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THE AMERICAN WAY OF AGING: AN EVENT HISTORY ANALYSIS

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ABSTRACT

The paper presents a methodology for studying the sequence and timing of life events past age 65. After estimating models of marital status, disability, living arrangements and income from the scattered segments of old age captured within the 17 year window of the Panel Study of Income Dynamics (PSID), we simulated up to 35 years of old age, using a sample of those turning 65 between 1980 and 1984. The simulated life expectancies correspond quite well with life-table estimates published by the National Center for Health Statistics. Even in this initial effort, we report some interesting findings: First, the prospects for rich and poor at age 65 were very different, those with high incomes living 4 years longer than those with low incomes. Second, women who were ever institutionalized were hardly identifiable at age 65, having similar income, marital status and disability status as other women at age 65. Third, women are much more vulnerable to changes in marital status, suffering a permanent 20% decline in their standard of living upon widowhood compared to a 10% decline for men. Fourth, poor widows at age 80 were likely to have been widows or poor already when they turned 65.

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Women who reach age 65 can expect to live 18 more years on average; men, 14 more years. Yet economists have largely ignored that part of the life-cycle after age 65. By 65, most American men and women have retired, but changes linked to marital status, health, economic support, living arrangements, institutionalization, and death lie ahead. This paper represents an attempt to bring into much sharper focus the timing and incidence of events past age 65.

The ideal data set for studying the event history of aging might carry 35 years of longitudinal information on several cohorts of 65 year-olds. Since such data do not exist, we used the 17-year Panel Study of Income Dynamics (PSID), piecing together different slices of old-age from individuals entering and exiting the survey at different ages. Imposing a general statistical structure, we estimated parameters which allowed us then to simulate 35 years of longitudinal data for a cohort of 65 year-olds. Essentially we have brought together the disparate segments of old age captured within the window of the PSID to draw a smoothed profile of the events of aging. In the end, we simulated the ideal data.

In order to do the simulations, we estimated models of marriage and widowhood, disability, economic status, shared living arrangements, institutionalization and death. We then applied the model to generate 8880 simulated life-times, using a representative sample of 444 65-year olds as the starting point.

With our simulations, we are able to both compare the futures of people with various characteristics at age 65 and to explore what people in particular end-states looked like in previous years. For instance, we were able to ask how the aging process differs for those who are white and black, rich and poor, healthy and disabled at age 65. We also analyzed the histories of poor elderly widows and asked what had led them there. Were poor elderly widows formerly middle-class married women, poor married women, or were they already widowed and poor at age 65? Who enters nursing homes? Are they people who are reasonably well to do when they turned 65 who become widowed and whose health failed? Or are they persons who have mostly been poor and sickly for an extended period?

In the paper, we will describe the models we estimated and explore their power and plausibility. We believe that with refinement one may well be able to use models such as this one for a much more detailed understanding of the later years of the life cycle.

The Data

Trying to estimate the effects of aging with cross-sectional data confuses cohort effects. Particularly with regard to economic status, such effects are likely to be large. For example, in our data, persons turning 65 in the early 1970's had considerably higher poverty rates than those turning 65 in the 1980's. Thus, some of the apparent rise in poverty observed in cross-sectional data among older age groups may reflect the fact that earlier cohorts earned less during their working lives than later ones.

To trace the event histories of those in their old age, we needed a panel data set following a nationally representative sample over an extended period. The Panel Study of Income Dynamics (PSID) is an on-going survey begun in 1968 following an original sample of 5000 families with annual interviews. We used the 17 year sample, following people up through 1984. Our sample consisted of all those who were over 65 for at least three years during the survey (since some of our models use 2 year lags). Ultimately we had a sample of 1671 persons, 745 men and 926 women.

Until recently, the PSID suffered a major flaw rendering it inappropriate for use in studying longitudinal patterns of aging. When persons left the sample due to institutionalization or death or any other reason, their record--including all previous years' information--was dropped from the sample. Thus, the only elderly left on the PSID were the survivors, presenting a potentially serious sample selection problem. Recently, however, a non-response sample has been released which includes all people ever surveyed. Most importantly, the non-response sample contains information on reason for non-response, such as death or institutionalization. Still, we were forced to do a considerable amount of recoding to identify the institutionalized and those who were dependents sharing the household of others. (See the Appendix for a description of our recoding of PSID data.)

Methodology

Our methodology consisted of three steps. First, we modeled income dynamics and the odds of several discrete events (widowhood and remarriage, disability and return to good health, death, institutionalization and dependent household sharing) separately for men and women. Except in modelling income where we used a simple OLS estimator, we used hazard models allowing for time-varying covariates. In each case, realizations of other past and contemporaneous events (such as marital status or health) were included as independent variables.

Next, we applied the models to sequentially simulate the paths of aging for a representative sample of 65 year olds. Each year, we used the models to predict a new set of outcomes for the following year. The simulated results for one year were then used to predict outcomes for the next year and so on for 35 years. Because we used a random sample of people and their reported characteristics upon turning 65 as the seeds for the simulations, our simulated life expectancies and institutionalization rates should match the actual aggregates for the cohort reaching age 65 during the period 1980-84.

As a final step, we tabulated the simulated dataset to study alternative paths of aging. We could compare the lives of those who were disabled and healthy, widowed and married, rich and poor at 65. Taking persons at age 65, we could ask how many were widowed, disabled, poor, dead or institutionalized by ages 80, 85, 90 and so on. Similarly we could look at where people ended up and ask what had led them there. Thus we could ask whether poor elderly widows were formerly middle class wives. And we could ask whether those entering institutions had been rich or poor, married or unmarried, disabled or healthy, living independently or as a dependent in earlier years.

Our models pull together the experiences of succeeding cohorts within the PSID, capturing the cross-event, intertemporal relationships found in the data. We are able to pool the experiences of various cohorts by putting restrictions on the form of the cohort effect. The simulations then reproduce those relationships, summarizing the lessons learned in a more intelligible way than might be gotten from piles of cross-tabulations from the original data. In effect, we have created an "ideal" data set, a projected 35 year event history for people just turning 65, reflecting the relationships gleaned from the original data.

