How Portfolios Evolve after Retirement: The Effect of Health Shocks

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Introduction

Coming generations can expect to reach retirement age with substantially more non-Social Security assets than their predecessors, thanks to the expansion of retirement savings programs and strong returns in housing and equity markets over the past several decades. For example, the median level of non-Social Security wealth (in $2003) for households aged 65-69 rose from $109,000 in 1984 (Poterba et. al., 1994) to $172,000 in 2002. At the same time, health shocks constitute a significant source of financial risk for the elderly. Examining how wealth evolves during retirement and how this process is affected by health shocks will help us to predict how future elderly will fare during retirement and what role Social Security will play in their economic well-being.

Given the primary role of housing equity in the wealth position of most elderly households, the study of housing has been central in analyzing the wealth behavior of the elderly. Venti and Wise (1989, 1990) and Feinstein and McFadden (1989) established that the elderly are very reluctant to sell their homes, except in the case of a shock such as the death of a spouse. Venti and Wise (2002) extend the analysis to the AHEAD data set and find similar patterns.

Beyond housing, another body of work looks more generally at household assets. Poterba and Samwick (2001) study household portfolio allocation across all ages, finding sharp differences in holdings across different asset classes. They also emphasize that different birth cohorts seem to have very different patterns of asset holdings. Milligan (2005) presents an analysis of household portfolios for Canada. Rosen and Wu (2004) examine the risk characteristics of the portfolios of the elderly, looking specifically for the effects of health in a cross-sectional setting. Feinstein and Ho (2001) and Wu (2003) relate changes in health status to the spending down of total assets; Wu finds significantly stronger effects when wives become ill than for husbands.

We build on and contribute to this literature by studying the portfolio allocation decisions of the elderly. First, we document the patterns of asset holding in numerous asset classes as households age. We employ various strategies to distinguish the true effects of aging from cohort effects or the effects of differential mortality. Second, as the literature on housing wealth suggests that shocks are critical to the understanding of

behavior, we examine changes in asset allocation before and after various types of health shocks occur. We use the Health and Retirement Study (HRS) in our analysis.

We have two principal findings. First, we find that the ownership rates for principal residences, vehicles, businesses, and real estate fall dramatically with age, while ownership rates of financial assets such as CDs and bonds do not have a strong and consistent association with age. Second, we find that health shocks play an important role in explaining changes in household portfolios over time, although the timing and the assets affected differ by the type of health shock.

Data and Empirical Strategy

In this analysis, we use the Health and Retirement Study (HRS). The HRS began in 1992 as a survey of individuals born 1931-1941 and their spouses, with re-interviews of these individuals every two years. In 1998, the HRS was expanded through a merger with the Study of Assets and Health Dynamics among the Oldest Old (AHEAD), which had interviewed households born before 1924 in 1993 and 1995. At the same time, the survey added two new cohorts, the Children of the Depression (CODA, born 1924-1930) and the War Babies (WB, born 1942-1947). In total, the enhanced HRS had nearly 22,000 respondents in 1998 and continues to interview these individuals every other year. We use all six waves of the HRS, 1992-2002.

The HRS is well-suited for our purposes because it contains detailed information on assets and health and follows the same individuals over time. For most analyses, we use data on all households for all waves they participate in the sample; thus, each household may provide up to 6 observations if from the original HRS cohort, 5 if from the AHEAD cohort, and 3 if from the CODA and WB cohorts.[1] We use the RAND version of the HRS, a user-friendly subset of the HRS with cleaned and consistent variables. Of particular note, we use RAND's model-based imputations for any missing wealth data.

Our analysis proceeds in two parts. First, we explore how wealth evolves with age, looking at ten different wealth categories: principal residence, other real estate,

[1] AHEAD data from 1993 and 1995 is treated as having been collected at waves 2 and 3, respectively; thus, there is no wave 1 observation. As detailed below, some analyses are conditioned on remaining in the sample through 2002 or are limited to certain age groups only.

vehicles, business, IRAs, stocks, bonds, CDs, bank accounts, and other savings.[2] We start with a simple cross-sectional analysis of wealth holdings by category and age using the 2002 HRS. However, any differences by age in such an analysis may also reflect cohort and time effects and be tainted by survivorship bias, as wealthy individuals tend to live longer. We begin to address these concerns by instead examining how asset holdings evolve over time for the same individuals. Finally, we formalize this by regressing asset holdings on age, first with cohort dummies and then with family fixed effects, which should account for any unmeasured effects and biases as long as they are time invariant.

These regressions using data for family *i* in time period *t* take the form:

$$Assetholdings_{it} = b_0 + b_1 age_{it} + b_2 X_{it} + e_{it}, \qquad (1)$$

where $Assetholdings_{it}$ is a measure of the holdings in a particular asset category, age_{it} is the age of the family, and X_{it} is a vector of control variables. The ß terms are parameters to be estimated from the data, and e_{it} is an error term. The control variables include dummies corresponding to the HRS wave of the observation and a set of indicators for marital status (widow, married, divorced/separated).[3] Here, and elsewhere in the paper, we measure the age of the family by taking the age of the older spouse. While the linear age specification is simple, it will provide some indication of which assets vary strongly with age.[4]

Throughout our analysis, we examine three measures of asset holdings: positive holdings of the asset class, share of total assets in the asset class, and median value conditional on holding the asset. Due to space limitations, we primarily present results on asset ownership, leaving the analysis of the other variables to future work.

In the second part of the analysis, we explore how health shocks affect asset holdings. Specifically, we estimate regressions of the following form:

[2] 'IRAs' includes all funds in Individual Retirement Accounts or Keoughs. 'Stocks' includes stocks, mutual funds, and investment funds. 'Bonds' includes bonds and bond funds. 'CDs' includes certificates of deposit, savings bonds, and t-bills. 'Other savings' includes items such as jewelry, money owed to the respondent by others, a collection for investment purposes, rights in a trust or estate where the respondent is the beneficiary, or an annuity.

[3] We include only these time-varying characteristics because our family fixed effect specification will control for any fixed characteristics of the family.

