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

by

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Abstract: Social Security benefits are the most important component of the income of a large fraction of older Americans. A significant fraction of persons approach the end of life with no financial assets, no home equity, and rely almost entirely on Social Security benefits for support. Whether persons reach late-life with positive non-annuity wealth depends importantly on health. Poor health is very persistent over a life-time. Persons in poor health at old age have a higher-than-average probability of having experienced low earnings while in the labor force, and thus also having low Social Security benefits in retirement. The progressivity of the Social Security benefit formula helps to provide a safety net to support low-wage workers in retirement. Still, a noticeable fraction of persons, especially those in single-person households, have income below the poverty level in their last years of life and have no assets to draw on to supplement their income. The members of this group are also disproportionately in poor health. In general, low assets and low income in old age are strongly related to poor health. We explore this nexus and, in particular, try help to understand the relationship between Social Security benefits and the exhaustion of non-annuity assets near the end of life. We seek to determine how the drawdown of assets between 1995, the first year of the AHEAD data, and the year last observed before death depends on health and on Social Security and other annuity benefits. We conclude that Social Security and defined benefit pension benefits are strongly "protective" of non-annuity assets and that poor health is an important determinant of the drawdown of non-annuity wealth

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 (2012a) find that 40 percent of all persons approach their last year of life with less than $20,000 in annuity income (primarily from Social Security but for some supplemented by defined benefit pension benefits) and less than $10,000 in financial assets. Moreover, 68 percent of persons in this group also have no housing wealth. These persons with low levels of financial resources are also in much poorer health that persons with higher levels of income and liquid assets. This raises the concern that adverse health events in old age may force households to prematurely exhaust assets.

We propose in this paper to estimate how the drawdown of non-annuity 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 non-annuity assets. Are persons with more Social Security income able to cover health and other expenses with less need to drawdown savings? The analysis is based on the drawdown of the non-annuity 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 death. A large proportion of this cohort died between 1993 and the latest available survey wave in 2010.

The analysis of the drawdown (or accumulation) of non-annuity 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 receive retirement income from Social Security benefits, employer-provided pensions, and private saving. 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. Many households supplement this annuity income with "income" from other sources such as withdrawals from tax-deferred personal retirement accounts (PRAs) such as IRAs and 401(k)s and the spend-down of other accumulated assets held outside of these accounts. These latter sources of "income" are difficult to measure and one source in particular—withdrawals from 401(k) plans—is becoming increasingly important for recent retirees (Fisher (2007), Angelov, Iams and Purcell (2012)). In particular, households may draw on these asset reserves to bridge the gap whenever expenditures—particularly unanticipated expenditures—exceed annuity income. Most surveys do not ask if households withdrew money from PRAs over the course of a year. In this paper we focus on the "income" that people obtain from drawing down assets. In particular, we seek to identify how the rate of asset spend-down is affected by health and by the presence of other sources of income. By considering income from traditional sources (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.

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 immediate antecedent of this paper is "Were They Prepared for Retirement? Financial Status at Advanced Ages in the HRS and AHEAD Cohorts" (Poterba, Venti, and Wise 2012a) that presents detailed descriptive data that motivates the analysis in this paper. The effect of health events and asset drawdown has been explored by Smith(1999, 2004, 2005) and by Coile and Milligan (xxxx). In earlier work we also emphasized the relationship between post-retirement asset drawdown and health (Poterba, Venti, and Wise 2010a— and 2010b).

The paper is in three sections. Section 1 presents descriptive data that underlies the empirical analysis and explains briefly the health index that is a key component of the analysis. Section 2 presents the empirical results. Section 3 is a summary of discussion of the results.

Section 1. The Data and Descriptive Results

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 70 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 are deceased 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 ascertained to be deceased, 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 under-reported in 1993. Second, several of the key variables used to construct the health index were not included in the 1993 survey instrument, so the health index could not be

