Health Insurance and Retirement of Married Couples

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Abstract

In this study we propose a new explanation for the fact that labor force participation of older married couples is strongly positively correlated, and we develop and estimate a model that allows us to determine its importance. Our explanation is based on the observations that (1) most health insurance is provided by employers until eligibility for Medicare begins at age 65, (2) many individuals are covered by health insurance from the spouse's employer, and (3) there is substantial variation across employer health insurance plans in coverage for retirees and the spouses of retirees. Descriptive evidence shows that couples who face employment incentives arising from shared health insurance appear to respond strongly to those incentives. We build a dynamic behavioral model of the employment and medical care decisions of older couples. The model places no restrictions on either the degree of complementarity of leisure hours of spouses in utility or the value of health insurance (i.e., risk aversion): these two key aspects of behavior are determined by parameters identified by variation in health risk and health insurance constraints and the behavior of couples in response to these constraints. Estimates of the model therefore allow us to determine the empirical importance of the explanation we propose. Estimates of the model using data from the Health and Retirement Survey indicate that couples have a strong preference for shared leisure and a relatively low degree of risk-aversion. The risk-reducing feature of health insurance does not contribute much to the observed correlation in labor force decisions of spouses.

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1. Introduction

The labor force status and transitions of older husbands and wives are strongly positively correlated. An older individual is much more likely to be employed if the individual's spouse is employed than if the spouse is not employed. An employed individual is much more likely to exit employment if the spouse is not employed than if the spouse is employed. These patterns have been documented in a number of countries and time periods, but the causes are not well-understood. The desire of spouses to share leisure time during retirement must be part of the explanation. Financial incentives could reinforce or offset behavior induced by complementarity of leisure. For example, husbands and wives who are close in age will reach the age of eligibility for Social Security benefits at around the same time, and therefore may face similar retirement incentives from Social Security. Jointly held private assets could have positive wealth effects on the demand for leisure of both spouses. However, if the private pension plans of the spouses have different early and normal retirement ages, pension incentives could induce one spouse to stay employed longer than the other. Also, a substantial disparity in wage rates could lead to incentives for one spouse to be employed while the other is not.

Previous research has found little evidence that financial incentives can explain the variation in joint labor force behavior of married couples. While many couples closely coordinate the timing of exit from employment, equally large numbers of couples do not. This variation has not been well-explained in studies that have incorporated measures of financial incentives. For example, Hurd (1990, p. 253) concludes that "cross-[spouse] economic variables do not have a strong effect on retirement ages, so they do not provide a good explanation for the correlation of retirement dates." Blau (1997, 1998) finds that the Social Security spouse benefit has small effects on the timing of retirement and that cross-spouse wage effects are small as well.[1] It is important to understand the sources of variation in the joint labor force behavior of older couples. Any policy that affects the retirement decisions of an individual by altering retirement incentives could also affect the retirement behavior of the spouse.

In this study we propose a new explanation for the variation in joint labor force behavior of older couples, and we develop and estimate a model that allows us to determine its importance. Our explanation is based on the observations that (1) most health insurance in the United States is provided by employers until eligibility for Medicare (public health insurance for the elderly and disabled) begins at age 65; (2) many individuals are covered by health insurance from the spouse's employer; and (3) there is substantial variation across employer health insurance plans in coverage for retirees and the spouses of retirees. To illustrate, consider two hypothetical couples with the same preferences and constraints except for health insurance, and assume that the husband is two years older than the wife. Suppose that the husband and wife are both employed when the husband is age 62 and the wife age 60, and that the wife's employer does not provide health insurance. The husband in couple *A* has health insurance from his employer that covers retired as well as active workers and their spouses. In couple *B*, the husband's health insurance does not cover retired workers or spouses. Couple *A* does not face any incentives from health insurance that affect the timing of retirement. Coverage of both spouses continues regardless of the employment status of either spouse. In couple *B*, the health insurance coverage of both spouses depends on the husband's but not the wife's employment

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[1]See Baker (1999), Blau and Riphahn (1999) and Gustman and Steinmeier (2000) for related evidence.

status until he reaches age 65 and becomes eligible for Medicare. At that point the wife's coverage but not the husband's depends on his employment status. If spouses have a strong desire for shared leisure, it seems likely that in couple *A* they would closely coordinate their labor force exit timing. In couple *B*, however, the husband has an incentive to remain employed until he is 67 in order to ensure health insurance coverage for his wife until she turns 65. But her employment decision has no impact on her health insurance coverage. She could remain employed herself and wait until age 65 to retire, but other incentives could induce her to retire earlier (poor health, low wage, a private pension plan). Thus if health insurance coverage is valuable to older couples, such considerations could help explain variation across couples in the degree of labor force coordination.

In section 2 we describe the association between joint labor force behavior of older couples and their health insurance coverage, using data from the Health and Retirement Study (HRS). These data reveal that couples who face employment incentives arising from shared health insurance appear to respond to those incentives. For example, a wife whose husband's health insurance coverage depends on her remaining employed is much more likely to be employed than is a wife whose husband has health insurance coverage that is independent of her employment status. This demonstrates the potential usefulness of an explanation of variation in the joint labor force behavior of older couples based on health insurance coverage.

In section 3 we describe a dynamic behavioral model of the employment and medical care decisions of older couples that can be estimated empirically. The model places no restrictions on either the degree of complementarity of leisure hours in utility or the degree of risk aversion: these two key aspects of behavior are determined by parameters identified by variation in health risk and health insurance constraints and the behavior of couples in response to these constraints. Estimates of the model therefore allow us to determine the empirical importance of the explanation we propose.[2]

Section 4 describes the HRS data that we use to estimate the model. These data include extensive information on health insurance and pensions collected from the current and former employers of the couples in our sample to supplement the information provided by the respondents. We also use the Social Security earnings records of the sample members in order to provide accurate measures of retirement incentives.

Section 5 presents estimates of the model and simulations of behavior generated from the estimated model. The model fits the observed employment choices well in many dimensions, but does not do a good job of capturing differences in employment choices by health insurance conditional on previous employment status. Health insurance enters the model only through the budget constraint, so this suggests that the risk-reducing feature of health insurance may not be the driving factor behind observed differences in employment choices by health insurance. Couples may value health insurance for other reasons not captured in our model. Consistent with this interpretation, the estimated coefficient of relative risk aversion is 1.10, substantially lower than the values often used in simulation studies of savings. In our analysis, this coefficient is identified by variation across individuals in health risk interacted with health insurance, and the estimate suggests that people are not as averse to the consequences of health risk as they are often assumed to be with respect to earnings and other risks. Section 6 concludes.

[2]See Berkovec and Stern (1991), Blau and Gilleskie (2001a), Rust and Phelan (1997), and Stock and Wise (1990) for other dynamic stochastic models of retirement.

