Retirement Wealth
and Lifetime Earnings Variability

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Abstract

This paper explores understand how earnings variability influences peoples' retirement preparedness by influencing their accumulated wealth levels as of retirement age. Prior research has demonstrated that the US average household nearing retirement would need to save substantially more in order to preserve consumption in old age. While some socioeconomic factors have been suggested that might explain shortfalls, previous studies have not assessed the role of earnings variability over the lifetime as a potential explanation for poor retirement prospects. Thus two workers having identical levels of *average* lifetime earnings might have had very different patterns of earnings *variability* over their lifetimes. Such differences could translate into quite different retirement wealth outcomes. We evaluate the effect of earnings variability on retirement wealth using information supplied by respondents to the Health and Retirement Study (HRS). This is a rich and nationally representative dataset on Americans on the verge of retirement, with responses linked to administrative records from the Social Security Administration. Our research illuminates key links between lifetime earnings variability and retirement wealth.

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To better understand the determinants of retirement preparedness, it is important to obtain extensive and detailed household information on peoples' pensions, social security, housing, and other forms of financial wealth. One excellent source is the Health and Retirement Study (HRS), which we use in this paper to assess the factors driving retirement wealth among older Americans. Previous research showed that the median US household on the verge of retirement held about 2/5 of its retirement wealth in the form of social security promises, 1/5 in employer pension promises, and the remainder in housing and other financial assets. Prior studies also indicated that the typical older household had not prepared for retirement adequately, in that substantial additional retirement saving would be needed to smooth old-age consumption. Factors associated with greater retirement wealth accumulations included having committed to "automatic saving" mechanisms including company pensions and having to pay off a mortgage. The present paper extends the literature by focusing on the nexus between household retirement wealth and the variability of workers' lifetime earnings. In particular, we use the HRS linked with administrative earning records data supplied by the Social Security Administration to evaluate the links between lifetime earnings variability and retirement preparedness.

Our research is relevant to researchers and policymakers for several reasons. First, potential pension or social security reform proposals might have very different impacts on retiree wellbeing, depending on how specific reforms link workers' earnings profiles to their retirement benefits. For this reason, it is useful to evaluate how earnings variability (EV) differs across people of various income levels and socioeconomic characteristics. Second, while theoretical models have begun to explore correlations between financial assets and human capital, little analysis explores how labor earnings variability empirically translates into retirement wealth accumulations in the real world. Third, we explore whether retirement wealth is more powerfully associated with earnings variability *per se*, holding constant other demographic, social, and economic characteristics of workers and their families, and also whether retirement wellbeing is particularly vulnerable to earnings fluctuations at particular points in the work-life cycle. In view of current macroeconomic volatility and associated unemployment and wage cut patterns, this topic should be of particular interest to pension system designers.

In what follows, we first briefly review prior studies regarding retirement wealth profiles for older Americans and describe the nature and scope of retirement saving. We then discuss alternative measures of lifetime earnings variability and describe what the data show. Last, we demonstrate how these EV measures are related to retirement wealth measures, holding constant other socioeconomic, health status, and preference factors in a multivariate statistical analysis.

Prior Studies

Our previous research used the nationally representative Health and Retirement Study linked to administrative records on earnings to explore how patterns of retirement wellbeing in the older US population are associated with differences in the length of worklife and pay levels.[1] The initial HRS cohort was first interviewed in 1992, when it was on the verge of retirement, that is, age 51-61 (also, spouses of any age were also interviewed). Using these data, Moore and Mitchell (1998) and Mitchell and Moore (2000) measured important saving shortfalls for this cohort, concluding that the median older household would need to save 16% more out of annual income each year, in order to maintain consumption levels after retirement at age 62. The targeted additional saving rate was cut in half, to 8% of annual income, if the retirement age could be raised to 65.[2]

Subsequent analysis evaluated several factors associated with retirement saving; this demonstrated that several factors played a role in retirement wealth accumulations (Mitchell, Moore and Phillips, henceforth MMP, 2000). These included respondents' and spouses' educational attainment, lifetime earnings, marital and children status, and ethnicity. Overall, socioeconomic variables accounted for a substantial portion of the saving deficits for retirement. In addition, health and preference proxies also accounted for 20-25% of explained variance, and in particular, households having longer financial planning horizons were likely to be closer to saving targets. Various other factors, including depression, memory problems, and earlier-than-predicted mortality, did not appear to be strongly associated with saving shortfalls. Finally, the analysis indicated that understanding married couples' preparedness for retirement requires one to take into account both spouses' economic, health, and preferences. Subsequent analysis by Levine, Mitchell and Phillips (LMP, 2000a and b, 2002) examined how married women's earnings contributed to HRS household wellbeing in retirement. Overall, married households, spousal effects accounted for about one-half of the explained variance in saving shortfall patterns.

One key issue left unexamined in prior research is whether the timing and variability of workers' lifetime earnings patterns are powerfully related to retirement asset accumulation. Dynarski and Gruber (1997) showed that idiosyncratic earnings variation had little effect on *pre-retirement consumption*, but there has been little analysis of how fluctuations in pay might influence *post-retirement wellbeing*.[3] In the present paper, therefore, we explore how aspects of lifetime earnings variability influence retirement wealth levels. The outcomes of special interest include levels of retirement wealth, including Social Security, pension, and other financial assets.

Research Design and Methods

The HRS, along with its companion employer pension and Social Security earnings and benefits records, affords a unique opportunity to analyze the influence of lifetime earnings variability on retirement and wealth. In addition to containing rich health and demographic information, the linked HRS datafile provides a comprehensive picture of workers' lifetime earnings patterns. These are obtained from Social Security Administration records of workers' taxable earnings from 1950 to 1991, provided with respondent consent. We use these lifetime earnings records to generate measures of lifetime earnings fluctuations for sample respondents as well as their spouses, and then we link these to the MMP datafile to examine retirement wealth.

