Health and Retirement

Do Changes in Health Affect Retirement Expectations?

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ABSTRACT

The choice of a retirement date is one of the most important decisions facing older workers. It is a decision that will affect their economic well-being for the remainder of their lives. One factor that undoubtedly impacts this choice is the worker's health. However, the many studies examining the relationship between health and retirement have failed to agree on the relative importance of health compared with financial variables. Efforts to do so have been hampered by the difficulty of correctly measuring health status. Much of the concern centers on the fear that subjective reports of health are biased by individuals using poor health as a justification for early retirement. This paper takes advantage of a unique measure of labor force attachment, the subjective probability of continued work, to reexamine the role of health and changes in health status. By focusing exclusively on workers, I eliminate the concern about justification bias among retired individuals and find that subjective reports of health do have important effects on retirement, effects that are arguably stronger than those of the financial variables. The effects of subjective health remain large even when the model includes more objective measures of health, such as disease conditions. I also find that changes in retirement expectations are driven to a much greater degree by changes in health than by changes in income or wealth.

I. Introduction

Many individuals view retirement as a time to be enjoyed. In the recent Health and Retirement Study (HRS) 63 percent of workers reported that they were looking forward to retirement and only 22 percent felt uneasy about it. However, in many cases retirement ends up being a difficult time, with financial concerns head-

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ing the list of unpleasant aspects. In the same survey, 58 percent of those who had already retired reported that they were bothered by the cost of living and 42 percent by not having enough income. Are financial difficulties a necessary part of retirement or do they arise from unexpected changes in retirement plans?

One factor that may hasten labor force departures is an unexpected change in health. A long list of studies has documented that poor health is frequently offered as an explanation for early retirement. There has, however, been a great deal of concern over the accuracy of these reports. In particular, scholars have hypothesized that many of those who report that they retired because of failing health are simply providing a socially acceptable excuse for nonwork, rather than an accurate description of their decision to leave the labor force. This phenomenon has been termed "justification bias." While most researchers agree that health affects labor market behavior substantial uncertainty remains about the strength of the relationship and a question of whether self-reported health is a valid measure of an individual's limitations with respect to employment. Anderson and Burkhauser (1985) state, "We are persuaded that self-reports of health are unsatisfactory measures . . ." (page 324). In contrast, Dwyer and Mitchell (1999) conclude, "(T)here is no evidence in support of the justification bias" (page 188). Even two of the most recent papers discussing this issue have reached widely disparate conclusions; Kreider (1999) and Kreider and Pepper (2002), for example, conclude that self reports are negatively biased while Benitez-Silva et al. (2000) find no bias on average.[1]

In addition to the overall role of poor health, it is also unclear whether the correlation between poor health and retirement primarily represents a *planned* departure from the labor force as a result of an anticipated decline in health, or whether the effect of health operates through unexpected shocks. If they plan early departures, individuals can alter lifetime savings patterns to compensate for the shorter worklife. In contrast, unexpected departures may be associated with insufficient retirement income if individuals do not have time to adjust other behaviors.

This paper takes advantage of an innovative measure of labor force attachment—the individual's subjective probability of working full-time at age 62—to reexamine the role of subjective health. Because this measure of labor force attachment varies over employed individuals, whereas a zero-one indicator of retirement does not, I can focus exclusively on a sample of current workers and avoid the potential for justification bias among those already retired. Furthermore, because this measure offers repeated observations over time, I can examine the role of changes in health status on changes in expected participation.

Unfortunately these benefits do not come without some cost. The drawback of this methodology is that because the expected probability of full-time work is available only for those still in the labor force, the sample is a selected one. Also, because the

1. Although the justification phenomenon is perhaps the most frequently cited problem, it is by no means the only one. For example, measures of health taken after retirement may be poor proxies for health at the time of departure, particularly if health is affected by employment, or if poor health is the result of a sudden onset of illness. Nor is it clear that health status measured prior to retirement is the appropriate measure. If individuals choose jobs that are commensurate with their physical capabilities, then it may not be the level, but changes in health that affect behavior. With too wide a window, these changes will be missed. Finally, there may be unobserved differences across individuals that are correlated with health status and with labor market behavior. These and other potential difficulties are developed more formally in Section II.

dependent variable in this study relates to expectations about work and is not actual labor force participation, the magnitudes of the estimated effects are not directly comparable to other studies.[2]

I find that subjective reports of health are powerful predictors of an individual's expected probability of working at a specified future age. Furthermore, the effect of poor health is substantially larger than the effects of financial variables. This result is consistent with the conclusions of other studies that used subjective health measures, but in this case the results cannot be explained away by justification bias. I also find that subjective health continues to have important explanatory power even when I include more objective measures of health in the participation equation. This finding suggests that traditional substitutes for subjective health may be poor proxies. Finally, I find that changes in the subjective probability of continued work are strongly correlated with changes in subjective health and only weakly correlated with changes in financial variables, indicating that health shocks may be an important factor in unplanned departures from the labor force.

In the following sections I first provide some background on the difficulties involved in assessing the role of health on retirement. I then describe the data used in this study, including a description of the subjective probability of continued work that is central to this analysis. In Section IV, I report the results of the regression analyses, focusing first on the cross-sectional responses and then drawing on data from two waves of the survey to examine changes in expected labor market attachment. Section V summarizes the results and presents my conclusions.

II. Background

Assessing the effect of health on retirement has proven to be particularly difficult, in large part because of problems in obtaining accurate measures of underlying health.[3] Consider first subjective reports of health by those who have retired. Individuals who intend to apply for disability benefits have an obvious incentive to misreport their health status and work limitations. Other retirees may feel a need to justify their decision to leave the labor force and may view health problems as the most legitimate excuse for nonwork (Parsons 1980). Thus regardless of the role health actually plays in the decision to retire, a significant number of retirees may cite it as the primary cause. This justification bias has received significant attention in the literature but there is conflicting evidence about its importance and the reasonableness of estimates using subjective measures of health.

As an alternative to subjective health status, researchers have turned to more objective measures, most specifically, subsequent mortality (Parsons 1980, 1982; Anderson and Burkhauser 1984, 1985). However, it is not clear that mortality at some later date

2. Several recent studies have assessed the quality of subjective probability data and determined that they are useful measures of individual expectations and accord well with what is known about empirical relationships between outcomes observable characteristics (Hamermesh and Hamermesh 1983; Dominitz 1998; Dominitz and Manski 1997; Hurd and McGarry 1995, 1999, 2002).

3. See Bound (1991) for an exceptionally clear and useful discussion of the various biases introduced with subjective health status and the use of objective indicators as instrumental variables in similar models.

is indicative of an individual's ability to remain employed at the time he contemplates retirement. Mortality need not be the end result of a long debilitating illness, but could rather represent a sudden decline in health or even the outcome of an accident. Conversely, many chronic conditions such as arthritis may severely limit one's ability to work, but have less of an effect on life expectancy.