2. Descriptive Overview

The HRS sampled men and women aged 51-61 in 1992 and their spouses, and has interviewed them every two years since 1992. In this section we describe the relationships among employment status, defined by whether an individual is employed at the survey date in 1992 and 1994, employment transitions between the 1992 and 1994 survey dates, and health insurance coverage. We classify individuals into the following health insurance coverage categories: (1) covered by a current or former employer that provides retiree health insurance (RHI); (2) covered by a current employer that does not provide RHI; (3) covered by the spouse's current or former employer that provides RHI for which the individual is eligible; (4) covered by the spouse's current employer that does not provide RHI for which the individual is eligible. Here we include individuals only if their health insurance coverage falls into one of these four categories *and* they have no other source of coverage. These restrictions are relaxed in the following sections.

Table 1 shows the employment status of each spouse conditional on the employment status of the other spouse. Wives are 13.9 percentage points more likely to be employed in 1992 if the husband is employed than if he is not employed, and 18.8 points more likely in 1994. Husbands are 10.6 percentage points more likely to be employed in 1992 if the wife is employed than if she is not employed, and 16.6 points more likely in 1994. Wives are 8.7 percentage points more likely to exit employment between 1992 and 1994 if the husband also exits during the period than if he remains employed, and they are 4.6 percentage points more likely to exit employment if he was not employed at the beginning of the period and remained not employed than if he was employed at both the beginning and end of the period. A husband's employment transitions are also strongly dependent on his wife's employment behavior: he is 10.8 percentage points more likely to exit employment if his wife also exits employment than if she remains employed, and is 7.8 percentage points more likely to exit employment if she remains non-employed than if she remains employed. The patterns shown in Table 1 are quite similar to those described in other data sources.[3]

Table 2 classifies couples by the husband's health insurance status in the upper panel and by the wife's health insurance status in the lower panel. Comparing husbands with coverage from their own employer with and without retiree coverage (upper panel, columns 1-3) shows that husbands with retiree coverage are 16 percentage points less likely to be employed in 1992 or 1994 (rows 1-2), and conditional on being employed in 1992 are one percentage point more likely to exit employment by 1994 (row 5). We and others have previously documented such patterns for men (Blau and Gilleskie, 2001b; Madrian, 1994), and interpreted them as evidence that absence of retiree health insurance is a strong deterrent to labor force exit before the age of 65. A similar pattern appears in the lower panel for wives, with employment level effects that are not quite as large as for men, and employment transition effects that are slightly larger than for men (lower panel, columns 1-3, rows 3-4 and 6).

The new information in Table 2 is in columns 4 to 6. These show that a wife whose husband would lose his health insurance coverage if *she* left employment is 8.5-10.7 percentage points more likely to be employed than a wife whose husband would not lose his coverage if *she* left employment (upper panel, columns 4-6, rows 3-4), and that the former wife has a biannual exit rate from employment 3.1 percentage points lower than the latter wife (row 6). Similarly, a

[3]See Baker (1999); Blau (1998); Blau and Riphahn (1999); Hurd (1990); Gustman and Steinmeier (2000); Zweimüller, Winter-Ebmer, and Falkinger (1996).

husband whose wife would lose coverage if *he* left employment is 19.8-22.3 percentage points more likely to be employed than a husband whose wife would not lose her coverage if *he* left employment (lower panel, columns 4-6, rows 1-2), although the former husband has an annual employment exit rate slightly higher than the latter husband (row 5). These findings suggest that interrelationships among health insurance and employment of spouses could be important, although they do not account for other factors that could be associated with both employment and health insurance.[4]

3. The Model and Estimation

The key features of the model are that health insurance can help couples smooth the marginal utility of consumption across health outcomes, and health insurance is linked to employment for many couples. An adverse health shock could increase the marginal utility of medical care. There is no saving in the model, so the only way to finance medical expenditures is to reduce consumption in the period in which the expenditures are incurred. Uninsured health risk reduces expected life time utility because it increases consumption variability, which risk-averse consumers dislike in standard life cycle models. Health insurance helps smooth consumption by reducing consumption in good health states via the insurance premium, and increasing consumption in bad health states via coverage of medical expenses. Because health

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[4]Madrian and Beaulieu (1998) compare the retirement decisions of married men who have a spouse 65 or older with those of men with younger spouses, in order to estimate the impact of Medicare eligibility on retirement. Using data from the 1980 and 1990 Censuses, they find that men aged 55-69 who worked in the previous calendar year are more likely to be retired at the census date if the spouse is Medicare-eligible than if she is not Medicare-eligible. This is consistent with our findings reported in Table 2, but is not directly comparable.

insurance coverage is valuable to risk averse consumers, a worker whose own or spouse's insurance coverage is tied to his employment status (because coverage for retirees is not offered) may make different employment decisions than an otherwise similar worker whose insurance coverage is independent of his employment status. If couples are highly risk-averse, then these differences could be substantial.

Two key assumptions that are imposed for computational feasibility are that there is no saving and no possibility of choosing health insurance coverage. By forcing consumers to satisfy a series of period-specific budget constraints, the model can be thought of as providing an upper bound on the effect of health insurance on employment decisions. If couples could save in anticipation of adverse health shocks (i.e., self-insure), then health insurance would not be as valuable and the incentive to make employment decisions based on health insurance considerations would be weaker. Similarly, if individuals could acquire retiree health insurance coverage by changing jobs or by purchasing private non-group insurance, then the employment decisions of individuals with and without retiree coverage might not be very different. Thus by limiting other mechanisms for smoothing consumption to account for health risk, the model forces consumers who wish to avoid exposure to health risk and who lack retiree health benefits to remain employed. If the estimates of this model imply little impact of health insurance on employment, then we would expect that relaxing these assumptions would also yield small impacts. On the other hand, if the estimates imply a large impact of health insurance on employment, then it would be important to determine whether the findings are robust to allowing savings and health insurance choice.[5]

We specify a discrete state, discrete time model of employment and medical care choices of married couples. At the beginning of a period, a couple learns the realizations of all stochastic processes for the period. Given these realizations and the values of deterministic state variables such as work experience and job tenure, the couple makes its choices for the period and these choices remain fixed for the duration of the period. State variables are updated at the end of the period, and the process repeats until the terminal date, T*. The length of a period is two years, corresponding to the time between interviews in the HRS. Below we describe the states, choices, and stochastic processes for employment, health insurance, health, medical care, income, and divorce, followed by specification of utility and value functions, the solution method, and estimation issues.

A. Employment

The employment status of member $a = m$ (male), f (female), of a couple at the end of period t is e_{at}, where e_{at}=0 denotes not employed, and e_{at}=1 denotes employed. Other employment-related state variables include x_{1at}, the cumulative labor market experience of spouse a at the end of period t; x_{2at}, the cumulative job tenure of spouse a at the end of period t; fe_a, the age at which spouse a first receives Social Security benefits; re_a, an indicator for whether spouse a ever re-enters employment after beginning to collect Social Security benefits; and L_{at}, a binary indicator of whether spouse a was laid off at the beginning of period t.[6] With probability δ an

[5]Starr-McCluer (1996) provides evidence that suggests that precautionary saving by individuals without health insurance is rare.

