Journal of Public Economics 162 (2018) 78–88

Contents lists available at ScienceDirect

Journal of Public Economics

journal homepage: www.elsevier.com/locate/jpube

Longitudinal determinants of end-of-life wealth inequality

James Poterba [a,*], Steven Venti [b], David A. Wise [c]

[a] MIT and NBER, United States
[b] Dartmouth and NBER, United States
[c] Harvard and NBER, United States

ARTICLE INFO

Article history:
Received 3 September 2017
Received in revised form 16 April 2018
Accepted 17 April 2018
Available online 4 May 2018

Keywords:
Retirement wealth
Lifecycle saving
Social Security
Precautionary saving
Health and wealth

ABSTRACT

Inequality in wealth among elderly households, and in particular the prevalence of very low wealth holdings, can be an important consideration in the design of social insurance programs. This paper examines the incidence and determinants of low levels of financial and total wealth using repeated cross-sections of the Health and Retirement Study (HRS) and a small longitudinal sample of HRS respondents observed both at age 65 and shortly before death. Most of those who report very low wealth holdings at the end of their life had little wealth at the traditional retirement age of 65. There is strong persistence over time in reports of very low wealth, and more generally relatively little evidence that wealth is drawn down in the first 15 years of retirement. The age-specific probability of reporting low wealth increases slowly after age 65. Low lifetime earnings are strongly predictive of low wealth at retirement and at the end of life. The post-retirement onset of a major medical condition, and, for married women, the loss of their spouse, are both associated with small increases in the probability of reporting very low wealth, but they account for a small fraction of low-wealth outcomes. Low levels of wealth accumulation before age 65, rather than gaps in the safety net after 65 or rapid spend-down of accumulated assets, appear to be the primary determinant of low levels of wealth just before death.

Atkinson (1971) explores how lifecycle considerations and intergenerational transfers interact to determine the observed wealth distribution at different ages. Dispersion in the first few decades of adult life reflects earnings variation as well as differences in the receipt of bequests and *inter vivos* transfers. Later in life, the rate of return on investments, the length of an individual's work life and, more generally, the cumulative level of lifetime earnings and random shocks such as out-of-pocket medical expenses contribute to the dispersion of wealth.

The distribution of wealth is an important input in the design of social insurance programs. The fraction of individuals with low wealth holdings late in life is particularly relevant for the analysis of Social Security and public health insurance programs, because such individuals may have limited access to capital markets and therefore be heavily dependent upon the state for both retirement income and protection against health and other outlay shocks. Several previous studies, including Gustman et al. (2014) and Poterba et al. (hereafter PVW) (2011), have compiled data on the wealth distribution at traditional retirement age and at older ages. A substantial fraction of elderly households reports low wealth. Among households headed by someone 65–69 in 2008, Poterba et al. (2011) find that 30% had net non-annuitized wealth of less than $72,000, and the same fraction had net financial assets of less than $2000. Absent other resources from family or government, such individuals would struggle to respond to financial shocks such as those associated with out-of-pocket medical spending.

The observation that a significant number of individuals have very low wealth levels late in life raises the question of how they reached this position. There are two broad explanations. One is that these individuals reached retirement with substantial saving, but drew down their resources rapidly, perhaps in response to unexpectedly large expenditure shocks. There is a large literature, summarized for example by DeNardi et al. (2016), on the rate at which retirees draw down their wealth. If some spend at a high rate, they could become low-wealth elderly in late life. This could either be due to high levels of consumption, or to gaps in the social safety net that leave the elderly exposed to expenditure shocks such as out-of-pocket spending for some types of medical care. Another factor that we will not explore is that some live to a very old age and deplete their assets without rapid spend down but as a result of many years of modest spending.

The second broad explanation of low wealth in late life is that individuals never accumulated very much wealth, and therefore reach late life with little wealth because they had low wealth at, and after, retirement. Understanding the relative importance of these alternative explanations for the lower tail of the wealth distribution is central for analyzing the impact of social safety net programs targeted to the elderly, and more generally for assessing the effect of changes in

* Corresponding author.
E-mail address: poterba@mit.edu (J. Poterba).

https://doi.org/10.1016/j.jpubeco.2018.04.008

programs such as Social Security, Medicare, and Supplemental Security Income (SSI).

A number of previous studies have addressed the determinants of low wealth in late life. The most closely related study is PVW (2017a), which examines the relationship between household wealth when an individual is first surveyed in the Health and Retirement Study (HRS), typically while in their 50s, and household wealth just prior to death. That study finds that low saving is the primary driver of low late-life wealth. It focuses on an initial wealth observation that could be as much as a decade prior to retirement, so it may not accurately reflect wealth at retirement for households that saved aggressively in their last years of work.

This paper compares net worth and financial assets of HRS respondents at age 65, a common age of retirement, with these assets just before death. It relies primarily on longitudinal data, and yields results on wealth persistence and the importance of pre-retirement accumulation that are broadly consistent with earlier results using repeated cross-sections as well as longitudinal data. It also provides new evidence on the role of educational attainment, lifetime earnings, adverse health shocks after retirement, and the death of a spouse[1] on the likelihood of reporting low wealth in late life. While substantial prior literatures have examined the effects of each of these factors on retirement wealth, this paper considers their roles in pushing individuals into the lower tail of the wealth distribution. These factors might be less important in the left tail of the distribution than at higher wealth levels.

A number of studies have documented negative cross-sectional associations between poor heath and wealth, and negative correlations in panel data between changes in health and changes in financial status.[2] For example, Smith (2005) finds, in the first five waves of the HRS, that households headed by individuals between the ages of 51 to 61 in 1992 exhibit a drop of roughly $40,000 ($2000) in wealth following a major health event. Lee and Kim (2008) study the older AHEAD cohort (age 70 and older in 1993) and find that new health conditions are associated with substantial asset depletion, particularly among older individuals. PVW (2017b) find that HRS respondents in better health in 1994 accumulated substantially more wealth by 2010 than did those with similar wealth, but poorer health, in 1994. Kelley et al. (2015) estimate the costs associated with different health conditions in the last five years of life. They report mean out-of-pocket spending of $61,522 ($2010) for those diagnosed with dementia, $35,294 for heart disease, and $28,818 for cancer. They do not explore how these outlays translate into changes in wealth, or ask how often they push those experience health care costs to very low wealth levels.

None of these studies explores the links between health shocks and the probability of reporting very low wealth holdings; that our focus. By using a longer span of HRS data than most previous studies, we are able to track a substantial set of HRS respondents from age 65 until death. We observe the complete post-65 wealth trajectory for these individuals. We also explore the links between education, lifetime earnings, and wealth at both retirement and the end of life, and provide new evidence on the determinants of late-life wealth levels.

Our analysis consists of four sections. Section 1 summarizes total wealth and financial asset holdings at age 65 and at the end of life. Section 2 compares wealth at retirement and at death using both repeated cross sections and longitudinal data and presents new evidence on the slope of the age-wealth profile for HRS respondents. Section 3 considers the impact of health shocks and spousal death on the post-retirement wealth trajectory. There is a brief conclusion.

[1] Studies that find that spousal death is associated with lower wealth include Sevak et al. (2003), Johnson et al. (2005), and Coile and Milligan (2009). De Nardi et al. (2015) find that spousal deaths are associated with a $30–60,000 reduction in wealth ($2005) in the AHEAD cohort, the oldest members of the HRS sample.

[2] Studies that find that health declines are correlated with wealth declines include Smith (1999, 2004), Levy (2002), Wu (2003), Coile and Milligan (2009), Cook et al. (2010), and Wallace et al. (2014).

1. The distribution of end of life wealth

Alvaredo et al. (2016) review the primary sources of information on wealth holdings for all the but very richest households. These are administrative (tax) data on estates at death, which can be used to estimate the wealth of the living by applying (the inverse of) mortality multipliers differentiated by age, sex and wealth class; administrative data such as tax data on investment income, which can be "grossed up" to estimate the associated wealth distribution; and household surveys, like the HRS. Tax evasion and avoidance can make the first two sources problematic, while low response rates and under-reporting of wealth at the top of the distribution can make surveys unrepresentative. The HRS response rate, between 81 and 91%, is unusually high for a household survey. As with most large cross-section surveys, the assets of the very wealthy tend to be underreported.[3] This is not a major concern for the analysis of low wealth holdings among the poorest elderly.

The HRS data have many strengths but they also suffer from several limitations. First, the HRS samples each respondent at two-year intervals. With respect to end-of-life wealth measures, if a respondent dies just after completing an interview, the last recorded wealth value is a timely estimate of wealth in the last weeks of life. For those who die many months after their last survey, however, wealth balances "at the end of life" are measured with error. Because expenditures associated with declining health are often substantial in the last few months of life, the reported balances in the last interview before death are likely to overestimate wealth at the time of death.[4] Second, there are data outliers. Some may be accurate, but others may be the result of misreporting. To minimize their impact, we exclude records for 153 persons reporting more than $10,000,000 or less than −$1,000,000 of total wealth. We also focus much of our analysis on the probability that respondents report wealth below a threshold value. Measurement errors that do not move respondents across this threshold will not affect our findings.

