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**DO THE SICK RETIRE EARLY?
CHRONIC ILLNESS, ASSET ACCUMULATION,
AND EARLY RETIREMENT**

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ABSTRACT

Our objective is to determine how chronic illness affects asset accumulation and retirement. Previous studies have found that poor health leads to early retirement, but those studies failed to look at the indirect impact of chronic illness on retirement. Using data from the Health and Retirement Study, we define an illness as chronic if the individual reports having asthma, cancer, heart disease, stroke, or diabetes for four or more years. We first estimate how a chronic illness influences asset accumulation. We then estimate how asset accumulation and current poor health influence retirement. We observe that the vast majority of the chronically ill population do not report their general health to be poor nor do they report functional limitations in activities of daily living. Nevertheless, our results indicate that chronic illness leads these people to accumulate fewer assets during their working years and consequently retire later. Neither researchers nor policy-makers discussing the many critical issues surrounding illness and retirement have addressed this issue.

INTRODUCTION

In this paper, we report the findings of our investigation of the connection between chronic illness, asset accumulation, and retirement behavior. The economics literature contains many studies examining the impact of asset income and health status on retirement behavior. However, this literature has not addressed the relationship between chronic illness and asset accumulation and the joint impact of these factors on retirement.

Chronic illness refers to illness that persists for several years. As the population ages, the effects of chronic illnesses on retirement decisions are of increasing importance. Many chronic illnesses, such as diabetes, may not be as debilitating as more acute illnesses that often afflict individuals nearing retirement age. Nevertheless, chronic illnesses that individuals must accommodate throughout several years of their working lives can have a significant impact on the retirement decision, although the impact may differ from that of a short-term illness occurring just prior to retirement. As such, the effects of chronic illness may call for alternative policy responses.

The individual's decision to retire will depend upon many factors: the wage rate, asset income, pension income, social security, and health status. Other things equal, poor current health is expected to raise the probability of retirement. However, in our research we consider the full effects of chronic (long-term) illness: A person with a chronic illness throughout his or her working life may have had reduced earnings during his/her career and may have built a smaller portfolio of assets than a healthy person. Because this leads to lower asset income in retirement, the person with a chronic illness has an incentive in later life to stay in the labor force rather than retire. In contrast, a working person who suffers the onset of a disabling disease toward the end of his/her career has had more opportunity to build a larger portfolio of retirement assets than his/her chronically ill counterpart and may retire from the labor force earlier, other things equal. Both individuals have poor health at retirement age, which increases the probability of

retirement, other things equal. However, the individual with long-term illness will have lower expected asset income, which decreases the probability of retirement. Thus, chronic illness may have two opposing effects on labor supply. In our empirical research, we use data from the Health and Retirement Study to estimate the net impact of these opposing effects on retirement. We find that chronic illness reduces asset accumulation for both men and women, and this is sufficiently important to reduce the probability of retirement for men.

LITERATURE REVIEW

Three areas of economic research are pertinent to this study. These studies focus on the relationship between health and retirement behavior, between health and wealth, and between chronic illness and health insurance. We begin by reviewing several studies of retirement behavior that examined the impact of poor health on the retirement decision. Two older studies that are relevant to this research are by Boskin (1977) and Quinn (1977).¹ Boskin (1977) found that the impact of asset income on retirement was much smaller than the Social Security effect and the effect of poor health was insignificant. Quinn (1977) found a large joint effect of Social Security and pension eligibility. When Social Security and pension eligibility were considered together, the probability of labor force participation decreased 26 percentage points. Quinn also found asset income to be an important determinant of retirement. Unlike Boskin (1977), Quinn (1977) found that the presence of a health limitation reduced the probability of labor force participation 20 percentage points.

In most empirical research, poor health and early retirement are positively associated. In an early study, Parsons (1982) used data from the National Longitudinal Surveys (NLS) and found that the larger the social security benefits for which older men were eligible, the more likely that they would declare

¹ Other studies of retirement include Reno (1971), Burkhauser (1979), Burtless (1986, 1987), Moffitt (1984, 1987), Burtless and Moffitt (1984, 1985, 1986), Butler et al. (1989), and Gustman and Juster (1995).

themselves as having poor health. This indicates that the declared health status and retirement status may be simultaneously determined. If this is the case, then in a retirement equation the coefficient of subjective health status might reflect both the legitimate effect of health and the financial incentives embedded in the retirement income programs. By using an objective measure of health (subsequent mortality), Parsons found a stronger effect of social security on retirement that clearly isolated the work disincentive effect of the Social Security replacement ratio (potential benefit relative to market wage) on retirement. This work disincentive effect of the Social Security replacement ratio was not easily perceived when self-rated health status was used as the health index in Parson's model.

Anderson and Burkhauser (1985) have pointed out that self-declared health status may be simultaneously determined with retirement status and that this self-declared health status is actually an endogenous variable. If this is the case, then in a single-equation labor supply model, the coefficient of the self-declared health status variable would be biased. Stern (1989) has rigorously tested this hypothesis, although his study sample is of limited relevance here because older workers were not included in his sample. Examining labor force participation and reported disability in a system of simultaneous equations, Stern used symptoms and diseases as instruments to reflect the underlying index of true health status. He did not find the health status variable to be endogenous and also concluded that there was very little bias in other coefficients in the equations. Thus, Stern found that the traditional disability measures of health status are reliable predictors of labor force participation.

Sickles and Taubman (1986), using data from the Retirement History Survey (RHS), report that the probability of retirement decreases if there is income gain from delaying retirement. Although this was their primary finding, they also report that better health decreases the probability of retirement.

Two studies examine disability status as a path to retirement. Riphahn (1997) compares two pathways into retirement: 1) unemployment to early retirement and 2) disability to early retirement. The

author finds in her analyses of the German Socio-Economic Panel that the probability of disability to early retirement rises due to poor health status. In contrast, the probability of unemployment to early retirement falls with poor health status. These differential effects and others lead Riphahn to conclude that the two pathways to retirement are not substitutes.

Dahl et al. (2000) also finds no conclusive evidence that disability and unemployment are substitute pathways to early retirement for men or women. Using Norwegian data for their analyses, the authors report that the effect of local unemployment on unemployment retirement is more pronounced for men than women and that the effect of disability on disability retirement is stronger for women than men.

McGarry (2002) examines the relative importance of health and financial variables. She finds that subjective reports of health status are significant determinants of retirement. Further, she reports that changes in retirement expectations are due more to changes in health than to changes in income or wealth. However, McGarry does not delineate between current illness and chronic illness.

A recent contribution to the retirement literature that addresses chronic illness is Wilson (2001). Using 1991 data describing a large sample of New Jersey households, Wilson reports “chronic disease striking in adulthood explains about 10% of total non-employment in the New Jersey among those aged 35 – 74.”² In examining several chronic conditions, Wilson finds wide variation in employment impacts, but stresses the importance of comorbid illnesses in explaining the lower probability of employment among individuals with multiple conditions. Rather than focusing on the reasons for exit from the labor force, we examine the retirement decisions of individuals who are in the workforce despite a chronic illness, but who may have lower savings because of their illness. As a result, these individuals may actually have higher labor force participation rates in their peri-retirement years because of the effects of their chronic health problems.

² Wilson (2001), page 1139.

Finally, a study closely related to our research is that of Bound et al. (1999). Using longitudinal data from the Health and Retirement Study (HRS), the authors examine the dynamic relationship between health shocks and labor force exit, job change, and application for disability insurance. Regarding labor force exit, the authors find that a health shock in the current period increases the probability of exiting the labor force, while a health shock occurring in an earlier period decreases the probability of exiting the labor force, other things equal.