The variables used in our analysis involve measures of retirement wealth and workers' earnings variability. Here we focus on the latter, since retirement wealth measures are described elsewhere (LMP, 2000a, 2002; also see the Data Appendix). Slightly different earnings information was available from the Social Security Administration depending on when the data were collected.[4] For the entire period 1950-91 earnings up to the Social Security tax ceiling were available; using these we compute workers' Average Indexed Monthly Earnings (AIME) as per Social Security formulas, which averaged $1,300 per month for an annual earnings level of approximately $16,000 (all dollar figures are expressed in $92). In addition, for the later period, from 1980 to 91, so-called "W-2" earnings were also available, which include labor compensation above the taxable Social Security earnings ceiling. Figure 1 indicates how often annual earnings were at the taxable cap, which for women was only 2% of the years between ages 20 and 50, as well as for each decade of life (i.e. 20-29, 30-39, and 40-49). Men were more likely to have capped earnings, with the percentage at 27% during their twenties, 49% in their thirties, and 30% in their forties. To mitigate the impact of such capping, we use the higher of the two values for years that both reports are available, and for other years (i.e. prior to 1980), we run year-specific Tobits to generate predicted earnings for those at the cap that year.[5] Finally, we create measures of lifetime earnings variability.

Figure 1 and 2 here

One way to represent lifetime earnings variability would rely on a concept familiar from financial markets, namely the standard deviation of lifetime earnings. For this paper, we employ this measure normalized by own average earnings, which is the coefficient of variation. One COEFVAR measure covers the entire period between the worker's 20th and 50th birthdays, which we call "lifetime COEFVAR". In addition, we also compute the coefficient of variation over each decade of the worker's life, when the individual was in his 20's, 30's, and 40's, respectively (COEFVAR20, 30 and 40). These decadal EV measures help identify patterns of earnings variability at different ages, to determine whether patterns are similar at different life stages.

Of course, if we were to use only COEFVAR, this would presume that earnings variability has a symmetrical impact – that is, that an earnings *drop* or an *increase* of the same size would have the same effect on key outcomes of interest. Since this is not *a priori* clear, we also develop an asymmetric EV measure which focuses only on *earnings declines*. We call this the "expected hit" to earnings (EXPIT), which allows us to evaluate whether earnings drops have a stronger negative effect on retirement wellbeing than do fluctuations *per se*. Lifetime EXPHIT captures the real wage loss in the event that it occurs over the worker's lifetime, multiplied by the probability that he or she experienced a loss (normalized by own average earnings). In this sense, it is a shortfall measure akin to those used in insurance and risk analysis. Decadal measures are also derived (EXPHIT20, 30, and 40), measuring, respectively, the conditional expected earnings drops when the worker was in his or her 20's, 30's, and 40's.

Descriptive statistics for these EV measures are provided in Table 1. Focusing first on the symmetric term, it is interesting that lifetime COEFVAR is larger than unity, but the measure is larger for younger workers and it shrinks by a third later in life. Thus earnings variability measured by COEFVAR declines with age. Turning to the asymmetric measure, the expected earnings loss conditional on having an earnings hit (EXPHIT) averaged about 24% of lifetime earnings overall. The decade-specific measures are smaller and have far less of an age pattern, since the loss is measured as a fraction of earnings during that period. In other words, the asymmetric EV measure displays less of a clear age decline than the symmetric one. We also offer a correlation matrix of the six EV measures developed, which shows higher correlation between the lifetime measures than the decade-specific measures. In addition, the EXPHIT measures are less correlated among themselves than are the symmetric COEFVAR measures. We also show that both EV measures vary by lifetime earnings levels, as proxied by AIME quintiles. In the case of the symmetric measure, COEFVAR, it is clear that earnings volatility is highest for people in lower lifetime earnings quintiles. A similar but attenuated pattern emerges for the asymmetric EXPHIT measure. In the analysis of retirement wealth, below, we explore separately how both lifetime EV and age-specific EV influences outcomes.

Table 1 here

Further descriptive information on earnings variability appears in Table 2, where we regress lifetime and decadal EV measures on a vector of controls including the respondent's lifetime earnings level (AIME), sex, education, race/ethnic status, and marital status. In addition, a health variable is included to assess whether the respondent was unable to carry out activities of daily living; this is clearly a noisy measure of lifetime health problems, but it still can provide insight into functional limitations. The estimates confirm our earlier conclusion that workers with higher lifetime earnings levels are also those with lower earnings variability, and the conclusion is strengthened after holding other factors constant. This age-trend is relevant for both lifetime and decadal EV measures, though the negative age relationship becomes stronger in the case of the symmetric measure, COEFVAR, but not for the asymmetric measure, EXPHIT. Evidently, the two EV concepts behave differently over the worklife. Table 2 also indicates that several demographic factors are significantly associated with EV patterns, even after controlling on lifetime earnings (via AIME). Both EV measures are higher for Blacks than Whites, though not systematically for Hispanics. Surprisingly, respondents with greater educational attainment are *more* likely to have higher COEFVAR late in life, but for EXPHIT the educational relationship is weak. By decade of age, differences by sex emerge, since women appear to have lower variability early and late in life as compared to men. Being divorced is associated with lower earnings variability early in life, while being widowed is associated with higher earnings hits later in life. The health limitation variable is positively associated with both EV measures early but not later in life.

Table 2 here

Earnings Variability and Retirement Wealth

Before turning to the evidence tying EV measures to retirement wealth, a few comments are in order about anticipated results.

Hypotheses. First, we test whether EV influences wealth differently, depending on the type of retirement wealth under consideration. In the US, for instance, the Social Security benefit formula is a redistributive function of average lifetime earnings, and thus it provides higher replacement rates to lifetime low-earners. By contrast, private pension benefit rules are less redistributive, mainly because they usually focus on final earnings replacement. Consequently, it is reasonable to expect that pension wealth levels would be far more sensitive to earnings variability than Social Security wealth, particularly for nonmarried individuals. The case for married couples is less clear, since a nonworking spouse is entitled to Social Security benefits based on his or her working spouse's lifetime earnings; this may make the household's total Social Security wealth potentially more sensitive to an earner's pay fluctuations than in the case of a single person. Hence we have:

Hypothesis 1: Pension and financial wealth levels are expected to be more sensitive to earnings variability than Social Security wealth.

