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"Retirement and Wealth"

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Abstract

This paper analyzes the relationship between retirement and wealth. In a simple model where the only heterogeneity is in leisure preference, other things the same, those who retire early accumulate more wealth while still working, enabling them to support themselves over their longer retirement period. Moreover, characteristics that encourage earlier retirement also encourage additional saving. If there were heterogeneity in both leisure and time preference, however, this simple relation is broken. Early retirees do not necessarily save more.

Using data from the first four waves of the longitudinal Health and Retirement Study, a cohort of individuals born from 1931 to 1941, we estimate reduced form retirement and wealth equations. Linked employer provided pension plan descriptions and social security administrative records are central to the analysis. The value of the pension and social security beyond current period accrual is measured by the difference between the present value of the benefit stream resulting from additional work until the date of retirement and the present value of a stream of benefits equal each year to the value of benefit accrual in the initial period. This measure, which we call the premium value, captures any excess value from the spikes at early and normal retirement age in a defined benefit plan. But it also has zero value in the case of a defined contribution plan.

Calculating benefit increments on the assumption that benefits are claimed as soon as eligible after retiring, and that respondents link delayed benefit claiming with delayed retirement, the estimated retirement equation indicates that a higher future reward from pensions and social security encourages postponed retirement.

Factors leading to early retirement do not systematically generate higher saving. Many independent variables do not have symmetric effects in the retirement and wealth equations. Unobservables from the retirement and wealth equations are only weakly correlated. A related finding, not easily reconciled with a simple life cycle model of saving, is that higher pension wealth and social security wealth do not substitute for other forms of wealth, but add to total wealth. In addition, other findings support a more complicated view of the underlying behavior. Most importantly, despite a significant payoff to waiting, retirees do not time the acceptance of their social security benefits so as to maximize expected value. Most respondents take their social security benefits as soon as eligible after retirement. This raises questions about the way social security and pensions are calculated as explanatory variables in reduced form retirement equations.

These and other findings, e.g., on measuring retirement and on the role of partial retirement, raise doubts about the value of using reduced form retirement equations to estimate the effects of changing such social security policies as the early retirement age. Reduced form retirement equations must be used with great caution in situations where they are analyzing new policy initiatives. Unobserved heterogeneity interacts with observable variables to produce the estimated coefficients in these equations, but these interactions are not necessarily the same if the policy changes in new ways.

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I. Introduction.

This paper presents a reduced form analysis of retirement and wealth accumulation for members of the Health and Retirement Study (HRS), a longitudinal survey of a nationally representative sample of the population who was 51 to 61 years old in 1992. We use the first four waves of the survey.

To predict the effects of important changes in social security and related policies on retirement and saving outcomes, one must have confidence in the specification of the retirement and saving equations that are used to project behavior. It is particularly important to understand how the relationship between retirement and saving outcomes are determined, and to ensure that critical dimensions of behavior and tastes have not been omitted so as to bias coefficients on variables used to project the effects of social security and pension programs on retirement and saving.

This paper attempts to enhance our understanding of the behavior underlying the retirement and saving decisions, and the relationship between these decisions. We start by reviewing what has been learned about retirement and saving behavior from the literature. We then put these findings into perspective by considering how retirement and saving decisions are linked in a simple life cycle model, where the principal heterogeneity is in preferences for leisure. In that framework, a person who intends to retire earlier accumulates more wealth at each age until retirement than a person with a weaker preference for leisure. We also consider how the relation between the parameters in the retirement and wealth equations may be affected by more complex forms of heterogeneity, e.g., independent or correlated distributions of the preference for leisure and time preference. Next we estimate reduced form equations for retirement and wealth. A reduced form model allows us to examine the patterns among the coefficients of the exogenous variables in the retirement and wealth equations and the relationships among the residuals, to see if a simple life cycle model with heterogeneity in leisure preferences is adequate to explain the relationship between saving and retirement.

Measures of the accrual in pension and social security values with continued employment play a central role in any study of the relation of pensions and social security to retirement and saving behavior. In the present paper, we measure these incentives by the immediate per period accrual in benefits from postponing retirement by one year, and the difference between the value

of the potential future benefits, including spikes in benefit accrual at early and normal retirement ages, and the value from the basic accrual in each period. Thus the measure of the future value is positive in a defined benefit plan with a sharp spike in the accrual profile at early retirement age, but has no value for a defined contribution plan with benefits that accrue evenly each period.

We show that when social security incentives are computed on the assumption that respondents accept benefits immediately upon retiring, the calculated incentives to retire are much sharper than when the date of benefit acceptance is timed to maximize the present value of benefits. If they are constrained to claim benefits immediately, due say to liquidity constraints, then the reward to postponing retirement, i.e., continuing to work, includes the value from postponing benefit receipt. Most of those entering retirement in fact claim their benefits immediately upon retiring. This raises a question about whether liquidity constraints or other complexities not reflected in a simple retirement model act to enhance the rewards to immediate retirement, or whether the decision to claim benefits is independent of the decision to retire. The related question is whether the reward to postponed retirement should include the accrual in benefit value from delayed benefit receipt.

Other evidence from previous studies also suggests it may be necessary to modify assumptions about perfectly operating capital markets, full-information and understanding of the social security system by all covered workers, equal valuation of own and spouse benefits, and other key assumptions typically made in modeling retirement and saving behavior. There also are related puzzles. Pensions do not bear a simple relation to nonpension saving, as they would if pensions were treated simply as a tax favored retirement saving device. Rather, although some of those with pensions reduce their nonpension saving, they reduce nonpension saving by much less than the value of their pension.

An advantage of using a reduced form approach to estimate separate retirement and saving equations is that it does not constrain the coefficients to be consistent with a simple life cycle specification. Rather, a reduced form approach allows the data to freely tell how retirement and wealth accumulation are related to social security and pension increments from postponing retirement. These findings help us to understand the behavior underlying the retirement and saving decisions, without constraining the analysis at a very early stage. Once we better understand the key dimensions of behavior governing the relation between retirement and

saving, we are in a better position to estimate a structural model that will be more useful for analyzing how retirement policies shape retirement outcomes and saving behavior, and how changes in policies will affect retirement and saving.

Incentives created by social security and pensions are measured using linked data. Earnings histories for work through 1991 have been obtained from the Social Security Administration, for respondents who signed permission forms allowing their earnings records to be used. Detailed descriptions of pension plan provisions have been obtained from the employers of respondents who indicated they were covered by a pension on present or past jobs.

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II. What Previous Studies Indicate About Underlying Behavior

Studies of retirement and saving typically are conducted independently of each other, and at times involve inconsistent assumptions. Most studies of saving take retirement behavior to be fixed. At best the retirement horizon or expected retirement date is included as a right hand side variable.[1] Studies of retirement typically assume that capital markets are perfect, so that saving and consumption decisions are made in the background, and do not affect the retirement decision.[2] Nevertheless, previous studies of retirement and saving contain a great deal of information that will help us to understand the relation between retirement and saving behavior.

Studies of retirement recognize that pension and social security benefit formulas affect the reward to continued work, and incorporate these incentives.[3] The saving literature is only now evolving to fully incorporate the influence of pensions and social security on saving. Although social security and pensions represent half the wealth accumulated for retirement (Gustman, Mitchell, Samwick and Steinmeier, 1999), many studies of saving ignore pension and

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[1]See Gustman and Juster (1996) for a discussion of inconsistencies between the saving, retirement and pension literatures. In the present paper we control for some factors correlated with precautionary and bequest motives, but do not explore these motivations systematically. We also do not consider behavioral reactions to uncertain lifetimes, annuities, the demand for life insurance, and related issues.

[2]Rust and Phalen (1997) is an exception. They assume that the capital market is not operative so that the retirement decision affects the path of consumption.

[3]See Lumsdaine (1996) and Lumsdaine and Mitchell (forthcoming) for recent summaries

social security wealth. Moreover, it is not just a question of whether pensions and social security are accounted for when analyzing saving. Even when pensions are counted as part of wealth, fundamental questions remain. Those with pensions accumulate more total wealth that those without pensions, holding lifetime income and the retirement horizon constant (Gustman and Steinmeier, 1999a). Thus pensions promote retirement saving.[4] Indeed, there is very little reduction in other wealth to compensate for higher pension values. As a result, a wealth equation cannot treat pensions simply as a tax favored method of saving that is a substitute for other forms of saving.

Considerable progress has been made in measuring the future value promised by a pension or social security, and in using these measures to explain retirement or job mobility. Lazear and Moore (1988) and Stock and Wise (1990a and b) dub the potential value of the pension resulting from continued work at the firm for a number of years in the future, the "option value" of the pension. A related measure is the difference between the projected liability and the legal liability of the pension, that is the value of a defined benefit plan that accrues from future expected employment, but is not legally owed to the worker based on employment to date. This measure is used by Ippolito (1986) to evaluate the implicit pension contract. Gustman and Steinmeier (1993, 1995) use a measure of pension backloading to estimate the disincentive to mobility from pensions. Coile and Gruber (1999a and b) adopt a measure they call the peak value, which is the maximum found for all future dates of retirement, and use it to evaluate retirement incentives from social security.

In a reduced form setting, the challenge is to properly value current and future benefits, especially the spikes in the pension accrual profile seen at the early and normal retirement dates. Yet one will downplay the relative importance of the spikes in the benefit accrual profile at early and retirement age by simply add up the expected future benefit for each year of future employment. That is, when benefits are simply summed, a defined contribution plan will have a misleadingly large future value. Below we will blend available measures for valuing future

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of retirement research.