Our research complements the findings of Bound et al. (1999). Using retrospective information in the Health and Retirement Study data, we examine two kinds of health problems: chronic health problems (which prevail throughout many years of a person's working life) and recent health problems (which occur only toward the end of a person's career). We investigate the differential effects on asset accumulation of these different kinds of health problems and the ramifications of the differential levels of asset accumulation on retirement decisions. While Bound et al. (1999) examined recent and lagged health shocks using the HRS data, their indicators of lagged health shocks are not comparable to our measures of chronic illness. Further, given the small lag period possible for the three years of the HRS, they were not able to examine the differential effects on asset accumulation of health problems of different duration. Our research using retrospective HRS information permits us to make a unique contribution to this literature by uncovering the differential effects of chronic and recent health problems on asset accumulation and retirement decisions.

Turning to the relationship between health and wealth, it can be noted first that the correlation between poor health and reduced wealth is well established in the health economics literature.³ Among working age individuals, it is often posited that low earnings and/or wealth leads to a reduced level of health inputs.⁴ However, it is also acknowledged that there is likely to be a simultaneous relationship between health and wealth. Not only may low earnings lead to less medical care and other health inputs and

³ See discussion in Ettner (1996) and Attanasio and Emmerson (2003).

thereby result in poorer health, but poor health may lead to reduced earnings because of its impact on labor supply.

A recent contribution to this literature that is especially relevant here is research by Salas (2002) which examines the relationship between poor health and socioeconomic status among older individuals. The author reports that among older individuals, researchers have reported conflicting findings regarding the relationship between low socioeconomic status and poor health. Salas' findings suggest that the discrepancies among research findings are largely due to differences in the measures of health status used across studies. Although we do not examine this issue, it is pertinent to our research because similar differences may occur among workers in our study sample.

Finally, we consider the connection between chronic illness, health insurance coverage, and retirement. Because of the need for health insurance among chronically ill persons, the availability of employer-provided health insurance may potentially have a strong impact on the retirement decision. Gruber and Madrian (1995) and Rogowski and Karoly (2000) address the connection between employer-provided health insurance and retirement in the general population. Using data for workers of 55 to 64 years of age from the Current Population Survey and the Survey of Income and Program Participation (SIPP), Gruber and Madrian examine the effects of government mandates ensuring the availability of continuing health insurance coverage following job separation. Analyses of both data sets yield similar results: One year of continuation coverage raises the probability of retirement by over 32 percent. Rogowski and Karoly (2000) use three panels of SIPP data to examine the effect of the availability of employer provided post-retirement health insurance on retirement. The authors find that "the availability of retiree health benefits increases the baseline probability of retiring by 50%" among men aged 55 to 62. Thus, both studies indicate that the decision to retire is strongly tied to the availability of post-retirement

⁴ See Ettner (1996) for a discussion of this literature.

health insurance.

Two recent studies permit us to relate the above results to chronic illness. Stroupe et al. (2000), using data for individuals residing in Indiana, finds that the presence of chronic illness lowered the probability of adequate health insurance coverage by about ten percentage points. The authors point out that an exclusion of coverage for permanent preexisting conditions is the primary barrier to adequate coverage. Although such exclusions for preexisting conditions are prohibited under the Health Insurance Portability and Accountability Act (HIPPA), the authors suggest that better enforcement of HIPPA is needed.

Stroupe et al. (2001) examines whether chronically ill workers are locked in their current jobs because of their need for employer-provided health insurance. Employing Cox proportional hazard models to data collected on workers in Indiana, the authors find that women are more frequently locked into their jobs than men. Their results indicate that the presence of a chronic illness or chronically ill family member decreases the probability of voluntary job quit by about 83 percent among women who rely on their employers for health insurance coverage. Among men who rely on their employers for health insurance coverage, the presence of a chronic illness or chronically ill family member decreases the probability of voluntary job quit by only 41 percent.

The research reported in the above articles suggests that health insurance is an important determinant of the retirement decision and that it is especially important for individuals with chronic illness. Unfortunately, because we are unable to ascertain the pre-retirement health insurance status of retirees, we are unable to address this issue in our research.

THEORETICAL MODEL

Because we empirically examine the impact of illness on asset accumulation during working years

and labor supply in later years, we use a two-period theoretical model. The first period represents prime working years and the second period represents later years when the worker nears retirement age.⁵ The two-period model allows us to consider the direct impact of chronic illness on asset accumulation in the first period and the direct impact of (chronic or recent) illness and accumulated assets on the retirement decision in the second period. If the individual has chronic illness in the first period, this decreases his or her ability to earn and save for retirement. This person continues to suffer from an illness in the second period, which increases the probability of retirement, other things equal. However, the reduction in saved assets lowers the probability of retirement in the second period, other things equal. In comparison, we expect the earnings and asset accumulation of a person who was healthy during the first period to be greater. If this person is ill in the second period, the probability of retirement is increased, other things equal. We expect to observe a higher overall probability of retirement, other things equal, for this person than for a person with a chronic illness because retirement savings are not reduced by a lower capacity for earning and saving over the working life.

Time allocation models are commonly used in labor economics to explain labor supply decisions. We assume that the individual has utility function,

$$(1) \quad U = U(C_1, L_1, H_1, C_2, L_2, H_2) ,$$

where C_1 is the amount of market goods and L_1 is the hours of leisure time the individual consumes in period one. H_1 is the individual's health status in period one. Similarly, C_2 is the amount of market goods, L_2 is the hours of leisure time the individual consumes, and H_2 is the individual's health status in period two. The individual maximizes his/her utility subject to the budget and time constraints:

$$(2) \quad Z_1 = W_1 S_1 + V_1 - P_{C1} C_1 ;$$

$$(3) \quad Z_2 = (1+r) Z_1 + (W_2 S_2 + V_2 - P_{C2} C_2) ; \text{ and}$$

$$(4) \quad T_i = L_i + S_i + \Pi_i(H_i) , \quad \text{for } i = 1, 2 .$$

⁵ Conforming to the HRS data, this peri-retirement period begins at age 51.

In the above constraints, Z_1 is savings in the first period and W_1 , S_1 , V_1 , and P_{C1} are the period one wage rate, labor hours, unearned income, and prices of market goods and services, respectively. Similarly, Z_2 is savings in the second period and W_2 , S_2 , V_2 , and P_{C2} are the wage rate, labor hours, unearned income, and prices of market goods and services, respectively, in the second period. The individual's savings from period one (Z_1) are compounded in period 2 with interest rate r . Equation 4 represents the division of total time (T_i) into leisure time (L_i), labor time (S_i), and time spent producing health (Π_i). Time devoted to health production in period i depends upon the person's health status (H_i) in that period.

We examine the differential effects of long-term or chronic (both first and second period) illness and recent (second period only) illness on the decision to retire. Better health status in period i is represented by a higher value of H_i , which implies both higher utility and less time required for health production: $\partial\Pi_i/\partial H_i < 0$. The individual's health status each period is assumed to be exogenously determined. However, the individual chooses the amount of time that he or she invests in curative health production each period.

In the context of this model, we derive $\partial S_2/\partial H_1$ and $\partial S_2/\partial H_2$, which express the impact of health on labor supply (i.e., retirement) in the second period. Expressions for these partial derivatives can be obtained by solving a constrained utility-maximization problem. Rewriting equation 4 as $L_i = T_i - S_i - \Pi_i(H_i)$ and substituting this in the utility function yields the following Lagrangian equation:

$$(5) \quad \begin{aligned} \mathcal{L} = & U[C_1, \{T_1 - S_1 - \Pi_1(H_1)\}, H_1, C_2, \{T_2 - S_2 - \Pi_2(H_2)\}, H_2] \\ & + \lambda_1[Z_1 - W_1 S_1 - V_1 + P_{C1} C_1] \\ & + \lambda_2[Z_2 - (1+r) Z_1 - W_2 S_2 - V_2 + P_{C2} C_2]. \end{aligned}$$

The choice variables are C_1 , S_1 , C_2 , and S_2 .