The HRS is a longitudinal survey that currently includes five cohorts defined by the year in which respondents are first surveyed. The original HRS cohort surveyed respondents between the ages of 51 and 61 in 1992 and the Asset and Health Dynamics of the Older Old (AHEAD) cohort surveyed respondents aged 70 and older in 1993. Subsequent cohorts include the War Babies (WB) cohort, first surveyed in 1998 when respondents were between the ages of 51 and 56, the Children of Depression (CODA) cohort first surveyed in 1998 when respondents were between the ages of 68 and 74, and the Early Baby Boomers (EBB) cohort that includes respondents aged 51 to 56 in 2004. All cohorts were surveyed every second year through 2012.[5]

Our primary sample includes HRS respondents from all cohorts who are known to have died and who were at least 65 years old in the last survey wave prior to their death. Of the 33,316 individuals who were alive in the HRS at some point between 1996 and 2012, 9215 died during this sample period. Of them, 7848 were age 65 or older at death. For some purposes, we also analyze a much smaller set of 1073 married respondents who were observed at age 65, the date we consider traditional retirement, and who also died during our 16-year sample period. We refer to this as our "longitudinal sample" because it allows us to track the full evolution of wealth and financial assets from age 65 to death.

[3] See HRS (2017) for response rates. Estimates of wealth from the HRS compare quite favorably to measures obtained from the Survey of Consumer Finances (SCF) that is widely believed to be the survey containing the highest quality wealth data. Estimates of wealth from the two surveys are very similar for the bottom 95% of the wealth distribution, but differ quite dramatically for the top 5%. See Bosworth and Smart (2009).

[4] The HRS conducts "exit interviews" with surviving relatives of deceased participants. These interviews contain some information on medical expenditure and asset drawdown in the interval between the last survey interview and death. We do not use the exit interview data because they are incomplete and would limit the sample size.

[5] We do not use data from the first two waves of the original HRS cohort (1992 and 1994) and the first wave of the AHEAD cohort (1993) because data on key health variables are incomplete.

We define wealth as the sum of home equity, the net value of other real estate, business assets, and net financial assets. We convert asset balances to $2012 using the CPI-U, and measure them net of outstanding liabilities; both wealth and net financial assets can be negative. Financial assets include IRA and Keogh balances, as well as 401(k) and other defined contribution balances associated with the respondent's current job.[6] Balances in accounts sponsored by previous employers are not included.[7] Our unit of observation is the individual, but for those who are married, we associate household wealth with each member of the couple. It can be difficult to assign ownership of assets, such as housing or jointly held financial assets, to specific household members.

For some tabulations, we stratify results by the distribution of household lifetime earnings at age 65. The sub-sample used to produce these results includes the roughly two-thirds of HRS respondents who approved linking their survey responses to earnings and benefit histories from the Social Security Administration.[8]

1.1. The prevalence of low wealth in late life

The upper panel of Fig. 1 shows the cumulative distribution of total wealth ($000 s) and of financial assets ($000 s) from the last survey wave prior to death for the 7848 HRS respondents over the age of 65 who died during our sample period. The figure shows the distribution for individuals, both married and single, with balances between -$50,000 and $1,000,000. We excluded 554 respondents with wealth values outside this range. Among those who died, the median wealth when last observed was $115,000 ($2012). More than three-quarters of respondents had financial assets less than that value. Four percent (including persons with balances less than −$50,000) had negative net worth, and 7% reported net worth of zero. About 8% of those who died were in households with negative financial assets, inclusive of 401(k) and IRA balances; 14% reported a zero balance. The median financial asset balance was $18,500. Most decedents were in households with relatively limited financial assets.

The lower panel focuses on the 1073 married individuals who are in the longitudinal sample. The distribution is similar to that in the upper panel, but the respondents in the longitudinal sample have somewhat higher wealth at most quantile rankings. This is largely because the longitudinal sample is limited to married individuals, and married individuals on average have more wealth than elderly singles.

Defining "low wealth" as wealth below $100,000 would include roughly half of the decedents in our sample. Somewhat arbitrarily, we use two definitions of "low wealth": wealth less than $100,000 and less than $50,000. We also consider two measures of low financial assets: less than $50,000 and less than $25,000. In our full sample, 46.5 (33.8) percent of decedents fell below the $100,000 ($50,000) total wealth threshold.

The low level of wealth for many households in their later years is not unique to the United States. Atkinson and Sutherland (1993) report

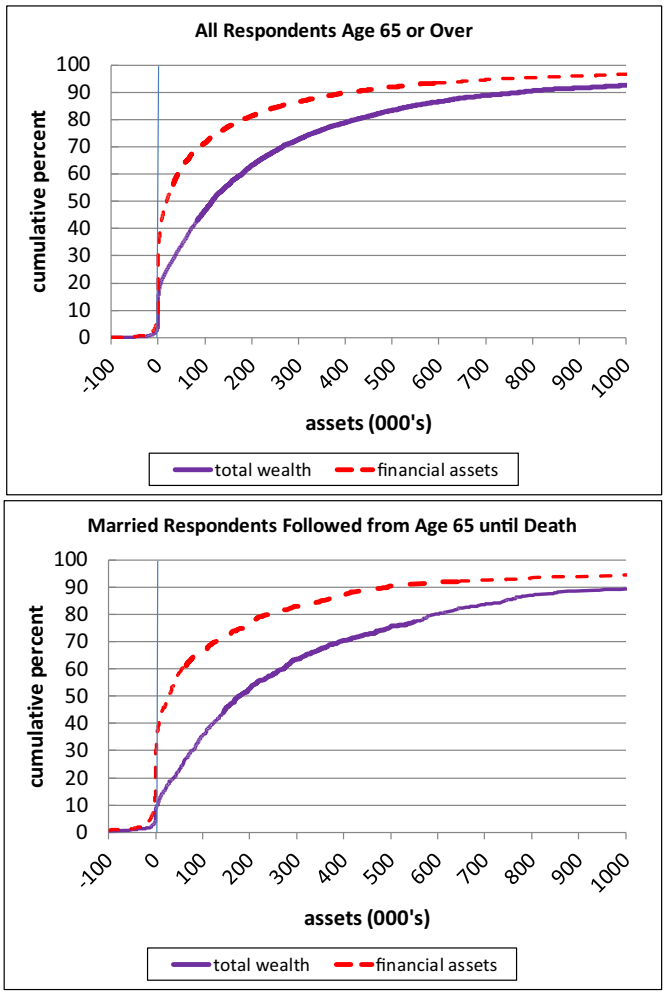

Fig. 1. Cumulative distribution of total wealth and financial assets at death for all respondents and for respondents in longitudinal sample. Notes: Data are from the 1996 to 2012 waves of the HRS. All dollar amounts have been converted to 2012 dollars using the CPI-U. See text for additional details.

that in the U.K., a substantial fraction of elderly households has little wealth and no private retirement support, and are therefore depends primarily on public support.

1.2. The evolution of wealth at older ages

The rate at which households draw down their wealth after retirement has long been an active research question. Particular attention for public policy purposes focuses on whether some individuals draw down their wealth rapidly after retirement, reaching old age with very limited wealth holdings. Fig. 2 plots the three-year moving average of the age-specific wealth of all HRS respondents (upper panel) and the married respondents who constitute the longitudinal sample. The figure shows average household wealth, in $2012, of all HRS individuals of a given age in any year of our data sample. The figures show the mean level of wealth, which is sensitive to the top wealth households, and the 25th, 50th and 75th quantiles. The slope of the profiles reflects both age and cohort effects, since those who older are, on average, from cohorts that were born earlier and had less lifetime income than their younger counterparts.

The upper panel suggests gradual wealth decline, perhaps with slight acceleration in the decline as respondents age. Mean wealth declines by more than $100,000 between ages 65 and 75, but the rate of decline in wealth is much slower than the rate of decline in remaining

[6] The AHEAD survey did not collect 401(k) balances. Its respondents were unlikely to have participated in 401(k) plans, which were first authorized in 1982 but did not become widespread until the late 1980s. They were unavailable to most members of the AHEAD cohort who were age 70 or older in 1993.

[7] We are unable to use data for 2012 for plans sponsored by former employers. Tabulations based on data for earlier years suggest that assets at defined contribution plans associated with previous jobs are a significant component of wealth for some households. The average current-job DC balance for all HRS respondents in 2010 was $32,057, compared with $40,379 when past jobs are included. For those over the age of 65, the respective values were $8,357 and $23,963.

[8] Earnings data for 1992 through 2012 are available bi-annually for each respondent in the core HRS survey, and we impute earnings for the years between the HRS waves by taking the average of adjacent years. Our measure of lifetime earnings is the sum of annual earnings (converted to 2012 dollars using the CPI-U) through age 65. We use lifetime earnings as an indicator of the capacity to save. One shortcoming of our measure of lifetime earnings is that some respondents were not covered by the Social Security system and thus their earnings are not recorded in the linked records. A second problem is that earnings are only reported up to the Social Security earnings cap.

