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Health Problems as Determinants of Retirement: Are Self-Rated Measures Endogenous?

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Keywords

measurement of health, retirement, ADL/IADL, self-reported and objective health

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JEL classification: I19, J26
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1. Introduction

Poor health can affect preferences for work, wage opportunities, and the time horizon workers face, and may therefore play an important role in the decision to retire. Previous research on this topic suggests that health problems do influence older workers' labor force participation, but the magnitude of their effect has yet to be precisely determined. The few measures available in most prior datasets tend to be subjective proxies measured with error and endogenous to labor supply choices. This paper uses the Health and Retirement Study (HRS), a new nationally representative survey of people age 51-61 in 1992 and their spouses. The data set offers a rich variety of economic and personal information including two distinct types of health measures which are the central focus of the analysis. We expect to minimize measurement error in health by using good objective measures of work capacity and exogenous health determinants as instruments.

In what follows we first provide background and offer a conceptual model, and then describe our empirical specification. The data set used and findings for measurement error models are reported, followed by an examination of the effects of specific conditions. A final section concludes.

2. The Framework

Identifying the effects of health and economic variables on retirement is complicated because people's health status is not directly observable. Surveys tend to record respondents' subjective self-assessments of their physical capacity for work, and researchers have used these to capture the effect of health capacity on work potential. However, estimated health effects using these subjective measures may be mis-estimated if individuals use health as a justification for leaving the labor force early. This phenomenon has been referred to as the "justification hypothesis" (Bound, 1991; Anderson and Burkhauser, 1985; Bazzoli, 1985;Chirikos & Nestel, 1984). When subjective health assessments measure leisure preferences instead of "true health capacity", estimates of health effects will tend to be biased in the direction of poorer reported health driving retirement. More specifically, people who enjoy their work will downplay their health problems and work longer, while those who dislike their work may exaggerate health problems and retire sooner.

Several studies on this "justification" hypothesis have confirmed the endogeneity of self-reported health measures[1]. An early analysis by Chirikos and Nestel (1984) compared the labor supply effects of a self-reported disability measure to that of a more objective impairment index, and concluded that self-reported health problems exaggerate the impact of poor health on work potential. In particular they argued that "considerable caution must be exercised when disability reports are used as proxy measures of health status, whether as explanatory variables in labor supply studies or as an outcome variables in health production functions... It is a mistake to interpret work disablement as incapacitation over which individuals have little choice". A subsequent study by Anderson and Burkhauser (1985) used early mortality to proxy health problems, and here too the more objective measure had a smaller effect on labor supply than did self-reported health problems.[2] Bazzoli (1985) analyzed this topic in a different context, by comparing retirees' self-assessed health before and after the retirement event. She found that the same individuals reported poorer health after retirement than they did earlier, a finding consistent with the justification hypothesis. In any event, the jury is still out on which health measures are the

[1]Although some studies have suggested that self-reported measures are reliable; see Haveman, Wolfe, and Huang, 1989; Stern 1989; Mossey and Shapiro 1982; Ferraro 1980; Nagi 1979; LaRue et al. 1979; Maddox and Douglas, 1973.

most useful in models of older workers' labor supply. In the meantime, researchers continue to treat these self-reported limitations as objective proxies of health (e.g., Haveman et al. 1994). As we show below, the new dataset we use here allows for tests of alternative models of health effects on retirement, using a range of different health measures.

We follow the literature in positing that at some planning period, a worker chooses a retirement age that maximizes utility over the remainder of his life. The present value of labor earnings and non-labor income (income from pensions and social security), as well as leisure, determine his lifetime budget constraint. In this formulation, the retirement period is the expected lifetime remaining minus the retirement age. The present discounted value of income over the remainder of his lifetime (PVY) includes the discounted sum of lifetime earnings net of taxes until retirement, plus pension contributions (PVE), and the net income from pensions and social security (PVP) from retirement to death. The worker retires when the utility gain from leisure exceeds that from working another year. Earlier research has shown that two economic variables play an important role in the selection of the optimal retirement date. First, "base year" wealth, or total discounted wealth available at early retirement, induces the worker to retire earlier. Second, a higher gain to delaying retirement, which is an increase in the slope of the budget constraint, has a theoretically ambiguous effect. Prior empirical research suggests however, that the net effect is positive (i.e. the substitution effect dominates the income effect).[3]

Incorporating health problems into this model is complex. Health status, defined here as the physical and mental ability to perform work, is likely to affect retirement age choices in many ways. Poorer health often detracts from productivity and can reduce earnings. Health can also

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[2] Whether early mortality is a good proxy for health problems was questioned by Bound (1991).

affect preferences; of relevance is its effect on the utility of consumption and leisure. For example, poor health can make work more difficult and less rewarding, depending on the severity of conditions and requirements of the job. Poor health can also increase the demand for non-work time to care for one's health. In both of these cases, the relative utility of leisure increases, which according to the theoretical model would result in earlier retirement. On the other hand, poor health can increase the marginal utility of consumption relative to leisure, which leads to postponed retirement. Therefore the effects of poor health on preferences for work are theoretically ambiguous (Sammartino, 1987). Health also affects people's remaining time horizon, in that some conditions alter life expectancy and hence years available to choose between retirement and work (Grossman, 1972). Some poor health problems are acute, meaning they strike quickly and end life early. Holding productivity and preferences constant, a condition that shortens life should induce a pure income effect, because it shifts up the budget constraint. To the extent this is anticipated, a reduction in years results in a shorter work life, and fewer retirement years.

