Forecasting Retirement Needs and Retirement Wealth

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Chapter 3
Projected Retirement Wealth and Saving Adequacy

James F. Moore and Olivia S. Mitchell

Future retirees will bear a larger responsibility for ensuring their own well-being in retirement, judging from projected social security system insolvency and the national shift from defined benefit to defined contribution private pension plans. Yet household saving rates in the United States have dropped from over 10 percent in the 1950s to around 3 percent in the first half of the 1990s (Gokhale et al. 1996). This discouraging pattern raises serious concerns about Americans' ability to maintain consumption levels in old age. They are underscored by a recent research controversy over whether workers are adequately prepared for retirement. A comparison of baby boomers' assets to those of their parents recently argued that saving for retirement is on track (CBO 1993). But, using a different benchmark, a recent study concluded that U.S. households were saving at only one-third the rate needed to fund a comfortable retirement (Bernheim 1992, 1994). The present work contributes to this debate by using the Health and Retirement Study to explore patterns of asset accumulation and saving shortfall among a cohort of older Americans. Our goals are to determine (1) how much retirement wealth older people on the verge of retirement actually have, and (2) how much more they would need to save if they wished to preserve consumption levels after retirement. Our research shows that the median older household is projected to have retirement wealth of approximately $400,000, yet will still need to save 16 percent of annual income to preserve pre-retirement consumption. This summary statistic conceals extraordinary heterogeneity in both assets and saving needs in the older population.

In what follows we first discuss the rationale for the replacement rate model and prior studies examining saving behavior. Next we describe wealth levels and composition for HRS households in 1992, and show how those wealth patterns would be expected to change at retirement ages of 62 and 65. These wealth measures are then converted to saving rates, which are then compared to optimal saving rates required to smooth lifetime consumption. A final section spells out implications.

Saving Patterns and Replacement Rates in a Life Cycle Model

Economic models of saving behavior rely on a life cycle model in which individuals are posited to maximize utility by smoothing consumption through time. In this framework, people are predicted to save when they have periods of relatively high income, and dip into accumulated savings or borrow when income is relatively low, including in retirement.[1] One recent study implementing an augmented life cycle model derived optimal saving rate paths using dynamic programming, in which the optimal saving path proves to increase with age up to retirement (Bernheim 1992).[2] Predicted saving rates are then compared with actual rates derived in empirical analysis of respondents. Bernheim concluded that workers in his sample saved at only one-third (35 percent) the prescribed rate that they should have been saving, if they sought to meet target consumption goals. However, this estimated shortfall omitted from people's wealth levels the value of their net housing wealth, on the argument that relatively few people liquidate their housing on retirement.[3] His calculations of saving shortfalls if housing assets are included in retirement wealth is somewhat lower—on the order of about 16 percent per year. The extent to which Bernheim's results are generalizable is unclear, however, because his sample is relatively small and better off than the average population. In addition he focuses on the typical saving pattern rather than examining the dispersion in saving shortfall, a topic of central interest below.

A different approach to the retirement saving question relies on a "replacement rate" approach. As we describe below, this methodology evaluates the ratio of household income needed to finance desired retirement consumption relative to annual pre-retirement income. The object here is to equate pre-retirement and post-retirement consumption on an expected value basis.[4] Recent work by Palmer (1988, 1991, 1993) uses several cross-section Consumer Expenditure Surveys to examine this issue, and concludes that gross replacement rates have varied over time depending on tax changes and household saving rates.

An invaluable dataset with which to explore older Americans' wealth positions as they near retirement is the Health and Retirement Study (HRS: see Chapter 1). This extensive questionnaire on wealth and income was addressed to a nationally representative sample of 7607 households in 1992, where at least one respondent was age 51 to 61.[5] Under certain restricted conditions, researchers may also access special files needed for measuring pension and social security wealth (described in more detail below). One other study using these data, Mitchell, Olson, and Steinmeier (this volume, hereafter MOS), explores expected present values of social security benefits for HRS respondents. A second analysis, by Gustman, Mitchell, Samwick, and Steinmeier (this volume, hereafter GMSS) examines both pension and social security wealth for these same households, using actual pension information and imputed or estimated social security data.

These two studies reveal that estimated median total household wealth for HRS respondents on the verge of retirement totaled approximately $340,000 in 1992 (with mean values of approximately half a million dollars). Total wealth depends on four components: net financial wealth, net housing equity, and the present value of expected pension and social security benefits. At face value, these wealth amounts would seem to indicate that the "average" HRS household is in relatively good shape for retirement. But Mitchell and Moore (this volume, hereafter MM) assess the adequacy of these asset accumulations, and suggest that the median older American family faces a substantial saving shortfall. Specifically, MM project anticipated wealth as of age 65 for a hypothetical median couple, and then compared this with the level of wealth needed to sustain the family's pre-retirement consumption derived from targets offered by Palmer (1994). The required saving rate needed to build assets to desired levels for this representative HRS household is quite high — 13–23 percent of gross income per year in the decade leading up to retirement. In the next section we will explore whether that conclusion — derived for a representative couple — is informative for the older population as a whole.

Initial and Projected Wealth in the Health and Retirement Study

The present study improves on previous analyses in three ways. First, we evaluate retirement wealth and saving needs for the entire nationally representative sample of HRS households. This is important since focusing on a median family conceals wide differences across the population, and asset levels are quite diverse across older households. Second, our approach determines replacement and saving rates jointly, given the household's earnings level and projected assets to age 62 and 65. Third, we assess saving needs in the older population as a whole, and describe these patterns by income and wealth level.

The starting point for our analysis is an examination of HRS households' net wealth levels. The primary components of this wealth can be broadly categorized into four groups[6]:

1. net financial wealth, including saving, investments, business assets, and nonresidential real estate less outstanding debt not related to housing;
2. net housing wealth, or the current market value of residential housing less outstanding mortgage debt;

3. pension wealth, or the present value of employer-sponsored retirement benefits; and
4. the present value of social security benefits.

"Current" values for net financial wealth and net housing wealth are those reported by respondents in the HRS 1992 survey. Values for pension and social security wealth reflect actuarial present values of these contingent income sources based on service and salary through 1992 (see the Appendix). Pension wealth for respondents with employer-provided pensions is calculated using software developed at the Institute for Social Research at the University of Michigan. This software uses information collected from employers of HRS participants to calculate benefit streams based on workers' salary and service. Social security wealth is calculated using administrative records on covered earnings and benefit formulas available from the Social Security Administration, as described in MOS.

Values of current wealth by deciles are reported in Table 1. One result that will not be surprising to many is the wide disparity of wealth across the population, even though the group is on the verge of retirement. The mean value in the tenth, or wealthiest decile, is $1.8 million, or 45 times that of the mean value for the poorest decile. The composition of this wealth also differs dramatically across wealth deciles. For the poorest decile, the value of anticipated social security benefits is greater than total wealth (107 percent), as a result of negative net housing wealth. At the other end of the wealth distribution, expected social security benefits comprise less than one-tenth of household wealth.

Graphical representations of the data are also useful. Dollar estimates of total wealth appear in Figure 1, and fractions of wealth are given in Figure 2. Mean values for almost all sources monotonically increase in total wealth, but the relative importance of the individual components varies across the group. For example, to focus first on social security payments, the present value of these benefits falls as a fraction of total wealth as wealth levels rise, because of the plan's redistributive benefit formulas. Net housing wealth is negative for the lowest decile, indicating that these households have overlevered their housing stock. Beyond the poorest group, housing assets rise as a fraction of wealth, attaining almost one-fifth of wealth for households in the middle of the total wealth distribution, and then fall in relative importance for the wealthiest households. Net financial wealth is rare among the poorer half of the wealth distribution: households in the bottom two-fifths have less than $50,000 in assets of this sort. Only the top two-fifths of the population have more than $100,000 in net financial assets.