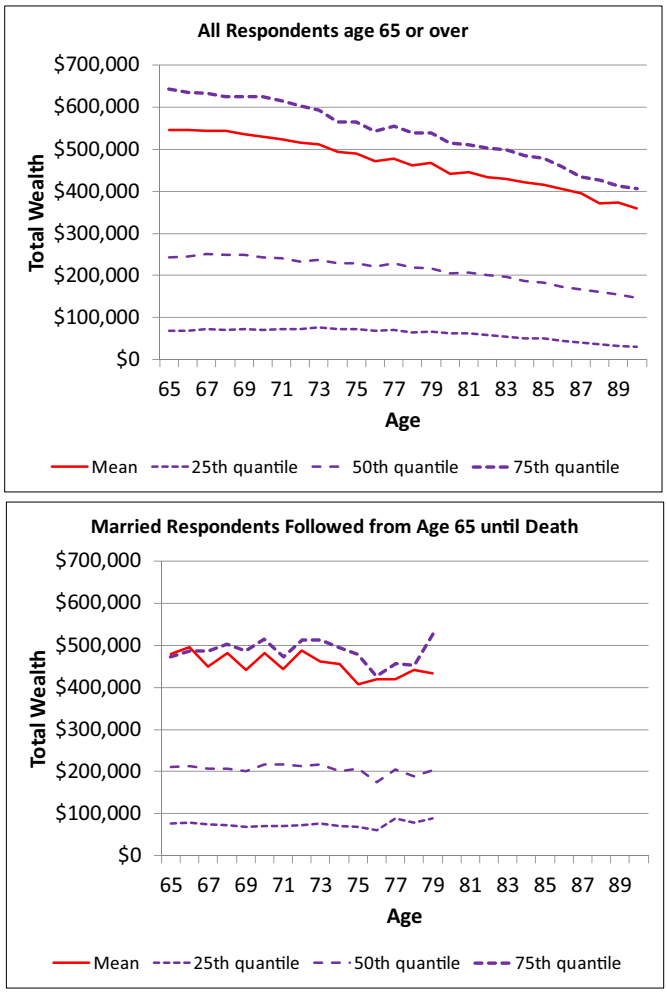

Fig. 2. Age profile of total wealth for all respondents and for respondents in longitudinal sample. Notes: Data are from the 1996 to 2012 waves of the HRS. All dollar amounts have been converted to 2012 dollars using the CPI-U. See text for additional details.

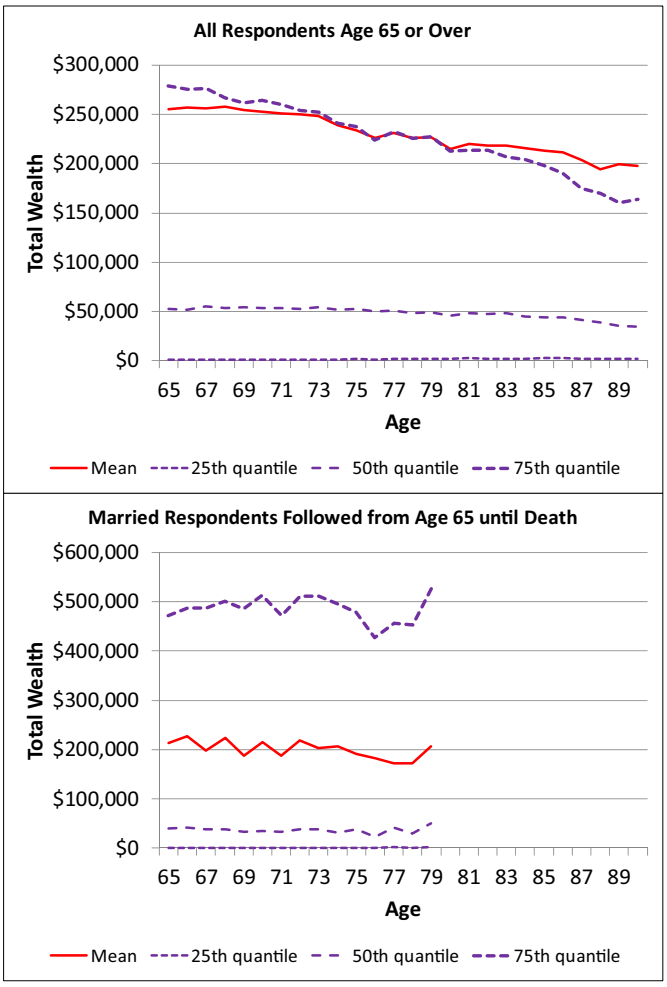

Fig. 3. Age profile of financial assets for all respondents and for respondents in longitudinal sample. Notes: Data are from the 1996 to 2012 waves of the HRS. All dollar amounts have been converted to 2012 dollars using the CPI-U. See text for additional details.

life expectancy. The absolute rate of decline is greatest for the mean and 75th percentile wealth holdings. For example, the mean ratio (wealth at 80/wealth at 65) is 0.81. This value is 0.80 at the 75th percentile, 0.84 at the 50th, and 0.92 at the 25th percentile of the wealth distribution. Fig. 2 suggests relatively modest wealth decline at each point in the distribution that we consider. Second, there is a substantial group of individuals – at least those up to the 25th percentile – who have very low wealth holdings throughout the retirement period.

The second panel in Fig. 2 shows wealth holdings for the individuals followed from age 65 to death. There is a notable difference between upper and lower panels: there is almost no downward slope for individuals in the lower panel. This is true for the mean and for all of the quantiles we consider. This raises the possibility that a mixture of cohort and age effects in the figure confounds estimating the age pattern of draw-down.

One factor that may confound the wealth-age profiles is housing equity. Previous studies, such as Venti and Wise (2004), have found that older households are slow to move from the homes that they have lived in for many years, and that they are also reluctant to tap the equity in their homes to support other consumption. It is therefore possible that the age-financial assets profile might differ from the age-wealth profile, particularly given the importance of housing equity in the portfolios of older households.

Fig. 3 addresses this issue. The upper panel shows the average financial assets of HRS respondents of each age, and the lower panel presents comparable information for the "longitudinal" sample of married individuals who die during the sample period. The results are very similar to those in Fig. 2: for the full HRS sample, there is a clear negative slope to the age-financial assets profile for the median and the 75th percentile financial asset value. The lower quantiles are much more stable across ages. For the longitudinal sample, there is very little change between age 65 and age 79 in the level of financial assets. These results also suggest that the negatively-sloped age-wealth profile from the simple tabulations may be spurious.

In a well-known study of age effects on portfolio holdings, Ameriks and Zeldes (2004) explain that in a linear model, age, cohort, and time effects are collinear. It is not possible to recover all three without imposing prior assumptions. To summarize the information in Figs. 2 and 3, we set all cohort effects to zero, and estimate a descriptive model for real ($2012) wealth of person i in year t:

$$W_{i,t} = \alpha_i + \sum_{s=1996}^{2012} \beta_s * I_{t=s} + \sum_{k=65}^{90} \gamma_k * I_{age(i,t)=k} + \varepsilon_{i,t}. \quad (1)$$

in this equation the $\{\beta_s\}$ coefficients are time (or wave) effects for each HRS survey wave, and the $\{\gamma_k\}$ coefficients describe the age-wealth profile.[9] The parameter α_i represents the wealth at age 65 of an individual in 1994.

[9] Respondents are surveyed approximately every two years. Thus, to capture all persons who pass through the traditional retirement age of 65, we include persons at either age 65 or age 66. This convention is maintained for all subsequent calculations labeled "at age 65." The "wave effects" are measured every other year.

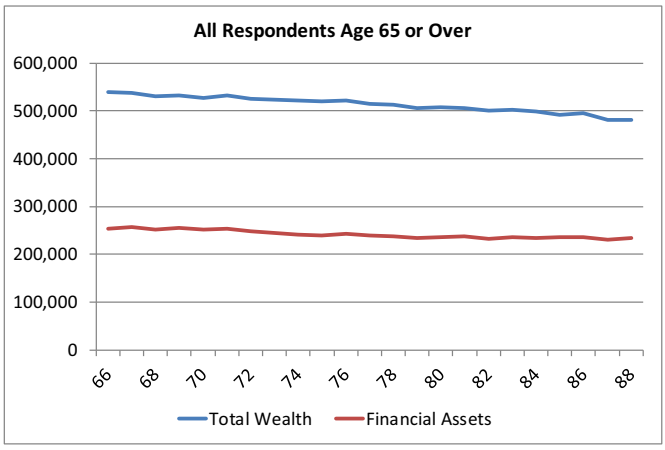

Fig. 4. Age profile of wealth and financial assets after removing time- and person-effects, for all respondents. Notes: Data are from the 1996 to 2012 waves of the HRS. All dollar amounts have been converted to 2012 dollars using the CPI-U. See text for additional details.

Fig. 4 shows the three-year moving average of the estimated age coefficients (γ_i) from Eq. (1) for specifications in which total wealth and financial assets are the dependent variable. The age-wealth profile for total wealth shows some decline with age, but the decline is much more gradual than for the full sample age-wealth profile in Fig. 2. The decline in average wealth between ages 65 and 88 in Fig. 4 is about one quarter the decline in Fig. 2. For financial assets, the wealth decline in Fig. 4 is much less pronounced than that in Fig. 3. This suggests that part of the declining age-wealth profile in simple HRS tabulations is due to time effects that confound the age profile. This factor appears to dominate the countervailing effect of dynamic sample selection: individuals in higher socio-economic strata live longer on average, so the survivors at older ages is disproportionately drawn from higher wealth individuals. This would lead to a positive bias between age and the measured wealth effects, since the lower wealth members of a given birth cohort would be likely to die at younger ages, imparting a positive bias to the slope of the age-wealth profile.

