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HEALTHY, WEALTHY AND KNOWING WHERE TO LIVE: PREDICTED TRAJECTORIES OF HEALTH, WEALTH AND LIVING ARRANGEMENTS AMONG THE OLDEST OLD

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ABSTRACT

Health, wealth and where one lives are important, if not the three most important material living conditions. There are many mechanisms that suggest that living arrangements and well-being derived from health and economic status are closely related. This paper investigates the joint evolution of the three conditions, using a microeconometric approach similar to what is known as "vector autoregressions" (VAR) in the macroeconomics literature.

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Healthy, Wealthy and Knowing Where to Live

Predicted trajectories of health, wealth and living arrangements among the oldest old

By Florian Heiss*, Mike Hurd** and Axel Börsch-Supan***

1. Introduction

Health, wealth and where one lives are important, if not the three most important material living conditions. This paper investigates the joint evolution of these three conditions. The elderly reach their early post-retirement years in an initial status that is characterized by housing wealth, non-housing bequeathable wealth, annuity income, health status, and family connections. The broad goal of this paper is to describe the trajectories of health, wealth and living arrangements in older age that start from this initial state; to understand how the trajectories of health status, wealth position and living arrangements are interrelated with each other; and to be able to predict how health and living arrangements will evolve when economic and other conditions change.

Projecting the trajectories of health, wealth and living arrangements into the future is not a trivial task. Simple cross-sectional statistics may lead one astray. For instance, we find in cross-section data an increasing propensity for elderly individuals to live with others, especially their children (Börsch-Supan, 1988, 1990; Ellwood and Kane, 1990; Wolf, 1995). But the living arrangements of the oldest may not be a good prediction of the living arrangement of those just entering their post-retirement years. Because of differences in the economic resources of the cohorts the younger cohorts are likely to reach the oldest ages with more resources, and, assuming that living alone is a superior good, they will have a greater propensity to live alone (Börsch-Supan, Kotlikoff and Morris, 1991; McGarry and Schoeni, 1998). Furthermore, the observed age profiles of living arrangements are not followed by any person or couple: because the poorest in a cohort die sooner than the better off, the average value of wealth, health or housing of a cohort will increase with age even in the absence of any systematic change at the individual or household level.

Yet, understanding the age path and determinants of living arrangements is important both from a social point of view and from a scientific point of view. For example, as shown in the

Table 1, living with other family members is a substantial economic resource that is frequently ignored in assessing the economic well-being of the oldest old (Cox and Raines, 1985; Kotlikoff and Morris, 1989; Sloan and Shayme, 1993; Grad, 1994). This is evidenced, for example, by a much lower poverty rate of elderly widows living with other family members as compared to the poverty rate of widows in the general population:

Table 1: Poverty and living arrangements

Poverty rates (percent)			
		Nonmarried women	
Age range	Couples	Live with other family members	Live with no family members
65-74	6	12	24
75-84	7	12	28
85 or over	10	10	31

Source: Grad, 1994

The frail elderly receive care when living with others, either with a spouse or with children, that can substitute for market-purchased care or for long-term care provided thought public programs such as Medicaid (Wolf, 1984, 1994; McGarry and Schoeni, 1998). There is even some suggestion that living arrangements affect the health of the elderly person: apparently being cared for in the home of a family member is better for health outcomes than institutionally provided long-term care (Moon, 1983; Horowitz, 1985; Stone et al. 1987).

From a scientific point of view, the main model of consumption and saving by the elderly, the life-cycle model, is incomplete if it does not recognize the additional resources that may be transferred through joint living (Hurd, 1990). For example, it is plausible that the magnitude of such transfers are greater than measured cash transfers to an independently living parent. There are many other examples of a close relationships among living arrangements, health and economic status. For instance, an unexpected decline in wealth may trigger a transition to joint living to conserve resources. A decline in health may cause a transition to joint living or into a nursing home for the provision of care. The probability of either transition would be modified by other important covariates. In the first case, health status could act through differences in life expectancy or need for care. In the second case, economic status would be important because of the possibility of purchasing care in the market. In both cases the number and location of children would be important as well as their sex and economic status. For example a well-to-do son may prefer to transfer cash for the market purchase of services whereas a daughter may prefer to provide the services directly.

These examples suggest that living arrangements and well-being derived from health and economic status are closely related and that their evolution over the life course should be studied jointly. This is the of this paper. We study the relationships among living arrangements, health and economic status using a microeconometric approach similar to what is known as "vector autoregressions" (VAR) in the macroeconomics literature.

The economic determinants of living arrangements have had relatively little research attention compared with other aspects of the well-being of the oldest old. For example, the early analyses of the Study of Asset and Health Dynamics of the Oldest Old (AHEAD) did not explicitly consider the choice of living arrangements (Henretta et al., 1997; Wolf et al., 1997), although the importance of family care for elderly parents was stressed in both articles.1 Because research on the economic determinants of living arrangements is not well developed, we are not adequately equipped to understand the decline in the propensity to co-reside with children that began in the late 1970s and early 1980s (Börsch-Supan, 1990; Ellwood and Kane, 1990; Kotlikoff and Morris, 1990; Wolf, 1995; Costa, 1997). It is important to understand how this decrease came about and whether it is related to changes in the economic circumstances of the elderly. Specifically, we would like to understand whether the decrease is related to a change in family linkages or to the increase in Social Security wealth and Medicare benefits, as suggested by Wolf (1995), Costa (1997) and McGarry and Schoeni (1998). This understanding would help to assess the likely impact of future changes in the generosity of Social Security and Medicare benefits, as well as the potential impact of changes in the extent of family links when the baby boom generation will need to support their elderly parents.

We also lack reliable knowledge of some fundamental facts. For example, it is controversial whether the elderly downsize housing in old age and extract equity for non-housing consumption (Ai et al., 1990; Venti and Wise, 1990, 2001; Sheiner and Weil, 1992). We do not know the quantitative importance of the progression of care from living independently to co-residing with children to living in a nursing home. We do not know whether co-residing with

1 Wolf (1994) provides an extensive survey of the literature.

children changes bequest behavior. The AHEAD data on which this paper is based are well-suited to start answering these questions.

Because many fundamental facts are still unclear, our research will proceed in steps. In this paper, we will begin with establishing a reliable account of how living arrangements, health and economic status evolve as the elderly age and by linking these trajectories to observable covariates. In this sense, this paper is mainly descriptive, although it does use multidimensional regression methods. It extends the analysis by Hurd, McFadden and Merrill (1998) by a third dimension, namely living arrangements, and applies a richer methodology. Further research will take account of the considerable heterogeneity in our sample. Accounting for the heterogeneity in order to properly isolate the effects of economic and other covariates will require more advanced econometric methods (e.g., the MPMNP-model in Börsch-Supan, Hajivassiliou, Kotlikoff and Morris, 1992, and the MIMIC-model in Börsch-Supan, McFadden and Schnabel, 1996). Once we have precise estimates of the influence that these covariates exert on living arrangements, health and economic status, we can compare our estimated coefficients and predicted trajectories to those generated by leading behavioral models. This will be the subject of further research.

The paper is structured as follows. Section 2 describes the AHEAD data and presents some central descriptive statistics. Section 3 develops our methodology to estimate transition probabilities based on relatively simple first-order Markov-processes. Section 4 describes our estimation results. Section 5 constructs and interprets predicted trajectories of health, wealth and living arrangements which start at age 70 and go through age 90. Section 6 focuses on a specific aspect of these trajectories, the reduction in homeownership. Section 7 briefly concludes.

2. Data

Our work is based on the first four waves of the Study of Asset and Health Dynamics of the Oldest Old (AHEAD). AHEAD is particularly well suited for the purposes of this paper because one module was specifically designed to study living arrangements and intergenerational transfers both of money and time help, and how they relate to health and economic status.

AHEAD is a biennial panel that is being collected by the Survey Research Center at the University of Michigan. It is now a part of the US Health and Retirement Survey (HRS). AHEAD is nationally representative of the cohorts born in 1923 or earlier with oversampling of blacks, Hispanics and Floridians. We will focus on age-eligible individuals, i.e. those persons from the cohorts of 1923 or earlier who were approximately ages 70 or older at baseline in 1993.

The AHEAD panel is the first data set that permits combining the study of asset decumulation and health with the study of living arrangements of the oldest old. In fact, AHEAD was specifically designed to enable a comprehensive understanding of how health and wealth status affect the well-being of the elderly as they age (Soldo et al., 1997).For instance, the AHEAD survey has much more reliable measures of the wealth of the elderly than the data sets employed in previous analyses, more extensive health information, and the AHEAD data identifies in a better way family links, in particular the economic resources of the children who, at some point in the future, may co-reside with the elderly person.

While the AHEAD data starts with a sample of the non-institutionalized, the panel tracks the elderly when they enter a nursing home or similar institutions. We can observe asset changes at the time of this transition. The AHEAD data supply information on changes in the economic status of children and parents, together with changes in health and changes in housing and living arrangements. The AHEAD data contain a proxy interview after the death of the respondent such that the living arrangement at the time of death can be ascertained.

AHEAD as well as the other cohorts in HRS have cores with questions in the following broad classes: Employment (current and former jobs); health measures including self-assessed health, performance measures, disease conditions, cognition, mood, and ADL and IADL limitations; income and assets; family structure and intergenerational transfers both of financial help and time help; housing; insurance; and pensions.

In addition to the core content, the survey obtained a roster of the extended family including a number of characteristics of each child of the AHEAD respondent. Of importance for this paper, the characteristics include education, income, home ownership, marital status and parental status. Children from the family roster were linked during the computer-assisted interview to both financial help and time help given to the AHEAD respondent. This linkage will permit analyses of motivations for transfers such as whether the less well-to-do child receives greater financial transfers from the AHEAD parent, and if, in turn, that child provides greater time help. Information about the beneficiaries of life insurance and of wills was obtained. Anticipated bequests were measured by questions about the subjective probability of giving a bequest and its magnitude. Considerable information about housing was obtained at baseline including adaptations of housing to disabilities. This is important since such adaptations offer an alternative to moving when health deteriorates.

The AHEAD survey contains a psychometric battery with questions asking for subjective beliefs such as: „Using any number from 0 to 100 where "0" means that you think there is absolutely no chance and "100" means that you think the event is absolutely sure to happen, what do you think are the chances that you will have to give major financial help to family members during the next 10 years? ...that you will receive major financial help from family members during the next 10 years? ...that you will move to a nursing home over the next five years?“ In a similar way subjects who were 70-74 at baseline were asked to give their subjective survival probability to age 85; subjects who were 75-79 were asked their survival probability to age 90 and so forth. These subjective survival probabilities are highly predictive of mortality between waves 1 and 2 (Hurd and McFadden, 1998).

As in all household level data sets, the frequency of missing asset items is fairly large in AHEAD. However, AHEAD (as well as HRS) made extensive use of bracketing techniques which converted nonresponses on asset amounts to intervals by a series of questions about the range of the asset amount (Smith, 1995). Because the distribution of financial assets in particular is highly skewed, these techniques are very valuable in reducing imputation error. We have spent considerable effort developing and implementing methods to impute missing asset items based on the brackets (Hoynes, Hurd and Chand, 1997). The methods involve using bracket information and covariates in a way that conserves the multivariate distribution of assets and other characteristics. The construction of wealth quartiles in this paper rests on this method.

