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The Nexus of Social Security Benefits, Health, and Wealth at Death

James M. Poterba, Steven F. Venti, and David A. Wise

The three-legged stool representing employer-provided pensions, private saving, and Social Security benefits is commonly used to describe support in retirement. However, a large fraction of retirees balance on only one leg, Social Security, and those balancing on this single leg are also in the poorest health. Poterba, Venti, and Wise (hereafter PVW) (2012) find that 40 percent of all persons approach their last year of life with less than $20,000 in annuity income and less than $10,000 in financial assets. Individuals in this group rely primarily on Social Security; for some, this income is supplemented by defined benefit pension benefits. Sixty-eight percent of those in this group also have no housing wealth, and they are also on average in much poorer health than persons with higher levels of income and liquid assets. This

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raises the concern that adverse health events in old age may lead individuals to exhaust their assets.

We estimate how the drawdown of nonannuity wealth in the years preceding death is related to the receipt of Social Security benefits, defined pension benefits, and the level and change in health in the last years of life. In particular, we want to know whether Social Security income is protective of nonannuity assets. Are persons with more Social Security income able to cover health and other expenses with less need to drawdown savings? Our analysis is based on the drawdown of the nonannuity assets of persons in the Asset and Health Dynamics Among the Oldest Old (AHEAD) cohort of the Health and Retirement Study (HRS). We observe these persons from 1995 until their deaths. A large proportion of this cohort died between 1995 and the latest available survey wave in 2010.

The analysis of the postretirement evolution of nonannuity wealth also helps to fill a gap in what we know about income that older Americans draw from accumulated assets. Using the three-legged stool metaphor again, households may draw support in retirement from Social Security benefits, employer-provided pensions, income from accumulated assets, and by drawing down their asset holdings. Income from Social Security benefits and annuity income from the second leg—principally defined benefit (DB) pensions—are accurately measured in surveys such as the HRS. Some income flows from assets, such as interest and dividends, are well measured, but the accruing value of capital gains is likely to be measured with substantial error. Moreover, it is often difficult to measure the drawdown of assets that households use to supplement their other sources of support. This includes withdrawals from tax-deferred personal retirement accounts (PRAs) such as IRAs and 401(k)s, which are becoming increasingly important for recent retirees. Fisher (2007) and Anguelov, Iams, and Purcell (2012) provide summary information on these withdrawals. Households may draw on these asset reserves to bridge the gap whenever expenditures—particularly unanticipated expenditures—exceed annuity income.

In this chapter, we examine how the rate of asset spend-down is related to health and on the presence of other sources of income. By considering income from Social Security and DB pensions jointly with changes in asset stocks, we hope to develop a more complete picture of the financial resources available to the elderly. We are also interested in the association between health status and these other variables.

The analysis is based on wave-to-wave changes in the assets of AHEAD households. For persons with the same level of assets in a particular wave, we ask how the level of assets in the next wave depends on the initial level of health, the change in health between the waves, and the receipt of annuity income. We estimate how the level of assets in each wave is related to annuity income and health, given the level of assets in the prior wave. The links between health events and asset drawdown have been explored in a number of earlier studies. Smith(1999, 2004, 2005) and Coile and Milligan (2009) are

notable contributions. In PVW (2010), we estimated the total cost of poor health by examining the association between poor health and the rate of change of wealth in retirement. In this chapter, we examine how annuitized income streams from Social Secuirty and DB pensions affect this association.

The chapter is divided into four sections. Section 4.1 describes the data that underlies the empirical analysis and explains briefly the health index that is a key component of the analysis. Section 4.2 presents descriptive data on the trajectory of assets during the retirement years. Section 4.3 reports our empirical results. Section 4.4 concludes and suggests several directions for further work.

4.1 The Data and Health Index

4.1.1 The AHEAD Survey

The analysis is based on data from the Asset and Health Dynamics Among the Oldest Old (AHEAD) survey of households that contained a person age seventy or older in 1993. These households were resurveyed again in 1995 and in every other year beginning in 1998 through 2010. In 1995 the AHEAD sample became one of several cohorts in the Health and Retirement Study (HRS). The AHEAD collects detailed information on household structure, sources of income, and assets. Because these households were at an advanced age when first surveyed in 1993, a large number of original respondents had died by 2010. This analysis focuses primarily on assets and income in the last survey wave prior to the wave in which a respondent is known to be deceased. We refer to this wave as the "last year observed" (LYO). Given the two-year spacing of waves (after 1998) in the AHEAD, the LYO will be within two years of the date of death. Persons who leave the sample, but are not known to have died, are excluded from the analysis.

The AHEAD respondents were first interviewed in 1993. However the data for 1993 are excluded from this analysis for two reasons. First, as Rohwedder, Haider, and Hurd (2006) explain, financial assets were underreported in 1993. Second, several of the key variables that we use to construct a health index were not included in the 1993 survey instrument. Our analysis therefore uses data for 1995, 1998, 2000, 2002, 2004, 2006, 2008, and 2010. All asset and income amounts are converted to 2010 dollars using the CPI-U (Consumer Price Index-Urban).

The unit of observation is the person. All income and asset amounts associated with the person are for the household. To structure the analysis we will first divide the AHEAD respondents into three groups defined by family status when first observed in 1993 and family status in the last year observed before death. These family "pathway" groups are: (a) persons in one-person households in 1993 that remain one-person households until last observed, (b) persons in two-person households in 1993 whose spouse is deceased in the last year observed before the person's death, and (c) persons in two-person households in 1993 whose spouse is alive when the person is

last observed.[1] We often refer to the second group as "two-to-one" households (the number of persons in the household in 1995 and the number in the LYO) and to the third group as "two-to-two" households. Most analyses are performed separately for each of these family "pathway" groups.

4.1.2 The Health Index

We use an index of health based on the first principal component of responses to twenty-seven health-related questions contained in the AHEAD. These questions asked about functional limitations, the presence of health conditions, and other indicators of overall health. The list of questions used to construct the index and a discussion of the general properties of earlier versions of the index are reported in PVW (2010, forthcoming). The index used here is based on all respondents in all cohorts in the HRS between 1992 and 2010 with the exception of the 1993 AHEAD cohort. Initial analysis revealed that principal component loadings were stable over time and similar for men and women, so we have pooled waves and combined men and women. For each respondent a raw health score is obtained from the principal component loadings and the raw scores have been converted to percentiles (1 to 100). Thus a value of the health index of 25 implies that a person's health is at the 25th percentile of all HRS respondents in all years. The index has several important properties, which are summarized in more detail in PVW (forthcoming): (a) it is strongly related to the drawdown of assets as shown in our previous work, (b) it is stable over time—the weights given to each of the health variables vary very little as persons age, (c) it is strongly related to mortality, (d) it is strongly predictive of future health events such as stroke and the onset of diabetes, and (e) it is strongly related to economic outcomes *prior* to retirement as well as to postretirement outcomes. Figure 4.1 shows the 10th, 50th, and 90th percentiles of health by age. In reporting the results, we often refer to the effect of a 10 percentile point change in health. We can see in figure 4.1 that 10 percentile points covers a much greater portion of the total range in health for the oldest persons. For example, the difference between the health index value for the individual in the 10th percentile of all seventy-two-year-olds, and the value of that index for the individual in the 90th percentile at age seventy-two, is about 73 percentile points. The comparable difference is about 49 percentile points at age ninety.

