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Managing Retirement Incomes

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Abstract

In this article 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 that allow for strong bequest motives and for the effects of medical expense risks have been shown to be able to rationalize 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 as well as 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, because issues concerning the management of retirement incomes, and insurance against different risks in retirement more generally, will become increasingly important for future cohorts of retirees.

1. INTRODUCTION

A large body 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. However, much of this research has focused on the accumulation part of the life cycle, that is, the decision of how much to save and how to save it. In this article 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 is deserving of more systematic study.

Once individuals retire from the labor market (which for simplicity we will treat as a permanent and irreversible event), they face decisions about how much wealth to spend and when. But they also face portfolio decisions such as whether—and if so, how—to annuitize any accumulated savings or defined contribution (DC) pensions and how to manage their housing consumption and housing equity. If considered more broadly, these decisions are an interrelated part of the wider context of managing retirement resources, which encompasses other insurance-related decisions including health care, long-term care, life insurance, and bequests, all of which also have implications for the smoothness of the 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.

These issues are becoming more important than they have been in the past for three (related) reasons. First, 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 toward funded DC-type retirement savings, and hence recent cohorts of retirees in these countries are arriving at retirement with larger fractions of their wealth that require some kind of active decision and management. Finally, from a policy-making and aggregate economy or market point of view, the aging of the population means that there are proportionately many more older individuals than there were in the past, 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 poor literacy for life-cycle saving 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 policy makers. 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 a 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, countries are not all moving in the same direction. The United States and Australia have been discussing the use of behavioral policies such as defaults and nudges to increase annuitization for some retirement savings, while at the same time the United Kingdom has been removing mandatory annuitization. The relative lack of any strong guidance for policy makers 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 it

creates perhaps the strongest case for more research to be done, both in terms of data collection and in terms of macroeconomic and microeconomic modeling and empirical analysis.

The remainder of this article makes these arguments in more detail and is structured as follows. In Section 2 we discuss the demographic and macroeconomic context, and we show why the decumulation of retirement wealth is becoming a more important issue and will continue to be so going forward. Section 3 discusses the literature on financial literacy and individuals' abilities to make complex financial choices, focusing not only 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 annuitization and drawdown of retirement savings, and finally 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 aging of populations around the world is well documented and studied. Individuals are living for much longer and spending more years in retirement; as a result of this trend, coupled with a decline in fertility rates, an increasing proportion of the population is of older age. When combined with lower levels of aggregate productivity growth, this population aging has led to a lack of fiscal sustainability of pay-as-you-go retirement saving systems in which public pensions are financed out of contemporaneous tax revenues. Hence many countries around the world have moved, or are moving, toward 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 through some formula based on career earnings, and individuals receive their incomes automatically. In the case of DC pensions, individuals make contributions into a pension pot or other retirement saving 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 analysis by the Organisation for Economic Co-operation and Development (OECD) for the relatively limited set of countries for which they were able to obtain comparable and accurate statistics. A number of things are immediately apparent from this table. First, there is substantial variation in the size of private (DC+DB) pension wealth across countries (column 5), and within that, there is considerable variation in the proportion of that private pension wealth that is held in DC form (column 6), suggesting that many of the issues we discuss in this article will be more important in some countries than in others, which is a point we will return to a number of times. Second, there is a considerable rise in the importance of private retirement wealth even over the comparatively short period 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; the United States represents an important case in which 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 United States, 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 from the OECD study. **Figure 1** shows the rise in importance of private retirement wealth from

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
United States	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

[a]Data from 2009 apart from Finland (2011) and Switzerland (2013).
[b]Data from 2019 apart from Canada (2015); Turkey (2016); and France, Korea, and Mexico (2018).
Abbreviations: DB, defined benefit; DC, defined contribution. Authors' calculations based on retirement wealth data from OECD (2020).

