Do Retiree Health Benefits Cause Early Retirement?

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Abstract

I examine whether the availability of early retiree health benefits increases the likelihood of early retirement. Although there is a positive association between the availability of retiree health benefits and early retirement, this association could be driven by other factors that are correlated with retiree health benefits and affect retirement decisions. I build a simple model to show that individuals in poor health and with poor outside insurance options value retiree health benefits more. I then use variation in health status and outside insurance options to examine, within a difference-in-differences framework, whether the estimated correlation between retiree health benefits and early retirement reflects demand for health insurance. My results indicate that the effect of retiree health benefits is not statistically significantly larger for those in poor health, but that it is larger for those who lack insurance from other sources, particularly from their spouses. I conclude that retiree health benefits do increase the hazard of early retirement and that demand for health insurance among the near-elderly is not closely tied to health status.

I. Introduction

Most working individuals obtain health insurance through their employers, and individuals over 65 are eligible for basic health insurance through Medicare. However, retirement before age 65 often creates a gap, during which people are no longer covered by their employers but are not yet eligible for Medicare. The possibility that this lack of coverage discourages early retirement is a form of "job-lock," the broader theory that the tying of health insurance to jobs discourages job transitions. The near-elderly might be especially subject to job-lock because they often experience deteriorating health and may face high medical bills or individual-market health insurance premiums if they are not covered by their employers. Discouraging the unhealthy near-elderly from retiring may have negative social welfare implications.

The proposition that job-lock discourages retirement has intuitive appeal, but the magnitude of such an effect is not well established. Much of the previous literature compares the retirement behavior of those who receive employer-provided early retiree health benefits, which fill the gap between work and Medicare, to the behavior of those who lack such benefits. Several empirical studies find a large positive association between these benefits and early retirement, but such estimates may be subject to severe omitted variables and endogeneity biases. For example, firms that provide retiree health benefits may also provide better (unobserved) pension benefits, or workers with a particular desire to retire early may seek out jobs that offer such benefits. Estimates based on models of the impact of retiree health benefits on the worker's budget constraint have generally been smaller than those based on reduced-form regressions, consistent with omitted variables or endogeneity bias. The lack of consensus among previous results suggests that further evidence is needed to determine the extent of retirement job-lock.

In this paper, I build a simple model to show that individuals in poor health and with poor outside insurance options value retiree health benefits more than those in good health and with better outside insurance options. I then use these variations in the valuation of health benefits in a difference-in-differences framework to examine whether the estimated effect of retiree health benefits on early retirement reflects demand for health insurance. My results, based on data from the Health and Retirement Study (HRS), do not show a greater response to employer-provided retiree health benefits among those who are in poor health but do show a greater response among those who lack outside insurance. The health-based estimates imply either little causal effect of retiree health benefits on retirement or little relationship between health and health insurance demand. The outside insurance-based estimates, however, show that the effect is in fact due to demand for health insurance, as retiree health benefits are valued much less by those who have other coverage. Thus I conclude that early retiree health benefits do encourage early retirement, but no more so for those in poor health than those in good health. Retirement job-lock does not disproportionately affect the unhealthy.

The paper proceeds as follows. Section II describes the institutional landscape facing older workers considering retirement and then reviews the existing literature on the effect of early retiree health benefits on retirement. Section III develops the theory of job-lock and derives the sources of variation in the valuation of retiree health benefits. Section IV describes the HRS data and lays out the empirical strategy motivated by the theory. Section V reports the results, and section VI discusses their interpretation. Section VII concludes.

II. Background and Previous Literature

A. Institutional Details

The problem of providing health insurance to individuals approaching the age of Medicare eligibility has received considerable attention from both economists and policymakers. While they are no more likely to be uninsured than younger adults, the near-elderly are at particular risk for serious health problems and high medical expenditures. Medicare covers nearly all of those 65 and older, but significant numbers of people are uninsured in the years before Medicare eligibility (14.3 percent of 45 to 60 year-olds and 16.3 percent of 61 to 64 year-olds in 1997).[1] As is true for all age groups under age 65, employment compensation packages are the most common source of health insurance for the near-elderly. Sixty-five is still considered the "normal" retirement age, but it is quite common to retire earlier; about half of those working in their mid-50s retire before age 65.[2]

Many of those who retire before age 65 continue to receive health insurance from a former employer. However, early retiree health insurance has become much less common in recent years. The best available information indicates that 66 percent of firms with over 200 employees offered health benefits to their under-65 retirees in 1988, but by 2001 this number had fallen to 34 percent of such firms.[3, 4] The decline is attributable at least partly to the rising cost

[1] Glied and Stabile (1999), tabulations from March 1997 CPS.
[2] Author's tabulations based on the HRS. The exact rate depends on the definition of retirement. For more details, see Table I and the discussion of retirement definitions below.
[3] These statistics come from the Retiree Health Benefits Surveys conducted by Jon Gabel for KPMG/Peat Martwick, the Kaiser Family Fund, and the Health and Retirement Educational Trust. HRET reports that "survey findings are based on a national random sample of nearly 2000 interviews with human resource and benefits administrators from firms with three or more workers." In this survey, firms with under 200 employees rarely offer retiree health benefits.
[4] Many firms also offer some health benefits to retirees over age 65. Because Medicare is the primary payer for this age group, however, this insurance market is quite different, and those over 65 face a rather different insurance landscape. Accordingly, in this paper I focus on the effect of health benefits available to under-65 retirees on retirement before age 65.

of insurance and to the implementation of a federal accounting rule which makes retiree health benefits a greater liability for firms (Turner *et. al.*, 1993).[5]

If they are not offered health insurance from their own or their spouses' employers, it is often very expensive or impossible for early retirees to obtain coverage. Medicaid and other public programs cover a relatively small proportion of the near-elderly, as nearly all states restrict Medicaid to those with dependent children. The seriously disabled may qualify for Social Security Disability Insurance (which brings with it Medicare after a two-year waiting period). Otherwise, the individual health insurance market is the last option.[6] A 2002 report from the advocacy group Families USA finds that annual individual market premiums for a 55-year-old, healthy, non-smoking woman average about $5,000. Premiums are higher for men, for smokers, and for the unhealthy, as high as $20,000 per year for those with chronic conditions. For many there is no policy available or only a policy that doesn't cover certain conditions (Families USA, 2002).

A number of policies and policy proposals address these concerns. The most important policy enacted to date is COBRA, which mandates that employees be allowed to continue their employer-provided health insurance for 18 months following a voluntary or involuntary job separation.[7] While the requirement to pay up to 102 percent of the employer's premium discourages uptake, this insurance is still less expensive than individual policies, especially for those with pre-existing conditions. An important proposal which has not been enacted is a voluntary Medicare buy-in at age 62, as was proposed by the Clinton administration in 1999 and 2000. To answer such questions as how many more people would retire before age 65 under

[5] FASB (Financial Accounting Standards Board) Statement 106, which was implemented in 1990, requires firms to count projected expenditures for retiree benefits as a current liability.
[6] A number of states have "high-risk pools" which supplement the individual insurance market. However, they are generally very small and very expensive.
[7] COBRA is an acronym for the Consolidated Omnibus Budget Reconciliation Act of 1986.

such a policy, it is necessary to identify the causal effect of retiree health insurance on early retirement.

B. Relevant Literature

There is a substantial literature investigating the extent to which job transitions are discouraged by the employer-provided health care system, a phenomenon referred to as "job-lock." Previous analyses of the effect of retiree health insurance on retirement can be divided into three groups: reduced-form studies which treat retiree health insurance as exogenous, reduced-form studies that account for endogeneity and omitted variables through instruments or other approaches, and structural approaches that model the impact of retiree health benefits on the budget constraint.[8]

The reduced form studies uniformly find a large positive association between retiree health insurance offers and early retirement. Rogowski and Karoly (2000) estimate probit models of early retirement as a function of retiree health insurance, health, and other characteristics using the first and third waves of the Health and Retirement Study (HRS). Madrian (1994), Hurd and McGarry (1993), and Karoly and Rogowski (1994) also find similar results, characterized by Gruber and Madrian (2002) as increasing the retirement hazard by 30 to 80 percent (p.11).

A causal interpretation of these estimates is difficult due to the potential for endogeneity and omitted variables biases. Individuals may consider health benefits in their job choice, and in particular those who intend or hope to retire early would be likely to look for jobs that provide early retiree health insurance. Therefore, retiree health insurance may be endogenous. If this is

[8] Gruber and Madrian (2002) survey this literature, including the subset which concerns the retirement decision in particular.

the case, then a higher propensity to retire early actually causes an individual to obtain retiree health insurance, rather than vice-versa. Omitted variables bias may also be important, as jobs that provide retiree health insurance may be different from jobs that do not, in ways that may also encourage early retirement. For example, jobs that offer retiree health insurance may also provide better pension benefits.[9] The level of pension benefits is difficult to observe and measure and for this reason is generally not included in the reduced form regressions in the literature. If there are unobserved job characteristics that are positively correlated with both the provision of retiree health benefits and the likelihood of early retirement, their exclusion from a regression will bias upward the estimated effect of retiree health benefits on early retirement. On the other hand, it is also possible that retiree health benefits are offered by jobs with better working conditions, which would lead to a downward bias on the estimated effect.

Correcting these biases requires finding an exogenous source of variation in health insurance offers or prices. Gruber and Madrian (1995, 1996) use the introduction of state continuation mandates leading up to COBRA as instruments. They find that one year of continuation coverage raises the retirement hazard by 30 percent.[10] Blau and Gilleskie (2001a) use an alternative identification strategy, jointly estimating models of early retirement, initial employment status, health status, health insurance coverage, and retiree health insurance coverage to show the endogeneity of these variables and use a semiparametric random-effects specification to control for unobserved heterogeneity. They find a large effect of employer-provided retiree health insurance on labor force exit, and this effect increases significantly with age.

[9] Although the quality of pension benefits is difficult to observe, there is a positive and significant correlation between the *provision* of retiree health insurance and pension benefits. (Author's tabulations based on HRS data.)
[10] They recognize that this result is quite large, economically speaking, implying a valuation much higher than the typical cost of private market insurance.