[4]Those with pensions may be more aware of the need for retirement savings, and save more as a result. Also consistent with this view, Lusardi (1999) finds that those who plan for retirement end up saving more for retirement.

benefits, basing our evaluation of the expected future value of the pension or social security on what we will call the "premium value", which we measure as the difference between the present value of the future benefit stream and the present value of a stream of benefits equal each year to the value of the basic level of accrual initially observed for the plan. The "premium value" differs from "peak value" used by Coile and Gruber (1999 a and b) in that the peak value counts all increases in benefits with continued work, and thus peak value continues to increase in time as benefits are accumulated in defined contribution plans, while the premium value does not.

A number of findings from the literature raise questions about the behavior governing retirement and saving decisions. People are not very well informed about the details of their pensions. Many cannot identify what type of pension they have, which is a particular problem for studies that would attempt to estimate retirement incentives from pensions using respondent surveys (Mitchell, 1988, Gustman and Steinmeier, 1989 and 1999b). Respondents are especially poorly informed about the location and size of the spikes in pension benefit accruals created by their defined benefit plans, which are key determinants of the incentives that pensions create for retirement behavior (Gustman and Steinmeier, 1999b). Imperfect information about pensions leads to two kinds of problems. One is that descriptions of pensions (or social security) obtained from respondents may be misleading. This problem can be remedied by using linked pension and social security data obtained from employers and from the Social Security Administration.[5] A second problem is that the respondents may be guided in their saving or retirement decisions by a misunderstanding of their pensions. This second problem cannot be fixed through the use of better data, but must be modeled.

There also are questions about the behavior that determines when people claim their social security benefits. There is a literature analyzing when it is optimal to claim benefits.[6]

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[5]Matched employer pension plan descriptions are available for use with the Survey of Consumer Finances of 1983 and 1989, the National Longitudinal Study of Mature Women, and with the Health and Retirement Study.

[6]Blinder, Gordon and Wise (1980) and Clark and Gohman (1983) have discussed the actuarial advantage of delayed claiming of social security benefits. See also Feldstein and Samwick (1992). Coile, Diamond, Gruber and Jousten (1999) also suggest that it is optimal for many to delay claiming social security benefits after early retirement age, but they find that only

From an expected value perspective, it is often optimal not to claim benefits when first eligible, but to delay claiming benefits so as to disproportionately increase the value of benefits, especially of spouse and survivor benefits.[7] Models of retirement and saving should be reconciled with observed claiming behavior.

There are a number of reasons why social security beneficiaries may not delay their acceptance of benefits to the optimal time. One possibility is that the primary beneficiary places less weight on spouse and survivor benefits than on own benefits.[8] If a primary earner places a lower weight on spouse and survivor benefits than on own benefits, we can expect to observe earlier claiming by the primary beneficiary. Another possibility is that liquidity constraints are important, because, perhaps, some are over-annuitized. A household with little liquid wealth will not be able to support consumption between retirement and the time of first receipt of delayed benefits. Or perhaps the answer is correlated leisure and time preferences.

It is important to understand claiming behavior in order to properly measure how social security affects the incentive to retire. If people claim their social security benefits so as to maximize expected value, we show below that the reward to postponing benefit claiming will be reduced. Even if benefits are claimed immediately upon retirement, as the evidence suggests in most cases it is, retirement and claiming behavior may not be tied in the respondent's mind. Accordingly, retirement decisions may not be influenced by the actuarial increase in the value of social security benefits from delayed claiming. Still another possibility is that individuals may

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a few delay claiming their benefits, and counter to expectations based on a lower expected value, that single men are more likely to delay claiming their benefits than are married men.

[7]Actuarial returns to social security vary with family status and age, and may be quite generous at younger ages. Using the social security benefit reduction rate on the assumption of normal retirement at age 65, at age 62 a 6.67 percent increase in benefits from delaying retirement for one year raises the benefit by 6.67/.8, or 8.33 percent. Given the life tables, that adjustment is better than actuarially fair, at least it is if one's spouse is not over the age of 65.

[8]The purpose of the Pension Equity Act is to protect spouses from circumstances where the primary earner takes a single life annuity and leaves the spouse with no pension income once he dies. For an analogous reason, even though Congress has just abolished the earnings test for those over 65, Congress refused to abolish the social security earnings test for those between the ages of 62 and 65. See Gustman and Steinmeier (1998) for an analysis of social security privatization that varies the weight given to spouse and survivor benefits relative to own benefits.

be sophisticated enough to understand the actuarial return to postponing benefits, but not sophisticated enough to divorce the decision to retire from the decision to accept benefits. Thus whether social security creates incentives that influence retirement outcomes depends on claiming behavior, and the valuation of deferred social security benefits in turn depend on the reason why most retirees do not defer their benefit claims.

When it comes to those who are working part time and are earning enough to be subject to the earnings test, more are willing to postpone benefit acceptance.[9] A person who is working part time and making more than the earnings test disregard is in roughly the same actuarial position with regard to the lost earnings as a person who postpones benefit receipt. Both will have their future benefits increased by a similar amount to cover their lost benefits.

We are aware of a number of other issues affecting the specification of retirement and saving equations. Findings are sensitive to how retirement is measured, based on self reported status, hours of work, or some combination (Gustman, Mitchell and Steinmeier, 1995; Gustman and Steinmeier, 2000). Findings will also be influenced by whether the partially retired are counted as retired or not retired (Gustman and Steinmeier, 1984). We address these issues below.

III. Joint Determination of Retirement and Wealth in a Simple Model

To facilitate the discussion of the relationship between retirement and wealth, let us examine a simple yet instructive model. In this model, the consumer maximizes a lifetime utility function:

$$U = \int_0^T e^{-\rho t} u[C(t)]\, dt$$

subject to a lifetime budget constraint

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[9]Many of those who continue to work have the option of immediately claiming some of the their benefits, with the remainder postponed due to the earnings test. Gustman and Steinmeier (1991, p. 742) found, using 1984 data from the Continuous Work History Survey, that only 30 to 40 percent of working individuals who are eligible for partial benefits at age 62 register for them.

$$\int_0^T C(t)\,dt \;=\; WR$$

where $C(t)$ is consumption at time t, W is the (constant) wage rate, R is the retirement age, and T is the lifetime.[10] The Euler-Lagrange condition for this problem is

$$U'[C(t)] \;=\; \lambda e^{\rho t}$$

where 8 is a Lagrangian multiplier which, in this problem, is constant over time. Differentiating this condition with respect to the retirement date R yields

$$U''[C(t)]\;\frac{\partial C}{\partial R} \;=\; \frac{\partial \lambda}{\partial R} e^{\rho t}$$

Since $UO < 0$, this condition implies that MC/MR and $M8/MR$ are of opposite signs, and furthermore, since 8 is constant over time, that the sign of MC/MR is uniform over time.

Differentiating the budget constraint with respect to R gives

$$\int_0^T \frac{\partial C}{\partial R}\,dt \;=\; W \;>\; 0$$

Since MC/MR has a uniform sign over time, that sign must be positive. Assets at any point in time before retirement are simply the difference between the cumulative wages and the cumulative consumption:

$$A(t) \;=\; Wt \;-\; \int_0^t C(t')\,dt'$$

Since an increase in the retirement age uniformly increases consumption over time, it must

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[10] Inserting a real interest rate into the budget constraint and/or allowing wages to grow over time makes the algebra more cluttered but does not affect any of the conclusions regarding the model.

reduce the level of assets at any point in time: $MA/MR < 0$.

Implications of Heterogeneous Leisure Preferences.

Suppose that different individuals have characteristics (either observed or unobserved) that make them either more or less inclined to retire early. Let X_i be one such characteristic, one such that high values of X_i are associated with earlier retirement: $MR/MX_i < 0$. We can also ask what the effect of X_i is on asset holdings at some time prior to retirement. Since X_i operates indirectly through the retirement age in the model above, and not directly on either assets or consumption, $MA(t)/MX_i = MA(t)/MR \; MR/MX_i < 0$. Holding all other things equal, a characteristic that makes an individual more inclined to retire early also induces that individual to hold more assets than otherwise.

A simple interpretation of this is that if the individual plans to retire early, he or she will hold more pre-retirement assets in order to finance the longer period of retirement without a sharp cutback on consumption. This finding is noted in the top part of Table 1. There, an earlier retirement is associated with an increased level of assets at any pre-retirement age.

Implications of Heterogeneous Time Preference.

Next, let us investigate the effects of heterogeneous time preference, holding leisure preferences (and hence the retirement date) constant. Without going through the details of the derivation in the model above, it can be shown that $MA(t)/M\Delta < 0$. Heuristically, an increase in time preference is associated in the consumption formula with a more rapid decline in consumption over the lifetime, and hence with a tendency to consume more in the early years. Increased consumption in the early years will lower the amount of accumulated savings with a given level of wages.

The second part of Table 1 indicates these results. A higher level of time preference will have no effect on the retirement age, given that we are assuming here that leisure preferences are constant. However, the higher level of time preference will result in lower rates of asset accumulation and lower levels of assets at any given age.

Correlated Leisure Preferences and Time Preferences.

The previous few paragraphs have examined either heterogeneous leisure preferences, holding time preference constant, or heterogeneous time preferences, holding leisure preferences

constant. If the two sets of preferences were independent, then the correlation between early retirement and higher wealth levels that are implied from the first panel in Table 1 would prevail overall. That is, an individual with high leisure preferences would be more likely to retire early and hold more wealth. Because there is no systematic correlation with leisure preferences, heterogeneous time preference does not change this relationship, although it does spread out the wealth distribution for a given leisure preference. The net result is that allowing for both preferences but requiring that they be independent implies that there is still a positive association between early retirement and wealth holdings, but they are not as tightly correlated as when we considered heterogeneous leisure with a given time preference.

