

Assets at End of Life and When First Observed: Looking Backwards

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Abstract: We consider assets when households were last observed prior to death in the Health and Retirement Study (HRS) and then trace assets backwards to the age when the household was first observed in the HRS. We find that for most households assets in the last year observed (LYO) were very similar to assets of households in the first year observed (FYO). We then estimate the relationship between individual attributes—in particular education, changes in health and changes in family composition—and the change in assets between the FYO and the LYO. We obtain estimates for HRS respondents who were 51 to 61 in 1992 and for AHEAD respondents who were age 70 and over in 1993. In addition, we obtain estimates by family status pathway—two-person in FYO and LYO, one-person in both years, and one-person in the LYO and two-person in the FYO.

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A large fraction of households reach the end of life with limited financial assets. Our goal of this paper is to increase our understanding of the determinants of asset balances at death. We do this by following persons in the Health and Retirement Study (HRS) backward from the last wave prior to their death until they were first observed in the HRS. We first document the relationship between the assets of households in the last year observed (LYO) before death (LYO) and their assets in the first year observed (FYO). We then estimate the effect of individual attributes, in particular health conditions and education, on the relationship between assets when first observed and assets when last observed.

There are several possible pathways by which households may reach the end of life with limited wealth. One is by entering retirement with modest or substantial assets, and then experiencing unanticipated events that drained financial resources. For some households the death of a spouse or divorce may result in a decline in wealth. The asset balances of some households may be reduced substantially by costs associated with a health event such as a stroke or the onset of a chronic illness. Other households experience asset declines that accompany a general decline in health (see Poterba, Venti and Wise (2010)). A second pathway to low assets at death is to have entered retirement with assets, but “outlived” these assets even without extraordinary expenditures at any point during retirement. A third pathway to low assets at death is simply failing to save adequately during working years. That is households die with little wealth because they entered retirement with little wealth. Our aim is to determine which of these pathways are most consistent with asset trajectories late in life.

We motivate the analysis with a series of figures that follow the path of assets between the year first observed (FYO) and the last year observed (LYO). These figures, based on median assets, are shown for persons age 51 to 61 in 1992 (the original HRS cohort) and those age 70 and older in 1993 (the original AHEAD cohort). We also show figures by education level and by family status. For the most part, the figures show little difference between assets in the FYO and assets in the LYO for the younger cohort and only modest decline in assets for the older cohort.

We then present regression estimates of the change in assets between the FYO and the LYO. For the most part the estimates support the limited change in assets between the LYO and the FYO. Simulations based on these estimates show that in the absence of change in family composition or health shocks, asset trajectories are relatively flat. However, substantial asset declines occur if households experience important medical events or family composition is disrupted. The change in assets between FYO and LYO is also strongly related to the level of education.

This analysis is closely related to Poterba, Venti, and Wise (2012), which focuses on the level of assets that households held in the last survey wave preceding their death. This analysis is also related to a much broader literature seeking to identify factors affecting wealth accumulation and decumulation in retirement. In particular, numerous studies have used the HRS to consider the effect of health or family disruptions on wealth. Smith (1999, 2004, 2005), Wu (2003), Lee and Kim (2007), and Coile and Milligan (2009) estimate the effect of new health events on wealth or on other measures of SES. In general, these studies find that new health events are important source of variation in wealth. Sevak, Weir and Willis (2003/2004), Johnson et. al. (2006) and Coile and Milligan (2009) show that widowhood is associated with large reductions in wealth.

The remainder of the paper is divided into four sections. Section one describes the data used in the analysis. Section 2 shows how asset balances in the LYO compare to balances households had when they were first observed. In particular, figures are used to show asset trajectories between the first and last year observed. Section 3 presents the results of regression analyses aimed at identifying the individual attributes associated with the change in assets between the FYO and LYO. Section 4 summarizes our results and discusses future directions for research.

1) Data

We address these questions using two cohorts from the HRS – the original HRS cohort whose members were first surveyed in 1992 when they were age 51 to 61 and the original Asset and Health Dynamics Among the Oldest Old (AHEAD) cohort whose members were age 70 and older when first surveyed in 1993. In both cohorts we drop “age ineligible” spouses (not age 51 to 61 in the HRS and not age 70+ in the AHEAD).

We also drop the 1992 wave of the HRS because of incomplete data for some variables. With one exception, respondents are surveyed biennially so we are able to use data for 10 waves: 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, 2010 and 2012 for the HRS cohort and 1993, 1995, 1998, 2000, 2002, 2004, 2006, 2008, 2010 and 2012 for the AHEAD cohort. We focus on the last year observed (LYO) for each respondent. If the last year observed is prior to 2012 then the data for the LYO pertain to the last year observed prior to death (we omit persons who leave the sample for reasons other than death). If the LYO is 2012 then then the data are for a respondent who is alive when last observed. Respondents are surveyed every two years, so the date at which assets are measured in the LYO may be as much as two years prior to the date of death. Because medical expenditures are often substantial in the last six months of life, asset balances observed in the last wave before death may over-estimate assets at the time of death. In principle, we can obtain more precise estimates of assets at the time of death from “exit interviews” administered to a surviving spouse, child or other knowledgeable person after the death of a respondent. These exit interviews obtain information on the finances of the deceased in the period between the last core survey and the time of death. We have not used these data in the present analysis because records for a large number of deceased respondents are either missing or incomplete. However, we plan to incorporate these data in future analyses.

A measure of “assets” or “wealth” is central to the analysis. The definition we use includes home equity and the net value of other real estate, business assets, and financial assets. IRA and Keogh balances are included in financial assets, but assets in 401(k) plans are not included--401(k) assets were not collected for the AHEAD cohort and the data are incomplete in some years (esp 1994 to 1998) for the HRS cohort. This is not a big concern for members of the older AHEAD cohort because they were unlikely to have participated in 401(k) plans. These plans were first authorized in 1982 and did not become widespread until the 1990’s and were thus largely unavailable to members of the AHEAD cohort who were age 70 or older in 1993. Members of the HRS cohort were more likely to work for an employer offering a 401(k). The portion of 401(k) balances not rolled over into an IRA at retirement is thus excluded from our measure of asset balances. The capitalized value of annuity income from Social Security or defined

benefit pensions is also not included in assets, although these sources of income are included in our definition of household income. All income streams and asset balances have been converted to 2012 dollars using the CPI-U.

The unit of observation is the person, but the asset balance associated with each person is the household asset balance. Some results are presented separately by a person's family status pattern which indicates whether a person is continuously single, continuously married, or transitions between being married and single. More details on how family status group are defined as well as on other aspects of the data are in the results section below.

2) Background and Descriptive Information

We begin with a series of tables that summarize information on assets when respondents are last observed and the distribution of assets when respondents are first observed. As noted above, the interval between the first and last observation for a person can be as short as two years or as long as nineteen years. The first two tables show distributions of assets for all deceased persons, regardless of the number of years between the LYO and the FYO. The next two tables only consider the distribution of assets for deceased persons for whom the number of years between the LYO and the FYO is eight or more. Each table (and the figures that follow) presents results separately for the HRS and AHEAD cohorts. We next provide additional detail on the prevalence of zero and negative asset balances in the LYO. We then present a series of figures that provide more detail by age, family status and level of education. Unlike the tables, these figures include persons alive when last observed as well as persons known to be deceased. Finally, we consider the joint distribution of assets in the LYO and annuity income in the LYO.

