Saving for Retirement: Wage Growth and Unexpected Events

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1. Introduction

The main economic resources that support retired households are Social Security, private pensions, owner-occupied houses, and financial savings. Social Security coverage is almost universal, and a large fraction of households reach retirement owning housing. But Social Security and housing alone will provide enough resources to keep the household only marginally above the poverty line. Therefore, those approaching retirement need to have accumulated some savings or to be qualified for a pension to have even a moderate level of economic status in retirement. However, most 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). Even among those households with pension income, most did not have large fractions of their incomes from pensions. For many households, then, their own savings are needed to provide for adequate retirement 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. 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). 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). Following retirement the distribution of savings is highly skewed with some households having substantial savings and many having none (Smith, 1997). There are, of course, some obvious explanations for the differences. 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.

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 will 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 goal of this research is to examine among individuals with similar lifetime earnings, the relationship between earnings growth and wealth, and unexpected events and wealth. To

accomplish this goal, we use Social Security earnings data matched with panel data and data from experimental modules from the Health and Retirement Study (HRS). We first describe the adequacy of households' retirement savings, paying particular attention to the characteristics of under-savers. We then describe the earnings profiles of the HRS respondents and how retirement savings vary with lifetime earnings profiles. We examine whether those who had low or no wage growth have lower retirement savings than those who had otherwise similar lifetime income but experienced wage growth. Individuals who experienced earnings growth early in their lives may have anticipated rising earnings throughout their work lives. Unexpected low wage growth of some may have resulted in under-savings. In that we do not have actual reports by the HRS respondents about unexpected wage growth, we use the change in earnings growth to ascertain unexpected growth. We analyze, among individuals with similar wage growth at age 30 and similar lifetime earnings, whether flat or negative earnings growth paths resulted in low wealth accumulation. Finally, we estimate a model of earning growth rates, change in growth rates and unexpected shocks due to marital disruptions and wealth shocks on retirement savings holding constant lifetime resources.

We find that low real income growth and unexpected losses are likely contributors to the explanations for inadequate retirement savings. We conclude by considering measurement error in lifetime earnings measures and next steps in the research to address this issue. While this analysis is based on a single cohort, future analysis will use the Retirement History Survey and older cohorts to further examine our hypothesis.

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.

A second type of evidence that the LCM cannot adequately explain low saving rates comes from studying actual consumption before and after retirement. This type of study is intrinsically difficult to do because consumption is difficult to measure. Furthermore, some purchases that are measured as consumption are in fact work-related expenses that would cease with retirement (Hurd, 1996a). Nonetheless, a consistent finding is that consumption drops at retirement more that could be explained by work-related expenses (Blundell, Meghir and Weber, 1993; Banks, Blundell and Tanner, 1995). An explanation within the LCM is that leisure and consumption are substitutes, so that people desire to consume less when they have more leisure. A more complex model specifies that people can use time to produce consumable goods which can substitute for market-purchased goods. Expenditure surveys would record a drop in market spending at retirement even though consumption remained constant. Regardless of whether the explanation is in terms of tastes or home production, there is little empirical evidence to support an explanation based on substitution rather than based on inadequate saving.

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. Furthermore, the drop in consumption at retirement is not consistent with an explanation based on social programs. Therefore, a restrictive version of the life cycle model, which is the main theoretical model of consumption and saving, apparently cannot explain 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.

The large literature on earnings inequality documents shocks to real wages in the 1970s, resulting earnings inequality and discusses demand and supply shift as possible explanations (see Levy and Murnane (1992) for a review of this literature). These shifts may have largely been unexpected by individuals. Several important trends have been documented: the end of rapid

real earnings growth beginning in 1973 and an increase in the growth of earnings inequality particularly among men beginning in 1979. There is general agreement in the literature that inequality between age and education group was stable in the 1970s as the education premia declined while the age premia increased and grew in the 1980s with an increase in the education premia. Both supply and demand explanations have been put forth as explanations. For example, on the supply side, the entry into the labor market of well educated baby boomers likely depressed wages for the well-educated during the 1970s coupled with an increase in the relative demand for high skilled workers in the 1980s (Katz and Murphy). Since the 1970s within age and education group earnings inequality has steadily increased. There is less agreement as to the reasons for this change although several hypotheses have been put forth. One hypothesis is that demand shifts across industries lead to variation across industries in wages holding education constant as the result of slow adjustment. Other hypotheses call on supply and demand shift in workers characteristics that are unobserved and not proxied by education (returns to skill).

Another type of explanation for differences in savings across households has to do with varying subjective time rates of discount. That is, some people highly 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). 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; consumption falls excessively at retirement; 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 unexpected low earnings growth and unexpected events resulted in low and insufficient retirement savings. 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 income, and these data appear to be of very high quality due to innovative survey techniques (Juster and Smith, 1997). This paper is based primarily on wave 1 data linked with 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.[1] 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% 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% in 1971 and then decreased to 5.2% in

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

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.[2]

The key variable for this study is individual earnings growth rates. We use Social Security earnings as a measure of lifetime labor income. 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, 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.[3] 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. Other important variables include assets, pension wealth and Social Security wealth. Missing data on non-pension and non-Social Security wealth is imputed.[4] Social Security wealth is computed as the present discounted value of future benefits at age 62, as is combined wealth for married couples and individual wealth for single individuals.[5] Pension wealth is computed assuming a 6.3 percent interest rate, 5 percent wage growth and 4 percent inflation.[6] We estimate an earnings growth rate for 7,839 respondents with 10 years of reported covered earnings between the ages of 21 and 60.[7] Using a tobit model to account for right censoring of observations above the Social Security maximum, we estimate log earnings as a function of a quartic in age.[8] We restrict the sample to age eligible respondents (6,013 observations).

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

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

[3] See footnote 14 for an explanation.

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

[5] 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.

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

[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.