Second, we hypothesize that any given earnings fluctuation would have a larger effect on nonmarried workers' wealth than on married household wealth levels. This is because lifetime pay fluctations would be expected to have a direct impact on retirement wealth for single individuals. By contrast, married households have opportunities for risk-sharing which could mitigate this link. For example, the wife might boost her labor market work when her husband experiences a negative earnings shock (this is the long-discussed "added worker" effect in the labor economics literature). [6] There is even the possibility that, through assortative mating, individuals would seek marital partners who have human capital risk characteristics orthogonal to their own, so as to more effectively manage risk within marriage. In any event, smaller sensitivity of retirement wealth to EV measures might be expected for married couples than for single individuals. Hence we have:

Hypothesis 2: *Retirement wealth for nonmarried workers will be more sensitive to EV measures than for married households.*

Third, we hypothesize that financial wealth may be the most sensitive form of wealth to pay variability, of all the types of wealth we examine. This is because, as mentioned above, Social Security and pensions tend to be formulaically related to earnings. Housing wealth is also less likely to be influence by lifetime earnings fluctuations, by virtue of the fact that mortgages must be paid on a regular basis. By contrast, financial wealth buildups have more of a discretionary character, requiring the individual to save rather than spend liquid income. Recent studies on how hard workers find it to exhibit self-control when it comes to saving (Madrian and Shea, 2001) therefore would imply that automatic savings mechanisms are better able to build up retirement assets than less automatic means. We would also anticipate that changes in other wealth could be most easily offset by changing financial assets, which again implies that this type of wealth would be treated as a buffer stock sort of holding. This might be less true of housing wealth, as compared to nonhousing financial assets. Hence we have:

Hypothesis 3: *Financial wealth will be more sensitive to pay fluctuations than other forms of wealth, including housing, pension, and Social Security.*

Fourth, we hypothesize that earnings variability early in life would be expected to have only a negligible effect on retirement wealth, since shocks would have a longer period to be smoothed by changes in consumption and/or saving. Conversely, earnings shocks closer to retirement would be expected to have a larger impact on retirement wealth, since fewer years remain to offset unexpected changes in earnings.

Hypothesis 4: Earnings variability early in life would be anticipated to have a smaller effect on retirement wealth than later in life.

In what follows, we evaluate the empirical data for evidence on each of these hypotheses.

Findings for Earnings Variability. Our empirical goal is to determine whether and how EV measures are linked to retirement wealth, controlling on socioeconomic, health, and preference factors including for respondents. In this section, we use multivariate analysis to explore whether fluctuations in earnings over the life cycle is associated with greater or lesser levels of pension, Social Security, housing, and other financial wealth. Summary statistics for the key wealth measures appear in Table 3. Since wealth has a highly skewed distribution, mean household wealth for an age-62 HRS respondent was around $643,000 in our data, while median total household wealth was approximately $400,000 (all in $92).[7] Total retirement wealth according to our formulation is made up of four components: employer pensions, Social Security, net housing wealth, and other financial wealth (stocks, bonds, etc). For our sample, medians amounted to about $150,000 for Social Security wealth, around $74,000 in pension wealth, about $50,000 in housing equity, and $40,000 in financial wealth.

Table 3 here

To evaluate how retirement wealth is associated with earnings variability among the older population, we next regress retirement wealth measures on the key EV variables of interest, along with a range of important control variables.[8] Results for Social Security, pension, financial, and housing wealth appear in Table 4, where separate equations are given for nonmarried and married households.

Table 4 here

Turning first to Social Security wealth, we had posited that variation in lifetime earnings would have relatively little impact since the benefit rules use smooth earnings in calculating benefits. It is interesting, therefore, that for nonmarried households, coefficients on both lifetime EV measures are <u>negative</u> and statistically significant in the Social Security wealth regressions. This suggests that earnings fluctuations in fact do have a detrimental impact on Social Security benefits, which could be the result of the fact that periods of joblessness can affect workers' later insured status for Social Security benefits, including people who are jobless for parts of their lives or work in uncovered jobs (LMP, 2000). In other words, attachment to "good jobs" early in one's career can make retirement wealth much more secure. This is a reasonable explanation for the nonmarried sample, since we find that early-life pay variability does not hurt Social Security wealth, but pay fluctuations in later middle age have a strong negative effect for singles (Hypotheses 1 and 4). For married workers, Social Security wealth has a rather different impact, since all EV lifetime measures are positive when statistically significant, though they tend to be quantitatively small. A possible explanation for this is tha, according to the benefits formula, nonworking spouses receive Social Security benefits that are a multiple of workers' retiree benefits, and since the formula is redistributive, negative earnings fluctuations are not directly translated into lower household benefits.

Turning to the results for pension wealth, we find that, among nonmarrieds, pension wealth is more sensitive to earnings losses than symmetric earnings EV measures, and in all cases this wealth measure is more sensitive than Social Security wealth. For nonmarrieds, the EXPHIT measure is large in magnitude, negative, and statistically significant, particularly later in life. This makes sense given that DB pensions in particular tend to reward high final salaries with higher eventual benefits; the effect is similar but less signficiant for married respondents. In both cases, we note that EV measures account for about 10% of explained variance in pension wealth, but almost nothing to variation in social security wealth (consistent with Hypothesis 2).