Looking across the entire HRS sample, we see that the median household group holds slightly over $325,000 in total wealth, while the mean household has almost $480,000. Not only do levels differ; composition also varies across the mean and median household. At the median, the split can be

TABLE 1: Mean Value and Composition of HRS Wealth (1992) by Wealth Decile

Wealth Decile	*Total Wealth*	*Net Housing Wealth*	*Net Financial Wealth*	*Social Security Wealth*	*Pension Wealth*
1	$ 39,470	$(5,719) −14%	$ 1,520 4%	$42,312 107%	$ 1,356 3%
2	97,452	11,052 11%	10,579 11%	69,239 71%	6,583 7%
3	156,288	24,951 16%	18,235 12%	93,920 60%	19,181 12%
4	219,797	37,095 17%	32,632 15%	115,224 52%	34,845 16%
5	287,692	53,787 19%	55,020 19%	128,377 45%	50,809 18%
6	364,802	68,637 19%	75,793 21%	136,116 37%	84,255 23%
7	459,858	81,432 18%	109,811 24%	142,981 31%	125,635 27%
8	590,079	95,414 16%	159,054 27%	149,310 25%	186,301 32%
9	804,934	112,039 14%	265,967 33%	158,976 20%	267,953 33%
10	1,764,414	180,894 10%	1,032,049 58%	161,605 9%	389,865 22%
Total sample					
Mean	478,313	65,940 14%	175,974 37%	119,793 25%	116,606 24%
Median 10%	325,157	59,746 18%	66,530 20%	133,606 41%	65,275 20%

Source: Authors' calculations. All values in 1992 dollars and calculated using HRS sampling weights.

characterized as a "rule of fifths." Social security constitutes two-fifths of total wealth, and the other three asset categories each comprise a fifth. This balance is shifted for the mean, since net financial wealth plays a much more prominent role for wealthier households (it comprises as much as two-thirds of wealth for the wealthiest group represented).

It is interesting to compare our results to those reported by GMSS who obtained a mean value of almost $500,000 in total net wealth, and $340,000 for the median 10 percent of households.[7] These are very close to our estimated values of $478,000 and $325,000 respectively. Our figures differ because,

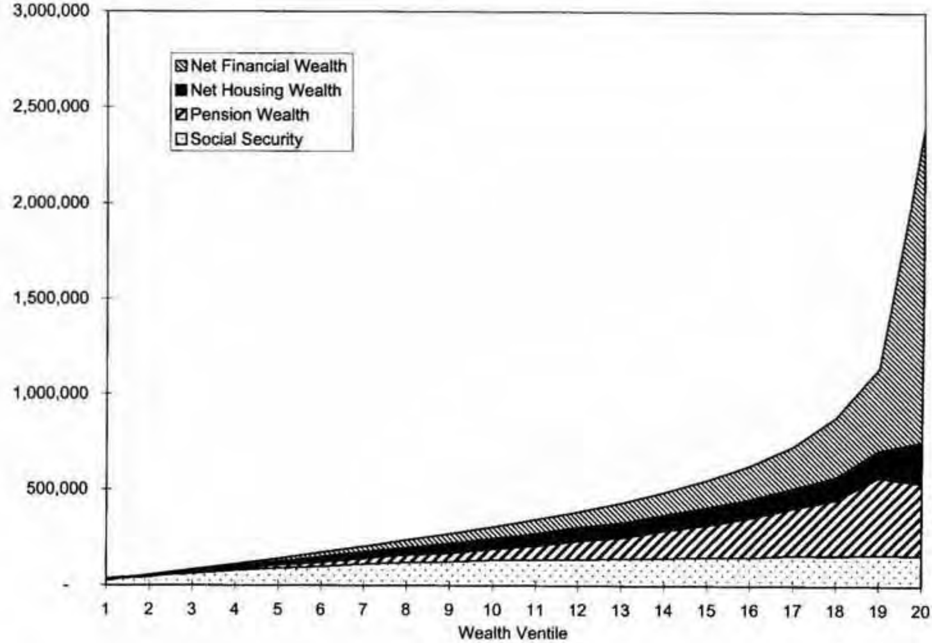


Figure 1. Composition of HRS (1992) wealth by type. Source: Authors' calculations.

first, GMSS calculate a value for retirement health insurance ($7,600 at the mean) which we do not include; and second, our analysis uses social security wealth from actual administrative earnings records. By contrast, GMSS do not use the restricted administrative records data, but instead estimated it from self-reported earnings data. Their estimated figures of $134,000 and $145,000 for the mean and median values are slightly higher—around 10 percent—than our mean and median of $120,000 and $134,000 calculated using actual Social Security Administration records.[8] Our estimates for pension wealth are very close to theirs, differing by less than 1 percent ($1,000) at the mean ($117,000 versus $116,000).

Having established current wealth levels and distributions for the HRS, the next step is to project existing assets to an assumed retirement age. We do this because two households holding the same initial wealth in different forms could prove to be in quite different circumstances a decade later, even assuming no additional saving out of earnings. To examine this possibility we project assets to two assumed retirement dates, the early and normal retirement ages for social security. Age 62 is the age of earliest entitlement for early social security retirement benefits and also corresponds to the modal retirement age in the United States. The social security normal re-

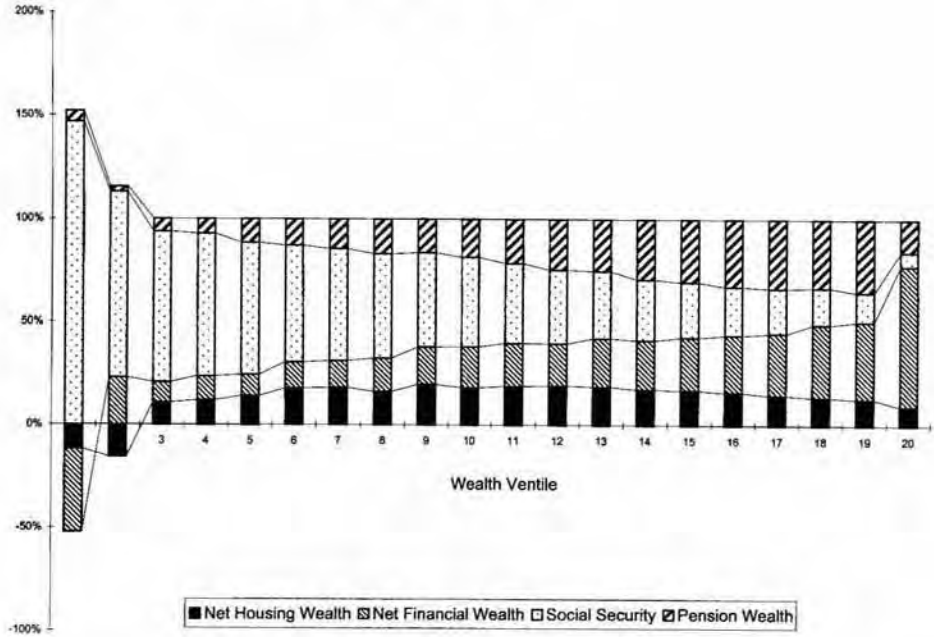


Figure 2. Composition of HRS wealth (1992) as percent of total wealth. Source: Authors' calculations.

tirement age, historically 65, is the age at which an individual is eligible for full, unreduced social security benefits and is a traditional benchmark age.[9]

While it is easy to specify an assumed retirement age for an individual, it is more problematic for a married couple. Spouses do not necessarily retire at the same time, and even when they do it is not clear which partner's age keys the decision. In the present study we follow HRS practice, where the survey interviewer designated as the primary respondent the household member with the greatest knowledge of the household's financial matters. Usually this respondent was age-eligible for the HRS survey; in this case we assume the retirement assumption is triggered on this person's attainment of age 62 or 65. If the primary respondent was not HRS age eligible, this guarantees that the secondary respondent is age eligible. In this instance, we assume that the retirement age is keyed off the attainment of 62 or 65 by this household member.