4.2 Descriptive Findings

To motivate our descriptive analysis of wealth trajectories, health, and income flows, figure 4.2 illustrates the potential pathways through which poor health can affect wealth at older ages. The schematic suggests two potential

1. A fourth group, persons in one-person households in 1993 who later married, is excluded from the analysis because sample sizes are too small for meaningful analysis.

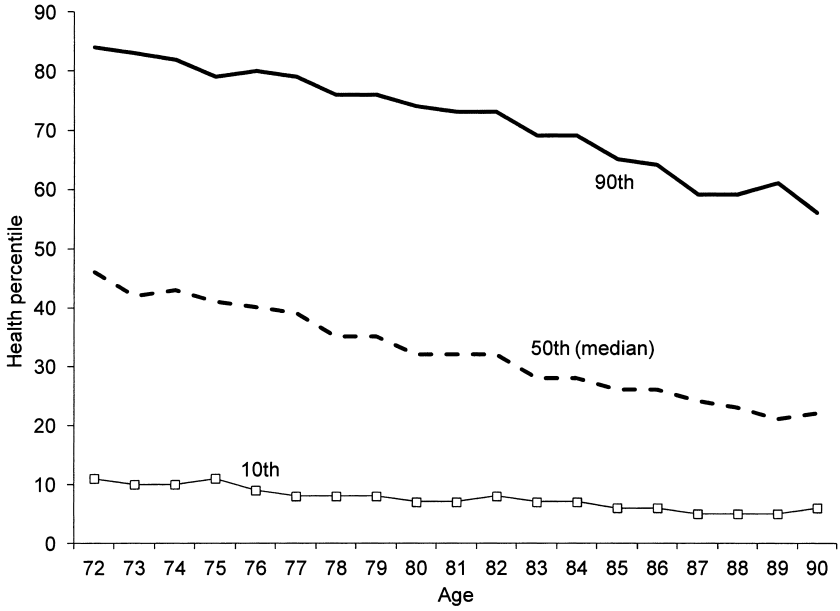

Fig. 4.1 The 10th, 50th, and 90th quantiles of the health index by age for all persons in AHEAD cohort, 1995–2010

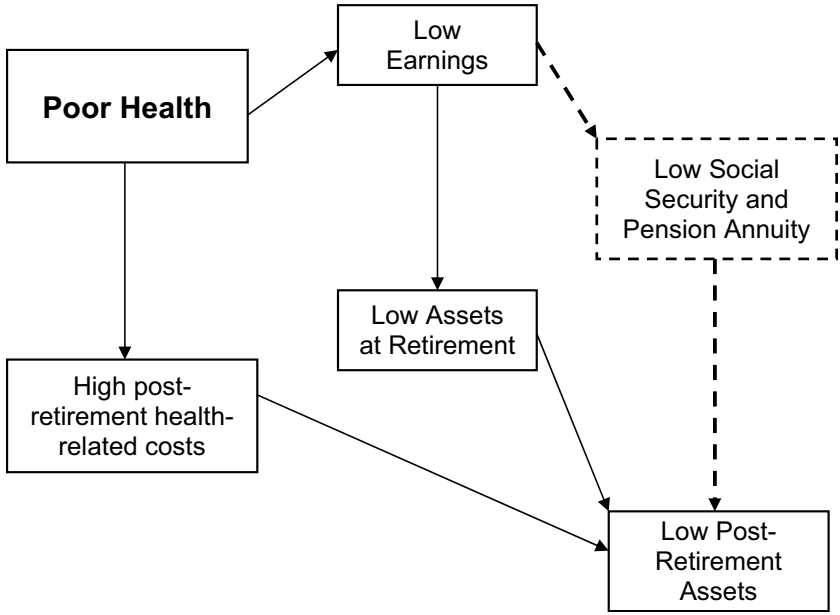

Fig. 4.2 Pathways from poor health to low postretirement assets

pathways between poor health and postretirement asset drawdown, keeping in mind the correlation between pre- and postretirement health status. First, poor health is associated with high postretirement medical costs, which may be financed by drawing on assets after retirement. Second, poor health contributes to low earnings prior to retirement. In turn low earnings reduce postretirement assets in two ways—(a) low preretirement earnings limit the accumulation of retirement assets, which in turn contributes to low asset levels at retirement; and (b) low preretirement earnings reduce the level of Social Security and private pension annuities paid after retirement. We are particularly interested in how the drawdown of nonannuity assets and the level of nonannuity assets at death are related to health status and to Social Security benefits.

4.2.1 Trends in Wealth from 1993 to the Last Year Observed

Several figures and tables help to motivate the analysis. Figure 4.3 shows the evolution of nonannuity wealth (primarily housing and other real estate, financial assets, and PRA balances) by last year observed (LYO) for each of the three family pathways. The last point plotted in each segment identifies the last year observed. Persons for whom the last year observed is 2006 or earlier died between the 2006 and 2008 waves; if the last year observed is 2010 (the "top" segment in each family pathway group) then the person is still alive in 2010, which is the last year data are available. Most waves in the AHEAD are spaced two years apart, with the exception of a three-year gap between the 1995 and 1998 waves. Thus for persons who have a last year observed before 2010, the last observation may be up to two years before the actual date of death (or three years if the last year observed is 1995). The estimation procedure discussed later essentially estimates how these trends for individuals are related to health and annuity income.

Two features of figure 4.3 stand out. First the nonannuity wealth of persons in the single-person pathway is much lower than the comparable wealth of persons in the two-to-one person pathway, who in turn have much lower wealth than persons in the two-to-two person pathway. Second, there is a strong negative correlation between nonannuity wealth in 1993 and subsequent mortality. Within each pathway, persons who began the period with higher wealth live longer. In each pathway group, the nonannuity wealth of persons who survive the longest is at least twice as large as the wealth of persons with the highest mortality. This is a startling illustration of the relationship between wealth and mortality noted by others, including Smith (1999, 2004, 2005), Adams et al. (2003), Wu (2003), Michaud and van Soest (2008), Case and Deaton (2005), Attanasio and Emmerson (2003), and Hurd, McFadden, and Merrill (2001). Both of these features of the data are also evident in profiles constructed for total wealth and for each of the other asset categories reported in PVW (2012).