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

3, which was fielded in 1996, modules 9 and 10 were devoted to some experimental questions about saving behavior and saving outcomes. In module 9, 573 individuals were asked about their savings behavior and in Module 10, 476 individuals responded to questions on savings behavior. Modules 9 and 10 address past saving behavior, current retirement savings and the perceived adequacy of the savings level and plans for future savings.[9]

4. Savings Adequacy

A goal of the experimental modules was to compare objective measures of preparation for retirement with subjective measures.[10] Median retirement wealth as directly reported in module 10 was $27.5 thousand, which suggests that many households are not adequately prepared for retirement. Questions in Module 9 and 10 were designed to ask directly about self-perceptions of savings adequacy. We used responses to these experimental questions to elicit information about both perceived savings adequacy and, important for this analysis, reasons for inadequate savings.

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% saved about right and only about 1.5% 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. The correspondence between subjective and objective savings behavior, however, does not indicate the cause of the high percentage of households who "saved too little."

A question on the adequacy of saving was also asked to respondents of Module 10 (M10-10): " 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

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

[10] 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.

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 retirement.

The self-reported saving inadequacy is consistent with the finding that for many households, consumption drops at retirement more that could be explained by work-related expenses (Blundell, Meghir and Weber, 1993; Banks, Blundell and Tanner, 1995). When working and non-working respondents were asked about their perceived "permanent" standard of living after retirement, 7.5% expect a higher standard, 57.2% expect the same and 35.1% lower (M11a and M10-16). Among retirees the distribution is remarkably similar. Ten and one half percent say they have a higher standard of living than before retirement, 57.9% report the same and 25.7% state they have a lower standard of living. This is suggestive of a persistence of savings behavior for many households even in light of an acknowledgment of inadequate savings. In fact, respondents do appear to be aware of the adequacy of their financial status. Among those still working, the level of self-reported retirement wealth (M10-1) 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--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 and 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.

5. Income growth and retirement wealth

The HRS cohort likely had much lower income growth than it anticipated. Indeed, as shown in Figure 1, during the period 1960 to 1972, the annual growth rate of real wages was 2% per year. The typical person in the HRS cohort would have aged from about 24 years old to 36 years old, and it is reasonable to suppose that he or she would have formed expectations about wage growth during that period. A life-cycle growth rate would have been combined with the secular trend, so that someone from the HRS cohort could have anticipated very high rates of income growth. Under the LCM, such a person would have begun saving at a rather late age including those with a low subjective time rate of discount. Real wage rates, however, began to decline beginning in 1974 when many of the HRS cohort were in their early 40's and by 1996 real wage rates were only 87% of the 1972 level. 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.

Earnings growth of HRS respondents

We examine the earning growth profiles of the 1931-1941 HRS cohort based on our estimates of lifetime earnings as a function of a quartic in age as described in Section 3. The estimated growth rates combined a life-cycle earnings path with the time trend described in the previous paragraph. 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 is 1.1% and 4.1% for females. It declines from age 25 to age 40 for both males and females but at a greater rate for females. By 45, growth is negative for females and by age 50, for males. The HRS cohort reached age 45 between the years 1976 and 1986, a period of declining real wages. Figure 3 shows the simulated real earnings levels for males and females implied by the estimated growth rates for each sex. Male real earnings reach a maximum at age 49 representing a 16 percent increase in earnings since age 25. For females, earnings reach a maximum at age 39 at 35 percent of age 25 earnings and remain flat until age 44 when they begin to decline. Earnings profiles based on white males in the 1964-1987 CPS survey waves show weekly wage rates reaching a maximum between the ages of 48 and 52 (Murphy and Welch, 1990).

Earnings profiles of HRS respondents by education and experience reveal a striking pattern. For all males, with the exception of college graduates, earnings are flat over their lifetime (Figure 4). Male college graduates have increasing earnings that flatten out after 33 year

of experience (age 55). At younger ages females from all education classes had growth in earnings (Figure 5). The earnings of the college graduates continued to increase until about 28 years of experience (age 50) whereas the wages of other women began to decline earlier.

For the youngest cohort of males and females (born 1939-1941), both college and high school graduates have lower earnings growth at age 25 and 30 than the older cohort born 1930 and 1931 (Figure 6 and 7). Earnings growth for the young cohort recovers slightly and at age 40, the younger cohort has higher earnings growth than the older cohort. The increase in 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) and attributed to the growth in relative demand for college educated workers as well as changes in the rates of growth of different labor force groups (Katz and Murphy, 1992). This demand shift and its effects on earnings was likely, for the most part, unexpected by workers.

Cohort differences are further described in Table 4. Table 4 shows average earnings growth age 25 to 40 and ages 41-55 by birth cohort categories. Generally, the 1940-1941 cohort has a much flatter earnings profile 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 flatten out around age 52. In contrast, the 1940 and 1941 cohort experienced growth in real wages 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.

Figure 8 shows earnings growth rates by occupation for males. Managers, professionals and sales persons reveal increasing earnings growth rates of the lifecycle while lower skilled occupation reveal wage growth near zero and decreasing over the lifecycle. This trend is consistent with increasing demand for high skilled workers. Figures 9a and 9b shows earnings growth for wholesale and service industries for high school graduates (Figure 9a) and college graduates (Figure 9b). Within education groups, individuals in a service industry had higher growth rates from age 35 on compared to individuals in a manufacturing or wholesale industry. Katz and Murphy (1992) find that much of the increase in demand for skilled workers is due to shifts in the industrial and occupational composition of employment toward skill-intensive sectors. They also find that most of the increase in demand reflects shifts in relative labor demand occurring within sectors reflecting skill-biased technological changes.

Many 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 because of changes in the economy (Levy and Murnane, 1992).[11] Thus high school graduates moved to lower paying sectors such as wholesale trade. Figures 9a and 9b also reveal the differences in earnings growth within industry by education. Levy and Murnane (1992) show that in 1979, among males working in manufacturing, those with a college degree had median earnings 21 percent higher than high school graduates and by 1987, the comparable earnings number was 50 percent. Moreover, the number of high school graduated employed in manufacturing increased by 6 percent 1979-1986 while the number of college graduates increased by 34 percent. This suggests a change in relative demand for high school and college educated workers within manufacturing.