Asset values for each of these classes are projected to these retirement dates using a range of projection technologies and assumptions.[10] *Net financial wealth* is projected forward using averages of market returns based on historical rates. Historical return rates are drawn from Ibbotson (1996). *Housing wealth* is projected forward using survey data on the purchase price of the respondent's house, year of purchase, outstanding debt owed on homes, and mortgage payment amount and frequency. The process consists of increasing the market value of the house into the future, and also reducing the debt outstanding on the house. We assume that the market value of the house grows in line with the general inflation rate so there is no real appreciation in housing values; rather what does change is the amount owed on the house for those with outstanding mortgage values. Each mortgage payment decreases the remaining principal on the mortgage. Respondents' *pension and social security wealth* values are projected assuming workers remain employed to their respective retirement ages. Pension benefits are derived based on the plan provisions of employer-provided pensions and respondents' answers to salary and years of service (where appropriate). Social security projected amounts are computed as described in MOS. Present values of benefits are calculated using mortality, interest rate, inflation, and wage growth assumptions as described in the Appendix; all values are in 1992 dollars.

Initial and projected wealth values for HRS respondents are reported in Table 2. Median household wealth is anticipated to grow by almost 20 percent in real terms by age 62, to slightly over $383,000. If retirement were postponed until 65, the median household wealth value would rise by approximately 30 percent, or $421,000. Mean increases are similar in percentage terms and translate to wealth figures of approximately $566,000 and $625,000 at ages 62 and 65 respectively.

While percentage changes are similar by decile, those in the top two wealth deciles are projected to have amassed considerable additional net worth. The second wealthiest decile has more than $1 million dollars on average, and the wealthiest has more than $2.3 million. For the wealthiest decile, this is largely due to financial and business assets which make up some 60 percent of assets ($1.4 million). Pension assets make up 23 percent ($535,000 on average), leaving social security and, surprisingly, net housing wealth as relatively unimportant, 8 percent each. Yet this is still almost $200,000 for each. Pension wealth plays a larger role for the ninth decile, comprising some 38 percent of total wealth.

The most dramatic change in projected benefits is attributable to increases in pension wealth, which is found to rise by one-third by age 62, and by one-half by age 65 for the mean household. For the median respondent family, pension present value figures rise by nearly one-half and three-quarters for the same ages. By contrast, social security wealth increases only 7–8 percent by age 62, and by about 20 percent by age 65. Much of this difference is attributable to the well-known nonlinear accrual pattern common to employer pensions, rewarding additional service at older ages. A smoother pattern characterizes social security benefits, since most HRS households have already reached entitlement and additional service changes their benefits by relatively little.[11] About the mean and median, the different rate of

TABLE 2: Mean Value of HRS Wealth (1992 and Projected) by Wealth Decile

Wealth Decile	*Current Wealth*	*Projected Wealth at Age 62*	*Projected Wealth at Age 65*
1	$ 39,470	$ 43,804	$ 49,031
2	97,452	109,578	121,123
3	156,288	182,494	202,946
4	219,797	256,636	283,184
5	287,692	338,153	372,701
6	364,802	429,253	471,308
7	459,858	543,397	595,408
8	590,079	699,681	763,756
9	804,934	944,894	1,030,054
10	1,764,414	2,117,052	2,362,963
Total sample			
Mean	**478,313**	**566,431**	**625,066**
Housing	65,940	76,410	80,507
Financial	175,974	205,653	228,133
Social Security	119,793	128,712	142,018
Pension	116,606	155,656	174,408
Median 10%	**325,157**	**382,678**	**420,537**
Housing	59,746	71,097	75,047
Financial	66,530	71,004	71,175
Social Security	133,606	143,864	160,824
Pension	65,275	96,713	113,491

Source: Authors' calculations. All values in 1992 dollars and calculated using HRS sampling weights.

growth of these asset classes has relative little impact in changing the composition of projected wealth. Pension wealth does play a slightly larger role at the assumed retirement ages, mostly gaining a few percentage points from net housing wealth and social security.

As social security plays a much greater role for the poorest decile, their wealth gains to age 62 and 65 are relatively modest. The value of their social security wealth rises by about $6,000 to age 65, matched by gains in housing wealth. Unfortunately, about half this gain is offset by declines in the average value of their financial and other assets, mainly due to decreases in vehicle value.[12] At 65 this poorest decile still has total wealth of under $50,000, the vast majority of which (98 percent) is comprised of future social security benefits.

It is important to note that averaging may mask significant differences at the household level. For example, a household with $100,000 in pension wealth and no housing assets at 55 looks very different at 62 from an equivalent household with a $100,000 house that is completely paid for. Both households will look different from a household with the same $100,000 in net housing wealth but with a substantial mortgage outstanding. Nonetheless, as we shall show below, prospects are slim for projected movement across wealth deciles with age. Most of those households that are projected to change deciles move up or down a only single decile. In other words, initial wealth is the best predictor of projected retirement wealth: our estimated correlation between initial and projected wealth to age 62 is 0.97. There is a much weaker correlation between initial earnings and initial wealth, of 0.44, and a nearly identical correlation between earnings and projected wealth.

Saving Needs, Replacement Rates, Wealth, and Income

Having established that asset holdings are quite diverse in the HRS, the question remains as to what this implies about saving needs and replacement rates for retirement. In this section we assess target replacement and saving rates jointly, given initial earnings levels and the households' projected assets at age 62 and 65.

To solve for saving and replacement rate targets simultaneously, we begin with the basic replacement rate concept. This equates net income pre-retirement to net income post-retirement[13]:

$$Y_P - T_P - S = Y_F - T_F \ , \tag{1}$$

where Y_P is pre-retirement income, T_P is pre-retirement taxes, S is saving, Y_F is post-retirement income, and T_F is post-retirement taxes. Rearranging (1), dividing through by Y_P, and expressing saving as a percent of income, $S = s\ Y_P$, gives the formula for replacement rate, RR.

$$RR = \frac{Y_P(1-s) - T_P + T_F}{Y_P} = \frac{Y_F}{Y_P} \ . \tag{2}$$

The replacement rate gives a target income level such that a household may smooth consumption before and after retirement.

