You can't take it with you: Asset run-down at the end of the life cycle

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Introduction and summary

The life-cycle model is the workhorse of most analyses of saving and is widely used to evaluate the macroeconomic and distributional effects of various policy proposals such as the repeal of estate taxation.

The life-cycle model presumes that people are forward-looking and make their current consumption and savings decisions based on their preferences for consumption and knowledge of their future income. In its simplest form, the model assumes that individuals know with perfect certainty the age at which they will die. Moreover, this simplest model assumes that individuals do not value inheritances to their children. That is, they have no bequest motive. Under this model, all individuals die with no wealth, because if an individual were about to die and had no bequest motive, he would be better off consuming all of his remaining wealth than if he died with some wealth remaining. Making a few additional assumptions about individuals' expectations of the future and their preferences[1] allows us to predict an individual's consumption and, thus, wealth at each age.[2]

Although this simple version of the life-cycle model is unrealistic, it is also simple to analyze. As a result, it is often used to evaluate policy reforms (Altig et al., 1997). However, this simple version of the life-cycle model is unable to replicate several key facts. Perhaps most importantly, empirical research shows that many households retain large amounts of assets even in old age (see Hurd, 1990, for a review).[3] Some have argued that the fact that many households do not run down their assets is evidence of a bequest motive, meaning that elderly people do not keep assets just for themselves, but also for their children.

Because most of the literature on policy reform relies on the simple life-cycle model, it has assumed saving behavior that compares poorly with the microeconomic data. It is possible that changing the assumptions of the simple life-cycle model to better describe the data will also change the results of the studies that use these models. Thus, a better understanding and quantitative analysis of household saving behavior may have a substantial impact on the evaluation of policy reforms, such as reforming the Social Security system, Medicare, and changing estate taxes.

To illustrate this point, we look at a policy issue where it is important to consider savings motives of individuals at the end of their lives: estate taxation. On July 7, 2001, the Economic Growth and Tax Relief Reconciliation Act was signed into law, which will gradually reduce estate taxation starting in the year 2002. The estate tax is a tax on assets that remain after an individual dies. The estate tax will be completely repealed in the year 2010.[4] Before the Economic Growth and Tax Relief Reconciliation Act was passed, only estates valued over $675,000 were taxed. By the year 2002, the exemption had risen to $1,000,000. Whether or not this reform increases or reduces gross domestic product (GDP) depends critically on the strength of the bequest motive. Therefore, whether we assume a bequest motive has a dramatic effect on the conclusions that we draw and the policy recommendations that we make. If, as in the simple life-cycle model, individuals have no bequest motive and, thus, do not value the estate they leave to their children, the estate tax will not affect the economic behavior of households.[5] The likely alternative to taxes on assets left after death is a tax on income while alive.

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In contrast to estate taxes, income taxes will likely reduce savings and work effort, which causes economic inefficiency, or "deadweight loss." It is likely that any loss of federal income due to a repeal of the estate taxes will force an increase in income taxes. Therefore, assuming that progressivity is a desirable feature in a tax system and distortions on work decisions and savings are undesirable, the repeal of the estate tax might be seen as undesirable; the decrease in estate taxes reduces progressivity, while the increase in the income tax distorts saving behavior.

On the other hand, if we move away from the simple life-cycle model, our conclusions may be different. If households have strong bequest motives, repealing the estate tax may have a non-trivial effect on saving decisions. (Castaneda et al., 2003, and Cagetti and DeNardi, 2003). For example, Cagetti and DeNardi (2003) find that eliminating the estate tax and replacing it with an increased labor income tax would raise GDP by .7 percent. Therefore, if bequest motives are very important, then the repeal of the estate tax is potentially a good idea.

In the above analysis, our conclusions differed dramatically depending on whether we used the simple life-cycle model or one that assumes a bequest motive. This indicates that understanding bequest motives is important to making policy decisions. An important first step for determining the strength of the bequest motive is to determine whether individuals decumulate or run down assets at the end of their lives. The absence of asset decumulation is potential evidence that bequest motives are important. The goal of this article is to provide new evidence on the extent to which households run down their assets near the end of the life cycle. Using data from Assets and Health Dynamics of the Oldest Old (AHEAD), we document asset growth at each age for members of different cohorts. This allows us to consider the quantitative importance of the asset decumulation puzzle.

There are several econometric problems with the existing evidence on asset run-down. We discuss these problems, as well as our approach to overcoming them. We find that whereas the usual approach for documenting asset run-down at the end of the life cycle shows some evidence of run-down, correcting for some important econometric problems removes almost all traces of asset run-down.

Asset run-down as predicted by the life-cycle model

In this section, we briefly describe the amount of asset run-down that we would expect to see if people behaved according to the life-cycle model. We calibrate a simple life-cycle model, as described in appendix A. Individuals in the model make consumption and saving decisions depending on their current assets, their perceived income and medical expenses in the future, how long they expect to live, and whether they have a bequest motive.

A model can not tell us what causes people to save. However, it can help us to frame the questions we need to ask in order to understand the causes of savings. A model that is calibrated to the data can also illuminate the likely causes of why individuals run down their assets so slowly. In this section, we provide evidence that uncertain life expectancy, uncertain medical expenses, and bequest motives are all potentially important savings incentives at the end of the life cycle.

We begin with the simplest version of the model, then move to more complex models. First, we present the case where individuals face no medical expense risk, have no bequest motive, and are certain to live 12 years, which is the average life expectancy for a man aged 70.