[6]Experience is a state variable because it affects the Social Security benefit. Tenure is a state variable because it affects the pension benefit, if any. We keep track of tenure only on the

individual who was employed in period t-1 is laid off at the beginning of period t. Individuals receive a job offer from a new employer at the beginning of each period. Jobs are assumed to be identical except for the earnings and health insurance they offer.

Let j_{at}=1, 2, 3 represent the job choice of spouse *a* in period t. If the individual was employed in period t-1 and not laid off at the beginning of period t, he chooses among (1) non-employment, (2) the new job offer, and (3) the old job. If the individual was laid off at the beginning of t or was not employed during t-1, he chooses between (1) non-employment and (2) the new job. The employment state at the beginning of period t is determined as: e_{at} = 1 if $j_{a,t-1}$>1 and L_{at}=0; e_{at} = 0 if $j_{a,t-1}$=1 or L_{at}=1.

B. Health Insurance

Until the age of Medicare eligibility, we assume that during a given period an individual can be covered by one and only one of the following types of health insurance: (0) none; (1) own-employer, with retiree coverage available; (2) own-employer, no retiree coverage available; (3) spouse-employer, with coverage available to the individual after the spouse retires; (4) spouse-employer, with coverage not available to the individual after the spouse retires; (5) private (non-employer); (6) Medicare. Medicare is available to individuals under the age of 65 only if they receive Social Security Disability Insurance (SSDI).[7] We assume that upon reaching age 65, an

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job held at the initial survey date, because pensions on jobs held after the first job are not modeled. An individual is assumed to become entitled for Social Security benefits in the first period in which he or she is not employed beginning at age 62. Thus, unlike Rust and Phelan (1997), we do not model the decision to apply for benefits. See the Appendix for details on the roles of fe_a and re_a in the model.

[7]Actually, Medicare is available only after two years on SSDI. We take SSDI enrollment as given and do not model applications to SSDI. Following SSDI policy, we assume that individuals younger than 65 can receive Medicare through SSDI only if not employed.

individual enrolls in Medicare and may have at most one additional source of coverage. Employer and private health insurance convert to Medigap coverage at age 65, as required by Medicare rules.[8]

As noted above, computational feasibility requires that we treat health insurance coverage as given. Thus, we assign a couple their observed health insurance coverage and characteristics in the periods for which we have data. Changes in coverage observed in the data are assumed to have been perfectly foreseen by the couple. We assume that couples expect their health insurance coverage to remain unchanged following the last period for which we have data. If an individual changes jobs, he is assumed to act as if he will be covered on the new job by the same type of health insurance he had in the last period of the data. The characteristics of health insurance on new jobs (premium, deductible, etc.) are assumed to be those of a “generic” plan described in the Appendix, instead of the characteristics of the plan the individual had in the data. If an individual is covered by his employer’s health insurance plan without retiree coverage, he becomes uninsured if he leaves employment. He remains uninsured until he becomes employed again or reaches age 65 and receives Medicare coverage. Similarly, if an individual is covered by his spouse’s employer’s plan without retiree coverage, he becomes uninsured when his spouse leaves employment, and remains uninsured until *she* gets a new job or he turns 65. Health insurance coverage of individuals covered by employer plans with retiree insurance or by private plans is unaffected by employment decisions.

C. Health

[8]Medigap insurance is secondary coverage that pays for expenses not covered by Medicare. Medicare rules require that employer and private plans must be the primary payer even after age 65 if the individual is employed. If retired, then Medicare is the primary payer.

Health status of spouse a, h_{at}, is a discrete variable that can take on values 0, 1, 2, where 0 denotes good, 1 denotes bad, and 2 denotes death. The probability of observing spouse a in health status h' during period t+1 given that he or she was in health status h during period t is

$$\pi_{at}^{hh'} = \Pr(h_{at+1}=h'|h_{at}=h) = \frac{\exp(\gamma_{0hh'}^{a} + \gamma_{1hh'}^{a}A_{at})}{\sum_{h''=0}^{2}\exp(\gamma_{0hh''} + \gamma_{1hh''}^{a}A_{at})} \tag{1}$$

where A is age, and the γ's are parameters. This first-order markov model does not allow medical care in period t to affect health in period t+1, so medical care is assumed to be desired only for "palliative" reasons, as specified in the utility function below.

D. Medical Care

Doctor visits (v_{at}) and hospital nights (k_{at}) are choice variables, with each freely chosen from a set of three alternatives. In principle, the choice sets should include all non-negative integers but for computational reasons we limit the choices to three. The three alternatives for doctor visits per period are 0, 3, and 10, and for hospital nights are 0, 2, and 14. These correspond to averages observed within categories defined by 0,1-5, and 6+. The out-of-pocket medical expenses m_t of the couple depend on the number of visits and hospital nights of each spouse, the price per visit, and the characteristics of the health insurance coverage of the spouses at the beginning of the period:

$$m_t = m(v_{ft}, k_{ft}, v_{mt}, k_{mt}, F_m, F_f, p_{vt}, p_{kt}) \tag{2}$$

where the p's are per-visit and per-night prices, and the F's are vectors of characteristics of insurance plans, such as deductibles, coinsurance rates, premiums, and so forth. These are specified in more detail below. This function is deterministic, and gives out-of-pocket medical expenses for any feasible combination of office visits and hospital nights. Medical care is modeled as a choice rather than as a draw from a distribution (as in Rust and Phelan, 1997) so that the information on characteristics of insurance plans (F) can be used in the budget constraint, and to allow for the possibility that the demand for medical care is not perfectly inelastic.

E. Income and Consumption

Earnings per period W_{at} are non-stochastic, and are determined by a function known to the couple (specified in the next section). Social Security and pension benefits b_t are also non-stochastic and depend on the age, experience, tenure, and employment status of the husband and wife according to known rules summarized in the function

$$b_t = b(\mathrm{e}_{\mathrm{mt}}, x_{1mt}, x_{2mt}, A_{\mathrm{mt}}, \mathrm{e}_{\mathrm{ft}}, x_{1ft}, x_{2ft}, A_{\mathrm{ft}}, g_{\mathrm{t}}) \qquad (3)$$

where g_{t} is income from assets. This function is shorthand notation for the rules of the Social Security system and the pension plans covering each individual in the sample. Employment status (e_{at}) matters because of the Social Security earnings test. Experience affects the Social Security Average Indexed Monthly Earnings, the basis on which benefits are computed. Tenure affects benefits in many pension plans. Age affects eligibility for Social Security and pension benefits and the level of benefits. Specific details are described in the next section and the Appendix. Asset accumulation is not modeled, so asset income is treated as given. Given the absence of savings, consumption in period t equals total family income in period t net of out-of-pocket medical expenses, and is given by

$$\mathrm{C}_{\mathrm{t}} = W_{mt}1[j_{mt}>1] + W_{ft}1[j_{ft}>1] + b_t - m_t - \Upsilon(w_{mt}1[j_{mt}>1] + w_{ft}1[j_{ft}>1], b_t, m_t) \qquad (4)$$

where $1[j_{at}>1]$ is an indicator function that takes on the value 1 if the individual chooses to be employed, and zero otherwise; and $\Upsilon(\,)$ is the tax function, incorporating income and payroll taxes and accounting for the medical expense deduction.