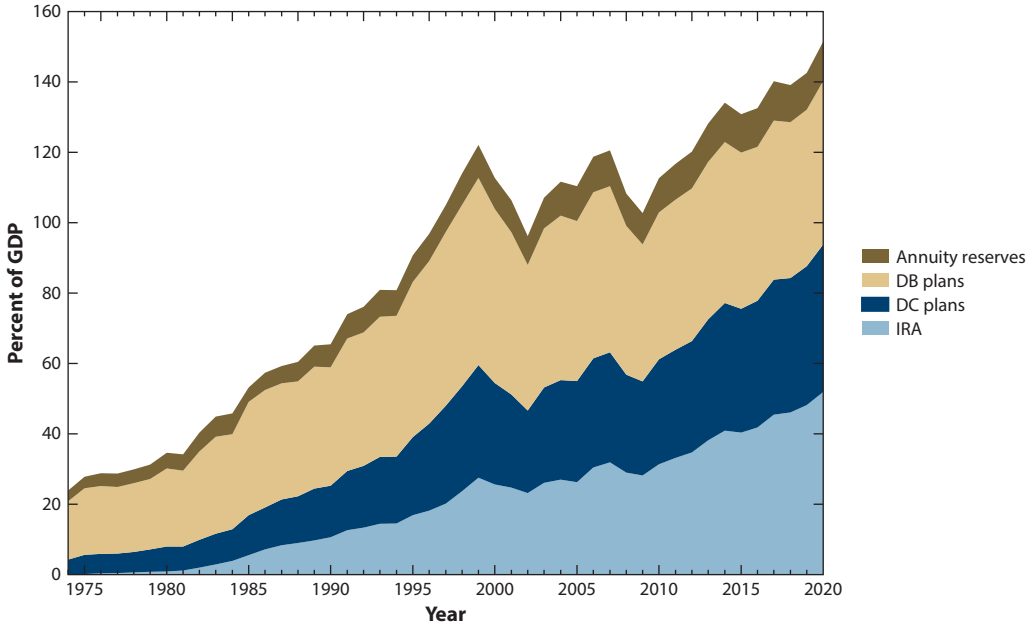

Figure 1

Retirement assets over time in the United States. Abbreviations: DB, defined benefit; DC, defined contribution; IRA, individual retirement account. Data from Invest. Co. Inst. (2020).

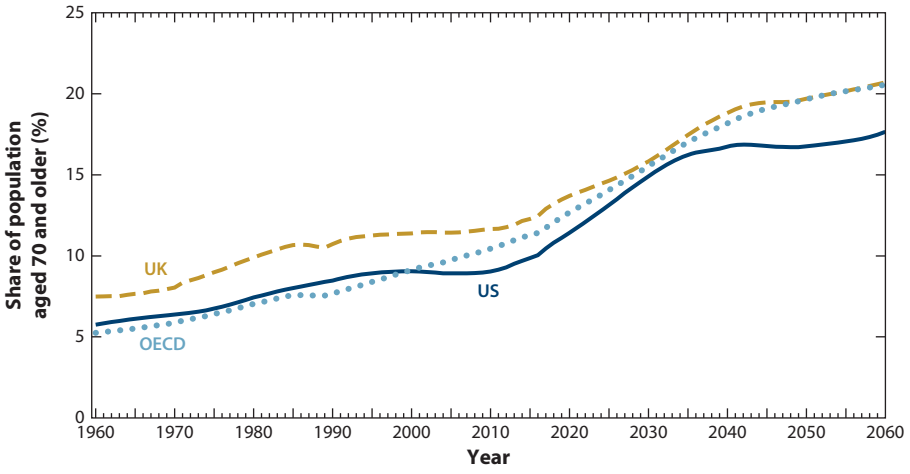

Figure 2

Share of total population aged 70 and over in the United States, the United Kingdom, and the OECD countries as a whole. Abbreviation: OECD, Organisation for Economic Co-operation and Development. Data from OECD.Stat (at **http://stats.oecd.org**).

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 (IRAs) since the mid-1980s.

However, the increasing importance of private retirement savings is due not only to the changing policy and savings environment but also 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 United States over the same 1974–2019 period covered in **Figure 1**—and, importantly, how this will rise steeply over the next 15 years, leading to even larger fractions of the future population reaching the age of peak retirement wealth. Over the next 10 to 15 years the proportion of the population aged 70 and over is set to increase by almost 50% in the United Kingdom, the United States, and the OECD countries 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 in the United States and the United Kingdom, calculated from cohort life tables for 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 United Kingdom, but, as is well documented, there has been a stagnation in women's longevity in the United States such that the difference, while 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 rather the substantially reduced chances of dying at ages below age 75 and the considerable increase in the chances of surviving to the age of 95 and over. Additionally, the increased spread of the distribution in the United States relative to the United Kingdom 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 in the face of risk, and the degree to which each

