Saving for Retirement: Wage Growth and Unexpected Events

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1. Introduction

Social Security wealth, possibly augmented with pensions wealth, is the main economic resource that supports retired households although Social Security alone will only provide enough resources to keep a household marginally above the poverty line. Many elderly household units do not have pension income: just 45 percent of households with a person aged 65-69 had either private pension income or public pension income in 1994, and the fraction decreased with age (Grad, 1996). For many households, then, their own savings are needed to provide for adequate retirement consumption.

Some households approaching retirement age have saved adequately for retirement and some have saved very little or nothing at all (Smith, 1995; Gustman and Juster, 1996; Venti and Wise, 1996). Social programs such as Social Security and Medicare may have substituted for private saving, but this explanation is only reasonable for households in the lower part of the income distribution. Households farther up in the income distribution with little private saving may have to reduce consumption sharply during retirement, which is not consistent with the implications of the main theoretical model for saving behavior, the life cycle model of consumption. The savings of households that are otherwise similar, as measured by current income or by a measure of lifetime income, can be very different. For example, in the Health and Retirement Study, median non-housing wealth among those with household income of $25-$50 thousand was $34 thousand yet, the 25th percentile was just $9.5 thousand and the 10th percentile just $1.2 thousand (Gustman and Juster, 1996). There are, of course, some obvious explanations for the differences in savings among household with similar earnings. Some households may have saved at an adequate rate, but they had unexpected large expenses such as medical or educational expenses. Some may have had interrupted earnings histories, which caused their savings plans not to be realized.

The goal of this research is to explore the role of unexpected low earnings growth in explaining the variation in wealth levels of household with similar lifetime earnings near retirement. To accomplish this goal, we use data on individuals born between 1931 and 1941 and their spouses from the Health and Retirement Study (HRS). In the aggregate, empirical evidence

is suggestive of this hypothesis. In particular we note the substantial decline in real wage rates that began in the mid-1970s. It was likely unanticipated, and according to the life-cycle model it would have led households to under-save.

Figure 1 shows real wages for the years 1956 to 1993 based on published data from the Bureau of Labor Statistics of annual hourly earnings in 1982 dollars. From 1956 to 1973 the annual growth rate of real wages was 2 percent per year. 1973 marks the end of rapid earnings growth and is followed by a long period of declining real wages. By 1993, real wages were only 87 percent of the 1972 level.

In 1966, the period of high real wage growth, the typical person in the HRS cohort was 30 years old. A life-cycle growth rate would have been combined with the secular trend, so that someone from the HRS cohort would probably have anticipated very high rates of income growth. Such a person may have begun saving at a rather late age. Even someone with a low subjective time rate of discount may have delayed saving. Real wage rates, however, began to decline beginning in 1974 when many of the HRS cohort were in their early 40's; therefore, many in the HRS cohort may have reached their high-saving years with real incomes that were considerably lower than they had forecast and, as a consequence, they under-saved relative to their lifetime earnings.

Although some households may have experienced unexpected low earnings, others did not experience these shocks. Thus, to explore our hypothesis, we match Social Security earnings data with panel data from the main HRS survey and with data from experimental modules. Using respondents' Social Security earnings records from 1951 to 1991 we calculate lifetime labor earnings, and we estimate for each individual earnings as a function of a quartic in age. For each individual we calculate an earnings growth rate as the first derivative of the earnings-age equation evaluated at a particular age. The second derivative, the change in earnings growth, is our indicator of a surprise in earnings growth. Thus the test is to hold lifetime earnings and earnings growth constant and to examine whether individuals with downward sloping earnings growth paths had lower wealth levels near retirement than those without downward sloping earnings growth paths. We estimate wealth levels in 1992 as a function of lifetime earnings, earnings growth and the change in earnings growth, controlling for other demographic characteristics. Due to measurement error in our measure of lifetime earnings, we employ instrumental variables estimation. We find that a decline in real income growth, as measured by

the change in wage growth at age 30, is associated with lower retirement wealth, which is consistent with our hypothesis that some of the subjective shortfall in wealth at retirement is due to an unexpected slowdown in wage growth. However, the magnitude is small for most households: only for those with extreme changes in wage growth is the effect quantitatively important.

2. Previous Studies

The standard model for analyzing saving decisions is the life-cycle model (LCM) of consumption, also know as the "life cycle hypothesis" (Modigliani and Brumberg, 1954). According to this model individuals and households choose a consumption path that will maximize lifetime utility. A fairly restrictive version of the LCM specifies that the only uncertainty is the date of death (Yaari, 1965). An important prediction is that households will accumulate savings during the working life, and spend some of the savings to finance consumption following retirement. Although the exact level of asset accumulation will depend on utility function parameters and the interest rate, a useful illustrative case is when the parameters are such that the consumption path is flat as a function of age. Then, in the absence of social programs such as Social Security and other forms of saving such as pensions, and holding the retirement age constant, an individual will save a fixed fraction of lifetime earnings. The intuitive appeal of this result is that if someone is poor during working life, he should still save. Otherwise, he will be very poor following retirement, which cannot be optimal. Lifetime utility could be increased by reallocating some consumption from the working life to the retired life. This result is useful to establish as a baseline because it makes clear that within the context of the LCM permanently low income cannot be a reason for not saving. Of course, if income is temporarily low rather than permanently low, someone will save at a lower rate or even a negative rate during that period.

With mandatory Social Security and Medicare systems these results will be altered for households with low income. Once again, take the case where under the LCM the optimal consumption path is flat, and consider someone with very low earnings. Because of the progressive structure of Social Security and Medicare benefits, a very poor household may find that its standard of living would increase after retirement even if it had no other resources. The optimal saving plan of such a household would be to borrow against future Social Security

benefits so that consumption during the work life would be increased at the expense of consumption after retirement. However, Social Security cannot be used as collateral for a loan, so this option is not available (Hurd, 1990). The next best solution is to retire when first eligible for Social Security benefits and, except for a claim on Social Security and Medicare, not to accumulate assets except possibly owner-occupied housing for its consumption value. This kind of model can explain the high rate of retirement at age 62 even though Social Security is approximately actuarially fair from age 62 to age 65 (Hurd and Boskin, 1984).

Hubbard, Skinner and Zeldes (1995) find that social programs, if they are large in relation to earnings levels, can explain low or zero saving rates among some households. This, however, is not likely to be an explanation for low saving rates among middle-income households. Consider, for example, a single worker whose earnings were average throughout his career. Then in 1995 his wage would have been $1,929 per month (Social Security Administration, 1996). Yet his monthly benefit were he to retire at age 62 would have been $702. The implicit value of Medicare and the differences in taxation of earnings and Social Security would reduce the difference between pre-retirement and post-retirement income somewhat, but, nonetheless, by relying only on Social Security the worker would have considerably less consumption in retirement than pre-retirement. Under the LCM this outcome would not be optimal: the worker could increase lifetime utility by saving during his work life. The conclusion is that, within the framework of the LCM, social programs can explain low saving rates among low-income households, but not among households with moderate to high-income levels.

The overall conclusion is that for the population at the lower end of the income distribution a lack of retirement wealth could be explained by social programs, but not for households in the middle part of the distribution. Therefore, the life cycle model, which is the main theoretical model of consumption and saving, apparently cannot explain some important features of the data.