[4] In results not included in this paper, we have tried a quadratic age specification.

$$Assetholdings_{it} = b_0 + b_1 shock\min us3_{it} + b_2 shock\min us2_{it} + b_3 shockplus1_{it} + b_4 shockplus2_{it} + b_5 shockplus3_{it} + b_6 shockplus4_{it} + b_7 X_{it} + e_{it} \quad (2)$$

where the $shock_{it}$ is a dummy equal to 1 if household *i* experiences a health shock in period *t* and the *shockplus* and *shockminus* variables are dummies equal to 1 if the observation occurs specified number of periods before or after the shock; *shockminus1* is the omitted category. This allows us to see whether there is any change in asset holdings prior to the shock and whether the response to the shock occurs immediately or later. The X_{it} vector includes a detailed list of demographic controls, along with dummies for age and for the HRS wave.[5] We estimate these models for all ten asset categories and for asset ownership as well as share of total assets, though we report only the former on the tables in the paper.

We use several definitions of a health shock: 1) experiencing an "acute event" (heart problems, stroke, or cancer), 2) receiving a new diagnosis of a chronic illness (high blood pressure, diabetes, lung disease, psychological problems, or arthritis), 3) reporting a worse health status than at the previous wave, 4) reporting more difficulty with activities of daily living (ADL) than at the previous wave,[6] and 5) becoming widowed. In all cases, we treat the household as experiencing a shock if either spouse receives a shock.

Age patterns of household asset holding

Table 1 provides a cross-sectional analysis of household asset holdings by age in the 2002 HRS.[7] The top panel indicates how the rate of ownership of various assets evolves with age and it reveals some interesting patterns. Home ownership is flat at 80% until age 80, but then drops consistently in every successive age group, to a rate of 54% in the age 90 and above group. Vehicle ownership displays a similar pattern of being relatively flat until age 80 and falling dramatically thereafter, from 82% in the age 75-79 group to 40% in the age 90 and above group. Three other asset categories – other real

[5] The controls include dummies for the respondent's Census region, religion, race, Hispanic status, being US born, and four educational categories.
[6] The ADL variable is formed by asking if any of the following five activities present difficulties: bathe, dress, eat, get in/out of bed, walk across room.
[7] Data are weighted by HRS household weights; age patterns in unweighted data are largely similar.

estate, business, and other savings – start at a lower level, but in all cases asset ownership is cut in half between the 60-64 age group and the 90 and above age group. IRA ownership falls dramatically after age 70, no doubt due to the automatic withdrawal

Table 1: Household assets by age, 2002 HRS (in 2003 dollars)

Asset Type	Age						
	60-64	65-69	70-74	75-79	80-84	85-89	90+
% With Positive Asset Holdings							
Home	0.82	0.80	0.80	0.79	0.73	0.65	0.54
Other Real Estate	0.18	0.18	0.16	0.12	0.12	0.12	0.08
Vehicles	0.89	0.87	0.83	0.82	0.74	0.61	0.40
Business	0.12	0.10	0.08	0.08	0.06	0.06	0.06
IRAs	0.42	0.41	0.40	0.33	0.25	0.09	0.03
Stocks	0.33	0.33	0.31	0.33	0.31	0.30	0.29
Bank Account	0.86	0.87	0.86	0.86	0.88	0.86	0.84
CDs	0.19	0.24	0.27	0.31	0.33	0.34	0.32
Bonds	0.07	0.07	0.09	0.09	0.08	0.08	0.11
Other Savings	0.16	0.16	0.13	0.10	0.08	0.08	0.06
Median Value, Conditional on Holding							
Home	122,735	121,712	117,621	104,325	102,279	86,937	81,312
Other Real Estate	71,595	76,709	71,595	91,540	76,709	81,823	N/A
Vehicles	10,228	10,228	10,228	9,205	6,137	5,114	4,091
Business	153,419	130,406	153,419	153,419	168,760	N/A	N/A
IRAs	46,189	59,833	61,367	51,140	32,474	20,456	N/A
Stocks	46,026	51,140	61,367	51,140	76,709	51,140	84,380
Bank Account	5,114	7,160	8,182	8,182	9,001	7,160	6,137
CDs	11,251	17,387	20,456	25,570	30,684	31,707	29,661
Bonds	25,570	40,912	31,707	43,469	35,798	51,140	N/A
Other Savings	20,456	20,456	25,570	23,524	20,456	17,899	N/A
Total Assets	169,783	175,920	184,153	174,999	142,168	122,735	92,460
Mean Share of Total Assets							
Home	0.493	0.451	0.479	0.480	0.430	0.397	0.367
Other Real Estate	0.048	0.048	0.040	0.033	0.035	0.051	0.031
Vehicles	0.130	0.125	0.102	0.088	0.073	0.057	0.037
Business	0.034	0.034	0.027	0.029	0.023	0.023	0.026
IRAs	0.091	0.098	0.095	0.066	0.047	0.013	0.006
Stocks	0.064	0.064	0.067	0.083	0.094	0.091	0.119
Bank Account	0.098	0.126	0.129	0.150	0.197	0.238	0.280
CDs	0.017	0.027	0.035	0.049	0.078	0.104	0.101
Bonds	0.007	0.007	0.008	0.011	0.011	0.014	0.024
Other Savings	0.018	0.020	0.017	0.012	0.012	0.012	0.008
# of Households	2,400	2,274	1,797	1,518	1,333	700	358

Age of family is defined by age of the oldest member. N/A indicates fewer than 50 observations with positive asset value. Values are weighted using HRS household weights.

provisions. On the other hand, ownership of CDs and bonds rises over time, perhaps due to the greater liquidity or lower risk properties of these assets. Stock and bank account ownership are essentially flat with age.

The other two panels on Table 1 display the share of total assets in each category and the median value conditional on holding the asset. The assets that experience a drop in ownership with age in the top panel also experience a slide in asset share. In the case of homes and vehicles, the median value conditional on holding the asset also falls over time. Asset shares rise with age in stocks, bonds, CDs, and bank accounts; the increase in the bank account share is particularly dramatic, rising from 10% at ages 60-64 to 28% in the oldest age group, while CDs also rise sharply, from 2% to 10%. The median value of total assets falls considerably starting at age 80, potentially reflecting some dissaving to finance retirement consumption.

As noted above, however, there are several potential problems with this analysis. Observed patterns may reflect cohort or time effects as well as age effects. Moreover, since wealthier households are more likely to survive, observed patterns may reflect the selection of a wealthier sample in the higher age groups.