There are important limitations, however. Since the relationships observed in current data are assumed to hold into the future, unmodelled trends will lead our projections astray. On other hand, any projection suffers from these flaws. Our method, at least, allows us to exploit the full longitudinal and cross-sectional information available from the PSID.

General Modeling Strategy

We used two different types of models in this paper: hazard models for discrete events such as death and institutionalization and a separate model for income dynamics. Below, we will discuss the hazard models first.

Hazard Models:

In order to predict discrete events such as death and widowhood, we estimated single and multiple-risk hazard models using fixed and time-varying covariates.[1] The odds of death, institutionalization and dependent household sharing were estimated within a multiple risk framework. Chances of moving into and out of marriage and into and out of good health were each modelled individually as single risks.

Only a small fraction of the sample was exactly age 65 at the start of the survey. Some turned 65 late in the survey, and thus were followed only a few years; others turned 65 long before the survey began, providing a glimpse of the later years of the aging process but carrying no information on the earlier years. In limiting ourselves to any one cohort, we might have observed at most 17 years of the aging process, ignoring either the earlier or the later years of the aging process.

We sought a way to learn from all the scattered segments of old age observed within the PSID. In defining aged "spells" and their distributions, we imposed a general statistical structure on the problem which allowed us to pool the experiences the succeeding cohorts to come up with a portrait of the dynamics of aging. We define a spell as the number of years we observed a person in a particular state starting at age 65 or the first year they were observed in the state (if they were over 65 at the beginning of the survey). Each period, the probability of an event was a function of Z(t), a vector of time-varying covariates (such as age, marital status and health status) and X, a vector of fixed characteristics (race and education). Note that "t" is the number of years in which we saw them in a particular state, not the number of years they have lived past 65.

We assume "t" to have an exponential baseline hazard. In effect, the baseline hazard was assumed to be constant, exhibiting no duration dependence. But by including age dummies among the time-varying covariates, we allow for a very general form of age-varying failure rates. Our single-risk hazard function takes the simple form below, with an exponential baseline hazard, fixed characteristics X, time-varying covariates Z(t) and no unobserved heterogeneity:

$$h(t;X,Z(t)) = Phi * \exp(XB_1+Z(t)B_2)$$

Because age is a time-varying covariate, the hazard is allowed to shift up or down with changes in age. Thinking in terms of a spell of old age, this amounts to a non-parametric form of duration dependence. Changes in other variables such as health or marital status will shift the hazard as well.

In most of our models, there was only a binary choice, but as will be discussed below, we jointly estimate the odds of death, institutionalization and sharing models. For simplicity, we assume that each alternative--death, institutionalization and sharing--is independent of the other alternatives in that period.

Models and Results

Before discussing the simulation results, we will briefly highlight the models and estimated parameters. The coefficient estimates and asymptotic standard errors are given in the appendix tables. Table 1 shows the specification of each one of our models.

Disability Models

We modeled movements into and out of disability as a function of income, age, marital status and race.[2] By including a dummy for disability status last period, we allowed for the possibility that the newly disabled or the newly healthy might be more likely to change states again, either because of some short-term event or measurement error.

An 80 year-old healthy man who reported being disabled one year earlier had a much higher likelihood of becoming disabled again right away (37%) than those in their second or later year of good health (12%). (See Table 2 for the probabilities of becoming disabled, other characteristics held at their means for those who were not disabled at age 80.) Disabled men aged 80 who only recently entered disability status had a 40% chance of becoming healthy again right away and had a 13% chance thereafter. (Estimated probabilities for movements out of disability are not shown in Table 2 since they are largely symmetric to those in Table 2.)

Persons of both sexes who were more educated or richer were less likely to become disabled. White women were less likely to become disabled and more likely to become healthy again once disabled.

Marriage Models:

We modelled movements both into and out of marriage as well. By far, the most common reason for becoming umarried was widowhood, but the rare cases of divorce were treated in the same model. Our models are based upon only the characteristics of the individual. In more complex models, one might include spousal characteristics such as age or disability in modelling widowhood, but that would greatly complicate the simulations.

In modeling movements out of marriage, we included disability this year and last, age, race and income. Table 3 reports the probability of becoming unmarried, varying one characteristic at a time, holding all else at the mean for those who were married at age 80. Not surprisingly, the most important predictor of widowhood was age. Holding other characteristics at their means for married men at age 80, the annual chances of becoming unmarried for men increased from 1.2% at age 65 to 3.8% at age 90. For two reasons--because they have longer life expectancies and because they are typically younger than their mates--women are much more likely to be widowed. Again holding other characteristics at their mean for women age 80, women's annual chances of widowhood increased from 3.2% to 14% between ages 65 and 90.

Income was an important predictor of a woman's chances of becoming widowed. An 80 year old married woman who was poor had a 17% annual chance of widowhood; an otherwise similar woman with income 5 times the poverty level had only a 11% chance.

Death, Institutionalization, and Dependent Sharing

We modeled the transition from independent living to death, institutionalization and dependent sharing separately for men and women. As shown in Table 1, the variables used to predict were health status in the past two periods, income, marital status and recent changes in marital status, age and race. For those who became dependent sharers, we also had to model transitions into death and institutionalization.[3]

Death:

Marital status, age and especially disability were the most important predictors of death rates for men and women. The average 80 year old man who was disabled in both of the past two years had a 13% chance of dying in the next year as compared to 4% for those who were healthy. (See Table 4.)

Marriage had opposite implications for men and women. Marriage helped men's and hurt women's chances of survival. This may reflect the traditional roles of husband and wife: Married men live longer because they are cared for by their wives. In the process. wives' health may be endangered lifting and helping a disabled husband.

As expected, death rates for both men and women rose with age.