In sum, the predicted effects of poor health on the optimal retirement age are theoretically ambiguous. Empirical evidence suggests that poor healthleads to earlier retirement because its effects on preferences and productivity dominate (Loprest, Rupp, and Sandell, 1995; Bound, 1991; Sickles and Taubman, 1986, Anderson and Burkhauser, 1985; Bazzoli, 1985).

3. Alternative Empirical Formulations

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[3]This model may be extended to a dynamicframework as more waves of the HRS data become available. See Burkhauser (1979), Fields and Mitchell (1984), Rust (1987), Sickles and Taubman (1986).

In order to ascertain precisely how health problems influence retirement, an empirical model must be formulated. Econometric issues arise because a worker's "true" health status is not known precisely; that is, the health measures observed in surveys may be incomplete or even biased indicators. For instance, if the justification hypothesis is accurate, people wanting to retire may exaggerate their bad health conditions. As a consequence, health effects will be overstated, and self-rated poor health measures will be endogenous to labor supply choices. To the extent that economic variables may also be correlated with omitted taste factors, estimates of behavioral responses to economic variables will also be biased.

These econometric concerns are evident in the following schematic model where retirement and economic factors are posited to depend on "true" but unobserved health (η^*) while observed health indicators (H) capture true health status with error:

$$R = \beta_1 w + \lambda_1 \eta^* + \gamma Z_1 + \varepsilon_1 \qquad (1)$$
$$w = \lambda_2 \eta^* + \gamma Z_2 + \varepsilon_2 \qquad (2)$$

Measurement Error Model:

$$H = \lambda_3 \eta^* + \varepsilon_3 \qquad (3)$$

where

R = desired retirement age,
w = vector of levels and changes in value of retirement income,
H = vector of observed health indicators,
η^* = unobserved "true" health or capacity for work,
Z_1, Z_2 = vector of other factors affecting retirement age and compensation, including demographics,
ε_1, ε_2, ε_3 = stochastic error terms.

Without restrictions on the error terms, the model is underidentified by five parameters (see Appendix 1 for the relevant variance covariance matrix). A number of identification strategies may be pursued. For instance, restricting ε_1 to be orthogonal to ε_2 assumes that the labor supply and labor demand equations are non-recursive. This is accurate if workers take compensation as given by the firm, an assumption prevalent in the literature (Bazzoli 1985; Bound 1991). An alternative identifying restriction would assume ε_1 and ε_3 are uncorrelated, which implies the health proxies are exogenous "good" measures of unobserved health capacity, η^*. However, under the justification hypothesis, people will cite poor health to justify early retirement and poor health will be systematically exaggerated for workers who prefer early retirement. This implies that a latent variable representing retirement leisure preferences or motivation is common to both disturbances, making H and R simultaneous. In this event, the estimated λ_1 may be an upper bound.[4] The implication of having variance in ε_3 is that health effects will then be biased. The classic errors in variable bias in H makes it endogenous, because of the presence of ε_3 in the disturbance of the labor supply equation.

A corollary of the justification hypothesis is that w is correlated with the resulting systematic measurement error, ε_3, because low earners will prefer retirement leisure and use poor health to justify their early withdrawal. Anderson and Burkhauser (1985) allow for this possibility by modeling H and R jointly, with w as a regressor for both. Bazzoli (1985) tests for this correlation between w and the disturbance. Bound (1991) includes w in the structural model of H to capture this. An alternative approach to this endogeneity problem is to use objective health measures that may not suffer from the systematic error due to justification for retirement. If H and η^* are sufficiently correlated, the assumption that $\varepsilon_1 \perp \varepsilon_3$ is accurate. If they are not sufficiently correlated, η^* would still be common to both error terms, and the economic indicators

[4] The sign of the bias is ambiguous because of attenuation caused by classic errors in variables bias (for details on identification see Dwyer, 1995).

will be correlated with it. Below, we experiment with several health measures that may be more objectively measured than the traditional self-reported health indicators.

The first model to be evaluated in the empirical analysis uses objective and subjective measures as alternative proxies for η^* and imposes all of the above identification restrictions. In sum, if the justification hypothesis holds, we would anticipate that self-reported health effects will be large and economic variables will be small in retirement models. If measurement error is a problem, however, we anticipate objective health measures to have a small effect and measured economic effects to be large. In general, the variables indicating poor health are expected to be positively related to early retirement.