However, there is no particular reason to assume that leisure preferences and time preferences are uncorrelated, and arguments for a correlation are relatively easy to make. A high time preference is symptomatic of an increased desire for short term gratification, the "I want it **now**" attitude. The same desire for short term gratification is likely to carry over into the leisure/work decision, where it manifests itself as an increased desire for leisure. Thus, it is plausible to argue for a positive correlation between time preference and leisure preference.

The lower panel of Table 1 gives the results of combining heterogeneous leisure preferences with positively associated heterogeneous time preferences. For an individual with high leisure preferences, retirement is more likely to occur early. Because of the longer retirement period, there is an incentive to have higher levels of wealth in the years leading up to retirement. However, offsetting this is the fact that such an individual is likely to have high levels of time preference as well. High levels of time preference work in the opposite direction in terms of wealth accumulation and tend to lower the level of wealth. Which effect is dominant is a priori unclear; hence the wealth of individuals with high leisure preferences is labeled as "ambiguous." The net result is that in this situation early retirement may be associated with either high or low levels of wealth, and the direction of the correlation between retirement and wealth is not determined.

Implications.

One of the purposes of this study is to find out what kinds of models are generally consistent with the data. Models which allow for individual heterogeneity in the preferences for leisure, but which assume that all individuals have the same time preferences, imply a negative

relationship between retirement ages and wealth levels. If this relationship is supported by the data, then it would be appropriate to estimate structural versions of this model. However, if the data do not contain evidence of this relationship, then the simple model will not suffice. Fortunately, a slightly more general version of this model, which includes both heterogeneous leisure preferences and heterogeneous time preferences and allows for these preferences to be correlated in plausible ways, can accommodate cases where retirement ages and wealth levels are not correlated, or are positively correlated. If this turns out to be the case, structural estimation should concentrate on these or similar models.

IV. Data and Variables.

The data used to investigate the relationship between retirement and wealth come from the first four waves of the original cohorts of the Health and Retirement Study (HRS). The HRS began in 1992 with about 9,800 respondents who were born between 1931 and 1941. Spouses were also interviewed, but unless they were born in this time period they are not included in this study, since they are not representative of their respective cohorts. The study continued to interview the respondents at two year intervals, and the current study uses these interviews through 1998, which is the last interview available.

Defining Retirement:

One of the focuses of the study is retirement, which in the empirical analysis we will take to be the transition from working in one survey year to being retired in the next. Measures of retirement as of the survey date are probably more precise and do not require us to infer exactly when between two surveys an individual actually retired. To implement this retirement definition, however, we must define exactly what it means to be working and what it means to be retired. There are several potential ways to measure retirement in the HRS, but these group into objective based measures, such as whether you have a job in the survey week, and subjective measures, such as whether on not you consider yourself to be retired.

These measures are not always consistent. Table 2 gives cross-tabulations of two measures: usual hours per week and self reported retirement.[11] The percentages along the

[11]For self reported retirement, there is a not applicable category, which applies to

diagonal are instances where the two measures agree, and these total to about 83.4% of the observations. For the remaining observations, which are about one-sixth of the total, there is disagreement between the objective measure and the self-reported retirement status.

Looking first above the diagonal, these are cases where the respondent is working more than would be expected with the self-reported retirement status. Since the respondent is working, it is probably not appropriate to classify him or her as completely retired. On the other hand, an examination of numerous individual records suggests that if the respondent responds that he or she is partially or fully retired, there is usually a reason for the response even if the current hours are in the full-time range. Perhaps the respondent has worked for 60 hours per week in previous jobs and is now only working 40 hours a week, or sometimes there is a noticeable drop in earnings, suggesting an easier job. Frequently the work history contains a change of employer around the date the respondent says he or she partially or fully retired. In any case, it appears to be sensible to treat respondents who are working but say they are partially or completely retired as though they are partially retired, since in most cases there is at least some evidence they are not working as hard as they did at one time.

Below the diagonal are respondents who claim to be working more than the objective measures suggest. One cell contains respondents who claim to be not retired at all even though their usual hours per week at their present job are below 35. To decide whether such individuals are not retired or partially retired, we look at previous jobs in the job history. If there were previous jobs with 35 hours of work or more, then there is evidence of a reduction of work effort, and the individuals are classified as partially retired. If there is no evidence of previous jobs with 35 or more hours per week, then there is no evidence of lower work effort, and the respondents claims that they are not retired at all are accepted. For the respondents who claim to be not retired or partially retired but who did not have current jobs, we look to see whether they also claim to be unemployed and how long ago their last job was. If they say they are unemployed but had a job within the previous twelve months, their self reported status is accepted. But for the remainder of the respondents, who are the large majority of this group, the claim of not being retired is not accepted, and they are classified as being completely retired.

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homemakers and respondents who have not worked for years. Such responses were included in the completely retired category.

In short, we are making a new definition of retirement status based both on objective hours and subjective self reports. By themselves, both self reports and objective hours have problems. Hours measures have problems with individuals who reduce work effort while still being above 35 hours and with individuals who have always worked less than 35 hours. Self reports appear to be unreliable both in cases where the individuals have jobs yet say they are completely retired and with individuals who do not have jobs yet claim to be not retired. The hybrid measure of retirement that we are using should ameliorate these deficiencies.

Measuring Wealth.

The second focus of the study is on wealth. The HRS went to a lot of trouble to gather good wealth numbers, including trying to bracket amounts for which the respondents were unable to provide exact numbers. This both reduces the need for imputation and probably increases the accuracy of the imputations that are made, increasing the accuracy of the wealth measures. The main problem in wealth regressions is one of scale. If wealth is entered in a linear format as a dependent variable, the wealth regressions are likely to be dominated by those with high levels of wealth. If instead wealth is entered in a logarithmic format, there is the problem of what to do with those with zero or negative wealth numbers. These problems can be avoided by using as the dependent variable the level of wealth as a percentage of potential wealth, which can be measured as the real value of lifetime household earnings. Lifetime earnings, in turn, can be measured fairly accurately from the social security earnings records which were collected as part of the survey. These records can be corrected for instances where earnings are masked by the social security earnings maximum or where earnings were not recorded because the respondent was in a non-covered job. The resulting dependent variable, which should lie between zero and one, should not be severely affected by scale. Roughly speaking, this approach treats a household that has $100,000 in assets out of $2,000,000 in lifetime earnings as in roughly the same situation as a household that has $25,000 in assets out of $500,000 in lifetime earnings.[12]

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[12]One can expect a nonlinear relationship between wealth and lifetime earnings on both the low and high ends of the income and wealth distributions. Those with low earnings and wealth are insured against adverse events by a variety of government income and wealth tested programs that are not available to those with higher wealth or income (Hubbard, Skinner and Zeldes, 1995). Moreover, the bequest motive, and tax treatment of bequests, may be very

Most of the explanatory variables in this study are fairly straightforward, and the Appendix table lists a short description of each variable. There are a few variables which merit a few words of additional discussion, however. The most important group of these relate to the incentives that pensions and social security provide either to keep on working or to retire. The first two of these variables measure the *increases* in future pension and social security benefits that come with continued work. These are usually called the pension and social security accruals. Since we are looking at the probability of retiring in the period between one survey and the next, there are really two accruals that are important. The first accrual, which we will call the beginning accrual, is measured as of the beginning of the period. For instance, if the respondent is 57 years and 5 months old at the beginning of the period, the beginning pension accrual would be the value of the pension if the respondent were to retire on his/her 58th birthday less the value if the retirement were on the 57th birthday. A large accrual at this date probably induces some individuals to delay retirement until after the beginning of the period, so they can collect the accrual. This should have a positive effect on retirement if subsequent accruals are less. The second accrual, which we will call the final accrual, is measured as of the end of the period. If this accrual is high, then respondents will probably delay retirement until after the date of the second interview, pushing down retirement rates.[13]

As discussed above, the additional benefits to be accrued as a result of continued employment into future years can also have incentives for retirement that are not necessarily captured by the accruals at either the start nor the end of the period over which we are measuring retirement. An example would be a pension which increases sharply in value a couple of years after the end of the second survey. In this case, a respondent might delay retirement not because the current accruals are high, but because of the prospect of the higher pensions if he or she waits until the sharp increase in value. This idea is called "option value" by Stock and Wise (1990a and b) and "peak value" by Coile and Gruber (1999a and b). However, neither of these measures

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different between those at the upper end of the income and wealth distributions and those who have less income and wealth.

[13]There may also be an interaction between the accrual at the beginning and end of the period since one would expect the impact of the accrual to depend on how it compares to the accrual at the other end of the period, rather than just on the absolute size of the accrual at each

quite embraces the idea that we are trying to capture, which is the potential of a future extra bonus on top of any current accruals. For instance, both the option value and the peak value would increase more or less indefinitely for defined contribution plans, and yet these plans in general are not perceived to provide a strong incentive to retire at any particular time.

For this reason we are introducing a new measure of future incentives which we call the "premium value." To calculate this measure, for each future year we calculate the value of the pension and compare it to the value the pension would have if the current accruals were to continue until the future year. The premium value is simply the maximum of the present value of these differences. For instance, using constant dollars, suppose that a pension were worth $100,000 if the individual retired now, $105,000 if retirement were next year, $112,000 if retirement were in two years, $150,000 if retirement were in three years, and $155,000 if retirement were in four years. The jump in value three years from now is not uncommon in defined benefit plans and is called the "pension spike" in some of our previous work.