calculated for this year. The analysis 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.
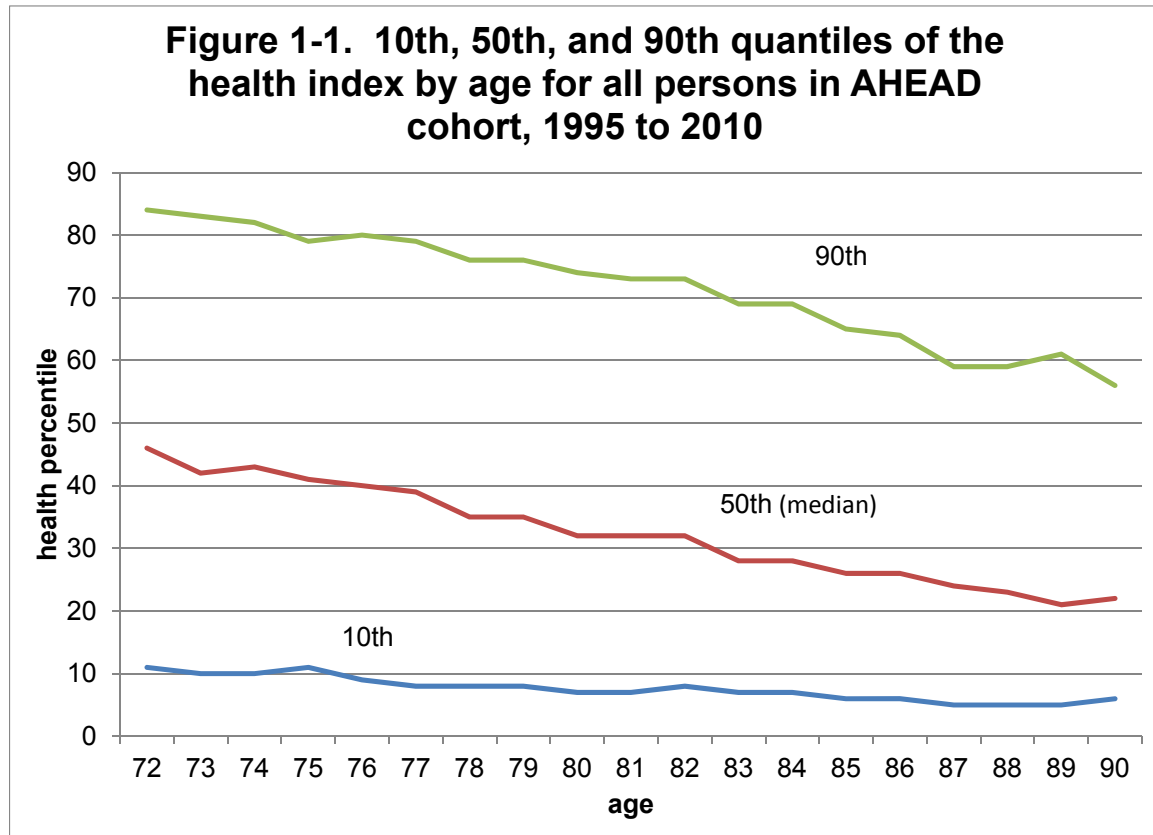
The unit of observation is the person. All income and asset amounts associated with the person are for the household. To structure the analysis we will first divide the AHEAD respondents into three groups defined by family status when first observed in 1993 and family status in the last year observed before death: These family "pathway" groups are: (1) persons in one-person households in 1993 that remain one-person households until last observed, (2) persons in two-person households in 1993 whose spouse is deceased in the last year observed before the person's death, and (3) 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.
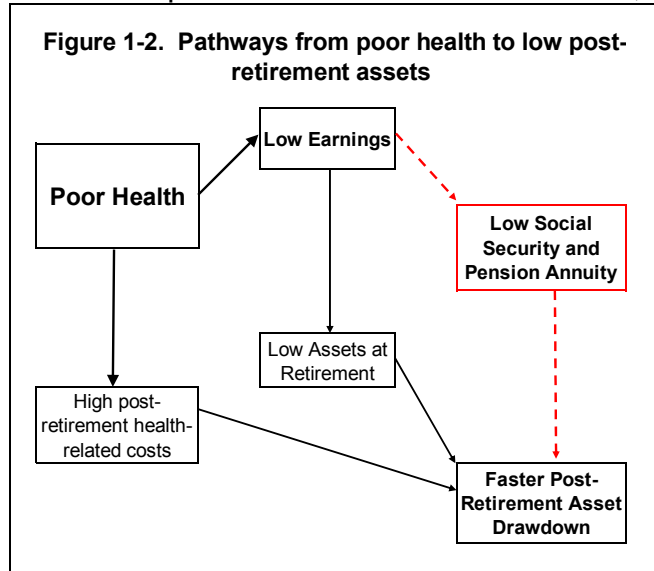
The Health Index: One of the key elements of the analysis is the relationship between health and asset drawdown. We use an index of health based on the first principal component of responses to 27 health-related questions contained in the AHEAD. These questions asked about functional limitations, the 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 Poterba, Venti and Wise (2010, 2012b). 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 by gender. 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 for our purposes: 1) it is strongly related to the drawdown of assets as shown in our previous work, 2) it is stable over time--the weights given to each of the health variables vary very little as persons age, 3) it is strongly related to mortality, 4) it is strongly predictive of future health events such as stroke and the onset of diabetes, 5) it is strongly related to economic outcomes prior to retirement as well as to post-retirement outcomes. See Poterba, Venti and Wise (2012b) for further discussion. Figure 1-1 shows the 10th, 50th, and 90th percentiles of health by age. In reporting results below we often refer to the effect of a 10 percentile point change in health. We can see in Figure 1-1 that 10 percentile points covers a much greater portion of the total range in health for the

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[1]A fourth group, persons in one-person households in1993 who later married, is excluded from the analysis because sample sizes are too small for meaningful analysis.

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oldest persons—e.g. the difference between the 10th and 90th percentiles is about 73 percentile points at age 72 and about 49 percenitle points at age 90..