A third set of papers uses structural models to analyze the effect of retiree health benefits on early retirement. Some of these, notably Gustman and Steinmeier (1994) and Lumsdaine, Stock, and Wise (1994), factor health insurance into the budget constraint based on the average cost of insurance and find that the resulting retirement behavior is quite similar to the behavior ignoring health insurance, implying a small or nonexistent effect of retiree health insurance on retirement. Rust and Phelan (1997) point out that "if individuals are risk averse and the distribution of health care costs is highly skewed, the person's *certainty equivalent* valuation" of health insurance is much larger than the population average cost.[11] Taking into account risk aversion and the full distribution of health costs, they find larger effects of retiree health insurance on retirement than papers which do not model risk aversion. Their recognition of the importance of the distribution of health care costs supports the first prediction to be tested in the present paper: that retiree health benefits should matter more to those in poor health. Blau and Gilleskie (2001b) estimate a structural model of joint retirement by married couples and find little effect of retiree health insurance when health insurance only enters the budget constraint; they find a larger effect when health insurance is allowed to influence utility directly.

This paper extends the retirement job-lock literature by using natural sources of variation in workers' valuations of retiree health benefits (due to health and outside insurance options) as a means of identifying the extent to which the association between retiree health benefits and early retirement is due to health insurance demand rather than omitted variables bias. A number of papers studying job-to-job transitions, rather than retirement, have exploited such variation. A good example is Holtz-Eakin, Penrod, and Rosen (1996). They find no evidence that those who lack spousal coverage or those in poor health are more constrained by employer-based insurance in transitions to self-employment. As high health expenditures and job exits are much more

[11] Rust and Phelan (1997), p. 784.

common for older workers, however, one might well expect such an approach to be more conclusive when studying retirement.

The only paper in the retirement job-lock literature that reports estimates of the interaction between retiree health insurance and health status is Blau and Gilleskie (2001a). Their cross tabulations indicate that men in bad health are 16 percent more likely to exit the labor force between waves 1 and 2 of the HRS if they have retiree health insurance.[12] In a multivariate regression framework, however, this effect is not significant. Blau and Gilleskie (2001a) and Gruber and Madrian (1995, 1996) examine how the effect of retiree health insurance varies with age. Blau and Gilleskie find an increasing effect of retiree health benefits with age, but as they use only waves 1 and 2 of the HRS they can examine retirement only up to age 63. Gruber and Madrian find no consistent pattern of COBRA effects by age.

III. Theory

In this section I construct a simple model of the retirement decision that predicts two sources of variation in individuals' valuations of retiree health insurance. The model clarifies the economic incentives that underlie the job-lock hypothesis and motivates the empirical analysis that follows.

An individual's utility is a function of consumption net of health care costs, $U(C)$.[13] As usual, assume decreasing marginal utility of consumption. The individual faces a budget constraint

$$C_W = Y_W - P_W \cdot x(H) \tag{1}$$

[12] Blau and Gilleskie use only one health measure, self-reported bad health defined in the same way as in the present paper. See details below.

[13] Of course, utility also depends on health. Excluding health from the utility function and modeling its role only through the budget constraint essentially assumes that the marginal utility of consumption is not directly affected by health status. This assumption is a useful simplification.

$$C_R = Y_R - P_R \cdot x(H) \quad (2)$$

where C_W and C_R are consumption if working or retired, respectively. Y_W and Y_R are income if working and retired, respectively.[14] I assume both are fixed, so as to focus attention on the direct costs of bad health. H represents health; larger H means worse health. $x(H)$ is total health expenditures, including both those paid out of pocket and those covered by insurance. $x'(H)$ is positive, as expenditures are greater for those in poor health. Health insurance is characterized by P, the proportion of health expenditures paid by the individual. While working, the individual receives insurance P_W, generally from his or her employer. When retired, the individual receives insurance P_R. P is relatively small if insured, 1 if uninsured, so this model includes the possibility of uninsurance both before and after retirement. P includes the individual's share of the health insurance premium, so non-group insurance that requires a premium equal to the individual's actual expenses would be represented by a P of 1. This is a model of the subsidy value of health insurance, the difference between the individual's health expenditures without insurance and his or her expenditures with insurance, including cost sharing. Note that I do not model the uncertainty of health expenditures, as the insight necessary for this paper can be gained from a deterministic model.[15]

The individual chooses to retire if

$$\theta = U(Y_R - P_R \cdot x(H)) - U(Y_W - P_W \cdot x(H)) > 0 \quad (4)$$

from which it follows that the impact of health on the retirement decision is

[14] Y_R might represent the income flow from assets, including vested pensions, or from a spouse's labor earnings.
[15] In a stochastic model, the same predictions would follow as long as expected health expenditures are positively correlated with bad health and individuals are not risk loving. Similarly, while a dynamic model would describe retirement behavior with more subtlety, as long as present health is predictive of future health the key comparative statics will still apply.

$$\frac{\partial \theta}{\partial H} = x'(H)\left[P_W U'(C_W) - P_R U'(C_R)\right] \tag{5}$$

The sign of (5) is ambiguous. If individuals get better insurance and higher consumption while working ($P_W < P_R$ and $C_W > C_R$), (5) is negative, and those in poor health are less likely to retire. Intuitively, this is because the financial subsidy of health insurance is more important to the unhealthy, both directly due to their higher health expenses, and indirectly due to their higher marginal utility of consumption (which results from their health expenditures if $P > 0$). This result is not robust to certain extensions of the model, however, such as including leisure in the utility function and specifying that poor health decreases the value of consumption relative to leisure, or including health directly in the utility function.

The effect of health on retirement varies with the extent of retiree health insurance P_R:

$$\frac{\partial^2 \theta}{\partial H \partial P_R} = x'(H)\left[P_R \cdot x(H) \cdot U''(C_R) - U'(C_R)\right] < 0, \tag{6}$$

which means that those with better health insurance in retirement (P_R is small) have a stronger incentive to retire when unhealthy (H is large). This prediction forms the basis of the first set of tests in this paper. If retiree health insurance causes early retirement, then its effect should be larger for the unhealthy.

The direct impact of health insurance in retirement on the retirement decision, which has been at the center of previous research, is

$$\frac{\partial \theta}{\partial P_R} = -x'(H) \cdot U'(C_R) < 0. \tag{7}$$

This expression is negative, since marginal health expenditures and marginal utility of consumption are both positive. Since higher P_R represents worse insurance, this means that those with worse health insurance coverage in retirement have less incentive to retire. Note, however, that P_R represents the health insurance that the worker would have in retirement, which may come from sources other than the individual's employer. If the individual has access to insurance from another source, P_R may be unaffected by the presence or absence of employer-based retiree health benefits. This forms the basis for the second set of tests: retiree health insurance should have a larger behavioral effect on those for whom it improves (lowers) P_R more; namely, those without alternative sources of group health insurance.

IV. Data and Empirical Strategy

A. Data Description

The theory developed above is tested using data from the Health and Retirement Study (HRS). The HRS surveys individuals born between 1931 and 1941 and members of their households. They were first interviewed in 1992 and then every two years thereafter. In this paper, I use the first five waves of the HRS, through the year 2000.[16] The data are well suited to this study, as they contain detailed financial, employment, and health information. Minorities and Florida residents are oversampled, so the HRS-provided weights are used throughout this paper.[17]

As the HRS is only a representative sample (with weights) for individuals born between 1931 and 1941, I treat only these individuals as sample observations. If both husband and wife were born between 1931 and 1941, I include both in the analysis and adjust the standard errors

[16] I use the final releases of the first three waves and preliminary releases of the fourth and fifth.
[17] The results are substantively similar without weighting.

for clustering by household. Spouses' insurance, labor force, and demographic information are available, however, even if the spouse is not in this age range, allowing the use of spousal information to explain respondents' behavior. The relevant HRS sample has 9,824 observations. Further sample restrictions will be discussed below.

B. Empirical Strategy

Comparing the early retirement rate of those with and without early retiree health benefits will produced a biased estimate in the presence of omitted variables. However, the model shows that the valuation of early retiree health benefits should vary with health status and outside insurance options. I first exploit the variation by health status to obtain a lower bound on the causal effect of retiree health benefits on early retirement for those in poor health. Subsequently, I use variation in outside insurance options to gain additional information about the true effect. The variation in outside insurance options comes from information about the spouse's employment and insurance options and from Medicare eligibility, which should make any effect of retiree health benefits effect decline or vanish at age 65.

1. Effect by Health Status

Let R denote the fraction retiring early in each cell of the following table:

		Health Status		
		Bad	Good	Total
Retiree Health Benefits?	Yes	R_{BY}	R_{GY}	R_Y
	No	R_{BN}	R_{GN}	R_N

Then $R_{BY} - R_{BN}$ reflects the effect of retiree health insurance on early retirement (for those in poor health) plus any omitted variables or endogeneity bias. Let E denote the true effect of

retiree health benefits on those in poor health, and α denote the bias. The bias α can be corrected by finding a "control group" of workers who are subject to the same selection process. The theory indicates that the effect of retiree health benefits on early retirement is smaller for those in good health, so let the effect on those in good health be $\lambda \cdot E$ with $\lambda < 1$. If the omitted variables affect the estimated effect on those in good health in the same way as the effect on those in bad health, then $R_{GY} - R_{GN} = \lambda \cdot E + \alpha$. As a result, the difference-in-differences estimate

$$(R_{BY} - R_{BN}) - (R_{GY} - R_{GN}) = (E + \alpha) - (\lambda \cdot E + \alpha) = (1 - \lambda) \cdot E \quad (8)$$

is a lower bound (since $\lambda < 1$) on the true effect of insurance for those in poor health, E. The finding of a positive lower bound would support the job-lock theory, that retiree health benefits do cause early retirement. Conversely, if $(1 - \lambda) \cdot E$ is not significantly different from zero, then either early retiree health benefits do not cause early retirement even for those in poor health (E is small) or the effect is no greater for those in poor health than those in good health (λ is close to one). To verify the robustness of the results, I use several measures of early retirement and several definitions of poor health, described in detail in the data appendix.