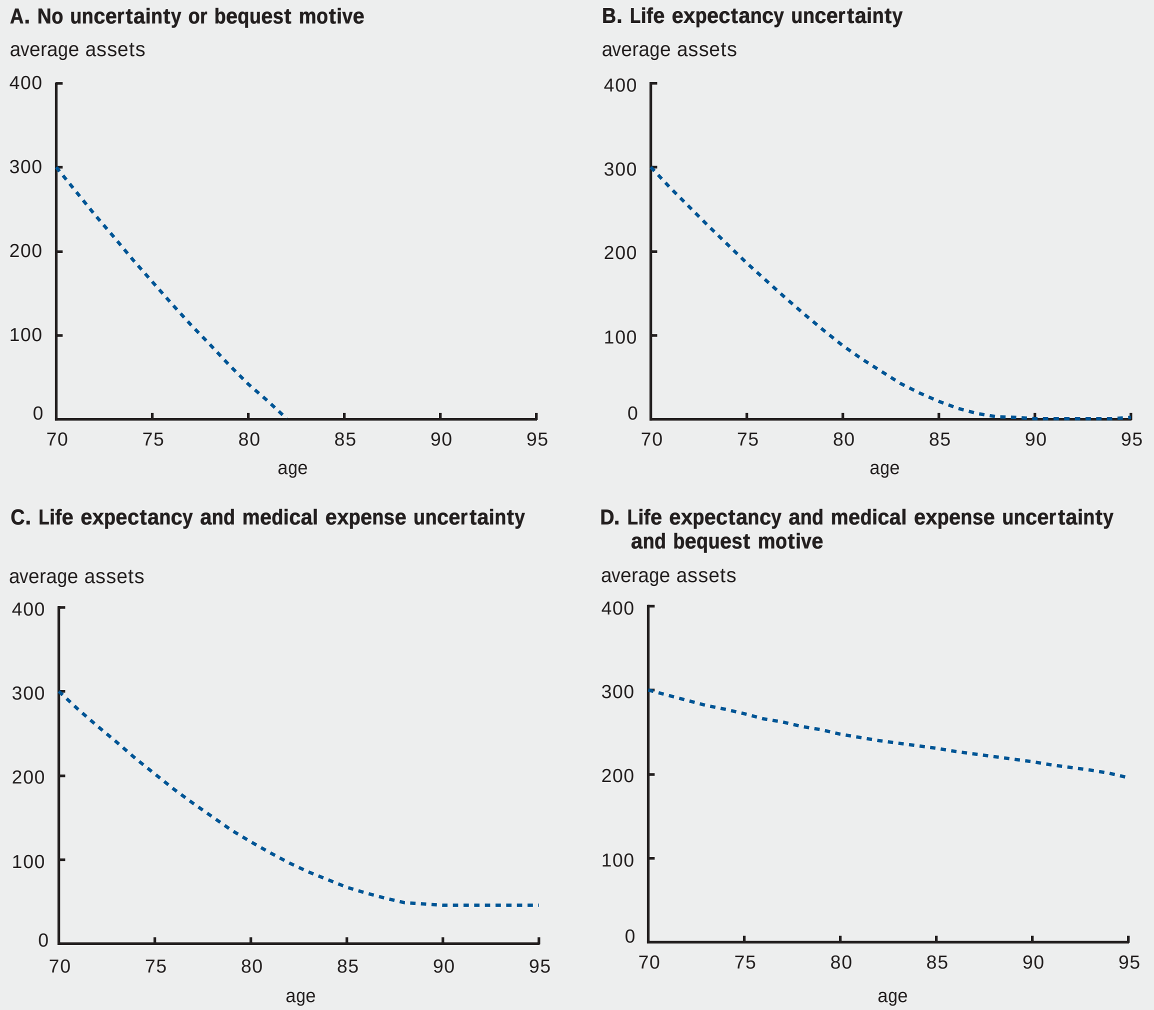
Panel A of figure 1 presents the asset profile implied by this model and highlights its key implication—Assets at age 82, the age of certain death, are equal to zero. This implication of the life-cycle model is at odds with the data, as we describe below.

Panel B of figure 1 presents the asset profile implied by a model augmented to include mortality risk. Life expectancy is still 12 years, but there exists the possibility of living much longer.[6] Panel B shows that individuals run down their assets much more slowly when the model is augmented to account for uncertain life expectancy. Because individuals are risk averse, they do not wish to outlive their financial resources. By holding assets until a very old age, they insure themselves against the risk of outliving their financial resources. Nevertheless, the model still predicts that by age 95, assets are near zero. Conditional on being age 70, there is only a 4 percent chance of surviving to age 95. Moreover, two annual mortality rates exceed 20 percent by age 95. Therefore, this model predicts that individuals would bear the risk of low consumption at age 95 in the event that they survive to that age. However, as we show below, this does not fit what is actually observed; many people still hold considerable levels of assets, even at age 95. Therefore, it seems that uncertain life expectancy alone cannot explain the slow rate of asset decumulation we observe in the data.[7]

The risk of catastrophic out-of pocket medical expenses also helps explain the absence of asset run-down. Even in the presence of social insurance (Medicare and Medicaid), households still face potentially substantial out of-pocket medical expenses (see French

FIGURE 1

Asset profiles



and Jones, 2004b; Palumbo, 1999; and Feenberg and Skinner, 1994). Moreover, nursing home expenses are potentially large and virtually uninsurable. French and Jones (2004b) find that in any given year, 1 percent of all households incur a medical expense shock that costs $44,000 over their lifetimes and .1 percent of all households incur a medical expense shock that costs $125,000 over their lifetimes. The risk of incurring such expenses repeatedly could financially decimate a household; this could cause a household to keep a large amount of assets in order to buffer itself against the possibility of catastrophic medical expenses. Therefore, the risk of catastrophic medical expenses might generate precautionary savings on top of those accumulated against the risk of living a very long life. Panel C of figure 1 presents the asset profile implied by a model augmented to include medical expenses, as well as mortality risk. It shows that individuals run down their assets much more slowly when faced with medical expense risk. Nevertheless, they still run down their assets much more quickly than we see in the data.[8]

Lastly, panel D of figure 1 presents the asset profiles implied by a model augmented to include a bequest function, as well as medical expenses and mortality risk. Unsurprisingly, asset run-down at the end of the life cycle is even slower when we augment to the model to include a bequest function. In short, uncertain life expectancy, uncertain medical expenses, and bequest motives all potentially play a part in asset run-down. Therefore, while a relatively slow rate of asset run-down is not necessarily *evidence* of a bequest motive, it is consistent with a bequest motive.

Data

In order to estimate the extent of asset run-down, we use data from the Asset and Health Dynamics Among the Oldest Old (AHEAD) dataset. The AHEAD is a sample of non-institutionalized individuals, aged 70 or older in 1993. A total of 8,222 individuals in 6,047 households were interviewed for the AHEAD survey in 1993. These individuals were interviewed again in 1995, 1998, and 2000. The AHEAD data include a nationally representative core sample, as well as additional samples of blacks, Hispanics, and Florida residents.

The AHEAD has information on the value of housing and real estate, autos, liquid assets (which include money market accounts, savings accounts, and Treasury bills), IRAs (individual retirement accounts), Keogh plans, stocks, the value of a farm or business, mutual funds, bonds, and "other" assets and investment trusts less mortgages and other debts. However, we do not include pension and Social Security wealth in order to maintain comparability with other studies (for example, Hurd, 1989, and Attanasio and Hoynes, 2000).