A second empirical approach relaxes some of these assumptions to allow for the possibility that measurement error plagues both objective and subjective health status variables. Instrumental variables estimation is then used to test exogeneity and measurement error. We hypothesize that if measurement error in the self-rated measures is a problem, estimated health effects will decline and economic effects will grow after instrumenting. If objective proxies are weakly measured, instrumenting them will strengthen estimated health effects and reduce measured economic effects.

4. Data and Empirical Results

The empirical analysis uses the first wave of responses to the Health and Retirement Study (HRS), focusing on men age 51 to 61 in 1992. Because most of the HRS sample had not yet retired by 1992, the dependent variable we used is the worker's expected age of retirement.[5]

[5]This is constructed by using the respondent's planned age of full retirement if available (69%); if missing, we used the age he expected to begin receiving social security or pension benefits (19%). If a respondent reported himself as already retired, had retired after age 44, and had worked at least 10 years, we used his actual retirement age (12% of the

Expected retirement may be measured with error correlated with age, since people may update their retirement age expectations as new information becomes available to them. To account for this possibility, we also control for the respondent's current age. Previous research by Bernheim (1987) using the older Retirement History Survey found that expected and actual retirement ages were strongly correlated. Preliminary unpublished research using partial segments of the second wave of the HRS suggests that actual and expected behavior is also closely linked for this cohort (Dominitz, 1996; Honig, 1996).[6]

In the first part of the analysis, we seek to assess the relative importance of the justification hypothesis and potential biases resulting from measurement error, using both self-rated and more objective health variables available in the HRS. Two self-rated health measures commonly reported in national surveys are overall self-rated health status, and a dichotomous variable indicating the presence of work limitations.[7] For a more objective indicator of health status we use an index that counts the number of health conditions the respondent reports, including a wide range of functional limitations, chronic physical and mental disorders, and acute illnesses. This index does not account for the severity of conditions experienced, so that reports of high blood pressure and open-heart surgery are weighted equally. Fortunately, since the variable is a count of conditions that are not likely independent, people with more severe symptoms tend to score higher. For example, those who have had severe heart trouble have a mean health condition score of 9, which is twice the overall mean of 4. This suggests the measure does pick up severity through co-morbidity.

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sample). For this sample (n=4,369), the mean age of expected retirement was 65. Respondents who reported that they would never retire were assigned a value of 85.

[6] The full public use file for the second wave of the HRS is not yet available for analysis.

[7] For more description of variables see Appendix 2.

Several other health measures may be more closely tied to functional capacity for work than the health conditions index used above, including indices of activities of daily living (ADL) and instrumental activities of daily living (IADL), as well as some other functional capacity (FL) measures. Researchers in the disability field often rely on such measures to evaluate work impairments among the disabled (Nagi, 1969). There remains the question of how to construct an index of these conditions. One approach is to develop a dichotomous variable equal to one if the respondent reported a problem with any of the ADL/IADLs in the HRS.[8] A different approach uses an 11-point scale accounting for the severity of the conditions included developed by Katz et al. (1963) and Spector et al. (1987).[9] We examine both in the analysis below.

In addition to the health variables of most interest here, several economic and demographic factors are also controlled. We compute each workers' discounted stream of income from retiring at age 62, as well as the income gain (or loss) in discounted income from delaying retirement to age 65. Net worth measures lifetime wealth or savings, and includes housing and all other financial assets.[10]

Means of variables used in the empirical analysis appear in Table 1 (definitions appear in Appendix 2). Roughly 20% of the HRS sample reported itself to be in poor health and/or had work limitations and 22% had some functional limitations (ADL/IADL/FL). It may be surprising that 83% of the sample reported a health problem, with an average of 4 conditions reported. Musculoskeletal and circulatory problems were most prevalent among reported conditions.

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[8]If the respondent reported having "some difficulty" (as opposed to "very difficult" or "impossible") we required at least two reports of problems with ADL/IADLs. We excluded problems with using a calculator or computer since these may not indicate physical impairment.

[9]The Katz et al. (1987) scale (as adapted to HRS questions) increases with poor health, and takes into account the severity of symptoms. Details are available on request.

[10]All earnings, pension, and social security benefits are valued in 1992 $, discounted to a common planning age (51) using sex-and age- specific mortality rates and a real discount rate of 2%. A data appendix is available on request.

Correlations of specific health conditions and retirement expectations by the subjective poor health measures appear in Table 2. Not surprisingly, respondents indicating they were in poor overall health or who had a work limitation, also had a much higher incidence of specific health problems. Of those who reported work limitations, 63% also reported severe difficulty with at least one ADL/ IADL/FL.[11] Poor overall health is strongly correlated with other underlying health conditions but not with functional status variables. Therefore, while self-ratings of overall poor health and the presence of work limitations are both correlated with work ability, they appear to be measuring different aspects of health status. This suggests that work limitations are closely linked to functional capacity, and will be more correlated with the ability to perform work than is self-reported overall poor health.