F. Divorce and Death.

Divorce is not modeled as a choice, but rather as the result of an exogenous stochastic process. A marriage ends in divorce or separation at the end of period t, an event denoted by D_t=1, with probability Pr(D_t=1). In practice, we simply set Pr(D_t=1) to the sample average divorce rate observed between 1992 and 1994. In order to avoid the complications of modeling behavior following divorce, we assign a “terminal value” to the event of the marriage ending as a result of divorce, and do not model behavior following divorce. The terminal value is denoted V(D_t=1), and is normalized to -200. We follow the same approach for widowhood: a terminal value is assigned and the behavior of the surviving spouse is not modeled. The terminal value function in the event of the death of spouse *a* is given by V(h_{at}=2) and is also normalized to -200. If both spouses die in the same period the terminal value function is also normalized: V($h_{mt} = h_{ft}$ = 2) ≡ -200.

G. Utility Function

Utility of the couple in period t depends on each member’s choice of employment and medical care, and on health, consumption, exogenous characteristics, and a shock. Define an indicator w_{at} for whether spouse *a* chooses to be employed in period t, regardless of whether the job is new or old: w_{at} = 0 if j_{at} = 1; w_{at} = 1 if j_{at} > 1. Utility in period t is (suppressing a household subscript)

$$
\begin{aligned}
U_t \;&=\; \bar{U}_t(j_{mt}, j_{ft}, h_{mt}, h_{ft}, v_{mt}, v_{ft}, k_{mt}, k_{ft}) \;+\; \epsilon_t(j_{mt}, j_{ft}, h_{mt}, h_{ft}, v_{mt}, v_{ft}, k_{mt}, k_{ft}) \\
&=\; \alpha_{0h_m h_f w_m w_f} \;+\; \frac{1}{1-\alpha_1} C_t^{1-\alpha_1} \;+\; \alpha_{2h_m} v_{mt} \;+\; \alpha_{3h_m} k_{mt} \;+\; \alpha_{4h_f} v_{ft} \;+\; \alpha_{5h_f} k_{ft}
\end{aligned}
$$

$$+ \ \alpha_{6h_m} e_{mt-1} 1[j_{mt}=2] \ + \ \alpha_{7h_m} e_{mt-1} 1[j_{mt}=1] \ + \ \alpha_{8h_f} e_{ft-1} 1[j_{ft}=2] \ + \ \alpha_{9h_f} e_{ft-1} 1[j_{ft}=1]$$

$$\alpha_{10h_m w_m} A_{mt} \ + \ \alpha_{11h_f w_f} A_{ft} \ + \ \epsilon_t(j_{mt}, j_{ft}, h_{mt}, h_{ft}, v_{mt}, v_{ft}, k_{mt}, k_{ft}) \quad \text{if } C_t > 0 \tag{5}$$

$$= \ \alpha_{12} + \ \epsilon_t(j_{mt}, j_{ft}, h_{mt}, h_{ft}, v_{mt}, v_{ft}, k_{mt}, k_{ft}) \qquad \text{if } C_t \leq 0 \tag{6}$$

where 1[ ] is a binary indicator that takes on the value 1 if the statement in the brackets is true, and zero otherwise. The utility function incorporates the following features. (1) The intercept (α_0) varies freely by employment choice and health of both spouses.[9] Hence, employment preferences are allowed to be non-separable within a period across spouses. (2) The utility of consumption is separable from other items and takes the isoelastic form, with coefficient of relative risk aversion α_1 independent of choices and states. (3) Preferences for medical care are linear, separable, and depend on own health. (4) Employment preferences are dynamic and depend on health. A utility cost of changing jobs (j=2) is included (α_6 and α_8), and the utility of being out of the labor force (j=1) depends on whether or not the individual was employed in the previous period (α_7 and α_9). (5) Age (A) affects utility with health-and-employment-specific parameters. (6) The parameter α_{12} allows for aversion to negative consumption, which was found to be important by Rust and Phelan (1997). (7) The utility shocks (ϵ) are assumed to be independently and identically Type I Extreme Value distributed, within periods and over time. This rules out both serial correlation and contemporaneous correlation in the shocks.

This function characterizes the utility of a couple in which both members are alive. Since we do not model behavior following the end of a marriage, we do not specify a utility function

[9]One of the 16 intercepts is normalized to zero. The α's are defined only for bad and good health (h=0 or 1), not for death (h=2).

for individual members of the couple. Given that the choices we model are all discrete, the implications of the family utility function model specified here cannot be distinguished from those of a collective model in which each spouse has his or her own utility function and the couple reaches a Pareto-efficient bargain.[10]

H. Value Function

The expected present discounted value (EPDV) of a couple's remaining lifetime utility in period t<T* resulting from a given set of choices, conditional on the vector of state variables other than health ($\mathbf{s_t}$), and the vector of period t utility shocks ($\boldsymbol{\epsilon_t}$) is

$$
\begin{aligned}
V^{h_{mt}h_{ft}}_{j_{mt}v_{mt}k_{mt}j_{ft}v_{ft}k_{ft}}(\mathbf{s_t}, \boldsymbol{\epsilon_t}) \quad = \quad & \bar{U}_t(\,) + \epsilon_t(j_{mt}, j_{ft}, h_{mt}, h_{ft}, v_{mt}, v_{ft}, k_{mt}, k_{ft}) \\
& + \beta(1-\Pr(D_{t+1}=1))[\sum_{h'_m=0}^{1}\sum_{h'_f=0}^{1} \pi_{mt}^{h_m h'_m}\pi_{ft}^{h_f h'_f} V^{h'_m h'_f}(\mathbf{s_{t+1}}) \\
& + \pi_{mt}^{h_m 2}\sum_{h'_f=0}^{1}\pi_{ft}^{fh_f h'_f}V(h_{m,t+1}=2) + \pi_{ft}^{h_f 2}\sum_{h'_m=0}^{1}\pi_{mt}^{h_m h'_m}V(h_{f,t+1}=2) + \pi_{mt}^{h_m 2}\pi_{ft}^{fh_f 2}V(h_{mt+1}=h_{ft+1}=2)] \\
& + \beta\Pr(D_{t+1}=1)V(D_{t+1}=1) \qquad (7)
\end{aligned}
$$

where β is the discount factor. The value function accounts for the divorce probability ($\Pr(D_t=1)$), the probability of death of one or both spouses ($\pi_{at}^{h_a 2}$), and the probability of arriving in period t+1 with the marriage intact and both spouses alive and in any combination of good and bad health.