All Deceased Persons: Tables 2-1a and 2-1b show assets in the first year observed and in the LYO for all persons known to be deceased by 2012, regardless of the length of time between the LYO and the FYO. The first table considers all persons age 51 to 61 in 1992 (the HRS cohort) and the second table considers all persons age 70 and older in 1993 (the AHEAD cohort). First, the last column of each table shows that a large fraction of persons die with minimal non-annuity assets (defined to include housing wealth, financial assets, other real estate and business assets). Among

persons age 51 to 61 in 1992, 30.9 percent had less than \$25,000 in non-annuity assets just prior to death. Of persons age 70 and older in 1993, 31.7 percent had less than \$25,000 in non-annuity assets just prior to death. Second, the cell entries in each table show that for a large proportion of households, non-annuity assets at death are similar in magnitude to the level of assets when first observed in the HRS or the AHEAD cohorts. For example, for households in the HRS cohort, 67.7 percent of those with less than \$25,000 in wealth when last observed had less than \$25,000 when first observed in 1992; 79.7 percent had less than \$50,000 when first observed.¹ Of those with greater than \$350,000 when last observed, 69.3 percent had \$350,000 or more when first observed and 92.7 percent had greater than \$150,000 when first observed. Similar patterns can be seen in the second table for person age 70 and older in 1993. In short, non-annuity assets at death are, on average, not so different from non-annuity assets when first observed in 1993 or 1994. This is true both for persons who were between 51 and 61 in 1993 and persons who were age 70 or older in 1994. In particular, most households with meager assets at death also had limited assets when first observed and most households with substantial assets at death also had substantial assets when first observed.²

Table 2-1a. Percentage of persons in each asset interval when first observed by asset interval in last wave prior to death, persons age 51 to 61 in 1992 (row percents)

asset interval in LYO	asset interval in first year observed (1994)						Percent in each LYO interval
	< \$25,000	\$25,000-\$50,000	\$50,000-\$75,000	\$75,000-\$150,000	\$150,000-\$350,000	> \$350,000	
< \$25,000	67.7	12.0	5.3	7.7	6.1	1.2	30.9
\$25,000-\$50,000	26.7	23.5	17.2	18.8	11.7	2.1	6.9
\$50,000-\$75,000	8.5	22.6	22.7	34.6	8.9	2.6	6.1
\$75,000-\$150,000	5.8	10.1	11.3	39.5	27.1	6.3	14.9
\$150,000-\$350,000	3.6	1.4	5.7	25.0	44.5	19.9	18.6
> \$350,000	1.3	1.1	0.7	4.3	23.4	69.3	22.7
Percent in each FYO interval	22.5	6.8	7.1	18.4	24.2	21.0	

note: sample excludes persons still alive in 2012

¹ The asset interval “< \$25,000” includes persons with zero and negative assets.

² Assets are converted to 2012 dollars using the CPI. Assets in Tables 2-1a and b are converted to 2012 dollars before constructing the intervals.

asset interval in LYO	asset interval in first year observed (1993)						Percent in each LYO interval
	< \$25,000	\$25,000- \$50,000	\$50,000- \$75,000	\$75,000- \$150,000	\$150,000- 350,000	> \$350,000	
< \$25,000	56.8	9.5	7.5	12.7	10.2	3.3	31.7
\$25,000-\$50,000	25.0	21.2	15.9	19.4	12.8	5.7	6.9
\$50,000-\$75,000	9.7	16.9	19.1	31.1	15.7	7.6	7.3
\$75,000-\$150,000	9.8	5.0	10.5	40.9	27.3	6.4	13.5
\$150,000-350,000	2.5	1.3	2.6	19.8	49.2	24.6	18.8
> \$350,000	1.0	1.0	1.5	7.0	27.2	62.2	21.8
Percent in each FYO interval	25.1	8.7	7.1	17.3	20.8	21.0	

note: sample excludes persons still alive in 2012

Assets Nearer Death: Tables 2-1a and 2-1b include persons first observed in 1994 for the HRS and 1993 for the AHEAD. The period between the FYO observed and the LYO could be as short as two years for both cohorts or as long as 18 years for the HRS cohort and 19 years for the AHEAD cohort. To direct attention to assets nearer death, we have reproduced Tables 2-1a and 2-1b excluding persons for whom the interval between the FYO and the LYO is fewer than eight years. These results are shown in Tables 2-1c and 2-1d for the two age cohorts. For the HRS cohort the results are quite similar to those in Tables 2-1a and 2-1b. For the AHEAD cohort, however, the proportion of households in the lowest asset interval in the FYO and the lowest asset interval in the LYO decline from 56.8 percent when all years are combined to 48.1 percent for those who died at least eight years after the FYO. The percentages decline only marginally in the other intervals. Overall, however, the persistence of asset levels is striking.

Table 2-1c. Percentage of persons in each asset interval when first observed by asset interval in last wave prior to death if 8 or more years elapsed between first and last year observed, persons age 51 to 61 in 1992 (row percents)

asset interval in LYO	asset interval in first year observed (1994)						Percent in each LYO interval
	< \$25,000	\$25,000-\$50,000	\$50,000-\$75,000	\$75,000-\$150,000	\$150,000-\$350,000	> \$350,000	
< \$25,000	65.2	12.5	4.7	9.1	7.0	1.5	31.1
\$25,000-\$50,000	26.0	22.7	16.5	18.0	14.3	2.5	7.2
\$50,000-\$75,000	9.3	17.8	21.7	38.8	8.5	3.8	5.3
\$75,000-\$150,000	4.3	9.3	12.5	38.1	28.7	7.0	14.5
\$150,000-\$350,000	4.7	1.6	6.4	22.5	46.9	17.8	17.8
> \$350,000	1.6	0.7	0.9	4.7	25.6	66.6	24.2
Percent in each FYO interval	24.4	8.2	7.0	16.9	22.4	21.2	

note: sample excludes persons still alive in 2012

Table 2-1d. Percentage of persons in each asset interval when first observed by asset interval in last wave prior to death if 8 or more years elapsed between first and last year observed, persons age 70 or older in 1993 (row percents)

asset interval in LYO	asset interval in first year observed (1993)						Percent in each LYO interval
	< \$25,000	\$25,000-\$50,000	\$50,000-\$75,000	\$75,000-\$150,000	\$150,000-\$350,000	> \$350,000	
< \$25,000	48.1	10.1	9.0	14.4	14.1	4.2	31.9
\$25,000-\$50,000	21.1	19.4	12.6	23.7	16.7	6.5	6.4
\$50,000-\$75,000	8.3	17.1	13.6	34.3	16.2	10.6	6.9
\$75,000-\$150,000	8.6	4.0	9.0	38.8	31.6	8.0	12.4
\$150,000-\$350,000	2.2	1.0	3.3	17.4	48.1	28.1	18.8
> \$350,000	0.8	0.9	1.1	6.8	28.3	62.2	23.6
Percent in each FYO interval	19.0	6.6	6.6	18.2	26.3	23.4	

note: sample excludes persons still alive in 2012

The tables above show the probability of being in a given asset interval in the FYO given the level of assets in the LYO. The probability of being in a given asset interval in the LYO given the level of assets in the FYO is shown in Tables 2-2a and 2-2b for the HRS and AHEAD cohorts respectively. Because results for those for whom the interval between the FYO and the LYO is eight or more years and the results for all years are similar, we only show the results for the subsample of persons who die at least eight years after first being observed. Again, the results show a great deal of persistence: persons who have substantial assets when first observed also tend to

have substantial assets prior to death. For both age groups over 80 percent of persons with fewer than \$25,000 in assets the FYO observed also have less than \$25,000 in assets in the LYO. For the younger age cohort 76 percent of persons in the top asset interval in the FYO are also in the top asset interval in the LYO. In the older cohort, however, persistence in the top asset interval is lower somewhat lower; only at 62.6 percent of those with assets greater than \$350,000 in the FYO also had assets above this level in the LYO.