Wealth and earnings growth

The macro-level data on wage rate trajectories from 1973 onward are consistent with low wage growth as an explanation for under-saving. The results show that wage growth of HRS respondents was close to zero by age 40 and zero or negative thereafter and respondents without a college education experienced zero and negative real wage growth throughout most of their working life. The relationship between earnings growth and lifetime earnings is described in Table 5. Tables 5 shows, for males and females, earnings growth at ages 25-55 for each quartile of lifetime earnings. Males and females with high lifetime earnings have lower earnings growth at young ages and higher lifetime earnings growth at middle and older ages than individuals with low lifetime earnings. The difference in wealth accumulation based on lifetime earnings is described in Table 6.[12] Lifetime earnings of households in the lowest 20th percentile of the earnings distribution is $228,283, and total wealth for these households is $105,717. In contrast, lifetime earnings of households in the highest 20th percentile of the earnings distribution is $2,055,529, and total wealth for these households is $355,869. Even within a lifetime earnings

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

[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.

group, wealth is highly skewed. For example, median household wealth for households in the 20th to 40th percentile is $51,500 compared to mean wealth of $129,704.[13]

Individuals, however, will accumulate different amounts of wealth because of differences in their lifetime earnings. Moreover, some HRS respondents did save adequately and undoubtedly some respondents did have earnings paths that satisfied their expectations. Thus, to explain inadequate savings at the household level we examine individual-level earnings paths and indicators of whether these paths were unexpected holding constant lifetime earnings. As shown above, HRS respondent had high earnings growth at young ages and likely anticipated this growth to continue. Some respondents were likely surprised by low, zero and even negative earnings growth later in life. To operationalize unexpected earnings growth we study the second derivative of the earnings model, the change in earnings growth. We hypothesize that a zero or negative change in earnings growth rates resulted in lower retirement wealth. Table 7 shows average wealth levels as a function of lifetime earnings growth at age 30 and the change in earnings growth at age 30. Lifetime earnings are categorized as above or below the median; wage growth and the change in wage growth are categorized as negative or non-negative. The estimate lifetime earnings are based on actual earnings as reported in the Social Security data but adjusted for upper truncation.[14]

For males workers with lifetime earnings above the median, and high earnings growth, those with a positive change in earnings growth had $182,000 in wealth compared to $140,000 of wealth for individuals with zero or 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, surprised by low wage growth, saved less than individuals that did not experience an unexpected downturn in earnings. Wealth levels examined in Table 7, 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 a lot of variation within these categories.

[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 7.

[14] 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.

Unexpected events and wealth

We examined the role of unexpected events earlier in life that caused a loss wealth on wealth near retirement. In HRS wave 1 respondents were asked about large wealth losses: "Thinking back over the last 20 years, have you had any really large unexpected expenses or events that have made it very difficult for you to meet your financial goals?" About thirty two percent of wave 1 households used in this analysis answer yes to this question (Table 8). The average loss, in present value terms, is $177,993. Average wealth among households that did not experience a loss is $225,338 and for those that did experience a loss, $145,972. The present value of the average loss is more than the gap between households that did and did not experience a loss.

6. Unexpected earnings growth, events and retirement wealth

We turn now to a multivariate analysis based on households. For married couples we study the effect of each spouse's lifetime earnings, wage growth and change in wage growth at age 30 on household wealth holding. We use 4,976 households where at least one individual in the household has positive reported Social Security covered earnings in the analysis. The first specification holds constant marital status, and examines the effect of earnings growth, the change in earnings growth and their interaction, and lifetime earnings on wealth. The earnings growth variables for males and females in a married household are weighted by the ratio of an individual's lifetime earnings to household lifetime earnings. The first specification also adds several variables to capture the effect of unexpected events: an indicator for wealth loss and timing of the loss, and an indicator for a prior marital disruption due to divorce or death of a spouse. The second specification adds age, a respondent's financial planning horizon, household Social Security wealth and pension wealth. 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.[15]

[15] Hurd and Zissimopoulos (2000) study financial planning horizon and it relation to savings plans and past behavior and conclude it is not a good proxy for the preference parameter. We find that it is likely an indicator of

Table 8 shows the results of an ordinary least squares model for log total wealth.[16] The first specification shows the results for lifetime earnings, earnings growth at age 30, change in earnings growth at age 30, and the interaction of earnings growth and its change holding constant only marital status. A 1 percent increase in a male's lifetime earnings increases wealth by 1.58 percent. Growth in the earnings of men has no significant effect on wealth. The effect of the second derivative is positive and statistically significant, but the magnitude is moderate: a change of two standard deviations in the second derivative increases wealth by about 18 percent. The interaction term shows that the effect of a positive second derivative is greater among those with higher wage growth. However, the interaction effect is small: for example if the rate of wage increase is 0.07 rather than zero the effect of the second derivative is about 1.71 rather than 1.60.

The effects of the earnings of females on wealth are much smaller than the effects of the earnings of males. For example, the elasticity of wealth with respect to the earnings of females is just 0.18. In that 84% of the women in this sample are married, this suggests that the work of wives may respond to need or equivalently the saving rate out of the earnings of wives is lower than the rate of saving out of the earnings of husbands.

Even though the wealth of singles is much less than the wealth of marrieds, the wealth of previously divorced or widowed men or women is even lower than the wealth of all singles, about 26% for men and 52% for women. Households that had a wealth shock within the last 5 years have 65 percent lower wealth compared to households that did not experience a shock. A household that experienced a shock more than 5 years ago does not have statistically different wealth than a household that experienced no shock. This suggests that the more distant shocks could be compensated for over a longer time period.

The second specification adds to the regression several additional variables of interest including age, health, financial planning horizon and other wealth. With the addition of these variables, the estimates of the effects of earnings and earnings changes are, for the most part, approximately the same. Notably, the effect of lifetime earnings on wealth for men and women decrease slightly. A one percent increase in lifetime income increases log wealth by 1.22 percent for men and by 0.18 percent for women. The second derivative of earnings is no longer

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productivity: longer time horizons are associated with higher wealth and income and as well as other measures of socio-economic status such as height, cognition, and parental education and is not correlated with the actual saving rate nor other indicators of saving behavior such as the age at which saving first began and future savings plans.