In the first AHEAD wave in 1993, 8,222 interviews were obtained. We restrict our analysis to those individual who were born before 1924, ignoring 779 younger spouses. In either of the waves 2 (1995) through 4 (1999), no interview could be obtained for 865 of the remaining respondents, leaving 6,578 for our analysis. By wave 4, 2,508 (38%) of those respondents have died. In total, 21,296 interviews (on average 3.2 interviews per respondent) and 14,718 transitions (2.2 per respondent) are available for the analysis.

Table 2 shows descriptive statistics of the most important variables for our study. The average age is 80 years and between two waves, on average 14.6 percent of the respondents die. 62 percent of the respondents are female, reflecting the higher life expectancy. 46 percent of the respondents are married – 85 percent of the others are widowed, the others are either divorced or never married. 72 percent of the interviewees own their home. 75 percent live on their own, 19 percent co-reside with others – mostly with their children and/or grandchildren. Since in wave 1 only non-institutionalized individuals were interviewed, only respondents who move to nursing homes after that are followed there. This results in only 4.3 percent of interviews in nursing homes. The average respondent has 2.8 children, 1.4 of whom are female. On average, 1.9 of these children are married and 2.3

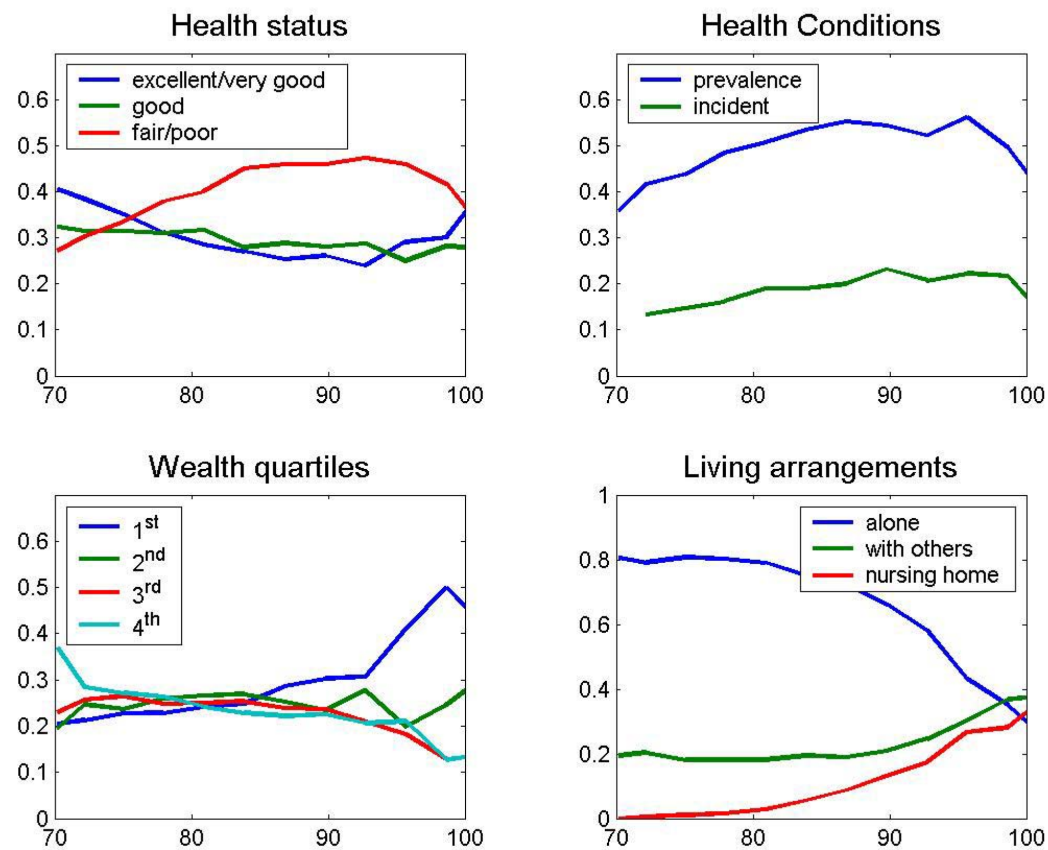
Table 2: Variables

Variable		Mean
Age		80.29
Mortality		0.146
Female		0.619
Married		0.461
Health condition prevalence (heart, stroke, cancer)		0.506
Health condition incidence		0.177
Health status:	Excellent / very good	0.306
	Good	0.303
	Fair / Poor	0.391
Home ownership		0.721
Living arrangements:	Alone	0.765
	with others	0.192
	nurs.home	0.043
Number of children:	Total	2.780
	Female	1.416
	Married	1.942
	With children	2.345

Source: AHEAD, pooled waves 1-4.

Figure 1 shows age-paths of the most important variables of our analysis. They represent simple averages of these variables for the respondents of the respective age in a pooled cross-section of the AHEAD data, waves 1 through 4. Three effects drive the shape of these curves. The first is cohort differences. The second effect is the evolution of the variables over the life course: Older respondents report a worse health status and face a larger threat of health condition incidents. The third effect is differential mortality. It affects the mean characteristics of the (surviving) respondents. This third effect seems to dominate the health measures for the very old: Health status and health condition prevalence are actually more favorable for the (very few) centenarians than for those aged around 90. The share of the respondents in the highest wealth quartiles gradually decreases in the age, whereas the rises of the share of the poorest quartile seems to be more pronounced for those aged 85 and above. This is the same age group for which the share of respondents living alone decreases dramatically and both nursing homes and co-residence become important alternatives.

Figure 1: Age patterns in the four pooled cross-sections 1993-1999



Source: Pooled AHEAD waves 1-4.

3. Estimation of the transition probabilities

Health, wealth, housing and living arrangements are multidimensional concepts. We analyze the joint evolution of the most important dimensions of health, wealth and living arrangements of elderly Americans. These dimensions are our state variables and comprise the following characteristics:

- Mortality
- Self-reported health status
- Prevalence and incidences of three major health conditions (heart condition, stroke, cancer)
- Wealth quartile (sum of real and financial wealth)
- Owner-occupancy
- Living arrangements (co-residence and nursing homes)

Table 3 gives an overview of these state-variables and their possible states:

Table 3: State variables

Variable	**State 1**	**State 2**	**State 3**	**State 4**
Mortality	Alive	Dead		
Health cond. preval.	Yes	No		
Health cond. incid.	Yes	No		
Health status	excellent/very good	Good	fair/poor	
Wealth quartile	1^{st}	2^{nd}	3^{rd}	4^{th}
Ownership	Yes	No		
Living arrangements	Alone	with others	Nursing home	

The joint evolution of the state variables is presumably quite complex. We chose a simple strategy to identify basic patterns. We do not aim at presenting a structural model and attach causal interpretations to our findings. Instead, we interpret our approach as a more sophisticated approach to present descriptive evidence. The model can be interpreted like a vector autoregression (VAR) common in macroeconometrics:

(1) $$y_t = Ay_{t-1} + Bx_t$$

where y is a vector of the state or left-hand-side variables detailed in Table 3 and x represents a set of shift variables. We actually do not estimate a linear relation since most variables in y are limited dependent in their nature, but it helps to keep the macroeconomic counterpart in mind since our approach shares the same fundamental properties and limitations.

More precisely, a given individual (whose subscript is omitted to ease the notational burden) can assume (almost) each combination of states in Table 3 at each point in time. Let a_t denote an indicator of whether the individual is alive (a_t=1) or not (a_t=0) at time t. Let y_{1t} through

y_{6t} indicate the states of the other variables from Table 3 at time t. There are 2*2*3*4*2*3=288 combinations of these other states. Let y_t denote an indicator of the state defined as a combination of these six variables. Finally, call $\boldsymbol{x}_t$ a vector of "exogenous" variables such as age and sex. We are interested in understanding the evolution of the states over time, that is the probability of the event $a_t = a^*$ and $y_t = y^*$ given the history of y_t and the explanatory variables $\boldsymbol{x}_t$. We denote this probability by $\Pr(a_t = a^*, y_t = y^* | y_{t-1}, y_{t-2}, ..., \boldsymbol{x}_t)$. It is the core explanatory variable.

In this general formulation, it is infeasible to econometrically identify this probability. We therefore have to impose restrictions. As a first step, we impose a first-order Markov structure on our model:

(2) $$\Pr(a_t = a^*, y_t = y^* | y_{t-1}, y_{t-2}, ..., \boldsymbol{x}_t) = \Pr(a_t = a^*, y_t = y^* | y_{t-1}, \boldsymbol{x}_t)$$

This is quite restrictive and could be generalized somewhat. But since we only have four waves of panel data, the dynamic structure that we can identify with these data is quite limited. A test of a more general structure such as a second-order Markov model is planned in the future.

Secondly, the estimation of a 288x288 transition matrix is infeasible with our data (and any other real-world data we can think of). We therefore impose structure on the joint dependencies. We choose a very simple approach by assuming that the outcome probabilities of the state variables are conditionally (on y_{t-1} and $\boldsymbol{x}_t$) independent. This allows us to write

(3) $$\Pr(a_t = a^*, y_t = y^* | y_{t-1}, \boldsymbol{x}_t) = \Pr(a_t = a^* | y_{t-1}, \boldsymbol{x}_t) * \Pr(y_{1t} = y_1^* | y_{t-1}, \boldsymbol{x}_t, a_t = a^*) * \Pr(y_{2t} = y_2^* | y_{t-1}, \boldsymbol{x}_t, a_t = a^*) * \ldots * \Pr(y_{6t} = y_6^* | y_{t-1}, \boldsymbol{x}_t, a_t = a^*)$$

An alternative feasible approach would be to model correlations between the different state equations with the help of random effects models similar to Börsch-Supan, Hajivassiliou, Kotlikoff and Morris (1992). However, this would increase the computational burden substantially since no closed-form solutions for the likelihood function can be derived for these nonlinear simultaneous models.

In addition, we exploit several "natural" restrictions:

- death is absorbing
- health conditions are absorbing: there is no transition from (health conditions = yes) to (health conditions = no)

- health conditions are preceded by health incidents: if (health conditions$_{t-1}$ = no), then Prob(health conditions$_t$ = yes)= Prob(health incident$_t$ = yes)

Given this structure, the models for the different state variables can be estimated separately. Again, we choose a very convenient approach by assuming conditional independence over time, ignoring the panel structure of our data. This simplifies the analysis even more. In particular, we can simply estimate our models conditional on the first observation for each individual. We specify the separate models as binary logits (health condition incidence, home ownership), ordered logits (health status, wealth quartile), and multinomial logits (living arrangements). Obviously, not a full set of 287 dummy variables for y_{t-1} is included in the regressions, but simplifications are made. The are described in the following section which presents our estimation results.

4. Estimation results

Given the independent first-order Markov structure, we can estimate transition probabilities for the categorical variables in Table 3 conditional on lagged left-hand-side and socio-economic variables. The results from these regressions are shown in Table 4. Except for the health incidence equation, all equations feature a satisfactory fit and the signs of the estimated coefficients – where significant – exhibit no surprises.