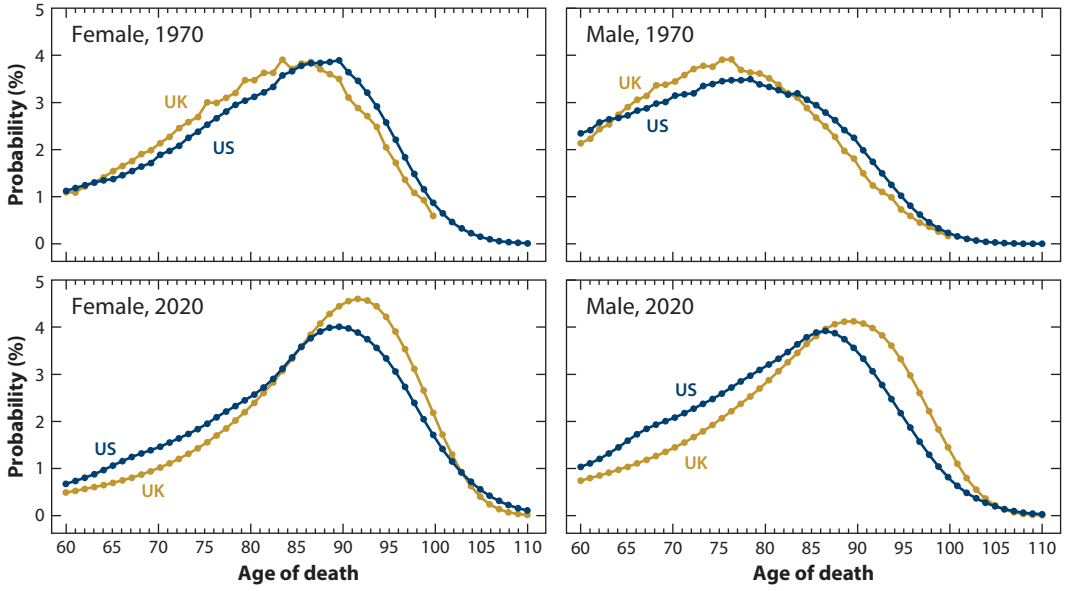

Figure 3

Distribution of expected age of death for individuals aged 60. Probabilities beyond age 100 are not available for the cohort reaching age 60 in the United Kingdom in 1970. US distributions are calculated from cohort life tables by Bell & Miller (2005). UK distributions are calculated from cohort life tables produced by Off. Natl. Stat. (2019).

component is reflected in an individual's subjective probabilities of survival, will be important when thinking of individuals' financial choices in later life.

The reason the above trends are important is not only that individual wealth decumulation and annuitization decisions will now have consequences over a longer fraction of people's life cycles, but also 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, in terms of both natural age-related decline and 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 aging and discuss how these might affect functioning. Whereas some decline in verbal and mathematical reasoning has been found from age 45 onwards, many more changes have been documented beginning at age 70. These include declines in white matter volume, verbal fluency and recall, and, most importantly, executive functioning—defined as the capacity to engage in independent, purposive behavior including a range of cognitive abilities such as the ability to self-monitor, plan, organize, and problem-solve. The United Kingdom's Cognitive Function and Aging Study (CFAS; see Matthews et al. 2013) is one of the longest running cross-cohort cognition studies and has shown that, while 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 cognitive limitations has increased, the proportion with other cognitive impairment no dementia (CIND) (broadly speaking, the normal cognitive aging defined by Harada and colleagues) 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 of 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 age 75 falls (**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 face in managing their retirement incomes and resources at older ages are becoming increasingly complex. This is true for issues such as pension wealth drawdown options, annuitization, and health care and long-term care insurance, whether considered individually or in combination, as well as for 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), following Atkinson & Messy (2012), financial literacy is "a combination of awareness, knowledge, skill, attitude and behavior necessary to make sound financial decisions and ultimately achieve individual financial well-being." In other words, people do not need only 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 note instead that Lusardi & 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 the finding that individuals have biased expectations, information, and knowledge in many contexts that directly matter for the decisions involved with managing retirement incomes. Numerous papers (e.g., Hurd & McGarry 1995, Elder 2013, Wu et al. 2015, Sturrock & 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 & Steinmeier 2005, Bottazzi et al. 2006, Crawford & Karjalainen 2020). In terms of the drawdown phase of pensions, Bateman et al. (2018) found that less than one-third of the 50–74-year-olds they surveyed understood the basic features of standard decumulation products like lifetime annuities, whereas Brown et al. (2017b) found that a substantial fraction of IRA holders misunderstood or were unaware of the rules around required minimum distributions that governed the rate at which they needed to decumulate their fund. Fong et al. (2021) examined a range of financial behaviors, including paying off of credit cards and age-related asset diversification, among older people, and they found that the more financially literate were more likely to do what would be thought of as recommended behaviors. Cognitive abilities, and numerical ability in particular, have been found to affect portfolio choices, with more able individuals being more likely to hold stocks and DC pensions in different countries (Banks & Oldfield 2007, Christelis et al. 2010, Fong et al. 2021); differences in cognitive abilities and numeracy have also been associated with different wealth accumulation and decumulation trajectories (Banks et al. 2010). Banks et al. (2015) examined annuitization choices in the United Kingdom and found that numeracy was associated with whether an individual shopped around for an annuity, which would provide significant financial benefits for most people, or took the easier path of purchasing an annuity from their original pension fund provider.

Table 2 Distribution of numeracy among older English adults

	Group 1	Group 2	Group 3	Group 4	Total	N
Age	**12.2%**	**43.1%**	**27.9%**	**16.8%**	**100%**	**10,577**
50–59	8.7%	38.0%	30.1%	23.2%	100%	3,727
60–69	10.1%	43.0%	30.4%	16.5%	100%	3,483
70–79	15.6%	51.5%	24.6%	8.2%	100%	2,330
80+	27.1%	51.0%	17.8%	4.1%	100%	1,017
Of those with DC pensions:						
Age	**6.1%**	**40.1%**	**32.8%**	**21.1%**	**100%**	**4,025**
50–59	4.4%	35.9%	33.6%	26.1%	100%	1,385
60–69	5.2%	40.6%	33.8%	20.5%	100%	732
70–79	9.7%	49.4%	30.6%	10.2%	100%	216
80+	17.0%	53.3%	25.0%	4.7%	100%	1,692

Numeracy groups are defined as in Banks et al. (2010). Those in Group 4 answer five numerical questions correctly, including one involving compound interest. Those in Group 1 fail to answer correctly any question involving fractions or percentages. Abbreviation: DC, defined contribution. Authors' calculations based on data from English Longitudinal Study of Ageing, 2008/10 to 2018/19 (at **https://www.elsa-project.ac.uk/**).

