rules do not target full depletion of assets before death (Mortenson et al 2019) and may be dominated by other strategies (Munnell, Wettstein and Hou, 2019), though Sun and Webb (2013) argue that withdrawing funds in line with the percentages specified in the RMD rules would be preferable to some other rules of thumb such as spending the interest and dividend income while retaining the capital investment, or consuming an inflation-linked 4% of initial assets.

There is empirical evidence of individuals interpreting statutory minimum withdrawal rates as implicit guidance. Brown et al (2017) find that nearly two-thirds of those who continued to take a distribution from their retirement plans in 2009 (despite a one year suspension of the RMD rules) described the rationale "View RMD as a Good Guide to Appropriate Speed of Drawdown" as very or somewhat important for them. Alonso-García et al (2021) also examine this issue of implicit guidance in an online experiment fielded in the Netherlands and Australia. They find that around 30 percent of participants altered their chosen retirement spending pattern when the pension policy environment they were presented with involved a regulated minimum rate of pension drawdown compared to when it did not.

Interestingly the UK, which recently removed its requirement to annuitise DC pension saving, has no statutory minimum withdrawal rates. To the extent that these provide implicit guidance to individuals as described above in other institutional contexts, for better or worse UK retirees do not have this benchmark. So far, there is little quality empirical evidence in the literature on how individuals in the UK are drawing on their DC pension assets in this most flexible of settings. Annuity purchases collapsed when the reforms were introduced (Cannon, Tonks, Yuile 2016), and in 2019/20 only 10% of funds accessed for the first time were used to purchase and annuity (Financial Conduct Authority, 2020). Recent data also show that, among funds that are in some sort of drawdown arrangement, many are being withdrawn at fairly rapid rates. A summary of these data is presented in Figure 6, which shows that around 42% of funds on average and, for example, 30% of funds with a value between £100,000 and £250,000 had 8% or more of the fund value withdrawn in 2019/20. At the other end of spectrum, around 10% funds in total, and one quarter of funds over £250,000 had less than 2% withdrawn. It is not possible to comment on the appropriateness of these withdrawal rates in isolation, since any sensible assessment would need to study the persistence of withdrawal rates over time on an individual basis, take into account the individuals' wider circumstances and resources and also acknowledge that withdrawn funds

may not be spent. But these high and low withdrawal rates do little to allay concerns that individuals may make inappropriate decisions and withdraw their funds either too rapidly or too slowly.

### 4.4 Insurance choices and consumption smoothing at older ages more generally

The fact that evidence on the 'optimality' or otherwise of different trajectories for the decumulation of DC pension wealth (whether through annuitisation or through fund drawdown) can only be viewed in the full light of other characteristics of the wealth portfolio is characteristic of a more general problem in trying to understand individual's success in managing their retirement incomes. The planning of retirement incomes and resources should best be conceptualised not in terms of wealth or income trajectories but in terms of consumption smoothing in the face of multiple different types of risks and with multiple different types of formal and informal insurances. The trajectory of wealth, and indeed any one component of wealth, is just a by product of this smoothing (or lack of smoothing) behaviour.

Fang (2016) provides a comprehensive and authoritative overview of evidence on insurance markets for the elderly that brings together discussion of risks of investment incomes, housing wealth, health and health-expenditures, long-term care and longevity, and discusses the nature of insurance markets and their interactions with social insurance programs. As well as providing a detailed survey of many issues we do not have the space to go into this paper, the paper discusses the fact that these risks are typically analysed in isolation and concludes that future research needs to take a portfolio approach to household insurance demand and consider the joint nature of risks and insurances, along with interactions between them, when assessing how well retirees are insured. Additionally, the complexity of insurance choices should be a consideration when thinking about the design and marketing of insurance products to older adults.

An alternative way to address the question of optimal decision making at older ages is, rather than looking at the portfolio of wealth, savings and insurances, to consider the dynamics of consumption profiles at older ages and assess whether this is consistent with optimal smoothing behaviour. Whilst there is a large literature on consumption smoothing over working life, and indeed a substantial literature on changes in consumption around retirement, there are relatively few full analyses of consumption trajectories throughout retirement into older ages, not least because good longitudinal data on retirees consumption expenditures is relatively uncommon.

As with the macroeconomic literature on wealth and savings dynamics which we discussed in section 4.1 (some of which actually involves a fitting of moments of the consumption distribution as part of the identification strategy), the key issue here is the nature of preferences for bequests and precautionary saving and whether 'reasonable' values for such preferences can explain observed behaviours. One interesting feature of such models is the potential role of health risks in rationalising consumption trajectories. In an early study using cross-sectional data, Börsch-Supan and Stahl (1991) argued that declining health might generate a consumption constraint as retirees age and that this could rationalise the consumption and savings patterns observed in German data. More recently, the interactions between health, health expenditure and the marginal utility of consumption have become of topic of some interest. Using US HRS data, although without actually using data on consumption expenditures, Finkelstein et al (2013) find that the marginal utility of consumption declines as health deteriorates and shows that this dependence can have a substantial effect on optimal levels of health insurance and life-cycle savings trajectories, a result which has been confirmed by Blundell et al (2020) using consumption data in the HRS and exploiting transitory health shocks for identification. Looking more directly at consumption expenditure profiles, Banks, Blundell, Levell and Smith (2019) show that the differing trajectories for post-retirement consumption in the US and UK, which are observed despite income paths being similar in the two countries, can be explained by differences in medical expenses and medical expense risks. This is in keeping with results such as those in Peijnenburg et al (2017) on the key role of medical expense risks in explaining the annuitisation puzzle, and those of macro papers such as DeNardi, French and Jones (2010) in emphasising the role of medical expense risks in driving wealth trajectories.