For the second period, the first order conditions (with respect to C_2 , S_2 , and λ_2) are:

$$(6.a) \quad \partial\mathcal{L}/\partial C_2 = U_{C2}[C_1, \{T_1 - S_1 - \Pi_1(H_1)\}, H_1, C_2, \{T_2 - S_2 - \Pi_2(H_2)\}, H_2] + \lambda_2 P_{C2} = 0,$$

$$(6.b) \quad \partial\mathcal{L}/\partial S_2 = -U_{S2}[C_1, \{T_1 - S_1 - \Pi_1(H_1)\}, H_1, C_2, \{T_2 - S_2 - \Pi_2(H_2)\}, H_2] - \lambda_2 W_2 = 0,$$

and

$$(6.c) \quad \partial \mathcal{L} / \partial \lambda_2 = \mathbf{Z}_2 - (1+r)\mathbf{Z}_1 - \mathbf{W}_2\mathbf{S}_2 - \mathbf{V}_2 + \mathbf{P}_{C2}\mathbf{C}_2 = \mathbf{0}.$$

To examine the effects of illness in period 2 on labor supply in period 2, we use these conditions to analyze the effect of illness on labor supply. Totally differentiating the conditions and assuming $dC_1 = dS_1 = d\Pi_1 = 0$, we find $\partial S_2 / \partial H_2 > 0$ under plausible conditions.⁶ Thus, we state our first hypothesis that we will empirically test:

H1: Other things equal, illness in period 2 increases the probability of retirement.

We also need to consider the impact of illness in period 1 on labor supply in period 2. This will permit us to compare the impact of long-term illness (poor health in both periods) on retirement ($\partial S_2 / \partial H_1 + \partial S_2 / \partial H_2$) to the impact of recent illness (poor health in period 2 only) on retirement ($\partial S_2 / \partial H_2$ only). Illness in period 1 will not have a direct effect on labor supply in period 2, but will have an indirect impact through savings in period 1. Illness in period 1 implies that more hours are needed for health production. Assuming $(\partial S_1 / \partial \Pi_1) < 0$,⁷ both market labor time in period 1 and labor earnings are decreased. Assuming that period 1 savings fall, the individual has less savings accumulated in period 2, which increases labor supply in period 2 and reduces the probability of retirement. Thus, we have

$$(7) \quad \partial S_2 / \partial H_1 = (\partial S_2 / \partial Z_1)(\partial Z_1 / \partial S_1)(\partial S_1 / \partial \Pi_1)(\partial \Pi_1 / \partial H_1) < 0.$$

This condition is divided into two hypotheses that we empirically test. The first addresses the effect of illness during period 1 on savings:

H2: Other things equal, $(\partial Z_1 / \partial S_1)(\partial S_1 / \partial \Pi_1)(\partial \Pi_1 / \partial H_1) > 0$, such that illness in period 1 implies lower savings during period 1.

Our second addresses the effect of lower assets on labor supply in period 2:

⁶ If an improvement in health or additional time spent in health production decreases both the marginal disutility of work and the marginal utility of consumption, then $\partial S_2 / \partial H_2 > 0$.

⁷ This assumption is similar to the effect of poor health on labor supply in period 2 that was posited in hypothesis H1.

H3: Other things equal, $\partial S_2 / \partial Z_1 < 0$, such that lower savings implies a lower probability of retirement in period 2.

The following section describes the data used in our empirical tests of the three hypotheses.

DATA

Our analysis uses data from the Health and Retirement Study (HRS). The HRS is a nationally representative survey intended to provide information describing the connections between health status and retirement decisions. Wave 1 was conducted in face-to-face interviews in the respondents' homes in 1992 for the 1931-41 birth cohort and their spouses (if married). The Wave 1 sample included over 12,600 persons in over 7,600 households.

Because we estimate the impact of chronic illness on the retirement decision, we limit the study sample to individuals who are active in the labor market or have been active in the labor market in recent years. To this end, we limit our study sample to individuals between 51 and 61 years of age who are working for pay, have worked for pay at some time during the past ten years, or are retired from paid employment. We exclude self-employed people, persons who receive Social Security Disability Insurance (SSDI) or Supplemental Security Income (SSI) because of a disability, because these individuals are not facing a retirement decision.

Finally, we drop observations of persons for whom we have incomplete information. An important component of the Wave 1 data from the HRS is the availability of confidential information describing the present value of Social Security and pension income were the person to retire at the time of the interview. However, this information is not available for all survey respondents and therefore limits inclusion in the study sample. However, all analyses are performed using the appropriate person weights (provided by HRS) for observations with pension and Social Security data. After all exclusions, our final study sample contains observations of 3146 people.

Because we focus on the retirement decision, we exclude from the study sample individuals who have not worked for pay within the preceding 10 years. As noted above, we also exclude self-employed persons and persons receiving SSI or SSDI. Because of these exclusions we expect the study sample to comprise a group that is healthier, on average, than would be the case if we studied all survey respondents between 51 and 61 years of age. Columns (1) and (2) of Table 1 display means and percentages comparing the two respondent groups. Approximately 16 percent of the study sample reported chronic illness (of at least four years duration), while over 25 percent of excluded survey respondents in the same age range reported chronic illness. Respondents in the non-working excluded group were much more likely to indicate that they had poor health (19.8% vs. only 3.2% for the study sample). Similarly, persons in the excluded group had a higher average number of functional limitations (1.51) than persons in our study sample (.35). However, despite the apparently consistent differences in the values reported for the two groups, none of the differences are statistically significant (one-tailed tests for $\alpha=.05$) because the sample variances of these variables are large.

To directly observe whether individuals with chronic illness who are in or retired from the labor force differ significantly from chronically ill individuals who have not worked for at least ten years, we compare characteristics of these groups in columns (3) and (4) of Table 1. Again, this comparison suggests that there may be important differences between chronically ill individuals who have not worked in at least ten years and those included in our study sample. Persons in the former group appear to have poorer health, more functional limitations, and fewer accumulated assets. We again find, however, that the differences between the two groups are not statistically significant (one-tailed tests for $\alpha=.05$).

Although the differences in the unconditioned values reported in Table 1 are not statistically significant, it is possible that when other characteristics are controlled for in a multivariate analysis these differences will lead to sample selection bias in our estimates. For this reason, it is important that our results be

understood to be pertinent only for the population of chronically ill persons who have worked within the last ten years and not to all chronically ill persons in the United States population. To the extent that their chronic illnesses have led them to leave the workforce before 41 years of age, our estimates will understate the impact of chronic illness on retirement behavior. As such, the results presented in this paper are conservative estimates of the impact of chronic illness on retirement behavior.⁸

EMPIRICAL MODEL

Our empirical analysis consists of two equations. The first is an equation explaining variation in total assets across respondents. The second equation is a probit equation of retirement status. To examine asset accumulation, we run a lognormal regression in which log of total assets is the dependent variable. We use the logged value of assets because the distribution of total assets is skewed with a tail to the right (larger values).

The explanatory variables in our analysis of total assets include indicators of chronic illness, functional limitations, income, marital status, number of dependents, race, education, gender, and age. CHRONIC is a dummy variable with a value of 1 if the individual has asthma or has had cancer, heart disease, stroke, or diabetes for four or more years, and 0 otherwise.⁹ Further, we include the interaction between the indicator variables and the sum of health limitations to assess the possible interaction between chronic illness and functional limitations.

Income is represented by work income and spouse's income. The respondent's work income is the

⁸ We are not able to assess the possibility of sample selection in our multivariate analysis because our regression and probit analyses require information on the present value of social security and pension income that is unavailable for persons excluded from the study sample.