[16] The means of the right-hand variables are given in the appendix table.

statistically significant at a 10 percent level, although the magnitude remains econonomically important.

Health is measured at the interview in 1992. While our motivation for this paper has emphasized the effects of an economy-wide slow-down of wage growth, at the individual level a health event is at least partly unexpected and probably reduces the rate of earnings growth. For the reasons we have discussed, it will cause wealth accumulation to be less than anticipated earlier in the work career. Said differently, a health event partly explains a negative second derivative of the earnings path, and, therefore, will reduce the estimated effects of the second derivative, as we have seen in this specification. Of course, health has other effects on wealth. Poor health is an indicator of out-of-pocket health care expenses, and it is associated with a lack of health care insurance. Healthy people anticipate longer survival and so should accumulate more wealth, and to the extent that good health is the result of an investment, they are likely to be the type of people that invest and save.

The effect of marital disruptions for men is no longer statistically significant. A previously widowed or divorced female has 31 percent lower wealth than a female without a previous marital disruption. The effect of a loss on wealth is slightly smaller. Households with a wealth shock within the last 5 years have 44 percent lower wealth compared to households who did not experience a shock but shocks that occurred more than 5 years ago have no effect. We would like to have a measure of the subjective time rate of discount, and the planning horizon has been used as such a measure. Indeed a long planning horizon is associated with higher wealth relative to shorter planning horizons. However, our prior work suggestions that the planning horizon is closely related to unmeasured productivity rather than the subjective time rate of discount, so that in the presence of measurement error on lifetime income it would be related to wealth.

Both pension and Social Security wealth are positively related to wealth, which is not consistent with a life cycle model of saving. Most likely our controls for lifetime earnings are not perfect: some have uncovered earnings and there is observation error. Then Social Security and pension wealth would add additional information about lifetime earnings, and so would be positively related to wealth.

7. Next Steps

Subject to the caveats we have discussed, the results in Table 9 provide estimates for the effects of lifetime earnings, wage growth and the change in wage growth on wealth. The results

are consistent with the hypothesis put forth in this paper: workers who were surprised by low wage growth have lower wealth than other workers. These estimates, however, may be biased due to measurement error in 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 10 shows mean lifetime earnings and total wealth by lifetime earnings grouped into 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 (0.46). 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 for the reasons outlined above. In comparison, the bottom panel of Table 10 shows wealth to lifetime earnings ratios by years of education. Mean lifetime income increases across education groups. The role of measurement error is brought out: using education as an instrumental variable we find that the rate of saving out of lifetime income increases in income rather than falls as in Table 10.

Future work will address the issue of measurement error in earnings. A possible strategy that we will explore is to use occupation, industry and education as instrumental variables for lifetime earnings and earnings growth. Empirical observation suggests a relationship. Figures 6 and 7 show earnings growth for two cohort groups and two education classes. Earlier we discussed reasons for the earnings premium associated with education that we see in the data. While this figure and Table 4 are suggestive of a cohort effect, 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 (RHS), 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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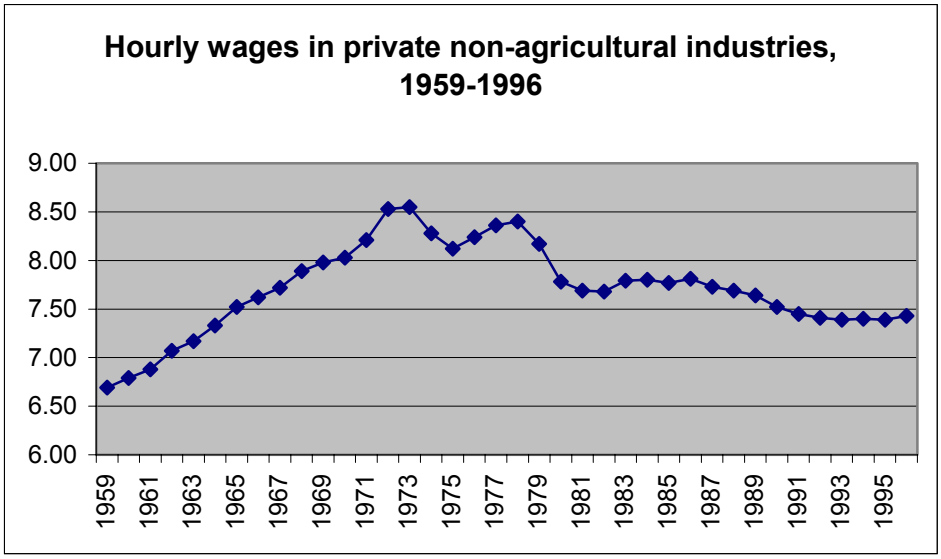
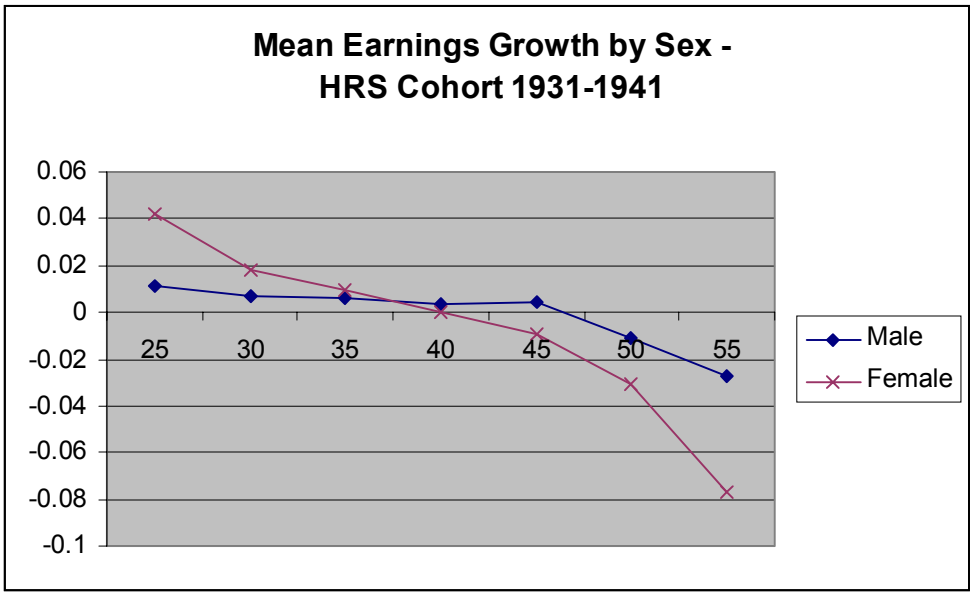
Figure 1.
Hourly Wages in Private Non-Agricultural Industries 1959-1996