The future income stream, Y_F, may then be converted to a level of wealth needed to sustain that income level in retirement by multiplying by an appropriate annuity factor, AF.[14] Thus the wealth level required to maintain a smooth consumption profile in retirement is:

$$AF * Y_F = AF * RR * Y_P = AF[Y_P(1-s) - T_P + T_F] \ . \tag{3}$$

The difference between this need level and the projected value of assets already held by any given household, $PROJ$, is the amount that must be saved between now and retirement, or the shortfall in projected retirement assets. This wealth shortfall may be defined as:

$$AF * Y_F - PROJ = AF[Y_P(1-s) - T_P + T_F] - PROJ \ . \tag{4}$$

The wealth shortfall may finally be used to determine a prescribed saving rate. This rate represents what the households would need to save as a percent of income each year until retirement to achieve the projected consumption standard. Assuming that a wealth shortfall is met by saving some level percent of earnings per year, the amount saved at retirement would be:

$$\sum_{t=1}^{T} Y_C (1+wg)^t (1+rtn)^{T-t} s = s\, Y_C \sum_{t=1}^{T} (1+wg)^t (1+rtn)^{T-t} = s\, Y_C Z \,, \qquad (5)$$

where Y_C is the household's current income and *wg* and *rtn* are assumed rates of wage growth and return on savings, respectively. Using (4) and (5) we can then solve for a rate of saving *s*. Equating the two expressions and solving for *s* gives

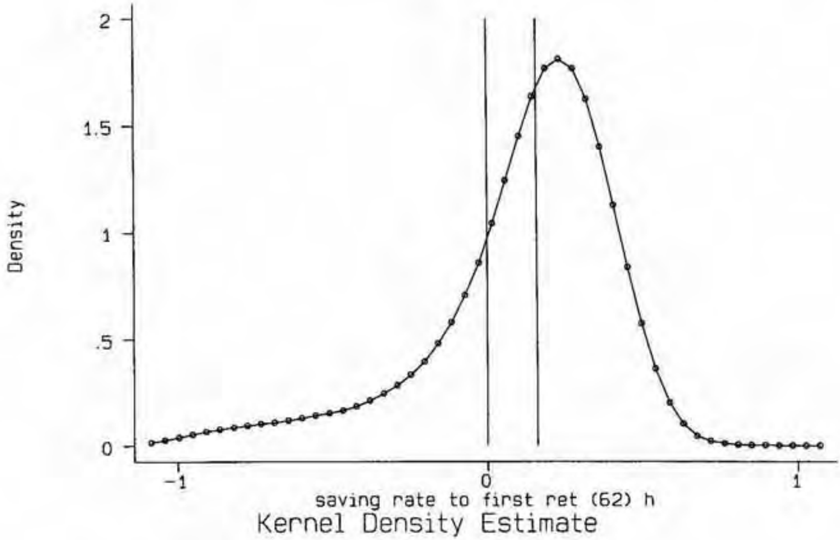
$$s = \frac{AF[Y_C (1+wg)^T - T_P + T_F] - PROJ}{Y_C[Z + AF(1+wg)^T]} \,. \qquad (6)$$

We note that it is not appropriate simply to pick a desired replacement rate and solve for the resulting saving rate, or vice versa. This is because a given replacement rate might imply an infeasible saving rate given a household's earnings and projected assets. In addition, taxes depend on how much the household has saved.[15] Thus replacement rates and saving rates are determined jointly through an iterative process. We first select an arbitrary replacement rate as a starting point and use this replacement rate to determine an initial level of post-retirement income and taxes. Then resulting taxes are substituted into equation (6) to obtain an implied saving rate. This saving rate is then substituted into equation (2) to determine a new replacement rate. The process is then iterated until saving and replacement rates converge such that both equations (2) and (6) hold. For our calculations, reported earnings are used to determine taxes using the IRS regulations in place for the 1991 tax year. Taxes are calculated using the standard deductions and married couples are assumed to file jointly.[16]

Saving and Replacement Rate Results

Saving and replacement rates are reported for the 6,306 HRS households who reported positive earned income in 1991. For this group, the median prescribed saving rate for retirement at age 62 in this sample is 16.1 percent, which corresponds to a replacement rate of 69 percent. The saving rate drops to a more modest 7.3 percent if retirement is delayed to age 65, with a replacement rate of 78.1 percent. In other words, the later the retirement date, the lower is the prescribed saving rate needed to achieve consumption smoothing.

Figure 3 illustrates the distribution of prescribed saving rates across HRS



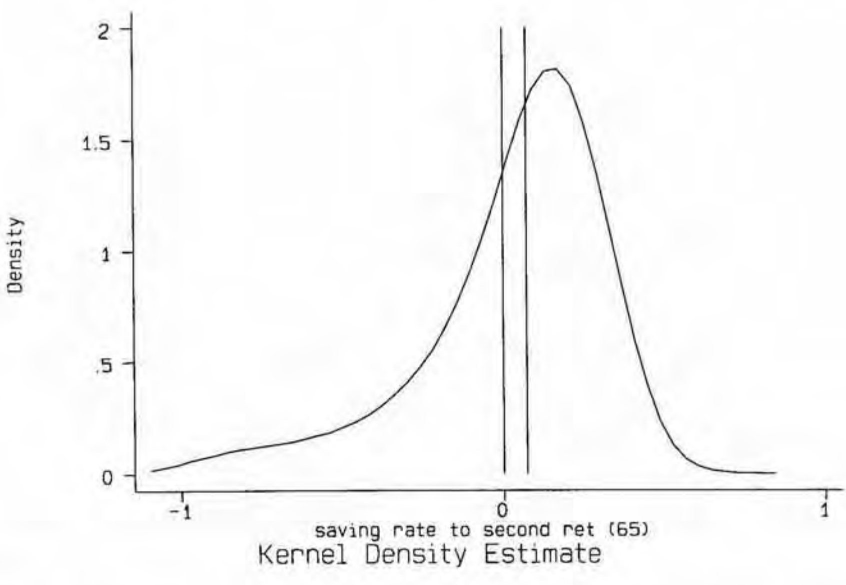


Figure 3. Distribution of prescribed saving rates: ages 62 (top) and 65 (bottom). Source: Authors' calculations.

households, who are alternatively assumed to retire at either age 62 or 65. Vertical lines represent, respectively, a zero prescribed saving level, and the median of the distribution. Both distributions have large tails below zero, indicating that there is a substantial segment of the population for whom additional saving is not prescribed. For retirement at 62, almost a third (31 percent) of the population is in this zero or negative saving category; for retirement at age 65, some 40 percent of the population is estimated to not need any further saving out of earnings beyond accumulation occurring "automatically" through asset appreciation. The peak of the density functions lies to the right of the medians, indicating that the modal, or most commonly prescribed, saving rate is in excess of the mean and median rates.

To further describe the heterogeneity of saving and replacement rate patterns across the HRS sample, we report median values in Table 3 sorted by 1992 wealth and earnings deciles.[17] One conclusion is that saving rates fall monotonically, and replacement rates rise, with wealth. Another conclusion is that many people are unlikely to be able to save significantly for retirement without making drastic changes in their current consumption levels. For the poorest decile, retirement at age 62 would require saving nearly 40 percent of pretax earnings. Waiting to retire until 65 would require a more modest, yet still substantial, 27 percent of gross earnings. The pattern of saving shortfall extends quite far up the wealth distribution: for each of the first four wealth deciles, prescribed saving rates to age 62 are greater than 20 percent of earnings and rates to age 65 are 13% or higher. By contrast, prescribed saving rates are quite small at the top of the wealth distribution. Those in the wealthiest decile have more than sufficient assets to fund a comfortable retirement, and for some, negative rates indicate that they could dip into their stock of assets to enhance current consumption.[18]

Another interesting result is that saving patterns switch sign for households in the eighth and ninth wealth deciles, inasmuch as they have positive prescribed saving rates to age 62, but negative ones to 65. This indicates that their "optimal" retirement age assuming no further saving might lie somewhere between these two ages. Households towards the middle of the wealth distribution have what are substantial but perhaps not impossible savings targets if they want to retire at age 62, needing to save 11–18 percent of income. This would yield replacement rates of about two-thirds of current earnings. If they continued to work to age 65, annual saving needs would be cut in half, and replacement rates rise to approximately three-quarters of current earnings.