Table 4 also indicates how EV measures are associated with housing and financial wealth. Results for nonmarried persons again differ from those of marrieds. For singles, symmetric earnings fluctuations are associated with higher housing wealth and only for people in their 30's, but asymmetric shocks have no statistically significant impact. By contrast, for married couples, symmetric lifetime EV is associated with higher total housing wealth, perhaps indicating substitution between couples' work effort when pay levels fluctuate. Results for financial wealth also appear in Table 4, where we see that COEFVAR estimates for nonmarried respondents are larger and more positive than in the other equations (Hypothesis 3). Consequently it appears that financial wealth rises when other forms of wealth decline in times of pay volatility, acing as a buffer asset in times of earnings variability.[9] Yet the EXPHIT coefficient is not significant for singles. By contrast, among married couples, higher EV raises financial wealth just as in most of the other cases. Consequently for couples, financial wealth does not appear to act as a buffer asset in times of earnings variability.[10]

For ease of interpretation, we next translate the coefficients reported in the previous tables into dollar figures. This was done by first predicting retirement wealth by type for each respondent in the sample using the models presented in Table 4; we then simulated how retirement wealth would change from a 10% increase in each EV measure. We report the difference between predicted and simulated values as the marginal effect of a change in EV on retirement wealth. Medians of the marginal effects for each wealth type by the EV measure are reported in Table 5.

Table 5 here

One clear lesson is that the impact of EV measures on retirement wealth are fairly small. In the case of Social Security wealth, a 10% increase in the symmetric lifetime EV measure (COEFVAR) is associated with $323 lower Social Security wealth for nonmarried respondents, and $623 more for married couples. Having higher earnings hits (EXPHIT) has a smaller effect. Measured effects for pensions are even less important, and the measures typically work in the direction of reducing pension wealth. Symmetric earnings variation appears to have a positive effect on the financial wealth of both married and unmarried respondents (with a 1% increase associated with more financial wealth of about $900 and $660, respectively). The effects of lifetime earnings drops on financial wealth appear to be larger for married couples than single respondents ($518 compared to $49), but the effects for both are small compared to the positive effects for COEVAR. Since the only EV coefficients with significance in Table 4 for net housing wealth are the COEFVAR measures for married couples ($1,210), it is not surprising that the calculated marginal effects for the other cases are quite small, ranging from $2 to $55.

Conclusions

This research project had two goals: first, to see how earnings variability (EV) differs in the population according to income levels and socioeconomic characteristics; and second, to examine whether and how pay variability over the lifetime is associated with retirement wealth levels. Our most interesting findings using HRS data matched with administrative records on lifetime earnings are as follows:

- Workers with higher lifetime earnings *levels* experience lower earnings *variability*. This conclusion is robust to controls for lifetime income levels and sociodemographic factors.
- The inverse relationship between lifetime pay and lifetime earnings variability grows statistically stronger with age in the case of the symmetric EV measure, COEFVAR, but weaker for the asymmetric measure, EXPHIT. Evidently, the two EV concepts behave differently over the worklife.

The second phase of our analysis used a multivariate model to relate the various EV measures to retirement wealth measures. Results point to several conclusions, holding other things constant:

- Retirement wealth is more sensitive to earnings variability for nonmarried individuals than for married households.
- Focusing on wealth components, we find that Social Security wealth is less responsive over the lifetime to earnings variability measures than other forms of wealth. For nonmarried workers, the effect is negative for pay fluctuations early in life, but for couples the relationship is positive. These patterns, we argue, result from eligibility and benefit rules.
- Pension wealth accumulations are sensitive to earnings fluctuations, especially so for nonmarried persons later in life.

- Other financial wealth does not act as a buffer asset for couples but does for singles, given earnings variability.

In sum, earnings variability appears to have interesting and powerful effects on retirement assets. The implication is that market volatility harms not only covered workers' short-term retirement saving, but it can also undermine longer run retiree wellbeing as well. Analysts focusing on the retirement impact of scary markets must take due account of these far-reaching consequences.

References

Dynarksi, Susan and Jon Gruber. 1997. "Can Families Smooth Variable Earnings?" *BPEA* 1: 229-0303.

Engelhardt, Gary and Christopher R. Cunningham. 2002. "Federal Tax Policy, Employer Matching, and 401(k) Saving: Evidence from HRS W-2 Records." *NTJ*, 55:3 (September): 617-645.

Gustman, Alan, Olivia S. Mitchell, Andrew A. Samwick, and Thomas L. Steinmeier. 1999. "Pension and Social Security Wealth in the Health and Retirement Study." In *Wealth, Work, and Health: Innovations in Survey Measurement in the Social Sciences*, ed. Robert Willis. Ann Arbor: University of Michigan Press: 150-208.

Hurd, Michael and Julie Zissimopoulos. 2003. "Saving for Retirement: Wage Growth and Unexpected Events." RAND Working Paper, presented at the 5th RRC Conference, May, Washington, DC.

Levine, Phillip, Olivia S. Mitchell, and James F. Moore. 2000a. "Women on the Verge of Retirement: Predictors of Retiree Well-being". In *Forecasting Retirement Needs and Retirement Wealth*, eds. Olivia S. Mitchell, Brett Hammond, and Anna Rappaport. Philadelphia, PA: University of Pennsylvania Press: 167-207.

Levine, Phillip, Olivia S. Mitchell, and John Phillips. 2000b. "A Benefit of One's Own: Older Women and Social Security." *Social Security Bulletin* 63(3): 47-54.

Levine, Phillip, Olivia S. Mitchell, and John Phillips. 2002. "Worklife Determinants of Retirement Income Differentials Between Men and Women." In *Innovations in Financing Retirement*, eds. Zvi Bodie, Brett Hammond, and Olivia S. Mitchell. Philadelphia, PA: University of Pennsylvania Press: 50-76.

Madrian, Brigitte, and Dennis Shea. 2001. "The Power of Suggestion: Inertia in 401(k)

Participation and Savings Behavior." *Quarterly Journal of Economics*: 116: 1149-1187.

Mitchell, Olivia S. and James Moore. 1998. "Retirement Wealth Accumulation and Decumulation: New Developments and Outstanding Opportunities." *Journal of Risk and Insurance* 65 (3) December: 371-400.