Institutionalization:

As described in the Appendix, we coded someone as institutionalized in several ways. Our data may understate the extent of institutionalization for several reasons: First, nursing home stays that are expected by family members to be short will not be reported. Second, those who enter nursing homes and die in the interval between annual interviews will be counted as non-response due to death, so the spell of nursing home residence will be missed. Third, those from single person households entering nursing homes after living alone are likely to be undercounted. PSID interviewers often pursued the last person in a sample household into an institution and provided no direct indicator where they were (until 1984, when an institutionalization indicator was added). We worked with PSID staff to develop a recoding scheme to capture this third group, as described in the Appendix. Still, we are uncertain whether we have fully resolved the problem.

While exits from nursing homes would be observed in some cases, most could not have been traced, given PSID procedures. As a result, we treated institutionalization as an absorbing state.

Age, disability, income and marital status were the best predictors of nursing home entry for men and women. Ninety year-olds were 20 times more likely to enter nursing homes than 65 year olds. Disability also had a moderate effect.

Wealthier men and women were less likely to enter nursing homes. For instance, a woman with the mean characteristics of an 80 year-old but with income at the poverty level was twice as likely as a women with income 5 times the poverty level to enter an institution within a year (1.6% *versus* .8%).

With a spouse to care for them, married men were less likely to enter institutions, recently widowed men more likely. We found similar results for women, but with large standard errors.

Dependent Sharing:

Adult children often return to their parents' home temporarily. To maintain the distinction between those who were dependents and those who were merely sharing their home, we adopted the label "dependent sharing." To be a "dependent sharer," one not only lived with others, but depended on others who owned or rented the house and accounted for more than half of the income.

Marital status, income and age were the most important predictors of dependent sharing. For both men and women, being married sharply reduced the chances of becoming a dependent sharer. Newly widowed women were especially likely to move in with their children.

There is a broad literature relating the increase in independent living among the elderly to higher incomes.[4] Our models provide consistent results that those with higher incomes were less likely to become dependent sharers.

Unlike death and institutionalization, dependent sharing was not assumed to be absorbing. We estimated separate models of the movement from dependent sharing to death and to institutionalization. (Virtually no one returned to independent living.) Because of small sample sizes, we pooled observations of males and females dependent sharing and modelled transitions into death and institutionalization as a function of age and race alone. We also included a sex dummy. Holding constant race and age, female dependent sharers were less likely to die and to enter nursing homes in a given year than men.

Income Dynamics

The major factor affecting the standard of living of the elderly is changed marital status. Since spousal benefits for Social Security are considerably lower than those of the primary beneficiary, one would expect a large fall in income for women if their husband dies. Pensions usually offer even less protection to widows. For men, we would also expect a fall in income since the spouse's benefits are lost, but not nearly as great a fall as for women.

In all of our models we use income relative to the poverty line as a simple indicator of economic well-being. Since the poverty line differs by family size, dividing income by the poverty need standard adjusts for family size. Alternatively, one could have modeled income separately and then divided by family size. We have estimated the models both ways and the results are similar. In the end, we used income/needs ratios because the coefficients are more readily interpretable.

We modelled the log of income relative to needs as a function of past disability, current marital status, recent and past changes in marital status, race, education, age and survey year (to account for cohort differences). We also included three years of lagged income/needs (in logs), restricting their coefficients to sum to one so that the model would not create regression to the mean due to measurement error.[5]

The poverty line in 1985 for a one person household was $5,156 and $6,503 for a two person home. Since the poverty line for a one person home is 79% of that for a two person one, income relative to the poverty needs ratio would fall when a person became widowed only if income fell by more than 21%.

New widowers and new widows face very different changes in economic status upon the death of a spouse. When a man loses his wife, his standard of living (income relative to needs) is estimated to fall by 10% initially (implying total income fell by roughly 30%). It remains 10% lower in succeeding years.

In sharp contrast, widows experience a 56% drop in standard of living initially (created by a 77% drop in income!). But more than half the loss is recovered in the next year, presumably as survivors' benefits of various sorts are paid. Ultimately, we estimated that women experience a 20% drop in their standard of living upon the death of their husband (caused by a 41% decline in their income). It is clear that the current system of income supports leaves women at far greater risk than men.

Simulation Results:

We used the parameter estimates to simulate the events of old-age for a representative sample of 65 year-olds. Starting with the 444 PSID sample members who turned 65 between 1980 and 1984, we used each individual as the seed for 20 different simulated life histories. In doing the simulation, we estimated the probability of each event in the subsequent year. Drawing from a uniform(0,1) distribution, we modeled the occurence of each event. We also estimated expected income/needs ratios for those at age 66 using the income model. Taking a draw from a normal distribution with mean zero and variance equal to the estimated variance of the disturbance term in the income equation, we reproduced the observed distribution of incomes. Proceeding sequentially, we used simulated characteristics at age 66 to predict characteristics at age 67 and so on. Generating 20 equiprobable lifetimes for each of the 444 sample members, we eventually had 8880 simulated spells of old age to study.

In Table 5, we compare our simulated life expectancies with those reported by the U.S. National Center for Health Statistics (NCHS).[6] This is a rough measure of the external validity of our predictions. With the exception of non-white females, our predictions were close for all groups. For instance, for white females, our simulations show a life expenctancy at age 65 of 18.5 years as compared to the NCHS estimate of 18.7 years. For white men and for non-white men, our estimates were also very close for those aged 65: 14.9 simulated versus 14.5 in the life-tables for white men; our simulations of life expectancies for non-white men at age 65 were equal to that in the life-tables, 13.4 years. Non-white females, though, had a simulated life expectancy of 19.4, though the life-table estimates was only 17.3.

In many respects, the close correspondence between our simulated and the actual life expectancies is remarkable. Each year, for each individual, life events are being simulated within 10 different models. Realizations in one year for each event help predict changes in all other events in future years. Poor predictions in one model would distort the entire simulation since each simulated event would be used to predict other events in later years. That such a large-scale serially-dependent model would correspond with life-table estimates is reassuring.