The maximal EPDV of remaining lifetime utility from being in health states h_{mt+1} and h_{ft+1}

[10] Blundell et al. (1998) show that a static collective model imposes different restrictions on the data than a static unitary utility function model when there is a continuous choice variable such as hours of work. In the absence of a continuous choice variable, the sharing rule parameters in the collective model are not identified. As shown in Blundell et al. (p. 12), the sharing rule parameters are identified from the labor supply function, and there is no labor supply function in a pure discrete choice model.

in period t+1 unconditional on period t+1 choices is

$$V^{h_{mt+1}h_{ft+1}}(\mathbf{s_{t+1}}) = E_t \max V^{h_{mt+1}h_{ft+1}}_{j_{mt+1}v_{mt+1}k_{mt+1}j_{ft+1}v_{ft+1}k_{ft+1}}(\mathbf{s_{t+1}}, \boldsymbol{\epsilon_{t+1}}) \tag{8}$$

where the expected value is taken with respect to $\boldsymbol{\epsilon_{t+1}}$, and the max is taken with respect to the choices j_{mt+1}, j_{ft+1}, v_{mt+1}, v_{ft+1}, k_{mt+1}, and k_{ft+1}.

I. Solution

The model is solved numerically by backward recursion, following the standard approach to solution of finite horizon discrete choice dynamic programing problems (e.g., Eckstein and Wolpin, 1989). We use two approximations in the solution instead of solving the model exactly. The recursive solution must be computed for every couple and every trial value of all parameters. The state space in our model is very large, and the exact solution takes too long to compute for this to be feasible. For computational feasibility, we truncate the decision period at T < T*. Following Mroz and Weir (1993) we specify an approximation to the value function at T+1, given by

$$V^{h_{mT+1}h_{fT+1}}(\mathbf{s_{T+1}}) \approx f(\mathbf{s_{T+1}}, h_{mT+1}, h_{fT+1} \mid \varsigma), \tag{9}$$

where f( ) is a function of the state space at T, and ς is a vector of parameters estimated jointly with other parameters of the model. In addition to reducing the computational burden, by setting T so that the oldest age to which we model behavior is relatively young (67 in what follows below), we avoid solving the model for ages far beyond those observed in the data. The second approximation is to compute the value function for a randomly selected subset of points in the state space at each period instead of for all points in the state space. Following Keane and Wolpin (1994) the value function is regressed on the state variables using the sample of randomly selected points in the state space for which the value function was computed exactly.

The estimated regression parameters are used to approximate the value function for the points in the state space for which the value function was not computed exactly. See Keane and Wolpin (1994) for details and for a monte carlo analysis of the method.

As part of the recursive solution, we compute choice probabilities for the observed choices for each couple. As a consequence of the assumptions about the ϵ's, the choice probabilities have the multinomial logit form:

$$p(d^{t}_{j_m v_m k_m j_f v_f k_f}=1|\mathbf{s_t},\ h_{mt},\ h_{ft}) \ = \ \frac{\exp(\bar{V}^{h_{mt}h_{ft}}_{j_{mt}v_{mt}k_{mt}j_{ft}v_{ft}k_{ft}}(\mathbf{s_t}))}{\sum\limits_{j'_{mt}=1}^{J(\mathbf{s_t})} \sum\limits_{v'_{mt}=1}^{K} \sum\limits_{k'_{mt}=1}^{K} \sum\limits_{j'_{ft}=1}^{J(\mathbf{s_t})} \sum\limits_{v'_{ft}=1}^{K} \sum\limits_{k'_{ft}=1}^{K} \exp(\bar{V}^{h_{mt}h_{ft}}_{j'_{mt}v'_{mt}k'_{mt}j'_{ft}v'_{ft}k'_{ft}}(\mathbf{s_t}))} \tag{10}$$

where $d^{t}_{j_m v_m k_m j_f v_f k_f}=1$ if the couple chooses alternatives j_m, j_f, v_m, v_f, k_m, k_f in period t, and equals zero otherwise, J( ) is the number of employment alternatives available (J=3 if the individual was employed in the previous period and not laid off at the beginning of the period ; otherwise J=2), K is the maximum number of medical care alternatives, and

$$\bar{V}^{h_{mt}h_{ft}}_{j_{mt}v_{mt}k_{mt}j_{ft}v_{ft}k_{ft}}(\mathbf{s_t}) \ = \ V^{h_{mt}h_{ft}}_{j_{mt}v_{mt}k_{mt}j_{ft}v_{ft}k_{ft}}(\mathbf{s_t},\ \boldsymbol{\epsilon_t}) \ - \ \epsilon_t(j_{mt},\ j_{ft},\ h_{mt},\ h_{ft},\ v_{mt},\ v_{ft},\ k_{mt},\ k_{ft}).$$

J. Estimation

Let t=1 denote the period in which we first observe a couple (the 1992 survey), and let t=0 denote the period prior to the first observation. We observe employment and medical care choices as well as health for t=1, 2, and employment-related state variables for periods t=0 and t=1. We treat employment in t=0 and health in t=1 as initial conditions that are not to be explained by the model. We take employment and medical care choices for t=1,2 and the health transition from t=1 to t=2 as quantities to be explained by the model. The likelihood contribution for a couple who does not divorce or attrit from the sample and in which neither spouse dies by period 2, is

$$\mathscr{L} = \left(\prod_{a=m}^{f} \pi_{a1}^{h_{a1}h_{a2}}\right)\left(\prod_{t=1}^{2} \left[p(d^{t}_{j_m v_m k_m j_f v_f k_f}=1|\mathbf{s_t},\ h_{mt},\ h_{ft})\prod_{a=m}^{f} L_{at}^{\delta}(1-L_{at})^{1-\delta}\right]\right)(1-\Pr(D_2=1))^{1-D_2} \quad (11)$$

The likelihood contribution for a couple that divorces before the beginning of period 2 omits the period 2 choice and layoff probabilities and replaces $(1-\Pr(D_2=1))^{1-D_2}$ with $\Pr(D_2=1)^{D_2}$ The likelihood contribution for a couple that experiences a death before period 2 omits the period 2 choice and layoff probabilities, and the divorce probability. The likelihood contribution for a couple that attrits before period 2 includes only the period 1 choice probability.