The current accrual rate is $5,000 (the difference between $105,000 and $100,000), which represents the increase in pension value from working the current year. The current accrual rate does not reflect the large increase three years later, however. The calculations for the premium value are maximized at the three year mark. In three years, the value of the pension at the current accrual rates would be $115,000, which is the original $100,000 plus three years of $5,000 accruals. The actual value of the pension would be $150,000. The difference of $35,000 is the premium value and represents the information about the future value of the pension beyond what is implied in the current accrual rate. Note that in this example the pension is not necessarily maximized in the third year; further increases would be possible without affecting the premium value as long as those increases are not larger than the current accrual rate. Note also that a defined contribution plan which increases steadily in value will have a zero premium value, since there are no future benefits in this type of plan that are not evident in the current accrual rate. Social security benefits can also have these premium values if the benefit increases for delaying benefits are more than actuarially fair. Such is frequently the case for married respondents whose spouses will be collecting benefits based on the respondents' earnings.

Table 3 gives the distributions of accruals and premium values for both social security

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end of the period.

and pensions for respondents who are considered to be not retired. For the premiums, the last section of the table details the amounts for the respondents who have non-zero values. The premium value is measured at the end of the period, because it is presumably the premium at this time which would induce respondents to delay retirement. Both the accruals and premium values are expressed as a percentage of the current earnings. Presumably the incentives from pensions and social security to continue working are more related to the percentage by which they increase the regular earnings than they are to the absolute values of the amounts.

Pension and social security accruals each average around 6-8% of current earnings, but the variation in pension accruals is almost twice as much as for social security accruals. This is important because if the estimated effects are the same, the differential impact of the accruals on retirement behavior for the respondents is related to the variance of the accruals and not necessarily to the mean. With regard to the premium values, when averaged across the whole population, the premium is actually higher for social security than for pensions, at 18% vs 11%, but again the variation in premium values for pensions is somewhat greater than for social security. Part of this comes from the fact that over four times as many respondents have social security premium values as have pension premium values. If we just look at respondents with positive premium values, both the mean and variation of the pension premium values are much higher than for the social security premium values.

The final data issue is the derivation of the sample to be analyzed from the observations in the data set. This information is reported in Table 4. The HRS interviewed 12,652 respondents in the initial wave in 1992, and by 1998 the survey had conducted almost 45,000 interviews with these individuals. However, only the respondents born between 1931 and 1941 are a representative sample, and imposing this restriction eliminates about a quarter of the interviews. We require that the individual initially be not retired, i.e., working full time; this leaves about 18,000 observations. We require usable age and earnings figures, and if the respondent is married, that the spouse is also interviewed so as to be able to compute household earnings variables. Finally, we require that if the individual reports a pension on the current job, the pension be included in the employer-provided pension provider file. We make this last requirement because the respondent interview provides a very poor basis for imputing pension accruals and premium values (Gustman and Steinmeier, 1999b). After these restrictions are

imposed, we are left with about 11,700 observations.

Since retirement is defined as a change in status between one wave and the next, we must consider periods in which the respondents were interviewed in two adjacent waves. Dropping interviews for which there was no subsequent interview leaves about 8,900. There are a couple of minor additional deletions because either the work status or age is not available in the final wave, so that the final number of observations used in the retirement part of the analysis is about 8,600. For the wealth regressions, there are some additional deletions. First, it would seem inappropriate to use the same regression for both married respondents and single respondents. Among the single respondents, there are problems with divorced and widowed respondents because the survey does not interview the former spouses, and hence we cannot tell the earnings potential of the household. The sample of the remaining single respondents, who are the never married group, is small enough that the results are questionable. Therefore, we only look at married respondents in wealth regressions. This brings the sample down to about 6,300. We further delete anyone in a household which reports any substantial inheritance (more than $10,000), or if the total wealth including pensions and social security exceeds the real value of the earnings for that household. This leaves around 5,600 observations for the wealth regressions.

V. Retirement and Wealth Regressions.

In this section we look at the results of the retirement and wealth regressions. Table 5 presents the principal results. The retirement regression is actually a probit equation, and the figures reported in the table are the marginal effects, that is, the change in probability of retirement that results from a one unit change in the independent variable.

First consider the retirement probit. The dependent variable in this probit is whether or not a respondent who was fully working in the initial survey had completely retired by the second survey, where retirement is as defined in the previous section. The overall probability of retirement between one survey year and the next is about 13.6%, so that numbers such as 0.06 or 0.07, while they may appear small, actually represent an increase in retirement rates of about 50 percent. In the retirement equation, the combined pension and social security incentive variables all come in significant and with the correct sign. We would have expected the two accrual

effects to be approximately equal and of opposite sign, whereas the effect of the final accrual is almost twice as large. However, the difference is not significant using a likelihood ratio test. These coefficients suggest that moving from an accrual value which is one standard deviation below the mean to one which is one standard deviation above the mean (see Table 3) changes retirement by around 3 percentage points, or by roughly one-quarter. A similar variation in the premium value would also change retirement by 2-3 percentage points.[14]

The age variables follow the expected path in that the retirement probability steadily increases at higher ages. There is almost no evidence of a pure age effect at age 65, although there is a considerable effect at age 62. Recall that age is measured at the beginning of the period and that the period is roughly two years, so respondents aged 60 or 61 at the beginning of the period will have passed 62 by the end of the period. Thus, the increases in the coefficients at ages 60 and 61 probably reflect a spike when individuals turn 62. The cause of this spike is still under debate. It could reflect liquidity constraints that are relaxed when the individual is able to collect social security benefits, or it could be that individuals do not value (or are not aware of) higher future social security benefits very much, so that at age 62 it appears that they are giving up benefits by continuing to work. In any case, most observers would probably agree that a major part of the cause of the retirement increase at age 62 has something to do with social security, even if the exact precess remains unclear.

The other variables in the retirement probit behave more or less as expected, to the degree to which they are significant. The two most important variables are poor health and having been laid off from the initial job, both of which substantially increase the probability of retirement. Tenure (years of service) in the initial job is also highly significant, with higher tenure levels appearing to increase the probability of retirement. Another significant variable is the share that the respondent has contributed to lifetime household income (as of 1992); primary earners retire later. The self employed are also likely to retire later. There is no systematic difference in

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[14]At the average earnings for the sample, the coefficient on premium value indicates that retirement would decrease by 0.072 percentage points, or about 0.036 percentage points per year since the average period in this study is two years, for each $1000 increase in premium value. This compares with a figure of 0.054 percentage points per year reported by Coile and Gruber (1999, Table 6) for their measure of peak value. Coile and Gruber did not find any significant

retirement associated with gender (although primary earners in the family are significantly more likely to retire later), or with Black or Hispanic status once the other independent variables are included in the retirement equation. Also note that the planning horizon, which is the closest direct measure we have to time preference, is not significant in the retirement equation. Lastly, those who are able to reduce their hours of work without leaving their job are less likely to proceed directly from full time work to full retirement, instead either prolonging the length of time spent on a job in which the workload can be modified, or partially retiring on such a job.[15]

In the wealth regression, the dependent variable is the ratio of non-pension, non-social security wealth to the lifetime household earnings. This variable may loosely be interpreted as the fraction of lifetime household resources that have been saved in addition to pensions and social security. Since many types of wealth, such as household wealth or financial wealth, cannot really be separated into parts due to each partner, this variable is necessarily a household variable, although the observations are still individuals. As with the retirement variable, the magnitude of the coefficients may be a little deceiving. A value of 0.01 is associated with an increase in household wealth of one percent of the lifetime earnings of both spouses, and this can translate into a sizable sum.

The first coefficient is that of the log of total lifetime family earnings.[16] The sign and magnitude of this coefficient suggests that, all other things equal, a doubling in earnings causes the wealth ratio to drop by about one percentage point.[17] The next two variables are the ratio of

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effect of social security accruals.

[15]See Gustman and Steinmeier (1984) for an analysis of partial retirement both on the main job and on other jobs.

[16]When a quartic in family lifetime earnings percentiles is added to the wealth equation, the coefficients are not individually or jointly significant over and above the log of family lifetime earnings, and the remaining coefficients appear to be hardly affected.

[17]Because the log of lifetime family lifetime earnings appears in the denominator of the dependent variable, there will be some downward bias in the coefficient estimated for lifetime earnings due to measurement error. When we fit the wealth regression including only respondents for whom we had social security records, and therefore for which any biases arising from errors in measuring lifetime household earnings should be less, the coefficient on total lifetime earnings for the family falls -.0110 to -.0161, with a t statistic of 2.90. This is in the

pension wealth and social security wealth to lifetime household earnings.[18] If there were perfect substitution between pension wealth, social security wealth, and other types of wealth, these coefficients would by -1, and reductions of other types of wealth would fully offset any pension or social security wealth. If there were no offset, the coefficients would be 0. In contrast to the predictions of a simple life cycle model, and consistent with our earlier results with slightly different specification, these coefficients suggest that the respondents do not reduce the amounts of other types of wealth very much to offset higher levels of pension and social security wealth.[19]

For reasons that are not completely clear, the coefficients on the accrual and premium value variables all are positive, although only one of them is significant. Significant coefficients on other variables have effects in plausible directions. These variables include the race variables, with blacks having five percent less wealth, the education variables, with more educated respondents having considerably more wealth (holding lifetime earnings constant), and the planning horizon variables, with those with short horizons having less wealth. The tenure variable is also highly significant in increasing wealth. There is some tendency of older respondents to have higher wealth ratios, but the tendency is fairly noisy. Households with a larger age difference between spouses, those in poor health and union workers have lower wealth. Self employment is associated with much higher wealth, suggesting a unique motivation for wealth accrual by the self employed.