Looking Forward From Age 65

The extent of institutionalization is much higher than might be expected upon an initial inspection of those who were in institutions at a point in time. For instance, according to the 1980 Census, only 4% of the population 75-79, and 12% of the population 80 and over were in institutions.[7] But the size of the stock of elderly in institutions leaves a false impression that only few of the elderly ever enter. In the simulations, 12% of men and 38% of women aged 65 were eventually institutionalized. These estimates are in fact quite consistent with alternative estimates of 25-50% for both sexes combined.[8]

We wanted to compare the prospects of those who were rich and poor, disabled and healthy, married and unmarried, white and non-white at age 65. In Tables 6 and 7, we report the status at age 80 for those with selected characteristics at age 65.

With the simulated data, we were able to pose a number of questions not answerable with cross-sections. Reassuringly, the answers were for the most part as expected. For example, men and women who were disabled at age 65 were much more likely to be dead or in nursing homes by age 80 than those who were healthy. Further, men and women who were married at age 65 lived 2 years longer than men who were unmarried. (Although marriage lowers women's chances of survival after controlling for income, married women tended to have higher standards of living.) White men were less likely to be institutionalized by age 80 than non-white men; white women more likely. White men and women were much less likely to be dependent sharers by age 80 than non-whites.

The differences in the prospects for those who were low and high income at age 65 were most dramatic. (Low income is defined as having income less than 2 times the poverty level, high income as having income greater than 5 times the poverty level.) Those who were low income at age 65 lived 4 fewer years on average, were much more likely to be in a nursing home or dependent sharers by age 80, and were much more likely to be disabled.

Looking Backward

We were also interested in tracing back the life histories of those in particular end-states. Two were of particular policy interest: institutionalization and poor widowhood. For instance, were those who ended up in institutions identifiable at age 65? Were they rich or poor, healthy or disabled, married or unmarried? What changes in disability status, marital status and income did they see in the few years preceeding their institutionalization? How many of those who were poor widows at age 80 were middle class wives at age 65?

We have already noted that in our simulations, 12% of men and 38% of women alive at age 65 eventually entered institutions. Table 8 compares the characteristics of the ever-institutionalized with the average characteristics at age 65. Men who were eventually institutionalized were disproportionately low income. However, their disability status was very similar to that of persons who did not enter institutions. We suspect this results from the fact that disabled men die more quickly, often not living long enough to be institutionalized.

The results for women are even more interesting. By the criteria shown in the table, women who eventually became institutionalized are virtually indistinguishable from those who do not. Once again, the result almost certainly reflects differential mortality. Low-income women are more likely to be institutionalized if they get very old, but they are less likely to reach very old age. Those who eventually enter institutions thus appear to be a real cross-section of American women at age 65.

In Table 9, we report the characteristics of the institutionalized in the few years immediately preceeding their institutionalization. Over one-third (38%) of men who were institutionalized were dependent sharers the year before entering institutions. For men who enter the nursing home from living independently, there is a sudden jump in widowhood and disability in the last year before institutionalization. Still, 68% of men who were institutionalized were married only the year before.

Women who enter nursing homes were more likely to have been living independently and more likely to have been widows for a while. Theirs seems to be a gradual deterioration and not a sudden change. Only 18% of women were sharing the year before institutionalization. Among eventually institutionalized women who were living independently, 72% were widows as many as 5 years before institutionalization, and two-thirds (66%) were widows 9 years before.

We also looked at the past history of poor, unmarried women at age 80. In our simulations, these women were often relatively disadvantaged even at age 65. About 60% had been below the poverty line 15 years before. Only 3% had had incomes 5 times the poverty level. Even more interestingly, over half of the poor unmarried women at age 80 were not married at age 65. In our results, few middle class wives became poor elderly widows.

Conclusion

Even in this initial effort, we have noted some intriguing results. For example, rich and poor at age 65 face very different experiences in old age, higher income persons living more than 4 years longer on average. Second, widowhood created a 20% drop in the standard of living of women as compared to a 10% drop for men. Third, women who ultimately enter institutions have very similar incomes, rates of disability and rates of marriage at age 65 to women who do not enter nursing homes. Finally, poor widows were likely to have been widowed or low-income already at age 65.

We see this paper as a pioneering effort to use recursive simulation models to explore the events of aging. It remains experimental. Nonetheless, we were suprised at the close correspondence between our results and external estimates. We outline a methodology for piecing together the disparate slices of old age captured within a panel survey covering a number of cohorts. Rather than wait 20 years for a long-term panel of a single cohort to trace the events of aging, the methodology described allows one to develop a smoothed profile of the aging process by pooling the experiences of a number of cohorts.

Footnotes

1. We gratefully acknowledge the help of Bruce Meyer of Northwestern University who provided us with the software for estimating the hazard models and offered much helful advice.

2. A person was categorized as disabled if they reported some limitation on the type or amount of work they could do.

3. We did not model movements from dependent sharing back to independent living as they were quite rare in our data.

4. For instance, see Saul Schwartz, Sheldon Danziger and Eugene Smolensky (1984); Robert T. Michael, Victor Fuchs and Sharon Scott (1980); Fred C. Pampel (1983).

5. We also estimated the model without these constraints with little effect on the results.

6. Our simulated "life expectancy" is the expected number of years before death or institutionalization in the simulations. To the extent that people live a while longer once entering institutions, we should understate life expectancies for those who are institutionalized. This should be less of a problem for men, who are much less likely to become institutionalized.

7. Drawn from Bureau of the Census (1984).

8. For instance, see Vicente,L., Wiley,J.A., and Carrington, R.A. (1979); C.E. McConnell (1984).

Appendix: Data Recoding on the PSID

Below, we describe our recoding scheme in more detail:

A. Non-Response

A sample member of the PSID can become a non-respondent for a number of reasons: death, institutionalization, refusal, disability, inability to locate, etc. We treated non-respondents for reasons other than death and institutionalization as right-censored observations.

B. Women's Health Status

In 6 out of 17 years, disability status data on wives, but not female heads, was missing. Since we would have had disability status for female heads but not for wives, measured disability would have been capturing marital status differences. As a result, we treated disability status as missing for all women in those years.