OLS and IV estimates of retirement models using five alternative measures of health status appear in Table 3. The first panel (A) employs the subjective health measures as controls for poor health, while panel B uses the more objective measures. In both cases poor health is associated with earlier retirement plans.[12] The estimated effect is large: men with work limitations plan to retire more than two years earlier, and those in poor overall health or indicating the presence of a functional limitation (ADL/IADL/FL) expected to work at least one year less. Results using the detailed ADL/IADL/FL index are not significant, but the health conditions indicator has a significant effect (inducing earlier retirement by three months).[13]

[11] Functional limitations include ADLs, IADLS, and other activities ranging in severity from mild to very physical (See Appendix 2 for details).

[12] Alternative model and sample specifications yielded virtually identical results, such as including job characteristics and omitting retirees from the sample.

[13] Additional models reported in Appendix 3 help us assess whether the objective and subjective measures are picking up similar factors, or are simply reflecting different dimensions of poor health. The results show that when both types of variables are included in a retirement model we find that self-reported work limitations are a close substitute for the ADL/IADL/FL indices, and self-reported overall poor health is a substitute for underlying conditions.

Comparing panels A and B, there appears to be little evidence of measurement error in either the objective or subjective indicators of poor health. Thus Hausman-Wu tests (Hausman, 1978; Wu, 1973) for exogeneity cannot reject the hypothesis that estimated OLS and IV self-rated health effects are equal in Panel A. Even in Panel B, OLS and IV estimates differ only at the 70% level for the health conditions index, and at the 50% level for the ADL/IADL/FL indices.

To check the adequacy of our instruments for the health variables, we computed goodness-of-fit statistics derived from the first stage health equations that appear in Table 4. Instruments include parents health and mortality, respondent's weight/height ratio, nights spent in a hospital, age, and number of children. All models pass on F (and likelihood ratio) test criteria, following the approach suggested by Staiger and Stock (1997). This lends support for our earlier conclusions on measurement error.

Another interesting result is that there is little evidence of the justification hypothesis. The work limitations measure is the only health effect that declines after instrumenting. This is consistent with the justification hypothesis, but the differences are not significant based on tests of exogeneity. Given the lack of measurement error described above, it is not surprising that IV estimates of economic variables are similar in magnitude.

One reason that the HRS evidence does not support the justification hypothesis may be that the HRS sample is a younger and not yet fully retired group. By contrast, researchers using older men in the Retirement History Survey believed that health was one of the few socially acceptable justifications for early retirement in the 1960's and 1970's, when that survey was collected (Bazzoli, 1985). Another reason our results may diverge from those of prior studies is that we use different variables to measure labor supply, health, and compensation. For instance, some prior research focused only on labor force participation to measure work status, while here we examine workers' expected retirement age. Previous datasets also had much less satisfactory measures of economic variables that did not capture retirement wealth as precisely as is possible in the HRS.[14] Finally, we control on several factors that prove important empirically, such as occupation and industry, region, and health insurance; these too were excluded from prior models.

Turning briefly to other variables, we find that the estimated effects of economic variables are statistically significant but quantitatively small across all models. For example, higher base retirement income (holding slope constant) results in a small negative income effect in Table 3: a $100,000 increase in net worth results in retirement just 14 days earlier. Also, the more a respondent accrues from postponing retirement (holding assets and base income constant) the later he retires, confirming the dominance of the substitution effect.[15] The most influential economic factors on the decision to retire are the health insurance controls.

4.1. The Effects of Specific Health Conditions on Retirement

Next we seek to determine how evidence on specific health conditions alters estimated effects of health on workers' expected retirement patterns. This type of research has not been possible before because data on specific health problems are typically not available in labor force surveys.

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[14] Anderson and Burkhauser (1985) use hourly wage and pension wealth to measure economic variables. Bound (1991) uses the additional income from working another year, accounting for pension and social security accruals, as well as lifetime earnings. Both of these studies use the expected age of retirement to calculate pension wealth, but the expected retirement age is endogenous to labor force participation and correlated with health. By contrast the HRS offers information on pension and social security benefits taken from administrative records, avoiding the need to rely on worker recall.

[15] The magnitudes of both effects are very small consistent with earlier studies using a similar retirement age model (Fields and Mitchell, 1984).

Multivariate results relating men's retirement age to several detailed health conditions appear in Table 5, where Equation 1 enters the health conditions separately; the remaining columns group these conditions by category. Hence Equation 2 includes high blood pressure in the circulatory category and back problems in the musculoskeletal category, Equation 3 excludes these two, and Equation 4 includes them separately.[16] Because high blood pressure and back problems are very common, and the severity of these conditions can vary considerably, we might expect these to have smaller estimated effects than would variables measuring more severe health symptoms. Back problems are also difficult to diagnose (being more subjective) and therefore self-reports may be unreliable. By separating them, we allow for these differences.