There are two important problems with our asset data. The first is that the wealthy tend to underreport their wealth in virtually all household surveys (Davies and Shorrocks, 2000). This will lead us to understate asset levels at all ages. However, Juster et al. (1999) show that the wealth distribution of the AHEAD matches up well with aggregate values for all but the richest 1 percent of households. A second important problem with our data is that it spans the years 1993 to 2000, a period in which there was a rapid rise in asset prices. This makes it difficult for us to distinguish between intended asset growth through active saving versus unintended asset growth though unexpectedly high asset returns.

There are also several econometric problems common to all panel data. Perhaps most importantly, the panel data suffer from attrition. In other words, people leave the sample over time. Interviewers make serious efforts to repeatedly interview the same individuals over time, but they are not always successful. There are many reasons for attrition in panel data. In the AHEAD survey, attrition is largely due to death. This information is recorded, and reported deaths are confirmed using the National Death Index. However, in some cases, interviewers are unable to track down sample members as they move homes, and some individuals refuse to give interviews.

This attrition raises two problems. First, those who leave the sample may be different from those who remain in the sample for systematic reasons. For example, wealthy individuals may not wish to report their wealth and refuse to be interviewed. Second, it is difficult to know whether an individual who leaves the sample is still alive. Individuals who cannot be contacted may have moved, but they also may be dead. Once again, this will cause problems if the people who are difficult to contact differ systematically from those we are able to keep track of. If, for example, it is relatively difficult to track down poor individuals who die, then we will potentially understate mortality rates for relatively poor people. Nevertheless, we find that, of 5,992 households, representing 23,053 household-year observations, only 502 leave the survey for reasons other than death versus 1,930 who die during the survey period. Removing those who leave for reasons other than death leaves us with a sample of 5,490 households, representing 20,527 household-year observations. Therefore, we view attrition for reasons other than death as a minor problem.

Another problem with the data is that the questions changed and became more comprehensive as time went by. Moreover, as respondents developed greater trust in the survey, they appeared to become more willing to report truthfully. As a result, much of the increase in assets over time, especially between 1993 and 1995, should be viewed with some skepticism. Table 1 shows average reported assets in each wave, by type of asset. Note that both reported business wealth and stock market wealth more than double between 1993 and 1995. Although asset prices grew quickly over this time period (see figure 5 on p. 47), they averaged less than 15 percent growth per year. This makes the wave 1 values of stock and business wealth appear especially suspicious.

Life-cycle asset profiles in the cross-section

Given that most studies use cross-sectional data to estimate the life-cycle profile of assets, we begin by repeating this exercise. By initially replicating the results of other studies, we can infer whether our results differ from previous results because we use different data or because we use different estimation techniques. Figure 2 shows mean household assets, by five-year age groups of the head of household, starting with age 70–74 and ending at 90–94, from the 1993, 1995, 1998, and 2000 waves of the AHEAD.

There are several things that we can note from figure 2. First, later cross-sections show higher assets than earlier cross-sections at each age. For example, at age 75–79 the 1993 cross-section shows assets equal to $210,000, the 1995 cross-section shows assets equal to $290,000, the 1998 cross-section shows assets equal to $300,000, and the 2000 cross-section shows assets equal to $400,000. Second, figure 2 shows some evidence that assets decline with age in each

TABLE 1

Mean assets, by year and asset category

	1993	1995	1998	2000
Housing	$88,217	$94,092	$95,423	$114,559
Liquid assets	33,288	53,874	52,844	51,299
Stocks	22,012	53,496	55,870	67,485
Autos	6,634	5,759	5,726	6,646
Businesses	3,907	8,270	10,847	9,923
IRAs	6,491	9,046	11,397	12,532
Trusts	34,343	37,148	46,060	79,582
Other assets	2,404	4,086	5,044	4,752
Total debt	3,090	3,393	3,942	3,540
Total assets	194,207	262,378	279,269	343,239
Number of observations	4,694	4,174	3,318	2,704

cross-section. The 1993 asset profile shows assets declining from $240,000 at age 70–74 to $100,000 at age 90–94. Asset profiles for other years also show rapid declines in assets between ages 70 and 94.

Because the distribution of assets is skewed (that is, a small number of households have very high assets), mean assets can give a misleading depiction of the asset distribution at each age. Nevertheless, median and mean asset profiles have similar shapes. For example, in 1993 median assets were $110,000 for households aged 70–74 and only $30,000 for households aged 90–94. These results suggest that assets do decline with age. Recall, however, that those who are 90–94 in a given year were born 20 years earlier than those aged 70–74 in the same year, and thus had lower lifetime income.

In the past, cross-sectional data were used to infer life-cycle saving decisions because of a lack of data. Until recently, panel data on wealth were not available, so most analyses of the life cycle were based on single cross-sections by necessity (see Hurd, 1990, who mentions the rare exceptions). Below, we discuss some of the problems associated with using a cross-sectional profile to infer the evolution of wealth over the life cycle.

Estimation issues

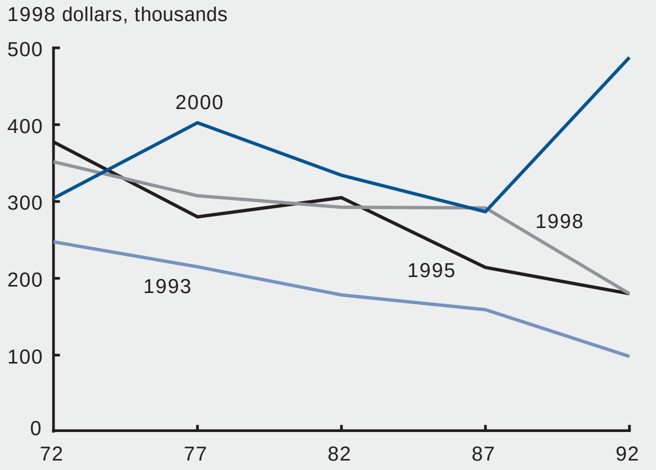
We estimate life-cycle asset profiles of households. However, there are three main problems with the estimation of life-cycle asset profiles. Below, we discuss these problems, as well as our approach to dealing with them.

First, in cross-sectional data we observe individuals who were born at different times (that is, older people were born in earlier years than younger people). Households from older cohorts have on average lower real lifetime earnings than households from younger cohorts. Thus, we would expect the asset levels of households in older cohorts to be lower than those of younger cohorts in any given year. Therefore, comparing older households with younger households leads the econometrician to overstate assets when young and to understate assets when old when looking at a particular year. In other words, this will potentially lead the econometrician to infer that individuals run down their assets near the end of their lives when this is not actually the case.