Ignoring the possibility of intentional misreporting, the effect of health status may also be misestimated if health itself depends on labor market behavior. Employer-provided health insurance may provide greater access to healthcare for those they currently employ than for those who leave their jobs before eligibility for Medicare (Ettner 1996). Greater access may result in healthier individuals, or it may uncover conditions that were not apparent to the patient causing him to downgrade his estimate of his health. Alternatively, absent the daily pressures and stresses of a job, a retired individual may be able to devote more time to exercise, good diet, and other habits that are thought to improve health (Waldron 1980). Finally, the physical and intellectual stimuli of a job may result in improved health. Thus, the act of leaving a job could itself cause either an improvement or a worsening in health, and the use of post-retirement health measures will lead to estimates of the role of health that are biased in an unknown direction.

Given the difficulties associated with the use of health status in the period following retirement, some studies have relied on measures of health taken prior to the (potential) transition (Hurd and Boskin 1984; Bazzoli 1985). However, if individuals choose jobs that accord with their physical abilities then someone with limited physical capabilities, whether measured by subjective reports of overall health status or more objective measures such as doctors' diagnoses, may hold a job wherein physical strength is not a requirement and will be productively employed despite poor health.[4] If individuals and jobs are well matched, there need be no relationship between the level of current health and retirement probabilities.[5] Rather, it will be the *onset* of diseases or conditions, or *changes* in overall health status, be they sudden or gradual, that will influence retirement. Thus, if retirement is caused by a worsening of health, then health measures taken prior to retirement may not reflect the health status at the time of the retirement decision and the report of poor health immediately following retirement may in fact be the correct measure.

An additional difficulty with assessing the effect of health on retirement results from the likelihood that unobserved differences across individuals can be correlated with both health and with retirement behavior. For example, differences in individual time rates of discount will affect both investment in health and attachment to the labor force. Similarly, individual differences in tastes for work may affect labor market behavior and important explanatory variables such as wages. In cross-section analyses, the inability to control for these variables could lead to omitted variable biases. With respect to other empirical questions, economists often employ panel data to

4. Consider a specific example. In a study of disability and labor market participation, Stern (1989) finds that blind individuals are significantly less likely to be participating in the labor force. However, conditional on being employed, it is not clear that a blind person would be any more likely to leave that job than a sighted individual.

5. Hurd and McGarry (1999) find no relationship between measures of the physical difficulty of the job and the probability of continued work, suggesting that individuals may indeed match with jobs that accord with their abilities.

conduct fixed effect analyses and contend with this heterogeneity.[6] Such statistical methods have not been used in the study of retirement because scholars typically observe the transition to retirement only once per individual. By using repeated observations on the subjective probability of working full-time at age 62 I can begin to explore the factors contributing to changes in the expected probability of continued work, exclusive of fixed individual-specific components.[7]

These various difficulties can be succinctly summarized by the use of a statistical model. The standard model of retirement behavior views a worker as weighing the utility from leaving the labor force and consuming leisure against the utility obtained from continued work, with the utility from work largely measured in terms of wages and accrued pension wealth. Following (roughly) the outline of Dwyer and Mitchell (1999) and previous authors, I write the value of retirement, in a reduced-form specification, as a linear function of a set of individual and job characteristics w that capture the costs and benefits from continued labor force participation. H^* is an unobserved measure of health relevant to the retirement *decision.* Z is a vector of demographic characteristics. If R^* denotes the net gain from retiring, then for a given individual at a specified point in time,

$$(1) \quad R^* = \beta_1 w + \beta_2 H^* + \beta_3 Z + u_r.$$

R^* is not observed. Instead one observes R where

$$R = \begin{cases} 1 \ if \ \ R^* > 0 \\ 0 \ if \ \ R^* \leq 0 \end{cases}$$

H^* is also unobserved, instead we observe self-reports of health, H, where

$$H = H^* + u_h$$

The error terms u_r and u_h are iid draws from a bivariate distribution. They may be correlated with each other and/or with various regressors.

As summarized above, there exist several problems in obtaining an unbiased estimate of β_2 in Equation 1. First, I do not have an observed measure of H^*, the measure of health relevant for the retirement decision. Because H^* is unobserved, researchers often turn to self-reported health status as the only measure. Retired individuals may give an overly negative assessment of their health to justify their employment status. In terms of the above notation, this assumption amounts to a negative correlation between u_r and u_h. Individuals who have retired and have a high value of u_r are also more likely to report worse (low) health, thus a low u_h. Thus, when H^* is replaced by H in Equation 1, there is a correlation between the right-hand side variable and the error term. Second, health may be endogenous if it is determined in part

6. Instrumental variables provide an alternative method of dealing with this problem, but it is difficult to conceive of an appropriate instrument. Variables that predict current health are likely to be correlated with past investments in health and other individual characteristics. Anderson and Burkhauser (1985) and Bound (1991) jointly model the determinants of health and labor force participation. Dwyer and Mitchell (1999) use parental health and mortality, among other variables, to identify such a model, although investments in health and attitudes toward healthy living may be passed on from one generation to the next. Accidents may also provide an identifying variable.

7. Kreider and Pepper (2001, 2002) take an alternative approach using the same dataset that is exploited here. Rather than seeking an unbiased estimate of health, they instead estimate bounds on the effects of interest.

by labor force status. In this case H^* (and therefore H) is a function of R, so that $H^* = H^*(R, \eta)$ where η consists of determinants of health other than those associated with employment status. This relationship also introduces a correlation between the error term in Equation 1 and a right-hand side variable.

Third, there may exist other unobserved individual specific effects contained in the u_r term that lead to biases in the estimated equation. For example, if individuals differ in their rates of time discount d, and if these rates affect investment in health and human capital, then both the error term u_r and H^* will be functions of d and u_r will be correlated with H and perhaps other variables. Similarly, individual tastes for work or industriousness may be correlated with both retirement and with one or more of the explanatory variables such as wages.

Even with unbiased reporting, there is likely to be measurement error in H^* because H^* is hypothesized to represent health relevant to employment, not general health. Using an observed measure of health, H, as a proxy for H^* will result in biased estimates of β_2 due to classical measurement error. β_1 and β_3 can also be biased if w or Z are correlated with the health measure.

III. The Data

In this paper I take a new approach to identifying the relative importance of health status in determining retirement using data from the Health and Retirement Study (HRS). The HRS is a nationally representative biennial survey of individuals born in the years 1931 to 1941 and their spouses or partners.[8] The initial wave of interviews took place in 1992 when the sample persons were approximately 51–61 years old. The second wave followed in 1994. The survey collects detailed data on income, wealth, and job characteristics, including the characteristics of pension plans and the existence of both health insurance on the job and in retirement. The HRS also collects a large amount of information on current health status and on the diagnosis of a number of diseases.