Mitchell, Olivia S., James Moore, and John Phillips. 2000. "Explaining Retirement Saving Shortfalls". In *Forecasting Retirement Needs and Retirement Wealth*, eds. Olivia S. Mitchell, Brett Hammond, and Anna Rappaport. Philadelphia, PA: University of Pennsylvania Press: 139-166.

Mitchell, Olivia S., Jan Olson and Thomas Steinmeier. 2000. "Earnings and Projected Benefits." In *Forecasting Retirement Needs and Retirement Wealth*, eds. Olivia S. Mitchell, Brett Hammond, and Anna Rappaport. Philadelphia, PA: University of Pennsylvania Press: 139-166.

Moore, James and Olivia S. Mitchell. 2000. "Projected Retirement Wealth and Saving Adequacy". In *Forecasting Retirement Needs and Retirement Wealth*, eds. Olivia S. Mitchell, Brett Hammond, and Anna Rappaport. Philadelphia, PA: University of Pennsylvania Press: 68-94.

Venti, Steven and David Wise. 1998. "The Cause of Wealth Dispersion of Retirement: Choice or Chance?" *AER Papers and Proceedings* 88(2) May: 185-191.

Data Appendix

Earnings Measures

The data used to compute earnings variability measures are derived from Social Security earnings histories provided under restricted access conditions. Social Security taxable earnings are available 1950-91; for 1980-91, we also had access to W-2 earnings which indicate total earnings even if pay exceeds the taxable earnings ceiling in a given year. For the EV measures described in the text, we used the greater of W-2 or Social Security taxable earnings for years from 1980 on. For years before 1980, we follow Engelhardt and Cunningham (2002) in using right-censored Tobit models to generate predicted values of year-specific real earnings, using a vector of explanatory variables including polynominals in age and education, controls for race and sex, marital status, longest occupation, interactions of the above, and parents' educational attainment. Predicted earnings were substituted for capped earnings if they were greater than the taxable maximum; in a handful of cases (0.5%) earnings were predicted to be higher than $1M and were set to $1M for the analysis (this was necessary only once or twice by decade of age for individual workers).

Retirement Wealth and Shortfall Measures

Retirement wealth was derived for all age-eligible respondents in the HRS datafile surveyed in 1992, along with real values of retirement wealth expected if the head retired at 62.[11] The 1992 measures include expected present values of contingent future income (pensions, social security), along with financial assets and housing wealth ($1992). To project retirement wealth to age 62, we forecasted (see Mitchell and Moore, 2000) financial wealth by projecting four types of household assets, with future growth rates depending on their past trajectories: 1) net financial wealth which includes such assets as savings, investments, business assets, and non-residential real estate less outstanding debt not related to housing, 2) net housing wealth - the current market value of residential housing less outstanding mortgage debt, 3) pension wealth, or the present value of retirement benefits, and 4) present value of social security. For instance, housing wealth is projected using HRS responses on the purchase price of each participant's house, year of purchase, and mortgage payment amount and frequency. Interest rates are drawn from the average interest rate for households in the American Housing Survey with the same year of purchase. Given these interest rates, we then determine amortization schedules for mortgages and project reduction in housing debt over time. This in turn implies an increase in net housing wealth. Pension wealth is projected to retirement based on the plan provisions of employer provided Summary Plan Descriptions and HRS data on salary and tenure of service where appropriate. Individuals are assumed to remain with their current employer until the retirement age and invest their pensions, if they have authority to do so, and returns assumed on defined contribution pensions are consistent with historical averages. Mortality follows actuarial tables obtained from the Social Security Administration. Social security wealth is derived from the earning and benefits file (EPBF) as described in Mitchell, Olsen, and Steinmeier (2000).

To derive saving shortfalls, we then projected retirement wealth forward to age 62 for each HRS household and computed how much additional saving beyond existing assets and pension plans would be needed to smooth that family's consumption patterns as of that retirement date.[12] To determine adequacy of saving we use the replacement rate, an annual income amount sufficient to smooth consumption before and after retirement, allowing for changes in tax status and the change from saving to spending in retirement. Each household's replacement rate is solved for, in conjunction with the determination of its saving rate, so as to determine how much income it would need in retirement to attain pre-retirement consumption levels from retirement at that given age.[13] For example, if the determined rate was 0.80 for a household with an income of $50,000 per year pre-retirement, the suggested annual income level in retirement is $40,000 for that household given differences in taxes and saving. More generally, assets needed at retirement are the result of taking into account i) household income at retirement, ii) the appropriate replacement rate for that income level, and iii) a joint and survivor annuity factor allowing for the age composition of the household (either individual or married couples). The rate of saving necessary to meet these levels is solved for simultaneously with the household's replacement rate. Given a replacement rate, the shortfall between a household's projected value of assets and its projected need determines its prescribed saving rate. This rate represents a prescription of what the older household would need to save as a percent of income each year until retirement to achieve that projected need. If the resultant projected saving rate was too small (large) to meet projected need, the replacement rate was lowered (raised) until replacement and saving rates balance.