Table 4: Regression results

	Health / mort.	Health Cond. Incid.	Wealth	Ownership	Live w/others	Nurs. Home
	Ordered Logit	Logit	Ordered Logit	Logit	Multinomial Logit	
Female	-0.192**	-0.245**	-0.023	-0.110	0.093	0.138
	(5.79)	(5.71)	(0.61)	(1.39)	(1.19)	(1.39)
Married	-0.138**	-0.124*	-0.054	0.811**	-0.612**	-0.642**
	(3.26)	(2.22)	(1.34)	(9.57)	(7.18)	(5.67)
Spouse died	-0.021	-0.040	1.814**	-1.074**	1.234**	1.168**
	(0.30)	(0.43)	(21.46)	(7.69)	(8.64)	(6.82)
Age	0.036*	0.034	0.027	-0.001	-0.093*	-0.059
	(2.12)	(1.39)	(1.45)	(0.03)	(2.48)	(0.82)
Age Spline >75	-0.012	0.001	-0.031	-0.105	0.160**	0.220*
	(0.49)	(0.02)	(1.13)	(1.70)	(2.84)	(2.20)
Age Spline >80	0.046*	0.018	-0.001	0.071	-0.060	0.021
	(2.07)	(0.63)	(0.04)	(1.40)	(1.20)	(0.32)
Age Spline >85	0.028	-0.019	0.025	0.039	0.057	-0.078
	(1.02)	(0.58)	(0.77)	(0.63)	(0.92)	(1.29)
Age Spline >90	0.046	-0.002	-0.053	-0.068	0.033	0.047
	(1.36)	(0.05)	(1.26)	(0.88)	(0.44)	(0.72)
Health cond. prev.	0.277**	0.381**	0.010	0.043	-0.182**	-0.043
	(9.65)	(10.38)	(0.32)	(0.64)	(2.74)	(0.55)
Health cond. incid..	1.243**		-0.020	-0.388**	0.177*	0.844**
	(33.38)		(0.44)	(4.49)	(2.05)	(9.34)
Health good	1.177**	0.272**	-0.187**	-0.012	-0.055	0.176
	(30.17)	(5.04)	(4.52)	(0.14)	(0.63)	(1.53)
Health poor/fair	2.438**	0.815**	-0.411**	-0.230**	0.330**	0.690**
	(52.91)	(14.56)	(9.53)	(2.61)	(3.84)	(6.42)
Wealth Q2	-0.255**	-0.203**	1.930**	0.518**	-0.018	-0.111
	(5.10)	(3.17)	(34.72)	(5.17)	(0.18)	(0.95)
Wealth Q3	-0.440**	-0.157*	3.420**	0.624**	0.015	-0.123
	(8.37)	(2.32)	(55.38)	(5.98)	(0.15)	(0.98)
Wealth Q4	-0.565**	-0.229**	5.506**	0.802**	-0.183	-0.255
	(10.31)	(3.22)	(77.63)	(7.33)	(1.62)	(1.91)
Home owner	-0.010	-0.034	0.560**	4.850**	-0.070	-0.574**
	(0.25)	(0.66)	(11.79)	(58.98)	(0.79)	(5.71)
Live w/others	-0.081	-0.123	-0.117**	0.109	4.464**	1.883**
	(0.57)	(0.66)	(2.67)	(1.22)	(60.95)	(16.11)
Nurs. Home	-1.237**	-1.266**	-0.921**	0.021	1.541**	4.348**
	(3.31)	(2.89)	(5.96)	(0.08)	(4.20)	(20.95)
# children					0.274**	-0.047
					(6.00)	(0.61)
# female children					0.067	-0.026
					(1.82)	(0.50)
# married children					-0.205**	0.037
					(5.52)	(0.66)
# children with children					-0.095*	-0.022
					(2.04)	(0.28)
Constant		-4.201*		-2.336	3.703	0.593
		(2.29)		(0.74)	(1.34)	(0.11)
Log-Lik	-18998.25	-8559.63	-14310.42	-3315.79	-5618.71	
rho^2	0.16	0.04	0.29	0.62	0.45	

Absolute value of z statistics in parentheses
* significant at 5%; ** significant at 1%

The first column shows ordered logit estimates for a combined health status/mortality regression. The dependent variable is coded as (1) excellent/very good health, (2) good health, (3) poor/fair health, (4) deceased. Not surprisingly, health deteriorates with increasing age. This effect accelerates in old age as the additional slope parameters of the age spline are positive. Being female and being married increases self-reported health. The prevalence of serious health conditions (heart condition, stroke, cancer) negatively affects the self-reported health status. A health condition incident since the previous wave dramatically increases mortality probabilities and decreases the self-reported health status. Health status is persistent over time in the sense that the reported health status in the previous wave is a strong predictor of mortality and current health status. In this health regression, we do not use lagged living arrangements directly. The reason for this is that living arrangements are driven by expectations of future health, leading to a serious endogeneity problem in this regression. Instead, we instrument living arrangements in this regression with detailed characteristics of children.

Many of the results of the health condition incidence regression are similar to the health status/mortality regression. The age coefficients are not individually significant, but a Wald-test shows high joint significance ($W = 83.59 \,^{a}\!\sim \chi^2_{[5]}$). Being in the lowest wealth quartile increases the probability to suffer from a major health incident, but there is no significant difference between the three highest quartiles.

Respondents reporting a positive health status are more likely to be wealthier in the next interview, but the health conditions we included in our measure have no effect on wealth. Marital status is an important determinant home ownership. Events like the death of the spouse and a major health incident lead to a high number of people selling their home. But variables like self-reported health status and wealth quartile also have important effects. The age spline has a significantly negative slope only for the respondents aged 75-80 years. For the others, factors like decreasing health seem to drive the further decrease of home ownership.

The results of the living arrangement regression show that living with others and nursing homes are in fact substitutes in the sense that the explanatory variables do have similar effects on the probabilities to choose one of these alternatives. Married couples tend to live alone until one spouse dies. The surviving spouse is very likely to move either to children or into a nursing home shortly afterwards. Health condition incidents also lead respondents to move together with somebody and – even more so – to move into a nursing home. Similarly, poor or fair health status leads to changes in this direction. Since most cohabitants are own children, their characteristics obviously play an important role in explaining cohabitation. Female children are more likely to live with their parents, whereas married children and those who have children themselves are less likely to do so.

5. Simulating trajectories

According to equation (3), we can rebuild a full 289x289 transition matrix of survival and the six other state variables y_t for a given set of shift variables $\boldsymbol{x}_t$. Starting from a suitably chosen initial state, we are thus able to simulate predicted trajectories for our left-hand-side variables.

More specifically, we start these trajectories at age 70 and follow an elderly person through age 90. A particularly interesting date of observation is age 80, approximately the conditional life expectancy given survival to age 70. In the simulations, the estimated transition matrices are interpreted as being valid for 2-year transitions in accordance to the biannual nature of the AHEAD data. This is important when interpreting the age variable.

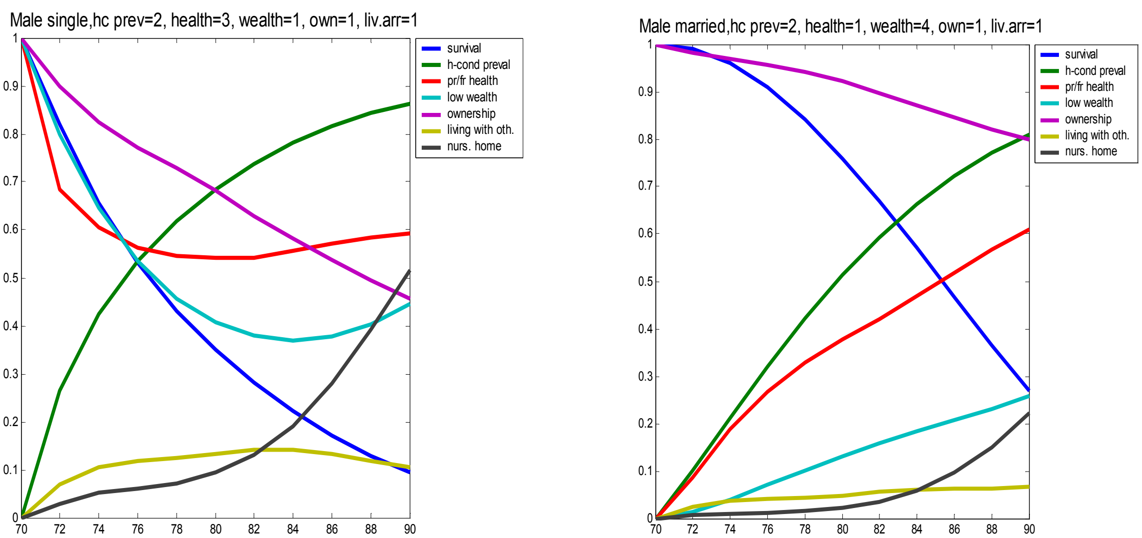
The simulations are done in four steps:

1. Start at initial probabilities (typically=1 for one state, 0 for the others) and a set of shift variables x for t=0
2. Calculate the 289x289 transition matrix as described above
3. Predict probabilities for t=1
4. Repeat steps 2.-3. until age 90 is reached.

We will perform several exercises. First, we predict whole system for different initial conditions, taking account of all (implicit) interactions. Second, in Subsection 5.1 through 5.3, we look at various dimensions separately (like wealthy vs. poor, healthy vs. sick, etc.). For instance, how does survival, how do living arrangements, change with initial health, with initial wealth? Third, in Subsection 5.4, we decompose the observed effects by leaving some of the left-hand-side variables at their starting values. This amounts to setting some off-diagonal elements in the transition matrix to zero and therefore annihilates interaction effects. Note that we painfully avoid any notion of causality – these exercises should be interpreted as simulations of persons under different circumstances and initial conditions. Finally, in Subsection 5.5, we simulate "shocks" such as the onset of a health condition and look at the resulting response pattern. This last exercise is well-known in the macroeconomics literature as "response analysis".

To warm up to our methodology, we start with Figure 2 which shows the trajectories of two very different people. The left figure shows a poor single person in bad health, while the right figure depicts a rich married person in good health. Good health is defined by a self-reported health status of excellent or very good; bad health by a self-reported health status of poor or fair. The rich person is in the highest wealth quartile, while the poor person is in the lowest one. All other characteristics are identical. Both persons are male, have no children, have no previous health conditions and live independently in an owner-occupied home.

Figure 2: Trajectories of two very different people:



The figure presents the evolution of our seven state variables, each represented by a line which starts at an initial probability and then moves from that initial probability as the two people age. The first five state variables start at identical initial values for both persons. The dark blue line depicts the survival probability, starting with 1 and declining with age. The dark green line shows the probability of a health condition, starting with zero and increasing with age. The purple line is the probability of homeownership. It starts at 1 and declines with age. The light green line represents the probability of living with others, the grey line living in a nursing home. Both start at zero and increase with age. Finally, two state variables start at different values, namely wealth, represented by a light blue line, and self-reported health, depicted in red.

Quite clearly, survival at age 80 is much higher (about 40%) for the healthy, rich and married person. The probability to end up in poverty is, as expected, also much lower. Note that the trajectories eventually converge. In the long run, we are all dead. Mathematically speaking, the outcome of the Markov process will eventually be independent of the initial state and converge on a state solely defined by the transition matrix. For a given age, this matrix depends on "shift" variables such as sex, the number of children etc., i.e. the $\boldsymbol{x}_t$ in equation (2).