A moderate extension of the life-cycle model allows for unexpected outcomes both for earnings and for expenses (Browning and Lusardi, 1996). For example, families have unexpected expenditures such as uninsured medical expenses or higher than expected educational expenses. These families may have planned to reach retirement with adequate resources, but were not able to realize their plans. On the earnings side, workers may have anticipated smoothly rising earnings, which would cause them to delay saving until their

earnings were higher, but in fact they had spells of unemployment or perhaps their earnings were flat. From a lifetime perspective, they would not have saved enough early in their work life, and so they would not have reached retirement with enough actual savings relative to their lifetime incomes. Allowing for a stochastic life-cycle model, Engen, Gale and Uccello (1999) study the adequacy of household savings by simulating optimal wealth-earnings ratios among observationally equivalent households. Using data from the HRS and the Survey of Consumer Finance, they analyze whether observed data are consistent with patterns of an optimizing model with earnings uncertainty. Although their general conclusion is that households are largely saving adequately, they acknowledge the sensitivity of their results to assumptions of the model. From our perspective their paper is valuable because it shows that unexpected events can generate substantial variation in wealth outcomes even though individuals are behaving optimally.

Another type of explanation for differences in savings across households has to do with varying subjective time rates of discount. That is, some people strongly prefer present consumption to future consumption causing them rationally to choose not to save (Dynan, 1993). While this may be true, it is not really an explanation. First, it is not testable without bringing in independent data on time preferences; yet data that plausibly measure only time rates of discount are rare if nonexistent. For example, the level of education is likely to be at least a weak measure of the time rate of discount but it is also related to a number of other unobserved personal characteristics and correlates of lifetime resources. Therefore, even holding constant observed measures of lifetime earnings, one could not expect the variation in savings as a function of education to show the variation in saving rates caused by variation in time rates of discount. The financial planning time horizon is often used as a measure of the subjective time rate. The rationale for using this measure is that someone with a high subjective time rate of discount discounts the future so much as not to care very much about future consumption. Therefore it is not worth planning for the distant future. This measure, again, is not a direct measure of the subjective time rate, and likely refers literally to the planning horizon, not to the subjective time rate. Finally, in the absence of restrictions on the data, explaining variation in saving rates as variation in time rates of discount basically restates the problem that apparently similar people reach retirement with very different wealth levels because their tastes are such that they choose those outcomes.

The LCM can explain a number of general features of the data. On average workers save at high rates during their 50s, when earnings usually reach a maximum and expenses have declined from the child-raising ages. The LCM predicts lower savings levels at advanced ages, which is typically found in panel data (Hurd; 1987, 1990, 1995, 1997). Also consistent with the LCM, Hurd, Smith and Zissimopoulos (2003) find that workers with high mortality risk retire earlier than workers with low mortality risk. Yet, there are a number of important features that, while not necessarily inconsistent with the LCM, are more difficult to explain. Many households in the middle of the income distribution apparently have inadequate levels of saving; among those with similar incomes wealth varies widely; and low levels of saving lead to a high risk of poverty should a surviving spouse live to extreme old age.

3. Data

We use data from the Health and Retirement Study (HRS) to explore the hypothesis that among individuals with similar lifetime earnings, those who experienced unexpected low rates of earnings growth, have lower retirement wealth than those who do not experiences these shocks. The HRS is a biennial panel with emphasis on retirement behavior and how it is affected by health status, economic status and work incentives. At baseline in 1992 the HRS had 12,652 respondents and was nationally representative of individuals born in 1931-1941 and their spouses except for over-samples of blacks, Hispanics and Floridians (Juster and Suzman, 1995). The HRS has a complete inventory of assets and these data appear to be of very high quality due to innovative survey techniques (Juster and Smith, 1997). In this study our main outcome measure is wealth levels in 1992 and is computed as the sum of wealth from real estate, businesses, IRAs, stocks, bonds, checking accounts, CDs and housing less the value of the mortgage, home loans and other debt. Missing data on wealth are imputed.[1] Other wealth variables include pension wealth and Social Security wealth. Social Security wealth is computed as the present discounted value of future benefits at age 62, and as combined wealth for married couples and individual wealth for single individuals.[2] The expected, discounted value of pension wealth at age 62 is computed assuming a 6.3 percent interest rate, 5 percent wage growth and 4 percent inflation.[3]

[1] The imputation process is described in SSA-HRS Data Documentation (St.Clair et al., 2002).

[2] See Mitchell, Olson and Steinmeier, "Social Security Earnings and Projected Benefits" in Forecasting Retirement Needs and Retirement Wealth for information on the Social Security Earnings file.

[3] The pension data was derived from the HRS wave1 Pension Plan Detail Data Set and using the Pension Estimation

The data from the first wave of the survey are linked with Social Security earnings records. The earnings data are based on historical earnings from 1951-1991 reported to the Social Security Administration and are available for 9,539 HRS respondents.[4] The matched data are well-suited for analyzing earnings dynamics. The administrative records are accurate and less subject to measurement error than self-reported earnings from household surveys. The data set covers a long history of earnings: from 1951 to 1991. That said, there are also several shortcomings. The level of earnings is reported up to the Social Security maximum. This maximum changed over time as did the number of individuals whose earning were above the maximum. In 1951, 1.4 percent of HRS respondents with matched record had earnings that exceeded the maximum. This percentage increased over the years to reach a maximum of 26.6 percent in 1971 and then decreased to 5.2 percent in 1991. In addition, individuals employed in a sector not covered by Social Security have no earnings records for the years he or she is employed in the uncovered sector.[5]

We use Social Security earnings as a measure of lifetime labor income. Lifetime earnings are calculated as the present discounted value (3 percent real interest rate) of real Social Security earnings adjusted to 1992 dollars using the CPI-U-RS, and we adjust for the upper truncation of Social Security earnings by using information on the quarter of the calendar year in which earnings reached the upper limit.[6] We use data on 9,382 HRS respondents that have a record of positive Social Security covered earnings. Social Security earnings may be a noisy measure of actual lifetime earnings, and it may underestimate lifetime earnings of individuals with substantial earnings from employment in sectors not covered by Social Security. We return to this issue later.

The key variable for this study is individual earnings growth rates. We estimate an earnings model for 7,839 respondents with 10 years of reported covered earnings between the ages of 21 and 60.[7] In the model of earnings, we only use observations on years with positive

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Program.

[4] See Haider and Solon (2000) for a discussion of characteristics of individuals with and without matched Social Security records.

[5] In 1996 92% of non-self-employed wage and salary workers were covered by Social Security.

[6] The adjustment method is based on the idea that the quarter of the year in which a worker reached the maximum can be used to estimate the quarterly flow of earnings, and, once the quarterly flow is known annual uncapped earnings estimated. For example, if a worker reached the maximum in two quarters we estimated that his or her annual earnings were twice the maximum.

[7] Earnings are converted to 1992 dollars using the CPI-UR-S and weighted to reflect quarters worked per year. The top and bottom 1% estimated earnings growth rates are trimmed. We use the 7,555 observations where estimates

earnings and we correct for partial years or work with the goal of estimating potential full year earnings. Using a tobit model to account for right censoring of observations above the Social Security maximum, for each individual we separately estimate log earnings as a function of a quartic in age.[8] With parameter values for each individual obtained from the estimation, we calculate an earnings growth rate as the first derivative of the earnings-age equation evaluated at each age. The second derivative, the change in earnings growth at age 30, is our indicator of a surprise in earnings growth: we interpret the change in the growth path at age 30 to be unexpected. We use age 30 because it is early in an individual's work career and the HRS cohort reached age 30 between the years 1961 and 1971, before the actual downturn in real wage growth.