Figure 3 helps quantify this point. It shows the level of real per capita income in the United States over the 1950–2002 period. Income per capita is indexed to 100 in 1950. Figure 3 shows that in most years, income per capita increases, averaging 1.7 percent growth over the sample period. Therefore, two cohorts born

FIGURE 2

Mean assets, by wave and age of head of household



Sources: AHEAD data and authors' calculations.

20 years apart tend to have lifetime incomes that are different by a factor of $1.017^{20} = 1.40$. In other words, members of the cohort that were age 70–74 in 1993 are likely to have average lifetime incomes that are 40 percent higher than those of the cohort that were 90–94 in 1993.

A second econometric problem occurs because people with lower income and wealth tend to die at younger ages than richer people. Therefore, the average survivor in a cohort has higher assets than the average deceased member of the cohort. As a result, "mortality bias" leads the econometrician to overstate the average lifetime income of members of a cohort. This bias is more severe at older ages, when a greater share of the cohort members are dead. With cross-sectional data, the econometrician is forced to treat the level of assets of surviving (and, on average, higher-asset) members as indicative of the entire cohort, had all members survived. This leads the econometrician to increasingly overstate assets as individuals age.

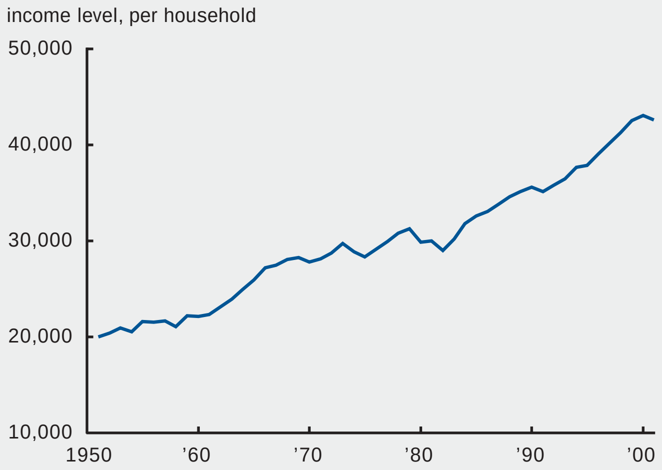
One way to ascertain whether mortality bias will be an issue is to look at probability of death at each age, conditional on wealth. We made predictions by regressing an indicator for whether the respondent died on a polynomial in age, a polynomial in the respondent's percentile in the wealth distribution, and interactions of age and percentile in the wealth distribution. Figure 4 shows this statistic for women and men in our sample. It shows that, conditional upon age, those with low wealth are more likely to die than those with high wealth. For example, in our sample, the average probability of death for men at age 80 in 1993 is 8.0 percent.[9] However, the probability of death for men who are at the 80th percentile of the wealth distribution is 7.0 percent, whereas the probability of death for men whose wealth is at the 20th percentile of the wealth distribution is 10.1 percent. Conditional on being alive at age 70, life expectancy is 14.2 years at the 80th percentile of the wealth distribution and 11.5 years at the 20th percentile. These differences in mortality across wealth quartiles are smaller than differences reported in Attanasio and Hoynes (2000), who use data from the Survey of Income and Program Participation. They report that those in the bottom quartile of the wealth distribution have mortality rates over double the rates of those in the top quartile of the distribution.

We solve both of these problems by using panel data, which allows us to track the same households over time. Our profiles are estimated using the growth rate of assets for surviving households in different years. Because we are tracking the same households over time, we are obviously tracking members of the same cohort over time. Because we estimate growth rates for surviving households, our estimates do not suffer from mortality bias. Next, we detail these procedures.

While tracking the same households over time solves the two problems discussed above, it also makes another more serious problem. Asset growth of a household not only represents anticipated asset growth through savings, but also unanticipated asset growth. Over our sample period, there are large shocks to the rate of return on savings, primarily due to the run-up in the stock market.

FIGURE 3

Real income per capita, 1950–2002



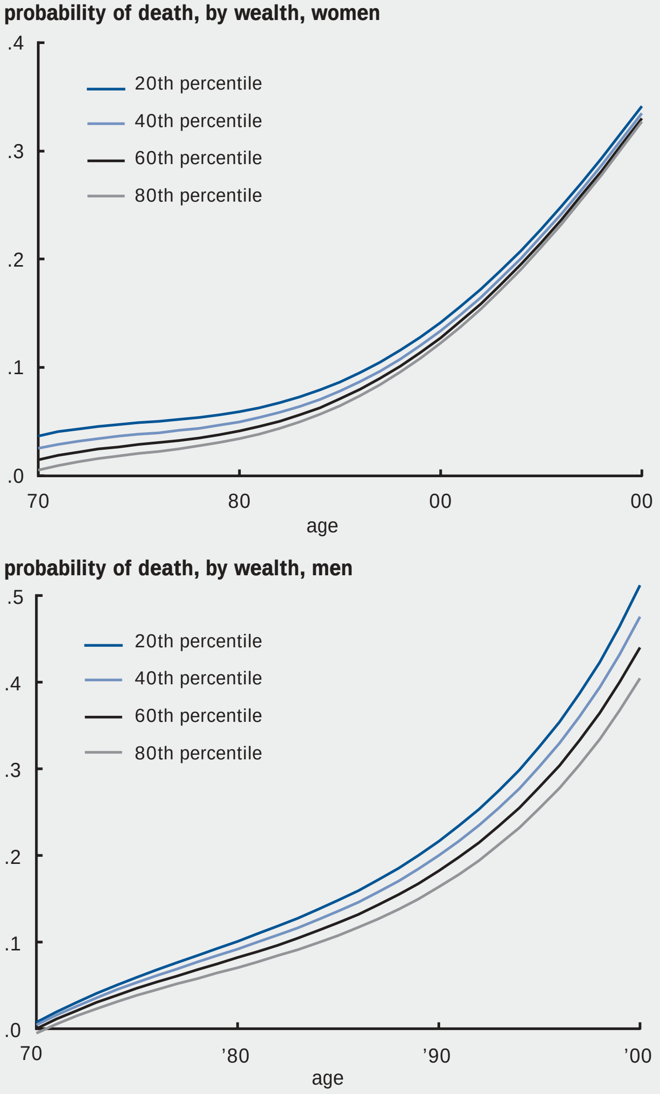
Source: U.S. Bureau of Labor Statistics data from Haver Analytics.