Results for the disaggregated health variables appear in Table 5. One clear-cut finding is the important role of functional limitations across all retirement models. In general, ADL/IADL/FL problems result in earlier expected retirement by about a year, and the effect is statistically significant. This result persists even when a diverse set of other health factors is controlled. When disaggregating the functional conditions, we see that problems with heavier physical activities had the greatest individual effects on retirement outcomes. Respondents with back problems (including arthritis) did anticipate retiring earlier, but those with other musculoskeletal problems were not affected. Another robust finding is that respondents who suffered from circulatory conditions planned to retire one year earlier. Since "circulatory conditions" is a broad category, ranging from high blood pressure (39%) to having had an angiogram and/or cardiac catheterization (9%), the analysis was conducted first excluding high blood pressure in Column 3, and then including it separately in Column 4. High blood pressure

[16] Other variables controlled in the multivariate models include economic factors (Ybase, Yslope, net worth, health insurance), as well as the demographic, spouse, and occupation information reported in Table 3. The effects of these

seems to have a greater impact than other circulatory disorders on retirement planning, but the effect of circulatory problems remains strong regardless of how it is measured. A robust, but surprising, finding is that nervous system disorders and head injuries appear to delay retirement by one to two years. Of course only survivors of such injuries are included in the HRS survey sample.

5. Discussion

We have used the Health and Retirement Study to evaluate the impact of health problems on men's retirement plans. Though estimated health effects vary with measures used, health problems always have a potent influence encouraging earlier retirement. Specifically, people self-reporting poor health, or indicating they suffer functional limits, planned retirement between one and two years earlier than average. Further, we find that self-rated health measures are not endogenously determined with labor supply, and appear not to be correlated with compensation variables in retirement equations. In other words, there is no evidence in support of the justification hypothesis.

There is little evidence of measurement error in the more objective health measures. We argue that the presence of functional limitations is a good objective proxy of underlying health in retirement models, but self-reported work limitations perform similarly. We also disaggregate reported health conditions and find differential effects of these on retirement. Some chronic conditions such as functional limitations and circulatory disorders accelerate retirement, while in our study, nervous disorders and injuries do not. Economic effects remain statistically significant after controlling for health problems.

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variables remain robust.

Future extensions of this research will re-evaluate the justification hypothesis by looking at actual retirement patterns, after additional waves of the HRS panel become publicly available. There also is more to be learned from the extensive health information available in the HRS, particularly regarding mental health and other measures of functional capacity.

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Table 1. Means for Selected Variables, HRS Men

Variables	Means or Frequencies (Std. Dev)
Subjective Health Measures	
Poor Overall Self-Rated Health (%)	19.4 (39.6)
Presence of Work Limitations (%)	19.2 (39.3)
Objective Health Measures	
Overall Indicators	
Health Conditions Index (#)	4.4 (3.2)
Health Problems (% with)	82.9 (37.6)
Specific Conditions	
ADL/IADL/FL (%)	21.6 (41.1)
Neoplasms (%)	3.0 (1.7)
Endocrine (%)	10.2 (3.0)
Nervous System (%)	3.1 (17.3)
Circulatory (%)	53.8 (49.9)
Respiratory (%)	10.6 (30.8)
Musculoskeletal (%)	61.0 (48.8)
Digestive/Ulcers (%)	8.9 (2.8)
Genitourinary (%)	7.6 (2.7)
Head Injuries (%)	16.4 (3.7)
Poor Hearing or Vision (%)	19.7 (39.7)
Mental Health (%)	19.7 (39.8)
Expected Retirement Age (years)	64.7 (9.1)
Economic Factors	
Ybase ('000s)	39.8 (44.5)
Yslope ('000s)	3.9 (7.6)
Net Worth ('0,000s)	25.5 (57.4)
Health Insurance tied to work	
Employer Provided (%)	72.2 (44.8)
Retiree (%)	40.2 (49.0)

Note: Weighted tabulations, gamma release of the 1992 HRS Wave 1 (N=4,369 men age 51-61 in 1992). See Appendix for variable definitions.

Table 2. Correlations between Subjective and Objective Health Measures for HRS Men

	Overall Self-Rated Health		**Work Limitations**	
Variables	Good (%)	Poor (%)	None (%)	Present (%)
Subjective Health Measures				
Poor Overall Self-Rated Health	-	-	9.0	62.2
Presence of Work Limitations	8.9	61.6	-	-
Objective Health Measures				
Overall Indicators				
Health Conditions Index	3.6	7.7	3.6	7.6
ADL/IADL/FL	12.6	58.8	11.5	63.4
Specific Conditions				
Neoplasm	2.1	6.8	2.3	6.0
Endocrine	6.9	23.7	7.9	19.7
Nervous	1.5	9.8	1.4	10.0
Circulatory	4.9	74.3	50.1	69.3
Respiratory	7.6	23.1	7.9	21.9
Musculoskeletal	56.2	80.8	55.0	86.3
Digestive/Ulcers	6.8	17.6	7.2	16.2
Genitourinary	5.3	17.3	5.4	17.0
Head Injuries	15.2	21.3	14.8	23.2
Poor Hearing or Vision	14.1	42.9	15.8	36.1
Mental Health	11.4	54.3	13.4	46.2
Expected Retirement Age (years)	65.3	62.6	65.6	61.3

See Table 1 for notes.