In addition to data previously described, we use data from the wave 3 experimental modules. Experimental modules, appearing in each survey wave, are sets of questions of a speculative or experimental nature that are asked of a random subset of the respondents. In wave 3, which was fielded in 1996, modules 9 and 10 were devoted to some experimental questions about saving behavior and saving outcomes.[9] Questions in Module 9 and 10 were designed to ask directly about self-perceptions of savings adequacy and reasons for this inadequacy.[10]

4. Savings Adequacy

Aggregate data on wage trends described previously supply indirect support of our hypothesis. At the individual level, our analysis of data from the experimental modules in the HRS provides clues about savings behavior and motivates this study of inadequate retirement savings.[11] In Module 9, respondents were asked if they saved enough: "Thinking of your saving over the past 20 or 30 years, do you think now that what you saved was about right, too little, or too much?" All else equal, with random events that average out to zero, we expect to have approximately the same number of "too little" and "too much." The data, however, show an asymmetry. Seventy two percent of the respondents stated they saved too little, 26 percent saved

converged.

[8] Murphy and Welch (1990) show that a quartic specification fits the data better than the commonly used quadratic specification.

[9] In module 9, 573 individuals were asked about their savings behavior and in Module 10, 476 individuals.

[10] See Hurd and Zissimopoulos (2000) for a discussion of the validity of data from these modules.

[11] This section was largely reproduced from an earlier paper (Hurd and Zissimopoulos, 2000) which provides a more complete study of savings behavior based on the experimental modules. See also Venti and Wise (2000) for a discussion of the module data and analysis.

about right and only about 1.5 percent said that they had saved too much. The objective data on lifetime income and wealth correspond to the subjective self-assessments. Mean and median wealth are approximately twice as high among those who saved enough compared to wealth among those who saved too little (Table 1). Households who "saved about right" have a higher wealth to lifetime income ratio indicating a greater saving rate. Individual level shocks cannot explain the high percentage of people who state they saved too little which suggests there may be something more systematic.

In Module 10 respondents are asked " Including any income that you expect from Social Security or pensions, will you have enough savings to maintain your current living standard after retirement?" The aim of the question was to elicit the respondent's evaluation of their future standard of living shortly after retirement. Among those still working about 64% of the respondents anticipate being able to maintain their current standard of living after retiring (Table 2). Although a much higher percent report being able to maintain their standard of living after retirement than those who report they saved adequately, the comparison is inexact. Individuals in the workforce may report that they did not save enough but anticipate saving more before choosing to retire. Moreover, because of unexpected events, individuals may have saved inadequately for retirement but in response to this shock, had lowered consumption before retirement and thus will not experience a change in standard of living pre- and post-retirement.

Respondents do appear to be aware of the adequacy of their financial status. Among those still working, the level of self-reported retirement wealth is approximately 4 times higher for respondents who saved adequately than for respondents who did not save enough and their wealth to income ratio is higher: 1.94 versus 0.62 (Table 2). Among those with a shortfall in retirement wealth, the self-reported additional amount needed is $91.2 thousand (Table 2). When added to actual retirement wealth, this amount would provide a total of $122.6 thousand, which is almost exactly the same wealth level as those who report having enough savings to maintain their current standard of living in retirement.

The most common answer by working respondents as to why they do not have enough savings to maintain their current standard of living after retirement is low or insufficient income (Table 3). In the LCM with a known income path this is not a reasonable answer. Those with low income today who fail to save will have even lower consumption levels in the future. Thus lifetime utility could be increased by reallocating consumption from pre-retirement to post-

retirement. Unexpected outcomes in earnings as well as for other expenses, however, may cause households that planned to reach retirement with adequate savings, not to realize their plans. This is the hypothesis we test.

5. Income growth and retirement wealth

We examine the earning growth profiles of the 1931-1941 HRS cohort based on our fitted estimates as described in Section 3. Figure 2 shows the earnings growth rate for males and females in the HRS by age. The growth rates are averages of the first derivatives of the individual earnings paths. At age 25, earnings growth for males was 7.7% and 4.1% for females. By age 40, growth was negative for females and for males. The HRS cohort reached age 40 between the years 1971 and 1981, largely a period of declining real wages.

Cohort differences in the HRS are described in Table 4. Table 4 shows average earnings growth over the ages 25 to 40 and ages 41 to 55 by birth cohort categories. Generally, the 1940-1941 cohort had lower earnings growth at young ages and larger earnings declines than the oldest HRS cohort born 1931 and 1932. This is true for both males and females and is consistent with the time trend shown in Figure 1. Indeed, according to the growth in real wages described in Figure 1, the 1931 and 1932 cohort would have experienced rising real wage rates up to age 42 and then periods of sharp declines until wage rates flattened out around age 52. In contrast, the 1940 and 1941 cohort experienced growth in real wages only until about age 32, then falling wage rates until about age 42 when wage rates began to flatten out. Thus our panel estimates generally reflect the time trend we see in the data.

Earnings profiles of HRS respondents, based on averages of our individual level estimates, are shown by education and experience in Figure 3 and Figure 4 for males and females respectively. As expected, earnings are ordered by education with college educated individuals revealing the highest earnings at all experience levels. Moreover, college graduates had greater earnings growth than individuals with lower levels of education. An increase in the education premium in the 1980s is well-established in the literature on earnings dynamics (see Levy and Murnane, 1992, for a review of the literature). Katz and Murphy (1992) attribute education premium to the growth in relative demand for college educated workers as well as changes in the rates of growth of different labor force groups. These demand and supply shifts and their effects on earnings were likely to have been unexpected by workers.

This conclusion is reinforced by data on the experience of previous cohorts. Figures 5 and 6 shows weekly earnings for 3 cohorts: workers age 25-29 in 1950, age 25-29 in 1960 and age 25-29 in 1970. These synthetic cohorts are based on cross-sectional data from the 1950, 1960, 1970, 1980 and 1990 PUMS. Figure 5 shows weekly earnings for individuals with 9 to 11 years of education. Among these individuals, the 1950 cohort realized an almost doubling of their weekly earnings from ages 25-29 to ages 45-49. The 1960 cohort realized less of an increase over 20 years and the 1970 cohort saw their earnings rise by only 11 percent. Figure 6 shows weekly earnings for individuals with 16 or more years of education. In contrast, to workers with fewer years of education, all cohorts experienced substantial earnings growth albeit the 1950 cohort witnessing the largest amount of growth. The HRS cohort was 19-29 years old 1960. Thus, initially the cohort had strong wage growth but later on average they experienced less earnings growth than previous cohorts, particularly workers with low levels of education.

In sum, the macro-level data on wage rate trajectories are consistent with low wage growth as an explanation for low wealth levels. Our results show that as a cohort, HRS respondents experienced declining real earnings by age 40 and zero or negative earnings growth thereafter.

Wealth and lifetime earnings

Table 5 shows wealth as a function of lifetime earnings.[12] Lifetime earnings of households in the lowest 20th percentile of the earnings distribution are $275,023 and total wealth for these households is $91,001. In contrast, lifetime earnings of households in the highest 20th percentile of the earnings distribution are $2,435,259 and total wealth for these households is $356,236. Within a lifetime earnings group, however, wealth is highly skewed. For example, median household wealth for households in the 20th to 40th percentile is $47,025 compared to mean wealth of $122,952.[13]

Table 5 shows that individuals will accumulate different amounts of wealth because of differences in their lifetime earnings. That said, there is substantial variation in wealth levels among households with similar levels of lifetime earnings. Some HRS respondents did save

[12] Total wealth is composed of wealth from housing, real estate, vehicles, business, IRAs, stocks, checking accounts, CDs, bond less value of mortgages, home loans and other debt.

[13] Venti and Wise (2000) studied wealth as a function of lifetime earnings. In this study we emphasize wage growth rather than wage level. Measurement error in lifetime earnings is discussed in Section 6.

adequately and undoubtedly some respondents did have earnings paths that satisfied their expectations. Thus, to explain savings levels at the household level we examine individual-level earnings paths and indicators of whether these paths were unexpected holding constant lifetime earnings.