Figure 4.4 shows median Social Security income by family pathway. The figure shows that for persons in one-person and two-to-two person house-

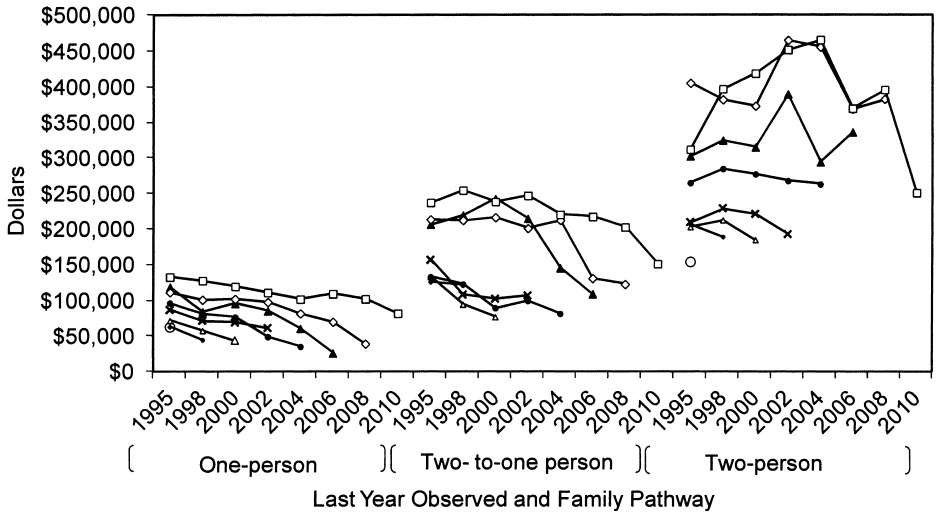

Fig. 4.3 Median nonannuity wealth by last year observed and family pathway

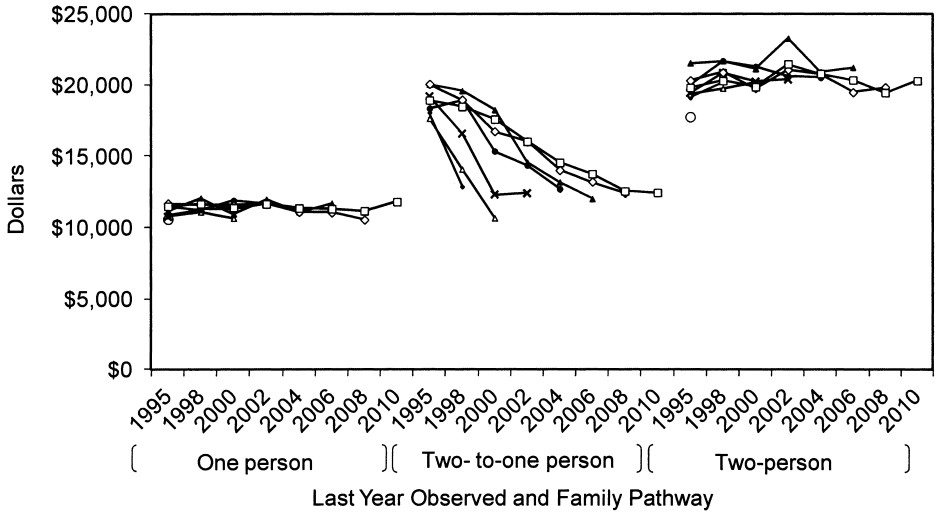

Fig. 4.4 Median Social Security income by last year observed and family pathway

holds there is little difference in Social Security income as persons age. But for the persons who transition from two- to one-person households, meaning that they outlived their spouses, there is a substantial decline in Social Security income with age. This presumably reflects the shift in many cases from two beneficiaries to one beneficiary.

Figure 4.5 shows the evolution of home equity. For one-person households the data show a very sharp decline in median home equity beginning two or three years before death. Indeed for each LYO, median home equity in the wave prior to death was zero for all but those whose LYO was 1993. For original two-person households with the spouse deceased at the LYO, a sharp decline near the end of life is also apparent, although the median at death is zero only for those whose LYO was 2002 or 2004. For original two-person households with the spouse alive at the LYO, there is a decline in home equity in the year or two before death, but it is more modest than that for the previous two groups. Home equity declines relatively little in prior years for this group. The results are consistent with the findings of Venti and Wise (2002, 2004) who emphasize that home equity tends to be husbanded until a precipitating shock such as entry to a nursing home or death of a spouse.

4.2.2 Nonannuity Assets and LYO

Figure 4.6 shows the median of home equity and financial assets (PRA assets and financial assets held outside of tax-deferred accounts) in 1995 by LYO and by pathway. The key feature of the figures is that persons with the greatest total nonannuity assets in1995 tend to live the longest, especially persons in one-to-one and in two-to-two households. The median for a third component—"other" nonannuity assets (mostly business assets, trusts, and vehicles)—is zero for each LYO for all pathways. The means of total nonannuity assets in 1995 (not shown) are not as strongly related to longevity and the mean of the "other" component is positive for all LYO and for each of the pathways.

4.2.3 The Distribution of the Change in Nonannuity Wealth between 1995 and the LYO

Figure 4.3 shows the median decline in nonannuity assets by family pathway. The median does not capture, however, the substantial diversity in the decline that our analysis relies on. Table 4.1 shows the distribution of nonannuity asset change between 1995 and the LYO (the beginning and end points for each profile shown in figure 4.3), showing selected percentile changes—10, 30, 50, 70, and 90. For original singles, the median change is negative in all LYO. But for each LYO, the difference between the 30th and the 70th percentiles and especially between the 10th and the 90th percentiles is quite large. The difference between the 10th and 90th percentiles in particular may be affected substantially by the misreporting of asset balances discussed in detail in Venti (2011).

Figure 4.3 shows that the median decline in assets is largest for persons who were originally married but were predeceased by their spouse. The values for this group are shown in the second panel of table 4.1. The large decline for many persons in this pathway, as well as the wide range in the changes, is again especially evident in the 10th and 30th and the 70th and