Figure 1-1. 10th, 50th, and 90th quantiles of the health index by age for all persons in AHEAD cohort, 1995 to 2010

Pathway from Health to Post-Retirement Assets: Figure 1-2 is an illustration of the potential pathways through which poor health can affect wealth at older ages. The schematic suggests two potential pathways between poor health and post-retirement asset draw-down, keeping in mind the correlation between pre- and post-retirement health status. First, poor health is associated with high post-retirement 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 post-retirement assets in two ways—(1) low pre-retirement earnings limit the accumulation of retirement assets which in turn contributes to low asset levels at retirement and (2) low pre-retirement earnings reduce the

Figure 1-2. Pathways from poor health to low post-retirement assets

level of Social Security and private pension annuities paid after retirement. We are particularly interested in how the drawdown of non-annuity assets and the level of non-annuity assets at death depend on health status and on Social Security benefits

Trends in Wealth from 1993 to the LYO: Several figures and tables help to motivate the analysis. Figure 1-3 shows the evolution of non-annuity 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 for which 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 below essentially estimates how these trends for individuals depend on health and annuity income.

Figure 1-3. Median non-annuity wealth by family pathway and last year observed
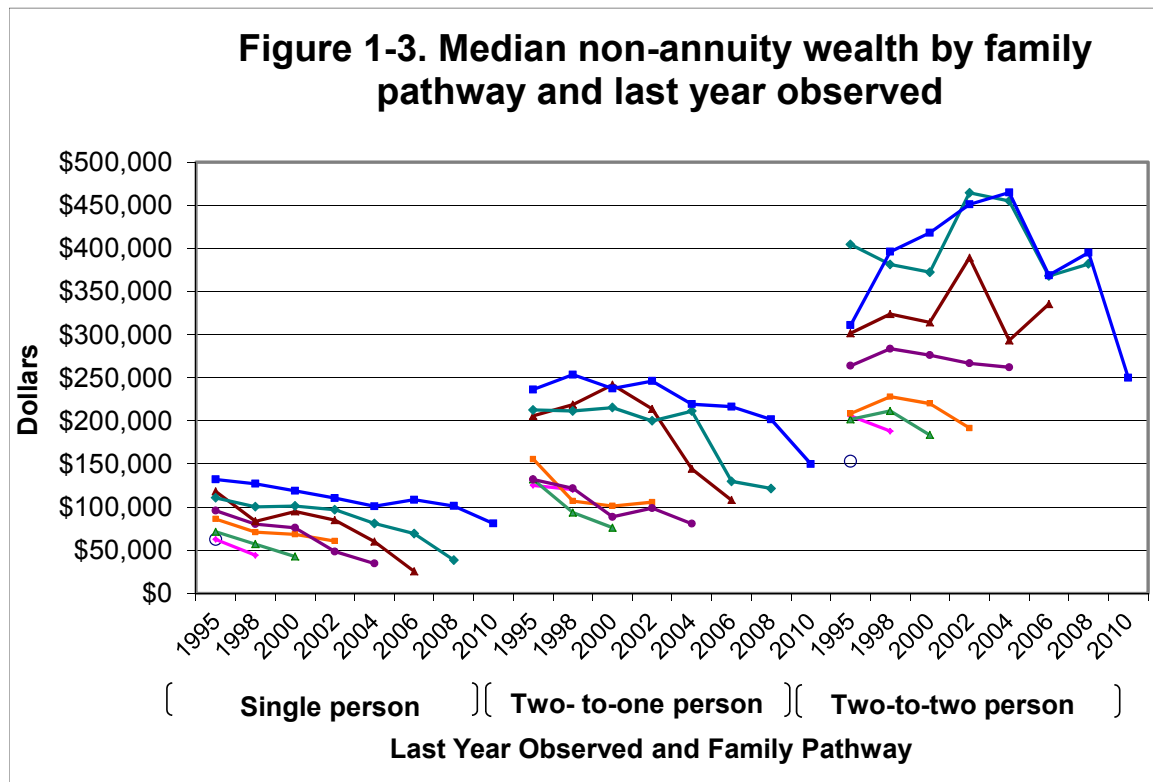
Two features of the Figure 1-3 stand out. First the non-annuity wealth of persons in the single-person pathway is much lower than the comparable wealth of persons in the two-to-one person pathway, who in turn have much lower wealth than persons in the two-to-two person pathway. Second, there is a strong

negative correlation between non-annuity wealth in 1993 and subsequent mortality. Within each pathway, persons who began the period with higher wealth live longer. In each pathway group, the non-annuity 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 (2009), Attanasio (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 (2012a).

Figure 1-4 shows median Social Security income by family pathway. The figure shows that for persons in one-person and two-to-two person households there is little difference in Social Security income as persons age. But for the persons who transition from two- to one-person households, the two-to-one pathway (who are predeceased by their spouses) there is a substantial decline in Social Security income as persons age.