C. Institutionalization

There are 4 different ways to identify the institutionalized on the PSID. First, someone is coded as institutionalized if remaining sample members of a household report the absence of a household member perceived to have left the household for a long-term stay in a nursing home. Those who are temporarily out of the household at the time of the interview--for instance on a short-term hospital stay--will not be coded as "institutionalized." Second, if a single person household enters a nursing home, and there are no remaining sample family members outside, the PSID interviewers will still attempt to obtain an interview. If they fail, the household should be coded as non-response due to institutionalization. Third, if the PSID staff succeeded in obtaining an interview in the nursing home, there is an indicator of institutionalization in 1984. Anyone who was coded as institutionalized in 1984 we reverse coded as institutionalized until their previous move.

Before 1984, however, there are no direct indicators of institutionalization for single person households who were interviewed in nursing homes. We worked with PSID staff in developing a method for identifying such households. If a single person moves into a housing type "other" (as opposed to an apartment, house, condominium or trailer) for involuntary reasons (such as health), if there are two rooms or less, and if the household size never grows past 1 before the person moves, then we coded them as "institutionalized."

Because we checked each recode by hand, we are confident that we have not over-counted institutionalization. However, we are uncertain about the degree of undercounting. We are particularly likely to miss short-term stays. Those who are in what are perceived to be short-term stays will not be reported as institutionalized when reported absent by household members. In addition, those who enter nursing homes and die between interviews will be reported as dead, the spell of nursing home use missed. For all the above reasons, our estimates of ever-institutionalization should be treated as lower bounds.

D. Dependent Sharing

We sought to distinguish between living arrangements where adult children move back in with their parents and cases where elderly parents move in with others, becoming economically dependent upon them. Having noted the frequency of adult childrens' return to their parents' home, we wanted to avoid treating both dependent sharers and household heads similarly.

At the start of the survey, who was designated as head did reflect the degree of economic independence. For instance, the head was often the person who owned the home. As a result, at the start of the survey, the elderly who were designated as non-heads were dependent sharers. However, if a person started the survey as a family head, it was rare that they would ever become a non-head, even if they became dependent. The key to understanding coding procedures is to note that the PSID is a family-centered survey that carries a host of questions specifically for family heads. In trying to maintain a consistent series of data for each head, PSID interviewers rarely changed the household status of those who ever were designated heads, except for reasons of marriage.

We identified three different groups of dependent sharers. The first group were those who were explicitly categorized as parents of the head or other relatives of the heads. Most of these started the survey in that status.

The second group was made up of family heads that moved in with other sample members. When a sample household moves in with another sample household, there is often no direct indicator that the other family is present. For instance, if an elderly parent moves in with an adult child who had been part of the original sample family in 1968 and both parent and child had been followed over the years, the PSID often did not recombine the two households' records if they moved back in with each other. Indeed, there was often no direct indicator that the other family was present. We worked with the PSID staff to develop a method for detecting such shared living arrangements. If the family composition was described as "other" (rather than primary family with relatives or non-relatives included within the family unit), if the person neither owned nor rented their housing, and the reason they neither owned nor rented was not that housing was some form of compensation, then we considered them dependent sharers.

Third, we tried to identify sample heads moving in with non-sample families. In such cases, the PSID usually carries no indicator that the other family is present. Even if someone in the non-sample household owns or rents the home, the sample head is listed as an owner or renter. Eventually (often in the second year of coresidence), the PSID will indicate the non-sample members as "moving-in" with the sample person's household, even if sample member had moved in with them. The sample head would have remained listed as head. Again, we worked with the PSID staff to develop a way of identifying such living situations. We coded someone as a dependent sharer if all of the following conditions are met: they are unmarried; they move; a child or grandchild is shown to move in with them; family size never returns to 1 before their next move; and the head's income is less than half the family's income over the period of coresidence.

One other problem arose. Little information is reported on non-heads. As a result, we had limited information on disability, marital status, and even income on sharing dependents if they were not heads. Thus we did not model these characteristics for sharers.

References

Bureau of the Census (1984) 1980 Census of the Population, Subject Reports, Persons in Institutions and Other Group Quarters PC80-2-4D, p.2.

C.E. McConnell (1984) "A Note on the Lifetime Risk of Nursing Home Residency," Gerontologist 24:193-198.

Robert T. Michael, Victor Fuchs and Sharon Scott (1980) "Changes in the Propensity to Live Alone: 1950-76" Demography 17:39-53.

Fred C. Pampel (1983) "Changes in the Propensity to Live Alone: Evidence from Coonsecutive Cross-Section Surveys, 1960-76" Demography 20:433-447.

Saul Schwartz, Sheldon Danziger and Eugene Smolensky (1984) "The Choice of Living Arrangements by the Elderly" in Henry Aaron and Gary Burtless (eds.), Retirement and Economic Behavior (Washington, DC: Brookings Institution)

Vicente, L., Wiley, J.A., and Carrington, R.A. (1979) "The Risk of Institutionalization Before Death," Gerontologist 19:361-367.

About the Authors

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Table 1.

Model Specification:

Variables:	Hazard Models: (at time t) Into and Out of Disability:	Into and Out of Marriage:	Into Death, Institut. and Dependent Sharing:	From Sharing to Death, Institut.
Disability_{t-1}		X	X	
Disability_{t-2}		X	X	
$\text{Income/Needs}_{t-1}$	X	X	X	
Age Group_{t-1}	X	X	X	X
$\text{Marital Status}_{t-1}$	X		X	
$\text{Newly Married}_{t-1}$	X		X	
$\text{Newly Unmarried}_{t-1}$	X		X	
$\text{Year of Survey}_{t}$	X	X	X	
Years of School Completed	X	X	X	
Race	X	X	X	X
Sex[1]				X

[1] All models except those from sharing into institutionalization and death are estimated separately for men and women.

Table 2.