To address these concerns, we conduct a cohort-based analysis that tracks asset holdings of the same households over time. Specifically, we divide the sample into 20 groups, each of which consists of two single birth cohorts (e.g., 1931-1932). Depending on whether the group is part of the original HRS, AHEAD, WB, or CODA cohorts, households appear in the survey 3 to 6 times. We drop households that do not stay in the survey for all waves where they might be observed, to avoid having the composition of a group change over time as households leave the survey due to death or attrition; however, we acknowledge that older cohorts may be wealthier due to differential mortality.

Figures 1a-1d and 2a-2d display the results of this analysis. Each of the short lines on a graph represents the asset holdings for a particular group at the ages they are observed. So for example, the 1931-1932 group, which is part of the original HRS cohort, appears in all 6 waves of the survey and contributes information for ages 60-61, 62-63, etc. through 70-71. Any given line shows the effect of aging for a fixed sample of households; if the various lines that cover the same age range are close together, this will indicate that cohort effects are small, at least for cohorts that are relatively close together.

Figure 1a: Home Ownership Rate by Age and Cohort

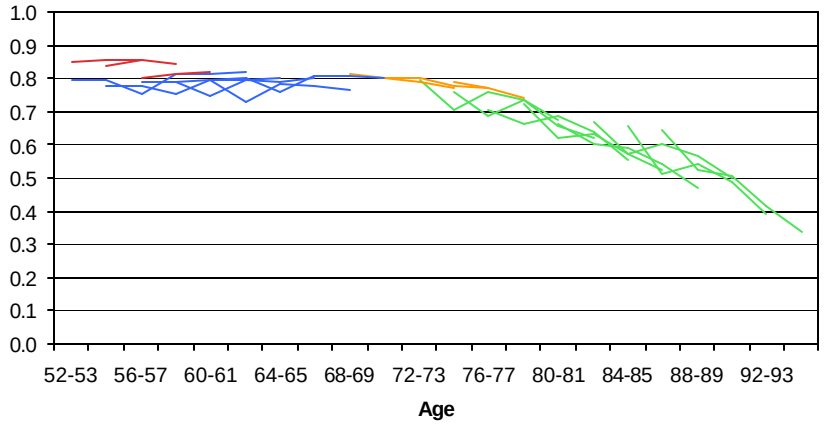


Figure 1b: Vehicle Ownership Rate by Age and Cohort

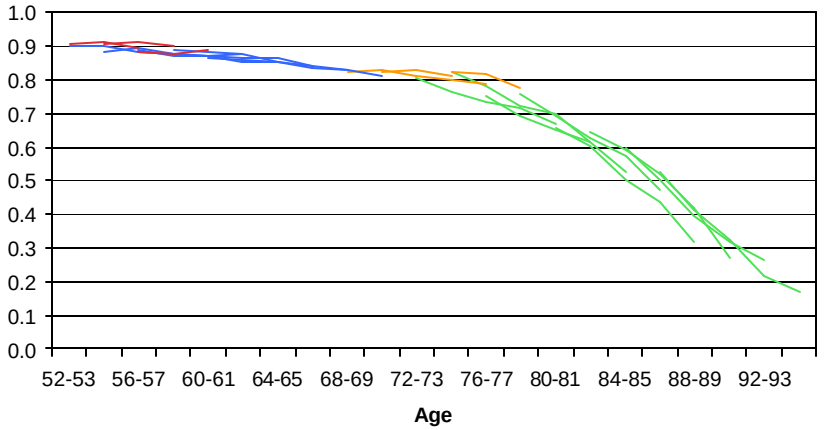


Figure 1c: Other Real Estate Ownership Rate by Age and Cohort

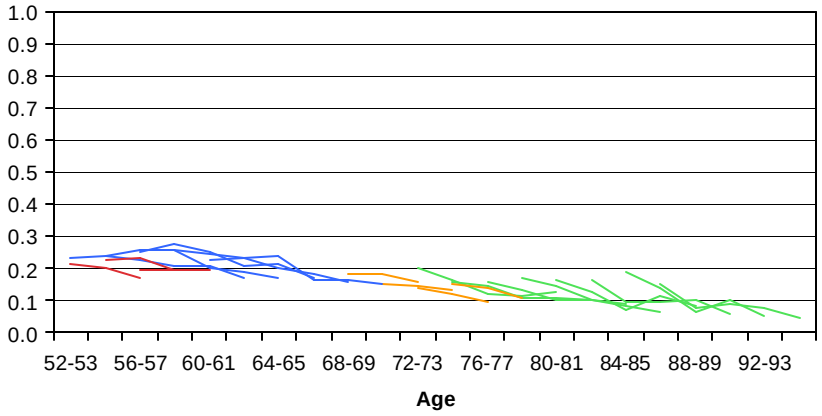


Figure 1d: Business Ownership Rate by Age and Cohort

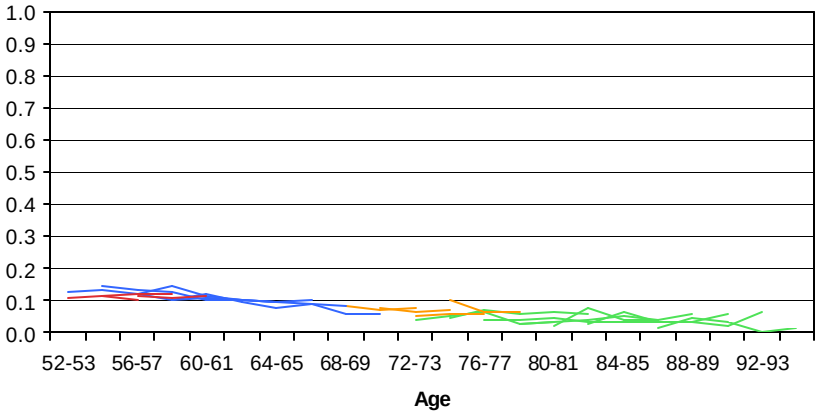


Figure 2a: Stock Ownership Rate by Age and Cohort

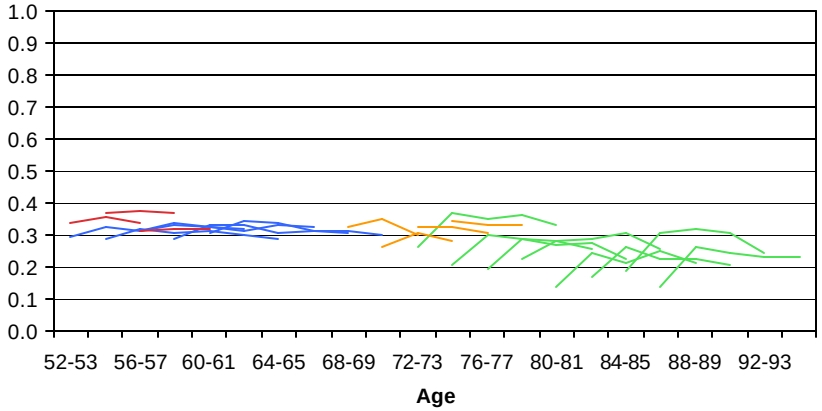


Figure 2b: Bond Ownership Rate by Age and Cohort

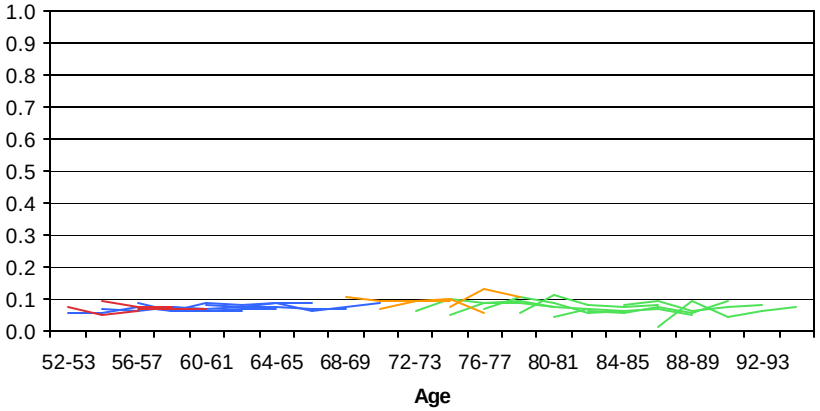


Figure 2c: Bank Account Ownership Rate by Age and Cohort

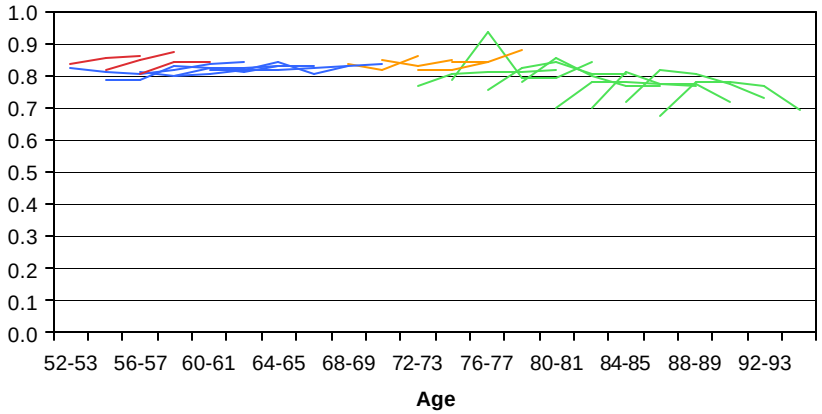
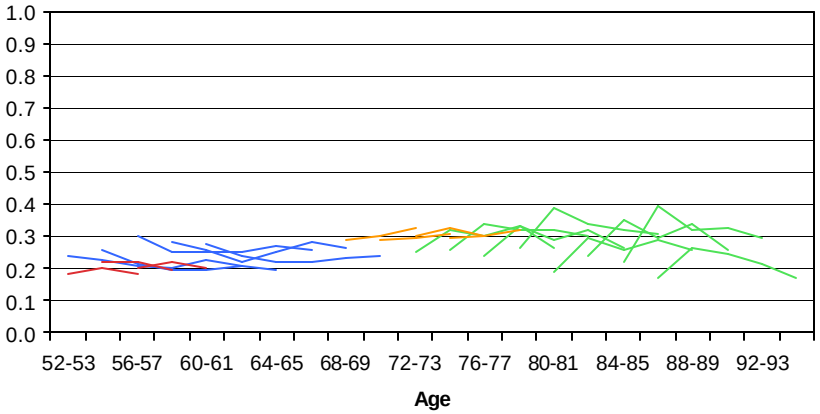


Figure 2d: CD Ownership Rate by Age and Cohort



The graphs largely confirm that the results from Table 1 remain when we do a better job of controlling for cohort effects and survivorship bias. Home and vehicle ownership rates fall dramatically after age 80, with the slide in vehicle ownership clearly visible at much younger ages as well. There is also a notable decline in the other real estate and business ownership rate, albeit from a lower starting level. Ownership of CDs is rising, as in Table 1, although here there is no clear increase in bond ownership. Ownership of stocks and bank accounts are roughly flat, as before.