Table 2-2a. Percentage of persons in each asset interval in last wave prior to death by asset interval when first observed if 8 or more years elapsed between first and last year observed, persons age 51 to 61 in 1992 (row percents)

asset interval in LYO	asset interval in first year observed (1994)						Percent in each LYO interval
	< \$25,000	\$25,000-\$50,000	\$50,000-\$75,000	\$75,000-\$150,000	\$150,000-\$350,000	> \$350,000	
< \$25,000	82.8	7.6	2.0	2.6	3.4	1.6	24.4
\$25,000-\$50,000	47.0	19.7	11.5	16.4	3.5	2.0	8.2
\$50,000-\$75,000	21.1	17.0	16.6	26.1	16.3	2.9	7.0
\$75,000-\$150,000	16.8	7.7	12.2	32.8	23.8	6.7	16.9
\$150,000-\$350,000	9.7	4.6	2.0	18.6	37.4	27.7	22.4
> \$350,000	2.3	0.9	1.0	4.8	15.0	76.1	21.2
Percent in each FYO interval	31.1	7.2	5.3	14.5	17.8	24.2	

note: sample excludes persons still alive in 2012

Table 2-2b. Percentage of persons in each asset interval in last wave prior to death by asset interval when first observed if 8 or more years elapsed between first and last year observed, persons age 70 or older in 1993 (row percents)

asset interval in LYO	asset interval in first year observed (1993)						Percent in each LYO interval
	< \$25,000	\$25,000-\$50,000	\$50,000-\$75,000	\$75,000-\$150,000	\$150,000-\$350,000	> \$350,000	
< \$25,000	81.0	7.2	3.0	5.6	2.2	1.0	19.0
\$25,000-\$50,000	49.2	19.1	17.9	7.6	2.9	3.3	6.6
\$50,000-\$75,000	43.6	12.3	14.2	16.8	9.4	3.9	6.6
\$75,000-\$150,000	25.4	8.4	13.0	26.4	18.0	8.8	18.2
\$150,000-\$350,000	17.2	4.1	4.2	14.8	34.3	25.3	26.3
> \$350,000	5.8	1.8	3.1	4.2	22.5	62.6	23.4
Percent in each FYO interval	31.9	6.4	6.9	12.4	18.8	23.6	

note: sample excludes persons still alive in 2012

Prevalence of zero and negative balances in the LYO: Table 2-3 provides additional detail for three groups of households: those who have positive, zero and negative asset balances in the LYO before death. Negative asset balances just prior to death are common, particularly for those in the younger cohort. The primary source of negative wealth is consumer household debt, primarily credit card debt, medical debt, and life insurance policy loans. A substantial fraction of these persons died before the Great Recession. The prevalence of negative home equity may now be greater than these data show. The older cohort is much less likely than the younger cohort to have negative asset balances in the LYO--2.1 percent vs 7.1 percent. A substantial proportion also have zero balances--8.2 percent of persons in the younger cohort and 10.7 percent of persons in the older cohort report asset balances that are exactly zero.

Table 2-3. Summary of asset balances in the LYO, noting zero and negative assets balances, for the HRS and AHEAD cohorts.

Assets in Last Year Observed	Percent of persons	Mean Assets in LYO	Median Assets in LYO	Percent with Negative Consumer	Percent with Negative Housing	Percent with Zero Home Equity
Persons age 51 to 61 in 1992						
<\$0	7.1	-\$29,949	-\$8,130	96.4	7.1	79.2
\$0	8.2	\$0	\$0	0.4	0.0	100.0
>\$0	84.8	\$416,121	\$140,667	28.4	0.4	16.6
Persons age 70 or older in 1993						
<\$0	2.1	-\$8,130	-\$2,850	93.8	6.2	91.7
\$0	10.7	\$0	\$0	0.1	0.0	100.0
>\$0	87.2	\$373,247	\$128,749	7.6	0.2	37.4

Note: a small number of persons hold negative positions in financial assets. Calculations exclude persons alive when last observed.

Asset paths by LYO: The series of figures that follow provide more detail on the path of assets between the year first observed and the year last observed. Each panel in Figure 2-1 shows median non-annuity assets for respondents in different age intervals. The profiles in each panel show assets in each year for respondents identified by their LYO. The LYO for each profile is easily identified by the most recent year for which assets are graphed. Thus the top profile in each panel shows median assets in 2012 and all prior years for all persons whose LYO is 2012. Another profile

shows assets in 2010 and all prior years for all persons whose LYO is 2010, and so forth.

The top two panels in Figure 2-1 show the assets in each year by the LYO for persons who were age 51 to 55 and age 56 to 61 in 1992. We draw attention to several features of the data. First, for persons last observed before 2012 (these persons were all deceased after the LYO) the profiles are flat, indicating little change in median assets between 1994 and the LYO. That is, asset balances in the LYO are essentially the same as the asset balances they had when first observed in the HRS. Second, for persons last observed before 2012, there appears to be no relationship between assets and mortality, as indicated by the absence of vertical gaps between the profiles. In other words, those who died earlier have roughly the same assets as those who died later. Third, there is however a strong relationship between assets and mortality if the group still living in 2012 (the uppermost profile) is considered. Persons that die after 2012 have much more wealth – when first observed in 1994 and when last observed in 2012 - than persons that died prior to 2012. For the group still living in 2012 there is some evidence of asset decline, but it is unclear whether age or year effects are responsible. In both figures the decline coincides with the Great Recession of 2007-2008. The bottom two panels of Figure 2-1 show profiles for two older age groups from the AHEAD cohort. Relative to the groups from the HRS cohort, these profiles show stronger evidence of asset decline approaching end of life, but again the decline coincides with the Great Recession. There is also some evidence of a positive asset-mortality relationship for both older groups, with one noticeable exception: in the figure for persons age 76 and older, the group still living in 2012 does not appear to be wealthier than several of the groups that died earlier.