Of central importance to this study is an unusual measure of labor force attachment. Specifically, the HRS asks respondents to report the probability with which they will be working full-time at age 62. One can view this subjective probability as a measure of the strength of the individual's attachment to the labor force.[9]

The question asks,

> *"Thinking about work generally and not just your present job, what do you think are the chances that you will be working full-time after you reach age 62?"*

The question is repeated for age 65 as well.[10] Thus instead of a 0/1 variable indicating retirement, I have a variable that provides a measure of expected participation

8. Details about the survey history and design can be found in Juster and Suzman (1995) and at http://www.umich.edu/~hrswww/center/center.html.

9. Previous work examining the probability of continued work and the probability of living to target ages has shown that individuals give valid responses to these types of questions in that the responses correlate well with known predictors of the probabilities (Hurd and McGarry 1995, 1999) and are updated over time with the arrival of new information (Hurd and McGarry 2002).

10. I do not use the age 65 measure because there is less variation across individuals than with the probability of working full-time at age 62.

that varies across people prior to changes in labor force status. This allows me to focus on the reports of currently employed persons and abstract from the possibility that poor health is being used as an excuse for nonwork.[11] As a matter of notational convenience I call this variable P_{62} or the "expected probability of continued work." The question is repeated in Wave 2 providing two observations per person on this measure of labor force attachment.

The initial sample consists of 12,652 individuals. For my analysis I limit the sample to those interviewed in both waves and exclude individuals who were aged 62 or older in the second wave of the survey. I thus focus on the labor market behavior and retirement probabilities prior to eligibility for early retirement benefits from Social Security. These restrictions leave me with a sample of 9,913. In addition I exclude the self-employed and those in the military (1,161 in total) because they are likely to have very different retirement patterns. Finally, because the central question in this study is asked only of those who are employed, I exclude those who are not working in Wave 1.[12] This final restriction eliminates 595 people who never worked and an additional 2,659 who were not working at the Wave 1 interview. The final sample consists of 5,498 observations.

Table 1 reports the means of several variables used in the analysis for the sample of 5,498 observations. For comparison I also report the mean values for those who left the labor market before the survey began but who had been employed at some point in the past. One notices several striking differences from this comparison. First, the mean ages of the two groups are not significantly different. However, a large difference in the fraction of the two subsamples is male; 31 percent of the nonworkers are male compared with 44 percent of those working. This difference likely stems from the traditionally weaker attachment to the labor force of women of this cohort relative to men. Mean family wealth is substantially higher for the retired sample than for the working sample, $244,500 compared with $216,480. This difference in wealth is consistent with leisure being a good and with those with greater wealth thus purchasing more leisure.

The working sample is less likely to be covered by a pension plan than is the sample who has already left the labor force and the difference is relatively large. Seventy-five percent of the "retired" sample reportedly has a pension compared with 67 percent of the employed sample. However, despite these differences in the probability of pension coverage, the working sample has substantially larger pension wealth.[13] This difference in pension wealth could reflect the fact that nonworkers may have had

11. An alternative measure of retirement that varies across employed persons is the individual's expected age of retirement. (See Dwyer and Mitchell 1999, for an analysis of this variable.) What is meant by the expected age in statistical terms is not clear. It could be viewed as the mean of the distribution of possible retirement ages, the mode, the median or some other value. Bernheim (1987) presents evidence suggesting the reported value is likely to represent the mode of the distribution. If so, one might expect more frequent changes in the probability of continued work in response to changes in underlying conditions than in the expected retirement age.

12. One could assign a value of zero to all those who are already retired, however, this procedure brings with it the prospect of justification bias if those who are retired report poor health to justify their status.

13. Pension wealth here is defined as the present discounted value of the stream of pension benefits were the individual to begin drawing benefits at the age he reportedly expects, or his current age if he is already collecting a pension. See McGarry and Davenport (1998) for details of the assumptions made to calculate the value of pension wealth used here.

Table 1
Means of Variables[a] Used in the Analyses by Employment Status

	Not Employed (n = 2,655*)		Employed Wave 1 (n = 5,498*)	
	Mean	Standard Error	Mean	Standard Error
Demographic characteristics				
Age	55.29	0.093	54.11	0.063
Male	0.31	0.009	0.44	0.007
White	0.84	0.007	0.86	0.005
Married	0.77	0.008	0.77	0.006
Years of schooling	11.71	0.058	12.79	0.037
Financial and job characteristics				
Earnings (in $1,000s)	—	—	27.32	0.430
Household wealth (in $1,000s)	244.50	8.50	216.48	4.73
Has pension	0.75	0.007	0.67	0.006
Pension wealth (in $1,000s)	31.01	2.17	56.77	1.39
Health insurance on job	0.58	0.010	0.86	0.005
Retiree insurance available	0.47	0.010	0.61	0.007
Union on job	0.20	0.008	0.26	0.006
Previously offered retirement incentive	0.050	0.004	0.053	0.003
Health status Wave 1				
Excellent	0.16	0.007	0.28	0.006
Very good	0.22	0.008	0.33	0.006
Good	0.25	0.008	0.28	0.006
Fair	0.19	0.008	0.09	0.004
Poor	0.18	0.007	0.02	0.002
Mental health fair/poor	0.27	0.009	0.12	0.004
Diseases Wave 1				
High blood pressure	0.43	0.010	0.34	0.006
Heart conditions/heart attacks	0.19	0.008	0.10	0.004
Cancer	0.08	0.005	0.05	0.003
Stroke	0.05	0.004	0.01	0.002
Diabetes	0.15	0.007	0.08	0.004
Lung disease	0.13	0.007	0.06	0.003
Arthritis	0.47	0.010	0.33	0.006
Activity limitations				
Running a mile	0.91	0.006	0.85	0.005
Walking several blocks	0.40	0.010	0.16	0.005
Walking a block	0.22	0.008	0.04	0.003
Walking across the room	0.10	0.006	0.01	0.001
Sitting for two hours	0.39	0.009	0.26	0.006
Getting up from a chair	0.47	0.010	0.30	0.006
Getting in and out of bed	0.16	0.007	0.03	0.002
Walking up several flights of stairs	0.63	0.009	0.42	0.007
Walking up a flight of stairs	0.33	0.009	0.09	0.004
Lifting 10 pounds	0.42	0.010	0.17	0.005
Picking up a small object (dime)	0.56	0.010	0.36	0.006
Total num of physical limitations	4.60	0.062	2.71	0.028
Probability of living to 85	0.40	0.006	0.44	0.004

* Number of observations differs for some variables due to missing values.
[a] The appendix gives more detailed definitions for some of the variables.

fewer years of covered employment and thus be entitled to lower pensions (or similarly may have accumulated less in a defined contribution pension account), or they could have lower pension wealth because some fraction of the pension has already been distributed.

Unsurprisingly there is a strong correlation between health and labor market participation. Those who exited the labor force before Wave 1 are much more likely to report being in poor health than those who are working; 37 percent of those in the first group report being in fair or poor health compared with just 11 percent of the second.[14] This difference is consistent with individuals being forced out of the labor market because of poor health, but it is also consistent with the justification phenomenon.