Unexpected earnings growth and wealth

As an informal test of the hypothesis that a change in earnings growth early in the work life led to reduced wealth at retirement we tabulate wealth levels as a function of lifetime earnings growth at age 30 and the change in earnings growth at age 30 (Table 6). Lifetime earnings are categorized as above or below the median; earnings growth and the change in earnings growth are categorized as negative or non-negative.

For males workers with lifetime earnings above the median, and high earnings growth, those with a positive change in earnings growth had $434,007 in wealth compared to $279,045 of wealth for individuals a negative change in earnings growth. This pattern holds for individuals with high lifetime earnings and low earnings growth. This pattern is also seen for male respondents with low lifetime earnings. This table is consistent with the hypothesis that individuals were surprised by low earnings growth, and saved less than individuals who did not experience an unexpected downturn in earnings. Wealth levels examined in Table 6, however, are based on household levels and this table controls for the earnings growth of only one member of the household for multi-person households. Moreover, the classification of lifetime earnings into high and low leaves considerable variation within these categories; therefore, we move to a regression framework.

6. Retirement wealth estimation results

We study the effect of household lifetime earnings, and each adult's earnings growth and change in earnings growth at age 30 on household wealth holding. We use in the analysis 5,446 households where at least one individual in the household has at least ten years of Social Security covered earnings from age 21 to 61. The specification holds constant marital status, age, a respondent's financial planning horizon, and Social Security and pension wealth, and examines the effect of earnings growth, the change in earnings growth, and lifetime earnings on wealth.

The earnings growth variables for males and females in a married household are weighted by the ratio of each spouse's lifetime earnings to household lifetime earnings.

As we noted in Section 3 there are two main problems with measuring lifetime earnings as the present discounted value of Social Security covered earnings: the level of earnings is reported up to the Social Security maximum; and individuals employed in a sector not covered by Social Security have no earnings records for the years he or she is employed in the uncovered sector. Furthermore, the comparison of wealth with lifetime earnings aggregated to later ages at a fixed interest rate to find a saving rate may involve considerable error. For example, someone who anticipates flat earnings will save early in life, and those savings will experience the interest rate path from a young age to 1992. Another person with rising wages will save late in life and those savings are exposed to interest rates from older ages to 1992. Thus people who intended to reach retirement with the same level of wealth could reach retirement with very different levels. This lack of an exact comparison can be thought of as observation error on lifetime earnings.

The top panel of Table 7 shows mean lifetime earnings and total wealth stratified by lifetime earnings percentiles. We also show the wealth to lifetime earnings ratios. The table shows that households in the lowest 20th percentile of the lifetime earnings distribution have the highest wealth to earnings ratio (0.33). This finding is inconsistent with the literature that finds saving is concentrated among those with high income, wealth and education. This result is likely due to misclassification in lifetime earnings percentiles because of observation error. In comparison, the bottom panel shows wealth to lifetime earnings ratios by years of education (for males). Mean lifetime income increases across education groups. The role of measurement error is brought out: using education as a variable to categorize lifetime earnings we find that the rate of saving out of lifetime income increases in income rather than falls.[14]

To address this issue of measurement error in lifetime earnings, we use instrumental variables estimation (IV). The source of identification is variation in lifetime earnings resulting from differences in the industry worked on the job with the longest tenure. Several studies have noted the decline in income for high school educated men due to decreases in the demand for these workers in the manufacturing sector during the 1980s.[15] For a review see Levy and

[14] This method is similar to instrumental variables estimation using education as the instrumental variable.

[15] For example, one hypothesis notes that a high dollar made imports cheaper and reduced demand for manufacturing output.

Murnane, 1992. We assume there is no correlation between unobserved variables in our wealth equation and industry categories.

Table 8 shows the estimation results for log total wealth, using industry of longest job as instruments for log household lifetime earnings.[16] Lifetime earnings have a large effect on wealth levels. A 1 percent increase in a household's lifetime earnings increases wealth by 0.65 percent. Once lifetime earnings are controlled for we do not expect an effect of earnings growth at age 30 on wealth and indeed we do not find one for either males or females. For men, the effect of the second derivative is positive and statistically significant, and the magnitude is moderate: For men the standard deviation in the second derivative is 0.085, so a change of two standard deviations in the second derivative increases wealth by about 20 percent. For women, there is no effect of a change in earnings growth on household wealth. In that 83 percent of the women in this sample are married, the effect is primarily identified from married women. We return to interpreting the economic content of the change in earnings growth and lifetime earnings results in a simulation exercise described below.

The specification includes several additional variables of interest including age, financial planning horizon and other wealth. Financial planning horizons over one year have a positive effect on wealth relative to a planning horizon of one year or less. The effect is economically important, a planning horizon of 10 years or more increases wealth by 83 percent for men and 56 percent for women relative to individuals with a planning horizon of one year or less. The subjective time horizon is often used as a measure of subjective time rates of discount. The rationale for using this measure is that someone with a high discount rate discounts the future so much as not to care very much about future consumption, and, therefore, would not engage in long-term planning. The expected, present, discounted value of pension wealth at age 62 has a positive impact on wealth, which is likely picking up unobserved taste for savings.

Table 9 uses the regression estimates to simulate differences in total wealth due to differences in earnings growth and then due to difference in lifetime earnings. The simulations are based on a married household with individuals of ages 60 to 61 and with 10-year financial planning horizons. All other covariates take on mean values. A household with a change in earnings growth at the 5th percentile of the distribution (for males) is simulated to have $89,231

[16] The means of the right-hand variables are given in Appendix Table A, the first stage regression results of the instrumental variables estimation is given in Appendix Table B, and OLS results are available in Appendix Table C.

in total wealth in 1992. In contrast, a household with a change in earnings growth at the 95th percentile has total wealth of $94,400. The differences are not large. Indeed, the micro level data, using our measure of unexpected earnings growths, cannot explain large wealth differences on average. What it does explain is differences in wealth for those individuals who had decidedly bad or good outcomes: that is, those at the extremes of the distribution (1^{st} and 99^{th} percentile). In contrast, if we compare a household with lifetime earnings at the 10^{th} percentile compared to the 90^{th} percentile (holding change in earnings growth at its mean value), wealth differences are $40,866 compared to $163,924.

7. Conclusion

We found that there is a perception of 'under-saving' for retirement among many individuals. Individuals who perceive they have saved inadequately attribute this mainly to having insufficient income. Under a lifecycle model of consumption with a known income path this is not a reasonable answer. Those with low income today who fail to save will have even lower consumption levels in the future and could increase lifetime utility by reallocating consumption from pre-retirement to post-retirement. Unexpected outcomes in earnings, however, may cause households that planned to reach retirement with adequate savings, not to realize their plans. The decline in real wages that began in 1973 suggests a compelling explanation for low wealth levels: individuals were surprised by low earnings growth and thus under-saved relative to their lifetime incomes. We find that the hypothesis fits the data for those with extreme outcomes but does not explain large wealth differences for individuals on average.

Future work will examine cohort differences as a method for understanding unexpected earnings growth and its impact on savings. At this stage in the analysis we do not have the data available to control for age in order to study cohort differences. We can begin to examine cohort effects using future waves of the HRS. Alternatively, The Longitudinal Retirement History Survey, based on individuals age 58-63 in 1969, can be linked with Social Security earnings records and provides longitudinal earnings data on an older cohort of individuals.

