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Savings After Retirement

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Abstract

Retired households, especially those with high lifetime income, decumulate their wealth very slowly, and many die leaving large estates. The three leading explanations for the "retirement savings puzzle" are the desire to insure against uncertain lifespans and medical expenses, the desire to leave bequests to one's heirs, and the desire to remain in one's own home. We discuss the empirical strategies used to differentiate these motivations, most of which go beyond wealth to exploit additional features of the data. The literature suggests that all the motivations are present, but has yet to reach a consensus about their relative importance.

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1 Introduction

The life-cycle framework of Modigliani and Brumberg (1954, 1980) postulates that households will smooth consumption by accumulating wealth during their prime earning years and spending it once they retire. The simplest version of the model, with no bequest motives or uncertainty, predicts that households will begin decumulating their wealth as soon as they retire and will die with no wealth. This stands in sharp contrast with the data, which show that retired households, especially those with high lifetime income, decumulate their assets very slowly. Many die leaving large estates. In the past two decades, a growing literature has sought to explain this "retirement savings puzzle."[1] In this article we review the three leading explanations for why older households seem reluctant to draw down their wealth.

Although Modigliani and Brumberg (1954) did not formalize these explanations, they described all three. The first is the precautionary motive, which they describe as "the desire to accumulate assets through saving to meet possible emergencies, whose occurrence, nature, and timing cannot be perfectly foreseen." Because retired households face the risk of living long and facing catastrophic medical and long-term care (LTC) spending, they may be holding onto their assets to cover potentially expensive medical needs at extremely old ages. In fact, observed longevity and out-of-pocket medical expenses can explain a significant portion of U.S. savings during retirement.

The second is the bequest motive: "the desire to add to the estate for the benefit of one's heirs." Individuals may enjoy leaving bequests to their children or other survivors. Alternatively, they may use bequests to reward their caregivers and elicit care.

The third is the need "to have an equity in certain kinds of assets before an individual can receive services from them," the most important of which is housing. Retirees may be reluctant to decumulate their housing wealth, as many enjoy living in their homes, find it costly to move, and face an underdeveloped reverse mortgage market. The data show that older households decumulate housing more slowly than other forms of wealth.

The three explanations are not mutually exclusive. As Modigliani and Brumberg (1954) pointed out, assets can serve multiple purposes: "For example, the ownership of a house is a source of current services; it may be used to satisfy part of the consumption planned for after retirement; it may be bequeathed; and, finally, it is a source of funds in emergencies." The fungibility of wealth makes it difficult to deter-

[1]The term "retirement savings puzzle" is sometimes associated with the debate over whether savings at retirement is puzzlingly low. Here we focus on changes in savings after retirement.

mine the role played by each of the explanations (Dynan et al., 2002). Researchers have applied various strategies to disentangle them.

These saving motivations were recognized well before the introduction of the life-cycle model. For example, Keynes (1936) discussed at length the desires to "build up a reserve against unforeseen contingencies" (the precautionary motive) and "bequeath a fortune" (the bequest motive). What is new is the availability of better data, which allow researchers to measure risks and outcomes more accurately, and greater computing power, which facilitates estimation of models containing multiple saving motivations.

In this article, we discuss what researchers have learned from the better data and faster computers, updating and extending the more technical survey in De Nardi et al. (2016b). We first describe how post-retirement wealth changes with age and income. We then introduce the competing explanations for these asset patterns, along with supporting evidence. Finally, we explain the leading approaches for disentangling the explanations.

Disentangling the explanations is no small feat – researchers continue to apply a variety of strategies to make progress on this question. In our opinion, there is considerable evidence that the precautionary motive and the bequest motive are both important. Furthermore, although the evidence on the role of housing is less developed than for the other two motives, it certainly deserves further study, if only for its prominence in most household portfolios.

2 Wealth Profiles after Retirement

In this section we establish three facts. First, the wealth of older households declines slowly with age. Second, the decline is slower among the rich. Third, those with low income have little wealth.

To document the savings of the elderly, we use data on older U.S. households from the Assets and Health Dynamics of the Oldest Old (AHEAD) cohort of the Health and Retirement Survey (HRS).[2] Our wealth measure is net worth, which is the sum of the value of housing and real estate, automobiles, liquid assets (which include money market accounts, savings accounts, T-bills, etc.), IRAs, Keoghs, stocks, the value of any farms or businesses, mutual funds, bonds, "other" assets, and investment trusts less mortgages and other debts. We use data on assets starting in 1996 and every two years thereafter through 2014.

[2]Our sample selection restrictions follow De Nardi et al. (2022).

Our measure of wealth, which is standard in the literature, excludes annuitized wealth, the discounted value of the Social Security and other defined benefit pension benefits that households expect to receive over the remainder of their lives. The value of annuitized wealth declines mechanically as individuals age and expected lifespans shorten, and falls to 0 at death. As a result, when our wealth measure is expanded to include annuitized wealth, it falls rapidly after retirement, and most of the wealth held at the start of retirement is depleted by the time of death (Love et al., 2009). Even if we include the value of annuitized wealth, however, the simplest version of the life-cycle model under-predicts wealth holdings late in life.

Older households differ along a variety of dimensions that potentially affect their saving decisions. Many of these differences are correlated with the households' lifetime earnings or permanent income. Households with different permanent income ranks receive different flows of retirement income and face different processes for health, mortality and medical expenses. Because this income is determined prior to retirement, it provides a useful ex-ante basis for stratifying retired households.

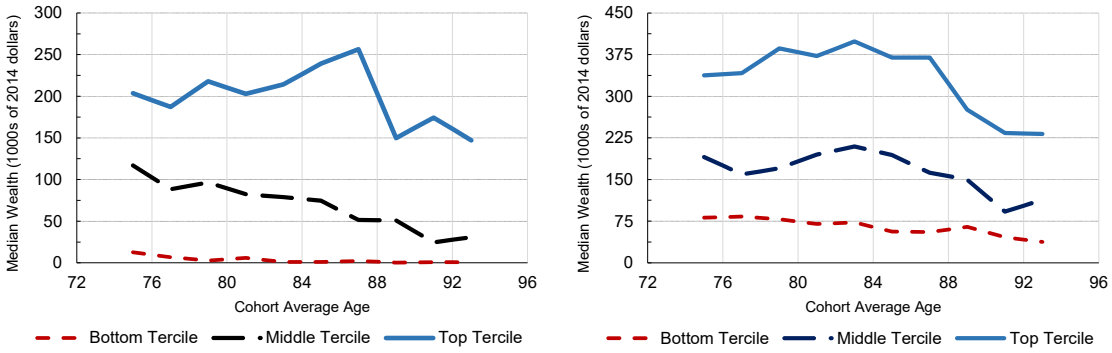
Our permanent income proxy is based on post-retirement annuitized income, the sum of Social Security benefits, defined benefit pension benefits, veterans benefits and annuities. Because households with higher lifetime earnings tend to have higher annuity incomes, this measure is a good indicator of the income they received when working. We use annuitized income to construct an income measure comparable across households of different ages and sizes.[3]

Figure 1 presents median wealth conditional on age and income tercile for the cohort aged 71-76 (which we index as 75) in 1996. These profiles come from De Nardi et al. (2022), who show that the facts we highlight here hold for other cohorts as well. Figure 1 presents wealth profiles for the unbalanced panel; each point represents the median for all the members of an age-income tercile cell who are alive at a particular date.