K. Identification

The key identifying assumptions are no saving, no income shocks, and no health insurance shocks. With these assumptions, consumption equals current income net of medical expenses, which can be computed for alternative employment and medical care choices both in the current period and in future periods. Given the normalization of terminal value functions in the event of divorce or death as described above, and given a normalization of one of the utility function parameters, the remaining parameters are identified. Details are given in the Appendix. Briefly, the observed employment and medical care choices directly identify all of the utility function parameters except α_1, the risk-aversion coefficient. The latter is identified by the employment choices of couples whose health insurance depends on employment. Given the health risk they face (and given the utility of medical care), their employment choices reveal how willing they are to bear risk. The health transition parameters are identified by the observed health transitions. Finally, the terminal value function parameters (ς, defined in equation 9) are identified by the highly nonlinear form in which they enter the choice probabilities.

4. Data

A. Sample

We use data from the first two waves of the Health and Retirement Study (HRS), fielded in 1992 and 1994. The survey includes an employment history, and extensive sections on pensions, health insurance, Social Security, earnings, assets, income, and health. Two additional sources of information have been matched to the survey responses. The Social Security earnings records of individuals who agreed to sign release forms were made available by the Social Security Administration. And individuals who reported being covered by a pension or by employer-provided health insurance were asked to provide the names and addresses of the firms that provide the coverage. These firms were surveyed by telephone as part of the Health Insurance and Pension Provider Survey (HIPPS) and asked to provide details of health insurance plans over the telephone and to provide written descriptions of their pension plans. These supplementary sources of data provide crucial pieces of information that allow us to accurately measure the budget constraint facing each couple. However, they also limit the sample that we can use because there are many cases in which the supplementary information is unavailable.

Of the 4,704 married couples who were surveyed in 1992, 3,027 meet our age criteria. The age criteria are that the husband is 51-63 at the 1992 survey, his wife is not older than him, and his wife is at most ten years younger than him. We restrict the sample to couples in which the wife is not older than the husband because the age of the husband is (arbitrarily) used to specify the terminal period (his age = 67). We lose many observations as a result of missing data on employer health insurance in the HIPPS file and missing information on Social Security. The estimation sample is 675 couples. The estimation sample is similar to the full sample in most respects (see Tables A-1 and A-2 in the Appendix). The only major difference is in health insurance coverage, with only half the couples in the estimation sample covered by employer health insurance compared to about three fourths in the full sample. This is a result of eliminating many couples with employer health insurance who did not have a HIPPS record or who were missing data on the HIPPS file. If the structural parameters are invariant across observations, then this sample can be used to obtain consistent estimates of the parameters despite its nonrepresentative nature with respect to health insurance.

B. Employment Status

Employment status is recorded at the wave 1 and wave 2 survey dates. The wave 2 survey is on average two years after the wave 1 survey. A job history collected at wave 1 allows us to determine employment status two years prior to the date of the wave 1 interview. This gives us a measure of employment status at t=0. Table 3 displays the employment distributions at the wave 1 and 2 survey dates for the estimation sample. The rate of non-employment increases by 2.9 percentage points between surveys for men and 2.1 points for women, and the rate of joint non-employment increases by 1.7 points between surveys.

C. Medical Care

The HRS asks respondents to report the number of nights spent in the hospital and the number of times they have seen or talked to a medical doctor about their health, including emergency room or clinic visits, during the 12 months preceding the wave 1 interview and during the interval between the wave 1 and wave 2 interviews. We collapse the distributions into the three categories shown in Table 4. Wives visit the doctor more often than husbands, but husbands are more likely to have a hospital stay.[11]

D. Health

The HRS has a rich set of health measures, including self-assessed general health and disability, functional limitations, chronic diseases, and many others. Despite this abundance of measures, we take a very simple approach to measuring health in order to focus on the economic aspects of the analysis and avoid the proliferation of parameters that would result from exploiting the richness of the health data.[12] We create a dichotomous measure of health at waves 1 and 2 from responses to the question "Would you say your health is excellent, very good, good, fair, or poor?" by combining excellent, very good, and good (good), and poor and fair (bad). The distribution of health and health changes is shown in Table 5. Of the men who report good health at wave 1, 7.3 percent are in bad health by wave 2 and 1.4 percent have died. The corresponding figures for women are 10.2 and 0.6 percent. Of those who report bad health at wave 1, 21.2 percent of men and 27.8 percent of women are in good health at wave 2, and 9.7 percent of men and 3.5 percent of women have died. The very large differential in death rates by self-assessed health status illustrates the fact that self-reported health contains useful information. There is a strong positive association between health of husbands and wives: of men in good health, 85 percent have wives who are also in good health, while for men in bad health only 65-67 percent

[11] The length of a period in our model is two years, but dollar magnitudes such as earnings and pension benefits are measured on an annual basis in the HRS. In solution of the model we divide the number of visits and hospital nights reported at wave 2 by two before assigning the individual to the appropriate category. This puts the wave 2 medical care variables on an annual basis. After computing annual consumption, we multiply it by two in solving the model.

[12] See Blau and Gilleskie (in press), Bound et al. (1999), and Dwyer and Mitchell (1999) for detailed analyses of the effect of health on employment in the HRS.

have wives in good health (not shown in the table).

E. Health Insurance

The HRS provides data on the source of the respondent's health insurance, but it does not provide information on the premium, deductible, coinsurance rate, etc. We use the HRS data to classify each individual into one of the 7 mutually exclusive and exhaustive health insurance categories shown in Table 6. Individuals with multiple sources of insurance were assigned to categories in the following order: own-employer with retiree health insurance (RHI); spouse employer with RHI; own-employer without RHI; spouse employer without RHI; Medicare; private. For example, a man with both employer-provided coverage and privately purchased coverage is assigned to employer coverage.[13] The characteristics of health insurance plans that we use in constructing the budget constraint are shown in Appendix Table A-3. They include the premium, deductible, coinsurance rate, maximum out-of-pocket costs, and maximum coverage. There is substantial variation across plans both in whether a given feature is present and the magnitude.

Private insurance plans were not included in the HIPPS survey and the characteristics of such plans (except for the premium) were not recorded in the HRS, so we use data from the 1987 National Medical Expenditure Survey (NMES) to construct a set of characteristics of a “generic” private plan, and assign these to all private plans. Finally, Medicare characteristics and rules governing the interaction between Medicare and other insurance beginning at age 65 are used.

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[13]Health insurance is a family affair. For example, of men with no health insurance, two-thirds or more of their wives are also uninsured. Of men with own-employer insurance with RHI, two thirds of their wives are covered by their husband’s insurance. Of husbands with private insurance, two-thirds or more of their wives also have private insurance. These figures are not shown in the table.

See the Appendix for details. The HRS also lacks information on the price per doctor visit and hospital night, so we derive these measures from the NMES as described in the Appendix.