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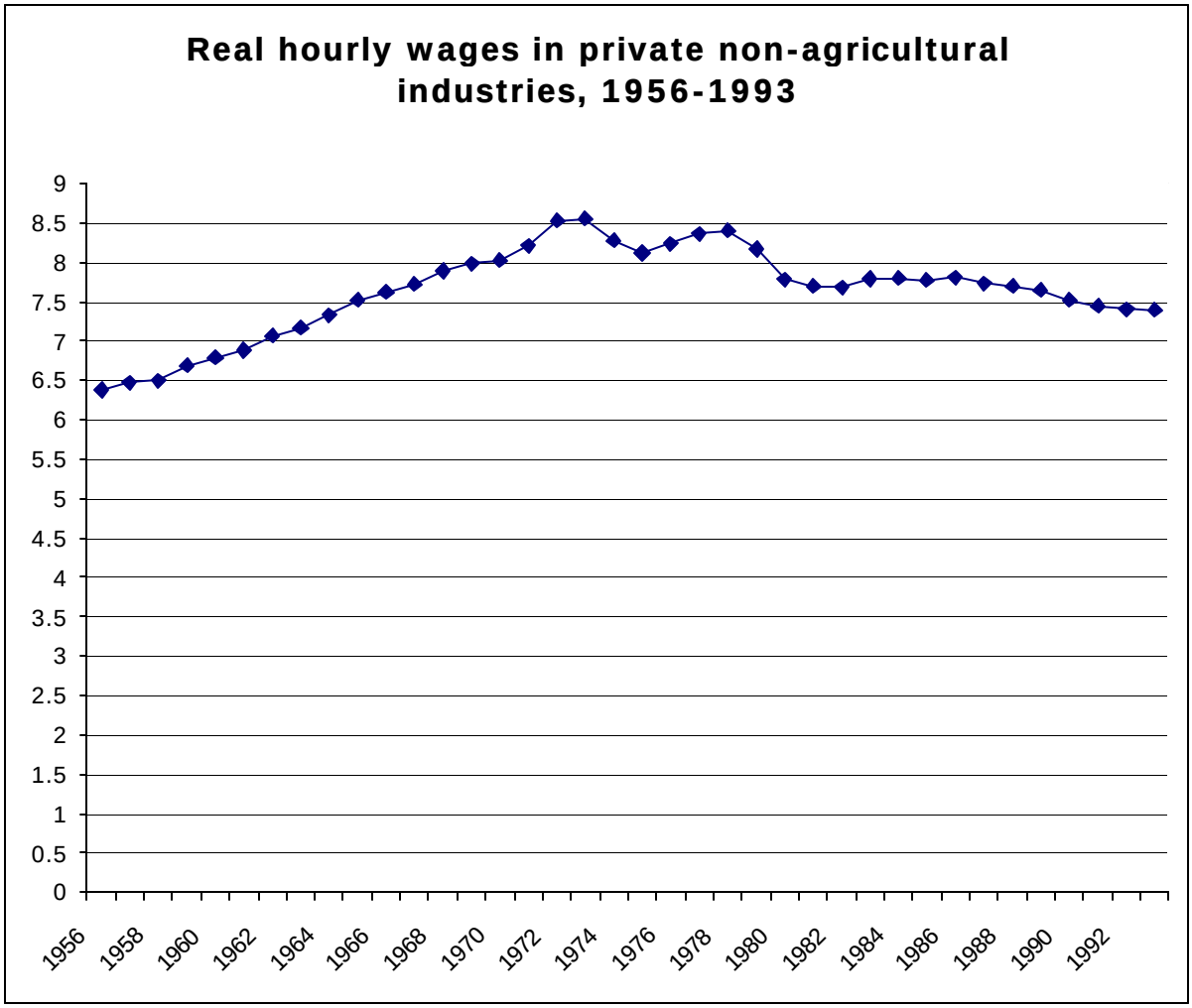
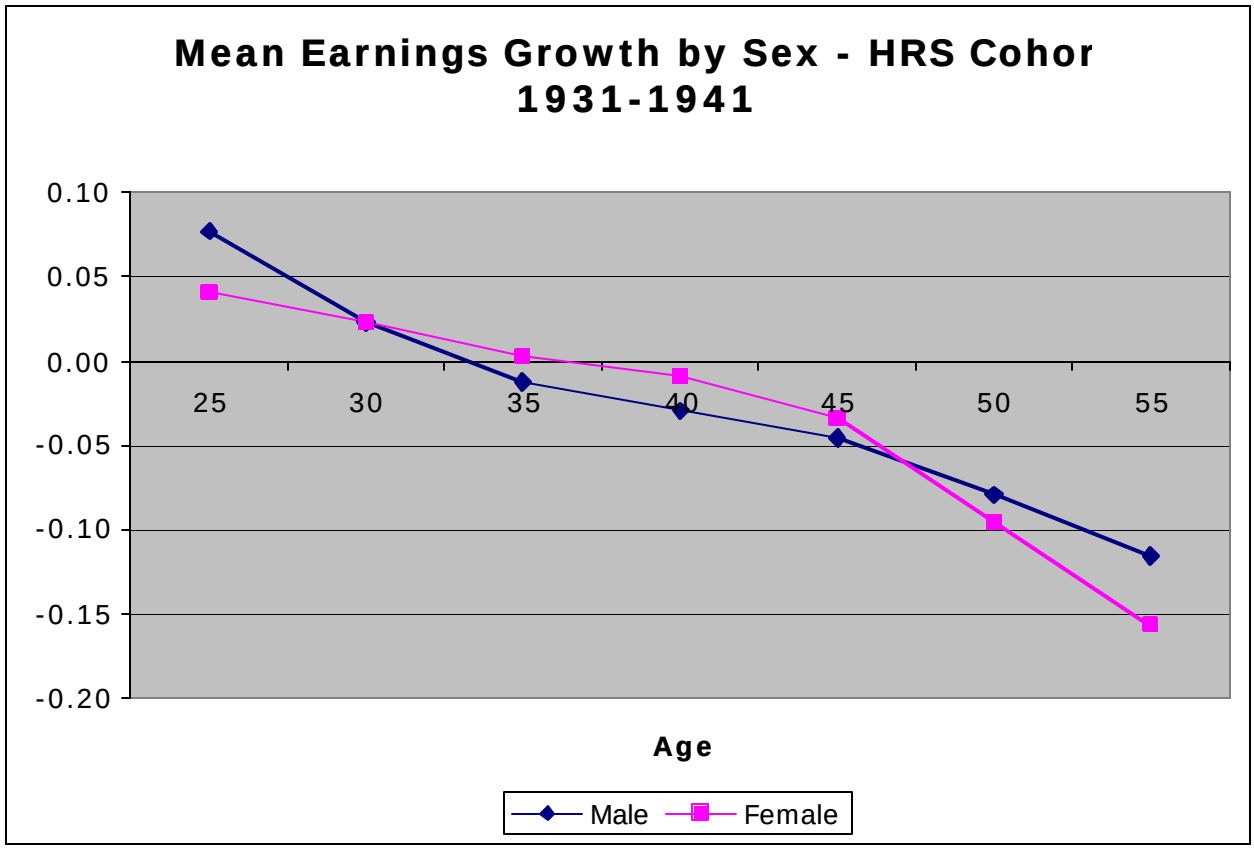
Figure 1



Source: Department of Labor, Bureau of Labor Statistics.
Notes: Average hourly earnings in 1982 dollars

Figure 2.



Source: HRS 1992 and Social Security earnings records.
Notes: Based on estimated earnings growth model.

Figure 3.