Figure 1. Percent of Respondents with Zero Earnings by Age and Sex

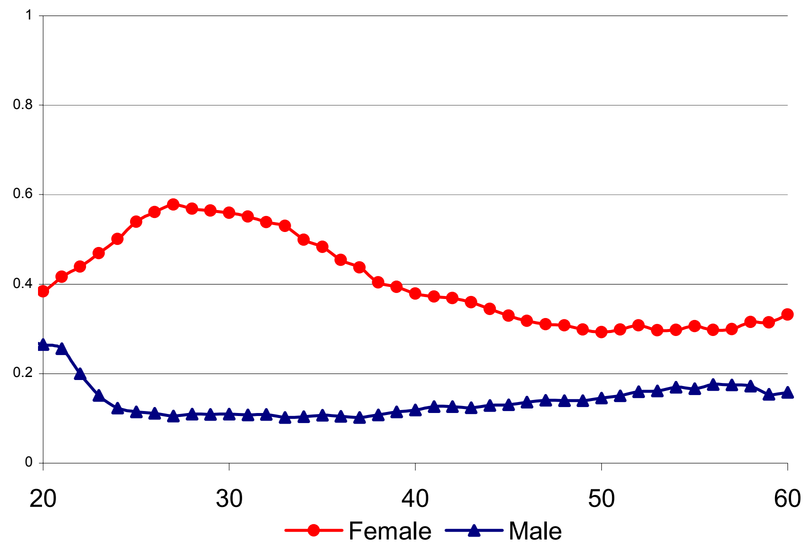

Figure 2. Percent of Respondents with Capped Earnings by Age and Sex

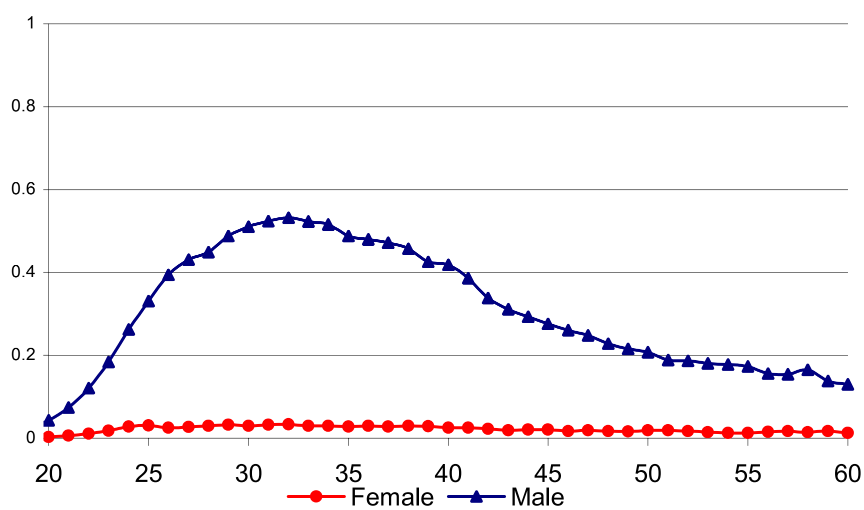

Table 1. Earnings Levels and Variability Measures for HRS Respondents
(Weighted data)

	Mean	*Stdev*
I. Earnings Levels		
AIME	$1,338	$969
Average Earnings		
II. Earnings Variability Measures: Lifetime and by Decade of Life		
COEFVAR	1.24	0.86
COEFVAR20	1.05	0.78
COEFVAR30	0.90	0.82
COEFVAR40	0.64	0.71
EXPHIT	0.24	0.38
EXPHIT20	0.12	0.41
EXPHIT30	0.11	0.47
EXPHIT40	0.10	1.63

III. Correlation Between Variability Measures

	COEFVAR	COEFVAR20	COEFVAR30	COEFVAR40	EXPHIT	EXPHIT20	EXPHIT30	EXPHIT40
COEFVAR	1.000							
COEFVAR20	0.345	1.000						
COEFVAR30	0.293	0.114	1.000					
COEFVAR40	0.462	0.098	0.178	1.000				
EXPHIT	0.503	0.188	0.149	0.232	1.000			
EXPHIT20	0.066	0.355	0.053	0.018	0.095	1.000		
EXPHIT30	0.068	0.005	0.317	0.082	0.030	-0.009	1.000	
EXPHIT40	0.009	-0.011	0.001	0.116	0.010	-0.003	-0.002	1.000

IV. Distribution of EV Measures by Lifetime Earnings Quintile

AIME quintile	COEFVAR	EXPHIT
1	2.20	0.48
2	1.25	0.20
3	0.89	0.15
4	0.89	0.17
5	0.97	0.19

Variable Definitions:

Average Earnings:	Average annual real earnings over the lifetime (in 1992$)
AIME:	Average indexed monthly earnings over the lifetime in $92)
COEFVAR	St. dev. of earnings/own lifetime avg earnings
COEFVAR#	By decade of life: St. dev. of earnings/own lifetime avg earnings
EXPHIT	(Prob. wage loss * size of loss}/Av lifetime earnings
EXPHIT#	By decade of life: (Prob. wage loss * size of loss}/Av lifetime earnings

Source: Authors' calculations using the Health and Retirement Study.

Table 2. Factors Associated with Lifetime and Decadal Earnings Variability
(Weighted data)

	COEFVAR			COEFVAR20			COEFVAR30			COEFVAR40		
	Coef.		*Std. Err*	*Coef.*		*Std. Err*	*Coef.*		*Std. Err*	*Coef.*		*Std. Err*
RAIME1000	-0.460	***	0.014	-0.146	***	0.014	-0.187	***	0.015	-0.387	***	0.012
Rfemale	-0.208	***	0.028	0.196	***	0.027	-0.044		0.029	-0.271	***	0.023
Rage	0.037	***	0.003	0.006	*	0.003	0.016	***	0.003	0.038	***	0.003
RBlack	-0.369	***	0.039	-0.118	***	0.039	-0.203	***	0.041	-0.182	***	0.033
RHispanic	-0.117	**	0.049	-0.313	***	0.048	-0.082		0.051	-0.016		0.041
RLTHS	-0.038		0.030	-0.040		0.030	-0.135	***	0.032	-0.018		0.025
RBAplus	0.027		0.023	0.039	*	0.023	-0.016		0.025	0.085	***	0.020
Revdivorce	-0.138	***	0.022	-0.034		0.022	0.022		0.024	0.024		0.019
Revwidow	-0.093		0.039	-0.062	*	0.038	-0.045		0.041	0.048		0.032
RADLany	0.030	**	0.045	0.015		0.044	-0.017		0.047	0.030		0.038
_cons	-0.022		0.185	0.835	**	0.182	0.362	*	0.194	-0.848	***	0.156
Adj. R-square	0.224			0.082			0.048			0.202		
Nobs	5283			5283			5283			5283		