Figure 1-4. Median Social Security income by family pathway and last year observed
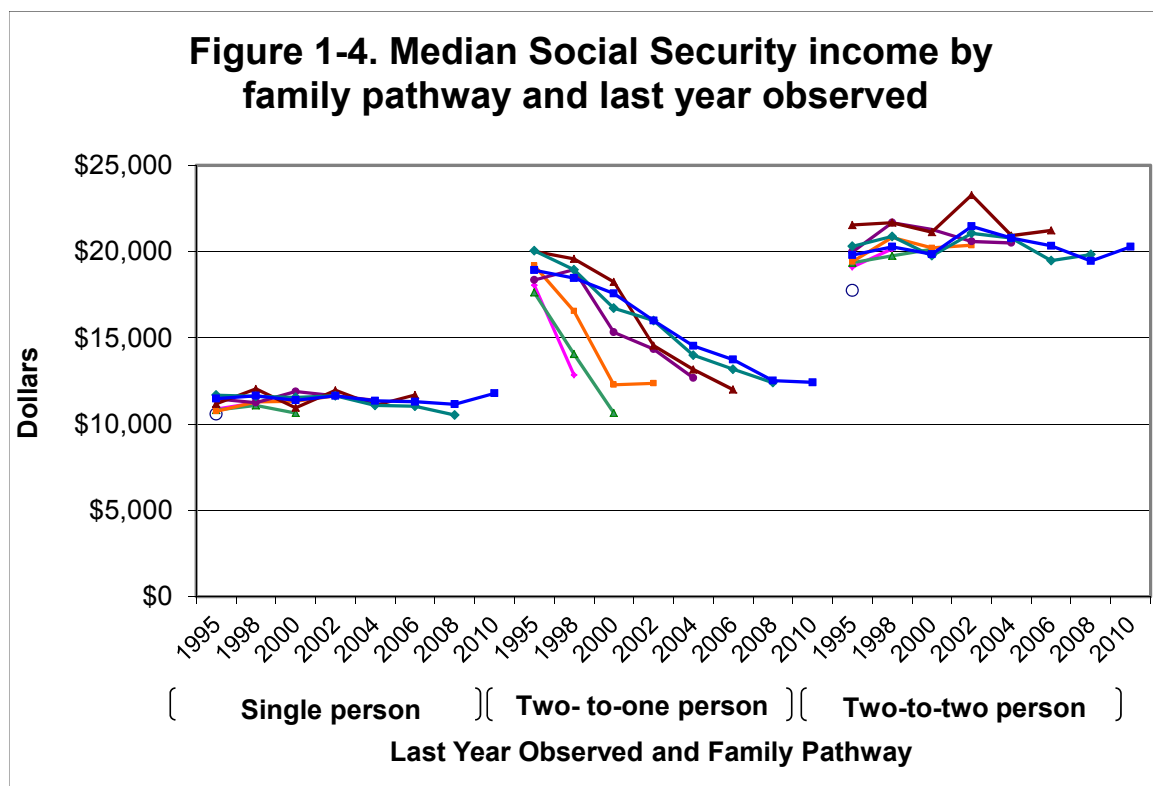
Figure 1-5 shows the evolution of home equity. For one-person households the data show a very sharp decline in median home equity beginning two or three years before death. Indeed for each LYO, median home equity in the wave prior to death was zero for all but those whose LYO was 1993. For original two-person 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 emphasizes that home equity tends to be husbanded until a precipitating shock such as entry to a nursing home or death of a spouse.