In addition to physical well-being, mental health may affect workforce behavior. As shown in Table 1, a substantially larger fraction of the nonworking group reports being in fair or poor mental health than does the working group, 27 versus 12 percent. Here again, the direction of causality is not obvious. Absent employment an individual may feel less vigorous mentally or less happy about his contribution to society and report less than good mental health (Ettner 1998).

Differences in disease conditions and physical limitations may be less susceptible to misreporting than subjective health status. The HRS asks a series of questions along both these lines. With respect to diseases, respondents are asked, "Has a doctor ever told you that you have . . ."[15] To assess an individual's ability to perform physical tasks the survey asks respondents about the difficulty they experience when walking or running a given distance, climbing stairs, bending, stooping, and so forth.[16] The patterns of differences across samples in both these measures echo the differences in self-reported health, despite a smaller probability of a justification bias. The probability of having been diagnosed with each of the conditions is higher for nonworkers than for workers; the largest differences are for the most serious problems—heart attacks and strokes.[17] With respect to physical activities, there are particularly large differences in the fractions of the samples that report difficulty walking several blocks, or even a single block. Perhaps surprisingly 22 percent of those not employed report that walking a block is difficult compared with only 4 percent of the working sample.

Past researchers have used both subjective health and the existence of specific conditions or limitations to analyze retirement behavior. As noted above, I have used an

14. The health question in the HRS asks, "Would you say your health is excellent, very good, good, fair, or poor?" It does not specifically ask the respondent to assess his health relative to others his age. The extent to which individuals condition their reported health status on age is not clear. I assume the decision to do so is uncorrelated with health or employment status.

15. The questions pertaining to a doctor's diagnosis of a particular disease do not indicate whether the individual currently has the disease. It could have been diagnosed and cured long before the survey took place. Thus some of the respondents answering in the affirmative are no longer impacted by the particular condition. Similarly, many conditions can vary substantially in their severity and thus have very different effects on different respondents.

16. Questions about activity limitations pertain to the time of the survey. A complete list of these questions is included in the appendix. There are also questions about limitations with respect to the standard activities of daily living and instrumental activities of daily living. I do not use these data.

17. The presence of disease in this sample is likely to be lower than population averages because the HRS sample is selected from the noninstitutional population and one would expect the institutionalize population to be in significantly worse health.

Table 2
Distribution of Subjective Probabilities of Continued Work to Age 62

Statistic	Wave 1	Wave 2	Change (Wave 2 −Wave 1)
Mean	0.44	0.42	–0.019
Standard error	(0.005)	(0.006)	(0.005)
25th percentile	0.0	0.0	–0.2
Median	0.5	0.4	0.0
75th percentile	0.8	0.8	0.1
Number of observations	5,470	4,806	4,786

alternative measure of health in an attempt to avoid reporting bias is the eventual date of death (Parsons 1980; Hurd and Boskin 1984; Anderson and Burkhauser 1985.) Although a sufficient number of HRS respondents have not yet died to make this a useful procedure, one can employ a similar measure. The HRS asks the respondent to report the probability with which he expects to live to age 75 and to age 85. These subjective measures contain a good deal of information about the individual's view of his health status but are unlikely to be altered as a means of justifying retirement. As shown in the table, both variables indicate that those who are initially employed expect to live longer than those who are not, but the differences are not large. The average probability of living to age 85 is 40 percent among the nonworkers compared with 44 percent among the employed.

Table 2 focuses directly on the distribution of the subjective probability of continued work. In the first wave of the survey, individuals were asked to report the probability of working full time at age 62 on a scale of 0 to 10. In Wave 2 the scale is expanded to run from 0 to 100. Thus some noise across waves is likely, as individuals adjust to the new scale.[18] To compare individual responses in the two waves, I rescale the reported probabilities to lie between zero and one, dividing by 10 and 100 respectively. As shown in Table 2, the average value for P_{62} is 0.44 and it falls slightly between waves to 0.42. Despite the small change in the mean, only 30 percent of the sample gave identical answers across waves.

IV. Expected Probability of Continued Work

The regression equations follow the standard specification used elsewhere in the retirement literature. As noted earlier, the use of the variable P_{62} for the working population avoids the potential biases from the misreporting of health among those already retired, as well as any biases introduced by a relationship wherein changes in labor force participation induces changes in health. It is possible that individuals who anticipate retiring early would begin to report worsening health in anticipation

18. As long as changes attributable to the rescaling are uncorrelated with the regressors in the model, the change will not affect the results.

of the event. However, the information on health in the HRS is obtained early in the survey, well before questions about labor force participation. Thus, while it is unlikely that someone would report poor health to justify a low reported probability of working to age sixty-two, or in anticipation of early retirement at sometime in the future, it is nearly impossible to believe that this happens given the ordering of the questions. While the use of P_{62} can reduce or eliminate these biases, it does not avoid biases introduced by unobserved individual effects correlated with the regressors. I will take up this problem in Section IVE.

Consider a specification of the traditional retirement model using this new measure of labor force attachment, which I term P_{62}.

$$(2) \quad P_{62} = \beta_1 w + \beta_2 H^* + \beta_3 Z + u_r.$$

I mentioned previously that P_{62} is observed only for those in the labor force. Readers should keep the sample selection in mind when examining the results. Using this specification with alternative measures of health, I first examine the probability of continued work in the cross-section. I report the results for Wave 1 although results for Wave 2 or for the two waves combined are nearly identical. I then repeat the analysis with several different measures of health. Finally I examine the correlates of changes over time in P_{62}.

A. Baseline specification

I report the results of the baseline specification in the first column of Table 3. Consistent with earlier research, poor health has a large effect on labor force attachment. Being in fair or poor health is associated with an expected probability of continued work that is 8.2 percentage points lower than for someone in excellent health.[19] The mean probability of continued work is 44.8 percent so those in poor health on average report a probability that is approximately 18 percent lower than for those in excellent health. The other health categories show a monotonic decline in P_{62} with worsening health.

Increases in labor income increase attachment to the labor force while increases in wealth decrease it; both effects are significantly different from zero at a 1 percent level. To put the estimated coefficients in perspective, a 10 percent increase in earnings (evaluated at the mean) increases the expected probability of working full-time at age 62 by 0.21 percentage points. A 10 percent increase in wealth reduces the probability by the same 0.21 percentage points.[20] By comparison, a change in self-reported health status from good to fair or poor decreases the reported probability of working full-time at age 62 by five percentage points.

What do these estimates imply about the relative importance of health versus financial variables? The most common health changes from Wave 1 to Wave 2 are from

19. Few workers in the sample report themselves to be in poor health (just 2 percent) so I combine fair and poor health. If the two categories are left disaggregated the estimated coefficient for each variable is significantly different from zero and the magnitudes are similar.

20. As an alternative way of assessing the magnitude of these effects, consider changes equal to one standard deviation for each variable. A one standard deviation increase in earnings increases the probability of working full-time at age 62 by 2.3 percentage points while a one standard deviation increase in wealth reduces the probability by 3.4 percentage points.