It is worth to look at various details in Figure 2 to understand which mechanisms are picked up by our estimated transition probabilities. For instance, it is noticeable that the probability to reach the lowest quartile in the wealth distribution increases again for the poorer person past age 84 which probably reflects nursing home costs – the poorer single person of worse health has a much higher likelihood of living in a nursing home than the richer married person of good health.

We now analyze the state variables separately and investigate their interaction with other state variables. Subsection 5.1 looks at survival and health, subsection 5.2 at wealth and homeownership, and subsection 5.3 at living arrangements of the elderly.

5.1 Survival and health

We begin with survival, and relate it to initial wealth and initial health. Figure 3 shows the probability of survival as a function of two initial health characteristics, self-reported health ("would you rate your health fair/poor vs. excellent/very good") and the existence of at least one previous serious health condition ("has a doctor ever told you...") where serious conditions include heart problems, stroke and cancer. The survival curves remain essentially parallel whether such a condition exists or not, while the effect of the self-rated health assessment is strong, maybe measuring other conditions such as arthritis or diabetes which are making life difficult without being immediately life threatening.

Figure 3: Survival by health status:

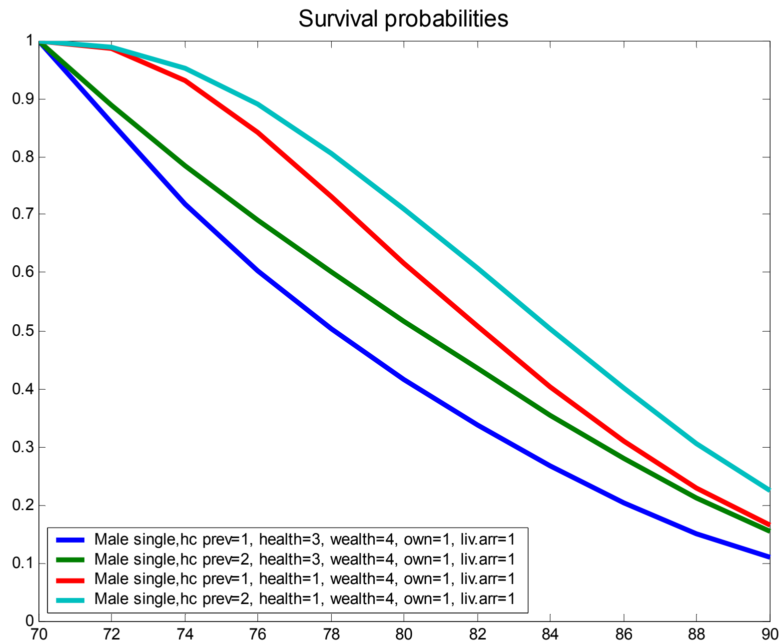
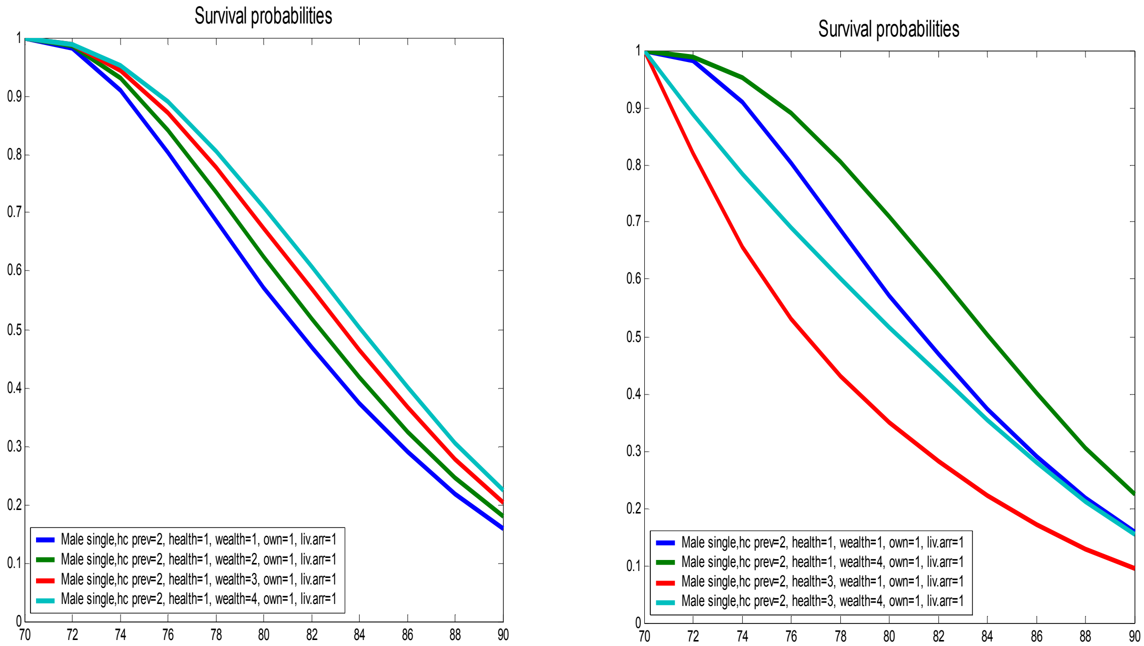


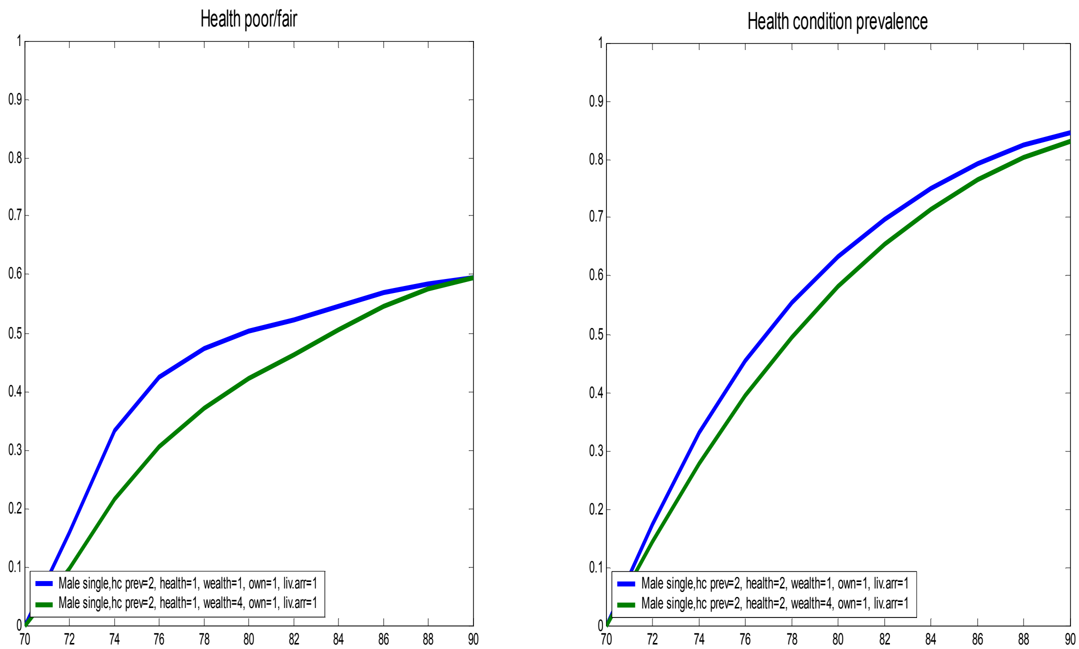
Figure 4 shows survival stratified by initial wealth. Survival at age 80, given survival until age 70, is about 15% higher in the highest wealth quartile as compared to the lowest wealth quartile. The right part of the figure shows the interaction of wealth and health in determining survival, and the relative magnitudes of the effects: survival, while clearly dependent on initial wealth, is much stronger influenced by initial health.

Figure 4: Survival by wealth quartile and its interaction with health



Similar to survival, health is quite clearly influenced by the initial economic status. Figure 5 shows the evolution of two dimensions of health over time, each stratified by whether the person is initially in the lowest and in the highest wealth quartile. The left part of the figure depicts self-reported health, the right part the prevalence of a serious health condition. Being wealthy decreases the likelihood of feeling in bad health by about 12 percentage points at age 75 relative to being in the lowest wealth quartile. This wealth effects is much smaller for an actual occurrence of a serious health condition.

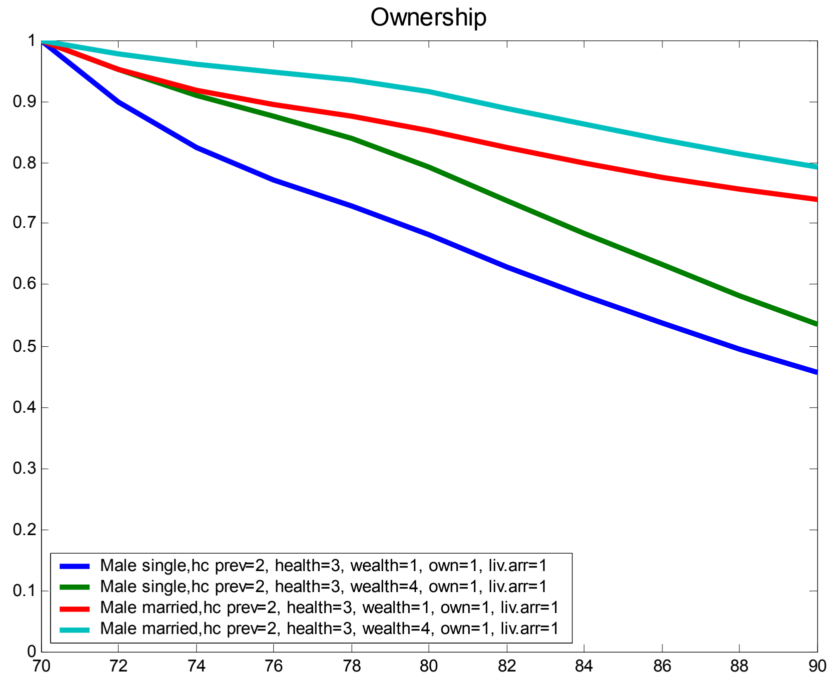
Figure 5: Health by lowest and highest wealth quartile



5.2 Wealth and homeownership

We now turn to wealth and homeownership, starting with the latter. Homeownership declines slowly but steadily as people age. The decline in homeownership follows from the tendency of the system to converge. Hence, its speed is the interesting observation since this relates to our regression estimates of Section 4. Quite clearly, homeownership declines much less for married elderly than for single ones. It also declines faster for the poor (more precisely: those with total wealth in the lowest quartile) than for the rich (highest wealth quartile). We will investigate this decline more closely in Section 6.