Figure 1-5. Median housing wealth by family pathway and last year observed
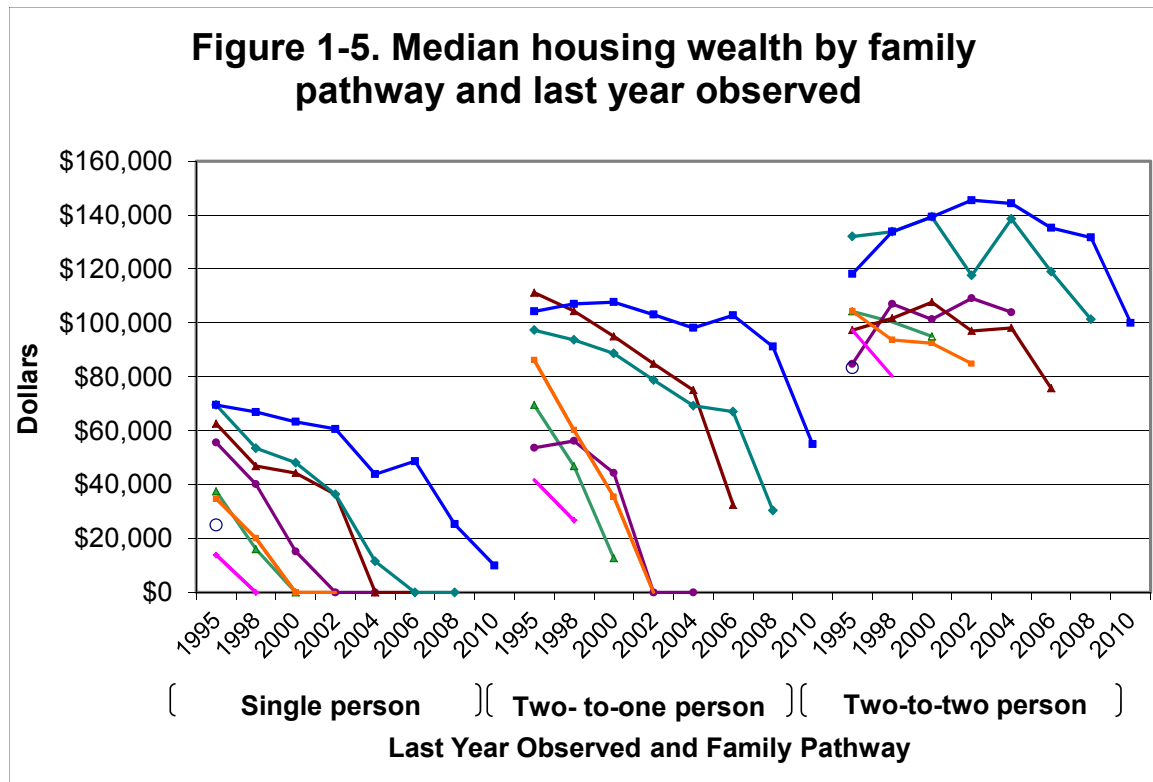
Non-Annuity Assets and LYO: Figure 1-6 shows the median of home equity and financial assets (PRA assets and financial assets held outside of tax-deferred accounts) in 1995 by LYO and by pathway. The key feature of the figures is that persons with the greatest total non-annuity assets in1995 tend to live the longest, especially persons in one-to-one and in two-to-two households. The median for a third component—"other" non-annuity assets (mostly business assets, trusts, and vehicles)—is zero for each LYO for all pathways. The means of total non-annuity 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.

Figure 1-6. Median home equity, and financial assets in 1995 by family pathway and last year observed
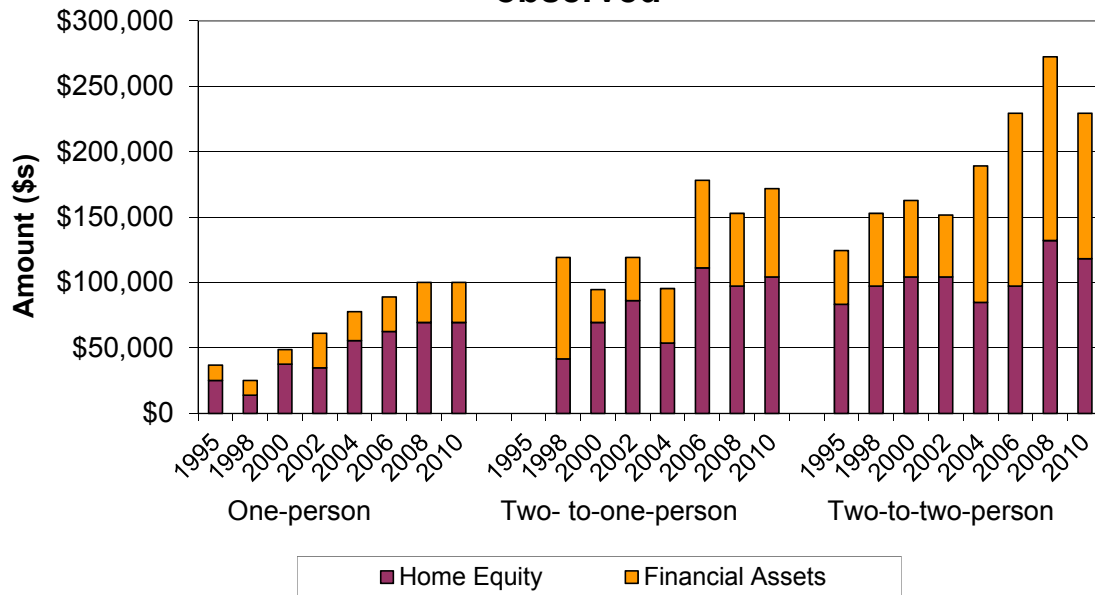
The Distribution of the Change in Non-Annuity Wealth between 1995 and the LYO: Figure 1-3 above shows the median decline in non-annuity assets by family pathway. There is, however, substantial diversity in the decline, which our analysis relies on. Table 1-1 shows the distribution of non-annuity asset change between 1995 and the LYO (the beginning and end points for each profile shown in Figure 1-3), 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).

Table 1-1. Percentiles of the distribution of the difference between non-annuity assets in LYO and non-annuity 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	-185,958	-73,714	-11	297,663
2008	-501,502	-154,432	-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 are still alive when last					

As seen in Figure 1-3, the median decline in assets is largest for persons who were originally married but were predeceased by their spouse and the values are shown in the second panel of the Table 1-1. 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 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.