We now turn to some basic regression analysis to document more precisely the trends observed in the figures. Table 2 contains regressions on the sample of families with the older spouse age 60 and higher. We provide results for the 10 asset classes, with three different econometric specifications. The regressions are estimated by OLS, and in all cases we adjust standard errors for heteroskedasticity using the robust adjustment.

The first column of the table shows the results from a specification with a linear age term and no controls for cohort or individual fixed effects. This specification most closely aligns with the simple analysis in Table 1, since no attempt is made to disentangle the age from the cohort effects. As the dependent variable is binary, the coefficient can be interpreted as a change in the probability in owning the asset for an additional year in age. For example, the first reported coefficient on real estate holdings is -0.0033. This coefficient suggests that as a family becomes one year older, the probability that the family holds any real estate will decline by 0.33 percent. Given the mean of 0.189, this coefficient suggests a 17.5 percent (or 3.3 percentage point) decline in the probability of ownership over a decade. Down the table, all results are highly significant, with bonds and CDs having positive relationships with age and all other categories negative.

In the second column of the table, we add a set of dummy variables for the year of birth cohort to which each family belongs. This specification effectively compares families of different ages within the same year-of-birth cohort, allowing the effect of age to be separated from the effect of cohort. The results change substantially from the first column. Real estate, Bonds, CDs, and other savings are no longer significant. Vehicle ownership, IRAs, and principal residence show strong, negative effects with age. For the principal residence, the coefficient of -0.016 implies a twenty percent drop in the probability of ownership over a decade, starting at the mean of 0.790.