Figure 5 shows growth in the stock market. Specifically, it shows the dollar value of a broad portfolio of stocks invested in 1950 (as measured by the Center for Research in Security Prices data or CRSP). The CRSP stock market index measures the growth of a portfolio of stocks that includes all stocks in the NYSE, AMEX, and NASDAQ indices. It is a broader measure of stock prices than the S&P 500 or the Wilshire 5000 index. Figure 5 shows that stocks grew at a much faster rate over the 1993–2000 period than during the previous 40 years. For example, the CRSP index grew at an average annual rate of 14.9 percent over the 1993–2000 period, compared with only 9.4 percent over the 1950–92 period.

Figure 6 shows growth in the housing market, based on the dollar value of a home purchased in 1950. For growth

FIGURE 4

Mortality probabilities, by wealth quartile



Sources: AHEAD data and authors' calculations.

rates between 1950 and 1971, data are from the price index for private residential investment divided by the price index for all personal consumption expenditures, as measured in the National Income and Product accounts. For housing price growth after 1971, data are the price series from the Conventional Mortgage Home Price Index from the Office of Federal Housing Enterprise Oversight, which is a price index of single family homes.[10]

Figure 6 shows that housing prices grew much more rapidly over the 1993–2000 sample period than over the previous 40 years; prices grew 2.3 percent over the 1993–2000 period, versus .8 percent over the 1971–92 period.

Table 1 shows that in our AHEAD sample, 28 percent of household wealth is held in stocks, either directly or through IRAs (Cheng and French, 2000, find that 60 percent of all IRA wealth was held in stocks during our sample period and we assume that 50 percent of all wealth in trusts are in stock market wealth). Another 36 percent of wealth is held in housing. Much of the remainder of household wealth is held in assets that likely did not grow very much over the sample period, such as short-term bonds.

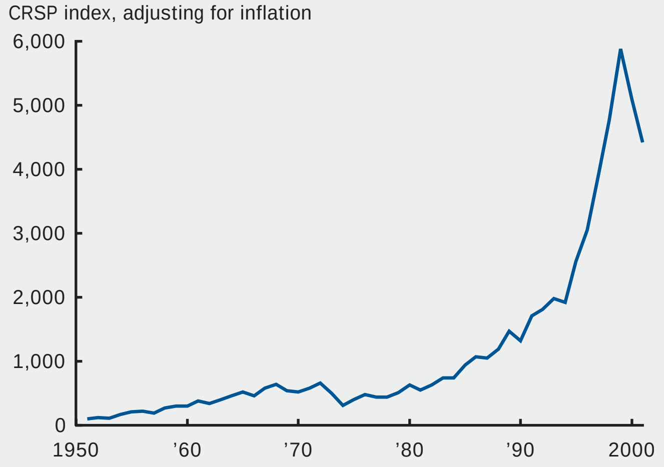
Life-cycle asset profiles

Panel A of figure 7 (p. 48) presents estimates of the life-cycle asset profile for five different five-year birth cohorts using both fixed-effects and ordinary least squares (OLS) (we detail our estimation methods in box 1 on p. 49). Consider the OLS estimates first. These life-cycle profiles are for the cohorts aged from 70–74 through 90–94 in 1993. Because the OLS estimator of assets at each age is merely the sample mean, it is unsurprising that the 1993 value of mean assets for each cohort reported in the panel A of figure 7 is roughly the same as the mean assets from the 1993 cross-section of assets reported in figure 2. Note that in 1993, mean household wealth was $283,000 for those aged 70–74, $230,000 for those 75–79, $191,000 for those 80–84, $163,000 for those 85–89, and $100,000 for those 90–94. In other words, wealth of the oldest cohort was 64 percent lower than wealth of the youngest cohort in 1993. One could argue that this is evidence of asset run-down within households (Hurd, 1990). Recall, however, that households aged 90–94 in 1993 were born 20 years earlier than households aged 70–74 in 1993. If aggregate income grows 1.7 percent per year, then the lifetime income of the oldest cohort is 34 percent lower than for the youngest cohort. Therefore, the fact that the 1993 wealth level is 65 percent lower for the 90–94 cohort relative to the 70–75 cohort is evidence of only a minor run-down in assets.

When tracking assets of households within a cohort, note the rapid increases in assets over the length of the panel. For example, assets increase about 37

FIGURE 5

Stock prices, 1950–2002



Source: Center for Research in Security Prices.

percent between 1993 and 2000 for the cohort aged 70–74 in 1993. Although one could argue that this is evidence that wealthy households intentionally increase their wealth, recall that asset prices increased rapidly over the sample period. Recall that stock price growth was 7 percent above its average over the 1950–1992 period and housing price growth was 1.5 percent above its average for the 1971–1992 period. If individuals expected average asset price growth over the seven years of the 1993–2000 period, their stock market wealth would be (1.055)7 –1 = 45% higher than anticipated and their housing wealth would be (1.015)7 – 1 = 11% higher than anticipated.[11] Given that 28 percent of household wealth is held in stocks and 36 percent in housing, household wealth was approximately (.28 × .45 + .36 × .11) = 17% higher than anticipated. Therefore, much (but not all) of the apparent run-up in assets results from the run-up in asset prices.

Next, consider the fixed-effects profiles. Fixed-effects profiles show less asset growth with age. If no members of the sample left the survey for death or other reasons, OLS and fixed-effects would produce the same results as fixed effects. However, because sample members die, the two profiles are different, especially for the older cohorts with higher mortality rates. Because the fixed-effects estimator estimates asset growth for the same households, it does not suffer from mortality bias.[12]

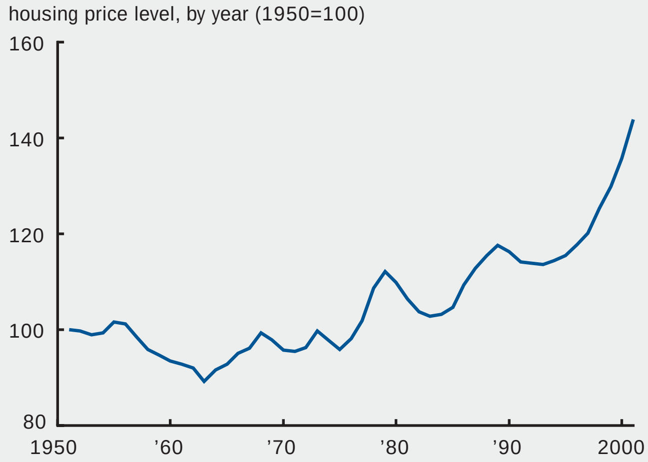
Although fixed-effects estimates indicate slower asset growth than OLS, they still show increases in assets with age, indicating that the same sample members had significant run-ups in assets during the sample period. The question remains, however, whether these run-ups in assets were anticipated. Because the sample period was 1993–2000 and the fixed-effects profiles track asset growth over the sample period, the fixed-effects profiles still suffer from mixing anticipated asset gains with unanticipated asset gains from the stock market, as mentioned earlier.