A more traditional way of examining replacement and saving rates is to tally these by household income rather than by wealth. The data in Panel B of Table 3 indicate that saving rates are quite negative for the lowest earnings decile: these households would desire to consume out of wealth prior to retirement if they could. In practice, however, such households probably

TABLE 3: Median Prescribed Saving and Replacement Rates

A. By 1992 wealth decile

Wealth Decile	*Median Household Net Wealth*	*Saving to Age 62 (%)*		*Saving to Age 65 (%)*	
		Saving Rate	*Replacement Rate*	*Saving Rate*	*Replacement Rate*
1	43,900	38.3	48.7	26.9	58.8
2	97,600	32.7	52.5	21.3	61.7
3	156,600	26.8	58.3	15.5	67.7
4	220,500	24.0	60.3	13.6	69.1
5	286,500	18.1	67.5	8.9	76.1
6	364,000	17.0	67.0	8.5	75.6
7	458,900	11.4	73.3	3.0	81.4
8	587,800	7.0	78.9	−0.9	87.1
9	792,600	1.0	88.3	−6.1	96.6
10	1,363,000	−25.4	126.8	−35.0	137.1
Total sample	325,000	16.1%	69.0%	7.3%	78.1%

B. By 1992 earnings decile

Earnings Decile	*Household Earnings*	*Saving Rate*	*Replacement Rate*	*Saving Rate*	*Replacement Rate*
1	4,500	−122.5	218.8	−132.8	227.8
2	11,930	5.9	84.8	−4.6	93.4
3	17,500	13.5	75.1	2.2	84.6
4	24,000	15.1	73.3	4.3	82.2
5	30,000	18.0	68.6	7.3	77.8
6	37,000	16.7	67.1	8.1	75.6
7	45,000	17.0	64.3	9.8	73.6
8	54,050	18.4	62.3	10.6	72.0
9	70,000	20.3	60.2	12.6	69.8
10	102,000	23.7	57.8	16.5	67.6
Total sample	33,000	16.1	69.0	7.3	78.1

Source: Authors' calculations. All values in 1992 dollars and calculated using HRS sampling weights.

face substantial liquidity constraints in that their wealth is not immediately available for consumption. This would be the case for workers anticipating social security or pension benefits at some future age.[19]

The results in Table 3B also show that prescribed saving rates rise with earnings. Those in the second pay decile need to save a little less than 6 percent of income to achieve a replacement rate of 85 percent by age 62. Without additional savings, they could achieve current living standards by retiring sometime before reaching 65. For higher earner deciles, double-digit saving is required to retire at 62 with the same relative standard of

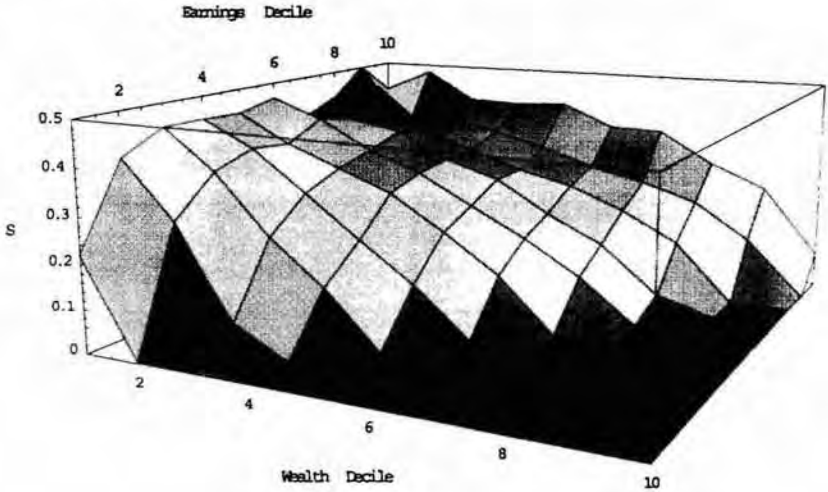


Figure 4. Prescribed saving rates by 1992 earnings and wealth for retirement at age 62. Shading represents median prescribed saving rate for each earnings-wealth decile pair. Source: Authors' calculations.

living. Delaying retirement to age 65 cuts required saving by 7–11 percent, depending on the family's earnings decile. Similarly, replacement rates fall with earnings but rise with retirement age.

A conclusion that our data on assets and pay highlights is that saving and replacement rates obscure the intertwined relationship between income and wealth. Of course, people with higher earnings also tend to have greater wealth, but this relationship is far from perfect, given that the correlation between earnings and initial wealth is only 0.44. Figure 4 plots prescribed saving rates as a function of both earnings and wealth. Median prescribed saving rate values by earnings-wealth decile pairs are presented for an assumed retirement age of 62.[20] Figure 5 presents the same information in a contour plot with contour lines at 5 percent intervals. These figures illustrate substantial heterogeneity in prescribed saving rates within the same income decile: most households fall along the "diagonal" with wealth increasing with earnings, but there are some households with substantial wealth given their earnings, as well as others whose net wealth seems low in comparison to earnings. The "diagonal" corresponds to the sloped region in Figure 4, running from the bottom left corner to the top right corner of the figure. The closeness of the contour lines in Figure 5 point out that the topology of the surface in Figure 4 is rather steep. In other words, saving rates for households falling along the diagonal are very sensitive to small changes in income or assets.

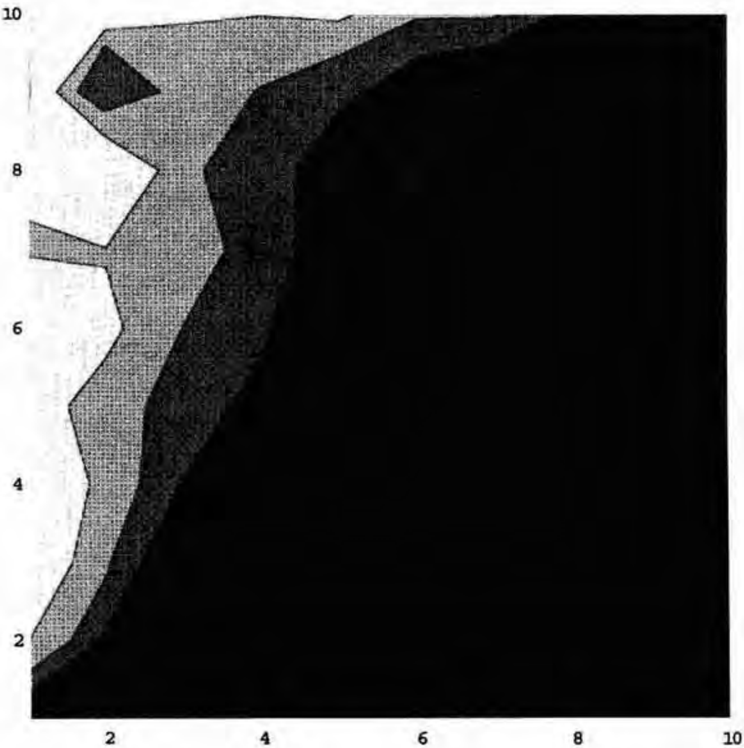


Figure 5. Contour plot of prescribed saving rates to age 62 for retirement at age 62. X-axis is wealth decile; Y-axis is earnings decile. Shading represents different prescribed levels of saving: darkest regions represent zero or negative prescribed saving, lighter regions need for greater saving. Contour lines are at intervals of 5.0 percent, corresponding to Figure 4. Authors' calculations.

Descriptive regressions of prescribed saving rates in Table 4 summarize some of the complex multivariate relationships. Coefficients are calculated using median regressions to minimize the effects of extreme observations. For each retirement age, we first relate saving rates as quadratic functions of income and earnings alone, and then add age and other indicator variables indicating whether the household is comprised of a single male or female (versus a married couple), whether individuals in that household have pension wealth, and whether the household owns its own home.