Table 3. Estimated Effects of Health and Economic Factors on HRS Men's Retirement Age

Panel A: Subjective Health Measures

Variable	Work Limitations For poor health OLS	Work Limitations For poor health IV	Poor Overall Self-Rated For poor health OLS	Poor Overall Self-Rated For poor health IV
Poor Health	-2.20**	-1.90	-1.03 **	-1.25
	(0.37)	(1.55)	(0.36)	(1.28)
Economic				
Ybase	-0.01*	-0.01*	-0.01*	-0.01
(0,000s)	(0.01)	(0.01)	(0.01)	(0.01)
Yslope	0.10**	0.10**	0.10**	0.10**
(0,000s)	(0.00)	(0.00)	(0.00)	(0.00)
Net Worth	- 0.04*	-0.05**	-0.04*	-0.04*
(00,000s)	(0.02)	(0.02)	(0.02)	(0.02)
Health Insurance				
Employer	-1.33**	-1.24**	-1.21**	-1.22**
	(0.37)	(0.37)	(0.37)	(0.37)
Retiree	-2.60**	-2.56**	-2.55**	-2.58**
	(0.32)	(0.31)	(0.31)	(0.32)
R-Square	0.15	0.15	0.15	0.15
Exogeneity Tests				
Hausman-Wu Test	-	0.89	-	0.68
Overid. Restrictns	-	0.89	-	0.85

(continued)

Table 3 (continued)

Panel B: Objective Health Measures

Variables	Health Conditions Index For poor health		ADL/IADL/FL Index For poor health		Dichotomous ADL/IADL/FL For poor health	
	OLS	IV	OLS	IV	OLS	IV
Poor Health	-0.19 **	-0.31 *	-0.08	-0.76	-0.98**	-1.87
	(0.04)	(0.17)	(0.12)	(1.62)	(0.34)	(1.56)
Economic						
Ybase	-0.01*	-0.01	-0.01*	-0.01	-0.01*	-0.01
('0,000s)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Yslope	0.10**	0.10**	0.10**	0.10**	0.10**	0.10**
('0,000s)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Net Worth	-0.04**	-0.05**	-0.03*	-0.05**	-0.04**	-0.04**
('00,000s)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Health Insurance						
Employer	-1.21**	-1.23**	-1.15**	-1.22**	-1.21**	-1.23**
	(0.37)	(0.37)	(0.37)	(0.37)	(0.36)	(0.37)
Retiree	-2.53**	-2.56**	-2.58**	-2.56**	-2.58**	-2.56**
	(0.31)	(0.32)	(0.31)	(0.32)	(0.31)	(0.32)
R-Square	0.15	0.15	0.15	0.15	0.15	0.15
Exogeneity Tests						
Hausman-Wu Test		0.34		0.51		0.54
Overid.Restrctns		0.96		0.91		0.86

Standard errors are in parentheses.
* t>1.671 ** t>1.96

See Table 1 for notes. In addition, models also include controls for respondent demographic variables (age, sex, race, education, region), occupation, industry, and spouse information (age, work history, present value of earnings). Results for these other estimates are available on request.

Table 4. Estimated Effects of Health Instruments in Models of Objective and Subjective Health, HR

Variable	Work Limitations	Poor Overall Self-Rated	Health Conditions Index	ADL/IADL/FL Hierarchical Index
Hospital nights	-2.46 **	0.06 **	0.08 **	0.00
	(0.00)	(0.01)	(0.01)	(0.00)
Weight/Height ratio	0.09 **	0.19 **	0.94 **	-0.03
	(0.05)	(0.05)	(0.11)	(0.04)
Mom alive	-0.27 **	-0.37 **	-0.51 **	-0.02
	(0.11)	(0.11)	(0.25)	(0.09)
Mom needs help	0.04 **	0.20 **	0.24	0.10 *
	(0.09)	(0.08)	(0.18)	(0.06)
Mom died young	-0.24 **	-0.27 **	-0.43 *	-0.03
	(0.11)	(0.10)	(0.23)	(0.08)
Mom sick prior to death	0.14 **	0.14 **	0.41 **	-0.02
	(0.06)	(0.06)	(0.13)	(0.05)
Dad alive	-0.05	-0.09	-0.34 **	-0.07
	(0.07)	(0.07)	(0.14)	(0.05)
Dad needs help	0.24 **	0.11	0.21	0.10
	(0.13)	(0.14)	(0.29)	(0.10)
Dad sick prior to death	0.10	0.03	0.20	a
	(0.09)	(0.10)	(0.21)	
# of children	0.03 **	0.05 **	0.09 **	0.04 **
	(0.01)	(0.01)	(0.03)	(0.01)
Age	0.03 **	0.01 **	0.06 **	-0.01
	(0.01)	(0.01)	(0.02)	(0.01)
Instrument Fit:	228.1	281.8	27.0	2.62

a – did not pass test of exogeneity for this model.