## 6. Discussion and conclusions

Financial decision making in later life, and the issue of managing retirement resources and incomes, is going to be increasingly important for future cohorts of retirees. This is most true in the anglophone countries where Defined Contribution pension wealth is already a large and increasing component of retirement wealth. But it is also likely to be true in other countries given the direction of travel of many social security systems. And in all countries there will be inevitable changes to health insurance and healthcare, long term care insurance and housing markets that will arise as a result of the broader economic pressures of population ageing and which will change the nature of retirement wealth and incomes needed. The complexity of the choices to be made by retirees, particularly when considering

the interactions between all these factors, is increasing, as is the ages at which these choices have to be made – which in turn raises the issue of cognitive decline influencing the quality and nature of choices being made.

In this paper we have shown that there is a large amount of relevant literature in this area and we have tried to give a sense of the main findings as well as point to a number of other excellent reviews and survey papers which go into more comprehensive detail on particular topics than we can here. Looked at from the highest level, the literature divides broadly into two camps. Papers in macro and labour economics look at wealth or consumption trajectories and have shown that, within the context of a relatively standard life-cycle decision making model there are preferences and risks, particularly relating to bequests and medical expenses, that can rationalise the average retirement wealth decumulation and spending data we see in many institutional contexts, as well as other empirical phenomenon such as the annuity puzzle, as a consequence of rational choices. As such, it is tempting to conclude individuals can manage their retirement incomes just fine and future cohorts will adapt to changing macroeconomic and institutional circumstances. On the other hand, the literature in finance and consumer decision making tends to look at empirical evidence on financial decisions with respect to individual portfolio and insurance choices and documents low levels of financial literacy, imperfect information, behavioural biases, poor numeracy and choice inconsistencies. Such results do not bode well for future cohorts of retirees who will need to make increasingly high stakes and complex financial choices at older ages, and are perhaps at the heart of concerns about the financial security of retirees within policymaking communities.

Our conclusion from looking at this conflicting evidence is that the increasing importance of this emerging issue of financial choices at older ages for cohorts of retirees going forward creates an opportunity for much valuable work in this area that could try to bring together these two types of previous literature. In particular, we would identify four particularly fruitful avenues for research.

Firstly, and most generally, research is needed that either exploits, or even collects, more comprehensive data on the overall financial situation and choices of retirees. That is to say data, whether from administrative records linked to existing surveys or from new waves of longitudinal surveys, which can put the specifics of individual financial choices into the context of individuals' overall retirement resources in the broadest sense (i.e. including social security wealth, housing, and the utility values of various public and private insurances).

Additionally, given the centrality of a complete understanding of preferences in assessing the optimality of existing behaviour, more work could usefully be done on incorporating empirical measures of risk preferences and bequest intentions into such data in order to facilitate a joint analysis of preferences, wealth trajectories and specific financial choices. Recent work on observed preferences, for example, has shown that risk preferences appear to change at older ages, partly just due to ageing, but partly in response to health shocks and other life events (Banks, Bassoli and Mammi, 2019) and the consequences of these types of issues for models of the smoothing of retirement income resources are yet to be explored.

Second, structural macroeconomic and labour work should acknowledge the findings in the literature on financial literacy and cognitive decline at older ages and begin to build models that can allow for limited capacity in decision making. This is a complex area but Keane and Thorp (2016) provide some pointers as to some possible ways forward, and a recent paper by Keane et al (2021) has built and estimated a structural model of healthcare plan choices that incorporates such decision making behaviour. More work along these lines in broader contexts of retirement saving would be hugely valuable. In addition, the ability of structural macro and labour models to explain the full distribution of choices and outcomes for retiree cohorts, as opposed to average profiles, should be investigated further.

Third, research into individual portfolio, annuitisation and insurance choices at older ages, the role of financial literacy, numeracy and cognitive decline in such choices, and in particular individual's susceptibility to behavioural biases, nudges and defaults, needs to place such choices in the context of broader portfolio and consumption smoothing issues and acknowledge the potential interactions between different retirement risks and assets, and how these might differ across the wealth and ability distribution.

Finally, given issues surrounding age-related cognitive decline that will affect all individuals, not just those with the lowest financial literacy, there is a need for more work on a broad set of theoretical and empirical issues surrounding financial advice and delegated decision making – whether this relates to government advice and information services, independent financial advisors or simply to the engagement of family members in the choices of their older relatives. Once again, such work needs to recognise the broader consumption smoothing context of the entire retirement resource portfolio rather than individual choices in isolation. Existing work has shown that the use of advice is relatively rare and focused more on the more able, wealthier, individuals. A key question is whether this will change, and if so

how, as individually provided retirement resources and the various choices that are taken to manage this wealth become more common and more important in future retiree cohorts

Until we have a more complete and holistic empirical picture of the way retiree cohorts manage their retirement resources, risks and incomes, and the degree to which this is 'optimal', there will continue to be somewhat of a gap in the information that policymakers need in order to effectively design public programmes aimed at retirees and regulate insurance markets. At present, policies such as the use of defaults to encourage annuitisation, changes to statutory withdrawal rates, or the encouragement of different forms of private pension saving such as more collective DC provision (which are all currently being discussed in different countries) risk being designed and implemented without sufficient evidence on their likely welfare implications. Policymakers discussing or implementing changes despite this should at least consider the simplicity and stability of the retirement income environment and the insurance markets faced by retirees in order to create a planning and choice environment that is as robust as possible to potential financial decision making errors and age-related cognitive decline.

**References**

Agarwal S, Driscoll JC, Gabaix X, Laibson D. 2009. The Age of Reason: Financial Decisions over the Life Cycle and Implications for Regulation. *Brookings Papers on Economic Activity*. 2009(2):51–117

Alonso-García J, Bateman H, Bonekamp J, Stevens R. 2021. Spending from Regulated Retirement Drawdowns: The Role of Implied Endorsement. *Scand. J. of Economics*. 123(3):810–47

Ameriks J, Briggs J, Caplin A, Shapiro MD, Tonetti C. 2015. Long-term care utility and late in life saving. Work.Pap., Vanguard Res. Initiat.