⁹ To evaluate what length of time most accurately represents a "long-term" illness, we examined two additional specifications of CHRONIC in which the number of years for which the person has had the chronic condition was increased to 'six or more' and 'nine or more'. The results were qualitatively similar to those reported in this paper, although due to the reduction in the number of persons with chronic conditions, the statistical significance of the variable is reduced. In addition to using the number of years since onset to define which illnesses are chronic, we were advised by a physician about diseases that are inherently chronic.

opportunity cost of retirement. Work income is represented by the respondent's earnings from his or her current job if still working or the last job if retired.¹⁰

All variables used in our empirical analyses are defined in Table 2. The following reduced form equation represents the relationship between asset levels and the above factors:

$$\begin{aligned}
 (8) \quad \text{Log (ASSETS)} &= \alpha_0 + \alpha_1 (\text{AGE}) + \alpha_2 (\text{AGE SQUARED}) \\
 &+ \alpha_3 (\text{EDUCATION}) + \alpha_4 (\text{MARRIED}) + \alpha_5 (\text{WHITE}) \\
 &+ \alpha_6 (\text{MALE}) + \alpha_7 (\text{DEPENDENTS}) + \alpha_8 (\text{WORK INCOME}) \\
 &+ \alpha_9 (\text{SPS INCOME}) + \alpha_{10} (\text{CHRONIC}) + \alpha_{11} (\text{LIMIT}) \\
 &+ \alpha_{12} (\text{CHRONIC*LIMIT}) + \varepsilon_1 .
 \end{aligned}$$

In our empirical analyses we estimate three specifications of equation (8). We include the number of functional limitations (LIMIT) in two of these specifications to represent the severity of the respondent's illness. The number of functional limitations indicates a respondent's difficulty in performing activities of daily living (ADLs). We expect the net effect of LIMIT to be negative because a person who has many health limitations will not be able to work as much as he/she would like to and as a result may have fewer assets accumulated, other things equal. For specifications including functional limitations, we assume that the number of limitations prior to age 51 is correlated with the number reported in the survey, so that LIMIT will proxy for the presence of functional limitations during prior working years when asset accumulation occurred.

Hypothesis 2 of our theoretical model implies that a person with chronic illness will have less asset accumulation than healthy workers, other things equal. Restating Hypothesis 2 in terms of our empirical model (assuming LIMIT=0):

Hypothesis 2E: Other things equal, chronic illness will reduce the value of accumulated assets ($\alpha_{10} < 0$).

¹⁰ Using current earnings for retirees would introduce simultaneity between earnings and retirement status. However, the availability of pre-retirement earnings data in the Health and Retirement Study allows us to avoid this problem.

For values of $LIMIT > 0$, the net impact of chronic illness will be evaluated as $(\alpha_{10} + \alpha_{12} LIMIT^{AVE})$, where $LIMIT^{AVE}$ is the average value of $LIMIT$ for the sample.

The signs of α_8 and α_9 are expected to be positive because people with higher income are more likely to accumulate more assets, other things equal. Marital status is expected to have a positive coefficient (α_4) because a married couple has an incentive to accumulate more assets for retirement than an unmarried person, other things equal. The sign of α_7 is expected to be negative, because the larger the number of dependents a person has, the fewer available resources a person will have for asset accumulation, other things equal.

Race and gender are included as control variables. These variables may capture the effects of discrimination as well as effects of time allocation choices regarding fertility and child rearing. Other explanatory variables, such as education and age, can also be expected to influence asset accumulation. We expect the signs of both α_3 and α_1 to be positive. A more educated person will have a lower cost of acquiring investment knowledge, implying that such a person will have accumulated more assets than his/her less educated counterpart, other things equal. If we only consider pre-retirement age, an older person is likely to have higher asset accumulation than his/her younger counterpart, other things equal, because the older person has had more years over which to save. However, after retirement an individual is likely to "spend down" his or her assets. To capture this potentially non-linear effect, we have included the squared value of age as an explanatory variable. For this reason, the expected sign of α_2 is negative, other things equal.

In our second analysis, we estimate a probit equation in which the dependent variable is a dummy variable indicating retirement status ($RET=1$ if the person is retired, $RET=0$ if the person is still working). The independent variables include socio-economic demographic factors such as gender, race, age, marital

status, education, and income. Other independent variables are current self-reported health status (POOR), the number of functional limitations (LIMIT), and total assets. We have the following equation:

$$\begin{aligned}
 \text{(9) } \text{RET} = & \beta_0 + \beta_1 (\text{AGE}) + \beta_2 (\text{AGE SQUARED}) + \beta_3 (\text{EDUCATION}) \\
 & + \beta_4 (\text{MARRIED}) + \beta_5 (\text{WHITE}) + \beta_6 (\text{MALE}) + \beta_7 (\text{DEPENDENTS}) \\
 & + \beta_8 (\text{WORK INCOME}) + \beta_9 (\text{SPS INCOME}) + \beta_{10} (\text{ASSETS}) \\
 & + \beta_{11} (\text{ASSETS SQUARED}) + \beta_{12} (\text{POOR}) + \beta_{13} (\text{LIMIT}) \\
 & + \beta_{14} (\text{POOR*LIMIT}) + \varepsilon_2 .
 \end{aligned}$$

Although economic theory does not predict the signs of the race and gender variables, we have again included these variables to control for cultural effects. The coefficient of the age variable is expected to be positive, because as a person gets older his/her probability of retirement increases, other things equal. If a person is married, he/she is more likely to retire than his/her unmarried counterpart, because a married couple is more likely to have joint retirement plans, other things equal. Thus, we expect the sign of β_4 to be positive. We expect β_3 to be negative, because a person with higher education may retire later (other things equal). This may occur because the more highly educated person has a position with more non-wage amenities or may have a stronger preference for work, other things equal.

Income is again represented by the respondent's work income and spouse's income. Work income (the respondent's earnings on the current or last job) represents the opportunity cost of retirement. The signs of the coefficients of work income and spouse's income are not predictable (other things equal), because of the income and substitution effects have opposing effects. For work income, the substitution effect implies that the larger the earnings (per year), the higher the opportunity cost of leisure, and therefore the more costly is retirement. Thus, a person with higher work income will have a lower probability of retirement, other things equal. The income effect implies that a person with higher income will demand more leisure (assuming that leisure is a normal good) and as a result will have a higher probability of retirement, other things equal. The net effect of work income on the decision to retire is

uncertain.

Spouse's income will also have substitution and income effects. The income effect of higher spouse income on the respondent's labor supply is similar to that for the respondent's work income. Higher income will increase the demand for leisure, thereby increasing the probability of retirement, other things equal. The substitution effect of an increase in spouse's income will reduce the probability of the spouse retiring, other things equal. If the leisure times of the respondent and the spouse are complements, the substitution effect will reduce the respondent's probability of retiring, other things equal. If their leisure times are substitutes, the substitution effect will increase the probability of retirement for the respondent, other things equal. The net effect of spouse's income on the respondent's retirement decision is not predicted by theory.

Coefficient β_{10} is expected to be positive because a person with a higher value of accumulated assets has a higher probability of retirement, other things equal. This is represented by our next empirical hypothesis:

Hypothesis 3E: Other things equal, a higher value of assets will increase the probability of retirement ($\beta_{10} > 0$).

We have included the squared value of assets as well to allow for nonlinear effects of assets on retirement. Although we expect higher asset levels to be associated with a higher probability of retirement, other things equal, the marginal impact of higher assets may decline after a threshold level is obtained. In our first analysis of retirement, we report estimates for specifications in which assets are treated exogenously. However, because asset levels observed for the study sample may be affected by retirement status, we also report coefficient estimates for specifications of the probit analysis in which assets are treated endogenously.