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In short, the median change in assets between 1995 and the YLO is rather modest but there is enormous heterogeneity in the change. For some the *drawdown* of non-annuity assets is very large; for other the *increase* in non-annuity asset is very large.

Table 1-2. Percentiles of the distribution of the percentage change between non-annuity assets in LYO and non-annuity 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 are still alive when last					

The Distribution of the Percent Change in Non-Annuity Wealth between 1995 and the LYO: Table 1-2 shows the percentile distribution of the percentage change in non-annuity 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 non-annuity assets in 1995 and thus small dollar declines

corresponded to large percent declines. The median percent changes are smallest for persons in original two-person households whose spouse was still alive at their death, from less than 1 percent to about 19 percent.

In short, in contrast to the modest median *dollar* drawdown in non-annuity assets for persons in single-person and in two-to-one households, the median *percent* drawdown in these households is large. But, as with the dollar drawdown, there is enormous heterogeneity, with the drawdown as much as 100 percent for some and the addition to non-annuity assets well over 100 percent for others. For two-person households the median percent change is small. But again there is enormous heterogeneity across households; the drawdown is over 80 percent for some and the addition over 100 percent for others.

The Distribution of Non-annuity Assets in the LYO: Table 1-3 shows the distribution of the level of non-annuity assets in the LYO (in $000's). Among original singles over 40 percent have less than $40,000 in non-annuity 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 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 non-annuity wealth in the LYO and a large fraction have substantial wealth in the LYO. Over all pathways combined at least 30 percent have wealth less than $40,000 in the LYO, ranging from $5,000 to $39,000 depending on the LYO.

Thus 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.

Table 1-3. Percentiles of the distribution of non-annuity assets in LYO (in 000's)

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 are still alive when last observed.

Health and the Change in Non-Annuity Assets between 1995 and the LYO: Table 1-4 shows the relationship between health and the decline in non-annuity assets between 1995 and the LYO for single persons. Persons whose LYO is 2010 (survivors) 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, was -42.6 percent for those in the middle health tercile, and was -22.9 for those in the third (best) health tercile. A similar trend holds for each of the age intervals.

Table 1-4. Comparison of median non-annuity wealth in last year observed to median non-annuity wealth in 1995, original one-person households

health tercile in 1995	Age Interval in 1995				
	70-74	75-79	80-84	85+	all
Non-annuity 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
Non-annuity 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

Comparable tables for persons in two-to-one and two-to-two-person households are shown in Tables 1-5 and 1-6 respectively. In each of 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 worst health tercile versus-43.6 percent for persons best health tercile; 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 best health tercile. In percentage terms the difference is greatest for persons in the two-to-one person pathway.

Table 1-5. Comparison of median non-annuity wealth in last year observed to median non-annuity wealth in 1995, original two-person households with spouse deceased in LYO

health tercile in 1995	Age Interval in 1995				
	70-74	75-79	80-84	85+	all
Non-annuity 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
Non-annuity 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 1-6. Comparison of median non-annuity wealth in last year observed to median non-annuity wealth in 1995, original two-person households with spouse alive in LYO

health tercile in 1995	Age Interval in 1995				
	70-74	75-79	80-84	85+	all
Non-annuity 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
Non-annuity 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

Section 2. Model and Results

To help frame our estimation procedure, it is helpful to consider the standard inter-temporal budget constraint for the evolution of assets:

$$(1) \quad A_w = (1+r)A_{w-1} + a_w + e_w - c_w$$

Here the subscript w denotes wave, A denotes the level of assets, r denotes the return on assets between wave *w* and *w-1*, a_w and e_w are annuity income and earned income respectively, and c_w denotes consumption. Assets in the prior period plus the return on these assets, along with annuity income from various sources (and earnings if the household is still working), can be spent or saved. The evolution of assets is determined by these income flows and spending decisions, including spending on medical care, which is likely to be closely related to health status.

The key goal of our analysis is to estimate the effect of Social Security benefits and health on the drawdown of non-annuity wealth. We estimate the

relationship between these variables and assets in wave *w*, controlling for assets in the previous wave. The specification is given by:

(2)
$$A_w = k + \lambda A_{w-1} + \alpha H_{w-1} + \beta \Delta H_{w,w-1} + aSS_w + bDB_w + cEarn$$
$$+ mM$$

In this specification the dependent variable is the level of non-annuity assets in wave *w*. The coefficient λ is the marginal effect of an additional dollar of assets in wave *w*, given the other covariates. 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 and ΔH 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 and DB annuity income DB are also expected to be positively associated with asset change, given the level of assets in the previous wave. The assumption is that persons with greater income can cover the cost of health-related and other expenses with less need to draw down their accumulated assets. *M* is an indicator of expected lifespan, which we discuss below. We also include year effects (not shown in the equation) that we interpret as controlling for differences in market returns across years.