Our findings provide new evidence on the decades-long debate about the extent to which the accumulation and draw-down pattern suggested by simple life cycle models can characterize observed age-wealth profiles. The finding of relatively slow drawdown of total wealth – from an average of about $550,000 at age 65 to less than $500,000 by age 88 – is consistent with models in which retirees are husbanding their resources for potential late-life expenses than with models in which they are drawing down assets as soon as they reach retirement age. It supports a number of earlier studies, including Blundell et al. (2016), DeNardi et al. (2016), and Love et al. (2009), that find relatively slow draw-down of wealth after retirement. These results underscore the importance of including bequest motives, precautionary saving motivated by stochastic late-life expenditure needs, or other factors that can rationalize the slow draw-down of wealth in models that explain post-retirement wealth dynamics.

1.3. Determinants of wealth at retirement

The relatively modest age-related changes in wealth that the foregoing figures exhibit suggest that the distribution of wealth near the end of life may be largely determined by wealth at age 65. We now turn to its determinants.

Table 1a reports the fraction of individuals in households with total wealth below either $25,000 or $100,000 at age 65, and it summarizes how the probability of falling in these low wealth categories varies with lifetime earnings and education. Among married 65-year olds, 9.3 (22.4) percent have household wealth less than $25,000 ($100,000). The fractions of single persons below each threshold are greater, 39% and 57.5% respectively. The wealth a household has accumulated by age 65 depends on its lifetime labor income as well as decisions about how much to save and how that saving was invested, which affects the rate of return it has earned.

Table 1a stratifies the age-65 population in three ways: by education, by the presence or absence of a pre-retirement health condition, and by lifetime earnings quintile. Each of these factors may affect retirement wealth. Regardless of whether low wealth as defined using the $25,000 or $100,000 threshold, the variation across range across levels of education is similar to the range across lifetime earnings quintiles. For example, using the $25,000 threshold for married persons, about 23% of those in the lowest education group and 3% of those in the highest fall into this "low wealth" category. The pattern is similar for singles.

Table 1b presents tabulations similar to those in Table 1a, but for financial assets. Single individuals have, on average, less wealth and fewer financial assets than those in married couples. Nearly 57% of single persons have household financial assets less than $10,000 at age 65, compared with 28.8% of individuals in married couples. Similarly, 68.2% of singles have less than $50,000 of financial assets, compared with 44.5% for married individuals.

Table 1b shows that the percentage of persons with low financial assets varies dramatically by lifetime earnings quintile and by level of education. Using the $10,000 threshold, married persons in the lowest education group are 7.5 times more likely to have low financial assets

Table 1a
Percent with wealth less than $25,000 and $100,000 for persons age 65, by lifetime earnings quintile, level of education, whether person ever experienced a major health condition, and marital status.

Lifetime earnings quintile	Less than HS	GED or HS graduate	Some college	College or more	Ever experience a major health condition?		All
					No	Yes	
Married persons							
	% with wealth less than $25,000						
1	36.6	16.3	16.6	**9.9**	**19.5**	**27.7**	22.7
2	13.8	12.8	14.8	7.0	**9.6**	**17.7**	12.5
3	12.7	5.3	2.8	**2.6**	4.9	5.9	5.3
4	6.0	3.2	2.0	1.4	1.5	4.6	2.6
5	33.2	3.2	4.0	**1.0**	2.4	4.3	3.1
all	22.8	8.0	7.1	**3.3**	**7.6**	**12.0**	9.3
	% with wealth less than $100,000						
1	67.0	40.3	35.4	**14.0**	**39.6**	**53.5**	45.0
2	48.2	37.1	28.0	**10.7**	**28.2**	**44.3**	33.9
3	37.1	18.1	13.0	**6.7**	15.8	20.6	17.6
4	14.8	11.0	8.3	4.0	6.7	12.3	8.7
5	41.2	9.8	7.2	**3.2**	**4.4**	**11.0**	7.0
all	50.9	23.0	16.4	**6.4**	**19.0**	**28.2**	22.4
Single persons							
	% with wealth less than $25,000						
1	78.4	62.5	45.3	**33.3**	**59.1**	**75.5**	66.8
2	65.0	53.5	53.8	**14.3**	50.6	53.6	52.0
3	71.8	28.5	27.5	**11.7**	**23.1**	**54.7**	34.1
4	33.9	26.1	36.0	13.2	22.3	34.2	27.4
5	6.0	29.6	5.3	1.8	16.6	9.1	14.4
all	67.4	37.6	33.1	**11.2**	**32.8**	**48.3**	39.0
	% with wealth less than $100,000						
1	90.1	88.8	77.5	**33.3**	77.2	90.6	83.5
2	89.9	67.9	75.8	**34.0**	65.7	79.4	72.0
3	88.3	60.3	55.8	**27.9**	**46.0**	**82.6**	58.7
4	88.0	53.3	41.6	**24.9**	**40.7**	**55.7**	47.1
5	20.4	41.2	21.5	8.4	24.7	28.0	25.7
all	86.6	59.6	51.6	**22.3**	**49.1**	**70.1**	57.5

Notes: Data are from the 1996 to 2012 waves of the HRS. Major health conditions are cancer, heart disease, lung disease and stroke. All dollar amounts (and the total wealth thresholds) have been converted to 2012 dollars using the CPI-U. See text for details on the construction of lifetime earnings. For results by level of education, estimates in bold indicate the difference between the first (less than HS) and fourth (college or more) columns is statistically different from zero at the 5% level. For results by health condition, estimated in bold indicate that the difference between the "No" and "Yes" columns is statistically different from zero at the 5% level.

Table 1b
Percent with financial assets less than $10,000 and $50,000 for persons age 65, by lifetime earnings quintile, level of education, whether person ever experienced a major health condition, and marital status.

Lifetime earnings quintile	Less than HS	GED or HS graduate	Some college	College or more	Ever experience a major health condition?		All
					No	Yes	
Married persons							
	% with financial assets less than $10,000						
1	83.9	42.9	48.2	**17.3**	**48.6**	**64.0**	54.6
2	63.0	43.5	35.7	**17.6**	38.6	50.7	42.9
3	50.5	22.0	21.1	**6.2**	**20.8**	**26.8**	23.1
4	24.6	16.5	14.8	**5.1**	10.6	18.7	13.6
5	32.1	14.3	9.8	**5.2**	6.6	14.4	9.6
all	65.3	27.6	23.4	**8.7**	**25.1**	**34.8**	28.8
	% with financial assets less than $50,000						
1	92.9	67.9	61.0	**31.2**	63.6	80.3	70.0
2	80.6	63.9	62.9	**34.7**	57.3	74.4	63.4
3	65.6	45.9	35.8	**19.7**	**39.1**	**45.5**	41.6
4	47.2	34.3	33.3	**14.2**	**27.4**	**33.3**	29.6
5	48.8	24.6	17.4	**12.3**	13.7	24.6	17.9
all	79.4	47.5	39.0	**19.5**	**40.3**	**51.4**	44.5
Single persons							
	% with financial assets less than $10,000						
1	93.8	93.4	72.3	**36.2**	**77.6**	**96.0**	86.3
2	91.8	75.4	71.3	**19.5**	66.5	78.7	72.1
3	72.4	54.4	55.6	**27.2**	**41.4**	**74.8**	53.0
4	84.1	59.0	39.1	**23.7**	**39.7**	**58.8**	47.9
5	14.2	41.0	17.5	5.9	24.0	22.7	23.6
all	85.4	61.6	48.5	**19.3**	**48.0**	**69.7**	56.7
	% with financial assets less than $50,000						
1	95.0	97.3	83.3	**36.2**	**81.7**	**97.6**	89.2
2	100.0	87.9	86.2	**31.0**	79.3	89.1	83.8
3	97.7	81.4	67.9	**32.2**	**64.1**	**86.9**	72.0
4	92.3	75.5	44.7	**33.4**	**51.5**	**68.4**	58.7
5	56.8	52.0	31.9	**16.6**	36.6	37.7	37.0
all	94.8	76.5	59.8	**27.6**	**61.2**	**78.8**	68.2

Notes: Data are from the 1996 to 2012 waves of the HRS. Major health conditions are cancer, heart disease, lung disease and stroke. All dollar amounts (and the financial asset thresholds) have been converted to 2012 dollars using the CPI-U. See text for details on the construction of lifetime earnings. For results by level of education, estimates in bold indicate the difference between the first (less than HS) and fourth (college or more) columns is statistically different from zero at the 5% level. For results by health condition, estimated in bold indicate that the difference between the "No" and "Yes" columns is statistically different from zero at the 5% level.

than those in the highest education group. Married individuals in the lowest lifetime earnings quintile are 5.7 times more likely to have low financial assets than those in the highest quintile, and those in the lowest education and earnings quintiles are 16.1 times more likely to have low financial assets that those with high education and earnings.