The sign of β_{12} is expected to be negative because poor current health will increase the cost of

working, leading to earlier retirement, other things equal. The sign of β_{13} is expected to be negative because the larger the number of health limitations the higher is the probability that a person will retire earlier, other things equal. If illness and limitations have a super-additive effect on retirement that causes the probability of retirement to rise more than the sum of their independent effects, β_{14} will also be negative. However, our theory does not predict the sign of this effect, if any. This leads to our final empirical hypothesis:

Hypothesis 1E: Other things equal, illness increases the probability of retirement ($\beta_{12} > 0, \beta_{13} > 0$).

Ideally, we would include explanatory variables representing the availability and depth of coverage of health insurance before and after retirement in our analysis of retirement. Although the HRS includes excellent information describing sources of income available to current workers if they were to retire, it does not provide information describing the health insurance options facing workers if they were to retire. Consequently, we are unable to include this information in our analysis. There is potential for bias in our results due to this omission. If, compared to healthy workers, workers with chronic health problems have made career accommodations that cause them to have a higher probability of working for employers who do not offer health insurance to retirees, this would decrease the probability of retirement for this group. Conversely, we might expect workers with chronic health conditions to self-select into firms that offer more generous health insurance benefits, including those to retirees. In this case, we would observe an increased the probability of retirement for this group, other things equal.

While we cannot directly observe the health insurance status of individuals in the study sample, we can examine the effect of chronic illness on the probability of retirement while holding constant *current* health status, asset values, and other determinants of retirement. Theoretically, we do not expect a direct effect of *chronic illness* on retirement because current labor supply decisions are based only upon current

health (represented by the CURRENT POOR and LIMITATIONS variables). Nevertheless, to test for the selection bias discussed above, in our empirical analysis we examine whether there is also a statistically significant direct effect of chronic illness on retirement by including CHRONIC in the probit analysis. Again, CHRONIC is a dummy variable with a value of 1 if the individual has asthma or has had cancer, heart disease, stroke, or diabetes for four or more years, and 0 otherwise.¹¹

Finally, it is possible that asset levels and retirement status are endogenously determined in the cross-sectional data used in this study. For example, while assets clearly affect the decision to retire, the process of spending down assets during retirement years may lead us to observe reversed causality. We test for endogeneity between assets and retirement and use the appropriate estimation methods indicated by the results of these tests. These are reported in the following section.

RESULTS

Table 2 contains the definitions and means (by gender) for the variables used in the analysis. Overall, 11 percent of the individuals in the study sample are retired (12 percent of the men and 10 percent of the women). Although 79 percent of all respondents are married, there is a large gender difference in marital status. While 84 percent of male respondents are married, only 71 percent of female respondents are married. This difference may reflect the average age of the study sample (55.7 years). On average, men die at younger ages than women, leaving more single women in the age range of the study sample. In addition, our selection of respondents with work experience is likely to have excluded many married female respondents in this age cohort. This is consistent with the relatively large percentage of men (59.5%) in the study sample.

The percentage of white respondents is similar for both genders, although there is a slightly

¹¹ Again, we also examined two specifications of CHRONIC in which the number of years for which the person has had the chronic condition was increased to 'six or more' and 'nine or more'. Once again, the results were qualitatively similar to those

smaller percentage of white women (84%) than white men (88%). This may reflect the higher labor force participation rate among nonwhite women (especially black women) in the United States.

The mean educational attainment of the sample is 13.3 years of schooling. Approximately 5% of the sample had only primary level education (less than nine years of education), 47% completed high school, 33% completed college, and 15% of the sample had post-graduate education. These levels of educational attainment are reasonable for the age range of individuals in the study sample.

In the HRS questionnaire, respondents are asked if their (self-assessed) health is excellent, very good, good, fair, or poor. Twenty-eight percent of the respondents in the sample report having excellent health, while only 3% of the respondents indicate they have poor health. The average number of functional limitations is 0.35. Sixteen percent of respondents in the sample have had a chronic health problem for at least four years.¹²

The percentages in Table 3 illustrate the effect of health status on retirement. The differences between retirees and non-retirees in the percentages reported for all of the health measures are statistically significant. Almost 10% of retirees report having poor health, while only 2.4% of non-retirees report having poor health. A larger percent of non-retirees (81.2%) report no limitations in performing activities of daily living than retirees (65.5%). The percentage of retirees with limitations, whether one or two or more than three, is significantly larger than that of non-retirees. Finally, while 18.7% of retirees report a CHRONIC health problem, only 15.8% of non-retirees report a similar chronic problem.

The findings reported in Table 3 illustrate that there are important differences between the retired and non-retired groups as to their current health status, ADL limitations, and chronic health status. It is notable that the largest differences between retirees and non-retirees are for current poor health

reported in this paper.

¹² Six percent of the respondents in the sample have had diabetes for four or more years, while 3% of the respondents have had cancer for at least four years. Another 2% of the respondents in the sample had a heart attack at least four years ago, or coronary heart disease or other heart problems for at least four years and 1% of respondents had a stroke at least four years

(CURRENT POOR=1) and the number of functional limitations (LIMIT). In contrast, the difference in the percentage of the two groups who report a chronic illness is relatively small. This suggests that many individuals with chronic illnesses continue to work despite their health impairment.

In the next section, we describe the results of our multivariate analyses. We examine the effects of the three measures of health status on the accumulation of assets and retirement status while controlling for confounding factors. The estimates reported in Tables 4 and 5 are from independent analyses of assets and retirement. We performed Smith-Blundell tests to determine whether assets and retirement should be treated endogenously in our analysis. The test statistics indicate that we cannot reject the assumption of exogeneity in the determination of assets and retirement.¹³

Asset Accumulation An individual's decision to retire is based, *inter alia*, on the level of retirement income available to him or her. In our analyses, we use the individual's total assets as a proxy for retirement income. In Table 4, we report estimates of the effects of factors that influence total assets. In our analyses, "assets" refers to the sum of accumulated private assets plus the present value of pension and Social Security benefits in retirement at the time of the interview.

The dependent variable in Table 4 is the log of total assets of the individual. The coefficient estimates for the socio-economic variables, with few exceptions, are statistically significant (for α values between .01 and .10). The two exceptions are the effects of dependents on men's assets and the effects of age on women's assets. As expected, older male respondents report higher asset levels than younger respondents. However, the negative sign of the coefficient of the age-squared term indicates that the positive association between age and assets lessens with age, suggesting that after retirement an individual spends down his or her assets. The values of the coefficients indicate that for men in the study

ago. Five percent 5% of respondents had asthma at the time of the survey.

¹³ The Smith-Blundell chi-square value for the fullest specification for men is .013 (Smith & Blundell (1986)). With one degree of freedom, this yields a p-value of .91, leading us to reject endogeneity. Similarly, the chi-square value for women is .08. With one degree of freedom, this yields a p-value of .78, leading us to again reject endogeneity.

sample, 'spending down' begins at 52 years of age. In contrast, the (statistically insignificant) values for women's coefficients indicate that 'spending down' does not begin until age 70.

Respondents of both genders who are married report greater asset levels than their single counterparts, other things equal. Notably, the estimated effect for women is more than twice that for men. Race appears to have a stronger effect for men, although for respondents of both genders, being white is positively associated with assets. Having dependents has differing effects on men and women. Among men, the number of dependents is positively associated with assets, while among women, the number of dependents is negatively associated with assets, other things equal.

For both men and women, asset levels increase with educational attainment, other things equal. As expected, for both men and women higher earnings of both the respondent and his or her spouse (at or before retirement) are associated with higher asset levels, other things equal. However, the impact of spouse's earnings on asset levels is larger for women than for men.