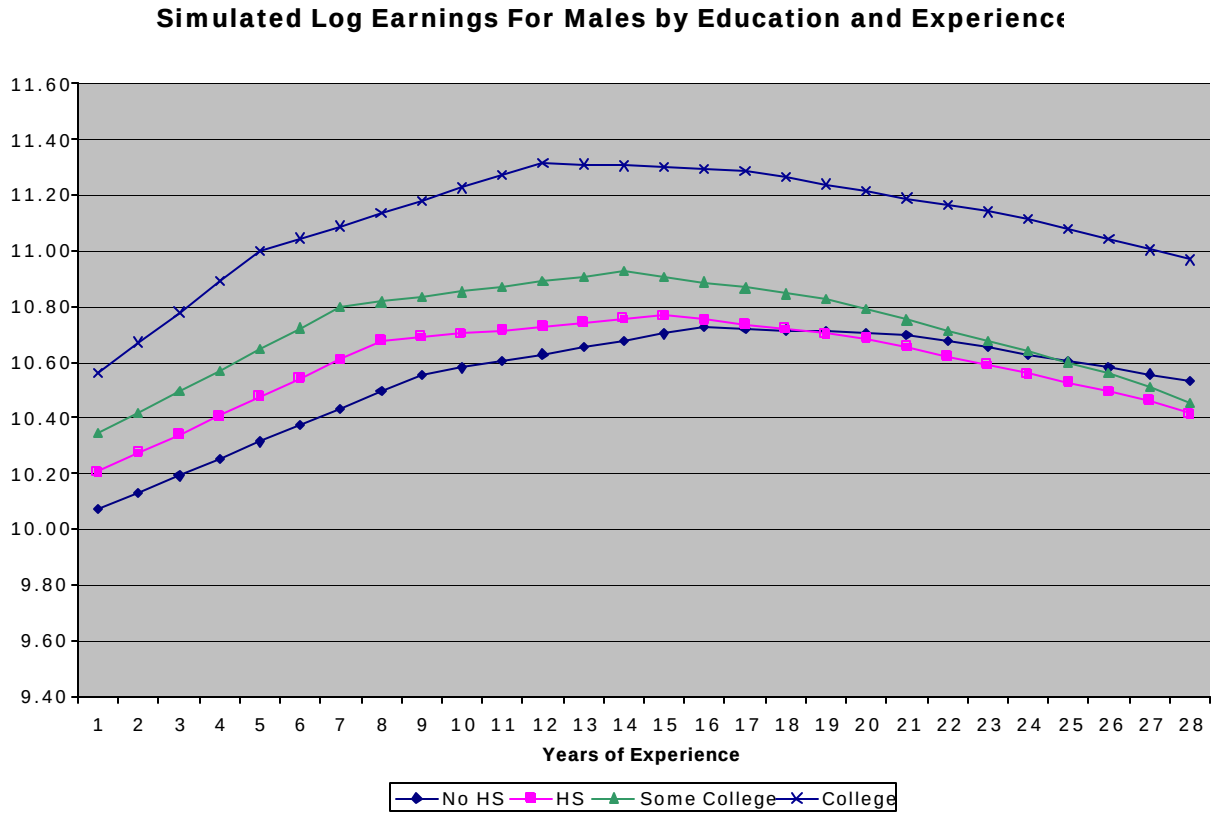

Simulated Log Earnings For Males by Education and Experience
11.60
11.40
11.20
11.00
10.80
10.60
10.40
10.20
10.00
9.80
9.60
9.40
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Years of Experience
No HS
HS
Some College
College

Figure 4.

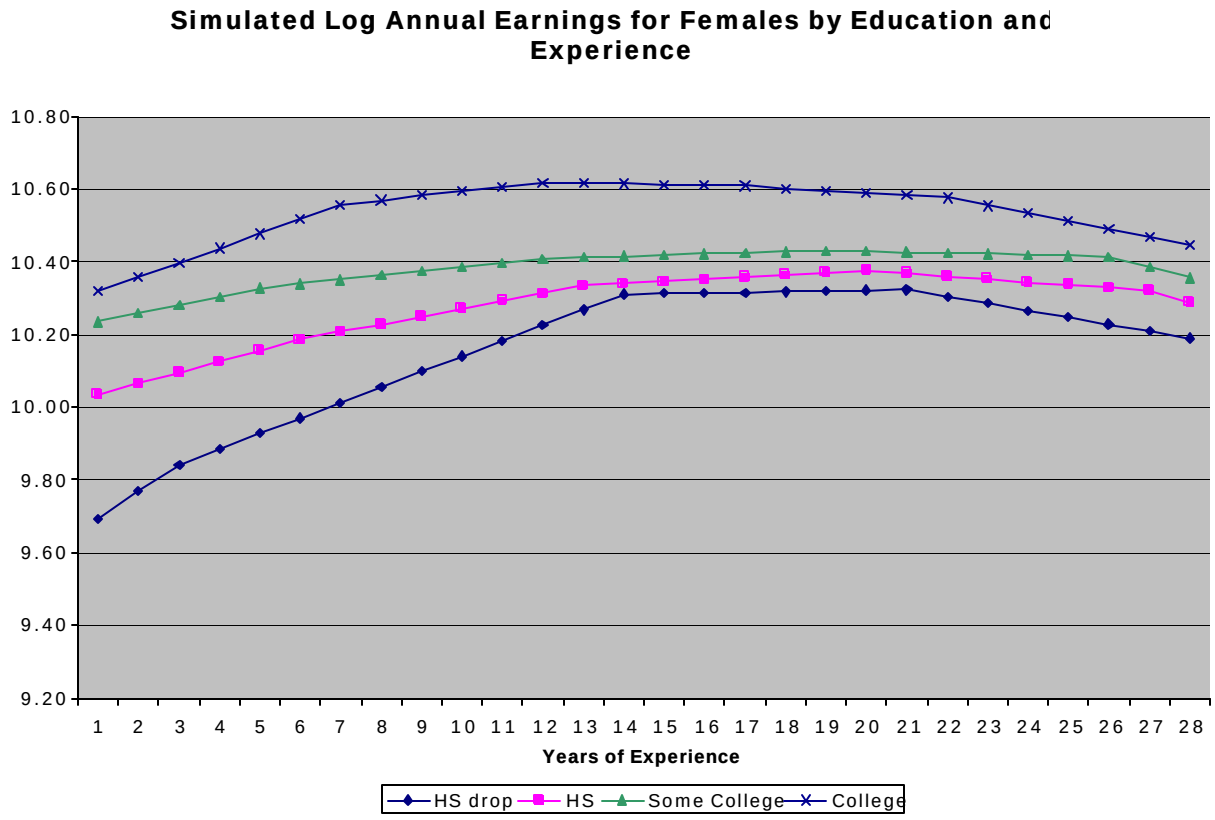

Simulated Log Annual Earnings for Females by Education and Experience
10.80
10.60
10.40
10.20
10.00
9.80
9.60
9.40
9.20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Years of Experience
HS drop
HS
Some College
College

Figure 5.