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 the changing cognition of older decision makers. This decline can be stark after age 70, and particularly so in areas of executive functioning such as numeracy. **Table 2** documents the distribution of numerical ability by age group in the English Longitudinal Study of Ageing (ELSA). For the purposes of this table, numeracy levels are divided into four groups, with Group 1 being unable to correctly answer any questions involving fractions or percentages and Group 4 correctly answering all questions, including those involving compound interest. In keeping with previous findings, we observe that 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.[1]

Keane & 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, age-related decline might affect complex economic decision making and life-cycle planning. Among the empirical findings are those of Agarwal et al. (2009), who show that financial mistakes (e.g., paying substantially higher-than-market interest rates, not optimizing credit card transfers, making mistakes in home equity loans, or incurring fees) display a U-shaped pattern with age and suggest this is due to cognitive decline. Korniotis & 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 analyze how these correlate with financial outcomes

[1]Even though, 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 because 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 mean, if anything, that this cross-sectional profile might be underestimating the decline with age.

at older ages. Angrisani & Lee (2019) and Mazzonna & 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 & Lee (2019) find that the associated wealth reductions are lower for those who rely on pension or annuity income rather than on 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 DC savings.

Although 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 couples than for singles or couples who keep their financial choices entirely separate. Indeed, Banks & Oldfield (2007) show that the maximum level of numeracy within a couple is more predictive of portfolio choices and behavior 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 & Lee (2019) highlight the importance of self-awareness of cognitive decline for its effects on financial outcomes.

The lack of awareness of cognitive decline is perhaps one of the reasons the empirical evidence shows a lower use of financial advice at older ages than might be expected. For example, Kim et al. (2020) show that only one-third of the 50+ population in the United States reported ever seeking financial advice. This is also a topic of particular concern in the United Kingdom, where only half of the individuals accessing a pension fund for the first time in 2019–2020 used either regulated advice or the free government-provided guidance service (see **Figure 4**). Although the proportion taking advice is greater for those accessing the largest funds, even at relatively large

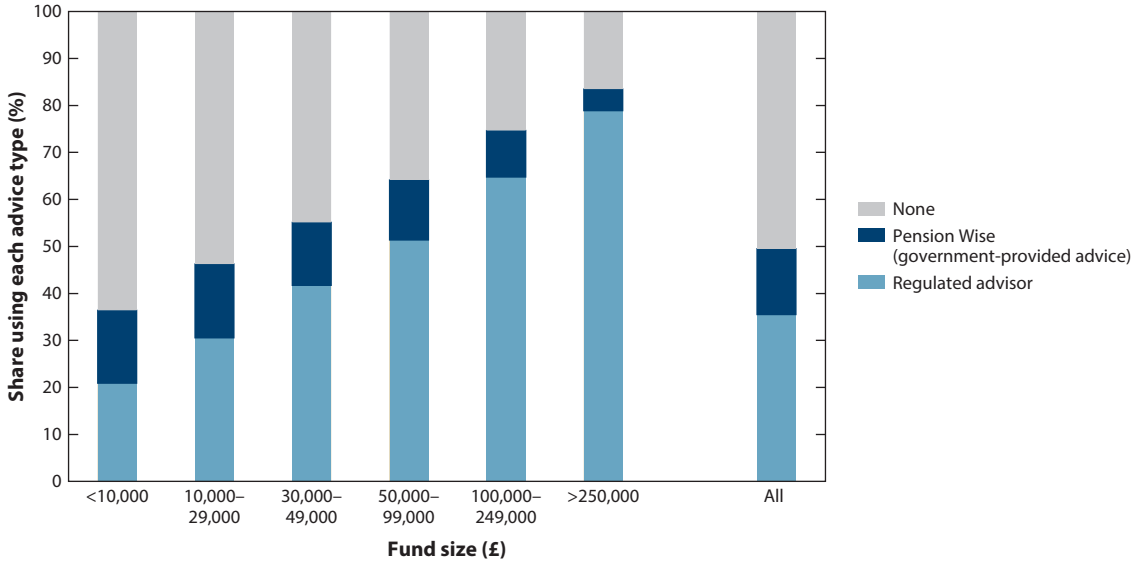

Figure 4

Use of advice for funds accessed for the first time in 2019–2020. Authors' calculations based on data from Financ. Conduct Auth. (2020).