Ameriks J, Caplin A, Laufer S, Nieuwerburgh SV. 2011. The joy of giving or assisted living? Using strategic surveys to separate bequest and precautionary motives. J. Finance 66:519–61

Angrisani M, Lee J. 2019. Cognitive decline and household financial decisions at older ages. *The Journal of the Economics of Ageing*. 13:86–101

Asher A, Meyricke R, Thorp S, Wu S. 2017. Age pensioner decumulation: Responses to incentives, uncertainty and family need. *Australian Journal of Management*. 42(4):583–607

Banks J, Bassoli E, Mammi I. 2020. Changing attitudes to risk at older ages: The role of health and other life events. *Journal of Economic Psychology*. 79:102208

Banks J, Blundell R, Levell P, Smith JP. 2019. Life-Cycle Consumption Patterns at Older Ages in the United States and the United Kingdom: Can Medical Expenditures Explain the Difference? *American Economic Journal: Economic Policy*. 11(3):27–54

Banks J, Crawford R, Tetlow G. 2015. Annuity choices and income drawdown: evidence from the decumulation phase of defined contribution pensions in England. *Journal of Pension Economics and Finance*. 14(4):412–38

Banks J, O'Dea C, Oldfield Z. 2010. Cognitive Function, Numeracy and Retirement Saving Trajectories. *The Economic Journal*. 120(548):F381–410

Banks J, Oldfield Z. 2007. Understanding Pensions: Cognitive Function, Numerical Ability and Retirement Saving. *Fiscal Studies*. 28(2):143–70

Bateman H, Eckert C, Iskhakov F, Louviere J, Satchell S, Thorp S. 2018. Individual Capability and Effort in Retirement Benefit Choice. *Journal Risk and Insurance*. 85(2):483–512

Bell FC, Miller ML. 2005. Life Tables for the United States Social Security Area 1900-2100. Actuarial Study No.120.

Benartzi S, Previtero A, Thaler RH. 2011. Annuitization Puzzles. *Journal of Economic Perspectives*. 25(4):143–64

Bershadker A, Smith PA. 2005. Cracking open the nest egg: IRA withdrawals and retirement finance. In Proceedings. Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association (Vol. 98, pp. 73-83). National Tax Association.

Blundell R, Borella M, Commault J, De Nardi M. 2020. Why does consumption fluctuate in old age and how should the government insure it? (No. w27348). National Bureau of Economic Research

Blundell R, Crawford R, French E, Tetlow G. 2016. Comparing retirement wealth trajectories on both sides of the pond. *Fiscal Studies*, 37(1):105-130

Bottazzi R, Jappelli T, Padula M. 2006. Retirement expectations, pension reforms, and their impact on private wealth accumulation. *Journal of Public Economics*. 90(12):2187-2212

Börsch-Supan A. and Stahl K. 1991. Life cycle savings and consumption constraints. *Journal of Population Economics*, 4(3), pp.233-255.

Brown JR, Kapteyn A, Luttmer EFP, Mitchell OS. 2017. Cognitive Constraints on Valuing Annuities. *Journal of the European Economic Association*. 15(2):429–62

Brown JR, Kapteyn A, Mitchell OS. 2016. Framing and Claiming: How Information-Framing Affects Expected Social Security Claiming Behavior. *Journal of Risk and Insurance*, 83(1):139-162.

Brown JR, Kling JR, Mullainathan S, Wrobel MV. 2008. Why Don't People Insure Late-Life Consumption? A Framing Explanation of the Under-Annuitization Puzzle. *American Economic Review*, 98(2):304–09

Brown JR, Poterba J, Richardson DP. 2017. Do Required Minimum Distribution Rules Matter? The Effect of the 2009 Holiday on Retirement Plan Distributions. *Journal of Public Economics*. 151:96–109

Butler M, Tepppa M. 2007. The Choice between an Annuity and a Lump Sum: Results from Swiss Pension Funds. *Journal of Public Economics*, 91(10): 1944–66.

Cannon E, Tonks I, Yuille R. 2016. The effect of the reforms to compulsion on annuity demand. *Natl. Inst. econ. rev.* 237:R47–54

Christelis D, Georgarakos D, Haliassos M. 2013. Differences in Portfolios across Countries: Economic Environment versus Household Characteristics. *Review of Economics and Statistics*. 95(1):220–36

Christelis D, Jappelli T, Padula M. 2010. Cognitive abilities and portfolio choice. *European Economic Review*. 54(1):18–38

Crawford R, O'Dea C. 2020. Household portfolios and financial preparedness for retirement. *Quantitative Economics*, 11(2):637-670.

Crawford, R. and Karjalainen, H., 2020. Awareness of state pension entitlements. In *The Dynamics of Ageing: Evidence from the English Longitudinal Study of Ageing 2002-2019*, London: IFS

Davidoff T., 2010. Home equity commitment and long-term care insurance demand. *Journal of Public Economics*, 94(1-2):44-49

Davidoff T, Brown JR, Diamond PA. 2005. Annuities and individual welfare. *American Economic Review* 95(5):1573–1590.

De Nardi M, French E, Jones JB. 2010. Why do the elderly save? The role of medical expenses. *Journal of Political Economy*. 118(1):39-75

De Nardi M, French E, Jones JB. 2016. Savings After Retirement: A Survey. *Annu. Rev. Econ.* 8(1):177–204

De Nardi M, French E, Jones JB, McGee R. 2021. Why Do Couples and Singles Save During Retirement? National Bureau of Economic Research Working Paper

DeLiema M, Deevy M, Lusardi A, Mitchell OS. 2020. Financial Fraud Among Older Americans: Evidence and Implications. *The Journals of Gerontology: Series B*. 75(4):861–68

Dynan KE, Skinner J, Zeldes SP. 2002. The Importance of Bequests and Life-Cycle Saving in Capital Accumulation: A New Answer. *American Economic Review*. 92(2):274–78

Elder TE. 2013. The Predictive Validity of Subjective Mortality Expectations: Evidence From the Health and Retirement Study. *Demography*. 50(2):569–589

Fang H. 2016. Insurance markets for the elderly. In Handbook of the Economics of Population Aging (Vol. 1, pp. 237-309). North-Holland.