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opposite direction from the change that would be caused strictly by measurement error in the lifetime earnings variable, so that there must be some systematic difference between the 4150 observations with an attached social security record, and the 1458 observations for families with at least one social security record missing. The coefficients on the other covariates are very similar between the two regressions.

[18]These ratios are calculated as of 1992, since the social security records provide earnings information up through 1991. For more detailed analysis of the substitution of pensions and wealth, see Gustman and Steinmeier (1999a).

[19]We reestimated the wealth equation using median and robust regressions. Among the differences in the significant coefficients, the coefficient on the log of lifetime family earnings turned from small and negative (-0.0110) in the OLS equation to small and positive in the robust regression (.0053); and the coefficient on pension value over lifetime earnings turned from small and negative (-.0548) to small and positive (.0296).

As indicated in Section III, one of the main interests of these regressions is to see whether retirement and wealth are correlated, as a model with heterogeneous leisure preferences but uniform time preferences would suggest. Such correlation should be evident in Table 5, which lists the results for both the retirement an wealth equations. To facilitate the comparison, the two equations in this table have corresponding observations, except that the wealth equation is limited to married respondents. However, the retirement equation is not much changed when it too is limited to married respondents, and a test of the proposition that married and single respondents have the same coefficients in the retirement equation is not rejected.

Correlation, to the extent it exists, should have two implications. First, the independent variables should work in the same direction in the retirement and wealth regressions.[20] While it is true that high levels of tenure have strong, positive effects on both retirement and wealth, for both the health variable and the self employment variable, the effects are significant in each equation but are of opposite signs.[21] Further, there are a number of variables which are significant in one equation, but not the other. Whether a layoff occurred, whether the respondent can reduce hours in the job, and the share that the respondent contributes to household resources are all significant in the retirement probit, but not in the wealth regression. On the other hand, race, education, the planning horizon, whether the respondent is a management or professional worker, and whether he or she is covered by a union are all significant in the wealth regression, but not the retirement probit. Excluding the age dummies, of the 40 independent variables in the retirement and wealth equations in Table 5, 23 variables have a significant coefficient in at least one of the equations. Among the variables with significant coefficients in at least one equation, nine have the same sign in both equations, and 14 have different signs in both equations. This pattern certainly does not yield the impression that there is a tight correlation between early

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[20]The omission of the pension and social security wealth variables from the retirement probit does not affect these results; when we run the retirement probit adding these variables, there is hardly any change in the coefficients.

[21]The finding with regard to the health variable is not a surprise. When a factor reduces labor market opportunities, especially when it is not clearly foreseen, and also creates expenses, it is reasonable to find earlier retirement accompanied by lower wealth. The perfect foresight model is too simple to explain the effects of health shocks on wealth and should be modified to

retirement and wealth.

However, the fit in both the retirement probit and the wealth regression is rather poor, so that most of the action is in the unobserved error terms. This means that a perhaps a more important way that retirement and wealth could be correlated is through a correlation in the error terms. When this correlation is calculated for individuals who are in both equations, however, the correlation is a mere -0.008.[22] This is in rough agreement with the lack of correlation we observe with regard to the effects of the observed explanatory variables. Both the explanatory variables and the error terms seem to be saying that there is not much relation between retirement and wealth. This means that a model with homogeneous leisure preferences and a uniform time preference is inconsistent with the observed pattern of retirement and wealth, and that any model which is used for structural estimation should probably include heterogeneous time preferences or something similar to break the implication of strongly correlated retirement and wealth.[23]

VI. Separate Pension and Social Security Effects.

The equations presented in Table 5 assume that the effects of accruals and premium values are the same whether they operate through pensions or social security. Table 6 presents partial results of an additional probit estimation for the retirement regression equation which splits up the effects of accruals and premium values into separate components for pensions and social security. The results for the probit where these variables are combined are repeated for convenience.

At first glance it would appear that the effects are indeed different. To be sure, all three pension effects are approximately both in magnitude and significance equal to the effects for the combined variables. For the social security variable, the premium value effect is about the same in both magnitude and significance as for the pension variable, but the social security variables

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incorporate unexpected events.

[22]For the retirement probit, the error term used in the correlation is either 1 or 0, depending on whether the respondent actually retired, minus the fitted probability of retirement from the estimated probit.

[23]Such a model should also include the other major motivations for saving, as outlined in Gustman and Juster (1996).

for both accrual variables are smaller in magnitude and are not significant. The effect for the initial level of the social security accrual measure is even of an unexpected sign, but the magnitude is very small.

However, the confidence intervals of the final accrual variable for social security clearly includes the point estimate of the pension variable, and the same thing is nearly true for the initial social security accrual variable. This raises the possibility that the two sets of estimates for the pension and social security variables are not significantly different and invites a test of the differences. Twice the difference in the log likelihoods is 3.12, which is clearly not significant when compared to a chi squared distribution with three degrees of freedom. Recall from Table 3 that the variability of the social security accrual variables was less than half as much as it is for the pension accruals. Evidently the lower variation in the social security accruals has led to less accurate estimates of these effects, so that we cannot reject the hypothesis that the effects of the social security and pension accruals and premium values are the same.[24]

One final note is that the point estimates of the effects of the premium values are the same for pensions and social security. Since the variation in premium values for pensions is wider than the variation in social security premium values, especially among the group for whom the premium values are positive, it would appear that the overall effect of pension premium values on retirement is somewhat larger than the effect of social security premium values.[25]

VII. Social Security Acceptance Behavior.

We have assumed to the current point that those who retire accept their social security benefits upon retiring, or will accept them at age 62 once they do retire. In addition, we have assumed that those who do not retire at all do not accept their social security benefits until they retire. The top panel of Table 7 indicates that the vast majority of those who are retired do claim

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[24]On the other hand, when we run a probit with the social security accruals, the likelihood ratio that these two coefficients are jointly zero is not rejected.

[25]We also estimated wealth equations with separate measures of pension and social security accruals. The findings were similar to the wealth equation reported in Table 5. The only significant coefficient is for the initial accrual created by pensions.

their benefits, with the share of claimants increasing with age between 62 and 65.[26] At age 62, 69.5 percent of retirees have accepted benefits. By age 65, the acceptance rate is up to 92 percent. The numbers accepting benefits among the partially retired are just slightly lower. Among those who are not retired, 11.5 percent claim benefits at age 62, rising to 42.1 percent by age 65.

The second panel of Table 7 shows that benefit acceptance was optimal only for a modest fraction of those 62 to 65 who actually accepted them. Among the completely retired who are 62 years old, less than a fifth of those who accepted benefits should have. Among 64 year old retirees, only a little more than a third of those accepting benefits should have. The third panel examines who should postpone acceptance, and it includes all individuals in the sample even if they are not currently eligible because of the earnings test. About 90 percent of married males and half of married females should postpone benefit receipt, while no single males over 63 or single females over 65 should delay. In the final panel, we see that among those for whom it would be optimal to postpone benefit acceptance, the average gains from doing so are close to $8,000 per year for both married males and married females at age 62. The value declines with age for married males, but remains over $7,000 for married females, even at ages 64 or 65, due to their longer life expectancy.

Evidence that benefit claiming is being driven by liquidity constraints, and not by the reward to postponing benefit receipt, can be seen in the first two rows of Table 8. Among those who are retired, those with a higher ratio of nonpension, nonsocial security wealth to social security wealth, are significantly less likely to have accepted benefits. Moreover, among those who have fully retired, those with the strongest incentive to postpone benefit receipt, as measured by a higher social security premium, are most likely to accept benefits. With the overwhelming majority of those who have retired claiming benefits, these regressions appear to distinguish behavior only among a minority of retirees who are on the margin of claiming benefits, and not to tell a clear and consistent story about what is motivating the overwhelming majority of retirees to claim their benefits earlier than optimal.

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[26]These numbers understate the fraction of eligible beneficiaries who accept benefits at age 62. See Olson (1999).

To this point we have assumed that even though the older population is failing to postpone benefit receipt so as to maximize the present value of expected future benefits, they still include the value of delaying a claim to benefits as part of the reward to delayed retirement. One way to remove the value of delayed benefit receipt from the reward to delayed retirement is somewhat counter intuitive. That is, we can calculate the social security incentives to retire on the assumption that whenever the individual retires, benefits will be claimed at the optimal age. To further investigate this issue, we have reestimated the retirement equation, measuring social security incentives assuming that benefits are evaluated as if they are claimed at the optimal age. When the regression combines the incentive from social security and pensions, the effect of computing social security incentives at the optimal retirement age is to drop the coefficient on the premium value by one third, from -.022 to -.014.[27] When pension and social security incentives are measured separately, the coefficient on the social security premium value is reduced from -.024 to -.010, and the t statistic on the social security premium becomes insignificant at -1.08. Accordingly, if increases in social security benefits from delaying benefit receipt are not taken into account when deciding on the retirement date, then the size of the reward to delaying retirement is reduced, and in addition, the effect of each dollar of reward in the form of increased social security benefits on retirement is also reduced, to insignificance.

VIII. Sensitivity Analysis.

There are several additional questions which might be raised about these results, particularly the retirement equations. In this section we will look at some of these issues.