Figure 2-1. Median assets (in 000's) in each year by last year observed

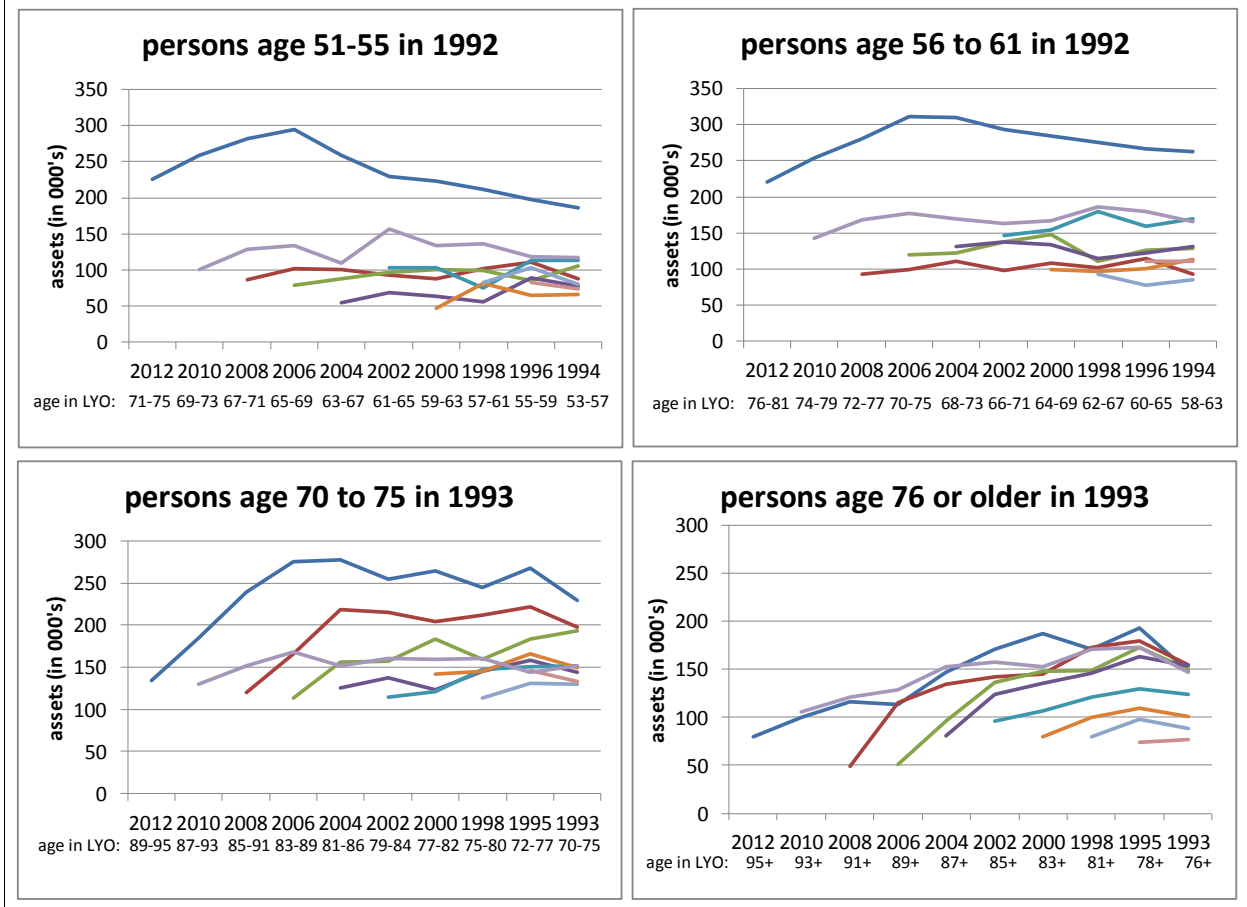
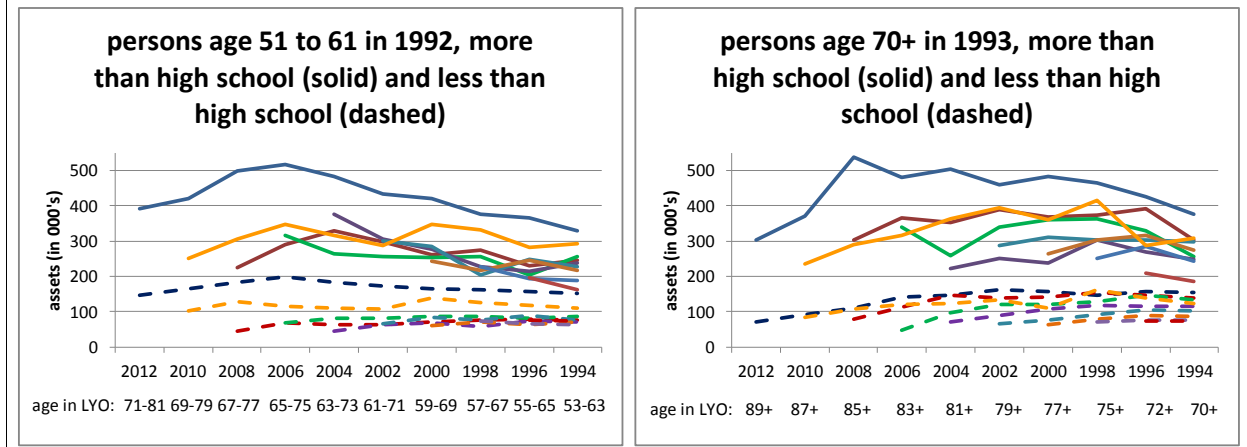


Figure 2-2 is based on the same data as Figure 2-1 but combines all persons in the top two panels of Figure 2-1 and combines all persons in the bottom two panels of Figure 2-1. For each of these groups, Figure 2-2 distinguishes persons by level of education. The solid lines pertain to persons with more than a high school education and the dashed lines are for those with less than a high school education. As expected, there is a very substantial difference in the initial non-annuity wealth of the two education groups. Among persons age 51 to 61 in 1992 with less than a high school degree, those who are still living in 2012 clearly have more wealth than those who died before 2012, but among those who died before 2012 there appears to be little relationship between age of death and wealth in 1994. In addition for this group wealth at death is approximately the same as wealth in 1994. For those with more than a high school education the same pattern holds - those who are still living in 2012 had

substantially more wealth in 1994 than those who died before 2012 but there is little relationship between wealth in 1994 and the age of death.

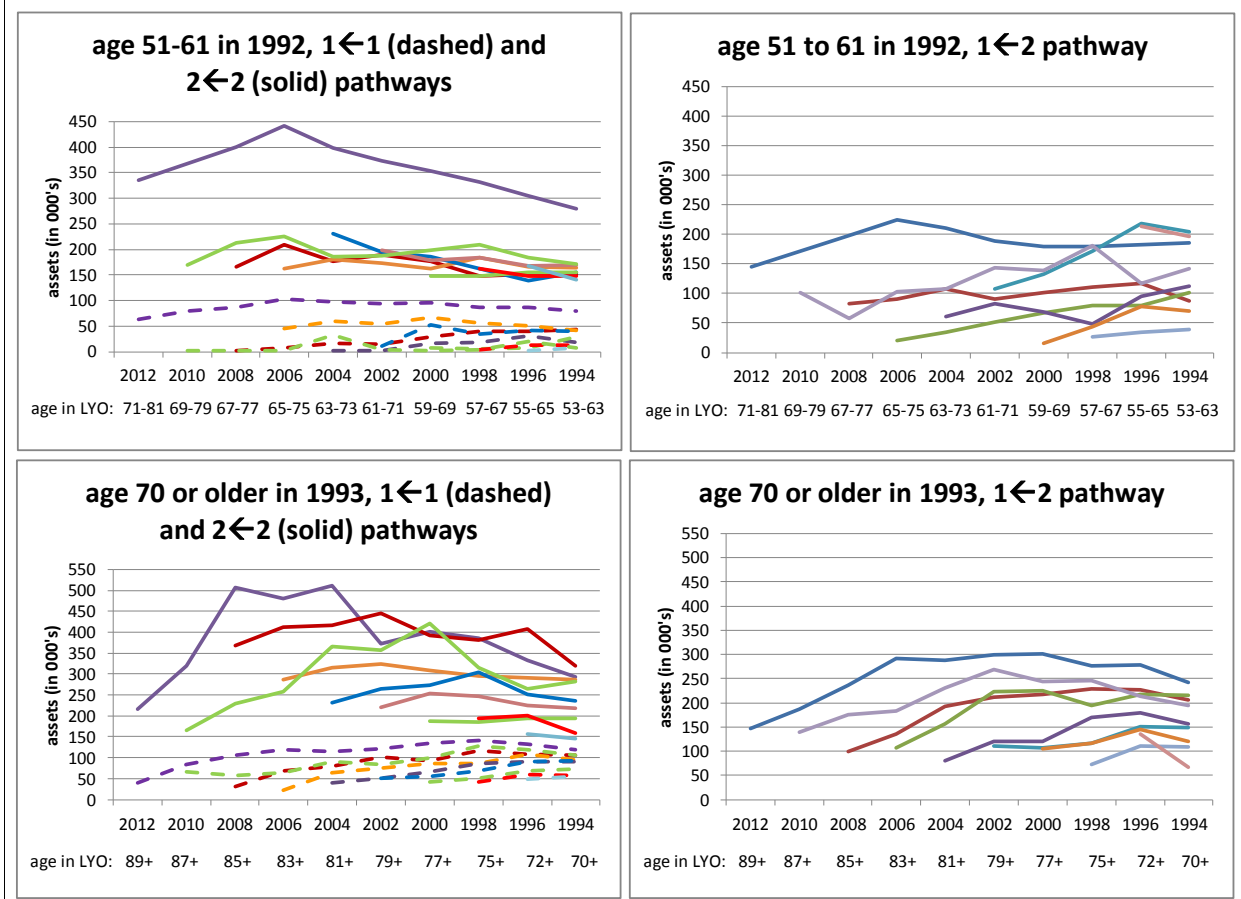
Figure 2-2. Median assets (in 000's) in each year by last year observed and level of education