Financial Conduct Authority. 2020. Retirement income market data 2019/20.

Finkelstein A, Luttmer EFP, Notowidigdo MJ. 2013. What good is wealth without health? The effect of health on the marginal utility of consumption. *Journal of the European Economic Association*. 11:221–58

Finkelstein A, Poterba J. 2004. Adverse Selection in Insurance Markets: Policyholder Evidence from the U.K. Annuity Market. *Journal of Political Economy* 112(1), 183–208.

Finkelstein A, Poterba J. 2014. Testing for Asymmetric Information Using Unused Observables in Insurance Markets: Evidence from the U.K. Annuity Market. *The Journal of Risk and Insurance* 81(4), 709–734

Fong JH, Koh BSK, Mitchell OS, Rohwedder S. 2021. Financial literacy and financial decision-making at older ages. *Pacific-Basin Finance Journal*. 65:101481

Gamble KJ, Boyle P, Yu L, Bennett D. 2014. The Causes and Consequences of Financial Fraud among Older Americans. Boston College Centre for Retirement Research Working Paper

Gan L, Gong G, Hurd M, McFadden D. 2015. Subjective mortality risk and bequests. *Journal of Econometrics.* 188(2):514-525

Gustman AL, Steinmeier TL. 2005. Imperfect Knowledge of Social Security and Pensions. *Industrial Relations*, 44(2):373-397

Hancock R. 1998. Housing wealth, income and financial wealth of older people in Britain. *Ageing & Society*, 18(1):5-33

Harada CN, Natelson Love MC, Triebel KL. 2013. Normal Cognitive Aging. *Clinics in Geriatric Medicine*. 29(4):737–52

Holden S, Bass S. 2012. The IRA Investor Profile: Traditional IRA Investors' Withdrawal Activity, 2007 and 2008. Investment Company Institute, Washington.

Horneff V, Maurer R, Mitchell OS. 2021. Do Required Minimum Distribution 401 (k) Rules Matter, and For Whom? Insights from a Lifecycle Model (No. w28490). National Bureau of Economic Research

Hu W-Y, Scott JS. 2021. Behavioral Obstacles in the Annuity Market. *Financial Analysts Journal*. 13

Hurd MD, McGarry K. 1995. Evaluation of the Subjective Probabilities of Survival in the Health and Retirement Study. *The Journal of Human Resources*. 30:S268

Inkmann J, Lopes P, Michaelides A. 2011. How Deep Is the Annuity Market Participation Puzzle? *Rev. Financ. Stud.* 24(1):279–319

Investment Company Institute. 2020. "The US Retirement Market, Fourth Quarter 2020" (March).

Keane M, Ketcham J, Kuminoff N, Neal T. 2021. Evaluating consumers' choices of Medicare Part D plans: A study in behavioral welfare economics. *Journal of Econometrics*. 222(1):107–40

Keane MP, Thorp S. 2016. Complex Decision Making. In *Handbook of the Economics of Population Aging*, Vol. 1, pp. 661–709. Elsevier

Kim HH, Maurer R, Mitchell OS. 2020. How Cognitive Ability and Financial Literacy Shape the Demand for Financial Advice at Older Ages. Pension Research Council Working Paper

Korniotis GM, Kumar A. 2011. Do Older Investors Make Better Investment Decisions? *Review of Economics and Statistics*. 93(1):244–65

Lockwood LM. 2012. Bequest motives and the annuity puzzle. *Review of Economic Dynamics*. 15(2):226–43

Lockwood LM. 2018. Incidental Bequests and the Choice to Self-Insure Late-Life Risks. *American Economic Review*. 108(9):2513–50

Love DA, Palumbo MG, Smith PA. 2009. The trajectory of wealth in retirement. *Journal of Public Economics*. 93(1–2):191–208

Lusardi A, Michaud PC, Mitchell OS. 2017. Optimal financial knowledge and wealth inequality. *Journal of Political Economy*, *125*(2), pp.431-477.

Lusardi A, Mitchell OS. 2014. The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature*. 52(1):5-44

Matthews FE, Arthur A, Barnes LE, Bond J, Jagger C, et al. 2013. A two-decade comparison of prevalence of dementia in individuals aged 65 years and older from three geographical areas of England: results of the Cognitive Function and Ageing Study I and II. *The Lancet*. 382(9902):1405–12

Mazzonna F, Peracchi F. 2020. Are Older People Aware of Their Cognitive Decline? Misperception and Financial Decision Making. IZA Discussion Paper

McGee R. 2019. Old Age Savings and House Price Shocks.

Mitchell OS. 1988. Worker knowledge of pension provisions. Journal of Labor Economics, 6(1):21-39.

Mitchell OS, Poterba JM, Warshawsky MJ. 1999. New Evidence on the Money's Worth of Individual Annuities. *American Economic Review*. 89(5):1299–1319.

Mortenson JA, Schramm HR, Whitten A. 2019. The Effects of Required Minimum Distribution Rules on Withdrawals From Traditional IRAs. *National Tax Journal*. 72(3):507–42

Munnell AH, Wettstein G, Hou W. 2019. How Best to Annuitize Defined Contribution Assets? Centre for Retirement Research at Boston College.

Nakajima M, Telyukova IA. 2016. Housing and Saving in Retirement across Countries. in Stiglitz J, Guzman M. Contemporary Issues in Microeconomics. Chapter 5

Nakajima M, Telyukova IA. 2018. Medical Expenses and Saving in Retirement: The Case of U.S. and Sweden. Institute Working Paper

Nakajima M, Telyukova IA. 2020. Home Equity in Retirement. *International Economic Review*. 61(2):573–616

OECD. 2012. OECD/INFE High-level Principles on National Strategies for Financial Education

OECD. 2020. Pension Markets in Focus.