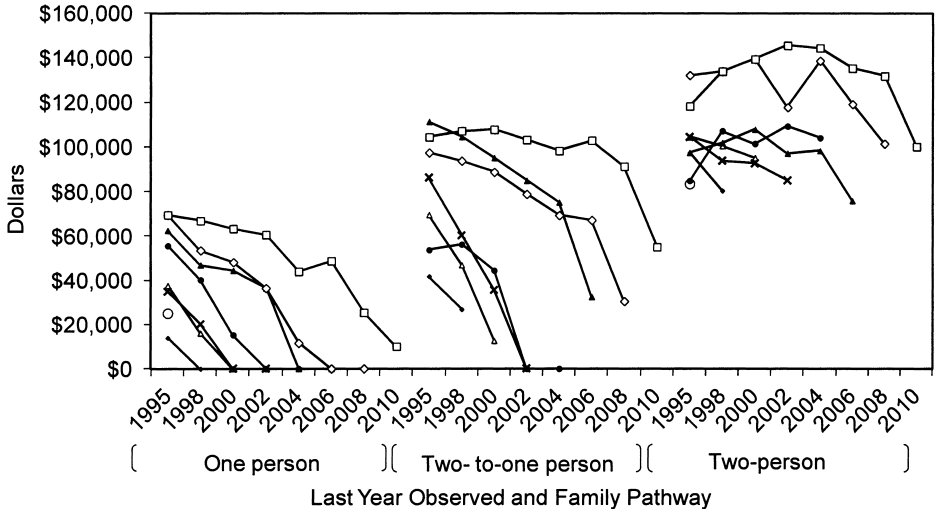

Fig. 4.5 Median housing wealth by last year observed and family pathway

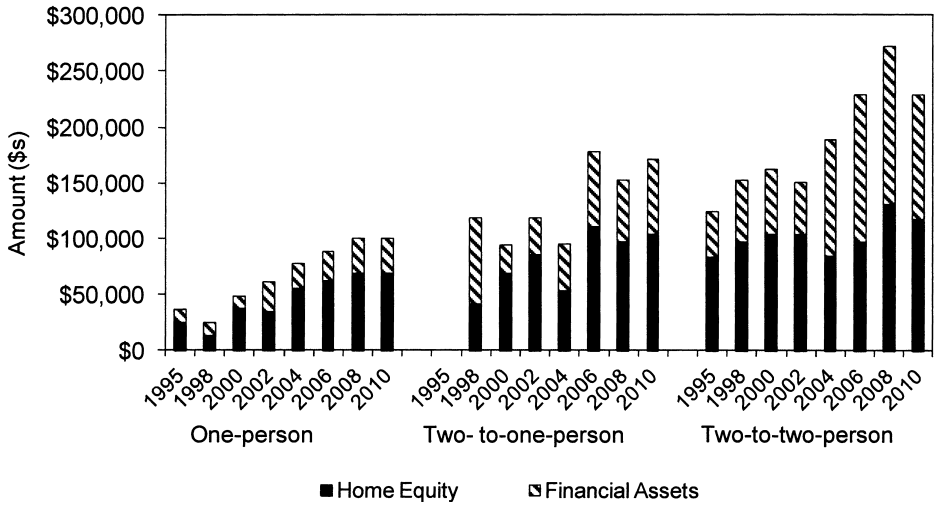

Fig. 4.6 Median home equity and financial assets in 1995 by family pathway and last year observed

90th percentiles. The bottom panel shows the median decline in assets for persons who were originally married and whose spouse was alive when they died. The median change is zero for the 2000 LYO and positive for the 2002 LYO. For other LYOs the medians are negative, but smaller than for the pathway shown in the middle panel.

Table 4.1 **Percentiles of the distribution of the difference between nonannuity assets in LYO and nonannuity assets in 1995**

LYO	10th	30th	50th	70th	90th
			Original singles		
1995	0	0	0	0	0
1998	–125,105	–21,102	–104	8,207	115,827
2000	–174,315	–40,782	–1,742	6,163	95,594
2002	–181,707	–41,702	–2,441	11,094	145,006
2004	–214,131	–57,687	–6,451	2,367	174,090
2006	–250,210	–83,403	–19,746	385	315,855
2008	–277,117	–69,503	–19,697	2,026	85,532
2010	–273,381	–83,403	–17,560	12,945	167,159
			Original two-person with spouse deceased in LYO		
1998	–794,458	–75,319	–2,696	5,672	125,891
2000	–579,605	–87,209	–19,768	0	74,761
2002	–302,770	–99,804	–13,472	30,155	149,042
2004	–517,101	–80,836	–9,361	12,806	168,856
2006	–416,367	–85,958	–73,714	–11	297,663
2008	–501,502	–54,432	–76,426	–7,411	232,418
2010	–520,941	–139,086	–43,558	–14,698	237,474
			Original two-person with spouse alive in LYO		
1995	0	0	0	0	0
1998	–254,517	–43,655	–2,174	35,349	246,125
2000	–328,204	–62,848	0	45,722	294,588
2002	–252,876	–72,025	970	43,734	288,280
2004	–355,825	–52,936	–2,780	85,256	279,605
2006	–726,559	–120,445	–24,396	89,251	341,245
2008	–394,767	–114,679	–10,969	79,876	503,577
2010	–344,674	–155,720	–37,365	19,516	351,595

Note: Persons whose LYO is 2010 were still alive when last observed.

The summary statistics in table 4.1 suggest that the median change in assets between 1995 and the LYO is rather modest, but there is enormous heterogeneity. For some the drawdown of nonannuity assets is very large; for other the increase in these assets is very large.

4.2.4 The Distribution of the Percent Change in Nonannuity Wealth between 1995 and the LYO

Table 4.2 shows the percentile distribution of the percentage change in nonannuity assets between 1995 and the LYO. While the median dollar declines in the singles group were small, the percentage declines are much larger, between 10 and 67 percent. That is, many persons in this group had very low nonannuity assets in 1995 and thus small dollar declines corresponded to large proportional declines. The median percent changes are smallest for persons in original two-person households whose spouse was

Table 4.2 **Percentiles of the distribution of the percentage change between nonannuity assets in LYO and nonannuity assets in 1995**

LYO	10th	30th	50th	70th	90th
			Original singles		
1995	0.0	0.0	0.0	0.0	0.0
1998	–100.0	–58.9	–10.2	15.5	237.4
2000	–100.0	–83.7	–33.9	17.8	203.7
2002	–100.0	–76.9	–27.3	21.1	192.2
2004	–100.0	–89.9	–41.3	9.2	178.3
2006	–100.0	–99.4	–67.3	–6.6	170.4
2008	–100.0	–92.7	–52.9	1.3	123.8
2010	–100.0	–72.9	–27.3	19.9	302.9
			Original two-person with spouse deceased in LYO		
1998	–80.7	–49.4	–32.4	12.1	200.6
2000	–100.0	–81.8	–41.2	–7.3	59.5
2002	–100.0	–78.4	–34.1	15.2	116.9
2004	–100.0	–82.7	–39.6	22.4	155.8
2006	–99.8	–81.2	–46.4	–6.0	130.8
2008	–100.0	–79.8	–45.6	–9.3	110.6
2010	–99.5	–70.2	–36.4	5.5	115.8
			Original two-person with spouse alive in LYO		
1995	0.0	0.0	0.0	0.0	0.0
1998	–82.2	–31.2	–4.6	21.5	110.7
2000	–81.4	–35.4	–0.9	38.6	181.1
2002	–81.2	–38.9	–0.7	25.7	116.3
2004	–80.1	–24.0	–2.6	41.9	172.9
2006	–91.0	–63.5	–12.9	45.9	138.5
2008	–73.8	–36.7	–6.8	39.8	151.0
2010	–80.9	–46.9	–19.2	9.7	103.7

Note: Persons whose LYO is 2010 were still alive when last observed.

still alive at their death. Thus, while we find modest median *dollar* drawdown in nonannuity assets for persons in single-person and in two-to-one households, we find that the median *percent* drawdown in these households is large. As with the dollar drawdown, there is enormous heterogeneity, with the drawdown as much as 100 percent for some and the addition to nonannuity assets well over 100 percent for others. For two-person households the median percent change is small. But again there is enormous heterogeneity.