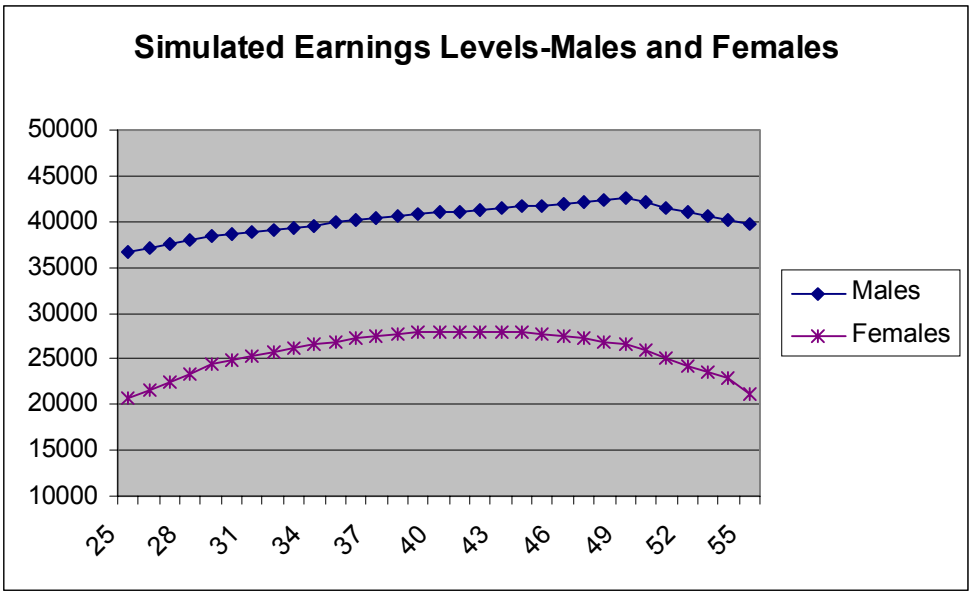
Source: Department of Labor, Bureau of Labor Statistics.
Notes: Average hourly earnings in 1982 dollars

Figure 2.
Mean Earnings Growth by Sex for HRS Cohort 1931-1941



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

Figure 3.
Simulated Earnings Levels for Males and Females



Source: HRS 1992 and Social Security earnings records.