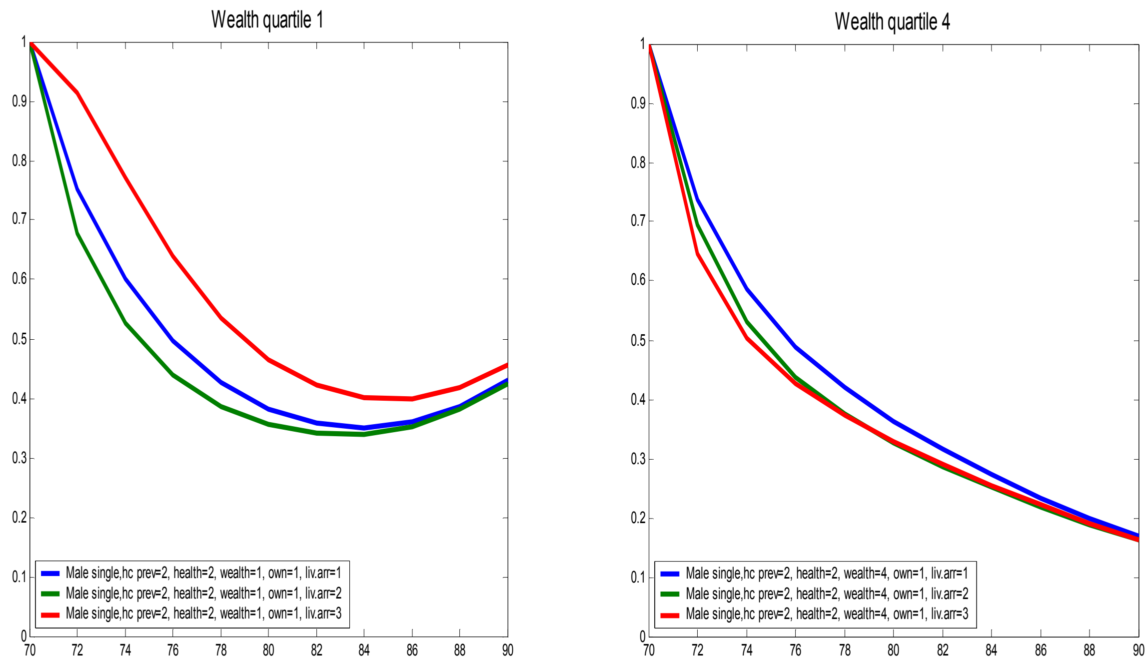
Figure 6: Homeownership by wealth and marital status



The tendency of the system to converge is also clearly visible in Figure 7 which depicts the evolution of wealth. The left part of this figure shows a poor person (lowest wealth quartile) and the probability to stay in this quartile. This probability declines, but increases again, most likely due to nursing home costs. Figure 7 stratifies this decline by initial living arrangement. Staying in the poor quartile is most likely when an elderly person lives in a nursing home, and least likely when this person lives with others.[2] The right part of Figure 7 shows the reversed patterns as it looks at the probability of staying in the highest wealth quartile. For the initially wealthy, living with others decreases the expected future wealth relative to living alone. This is consistent with the notion that cohabitation implies intra-family transfers to the needy.

2 Remember that this finding should not be interpreted in a causal fashion: we only know that the two processes (wealth decumulation and where to live) are correlated, but not which process causes which other process to change.

Figure 7: Wealth by living arrangement



5.3 Living arrangements

We now turn to the main topic of this paper, namely living arrangements. We distinguish three living arrangements: living alone (or as a couple), living with others (mainly with adult children), and living in a nursing home. Figure 8 depicts the probability of the first two living arrangements and shows the effect of additional children, in this case three daughters. Figure 9 adds the probability of living in a nursing home. The figures compare a single male, who has no previous health conditions, who rates his health as fair or poor, who he is in the lowest wealth quartile and who has one son, with a similar male, who has, in addition, three daughters.

Having daughters substantially decreases the probability of being alone at age 80 (by about 20%) and living in a nursing home (by about 10%) in favor of living with others – i.e., being taken in by one of the daughters (by almost 30%). Interesting is the gender-specific effect of additional children. As shown in many other papers, daughters reduce the likelihood of living in a nursing home substantially more than sons (right panel of Figure 9).

Figure 8: Probability to live alone or with another person in the community

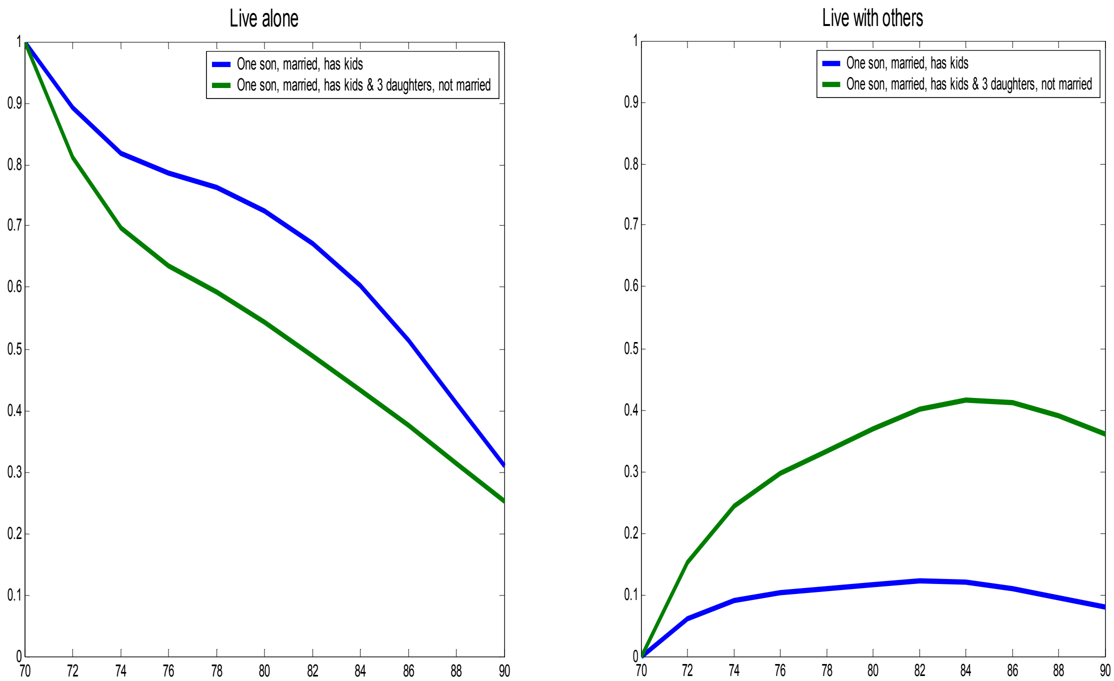
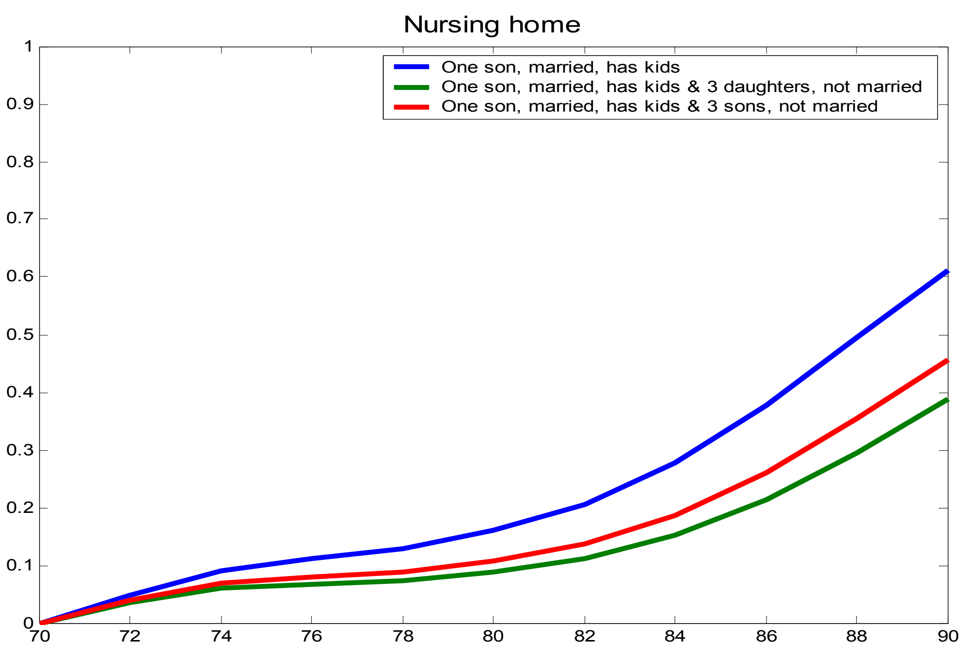


Figure 9: Probability to live in a nursing home



5.4 Decomposing the effects: keep some dimensions fixed

The next experiment separates direct and indirect effects. In the previous simulations, all left-hand-side variables in equation (1) were predicted using the full transition matrix. Now we hold certain dimensions constant. As an example, we show the evolution of the survival probabilities (Figure 10) and the probability of being in the highest wealth quartile (Figure 11). The figures show how the interaction effects in the full model dampens the effects that would be predicted without the interactions.

We begin with the survival probabilities in Figure 10. The blue line shows the trajectory using the full model with all interactions. In all other lines, the occurrence of a serious health condition is fixed at “no occurrence”. This shifts, as expected, the survival probabilities up (green line). If we also assume that self-reported health stays fixed at “excellent or very good”, survival rates stay very high and decline only slowly (red line). Fixing self-reported health at a “poor or fair” level, of course, creates the opposite effect (turquoise line).