Table 3
Linear Probability of Working Full-time at Age 62

Variable Name	(1) Baseline Specification	(2) With Subjective Survival Prob
Subjective health status		
Excellent (omitted)	—	—
	—	—
Very good	–0.011	–0.003
	(0.013)	(0.013)
Good	–0.032	–0.017
	(0.014)	(0.014)
Fair/poor	–0.082	–0.054
	(0.019)	(0.019)
Probability of living to 85	—	0.102
	—	(0.017)
Financial and job characteristics:		
Earnings ($100,000)	0.077	0.074
	(0.020)	(0.020)
Wealth ($100,000)	–0.010	–0.010
	(0.002)	(0.002)
Pension wealth ($100,000)	–0.043	–0.045
	(0.006)	(0.006)
Early out	–0.091	–0.092
	(0.024)	(0.024)
Insurance status		
On job and retiree	–0.071	–0.071
	(0.017)	(0.016)
On job only (omitted)	—	—
	—	—
No health insurance	–0.006	–0.008
	(0.021)	(0.021)
Probability of layoff	–0.002	–0.001
	(0.002)	(0.002)
Number of observations	5,321	5,321
Mean of dep variable	0.448	0.448

Also included are age, race, sex, marital status, union, schooling level, part-time versus full-time, and dummy variables for missing values of some regressors.

excellent to very good and from very good to good. Based on the cross-section estimates from Wave 1, these changes would be associated with declines in P_{62} of 1.1 and 3.2 percentage points, respectively. In contrast, the average change in income across the two periods is $1,037 and the average change in wealth is –$9,266. These changes correspond to changes of 0.08 and 0.09 percentage points in P_{62}; the effects of median

changes in income and wealth are substantially smaller. Given these results health appears to have an effect that is substantially larger than those of the financial variables.[21] It is important to note that in contrast to past studies of actual retirement, the health indicators in this equation ought not to be biased by incentives to misreport yet they continue to have a strong effect.[22]

Much of the bequeathable wealth held by individuals is in the form of housing wealth. Although in theory resources are fungible, in practice individuals may be less likely to consider these assets as retirement savings compared with assets held in pension plans. Perhaps because of this perceived difference in purpose, the effect of a dollar of pension wealth on labor force attachment is nearly four times larger than the effect of a dollar of nonpension wealth. However, because the mean value of pension wealth is substantially smaller, the relative strength of the effects of identical percentage changes are reversed. A 10 percent increase in pension wealth decreases the expected probability of working at age 62 by 0.13 percentage points.[23]

It has been shown elsewhere (Karoly and Rogowski 1994; Gruber and Madrian 1995) that retiree health insurance increases the retirement probability while health insurance on the job decreases it. Here retiree health insurance significantly decreases the probability of continued work and does so by a substantial amount, lowering P_{62} by 7.1 percentage points, nearly as much as a fall from excellent into poor health. In terms of pension wealth, the availability of retiree health insurance is equivalent to $175,000. It is difficult to believe that the monetary equivalent of retiree insurance is that great.[24] Rather, it may indicate that individuals have difficulty buying health insurance in the nongroup market or obtaining coverage for preexisting conditions, and they therefore value retiree health insurance at more than its actuarially fair price.[25]

21. Bound (1991) also finds substantial health effects and relatively small financial effects when subjective health status is used as the measure of health. (In his paper Bound reports estimates from a large number of specifications and in doing so provides bounds for the true effect of health. These subjective health results are an upper bound.) More recently, Dwyer and Mitchell (1999) in a similar exercise, estimate the effect of subjective health on the expected age of retirement also using the HRS. They find that those in poor health retired approximately two years earlier than those in better health. As in this current paper, the effects of financial variables were substantially smaller than the effects of poor health. A 10 percent change in income (evaluated at the mean) corresponded to just a (positive) change of 0.04 days while a one standard deviation change in wealth was associated with a (negative) change of 0.13 days. Note, however, that results are not directly comparable across studies. The various investigators use different statistical techniques, different samples, and even different left hand side variables. Taken together, however, they are useful in showing the pattern that the measures of poor health have large effects relative to financial variables when subjective health status is used.

22. Dwyer and Mitchell (1999) examine expected age at retirement, which also varies across a sample of employed workers. However the authors use the actual age of retirement for those already out of the labor force. If these individuals are using reports of poor health to justify their early retirement then the estimated effects of health will again be biased just as in the typical specification analyzing actual retirement.

23. In terms of a one standard deviation increase, the effect of pension wealth is substantially greater than that of bequeathable wealth. A one standard deviation increase in pension wealth decreases the probability of working full-time at age 62 by 4.5 percentage points, one-third greater than the effect of other wealth on the reported probability.

24. Individual policies for men in their early 60s (pre-Medicare eligibility) cost roughly $3000 per year but can go much higher. With eligibility for Medicare at age 65, however, complete coverage need only be purchased for a limited period of time.

25. The Health Insurance Portability and Affordability Act of 1996 (HIPAA) put limits on the exclusion of coverage for pre-existing conditions. These limits were not in place in 1992 during the first wave of the HRS and would not have affected the behavior of the respondents.

Alternatively, the large effect may indicate that some factors associated with early retirement also are positively correlated with the presence of retiree health insurance such as individual tastes or employer attitudes toward retirement. Perhaps surprisingly, having been previously offered an incentive to retire in the form of an "early-out window" significantly *lowers* the probability of continued work. One might have imagined that those who did not respond to an earlier offer have a higher than average taste for work and would therefore have a stronger attachment to the labor force. However, it may well be that these workers anticipate another (perhaps more generous) retirement incentive program and expect to act on it. Similarly, firms that have offered early-out windows in the past likely did so to decrease the size or age of their labor force. If they did not induce as many retirements as they had hoped for, they may be using other means to encourage workers to leave, resulting in a lower probability of working to age 62 for those in such firms.

Early-out windows are one method a firm can use to reduce the size of its workforce or to "encourage" certain workers to leave. Firms also can alter the probability a worker remains employed through the use of layoffs or terminations. The HRS asks respondents to report the probability that they might lose their job in the next year. I include this variable in the regression but it does not significantly affect the employment probability.