Figure 4.
Simulated Earnings Levels by Education for Males

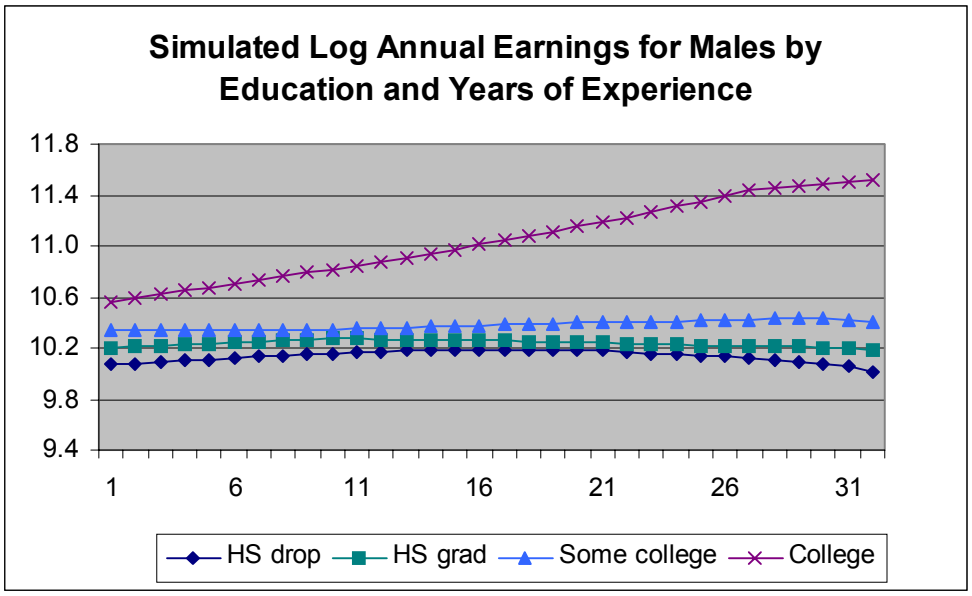


Figure 5.
Simulated Earnings Levels by Education for Females

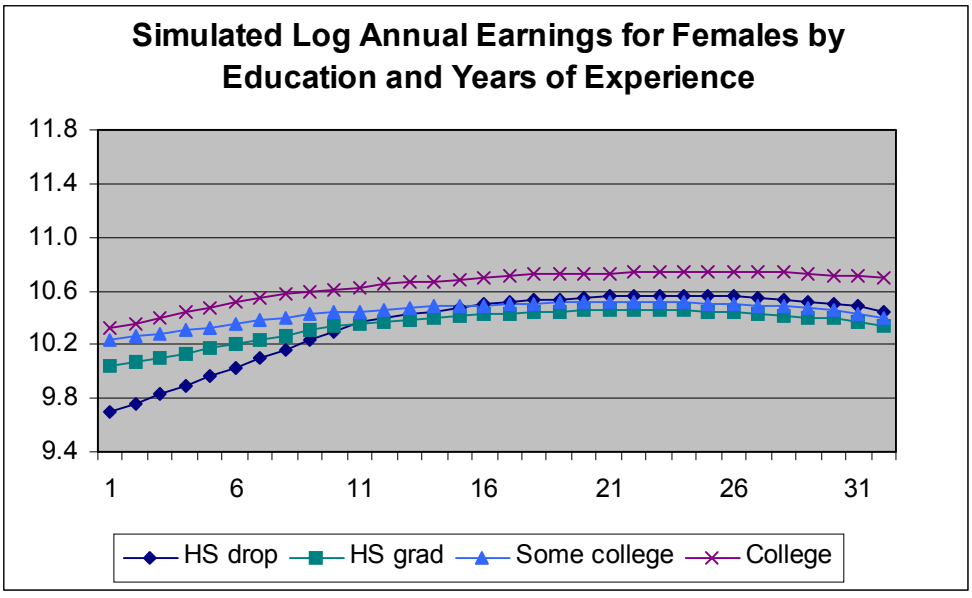


Figure 6.
Earnings Growth by Cohort and Education for Males

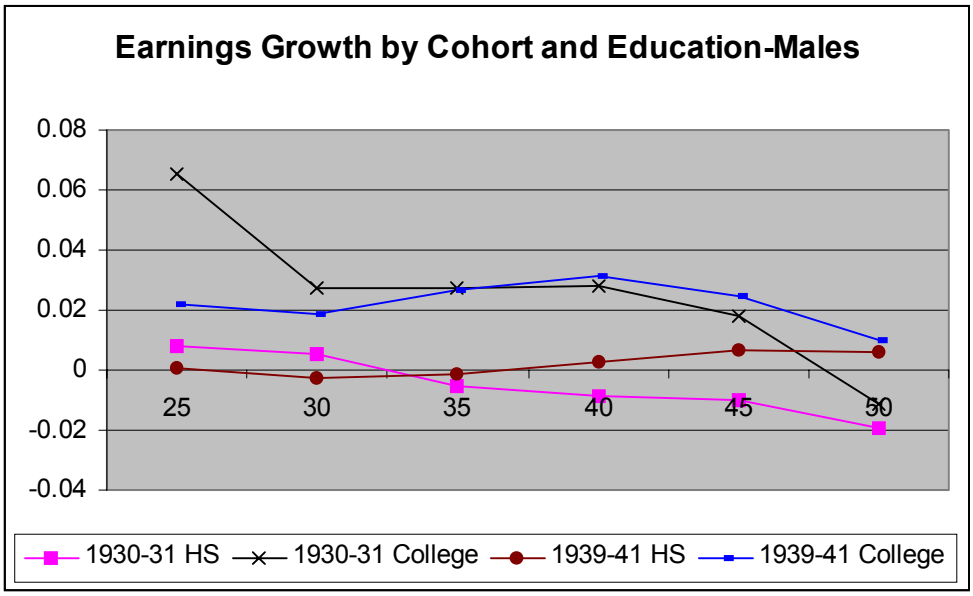


Figure 7.
Earnings Growth by Cohort and Education for Females

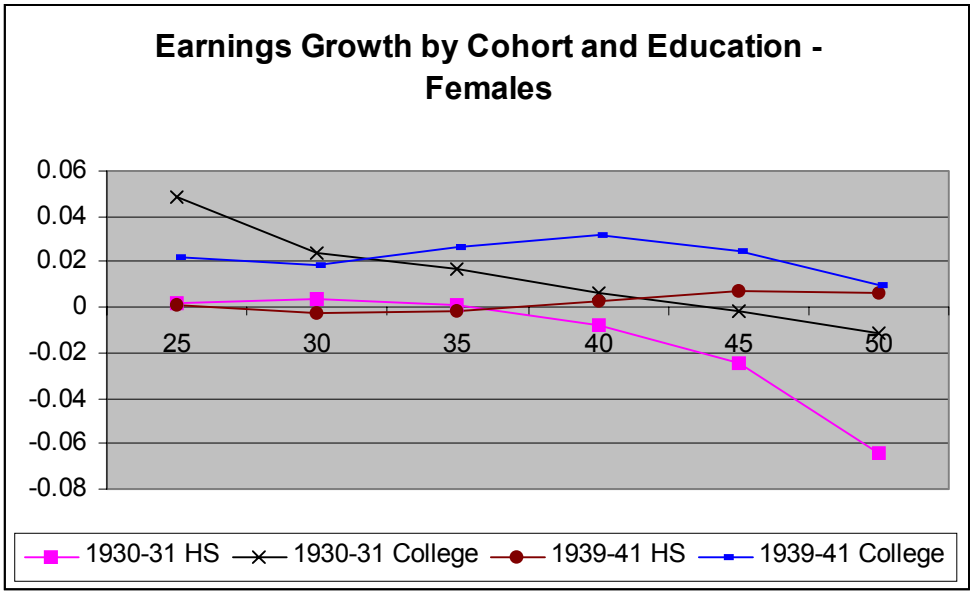


Figure 8.
Earnings Growth by Occupation for Males

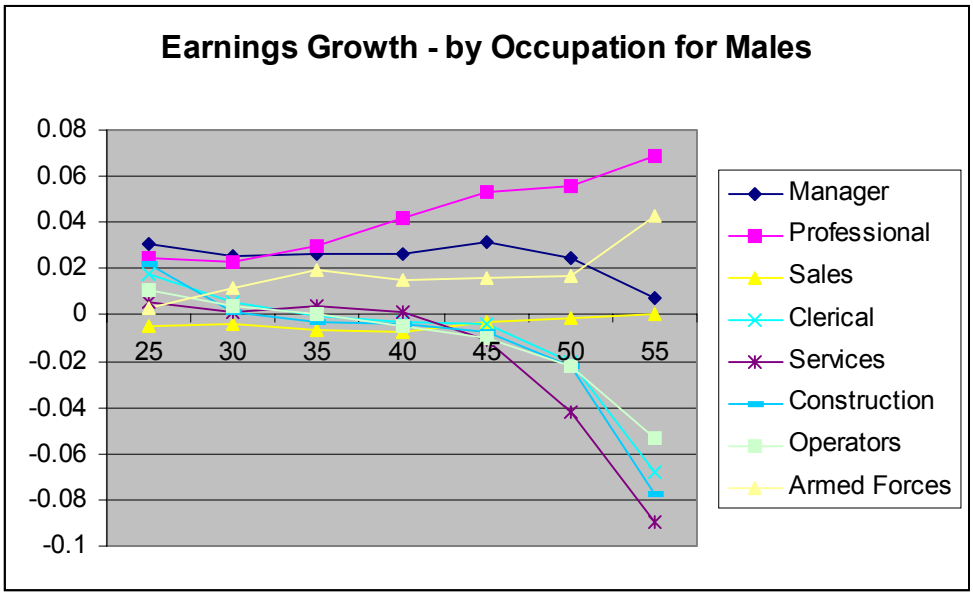


Figure 9a.
Earnings Growth by Industry for Male High School Graduates

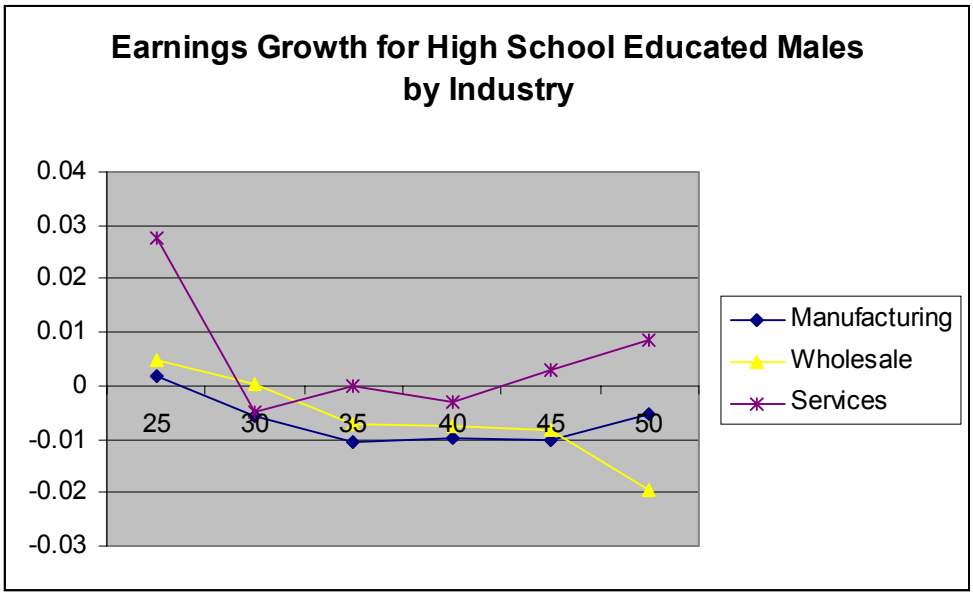


Figure 9b.
Earnings Growth by Industry for Male College Graduates

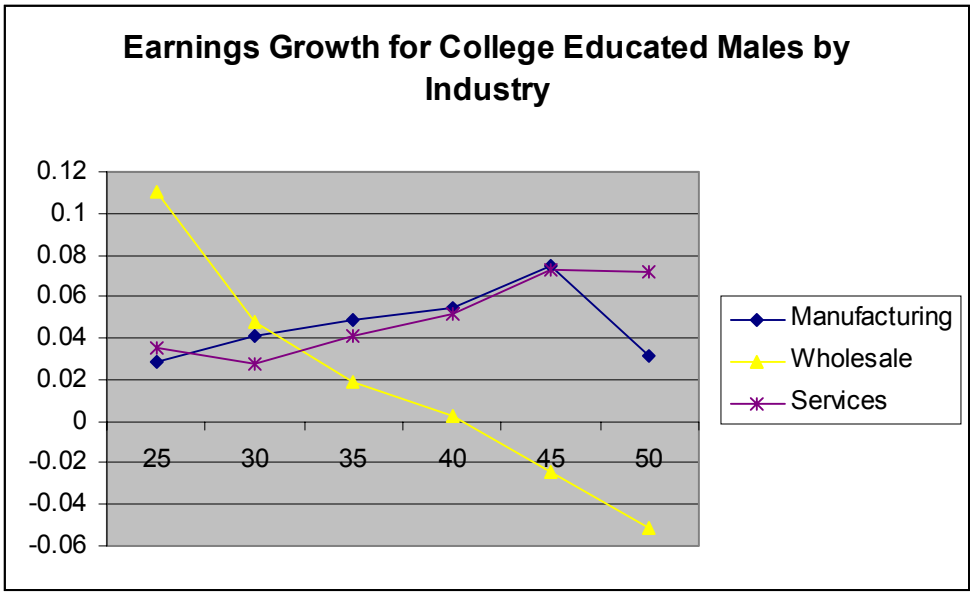


Table 1.
Self-Assessed Savings Adequacy Over Past 30 years:
Wealth and Lifetime Income (thousands)

		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 (4) 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	No
Actual retirement wealth (M10-1)	124.0	31.4
Additional amount needed (M10-12)	--	91.2
Total wealth for retirement adequacy	124.0	122.6
HRS wave 3 household income	74.5	54.9