	EXPHIT			EXPHIT20			EXPHIT20			EXPHIT40		
	Coef.		*Std. Err*	*Coef.*		*Std. Err*	*Coef.*		*Std. Err*	*Coef.*		*Std. Err*
RAIME1000	-0.097	***	0.007	-0.025	***	0.008	-0.073	***	0.009	-0.018		0.031
Rfemale	-0.068	***	0.014	0.058	***	0.015	-0.065	***	0.017	0.005		0.059
Rage	0.006	***	0.002	-0.002		0.002	0.003		0.002	0.013	*	0.007
RBlack	-0.115	***	0.020	-0.025		0.021	-0.046	*	0.024	-0.056		0.085
RHispanic	-0.051	**	0.025	-0.060	**	0.026	-0.042		0.030	-0.072		0.105
RLTHS	-0.008		0.015	-0.005		0.016	-0.036	*	0.019	0.135	*	0.065
RBAplus	-0.055	***	0.012	-0.024	*	0.012	0.009		0.014	0.006		0.050
Revdivorce	-0.024		0.011	0.011		0.012	0.015		0.014	0.001		0.048
Revwidow	-0.028		0.019	0.017		0.021	-0.007		0.024	0.284	***	0.083
RADLany	0.094	***	0.022	-0.014		0.024	-0.010		0.028	-0.048		0.096
_cons	0.117		0.091	0.233	***	0.098	0.083		0.114	-0.646	*	0.397
Adj. R-square	0.059			0.017			0.014			0.003		
Nobs	5283			5283			5283			5283		

Note : *** significant at 1%; ** significant at 5%; * significant at 10%

Variable definitions:

COEFVAR	Coefficient of variation age 20-50	RBlack	Respondent Black (=1)
COEFVAR#	Coefficient of variation for specific decade	RHispanic	Respondent Hispanic (=1)
EXPHIT	(Prob. wage loss * size of loss}/Av lifetime earnings)	RLTHS	Respondent Ed < High School
EXPHIT#	Exp. Hit for specific decade	RBAplus	Respondent Ed >= college
RAIME1000	Respondent lifetime AIME/1000 ($)	Revdivorce	Respondent divorced
Rfemale	Respondent female (=1)	Revwidow	Respondent widowed
Rage	Respondent age in 1992 (yrs)	RADLany	Respondent has at least some ADL impairment

Source: Authors' calculations using the Health and Retirement Study.

Table 3. Total Retirement Wealth and Components for HRS Respondents (1992$)
(Weighted data)

	Median 10%	*Mean*	*Stdev*
Total Wealth	$404,727	$642,855	$743,823
Pension Wealth	$73,778	$199,602	$293,425
Social Security Wealth	$152,048	$149,211	$56,085
Financial Wealth	$39,016	$214,862	$621,093
Net Housing Wealth	$52,062	$79,180	$85,043

Note: Retirement wealth measures contingent on age-62 retirement and expressed in 1992 $.
Variable definitions:

Total Wealth	Total real household wealth ($92) = Pension+Social Security+ Financial + Net Housing wealth.
Pension Wealth	Total real household pension wealth ($92) from all pensions.
Social Security Wealth	Total real household Social Security wealth ($92)
Financial Wealth	Total real household financial wealth ($92)
Net Housing Wealth	Total real household nonfinancial wealth ($92)

Source: Authors' calculations using the Health and Retirement Study following Mitchell and Moore (2000).

Table 4: Effects of Earnings Variation on (ln) Retirement Wealth

(Weighted data)

Nonmarried Households

	Variable Name	Social Security Wealth		Pension Wealth		Financial Wealth		Housing Wealth	
		COEFVAR	EXPHIT	COEFVAR	EXPHIT	COEFVAR	EXPHIT	COEFVAR	EXPHIT
1	Earnings Variance	-0.047***	-0.042**	-0.230	-0.625**	0.504***	0.205	0.309	0.115
	Lifetime	[0.013]	[0.019]	[0.199]	[0.289]	[0.149]	[0.200]	[0.248]	[0.359]
2	Earnings Variance	0.025***	0.016	0.183	0.309	0.246**	0.189	0.269	0.144
	ages 20-29	[0.011]	[0.015]	[0.168]	[0.237]	[0.125]	[0.404]	[0.208]	0.294
3	Earnings Variance	-0.017*	-0.026*	-0.021	-0.06	0.063	0.200	0.575***	0.28
	ages 30-39	[0.010]	[0.015]	[0.163]	[0.234]	[0.121]	[0.204]	[0.201]	[0.291]
4	Earnings Variance	-0.079***	0.002	-0.502***	-0.018	0.044	0.022	-0.325	0.025
	ages 40-49	0.014	[0.002]	[0.220]	[0.036]	[0.165]	[0.025]	[0.273]	[0.044]