Table 4.2 provides information that bears on the long-standing question of whether households draw down assets in retirement as the lifecycle hypothesis predicts. The results demonstrate that for each subgroup of the population, more than half of the households draw down assets by a substantial percentage, but that more than a quarter of the households seem to draw down assets by very little, or to accumulate assets, as they age.

Table 4.3 Percentiles of the distribution of nonannuity assets in LYO (in 000s)

LYO	10th	20th	30th	40th	50th	60th	70th	80th	90th
				Original singles					
1995	0	2	14	38	63	95	143	232	411
1998	0	0	3	16	44	87	134	198	401
2000	0	0	3	18	43	75	125	190	341
2002	0	0	2	24	61	109	178	252	533
2004	0	0	1	12	35	72	174	283	606
2006	0	0	0	2	26	81	156	303	599
2008	0	0	4	17	38	76	152	253	387
2010	0	2	20	51	81	117	190	344	529
				Original two-person with spouse deceased in LYO					
1998	0	6	40	72	120	217	305	426	559
2000	0	2	15	49	76	119	176	217	507
2002	0	2	23	61	106	138	232	379	800
2004	0	1	6	25	81	127	191	387	666
2006	0	3	29	60	108	183	289	389	800
2008	0	15	35	76	122	176	285	405	781
2010	1	20	51	96	150	220	305	473	860
				Original two-person with spouse alive in LYO					
1995	14	42	77	113	153	221	313	503	851
1998	10	47	83	122	188	274	376	569	988
2000	19	48	94	133	184	257	367	526	1,089
2002	27	64	97	146	192	276	371	503	849
2004	35	100	130	187	262	320	456	615	860
2006	25	49	107	209	335	400	533	583	1,177
2008	35	101	191	258	382	447	613	901	1,059
2010	21	83	146	179	250	350	570	996	1,581
				All pathways combined					
1995	0	14	39	70	104	145	225	343	623
1998	0	3	20	61	98	142	221	356	680
2000	0	2	23	51	94	135	199	328	648
2002	0	2	27	63	106	155	242	373	697
2004	0	1	12	51	104	175	260	404	706
2006	0	1	5	43	97	168	303	449	800
2008	0	4	28	61	118	188	308	432	821
2010	1	18	54	92	150	220	321	507	969

Note: Persons whose LYO is 2010 were still alive when last observed.

4.2.5 The Distribution of Nonannuity Assets in the LYO

Table 4.3 shows the distribution of the level of nonannuity assets in the LYO (in $000s). Among original singles over 40 percent have less than $40,000 in nonannuity assets in the last year observed before death—the 40th percentile ranges from $2,000 to $38,000 depending on the LYO (persons for whom the LYO is 2010 are excluded from this and subsequent calculations because these persons are still living when last observed). Among persons in

Table 4.4 **Comparison of median nonannuity wealth in last year observed to median nonannuity wealth in 1995: Original one-person households**

	Age interval in 1995				
Health tercile in 1995	70–74	75–79	80–84	85+	all
	Nonannuity wealth in 1995				
1	71,032	66,028	69,503	55,602	63,943
2	132,194	112,595	104,254	83,959	109,815
3	202,253	135,531	147,346	173,757	150,126
All	115,097	84,376	82,430	64,603	83,403
	Nonannuity wealth in last year observed				
1	25,532	19,247	29,210	14,548	20,265
2	115,172	48,494	59,405	57,536	63,042
3	170,600	99,854	86,593	102,844	115,757
All	65,861	37,481	43,644	26,493	39,516
	Percentage change from 1995 to LYO				
1	–64.1	–70.9	–58.0	–73.8	–68.3
2	–12.9	–56.9	–43.0	–31.5	–42.6
3	–15.7	–26.3	–41.2	–40.8	–22.9
All	–42.8	–55.6	–47.1	–59.0	–52.6

two-to-one households at least 30 percent have less than $40,000 in the LYO. But even in these pathways a large fraction of persons have substantial wealth in the LYO. Fewer persons in two-to-two households have little nonannuity wealth in the LYO and a large fraction has substantial wealth in the LYO. Over all pathways combined at least 30 percent have wealth less than $40,000 in the LYO. This amount ranges from $5,000 to $39,000 depending on the LYO. The table shows that while a large fraction of households have little or no wealth at retirement, a large fraction also have a great deal of wealth and indeed many households increased their wealth between 1995 and the LYO.

4.2.6 Health and the Change in Nonannuity Assets between 1995 and the LYO

Table 4.4 shows the relationship between health and the decline in nonannuity assets between 1995 and the LYO for single persons. Survivors—those whose LYO is 2010—are excluded from the table. To facilitate health comparisons we have allocated persons to three health terciles based on the value of their health index in 1995. Over all age groups combined the decline was –68.3 percent for those in the lowest health tercile, –42.6 percent for those in the middle health tercile, and –22.9 for those in the third (best) health tercile. A similar trend holds for each of the age intervals.

Comparable information for persons in two-to-one and continuing two-person households are shown in tables 4.5 and 4.6, respectively. In each of

Table 4.5 **Comparison of median nonannuity wealth in last year observed to median nonannuity wealth in 1995: Original two-person households with spouse deceased in LYO**

	Age interval in 1995				
Health tercile in 1995	70–74	75–79	80–84	85+	all
	Nonannuity wealth in 1995				
1	112,595	155,686	129,970	180,707	152,906
2	293,858	164,027	270,366	210,246	209,899
3	225,189	315,543	139,006	430,918	239,785
All	202,948	171,116	144,566	210,246	173,757
	Nonannuity wealth in last year observed				
1	53,521	70,910	78,807	121,234	72,738
2	176,060	80,027	67,871	107,043	119,056
3	173,187	167,253	86,593	691,299	135,236
All	129,720	91,170	78,807	121,234	99,746
	Percentage change from 1995 to LYO				
1	–52.5	–54.5	–39.4	–32.9	–52.4
2	–40.1	–51.2	–74.9	–49.1	–43.3
3	–23.1	–47.0	–37.7	60.4	–43.6
All	–36.1	–46.7	–45.5	–42.3	–42.6

Table 4.6 **Comparison of median nonannuity wealth in last year observed to median nonannuity wealth in 1995: Original two-person households with spouse alive in LYO**

	Age interval in 1995				
Health tercile in 1995	70–74	75–79	80–84	85+	all
	Nonannuity wealth in 1995				
1	154,991	209,899	208,717	236,310	200,168
2	273,841	274,536	206,007	180,707	252,990
3	304,423	217,961	250,210	257,161	269,532
All	257,161	241,870	208,745	205,728	237,700
	Nonannuity wealth in last year observed				
1	178,584	204,452	231,480	127,004	185,310
2	267,401	265,976	198,848	173,365	249,510
3	408,241	247,537	294,368	268,276	294,368
All	249,742	241,649	208,981	167,255	219,370
	Percentage change from 1995 to LYO				
1	15.2	–2.6	10.9	–46.3	–7.4
2	–2.4	–3.1	–3.5	–4.1	–1.4
3	34.1	13.6	17.6	4.3	9.2
All	–2.9	–0.1	0.1	–18.7	–7.7

these pathways the health effects are also noticeable—for persons in the two-to-one pathway the decline is –52.4 percent for persons in the lowest health tercile versus –43.6 percent for persons in the highest; for persons in the two-to-one person pathway the decline is –7.4 percent for persons in the worst health tercile versus +9.2 percent for persons in the best. In percentage terms the difference is greatest for persons in the two-to-one person pathway.