Education may have an indirect association with wealth at retirement through the effect of education on lifetime earnings. However, education also has an association with wealth that is independent of lifetime earnings. Within each earnings quintile, there are sharp differences in the probability of reporting low wealth. For married persons in the highest earnings quintile, for example, the probability of reporting less than $10,000 in financial assets is 32% for those with less than a high school degree, compared with 5% for those with at least a college degree. These differences could reflect a direct effect of education on saving rates and retirement preparation, such as an effect of education on financial literacy, or a spurious correlation between time preference rates and educational attainment that is manifest in different levels of retirement wealth.

Tables 1a and 1b also explore the relationship between the pre-retirement onset of a major health condition and the likelihood of reaching retirement age with low wealth. For married persons, the probability of reporting low wealth is higher for those who experienced a major health condition. For example, using the $25,000 threshold (top panel of 1a), 7.6% of those who did not experience a major health condition had low wealth, compared with 12% of those who did. For singles, the percentage below the $25,000 threshold is 32.8% for those who did not experience a major health event and 48.3% for those who did. Not only is the probability of falling below this threshold higher for singles, the derivative effect of poor health for singles is larger than for married individuals. This casts doubt on the empirical significance of intra-household insurance mechanisms against chronic health shocks and other financial difficulties.

Across lifetime earnings quintiles, the differences in the probability of reporting low wealth conditional on a health issue, even conditioning on lifetime earnings quartile, suggest that the effect of poor health on retirement wealth is not due only to its impact on earnings. Poor health can lead to reduced labor supply as well as higher levels of health-related spending. Dobkin et al. (2018), using several merged administrative data sets, find that hospitalizations among those under 65 are associated with reduced earnings and elevated debt levels. Our findings are supportive, and suggest that even after conditioning on lifetime income quantile, there are negative effects of a chronic health condition on wealth at retirement. This underscores the possibility of a non-earnings channel, such as out-of-pocket medical expenses that draw down wealth.

2. Wealth dynamics: From age 65 to the end of life

The slow rate of post-65 wealth decline suggested by the foregoing figures implies that wealth at 65 is likely to be a key determinant of wealth at the end of life. We now explore this relationship in more detail, first comparing wealth at 65 and at the end of life in repeated HRS cross sections, and then studying the subset of respondents who are observed both at age 65 and just before death.[10]

2.1. Repeated cross-section evidence

3546 HRS respondents have linked earnings histories and are observed either at age 65 or 66. 2841 respondents have linked earnings histories and who die within our sample period. We can compare the wealth at retirement and wealth when last observed of these two groups – which have 1073 married respondents in common – to explore the differences between wealth at retirement and at death.

Table 2 reports these comparisons. More HRS respondents have less than $100,000 in total wealth in the last survey before death than at age 65. For married individuals, the chance at age 65 of having wealth (financial assets) below $100,000 ($50,000) was 22.4 (44.5) percent. We reject the null hypothesis of an equal percentage of respondents below these thresholds at 65 and when last observed at the 95% confidence interval for the whole sample and for several subgroups stratified by lifetime earnings.[11] The same pattern, but weaker statistical significance, is observed for singles.

For some subgroups reported in Table 2, the probability of low wealth is higher at retirement than at death, but the null hypothesis of equality is only rejected in one of these cases. Most individuals

[10] PVW (2017a) present related tabulations, comparing a decedent's wealth when last observed with wealth when first observed in the HRS or AHEAD cohorts – an age as young as 51 for some HRS respondents. The analysis begins with the 1993 (AHEAD) and 1994 (HRS) cohorts and excludes decedents who were not in the sample for at least eight years. The present tabulations are based on data beginning in 1996, when health reporting becomes more complete, without any a minimum constraint on the number of years that elapse between the year when a respondent turns 65 and the year of death.

[11] The estimates in both panels of this table use the same cut-points, defined in 2012 dollars, to define lifetime earnings quintiles. We estimate the quintile cut-points for persons aged 65 or 66 to produce the results in the left panel. We use the same cut-points to assign lifetime earnings quintiles to persons in the right panel. Since a person's indexed lifetime earnings does not change as the person ages, our method assigns each person in the right panel the earnings quintile that person would have been in when they were 65. Together the two panels allow us to compare assets at age 65 (or 66) and assets in the last year before death for persons in the same earnings quintile at age 65.

Table 2
Percent of persons in each lifetime earnings quintile having low wealth, for persons age 65 and persons in the last year observed before death.

	Total wealth less than $100,000		Financial assets less than $50,000	
Lifetime earnings quintile	At age 65	In last year observed	At age 65	In last year observed
Married persons				
1	45.0	45.1	70.0	65.6
2	33.9	30.4	**63.4**	**54.0**
3	17.6	20.7	41.6	41.7
4	**8.7**	**14.3**	29.6	35.2
5	7.0	7.5	**17.9**	**28.1**
all	**22.4**	**30.7**	**44.5**	**52.4**
N	2911	2309	2911	2309
Single persons				
1	83.5	78.9	89.2	86.5
2	72.0	77.2	83.8	87.4
3	**58.8**	**70.7**	72.0	76.0
4	47.1	41.1	58.7	56.6
5	25.7	13.0	37.0	28.4
all	**57.5**	**63.2**	68.2	73.1
N	635	532	635	532

Notes: Data are from the 1996 to 2012 waves of the HRS. All dollar amounts have been converted to 2012 dollars using the CPI-U. Results for the last year observed before death are for persons at least age 65 at death. Bold indicates that the difference between the percent at age 65 and the percent in the last year observed is statistically different from zero at the 5% level.

who report low late-life wealth were also low lifetime earners. Nearly half – 47.8% – of the married individuals with wealth of less than $100,000 in the last survey before death were in the lowest quintile of lifetime earnings, as were 40.1% of those with less than $100,000 of total wealth at age 65. The pattern is similar for financial assets: 40.7% of those with less than $50,000 in financial assets at death were in the lowest lifetime earnings quintile; 31.5% of those with this level of financial assets at retirement were in the lowest earnings quintile. These data suggest that low lifetime earnings are a key predictor of low wealth at both retirement and end-of-life.

2.2. Evidence from HRS cohorts, retirement through death

The entries in Table 2 compare individuals at age 65 and at the end of life, but relatively few of the individuals in these two samples – 1073 married and 481 single respondents – are observed at both 65 and at the end of life.[12] To provide longitudinal information on wealth trajectories, we now focus on this subsample of married individuals, and explore the relationship between wealth at 65 and at the end of life. We caution that this sample disproportionately includes individuals who died at young ages, because our sample spans only 16 years. No one in this longitudinal sample died at an age beyond 82. Our findings thus apply to the draw-down patterns of the "young elderly" but may not generalize to older groups.

Fig. 5 graphs total wealth at age 65 and total wealth at death for the longitudinal sample; it shows only the 932 individuals with total wealth less than $1,000,000 at each date. The number of years that elapse between the two wealth measurements can be anything from two years for those who die in their mid-60s to nearly 16 years for those who die in 2012 and who were first surveyed in 1996. Those with flat trajectories of wealth in retirement will fall close to the 45-degree line. The figure shows substantial numbers of respondents with trajectories that place them above or below the 45-degree line. There percentage for whom the difference between the two wealth values exceeds $100,000 is relatively small, however: 30.8%. At low levels of wealth, most individuals are close to the 45-degree line, suggesting little change in wealth holdings between age 65 and the last HRS observation before death.

Wealth declined for 54.9% of the longitudinal sample, was recorded as zero in both surveys for 1.0%, and increased for 44.1%. One shortcoming of the longitudinal sample is that the maximum number of years between age 65 and the last wave before death is about 14 years, so we are not observing wealth trajectories for those who die after age 79. It is likely that if we had longitudinal data for an even longer period, we would observe larger differences between wealth at age 65 and at death.

Measurement error may explain some of the wealth movements that we observe. Wealth is self-reported and accurate reporting of a household's financial circumstances is a challenging task that may become more difficult as respondents age and cognitive skills decline. Researchers have long recognized the potential for measurement error to confound studies of household wealth, particularly when the analysis focuses on wealth differences. Hill (2006), Venti (2011), and Meijer et al. (2013) all report evidence of significant measurement error in the HRS, but none offer suggestions for resolving it nor a calibration that would enable us to assess the potential impact on our results. For example, Hill (2006) finds that call-back verification reduced the variance of wave-to-wave asset changes about 50%. Hurd et al. (2016) demonstrate that greater cross-wave validation effort reduces the variation across waves and improve the quality of data imputation. The HRS data file that we analyze incorporates the insights of this analysis. We focus our empirical strategy on measures of whether wealth falls below a threshold value in part to reduce the impact of measurement error. For respondents whose true wealth value is far from the threshold, even a large and transitory measurement error in one year will not bump the respondent across the low-wealth indicator.

Tables 3 and 4, which present core transitions between wealth at age 65 and wealth when last observed before death. The top panel shows the percentage of married persons in various total wealth intervals at age 65 who were in various intervals when last observed. The off-diagonal entries reflect movements in wealth or financial assets. For example, 31.7% of the respondents who reported between $10,000 and $50,000 of total wealth at age 65 were in this same wealth category at death. There is greater persistence in the top and bottom categories: 73.6% of those who reported less than $10,000 in wealth at age 65 were in this wealth interval in the survey before death; 76.7% of those with more than $250,000 in assets at age 65 were similarly categorized when last surveyed.