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

	Group 1	Group 2	Group 3	Group 4	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**	**2,495**

The table refers to individuals with defined contribution (DC) pensions aged 50 to 64. Sources of information do not sum to total in some cases because individuals can report multiple individual types of information. Authors' calculations based on data from English Longitudinal Study of Ageing, 2008/10 to 2018/19 (at **https://www.elsa-project.ac.uk/**).

fund values such as £50,000–£100,000 and £100,000–£250,000 it is still the case that one-third and one-quarter of decisions, respectively, are taken without any advice.

Furthermore, whereas the potential gains from delegating or seeking assistance with 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 et al. (2020) find that in the United States, cognitive ability and financial literacy affect the quality of financial advice sought at older ages, with the more able and more literate being more likely to seek financial advice from professional advisors. In England, too, 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 DC pension wealth. The least numerate are more than 1.5 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 4 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.

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

	Does 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**	**1,167**

The table refers to individuals with defined contribution (DC) pensions aged 50 to 64 who were asked about their DC fund values. Sources of information do not sum to total in some cases because individuals can report multiple individual types of information. Authors' calculations based on data from English Longitudinal Study of Ageing, 2008/10 to 2018/19 (at **https://www.elsa-project.ac.uk/**).

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 United Kingdom, 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 victimization. Gamble et al. (2014) find that decreasing cognition and overconfidence in financial knowledge are indeed associated with fraud victimization, whereas DeLiema et al. (2020) find that empirical patterns of fraud are complex and there are few strong predictors of victimization, even when looking only at investment fraud.

Our takeaway from this more recent literature on advice and fraud is that, although 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 at which 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 being more explicitly 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. Whereas much of the rising interest in this topic is driven by the shift toward 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 10 years of retirement might be optimizing behavior for someone with owner-occupied housing and a large (annuitized) income from a DB pension, but it 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 it would be especially 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 captures 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 annuitization decision first and then the drawdown of unannuitized DC assets. We finish by briefly discussing broader issues around insurance choices at older ages and putting this into the context of the trajectory of spending patterns in retirement.

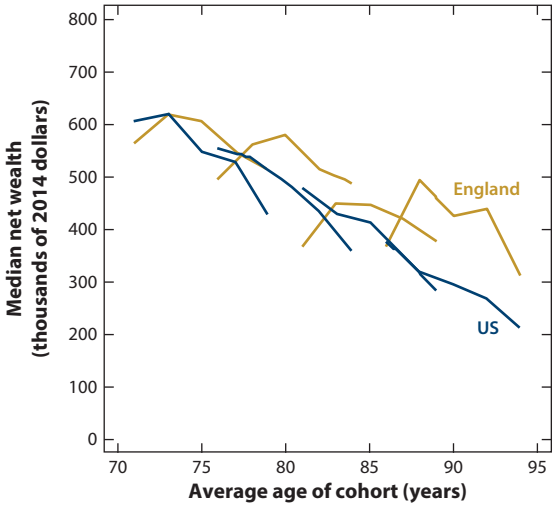

Figure 5

Age profiles of total net wealth including present discounted value of future non-labor income in the United States and England, 2002–2010. In both countries the calculations use the balanced panel sample comprising just households where at least one individual responded to all waves. Data from the US Health and Retirement Study, 2002 to 2010, and the English Longitudinal Study of Ageing 2002/3 to 2010/11. Figure adapted from Blundell et al. (2016) (CC BY 4.0).

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, De Nardi et al. 2010, Poterba et al. 2011, Blundell et al. 2016, De Nardi et al. 2021). **Figure 5** illustrates this for the United States and England. Retirement resources declined with age in the United States over the 2000s, but only by around two-thirds on average between age 70 and 95. In England the decline with age was even less marked, as the age profiles of total wealth were 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 emphasized the role of uncertain life expectancies, medical expense risk, and bequest motives (Love et al. 2009, De Nardi et al. 2010, Lockwood 2018, McGee 2019, De Nardi et al. 2021). However, separating the relative importance of these motivations is challenging due to 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 countries that do not (Van Ooijen et al. 2015; Blundell et al. 2016; Nakajima & Telyukova 2016, 2018). 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) argue that the motives themselves are overlapping and 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 work by Gan et al. (2015), who incorporate subjective survival expectations into a life-cycle model and find that this performs better in terms of predicting wealth holdings at older ages than life-table survival probabilities, and by Lusardi et al. (2017), who endogenize financial wealth accumulation in a stochastic life-cycle model and argue that 30–40% of retirement wealth inequality could be accounted for by financial knowledge. Keane & Thorp (2016) provide a review of models of choice behavior that incorporate irrational behavior and confusion, and they point to some possible approaches for future work on modeling retirement wealth accumulation and decumulation. These include allowing perceived attributes to differ from actual attributes, allowing individuals to use heuristics to solve optimization 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 toward 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 behavior and standard preferences will become increasingly unattractive.

One branch of the literature on wealth trajectories in retirement that has considered optimization frictions—albeit not ones driven by financial literacy or cognitive capacity—is the one that 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 United States and the United Kingdom (Christelis et al. 2013, Crawford & O'Dea 2020), and therefore choices with respect to the use of housing wealth in retirement have an important bearing on retirement resources, overall wealth trajectories, and retirees' welfare.