Predicted One Year Probabilities Of Moving Into Disability from Good Health For 80 year-old Men and Women Living Independently

Characteristic:	Men	Women
Grand Mean	0.1597	0.2187
Previous Disability Status:		
Disabled one year ago	0.3672	0.4699
Not Disabled two years	0.1233	0.1944
Marital Status:		
Married	0.1682	0.2343
Unmarried	0.1570	0.2136
Newly Unmarried	0.0521	0.1893
Income:		
At Poverty Level	0.2266	0.2752
2 X Poverty	0.1974	0.2269
3 X Poverty	0.1819	0.2021
4 X Poverty	0.1716	0.1859
5 X Poverty	0.1640	0.1742
Age:		
Age 65-69	0.1143	0.1877
Age 70-74	0.1220	0.2037
Age 75-79	0.1419	0.2245
Age 80-84	0.1597	0.2187
Age 85-89	0.2340	0.3076
Age 90+	0.0898	0.4076
Race:		
White	0.1585	0.2151
Non-White	0.1813	0.2974

Note: When varying each characteristic, other characteristics are held at sample means

Table 3.

One Year Probabilities of Becoming Unmarried For Currenly Married 80 year-old Men and Women Living Independently

Characteristic:	Men	Women
Grand Mean	0.0383	0.1337
Income:		
At Poverty Level	0.0463	0.1668
2 X Poverty	0.0425	0.1413
3 X Poverty	0.0404	0.1281
4 X Poverty	0.0390	0.1195
5 X Poverty	0.0379	0.1131
Age:		
Age 65-69	0.0117	0.0323
Age 70-74	0.0220	0.0431
Age 75-79	0.0212	0.0759
Age 80-84	0.0383	0.1337
Age 85-89	0.0306	0.0593
Age 90+	0.0377	0.1397
Race:		
White	0.0387	0.1330
Non-White	0.0346	0.1598

Note: When varying each characteristic, other characteristics are held at sample means

Table 4

Probability of Death, Institutionalization, or Dependent Sharing for 80 Year-Old Men and Women Currently Living Independently

	Men			Women		
Characteristic:	Death	Institution	Share	Death	Institution	Share
Grand Mean	0.0819	0.0036	0.0067	0.0314	0.0124	0.0044
Disability:						
Disabled at least 2 yrs	0.1265	0.0041	0.0120	0.0[illegible]41	0.0519	0.0069
Healthy at least 2 yrs	0.0418	0.0028	0.0030	0.0236	0.0085	0.0038
Newly Disabled	0.0823	0.0069	0.0020	0.0[illegible]38	0.0355	0.0071
Marital Status:						
Married	0.0751	0.0029	0.0041	0.0380	0.0121	0.0019
Unmarried	0.1010	0.0053	0.0202	0.0292	0.0125	0.0057
Newly Unmarried	0.0927	0.0158	0.0448	0.0311	0.0163	0.0212
Newly Married	0.0675	0.0029	0.0041	0.1546	0.0121	0.0019
Income:						
At Poverty Level	0.0952	0.0206	0.0058	0.0346	0.0164	0.0061
2 X Poverty	0.0883	0.0085	0.0062	0.0310	0.0121	0.0042
3 X Poverty	0.0844	0.0051	0.0065	0.0291	0.0101	0.0034
4 X Poverty	0.0818	0.0035	0.0067	0.0278	0.0089	0.0029
5 X Poverty	0.0799	0.0026	0.0068	0.0268	0.0080	0.0026
Age:						
Age 65-69	0.0395	0.0005	0.0022	0.0187	0.0025	0.0034
Age 70-74	0.0429	0.0008	0.0019	0.0232	0.0038	0.0028
Age 75-79	0.0561	0.0017	0.0040	0.0246	0.0048	0.0047
Age 80-84	0.0819	0.0036	0.0067	0.0314	0.0124	0.0044
Age 85-89	0.0928	0.0042	0.0100	0.0481	0.0117	0.0076
Age 90+	0.1605	0.0122	0.0107	0.1480	0.0543	0.0076
Race						
White	0.0831	0.0035	0.0064	0.0323	0.0138	0.0042
Non-White	0.0733	0.0041	0.0095	0.0242	0.0051	0.0051

Note: When varying each characteristic, all other characteristics are held at the means for 80 year-old men or women

Table 5.

Comparison of Simulated Life Expectancies with Life-Table Estimates

	Life Expectancy at Age:				
	65	70	75	80	85
White Females:					
Life-Table	18.7	15.1	11.8	8.8	6.5
Simulated	18.5	15.7	12.6	9.8	6.9
Non-White Females:					
Life-Table	17.3	14.1	11.5	9.0	7.4
Simulated	19.4	16.1	12.5	9.7	7.1
White Males:					
Life-Table	14.5	11.5	9.0	6.9	5.2
Simulated	14.9	12.6	9.9	8.3	6.0
Non-White Males:					
Life-Table	13.4	10.9	9.0	7.1	6.0
Simulated	13.4	11.3	8.7	7.1	5.8

Note: Life-table estimates drawn from U.S. Bureau of the Census, Statistical Abstract of the United States, 1987 (Wash., DC: U.S. Government Printing Office, 1986) Table 108. Life-table estimates are for blacks, simulations for non-whites.

Table 6

Simulated Status at Age 80 for Those with Selected Characteristics At Age 65 (Men)

	Of Persons Alive at 65			Of Persons Alive at 80	Of Persons Alive And Independent at 80		
Characteristic At Age 65:	Life Expectancy At Age 65	Percent Dead by Age 80	Percent Institutional by Age 80	Percent Sharing	Percent Unmarried	Percent Disabled	Percent Below 2 X Poverty
All Persons	14.7	53	4	20	15	43	28
White	14.9	52	4	18	15	41	26
Nonwhite	13.4	55	7	34	17	72	35
Disabled	12.7	59	6	16	17	54	35
Not Disabled	16.0	48	3	16	15	39	23
Married	14.9	52	4	16	14	43	28
Unmarried	12.9	60	6	21	44	61	30
Income < 2 X Poverty	12.4	58	10	49	18	76	61
Income 2-5 X Poverty	14.3	54	4	17	19	48	36
Income 5+ X Poverty	16.8	46	2	12	11	30	10

Table 7

Simulated Status at Age 80 for Those with Selected Characteristics At Age 65 (Women)