Some individuals make significant transitions in wealth holdings. 7.4% of those who reported more than $250,000 at age 65 had less than $100,000 when last surveyed. While we would like to explore what happened to the respondents in this group, the number of respondents with large declines is too small. The patterns are broadly similar for financial assets (lower panel), and if anything, low values are more persistent in that case.

Table 4 reverses the conditioning: it stratifies married individuals in various total wealth intervals in the last year observed before death by their reported wealth at age 65. It shows column percentages rather than the row percentages shown in Table 3. For example, 48.2% of those last observed with less than $10,000 of total wealth also had less than $10,000 of total wealth at age 65. Persistence is particularly strong for persons dying with substantial wealth: 81.6% of those who have more than $250,000 when last observed also had more than $250,000 at age 65. At low wealth levels, of those with less than $10,000 of total wealth at death, 18.6% had more than $100,000 entering retirement, while over 50% of those with between $10,000 and $50,000 of wealth when last observed had wealth of more than $50,000 at age 65.

[12] We omit results for singles because of the small sample size. For the longitudinal sample, the response at age 65 defines marital status. There are two noticeable differences between the longitudinal sample and the sample used in Table 2. First, the longitudinal sample is less wealthy (and presumably less healthy) at age 65 because it only includes individuals who die before age 79 (individuals age 65 in 1996 will be age 79 in 2010 when last observed before death). Second, the age at death is younger in the longitudinal sample, again because the sample is limited to individuals who were observed at age 65 and who died before 2012.

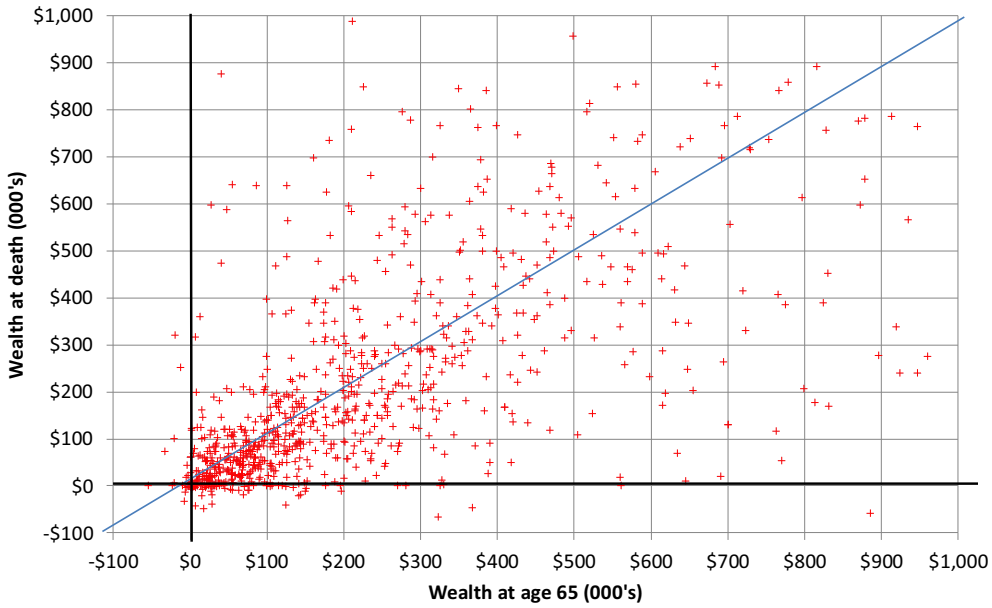

Fig. 5. Wealth at age 65 and at death for married individuals followed longitudinally. Notes: Data are from the 1996 to 2012 waves of the HRS. The sample is restricted to respondents observed at age 65 and in the last wave prior to death. All dollar amounts have been converted to 2012 dollars using the CPI-U. See text for additional details.

Table 3
Percentage of persons in each asset interval in last wave prior to death by asset interval at age 65 (row percents).

Total wealth						
	Wealth interval in last year observed prior to death					Percent in each row
Wealth interval at age 65	<$10,000	$10,000–$50,000	$50,000–$100,000	$100,000–$250,000	>$250,000	
<$10,000	73.6	12.3	5.7	4.7	3.8	9.9
$10,000–$50,000	30.1	31.7	21.1	13.0	4.1	11.5
$50,000–$100,000	12.3	28.3	37.0	19.6	2.9	12.9
$100,000–$250,000	7.2	7.6	18.4	44.8	22.0	25.8
>$250,000	2.3	2.3	2.8	15.9	76.7	40.0
Percent in each column	15.1	11.4	13.6	22.4	37.6	

Financial assets						
	Financial asset interval in last year observed prior to death					Percent in each row
Financial asset interval at age 65	<$10,000	$10,000–$50,000	$50,000–$100,000	$100,000–$250,000	>$250,000	
<$10,000	85.9	8.8	1.6	1.9	1.9	40.2
$10,000–$50,000	47.4	31.2	8.1	9.3	4.1	16.1
$50,000–$100,000	26.7	29.3	20.7	16.4	6.9	10.8
$100,000–$250,000	11.3	11.3	19.2	27.8	30.5	14.1
>$250,000	6.9	5.5	5.0	23.8	58.9	18.8
Percent in each column	47.9	14.4	7.8	12.4	17.5	

Notes: Data are from the 1996 to 2012 waves of the HRS. All dollar amounts have been converted to 2012 dollars using the CPI-U. Results for the last year observed before death are for persons at least age 65 at death.

This suggests some "downward mobility" between age 65 and death among those who had accumulated substantial assets at retirement. The bottom panel of Table 4 suggests similar patterns for financial asset mobility.[13]

Tables 3 and 4 suggest that about one third of those who are observed with low wealth at death entered this state between age 65 and death. While large movements in wealth or financial assets between age 65 and death are relatively uncommon for those who die before the age of 80, there are some households that draw down their assets and are poorer at death than at they were at retirement age. Most of those with low wealth at death, however, had low wealth at retirement.

3. Health shocks, spousal deaths, and post-retirement wealth trajectories

We now examine two potential shocks – the onset of a health condition and death of a spouse - that could lead some individuals to fall into the low-wealth category. We in particular ask if these shocks could explain the wealth trajectory of the subset of HRS respondents who did not have low wealth at age 65, but did at the time of death.

[13] The entries in Tables 3 and 4 can be combined to recover transition probabilities corresponding to the broader asset categories that were described earlier in previous tables. For example, among those with less than $100,000 ($50,000) in wealth at age 65, 83.4 (73.0) percent were also in this wealth category when last observed before death. For low financial assets, 90.4% of those with less than $50,000 in financial assets at age 65 are also in this "low financial assets" group when last observed before death. Reversing the conditioning yields a similar result. For total wealth, 71.2 (58.8) percent of those with less than $100,000 ($50,000) at death were similarly situated at age 65.

Table 4
Percentage of persons in each asset interval at age 65 by asset interval in last wave prior to death (column percents).

Total wealth

	Wealth interval in last year observed prior to death					Percent in each row
Wealth interval at age 65	<$10,000	$10,000–$50,000	$50,000–$100,000	$100,000–$250,000	>$250,000	
<$10,000	48.2	10.7	4.1	2.1	1.0	9.9
$10,000–$50,000	22.8	32.0	17.8	6.7	1.2	11.5
$50,000–$100,000	10.5	32.0	34.9	11.3	1.0	12.9
$100,000–$250,000	12.4	17.2	34.9	51.7	15.1	25.8
>$250,000	6.2	8.2	8.2	28.3	81.6	40.0
Percent in each column	15.1	11.4	13.6	22.4	37.6	

Financial assets

	Financial asset interval in last year observed prior to death					Percent in each row
Financial asset interval at age 65	<$10,000	$10,000–$50,000	$50,000–$100,000	$100,000–$250,000	>$250,000	
<$10,000	72.0	24.7	8.3	6.0	4.3	40.2
$10,000–$50,000	16.0	35.1	16.7	12.0	3.7	16.1
$50,000–$100,000	6.0	22.1	28.6	14.3	4.3	10.8
$100,000–$250,000	3.3	11.0	34.5	31.6	24.5	14.1
>$250,000	2.7	7.1	11.9	36.1	63.3	18.8
Percent in each column	47.9	14.4	7.8	12.4	17.5	

Notes: Data are from the 1996 to 2012 waves of the HRS. All dollar amounts have been converted to 2012 dollars using the CPI-U. Results for the last year observed before death are for persons at least age 65 at death.

3.1. Adverse health events

The probability of ever having experienced a major health condition – cancer, heart disease, lung disease, or stroke – rises as individuals age. In our HRS sample, this probability is about 35% at age 65. It is nearly 65% by age 90. The probability of experiencing one of these conditions for the first time rises from about 5% per two-year interval (between HRS waves) at age 65 to between 6 and 7% at ages above 80. It is relatively stable for individuals of the ages we consider in our longitudinal sample.