Housing wealth can be used to fund nonhousing 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 without a change in housing consumption, such as by unlocking the financial value of the property through an equity release product. In practice, many papers have shown that, across different countries with varying institutional settings, housing wealth is not drawn down rapidly in retirement (see, e.g., Blundell et al. 2016, Nakajima & Telyukova 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 they do to other assets. In addition, housing-specific factors have also been found to be important. Sinai & Souleles (2005) argue that 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 2010). Venti & Wise (1991) and Hancock (1998) find that the income gains from equity release would be small for most households and therefore may not be worth the transaction costs involved. Nakajima & Telyukova (2020) estimate a life-cycle 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, finding 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 effect of financial literacy on economic decisions is understudied as a potential driver of some of these patterns, and it is of rising importance in countries that are experiencing a shift toward 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, the attention is often on trajectories of average wealth rather than on the behavior of individuals across the whole distribution, and particularly at the tails (i.e., those spending down private wealth particularly rapidly or particularly slowly), and on the drivers of this behavior. Such drivers are less important when the object of interest is estimating average preference parameters, but they are 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 United States 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 who are more reliant on accumulated DC assets. Given this, a natural place to turn our attention to is the existing evidence on how DC assets specifically are drawn on in retirement.

4.2. Annuitization Choices

One important reason why managing retirement incomes is so complex 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 & McGarry 1995 for the United States and Sturrock & O'Dea 2021 for England) have shown that when data on subjective survival probabilities are collected, such individual 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, whereas 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; this is the so-called annuity puzzle (Mitchell et al. 1999, Davidoff et al. 2005). This is true internationally, across many different institutional settings. In the United Kingdom, the announcement in 2014 of the removal of the 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 et al. 2016).

If the lack of longevity insurance being bought by those with DC assets was 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 United States, the United Kingdom, Denmark, and Australia. There is a relatively large literature that has explored aspects of financial literacy and found a relationship with annuitization demand. Sturrock & O'Dea (2021)

examine misperceptions 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. (2017a) highlight the difficulties consumers have in valuing annuities, noting that those with less education and lower numerical abilities struggle more. Bateman et al. (2018) stress the importance of information, and its interaction with financial literacy, for annuity demand. The framing of retirement income choices and the nature of the default arrangement have also been shown to be important (Butler & Teppa 2007, Hu & Scott 2007, Brown et al. 2008, Benartzi et al. 2011).

However, other rational explanations have been advanced to explain low voluntary annuity demand. Finkelstein & 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 behaviors, and the mortality of their parents) compared to what is available to the insurer. On the demand side, Inkmann et al. (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 annuitized 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 annuitization 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 Defined Contribution Assets

If individuals are not annuitizing DC pension assets in institutional settings where that is not mandated, then how are they 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 these are difficult questions to answer. As already stressed, to assess the appropriateness of drawdown decisions (let alone the heterogeneity in decisions across individuals), one needs to examine them in the context of households' total wealth portfolio and 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 US Health and Retirement Study (HRS) and its equivalents around the world have the necessary breadth of panel data, but the sample size is often too limited for a detailed examination of the behavior of those with DC pension savings, and the self-reported data are subject to reporting errors. On the other hand, administrative data from financial institutions or tax records have high-quality information on aspects of pension holdings or withdrawals for large samples but often contain only limited other information. 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 savings—will have a crucial bearing on individuals' behaviors and the appropriateness or optimality of their decisions.[2] 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 savings have been mandatory for employees since 1992, and so these assets are relatively widely held, though the amounts accumulated are still increasing for each subsequent generation reaching retirement. Despite concerns that Australian retirees would draw down their assets too rapidly and move onto the means-tested public pension during retirement, the empirical literature suggests that households are typically prudent and cautious in their drawdown behavior. Less than 30% of funds are taken as lump sum withdrawals, and those lump sums that are taken are typically small (Product. Comm. 2015). In terms of funds that are taken through phased withdrawal (known as account-based pensions in the Australian context), Rothman & Wang (2013) find that many retirees simply withdraw the minimum amount permitted each year: around 50% for those aged under 79, rising to 70% for those aged 85–89. Using alternative data, the Product. Comm. (2015) estimates 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 8-year period, and they find that on average households are cautious: Whereas younger retired households draw down their nonhousing assets, older 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 being said, Asher et al. (2017) find considerable heterogeneity in drawdown patterns: 10% of Australian pensioners experienced a decline in asset values of more than 50% over the 8-year period. This tail is worthy of further examination because, although there may be innocuous explanations, it could be indicative of poor financial management, fraud, or unsustainable spending behavior due to individuals' struggling with the complex financial decisions they have to make.

There is a growing literature that has examined withdrawals from personal pension accounts in the United States. The US context is somewhat peculiar in that while (as in 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 (70.5 years until 2020 and now 72), they must start taking required minimum distributions (RMDs) from their retirement accounts.