The baseline for this analysis (period 0) is the first survey wave, in 1992. Period t is the last observation of the respondent before he or she turns 65. The sample is restricted to those who are working at period 0.[18] As Blau and Gilleskie (2001a) note, however, this does mean that the estimates exclude the least healthy individuals and may also miss some people who have retired very early (i.e. before the baseline survey). I further exclude those who do not have health insurance at period 0, as they cannot be subject to job-lock.[19] Much of the retirement

[18] There is no retirement decision to model for those who are not working at baseline.
[19] They also very rarely have retiree health benefits, and the results are insensitive to their inclusion.

literature further restricts the sample to men only; I include both men and women, as the key estimates do not vary significantly by gender.[20]

I estimate a simple non-parametric hazard model, regressing the probability of retiring at any given age (conditional on still being in the labor force) on baseline characteristics. The sample includes one record for each observation of each respondent, beginning with period 0 (1992) and recurring every two years until he or she is observed to retire or turns 65, at which point observation stops. The dependent variable, retirement, is recorded as zero if the respondent is still working and one at the first observation of retirement.[21]

I estimate probit regressions of the form

$$R_{it} = \beta_0 + \beta_1 RHI_{i0} + \beta_2 H_{i0} + \beta_3 H_{i0} RHI_{i0} + X_{i0}' \beta_4 + A_{it}' \beta_5 + \varepsilon_{it} \quad (9)$$

where R_{it} is one if individual i is retired before age 65, RHI_{i0} is one if he or she works for a firm that offers health insurance to early retirees, H_{i0} is a measure of poor health, X_{i0} is a vector of other characteristics, and A_{it} is a vector of indicators for age at time t.[22] Hence, β_1 is the main effect of retiree health insurance on early retirement, and β_2 is the main effect of poor health. The coefficient of interest is β_3, which indicates how the impact of early retiree health insurance varies with health status; with the appropriate probability transformation (to compute the marginal effect from the probit coefficient), this is the difference-in-differences estimate described above, $(1 - \lambda) \cdot E$. If β_3 is positive, this supports the theory that retiree health benefits induce early retirement by providing health insurance to those who need it but would otherwise lose it if they retired.

[20] In the results section, however, I will briefly discuss the results of separate estimations.
[21] Observations for individuals who have been retired for more than one period or are over 65 are not included as sample observations.
[22] Throughout this paper I estimate probit models, although linear probability models produce similar estimates. I will estimate this equation using several different measures of retirement and poor health.

RHI_i, H_i, and X_i are measured in 1992, at the first wave.[23] In all specifications, X_{i0} includes gender, race (white/other), age dummies, marital status, spouse's age, and whether the individual is covered by a pension plan. In most specifications, it also includes initial health insurance status, log wages, whether the spouse is working, log spouse wages, log household net worth, log firm size, and a set of industry and occupation dummies.[24] Pension plan coverage may be another important determinant of retirement. Income and assets naturally factor into the decision as well. Larger firms generally offer better benefits (including retiree health benefits), so inclusion of firm size in the regression may reduce the omitted variables bias. Benefit offerings and other amenities that may encourage or discourage retirement vary by job, so industry and occupation indicators are also included.

An alternative is to model the probability of early retirement at any age less than 65 as a function of baseline characteristics, a cross-sectional approach. Since retirement probabilities evolve in a complex way as an individual ages, however, it is more appropriate to model retirement behavior with a hazard model.[25] The hazard of early retirement is not constant with age, so the hazard specification allows a better fit to the data. More importantly, the hazard model allows the inclusion in the sample of individuals who do not reach age 65 by the last interview, as under this specification their behavior at ages less than 65 can provide information on the retirement hazard at those ages, whereas in the cross-sectional approach these observations cannot be used.

[23] It is also possible to allow health status to vary over time for each individual. Using contemporaneous health rather baseline health status does not affect the results.
[24] I have also estimated the models including census region indicators, but as they have no effect on the results and are not jointly significant, I do not include them in the reported regressions.
[25] For more on this issue, see Hausman and Wise (1985) and Diamond and Hausman (1984).

2. Effect by Outside Insurance Options

I next proceed to the second set of tests, exploiting the variation in valuations of retiree health benefits induced by the availability of outside insurance options. This analysis is structurally similar to the tests based on health status and uses the same sample. It differs in two important ways. First, it relies on different assumptions about the unobservables. For this analysis, the unobservables must be correlated with retiree health benefits in the same way for those with and without other insurance, rather than for those in good versus poor health status. Second, the analog in this section to the assumption (derived from the theory) that $\lambda < 1$ (i.e., that health benefits have more effect on the unhealthy) is that retiree health benefits have more value to those without other sources of health insurance. This result is also derived from the theory, but does not rely on any assumptions about the nature of demand for health insurance. Thus, λ close to one would not explain a small difference-in-differences for these estimates – the natural interpretation if both sets of estimates are insignificantly different from zero is that E is close to zero, and retiree health benefits have little causal effect on retirement.

Recall that P_R in the model represents the health insurance that would be chosen in retirement. The offer of retiree health insurance improves P_R less for those with better outside options. Hence, those covered by health insurance that is not from their own employer should be less sensitive to retiree health insurance.[26] I consider the effect of two sources of group health insurance: coverage through a spouse's employment and Medicare for those over 65.[27]

[26] If an outside group insurance option is preferred to retiree health insurance, then retiree health insurance is an irrelevant alternative and does not affect the decision under conventional utility assumptions. Even if the outside option is inferior to retiree health insurance, the availability of the outside option reduces the economic value of retiree health insurance, since the economic value is its difference from the best outside opportunity.

[27] I have also explored the effect of non-employment based insurance such as veterans benefits, individual-market health insurance, and Medicaid. Since there are very few people who have retiree health benefits from an employer but are covered by non-employer health insurance, these estimates are inconclusive.

I begin by testing whether retiree health insurance has a larger effect on early retirement for those without spousal coverage.[28] To do so, I estimate the following equation:

$$R_{it} = \beta_0 + \beta_1 \cdot RHI_{i0} + \beta_2 \cdot SI_{i0} + \beta_3 \cdot RHI_{i0} \cdot SI_{i0} + \beta_4 \cdot H_{i0} + X_{i0}' \cdot \beta_5 + \varepsilon_{it} \quad (10)$$

where SI_{i0} indicates spousal insurance at period 0. Due to the possibility of joint retirement decision-making, I use two definitions of spousal insurance – under the first, individuals are considered to have spousal coverage if their health insurance at baseline actually comes from their spouses' employers. Under the second, their spouses must additionally have retiree health benefits that would cover the individuals if their spouses retired as well. Under the hypothesis that own retiree health insurance has less effect on retirement for those with spousal insurance, β_3 is negative. If β_3 is not negative, then retiree health benefits have just as much effect on retirement for those who already have health insurance, implying that their association with early retirement is not due to health insurance demand.[29]

At age 65, everyone has access to outside group insurance through Medicare. Accordingly, retiree health benefits should have less effect on retirement rates after age 65 than before.[30] I test this prediction using the hazard model framework, which allows variables to have different effects on retirement at different ages. I reintroduce to the sample those who are over 65 and estimate the following model:

$$R_{it} = \beta_0 + \beta_1 RHI_{i0} + \beta_2 H_{i0} + \beta_3 H_{i0} RHI_{i0} + \sum_a \beta_{4,a} Age_{it} + \sum_a \beta_{5,a} Age_{it} RHI_{i0} + X_{i0}' \beta_6 + \varepsilon_{it} \quad (11)$$

[28] As above, I focus on early retirement by including only observations before individuals reach age 65.
[29] An alternative explanation would be that own coverage is more valuable than spousal coverage. However, in most cases both partners are included separately (with the standard errors adjusted for clustering), and where only one is included the selection is based only on being in the HRS age frame. Thus, the respondents' benefits are unlikely to be systematically better than their spouses. In fact, since spousal coverage as defined here requires that the spouse's coverage was actually selected, it must be more desirable than the respondent's own coverage.
[30] The data do not separately identify which retirement health insurance would continue to provide supplementary insurance under Medicare, as some do. However, even these plans are relatively more valuable before Medicare eligibility. Retiree health plans as defined in this paper provide continuing coverage at the time of early retirement.

where Age_{it} are indicators for a set of age categories, $\sum_a$ denoting the sum across those categories. For example, if there are only two age categories, a = 0 for those under 65 and a = 1 for those 65 and older, the prediction is that $\beta_{5,0}$ is larger than $\beta_{5,1}$. This is the simplest specification. However, to avoid comparing people of very disparate ages, it is preferable to include more categories, such as age under 62, age 62-64, and age 65 and above; or age under 62, 62 to 63½, 63½ to 64, and 65 and above. These are logical break-points due to the availability of Social Security retirement benefits at age 62 and COBRA continuation coverage reaching to age 65 at age 63½.[31] I then test whether the effect of retiree health benefits is the same for people 65 and over as in the oldest age group less than 65. A larger estimated effect of retiree health benefits for those under age 65 is consistent with a causal effect.

C. Measurement

In this section, I briefly describe the definitions I use for early retirement, bad health, and the availability of retiree health insurance. Details are provided in the Data Appendix.

1. Early Retirement

Defining retirement is not straightforward, as many individuals report retirement but continue to work, while others cease working but do not report retirement for some time thereafter. Rather than making an assumption about whether retiree health benefits should be expected to encourage individuals to leave the labor force entirely or perhaps to retire into part-time work without health benefits, I estimate the effect of these benefits on three early retirement

[31] It is also acceptable to let β_4 be of higher dimension than β_5, including for example a full set of age dummies but letting the interaction vary only in a few categories. Empirically, this does not affect the results.

definitions. Respondents are considered to retire early in these models if, at a survey wave before the year in which they turn 65, they are not working (definition 1), self-identify as retired (definition 2), or self-identify as retired and are not working (definition 3).

2. Health

I use three distinct health measures to operationalize a definition of bad health. These are self-reported health status, chronic conditions, and difficulty with activities of daily living. While this approach will demand a large number of estimations, it allows great flexibility in the form of health that might be relevant in this context.

For the first measure, I consider those who report themselves to be in "fair" or "poor" health status to be in bad health, assigning them an H_i value of 1 and others an H_i value of 0.[32] The second and third measures are based on the number of chronic health conditions reported by respondents. I alternatively use the number of reported conditions and an indicator for the presence of at least two chronic conditions. The HRS respondents also answer a standard battery of questions about whether they have difficulty with each of twenty-one activities of daily living (ADLs) and whether they have difficulty with any of them. The last two measures of bad health are a count of the number of difficult ADLs and an indicator for having difficulty with more than two.

3. Early Retirement Health Insurance

HRS respondents are asked whether their current employment-based health insurance plan is available to people who retire, and if not they are asked whether their employer or union

[32] Experimenting with alternative definitions, for example entering into the regression dichotomous variables for all five possible answers (interacted with insurance where appropriate) yields substantively similar results.

has any health insurance plan available to retirees. In this paper, I consider workers to have retiree health insurance if they answer yes to either of these questions. That is, they have retiree health insurance if they could continue their current employer-based coverage or obtain another health insurance policy from current employer, regardless of whether they would have to pay more and regardless of whether family coverage would continue.[33]

V. Results

A. Descriptive Statistics

Table I shows baseline descriptive statistics for the analysis sample, all HRS respondents who are working and have health insurance at wave I (1992).[34] Nearly three-fourths of respondents are married, which will prove useful in the analysis. Slightly less than half are female. 10.4 percent report themselves to be in fair or poor health (treated as "bad health" in this analysis). Functional impairments and chronic conditions, however, are quite common, with an average of 2.7 difficult ADLs and 2.1 chronic conditions, including zeros. 42.3 percent have more than two difficult ADLs and 57.1 percent have at least two chronic conditions.[35] 43.4 percent of respondents have access to retiree health benefits from their employer. 86.3 percent of respondents receive current insurance from an employer (their own or their spouse's), and 63.3 percent of respondents have insurance that covers their spouse, while 28.4 percent actually take up their spouse's employer's insurance. 45.3 percent fit the first early retirement definition (not working) and 39.0 percent retire early by second definition (self-reported retirement). 30.2 percent are not working and describe themselves as retired at the time of a survey wave before the year they turn 65, the third early retirement definition.