Additionally, the wealth profiles presented above mix the asset growth of different types of households. Panel B of figure 7 shows that for households with both a husband and a wife present in wave 1 (that is, in 1993), asset growth was even more rapid than for the full sample. Panels C and D of figure 7 show that for single women and men in wave 1, respectively, there is very little evidence of asset run-up over the sample period. Hurd (1990) also finds more evidence of asset run-down by singles than couples.

There are three possible reasons the asset profiles of these three groups differ. First, asset compositions may be different across household types. However, the differences turn out to be fairly small. For example, both couples and single women have 23 percent of

FIGURE 6

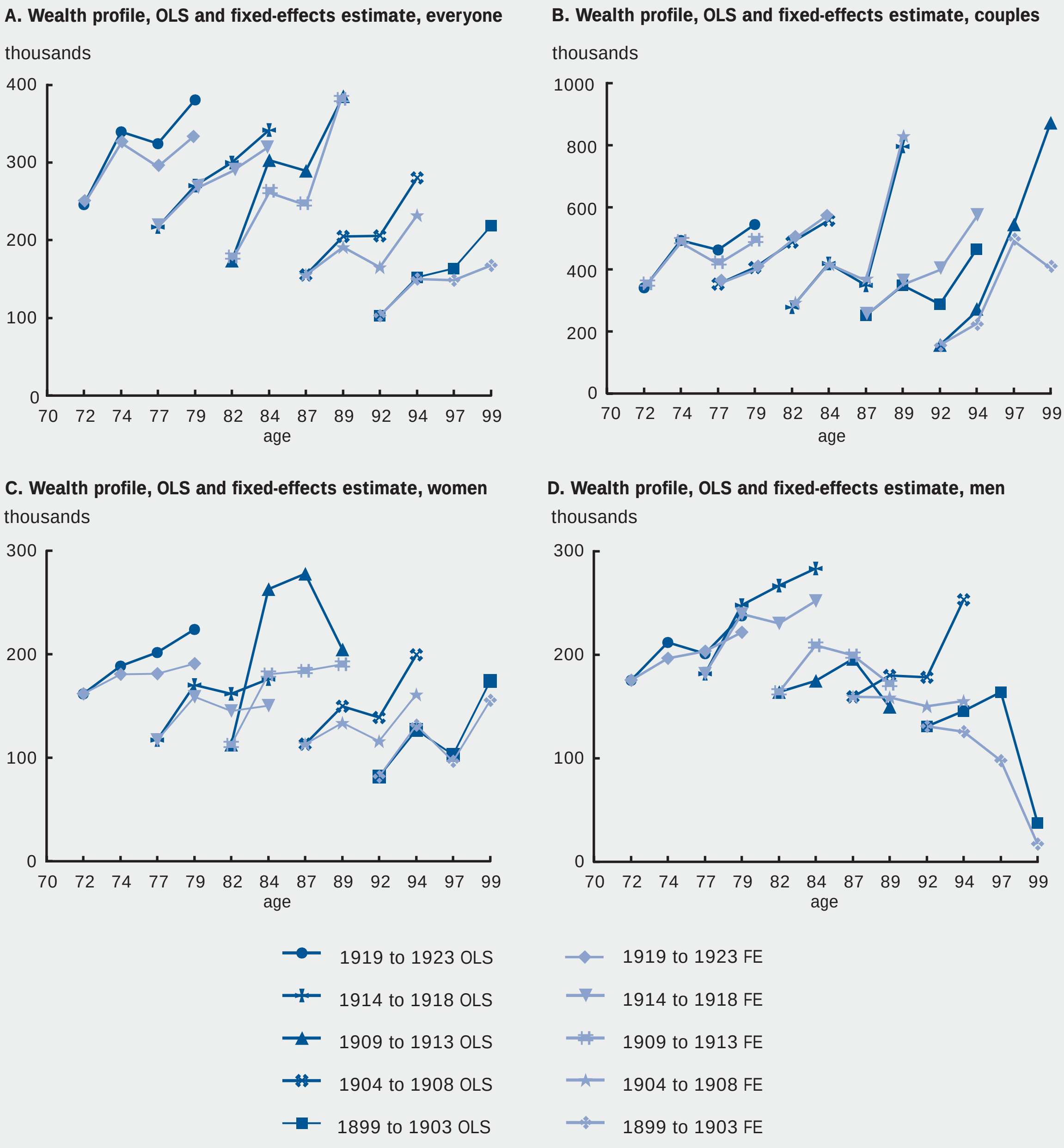
Housing prices, 1950–2002



Source: Office of Federal Housing Enterprise data from Haver Analytics.

FIGURE 7

Average assets, by age and cohort



Sources: AHEAD data and authors' calculations.

their assets in stocks, and single men have 18 percent of their assets in stocks. Therefore, couples benefited only slightly more from the run-up in the stock market than did singles. A second possible explanation is that singles are less likely to have children than couples (although there are many singles who were previously married in our sample) and are less likely to have a strong bequest motive. Third, it may be that couples have stronger life-cycle savings motives than singles. Married individuals tend to live longer than singles. We leave a deeper understanding of these differences for future research.

BOX 1

Statistical methods

In the section, "Life-cycle asset profiles," we provide estimates of expected wealth at each age given that the individual was observed in the initial period. We do this using both OLS and fixed-effects estimators. This box discusses the difference between the two estimators. Specifically, we show that using fixed-effects estimators overcomes the mortality bias problem, where the OLS estimator does not.

Consider a set of individuals referenced by $i \in \{1, ..., I\}$ who were born in 1923 (in practice, we use five-year cohorts, one being born 1919–23). As we described earlier, we observe these individuals in 1993, 1995, 1998, and 2000. Therefore, we observe members of this cohort at age 70, 72, 75, and 77. We denote their age by $a \in \{70, 72, ..., A\}$, where $A = 77$. Assets of a particular individual at a certain age, denoted A_{ia}, are determined by the following function:

1) $$A_{ia} = f_i + \beta(a) + u_{ia},$$

where f_i is the individual's fixed effect, which includes all age-invariant factors, u_{ia} is a residual, and $\beta(a)$ is a function of a. We wish to estimate the function $\beta(a)$ which measures how assets change as individuals age. The results from the section on asset run-down in the life-cycle model indicate that understanding $\beta(a)$ will help us better understand savings motives after retirement. We estimate the function using a full set of dummy variables, that is,

2) $$\beta(a) = \sum_{age=72}^{A} \beta_{age} \times 1\{a = age\},$$

where $\{\beta_{age}\}_{age=72}^{A}$ represents[1] a vector of parameters to estimate and the 0-1 indicator function $1\{.\}$ returns 1 when the statement in parentheses is true and returns 0 otherwise.