Standard errors are in parentheses
* t > 1.671 ** t>1.96

F-statistic reported for continuous variables and the likelihood ratio tesstatistic reported for dichotomous health indicators.
See Table 1 for notes. Instruments included all pass goodness of fit tests for these models. Instruments that failed on the basis oexoge
that dad died younger than expected, and marital status.

Table 5. Estimated Effects of Disaggregated Health Conditions on HRS Men's Retirement Age

Variable	Equation 1	Equation 2	Equation 3	Equation 4
ADL/IADL:		-0.75 (0.4)**	-0.89 (0.4)**	-0.73 (0.4)**
Difficulty with:				
Basic	1.03 (1.12)			
Physical	-0.09 (0.53)			
Very Physical	-1.00 (0.5)**			
Sitting	-0.34 (0.49)			
Neoplasms:		-0.12 (0.75)	-0.13 (0.75)	-0.13 (0.75)
Cancer	0.12 (0.99)			
Severe Cancer[1]	-0.36 (1.13)			
Endocrine:		-0.11 (0.43)	-0.27 (0.43)	-0.12 (0.44)
Diabetes	-0.59 (0.51)			
Severe Diab	0.99 (0.74)			
Nervous System:		1.92 (0.8)**	1.70 (0.8)**	1.92 (0.77)**
Stroke	5.25 (1.5)**			
Severe Stroke	0.75 (0.89)			
Circulatory:		-1.15 (0.3)**	-0.56 (0.3)**	-0.73 (0.32)**
Bad heart	-1.05 (0.3)**			
Hbp				-1.01 (0.27)**
Severe heart	-0.28 (0.44)			

(continued)

Table 5 (continued)

Variable	Equation 1	Equation 2	Equation 3	Equation 4
Respiratory:		0.61 (0.43)	0.61 (0.42)	0.63 (0.42)
Bad	0.58 (0.62)			
Severe	0.80 (0.56)			
Musculoskeletal:		-0.58 (0.3)**	-0.20 (0.27)	-0.07 (0.28)
Bad	-0.51 (0.34)			
Back Trouble				-0.55 (.28)**
Severe	-0.05 (0.34)			
Digestive/Ulcers:	-0.30 (0.46)	-0.35 (0.46)	-0.40 (0.46)	-0.34 (0.46)
Kidneys	-0.29 (.50)	-0.33 (.50)	-0.37 (.50)	-0.32 (.50)
Head Injuries:	0.77 (0.35)	0.74 (0.4)**	0.72 (0.4)**	0.75 (0.35)**
Hearing/Vision:		-0.38 (0.35)	-0.34 (0.35)	-0.36 (0.35)
Poor	-1.05 (.54)**			
Severe	0.06 (0.41)			
Mental Health		0.13 (.36)	-0.01 (.36)	0.15 (0.36)
Bad	0.30 (0.39)			
Severe	-0.16 (0.62)			
R-Square	0.16	0.15	0.15	0.15

Standard errors are in parentheses.

* t>1.67,   ** t>1.96

See Table 3 for sample and other controls. Also included Ybase, Yslope, net worth, and health insurance variables. See the Appendix for variable definitions.

Appendix 1: Variance-Covariance Matrix for Structural Model[1]

	R	w	H
R	$(\beta_1^2 \lambda_2^2 + 2\beta_1\lambda_1\lambda_2 + \lambda_1^2)\sigma_\eta^2$ $+2\beta_1\sigma_{\varepsilon1\varepsilon2}+\beta_1^2\sigma_{\varepsilon2}^2+\sigma_{\varepsilon1}^2$		
w	$(\beta_1\lambda_2 + \lambda_1)\lambda_2\sigma_\eta^2 + \beta_1\sigma\varepsilon_2^2 + \sigma_{\varepsilon1\varepsilon2}$	$\lambda_2^2\sigma_\eta^2 + \sigma_{\varepsilon2}^2$	
H	$(\beta_1\lambda_2 + \lambda_1)\lambda_3\sigma_\eta^2 + \beta_1\sigma_{\varepsilon2\varepsilon3} + \sigma_{\varepsilon1\varepsilon3}$	$\lambda_2\lambda_3\sigma_\eta^2 + \sigma_{\varepsilon2\varepsilon3}$	$\lambda_3^2\sigma_\eta^2 + \sigma_{\varepsilon3}^2$

[1] The correlations exclude the exogenousregressors from the analysis, since they are identified and do not affect the results. The variable w represents the additional income from working another year, so it is actually a vector of economic variables.