	Of Persons Alive at 65			Of Persons Alive at 80	Of Persons Alive And Independent at 80		
Characteristic At Age 65:	Life Expectancy At Age 65	Percent Dead by Age 80	Percent Institutional by Age 80	Percent Sharing	Percent Unmarried	Percent Disabled	Percent Below 2 X Poverty
All Persons	18.6	26	12	16	69	42	34
White	18.5	26	13	13	68	40	31
Nonwhite	19.4	26	8	38	80	64	57
Disabled	17.2	28	15	14	70	42	41
Not Disabled	19.8	22	11	9	68	42	29
Married	19.3	25	10	11	55	41	28
Unmarried	17.9	24	18	10	97	44	43
Income < 2 X Poverty	16.3	32	15	34	84	52	70
Income 2-5 X Poverty	19.6	22	12	9	69	43	28
Income 5+ X Poverty	20.8	22	7	6	56	33	9

Table 8

Comparison of Characteristics of Persons Who Eventually Become Institutionalized with the Characteristics of All Persons at Age 65 By Sex

Characteristics At Age 65:	Men		Women	
	All	Ever Institutionalized	All	Ever Institutionalized
Unmarried	5	7	37	41
Disabled	38	41	38	38
<2 X Poverty	17	29	33	37
2-5 X Poverty	49	50	43	40
5+ X Poverty	34	21	24	22

Table 9

Simulated Characteristics of Persons in Various Years Prior to The First Year of Institutionization
(Persons Who Were Simulated to Enter Institutions Only)

	Years before Instutitionalization:				
	1	2	3	4	9
Percent of All Men Dependent Sharing	38	34	31	27	22
Of All Men Who Were Not Dependent Sharing:					
Percent Unmarried	32	22	21	21	19
Percent Disabled	66	45	51	47	45
Percent <2 X Poverty	71	66	62	54	46
Percent 2-5 X Poverty	23	28	29	37	37
Percent 5+ X Poverty	5	6	8	9	16
Percent of All Women Dependent Sharing	18	16	15	13	11
Of All Women Who Were Not Dependent Sharing					
Percent Unmarried	81	78	77	72	66
Percent Disabled	80	64	53	43	38
Percent <2 X Poverty	47	45	46	44	40
Percent 2-5 X Poverty	32	44	33	35	40
Percent 5+ X Poverty	21	21	21	21	21

Appendix Table 1.
Hazard Models for Movements into Disability

	Men		Women	
	Healthy==>Disabled		Healthy==>Disabled	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
White	-0.147	0.125	-0.377	0.160
Education	-0.021	0.012	-0.034	0.016
Disabled(t-2)	1.255	0.093	1.077	0.132
logInc/Need(t-1)	-0.224	0.075	-0.323	0.093
Married(t-1)	0.026	0.133	0.101	0.118
Newly Unmarr(t-1)	-1.210	0.781	-0.141	0.410
Year of Survey	0.040	0.011	0.007	0.012
Newly Married(t-1)	0.538	0.452	-0.161	1.429
Health Missing(t-2)			0.348	0.127
Age 70-74	0.070	0.111	0.091	0.131
Age 75-79	0.[illegible]32	0.136	0.201	0.154
Age 80-84	0.[illegible]60	0.173	0.171	0.203
Age 85-89	0.787	0.238	0.570	0.255
Age 90+	-0.254	0.645	0.924	0.369
PHI	0.305	0.017	0.308	0.018
Observations	832		1227	

Appendix Table 2.
Hazard Models for Movements out of Disability

	Men		Women	
	Disabled==>Healthy		Disabled==>Healthy	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
White	0.016	0.144	0.291	0.166
Education	-0.001	0.014	0.019	0.018
Disabled(t-2)	-1.320	0.098	-0.939	0.143
logInc/Need(t-1)	0.320	0.086	0.121	0.106
Married(t-1)	-0.065	0.140	0.301	0.135
Newly Unmarr(t-1)	0.535	0.302	0.104	0.342
Year of Survey	0.010	0.011	-0.024	0.014
Newly Married(t-1)	-0.136	1.010		
Health Missing(t-2)			-0.490	0.149
Age 70-74	-0.005	0.125	-0.040	0.146
Age 75-79	-0.301	0.151	-0.293	0.180
Age 80-84	-0.105	0.177	0.304	0.187
Age 85-89	-0.502	0.301	-0.014	0.301
Age 90+	-0.307	0.518	-0.390	0.607
PHI	0.295	0.017	0.274	0.017
Num Obs	932		1243	

Appendix Table 3.
Hazard Models for Becoming Unmarried

	Men		Women	
	Married==>Unmarried		Married==>Unmarried	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
White	0.113	0.341	-0.199	0.314
Disability(t-1)	-0.239	0.317	-0.294	0.246
Disability(t-2)	0.314	0.283	-0.311	0.283
logInc/Need(t-1)	-0.127	0.203	-0.260	0.154
Year of Survey	0.031	0.030	0.020	0.021
Health Missing(t-1)			-0.048	0.193
Health Missing(t-2)			0.053	0.195
Age 70-74	0.639	0.325	0.295	0.222
Age 75-79	0.601	0.357	0.877	0.234
Age 80-84	1.200	0.372	1.475	0.296
Age 85-89	0.975	0.600	0.621	0.773
Age 90+	1.186	1.029	1.523	3.262
Phi	0.014	0.003	0.038	0.005
Num Obs	712		541	

Appendix Table 4.
Hazard Models for Becoming Married from Unmarried

	Men		Women	
	Unmarr ==> Marr		Unmarr ==> Marr	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
White	0.037	0.565	0.343	0.974
Education	0.055	0.058		
Disabled(t-1)	-0.160	0.620	-0.831	1.775
Disabled(t-2)	0.320	0.622	1.494	1.392
logInc/Need(t-1)	0.302	0.363	-0.082	1.028
Year of Survey	0.032	0.054	-0.047	0.109
Health Missing(t-1)			-0.667	1.481
Health Missing(t-2)			0.779	1.117
Age 70-74	-0.453	0.561	-0.328	0.976
Age 75-79	-0.409	0.558	-1.647	1.518
Age 80+	-1.738	0.804	-1.687	1.751
Phi	0.024	0.007	0.003	0.002
Num Obs	216		687	