4.3 Regression Models for Asset Evolution

The goal of our analysis is to determine the relationship between the post-retirement evolution of nonannuity assets and the health and the income flows of persons at advanced ages. We do this by estimating regression models in which assets in a given wave are explained by assets in the previous wave, as well as key health and income variables:

$$(1) \qquad A_w = k + \lambda^* A_{w-1} + \alpha^* H_{w-1} + \beta^* \Delta H_{w,w-1} + a^* \mathrm{SS}_w + b^* \mathrm{DB}_w + c^* \mathrm{Earn}_w + m^* \mathrm{M}_w + \varepsilon_w.$$

In this equation, where the subscript w denotes wave, A_w denotes the level of assets, λ is the marginal effect of an additional dollar of assets in wave w-1, given the other covariates, on assets in wave w. H_{w-1} and $\Delta H_{w,w-1}$ denote the level of health in the previous wave and the change in health since the last wave respectively. Higher levels of H_{w-1} and $\Delta H_{w,w-1}$ are expected to reduce the need to rely on assets to finance health care needs and thus are likely to be associated with a positive change in assets. Higher levels of Social Security benefits SS_w and DB annuity income DB_w are also expected to be positively associated with asset change, given the level of assets in the previous wave, since persons with greater income should be able to cover the cost of health-related and other expenses with less need to draw down their accumulated assets. The M_w is an indicator of expected lifespan, which we discuss later. We also include year effects (not shown in the equation) that we interpret as controlling for differences in market returns across years. In PVW (forthcoming), we use a specification similar to equation (1) to investigate how education is related to the evolution of late-life asset holdings for households in the HRS.

One interesting feature of our data set and the specification in equation (1) is that real Social Security benefits are "fixed" at the date of first receipt for single-person households. Thus these benefits vary across households, but not over time for the same household, as shown by the flat profiles for continuously single and continuously married individuals in figure 4.4. The DB pension benefits are only partially indexed and thus real benefits will vary over time.

4.3.1 Baseline Estimates

Our baseline estimates of equation (1) are shown in table 4.7. We focus on persons in AHEAD in the three family pathway groups defined using

Table 4.7 **Trimmed GLS estimates of the effect of health and annuity income on the evolution of nonannuity assets between 1995 and LYO, by family pathway**

	Continuously single		Original two-person household with spouse deceased in LYO		Original two-person household with spouse alive in LYO	
Variable	Estimate	*t*-stat	Estimate	*t*-stat	Estimate	*t*-stat
Assets *t*-1	0.73	117.63	0.61	84.84	0.69	83.90
Age	–422	–1.00	391	0.55	–4,199	–3.54
Health(*t*-1)	638	6.67	1,216	6.82	1,445	5.97
Δ health	448	3.05	542	2.08	1,732	4.83
SS benefits	2.41	5.76	5.83	11.44	4.13	5.92
DB pension benefits	1.75	9.77	3.66	13.87	1.83	7.07
Year 2000	5,168	0.89	22,874	1.73	36,215	2.34
Year 2002	1,104	0.18	7,618	0.59	28,487	1.82
Year 2004	3,873	0.54	39,928	2.83	84,621	4.26
Year 2006	46,131	4.31	47,064	3.19	102,958	4.02
Year 2008	–8,084	–0.80	59,168	3.39	100,063	2.59
Year 2010	–13,070	–1.08	8,703	0.45	–19,581	–0.58
Constant	23,571	0.65	–103,600	–1.81	297,958	3.12
N	7,905		5,871		4,989	
Wald	16,172		9,291		8,460	

marital status in 1995 and marital status in the last year observed. We restrict the sample to persons who are known to be deceased and thus exclude all persons whose last year observed is 2010 (survivors). As noted earlier, there is substantial measurement error in assets. To minimize the effect of misreported asset values we trim the sample by running a first stage model and then excluding observations with residuals in the top or bottom 1 percent. Because lagged assets are likely to be measured with error, the coefficient on lagged assets (λ) may be biased toward zero and the coefficients on other variables, such as SS and DB, may be biased to the extent that these variables are correlated with the "true" value of lagged assets.

The best way to address this measurement error problem would be to find instrumental variables that are correlated with "true" lagged assets but can be excluded from the model for current assets. We are not convinced that the exclusion restrictions needed for such a strategy would be defensible. We therefore present the results from trimmed GLS estimation of equation (1), and then discuss several ways to evaluate the possibility that measurement error in lagged assets is leading to biased estimates on the SS and DB coefficients.

Several findings are noteworthy. First, the age effect is small and not significantly different from zero for the first two pathways. Thus, holding

income and health constant, there is little evidence of purely age-related asset drawdown. However, the age effect is –$4,199 and statistically significant for persons in original two-person households whose spouse is alive at their death.

Second, the health variables and the annuity income variables are large and statistically significant. Figure 4.7 graphs the effect of a 10 percentile point increase in the level of health in the previous wave, a 10 percentile point change in health since the previous wave, a $5,000 increase in Social Security benefits, and a $5,000 increase in DB benefits on nonannuity assets. Each of the effects is large for each family pathway group, but is lower for single persons than for the other two family pathway groups, presumably because single persons have the lowest levels of nonannuity assets. The relationship between a 10 percentile point increment in lagged health and nonannuity wealth is over $6,000 for single persons, about $12,000 for persons originally in two-person households whose spouse predeceased them, and over $14,000 for persons originally in two-person households and whose spouse survives them. The relationship between a 10 percentile point increment in the change in health and nonannuity wealth ranges from over $4,000 for single persons to over $17,000 for persons originally in two-person households and whose spouse survives them. The relationship between nonannuity wealth and a $5,000 increment in Social Security benefits is about $12,000 for single persons, $29,000 for persons in original two-person households whose spouse was predeceased, and $21,000 for persons in original two-person households whose spouse survives them. The relationship between nonannuity wealth and a $5,000 increment in DB pension benefits ranges from about $9,000 in single-person households to over $18,000 for persons in original two-person households whose spouse predeceased them. This suggests that both Social Security income and DB income are "protective" of nonannuity wealth, while poor health is an important determinant of the drawdown of nonannuity wealth.