The left panel shows wealth profiles for households who are single (most of whom were widowed or divorced) throughout the entire sample period. Median wealth is increasing in income, with the median 75-year-old in the top income tercile holding about $200,000 (in 2014 dollars) and the one in the bottom tercile holding essentially no wealth at all. Over time, those with the top income tercile tend to hold onto significant wealth well into their nineties, those in the middle tercile display some asset decumulation as they age, and those at the bottom hold little wealth at any

[3]To construct our income measure, we regress annuity income on a household fixed effect and controls for household composition and age. The rank order of each household's estimated fixed effect provides our measure of its income. This is a time-invariant measure that follows the household even after one of its members dies.

age. Thus, even at older ages, richer people save more, a finding first documented by Dynan et al. (2004) for the whole life cycle.



(a) Initial singles (b) Initial couples

Figure 1: Median wealth, AHEAD data. Each line shows medians over the period 1996-2014 for a subset of the AHEAD households aged 71-76 in 1996. Profiles from De Nardi et al. (2022).

The right panel of Figure 1 reports median wealth for households who are couples in 1996. In later years, many of these households lose a member and become singles, in which case we report the wealth of the surviving spouses. The first thing to notice is that couples are richer than singles. Couples in the highest income tercile hold around $300,000, compared with $200,000 for singles. Even the couples in the lowest income tercile hold over $70,000 in the early stages of their retirement, while the singles have almost no wealth whatsoever. As with the singles, couples in the highest income tercile hold large amounts of wealth well into their nineties, while those in the lowest tertile hold little wealth. Many couples experience a significant decline in wealth when one of the spouses dies (French et al. (2006), Poterba et al. (2011) and De Nardi et al. (2022)). As married households become single, this drop imparts a downward slope on their asset profiles. While both spouses are still alive, couples run down their assets at least as slowly as singles.

It is well-documented that health and wealth are positively correlated (see, for instance, Smith 1999, Poterba et al. 2017, De Nardi et al. 2017). As a result, poor people die more quickly, and as a cohort ages, its surviving members are increasingly likely to be rich. Failing to account for this mortality bias will lead a researcher to understate asset decumulation late in life (Shorrocks, 1975). De Nardi et al. (2010) show that mortality bias is quantitatively important, although conditioning on income, as we do in the above graphs, reduces its effects.

Regardless of how mortality bias is addressed, the puzzle remains: the asset decumulation of older households is significantly slower than that implied by a simple life-cycle model where individuals face no uncertainly and receive no utility from leaving bequests. In the next section we discuss extensions to the life-cycle model that encourage older households to save more and die with positive wealth.

3 Drivers of Savings

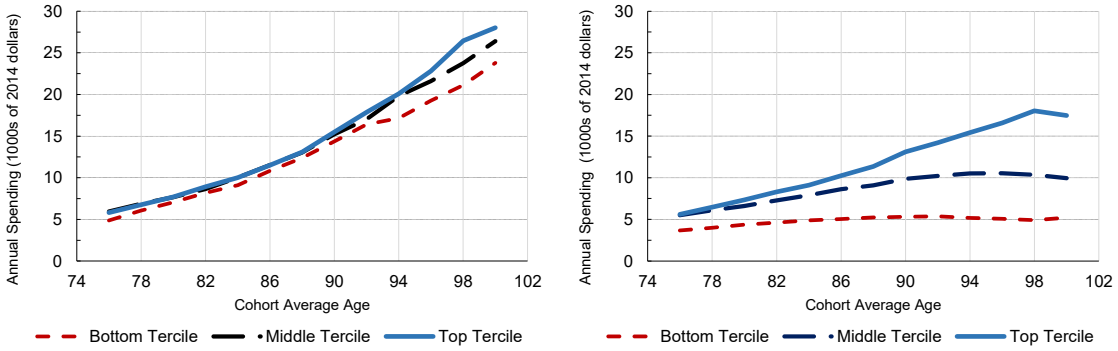
3.1 Precautionary savings motives

One explanation for why retirees appear reluctant to spend down their wealth is that, by saving, they insure themselves against the risk of living long and having high medical spending.

In an important early study, Davies (1981) showed that when lifespans are uncertain individuals are reluctant to exhaust their financial resources. In the absence of annuity income, lifespan uncertainty means that individuals will never fully deplete their wealth if their preferences are of the constant relative risk aversion type with reasonable parameter values. The risk of living long may be especially strong for rich people, women, and people in good health, who tend to live longer than their poor, male, and sick counterparts. Using mortality rates estimated from the AHEAD, De Nardi et al. (2009) report two extremes that illustrate this point. They find that an unhealthy 70-year-old male at the bottom quintile of the income distribution expects to live only 6 more years, that is, to age 76. In contrast, a healthy woman at the top quintile of the permanent income distribution expects to live 16 more years, thus making it to age 86. Similar income gradients are found in administrative data (Waldron 2007, Chetty et al. 2016), and in other countries (Banks et al., 2021). De Nardi et al. (2009) use a life-cycle model to study how differences in life expectancy due to health, gender, and income affect saving. They find that these differences all significantly affect saving, and that the effects are all of a similar order of magnitude. The greater longevity of those with high income can partially explain their higher rates of saving, as they have a longer lifespan to finance.

In addition to the risk of living long, older households face the risk of high medical spending. Although almost all Americans aged 65 and older receive public health insurance through the Medicare program, many types of health care are largely uninsured. For example, Medicare only pays for the first 20 days of a nursing home stay (and part of the cost for the next 80 days). Some households have their nursing home expenses covered by Medicaid, another public health insurance program, but

Medicaid is available only to those with limited financial resources. This leaves many retirees facing considerable medical spending risk.



(a) Out-of-pocket plus Medicaid (b) Out-of-pocket

Figure 2: Mean medical spending of singles. Profiles from De Nardi et al. (2022).

To give a sense of this risk, Figure 2 shows average medical expenses conditional on age and income for singles. These profiles come from De Nardi et al. (2022), who estimate medical spending as a flexible function of age, health, income, and gender. They then simulate a large number of medical spending histories and take averages. We focus here on the medical spending of singles, as the spending of couples exhibits similar patterns: De Nardi et al. (2022) show that for any level of age and income, the medical spending of married households is roughly double that of singles.