B. Mortality

One of the more clever variables to be used in past work is the eventual mortality of the worker. One would expect longevity, like health, to affect labor market participation in two ways. First, as a proxy for current health it could affect the utility/disutility of employment (or leisure). Second, all else constant, a longer life span means a longer potential retirement over which a worker must finance consumption and thus a need for greater retirement assets. Respondents in my sample have not yet been followed for a sufficient period time for there to be enough deaths to use in a regression. Instead I use the probability with which the respondent expects to live to age 85. For notational convenience I term this variable *PLIVE85*.[26] The second regression in Table 3 recognizes these two pathways and includes the probability of living to age 85 as a regressor along with the excellent, very good, good, and fair/poor categorization of health. The variable *PLIVE85* is highly significant and operates in the expected direction. A ten percentage point increase in the survival probability increases the expected probability of continued work by one percentage point. When *PLIVE85* is included in the specification, fair/poor health remains a strong predictor but its effect falls to 5.4 percentage points, approximately two-thirds of its original magnitude. Because *PLIVE85* ought to capture the length of life over which the individual needs to finance consumption, the indicator of poor health may be primarily capturing the disutility/difficulty of working with health problems. Previous studies have found very different effects for the financial variables when subjective health status is

26. In a companion survey to the HRS these survival probabilities were shown to correlate with actual mortality (Hurd, McFadden, and Merrill, 1999). Studies based on the HRS have also shown that these indicators are highly correlated with other measures of expected longevity such as smoking and body mass index (Hurd and McGarry 1995).

replaced with data on eventual mortality (Anderson and Burkhauser 1985; Bound 1991) Surprisingly, in this specification the effects of income and wealth are not changed by the addition of the subjective survival probability.[27]

C. Alternative Health Measures

Several past studies have attempted to circumvent the problem of justification bias by using measures of health other than subjective health status. In Table 4, I report the estimates of alternative specifications that use measures other than self-reported health status.[28] In this table I report only the coefficients for earnings, wealth and the health indicators; the estimated effects of the remaining variables are nearly identical to those in Column 1 of table 3. The first column reproduces the baseline estimates for ease of comparison.

1. Lagged Health

In past analyses of retirement behavior, the biases potentially contained in subjective reports of health status led researchers to explore the use of alternative measures of health. One such measure is subjective health measured prior to the period in which retirement is observed. In these studies lagged health is found to have a smaller effect on retirement than post-retirement health status. This result could indicate that individuals do in fact alter their subjective reports of health based on their employment status or alternatively that retirement is caused by sudden changes in health that are not observable in the pre-retirement interview.

I can conduct a similar type of analysis in this context by assessing the effect of Wave 1 health on the probability of continued work as reported in Wave 2. Column 2 of Table 4 shows the results. The left-hand side variable in this regression is the reported probability of continued work as measured in Wave 2. All right-hand side variables, except for self-reported health status, take their Wave 2 values. The self-reported measures of health status are those reported in Wave 1, that is, lagged health. The estimated effect of fair/poor health, 9.3 percentage points, is quite similar to that Column 1. The effects of income and wealth are somewhat larger in absolute terms but not significantly different from the original specification. Although noteworthy for their robustness, these results cannot disentangle the two possible explanations for the differing estimates in past research. Both explanations—changes in observed health and reporting bias—are consistent with the observed effects.

2. Diseases

Rather than use subjective assessments of health and mortality one might wish to use objective reports of specific conditions. In the HRS such questions are asked in the following manner: "Has a doctor ever told you that you have . . ." The conditions vary

27. Nor are they affected with *PLIVE85* is used as the sole indicator of health (not shown).

28. Despite evidence that mental health can play a role in labor market participation (Ettner, Frank, Kessler 1997) an indicator of fair/poor mental health was not significantly different from zero in any of the specifications. The regression results for these specifications are therefore not reported.

Table 4
Linear Probability of Working Full-time at Age 62

	Health Measure Used in Regression					
Variable Name	(1) Baseline	(2) Lagged Health	(3) Disease Conditions	(4)	(5) Activity Limitations	(6) All
Subjective health status[a]:						
Excellent (omitted)	—	—	—	—	—	—
	—	—	—	—	—	—
Very good	–0.011	–0.017	—	—	—	0.003
	(0.013)	(0.015)	—	—	—	(0.014)
Good	–0.032	–0.032	—	—	—	–0.006
	(0.014)	(0.016)	—	—	—	(0.015)
Fair/poor	–0.082	–0.093	—	—	—	–0.034
	(0.019)	(0.022)	—	—	—	(0.021)
Probability of living	—	—	—	—	—	0.098
to age 85	—	—	—	—	—	(0.017)
Number activity limits	—	—	—	—	–0.010	–0.005
	—	—	—	—	0.003	(0.003)
Any condition	—	—	—	–0.035	—	–0.015
	—	—	—	(0.011)	—	(0.011)
Specific conditions:						
High blood pressure	—	—	–0.009	—	—	—
	—	—	(0.011)	—	—	—
Heart condition	—	—	–0.027	—	—	—
	—	—	(0.018)	—	—	—
Cancer	—	—	0.013	—	—	—
	—	—	(0.024)	—	—	—
Stroke	—	—	–0.030	—	—	—
	—	—	(0.042)	—	—	—
Diabetes	—	—	–0.028	—	—	—
	—	—	0.019	—	—	—
Lung disease	—	—	–0.017	—	—	—
	—	—	(0.022)	—	—	—
Arthritis	—	—	–0.013	—	—	—
	—	—	(0.011)	—	—	—
Financial and job Characteristics:						
Earnings ($100,000)	0.077	0.108	0.078	0.079	0.080	0.074
	(0.020)	(0.023)	(0.020)	(0.021)	(0.020)	(0.020)
Wealth ($100,000)	–0.010	–0.013	–0.010	–0.010	–0.010	–0.010
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Number of observations	5,321	4,103	5,322	5,311	5,322	5,321
Mean of dependent variable	0.448	0.441	0.448	0.447	0.448	0.448

a. Also included are age, race, sex, marital status, union, schooling level, part-time versus full-time, and dummy variables for missing values of some regressors.

from acute events such as a stroke, to chronic conditions like high blood pressure and arthritis. None of these conditions is individually significant in the regression (Column 3), perhaps because most are so rare that the effects are difficult to identify. When they are replaced with a summary measure indicating the diagnosis of any condition (Column 4) the effect is significantly different from zero at a 1 percent level. Having been diagnosed with any one of these diseases reduces the probability of continued work by 3.5 percentage points, or 7.8 percent, less than half the magnitude of the effects of the subjective measure of fair/poor health.[29] Despite the dampening of the health effect, the effects of income and wealth remain substantially unchanged.

3. Activity Limitations

Other papers have used work limitations directly in lieu of self-reported health status, relying on responses to subjective questions about whether the respondent's health limits his ability to work. As in the case of self-reported health status, these reported work limitations may suffer from justification bias. A respondent who is not working may attempt to justify his decision to leave the labor force by stating that his health does indeed limit his ability to work.[30] Instead of these measures I use measures of more general activity limitations such as problems with respect to walking a given distance.[31] I create an indicator for the total number of physical activities that the respondent has difficulty performing as well as separate zero/one indicators for trouble with each listed activity. As shown in Column 5 of Table 4, the aggregate variable measuring the total number of limitations significantly affects labor force attachment. Each additional difficulty reduces the probability of continued work by one percentage point. Going from 0 to 5 limitations has a similar effect to a change from good to fair/poor health.

When examining the effects of specific limitations (not shown), only having difficulty running a mile has a significant negative effect on participation, reducing the probability of working full-time at age 62 by 3.2 percentage points. Again, as was the case with the substitution of diseases for subjective health, the effects of income and wealth are unaffected by the change in the measure of health.