[33] Data on the premiums required for retiree health benefits are not available.
[34] Throughout the analysis I use the person weights provided in the HRS. All covariates are measured at wave 1.
[35] See the data appendix for a list of the ADLs and chronic conditions included here.

Charts I through IV describe the growth of retirement rates (here measured as self-reported retirement) with age and the interaction between retiree health benefits and health status in predicting retirement. Chart I plots the fraction retired by age. Plotting the 1992 and 1998 waves of the HRS on same graph shows that the pattern did not change significantly through the 1990s, at least up to age 61. Less than 10 percent retire before age 58. This increases to 20 percent by age 61 and then rises rapidly but linearly to 47 percent by age 65. The rapid increase beginning at age 62 coincides with the availability of Social Security retirement benefits. Interestingly, there does not appear to be a trend break or discontinuity at age 63½ associated with the date at which early retirees can purchase COBRA coverage that would last until Medicare eligibility at age 65.

Chart II breaks down the fraction retired (in 1998) by whether individuals were offered a retiree health plan in 1992. Those with retiree health benefits are clearly more likely to have retired at any age. However, the gap does not appear to narrow after age 65, when retiree health benefits become less valuable due to the availability of Medicare. This will be explored further in Table V. Chart III shows the fraction retired (in 1998) by health status in 1992. Health status (self-reported) has less effect on retirement rates than retiree health benefits. Note that while the raw data show higher retirement rates for those in good health, health is highly correlated with income and other determinants of retirement behavior. As a result, the multivariate analysis will often show the reverse pattern, with higher retirement rates (controlling for demographic and economic characteristics) for those in bad health.

Chart IV combines II and III to show retirement rates broken down by health status and the availability of retiree health benefits. This chart shows that there is a positive association between retiree health benefits and retirement for both health groups. If retiree health insurance

affects retirement mostly through demand for health care, then those in good health should be less affected by retiree health benefits than those in bad health, but that does not appear to be the case. In fact, for those in poor health, the largest difference in retirement rates between those with and without retiree health benefits appears after age 65, when health benefits should matter least. Overall, however, there is little visible interaction between retiree health benefits and health status in predicting retirement. This univariate analysis is purely descriptive and suggestive; conclusions will rest on the multivariate analysis.

B. Multivariate Analysis

Following previous literature, Table II shows multivariate results that do not include an interaction between health and retiree health insurance. I model the hazard of early retirement – the probability of retiring conditional on having not retired yet.[36] I assume that retirement depends in the same way on the explanatory variables at any age, but by including a full set of age and wave dummies I allow the level probability of retirement to vary non-parametrically with age. The reported coefficients are marginal effects from probit models.[37] While the results are somewhat sensitive to the definition of early retirement and the set of explanatory variables, they generally confirm the finding that β_1, the main effect of retiree health benefits on the hazard of early retirement, is positive and significant, ranging from 1.3 to 2.6 percentage points. Relative to a baseline hazard of 8 to 12 percentage points, this represents an increase in the hazard of 11 to 32 percent. As discussed above, this regression is likely to be subject to omitted

[36] I focus on early retirement by ending the observation of individuals at age 65 even if they have not retired yet.
[37] Marginal effects are calculated by Stata's dprobit command as the effect of a discrete change in the dependent variable from zero to one with other coefficients held at their means. An alternative approach is to compute the effect of a discrete change in the dependent variable for each actual value of the other variables and then to average across observations. Practically, it does not have a substantial effect on the numerical results.

variables and endogeneity biases, so I do not interpret these results as causal. They simply verify that my data display the same reduced-form patterns reported in the literature.[38]

The estimated effect of bad health is very sensitive to the choice of early retirement definition. It has large effects on the first measure of early retirement – being in fair or poor self-reported health as opposed to good or better health is associated with being 4.9 to 5.2 percentage points more likely to retire (standard error 0.9 percentage points).[39] It is small and insignificant using the second and third definitions, indicating that those in poor health are more likely to stop working but not to describe themselves as retired. This could be due to people who consider themselves disabled rather than retired.[40]

The effect of other covariates remains roughly constant throughout the analysis. Other covariates included in these and subsequent regressions fall into three categories: demographics (marital status, education, sex, race, spouse's age), individual-level economic characteristics (pension coverage, previous health insurance, spouse's employment, whether either partner's insurance covers the other, each partner's log wages, and household net worth), and job-level characteristics (14 industry and 18 occupation categories and log firm size).[41] These covariates generally have small and imprecisely estimated effects, although some are significant.

[38] The most comparable result is Rogowski and Karoly (2000), who estimate the cross-sectional model mentioned as an alternative above using the first three waves of the HRS. These results are consistent with theirs.
[39] This variable measures health status at the first interview, in 1992, but is being used to predict early retirement up to 8 years later. Including contemporaneous health. Bound et. al. (1998) show that changes in health status may be a more important predictor of retirement behavior than levels, but modeling this phenomenon requires considerable additional complexity that is not the focus of the present paper.
[40] Analysis of disability is limited by the lack of direct information on the receipt of disability insurance. However, there is a question on disability that limits work, a broader definition than the Social Security Administration's. Excluding the disabled from the analysis changes the coefficients on bad health somewhat, but does not change the coefficients of primary interest.
[41] Firm size is highly correlated with the offer of retiree health benefits, as are industry and occupation, so their exclusion may lead to a bias.

1. Effect by Health Status

As developed above, I proceed to use a difference-in-differences strategy to generate lower bounds on the true effect of retiree health benefits on retirement. In Table III, I estimate equation (9), augmenting each of the regressions in Table II with the interaction of retiree health insurance and bad health. The estimated coefficients on retiree health insurance are only slightly smaller than without this interaction. The coefficients on bad health are slightly smaller, 4.1 to 4.4 percentage points using the first retirement definition and almost identically zero using the second and third. The key interaction of retiree health insurance and bad health, which the model predicts to be positive, has positive point estimates, but is in no case statistically significant. Estimates range from 1.2 to 1.4 percentage points (standard error 1.5) under the first definition and from 0.4 to 0.6 percentage points with standard errors from 1.1 to 1.2 under the second and third. Thus, I do not find a larger effect of retiree health insurance on those in poor health.[42] As developed above, this indicates that either retiree health benefits do not have a causal effect on early retirement or that those in poor health do not have greater demand for health insurance.[43]

Rather than reporting the age effects in Table III, they are graphed in Chart V, showing the retirement hazard by age relative to age 60. This is just a different way of showing the retirement probabilities by age in Chart I, (which can be thought of as one minus the survivor function associated with this hazard function). Adding the controls does not change the picture very much. Despite their different correlations with health and retiree health insurance, the three measures of retirement show very similar age patterns.

[42] Estimating these regressions separately by gender, the key interaction is generally closer to zero for men than for women, but not statistically significant for either men or women.

[43] This interaction remains insignificant excluding those who report a disability that limits work or including those who lacked health insurance in 1992. Subsequent results are similarly robust to these variations in the sample.

Table III B shows the results of the hazard model estimations using alternative bad health definitions. In none of these 12 regressions does retiree health insurance have a statistically significantly larger effect on early retirement for those in bad health. These results, in fact, contradict the model's predictions more strongly. Retiree health insurance actually has a *smaller* estimated effect among those with more than two difficult activities of daily living. Entering the number of difficult ADLs rather than an indicator for more than 2, the estimates are almost identically zero. The estimates of the interaction of the number of chronic conditions with retiree health insurance are positive, but not statistically significant. Thus the analysis based on differences in health status, using three definitions of early retirement and five bad health measures, uniformly fails to find a positive lower bound on the effect of early retiree health benefits.[44]

2. Effect by Outside Insurance Options

Table IV shows the coefficients of interest for the hazard-model analysis of the differential effect of retiree health insurance on those with and without spousal health insurance. The first panel shows the effect of retiree health insurance on early retirement for those who are and are not covered (at baseline) by health insurance from their spouses' employers. The second panel narrows the definition of spousal coverage to include only those whose spouses could continue to cover them even if the spouse retires, through family retiree health benefits. The job-lock theory predicts that those not covered by their spouses should be more sensitive to their own retiree health benefits, so the coefficients on "Own retiree health insurance * covered by spouse"

[44] Using the subsample which reaches age 65 by the final observation, for whom it can be observed whether or not they retire early, it is possible to estimate the effect of retiree health benefits by health status without using the hazard specification, simply regressing early retirement on baseline health benefits for each individual. These results are very similar to those from the hazard models, and are not shown.

and "Own retiree health insurance * covered by spouse and eligible for spouse retiree coverage" should be negative.

In the upper panel, I find that those who are covered by their spouses while they are working are in fact less affected by retiree health benefits. For the first two retirement definitions, the coefficient on "Own retiree health insurance * covered by spouse" is –1.8 to –1.9 percentage points, statistically significant with a standard error of 0.6 percentage points. For the third early retirement definition, the evidence is somewhat weaker, with a point estimate of –1.2 and a standard error of 1.0. These estimates are about two-thirds the magnitude of the main effect of own retiree health benefits, largely undoing the main effect. The fact that the negative interaction does not fully offset the main effect of own retiree health benefits suggests that about one-third of the estimated effect of retiree health benefits is not due to health insurance. For the narrower spousal insurance definition (in the lower panel), requiring the spouse to provide retiree benefits as well, the results are even stronger. The estimated interactions between "Own retiree health insurance * covered by spouse and eligible for spouse retiree coverage" range from –3.9 (standard error 0.8) to –6.2 (standard error 1.5) percentage points, more than offsetting the own retiree health benefits effect. Hence, it appears that retiree health benefits are not valued by those who already have insurance provided by their spouses. This is consistent with the job-lock theory.