Table 2: Effect of Age on Asset Holdings

	Positive holdings of asset class			
	Mean	Just Age	Cohort Dummies	Family Fixed Effects
Observations	75807			
Real Estate	0.195	-0.0033***	-0.0030***	0.0000
		[0.0002]	[0.0006]	[0.0012]
Vehicles	0.840	-0.0076***	-0.0061***	-0.0037***
		[0.0002]	[0.0004]	[0.0009]
Business	0.093	-0.0027***	-0.0029***	0.0006
		[0.0001]	[0.0005]	[0.0008]
IRA	0.372	-0.0122***	-0.0116***	-0.0010
		[0.0002]	[0.0007]	[0.0011]
Stocks	0.333	-0.0010***	-0.0033***	0.0018
		[0.0002]	[0.0007]	[0.0013]
Bank accounts	0.854	-0.0007***	-0.0036***	-0.0001
		[0.0002]	[0.0005]	[0.0013]
CDs	0.282	0.0045***	0.0013*	-0.0019
		[0.0002]	[0.0007]	[0.0015]
Bonds	0.087	0.0013***	0.0001	-0.0004
		[0.0001]	[0.0005]	[0.0009]
Other Savings	0.146	-0.0039***	-0.0033***	0.0019
		[0.0002]	[0.0006]	[0.0013]
Principal Residence	0.799	-0.0045***	-0.0046***	-0.0049***
		[0.0002]	[0.0005]	[0.0009]

Coefficient reported is for linear age. Standard errors appear in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated with one, two, or three stars, respectively.

The final column of Table 2 provides the results using family fixed effects. In this specification, the age coefficient is identified by variation within each family, exploiting the panel structure of the data. Two of the results from the second column hold up strongly – vehicle ownership and principal residence. The IRA result dissipates completely, while the significance of other coefficients wane. Interestingly, the sign of the coefficient on holdings stocks reverses between columns 2 and 3. Both other savings and business ownership show up significant in the final column as well, also reversing their signs from previous specifications.

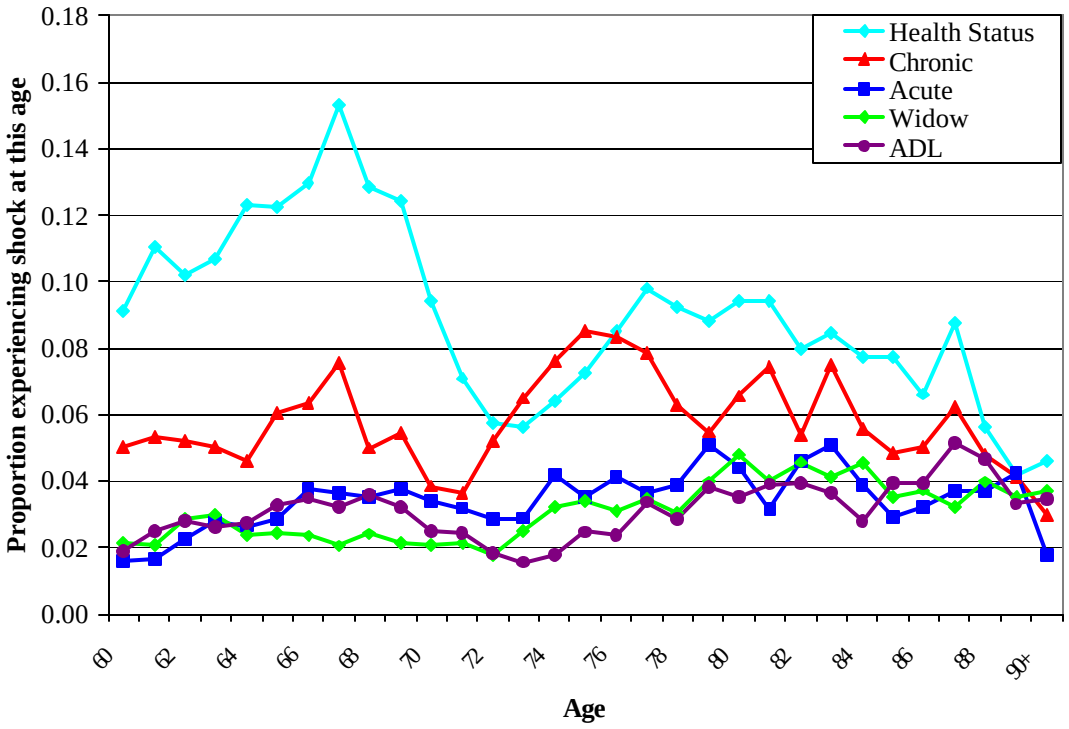
This regression analysis has revealed two important findings. First, the relationship between asset holdings and age changes substantially when one controls

more rigorously for individual cohort and family effects. This suggests that cross-sectional age relationships ought to be interpreted very cautiously, as age and cohort effects are entangled. Second, the results reveal a persistent and strong relationship between age and the holding of two asset categories: vehicle ownership and principal residence.

The effect of health shocks

Could health shocks lie behind the age-trends in asset decisions observed in the analysis? Figure 3 graphs the incidence (over a two-year period) by age of the five health shocks we consider. Because our asset data is at the family level, we consider a shock to have hit the family when either member of the couple experiences the change in health. In the 60s, the shock with the highest incidence is for changes in self-assessed health status, peaking at a proportion of 0.153 at age 67. After the mid-70s, the incidence of acute, widow, and ADL shocks increases. For widowhood, the probability of suffering a shock increases from 0.021 at age 70 to 0.048 at age 80; more than doubling. Overall, this figure demonstrates the relatively high incidence of health shocks for the elderly.

Figure 3: Proportion of families suffering shock at ages 60 to 90



More striking than the period-by-period rate of incidence is to look at how many families last until age 89 without suffering a shock. For widowhood, only 39.9% of families survive to 89 without one or the other partner dying. For ADL, only 13.7% of families do not have some ADL difficulties by age 89. The magnitude of these numbers suggests that the changes in asset holdings seen previously could conceivably be related to health shocks.

To rigorously examine the link between the health shocks we graphed in Figure 3 and the asset changes we graphed in Figures 1 and 2, we present regression analysis based on equation (2) described earlier. For this analysis, we select the data for each shock by choosing any family in which one member of the couple experiences the shock between one HRS wave and the next. We then use the panel structure of the data set to observe their asset choices several periods before and after the onset of the shock. For some families, we might see a shock occur between waves 1 and 2. For that family, we would observe one 'pre-shock' period, the shock period itself, and several 'post-shock' periods. For other families, we might observe a shock between waves 5 and 6. For that family, we would observe five 'pre' periods (waves 1 to 5) as well as one period after the shock. Across all the families in the sample, therefore, we can develop a very complete picture of the effect of health shocks on asset decisions before and after the onset of the shock.