4. Multiple Measures of Health

The final column reports the results for a specification that includes all measures of health simultaneously. Being in fair or poor health continues to have a relatively large effect on continued work, although its magnitude is dampened relative to the original estimate, falling to nearly 40 percent of its initial value (0.082 to 0.034). The coefficient on the subjective survival probability remains highly significant and its effect is

29. Sixty-two percent of the sample had at least one of these medical conditions. The most common ailments were high blood pressure (34 percent) and arthritis (33 percent). None of the other conditions affected more than 10 percent of the respondents (see Table 1).

30. Questions on work limitations in the HRS have been used by Kreider (1999) and Benitez-Silva et al. (2000).

31. The exact phrasing of the questions and the specific activities covered are included in the data appendix. They encompass walking, jogging, climbing stairs, and stooping, among others.

nearly identical to that in Column 2 of Table 3 (0.10 compared with 0.098). The indicator of the number of activity limitations is significant at a 10 percent level, but each additional limitation only decreases the probability of working by 0.5 percentage points, approximately half of the effect when it is entered into the equation alone. The dummy variable indicating the presence of at least one disease condition does not have a significant effect and in magnitude it is much smaller than the estimate in Column 5.

As has been the case in each of the specifications, changes in the included measure of health do not affect the estimated effects of income and wealth.

D. Summary of Health Effects

Several important conclusions can be drawn from the estimates in Tables 3 and 4. First, despite the lack of justification bias, poor health has a large and significant effect on labor market attachment. By several measures the effect of health on labor market participation is larger than that of the financial variables. Using the observed changes in health, income, and wealth across waves as indicators of reasonable magnitudes for each variable, the impact of health is substantially greater than either income or wealth. Second, when these alternative measures of health are included along with subjective health status, several have significant effects. In particular, the probability of living to age 85 remains a strong predictor of expected behavior. However, despite these additional variables, fair/poor health remains an important explanatory variable. This continued significance of self-reported health status indicates that studies of retirement that attempt to circumvent the potential biases in self reported health status by replacing it with alternative measures risk omitting important explanatory variables. Third, and perhaps most striking, the various alternative measures of health (survival probability, activity limitations, diagnosis of diseases) all have significant effects on the reported probability of continued work, but switching among them does not alter the estimated effects of other variables (primarily the financial variables).

E. Changes Over Time

Although the measure of labor force attachment used here unlikely suffers from justification bias, unobserved individual factors correlated with both the strength of the attachment to the labor force and with health could bias the results. For instance, someone with a low time rate of discount might invest in health and remain in the labor force longer to ensure a financially comfortable retirement.

It is also likely that workers choose jobs commensurate with their abilities; workers in poor health have jobs that do not require a great deal of physical effort. In this case changes in health, particularly unexpected changes, rather than absolute levels cause an individual to reassess his future labor market behavior. These unexpected changes in retirement plans could leave the worker with insufficient savings to finance a comfortable retirement. Insight into how individuals update their retirement probabilities is thus of important policy interest.

To address these issues, I take advantage of the multiple observations available on the probability of continued work and specify a statistical model for the change in P_{62} across waves. Modeling changes in P_{62} as a function of changes in the explanatory

variables in effect differences-out characteristics of the individual that are constant across waves (whether observed or not) and the results are therefore robust to this form of unobserved heterogeneity. The equation to be estimated is now of the form

$$(3) \quad P_{62_2} - P_{62_1} = \beta_1(w_2 - w_1) + \beta_2(H_2^* - H_1^*) + \beta_3(Z_2 - Z_1) + u_{2,r} - u_{1,r}.$$

where numerical subscripts represent the period. Components of the *u*s that are constant across time, such as time rates of discount or tastes for work, are eliminated by this procedure. Similarly, measurement error that is constant over time is also eliminated.

While this type of specification is useful in many regards, it has two important drawbacks. First, because many of the variables of interest change only rarely, their effects cannot be identified precisely. For example, few workers have changes in employee benefits over the period (existence of a pension, health insurance, or retiree health insurance) so these variables are not well identified in the regression. I therefore do not discuss these estimated coefficients.

One must also exercise caution when interpreting the results because P_{62} represents the individual's *expectation* about the future. I assume that individuals incorporate all information known at the time of the interview when determining a value for P_{62}. This information includes anticipated changes in income, wealth, or health. Thus, changes in these variables that are anticipated by the respondent ought not affect the reported probability in the second wave. P_{62} can therefore remain unchanged despite large changes in the explanatory variables. Changes in P_{62} will instead be correlated with *unexpected* changes in these variables. Estimates of this model are therefore not simply replicates of the cross-sectional estimates with individual effects controlled for. Rather, they provide an indication of how individuals update their retirement plans with the arrival of new information. As such, these estimates shed light on an important issue, the extent to which changes in health, as well as changes in other determinants of retirement, can alter individual plans. If changes in health lead to unanticipated changes in labor market behavior then the onset of poor health may push individuals into retirement earlier than they had anticipated. This premature retirement may in turn lead to lower than expected pensions and other financial wealth making it difficult to finance the longer span of nonwork. Through this regression analysis one can assess the relative importance of changes in health and changes in financial variables in affecting the observed change in the probability of continued work.[32]

In Column 1 of Table 5 I report estimates for the most basic specification for the change in P_{62}. Here changes in health are responses to a question about health relative to Wave 1, rather than changes in the excellent to poor classification over time.[33] Health

32. Fortunately all changes need not be for the worse. An individual's expectation of his health or financial trajectory could be revised upward. Given the previous results, an upward revision of health would be expected to increase attachment to the labor force while an increase in expected pension wealth, for example, could hasten departure.

33. The question asked "Compared with your health in Wave 1, would you say that your health is much better, somewhat better, the same, somewhat worse, much worse?" I aggregate much better and somewhat better as well as much worse and somewhat worse. Regressions using the disaggregated categories led to an identical result with a monotonic decline in P_{62} with worsening health. The estimated effects of both worse health and somewhat worse health were significantly different from zero. The alternative is to examine changes over time in the reported category (excellent, very good, good, fair, poor). By using the reported

Table 5
Changes in the Probability of Working Full-Time at Age 62

Variable Name	(1) Baseline	(2) P85	(3) All
Subjective health status:			
Better than last period	0.013	0.011	0.012
	(0.018)	(0.018)	(0.018)
Same (omitted)	—	—	—
	—	—	—
Worse than last period	–0.041	–0.039	–0.040
	(0.019)	(0.019)	(0.019)
Probability of living to age 85	—	0.079	–0.012
	—	(0.020)	(0.019)
Change in number of activity limits	—	—	–0.006
	—	—	(0.004)
Change in having any condition	—	—	–0.002
	—	—	(0.024)
Financial and job characteristics:			
Change in earnings ($100,000)	–0.009	–0.008	–0.009
	(0.032)	(0.032)	(0.032)
Change in wealth ($100,000)	–0.002	–0.002	–0.001
	(0.002)	(0.002)	(0.002)
Number of observations	4,105	4,105	4,105
Mean of dep variable	–0.017	–0.017	–0.017

Also included are elapsed time, changes in marital status, union status, part-time versus full-time, and dummy variables for missing values of some regressors.

status being the same is the omitted category. I do not report all the coefficients in the table, focusing instead only on changes in health and financial variables. A complete list of variables included in the regression is available in the footnote to the table.