Additionally, the model indicates that retiree health insurance should have a smaller effect on the probability of retirement after age 65, since at this point the outside insurance option generally improves greatly with the availability of Medicare. Table V shows the effect of retiree health insurance by age. These regressions extend the hazard-model specifications in Table II by allowing the effect of retiree health insurance to vary with age, as described in

equation (11), and continuing to observe individuals past their 65th birthdays. For clarity of interpretation I let the effect of retiree health insurance vary at ages 51-61, 62-64, and 65 or higher. Other choices of age classification do not affect the results.[45]

Following column (2) for exposition, I estimate that retiree health insurance has a 1.1 percentage point smaller effect (standard error 0.9) on those over 65 than on those under 62, and a 0.6 percentage point greater effect (standard error 0.8) on those 62-64. These estimates have the sign predicted by the theory – less effect of early retiree health benefits on those over 65 – but they are statistically imprecise. The $\chi^2(1)$ test statistic for equality of these estimates is 2.43, not sufficient to reject ($p = 0.119$). For the other two retirement definitions the results are similar, with p-values of 0.097 and 0.480, again failing to reject the equality of the effect of retiree health insurance for those over 65 and those 62-64. Acknowledging the weakness of this test, retiree health insurance seems to have somewhat less effect on those with a better outside health insurance option, Medicare.[46] The weakness of this result may be due to a correlation between retiree health benefit offerings before and after age 65. The spousal insurance results, however, are more compelling, and demonstrate that the association between retiree health benefits and early retirement does reflect demand for health insurance.

[45] It is logical to add an age category beginning at age 62 because this is the age at which Social Security retirement benefits become available. In the context of studying health insurance, it would also be reasonable to use a category beginning at 63½, since this is the age at which retirees can purchase COBRA coverage which extends to age 65. I have also allowed the effect of retiree health insurance to vary for each age and tested the difference of the average effect over age 65 and the average effect under age 65. The results are invariant to such alternatives.

[46] I have also estimated models with a three-way interaction structure, in which I allow the effect of retiree health insurance on those over and under 65 to vary by health status. Not surprisingly, given the insignificance of the two-way interactions, the interaction of retiree health insurance and health is not significantly different before and after age 65.

VI. Discussion

Estimates of the difference between the effect of retiree health benefits on early retirement for those in good health and those in bad health show that retiree health benefits do not have a statistically significantly larger effect for those in bad health. This has two possible interpretations: either the association between retiree health benefits and early retirement is not due to health insurance demand, and is hence not causal, or demand for health insurance is not strongly related to health status.

Early retiree health benefits do, however, have considerably less effect on early retirement for those who have other sources of coverage, particularly spousal insurance, than for those who do not. These estimates do not rely on any relationship between health status and demand for health insurance. This allows me to distinguish between the two possible explanations following from the health-based estimates – the estimates based on other sources of insurance imply that the association between early retiree health benefits and early retirement is due to demand for health insurance. Those who do not demand health insurance do not respond to the benefits. In combination, the health results and the spousal insurance results imply that early retiree health benefits do encourage early retirement and that health status is not a good indicator of health insurance demand for this age group.

Are the results reliable? The identifying assumption underlying the health estimates is that omitted variables are uncorrelated with health status and that health status is independent of the potential endogeneity of retiree health insurance with respect to retirement. The most likely candidates for omitted variables that would be correlated with both retiree health benefits and retirement (thus biasing the naïve estimates) are omitted job characteristics. To the extent that any such characteristics are correlated with health, retiree health benefits, and retirement in such

a way as to bias the key interactions, they probably bias the estimates upwards. This would be the case, for example, if those in poor health who have stronger preferences for retirement select into jobs with retiree health benefits. Given the possibility of such a bias, the finding that the estimated interactions are small and insignificant is particularly convincing.

The identifying assumption required for the spousal insurance estimates to be valid is that any omitted variables correlated with both retiree health insurance and early retirement are independent of outside insurance offering. The most plausible scenario that would generate an endogeneity bias in these estimates is that those with greater demand for insurance, if they cannot obtain retiree health insurance, try to obtain insurance from their spouses or public programs (i.e., endogeneity of spousal job search). In this case, those with other health insurance would have greater unobserved demand for insurance, which might bias the interaction between retiree health benefits and spousal health insurance upward, or towards zero for a negative coefficient. This potential bias makes my finding of a significant negative interaction more convincing.[47]

It may seem puzzling that the effect of retiree health insurance on retirement is not stronger for those in poor health, who have the greatest need for continuing employer-based health benefits due to both higher expected health expenditures and higher cost of non-group health insurance. Recall the language of the empirical strategy section, in which λ represents the ratio of the effect on those in good health to those in poor health and E represents the true effect of insurance on those in poor health. Then the finding that $(1 - \lambda) \cdot E$ is close to zero indicates either that there is no effect of health insurance (E=0), or that demand for health insurance is not

[47] I also find that poor health does not predict spousal coverage, consistent with the exogeneity of spousal coverage.

related to health ($\lambda = 1$). The result for spousal insurance indicates that E is not zero, implying that λ is close to 1.

It is possible that demand for health insurance is not correlated with health. This would be consistent with Blau and Gilleskie (2001b), who find little effect of retiree health insurance when it is forced to operate through the budget constraint but a larger effect when it enters the utility function directly. There are several potential explanations. Strong risk aversion might lead the healthy to have just as much demand for health insurance as the unhealthy. This would be especially true if the unhealthy are less risk-averse, which is plausible – in fact, less risk aversion may contribute to poor health if it encourages risky (unhealthy) behaviors. Similarly, myopic preferences would contribute to bad health and reduce demand for health insurance. Another possible explanation is that the some of the unhealthy have more information about how the health care system works than the healthy, and this information may mitigate fear of entering the system without a "gatekeeper" such as is provided by HMOs. Alternatively, some of the unhealthy may be unhealthy precisely because they have not sought medical care in the past due to unobserved preferences against medical care; such people would have less demand for health insurance due to their dislike of medical care.

A fact that reinforces these explanations is that for individuals in their early sixties, the probability of having a bad health event and high expenditures is fairly high even for those who are healthy. Of those in excellent health in 1992, only one-third remained in excellent health in 1998, and of those in very good health in 1992, fully one-tenth were in fair to poor health by 1998. Given the considerable risk involved, even the healthy may quite reasonably exhibit high demand for health insurance. This would help to explain the difficulty economists have had in

finding evidence of adverse selection in basic health insurance.[48] A review of this literature can be found in Linsenmeier (2002).[49]

VII. Conclusion

There is a considerable literature on job-lock, both for job-to-job transitions and for job exits into retirement. Much of the existing literature argues that because health benefits are tied to employment, many people are prevented from leaving their jobs by the consequent loss of health insurance. Since this problem is mitigated for those with employer-provided retiree health benefits, the job-lock theory predicts that early-retiree health insurance should increase early retirement probabilities. A number of studies, particularly those following a reduced-form strategy, have found empirical evidence that appears to support this theory. Omitted variables are the most likely alternative explanation, as the details of pension benefits and other retirement amenities are likely to be correlated with both retiree health insurance offers and early retirement, but are hard to measure and rarely included in conventional data sources.

A simple theoretical examination shows that if the job-lock theory is the correct explanation for the estimated effect of retiree health benefits on early retirement, then the effect should be stronger for those who value health insurance more, namely those in poor health and those with no other sources of group health insurance. This paper tests these two predictions in numerous ways. The health-based estimates imply either little causal effect or little relationship

[48] The contrast between this result and the finding of substantial adverse selection in prescription drug insurance in Linsenmeier (2002) may be explained by the greater predictability of drug expenditures than overall health expenditures, along with market regulations that prevent Medigap policies from using health status to set premiums or deny coverage, creating a more serious asymmetric information problem in that market than exists in basic health insurance.

[49] Research that finds little or no adverse selection in basic health insurance includes, for example, Cardon and Hendel (2001), Swartz and Garnick (2000), Feldman, Dowd and Coulam (1999), and Kilbreth, Coburn, McGuire, Martin, Diehr, Madden, and Skillman (1998), which represent a wide range of empirical approaches. It should be noted that Cutler and Reber (1998) do find adverse selection in basic health insurance, although for a younger population than the HRS.

between health and health insurance demand. The outside insurance-based estimates allow only the second explanation.

I find that early retiree health benefits do have a causal effect on early retirement. Retiree health benefits increase the hazard of early retirement by 15 to 35%, at the low end of previous estimates.[50] Finding no difference in the effect of retiree health benefits by health status has important implications. As Gruber and Madrian (2002) observe, little research has been done on the welfare implications of retirement job-lock. Intuitively, the welfare implications would be more serious if it were disproportionately the unhealthy who were job-locked, which would be plausible given the high cost of individual health insurance for the unhealthy near-elderly. However, this turns out not to be the case – retirement job-lock is not significantly greater among the unhealthy. This result also has implications for Medicare buy-in proposals: a Medicare buy-in at age 62 would probably have a negative labor supply effect, but the effect would not be concentrated among the unhealthy, and adverse selection into the program would probably not be severe.

[50] Throughout the analysis, the estimated main effect of retiree health benefits on the hazard of early retirement ranges from about 1.5 to 3.0 percentage points on a baseline hazard of 8 to 11 percentage points depending on the retirement definition.

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Data Appendix

1. Early Retirement

The three definitions of early retirement are correlated, but not identical, as described in the table below.[51] As a result, it is not necessary that the analysis will show the same patterns predicting them.

Retirement definition	First	Second
Second	0.6493	1
Third	0.7092	0.9063

2. Health

Self-reported health status is measured on a five-point scale. Respondents are asked "Would you say your health is excellent, very good, good, fair, or poor?" The twenty-one activities of daily living (ADLs) are: running a mile, walking several blocks, walking one block, walking across a room, sitting for 2 hours, getting up from a chair after sitting for a long time, getting in and out of bed without help, climbing several flights of stairs without resting, climbing one flight of stairs without resting, lifting or carrying 10 pounds, stooping and kneeling, picking up a dime from a table, bathing or showering unassisted, extending arms above shoulder level, pushing or pulling a living room chair, eating without help, dressing without help, using a map, using a microwave oven, using a calculator, and using a computer. In previous work using the Medical Expenditures Panel Survey I have found these (collectively) to be strong predictors of health expenditures. The chronic conditions are hypertension, diabetes, cancer, lung conditions other than asthma, heart problems (with separate indications of congestive heart failure, angina,

[51] The table shows the weighted correlations for the sample who are working in wave 1 and reach age 65 by the wave 5 interview, since for these people early retirement can be definitively observed.

and heart attack), stroke, "emotional, nervous, or psychiatric problems," arthritis or rheumatism, back problems, foot and leg problems, kidney or bladder problems, stomach and intestinal ulcers, and high cholesterol, diagnosed by a physician.