Note: Based on Module 10 questions (1), (10), (12); Universe: Working for pay.

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, 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	0.0033	-0.0076	0.0161	-0.0334
1938-39	0.0005	-0.0086	0.0121	-0.0411
1936-37	0.0096	-0.0105	0.0142	-0.0340
1933-35	0.0109	-0.0081	0.0243	-0.0286
1931-32	0.0093	-0.0263	0.0175	-0.0629

Source: HRS 1992 and Social Security earnings records 1951-1991.

Table 5.
Earnings Growth by Lifetime Earnings Quartile for Males and Females

	Males				Females			
	Lifetime Earnings				Lifetime Earnings			
Age	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
25	0.0338	0.0121	-0.0018	0.0004	0.0672	0.0457	0.0356	0.0184
30	0.0124	0.0052	-0.0007	0.0097	0.0309	0.0190	0.0149	0.0083
35	0.0010	0.0033	0.0036	0.0160	0.0194	0.0077	0.0059	0.0042
40	-0.0083	-0.0025	0.0066	0.0198	0.0024	-0.0044	0.0000	0.0018
45	-0.0188	-0.0092	0.0090	0.0362	-0.0149	-0.0174	-0.0042	-0.0004
50	-0.0542	-0.0244	0.0104	0.0234	-0.0581	-0.0446	-0.0151	-0.0061
55	-0.1244	-0.0504	0.0293	0.0350	-0.1490	-0.1042	-0.0409	-0.0134

Source: HRS 1992 and Social Security earnings records 1951-1991.