The figures above show profiles for all households in each age group. It is likely that wealth profiles differ by marital status and, in particular, may be strongly affected by changes in marital status. Figure 2-3 shows separate asset profiles for households that experienced different family status patterns over the observation period. We identify persons who were single when last observed in the HRS or AHEAD and single when first observed ($1 \leftarrow 1$), persons who were single when last observed but in a two-person household when first observed ($1 \leftarrow 2$), and persons who were in a two-person household when last observed and in a two-person household when first observed ($2 \leftarrow 2$). A fourth group – persons in two-person households when last observed who were in a one-person household when first observed – was too small for meaningful analysis. The top two panels show data for persons age 51-61 in 1992; the left panel shows data for the $1 \leftarrow 1$ and the $2 \leftarrow 2$ groups and the right panel shows data for persons in the $1 \leftarrow 2$ group. The $1 \leftarrow 1$ group has the lowest level of assets and for this group there is little difference between assets in 1994 and assets in the LYO. The $2 \leftarrow 2$ group has the highest level of assets and for this group assets in the LYO tend to be larger than assets in 1994. The assets of the $1 \leftarrow 2$ group are the most dispersed in the LYO and the level in the LYO tends to be similar to the level of assets when first observed in 1994, with two or three exceptions.

Profiles for the group age 70 and older in 1993 are shown in the bottom two panels of the Figure 2-3. Again the left panel shows profiles for the 1←1 group. The assets of this group tend to decline with age and the data show a more pronounced relationship between wealth and mortality, with those with more wealth in 1993 living longer. The 2←2 group also shows a substantial wealth-mortality relationship. The profiles for households with a LYO of 2006 or earlier are very similar to assets in 1993. The two profiles for the 2←2 group show a substantial increase in wealth until about six years before the LYO and then a rather sharp decline. The 1←2 group exhibit a strong wealth-mortality relationship with assets in the LYO substantially lower than the asset in 1993.

Figure 2-3. Median assets (in 000's) in each year by last year observed and family status pathway



Annuity Income: It is clear from the above tables and figures that a substantial number of households have few non-annuity assets in the last years of life. For many of

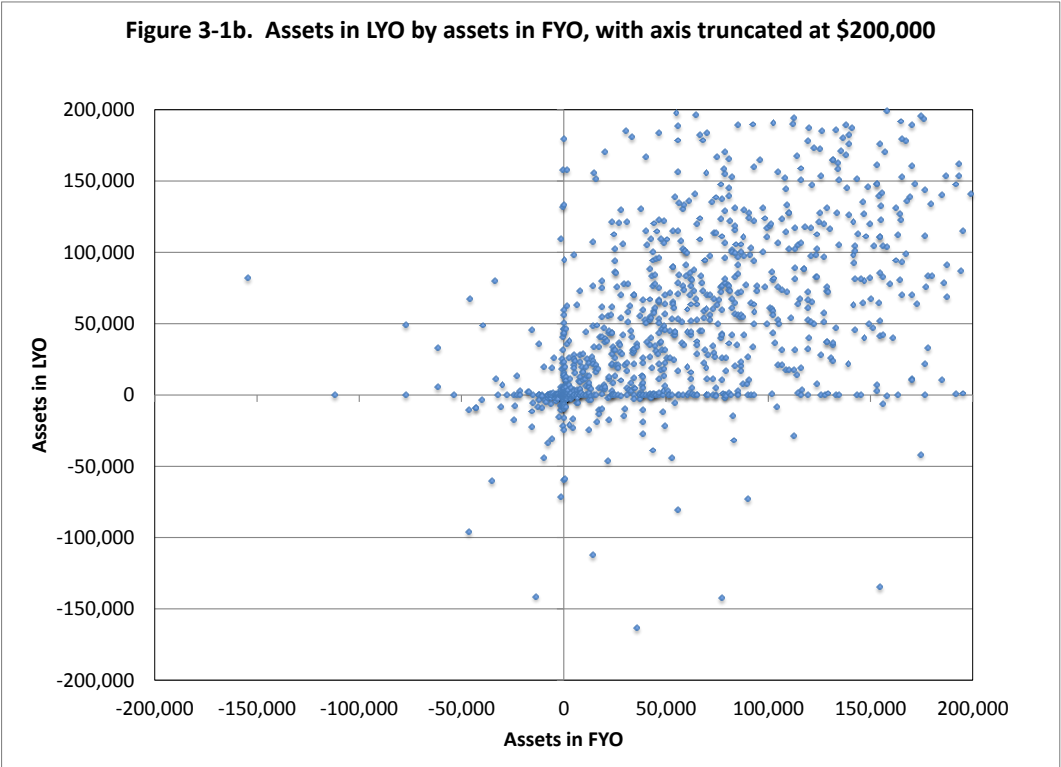
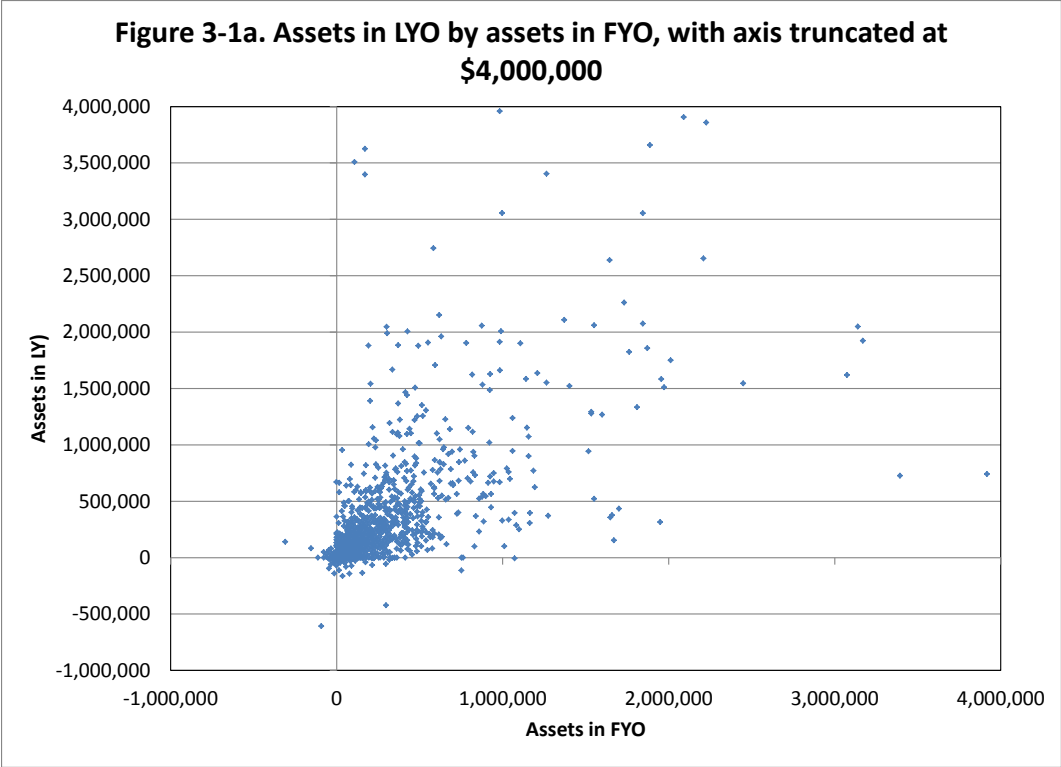
these households annuity income – primarily from Social Security but also from DB pensions – is the sole means of support. The crucial role of annuity income is illustrated in Table 2-4 which tabulates the level of annuity income in the LYO by the level of non-annuity assets in the LYO. Both assets and income are in 2012 dollars. Among households with low levels of assets (less than \$25,000 in the LYO), 31.5 percent have less than \$10,000 of annuity income and 79.4 percent have less than \$20,000 of annuity income.