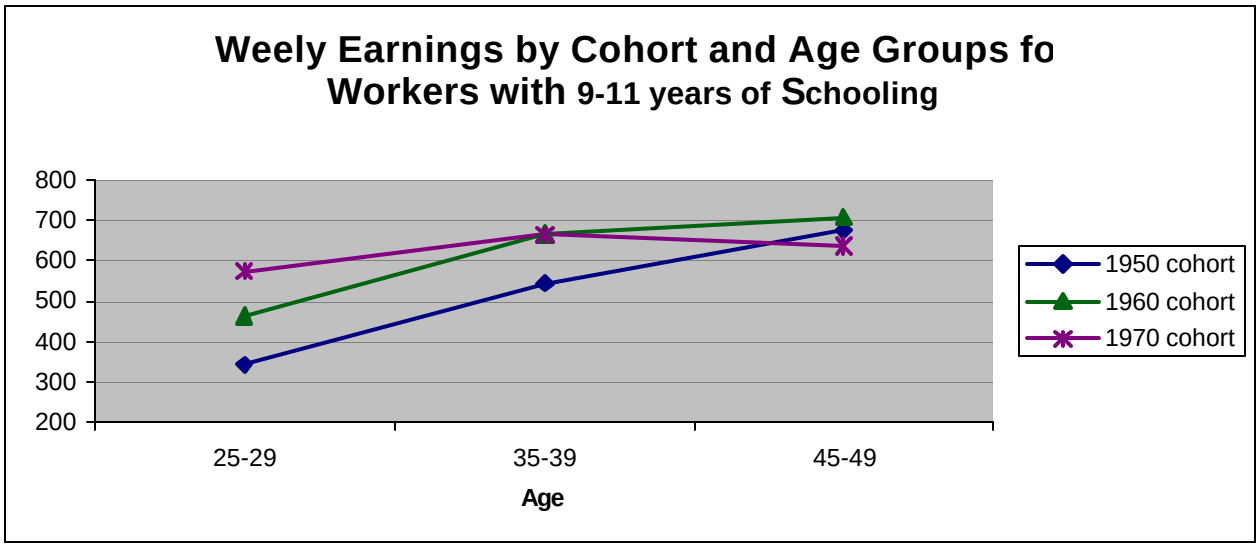


Figure 6.

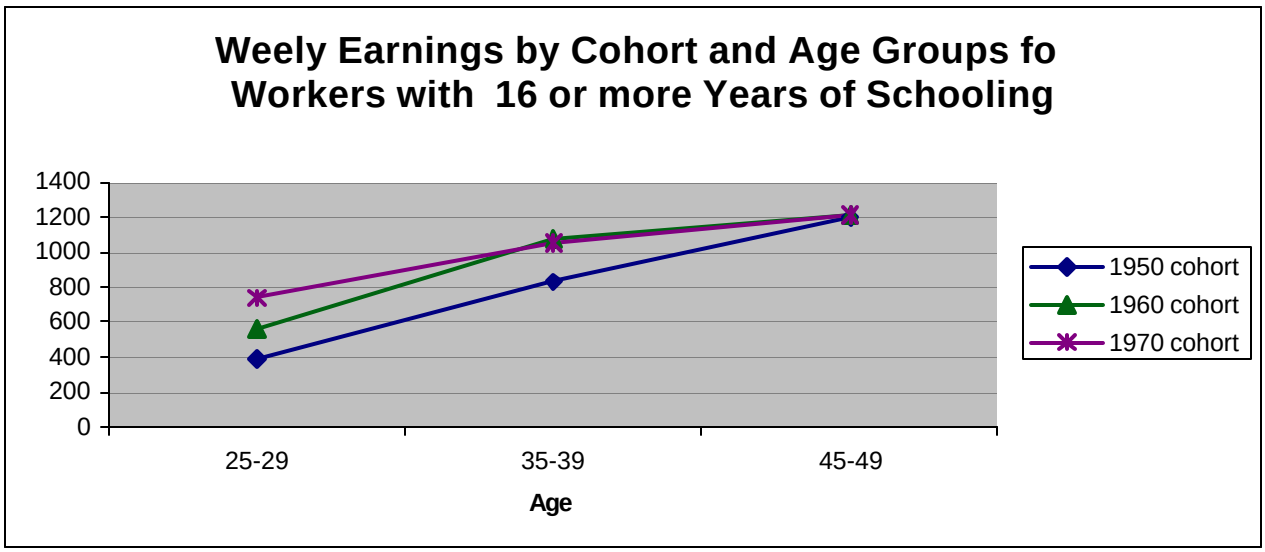


Table 1.
Self-Assessed Savings Adequacy Over Past 30 years:
Wealth and Lifetime Income (thousands)

		Wealth		Lifetime Income		Wealth to Income	
Saved too Little	Percent	Mean	Median	Mean	Median	Mean	Median
Yes	72.6%	171.4	92.5	1227.7	1256.6	0.14	0.07
No	27.4%	350.8	177.9	1460.8	1536.8	0.24	0.12

Note: N=290. Based on Module 9 and HRS wave 1

Table 2.
Retirement Wealth: Actual and Needed (thousands) and Household Income (thousands)

	Saved Enough to Maintain Standard of Living After Retirement?	
	Yes (64%)	No (36%)
Actual retirement wealth	$124.0	$31.4
Additional amount needed	--	91.2
Total wealth for retirement adequacy	124.0	122.6
HRS wave 3 household income	74.5	54.9

Note: N=307. Based on workers in Module 10.

Table 3.
Self-Reported Causes of Inadequate Saving

Causes of Inadequate Savings	Percent
Income too Low	26.9
High cost of Living	25.0
Mistake	20.2
Extraordinary Expenditures	9.6
Other	18.3
Total	100.0

Number of observations: 104. Based on Module 10 respondents who expect lower standard of living in retirement and are working for pay.

Table 4.
Earnings growth by cohort

	Males		Females	
Birth Cohort	Age 25-40	Age 41-55	Age 25-40	Age 41-55
1940-41	0.0023	-0.1018	0.0140	-0.1031
1938-39	0.0073	-0.0650	0.0149	-0.0816
1936-37	0.0143	-0.0819	0.0180	-0.0551
1933-35	0.0181	-0.0705	0.0210	-0.0491
1931-32	0.0219	-0.0719	0.0186	-0.0691

Source: HRS 1992 and Social Security earnings records 1951-1991.
Notes: 3,834 male observations and 3,721 female observations.

Table 5.
Household Wealth and Lifetime Earnings by Household Lifetime Earnings Quartiles

Lifetime earnings	Lifetime earnings	Total wealth		Financial wealth	
Percentiles	Mean	Mean	Median	Mean	Median
0-20th	275,023	91,001	28,100	19,355	0
21st-40th	714,355	122,952	47,025	28,062	1,000
41st-60th	1,233,475	164,632	68,000	30,690	3,250
61st-80th	1,768,821	231,768	114,300	45,142	10,000
81st and above	2,435,259	356,236	186,600	99,734	28,000
All	1,285,598	193,348	81,725	44,607	5,000

Note: Lifetime earnings are calculated as the present discounted value (3% real interest rate) of real Social Security earnings adjusted to 1992 dollars using the CPI-U-RS. N=5,446 households.

Table 6.
Mean household wealth by lifetime earnings, earnings growth and change in earnings growth - Males

	Total Wealth			
	Lifetime earnings			
	High		Low	
	Earnings growth age 30		Earnings growth age 30	
Change in earnings growth age 30	High	Low	High	Low
High	434,007	289,152	121,964	139,253
Low	279,045	212,545	112,938	125,256

Notes: High lifetime earnings indicates above 50 percentile. High earnings growth and change in earnings growth indicates a positive growth or change in growth.

Table 7.
Lifetime Earnings, Wealth and Wealth to Earnings Ratios by Lifetime Earnings Percentiles and Years of Education

	Lifetime earnings percentiles		
	Lifetime earnings	Total Wealth	Wealth/Earnings
Percentiles	Mean	Mean	Ratio
0-20th	275,023	91,001	0.331
21st-40th	714,355	122,952	0.172
41st-60th	1,233,475	164,632	0.133
61st-80th	1,768,821	231,768	0.131
81st-100th	2,435,259	356,236	0.146
Years	Years of education - males		
1-8	1,042,360	80,661	0.077
9-11	1,379,778	137,109	0.099
12	1,522,748	189,246	0.124
13-15	1,513,084	226,420	0.150
16+	1,654,138	435,890	0.264

Notes: Number of observations is 5,446 for lifetime earnings percentiles and 3,834 for education years for males.