Figure 10: Decomposing survival probabilities by health effects

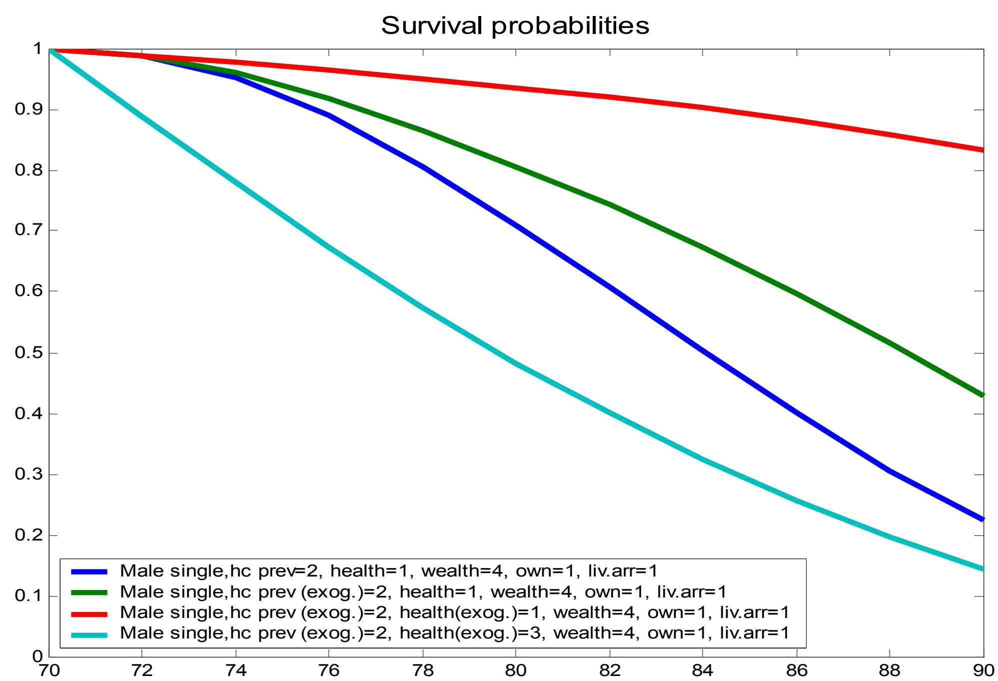
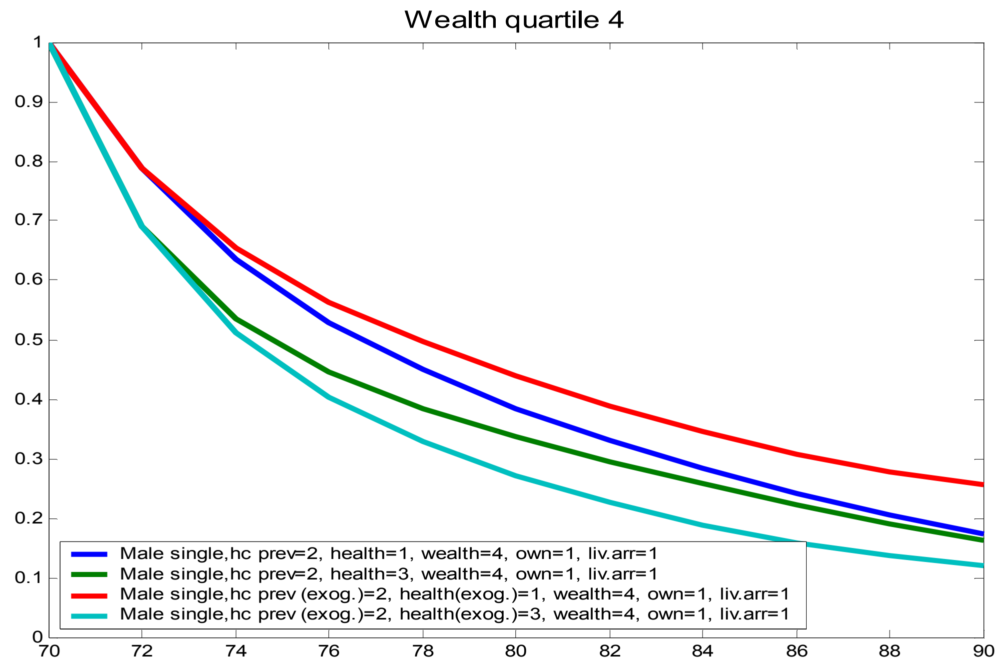


Figure 11 performs a similar exercise with the probability of being in the highest wealth quartile. The blue and the green lines shows initial trajectories using the full model with all interactions. The blue line starts with a healthy individual (self-rated health "excellent or very good"), the green one with an unhealthy elderly (self-rated health "poor or fair"). Note that the two lines eventually merge – there is no long-run effect of health on wealth, although at age 75 the probability of being in the highest wealth quartile is substantially higher for the initially healthy individual.

If we now keep the initial health status fixed (red and turquoise lines), the trajectories stay apart. The probability of staying in the highest wealth quartile is about 15% higher for the elderly, who stays healthy through age 90.

Figure 11: Decomposing the probability of being wealthy



5.5 Dose and response analysis

Finally, we look at the behavior of the multidimensional system in response to shocks. Figure 12 depicts the survival probability after a health shock ("doctor told person about one of the following three conditions: heart problem, onset of cancer, or stroke"). We compare this turquoise trajectory to the one generated by the full model (with all interactions, blue line) and to two variants in which the health condition is kept fixed, as we did in the previous subsection. We fix it at "no conditions" (green) and at "some conditions exist at the age of 70, but no further incidents occur" (red).

Figure 12: Survival probabilities in response to a health shock

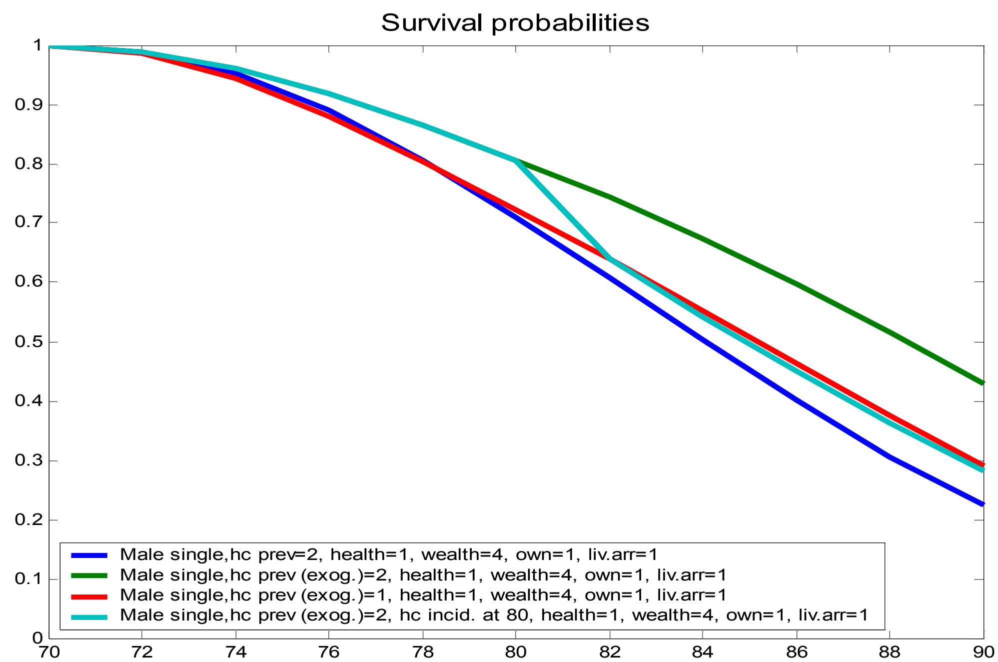
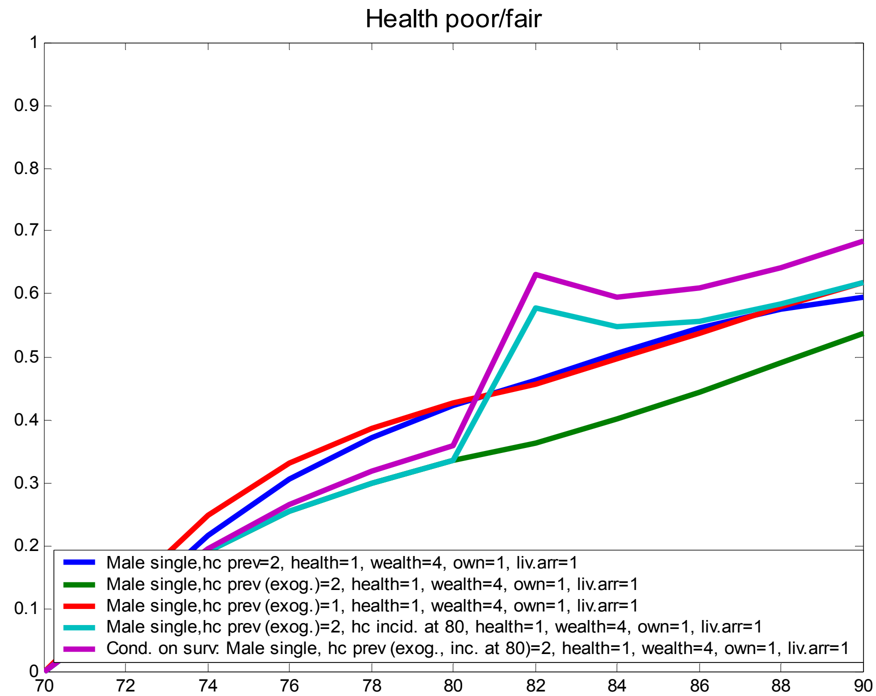


Figure 12 show that the survival probabilities in the aftermath of a health shock follow pretty much the long run paths. There are no overshooting or other complex dynamic effects. This is quite different for the self-reported health status, see Figure 13. We apply the same shock, but focus on self-reported health as outcome variable. The light blue line depicts the typical "overshooting" after a shock vis-à-vis the trajectory where this condition has been happened in the past. After a while, the health status perception variable returns approximately to the long run path.

Part of this effect, however, is a selection effect due to differential mortality. If we also keep the survival variable fixed at probability one, see the purple line in Figure 13, subjective health stays worse for a long time past the occurrence of the shock for those who actually survive.

Figure 13: Self-rated health in response to a health shock



6. Do the elderly downsize housing?

In the preceding section, we found that homeownership decreases with age. We noted that the Markov process has the built-in property of convergence, hence, declining homeownership is, to some extent, an artifact built into the model. We did, however, detect some significant differences in the speed of decline depending on the initial characteristics of the elderly person. This suggests that there are elderly in our sample who systematically decumulate housing. This section looks closer at the issue of homeownership. We note that ownership is somewhat different from housing equity which can be influenced by mortgage repayment, housing price changes, or neglect of maintenance. Venti and Wise (1990, 2001) found that in general the elderly to not reduce home equity except at the death of a spouse.

Table 5 shows cross-section housing and living arrangements by age bands. About 82% of those 70-74 years old were owners, and most of them lived "alone," either with a spouse only or singly. The table shows a slow but accelerating decline in ownership with age and a corresponding increase in renting, although until 85 or over the increase is small. Most notable in the table is the increase in "other" which includes neither renting nor owning (mostly living with children in their house) and living in a nursing home, especially at 85 or over.

Table 5: Homeownership and living arrangements, percent distribution.

	70-74	75-79	80-84	85+
Own	81.6	77.2	70.7	57.6
own, alone	66.4	64.0	57.3	43.1
own, with others	14.7	12.1	11.5	9.0
own, nursing home	0.5	1.1	1.9	5.5
Rent	14.0	16.3	18.1	22.2
rent, alone	11.1	13.7	15.7	18.7
rent, with others	2.9	2.6	2.4	3.5
neither own nor rent	4.3	6.0	9.5	13.1
not own, nursing home	0.2	0.6	1.8	7.0
All	100.0	100.0	100.0	100.0
N	*4,099*	*7,157*	*5,427*	*4,535*

Source: AHEAD pooled cross-sections (four waves)

Because of differential mortality we would expect a greater decline in owning in panel than we see in cross-section, although cohort differences could obscure this decline.

Table 6 has cross-section housing and living arrangements for married persons. The patterns are similar to the patterns in Table 5, but there is a much slower reduction in ownership with age. By age 85 or over the ownership rate is 13 percentage points lower than at 70-74 whereas in Table 5 it is 24 percentage points lower. In the oldest group about 7% live in a nursing home.

Table 6: Homeownership and living arrangements, percent distribution. Married.

	70-74	75-79	80-84	85+
Own	90.4	88.6	85.5	77.1
own, alone	76.7	77.8	75.3	67.1
own, with others	13.3	10.2	8.8	5.9
own, nursing home	0.4	0.6	1.4	4.1
Rent	7.7	8.6	10.0	14.0
rent, alone	6.5	7.2	9.2	13.2
rent, with others	1.2	1.4	0.8	0.8
neither own nor rent	1.9	2.5	4.2	5.8
not own, nursing home	0.0	0.2	0.4	3.0
All	100.0	100.0	100.0	100.0
N	*2,555*	*3,733*	*2,238*	*1,232*

Source: AHEAD pooled cross-sections (four waves)

Table 7 has similar results for singles. The levels of ownership are lower and decline at a greater rate with age. By age 85 or over 14.5% live in nursing home and 15.9% neither own nor rent.