In the regression analysis we consider five shocks. The coefficients reported are for the dummy variables indicating the distance in time from the shock period. The omitted category is the period just before the shock occurred, so all of the coefficients should be interpreted as the change in the probability of holding positive values of the asset category *relative to* the period before the shock. We also report the mean of the dependent variable for each asset class, which corresponds to the proportion of the sample that holds a positive value of the asset.

We begin with an analysis of the widow shock in Table 3. This marks a sensible starting point because earlier research by Venti and Wise (2002) highlights the importance of widow shocks on housing changes. Across the ten asset categories, the clearest results are for vehicle ownership and for the principal residence. In both cases, there is a sharp drop in ownership following the death of one of the spouses. For vehicles, the drop is estimated to be 9.6 percentage points in the first period after the

shock, rising to 17.2 points four periods after the shock. This 17.2 point drop represents 21.6 percent of the 0.797 proportion of this population that has a vehicle. Since there are two years between waves, four periods after the shock corresponds to about 8 years. For the principal residence, the drop in ownership is 5.8 percentage points in the first period after the shock, growing to 12.4 points by the fourth period after the shock. This represents a 16.4 percent drop from the mean. This corroborates the existing findings on housing equity and extends the finding both by showing the dynamic path of the adjustment of housing equity and by showing the co-movement of vehicle ownership.

Table 3: Widow shock - Positive holdings of asset class

	Mean	3 before	2 before	1 after	2 after	3 after	4 after
Real Estate	0.154	-0.001	-0.002	0.007	0.005	0.011	0.037
		[0.018]	[0.014]	[0.013]	[0.014]	[0.017]	[0.024]
Vehicles	0.797	0.031**	0.017	-0.096***	-0.101***	-0.101***	-0.172***
		[0.013]	[0.011]	[0.013]	[0.016]	[0.020]	[0.028]
Business	0.058	0.020*	0.007	-0.001	0.000	0.000	-0.022
		[0.011]	[0.008]	[0.009]	[0.010]	[0.013]	[0.014]
IRA	0.254	0.041**	0.028*	-0.023	-0.037**	-0.032	-0.050*
		[0.019]	[0.016]	[0.015]	[0.017]	[0.021]	[0.027]
Stocks	0.286	0.031	0.023	-0.001	-0.002	0.010	0.000
		[0.020]	[0.016]	[0.016]	[0.018]	[0.022]	[0.029]
Banks	0.830	0.019	0.016	0.012	0.004	0.019	-0.027
		[0.015]	[0.013]	[0.012]	[0.014]	[0.016]	[0.023]
CDs	0.280	0.007	0.004	0.015	0.001	0.000	-0.046
		[0.020]	[0.016]	[0.016]	[0.018]	[0.023]	[0.029]
Bonds	0.074	0.014	0.018*	-0.007	-0.014	0.000	0.020
		[0.012]	[0.010]	[0.009]	[0.011]	[0.014]	[0.021]
Other Savings	0.119	0.005	-0.015	-0.021*	-0.010	-0.005	-0.035*
		[0.016]	[0.012]	[0.012]	[0.013]	[0.016]	[0.020]
Principal Residence	0.754	0.008	0.005	-0.058***	-0.077***	-0.076***	-0.124***
		[0.018]	[0.015]	[0.015]	[0.018]	[0.022]	[0.031]

Coefficient reported is for a dummy variable 'X' periods away from the health shock. The excluded dummy is for the period before the shock. Standard errors appear in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated with one, two, or three stars, respectively. There are 9,600 observations.

For the other asset categories, there is surprisingly little consistent evidence of a relationship between widowhood and asset ownership. One exception is for IRA

ownership. The significant positive coefficients for the periods before the shock indicate that the probability of owning an IRA was higher in the 3rd and 2nd periods before the shock than in the period just before the shock. This indicates that IRA ownership drops *before* the shock occurs. Such a pattern might be expected if families were more likely to liquidate their IRA accounts in the last years before death, either in anticipation of the shorter lifespan or because of increased medical bills through those years. By looking at more subtle measures of health changes, we can explore this phenomenon further.

Table 4: Health status shock - Positive holdings of asset class

	Mean	3 before	2 before	1 after	2 after	3 after	4 after
Real Estate	0.241	-0.012	-0.003	-0.006	-0.007	-0.010	-0.050***
		[0.015]	[0.011]	[0.010]	[0.011]	[0.013]	[0.017]
Vehicles	0.949	-0.010*	0.000	-0.003	-0.005	-0.004	0.008
		[0.006]	[0.005]	[0.005]	[0.005]	[0.007]	[0.008]
Business	0.120	-0.020*	-0.012	-0.002	-0.012	-0.014	0.003
		[0.011]	[0.009]	[0.008]	[0.009]	[0.010]	[0.014]
IRA	0.488	-0.037**	-0.026**	-0.003	-0.012	-0.009	-0.052***
		[0.015]	[0.012]	[0.011]	[0.012]	[0.014]	[0.020]
Stocks	0.402	-0.023	-0.011	-0.017	-0.026**	-0.033**	-0.035*
		[0.015]	[0.012]	[0.011]	[0.012]	[0.015]	[0.020]
Banks	0.899	-0.013	-0.008	-0.004	-0.003	-0.007	-0.011
		[0.009]	[0.007]	[0.006]	[0.007]	[0.009]	[0.011]
CDs	0.313	-0.004	0.001	-0.005	0.007	-0.002	0.001
		[0.015]	[0.011]	[0.010]	[0.012]	[0.014]	[0.019]
Bonds	0.103	-0.004	0.001	0.001	0.007	0.008	0.011
		[0.010]	[0.008]	[0.007]	[0.008]	[0.009]	[0.013]
Other Savings	0.182	-0.013	-0.009	0.002	0.010	0.016	0.032**
		[0.013]	[0.010]	[0.009]	[0.010]	[0.012]	[0.016]
Principal Residence	0.898	0.027***	0.016**	-0.001	-0.011	-0.013	-0.011
		[0.010]	[0.007]	[0.007]	[0.007]	[0.009]	[0.012]

Coefficient reported is for a dummy variable 'X' periods away from the health shock. The excluded dummy is for the period before the shock. Standard errors appear in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated with one, two, or three stars, respectively. There are 27,111 observations.