We have explored in some detail the concern that assets are measured with error. Our use of a trimmed sample (we trim the top and bottom 1 percent based on residuals of a preliminary regression) is an attempt to address this potential problem. Indeed, estimates based on untrimmed data show substantially lower coefficients on lagged assets and larger coefficients on SS and DB. Additional trimming however—as much as the top and bottom 3 percent of asset values and based on different methods of trimming—has very little effect on either the estimated coefficients on lagged assets or on the estimated coefficients of the SS or DB variables. In addition, estimates based on a similar specification used in Poterba, Venti, and Wise (forthcoming), which imputes a rate of return to lagged assets based on individual attributes, yields essentially the same results as those reported in table 4.7. The importance of this comparison is that the estimates on lagged assets in the earlier paper are in the 0.8 to 1.1 range. Whatever the extent of errors

in variables, it is essentially the same in the data sets used in the two papers. The sample underlying table 4.7 is all AHEAD respondents who die by 2010, while that in Poterba, Venti, and Wise (forthcoming) is all persons over the age of sixty-five in all cohorts of the HRS.

We have also obtained median regression estimates comparable to the estimates shown in table 4.7. As expected, the estimates on health and annuity income are all smaller than the linear regression estimates—the largest is just over 2—but the median regression estimates on lagged assets are little different from the linear regression estimates. This finding suggests that while there may well be measurement error in lagged assets, this measurement error is not the primary reason for the large coefficients on SS and DB.

The size of the coefficients on both SS and DB suggest not only that the receipt of these annuitized income streams may help to avoid the drawdown of financial assets, but also that they may be correlated with other income streams or with an unobserved household propensity to save. Consider the coefficient on SS income for a married couple with both spouses still alive (coefficient 4.13) and with only one member of the couple still living (coefficient 5.83). Recall that the typical time period between two waves of the HRS is two years, so additional income of $1,000 per year would imply $2,000 of total payments between waves. If the individual saved all of the income from Social Security, the resulting coefficient would be somewhat larger than 2.0. The estimated coefficients more than twice this size raises the concern of omitted variables that are correlated with the SS variable. In the standard omitted variable setting, the estimated coefficient on SS in part reflects these omitted variable influences.

We suspect that the coefficient values on SS and DB in part reflect a correlation between these variables and unobserved individual attributes that affect the propensity to accumulate assets in retirement. As the descriptive tables 4.1, 4.2, and 4.3 show, many households increase assets substantially from wave to wave, even after retirement. These households tend to be those with substantial assets, and also to be those with high lifetime earnings and large SS benefits. If characteristics that permitted long, high-income labor market careers are correlated with individual attributes that persist over time, and that are related to late-life wealth accumulation behavior, then the cross-sectional variation in SS benefits that underlies our estimates will in part capture this variation in unobserved individual attributes, perhaps saving behavior that persists into old age but is not determined by Social Security benefits. This makes it difficult to interpret the coefficient estimate as purely a "protective effect" of Social Security income on assets. This issue merits further analysis.

4.3.2 Subjective Mortality

Life cycle theory suggests that all else being equal, those who expect to have long lives will spend down assets more slowly that those who expect

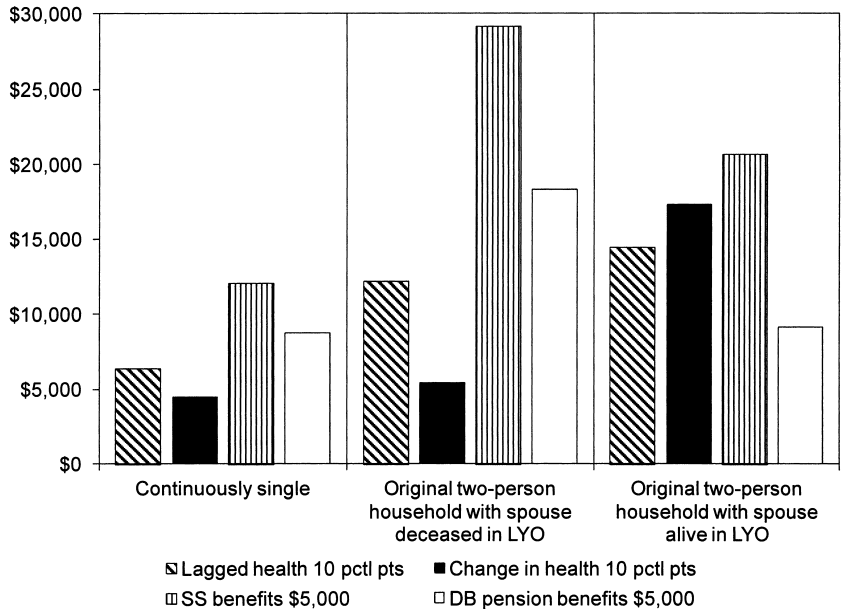

Fig. 4.7 Effect of health and income on assets, by family pathway

to live shorter lives. The next set of regressions adds a measure of the self-reported survival probability to the specification used in table 4.7. The subjective probability measure is the ratio of the probability that the respondent expects to live ten more years divided by the probability that the respondent will live ten more years based on the life table values for a person of the same age and gender. Unfortunately, the subjective probability of survival is only available for some respondents in most years and is not available for anyone in 1998. Thus the sample used in these regressions is smaller than that used in table 4.7. The reduction in the sample due to each of these reasons is described in table 4.8. Between 43 and 62 percent of the sample are missing the survivor probability variable and are thus excluded from the sample used to obtain the estimates in table 4.7.

The estimation results are shown in table 4.9. First, the estimated coefficients on the age, health, and income variables are in some cases very different from the estimates based on the full sample. This is perhaps not surprising given that 62 percent of the observations on singles, 43 percent for the second pathway, and 48 percent for the third pathway are excluded as the result of missing data. Because of the apparent nonrandomness of the missing observations, perhaps limited credence should be put in these results. Nonetheless, the estimated subjective probability coefficient is statistically insignificantly different from zero in each of the three pathways. It appears though that the restricted sample used in table 4.9 makes it difficult to draw

Table 4.8 **Sample size (before trimming) when using subjective mortality**

	1998	2000	2002	2004	2006	2008	2010	Total
				Singles				
Sample for table 7	2,161	1,764	1,381	1054	783	556	365	8,064
Delete if no 1998 mortality data	0	1,764	1,381	1054	783	556	365	5,903
Delete if no response to mortality question	0	1030	740	540	378	239	109	3,036
Percent decline	100%	–42%	–46%	–49%	–52%	–57%	–70%	–62%
				Two-person spouse deceased				
Sample for table 7	1,124	1,074	983	893	775	645	495	5,989
Delete if no 1998 mortality data	0	1,074	983	893	775	645	495	4,865
Delete if no response to mortality question	0	819	753	655	529	399	257	3,412
Percent decline	100%	–24%	–23%	–27%	–32%	–38%	–48%	–43%
				Two-person spouse alive				
Sample for table 7	1,417	1,093	829	639	480	373	259	5,090
Delete if no 1998 mortality data	0	1,093	829	639	480	373	259	3,673
Delete if no response to mortality question	0	825	599	474	331	257	156	2,642
Percent decline	100%	–25%	–28%	–26%	–31%	–31%	–40%	–48%