All estimated parameters are statistically significant at conventional levels. The estimates suggest that, about the median earnings level of $33,000, the effect of an extra $100 per year in earnings is to raise the prescribed saving rate by 0.095 percent (for retirement by 62) or by 0.097 percent (at age 65). That is, given the median saving rate of 16.1 percent, raising the

TABLE 4: Descriptive Regression of Prescribed Saving Rates

	Prescribed Saving Rate to Age 62		*Prescribed Saving Rate to Age 65*	
Household earnings	1.01	1.03	1.09	1.05
($*10^{-5}$)	89.46	125.94	89.14	101.37
Earnings squared	−1.18	−1.22	−1.35	−1.24
($*10^{-7}$)	−66.24	−95.43	−69.76	−76.85
Total household wealth	−9.93	−9.73	−1.01	−9.60
($*10^{-7}$)	−93.44	−119.81	−87.07	−93.79
Wealth squared	9.71	9.18	9.12	7.27
($*10^{-9}$)	45.75	57.93	39.34	36.29
Single male		−0.07		−0.13
		−9.06		−12.77
Single female		0.02		−0.05
		3.02		−6.04
Primary respondent age		0.004		0.002
		9.11		2.72
Have pension		−0.03		−0.04
		−7.18		−6.49
Own home		−0.08		−0.08
		−13.08		−10.31
Constant	0.13	−0.01	0.01	0.04
	24.87	−0.442	2.217	1.3
Pseudo R^2	0.09	0.09	0.09	0.09
N	6306	6306	6306	6306
Wtd. sum of absolute deviations	7808.74	7782.49	7782.49	7978.5

Source: Authors' calculations.
Notes: Coefficients estimated using median regressions to minimize effects of extreme outliers. Coefficients calculated using HRS household sampling weights. T-statistics appear below estimated coefficient values.

rate to 16.195 percent implies that $47.5 of the additional $100 in income would be saved.[21] The effect of $1000 more total wealth on prescribed saving is about the same for the median household, but in the opposite direction, causing the saving rate to 62 to fall 0.097 percent. This translates to approximately $32 less in saving in the first year. The coefficients for single men and women reflect the impact of different mortality rates by sex; since women live longer than men, they need to save at a greater rate, and this difference is rather substantial. For example, if age 62 retirement is the target, a woman's prescribed saving rate would exceed the otherwise equivalent man's by 9.1 percent. The results also show that owning a home and having an employer-sponsored pension affect prescribed saving substantially. Since "current" pension wealth and net home values are captured in the initial household wealth variable, these estimated coefficients reflect additions to future wealth—in pensions due to additional service, contributions, and portfolio returns where applicable, and in housing stock due to the paying down of outstanding mortgage debt and home appreciation. The regressions indicate that the presence of a pension reduces prescribed saving by 3–4 percent per year, while saving done through the home is equivalent to saving an additional 7.6 percent out of annual earnings at the median.

Discussion

We have explored the adequacy of asset holdings in the Health and Retirement Study, a nationally representative survey of older Americans on the verge of retirement. We conclude that, despite seemingly large accumulations of total retirement wealth, the majority of older households will not be able to maintain current levels of consumption into retirement without additional saving. In particular, the median HRS household has more than \$380,000 dollars in projected wealth by age 62, but it would still have to save an additional 16 percent of earnings to smooth consumption for age 62 retirement.

Another lesson from our analysis is the importance of retirement decisions in generating adequate retirement consumption. Delaying retirement by only three years reduces the saving burden substantially, and allows for a sizable increase in consumption both before and after retirement. In our sample, if retirement were delayed to age 65, the asset base would total \$421,000 and prescribed additional saving would be a relatively manageable 7 percent of earnings at the median.

We also show that initial and projected assets are distributed quite unevenly across the older population. Therefore, conclusions about the median household conceal extraordinary heterogeneity in saving needs among these households. Small changes in earnings or assets may lead to sizable differences in prescribed saving rates near the median. Average current holdings of the wealthiest HRS decile are 45 times those of the poorest decile, and 48 times that of the poorest by age 62. This difference arises mainly because of pension and financial wealth, since social security wealth is relatively evenly distributed and housing wealth does not comprise a large fraction of assets for the wealthiest. Assets are more evenly distributed across the other deciles, with the second highest group having 8 times more total wealth than households in the second lowest.

How do our conclusions square with other research on saving patterns? One way to compare them is to see how well prescribed saving rates from our methodology align with actual rates, as in Table 5. Here we tabulate our saving rates for HRS married couples and actual saving rates derived from

TABLE 5: Comparison of HRS Prescribed Saving Rates and CES Actual Rates

Household Earnings	*HRS Prescribed Saving Rates (%)*			*Actual CES Saving Rates (%)*
	Age 62	*Age 65*		
20,000	6.0	−1.9	?	2.3
30,000	16.8	8.5	>	2.8
40,000	17.7	10.0	>	3.3
50,000	17.9	11.1	>	3.7
60,000	20.2	13.1	>	4.1
70,000	20.3	13.5	>	4.5
80,000	21.1	14.2	>	5.0
90,000	20.5	13.3	>	5.4

Source: Authors' calculations.
Notes: Prescribed saving rates calculated using HRS (1992); Median values given for married couples with earnings within ±\$5000 of reported earnings using HRS household sampling weights. CES saving rates taken from Palmer's (1994) calculations using the 1990 Consumer Expenditure Survey for respondents age 50–64. Rates are adjusted to reflect saving as a percent of total earnings.

the 1990 Consumer Expenditure Survey (CES) for the worker group age 50–64 (Palmer 1994). The evidence indicates that actual saving rates are only about a third of the levels prescribed by our calculations.[22]

Another approach is to compare our results to those of Bernheim (1994), who presents after-tax "target" saving rates about twice as large as ours for similarly aged households. For example, his target saving rates for a married couple age 55–64 with (without) a pension and earnings of \$30,000 are 12.1 percent (18.1 percent); at \$50,000 19.2 percent (24.3 percent); and at \$75,000 22.9 percent (28.1 percent). Adjusting these rates to reflect saving as a percent of gross income reduces them by approximately 20–30 percent. However, as noted earlier, Bernheim's target rate calculations omit housing wealth, which if included would substantially narrow the difference between our prescribed saving rates.[23]

A third way to assess the comparability of our results with those in the literature is to compare projected replacement rates. Figure 6 shows our HRS target replacement rates with those generated using the 1990 CES (Palmer 1994), and some differences emerge. The HRS profiles both fall with earnings, in contrast to those derived from the CES data which are flatter and rise for higher incomes. Part of the difference between our results and Palmer's is that his method implicitly assumes that observed saving rates are optimal. To the extent that retirement income is not provided by social security, pensions, or existing assets and needs to be provided by additional saving, this will lead to Palmer's replacement rates overstating actual replacement rates.[24] Palmer's research also assumes an age 65 retire-