The left panel of Figure 2 shows total medical spending, here defined to be the sum of the out-of-pocket payments made by patients themselves and the payments made by Medicaid. Out-of-pocket expenses are the sum of what an individual spends on drugs, hospital stays, nursing home care, home health care, doctor visits, dental visits and outpatient care, along with premia for private and Medicare insurance. A strength of the AHEAD is that its "exit interviews" collect information on out-of-pocket medical expenses incurred at the very end of life, which tend to be large (French et al. 2006, Marshall et al. 2010). The public component of the HRS lacks Medicaid spending data, but we can impute it by combining the HRS with the administrative data contained in the Medicare Current Beneficiary Survey; see De Nardi et al. (2022) for a description.

The left panel of Figure 2 shows that medical expenses rise rapidly with age. For individuals in the middle income tercile, mean spending rises from roughly \$6,000 at age 76 to \$26,000 at age 100. Medical expenses rise with age because older individuals are more likely to die and incur costly end-of-life expenses and because

older individuals face higher out-of-pocket expenses, such as nursing home care, while alive.

The impacts of medical spending and mortality risk on saving reinforce each other. Saving is driven not only by the risk of facing high medical spending or the risk of living long, but by the joint risk of facing high medical spending when very old and having outlived one's resources. Using an estimated model, De Nardi et al. (2009) show that if individuals face medical expense risk, changes in life expectancy lead to larger absolute changes in wealth. For example, in the absence of medical expenses, giving the richest people the mortality rates of a sick, low-income male would cause wealth at age 85 to fall by $32,000. But when individuals face medical expenses, the reduction is $50,000.

The right panel of Figure 2 shows out-of-pocket medical expenditures. Out-of-pocket expenditures depend not only on the medical services that households receive, but also on their insurance coverage. People with low wealth on average pay a smaller share of their total medical charges out of pocket because they receive more assistance from means-tested social insurance programs such as Medicaid. They are also more likely to utilize the implicit insurance provided by bankruptcy and other forms of medical debt forgiveness (Mahoney, 2015). These mechanisms turn out to be more important for the observed income gradient of out-of-pocket expenditures than any differences in underlying medical spending (De Nardi et al., 2016c). The right panel of Figure 2 thus shows that the income gradient for out-of-pocket spending is far steeper than the gradient for total spending. Because out-of-pocket medical expenditures rise with permanent income, the saving motives they generate should, all else equal, be stronger for those with with higher income, consistent with their tendency to decumulate wealth more slowly.

Medical spending is not only high at old ages, but it is also risky, even after conditioning on age. De Nardi et al. (2016c) show that at older ages the distribution of out-of-pocket medical spending is very concentrated, with the top 5% of spenders accounting for 49.1% of expenditures in a given year. Arapakis et al. (2021) show that the risk does not average out over time. Calculating the present value of remaining lifetime medical spending, they find that the 90th percentile of discounted medical spending at age 65 is twice the size of the mean.

Medical expense uncertainty reinforces the risks associated with lifespan uncertainty and increases the impact of medical expenses on saving. The total effect of medical spending is potentially quite large: modelling the entire life-cycle, Kopecky and Koreshkova (2014) calculate that 13.5% of aggregate U.S. wealth is attributable to saving for old-age medical expenditures.

Because poor health raises medical spending and shortens lifespans, it impacts

lifetime resources and thus the marginal utility of non-medical consumption. Poor health may also affect the marginal utility of non-medical consumption more directly. For example, functional limitations likely reduce the marginal utility of recreational goods like ski equipment, while raising the marginal utility of home services like housecleaning and lawn care.

If the marginal utility of non-medical consumption rose at older ages because of declining health, retirees would have another reason to hold onto wealth. Laitner et al. (2018) show that the risk of an increase in the marginal utility of consumption is in many respects equivalent to the risk of higher medical expenses. Models of endogenous medical spending take a similar approach, with medical spending shocks shifting the marginal utility of *medical* spending, either directly as in De Nardi et al. (2010), or by changing the marginal productivity of medical spending in building and preserving health (Khwaja, 2010; Yogo, 2016).

However, the literature has yet to reach a consensus about whether bad health raises or lowers the marginal utility of consumption, let alone the effect's magnitude (Finkelstein et al., 2009). Recent papers include Hong et al. (2015), who use consumption data and find that bad health reduces marginal utility at younger ages and increases it at older ages. Blundell et al. (2020), also examining consumption, find that declines in health reduce the marginal utility of consumption, while Ameriks et al. (2020), using survey evidence, find that requiring long-term care raises it.

In addition to changes in health, events such as the need to acquire a new car or support a grandchild's education can impact the marginal utility of consumption. Inferring fluctuations in marginal utility directly from observed consumption, Christensen et al. (2022) find the fluctuations to be an important driver of retiree savings.

3.2 Means-tested programs and savings crowd-out

Poorer households often receive income- and asset-tested transfers from the government. The two most important of these programs are Medicaid and Supplemental Security Income (SSI). Bankruptcy and other forms of implicit insurance play similar roles. Means-tested programs discourage saving for a number of reasons. They reduce both the average level of medical spending – see Figure 2 – and the risk of catastrophic expenses. Moreover, they impose a steep implicit tax on the saving of poorer families. As long as a household receives means-tested insurance, increases in its wealth lead to lower benefits (or less debt forgiveness), with little if any change in the resources available for consumption. Asset-tested insurance thus has the potential to crowd out private savings, especially among the poor, a point first made

by Hubbard et al. (1995). Social insurance programs could explain why low-income retirees hold very modest amounts of wealth, while richer retirees have substantial precautionary savings.

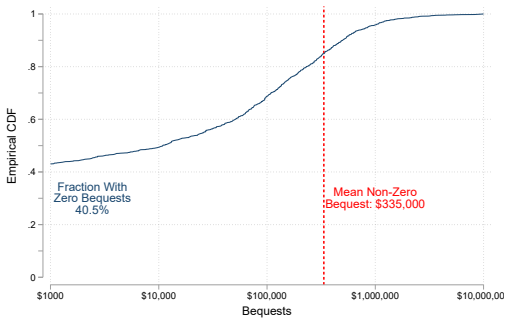
The evidence on the impact of Medicaid and other welfare programs on savings is mixed. Hurst and Ziliak (2006) find no evidence that the relaxation of welfare asset limits in the 1990s increased the savings of younger households. Likewise, Gardner and Gilleskie (2012) examine state-level reforms that increased Medicaid generosity and find no evidence that Medicaid crowds out private savings. In contrast, Greenhalgh-Stanley (2012) shows that estate-recovery programs, which enforce Medicaid asset limits among homeowners, crowd out home equity holdings and reduce homeownership. This is consistent with the view that Medicaid crowds out private savings among retirees, for whom asset thresholds are more likely to bind.