The fixed effect f_i and the residual u_{ia} merit further discussion. The fixed effect captures objects such as lifetime earnings. Individuals with high lifetime earnings likely have high wealth at every age.

The residual captures variation in wealth arising from short-term contingencies, such as medical expenses. It also captures the difference between the true level of assets and reported assets, that is, it is possibly measurement error.

We are interested in obtaining consistent estimates of the parameter vector $\{\beta_{age}\}$. However, OLS estimates of the regression

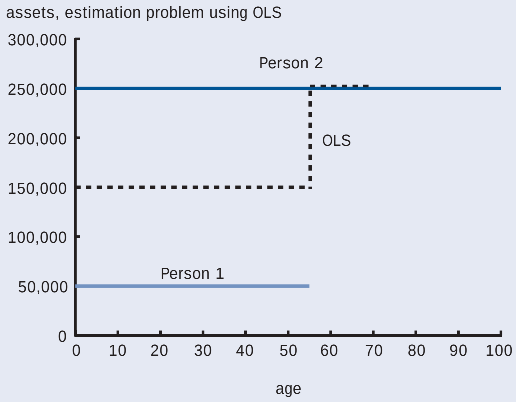
3) $$A_{ia} = f + \sum_{age=72} \beta_{age} \times 1\{a = age\} + e_{ia}$$

will not yield consistent estimates $\{\beta_{age}\}$.

To see the problem with OLS and how fixed effects circumvents this problem, consider figure B1. It shows wealth profiles of two households. The first household has \$250,000 in every year. The second household has \$50,000 in every year until death, at age T. In the notation above, $f_1 = \$250{,}000$, $f_2 = \$50{,}000$, $\beta_{age} = 0$ for all ages, and $u_{1a} = u_{2a} = 0$ for all ages.

FIGURE B1

OLS estimators



The OLS estimator estimates average assets at each age. When both households are alive, average assets are \$150,000. When only the wealthy household is alive (after age T), average assets are \$250,000. Therefore, the OLS estimator infers that average assets jump at age T. While assets did rise at this age, they did not rise for any individual.

The fixed-effects estimator, on the other hand, infers whether assets rise relative to the fixed effect (f_i). The fixed effects estimator correctly infers that assets do not rise at any age for individual i and thus $\beta_{age} = 0$ at all ages. We give a more technical discussion in appendix B.

[1]Because we have a fixed-effect for each household, the age 70 coefficient is captured in the intercept term f_i because the age 70 wealth level is just the average fixed effect for individuals age 70.

Conclusion

A key implication of the simplest version of the life-cycle model is that assets are run down as individuals near death. This article presents new evidence on the lack of asset run-down at the end of the life cycle. We show that assets decline with age when observing different individuals at different ages at a single point in time. However, the younger individuals in the sample, who were born more recently, are likely to have higher income and wealth at every age. When looking at a single point in time, this leads to an overstatement of wealth when young and thus overstates the extent to which assets decline with age. We also show that wealth rises with age when tracking the same individuals as they age. Because we track households over the 1993–2000 period, we observe individuals in 1993 and the same individuals seven years later, in 2000. Although we can measure the asset growth of the exact same people, we do not know whether assets grew because of intentional savings decisions or because of the run-up in the stock market over this period. We are partly able to resolve these discrepancies. When we make some simple adjustments, we find little evidence that people intend to either increase or decrease their assets near the end of their lives. We take this as evidence against the simplest versions of the life-cycle model. We also show that our results fit better with versions of the life-cycle model that are augmented to include life expectancy and medical expense uncertainty as well as bequest motives.

APPENDIX A: A MATHEMATICAL REPRESENTATION OF THE LIFE-CYCLE MODEL

In order to fix ideas about the life-cycle model, we discuss a parameterized mathematical model of how individuals consume and save over their lives. In figure 1 (p. 42), we show the implied consumption and wealth profiles for a given initial value of wealth and for income over the life cycle. As in the introduction, assume that there is no uncertainty about income, or medical expenses, although we will allow for uncertainty about age of death. The model is similar to that of Palumbo (1999), although it also allows for a bequest function, as in Hurd (1990).

Specifically, consider a household head seeking to maximize his expected lifetime utility at age $t = 70, 71, 72, \ldots$. Each period that he lives, the individual receives utility, U_t, from consumption, C_t. Furthermore, assume that his preferences are of the constant relative risk aversion form, so that $U_t = \frac{(C_t)^{1-\gamma}}{1-\gamma}$. The parameter γ is called the coefficient of relative risk aversion. The greater the value of γ, the more risk averse the individual. Most estimates of γ are between 1 and 5. A value of γ equal to 1 implies that an individual would be indifferent between consuming $14,140 this year or consumption determined by the following lottery: with probability 1/2 consume $10,000 this year and with probability 1/2 consume $20,000. Note that this lottery has an expected payout of 1/2 × $10,000 + 1/2 × $20,000 = $15,000. If the individual has a coefficient of relative risk aversion of 5, an individual would be indifferent between consuming $11,700 this year or consumption determined by the lottery described above. In other words, the greater the value of γ, the greater the amount the individual is willing to pay to avoid the risk associated with a lottery.

When he dies, he values bequests of assets, A_t, according to a constant relative risk aversion bequest function $b(A_t) = \theta_B \frac{(C_t)^{1-\gamma}}{1-\gamma}$. The greater the value of θ_B, the stronger the bequest motive. We know very little about this parameter.

Let s_t denote the probability of being alive at age t conditional on being alive at age $t-1$, and let $S(j,t) = (1/s_t)\prod_{k=t}^{j} s_k$ denote the probability of living to age $j \geq t$, conditional on being alive at age t. Let $T = 95$ denote the terminal period, so that $s_{T+1} = 0$.

We assume that preferences take the form

$$4)\quad U(C_t) + E_t\left(\sum_{j=t+1}^{T+1} \beta^{j-t} S(j-1,t)\left[s_j U(C_j) + (1-s_j) b(A_j)\right]\right),$$

where E_t is an expectations operator and β is the time discount factor. The smaller the value of β, the more individuals discount the future relative to the present. Most estimates of β are between .95 and 1.