The first question that might be raised is whether the self-employed respondents are driving the results. Recall that the self-employed have large coefficients, especially in the wealth equation, and that the conditions under which they work may make the retirement decision for these respondents much different from the other respondents. The real question is whether the retirement equation will look very different if the self employed are excluded.

This question is examined in the second column of Table 9. This column estimates the

[27]The t-statistic on the measure of the combined premium declines from -2.85 to -2.08. The coefficients on the two delta measures change only very slightly.

probit only for those who are not self employed. Compare this to the first column, which estimates the equation for the entire sample. The effects of the two accrual variables are virtually identical, both for the pension versions of the variables and for the social security versions of the variables. The magnitudes of the premium values for both pensions and social security are 20 to 25% lower with the restricted sample, and are no longer significant. However, when the premium value variables are combined, the resulting variable is significant (This result is not shown in the table). There is no evidence in the second column of Table 9 that the premium value effect of pensions is any different from the premium value effect of social security.

Another question relates to using some observations where the social security values are imputed. In our analysis we exclude observations where the respondent indicates there is a pension, but the pension plan description was not collected from the employer; we do so on the grounds that the imputations of pension incentives (accruals and premium values) from the respondent information alone is mostly noise. The same problem is less true of social security, since social security operates with a uniform set of rules which are known even if the respondent did not give permission to obtain the social security record. Whether including these imputed records has affected the results is an open question, however, since we must still impute the wage history if the social security record is missing.

The third column of Table 9 gives the results of the retirement probit when the sample only includes those for whom social security records were actually obtained. There are some differences here, and the standard errors are in general larger, as one would expect given the reduction in the sample size. The two social security accrual variables are still insignificant, but the effect of the social security premium value variable is almost twice as large. With regard to the pension variables, the premium value effect and the effect of the final accrual are very close, but the effect of the initial accrual is just less than half as great as in the base estimates.

However, for all six variables the confidence intervals constructed around the estimates with the restricted sample include the value estimated from the full sample. This leads to the possibility that the effects between the two estimates are not significantly different. One can do the test by estimating over the two subsamples and comparing the log likelihoods to the full sample. When this is done, the test statistic is 69.06, which compares to a 5% significance level

statistic of 76.88 for 55 degrees of freedom. Thus we would conclude that although the point estimates are different, particularly for a couple of variables, the differences are not statistically significant.

The next question relates to the definition of retirement. In Section IV we argued that both objective based retirement definitions, such as that based on hours, and self reported retirement definitions, contain problems. We developed a hybrid definition of retirement that combines the information in the objective measures with the self reports to give what we feel is a more sensible result when the objective measure differs from the self-reported measure. However, we would like to know how sensitive the results presented here are to this approach. The last two columns of Table 9 suggest the point estimates are not too sensitive to the specification of the dependent variable. The only coefficient that changes substantially is in the direction of our apriori expectations. The coefficient on the final accrual measure for social security is positive and almost significant when the dependent variable is defined using only self reported status. The coefficients of the premium variables fall somewhat and are no longer significant, but they are still within the confidence intervals of the base estimates.

IX. Probability of Partial Retirement

To this point we have examined only the flow from full time work into full retirement. In this section we examine other flows away from full time work, both the flow from full time work to any kind of retirement and the flow specifically to partial retirement. Probit estimates for these flows are reported in Table 10, using the same set of explanatory variables as was used in Table 5. The left equation is a probit for leaving full time work for any retirement, either partial or full, while the right equation is a probit for leaving full time work for partial retirement only. For some variables, the effect in the partial retirement equation is to amplify the effect in the full retirement equation in Table 5, while for others the effect in the partial retirement equation offsets the effect in the full retirement equation. Although the pattern of significant coefficients is somewhat different for leaving full time work equation in Table 10 as compared to the full retirement equation in Table 5, there appears to be no more correspondence between these coefficients and the wealth equation than there was for the full retirement equation in Table 5. This implies that the conclusions reached in Section V are not substantially altered by

considering retirement as a move from full time work to either partial retirement or full retirement.

The coefficient on earnings in the partial retirement equation is negative and of about the same size as the negative coefficient in the equation for full retirement, so that higher earnings are twice as effective in slowing the flow from full time work than is suggested by the coefficient in the full retirement equation. Similarly, a higher pension premium reduces the flow into partial retirement, in addition to reducing the flow into full retirement. In contrast, the negative coefficient on the measure of initial benefit accrual in the partial retirement equation offsets to some degree the positive coefficient in the equation for full retirement, and the result is that while a high initial period benefit increment increases the flow to full retirement in the following period, the effect on the flow out of full time work is about only about three-quarters as much.

Notice next that the age effects are significant and in the same direction in the equations for partial and full retirement, but they are substantially smaller in the partial retirement equation. Among the other independent variables, note that while self employment reduces the flow from full time work to complete retirement, it increases the flow into partial retirement by even more. Interestingly, those who are free to reduce hours of work on their jobs are two percent less likely to move from full time work into full retirement, and are 3.5 percentage points more likely to flow into partial retirement. Having experienced a past layoff raises the likelihood of moving into full retirement by 15 percent, and in addition, increases the likelihood of moving from full time work into partial retirement by another 4 percent, altogether increasing the likelihood of leaving full time work by almost a fifth.

X. Conclusions.

This paper began with a simple theoretical model of the relationship between retirement and wealth accumulation. If the only heterogeneity were in leisure preference, those who retire early would be found to accumulate more wealth, enabling them to support themselves in retirement. Moreover, those characteristics that encourage earlier retirement would also encourage more saving. With heterogeneity in both leisure and time preference, this simple relation is broken.

We estimated a reduced form model of retirement and wealth accumulation, and asked

whether the variables have corresponding effects in both equations, as would be predicted by a model with only heterogeneous leisure preferences. We do find some variables which induce early retirement and which also induce higher wealth. However, in many cases the coefficients do not have comparable effects in retirement and wealth equations. Moreover, the unobservables from the retirement and wealth equations are only weakly correlated. This suggests that more than heterogeneous leisure preferences is required to explain the observed patterns.

This finding suggests caution is required when using reduced form equations to evaluate new policies. Reduced form models may be adequate for estimating the impact of changes that are common in the period generating the data, but they may be less reliable for other kinds of changes. An example is estimating the impact of raising the early retirement age. The reduced form retirement equation estimated here contains evidence that there is a substantial increase in retirement around age 62, at least part of which is probably due to the social security early retirement age. But how much of this increase is due to the early retirement age, and how much would be transferred to a later age were the early retirement age increased? Since the early retirement age has not changed in decades, it cannot be directly included in an analysis. It is conceivable to introduce other variables which would measure the effect, but one would still have to be wary as long as there was any residual increase in retirement around age 62 in the equation.

The main purpose of this paper, however, is focused on another issue, that of gathering evidence to specify a proper structural model to be estimated. The advantage of estimating structural models is that it is possible to investigate the effects of policy changes such as increasing the early retirement age even if those changes have not been observed in the data sets used to estimate the model. The evidence suggests that there are more complexities in behavior than those created by heterogeneous leisure preferences alone, and that heterogeneity in time preference is also probably required to generate the observable relations between retirement and wealth.

Heterogeneity in time preferences could also explain several results which are puzzling in reduced form equations. Individuals with high time preferences may value future income from pensions and social security much less than the amounts calculated using the interest rate. This could be one reason why we observe much less than one for one substitution of other wealth for

measured pension and social security wealth in conventional saving equations. Moreover, if individuals with high levels of pension and/or social security wealth have lower time preferences, as for instance in the sorting mechanism suggested by Ippolito (1998), then any substitution between pension and non-pension wealth would be further obscured.

The failure of most retirees to delay claiming social security benefits suggests that many individuals value future benefits less than using the interest rate would suggest. This raises questions about the way social security and pension benefits are calculated as explanatory variables in reduced form retirement equations. In a world with heterogeneous time preferences, it may not be appropriate to evaluate payment streams using an interest rate which is constant across individuals. Structural models which allow for the possibility of heterogeneous time preferences may allow for a more natural treatment of this problem. Analyses in which at least some respondents poorly understand the benefit schedule, or do not value spouse and survivor benefits in accordance with their expected value, may also be appropriate.

These findings are unsettling for public policy analysis. Reduced form equations, such as the retirement equation or the wealth equation, must be used with great caution in situations where they are applied to analyze new policy initiatives. Unobserved heterogeneity interacts with the observable variables to produce the estimated coefficients in these equations, but the comparable interactions are not necessarily the same if the policy changes in new ways. Structural models which depend on the underlying utility parameters, are less subject to this criticism. But such models are almost certainly more difficult to estimate, and the researcher must incorporate the heterogeneity into the model in sensible (and testable) ways.