Peijnenburg K, Nijman T, Werker BJM. 2017. Health Cost Risk: A Potential Solution To the Annuity Puzzle. *The Economic Journal*. 127(603):1598–1625

Poterba J, Venti S, Wise D. 2011. The Composition and Drawdown of Wealth in Retirement. *Journal of Economic Perspectives*. 25(4):95–118

Poterba J, Venti S, Wise D. 2013. "The Drawdown of Personal Retirement Assets: Husbanding or Squandering?" NBER Working Paper 16675.

Productivity Commission. 2015. Superannuation Policy for Post-Retirement. Australian Government Productivity Commission.

Richardson C, Stephan BCM, Robinson L, Brayne C, Matthews FE. 2019. Two-decade change in prevalence of cognitive impairment in the UK. *European Journal of Epidemiology.* 34:1085-1092

Rothman GP, Wang H. 2013. Retirement income decisions: take up and use of Australian lump sums and income streams. Department of the Treasury.

Sabelhaus J. 2000. Modeling IRA Accumulation and Withdrawals. *National Tax Journal*. 53(4.1):865–75

Sinai T, Souleles NS. 2005. Owner-occupied housing as a hedge against rent risk. *The Quarterly Journal of Economics.* 120(2):763-789

Skinner J. 1996. Is Housing Wealth a Sideshow? In Wise D. *Advances in the Economics of Aging*. Chicago IL: University of Chicago Press

Spicer A, Stavrunova O, Thorp S. 2016. How Portfolios Evolve after Retirement: Evidence from Australia. *Econ Rec*. 92(297):241–67

Sturrock C, O'Dea C. 2021. Survival Pessimism and the Demand for Annuities. *Review of Economics and Statistics*. Forthcoming.

Sun W, Webb A. 2013. Should Households Base Asset Decumulation Strategies on Required Minimum Distribution Tables? *Geneva Pap Risk Insur Issues Pract*. 38(4):729–52

van Ooijen R, Alessie R, Kalwij A. 2015. Saving Behavior and Portfolio Choice After Retirement. *De Economist*. 163(3):353–404

Venti SF, Wise DA. 1991. Aging and the income value of housing wealth. *Journal of Public Economics*, 44(3):371-397.

Wu S, Stevens R, Thorp S. 2015. Cohort and target age effects on subjective survival probabilities: Implications for models of the retirement phase. *Journal of Economic Dynamics and Control* 55:39–56

**Table 1 Importance of DC retirement assets by country**

| Country | 2009[a] | | | 2019[b] | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | DC % of GDP | DB+DC % of GDP | DC % of DC+DB | DC % of GDP | DB+DC % of GDP | DC % of DC+DB |
| Denmark | 156.8 | 159.4 | 98.3 | 216.8 | 219.7 | 98.7 |
| Iceland | 90.4 | 118.6 | 76.2 | 165.4 | 178.2 | 92.8 |
| US | 70.3 | 112.1 | 62.7 | 104.2 | 150.3 | 69.4 |
| Canada | 44.5 | 114.5 | 38.9 | 61.7 | 154.8 | 39.9 |
| Israel | 8.7 | 43.8 | 19.9 | 29.3 | 63.9 | 45.9 |
| Korea | 5.7 | 8.5 | 66.9 | 20.4 | 26.9 | 76.0 |
| Switzerland | 13.9 | 126.8 | 11.0 | 15.2 | 142.2 | 10.7 |
| Mexico | 9.7 | 12.6 | 77.0 | 14.3 | 16.3 | 87.7 |
| Italy | 4.1 | 4.7 | 87.2 | 10.5 | 10.9 | 96.5 |
| France | 5.6 | 8.0 | 70.5 | 8.3 | 10.7 | 77.4 |
| Spain | 5.7 | 12.5 | 45.6 | 8.2 | 13.0 | 62.5 |
| Finland | 5.5 | 50.2 | 10.9 | 5.1 | 59.5 | 8.6 |
| Turkey | 0.4 | 0.9 | 41.6 | 1.2 | 2.2 | 52.1 |

Notes to table:
[a] except Finland 2011, Switzerland 2013
[b] except Canada 2015, Turkey 2016, Korea Mexico France 2018
Authors calculations based on retirement wealth data in OECD (2020)

**Table 2. Numeracy among older English adults**

| | Worst | Group 2 | Group 3 | Best | N |
|---|---|---|---|---|---|
| **All** | **12.2** | **43.1** | **27.9** | **16.8** | 10,577 |
| 50-59 | 8.7 | 38.0 | 30.1 | 23.2 | 3,727 |
| 60-69 | 10.1 | 43.0 | 30.4 | 16.5 | 3,483 |
| 70-79 | 15.6 | 51.5 | 24.6 | 8.2 | 2,330 |
| 80+ | 27.1 | 51.0 | 17.8 | 4.1 | 1,017 |
| *Of those with DC pensions:* | | | | | |
| **All** | **6.1** | **40.1** | **32.8** | **21.1** | 1,692 |
| 50-59 | 4.4 | 35.9 | 33.6 | 26.1 | 1,385 |
| 60-69 | 5.2 | 40.6 | 33.8 | 20.5 | 732 |
| 70-79 | 9.7 | 49.4 | 30.6 | 10.2 | 216 |
| 80+ | 17.0 | 53.3 | 25.0 | 4.7 | 4,025 |

Notes: Numeracy groups are defined as in Banks, O'Dea and Oldfield (2010). Those in the best group answer five numerical questions correctly, including one involving compound interest. Those in the worst group fail to answer correctly any question involving fractions or percentages. Authors calculations using English Longitudinal Study of Ageing 2008/10 to 2018/19.