Furthermore, assume that individuals have the following asset accumulation equation:

$$5)\quad A_{t+1} = (1 + r)(A_t + Y_t - m_t - C_t),\ A_{t+1} \geq 0,$$

where r is the interest rate, Y_t is income, and m_t denotes medical expenses. Assets must always be non-negative in all periods.[1] In this article we present simulations from this model.

When presenting profiles implied by the model, we consider a value of γ equal to 3 and β equal to .95. Throughout the article, we assume that assets in the bank receive a 4 percent rate of interest. Initial assets at age 70 are $300,000 (which is close to the mean for our sample), income at each age is $20,000 (which is close to the mean in our sample).

[1]If the non-negativity constraint on assets implies consumption below $5,000 (which is a conservative estimate of the SSI, housing, and Medicaid benefits the elderly can receive), we set consumption equal to $5,000. See French and Jones (2004a) for more on this.

APPENDIX B: WHY OLS WILL NOT YIELD CONSISTENT ESTIMATES, BUT FIXED EFFECTS WILL: A TECHNICAL DISCUSSION

To understand why OLS is unlikely to produce consistent estimates, consider the "true" model in equations 1 and 2 as well as the OLS estimator in equation 3 (in box 1). Note that $e_{ia} = f_i + u_{ia} - f$. Recall that those with above average values of wealth (an above average value of f_i) are likely to live longer than average. As a result, $E[(f_i - f)1\{a = age\}] > 0$ for a large value of a (that is, at older ages), which will result in $\{\beta_{age}\}$ being biased upwards for a large value of a. We obtain consistent estimates of $\{\beta_{age}\}$ only if $E[e_{ia} \times 1\{a = age\}] = 0$.

By de-meaning the data, however, we can overcome this problem. Specifically, we estimate the regression:

$$6)\quad A_{ia} - \overline{A}_i = f_i - \overline{f}_i + \sum_{age} \beta_{age} \times 1\{a = age\} - \left[\overline{\sum_{age} \beta_{age} \times 1\{a = age\}}\right] + u_{ia} - \overline{u}_i\ ,$$

where $\overline{A}_i = \frac{1}{A}\sum A_{ia}$, $\overline{f}_i = \frac{1}{A}\sum f_i$, and so on. Note that $f_i - \overline{f}_i = 0$. If $E[u_{ia} \times 1\{a = age\}] = 0$, then $E\left(1\{a = age\} - \left[\overline{\sum_{age} \beta_{age} \times 1\{a = age\}}\right]\right)\left(u_{ia} - \overline{u}_i\right) = 0$, and we will obtain consistent estimates. We discuss the plausibility of this assumption in the text.

When predicting assets using the fixed effects estimator, we use the average fixed effect of the cohort members observed in 1970.

NOTES

[1]In the simplest life-cycle model, the assumptions are that individuals know their future income, medical expenses, and health status, and that individuals have constant relative risk aversion preferences.

[2]If individuals are certain of all future events, then whether consumption is increasing or decreasing over the life cycle depends on only two things: the discount rate and the rate of interest. First, if individuals are very impatient (have a high discount rate), then they will consume more in the present, less in the future. Second, if the market rate of interest is high, then individuals will have an incentive to save money, consuming less in the present, more in the future.

[3]There are several other facts that the simplest version of the life cycle cannot explain. For example, the distribution of wealth is much more skewed than the distribution of income (Díaz-Giménez et al., 1997). Also, the saving rate of people with higher lifetime income is much higher than the one of people with lower levels of lifetime income (Dynan et al., 1996).

[4]Under this law, the estate tax will be re-imposed in 2011.

[5]Assuming no bequest motive and uncertain mortality, and holding income taxes constant, repealing estate taxes might reduce savings levels and thus output. The intuition behind this is that children of the deceased might reduce savings rates given that they can finance retirement with assets that their parents leave behind to hedge against extended life. This would, in turn, reduce aggregate savings and thus capital.

[6]Survivor probabilities are taken from U.S. life tables.

[7]Hurd (1989) argues that uncertain life expectancy can explain the slow rate of asset run-down in his data from the Retirement History Survey.

[8]However, we found that medical expense risk could generate a large amount of savings for some parameter of the model. For example in results not reported, we found that the importance of medical expenses depends critically upon the extent to which the government provides insurance against catastrophic medical expenses through what we refer to as "consumption floors." Consumption floors are meant to capture social insurance schemes such as Medicaid, Supplemental Security Income (SSI), and food stamps. Results presented are for the case when we set the consumption floor to $5,000. Given that Medicaid covers virtually all medical expenses, and SSI provides income to individuals who have low income and assets, we believe that this is a conservative value for the consumption floor. For example, SSI benefits are $9,480 per year in California and $7,200 in Nevada. Nevertheless, lowering the consumption floor to $100 produces much higher savings rates. Also, higher levels of risk aversion produce higher levels of savings.

[9]In the life tables for the U.S., the corresponding probability of death at age 80 is 8.6 percent. This discrepancy is possibly due to the fact that the core sample in the AHEAD was not in a nursing home in 1993. Therefore, the AHEAD sample is healthier than the U.S. population.

[10]The main difference between the two measures is in the controls for the quality of the home. The quality of homes has changed over time as different amenities become available for homes. Some features on homes, such as intercom service, were not available 50 years ago. Therefore, comparing average home price from year to year provides a misleading picture of housing price appreciation. The price index for private residential investment measures the price of new homes. Adjustments for changes in the quality of new homes is made using a hedonic adjustment. The other index is constructed using resale prices of the exact same homes whose mortgages are held or guaranteed by Fannie Mae or Freddie Mac. Although this approach overcomes the problems associated with hedonics, the approach still has problems. Most importantly, the approach does not account for home improvements. Moreover, these indices are available only back to 1971.

[11]This is assuming that the run-up in assets did not affect savings behavior.

[12]Shortly before death, assets may decline because of high medical expenses. Because of this, we may miss significant asset declines if they take place between the time that the individual is last interviewed and the date of death. This potentially leads us to understate asset declines before death. French and Jones (2004) and Hurd and Smith (2001) find that this problem is relatively minor. Using AHEAD data, Hurd and Smith find that medical expenses just before death are $4,200 and death expenses (such as burial expenses) are $4,300. Nevertheless, they find that the size of the estate is on average $36,000 less than the self-reported level of assets in the interview before death.

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