Table 6.
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	228,422	105,717	38,500	25,209	200
21st-40th	567,600	129,704	51,500	32,514	1,500
41st-60th	1,011,997	158,582	64,500	31,305	3,500
61st-80th	1,531,247	251,538	113,500	53,492	9,800
81st and above	2,213,543	355,869	169,610	90,159	22,000
All	1,110,694	200,307	84,000	46,544	5,050

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=4976 households.

Table 7.
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	510,225	347,862	152,413	149,339
Low	302,047	206,516	125,004	141,210

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 8.
Amount of Wealth Loss, Wealth Levels and Savings Adequacy

	Unexpected Loss	
	Yes	No
Percent[a]	31.5%	68.5%
Present value of loss[a]	$177,993	$0
Total wealth	$145,972	$225,338
Savings over past 30 years[b]		
About right or too much	17.2	30.1
Too little	82.9	69.9
Total	100.0	100.0

[a]Based on HRS 1992 sample.
[b]Based on HRS Module 9. N=537.

Table 9. Estimates of Log Total Wealth

Variable	Estimate	Pr > |t|	Estimate	Pr > |t|
Intercept	-14.236	0.000	-9.988	0.000
Male Earnings:				
Log lifetime earnings	1.580	0.000	1.220	0.000
Wage growth at age 30	0.257	0.688	-0.159	0.797
Change in wage growth at 30	0.952	0.065	0.768	0.125
Wage growth*change in growth at 30	1.596	0.112	1.983	0.042
Female Earnings				
Log lifetime earnings	0.292	0.000	0.175	0.000
Wage growth at age 30	0.064	0.933	-0.007	0.992
Change in wage growth at 30	-1.049	0.298	-1.387	0.155
Wage growth*change in growth at 30	3.537	0.016	3.552	0.012
Shocks:				
Previously widowed or divorced-male	-0.255	0.048	-0.167	0.183
Previously widowed or divorced-female	-0.524	0.000	-0.320	0.013
Loss was more than 10 years ago	-0.103	0.463	-0.019	0.890
Loss was between 5 and 10 years ago	0.001	0.992	0.050	0.732
Loss was less than 5 years ago	-0.647	0.000	-0.436	0.000
Marital Status:				
Not married - male	-2.020	0.000	-1.933	0.000
Not married - female	-2.827	0.000	-2.586	0.000
Demographics Male:				
Excellent/very good health			0.448	0.000
Good health (excluded)				
Fair/poor health			-0.381	0.019
Demographics Female:				
Excellent/very good health			0.665	0.000
Good health (excluded)				
Fair/poor health			-0.972	0.000
Planning Horizon-Male:				
Months/year excluded				
2-10 years			0.616	0.000
More than 10 years			0.672	0.002
Planning Horizon-Female:				
Months/year excluded				
2-10 years			0.387	0.002
More than 10 years			0.606	0.006
Other Wealth:				
Social Security Wealth at age 62			0.058	0.000
Pension wealth at age 62 - female			0.045	0.000
Pension wealth at age 62 - male			0.021	0.022
Number of observations			4976	
Mean of dependent variable			10.35	

Notes: Includes controls for missing spouse earnings data, other variables if not married or spouse is age ineligible and age.

Table 10.
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	228,422	105,717	0.463
21st-40th	567,600	129,704	0.229
41st-60th	1,011,997	158,582	0.157
61st-80th	1,531,247	251,538	0.164
81st-100th	2,213,543	355,869	0.161
Years	Years of education - males		
1-8	995,063	72,318	0.073
9-11	1,324,866	144,216	0.109
12	1,510,137	186,588	0.124
13-15	1,457,337	219,925	0.151
16+	1,628,004	459,039	0.282
All	1,110,694	200,307	0.180

Notes: Number of observations is 4,976 for lifetime earnings percentiles and 3,178 for education years for males.

Appendix Table: Mean and Standard Deviation of Right-Hand Side Variables in Table 9.

Variable	Mean	Std Dev
Male earnings:		
Log lifetime earnings	8.900	6.679
Wage growth at age 30	0.004	0.072
Change in wage growth at 30	0.003	0.092
Wage growth*change in growth at 30	-0.002	0.047
Female earnings:		
Log lifetime earnings	8.185	6.119
Wage growth at age 30	0.007	0.073
Change in wage growth at 30	-0.004	0.081
Wage growth*change in growth at 30	-0.004	0.050
Shocks:		
Previously widowed or divorced-male	0.195	0.396
Previously widowed or divorced-female	0.168	0.374
Loss was more than 10 years ago	0.114	0.317
Loss was between 5 and 10 years ago	0.098	0.298
Loss was less than 5 years ago	0.161	0.368
Not married - male	0.097	0.296
Not married - female	0.182	0.386
Excellent/very good health-male	0.329	0.470
Fair/poor health-male	0.131	0.337
Excellent/very good health-female	0.340	0.474
Fair/poor health-female	0.132	0.338
Planning horizon 2-10 years-male	0.395	0.489
Planning horizon more than 10 years-male	0.054	0.226
Planning horizon missing-male	0.037	0.188
Planning horizon 2-10 years-female	0.399	0.490
Planning horizon more than 10 years-female	0.050	0.218
Planning horizon missing-female	0.019	0.135
Social Security Wealth at age 62	6.544	5.901
Pension wealth at age 62 - female	2.206	4.468
Pension wealth at age 62 - male	3.250	5.322
Males age 54-56	0.173	0.378
Males age 57-59	0.172	0.377
Males age 60-61	0.106	0.308
Females age 54-56	0.194	0.395
Females age 57-59	0.166	0.372
Females age 60-61	0.095	0.293
Female household with no spouse observation	0.359	0.480
Male household with no spouse observation	0.346	0.476
Male with no earnings record	0.006	0.076
Female with no earnings record	0.081	0.272
Number of observations	4976	