Table 2-4. Percentage of persons in each annuity income interval in last wave prior to death by asset interval in last wave prior to death, persons age 70 or older in 1993 (row percents sum to 100)

asset interval in LYO	annuity income interval in LYO					Percent in LYO interval
	< \$10,000	\$10,000-\$20,000	\$20,000-\$30,000	\$30,000-\$40,000	> \$40,000	
< \$25,000	31.5	47.9	13.5	4.9	2.3	31.7
\$25,000-\$50,000	19.1	47.1	23.5	3.7	6.6	6.9
\$50,000-\$75,000	19.3	43.7	24.3	7.8	4.9	7.3
\$75,000-\$150,000	13.1	43.7	25.3	10.3	7.7	13.5
\$150,000-\$350,000	8.2	35.5	25.5	16.5	14.2	18.8
> \$350,000	7.3	25.1	27.1	16.6	23.8	21.8

3) Regression Estimates

Model specification: Before discussing details of the estimation we describe some features of the data that motivate the estimation procedure that we follow. Figures 3-1a and 3-1b below show the relationship between assets in the FYO and assets in the LYO, for persons 51 to 61 in 1992. Asset balances larger than \$4,000,000 are not shown in the figure. Many, but not all, of the observations excluded from the figure are likely reporting errors. Thus it is clear that there are many outliers in the data. The asset balances shown in Figure 3-1b are truncated at \$200,000. Note also that there are many negative asset balances in both the FYO and in the LYO.



To minimize the effect of outliers, our analysis focuses on the natural log of wealth. We have also “trimmed” the data in estimation, as explained below. The presence of zero and negative asset balances poses an obvious problem in logarithmic

specifications. We experimented with transformations of the data, in particular the inverse hyperbolic sine transformation—that we hoped would allow us to use negative values—but ultimately we base our estimates on observations with positive values of assets in both the FYO and the LYO (the data in the upper left right quadrant of the figures). For the sample age 51 to 61 in 1992, 23 percent of the sample had assets in the FYO or LYO less than zero and are excluded from the analysis. For the sample age 70 or older in 1993, about 19 percent had assets in the FYO or LYO less than zero and are excluded. It is difficult to assess the effect of these exclusions on our results. One simple test is to estimate models based on *levels* and compare results for the full sample to results from the sub-sample that excludes negative and zero values. We use the simple specification:

$$Assets_{LYO} = \alpha + \beta Assets_{FYO} + \varepsilon$$

Table 3-1 shows results using trimmed OLS³.

	β	t-statistic	α	t-statistic
Persons 51 to 61 in 1992				
Full sample	1.085	85.2	11,677	2.3
Positive asset subsample	1.097	69.1	21,601	3.0
persons 70 and older in 1993				
Full sample	0.964	92.0	18,714	5.4
Positive asset subsample	0.956	73.7	35,293	7.4

It makes very little difference whether observations with negative and zero asset values are included. This result gives us some confidence that a model specified in logs may not be appreciably affected by the exclusion of observations with zero or negative asset balances.

Our goal is to estimate the effect of personal attributes, in particular health, family status and education, on the relationship between assets in the FYO and assets in the

³ All regression estimates in this paper are based on trimmed samples. We first estimate a regression on the full sample, order the residuals, and then delete the top and bottom 3 percent of the observations.

LYO, graphed in Figures 2-1 to 2-3. We begin with a simple model in which the relationship between assets in the LYO and assets in the FYO is log-log and the relationship between assets in the LYO and other covariates is log-linear⁴:

$$\ln(\text{Assets}_{LYO}) = \alpha + \beta \ln(\text{Assets}_{FYO}) + d_1(\text{Years Since FYO}) + d_2(\text{Age in FYO}) + d_3(\text{Cancer}) + d_4(\text{Heart Problems}) + d_5(\text{Stroke}) + d_6(\text{Lung Disease}) + d_7(\text{Psychological Problems}) + d_8(\text{Diabetes}) + d_9(\text{High School}) + d_{10}(\text{Some College}) + d_{11}(\text{College or More}) + e_3 + \mu$$

More detail about the covariates included in this equation is provided together with the discussion of the estimates below. The log-log specification for assets in the FYO implies that a one percent change in assets in the FYO will lead to a constant percentage change in assets in the LYO. The log-linear specification implies that a unit change in each of the covariates leads to a constant percentage change in assets in the LYO.

Estimates: Estimates of the relationship between assets in the FYO and assets in the LYO with and without covariates are shown in Table 3-2 below. Estimates are shown for persons age 51 to 61 in 1992 and for persons age 70+ in 1993. As noted above, these estimates are based on trimmed samples that exclude observations with zero or negative asset values. The sample used here, and for all subsequent estimates, only includes persons who are known to be deceased. Persons still alive when last observed in the 2012 wave of the HRS are excluded as are persons who leave the sample but are not known to be deceased. For each age cohort the first column shows results excluding covariates and the second column includes covariates. In the specification with no covariates, the estimates of α indicate the log of assets in the LYO if a person had one dollar of assets in the FYO. The estimates of β indicate the fraction of the log of assets in the FYO that are carried over to the LYO. A comparison between estimates without covariates for the two age cohorts shows that the coefficient on assets in the FYO is lower for the 70+ group than the age 51 to 61 groups. This is consistent with the patterns observed in Figures 2-1 to 2-3.

⁴ Figures 2-1 to 2-3 show medians.

Table 3-2. Personal attributes associated with the change in assets between first and last year observed (dependent variable is log of assets in last year observed)

Variable	Age 51 to 61 in 1992		Age 70+ in 1993		Age 51 to 61 in 1992		Age 70+ in 1993	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Log(assets in FYO)	0.947	54.98	0.873	46.24	0.912	73.89	0.856	64.14
Years since FYO			0.006	0.93			-0.032	-6.00
Age in FYO			0.006	0.73			-0.008	-2.07
Health in FYO			0.003	2.70			0.002	2.73
Cancer			-0.023	-0.39			0.052	0.93
Heart problems			-0.050	-0.81			0.092	1.89
Stroke			-0.284	-3.85			-0.069	-1.34
Lung disease			-0.224	-3.17			-0.002	-0.02
Psychological problems			-0.253	-3.49			-0.214	-3.77
Diabetes			0.008	0.12			-0.176	-2.53
High school degree			0.196	3.01			0.127	2.69
Some college			0.252	3.25			0.289	4.98
College or more			0.413	4.80			0.406	6.20
2←2 Pathway			0.298	3.59			0.394	6.71
1←1 Pathway			-0.048	-0.50			0.058	1.02
Constant	0.594	2.87	1.014	4.34	0.842	5.73	1.415	8.43
R ²	0.7019		0.7201		0.606		0.6232	
N	1,286		1,285		3,549		3,550	

Notes: Sample excludes all persons who were alive when last observed. The variable "age in LYO" is the number of years over the age of 53 in the LYO for the age 51 to 61 group and the number of years over the age of 70 for the age 70 or older group.

In the specifications with covariates, the variable *Years since FYO* is the number of years elapsed between the FYO and the LYO. The variable *Age in FYO* is the number of years over the age of 53 in the LYO for the age 51 to 61 group and the number of years over the age of 70 for the age 70 or older group. The next seven variables are intended to capture the effect of health on the change in assets between the FYO and the LYO. The first variable, *Health in FYO* is the value of a percentile health index in the FYO. This index is constructed from 27 health-related questions in the HRS and is scaled to range from 1 (lowest) to 100 (highest). Construction of the index is described in more detail in Poterba, Venti and Wise (2013). The next six

variables are indicator variables for the onset of particular health conditions between the FYO and the LYO. There are three indicator variables for level of education (less than a high school degree is the excluded category) and two indicator variables for family status pathway (the 1←2 category is excluded).