The impact of policy reforms on wealth is difficult to identify because the reforms impact the rate of saving, which is a flow. Savings in turn alter the level of wealth (a stock) only slowly. A reform that has a relatively large effect on wealth in the long run may have only modest effects on savings in any period. Consequently, a popular approach for evaluating the impact of policy reforms is to calibrate or estimate structural models with realistic risks and means-tested insurance. These models are usually required to match additional features of the data, such as wealth levels for different households at different ages. Once estimated, the models can be used to evaluate policy reforms. Models of this sort will feature prominently in our discussion below.

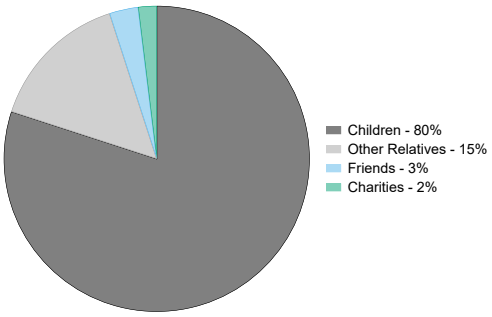
3.3 Bequest motives

Efforts to quantify the role of bequests for understanding the aggregate wealth date back at least to the debate between Kotlikoff and Summers (1981) and Modigliani (1988). Many studies find bequests to be an important; for example, Gale and Scholz (1994) estimate that bequests account for around 30% of U.S. wealth holdings. De Nardi (2004) concludes that bequests are key to explaining why the distribution of wealth is more concentrated than the distribution of earnings. At the same time, most bequests are very modest. Figure 3 shows the distribution of bequests and to whom they go. 41% of households leave no bequests, and many other bequests are small. Nonetheless, some estates are large – the 95th percentile is over $1,000,000 – and the mean non-zero bequest is $335,000. Most, but not all, estates go to children.

Figure 3 shows *terminal bequests*, the bequests left when the final member of the household dies. In addition to terminal bequests, many couples who lose a spouse leave significant bequests to non-spousal heirs. De Nardi et al. (2022) show that 31%



(a) Distribution of Bequests



(b) Recipients

Figure 3: Bequests and their Recipients. Both panels, Authors' calculations from the AHEAD cohort of the HRS. Panel (a): Distribution of non-zero bequests at the death of final household member and mean value (red dashed line). Distribution censored at the 99th percentile of the conditional distribution. Panel (b): Average share disbursed to recipient group.

of couples transfer wealth to non-spousal heirs when the first spouse dies, with an average value (when positive) of $248,000.

The presence of bequests need not imply that households possess bequest motives. Even if they receive no benefit from bequests, households that die prematurely or incur unusually low medical expenses may find themselves leaving *accidental bequests* as a byproduct of their precautionary saving. In such a case, the skewed distribution of bequests observed in the data may reflect the skewed distribution of the precautionary motives behind the accidental bequests, reflecting, for example, the tendency of low-income households to rely more heavily on means-tested insurance.

Alternatively, households may enjoy conferring wealth to their heirs and would, even in the absence of risk, choose to make *intentional bequests*. In this case the concentrated distribution of bequests may indicate that they are luxury goods, giving bequests the potential to explain why high-income households decumulate their wealth more slowly. One reason why bequests may be luxuries is that high-income parents are more likely to have higher incomes than their children. Thus, they have lower marginal utilities of consumption. This gives altruistic high-income parents an incentive to transfer resources to their children that low-income parents lack. Using calibrated overlapping generations models, Castañeda et al. (2003) and De Nardi (2004), show that these intergenerational incentives can explain both why high income parents hold so much wealth and why the distribution of bequests is skewed.

Finally, households may save largely for precautionary reasons or to maintain

their home, but receive utility from any *incidental bequests* that they might leave. In this case, bequest motives lower the opportunity cost of saving for those other reasons. For example, households who reduce their consumption to insure against a long life or high medical expenses may end up dying with unspent wealth. In the absence of bequest motives, these accidental bequests would have no value. Bequest motives thus make self-insuring through saving a more appealing option (Dynan et al., 2002; Lockwood, 2018). Incidental bequests imply that precautionary and bequest motives, rather than being mutually exclusive, are complements.

Accidental bequests are best understood in the context of terminal bequests made after both spouses have died. Like inter-vivos transfers, bequests left to non-spousal heirs after the death of the first spouse are almost surely deliberate, because the wealth could have been directed to the surviving spouse instead. These transfers suggest that bequest motives are present.

3.4 Housing

The most important asset for most households in most countries is their primary home. HRS data show that, on average, U.S. retirees hold 46% of their wealth in housing (and 69% among homeowners). In most countries, people run down their non-housing wealth more quickly than their housing wealth (Nakajima and Telyukova 2020, Blundell et al. 2016). For example, Blundell et al. (2016) show that between 2002 and 2012 the median non-housing wealth of older English and U.S. households declined more rapidly than median housing wealth. They also show that homeownership rates do decline with age, but the decline is slow. Homes are often sold when the first member of a couple dies (Venti and Wise 2004, Chang and Ko 2021).

Housing differs from other assets by providing consumption services as well as financial returns. Many older individuals seem to prefer living in owner-occupied housing to living in rental properties. This may be because they can more easily modify their own property to fit their needs, or for sentimental reasons. Estimating a structural model of saving and housing decisions, Nakajima and Telyukova (2020) find that a substantial ownership premium is needed to explain the tendency of retirees to age in place. The desire to remain in one's own home is a likely reason why older households are reluctant to run down their housing, and thus overall, wealth.

In addition to the desire to remain in one's home, there are other reasons why older individuals might liquidate their financial wealth before they liquidate their housing wealth. Most of these explanations center around tax-related issues or the

costs associated with selling a home (e.g., Engen et al. 1999). In short, retirees may be holding onto their homes for purely financial reasons, rather than any preference for living in them.

Liquidating a house entails substantial transaction costs. Most buyers and sellers use real estate agents, who typically charge 5-6% of the selling price of the house. These charges are in addition to the taxes and other fees associated with selling a house and the time and effort spent moving. Using a quantitative structural model, Yang (2009) shows that observed housing transaction costs can explain why older U.S. households decrease their consumption of housing more slowly than their consumption of other goods and services. McGee (2022) exploits quasi-experimental variation in transaction taxes to show that English retirees' housing adjustments are responsive to financial incentives, providing causal evidence that transactions costs delay the downsizing of housing.

Moreover, housing is typically tax-advantaged relative to other assets, in several ways. For example, in the U.S. housing can often be bequeathed to one's heirs tax-free, whereas selling a house will often force the seller to pay capital gains taxes. Furthermore, housing assets are often exempt from the asset tests associated with the Medicaid and SSI programs (De Nardi et al. 2012, Chang and Ko 2021). Households that sell their home and convert the proceeds to financial assets become ineligible for these government transfers until the financial assets are depleted. Finally, income from financial assets is usually taxable, but the "rent" homeowners pay themselves is untaxed.