Table 1 **Effects of Leisure Preferences and Time Preferences on Retirement and Wealth**		
Effects of Leisure Preference		
Leisure Preference	*Low*	*High*
Retirement Decision	Late	Early
Level of Wealth	Low	High
Effects of Time Preference		
Time Preference	*Low*	*High*
Retirement Decision	No Effect	No Effect
Level of Wealth	High	Low
Effects of Positively Correlated Leisure and Time Preferences		
Leisure Preference	*Low*	*High*
Retirement Decision	Late	Early
Level of Wealth	Ambiguous	Ambiguous

Table 2

Objective vs. Self Reported Retirement

(Figures are percentages of total)

	Self Reported Retirement Status			
Usual Hours per Week	Not Retired at All	Partially Retired	Completely Retired	Total
More than 35	47.6%	2.9	0.4	50.9
1-35	3.9	3.4	0.8	8.0
0	5.5	3.2	32.4	41.1
Total	57.0	9.5	33.6	100.0

Table 3

Accruals and Premium Values
for Pensions and Social Security

(Accruals and Premium Values are Expressed
as Percentages of the Current Earnings)

	Mean	Standard Deviation	Percent Nonzero
	Accruals at the Start of the Period		
Pension	8.5%	27.6%	42.7%
Social Security	6.1	11.4	78.0
Combined	14.6	29.8	85.2
	Accruals at the End of the Period		
Pension	6.6	23.1	43.9
Social Security	5.6	10.8	80.0
Combined	12.2	25.4	86.6
	Premium Values		
Pension	10.6	46.1	14.2
Social Security	17.9	38.4	61.3
Combined	22.2	57.1	50.9
	Premium Values (for Respondents with Nonzero Values)		
Pension	74.8	100.9	
Social Security	29.2	45.6	
Combined	43.7	74.0	

Table 4

Derivation of the Sample

	Wave 1	Wave 2	Wave 3	Wave 4	Total
Interviews	12652	11316	10653	10119	44740
Age-Eligible Interviews	9824	8804	8312	7886	34826
In Initial Year					
Working Full Time	6310	4927	3845	3088	18170
With Nonmissing Age	6310	4742	3845	3088	17985
With Nonmissing Earnings	5343	3962	3211	2527	15043
With Nonmissing Spouse	5194	3847	3075	2381	14497
With Nonmissing Pension	4072	3069	2523	2008	11672
In Next Survey Year					
With Interview	3739	2844	2332	0	8915
With Nonmissing Work Status	3735	2842	2331	0	8908
With Nonmissing Age	3474	2825	2331	0	8630

Table 5

Retirement and Wealth Equations

	Full Retirement Probit			Wealth Regression	
	Marginal Effect	t-statistic		Coefficient	t-statistic
Constant				0.2272	3.42
Measures of earnings:					
Log of annual earnings	-0.0143	-2.48			
Log of lifetime family earnings				-0.0110	-2.48
Pension & social security values:					
Pension value / lifetime earnings				-0.0548	-2.65
Social security / lifetime earnings				0.1000	2.57
Pension & social security incentives:					
Initial accrual / annual earnings	0.0348	3.29		0.0142	2.46
Final accrual / annual earnings	-0.0656	-3.63		0.0111	1.64
Premium value / annual earnings	-0.0216	-2.85		0.0038	1.23
Age binary variables:					
50				-0.0407	-1.07
51	0.0114	0.47		-0.0129	-1.33
52	0.0025	0.12		-0.0076	-0.90
53	0.0531	2.66		0.0007	0.09
54	0.0449	2.42		0.0023	0.32
56	0.0290	1.58		0.0121	1.68
57	0.0474	2.57		0.0044	0.62
58	0.0584	3.06		0.0149	2.01
59	0.1100	5.41		0.0074	0.95
60	0.1849	8.35		0.0128	1.65
61	0.2559	10.54		0.0148	1.78
62	0.2514	8.55		0.0009	0.09
63	0.3232	8.92		0.0231	1.69
64	0.3252	6.85		-0.0081	-0.44
65	0.3110	3.69		0.0699	2.05
Personal characteristics					
Female	-0.0026	-0.23		0.0101	1.52
Married	-0.0318	-2.19			
Age difference if married	-0.0003	-0.39		-0.0017	-4.83
Race					
Black	0.0008	0.08		-0.0511	-9.16
Hispanic	-0.0218	-1.60		-0.0171	-2.49
Fair or Poor Health	0.1035	8.69		-0.0145	-2.62
Not available				-0.0575	-0.46

Education					
Less than high school	0.0149	1.49		-0.0203	-4.13
Some college	-0.0125	-1.27		0.0211	4.41
Undergraduate degree	-0.0032	-0.24		0.0223	3.41
Graduate work	-0.0058	-0.43		0.0366	5.61
Children	0.0102	0.69		0.0029	0.28
Planning horizon					
Next year	0.0048	0.56		-0.0204	-4.63
More than ten years	0.0077	0.56		0.0084	1.27
Not available	0.0245	1.09		0.0096	0.93
Word recall (number of words)	0.0000	-0.01		0.0006	0.84
Not available	-0.0172	-0.80		-0.0227	-2.15
Share of lifetime household earnings	-0.0773	-3.82		0.0100	0.98
Job Characteristics					
Self employed	-0.0298	-2.26		0.1072	16.65
Not available	0.8905	11.82		0.1409	1.02
Years of service	0.0016	4.54		0.0012	7.07
Not available	0.2678	2.43		0.0141	0.30
Industry:					
Manufacturing	0.0124	1.08		-0.0038	-0.72
Public administration	0.0170	1.06		-0.0061	-0.81
Occupation:					
Management or professional	0.0016	0.14		0.0128	2.52
White collar	-0.0025	-0.27		0.0064	1.39
Covered by union	0.0133	1.45		-0.0106	-2.36
Not available	0.1045	0.85		-0.0197	-0.31
Covered by pension	0.0224	2.23		-0.0075	-1.50
Not available	-0.1186	-31.42		-0.0926	-0.62
Firm with more than 100 employees	0.0174	1.57		-0.0010	-0.18
Not available	0.0309	1.80		-0.0127	-1.56
Availability of reduced hours	-0.0231	-2.16		0.0071	1.27
Laid off from initial job	0.1497	8.00		-0.0080	-0.96
Pseudo R^2 or Adjusted R^2	0.1024			0.146	
Number of Observations	8612			5608	

Note: The probit estimates are the marginal effects on the probability of retirement of a one unit change in the explanatory variable.

Table 6

Comparison of Pension and Social Security Effects
in the Retirement Probit

(t-statistics in parentheses)

	Pension	Social Security	Combined
Initial Accrual / Annual Earnings	0.0402	-0.0077	0.0348
	(3.59)	(-0.22)	(3.29)
Final Accrual / Annual Earnings	-0.0679	-0.0378	-0.0656
	(-3.42)	(-0.88)	(-3.63)
Premium Value / Annual Earnings	-0.0202	-0.0242	-0.0216
	(-2.17)	(-2.11)	(-2.85)
Log Likelihood	-3073.38		-3074.94

Table 7

Social Security Benefit Acceptance*

	Age			
	62	63	64	65
Current Retirement Status:	Actual Benefit Acceptance Rates			
Not Retired	11.5%	22.5%	20.4%	42.1%
Partially Retired	65.3	77.4	79.8	89.8
Completely Retired	69.5	83.8	88.7	91.8
Current Retirement Status:	Percentage of Actual Acceptors for Whom Acceptance Was Optimal			
Not Retired	3.9%	9.1%	9.1%	36.3%
Partially Retired	13.2	23.9	23.1	63.8
Completely Retired	16.6	29.0	37.7	65.7
Demographic Group:	Percentage of All Pontential Recipients Who Should Delay Benefit Acceptance			
Married Males	91.9%	91.0%	87.2%	38.1%
Single Males	93.6	0	0	0
Married Females	55.9	51.1	44.4	40.5
Single Females	83.8	83.3	60.2	0
Demographic Group:	Average Present Value of Delay Among Those Who Would Gain From Delay			
Married Males	$7,991	$5,496	$2,684	$1,806
Single Males	293	-	-	-
Married Females	7,786	7,260	7,161	7,220
Single Females	1,778	654	92	-

Notes:

1. Social Security receipt refers to the previous year in 1992, the previous month in 1994, and current receipt in 1996 and 1998.
2. Social Security receipt excludes respondents who currently or previously received SSDI disability or SSI before age 65.

*These numbers understate the fraction of eligible beneficiaries who accept benefits at age 62. See Olson (1999).

Table 8

Probits for Social Security Acceptance by Retirement Status

	Retirement Status							
	Completely Retired			Partly Retired			Not Retired	
	Coefficient	t-statistic		Coefficient	t-statistic		Coefficient	t-statistic
Liquidity constraint measure (see note)	-0.0492	-2.91		-0.0708	-1.74		0.0136	0.4
Social security premium ($1,000's)	0.0110	6.26		0.0050	1.55		-0.0030	-0.88
Age								
63	0.1052	8.33		0.0760	2.67		0.1461	4.67
64	0.1330	10.26		0.1297	4.29		0.1628	4.21
65	0.1699	12.78		0.1658	5.33		0.3972	7.69
66	0.1649	11.27		0.1777	5.42		0.6266	9.27
67	0.1468	7.14		0.1760	3.32		0.6207	5.42
Female	-0.0048	-0.32		0.0133	0.33		0.0395	1.16
Married	-0.0179	-1.12		-0.0725	-1.5		-0.1184	-2.56
Age difference if married	-0.0014	-0.98		-0.0036	-1.19		-0.0002	-0.07
Race								
Black	-0.0940	-5.32		-0.0821	-1.95		-0.0623	-1.94
Hispanic	-0.1101	-4.86		-0.1296	-2.01		-0.1303	-3.22
Fair or poor health	-0.0374	-2.89		-0.0090	-0.24		0.1380	3.93
Not available	-0.1979	-0.96						
Education								
Less than high school	0.0059	0.4		-0.0256	-0.69		0.0625	1.94
Some college	0.0005	0.03		-0.0996	-2.63		-0.0437	-1.42
Undergraduate degree	-0.0690	-2.72		-0.1519	-3.15		-0.0508	-1.26
Graduate work	-0.1367	-4.94		-0.1779	-3.71		-0.1310	-3.76
Children	-0.0154	-0.71		0.2268	3.16		0.0837	1.83

Not available	0.0256	0.23						
Planning Horizon								
Next year	-0.0126	-0.97		0.0291	1		0.0906	3.2
	-0.0166	-0.75		-0.0275	-0.59		0.0796	1.63
More than ten years	-0.0119	-0.46		-0.1266	-1.58		0.0718	1.16
Not available								
Word recall (number of words)	0.0061	2.62		0.0074	1.52		-0.0047	-0.99
	-0.0049	-0.17		0.0646	1.07		-0.0382	-0.67
Not available								
Share of lifetime household earnings	0.0671	4.15		0.0157	0.23		-0.2573	-4.51
Pseudo R^2	0.110			0.116			0.185	
Number of observations	4236			1031			1446	

Notes:
1. The probit estimates are the marginal effects on the probability of retirement of a one unit change in the explanatory variable.
2. The liquidity constraint measure is the ratio of non-pension, non-social security wealth to social security wealth.