Appendix Table 5.
Hazard Models of Elderly Living Arrangements

	Transition to Death			
	Men		Women	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
White	0.131	0.184	0.295	0.235
Education	0.007	0.019	0.003	0.026
Disability(t-1)	0.700	0.180	0.839	0.217
Disability(t-2)	0.454	0.177	0.580	0.211
logInc/Need(t-1)	-0.114	0.108	-0.161	0.144
Married(t-1)	-0.312	0.151	0.265	0.175
Newly Unmarr(t-1)	-0.093	0.428	0.067	0.525
Newly Married(t-1)	-0.112	1.023	1.470	0.734
Year of Survey	0.005	0.015	-0.057	0.018
Health Missing(t-1)			0.710	0.223
Health Missing(t-2)			0.202	0.212
Age 70-74	0.085	0.180	0.218	0.204
Age 75-79	0.359	0.183	0.278	0.225
Age 80-84	0.752	0.196	0.525	0.264
Age 85-89	0.882	0.259	0.962	0.304
Age 90+	1.468	0.364	2.144	0.407
PHI	0.037	0.004	0.022	0.003
Observations	745		926	

Appendix Table 6.
Hazard Models of Elderly Living Arrangements

	Transition to Institutionalization			
	Men		Women	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
White	-0.160	0.472	0.998	0.495
Disability(t-1)	0.920	0.738	1.439	0.521
Disability(t-2)	-0.525	0.489	0.388	0.366
LogInc/Need(t-1)	-1.280	0.373	-0.448	0.184
Married(t-1)	-0.562	0.450	-0.028	0.313
Newly Unmarr(t-1)	1.129	0.703	0.276	0.800
Year of Survey	0.050	0.048	0.052	0.335
Health Missing(t-1)			1.398	0.508
Health Missing(t-2)			-0.246	0.401
Age 70-74	0.369	0.870	0.406	0.420
Age 75-79	1.149	0.733	0.652	0.476
Age 80-84	1.883	0.695	1.605	0.435
Age 85-89	2.047	0.897	1.541	0.508
Age 90+	3.116	0.910	3.101	0.471
PHI	0.0012	0.0007	0.0029	0.0010
Observations	738		921	

Appendix Table 7.
Hazard Models of Elderly Living Arrangements

	Transition to Dependent Sharing			
	Men		Women	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
White	-0.401	0.896	-0.373	0.606
Disability(t-1)	-0.423	0.612	0.621	0.630
Disability(t-2)	1.820	1.004	-0.033	0.748
logInc/Need(t-1)	0.105	0.494	-0.536	0.446
Married(t-1)	-1.585	0.657	-1.053	0.574
Newly Unmarr(t-1)	0.834	1.113	1.376	0.639
Year of Survey	-0.033	0.098	-0.041	0.068
Health Missing(t-1)			1.440	0.593
Health Missing(t-2)			0.611	0.642
Age 70-74	-0.112	0.915	-0.178	0.530
Age 75-79	0.621	0.857	0.335	0.545
Age 80-84	1.130	0.879	0.256	0.561
Age 85-89	1.540	1.154	0.818	0.791
Age 90+	1.605	1.273	0.818	0.791
PHI	0.0014	0.0007	0.0028	0.0011
Observations	737		917	

Appendix Table 8.
Hazard Models of Elderly Living Arrangements

	Men & Women Dependent Sharing==>Death		Men & Women Dependent Sharing==>Institut.	
Variable	Coefficent	Standard Error	Coefficient	Standard Error
White	-0.459	0.242	-0.270	0.469
Male	0.492	0.233	0.844	0.385
Year of Survey	0.003	0.027		
Age 70-74	0.330	0.354		
Age 75-79	1.002	0.324		
Age 80-84	1.344	0.335	3.211	0.976
Age 85+	2.301	0.318	3.780	0.961
PHI	0.0329	0.0048	0.0029	0.0019
Observations	194		194	

Appendix Table 9.
Ordinary Least Squares Estimates of Determinants of Log of Income/Needs Ratio

	Men		Women	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
Intercept	-0.0375	0.0275	0.0580	0.0269
Disab(t-1)	-0.0059	0.0143	0.0016	0.0166
Disab(t-2)	0.0103	0.0144	0.0007	0.0166
Unmar(t)	0.0022	0.0162	0.0129	0.0100
New Unm(t)	-0.0991	0.0447	-0.5621	0.0307
New Unm(t-1)	-0.0493	0.0460	0.0600	0.0321
New Unm(t-2)	-0.0134	0.0460	0.0761	0.0313
New Unm(t-3)	0.0263	0.0450	0.0997	0.0320
New Mar(t)	0.1799	0.0820	0.4118	0.1118
New Mar(t-1)	0.0453	0.0750	0.3668	0.0915
New Mar(t-2)	-0.0391	0.0780	0.1287	0.0[illegible]89
New Mar(t-3)	-0.0799	0.0750	-0.0569	0.0773
Health Missing	0.0250	0.0799	-0.0375	0.0119
Education	-0.0018	0.0014	-0.0021	0.0014
LogInc/Need(t-1)*	0.5707	0.0160	0.5392	0.0138
LogInc/Need(t-2)*	0.2432	0.0180	0.2464	0.0151
LogInc/Need(t-3)*	0.1860	0.0160	0.2143	0.0135
White	-0.0118	0.0158	-0.0021	0.0135
Age 70-74	0.0281	0.0130	-0.0001	0.0109
Age 75-79	0.0193	0.0150	0.0114	0.0133
Age 80-84	0.0160	0.0200	0.0038	0.0170
Age 85-89	0.0698	0.0320	0.0376	0.0260
Age 90+	0.0131	0.0720	-0.0003	0.0546
Year of Survey	0.0018	0.0016	-0.0033	0.001[illegible]
Observations	3538		4886	
R-Square	0.8063		0.8114	
MSE	0.1004		0.0979	

* The coefficients on lagged income were constrained to sum to 1.