[2] As an example, two of the most-studied countries—the United Kingdom and the United States—have similar tax systems for most DC pensions, whereby contributions and accumulation within the fund are exempt from tax, and withdrawals are subject to income tax and are accessible without a tax penalty only after a certain age. However, in the United States DC pensions represent additional savings over and above the earnings-related social security, whereas in the United Kingdom DC pensions are for many the only form of earnings-related pension savings (as social security consists only 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 tax exempt at the withdrawal stage, and the remainder of contributions being 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 savings 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.

Empirical evidence to date has exploited tax return data (Sabelhaus 2000, Bershadker & Smith 2005, Mortenson et al. 2019), fund administrative data (Holden & Bass 2012, Brown et al. 2016), and survey data (Poterba et al. 2013) to study withdrawal behavior. These papers have found that in fact the majority of individuals do not 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. Brown et al. (2017b), Mortenson et al. (2019), and Horneff et al. (2021) attribute this to bequest motives. However, there is also evidence of optimization 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 (e.g., not realizing the rules had been suspended), the hassle costs associated with changing withdrawals for just one year, or an interpretation of the RMD rules as an implicit guidance about the appropriate rate at which to withdraw assets.

The latter point is important, as it highlights the difficulty that individuals face when trying to calculate appropriate withdrawal rates. Although individuals may interpret the RMD rules as implicit guidance, these rules do not target full depletion of assets before death (Mortenson et al. 2019) and may be dominated by other strategies (Munnell et al. 2019). However, Sun & 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 the initial assets.

There is empirical evidence that some individuals interpret statutory minimum withdrawal rates as implicit guidance. Brown et al. (2017b) find that nearly two-thirds of those who continued to take a distribution from their retirement plans in 2009 (despite a 1-year suspension of the RMD rules) described the rationale defined as "viewing RMD as a good guide to appropriate speed of drawdown" as very or somewhat important for them. Alonso-García et al. (2021) also examine the issue of implicit guidance in an online experiment fielded in the Netherlands and Australia. They find that around 30% 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.

Interestingly the United Kingdom, which recently removed its requirement to annuitize DC pension savings, has no statutory minimum withdrawal rates. To the extent that those 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 United Kingdom are drawing on their DC pension assets in this most flexible of settings. Annuity purchases collapsed when the reforms were introduced (Cannon et al. 2016), and in 2019–2020 only 10% of funds accessed for the first time were used to purchase an annuity (Financ. Conduct Auth. 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 30% of funds with a value between £100,000 and £250,000—had 8% or more of the fund value withdrawn in 2019–2020. At the other end of the spectrum, around 10% of funds in total, and one-quarter of funds over £250,000 had less than 2% of value 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

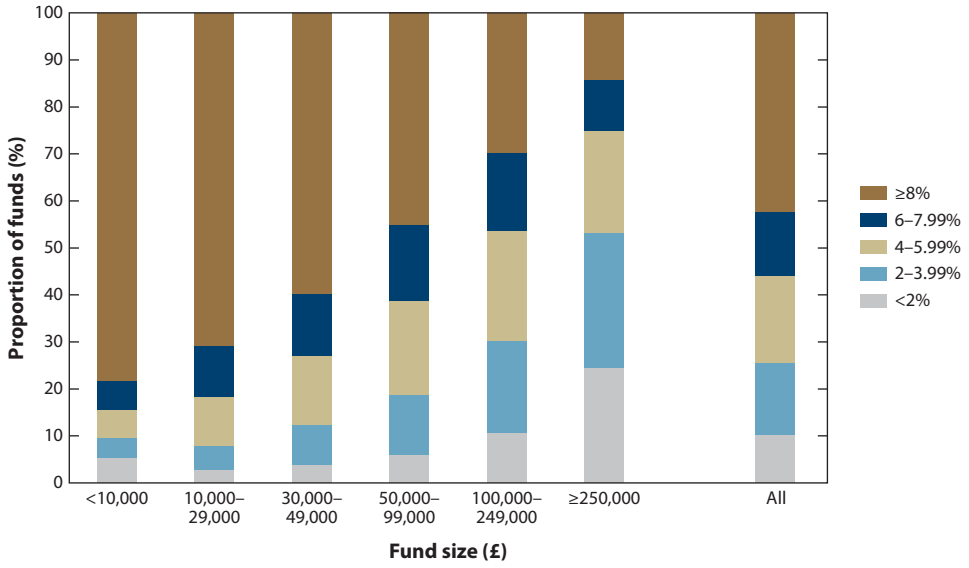

Figure 6

Regular withdrawal rates by fund size in 2019–2020. Authors' calculations based on data from Financ. Conduct Auth. (2020).

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 sub-optimality of different trajectories for the decumulation of DC pension wealth (whether through annuitization or through fund drawdown) can only be viewed in the light of other elements of the wealth portfolio is characteristic of a more general problem in trying to understand individuals' success in managing their retirement incomes. The planning of retirement incomes and resources should be best conceptualized not in terms of wealth or income trajectories but rather in terms of consumption smoothing in the face of different types of risk and different types of formal and informal insurance. The trajectory of wealth, and indeed of any single component of wealth, is just a byproduct of this smoothing (or lack of smoothing) behavior.