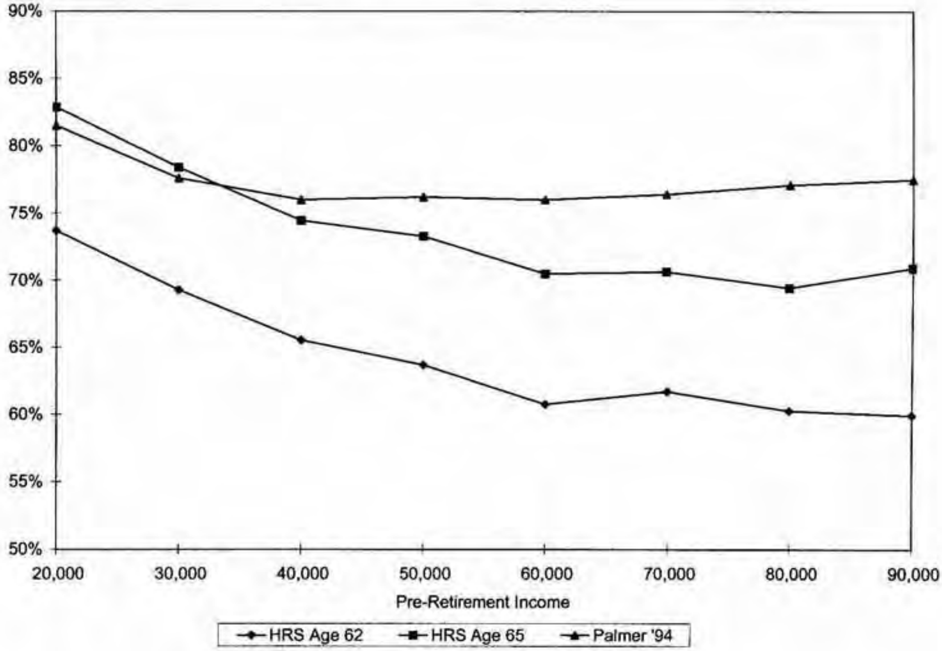


Figure 6. Comparison of replacement rates. Source: Authors' calculations.

ment age. We also note that the age-65 replacement rate for the HRS sample is substantially above the age 62 rate, illustrating the importance of retirement ages in the methodology. If retirement occurs earlier, and empirical evidence suggests it does, this is further cause to believe that average actual replacement rates fall below those estimated by Palmer.

One question we have not yet explored in any depth is why observed saving patterns appear to fall short of target saving benchmarks, both ours and others such as Bernheim's. One possible answer is that some households are simply too poor to defer consumption, but this appears unlikely for those other than the poorest in our sample. Other possible explanations center around informational issues, for example, households may simply underestimate their likely life expectancy in retirement, though recent research by Hurd and McGarry (1995) suggests that HRS respondents have quite reasonable forecasts of survival probabilities into old age. An additional hypothesized explanation is that people discount the future to varying degrees and some may do so very heavily. The rich set of standard and experimental questions in the HRS and future information provided by these households may provide clues to discovering the answers.

Appendix: Wealth Projections Using the Health and Retirement Study

In this Appendix we describe briefly the methods used to project elements of retirement wealth forward to age 62 and 65 for the HRS sample described in the text.

Social Security Wealth

Social security wealth measures are contained in the Earning and Benefits File (EBF), a restricted dataset available under controlled access conditions and described in MOS (1996). This file reports covered earnings under the social security law and estimated old-age and disability benefit amounts for HRS respondents who gave permission for administrative data to be linked to their survey responses. Retirement benefits are calculated based on earnings through 1991 and projected earnings to age 62 (the eligibility age for early retirement benefits), and also to the social security normal retirement age (65 for most HRS participants). In addition the EBF file indicates household wealth figures, which for married couples include spouse and survivor benefits.

Assumptions used to compute these benefit amounts are consistent with those used by the Social Security Administration (SSA) under its "intermediate assumptions" scenario outlined by the Social Security Trustees to forecast the system's fiscal status. Details of the calculations of social security benefit amounts, present values, and other available variables are described in MOS. Of the 7,607 HRS households, 4,334 had useable social security wealth from the EBF file.

For those households where earnings records were not available, values were imputed using the HRS dataset. Separate regression models were constructed for married couples and households with single individuals. The coefficients of the prediction model were estimated using the sample for which EBF social security wealth was available. Regressor variables used were those common to all households in the HRS dataset and include male earnings, female earnings, financial net wealth, net housing wealth, respondent's age, spouse's age, a dummy for white primary respondents, and a dummy for single female, with the log of social security wealth as the dependent variable. Estimated coefficients were used out of sample to estimate social security wealth for those households not appearing in the EBF.

Pension Wealth

The Institute for Survey Research (ISR) at the University of Michigan asked HRS respondents covered by employer-provided pensions for permission to contact their employers for information about these pension plans. Having obtained the names and addresses of the employers, ISR requested a pension plan Summary Plan Description (SPD) for each worker's current and past plans, and followed up with requests for the SPD at the U.S. Department of Labor where employer-supplied documents were not obtained. The SPDs were then coded using a format developed at ISR, and combined with a special software program developed by Curtin and others (1997). The software uses information collected from the SPDs to calculate benefit streams based on respondents' salary profiles and service, at alternative retirement ages. Vested terminated benefits as well as benefits available from current pension plans are included in the analysis in this paper. The employer-sponsored pension information and pension provider software are in the developmental phase and can currently be accessed only under restricted conditions.

Mortality, interest rate, inflation, and wage growth valuation assumptions are consistent with those used by the Social Security Administration in its annual reporting to Congress. For defined benefit plans, present values are calculated assuming a 2.3 percent real interest rate and a 4.0 percent inflation assumption (implying a 6.3 percent nominal discount rate). For defined contribution plans, real returns on contribution balances are assumed to be 4.0 percent annually (8.0 percent nominal). The same assumption is used for calculating present values. The pension provider software does not permit different assumptions for contribution growth and discounting, but we feel it is appropriate to use the higher discount rate in the defined contribution pensions plans due to the greater uncertainty of future benefit levels. Defined benefit plans sponsored by HRS participants' current employers are assumed to pay cost-of-living adjustments of half the inflation rate, mirroring historical practice. Benefits from previous employers and defined contribution plans are assumed to have no cost-of-living adjustment. The percentage of plans for which we were able to use the ISR software to estimate the present value of plan benefits varied by plan type, but was generally 60–70%.

For those households where pension plan data were not generated by the ISR software, values were imputed using the HRS dataset. Separate regression models were constructed for each pension type. Regressor variables used were those common to all households in the HRS dataset and include earnings, age, service in the plan, industry dummies, job description, race, sex, and union status. The log of pension wealth is the dependent variable. Estimated coefficients were used out of sample to estimate pension wealth for those households with missing pension data.

Housing Wealth

Net housing wealth reported in the HRS is the value of owner-occupied primary housing less debt owed on the property. The projected net value we use in this study is derived as the projected market value of the housing less projected debt. We assume that the market value of housing assets is constant in real dollars, or in other words, the increase in home value is equal to the assumed rate of inflation. Projecting debt is more complicated, as will be explained.

The HRS provides information on first mortgages, second mortgages, home equity loans, and lines of credit against housing equity. To roll forward debt we need a) the outstanding balance on the mortgage or other debt, b) the payments and frequency of payments on that debt, and c) the interest rate on the debt. The HRS provides the first two of these three, necessitating the use of alternative sources for the mortgage rate.

Given the purchase date of the house, a datum reported by HRS respondents, we use historical interest rates as proxies for current rates. However, this ignores the possibility that the homeowner refinanced the mortgage. We know that interest rates fluctuate over time, and a common "rule of thumb" has the mortgage holder refinance when rates drop by more than 200 basis points (2 percent). Therefore, for example, using the May 1980 average 30-year mortgage rate for a house purchased in May 1980 would be likely to overstate the actual interest costs for many if not most households. A different approach would be to take the purchase price of the house reported in the HRS, the payment amount, and some assumption regarding the term of the mortgage (e.g., assume a 30-year fixed-rate mortgage). This has the problem that many households' mortgage payments include their property taxes, homeowners' insurance premiums, or both. Imputing mortgage interest rates from the raw payments would bias upward the derived mortgage interest rates.

Data from another survey mitigate some of these problems. The American Housing Survey (AHS 1993) provides interest rate data for houses in its sample. From this source, we calculate a series of actual mortgage rates paid by averaging conditional on year of home purchase and use these to roll forward first-mortgage debt. Analysis of these rates as opposed to issue rates indicates that they embed substantial refinancing for periods such as the early 1980s. For years prior to 1953 where data are thin, or where HRS households do not indicate a year of purchase, we use the average mortgage interest rate for the sample, approximately 8.5 percent.