Table 8.
Estimates of Determinants of Log Total Wealth:
Instrumental variable estimation

	Coefficient	P>|t|
Log household lifetime earnings	0.651	0.022
Male - wage growth at age 30	0.722	0.308
Male -change in wage growth at 30	1.203	0.026
Female - wage growth at age 30	-0.803	0.352
Female - change in wage growth at 30	-0.025	0.970
Not married – male	-1.458	0.000
Not married – female	0.121	0.673
Planning horizon 2-10 years-female	0.469	0.000
Planning horizon more than 10 years-female	0.564	0.002
Planning horizon missing-female	-0.071	0.770
Planning horizon 2-10 years-male	0.706	0.000
Planning horizon more than 10 years-male	0.833	0.000
Planning horizon missing-male	0.178	0.351
Social Security Wealth at age 62	0.093	0.000
Pension wealth at age 62 – female	0.048	0.000
Pension wealth at age 62 – male	0.056	0.000
Constant	-0.830	0.826
Observations	5446	
F	43.660	
R-squared (adjusted)	0.228	

Notes: Includes age dummies, an indicator for age for non-age eligible spouses and controls for missing spouse earnings data because of no earnings or no Social Security record match.

Table 9.
Simulated Total Wealth Results

Change in earnings growth at (percentile):	Simulated total wealth ($)
1st	72,519
5th	89,231
10th	90,564
25th	91,900
75th	92,646
90th	92,980
95th	94,400
99th	144,879
Lifetime earnings at (percentile):	
1st	18,291
5th	30,303
10th	40,866
25th	66,529
75th	142,940
90th	163,924
95th	175,158
99th	198,322

Note: simulated wealth based on regression coefficients in Table 8.

Appendix Table A: Mean, Standard Deviation of Right-Hand Side Variables in Table 8.

Variable	Mean	Std. Dev.
Log household lifetime earnings	13.789	0.862
Male - wage growth at age 30	0.010	0.065
Male -change in wage growth at 30	-0.002	0.085
Female - wage growth at age 30	0.009	0.062
Female - change in wage growth at 30	-0.007	0.082
Not married - male	0.090	0.286
Not married - female	0.173	0.378
Planning horizon 2-10 years-female	0.527	0.499
Planning horizon more than 10 years-female	0.071	0.257
Planning horizon missing-female	0.035	0.184
Planning horizon 2-10 years-male	0.476	0.499
Planning horizon more than 10 years-male	0.065	0.247
Planning horizon missing-male	0.070	0.255
Social Security Wealth at age 62	8.634	5.299
Pension wealth at age 62 - female	5.250	5.764
Pension wealth at age 62 - male	6.988	5.949
Males age 54-56	0.171	0.376
Males age 57-59	0.165	0.371
Males age 60-61	0.100	0.301
Females age 54-56	0.192	0.394
Females age 57-59	0.172	0.377
Females age 60-61	0.100	0.300
Age ineligible females 45 years old or younger	0.068	0.251
Age ineligible female 46-50 years old	0.124	0.330
Age ineligible female 62 years and older	0.023	0.151
Missing female earnings growth observation	0.227	0.419
Female has no Social Security record match	0.060	0.238
Age ineligible males 45 years old or younger	0.008	0.089
Age ineligible male 46-10 years old	0.022	0.147
Age ineligible male 62 years and older	0.153	0.360
Missing male earnings growth observation	0.123	0.328
Male has no Social Security record match	0.067	0.249
Number of observations	5,446	

Appendix Table B. First Stage IV regression for Log Household Lifetime Earnings

	Coef.	P>|t|
Intercept	0.331	0.013
Male - earnings growth at age 30	0.557	0.000
Male -change in earnings growth at 30	0.519	0.001
Female - earnings growth at age 30	0.489	0.000
Female - change in earnings growth at 30	-0.310	0.000
Not married - male	-0.546	0.000
Not married - female	0.091	0.000
Planning horizon 2-10 years-female	0.124	0.000
Planning horizon more than 10 years-female	-0.029	0.527
Planning horizon missing-female	0.093	0.000
Planning horizon 2-10 years-male	0.064	0.072
Planning horizon more than 10 years-male	-0.011	0.767
Planning horizon missing-male	0.331	0.013
Males age 54-56	0.049	0.060
Males age 57-59	0.054	0.050
Males age 60-61	0.149	0.000
Females age 54-56	0.057	0.022
Females age 57-59	0.102	0.000
Females age 60-61	0.135	0.000
Age ineligible females 45 years old or younger	-0.116	0.001
Age ineligible female 46-10 years old	-0.068	0.022
Age ineligible female 62 years and older	0.040	0.467
Missing female earnings growth observation	-0.146	0.000
Female has no Social Security record match	-0.267	0.000
Age ineligible males 45 years old or younger	-0.354	0.000
Age ineligible male 46-10 years old	-0.122	0.033
Age ineligible male 62 years and older	0.106	0.001
Missing male earnings growth observation	-0.423	0.000
Male has no Social Security record match	-1.036	0.000
Social Security Wealth at age 62	0.030	0.000
Pension wealth at age 62 - female	0.027	0.000
Pension wealth at age 62 - male	0.027	0.000
Industry for Males		
Agriculture	-0.392	0.000
Mining/construction	-0.086	0.006
Transportation	-0.205	0.000
Wholesale	-0.027	0.548
Retail	-0.070	0.050
Financial/Insurance/RealEstate	-0.022	0.663
Business/Repair Service	-0.023	0.631
Personal Service	-0.064	0.414
Professional related services	-0.221	0.000
Entertainment/recreation	-0.095	0.338
Public Administration	-0.442	0.000
Industry missing	-0.252	0.000
Industry for Females		

Agriculture	-0.216	0.003
Mining/construction	0.056	0.537
Transportation	0.099	0.036
Wholesale	0.031	0.612
Retail	-0.106	0.001
Financial/Insurance/RealEstate	0.113	0.005
Business/Repair Service	-0.111	0.022
Personal Service	-0.221	0.000
Professional related services	-0.041	0.134
Entertainment/recreation	0.039	0.654
Public Administration	-0.158	0.003
Industry missing	-0.086	0.014
Number of observations	5,446	
R-squared	0.547	

Notes: Industry code for job with longest tenure. Missing category is manufacturing.

Appendix Table C. Ordinary Least Squares Regression Results for Log Total Wealth

	OLS	
	Coef.	P>|t|
Log household lifetime earnings	1.241	0.000
Male - wage growth at age 30	0.536	0.443
Male -change in wage growth at 30	0.901	0.083
Female - wage growth at age 30	-1.054	0.214
Female - change in wage growth at 30	-0.292	0.647
Not married - male	-1.270	0.000
Not married - female	0.509	0.022
Planning horizon 2-10 years-female	0.412	0.000
Planning horizon more than 10 years-female	0.488	0.006
Planning horizon missing-female	-0.044	0.856
Planning horizon 2-10 years-male	0.650	0.000
Planning horizon more than 10 years-male	0.794	0.000
Planning horizon missing-male	0.188	0.322
Social Security Wealth at age 62	0.075	0.000
Pension wealth at age 62 - female	0.031	0.000
Pension wealth at age 62 - male	0.040	0.000
Constant	-8.681	0.000
obs	5446	
F	54.120	
R-squared (adjusted)	0.238	

Notes: Includes age dummies, an indicator for age for non-age eligible spouses and controls for missing spouse earnings data because of no earnings or no Social Security record match.