As is apparent from the regressions, changes in health, in particular a worsening of health, has a significant effect on the probability of continued work. Those whose health worsens over the two-year period lower their reported P_{62} by four percentage points. In contrast, changes in income and wealth have no effect. These results are robust to specifications that use quadratics, percent changes, and those that include levels as well as changes.

In the second column the change in the individual's subjective probability of survival is included. This variable has a significant effect. Increases in expected survival

change in health rather than differencing reports over time, I am able to capture changes in health that are not sufficient to prompt the respondent to change categories. The conclusions of the analysis are broadly consistent with either measure.

probability are strongly correlated with increases in P_{62}. A change in *PLIVE85* from zero to one increases the probability of working full-time at age 62 by eight percentage points. However, because the variable *PLIVE85* is a probability and thus varies from 0–1, a change of one unit is extreme.[34] Despite the addition of changes in *PLIVE85*, the effect of worsening health is nearly identical to that in Column 1. Again, the effects of changes in income and wealth are not significantly different from zero.

The final column includes changes in subjective health status and the survival probability along with the onset of disease conditions and activity limitations.[35] Worsening health continues to matter but changes in *PLIVE85* are no longer significantly different from zero.

The results in Table 5, while not directly comparable to the linear specifications for P_{62}, provide evidence to reinforce the earlier conclusions; subjective health has a significant effect on retirement expectations exclusive of a justification bias. Furthermore, these results also make an important point about the potential for financial well-being in retirement to be affected by unanticipated deteriorations in health status. Because changes over time in P_{62} likely correspond to unanticipated changes in labor market behavior, the significant correlation between changes in health and changes in P_{62} suggests that alterations in retirement plans may be due in large part to changes in health.

Because the well-being of our elderly population takes center stage in many policy discussions, this result merits further investigation. Effective methods for protecting individuals against unanticipated deteriorations in health and unexpected early retirement depend on the types of innovations observed. If individuals systematically underestimate the risk of poor health and overestimate their potential worklife, then educational programs on the importance of savings and the potential for negative shocks need to be emphasized. In contrast, if unexpected shocks are symmetric so that some individuals work longer than expected while others are forced to retire early, then perhaps more comprehensive insurance against early departures from the labor force, along the lines of the Social Security disability program, is needed. Changes in disability programs could allow older workers to access benefits more readily if their health necessitates an earlier than expected retirement.[36]

V. Conclusion

The results of this study suggest that poor health is strongly correlated with the decision to remain employed, and that the observed correlations are not due solely to a justification bias. I find that absent an incentive to justify nonwork, poor

34. The average change in *PLIVE85* across waves was 0.05. Other work (Hurd and McGarry 2002) has shown that shocks such as the death of a parent are associated with updates in the subjective probability of survival.

35. The coefficient on the variable "change in the number of activity limits" can be either positive or negative as an individual's ability to perform the specified tasks improves or worsens between waves. In contrast, because the questions about the diagnosis of a particular disease ask "has a doctor ever told you that you have . . . ?" they can only change from no to yes. This variable is therefore one if at least one new condition has been diagnosed and is zero otherwise.

36. Note that the average change in P_{62} across waves is negative, providing some evidence that the phenomenon of misestimating the potential for negative shocks may be the more relevant scenario.

health continues to have a large and significant effect on the probability of continued work, an effect substantially larger than the effects of financial variables. Furthermore, it continues to be a powerful predictor of behavior even when other measures of health are included in the model.

In addition, the strength of the estimated effects of subjective health status relative to other health measures—such as the subjective probability of survival, activity limitations, and the presence of various diseases—suggests that researchers attempting to circumvent the problem of justification bias by using alternative measures risk imposing substantial biases due to omitted variables.

The importance of poor health relative to the financial variables and the robustness of the estimates of the coefficients of the financial variables is consistent with recent work by Dwyer and Mitchell (1999) also using the HRS, but refutes conclusions drawn by some earlier authors. A possible explanation for the difference between these recent studies and earlier efforts, which were based primarily on the Retirement History Study (RHS), is that attitudes toward retirement may have changed over time. One could well imagine that early retirement in the 1970s (when the RHS was being administered) was viewed differently from early retirement today. Those who can afford to retire early nowadays may well be proud of their financial independence and will not feel the need to rationalize the decision with appeals to poor health.

The paper also makes the important point that changes in P_{62} (or changes in retirement plans) are strongly correlated with changes in health and only weakly related to changes in financial variables. Because retirement plans ought to incorporate all expected changes in health, one can infer that it is unexpected changes in health that are affecting expected labor force attachment. This suggests that individuals may be forced from the labor force earlier than expected because of unanticipated declines in health, and through this mechanism, poor health may affect financial well-being in retirement.

Appendix

Variable Definitions

Health Status

In each wave respondents were asked,

"Would you say your health is excellent, very good, good, fair, or poor?"

I define five 0/1 dummy variables corresponding to each of these states. In the regression analyses fair and poor health are aggregated together. Following this question they were asked about their mental health,

"What about your emotional health-how good you feel or how stressed, anxious or depressed you feel? Is it excellent, very good, good, fair, or poor?"

Again I create five dummy variables for each level of health and combine the fair and poor categories in the statistical analyses.

Diseases

The HRS asks numerous questions about doctor-diagnosed illnesses. Here I list the questions with the shorthand notation I use in the subsequent tables.

"(Has a doctor ever told you that you) . . .
. . . have high blood pressure or hypertension? [high blood pressure]
. . . have diabetes or high blood sugar? [diabetes] . . .
. . . have cancer or a malignant tumor of any kind except skin cancer? [cancer]
(Not including asthma) has a doctor ever told you that you . . .
. . . have chronic lung disease such as chronic bronchitis or emphysema? [lung disease]
. . . had angina, congestive heart failure or other heart problems? [heart conditions]
. . . had a stroke [stroke]
. . . arthritis or rheumatism?" [arthritis]

Measurement of Activity Limitations

Questions about limitations with respect to the following activities are asked about in the HRS:

"We are interested in how much difficulty people have with various activities because of a health or physical problem. Please look at the answer categories at the top of page one of the booklet and tell me how difficult each activity is for you. Exclude any difficulties that you expect to last less then three months. How difficult is it for you to
. . . run or jog a mile?
. . . walk several blocks?
. . . walk one block?
. . . walk across a room?
. . . sit for about 2 hours?
. . . get up from a chair after sitting for long periods?
. . . get in and out of bed without help?"

The questions can be answered using the following categories:

1. Not at all difficult.
2. a little difficult.
3. somewhat difficult.
4. very difficult/can't do.
5. don't do.

I categorize an individual as having difficulty if they report that it is very difficult, somewhat difficult, a little difficult, or they can't do the activity.

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