Finally, we consider the effects of CHRONIC, LIMIT, and the interaction of CHRONIC and LIMIT. We do not include our measure of *current* poor health (CURRENT POOR) in the regression analysis of assets because the value of assets depends upon health status during the period of accumulation.¹⁴ The negative coefficient of CHRONIC implies that a person with a chronic illness accumulates fewer assets, other things equal. The LIMIT variable (representing the number of functional limitations in performing activities of daily living) is also statistically significant in all the regression results of Table 4. The negative coefficient of the LIMIT variable indicates that a person with more health limitations accumulates fewer assets, other things equal. For men with both chronic illness (CHRONIC=1) and at least one functional limitation (LIMIT \geq 1), half of the net effect of these two aspects of health is offset by the positive coefficient of the interaction of CHRONIC and LIMIT. Among women, however, the interaction of CHRONIC and

¹⁴ Adding current poor health to the explanatory variables does not change the effects of CHRONIC or LIMIT on asset

LIMIT is negative, such that the net effect of these two aspects of health is increased by the interaction effect. In general, we can conclude that the coefficient estimates in Table 4 indicate that both the *chronicity* of illness and the *severity* of the illness influence asset accumulation. These findings support Hypothesis 2E: Other things equal, poor health implies lower savings for retirement. The impact of these effects on asset levels and their influence on the retirement decision will be examined after our discussion of Table 5.

Retirement In Table 5, we report the marginal effects of the explanatory variables on the probability of retirement for men and women. Although all the respondents in our sample are (or were) active in the labor market, we conduct separate analyses by gender because the typical labor market histories of men and women in this age group differ importantly. In addition, among individuals in this age cohort there are likely to be differences in health status by gender that may impact retirement decision-making.

Table 5 reports the marginal effects of the determinants of retirement for men and women. For both men and women the marginal effect of AGE is negative and the marginal effect of AGESQ is positive. None of these marginal effects are statistically significant, even for $\alpha=.15$. Although we generally expect the probability of retirement to rise with age, a negative effect is not surprising for individuals in our study sample because the sample is restricted to workers approaching the age at which pension and Social Security eligibility accrue. It is likely that, after controlling for the other factors that influence the retirement decision, the negative effect of age for individuals between 51 and 61 years old reflects the inducement to stay in the workforce until pensions and Social Security benefits become available (at ages 62 and 65). To investigate this, we estimated the effects of AGE and AGE SQUARED on retirement excluding all other explanatory variables. For both men and women, we found that AGE is positively related to the probability of retirement and AGE SQUARED is negatively related to the probability of retirement. Thus, it appears

that the simple correlation between AGE and the probability of retirement is positive. These results are consistent with our conjecture that we are observing the effects of prolonged workforce attachment induced by the structure of pension plans and the Social Security program.

The marginal effect of education is positive but insignificant for both men and women, indicating that individuals with more schooling have a lower probability of retirement, other things equal. The marginal effect of being married is positive for both men and women, although the effect is larger for women (and statistically significant). This implies that a married woman is more likely to retire than her unmarried counterpart, other things equal. This may be the result of the desirability of sharing retirement years with a marital partner who is already retired or about to retire.¹⁵ Compared to other races, being white reduces the probability of retirement for both men and women. Other things equal, a man with more dependents is more likely to be retired from the workforce, but a woman is less likely to be retired.

The next group of variables describes the individual's earnings and assets. We find a positive marginal effect of earnings for both men and women, indicating that the higher a person's earnings while in the workforce the more likely that person is to retire, other things equal. This implies that the income effect of earnings on retirement dominates the substitution effect for individuals of both genders. The own income effect of earnings is much larger for women than men, implying that the retirement decision appears to be less sensitive to own earnings among men than among women. This may reflect the relatively stronger adherence of men to the workforce (on average). In contrast, it may be that among women, those with relatively high earnings have a stronger adherence to the workforce (similar to most men) and those with lower earnings have a weaker adherence to the workforce, resulting in a greater average sensitivity of retirement to earnings.

Other things equal, the retirement decisions of men and women appear to be more equally

¹⁵ Note that the signs of education and marital status are somewhat sensitive to whether ASSETS are treated endogenously.

influenced by the spouse's earnings, although the effect for women is larger than that for men. The negative effect, which indicates that the greater is the spouse's earnings, the less likely the individual is to be retired, is much larger than the effect of the respondent's own earnings for individuals of both genders.

The level of total assets has a small positive effect on retirement among men. This indicates that the probability of retirement rises with the level of total assets. The negative marginal effect of squared assets implies that the positive relationship between assets and the probability of retirement decreases with the level of assets. However, the maximum for men is not reached until assets equal \$5 million and the maximum for women is not reached until assets equal \$2.5 million. These asset levels lie above the 99th percentile in the respective distributions of assets for men and women in the study sample, so for the vast majority of men and women, higher levels of assets are associated with a higher probability of retirement. This result is consistent with Hypothesis 3E: Other things equal, lower savings implies a lower probability of retirement.

The large, positive, and statistically significant marginal effect of POOR for men means that current poor health increases the probability of retirement, other things equal. The small, positive marginal effect of the number of functional limitations for men indicates that a man with health limitations is somewhat more likely to retire, other things equal. However, for men in poor health and reporting a health limitation, the negative marginal effect of the interaction of POOR and LIMIT approximately offsets the effect of LIMIT. These findings are consistent with research findings discussed in our review of the literature that current poor health is positively associated with the probability of retirement. These findings support Hypothesis 1E: Other things equal, poor health implies a higher probability of retirement.

The small, positive, and weakly significant marginal effect of POOR for women means that current poor health slightly increases the probability of retirement, other things equal. This is consistent with prior research indicating that current poor health is positively associated with the probability of retirement and

weakly supports Hypothesis 1E: Other things equal, poor health implies a higher probability of retirement. However, the marginal effect of the number of functional limitations for women is negative, although small. This indicates that a woman with health limitations is less likely to retire, other things equal. In addition, for women reporting current poor health and a health limitation, the negative marginal effect of the interaction of POOR and LIMIT indicates that these women are less likely to retire, other things equal. These effects, though of small magnitude, are counter to our hypothesis that current poor health will increase the probability of retirement.

We do not include CHRONIC in our probit analyses because past health does not directly impact the retirement decision in our theoretical model. However, we examined the appropriateness of this assumption by including CHRONIC in probit analyses otherwise identical to the specifications reported in Table 5. We found that the marginal effect of CHRONIC is not statistically significant. However, when we drop the assets variables from these analyses, the effect of CHRONIC becomes weakly significant. This is consistent with our assertion that chronic health problems do not have a direct effect on retirement, but that they indirectly influence the probability of retirement via the level of assets available for retirement. Further, these results suggest that the omission of health insurance variables in the retirement analysis does not introduce a selection bias. It appears that workers with chronic illness are neither more nor less likely than other workers to be employed by firms that provide health benefits to retirees.¹⁶

Net Effects of Health on Retirement Table 6 summarizes the net effects of current poor health, functional limitations, and chronic illness on retirement. Only six percent of individuals in the study sample with chronic conditions report having poor health. Only one in ten people with chronic illness report a single functional limitation and only one in one hundred reports five functional limitations. In the few cases in which POOR equals one and/or LIMIT is nonzero, the figures in Table 6 indicate that the severity of the

¹⁶ There may be an omitted variable bias in the estimated effects of some of the independent variables, but these biases do not

individual's current poor health will usually outweigh the effects of fewer assets due to chronic illness. In these cases, the person is *more* likely to retire than a healthy person. However, for the 90% of individuals with chronic illness who report neither current poor health nor functional limitations, the effect of chronic illness is illustrated in the first column of Table 6. For these chronically ill men and women, there is a negative net effect on retirement. Although the net effect is slightly larger for men, for both men and women *the probability of retirement is reduced* because the chronic illness leads to lower asset levels available to provide retirement income.