**Table 3a. Sources of information on DC pensions among English pension holders aged 50-64**

| | Worst | Group 2 | Group 3 | Best | All |
|---|---|---|---|---|---|
| No information | 20% | 13% | 15% | 12% | 14% |
| Some information | 80% | 87% | 85% | 88% | 86% |
| *of which:* | | | | | |
| Accountant or Independent Financial Advisor | 2% | 5% | 9% | 8% | 7% |
| Scheme reports | 60% | 63% | 68% | 71% | 67% |
| Pension representative | 11% | 8% | 9% | 7% | 8% |
| Employer | 18% | 26% | 18% | 17% | 20% |
| N | 103 | 878 | 864 | 650 | 2495 |

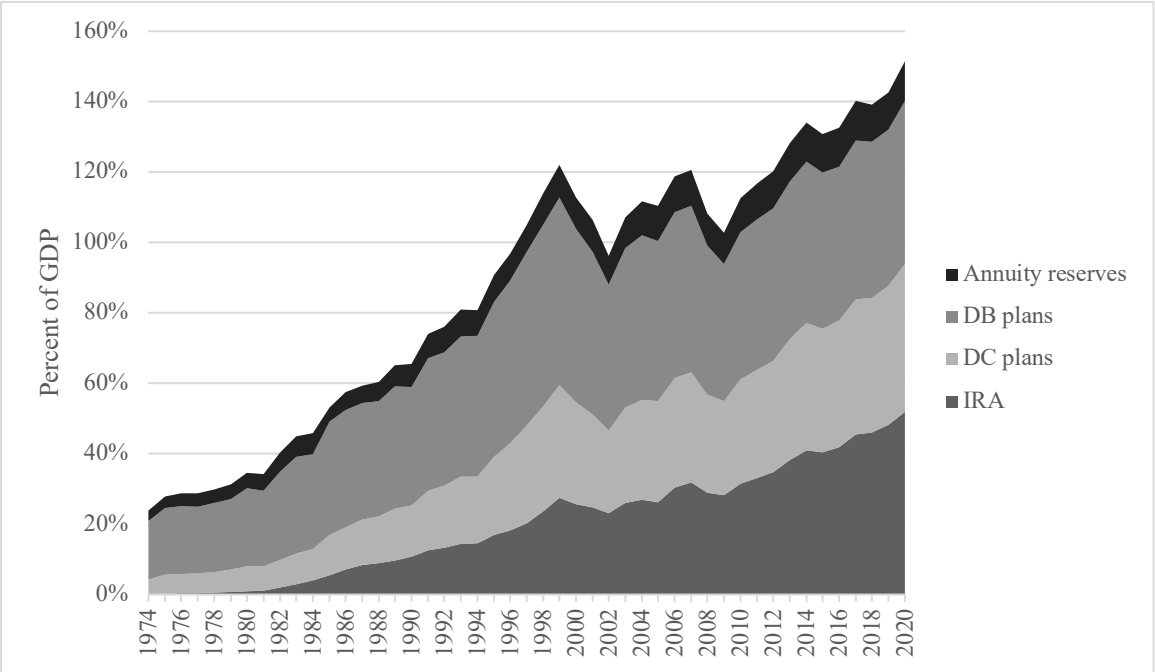
Note to table: Authors calculations using English Longitudinal Study of Ageing 2008/10 to 2018/19. Individuals with DC pensions aged 50 to 64. Sources of information do not sum to total with some information since individuals can report multiple individual types of information.

**Table 3b. Sources of information on DC pensions among English pension holders aged 50-64**

| | Did not know DC wealth | Lowest 1/3 DC wealth | Middle 1/3 DC wealth | Top 1/3 DC wealth | All |
|---|---|---|---|---|---|
| No information | 13% | 11% | 5% | 10% | 11% |
| Some information | 88% | 89% | 95% | 90% | 89% |
| *of which:* | | | | | |
| Accountant or Independent Financial Advisor | 4% | 6% | 7% | 23% | 8% |
| Scheme reports | 62% | 74% | 81% | 72% | 68% |
| Pension representative | 7% | 6% | 13% | 9% | 8% |
| Employer | 24% | 25% | 14% | 15% | 22% |
| N | 646 | 176 | 172 | 173 | 1167 |

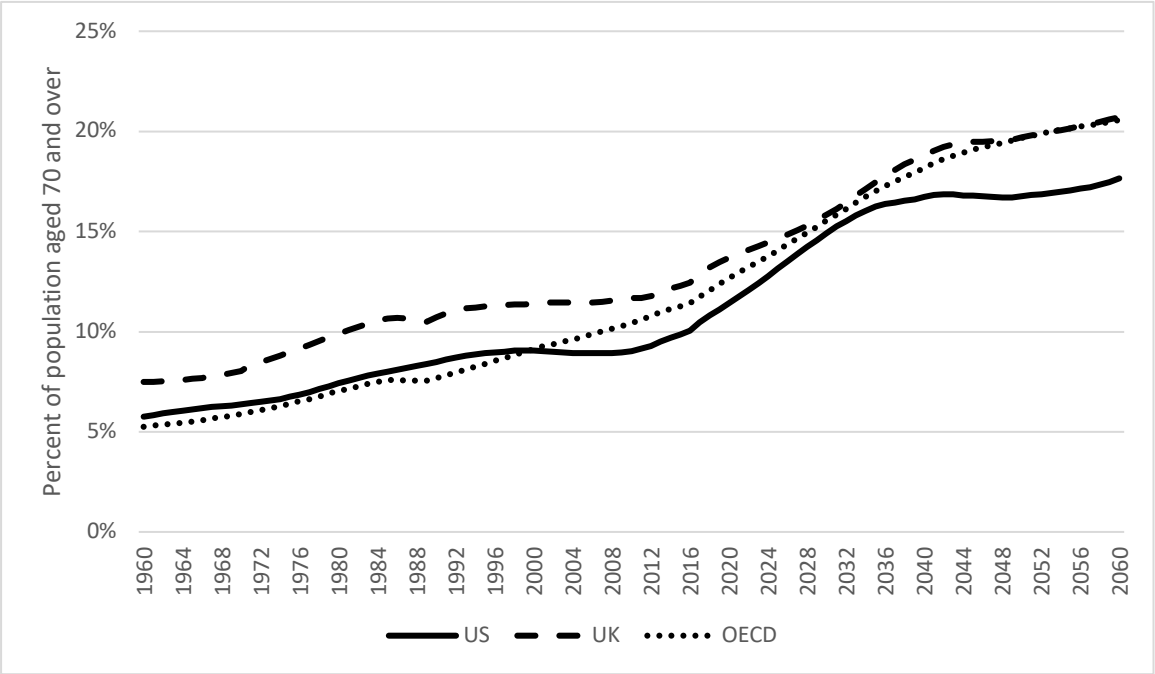
Note to table: Authors calculations using English Longitudinal Study of Ageing 2008/10 to 2018/19. Individuals with DC pensions aged 50 to 64 who were asked about their DC fund values. Sources of information do not sum to total with some information since individuals can report multiple individual types of information.