Regardless of its cause, the desire to remain in one's own home will slow down the decumulation of *total* wealth only if there are impediments to extracting home equity while remaining in the home through financial products such as reverse mortgage loans. However, Nakajima and Telyukova (2017) report that in 2011 only 2.1% of eligible homeowners had reverse mortgages. The low take-up of reverse mortgages may reflect market frictions, such as difficulties by consumers in understanding these products. Alternatively, retirees may wish to hold on to their wealth for precautionary reasons or to leave bequests, reducing their willingness to borrow against their homes.

To the extent that homeownership explains the slow rundown of wealth, its effects will be strongest among high-income households, who are morely likely to own their home (Achou et al., 2020). The homeownership motive is therefore consistent with the observation that those with high income are less likely to decumulate their assets.

4 Identifying the Different Motivations

The three sets of saving motivations, precautionary, bequest, and housing, have similar implications for saving at older ages, making it diffcult to disentangle their relative importance. All three motivations encourage saving, and all three motivations are strongest for the rich. Precautionary savings motives are stronger for richer households because they rely less heavily on means-tested government insurance, potentially exposing them to more consumption risk. The observed distribution of bequests, which has substantial mass at zero and is highly skewed, shows that they are luxury goods. This is perhaps because rich retirees are most likely to have a lower marginal utility of consumption than their (often less rich) potential heirs. Homeownership is likewise concentrated among the rich.

Given that each motivation can generate similar saving behavior, and the likelihood that all the motivations hold simultaneously, it is difficult to disentangle them using wealth data alone. Although we can estimate many of the risks facing households from the data, tests that distinguish between and quantify the competing hypotheses depend on preferences that are not observed. In particular, we need measures of risk aversion, patience, the strength of the bequest motive, the extent to which bequests are a luxury good, and the desire to remain in one's own home. Numerical simulations of the life-cycle model show that different values of these parameters, implying different underlying motivations, fit the observed asset data more or less equally well.

A number of papers attempt to resolve this problem by going beyond savings and considering additional features of the data. Some studies note that there are financial products, such as annuities or LTC insurance, that insure against particular risks more efficiently than standard financial assets or housing. The use of these products tends to be low, suggesting that precautionary motives cannot be the only explanation for high savings at old ages. Other studies use "strategic surveys" to measure the motives directly, asking individuals to evaluate hypothetical scenarios that contain clear trade-offs between leaving bequests and having consumption when old and sick. Still others exploit cross-country variation in the amount of publicly-provided LTC insurance. If self-insuring against LTC expenses is a pressing concern, households should save more in countries with less public funding, all else equal.

4.1 Matching wealth

We begin by considering whether wealth data alone can differentiate the motivations. The idea here is that if precautionary motives by themselves are unable

to generate the slow wealth decumulation found in the data, other motives must be present.

One of the earliest structural analyses in the literature is Hurd (1989), who estimates a life-cycle model of retiree saving containing the survival risks found in the data. Palumbo (1999) introduces medical spending risk, finding that it increases saving but not to the levels found in the data. De Nardi et al. (2010) extend Palumbo's model to include additional dimensions of heterogeneity and utilize the higher-quality medical spending data available in the AHEAD. They find that, using reasonable preference parameters, a model with these risks can match observed median wealth holdings by age, income quintile, and cohort. Furthermore, even in the absence of bequest motives, the model generates a realistic distribution of bequests, all accidental. Nonetheless, when their model is augmented to allow for intentional bequests, De Nardi et al. (2010) estimate strong bequest motives, especially for the richest, with only modest changes in other parameters. This specification fits the data slightly better than the specification without a bequest motive, but the improvement is not statistically significant. The ability of the model to fit wealth data almost equally well with or without bequest motives embodies the fundamental identification problem in this literature.

To extract additional identifying variation from the wealth data, Kaji et al. (2020) apply recent advances in machine learning. Their adversarial estimator exploits differences in savings across gender, income, and health histories. Kaji et al. (2020) find that among richer households, bequest motivations and precautionary saving against medical expense risk are equally important; among poorer households, bequest motives remain important, but precautionary motives are not.

Pashchenko and Porapakkarm (2020) extract additional identifying variation from saving behavior earlier in the life cycle. They find that even though precautionary and bequest motives produce similar patterns of saving after retirement, they have different implications for the saving of the young. Precautionary motives encourage wealth accumulation at younger ages, but bequest motives do not. The relatively slow wealth accumulation of the young thus suggests a large role for bequests at older ages since precautionary motives alone can match the savings of older households, but only by overstating the savings of the young.

Disaggregating the data more finely, or considering savings over the entire life cycle, yields some evidence that bequest motives are at times important. Nonetheless, the broad message of the literature is that precautionary and bequest motives explain retiree wealth data equally well. This has led many researchers to seek additional identification from other, non-wealth sources.

4.2 Insurance choices

The life-cycle model with longevity and health risk, but without bequest motives, implies a high demand for insurance products such as annuities (insurance against long life) and Long Term Care (LTC) insurance (insurance against poor health). If priced fairly, these products insure against lifespan or medical expense risk much more efficiently than standard assets. For example, using a simple version of the life-cycle model with only lifespan uncertainty, Yaari (1965) shows that people should immediately annuitize all their wealth. However, it is well-documented that U.S. households hold small amounts of annuities and LTC insurance; see Fang (2014) for a recent survey.

Purchases of annuities and LTC insurance reduce wealth left to heirs but insure against medical and longevity risks. The fact that most households do not purchase these products is sometimes taken as evidence that people prefer leaving wealth to heirs, and thus evidence in favor of bequest motives (Lockwood, 2018). The low take-up of annuities and LTC insurance does not imply an absence of precautionary motives, however, but only that there are other considerations leading households to self-insure through savings. For example, households with modest bequest motives may prefer to insure against medical or longevity risks by holding assets that, when not spent, can be left to their heirs (Dynan et al., 2002; Lockwood, 2018). While insurance choices suggest that bequests are not accidental, they may be incidental rather than intentional.

Moreover, there may be other reasons why risk-averse households rarely purchase annuities or LTC insurance. Many studies of the underannuitization puzzle focus on adverse selection: long-lived people are more likely to purchase annuities, driving annuity prices up and pricing out those who do not expect to live so long. Using the mortality risk of those who purchase annuities at age 65, Mitchell and Poterba (1999) show that, for every dollar purchased, annuities pay back 93 cents in expected present discounted value to those who purchase them. If the annuities had been purchased by the general population, the return would have been only 81 cents, showing that the annuity purchasers were longer-lived. But even at observed levels of adverse selection, most reasonably calibrated life-cycle models with only lifespan risk still imply that people should completely annuitize. For example, Lockwood (2012) shows that people would be willing to pay up to 16% of their wealth to access annuity markets with a 10% load. O'Dea and Sturrock (2021) argue, however, that many individuals underestimate their expected lifespans and thus undervalue the returns to annuitization, substantially reducing annuity demand.