The health measures are correlated, but still quite different, as shown in the table: [52]

Health measure	Self-reported "fair" or "poor" health	More than 2 difficult ADLs	Number of difficult ADLs	At least 2 chronic conditions
More than 2 difficult ADLs	0.2412	1		
Number of difficult ADLs	0.3541	0.7860	1	
At least 2 chronic conditions	0.2365	0.3186	0.3272	1
Number of chronic conditions	0.3757	0.3816	0.4620	0.7500

[52] The table shows the weighted correlations for the sample who are working in wave 1 and reach age 65 by the wave 5 interview.

Table I: Descriptive Statistics

HRS Panel -- workers with health insurance at baseline only.

	mean	standard deviation
Married	0.745	0.436
Years of Education	13.0	2.7
Female	0.452	0.498
White	0.857	0.350
Age	55.7	3.1
Spouse's age	54.7	5.6
Pension plan	0.295	0.456
Retires Early -- stops working	0.453	0.498
self-reports retired	0.390	0.488
not working & retired at interview before age 65	0.319	0.466
Health is "poor" or "fair"	0.104	0.305
Number of difficult ADLs	2.669	2.426
More than two difficult ADLs	0.419	0.493
Number of chronic conditions	2.070	1.656
At least two chronic conditions	0.572	0.495
Retiree health plan offered	0.434	0.496
Retiree health plan and bad health	0.041	0.199
Current insurance from (own or spouse's) employer	0.863	0.344
R's insurance from spouse's employer	0.284	0.451
Spouse covered by R's employer	0.633	0.482
Spouse's retiree health insurance covers R	0.216	0.411
Non-employer-based insurance	0.142	0.349
Own wages and salary income	$30,727	$33,439
Wages not reported (or zero)	0.088	0.283
Spouse's wages and salary income	$25,661	$21,572
Spouse's wages not reported (or zero)	0.461	0.499
Spouse working	0.500	0.500
Firm size	8915.0	55295.1
Firm size not reported	0.154	0.361
Net worth including housing	$268,701	$574,943
Net worth missing	0.336	0.472
Number of individuals	5533	

Note: All calculations use person weights.
All variables measured in wave I (1992)