The estimates of greatest interest are the health variables. For both age groups the effect of the overall level of health in the FYO is statistically significant. The coefficient for the younger group (0.003) suggests that an increase in health that moves an individual up by ten percentiles in the FYO is associated with an increase of approximately three percent in assets in the LYO. For the younger group, a stroke, the onset of lung disease and the onset of psychological problems are all associated with substantial reductions (approximately 25 percent) in assets in the LYO. For the older group the onset psychological problems and diabetes are associated with declines in assets. The effect of education on assets in the LYO is very substantial, given assets in the FYO. The education estimates for the younger and older groups are similar, with the effect of *college or more* larger than the effect of *some college*, which in turn is larger than the estimated effect of *high school degree*. On average, persons in the 2←2 family status pathway increased assets by 30 to 40 percent relative to the other pathways.

Table 3-3 shows estimates by pathway for persons 51 to 61 in 1992 and Table 3-4 shows estimates by pathway for persons 70 and older in 1993. The sample size for the 1←2 pathway for the 51 to 61 group is quite small and many of the estimates are not significantly different from zero. For the 2←2 group the lung disease, psychological problems, and stroke conditions have the greatest negative effect on assets in LYO given assets in FYO. For the 1←1 group the most consequential conditions for assets in the LYO are psychological problems, heart problems, and stroke. The PVW general health index level of health in the FYO is associated with higher LYO assets in both the 1←1 and the 1←2 groups, but perhaps surprisingly not the 2←2 group. For the 2←2 and the 1←1 groups the education estimates are large and especially for the 2←2 group are precisely measured.

Table 3-3. Personal attributes associated with the change in assets between first and last year observed, persons age 51 to 61 in 1992 (dependent variable is log of assets in last year observed)

Variable	Coefficient		t-stat		Coefficient		t-stat		Coefficient		t-stat		Coefficient		t-stat	
	2-person from 2-person				1-person from 1-person				1-person from 2-person							
Log(assets in FYO)	0.849	40.44	0.804	35.92	0.970	23.98	0.872	20.22	1.060	11.59	0.965	10.20				
Years since FYO			0.007	1.17			-0.001	-0.04			-0.002	-0.05				
Age in FYO			-0.004	-0.47			0.073	2.68			0.074	1.84				
Health in FYO			0.001	0.58			0.006	2.14			0.016	3.45				
Cancer			0.027	0.47			-0.120	-0.54			-0.010	-0.03				
Heart problems			-0.019	-0.31			-0.545	-2.62			0.320	0.97				
Stroke			-0.188	-2.65			-0.506	-1.83			-0.507	-1.24				
Lung disease			-0.318	-4.49			-0.105	-0.45			0.475	1.37				
Psychological problems			-0.202	-2.74			-0.825	-3.30			-0.540	-1.70				
Diabetes			-0.059	-0.94			0.143	0.60			0.884	2.40				
High school degree			0.225	3.39			0.224	1.04			-0.229	-0.79				
Some college			0.369	4.66			0.219	0.89			0.175	0.48				
College or more			0.438	5.07			0.541	2.03			0.186	0.36				
Constant	1.917	7.48	2.267	8.54	0.062	0.14	0.544	1.14	-1.212	-1.11	-1.262	-1.12				
R ²	0.656		0.681		0.69		0.723		0.45		0.525					
N	858		858		261		260		166		166					

Notes: Sample excludes all persons who were alive when last observed. The variable "age in LYO" is the number of years over the age of 53 in the LYO.

Table 3-4. Personal attributes associated with the change in assets between first and last year observed, persons age 70 or older in 1993 (dependent variable is log of assets in last year observed)

Variable	Coefficient		t-stat		Coefficient		t-stat		Coefficient		t-stat		Coefficient		t-stat	
	2-person from 2-person				1-person from 1-person				1-person from 2-person							
Log(assets in FYO)	0.894	57.25	0.868	50.11	0.841	42.94	0.820	40.41	0.910	22.71	0.870	20.00				
Years since FYO			-0.014	-2.34			-0.044	-4.58			-0.045	-2.95				
Age in FYO			-0.003	-0.77			-0.008	-1.25			-0.011	-0.88				
Health in FYO			0.000	-0.39			0.003	1.83			0.006	2.32				
Cancer			0.002	0.03			0.101	0.89			-0.009	-0.05				
Heart problems			0.108	2.12			0.190	2.13			-0.081	-0.56				
Stroke			0.051	0.96			-0.252	-2.67			-0.167	-1.11				
Lung disease			-0.040	-0.61			-0.107	-0.83			0.243	1.20				
Psychological problems			-0.148	-2.51			-0.421	-3.90			-0.260	-1.65				
Diabetes			-0.069	-1.06			-0.110	-0.76			-0.253	-1.08				
High school degree			0.083	1.64			0.281	3.36			0.160	1.13				
Some college			0.252	3.95			0.279	2.73			0.297	1.76				
College or more			0.190	2.80			0.674	5.29			0.586	3.12				
Constant	1.299	6.77	1.657	8.04	1.520	6.80	1.899	7.75	0.606	1.25	1.273	2.47				
R ²	0.71		0.709		0.544		0.567		0.44		0.465					
N	1338		1338		1548		1546		659		660					

Notes: Sample excludes all persons who were alive when last observed. The variable "age in LYO" is the number of years over the age of 70 in the LYO.

Table 3-4 shows estimates by pathway for the age 70 and older group. The sample sizes are much larger than the sample sizes for the 51 to 61 group. The general level of health is statistically significant in only one of the three family status pathways, although the magnitude of the estimated effect is quite large: a 10 percent increase in the index is associated with a 6 percent increase in assets in the LYO. Among the variables indicating the onset of medical conditions, psychological problems has a strong negative effect in two of the three pathways and a stroke has a negative effect for continuously single-person households. Surprisingly, the onset of heart problems has an estimated positive effect in two of the three pathways.

Education is very strongly related to LYO assets for both the 1←1 and the 1←2 groups. For example for the 1←1 group a college degree (compared to less than a HS degree) is associated in a 67 percent increase in assets in the LYO. For the 1←2 group the comparable increase is 59 percent. For the 2←2 group the education effects are much smaller and the “expected” pattern of the effects is reversed in one case—0.083, 0.252, and 0.190 for high school degree, some college, and college or more respectively.

Psychological problems (emotional, nervous or psychiatric problems) is the condition most commonly related to lower assets in the LYO, looking across all persons 51 to 61 in 1992 and persons 70 and over in 1993 and across the three pathway groups individually. In addition, health in FYO is associated with greater assets in the LYO with the exception of the 2←2 group.

We can illustrate the relative magnitudes of the effects estimated in Table 3-2 through simulation. Table 3-5 below presents simulated asset balances based on the estimates for ages 51 to 61 in 1992 (shown in Table 3-2) and Table 3-6 presents simulations for the persons age 70 and over in 1993. The first two rows of each table show the simulated assets in the LYO for a baseline person who has \$100,000 of assets in the FYO, for each of the four levels of education, and the weighted average across all education groups. The first row simulates assets in the LYO when all covariates (except assets in the FYO and education) are set to their sample means. The first entry in the first row shows that assets fall by about \$16,000 (from \$100,000 to \$84,139) for persons without a high school degree. The remaining entries in this row

show terminal assets for persons with other levels of education. The differences by level of education are substantial, especially noting that we hold constant assets in the FYO (both in estimation and in the simulation). The last entry in the row shows that, on average, assets remain essentially constant between the FYO and LYO (close to \$100,000). The second row shows the results of the same simulation, except that all of the health condition variables are set to zero rather than to their means. The last entry in this row shows that, on average, persons who do not experience health events increase asset balances between the FYO and the LYO.