The AHS also has data on tax and insurance payments. These, in addition to tax payment information contained in the HRS, are used to calculate an effective mortgage payment, or the amount of the mortgage that actually services the debt. HRS households indicate whether given payments include taxes, insurance, both, or neither. When taxes are given, these are used to reduce mortgage payments. When they are not, the average rate of tax as a percent of payment as calculated from the AHS is used instead. A similar procedure is used for insurance payments when they are included in mortgage payments. The AHS derived values for taxes and insurance are 18.11 percent and 5.90 percent of mortgage payments, respectively.

For second mortgages and home equity loans the HRS does not contain information on year of issue. These amounts are therefore projected forward using the average rate on such debt from the AHS, approximately 9.5 percent.

Missing observations on mortgage payment amounts are imputed assuming a 30-year fixed mortgage at the rate associated with the purchase year when purchase year and price are available. When this information is unavailable, it is assumed that the payments are such that the mortgage is paid off at age 70. For missing secondary debt, a 10-year term is assumed to pay off the remaining balance. There are respectively 123, 47, and 36 missing payments imputed in this manner.

Other Financial Wealth

"Other financial wealth" includes such assets as savings, investments, business assets, and nonresidential real estate less outstanding debt not related to housing. Asset values in 1992 are provided by HRS respondents. To obtain projected net financial assets, as noted in the text, we project individual components of this asset category separately. That is, equity components of assets are projected in line with historical equity returns, bond returns are used to project fixed income holdings, and personal business assets are projected using the equity rate of return. Assumed growth rates are geometric averages of real returns over the period 1926–95 as calculated using the Stocks, Bonds, Bills, and Inflation series from Ibbotson Associates.

The components of net financial wealth as tabulated in the HRS and the rates used to project them:

- Vehicle and RV wealth—depreciated over ten years using straight line depreciation.
- Checking, savings, money market accounts—Real T-bill rate (0.5 percent)
- CDs, savings bonds, T-bills—Real T-bill rate (0.5 percent)
- IRA and Keough accts.—50/50 corporate bonds/stocks (2.3 percent/ 7.2 percent)
- Stocks, mutual funds—stocks (7.2 percent)
- Business equity—stocks (7.2 percent)
- Other assets, real estate, second home—held constant in real terms
- Other debt, second home debt—held constant since we lack other information to estimate changes in value

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Notes

1. Franco Modigliani was a believer in this model, which garnered him the Nobel prize. When asked what he would do with his prize money, he is alleged to have responded that he would spend $1/T$ of it, where T represented the remaining (and assumed known) years of life remaining.

2. Bernheim solves backward from the household's last possible period, T, in which all wealth and income is assumed to be exhausted. Then the household is posited to maximize utility in period $T-1$ given uncertainty of living to period T. Actual consumption (and hence saving) is determined by solving for C_{T-1} given $U(C_T)$, the utility of consumption; β, the rate of pure time preference (discount); p_{T-1}, the probability of surviving from time $T-1$ to time T; and the objective function max $U(C_{T-1})+p_{T-1}\,\beta U(C * T)$. The process is then resolved for periods back to the starting point, and under a range of assumptions regarding other variables.

3. Whether housing wealth should be included in a tally of retirement assets is a hotly debated issue. Retirees are often reluctant to move from the houses they lived in while working, in which case they see their housing wealth as an emergency contingency fund (and possibly as a bequest). In addition, moving costs can make accessing housing equity expensive. However, we note that housing wealth may be used to increase consumption through mechanisms such as second mortgages, home equity loans, and reverse mortgages, so in this paper we include housing wealth in the set of assets that could finance retirement.

4. From a theoretical economic perspective, this is less appealing than a true life cycle dynamic programming approach, as it ignores utility theory and behavioral responses to uncertainty. However, it is a popular model among retirement planning practitioners and can be seen as a relatively tractable approximation or rule of thumb to the life cycle model.

5. The HRS is structured as a longitudinal or panel dataset with households resampled every two years, and should prove a fertile source for researchers in the future. Currently only the first wave is available in public release, and only public release data can be merged with the pension and social security data to be described below.

6. All wealth values reported in this paper are weighted by HRS sample weights.

7. The value for the median 10 percent is the mean value for those households falling between the 45th and 55th percentile of the wealth distribution. This value is presented instead of the true median to allow for representative disaggregation.

8. GMSS recognize the upward bias of their numbers but were not permitted at that time (February 1997) to combine pension with social security administrative data.

9. Legislation is increasing the normal retirement age to 67 over a period of several years, and for a few HRS respondents the normal retirement age will be age 66.

10. More discussion of projection methodology and rates of growth is given in the Appendix.

11. In other words, the payroll tax at older ages is more of a true tax than at younger ages, where additional benefits may be accrued by extra years of contribution to social security.

12. We assume vehicles depreciate over a 10-year period.

13. One could extend the analysis by allowing for changes in specific consumption prior to and after retirement, and Palmer (1994) does this. In this paper we do not model this possibility and note that consumption choices are a decision variable rather than an exogenous variable, dependent on assets and income.

14. Annuity factors are calculated with the same assumptions as those used for valuing pension and social security wealth, a real interest rate of 2.3 percent, and the moderate assumptions used in the long range projections of the Social Security Administration. Annuity factors employ the SSA mortality tables (see MOS). For

married couples the annuity factor used was a Joint and Survivor annuity paying 75 percent to the surviving spouse.

15. Depending on how the saving is done, the rate of saving may affect either pre-retirement taxes, post-retirement taxes, or both. For our current calculations we assume saving out of earnings is done on an after-tax basis so it only affects post-retirement taxes; all pension saving is assumed to be pre-tax.

16. We do not account for state and local taxes in this chapter's analysis. To the extent that these differ pre- and post-retirement, this may bias calculated replacement rates. If pre-retirement state and local taxes were higher than post-retirement taxes, our replacement rates would be too high.

17. Medians are presented instead of means as they give a more accurate representation of typical values within deciles. Means give curious results because of the presence of outliers; for example, a saving rate value for a household where earnings are at the lower extreme for earnings within a wealth decile might indicate significant dissaving as optimal behavior, possibly to the tune of large multiples of earnings. Averaging that value with others more representative of the subsample would drastically understate the prescribed saving rate for the "typical" household.

18. Of course, it is possible that these households may have a strong bequest motive, in which case the pure replacement model may understate their need and taste for saving. To the extent that there is heterogeneity in the desire to provide bequests, those with a stronger motive are likely to have accumulated greater assets to date and appear here as "over-savers."

19. In addition, their "desire" to consume out of future income may be overstated, inasmuch as earnings exclude noncash transfers such as food stamps and housing subsidies to the very poor.

20. Plots for age 65 retirement look qualitatively very similar.

21. Additional savings equals savings on the additional dollars of income plus increase in saving on previous income, i.e., $0.16195 * 100 + 0.00095 * 33{,}000$.

22. Palmer (1994) shows that the 1984 and 1988 CES saving rates are higher for certain earnings groups, yet they still fall short of our median prescribed rates.

23. Another way to think about housing wealth is that mortgage payments have both an investment component and a consumption component. The investment component recognizes the purchase of the house as an investment in a tangible asset. The consumption component represents what the homeowner would pay for housing services, or for the non-homeowner, rent. Since shelter is a large consumption expense, paying off the mortgage represents a substantial decrease in income required to cover consumption needs or a prefunding of later housing consumption.

24. Schieber (1996) offers additional criticism of Palmer's methodology arguing that his figures are upwardly biased.

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