Chart I: Fraction Retired by Age

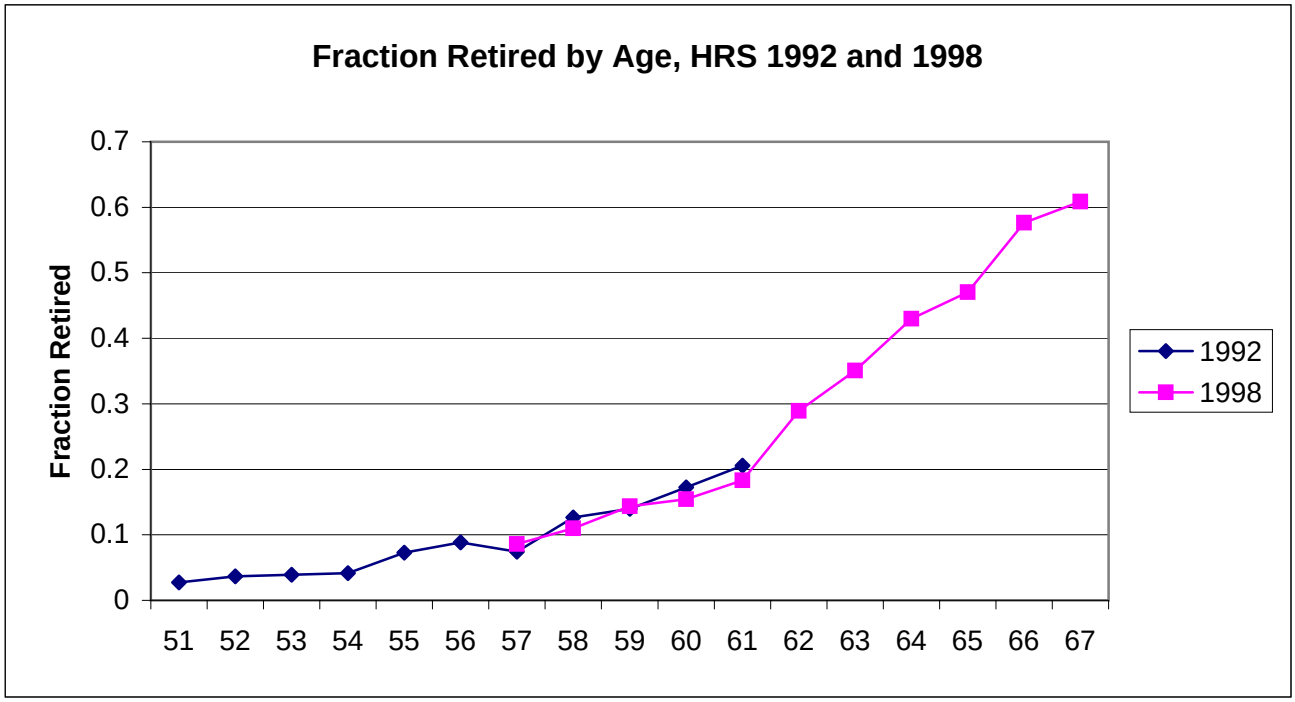


Chart II: Fraction Retired in 1998 by Retiree Health Plan offer in 1992

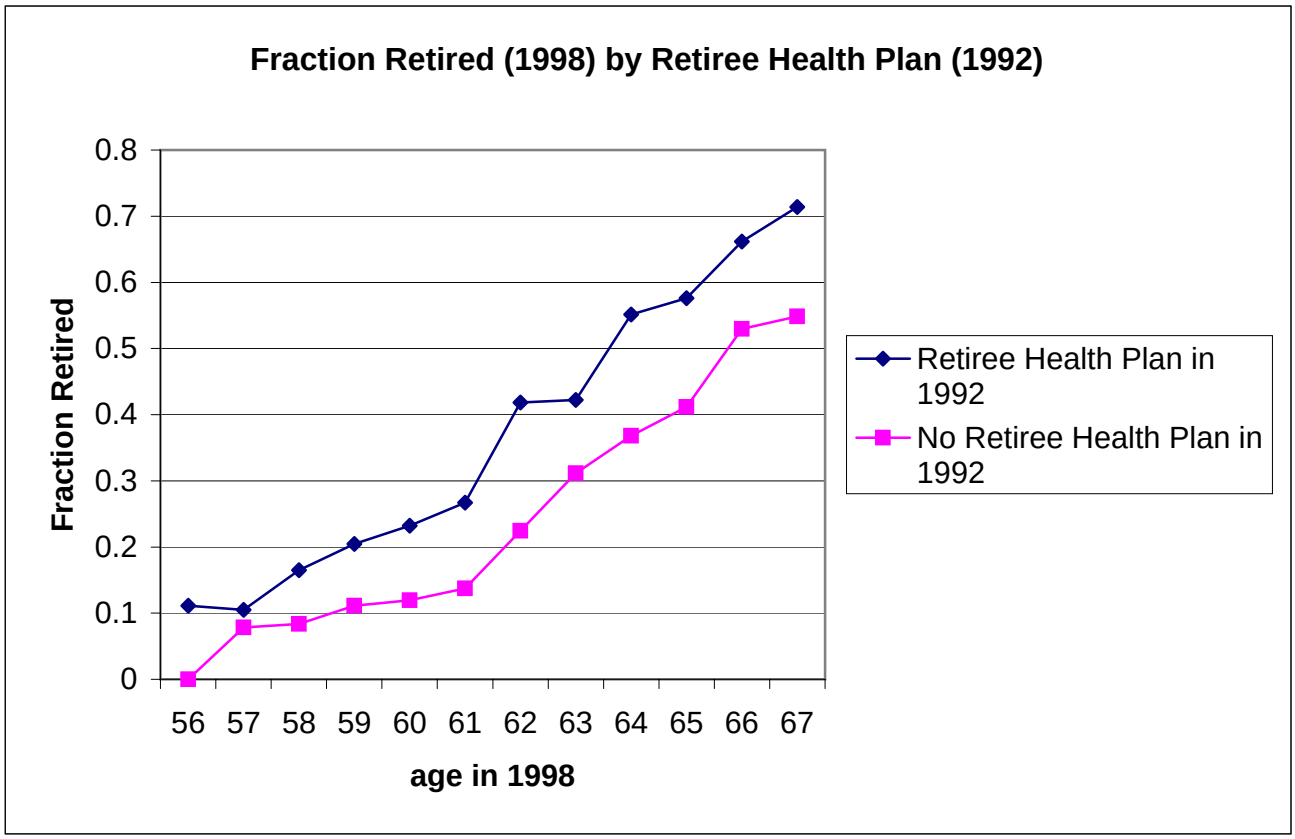


Chart III: Fraction Retired in 1998 by Health status in 1992

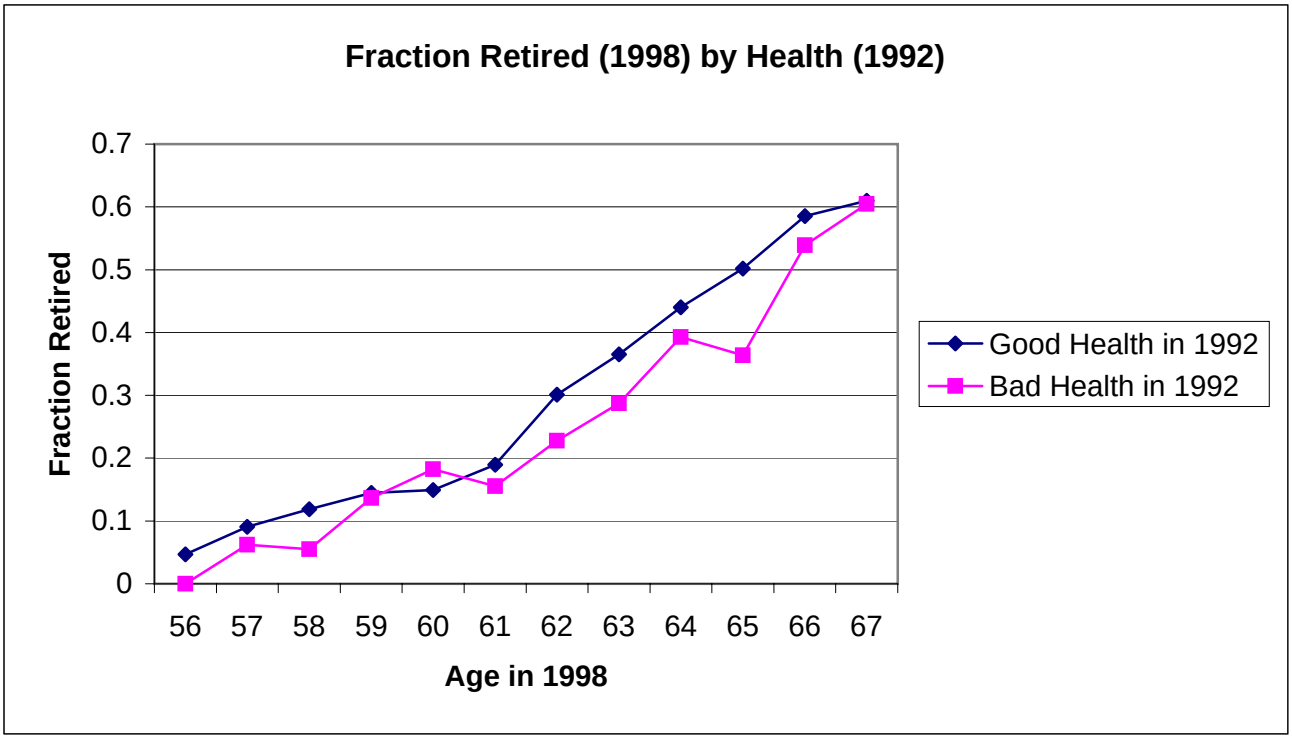
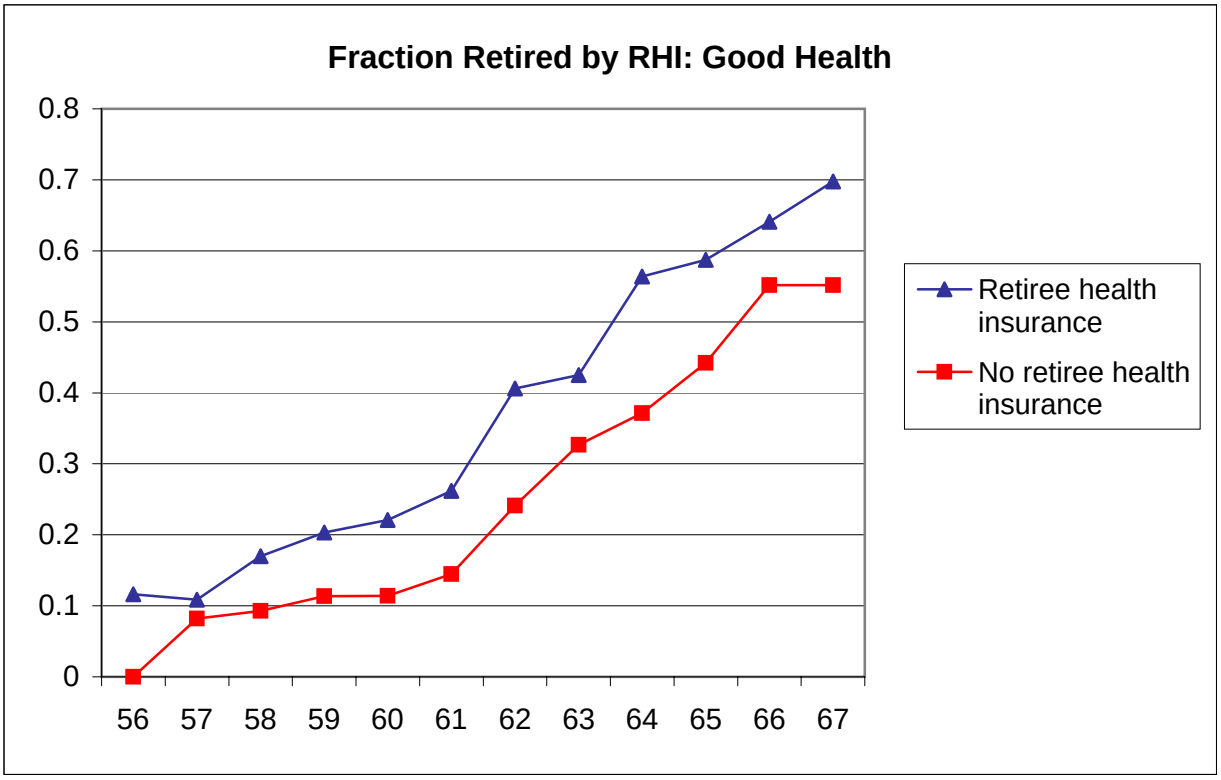


Chart IV: Fraction retired in 1998 by health status and retiree health insurance offers in 1992



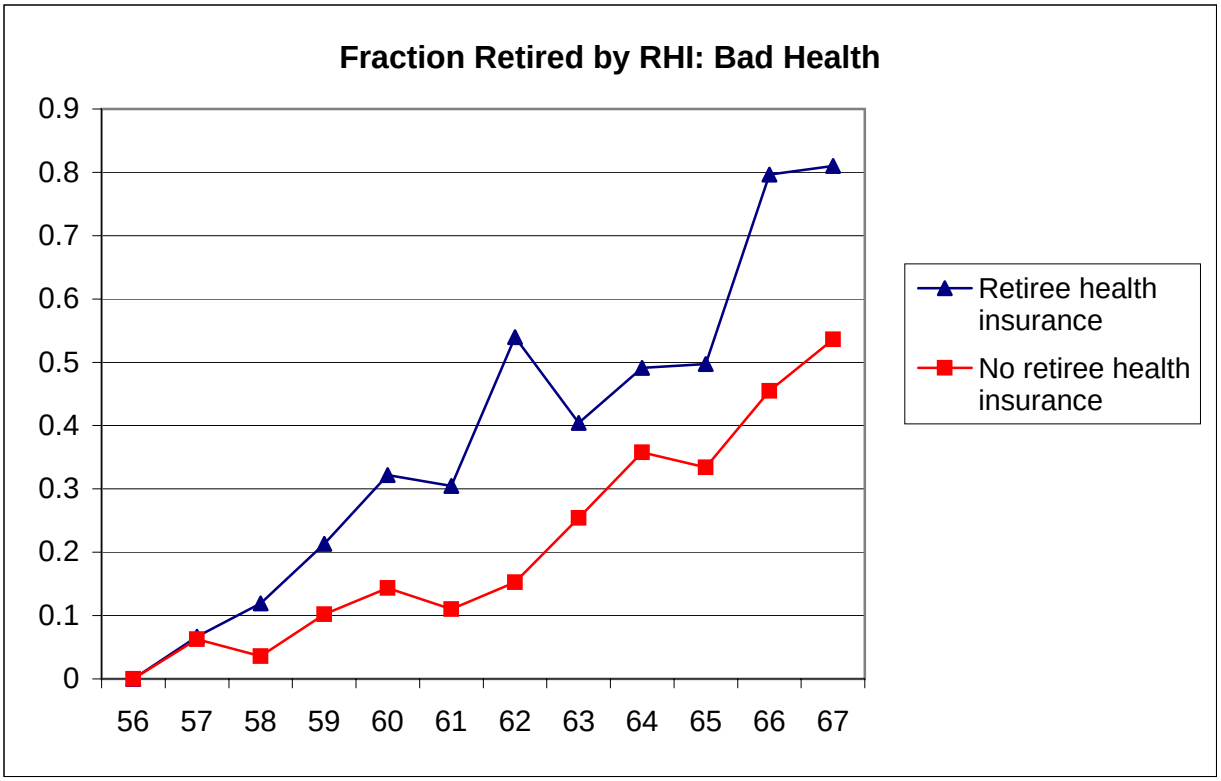
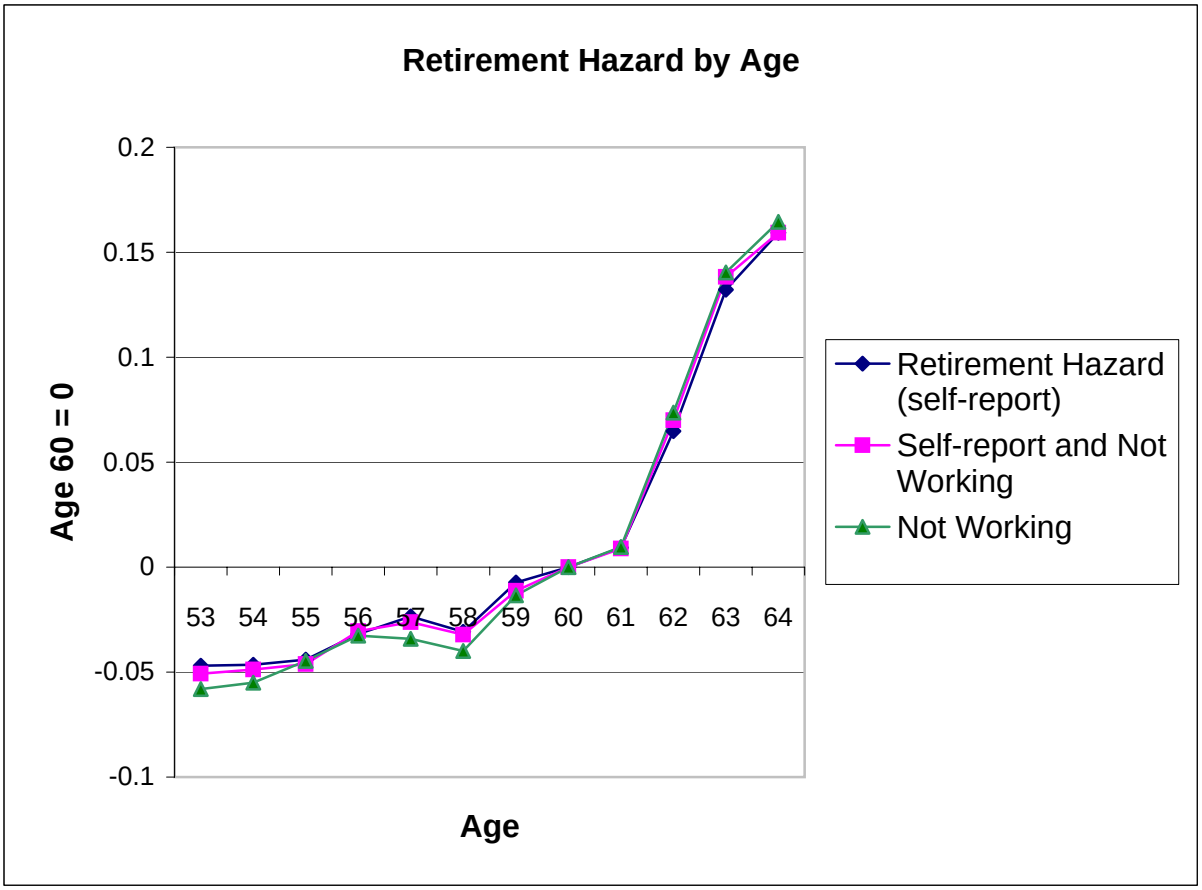


Chart V: Regression-adjusted Retirement Hazard by Age



Coefficients from Table III columns (3), (6), and (9); see Table III for list of controls.