We do not measure consumption but the inter-temporal budget constraint implies that:

$$c_w - a_w = (1+r)A_{w-1} - A_w$$
$$c_w > a_w \implies A_w < A_{w-1} + rA_{w-1}$$

Thus if consumption is greater than annuity income, the gap is filled by spending down non-annuity assets and the difference is given by $A_w - (1+r)A_{w-1}$. Thus if we knew r—the return on assets earned by each person—we could estimate "income" from assets.

One interesting feature of this set-up 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 in Figure 1-4. DB pension benefits are only partially indexed and thus real benefits will vary over time.

Our baseline estimates are shown in Table 2-1 As discussed above, we focus on persons in AHEAD in the three family pathway groups defined using 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 above, 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 one percent.

Table 2-1. Trimmed GLS estimates of the effect of health and annuity income on the evolution of non-annuity assets between 1995 and LYO, by family pathway.

Variable	Continuously single		Original two-person household with spouse deceased in LYO		Original two-person household with spouse alive in LYO	
	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	

There are several noticeable features of the results: First the health variables and the annuity income variables are large and statistically significant. Figure 2-1 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 non-annuity 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 non-annuity assets. The relationship between a 10 percentile point increment in lagged health and non-annuity 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 non-annuity 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 non-annuity 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 survives them. The relationship between non-annuity 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 was predeceased them. This suggests that both Social Security income and DB income are protective of non-annuity wealth, while poor health is an important determinant of the drawdown of non-annuity wealth.

Second, 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.

Figure 2-1. Effect of health and income on assets, by family pathway
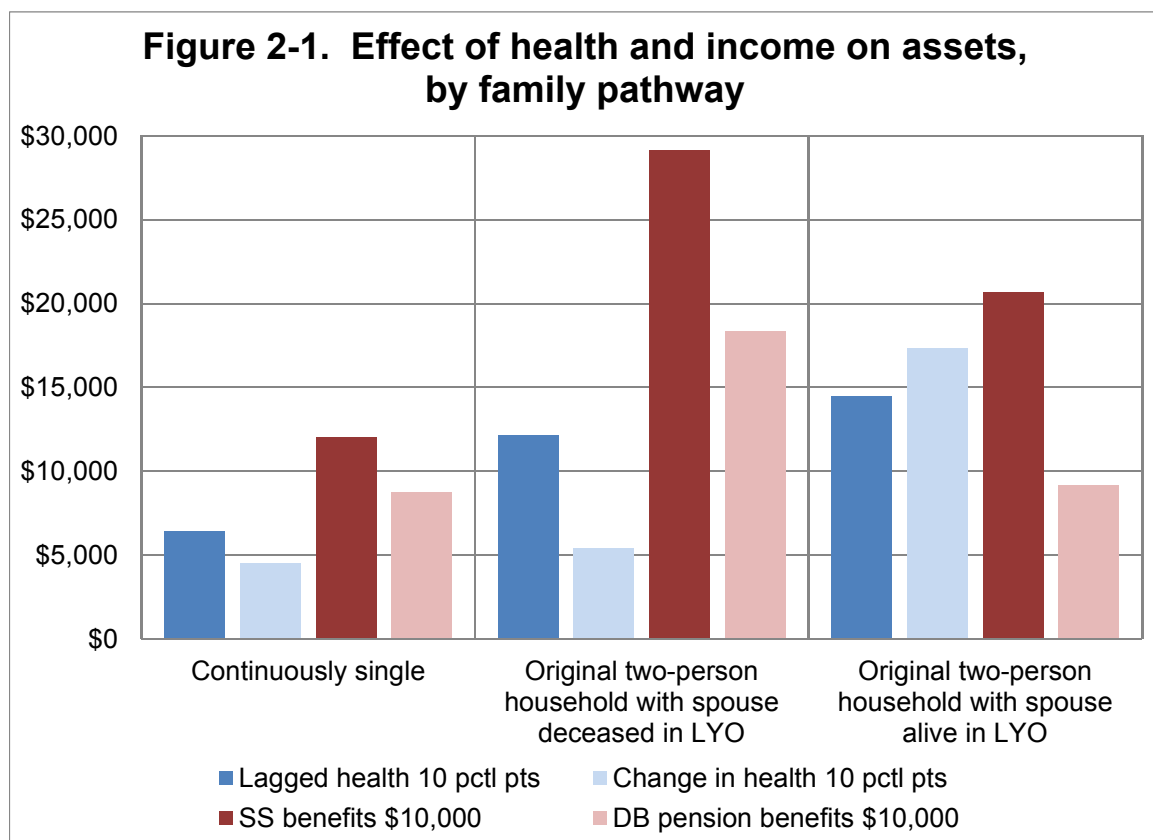
Subjective Mortality: Life cycle theory suggests that persons who expect to have long lives will spend down assets more slowly that those who expect to live shorter lives. The next set of regressions adds a measure of the survival probability to the specification used in Table 2-1. The subjective probability measure is the ratio of the probability that the respondent expects to live 10 more years divided by probability that the respondent will live 10 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 was not asked at all in 1998. Thus the sample used in these regressions is smaller than that used in Table 2-1. The reduction in the sample due to each of these reasons is described in Table 2-2. Between 43 and 62 percent of the sample are missing the survivor probability and are thus excluded from the sample used to obtain the estimates in Table 2-3.