**Figure 1. Retirement assets over time in the US**



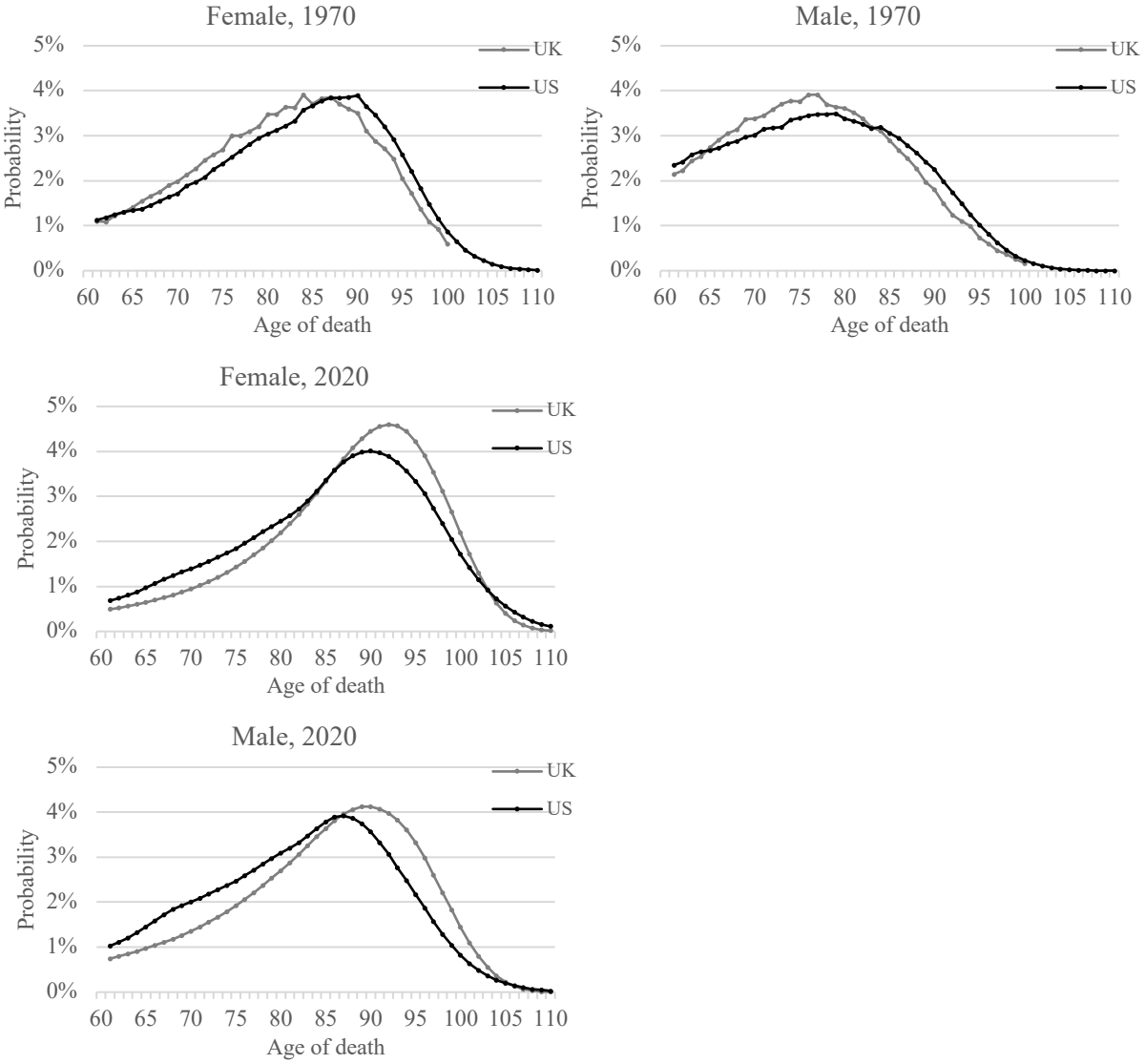

Source: Investment Company Institute. 2020.