DISCUSSION

The objective of this research is to examine the direct impact of chronic illness on asset accumulation and the indirect impact (via asset accumulation) on the probability of retirement. Using retrospective data drawn from the Health and Retirement Study, we (1) perform regression analyses to estimate the effect of chronic illness and other factors on asset accumulation and (2) conduct probit analyses to estimate the effect of assets, current poor health, and other factors on the probability of retirement. We use three measures of health: A dummy variable indicating if the respondent self-reported his or her current health to be poor, a continuous variable representing the number of functional limitations in activities of daily living, and a dummy variable indicating whether the respondent reports a chronic illness.

Consistent with prior research, we find a large positive impact of current poor health on the probability of retirement. However, we also find that individuals with chronic illness have lower asset accumulation than other people, other things equal. In turn, lower asset levels are significantly related to a *lower* probability of early retirement for both men and women in our study sample. This effect is sufficiently strong to infer that for the vast majority of individuals who report chronic illness, the chronic illness reduces

appear to differ between workers with and without chronic health problems.

their likelihood of retirement, other things equal.

This study focuses on workers with chronic illness, a group often overlooked in studies of retirement. The majority of the chronically ill population do not have limitations on activities of daily living nor do they report their current general health status as poor. Yet these people are unable to function in the labor force to their fullest capacity due to their chronic illness. During their working careers, these individuals with chronic illness may have accommodated their illness by working fewer hours and/or working in lower paying (but more flexible) positions than their healthy counterparts. As a result of their chronic illness, it appears that these workers accumulate fewer assets and consequently retire later. Policy-makers discussing the many critical issues surrounding poor health and retirement need to direct attention to the needs of this group.

REFERENCES

- Anderson, K. H., & Burkhauser, R. V. (Summer 1985). The retirement-health nexus: A new measure of an old puzzle. *Journal of Human Resources* 20, 315-330.
- Attanasio, O.P., & Emmerson, C. (2003). Mortality, Health Status, and Wealth. *Journal of the European Economic Association* 1(4), 821-50.
- Boskin, M. J. (January 1977). Social security and retirement decisions. *Economic Inquiry* 15, 1-25.
- Bound, J., Schoenbaum, M., Stinebrickner, T. R., & Waidmann, T. (1999). The dynamic effects of health on the labor force transitions of older workers. *Labour Economics* 6, 179-202.
- Burkhauser, R. V. (Winter 1979). The pension acceptance decision of older workers. *Journal of Human Resources* 14, 63-75.
- Burtless, G. (1986). Social security, unanticipated benefit increases, and the timing of retirement. *Review of Economic Studies* 53, 781-805.
- Burtless, G. (1987). Occupational effects on the health and work capacity of older men. In *Work, Health and Income Among the Elderly*. Edited by Gary Burtless, 103-142. Washington, D. C.: The Brookings Institution.
- Burtless, G., & Moffitt, R. A. (1984). The effect of social security benefits on the labor supply of the aged. In *Retirement and Economic Behavior*. Edited by Henry J. Aaron and Gary Burtless, 135-171.

Washington, D. C.: The Brookings Institution.

Burtless, G., & Moffitt, R. A. (April 1985). The joint choice of retirement age and postretirement hours of work. *Journal of Labor Economics*, 3, 209-236.

Burtless, G., & Moffitt, R.A. (January 1986). Social security, earnings test, and age at retirement. *Public Finance Quarterly* 14, 3-27.

Butler, J. S., Anderson, K. H., & Burkhauser, R. V. (February 1989). Work and health after retirement: A competing risks model with semi parametric unobserved heterogeneity. *Review of Economics and Statistics* 71, 46-53.

Dahl, S-A., Nilsen, O. A., & Vaage, K. (November 2000). Work or retirement? Exit routes for Norwegian elderly. *Applied Economics*, 32, 1865-1876.

Ettner, S. L. (1996). New Evidence on the relationship between income and health. *Journal of Health Economics* 15, 67-85

Gruber, J., & Madrian, B.C. (1995). Health insurance availability and the retirement decision. *American Economic Review* 85, 938-948.

Gustman, A. L., & Juster, F. T. (1995). Income and wealth of older American households: modeling issues for public policy analysis. NBER Working Paper, No. 4996.

McGarry, K. (2002) Health and Retirement: Do changes in health affect retirement expectations? NBER Working Paper, No. 9317.

Moffitt, R. A. (1984). Trends in social security wealth by cohort. In *Economic Transfers in the United States*. Edited by Marilyn Noon, 327-347. Chicago: The University of Chicago Press.

Moffitt, R. A. (1987). Life-cycle labor supply and social security: A time-series analysis. In *Work, Health and Income Among the Elderly*. Edited by Gary Burtless, 183-220. Washington, D. C.: The Brookings Institution.

Parsons, D. O. (February 1982). The male labour force participation decision: Health, reported health, and economic incentives. *Economica* 49, 81-91.

Quinn, J. F. (Summer 1977). Microeconomic determinants of early retirement: A cross-sectional view of white married men. *Journal of Human Resources* 12, 329-347.

Reno, V. (1971). Why men stop working at or before age 65: Findings from the survey of new beneficiaries. *Social Security Bulletin* 35, 3-17.

Riphahn, R. T. (May 1997). Disability retirement and unemployment – substitute pathways for labour force exit? An empirical test for the case of Germany. *Applied Economics* 29, 551-561.

- Rogowski, J., & Karoly, L. (2000). Health insurance and retirement behavior: evidence from the health and retirement survey. *Journal of Health Economics* 19, 529-539.
- Salas, C. (2002). On the empirical association between poor health and low socioeconomic status at old age. *Health Economics* 11, 207-220.
- Sickles, R. C., & Taubman, P. (November 1986). An analysis of the health and retirement status of the elderly. *Econometrica* 54, 1339-1356.
- Smith, R.J., & Blundell, R.W. (May 1986). An exogeneity test for a simultaneous equation tobit model with an application to labor supply. *Econometrica* 54 (3), 679-686.
- Stern, S. (Summer 1989). Measuring the effect of disability on labor force participation. *Journal of Human Resources* 24, 361-395.
- Stroupe, K.T., Kinney, E.D., & Kniesner, T.J. (2000). Does chronic illness affect the adequacy of health insurance coverage? *Journal of Health Politics, Policy and Law* 25(2), 309-341.
- Stroupe, K.T., Kinney, E.D. & Kniesner, T.J. (2001). Chronic illness and health insurance-related job lock. *Journal of Policy Analysis and Management* 20(3), 525-544.
- Wilson, S. (2001). Work and the Accommodation of Chronic Illness: A Re-examination of the Health-Labour Supply Relationship. *Applied Economics* 33(9), 1139-56.

Table 1
Comparison of Selected Study Sample to Other Survey Respondents^a

<u>Variable</u>	(1) <u>Respondents in the Study Sample</u> (obs=3146)	(2) <u>Excluded Survey Respondents</u> (obs=1028)	(3) <u>Chronically Ill Respondents in the Study Sample</u> (obs=496)	(4) <u>Chronically Ill Excluded Survey Respondents</u> (obs=288)
CHRONIC ILLNESS	16.1%	25.4%		
POOR HEALTH	3.2%	19.8%	5.7%	38.4%
AVERAGE # LIMITATIONS	.35	1.51	.57	2.26
LIMITATIONS	79.5%	45.5%	71.8%	30.5%
1≤LIMITATIONS≤2	16.9%	30.8%	20.7%	31.0%
LIMITATIONS≥3	3.6%	23.7%	7.6%	38.6%
AVERAGE AGE	55.7 years	56.2 years	56.0 years	56.6 years
AVERAGE ASSETS	\$409,667	\$415,784	\$343,479	\$276,517

^a None of the differences between values reported in columns (1) and (2) or between values reported in columns (3) and (4) are statistically significant for $\alpha=.05$.