Table 2-2. Sample size (before trimming) when use subjective mortality.								
	1998	2000	2002	2004	2006	2008	2010	Total
			Singles					
Sample for Table 2-1	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 2-1	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 2-1	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%

The estimation results are shown in Table 2-3. 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 non-randomness of the missing observations, perhaps limited credence should be put in these results. Nonetheless, the estimated subjective probability coefficient is insignificant for

each of the three pathways and in two cases has the "wrong" sign according to the life cycle theory.

Table 2-3. Trimmed GLS estimates of the effect of health and annuity income on the evolution of non-annuity 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
D 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	

Section 3. Summary and Discussion

Social Security benefits are the most important component of the income of a large fraction of older Americans. A significant fraction of persons approach the end of life with no financial assets, no home equity, and rely almost entirely on Social Security benefits for support. The non-annuity wealth of persons late in life depends importantly on health. Poor health is very persistent over a life-time. Persons in poor health at old age have a higher-than-average probability of having experienced low earnings while in the labor force, and thus also having low Social Security benefits in retirement. The progressivity of the Social Security

benefit formula helps to provide a safety net to support low-wage workers in retirement. Still, a noticeable fraction of persons, especially those in single-person households, have income below the poverty level in their last years of life and have no assets to draw on to supplement their income. Those with such low asset levels have little capacity to pay for unanticipated needs such as health or other shocks or to pay for entertainment, travel, or other activities. The members of this group are also disproportionately in poor health. In general, low assets and low income in old age are all strongly related to poor health. We explore this nexus and in particular estimate the relationship between health and Social Security benefits and the drawdown of non-annuity assets near the end of life. We seek to determine how the drawdown of assets between 1995, the first year of the AHEAD data with adequately-measured assets and health, and the last year observed (LYO) before death depends on health and on Social Security benefits.

To structure the analysis we first categorized AHEAD respondents who died between 1995 and 2010 as belonging to one of three family status "pathways" to the end of life. A person could be single when first observed and single in the LYO, a person could be married when first observe and be predeceased by a spouse, or a person could be married when first observed and survived by a spouse. A descriptive analysis of asset drawdown at the end of life shows that the median change in assets between 1995 and the YLO is rather modest for all three pathways, but that there is enormous heterogeneity in the change. For some the *drawdown* of non-annuity assets is very large; for other the *increase* in non-annuity asset is very large. Although the median dollar drawdown in non-annuity assets is modest, the median percent drawdown for these persons is large. 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 was still alive at their death were much smaller. But, as with the dollar drawdown, there is enormous heterogeneity in the percent reductions as well. The *drawdown* is as much as 100 percent for some and the *addition* to non-annuity assets well over 100 percent for others.

We find that a large fraction of households reach the LYO with little or no wealth but others enter the LYO with substantial wealth. Considering those with no wealth, one possible interpretation of the results is that people are able to anticipate how long they will live and "optimally" planned to exhaust their wealth as they were approaching death. Several results are inconsistent with this view. First, many of those with little wealth at death also had little wealth in 1995. 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.

Moreover, 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. Third a large fraction of households ended life with substantial wealth and indeed a large fraction accumulated wealth between 1995 and the LYO. Finally, we use a regression framework to determine if each respondent's subjective probability of life expectancy can explain the cross-section variation in assets near death. The results we obtain, however, provide no evidence that the rate of drawdown is related to expected mortality.

The emphasis of our analysis is the relationship between the drawdown of non-annuity assets on the one hand and health and annuity income on the other hand. Given assets in a particular wave, we ask how the level of assets in the next wave is related to the initial level of health, the change in health between the waves and the receipt of annuity income. 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, over $12,000 more for persons originally in two-person household 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 increment 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 ranging from 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 non-annuity wealth and a $10,000 increment 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 non-annuity wealth, while poor health is an important determinant of the drawdown of non-annuity wealth.

These results raise important questions about the adequacy of preparation for retirement and the adequacy of the Social Security safety net for retirees. Many households seem to be well-prepared for retirement and a substantial fraction of households increase their non-annuity wealth even as they approach the last years of their lives. But many others approach the end of life with essentially no non-annuity assets. This raises at least two issues. One is that many persons seem to be ill prepared for retirement because they did not plan and save adequately while in the labor force. The second issue pertains to the adequacy of the Social Security safety net. Some persons may have little wealth at retirement because they had low earnings while working—perhaps due to a lack of education of skills or perhaps because of ill health. These persons were not in a position to save adequately for retirement—presumably the reason for the safety net. Those with the least wealth at retirement and those who draw down assets the quickest are also in the poorest health. With the possibility, or

anticipation, of rapidly increasing health care costs in the future, the adequacy of Social Security benefits for this group becomes increasingly important.

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