**Figure 2. Share of total population aged 70 and over**



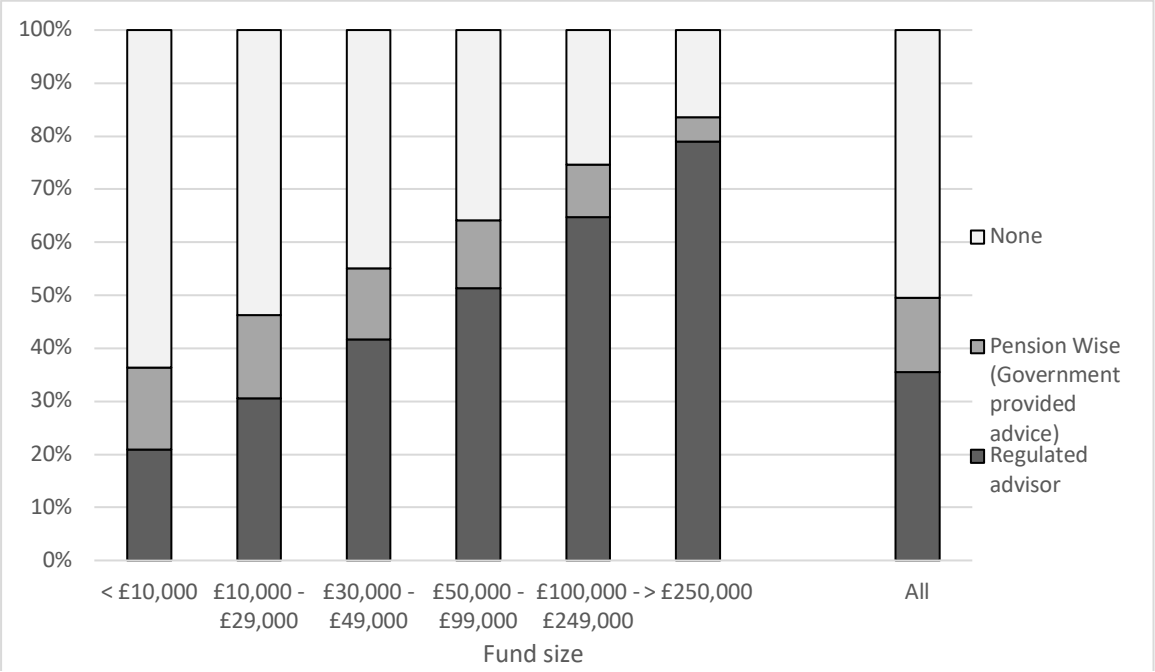

Source: OECD.stat

**Figure 3: Distribution of expected age of death for individuals aged 60**



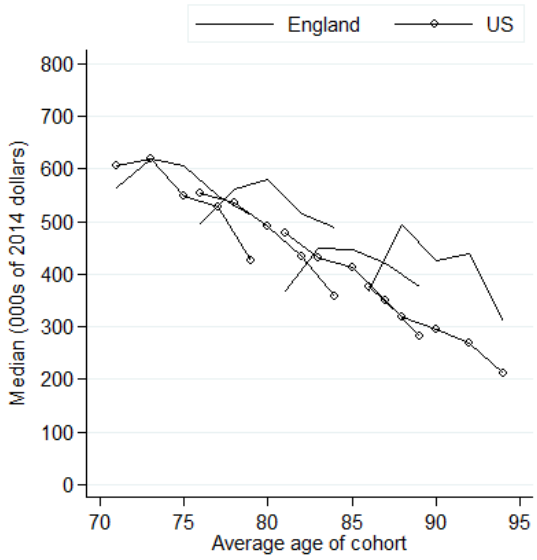

Source: US distributions calculated from cohort life tables in Bell and Miller (2005). UK distributions calculated from cohort life tables produced by the Office for National Statistics (2019), probabilities beyond age 100 not available for the cohort reaching age 60 in 1970.

**Figure 4: Use of advice for funds accessed for the first time in 2019/20**



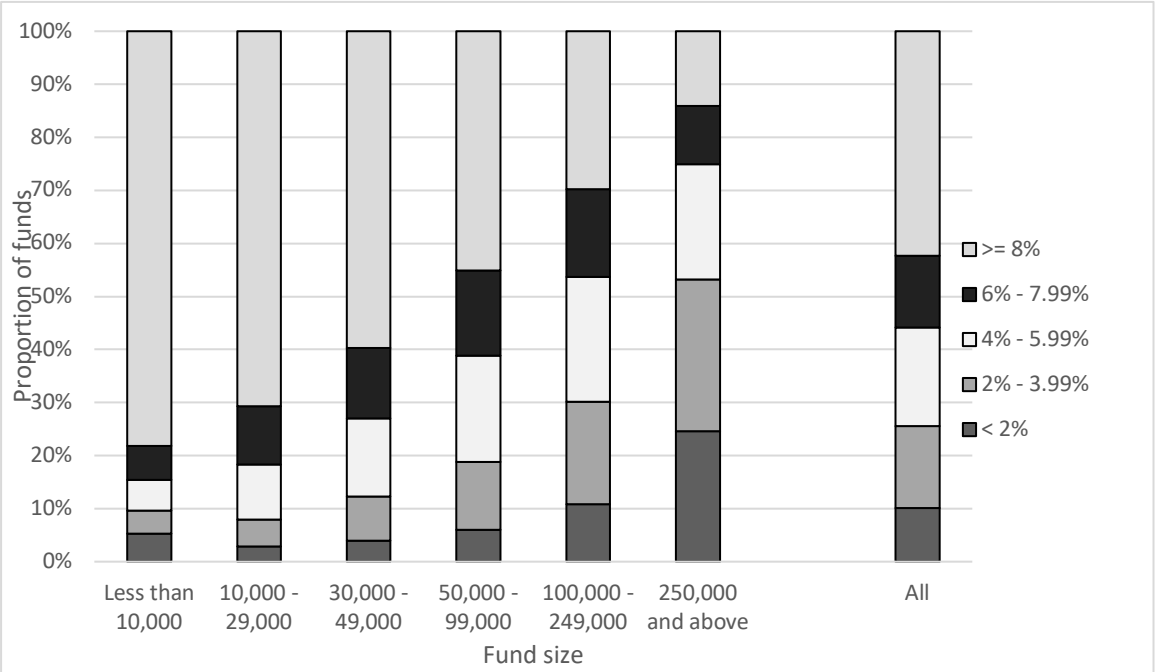

Notes:
Authors calculations from Financial Conduct Authority (2020) Retirement Income Market Data.

**Figure 5: Age profiles of total net wealth including present discounted value of future non-labour income, 2002-2010**




Notes: HRS 2002 to 2010 and ELSA 2002/3 to 2010/11. Balanced sample of responding households.
Source: Reproduced from Blundell, Crawford, French and Tetlow (2016).

**Figure 6: Regular withdrawal rates by fund size in 2019/20**




Notes: Authors calculations from Financial Conduct Authority (2020) Retirement Income Market Data.