Table 4 reports the results using the change in self-reported health status shock. The only consistently significant effect after this shock is for stocks, with a 3.5 percentage point drop by four periods after a self-assessed health status change. This might indicate a decrease in risk-tolerance after a downgrade in self-assessed health. For

IRAs and the principal residence, there is some indication that asset positions reacted in the period before the shock occurred, although in the case of IRAs the pre-shock coefficients have switched signs relative to Table 3. To summarize, the effects of self-assessed health status appear to be less than what was observed for widowhood.

Table 5: ADL shock - Positive holdings of asset class

	Mean	3 before	2 before	1 after	2 after	3 after	4 after
Real Estate	0.200	0.030	0.012	-0.017	-0.026	-0.044**	-0.007
		[0.022]	[0.017]	[0.015]	[0.017]	[0.020]	[0.028]
Vehicles	0.912	0.019*	0.009	-0.021**	-0.040***	-0.060***	-0.037**
		[0.011]	[0.009]	[0.010]	[0.011]	[0.014]	[0.018]
Business	0.098	0.024	-0.007	-0.018	-0.036***	-0.045***	-0.054***
		[0.018]	[0.013]	[0.012]	[0.013]	[0.015]	[0.020]
IRA	0.358	0.015	0.002	-0.023	-0.036*	-0.063***	-0.105***
		[0.024]	[0.019]	[0.017]	[0.021]	[0.024]	[0.032]
Stocks	0.311	0.037	0.014	-0.025	-0.051**	-0.053**	-0.054*
		[0.023]	[0.018]	[0.017]	[0.020]	[0.024]	[0.031]
Banks	0.853	0.011	0.006	-0.012	-0.009	-0.025	-0.043*
		[0.017]	[0.013]	[0.012]	[0.014]	[0.017]	[0.026]
CDs	0.272	0.024	-0.002	-0.024	-0.053***	-0.076***	-0.086***
		[0.022]	[0.018]	[0.017]	[0.019]	[0.023]	[0.030]
Bonds	0.082	0.010	0.012	-0.004	-0.005	-0.018	-0.024
		[0.014]	[0.012]	[0.011]	[0.012]	[0.014]	[0.018]
Other Savings	0.145	0.033*	0.020	0.005	-0.013	-0.012	-0.031
		[0.019]	[0.014]	[0.013]	[0.015]	[0.018]	[0.024]
Principal Residence	0.852	0.030*	0.016	0.005	-0.005	-0.036*	-0.018
		[0.017]	[0.014]	[0.013]	[0.015]	[0.019]	[0.025]

Coefficient reported is for a dummy variable 'X' periods away from the health shock. The excluded dummy is for the period before the shock. Standard errors appear in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated with one, two, or three stars, respectively. There are 9,142 observations.

Table 5 repeats the analysis for changes in ADL. Vehicle ownership suffers an immediate drop, which grows slightly larger through time, suggesting that the physical demands of driving may become too strong for some with ADL difficulties. For housing, there is no consistently observed change in the propensity to hold onto the principal residence. The share of families that hold business equity declines significantly following an ADL shock. After 4 periods, 5.4 percentage points fewer families hold a

business, compared to the mean of only 0.098. Again, this may relate to the physical demands of running a small business; demands that are harder to meet when physical health deteriorates. Finally, financial assets (IRAs, stocks, CDs, and bonds) exhibit a mixed pattern of decline following an ADL shock. For CDs, the decline is 8.6 percentage points, or 32 percent of the mean. This decline in financial asset holdings may relate to the increased financial stress of those with ADL difficulties, stemming from increased health expenditures or decreased earnings.

Table 6: Acute shock - Positive holdings of asset class

	Mean	3 before	2 before	1 after	2 after	3 after	4 after
Real Estate	0.221	0.014	0.007	0.003	0.000	-0.025	-0.040
		[0.022]	[0.017]	[0.015]	[0.016]	[0.019]	[0.025]
Vehicles	0.935	0.001	0.002	-0.015*	-0.028***	-0.031***	-0.059***
		[0.009]	[0.008]	[0.008]	[0.009]	[0.011]	[0.018]
Business	0.101	0.039**	0.024**	-0.009	-0.025**	-0.045***	-0.046**
		[0.017]	[0.012]	[0.011]	[0.012]	[0.014]	[0.018]
IRA	0.440	0.025	0.014	-0.037**	-0.037**	-0.033	-0.074**
		[0.022]	[0.018]	[0.016]	[0.019]	[0.022]	[0.030]
Stocks	0.387	0.025	0.021	0.003	-0.013	-0.068***	-0.088***
		[0.023]	[0.018]	[0.016]	[0.019]	[0.023]	[0.030]
Banks	0.889	-0.006	-0.005	0.000	-0.005	-0.019	-0.018
		[0.015]	[0.011]	[0.010]	[0.012]	[0.014]	[0.020]
CDs	0.314	-0.020	-0.011	0.013	-0.011	-0.022	-0.061**
		[0.021]	[0.017]	[0.016]	[0.019]	[0.022]	[0.030]
Bonds	0.106	0.023	-0.004	0.005	-0.001	-0.005	-0.011
		[0.015]	[0.011]	[0.011]	[0.012]	[0.015]	[0.020]
Other Savings	0.167	0.011	-0.017	-0.003	-0.010	-0.002	-0.021
		[0.019]	[0.015]	[0.013]	[0.015]	[0.017]	[0.022]
Principal Residence	0.880	0.018	0.023**	0.001	-0.015	-0.039**	-0.052**
		[0.015]	[0.011]	[0.011]	[0.012]	[0.016]	[0.024]

Coefficient reported is for a dummy variable 'X' periods away from the health shock. The excluded dummy is for the period before the shock. Standard errors appear in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated with one, two, or three stars, respectively. There are 10,015 observations.