Married Households

	Variable Name	Social Security Wealth				Pension Wealth				Financial Wealth				Housing Wealth			
		COEFVAR		EXPHIT		COEFVAR		EXPHIT		COEFVAR		EXPHIT		COEFVAR		EXPHIT	
		Resp.	Spouse	Resp.	Spouse	Resp.	Spouse	Resp.	Spouse	Resp.	Spouse	Resp.	Spouse	Resp.	Spouse	Resp.	Spouse
5	Earnings Variance	0.028***	0.021***	0.041**	0.032**	0.057	-0.05	-0.662***	-0.560***	0.103**	0.153***	0.308***	0.328***	0.321***	0.243***	0.073	0.112
	Lifetime	[0.005]	[0.005]	[0.018]	[0.014]	[0.099]	[0.097]	[0.224]	[0,224]	[0.045]	[0.044]	[0.069]	[0.078]	[0.075]	[0.077]	[0.150]	[0.152]
6	Earnings Variance	0.013***	0.021***	0.011	0.018**	0.095	0.179*	0.034	-0.346	0.061	0.053	0.121***	0.204***	-0.021	0.036	-0.025	0.169
	ages 20-29	[0.004]	[0.005]	[0.007]	[0.008]	[0.101]	[0.099]	[0.151]	[0.237]	[0.045]	[0.045]	[0.047]	[0.081]	[0.082]	[0.077]	[0.109]	[0.107]
7	Earnings Variance	0.002	0.008	-0.004	0.022	-0.002	0.053	-0.143	-0.48	0.017	-0.02	0.008	0.047	0.077	0.105	0.099	0.203**
	ages 30-39	[0.005]	[0.005]	[0.017]	[0.014]	[0.094]	[0.094]	[0.127]	[0.172]	[0.040]	[0.043]	[0.066]	[0.127]	[0.069]	[0.074]	[0.082]	[0.123]
8	Earnings Variance	0.005***	0.006	0.003	0.013	-0.061	-0.102	0.200	-0.480***	0.028	0.165***	-0.008	0.126	0.045	0.091	0.054	-0.099
	ages 40-49	[0.007]	[0.007]	[0.003]	[0.010]	[0.119]	[0.116]	[0.219]	[0.172]	[0.058]	[0.054]	[0.026]	[0.099]	[0.088]	[0.082]	[0.041]	[0.260]

Note: Complete regression results available on request.

Models 1 and 5 include only one measure of EV as indicated. Remaining models include all three decadal EV measures in same equation.

Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Source: Authors' calculations using the Health and Retirement Study

Table 5. Median Simulated Effect of a 10% Increase in EV on Retirement Wealth
(Weighted data)

	10% Increase in mean of:	
	COEFVAR	EXPHIT
Social Security Wealth:		
Married	$623	$174
Single	-$323	-$50
Pension Wealth:		
Married	$79	-$190
Single	-$6	-$3
Financial Wealth:		
Married	$902	$518
Single	$658	$49
Housing Wealth:		
Married	$1,210	$55
Single	$25	$2

Note: Derived using regression results described in text.

Source: Authors' calculations using the Health and Retirement Study

Endnotes

[1] See for example, Levine et al., 2000a and b, 2002; Mitchell and Moore, 1998; Mitchell, Moore and Phillips, 2000; and Moore and Mitchell, 2000.

[2] Related research by Venti and Wise (1998) also uses the HRS to examine the dispersion of retirement wealth, but it employed respondent pension descriptions instead of employer-provided data, and it also omits Social Security wealth which we have argued is a substantial element of the retiree portfolio. That analysis does include controls for lifetime earnings levels but it does not examine earnings variability, as we do here.

[3] Hurd and Zissimopoulos (2003) analyze the impact of unexpected declines in earnings growth levels, whereas we focus on first-differences in earnings trajectories.

[4] Because of the confidential nature of the administrative data, researchers may access them only under restricted conditions; see www.umich.edu/~hrswww for details. The data were obtained for a majority of HRS respondents and spouses providing permission to link their survey data with administrative records supplied by the Social Security Administration and also with pension plan descriptions provided by respondents' employers; see Mitchell, Olson, and Steinmeier (2000), and Gustman, Mitchell, and Steinmeier (2000). A match with SS earnings records was feasible for approximately 75% of the respondents; in addition we dropped approximately 700 married respondents from the analysis due to missing data on spouse lifetime earnings. While omitting these nonmatched cases might bias the sample, if those who with a matched file differ from those lacking a match, early analysis suggests little reason for any concern.

[5] This approach (results not reported here) follows Engelhart and Cunningham (2002); see also the Data Appendix.

[6] A caveat to this anticipated difference by marital status, of course, is that people who report themselves as nonmarried on the verge of retirement may well have been married earlier in life, which would mitigate observed marital status differences in the EV coefficients. The models also control for marital history (ever married and ever divorced) as well as for the number of children, for both married and currently nonmarried respondents.

[7] In keeping with past practice, we report the median 10% of the distribution. These figures are comparable to those reported by Moore/Mitchell (2000).

[8] Controls include AIME, several health status measures, education measures, marital status indicators, number of children, sex, age, race/ethnicity, risk aversion and planning horizon indicators, and whether the worker ever had a defined benefit or a defined contribution pension plan. Equations for married respondents include the relevant characteristics of their spouses, including spousal EV measures. For additional discussion see MMP (2000).

[9] Rather than reviewing all the results for other independent variables, we simply summarize here the other results available from the authors on request. In general, the results are sensible and conform to those reported in our earlier work. Not surprisingly, single as well as married workers with higher levels of AIMEs tend to have accumulated statistically significantly larger pension, Social Security, and financial assets, as well as housing wealth, across the board. Higher educational attainment is generally associated with higher retirement wealth levels. Larger families tend to have less wealth than smaller ones, perhaps reflecting constraints on saving. Hispanic sample members tend to have rather low wealth, but there is no significant relationship for Black respondents in equations that control for earnings variation. Health and preference controls also appear to be linked to retirement wealth in predictable ways. Those having difficulty with ADLs, who are pessimistic about surviving to age 75, smokers, and those who

have low cognitive scores, tend to have less wealth than their counterparts. Moderate drinking is associated with relatively higher wealth than not drinking at all. The models also control for a number of "preference proxy" variables, including a measure of risk aversion that uses responses from a battery of questions on gambles to determine a respondent's taste for risk. Here we find that risk averse respondents tend to hold more wealth than do their risk taker counterparts. We also find, consistent with prior work, that those stating they have relatively long planning horizons hold more retirement wealth than do respondents with shorter horizons. Finally, we included a variable identifying which respondents contacted the Social Security Administration to learn about their benefit amounts. Probably not surprisingly, those who did contact SSA had less wealth than those who did not, overall.

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[11] This discussion follows MMP (2000).

[12] Age 62.5 is the modal retirement age currently, where retirement is defined as the age at which people apply for Social Security benefits.

[13] This iterative approach to solving for the household's saving shortfall is described in MM (2000).