Annuity demand may depend not only on longevity risk itself, but also on its interaction with medical expense risk. If medical spending risk increases the need for

liquid assets, it may reduce the desirability of annuities, which tend to be quite illiquid. Davidoff et al. (2005) and Peijnenburg et al. (2017) find that high medical risk early in retirement tends to decrease annuity demand, but high medical risk late in retirement tends to increase it (see also Pang and Warshawsky 2010).[4] Pashchenko (2013) and Lockwood (2012), who employ rich frameworks with medical expense risk, stress the importance of bequest motives in reducing annuity demand. In contrast, Reichling and Smetters (2015) emphasize that a bad health shock simultaneously raises a person's expected (current) medical expenses and lowers their expected lifespan, reducing the value of their annuities and increasing their need for liquid assets. They conclude that once this correlation is accounted for, few households should hold positive amounts of annuities.

Unlike annuities, which pay out benefits as long as the individual remains alive, LTC insurance pays out only when the individual needs expensive LTC services. In principle, the demand for LTC insurance should be large, since this insurance pays out when care needs are high. Furthermore, LTC needs often occur very late in life when other financial resources have been exhausted. However, access to comprehensive LTC insurance is often limited. Fang (2014) reports that the typical LTC insurance contract caps both the maximum number of days covered over the life of the policy and the maximum daily payment for a nursing home stay, a daily payment that is often fixed in nominal terms. Hendren (2013) estimates that 23% of 65-year-olds have health conditions that preclude them from purchasing LTC insurance at all, as the conditions indicate that applicants hold large amounts of private information about their risks. Insurers refuse to underwrite such applicants because the potential for adverse selection is too high.

In addition to issues of adverse selection, suppliers of LTC insurance face the risk that holding private LTC insurance may lead households to switch from informal long-term care provided by family members to formal long-term care. This moral hazard problem not only drives up the cost of LTC insurance, but it makes LTC insurance unappealing to individuals who prefer to be cared for by their relatives (Pauly 1990, Mommaerts 2020). Ko (2022) finds that purchasers of LTC insurance would be, even in the absence of insurance, more likely to utilize formal care.

Middle- and low- income households may view themselves as well-insured against LTC expenses through Medicaid. Because Medicaid is the "payer of last resort", covering only expenses not reimbursed by other insurers, private LTC insurance mostly displaces Medicaid payments among Medicaid recipients. Thus it may be

[4]Relative to standard assets, annuities pay high returns to surviving individuals, in exchange for ceasing payments once they die. This makes annuities an especially effective way to save for large medical expenditures at very old ages.

that Medicaid crowds out private insurance. Brown and Finkelstein (2008) calculate that Medicaid imposes an implicit tax on private insurance of about 65% for the median wealth individual. Braun et al. (2019) likewise find that Medicaid crowd-out explains low LTC insurance holdings among poorer households, although adverse selection and administrative costs are more important in explaining low take-up among the rich.

The extent to which retirees run down their wealth to qualify for Medicaid and other means-tested benefits may tell us something about the value retirees place on these benefits. If people view Medicaid-funded care as being of low quality (i.e., they have "public care aversion" (Ameriks et al., 2011, 2018)), they will maintain high asset levels to avoid it, even though it is free. Thus public care aversion strengthens precautionary savings motives. De Nardi et al. (2016a) match Medicaid recipiency rates in addition to asset holdings. Because Medicaid reduces exposure to medical spending risk, matching Medicaid recipiency helps identify the extent to which households have precautionary motives related to uncertain medical spending. Most low-income individuals receive Medicaid, suggesting that they are not particularly averse to this insurance and face limited medical spending risk.[5] To match observed asset holdings in this environment, the model attributes a significant part of savings to bequest motives.

Home equity may also substitute for LTC insurance (see Davidoff (2010) and Achou (2021) for conflicting results) and for annuities as well (Poterba et al., 2011). Indeed, it has been shown that health shocks and loss of a spouse are associated with housing wealth decumulation (Poterba et al. 2011). This point reinforces a recurrent theme: assets can simultaneously serve many purposes and can be used for many contingencies.

Another well-known insurance product is life insurance. Because (term) life insurance pays out only when its holder dies, individuals should purchase it only if they have bequest motives. In contrast to annuities and LTC insurance, life insurance is widely held; this has been taken as evidence for bequest motives (Inkmann and Michaelides, 2012; Hong and Ríos-Rull, 2012).

The limited use of reverse mortgages may also provide clues as to which saving motives are present. Reverse mortgages allow homeowners to liquidate their home equity while continuing to reside in their own house. In principle such a service should be appealing to retirees wishing to stay in their own homes. The low use of reverse mortgages may therefore suggest the presence of other saving motives. Estimating a structural model of saving and housing decisions, Nakajima and Telyukova (2017)

[5]It bears noting that the poorest households enter retirement with neither the wealth nor the income to easily self-insure against LTC expenses.

find that bequest motives, nursing-home risk, house price risk, and loan costs all contribute to the low take-up of reverse mortgages.

Market frictions are also a possibility. Cocco and Lopes (2020) argue that home maintenance requirements eliminate the benefits of reverse mortgages because they block home equity decumulation via foregone repairs. Davidoff et al. (2017) point to low levels of financial literacy. Caplin (2002) finds that older homeowners fail to meet the debt-to-income requirements imposed by lenders.

4.3 Strategic surveys

Perhaps the most direct way to understand why households are saving is to ask them. Ameriks et al. (2011, 2020) consider the responses to "strategic survey questions" that present the respondents with hypothetical, explicit trade-offs between consuming long-term care and leaving bequests. For example, Ameriks et al. (2011) ask survey respondents how they would divide a $100,000 (or $250,000) prize between a "bequest locked box" that would be given to the respondents' heirs when they died and an "LTC locked box" that could be accessed only to pay for long-term care. Requiring the life-cycle model to match the respondents' choices provides additional identifying variation than can pin down the relative importance of the competing motivations. Their results suggest that for many older individuals precautionary motives are at least as important as bequest motives.

4.4 Variation across countries and time

The approaches we have discussed to this point use within-country cross sectional variation. An alternative strand of research exploits variation in the generosity of public programs across countries or over time.

Although most countries have universal public health insurance programs for the elderly, including the U.S. Medicare program, there is considerable cross-country variation in the coverage of long-term care. Cross-country comparisons exploit this variation but require researchers to control for the other, non-medical spending, ways in which countries differ.

Cross-country evidence supports the view that the precautionary savings motive is important. Nakajima and Telyukova (2022) show that institutional differences in health insurance generosity can explain a third of the difference in median wealth decumulation between Sweden and the U.S. by age 85. Similarly, Banks et al. (2019) argue that differences in the level and risk of out-of-pocket medical expenses between the UK and the U.S. rationalize the additional deferred consumption spending, and

continued saving, of older U.S. households.

Lee and Tan (2019) examine changes in Social Security generosity over time. They find that the Social Security Notch, an unanticipated increase in Social Security benefits, led to significantly higher bequests, which they interpret as evidence in favor of a robust bequest motive.