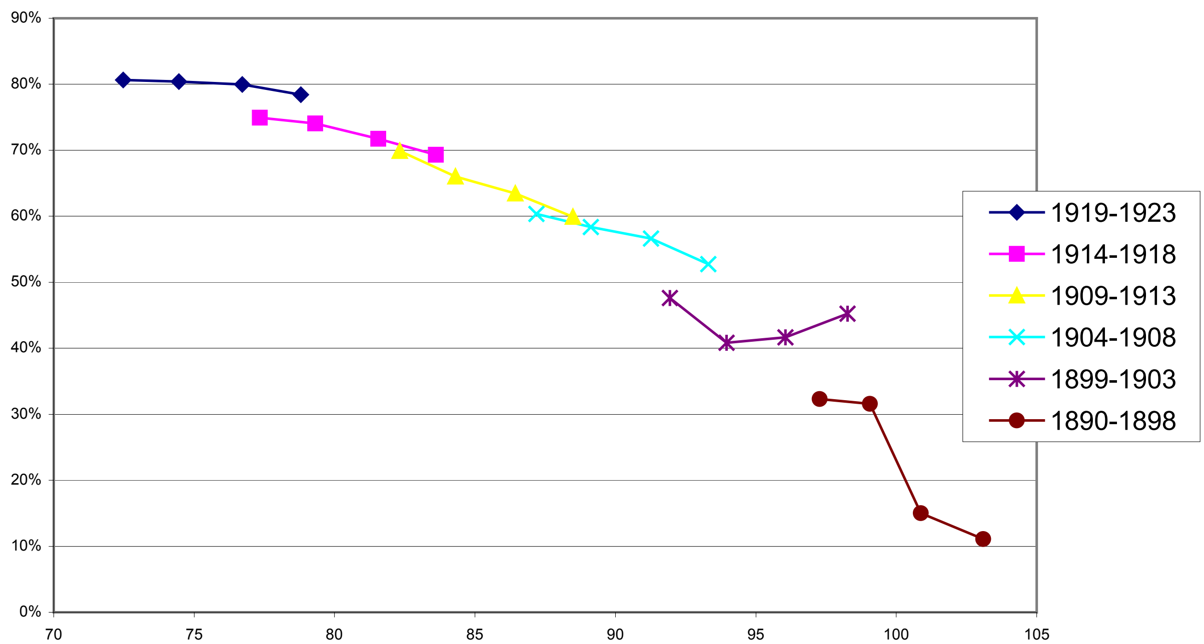
Table 7: Homeownership and living arrangements, percent distribution. Singles.

	70-74	75-79	80-84	85+
Own	66.8	64.7	60.1	50.3
own, alone	49.2	48.9	44.5	34.1
own, with others	17.0	14.2	13.4	10.2
own, nursing home	0.6	1.6	2.2	6.0
Rent	24.6	24.5	23.8	25.3
rent, alone	18.8	20.7	20.3	20.8
rent, with others	5.8	3.8	3.5	4.5
neither own nor rent	8.2	9.8	13.3	15.9
not own, nursing home	0.5	1.0	2.8	8.5
All	100.0	100.0	100.0	100.0
N	*1,544*	*3,420*	*3,178*	*3,298*

Source: AHEAD pooled cross-sections (four waves)

Figure 14 has the average ownership rates by cohort. For example approximately 75% of the cohort of birth years 1919-1923 owned a house in wave 1 of AHEAD (when the cohort was approximately 77) and the ownership rate of the cohort declined to 69% when the cohort was about 84 in 2000. The figure shows that cohort differences are relatively minor: holding age constant cohort ownership rates are approximately the same.[3] The cohort comparisons include differential mortality, the tendency for renters to die sooner than owners. Differential mortality causes average ownership to increase even if there is no reduction in ownership in panel.

Figure 14. Homeownership rates in six cohorts. Percentages.



Source: AHEAD pooled cross-sections (four waves)

Table 8 shows panel transitions among survivors. Among marrieds in the youngest age group, there were very low rates of transition out of ownership, and some transitions into ownership. But the predominant flow is out because of high rates of ownership. The transition rate out of ownership increases with age.

3 But the sample sizes are small in some cases.

Table 8: Home ownership transition rates (percent). Survivors only

Marital transition	Age	lagged ownership	number	ownership status: own	ownership status: not own
Married to married	70-74	own	2013	98.3	1.7
		not own	179	9.5	90.5
	75-79	own	2142	97.0	3.0
		not own	259	11.2	88.8
	80-84	own	1068	94.4	5.6
		not own	160	12.5	87.5
	85+	own	419	93.8	6.2
		not own	114	10.5	89.5
single to single	70-74	own	929	94.6	5.4
		not own	449	8.9	91.1
	75-79	own	1568	91.8	8.2
		not own	858	8.2	91.8
	80-84	own	1201	90.0	10.0
		not own	762	4.2	95.8
	85+	own	855	89.0	11.0
		not own	817	5.4	94.6
married to single	70-74	own	146	93.2	6.8
		not own	34	8.8	91.2
	75-79	own	223	86.1	13.9
		not own	55	12.7	87.3
	80-84	own	155	85.2	14.8
		not own	44	0.0	100.0
	85+	own	86	79.1	20.9
		not own	28	7.1	92.9

Source: AHEAD pooled cross-sections (four waves)

From the flows the steady-state rate of ownership (the ownership rate were the transition rates into and out of ownership to remain constant for the indefinite future) is given by

$$\frac{T}{1+T}$$

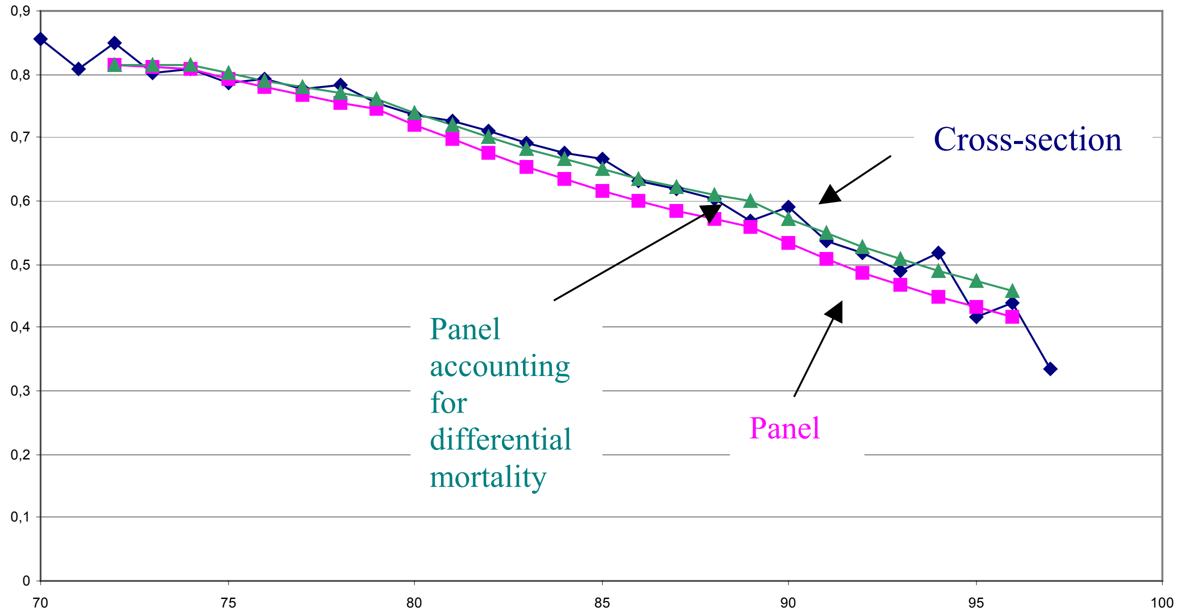
where $T = \frac{1-P_{00}}{1-P_{11}}$, and P_{00} is the transition probability from not owning to not owning, and P_{11} is the transition probability from owning to owning. Among those married in both waves t and $t+1$ and in the age band 70-74 the steady-state rate of ownership is 84.8% and the actual average is 91.8%. Thus there is a trend out of ownership among marrieds, but the trend is slow. Among marrieds aged 85 or over the steady-state rate is 62.9% and the average is 78.6%, also showing a downward trend in ownership.

Among those who were single in two adjacent waves the transition rate out of ownership increases with age. The steady-state rates decline from 62.2% in the age band 70-74 to 32.9% in the age band 85 or over.

Widowing is associated with considerably higher rates of transition out of ownership: for example, among those aged 70-74 who were widowed between adjacent waves the transition rate out of ownership was 6.8% compared with just 1.7% among surviving couples. This rate increases sharply with age.

We ask whether the panel transitions can explain the cross-section patterns of ownership that are in Table 5. Figure 14 indicated that cohort differences are not important but we must still address differential mortality. The average risk (holding age constant) of a renter dying compared with an owner dying is about 1.39: said differently, the age adjusted mortality rate of renters is about 39% higher than the mortality rate of owners. In that renters die more frequently than owners the average rate of ownership by a cohort will increase over time even if there are no transitions into or out of ownership in panel among survivors. However, the rate of ownership is high so that differential mortality will not increase the average ownership rate substantially as a cohort ages. Under the assumption that owners and renters have the same mortality risk, the average over all groups, the home ownership rate would decline by about 0.4% per year more than the observed cohort rate. The difference is shown in Figure 15: It shows the cross-section ownership rates averaged over four waves of AHEAD data; the rates predicted from the panel ownership transitions reported in Table 8 (panel), and the rates predicted both from the panel and from differential mortality (panel accounting for differential mortality).

Figure 15: Ownership rates: cross-section and simulation

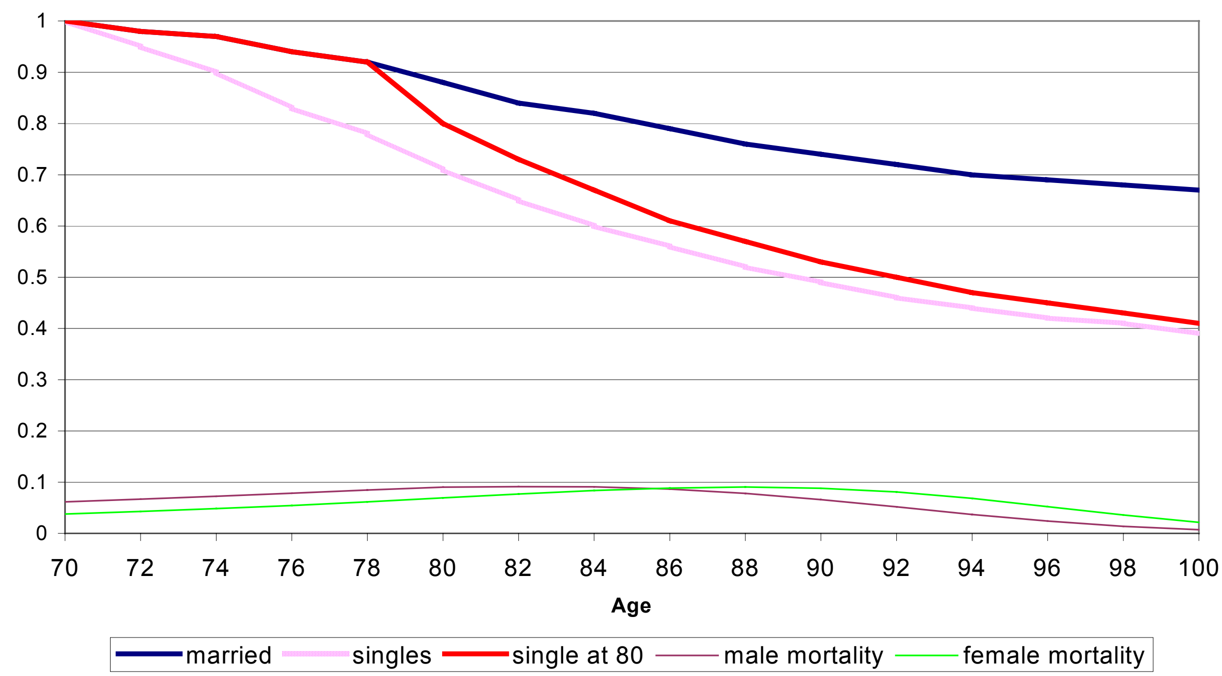


Source: Own computations based on AHEAD.