Table 9 Sensitivity Tests for Retirement Probit					
	Base Estimates	Excluding Self-Employed	Excluding Imputed Social Security	Using Self Reported Retirement	Using Objective Retirement
Pensions					
Initial Accrual / Annual Earnings	0.0402	0.0430	0.0198	0.0355	0.0441
	(3.59)	(3.67)	(1.24)	(3.47)	(3.71)
Final Accrual / Annual Earnings	-0.0679	-0.0626	-0.0512	-0.0634	-0.0704
	(-3.42)	(-3.06)	(-2.38)	(-3.40)	(-3.33)
Premium Value / Annual Earnings	-0.0202	-0.0163	-0.0215	-0.0147	-0.0134
	(-2.17)	(-1.67)	(-1.89)	(-1.71)	(-1.42)
Social Security					
Initial Accrual / Annual Earnings	-0.0077	0.0056	-0.0029	-0.0197	-0.0171
	(-0.22)	(0.15)	(-0.07)	(-0.63)	(-0.46)
Final Accrual / Annual Earnings	-0.0378	-0.0393	-0.0081	0.0451	-0.0303
	(-0.88)	(-0.80)	(-0.18)	(1.92)	(-0.71)
Premium Value / Annual Earnings	-0.0242	-0.0180	-0.0460	-0.0147	-0.0078
	(-2.11)	(-1.48)	(-2.81)	(-1.37)	(-0.72)
Number of Observations	8612	7377	6585	8469	8513

Table 10

Probits for Leaving Full-Time Work and for Partial Retirement

	Leaving Full-Time Work			Partial Retirement	
	Marginal Effect	t-statistic		Marginal Effect	t-statistic
Measures of earnings:					
Log of annual earnings	-0.0349	-4.90		-0.0160	-4.09
Pension & social security incentives:					
Initial accrual / annual earnings	0.0271	1.82		-0.0272	-1.98
Final accrual / annual earnings	-0.0671	-3.20		0.0029	0.25
Premium value / annual earnings	-0.0283	-3.05		-0.0068	-1.18
Age binary variables:					
51	0.0316	1.05		0.0228	1.16
52	0.0061	0.23		0.0040	0.24
53	0.0557	2.31		0.0029	0.19
54	0.0750	3.30		0.0325	2.15
56	0.0765	3.35		0.0473	3.03
57	0.1137	4.96		0.0678	4.23
58	0.1220	5.18		0.0692	4.19
59	0.1679	6.91		0.0605	3.66
60	0.2987	11.58		0.1276	6.79
61	0.3780	13.79		0.1449	7.20
62	0.3508	10.55		0.1273	5.35
63	0.4574	11.36		0.1830	6.05
64	0.5336	10.12		0.2880	6.88
65	0.4224	4.30		0.1385	2.10
Personal characteristics					
Female	-0.0170	-1.21		-0.0135	-1.58
Married	-0.0196	-1.09		0.0087	0.83
Age difference if married	-0.0015	-1.39		-0.0010	-1.58
Race					
Black	0.0000	0.00		0.0000	0.00
Hispanic	-0.0241	1.36		0.0028	0.25
Fair or Poor Health	0.1061	7.27		-0.0035	-0.42
Education					
Less than high school	0.0001	0.00		-0.0141	-1.92
Some college	-0.0066	-0.52		0.0040	0.54
Undergraduate degree	-0.0060	-0.35		-0.0041	-0.41
Graduate work	-0.0023	-0.14		0.0031	0.30

Children	0.0053	0.28		-0.0056	-0.47
Planning horizon					
Next year	-0.0009	-0.09		-0.0054	-0.83
More than ten years	0.0220	1.27		0.0116	1.13
Not available	-0.0390	-1.48		-0.0473	-3.60
Word recall (number of words)	0.0011	0.64		0.0011	1.10
Not available	0.0039	0.13		0.0277	1.39
Share of lifetime household earnings	-0.0926	-3.59		-0.0128	-0.84
Job Characteristics					
Self employed	0.0184	1.08		0.0390	3.68
Not available	0.8118			0.9371	22.77
Years of service	0.0019	4.30		0.0002	0.57
Not available	0.3881	3.00		0.1012	1.37
Industry:					
Manufacturing	-0.0071	-0.49		-0.0201	-2.31
Public administration	0.0408	1.96		0.0220	1.65
Occupation:					
Management or professional	0.0171	1.23		0.0152	1.81
White collar	0.0094	0.79		0.0123	1.71
Covered by union	0.0299	2.47		0.0141	1.79
Not available	0.0347	0.24		-0.0688	23.09
Covered by pension	-0.0049	-0.38		-0.0266	-3.39
Not available	-0.2030	-12.94		-0.0636	23.49
Firm with more than 100 employees	0.0055	0.39		-0.0097	1.19
Not available	0.0318	1.55		0.0016	0.15
Availability of reduced hours	0.0134	0.95		0.0354	3.99
Laid off from initial job	0.1980	8.67		0.0413	3.07
Pseudo R^2	0.1011			0.0778	
Number of Observations	8612			8612	

Note: The probit estimates are the marginal effects on the probability of retirement of a one unit change in the explanatory variable.

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Appendix: List of Independent Variables

Variable Definitions

lnearn	Log of 1992 earnings (amounts < $100 disregarded)
wealth	Non-pension, non-social security wealth as of 1992
ssvalue	Household social security wealth, assuming spouse works to expected retirement age
penvalue	Pension value as of 1992
sppenval	Spouse pension value as of 1992
totwlth	The wealth variable plus pension and social security values.
wrat	Ratio of wealth to family lifetime earnings
saccpt	Dummy variable for acceptance of social security benefits. Note: variable is defined differently in different surveys.
liqrat	Ratio of non-pension, non-social security wealth to social security wealth, limited to being between 0 and 1
premval	Current amount of social security premium value

Note: If the following four variables are preceded by a "p", the variable refers to pension values only. If preceded by a "s", they refer to social security values only. If followed by a "c" the social security values are calculated assuming respondents collect benefits as soon as possible. If followed by a "m", they are calculated assuming that respondents wait until the optimal date to register for benefits.

accrat	Ratio of accrual to earnings in initial survey year. Accrual is the benefits if the respondent retires in the following year vs. the benefits if the resondent retires in the current initial survey year.
excrat	Excess value / earnings further divided by the number of years until the excess value is realized.
facrat	Ratio of accrual to earnings in the final survey year.
fexrat	Similar to excrat, but measured in the final year.
daccrat	Difference in accrual rates in final minus initial year.

Personal characteristics:

age	Age in years at the time of the initial survey
female	Binary variable for respondent being female
mar	Binary variable for being married in the initial year
white	Binary variable for respondent being white
black	Binary variable for respondent being black
hisp	Binary variable for respondent being hispanic
health	Binary variable for fair/poor health in initial year
hsdrop	Binary variable for high school dropout
hs	Binary variable for high school graduate
somecol	Binary variable for some college, but no degree
coll	Binary variable for bachelor's degree
gradsch	Binary variable for graduate school attendance
child	Binary variable for at least one child
childdk	Binary variable for unknown child status (family respondent not interviewed)
homeownr	Binary variable for home ownership in initial year
hmowndk	Binary variable for unknown home ownership status
planhr1	Binary variable: Planning horizon next year or less
planhr2	Binary variable: Planning horizon 2/10 years
planhr3	Binary variable: Planning horizon 10+ years
plnhrdk	Binary variable: Planning horizon unavailable
recall	Number of words recalled in second attempt
recalldk	Binary variabel for unknown recall status
expret	Age of expected retirement
expretnv	Binary variable: Expects to never retire (expret = 0)
expretdk	Binary variable for unknown expected age of retirement

spwrk45 Binary variable if spouse has worked since age 45
respwshr Fraction of combined lifetime earnings attributable to responedent

Job Characteristics (for job in initial year):

selfempl Binary variable for self employment
sempldk Binary variable for unknown self employment status
tenure Number of years of service in job
tenurdk Binary variable for unknown tenure
mfg Binary variable for manufacturing
publ Binary variable for government job
mgmtpf Binary variable for management or professional job
whitec Binary variable for white collar job
bluec Binary variable for blue collar job
union Binary variable for union job
uniondk Binary variable for unknown union status
pension Binary variable for job with pension
pensdk Binary variable for unknown pension status
lrgfm Binary variable for firms with > 100 employees
lrgfmdk Binary variable for unknown firm size
redhours Binary variable if respondent can reduce hours
layoff Binary variable for layoff from initial year job */