Table 2
Definitions and Gender-Specific Means^a

<u>Variable</u>	<u>Definition</u>	<u>Men</u>	<u>Women</u>
AGE	Respondent's age (years)	55.8	55.6
ASSETS	Sum of joint household assets, expected Social Security benefits, and expected pension benefits (in units of \$100,000)	3.80	3.97
CHRONIC	=1 if the individual has had asthma, cancer, heart disease, or diabetes for four or more years	0.15	0.18
DEPENDENTS	Number of dependents living in the household	0.04	0.50
EDUCATION	Highest grade of school completed by the individual	13.34	13.31
LIMIT	Total number of limitations in activities of daily living (ability to walk several blocks, sit for about two hours, get in and out of bed without help, climb several flights of stairs without resting, lift or carry weights over 10 pounds, stoop, kneel, or crouch, bathe or shower, pull or push objects like a living room chair, eat without help, dress without help, and use calculator to balance checkbook)	0.32	0.44
MALE	=1 if the individual is male (59.5% of the sample is male)	1.00	0.00
MARRIED	=1 if the respondent currently has a marriage-like relationship	0.84	0.71
POOR	=1 if the respondent has 'poor' self-rated health	0.04	0.03
RETIRED	=1 if the individual is retired	0.12	0.10
SPS INCOME	Current income of spouse (in units of \$100,000)	0.15	0.15
WHITE	=1 if the respondent is White	0.88	0.84
WORK INCOME	Current income of respondent or income in the year before retirement (in units of \$100,000)	0.65	0.52

^a Means are calculated using weighted observations of 1794 male and 1352 female survey respondents.

Table 3
Health Status
by Retirement Status^a

<u>Variable</u>	<u>Percent of Sample</u>	<u>Percent of Retired</u>	<u>Percent of Working</u>
POOR=1^b	3.2	9.8	2.4
LIMIT=0^b	79.5	65.5	81.2
1≤LIMIT≤2^b	16.9	24.1	16.0
LIMIT≥3^b	3.6	10.4	2.8
CHRONIC=1^c	16.1	18.7	15.8

^a Percentages are calculated from 2799 weighted observations of working persons and 347 weighted observations of retired persons. Note that having current poor health, functional limitations, and chronic illness are not mutually exclusive states, so the columns do not necessarily sum to 100 percent.

^b The difference between retired and working respondents is statistically significant at $\alpha = .05$.

^c The difference between retired and working respondents is statistically significant at $\alpha = .10$.

Table 4
Regression of Log of Total Assets^a

Variable	MEN			WOMEN		
	(1) Coefficient Estimate	(2) Coefficient Estimate	(3) Coefficient Estimate	(1) Coefficient Estimate	(2) Coefficient Estimate	(3) Coefficient Estimate
AGE	.30 ^d	.30 ^d	.31 ^d	.15	.14	.14
AGESQ	- .002 ^d	- .002 ^d	- .003 ^d	- .001	- .001	- .001
EDUCATION	.04 ^b	.04 ^b	.04 ^b	.05 ^b	.05 ^b	.05 ^b
MARITAL STATUS	.13 ^b	.13 ^b	.13 ^b	.32 ^b	.32 ^b	.32 ^b
WHITE	.20 ^b	.19 ^b	.19 ^b	.13 ^b	.13 ^b	.13 ^b
DEPENDENTS	.04	.04	.04	- .06 ^b	- .06 ^b	- .06 ^b
WORK INCOME	.01 ^b	.01 ^b	.01 ^b	.02 ^b	.02 ^b	.02 ^b
SPOUSE INCOME	.20 ^b	.18 ^b	.18 ^b	.39 ^b	.37 ^b	.37 ^b
CHRONIC LIMIT	- .06 ^b	- .05 ^c - .07 ^b	- .08 ^c - .08 ^b	- .06 ^c	- .05 ^d - .03 ^b	- .05 - .03 ^b
CHRONLIM INTERCEPT			.08			- .01
	- 8.04 ^d	- 8.04 ^b	- 8.34 ^d	- 3.89	- 3.64	- 3.63
R ²	.10	.11	.10	.25	.26	.26
Adjusted R ²	.10	.11	.11	.25	.25	.25
F Value	30.77	29.76	30.77	51.50	46.91	42.85
Prob>F	.00	.00	.00	.00	.00	.00

^a Weighted probits using 1794 observations of men and 1352 observations of women.

^b Denotes statistical significance for $\alpha \leq .05$.

^c Denotes statistical significance for $\alpha \leq .10$.

^d Denotes statistical significance for $\alpha \leq .15$.

Table 5
Marginal Effects of Economic Variables
on Retirement Status^a

<u>Variable</u>	<u>MEN</u>	<u>WOMEN</u>
	<u>Marginal Effect</u>	<u>Marginal Effect</u>
AGE	- .02	- .04
AGESQ	- .0003	- .0005
EDUCATION	.001	.0004
MARITAL STATUS	.03	.08 ^b
WHITE	- .03 ^c	- .04 ^c
DEPENDENTS	.07 ^b	- .05 ^b
WORK INCOME	.02 ^b	.08 ^b
SPOUSE INCOME	- .24 ^b	- .31 ^b
ASSETS	.01 ^b	.01 ^b
ASSETS SQUARED	- .0001 ^b	- .0002 ^b
POOR	.27 ^b	.01 ^d
LIMIT	.04 ^b	- .01
POORLIM	- .04 ^b	- .02
Wald chi-square (12)	209.98	111.57
Prob>chi-square	.00	.00
Pseudo R ²	.32	.38

^a Weighted probits using 1794 observations of men and 1352 observations of women.

^b Denotes statistical significance for $\alpha \leq .05$.

^c Denotes statistical significance for $\alpha \leq .10$.

^d Denotes statistical significance for $\alpha \leq .15$.

Table 6
Marginal Effects of Health Status on the Probability of Retirement^a

	POOR = 0			POOR = 1		
	<u>LIMIT = 0</u>	<u>LIMIT = 1</u>	<u>LIMIT = 5</u>	<u>LIMIT = 0</u>	<u>LIMIT = 1</u>	<u>LIMIT = 5</u>
<u>MEN</u>						
CHRONIC						
Indirect Effect	- 0.001	- 0.0001	0.004	- 0.001	- 0.0001	0.004
POOR						
Direct Effect				0.269	0.229	0.071
LIMIT						
Direct Effect		0.040	0.040		0.001	0.001
Indirect Effect ^b		- 0.0001	- 0.0004		- 0.0001	- 0.0004
TOTAL EFFECT	- 0.001	+ 0.040	+ 0.044	+ 0.268	+ 0.230	+ 0.075
<u>WOMEN</u>						
CHRONIC						
Indirect Effect	- 0.0005	- 0.0006	- 0.001	- 0.0005	- 0.0006	- 0.001
POOR						
Direct Effect				0.179	0.155	0.061
LIMIT						
Direct Effect		0.013	0.013		- 0.011	- 0.011
Indirect Effect ^b		- 0.004	- 0.021		- 0.004	- 0.021
TOTAL EFFECT	- 0.0005	+ 0.008	- 0.009	+ 0.179	+ 0.140	+ 0.028

^a Estimates of coefficients and marginal effects from Table 3 (specification (3) for both men and women) and Table 4 (specifications Men (1) and Women (2)) were used to calculate the effects reported in this table. The values of TOTAL EFFECTS may differ from the column totals due to rounding.

^b The indirect effect of LIMIT is calculated assuming CHRONIC=1.