Table 4.9: Trimmed GLS estimates of the effect of health and annuity income on the evolution of nonannuity assets between 1998 and LYO, by family pathway

	Continuously single		Original two-person household with spouse deceased in LYO		Original two-person household with spouse alive in LYO	
Variable	Estimate	*t*-stat	Estimate	*t*-stat	Estimate	*t*-stat
Assets *t*-1	0.68	60.82	0.62	61.23	0.75	65.48
Age	–1,840	–1.47	–391	–0.34	–4,555	–2.15
Health(*t*-1)	976	5.57	1,534	5.93	1,841	4.95
Δ health	1,103	3.98	469	1.24	3,117	5.69
SS benefits	1.48	1.94	5.89	8.18	4.38	4.22
Pension benefits	1.60	5.76	4.00	11.31	1.76	5.32
Prob(10 yrs) ratio	118	0.96	–39	–0.21	–367	–1.34
Year 2002	–4,898	–0.52	–38,574	–2.45	–20,848	–1.03
Year 2004	–3,144	–0.28	20,138	1.15	52,894	2.12
Year 2006	62,355	3.37	29,931	1.52	55,673	1.69
Year 2008	–13,973	–0.81	62,231	2.25	75,295	1.46
Year 2010	8,432	0.35	–48,014	–1.69	–102,789	–1.76
Constant	157,071	1.51	–28,066	–0.30	335,361	1.96
N	2,974		3,162		2,550	
Wald	4,336		4,931		5,103	

conclusions about the role of subjective life expectancy in contributing to asset drawdown. However, a similar specification was used in PVW (forthcoming) but estimation was based on all HRS cohorts. That analysis was not affected to the same extent by missing responses to the subject survival questions. The results also showed no statistically significant effect of the subjective probability of survival on assets.

4.4 Conclusions and Future Directions

Our analysis of asset drawdown at the end of life suggests that the median change in assets between 1995 and the last year observed (LYO) is rather modest, but that for more than half of households, assets when last observed are below those in the early retirement period. It is difficult to summarize the drawdown of assets in any simple way; however, there is enormous heterogeneity in the change. Because many individuals were observed in 1995 with relatively low levels of nonannuity assets, the median percent drawdown is sometimes quite large even though the dollar amount of drawdown is small. Persons who remained single and married persons predeceased by a spouse

experienced median asset reductions of 30 to 50 percent between 1995 and the last year observed before their death. The reductions for persons whose spouse outlived them were much smaller.

We find that a large fraction of households have little or no wealth when they are last observed in the survey. Some might suggest that these households had "perfect foresight": they anticipated how long they would live and exhausted their wealth as they were approaching death. Several results are inconsistent with this view. First, most of those with little wealth at death also had little wealth in 1995. Thus the pattern is not one of wealth drawdown after retirement, but of arrival at retirement age without much wealth. Second, the drawdown of wealth is closely associated with poor health. In order to "time" the wealth profile to hit zero at death, persons would also have to anticipate health shocks. There is some evidence (Hurd and McGarry [2002]; Hurd, McFadden, and Merrill [2001]) that people are good judges of their own life expectancy, but the size and randomness of many health shocks would suggest that for many the depletion of assets was unanticipated and not planned for. Third, among those persons who had assets in 1995, many apparently exhausted their assets *before* death—our last measurement of assets is within two years of death, but many of these persons have yet to face large medical expenditures that occur disproportionately in the last six months of life. Finally, we find no significant relationship between the drawdown of assets and a variable that measures an individual's subjective life expectancy relative to population averages for persons of the same age and gender.

While we do not uncover significant links between subjective mortality and asset drawdown, we do find substantively important links with other variables. We estimate that a 10 percentile point increment in health in the previous wave is associated with over $6,000 more wealth for single persons in the current wave, over $12,000 more for persons originally in two-person households with a deceased spouse by the LYO, and over $14,000 more wealth for persons originally in two-person households with a surviving spouse at the LYO. The estimated effect of a 10 percentile point change in health between waves ranges from over $4,000 for single persons to over $17,000 for two-person households. A $5,000 increment in Social Security is associated with increments in wealth (over a two-year period) ranging from about $12,000 for single persons to over $29,000 for persons originally married with a deceased spouse in the LYO. The relationship between nonannuity wealth and a $5,000 increment (again over a two-year period) in DB pension benefits ranges from about $9,000 for single persons to over $18,000 for persons originally married with a deceased spouse in the LYO. Thus our estimates suggest that both Social Security income and DB income are "protective" of nonannuity wealth, while poor health is strongly associated with the drawdown of nonannuity wealth. Some of the estimated effects of annuity income on assets appear to be quite large, implying that one dollar

of income is associated with more than one dollar of additional assets. We investigated measurement error in assets as a possible explanation for the magnitude of these estimates and we conclude that measurement error is not the key explanation for the large effects. A more likely explanation is that Social Security benefits are correlated with unobserved individual attributes that affect the propensity to accumulate assets in retirement. This explanation merits further investigation.

Our results raise a number of important questions about the preretirement planning of those who reach late life with essentially no nonannuity assets. These households are disproportionately dependent on Social Security as their primary source of income, and they are unlikely to be able to respond to financial shocks such as out-of-pocket medical costs by relying on their own resources. One question about this group is whether their level of consumption in retirement is lower than their preretirement standard of living. Some households may choose to accept low levels of consumption at advanced ages and thus save little for retirement while young. On the other hand, HRS data summarized in Venti and Wise (2001) show that two-thirds of respondents say they would save more if they "could do it again." And those who said they saved too little had assets at retirement that were a much lower proportion of lifetime earning than those who said their saving was "about right."

A second question is the extent to which low levels of retirement wealth accumulation reflect hardship prior to retirement. Particularly for households that have experienced chronic poor health, and associated low earnings, the observed level of assets at retirement may be the outcome of many years of financial struggle. For such households the level of Social Security benefits and other aspects of the social safety net, such as Medicare and Medicaid, are key determinants of retirement consumption.

Finally, the evidence that those with the lowest wealth in retirement are often those in the poorest health underscores the need to better understand the causal pathways linking health to wealth at older ages as well as during traditional working years. The prospect of continued increase in health care costs suggests that the financial burden of out-of-pocket medical spending may continue to grow; this could strengthen some of the channels linking health and wealth. Our findings highlight the need to search for opportunities to identify how both chronic health conditions, and acute health shocks, affect the trajectory of wealth.

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