Fang (2016) provides a comprehensive and authoritative overview of evidence on insurance markets for the elderly that brings together analyses of the risks of investment incomes, housing wealth, health and health expenditures, and 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 cannot present here because of space constraints, the paper discusses the fact that these risks are typically analyzed 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 the 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 behavior. Whereas there is a large literature on consumption smoothing over the 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 are relatively uncommon.

As with the macroeconomic literature on wealth and savings dynamics that 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 issues here are the nature of preferences for bequests and precautionary savings and whether reasonable values for such preferences can explain observed behaviors. One interesting feature of such models is the potential role of health risks in rationalizing consumption trajectories. In an early study using cross-sectional data, Börsch-Supan & Stahl (1991) argued that declining health might generate a consumption constraint as retirees age, and this could explain the consumption and saving patterns observed in German data. More recently, the interactions between health, health expenditure, and the marginal utility of consumption have become topics of some interest. Using US HRS data, but without considering data on consumption expenditures, Finkelstein et al. (2013) find that the marginal utility of consumption declines as health deteriorates, and they show that this dependence can have a substantial effect on optimal levels of health insurance and life-cycle saving trajectories; this result 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 et al. (2019) show that the differing trajectories for post-retirement consumption in the United States and the United Kingdom, which are observed despite the similarity of income paths 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 found by Peijnenburg et al. (2017) on the key role of medical expense risks in explaining the annuitization puzzle and those of macro papers (e.g., De Nardi et al. 2010) emphasizing the role of medical expense risks in driving wealth trajectories.

5. DISCUSSION AND CONCLUSIONS

Financial decision making in later life, and the issue of managing retirement resources and incomes, are going to be increasingly important for future cohorts of retirees. This is especially true in anglophone countries where DC 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. Moreover, in all countries there will be inevitable changes to health insurance and health care, long-term care insurance, and housing markets that will arise as a result of the broader economic pressures of population aging and will change the nature of retirement wealth and incomes needed by the older population. The complexity of the choices to be made by retirees, particularly when considering the interactions between all these factors, is increasing, as are the ages at which these choices have to be made—which, in turn, raises the issue of the influence of cognitive decline on the quality and nature of such choices.

In this article 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 while pointing to a number of other excellent reviews and surveys that go into more detail on particular topics. Observed from the highest level, the literature divides broadly into two camps. Papers in macroeconomics and labor economics look at wealth or consumption trajectories and show 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 rationalize the average retirement wealth decumulation and spending data we see in many institutional contexts, as well as other empirical phenomena such as the annuity puzzle, as a consequence of rational choices. Therefore, it is tempting to conclude that individuals can manage their retirement incomes just fine and that 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 this literature documents low levels of financial literacy, imperfect information, behavioral 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 who are perhaps at the heart of existing concerns about the financial security of retirees within policy-making communities.

Our conclusion is that this conflicting evidence, when coupled with the increasing importance of the issue of financial choices at older ages for future cohorts of retirees, suggests there is an opportunity for valuable future work that aims to reconcile these two strands of literature. In particular, we can identify four fruitful possibilities for such research.

First, and most generally, research is needed that exploits, or even collects, more comprehensive data on the overall financial situations and choices of retirees. Such data, whether from administrative records linked to existing surveys or from new waves of longitudinal surveys, can put the specifics of individual financial choices into the broader context of individuals' overall retirement resources (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 behavior, more work could be done to incorporate 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 due to aging itself, but partly in response to health shocks and other life events (Banks et al. 2020), 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 labor work should acknowledge the findings in the literature on financial literacy and cognitive decline at older ages and begin to build models that allow for limited capacity in decision making. This is a complex area, but Keane & Thorp (2016) provide some pointers as to possible ways forward, and a recent paper by Keane et al. (2021) has built and estimated a structural model of health care plan choices that incorporates such decision-making behavior. More work along these lines in broader contexts of retirement savings would be hugely valuable. In addition, the ability of structural macro and labor models to explain the full distribution of choices and outcomes for retiree cohorts, as opposed to average profiles, should be investigated further.

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

Finally, given that issues surrounding age-related cognitive decline 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 the engagement of family members in the choices of their older relatives. Once again, such

work needs to recognize 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 has 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 a gap in the information that policy makers need to effectively design public programs aimed at retirees and to regulate insurance markets. At present, policies such as the use of defaults to encourage annuitization, changes to statutory withdrawal rates, or the encouragement of different forms of private pension savings such as more collective DC provisions (which are all currently being discussed in different countries) risk being designed and implemented without sufficient evidence on their welfare implications. Policy makers discussing or implementing changes despite this lack of evidence should at least consider the simplicity and stability of the retirement income environment and of the insurance markets faced by retirees in order to create a planning and choice environment that is as robust as possible to financial decision-making errors and age-related cognitive decline.

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