In Tables 6 and 7, we move to the study of acute and chronic health shocks on asset ownership. The patterns for these two types of health changes differ in some respects. The results for acute shocks are in Table 6. For vehicle, home, and business

ownership, there are strong drops following a shock, although the effect doesn't always show up immediately, particularly for home ownership. There is also evidence of declining financial asset ownership in the longer term, especially in stocks and CDs.[8]

Table 7: Chronic shock - Positive holdings of asset class

	Mean	3 before	2 before	1 after	2 after	3 after	4 after
Real Estate	0.222	0.029	0.014	-0.005	0.008	0.006	0.005
		[0.019]	[0.014]	[0.012]	[0.013]	[0.015]	[0.019]
Vehicles	0.930	0.004	-0.002	-0.005	-0.016**	-0.015*	-0.039***
		[0.008]	[0.006]	[0.006]	[0.007]	[0.009]	[0.013]
Business	0.113	-0.012	0.003	-0.005	-0.005	-0.006	-0.022
		[0.014]	[0.011]	[0.009]	[0.010]	[0.012]	[0.014]
IRA	0.439	0.054***	0.036**	-0.027**	-0.044***	-0.030*	-0.052**
		[0.020]	[0.015]	[0.013]	[0.015]	[0.017]	[0.023]
Stocks	0.386	0.031	0.017	-0.009	-0.027*	-0.035**	-0.039*
		[0.020]	[0.015]	[0.013]	[0.015]	[0.017]	[0.023]
Banks	0.893	0.014	0.011	0.010	0.005	-0.002	0.010
		[0.013]	[0.010]	[0.008]	[0.009]	[0.010]	[0.014]
CDs	0.314	0.048**	0.031**	0.018	0.025*	0.017	0.013
		[0.019]	[0.014]	[0.013]	[0.015]	[0.017]	[0.022]
Bonds	0.105	0.010	0.005	-0.017**	-0.017*	-0.014	-0.032**
		[0.013]	[0.010]	[0.009]	[0.010]	[0.012]	[0.015]
Other Savings	0.165	0.042**	0.014	0.010	-0.001	0.014	-0.006
		[0.017]	[0.012]	[0.010]	[0.012]	[0.014]	[0.016]
Principal Residence	0.883	0.005	-0.001	-0.012	-0.027***	-0.032***	-0.054***
		[0.013]	[0.009]	[0.009]	[0.010]	[0.011]	[0.016]

Coefficient reported is for a dummy variable 'X' periods away from the health shock. The excluded dummy is for the period before the shock. Standard errors appear in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated with one, two, or three stars, respectively. There are 16,665 observations.

Finally, Table 7 presents the results for the chronic shocks. Because the health impacts of chronic shocks might be slower to manifest themselves, it is not surprising that the reaction of vehicle and principal residence ownership responds more slowly than was the case for widows in Table 3. In contrast to the acute shocks, there is no measurable impact of the shocks on business ownership. The other interesting feature of

[8] Coile (2004) examines the effect of health shocks on couples' labor supply. She finds that acute events have a larger effect on labor supply than the do diagnoses of new chronic illnesses, though the effects of both are significant. The large labor supply response to acute shocks may help explain the drop in financial assets, as least for younger elderly families who may still be in the labor force.

the reaction to chronic shocks is the set of significant positive pre-shock coefficients for IRA, CDs, and other savings. These positive signs for periods 2 and 3 before the shock indicate that ownership of these asset classes drops in the period *before* the shocks occur. Because the chronic condition may exist but not yet be assessed, it could be that this result derives from some measurement error in the timing of the true onset of the condition.

Conclusions

In this paper, we contribute to the growing literature on the effects of age and health on household portfolio choices. We document a sharp decline in home and vehicle ownership with age, but find no strongly consistent results for the other asset categories. When we relate these patterns to changes in health, we find distinctly different effects for the various health shocks we consider. The death of a spouse leads to an immediate and sharp decline in home and vehicle ownership. ADL difficulties lead to declines in business and vehicle ownership, as well as a drop in financial asset holding. Acute shocks have no immediate impact on the home ownership but do lead to a decline in business ownership and ownership of financial assets, while chronic shocks have no effect on business ownership. Changes in self-reported health status have much less of an effect on asset holdings than do any of the other types of health shock.

We view this evidence as an interesting first step in the study of health and asset holdings. In the future, more detailed work on the effects of these shocks on the intensive margin (the amount of wealth as well as the share of wealth) would further our understanding of the relationships uncovered here, as would more analysis of whether the response differs depending on which spouse has suffered the shock or on other household characteristics such as age or marital status. Such research would bring important empirical evidence to bear on different theories of household risk taking and asset allocation.

References

Coile, Courtney C. 2004. "Health Shocks and Couples Labor Supply Decisions." NBER Working Paper No. 10810.

Feinstein, Jonathan S. and Chih-Chin Ho. 2001. "Elderly Asset Management and Health." In *Rethinking Estate and Gift Taxation*, edited by William G. Gale, James R. Hines, and Joel Slemrod, 457-98. Washington DC: Brookings Institution Press.

Feinstein, Jonathan and Daniel McFadden. 1989. "The Dynamics of Housing Demand by the Elderly: Wealth, Cash Flow, and Demographic Effects." In *The Economics of Aging*, edited by David A. Wise, 55-86. Chicago and London: University of Chicago Press.

Milligan, Kevin. 2005. "Lifecycle Asset Accumulation and Allocation in Canada." *Canadian Journal of Economics* 38(3).

Poterba, James M. and Andrew A. Samwick. 2001. "Portfolio Allocations Over the Life Cycle." In *Aging Issues in the United States and Japan*, edited by Seiritsu Ogura, Toshiaki Tachibanaki, and David A. Wise, 65-103. Chicago: University of Chicago Press.

Poterba, James M., Steven F. Venti, and David A. Wise. 1994. "Targeted Retirement Saving and the Net Worth of Elderly Americans." *American Economic Review* 84(2): 180-85.

Rosen, Harvey S. and Stephen Wu. 2004. "Portfolio Choice and Health Status." *Journal of Financial Economics* 72(3): 457-84.

Venti, Steven F. and David A. Wise. 1989. "Aging, Moving, and Housing Wealth." In *The Economics of Aging*, edited by David A. Wise, 9-48. Chicago and London: University of Chicago Press.

Venti, Steven F. and David A. Wise. 1990. "But They Don't Want to Reduce Housing Equity". In *Issues in the Economics of Aging*, edited by David A. Wise, 13-29. Chicago and London: University of Chicago Press.

Venti, Steven F. and David A. Wise. 2002. "Aging and Housing Equity". In *Innovations in Retirement Financing*, edited by Olivia S. Mitchell et al., 254-281. Pension Research Council Publications. Philadelphia: University of Pennsylvania Press.

Wu, Stephen. 2003. "The Effects of Health Events on the Economic Status of Married Couples." *Journal of Human Resources* 38(1): 219-30.