F. Pensions

The HRS collects detailed data from respondents on pensions for all current and former jobs that provide pension coverage. This includes information on the type of plan (defined benefit or defined contribution), years included in the plan, the respondent's current contribution rate, the age at which the respondent expects to receive benefits, the expected benefit amount, and various other features. These data provide a rich source of descriptive information, but do not include the actual formula used to determine the benefit as a function of age of exit from the firm, tenure, earnings, and so forth. The formula is needed in order to compute the benefit to which the respondent would be entitled at different ages of exit from the firm. The written plan descriptions provided as part of the HIPPS interview provide the information needed to construct the formula. We used these data together with the HRS survey responses to compute the benefit from the pension on the job held at period t=1 (if any) for every possible quit date from 1992 until the respondent reaches the terminal age. For pensions provided by previous employers we compute the benefit to which the individual would be entitled at the earliest age at which he is eligible for a benefit under the plan. Appendix Table A-4 summarizes characteristics of pensions.

G. Earnings

We treat earnings as deterministic because of the computational complexity of modeling earnings uncertainty and the drastic increase in the size of the state space that would be caused by allowing the distribution of earnings to depend on earnings in the previous period. Aside from the risk of layoff, which we do model, we view earnings fluctuations as a relatively minor source of risk at older ages compared to health risk. Consequently, the main issue for modeling earnings is how to obtain good forecasts to include in the model as a measure of expectations about future earnings. After considerable experimentation, we decided to use the most recent measure of earnings from the Social Security Earnings Record (SSER) file, denoted "lastearn," as an estimate of an individual's earnings in any period in which he chooses to be employed on the job (if any) held at the survey date in 1992. The mean in the estimation sample is $23,481 (sd $17,863) for men, and $11,240 ($11,465) for women in the full sample.[14] For earnings on new jobs, we estimated a regression explaining log annual earnings from the 1992 and 1994 HRS interviews as a function of lastearn, health, and whether the job was different from the job held two years earlier. The parameters from these regressions are used to assign earnings expectations for new jobs in solution of the model. See the Appendix for the estimates.

H. Social Security Benefits

We use the SSER earnings history from 1951 through 1991 to construct each individual's Average Indexed Monthly Earnings (AIME) and Primary Insurance Amount (PIA) as of 1991, using the formula in effect for 1991. The AIME is a deflated average of earnings from age 21 to the current age, minus the lowest five years of earnings. The PIA is a progressive function of the AIME, and is the basis for computing the Social Security Benefit (SSB). We then use the earnings measures described above to update the AIME and PIA for each of the possible total number of years of experience the individual could accumulate from 1992 through the terminal age. We use these to compute the SSB for which an individual would be eligible upon exiting the

[14] Earnings records in the SSER file are truncated at the maximum taxable annual earnings.

labor force for each possible number of years of experience from 1992 through age 67. These benefit measures are based on the exact formulas used by the Social Security Administration (which differ by cohort as the 1983 Social Security reforms are phased in), accounting for reduced benefits for early retirement and increased benefits for delayed retirement. We do not model the decision to apply for Social Security benefits. Instead, we assume that an individual begins to receive Social Security benefits in the first period in which he or she is not employed from age 62 on. Further details and summary statistics are provided in the Appendix.

I. Other Income and Taxes

Other sources of nonwage income include income from assets, rent, alimony, veteran's benefits, and earnings of family members other than the husband and wife. We treat these sources of income as exogenous and certain. Benefits from SSDI are included if an individual is covered by Medicare while under 65 and chooses non-employment. These are computed using the SSDI rules. Income from means-tested government programs such as Supplemental Security Income (SSI) is excluded. We summed these sources to create a measure of nonwage income for the calendar years prior to the wave 1 and wave 2 interviews. The average of these two measures is assigned as the value of nonwage income for all periods.

We use the 1992 Federal income tax and payroll tax schedules to compute measures of after-tax income. The computations account for taxation of Social Security benefits and the medical expense deduction. Because income is measured on an annual basis and the length of a period is two years in our model, we set consumption equal to twice the value of after-tax income net of out-of-pocket medical expenses.

5. Results

A. Estimates

Table 7 shows estimates of the utility function parameters. The coefficient of relative risk aversion (α_1) is estimated to be 1.116. This is fairly close to Hurd's (1989) estimates using micro data of 0.73 and 1.12, but substantially lower than the values often assumed in simulation studies of savings behavior.[15] A CRRA of 1.116 implies that the certainty-equivalent value of a gamble that pays \$20,000 and \$40,000 with equal probability is \$28,100, compared to \$30,000 under risk neutrality (CRRA=0). This is a moderate degree of risk aversion. The utility function intercept (α_0) was normalized to zero for the case in which both spouses are in good health and not employed. The utility intercepts are lower when the wife is in bad health compared to good health, other things equal, but the pattern for husbands is mixed. Similarly, the utility intercepts are always lower when the wife is not employed than when she is employed, other things equal, as would be expected if leisure is a normal good. But this pattern appears for husbands only when he is in bad health, not when he is in good health.

Preliminary estimates indicated that the parameters on medical care and employment transition indicators were very similar across spouses, so the specification presented here constrains them to be equal for husbands and wives. These restrictions were not rejected by a likelihood ratio test. Medical care provides greater utility (or less disutility) when in bad health than in good health ($\alpha_{i0} > \alpha_{i1}$, i=2-5). Changing jobs and exiting employment are estimated to have utility costs (α_6, α_7, α_8, $\alpha_9 < 0$) in the period in which these events occur. The utility of

[15] Hubbard, Skinner, and Zeldes (1995) and Engen, Gale, and Uccello (1999) calibrate the coefficient of relative risk aversion to 3; Deaton (1991) uses values of 2 and 3; Carroll (1997) uses 2; and Laibson, Repetto, and Tobacman (1998) use values of 1 and 3.

being not employed while in good health rises with age for both spouses ($\alpha_{10,00}$, $\alpha_{11,00} > 0$), but the utility of non-employment while in bad health declines with age ($\alpha_{10,10}$, $\alpha_{11,10} < 0$). The utility of being employed declines with age much faster if in bad health than in good health ($\alpha_{10,01} > \alpha_{10,11}$; $\alpha_{11,01} > \alpha_{11,11}$). The utility associated with negative consumption is negative and large ($\alpha_{12} < 0$).

Other parameter estimates are shown in the Appendix. The health transition parameters were estimated outside the model (by multinomial logit) as in Rust and Phelan (1997). Given the assumed absence of unobserved heterogeneity, this provides consistent estimates, although the standard errors of the utility function parameters have not been adjusted to reflect the separate estimation of the health transition parameters. The parameters for the probability of divorce and layoff were estimated outside the model and fixed. The discount factor was fixed at .925 for two year periods, implying a biannual rate of time preference of 8.1 percent. After considerable experimentation with alternative forms for the terminal value function, we found that the other parameters of the model were insensitive to the form of the latter. Hence, we specified the terminal value function as $-e^{\varsigma}$, where ς is a constant. The estimated value of ς is 4.536, which implies a terminal value at age 67 of the husband of -93.3 in the event that both spouses are alive at that date. This is higher than the terminal values for death and divorce, which were normalized to -200.