4.5 Bequests and children

If bequest motives are mostly due to parents' desire to leave resources to their offspring – as opposed to other relatives, friends or charity – then households without children should have weaker bequest motives. This suggests that differences in the wealth accumulation of those with and without children should be useful for identifying bequest motives.

Hurd (1987) shows that older households with living children decumulate their wealth at roughly the same rate as those without. Such similarities are sometimes taken as evidence against bequest motives. Hurd (1989) estimates a life-cycle model with bequest motives. Assuming that those without children lack bequest motives, he finds bequest motives to be quantitatively unimportant.

Kopczuk and Lupton (2007) estimate a life-cycle model with heterogeneity in bequest motives and find that the presence or absence of children is not important to determining either the existence or the strength of bequest motives. In contrast, Ameriks et al. (2011) find that households with children answer strategic survey questions in a way consistent with stronger bequest motives. Laitner and Juster (1996) find considerable heterogeneity in both the presence of bequest motives and their strength. Their results include evidence that bequest motives are correlated with the number of children.

4.6 Taking stock

A number of recent studies, exploiting different features of the data, suggest that both precautionary and bequest motives are present. However, the relative importance of these motives remains an open question. Papers matching demand for annuities and LTC insurance tend to find stronger bequest motives. Papers utilizing strategic survey questions tend to find a larger role for precautionary motives. The slower decumulation rates of homeowners imply that the desire to remain in one's own home is also important, but the limited use of reverse mortgages suggests that it cannot be the only motive present.

Different motives likely dominate at different points of the income distribution,

reflecting differences in the extent to which each motive behaves as a luxury good. For example, De Nardi et al. (2022) find that precautionary motives are dominant in the middle tercile of the income distribution, while bequest motives play a larger role at the top.

5 Understanding the role of the family

5.1 Couples

As noted in Section 2, asset decumulation patterns of singles and couples are similar, with the key difference being that couples tend to be wealthier. This notwithstanding, the savings of couples have been studied much less than those of singles, even though they face different incentives and risks. Couples may be able to pool both their risks and their wealth, and they may be able to partially self-insure by having the healthier partner care for the sicker one. Conversely, two-person households face the risk of having one person die. While single households likely have lower needs, Braun et al. (2017) show that the death of the husband often leads to a large reduction in the wife's income: widows are much more likely to be impoverished than wives. Saving is an important mechanism for insuring against this risk.

5.2 Informal care

Long-term care is often provided informally by spouses or children, especially in countries with limited public LTC insurance (Barczyk and Kredler, 2019). Informal care may reduce the demand for precautionary saving or formal LTC insurance. However, it may require older households to save to provide bequests (or inter-vivos transfers) to encourage their children to provide care. This raises the possibly that bequest motives are driven less by altruism than by the need to reward informal caregivers (Bernheim et al., 1985). Given that these strategic bequests are meant to secure the provision of care in the event of illness, and are not for altruistic purposes, they share many similarities with precautionary saving. In both cases, households hold wealth late in life to insure against the risk of living long and having high medical needs.

The evidence on the strategic bequest motive is mixed. Brown (2006) finds that among AHEAD households aged 69 and older, 14% receive regular care from their children, while only 1% pay a child for care. Although caregivers receive more end-of-life transfers, the additional transfers are modest. While McGarry and Schoeni (1997) show that in the AHEAD data, financial transfers from living parents to their children

do not favor caregivers, Groneck (2017) provides evidence that written wills reward caregivers with bequests. Structural models with strategic bequest motives (such as Ko 2022, Mommaerts 2020, Barczyk and Kredler 2018, and Barczyk et al. 2022) develop frameworks where altruistic and strategic motives interact. Children may provide care in exchange for inter-vivos transfers or expected bequests, or for purely altruistic reasons. Consistent with the reduced-form evidence, in these estimated models altruism helps drive bequests. In summary, the evidence for an operative strategic bequest motive is modest. To the extent they are intentional, bequests appear to be largely altruistic.

6 Trends in Savings

As the population continues to age, the importance of retiree savings will only increase. Concerns about low and declining savings rates have led some to believe that younger cohorts may be unprepared for retirement (Skinner, 2007). Unfortunately, predicting retirement wealth patterns is not straightforward. It is difficult to know how future generations will accumulate wealth during their working years or how they will draw down this wealth once they retire.

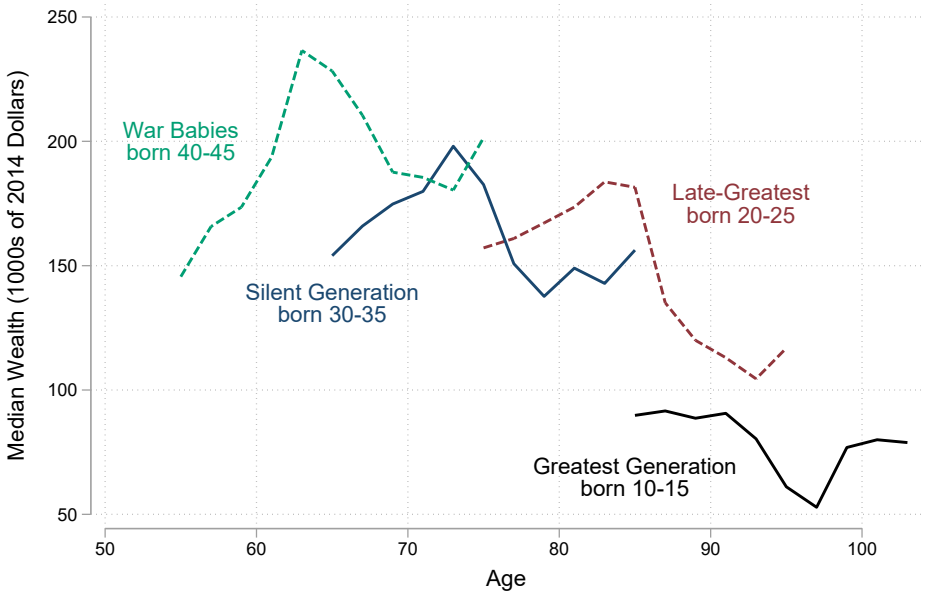


Figure 4: Median Wealth of Successive Cohorts. Authors' calculations from the HRS.

However, recent changes in savings patterns may provide some clues. Figure 4 plots the median wealth of four cohorts between 1998-2018, each born in a different decade, against the average age of the cohort members. Within each cohort, we pool all households of all income levels. Except for the oldest old ("the Greatest Generation"), all of the profiles have similar shapes. Wealth rises between 1998-2006 before falling, reflecting the rise and fall of asset prices around the Great Recession. For those in their 50s and 60s, there is some evidence of wealth accumulation, while there is evidence of decumulation after age 70. These dynamics aside, Figure 4 shows that cohorts born more recently hold more wealth. The trend is particularly stark for the older cohorts.