We explore the association between the onset of a major health condition and low wealth on the eve of death by comparing the wave-to-wave change in the probability of low wealth for those first reporting the onset of a major health condition to the wave-to-wave change for those who have never experienced any major health condition. The "never experienced" group is one of several comparison groups that could be used for this analysis; it is attractive because it does not raise confounding issues about the lagged effect of past major health conditions. There are 3832 respondent-years for our married person sample in which a new health condition is reported, and 17,063 respondent-years in which a survey participant who has never reported a major condition.[14]

Our estimating equation for the wealth effect of health condition onset relates an indicator variable for low wealth to an indicator variable for the onset of the health condition, indicator variables for each HRS wave, and control variables (X_i) including the respondent's age and categorical variables for educational attainment:

$$I(W_{i,t} < A) = \alpha + \delta * I(\textit{first health shock})_{i,t} + \sum_{s=1996}^{2012} \beta_s * I_{t=s} + X_i * \theta + \varepsilon_{i,t} \quad (2)$$

Including a set of indicator variables for the level of educational attainment controls for the variation in the baseline risk of reporting low wealth that is education-related.

Table 5 presents the results of estimating Eq. (2). The onset of a major medical condition is associated with an increase of about 0.8 percentage points in the chance that total wealth is below $25,000 for married individuals. The point estimates of the effects are larger but less precisely estimated for singles and we do not reject the null hypothesis of no effect. We also estimated effects over longer time periods – two and three waves – for both married and single respondents, and found that the standard errors rose and we could not reject the null hypothesis of no effect. Our analysis differs from the many previous studies that focus on the change in wealth at the time of a new health condition in that we focus on the likelihood of reporting low wealth, which as we explained at the outset, is particularly relevant for a number of policy issues.

3.2. Death of a spouse

Fig. 6 reports the percent of married persons in the HRS over the age of 65 in each wave whose spouse died before the next wave. The horizontal axis is the age of the surviving spouse at the beginning of the two-year interval. Women tend to have older spouses and men tend to have younger spouses, so the age at which one partner becomes a widow/widower (on the horizontal axis) may be an imperfect indicator of the age of the partner at their death. The probability that a partner will die in a two-year interval increases from about 2% at age 65 to a little over 3% at age 70 and to almost 9% by age 80.

Table 5
Estimated impact of a major health condition on the percent with low wealth and low financial assets, persons age 65 or older.

Condition	Married persons	Single persons
% with wealth less than $25,000	0.778	1.346
	(0.462)	(0.871)
% with wealth less than $100,000	0.827	0.967
	(0.635)	(0.971)
% with financial assets less than $10,000	0.234	−0.525
	(0.709)	(0.954)
% with financial assets less than $50,000	−0.757	−0.885
	(0.747)	(0.922)
N with major condition	3832	2362
N without major condition	17,063	9759

Notes: Data are from the 1996 to 2012 waves of the HRS. All dollar amounts have been converted to 2012 dollars using the CPI-U. Major health conditions are cancer, heart disease, lung disease and stroke. Estimates correspond to Eq. (2) in the text. Each equation includes year effects, gender, age and indicator variables for education attainment. Standard errors are shown in parentheses.

[14] Because lifetime earnings are not necessary for the calculations for Table 10, the sample is larger than in earlier tables. We also include widows; they were also excluded from tabulations using lifetime earnings.

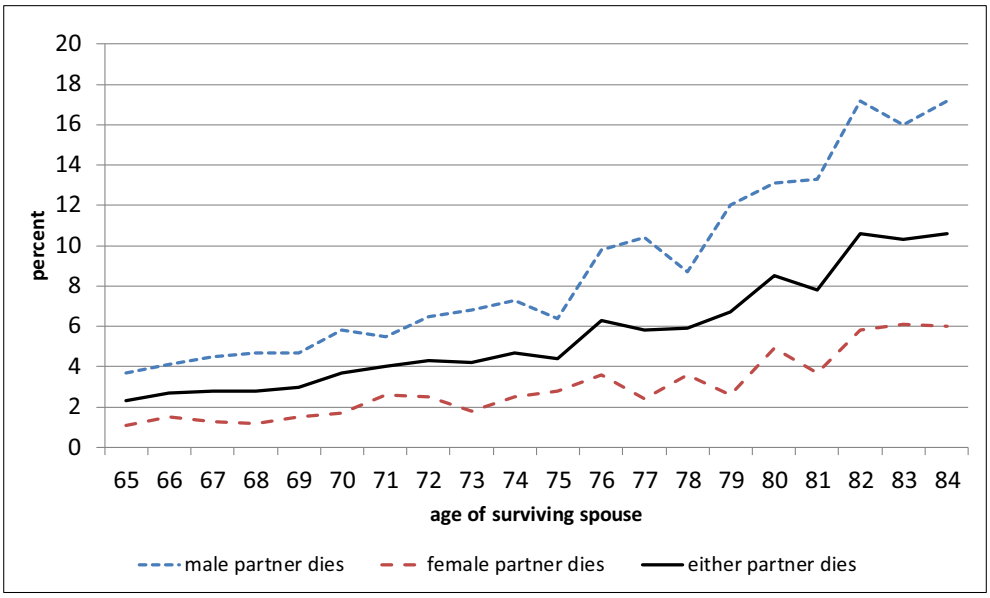

Fig. 6. Percentage of spouses that die over a two-year period by age of surviving spouse. Note: Data are from the 1996 to 2012 waves of the HRS.

Table 6 reports a specification similar to that in Eq. (2), but the central explanatory variable of interest is now the death of a spouse between wave t-1 and wave t. These estimates use a longer sample, but a similar approach, to the study by Sevak et al. (2003). The findings suggest that when a husband dies, the probability that his wife will report total wealth below $100,000 rises by about 1.6 percentage points, and the probability that she will report wealth below $25,000 rises by about 2 percentage points. For men, we do not reject the null hypothesis that the loss of a spouse has no effect.

Some point estimates for financial assets, although none that are statistically significantly different from zero, suggest that loss of a spouse is associated with a rise in financial assets. Could there be any circumstances under which this might occur? Death-related payouts, such as life insurance benefits could lead to this outcome, especially because even a modest payout could move someone out of the low-wealth status. Financial assets could also rise if caring for a declining spouse leads to sale of a house and an associated set of balance sheet transfers. We explored the role of life insurance, and did not find any consistent evidence that the survivors of spouses with insurance were more likely to exit the low wealth state than the survivors of uninsured spouses. Even for the survivors of spouses without insurance, there were some reductions in the probability of reporting low wealth.

Table 6
Estimated impact of death of a spouse on the percent with low wealth and low financial assets, persons age 65 or older.

Condition	Female dies	Male dies	Either dies
% with wealth less than $25,000	0.521	2.048	1.564
	(1.24)	(0.819)	(0.692)
% with wealth less than $100,000	0.226	1.600	1.164
	(1.473)	(1.019)	(0.849)
% with financial assets less than $10,000	−0.239	−0.270	−0.261
	(1.448)	(1.132)	(0.913)
% with financial assets less than $50,000	−2.395	−2.021	−2.140
	(1.805)	(1.252)	(1.043)
N with death of spouse	756	1673	2429
N (total)	40,026	40,026	40,026

Notes: Data are from the 1996 to 2012 waves of the HRS, with dollar amounts converted to $2012 using the CPI-U. Major health conditions are cancer, heart disease, lung disease, and stroke. Estimates correspond to Eq. (2) in the text. Each estimating equation includes year effects, age and indicator variables for education attainment. Standard errors are shown in parentheses.

We also explore the relationship between changes in wealth between age 65 and death, and new health conditions or the death of a spouse, in our longitudinal sample. 59.1% of those who experienced a major new health condition between age 65 and death reported a decline in wealth, compared with 52.7% of those who did not report but died within the sample. This difference is statistically significantly different from zero. For financial assets, the values are 59.2 and 54.2%, with a t-statistic of 1.58 for the difference. 63.2% of those who lost a spouse and also died within the sample reported a decline in wealth between 65 and death, compared with 54.3% of those who died but did not report losing a spouse (this difference is also statistically significantly different from zero). Reversing the conditioning, among those who experienced a decline in wealth (financial assets) between age 65 and death, 45.7% (45.4%) were diagnosed with a new health condition. This corresponds to 39.3% (40.5%) for those whose assets increased. Those whose wealth declined were also more likely (14.6 *vs* 10.6%) to have lost a spouse (t-statistic of 1.98). These findings do not control for potential differences between the various groups, but they suggest that there may be cumulative effects of both adverse health shocks and loss of a spouse.

4. Conclusions

Low lifetime wealth accumulation, which results in low wealth at retirement, is the most important factor contributing to low wealth in late life. Nearly two thirds of HRS respondents who were observed both at age 65, and about one year before their death, and who had net worth of less than $50,000 at death, also had similarly low wealth levels at age 65. Lifetime earnings and educational attainment are important determinants of wealth at age 65, and education is strongly correlated with wealth even after controlling for lifetime earnings. Just over 50% of high school graduates have low wealth, compared with only 6.4% of those with a college degree. Forty-five percent of married persons in the lowest quintile of the distribution of lifetime earnings have net worth of less than $100,000 at age 65, compared with only 7% of those in the highest quintile.

These findings document an association but do not explain the mechanism linking education and wealth at retirement. One possibility is that education increases awareness of the need to save, or it makes individuals wiser investors who can earn a higher rate of return on their savings. Reverse causality is another possibility: those with more

education may have wealthier parents and may have received larger bequests or other transfers. Still another possibility is that some third factor, perhaps time preferences, may have similar effects on financial and educational investments, inducing the strong positive correlation between education and wealth. Identifying a causal mechanism underlying the strong association merits further attention.