APPENDIX 2: Definitions of Variables:

Expected Retirement Age: age expect to leave labor force or age retired already, or age plan to begin receiving benefits.

Economic Factors:

Ybase : present value of income generated by working to age 62 and then retiring; by the discounted sum of earnings and retirement benefit payments (x10^{-4} \$1992).
Yslope :the difference between the present discounted value of income generated by retiring at 62 versus at age 65 (x10^{-4} \$1992).
Net Worth: assets including real estate, vehicles, businesses, IRAs, savings, inheritances, trusts, minus debts (x10^{-5} \$1992). Missing values, if any, imputed by Juster and Suzman (1995).
Health Insurance : dichotomous variable indicating presence of this benefit.

Subjective Health Measures:

Poor Overall Self-Rated Health: dichotomous variable indicating poor overall health.
Presence of Work Limitations : dichotomous variable indicating presence of work limitations.

Objective Health Measures:

Health Conditions Index: count of health conditions reported.
ADL/IADL/FL:

- *dichotomous variable:* indicating the presence of problems with Activities of Daily Living/Instrumental Activities of Daily Living, and other functions. (Includes bathing, dressing, eating alone, lifting and carrying, pushing and climbing, sitting, walking...)
- *hierarchical index:* 11 category index increasing in severity of ADLs, IADLs, and functional limitations. (Spector et al., 1987).

Neoplasms : dichotomous variable indicating the presence of neoplasms (cancers). Severe means the respondent reports having had chemotherapy, biopsy, or radiation. Assigned to ever had or severe, but not both.
Endocrine : dichotomous variable indicating the presence of endocrine problems (diabetes or high blood sugar).
Nervous System : dichotomous variable indicating the presence of nervous disorders (i.e. ever had a stroke).
Circulatory : dichotomous variable indicating the presence of circulatory problems (I.e. high blood pressure, hypertension, heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems, or high cholesterol).
Respiratory : dichotomous variable indicating the presence of respiratory condition (i.e. chronic lung disease, bronchitis or emphysema or asthma).
Musculoskeletal : dichotomous variable indicating the presence of musculoskeletal conditions (i.e. arthritis or rheumatism, back problems, feet or leg problems, fracture or broken bone since age 45, slipped disk).
Digestive/Ulcers : dichotomous variable indicating the presence of digestive disorders (i.e. stomach ulcers).

Genitourinary : dichotomous variable indicating the presence of genitourinary problems (i.e. kidney or bladder disorders).
Head Injuries : dichotomous variable indicating whether ever unconscious due to head injury.
Poor Hearing or Vision : dichotomous variable indicating poor or fair eyesight or hearing.
Mental Health: dichotomous variable indicating the presence of an emotional, nervous, or psychiatric problem, or receiving psychological or psychiatric treatment, or on anti-depressants.
ADL/IADL Difficulties:
Basic: functions of daily living like getting in and out of bed, bathing, dressing, eating alone.
Physical: includes walking, stooping, arm raising, pick up dime.
Very Physical: includes climbing stairs, carrying and lifting, pushing and pulling.
Sitting: includes sitting for 2 hours at a time, and problems getting up after sitting for a while.

Instruments:
*Hospital nights: C*ount of the number of nights spent in a hospital last year.
Weight/Height ratio: Ratio of weight in lbs. to height in inches.
Mom alive: Dichotomous variable indicating whether the mother is still living or not.
Mom died young: Dichotomous indicator of premature death. We used the 1991 life tables combined with the mother's birth year to determine life expectancy.
Mom needs help: Dichotomous indicator of mom's health (if alive – is she dependent).
Mom sick prior to death: Dichotomous variable indicating an illness in the three months prior to death.
Dad alive: Dichotomous variable indicating whether the father is still living or not.
Dad needs help: Dichotomous indicator of dad's health (if alive = is he dependent).
Dad sick prior to death: Dichotomous variable indicating an illness in the three months prior to death.
# of children: Number of children whether in household or not.
Age: Respondent's current age.

Appendix 3: OLS Estimates of Health on Expected Retirement, Using Multiple Health Measures[2]

Health Variables	Model 1	Model 2
Objective Measures		
Health Counts	-0.11 (0.05)	
ADL/IADL/FL		-0.73 (0.35)
Subjective Measures		
Limitations	-1.81 (0.41)	
Overall Poor Health		-0.77 (0.38)

All of these are statistically significant at the 5% level.
Standard Errors are in parenthesis.

[2] There are 11 different possible combinations of these 4 health variables. While we ran all of these combinations, including a model with all four, we only report results for the two cases where the variables are not substitutes, ie where there is an independent contribution by more than 1 health measure.