The cumulative effects of differential mortality can be seen by comparing the two panel lines: after about 15 years the simulation that accounts for differential mortality is about five percentage points above the simulation that does not. The cross-section is very closely matched by the simulation that accounts for differential mortality showing that cohort effects are not very important and that the transition rates over the period of our sample (mid- to late-1990s) have been stable for a considerable time.

The difference between the time paths of ownership by singles and by couples and the effects of widowing on ownership are shown in Figure 16. The top curve, for couples, and the bottom curve, for singles, are derived from the estimated transition rates in ownership in Table 8-4 beginning with an ownership rate of 100% at age 70. The curves are conditional on survival and so have the interpretation of anticipated lifetime probabilities of owning. Thus, if both spouses of a couple survive to 90, the probability of owning will decline to about 75%. Among singles who are owners at age 70 the rate of decline is considerably greater, and the probability of owning at age 90 less than 50%. The middle curve shows predicted rates of ownership of couples who are owners at age 70, but where one spouse dies between 78 and 79. During the one-year transition period to widowhood the probability of owning declines sharply as shown in Table 8-4, and then the probability follows the path of singles but at a higher level.

Figure 16: Projected ownership rates

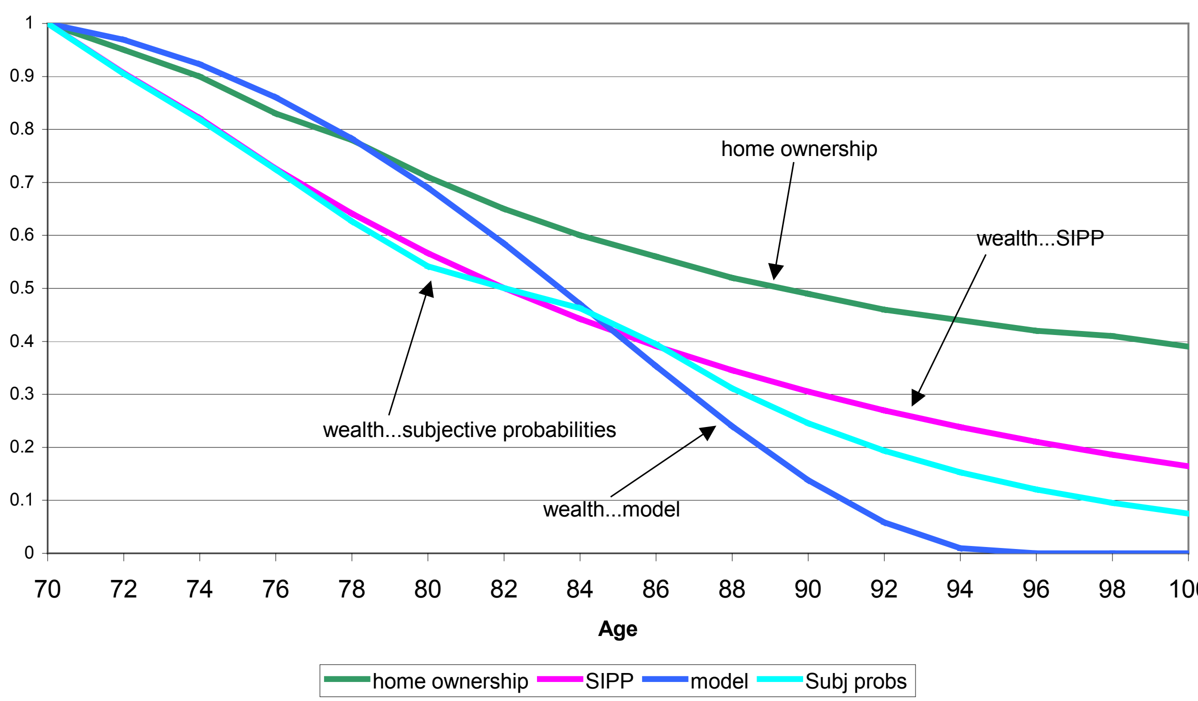


Source: Own computations based on AHEAD.

The two curves at the bottom of Figure 16 show the probability of males and of females dying at each age conditional on reaching age 70. The most likely age for males to die is 82 and it is 88 for females. The figure suggests that 50-60% of couples who are owners at age 70 will be owners at the death of the surviving spouse, and that a somewhat lower fraction of singles will be owners. These percentages are not much different from the estimates of Sheiner and Weil (1992) who estimated that among couples who were owners at age 65, just 41% of the last survivor would die still owning.

The life-cycle model (LCM) predicts that wealth will be decumulated as people age, and in Figure 17 we compare the wealth paths predicted in three different ways with the rate of ownership among singles. The objective of the comparison is to find whether the path of ownership as an indicator of housing wealth is broadly consistent with wealth paths as predicted by the LCM. The first wealth forecast (labeled wealth...SIPP) uses observed wealth change in the 1984-85 SIPP panel. The second (labeled wealth...subjective probabilities) is based on the subjective probability of bequests as elicited in the HRS. Hurd and Smith (2002) compared them with actual bequeathable wealth to estimate annual rates of anticipated dissaving, which we use to construct the curve. The third (labeled wealth...model) uses a life-cycle model estimated over the 1969-1979 Retirement History Survey to predict the path of bequeathable wealth (Hurd, 1989).[4] The rates of decumulation of bequeathable wealth are broadly consistent with each other. They predict that a single person who survives into his or her 90s will have consumed three fourths or more of bequeathable wealth.

Figure 17: Homeownership and wealth



Source: Own computations based on AHEAD.

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4 We would like to use the AHEAD wealth data for this comparison but two problems prevent its use: stock ownership was apparently under-reported by about 10 percentage points in the 1993 wave, leading to a very large increase in measured wealth between 1993 and 1995 (Haider, Hurd and Rohwedder, 2003). There is no obvious way to correct for this data error. The 1995 wave of AHEAD was followed by the stock market boom, leading to wealth increases that were likely unanticipated, and do not reflect planned life-cycle wealth accumulation.

The path of home ownership initially follows the path of bequeathable wealth, but after about 10 years it is higher than all of them. The lower rate of decline probably reflects a number of ways in which housing wealth is treated differently from nonhousing wealth. There are substantial transaction costs in moving from home ownership to renting, so that there will be a tendency to retain housing beyond what would be optimal were adjustment costless. People have a sentimental attachment to a particular house which increases the transaction costs. There is risk associated with renting such as inflation in rental costs whereas, except for property tax and maintenance, owned housing is a way of purchasing a stream of real consumption.

We can find whether the increase with age in the rate transitions out of owning is a pure age effect or is associated with characteristics such as health or economic circumstances. Our method is to estimate the probability of owning in wave t+1 as a function of characteristics and economic circumstances as well as ownership status in wave t. Using four waves of AHEAD we have three transitions. Table 9 shows the ratio of the probability of owning to not owning (the risk of owning) of someone with one of the characteristics displayed in the first column divided by the risk of owning of someone in the reference group. These results are estimated by multivariate logit over the three transitions. Thus someone who is married has a risk of owning in wave t + 1 which is 124% higher than the risk of someone who is not married and the difference is significant at less than the 0.001 level.

Table 9: Relative risk for home ownership; logit estimates.

	Risk	P-value
Female	0.90	0.169
Married	2.24	0.000
spouse died	0.34	0.000
age splines 70	1.00	0.994
75	0.90	0.090
80	1.07	0.174
85	1.04	0.526
90	0.93	0.377
health condition	1.05	0.484
health incident	0.68	0.000
health good	0.99	0.936
health fair/poor	0.79	0.006
housing wealth quartile lowest	0.60	0.000
quartile 2 and 3	--	--
highest	1.19	0.063
nonhousing wealth quartile lowest	0.87	0.094
quartile 2 and 3	--	--
highest	1.32	0.002
Homeowner	101.67	0.000
live with others	1.09	0.359
nursing home	1.13	0.607

Source: Own computations based on AHEAD.

The covariates with substantial explanatory power and statistical significance are the death of a spouse, which reduces the likelihood of owning in the next wave; the incidence of a health event; baseline health of fair or poor; and measures of wealth, as well as ownership itself. Of note is that age per se is not associated with an accelerating transition out of home ownership. This implies that the increased transition rates by age band that are in Table 8 are due to worsening health and possibly reductions in wealth that occur with age.

We have included two wealth measures: housing wealth and nonhousing wealth. For each we define three categories: the lowest wealth quartile, the second and third quartiles, and the highest quartile. Both types of wealth are associated with higher levels of ownership. That is, those with more housing wealth and those with more nonhousing wealth tend to retain ownership. We had anticipated that high housing wealth combined with low nonhousing wealth would be associated with an elevated probability of selling the home, but the four interactions were neither economically nor statistically significant.

In summary we find that homeownership is reduced with age but that the rate of reduction is less than the rate of reduction of nonhousing wealth. The lower rate of decline is likely due to a mixture of causes: housing may be held for a precautionary motive as in Skinner (1996); it may be held until health makes ownership infeasible whereas health should not affect the ability to hold financial wealth; in that its sale is often associated with widowing as in Venti and Wise (2001), it may be use to cover costs associated with widowing.

Some of these explanations are consistent with a life-cycle model extended to include precautionary saving: poor health or a health event are predictors of reduced life expectancy, which should accelerate the decumulation of wealth. However, the interaction of health with the requirements of homeownership make the study of ownership more complex than the study of nonfinancial wealth.

7. Conclusions

This paper investigated the interaction among health, wealth and where elderly persons live. We reproduce the finding that wealth and health are strongly related to each other. Wealthier persons live longer and are longer healthy. This interaction is moderated by where elderly persons live. Remaining in the lowest wealth quartile is most likely when an elderly person lives in a nursing home, and least likely when this person lives with others. The reversed patterns is true for the probability of remaining in the highest wealth quartile. For the initially wealthy, living with others decreases the expected future wealth relative to living alone. This is consistent with the notion that cohabitation implies intra-family transfers to the needy. For those, who remain living independently, homeownership declines, but the speed of reduction is slower than we would expect for financial wealth.

Results in this paper are descriptive and imply no causality. Further research will apply more sophisticated econometric methods in order to identify patterns of causality.

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