Table II: Replication of previous literature

Early retirement definition	Stops working			Self-reports retired			Not working & retired at interview before age 65		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Retiree health insurance	0.013	0.017	0.016	0.023	0.023	0.026	0.023	0.024	0.023
	(0.004)	(0.005)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Bad health	0.052	0.049	0.051	0.000	0.004	0.008	0.001	0.004	0.008
	(0.009)	(0.009)	(0.009)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)
Married		0.015	0.002		0.017	0.003		0.017	0.001
		(0.005)	(0.009)		(0.004)	(0.006)		(0.004)	(0.006)
Years of education		-0.002	-0.002		0.001	-0.001		0.001	-0.001
		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)
Female		0.009	0.006		-0.007	-0.010		-0.004	-0.005
		(0.005)	(0.006)		(0.003)	(0.004)		(0.004)	(0.004)
White		0.001	0.003		0.005	0.005		0.006	0.007
		(0.005)	(0.006)		(0.004)	(0.004)		(0.004)	(0.004)
Pension plan		-0.009	-0.008		-0.001	0.001		-0.010	-0.008
		(0.005)	(0.005)		(0.004)	(0.004)		(0.004)	(0.004)
Spouse covers R			0.007			0.004			0.006
			(0.007)			(0.005)			(0.005)
Spouse working			0.000			0.001			0.001
			(0.007)			(0.005)			(0.005)
R covers spouse			-0.003			0.001			0.003
			(0.007)			(0.005)			(0.005)
Log wages			-0.010			0.002			0.004
			(0.004)			(0.003)			(0.003)
Spouse log wages			0.007			0.003			0.003
			(0.003)			(0.003)			(0.003)
Log net worth			0.004			0.005			0.005
			(0.002)			(0.002)			(0.002)
Log firm size			0.004			0.003			0.004
			(0.001)			(0.001)			(0.001)
Industry and Occupation	No	No	Yes	No	No	Yes	No	No	Yes
Baseline hazard	0.1182	0.1182	0.1182	0.0811	0.0811	0.0811	0.0826	0.0826	0.0826
Log-likelihood	-6864	-6852	-6785	-5518	-5497	-5389	-5317	-5296	-5174
Number of individuals	5533	5533	5533	5533	5533	5533	5533	5533	5533
Number of observations	20463	20463	20463	22149	22149	22149	21249	21249	21249

Notes: Marginal effects from probit regressions. Standard errors in parentheses adjusted for clustering within individuals over time.
Regressions also include indicators for survey wave and age at observation.
See text for explanation of dataset construction.

Table III: Effect by health status (hazard model)

Retirement definition:	Not working			Self-reported retired			Self-report retired & not working		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bad health	0.041	0.043	0.044	0.002	0.003	0.006	0.001	0.003	0.006
	(0.011)	(0.011)	(0.011)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Retiree health insurance	0.016	0.024	0.014	0.023	0.033	0.026	0.023	0.032	0.023
	(0.005)	(0.006)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
Bad health * RHI	0.014	0.012	0.013	0.005	0.005	0.004	0.006	0.006	0.005
	(0.015)	(0.015)	(0.015)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.011)
Pension plan	-0.009	-0.009	-0.008	-0.001	0.001	0.001	-0.010	-0.009	-0.007
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Log wages		-0.004	-0.010		0.007	0.002		0.011	0.004
		(0.003)	(0.004)		(0.003)	(0.003)		(0.003)	(0.003)
Log spouse wages		0.008	0.008		0.004	0.003		0.005	0.004
		(0.003)	(0.003)		(0.003)	(0.002)		(0.003)	(0.002)
Spouse working		-0.002	0.000		0.000	0.001		0.000	0.002
		(0.007)	(0.007)		(0.005)	(0.005)		(0.005)	(0.005)
Log net worth		0.001	0.004		0.003	0.005		0.003	0.005
		(0.002)	(0.002)		(0.002)	(0.002)		(0.002)	(0.002)
Log firm size			0.004			0.003			0.003
			(0.001)			(0.001)			(0.001)
Industry and occupation	No	No	Yes	No	No	Yes	No	No	Yes
Log-likelihood	-6852	-6836	-6785	-5497	-5458	-5389	-5295	-5250	-5175
N (unique individuals)	5533	5533	5533	5533	5533	5533	5533	5533	5533
N (observations)	20463	20463	20463	22149	22149	22149	21249	21249	21249

Notes: Marginal effects from probit regressions. Standard errors in parentheses, adjusted for clustering within individuals over time.
All regressions control for marital status, years of education, sex, race, and dummy variables for missing wages, net worth, and firm size if appropriate.
Regressions include a full set of age (at time of observation) indicators as well as indicators for survey wave. The age indicators are shown in Chart V.

Table III B: Alternative health measures (hazard model)

Early retirement definition	Not working (1)	Retired (2)	Retired & not working (3)
Retiree health insurance	0.023	0.026	0.024
	(0.007)	(0.005)	(0.005)
More than 2 difficult ADLs	0.023	0.002	0.003
	(0.006)	(0.005)	(0.005)
More than 2 difficult ADLs * RHI	-0.016	-0.003	-0.004
	(0.008)	(0.007)	(0.007)
Log-likelihood	-7875	-6584	-6391
Retiree health insurance	0.019	0.022	0.019
	(0.008)	(0.006)	(0.006)
Number of difficult ADLs	0.005	0.000	0.000
	(0.001)	(0.001)	(0.001)
Number of difficult ADLs * RHI	-0.001	0.001	0.001
	(0.002)	(0.001)	(0.001)
Log-likelihood	-7867	-6584	-6391
Retiree health insurance	0.012	0.017	0.016
	(0.008)	(0.006)	(0.006)
At least 2 chronic conditions	0.016	-0.002	-0.001
	(0.006)	(0.005)	(0.005)
At least 2 chronic conditions * RHI	0.006	0.013	0.011
	(0.009)	(0.007)	(0.007)
Log-likelihood	-7874	-6582	-6389
Retiree health insurance	0.014	0.019	0.016
	(0.008)	(0.006)	(0.006)
Number of chronic conditions	0.007	0.001	0.000
	(0.002)	(0.001)	(0.001)
Number of chronic conditions * RHI	0.001	0.003	0.003
	(0.003)	(0.002)	(0.002)
Log-likelihood	-7868	-6581	-6389
N (unique individuals)	5533	5533	5533
N (observations)	22261	24257	23408

Notes: Marginal effects from probit regressions. Standard errors in parentheses, adjusted for clustering.
All regressions control for marital status, years of education, sex, race, and dummy variables for missing wages, net worth, and firm size if appropriate.
Regressions include a full set of age (at time of observation) indicators as well as indicators for survey wave.
This is the same set of controls as columns (3), (6), and (9) of Table IV.

Table IV: Effect of retiree health status by spousal insurance coverage (hazard-model)

Early retirement definition:	Stops working (1)	Self-reports retired (2)	Not working & retired at interview before age 65 (3)
Own retiree health insurance	0.028	0.032	0.019
	(0.005)	(0.005)	(0.006)
Covered by spouse's employer-based insurance	0.013	0.012	0.010
	(0.006)	(0.006)	(0.008)
Own retiree health insurance * covered by spouse	-0.018	-0.019	-0.012
	(0.006)	(0.006)	(0.010)
Eligible for spouse's retiree benefits	0.025	0.027	0.025
	(0.006)	(0.006)	(0.007)
Log-likelihood	-5155	-5367	-6776
Own retiree health insurance	0.026	0.029	0.019
	(0.005)	(0.005)	(0.006)
Covered by spouse's employer-based insurance	0.006	0.004	0.007
	(0.005)	(0.005)	(0.007)
Eligible for spouse's retiree benefits	0.029	0.031	0.028
	(0.006)	(0.006)	(0.007)
Own retiree health insurance * covered by spouse and eligibile for spouse retiree coverage	-0.039	-0.040	-0.062
	(0.008)	(0.008)	(0.015)
Log-likelihood	-5155	-5367	-6773
Number of individuals	5533	5533	5533
Number of observations	21249	22149	20463

Notes: Marginal effects from probit regressions. Standard errors in parentheses, adjusted for clustering. All regressions also control for bad health, marital status, years of education, sex, race, pension coverage, whether the respondent's insurance covers his or her spouse, spouse working, own log wages, spouse log wages, log net worth, a complete set of age indicators, and industry and occupation, as well as including dummy variables for missing wages, net worth, and firm size.
This is the same set of controls as columns (3), (6), and (9) of Table III.

Table V: Effect by age (hazard model)

Early retirement definition	Not working (1)	Retired (2)	Retired & not working (3)
Bad health	0.045	0.002	0.001
	(0.012)	(0.008)	(0.008)
Retiree health insurance	0.008	0.026	0.021
	(0.007)	(0.006)	(0.006)
Retiree health insurance * Bad health	0.012	0.009	0.010
	(0.016)	(0.013)	(0.013)
Age 62-64	0.150	0.154	0.156
	(0.011)	(0.010)	(0.010)
Age 65+	0.201	0.227	0.224
	(0.018)	(0.017)	(0.017)
Age 62-64 * Retiree health insurance	0.022	0.006	0.006
	(0.012)	(0.008)	(0.008)
Age 65+ * Retiree health insurance	0.010	-0.011	-0.010
	(0.015)	(0.009)	(0.008)
p-value for chi^2 test of equality	0.480	0.119	0.097
Log-likelihood	-8022	-6717	-6551
N (unique individuals)	5533	5533	5533
N (observations)	22794	24257	24571

Notes: Marginal effects from probit regressions. Standard errors in parentheses, adjusted for clustering.
All regressions also control for marital status, spouse's age in 1992, years of education, sex, race, pension coverage, whether the respondent's insurance covers his or her spouse, whether the respondent is covered by insurance provided by his or her spouse's employer, spouse working, own log wages, spouse log wages, log net worth, and industry and occupation, as well as including dummy variables for missing wages, net worth, and firm size.
This is the same set of controls as columns (3), (6), and (9) of Table III.
The results are similar when age62-64 and age65+ are replaced with a full set of age indicators.
Exluding the interactions of bad health status with age assumes that bad health itself does not have different effects by age. The data do not reject this assumption, and the results are not sensitive to this choice.