For cohorts younger than those shown in Figure 4, such as the Millenials, wealth accumulation has stalled and perhaps even fallen. Gale et al. (2021) show that among those aged 55-64 and younger, median wealth has declined since 2007, although mean wealth has remained more or less constant over the same period. (Consistent with our Figure 4, they find that mean and median wealth among older groups have continued to rise.) These patterns are not unique to the US. Using UK data, Crawford and Sturrock (2019) report that even though the very oldest cohorts hold the least wealth at every age, wealth accumulation has stalled among younger cohorts. They attribute much of the slowdown to lower earnings growth. Such findings raise the possibility that younger generations could enter retirement with less wealth than older generations. One trend working in the other direction is the continued rise in employment after age 60. If younger generations work longer, they might retire with at least as much wealth as older ones.

Even after conditioning on wealth at retirement, the saving behavior of retirees may change over time. As Figure 4 shows, trends in household portfolios, particularly related to changes in house prices, will continue to play a pivotal role.[6] It remains to be seen if the ongoing delay in first-time home-buying will ultimately lead to a reduction in home equity or total wealth at retirement (Gale et al., 2021). On the other hand, a continued run-up in house prices may leave a greater fraction of retiree wealth locked up in illiquid housing, although this might be attenuated by increased home equity extraction through channels such as reverse mortgages or downsizing (McGee, 2022).

Savings may also change in response to changes in health, longevity and medical spending. Figure 5 presents life expectancy at age 65 from 1950 to present. Over much of this period life expectancy has risen linearly, increasing by 5.7 years between

[6]On average, portfolios have also become riskier due to increased participation in defined contribution pensions and mutual funds (Guiso and Sodini, 2013). However, Kuhn et al. (2020) document that these effects mostly accrue to the top 10%, while housing is "the asset of the bottom 90%".

1950 and 2019. Covid-19 has undone 15 years of this growth, although perhaps only temporarily. It remains unclear how Covid-19 and other health trends, such the rapid growth of obesity or the rise in "deaths of despair" documented by Case and Deaton (2017, 2021), will impact retirees' lifespans or the ages at which they stop working. Changes along either dimension will affect the number of years that retirees need to fund.

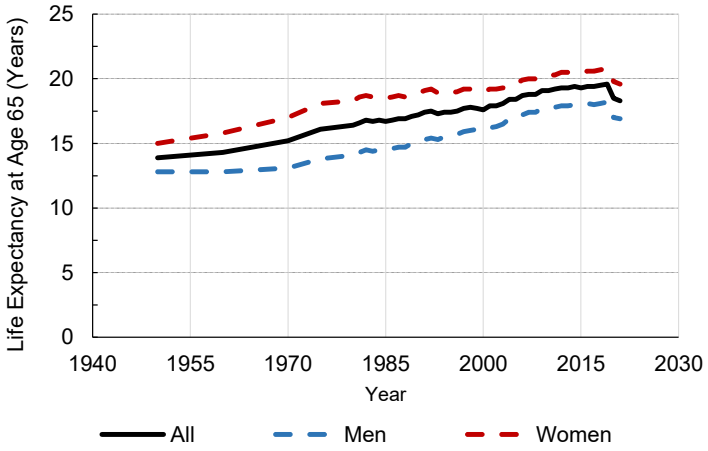


Figure 5: Life Expectancy at Age 65, United States, 1950-2021. Compiled from National Center for Health Statistics (2011, Table 22), National Center for Health Statistics (2017, Table 15), Arias et al. (2019, Table A), Arias and Xu (2018, 2019, 2020, 2022a,b, Table A) Arias et al. (2022). 2021 estimates are provisional.

Changes in lifespan might be accompanied by changes in medical spending that impact the need to save. The effects of longer lifespans on medical spending should be modest if the additional years are spent in good health. The extent to which such a happy outcome is likely is a matter of some debate. Projecting growth in medical spending is always a fraught exercise, as it depends not only on trends in health but on the creation and adoption of new medical technologies (Chandra et al., 2013). Given that households care mostly about the expenses paid out of pocket, changes in the generosity of health insurance will also be important. Ongoing expansions in coverage have held down out-of-pocket spending: between 1990 and 2020, even as per capita medical spending rose by 113%, out-of-pocket spending rose by only 13%. Among those 65 and older, between 2002 and 2014 (when data are available), per capita out-of-pocket spending fell by 5%, even as total spending increased by 7%.[7]

[7]National Health Expenditure Accounts (NHEA) data. Data for all ages come from the main

Lifespans and medical expenditures will likely continue to rise (see, e.g., Social Security Administration 2022, or Centers for Medicare and Medicaid Services 2022a). These and other trends raise the risk that government programs such as Social Security and Medicare will have to be scaled back. To the extent they are not offset by longer careers or increased pre-retirement savings, reduced benefits and higher out-of-pocket expenses should increase the need for saving among retirees.

7 Implications, and Conclusions

Nearly 40% of total non-pension wealth in the United States is held by households whose heads are 65 or older (Bhutta et al., 2020), a fraction that will almost surely continue to grow. This wealth is one of the principal resources used to fund retiree consumption, along with private pensions and Social Security. Among households with above-median lifetime income wealth is the largest resource (Scholz et al., 2006).

A large body of work has shown that retirees run down their wealth much more slowly than implied by a basic life-cycle model with no bequest motive and a known date of death. The literature suggests that uncertainty in the length of life and medical spending, along with bequest motives, are important to understanding the slow decumulation of retirement wealth. Homeownership is almost surely important as well. The relative importance of these motives is still an open question, however. Answering this question should remain a research priority, because the consequences of policy reforms hinge on the relative strengths of the saving motives. To give just one example, it has been long understood that if households do not face risk and do not possess altruistic bequest motives, an unfunded Social Security system crowds out private savings, reduces the aggregate capital stock, and likely reduces welfare (Diamond, 1965). However, altruistic bequest motives can undo many of these distortions (Barro, 1974). Moreover, precautionary motives allow Social Security to have insurance value and in some cases even improve welfare (Harenberg and Ludwig, 2019).[8]

We expect the life-cycle model to remain essential to answering these questions. The life-cycle framework has been one of the great successes in economics, shaping our understanding of issues ranging from aggregate saving to the distributional effects of Medicaid. Furthermore, the theory, in its simplest form, has stark testable impli-

tables (Centers for Medicare and Medicaid Services, 2022c, Tables 1 and 6), and data for older individuals come from the Age and Gender tables (Centers for Medicare and Medicaid Services, 2022b, Table 7). All values deflated by CPI.

[8]Like many analyses of Social Security, Diamond (1965), Barro (1974) and (Harenberg and Ludwig, 2019) abstract away from housing.

cations. That some of these implications have been falsified only shows the model's power. We hope that future cohorts of economists will confront the model's shortcomings, bringing new data and theory, in order to better understand the retirement savings puzzle.

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