The remaining rows of Table 3-5 show the simulated level of assets in the LYO when selected attributes are set at specified values and the other covariates are set to their means. For example, averaging over all education groups (the last column), an increase in health in the FYO from the 25th percentile to the 75th percentile is associated with an increase in assets in the LYO from \$96,001 to \$108,966. Overall, the relationship between a change in health in the FYO on terminal assets is modest (although statistically significant). However, a change in family status and a change in a health condition have substantial effects on assets in the LYO. For example (using the “all” column), continuously married households will have approximately \$29,000 (\$83,821 versus \$112,920) more in assets in the LYO than persons who went from a two-person household to a one-person household. Finally, the effect of two of the more important health conditions (a stroke and psychological problems) show that each is associated, on average, with a \$25,000 to \$30,000 reduction in assets.

Table 3-6 presents comparable results for persons age 70 and older in 1993. The last entry of the first row of simulations suggests that, on average, the assets of this group declined modestly between the FYO and the LYO. The second row shows that assets would have been only marginally higher if the baseline person had experienced no health conditions. A comparison with the previous table suggests that the effect of health conditions is much greater for the younger cohort than for the older cohort. The effects of most of the other covariates are of similar orders of magnitude for the two age cohorts.

Table 3-5. Simulated assets in LYO for baseline person with \$100,000 of assets in FYO, based on estimates for persons age 51 to 61 in 1992

Baseline assets and attribute change	Level of Education				
	Less than high school	High school degree	Some college	College or more	All
Baseline assets in LYO					
Mean attributes	\$84,139	\$102,309	\$108,296	\$163,617	\$101,921
No health conditions	\$95,785	\$116,470	\$123,286	\$144,714	\$116,028
Change in attribute					
Health in FYO					
25th percentile	\$79,253	\$96,937	\$102,006	\$154,114	\$96,001
75th percentile	\$89,955	\$109,382	\$115,782	\$174,927	\$108,966
Family status					
1←2	\$69,198	\$84,142	\$89,065	\$104,546	\$83,821
2←2	\$93,220	\$113,351	\$119,984	\$181,274	\$112,920
Health conditions					
None	\$95,785	\$116,470	\$123,286	\$144,714	\$116,028
Stroke	\$72,126	\$87,702	\$92,834	\$144,714	\$87,369
Psychological problems	\$64,347	\$90,403	\$95,693	\$112,325	\$90,059

Table 3-6. Simulated assets in LYO for baseline person with \$100,000 of assets in FYO, based on estimates for persons age 70 or older in 1993

Baseline assets and attribute change	Level of Education				
	Less than high school	High school degree	Some college	College or more	All
Baseline assets in LYO					
Mean attributes	\$74,487	\$84,559	\$99,432	\$111,752	\$86,024
No health conditions	\$76,396	\$86,225	\$101,980	\$114,615	\$88,227
Change in attribute					
Health in FYO					
25th percentile	\$72,284	\$82,057	\$96,490	\$108,445	\$83,478
75th percentile	\$80,874	\$91,809	\$107,957	\$121,333	\$93,399
Family status					
1←2	\$62,062	\$70,453	\$82,845	\$93,109	\$71,673
2←2	\$92,008	\$104,448	\$122,820	\$138,037	\$106,257
Health conditions					
None	\$76,396	\$86,725	\$101,980	\$114,614	\$88,227
Stroke	\$71,336	\$80,981	\$95,225	\$107,023	\$82,384
Psychological problems	\$61,663	\$70,000	\$82,313	\$92,511	\$71,213

4. Summary

In this paper we consider the determinants of assets at death. In particular, we observe asset balances when households were last observed prior to death, and then trace asset balances backwards to the age when the household was first observed. The analysis is based on data from respondents of the Health and Retirement Study (HRS). We have data through 2012 for members of two HRS cohorts--respondents age 51 to 61 when first observed in 1992 and respondents age 70 or older when first observed in 1993. Thus we are able to track assets back from 2012 for as many as 19 years.

We first document levels of assets near the end of life for each of the HRS cohorts. Asset balances are quite persistent in the later stages of life. For the younger cohort, 68 percent of the households that had fewer than \$25,000 in assets when last surveyed before death also had fewer than \$25,000 in assets when first surveyed. For the older cohort, 57 percent of the households that had fewer than \$25,000 in assets

when last surveyed before death also had fewer than \$25,000 in assets when first surveyed. Those who had substantial assets at the end of life also had substantial asset balances when first observed. The persistence of wealth is confirmed in a series of figures showing median assets in each survey wave between the wave first observed and the last wave observed before death. For the younger cohort the path of assets is essentially flat. For older cohorts there is some evidence of a modest decline

In more formal analysis we estimate the relationship between individual attributes and the change in assets between the FYO and the LYO. We obtain estimates for HRS respondents who were 51 to 61 in 1992 and for AHEAD respondents who were age 70 and over in 1993. In addition, we obtain estimates by family status pathway—two-person in both the FYO and the LYO, one-person in both the FYO and the LYO years, and those who were in one-person households in the LYO and two-person households in the FYO.

We pay particular attention to how changes in health (the onset of chronic conditions), level of education, and changes in family composition, such as death of a spouse, are associated with changes in assets. Our estimation results are summarized through simulations. On average, assets remain roughly constant between the FYO and the LYO for the younger cohort and decline modestly for the older cohort. For households that do not experience a health event or family disruption, the asset profile slopes upward for the younger cohort and slightly downward for the older cohort. However, households that experience adverse health events, conditions—such as a stroke, the onset of psychological problems, or other severe health events—the decline in assets can be quite large. Similarly, households that experience a change in household composition, to one-person from two-person, incur substantial declines in wealth.

Taken as a whole, these results suggest that the level of assets of households at death is determined primarily by assets when first observed in the HRS. In particular, households with limited assets at death also had limited assets earlier in life. For these households the problem isn't "running out" of assets, the problem is never having had any assets. However, there are also some households that entered retirement with modest or even large asset balances and experienced health shocks or family

disruption that resulted in significant declines in assets. For the cohort age 51 to 61 in 1992 we find little evidence of asset decline among households that do not experience health shocks or family disruption. For these households, there is no evidence that asset balances are being depleted by normal consumption expenditure in retirement. For older households it is also the case that assets at death are determined primarily by asset balances earlier in retirement. However, for the older households – who were age 70+ in 1993 and thus most are over the age of 90 by 2012 – there is some evidence that assets decline modestly prior to death, even in the absence of health or family shocks. The onset of health conditions can have large negative consequences for asset balances of the older cohort as well, but on the whole the effects of health conditions are smaller than for the younger cohort.

The analysis in this paper is aimed at understanding the determinants of assets at the end of life. A natural extension is to ask what households might have been able to do earlier in life to avoid reaching late life with few resources and we will pursue this issue in future analysis. Some households had lower assets in the LYO than in the FYO. In this case the purchase of an annuity earlier in life might have improved well-being in later years. To assess this possibility we plan to calculate the potential annuity income that each household could have obtained by purchasing an annuity in the first year observed. We also plan to obtain more precise estimates of the number of households that did not save adequately during their working years.. One explanation of low saving, which is difficult to address, is that some households did not earn enough to save while working. In short, were there some households that did not earn enough to both maintain a “reasonable” consumption level and accumulate assets? Of course, the more interesting – and certainly the more difficult – question is why so many households apparently enter retirement with few assets. Previous research (Venti and Wise (1998, 1999), Hendricks (2007), Yang (2009) and Bozio, Emmerson and Tetlow (2011)) has shown that at each level of (lifetime) earnings, some households save and other do not. This suggests that “low earnings” can only provide a partial explanation.

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