In contrast to concerns that some households will draw down their retirement wealth at a rapid rate in the years following retirement, and exhaust their wealth before they die, we find relatively few households dropping to low wealth at death from modest wealth at retirement. In our longitudinal sample, 34.3% of married persons had wealth of less than $100,000 at age 65, compared with 40.1% just prior to their death. 67.1% had financial assets worth less than $50,000 at retirement, compared with 70.1% just prior to death. 55% reported lower wealth at death than at retirement. Both a decline in health, and the loss of a spouse, raise the likelihood of reporting low wealth, but the effects are modest. Onset of a major health condition is associated with an increase in the fraction of married persons with wealth below $100,000 from 21.3 to 23.8%. Death of a spouse is associated with a rise from 29.7 to 30.9%.

The findings regarding health shocks are consistent with the view, described for example in Barcellos and Jacobson (2015) and Dobkin et al. (2018), that Medicare protects most of the over-65 population from substantial burdens associated with health shocks. This may be particularly true for those low in the wealth distribution. Poterba and Venti (2017) find that the negative wealth effects of three health-related shocks – hospitalization, admission to a nursing home, and use of a home health aide – are all much greater for those with net worth above $500,000 than for those with net worth below $100,000. This can reconcile the possibility that wealth declines, on average, in response to these shocks, while there is only a small effect on the probability of falling into low wealth. Households near the low wealth threshold may experience relatively less draw-down in wealth in response to these shocks than those higher up in the distribution.

We have implicitly treated health shocks as creating mandatory expenditure needs that must be met, but there is another channel through which such shocks could influence the draw-down of wealth. Households experiencing such shocks might change their spending patterns, and hence their wealth trajectories. If adverse health events cause individuals to reduce their estimate of their longevity, they might respond by increasing their consumption spending and the rate at which they draw down wealth. Because the change in wealth reflects the return on wealth, plus other income, less consumption and health expenditures, an increase in consumption would appear as a decline in wealth for those experiencing adverse health shocks. Exploring competing mechanisms for the wealth health linkage is a topic for future work.

Most of our results are based on a sample of individuals who died before age 80. It is possible, as Lee and Kim (2008) argue, that adverse health shocks at later ages are costlier than similar shocks at younger ages. More generally, wealth dynamics at older ages may differ from those at younger ages. As longer HRS longitudinal samples become available, it will be possible to extend our findings; they may change.

Acknowledgements

We are grateful to Alice Henriques, Michael Hurd, Henrik Kleven, James Smith, and two anonymous referees for very helpful comments. This research was supported by the U.S. Social Security Administration through grant #RRC08098400-06 to the NBER as part of the SSA Retirement Research Consortium. Funding was also provided through grant P01 AG005842 from the National Institute on Aging. Poterba is a trustee of the College Retirement Equity Fund (CREF), a provider of retirement income services. The findings and conclusions expressed are solely those of the authors and do not represent the views of SSA, any agency of the federal government, TIAA, or the NBER.

References

Alvaredo, Facundo, Atkinson, Anthony, Morelli, Salvatore, 2016. The challenge of measuring UK wealth inequality in the 2000s. Fisc. Stud. 37 (1), 13–33.
Ameriks, John, Zeldes, Stephen, 2004. How Do Household Portfolio Shares Vary with Age? Columbia University, Manuscript
Atkinson, Anthony B., 1971. The distribution of wealth and the individual life-cycle. Oxf. Econ. Pap. 23 (2), 239–254.
Atkinson, Anthony B., Sutherland, Holly, Atkinson, A.B., Rein, M., 1993. Two nations in retirement? The case of Britain. Age, Work, and Social Security. St. Martin's Press, New York, pp. 132–160.
Barcellos, Silvia Helena, Jacobson, Mireille, 2015. The effects of medicare on medical expenditure risk and financial strain. Am. Econ. J. Econ. Pol. 7 (4), 41–70.
Blundell, Richard, Crawford, Rowena, French, Eric, Tetlow, Gemma, 2016. Comparing retirement wealth trajectories on both sides of the pond. Fisc. Stud. 37 (1), 105–130.
Bosworth, Barry, Smart, Rosanna, 2009. Evaluation Micro-survey Estimates of Wealth and Saving. Center for Retirement Research. Boston College. WP No. 2009-4.
Coile, Courtney, Milligan, Kevin, 2009. How household portfolios evolve after retirement: the effect of aging and health shocks. Rev. Income Wealth 55 (2), 226–248.
Cook, Keziah, Dranove, David, Sfekas, Andrew, 2010. Does major illness cause financial catastrophe? Health Serv. Res. 45 (2), 418–436.
De Nardi, Mariacristina, French, Eric, Jones, John Bailey, 2015. Couples' and Singles Savings after Retirement. Michigan Retirement Research Center Working Paper No. 2015-322.
DeNardi, Mariacristina, French, Erick, Jones, John B., 2016. Saving after retirement: a review. Annu. Rev. Econ. 8, 177–204.
Dobkin, Carlos, Finkelstein, Amy, Kluender, Raymond, Notowidigdo, Matthew J., 2018. The economic consequences of hospital admissions. Am. Econ. Rev. 108, 308–352.
Gustman, Alan, Steinmeier, Thomas, Tabatabai, Nahid, 2014. The great recession, decline and rebound in household wealth for the near retirement population. J. Retirement 2 (Fall), 27–44.
Health and Retirement Study, 2017. Sample sizes and response rates. April. https://hrs.isr.umich.edu/sites/default/files/biblio/ResponseRates_2017.pdf.
Hill, D.H., 2006. Wealth dynamics: reducing noise in panel data. J. Appl. Econ. 21, 845–860.
Hurd, Michael, Meijer, Erik, Modloff, Michael, Rohwedder, Susann, 2016. Improved Wealth Measures in the Health and Retirement Study: Asset Reconciliation and Cross-Wave Imputation. RAND Corporation Working Paper WR-1150.
Johnson, R., Uccello, C., Goldwyn, J., 2005. Who forgoes survivor protection in employer-sponsored pension annuities. The Gerontologist 45 (1), 26–35.
Kelley, Amy, McGarry, Kathleen, Gorges, Rebecca, Skinner, Jonathan, 2015. The burden of health care costs for patients with dementia in the last five years of life. Ann. Intern. Med. 163 (10), 731–736 November.
Lee, Jinkook, Kim, Hyungsoo, 2008. A longitudinal analysis of the impact of health shocks on the wealth of elders. J. Popul. Econ. 21, 217–230.
Levy, Helen, 2002. The Economic Consequences of Being Uninsured. Economic Research Initiative on the Uninsured Working Paper 12, October.
Love, David, Palumbo, Michael, Smith, Paul, 2009. The trajectory of wealth in retirement. J. Public Econ. 93 (1–2), 191–208.
Meijer, E., Spierdijkand, L., Wansbeek, T., 2013. Measurement error in the linear dynamic panel data model. In: Sutradhar, B.C. (Ed.), Longitudinal Data Analysis Subject to Measurement Error, Missing Values, and Other Outliers. Springer, New York.
Poterba, James, Venti, Steven, 2017. Financial Well-being in Late Life: Understanding the Impact of Adverse Health Shocks and Spousal Deaths (Mimeo).
Poterba, James, Venti, Steven, Wise, David, 2011. The composition and drawdown of wealth in retirement. J. Econ. Perspect. 25 (4), 95–118 Fall.
Poterba, James, Venti, Steven, Wise, David, 2017a. What determines end-of-life assets: A retrospective view. In: Wise, D. (Ed.), Insights in the Economics of Aging. University of Chicago Press, pp. 127–157.
Poterba, James, Venti, Steven, Wise, David, 2017b. The asset cost of poor health. J. Econ. Aging 9, 172–184.
Sevak, Purvi, Weir, David, Willis, Robert, 2003. The economic consequences of a husband's death: evidence from the HRS and AHEAD. Soc. Secur. Bull. 65 (3), 31–44.
Smith, James P., 1999. Healthy bodies and thick wallets: the dual relation between health and economic status. J. Econ. Perspect. 13 (2), 145–166.
Smith, James P., 2004. Unraveling the SES-health connection. Population and Development Review Supplement: Aging, Health and Public Policy. 30, pp. 108–132.
Smith, James P., 2005. Consequences and predictors of new health events. In: Wise, D. (Ed.), Analyses in the Economics of Aging. University of Chicago Press, pp. 213–240.
Venti, Steven F., 2011. Economic measurement in the health and retirement study. Forum Health Econ. Policy 14 (3):1558–9544. https://doi.org/10.2202/1558-9544.1273.
Venti, Steven F., Wise, David A., 2004. Aging and housing equity: another look. In: Wise, D. (Ed.), Perspectives on the Economics of Aging. University of Chicago Press, pp. 127–175.
Wallace, Geoffrey, Haveman, Robert, Wolfe, Barbara, 2014. Health Status, Health Shocks, and Asset Adequacy over Retirement Years. University of Wisconsin-Madison, Department of Economics, Mimeo.
Wu, Stephen, 2003. The effects of health events on the economic status of married couples. J. Hum. Resour. 38, 219–230.