B. Model Fit

Table 8 illustrates some aspects of the fit of the model to the data. The overall fit of the model to the employment data shown in panel A is good: the predicted non-employment and job changing probabilities are only 1.8-1.9 points too high for husbands, and 2.8 points too high for wives. The model also fits reasonably well in most cases when choices are classified by employment status in the previous period. An exception is that the model predicts an exit rate from employment for wives of .228, much higher than the observed exit rate of .145. The predicted distribution of joint husband-wife employment choices shown in panel D fits the actual distribution very well unconditional on employment status in the previous period. However, the model substantially under-predicts the probability that both spouses remain not employed when both were not employed in the previous period (.646 predicted versus .730 actual) and the probability that both spouses remain employed when both were employed previously (.558 predicted versus .717 actual).

The model places too much weight on the tails of the doctor visit distribution (panel B), over-predicting the probability of no visits and of 6+ visits, and substantially under-predicting the probability of 1-5 visits. For hospital nights, the model under-predicts the probability of no hospital nights, over-predicts the probability of 1-3 nights, and gets the probability of 4+ nights about right. Both patterns also appear when medical care choices are disaggregated by health status.

Table 9 illustrates the fit of the model to employment choices by health insurance category. Recall that health insurance enters the model only through the budget constraint - there are no utility function or other parameters on health insurance. In view of this, the model does a surprisingly good job of fitting employment choices by health insurance category, at least qualitatively, if not quantitatively. The model captures the higher rate of non-employment of individuals with own-employer insurance with retiree benefits compared to individuals without retiree benefits (men: actual .241 vs. .031; predicted .269 vs. .160; women: actual .138 vs. .048; predicted, .279 vs. .217). The model also captures the higher non-employment rate of the spouse when an individual's insurance coverage is from the spouse's employer with versus without retiree benefits (men: actual .280 vs. .013; predicted .288 vs. .145; women: actual .152 vs. .048; predicted .275 vs. .210).

Table 10 compares predicted to actual employment choices by health insurance category *conditional* on employment status in the previous period. The model fits the qualitative features of the data in most cases, but is often far off quantitatively. The model predicts that non-employed men with retiree benefits are more likely to remain non-employed than are non-employed men without retiree benefits (.786 versus .679) but the actual difference (.789 versus .200) is much larger than the predicted difference. The same is true conditional on having been employed the previous period (.111 vs. .022 actual, and .147 vs. .132 predicted). The model captures the fact that wives of husbands whose insurance is from the wife's employer are more likely to exit employment if they have retiree insurance than if they don't (.083 vs. .000 actual; .221 vs. .189 predicted), but again the magnitude of the effect is under-predicted. The patterns are similar when employment choices are classified by the wife's health insurance.

C. Policy Simulations

In order to assess the implications of the estimates, we used them to simulate employment behavior under alternative scenarios. The simulations were computed for each couple in the sample conditional on the couple's initial state observed at the beginning of period t=1. Couples were randomly assigned an alternative from their choice set in period 1, with the probability of a particular alternative equal to the choice probability for that alternative computed from the model. The estimated health transition and layoff probabilities were used to randomly assign health and layoffs in period 2. The assigned choice along with health and layoff status were then used to update the state for the next period. This was repeated through t=6 or T, whichever came first.[16] The results were then averaged over the sample and, for the results shown in Table 11, over age.

Column one of Table 11 shows results from a baseline simulation of employment choices and transitions using the observed values of all variables and policies. Columns two and three show results from simulations in which all individuals are assigned no health insurance (column two) and universal health insurance independent of employment status (column three). Universal health insurance was implemented by re-assigning all cases with no health insurance and with Medicare under 65 to the generic private plan, and by re-assigning all cases with own or spouse employer insurance without retiree benefits to own or spouse employer insurance with retiree benefits, assuming the plan provisions are the same for retirees and active workers. This ensures that everyone has health insurance and no one loses insurance by leaving employment. These are extreme policy changes, but they are useful for bracketing the magnitudes of the employment responses implied by the model.[17] If health risk causes couples to remain employed longer than they might otherwise prefer in order avoid being uninsured, then universal health insurance should increase the rate of non-employment compared to the baseline and to the no-health-insurance scenario. In fact, the results in Table 11 shows the opposite: universal health insurance

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[16]In principle, this could be done for up to nine periods, the maximum number of periods for which the model is solved for the youngest cohort (a man who is 51 in t=1 is 67 in t=9). However, in simulation, unlike in estimation, choice probabilities must be stored for each possible alternative at every point in the state space, and for periods 7-9 the state space is too large to make this feasible. In the simulations we assume that there are no divorces or deaths, so the sample composition does not change over time.

[17]Health insurance is universal in the column three simulation in the sense that everyone has it regardless of employment status, but not in the sense that everyone has the same plan.

causes small *decreases* in non-employment for husbands and, compared to the no-health-insurance scenario, for wives. This results mainly from a higher rate of entry to employment from non-employment, since the exit rate from employment changes very little for husbands and increases for wives. Simulations by age (not shown) do not reveal any patterns.

Columns 4 and 5 show the simulated employment response to policies that add retiree health insurance (RHI) to all employer plans that lack it (column 4) and that remove RHI from all employer plans that have it (column 5). These responses are negligible. The largest impact of eliminating RHI is a one point decrease in the probability that both spouses remain non employed conditional on non-employment in the previous period (.768 versus .779). This effect is in the right direction if aversion to health risk matters, but is very small in magnitude. The employment responses to simulations that change all spouse coverage to own-employer coverage (column 6) and shift the age of eligibility for Medicare from 65 to 67 (column 7) are also quite small. Both policy changes increase non-employment, as expected, but by no more than 1.5 points. Even at older ages there was no evidence of a strong impact of shifting the Medicare eligibility age to 67.

We examined several possible explanations for the small impact of health insurance on employment. First, the model allows the demand for medical care to be downward-sloping. Going uninsured would not reduce expected lifetime utility much if the demand for medical care is price-elastic. To examine this issue, we computed the price elasticities of demand for office visits and hospital nights implied by the model. These were close to zero, so this cannot explain the small impact of health insurance on employment.[18]

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[18]The price elasticity of demand for medical visits was computed by repeating the simulation shown in column two of Table 11 for the no-health-insurance case, with the price of medical visits set to zero. The arc elasticity was computed for the change in simulated medical

Second, the estimated coefficient of relative risk aversion of 1.116 indicates that couples are not very averse to the income fluctuations associated with health shocks. If couples are not very risk averse, then insurance will not be very important. In order to determine whether absence of substantial risk-aversion is responsible for the weak impact of health insurance we computed simulations in which the risk aversion coefficient was set to a value of 3.0, while all other parameters and variables remained unchanged. A CRRA of 3 implies a certainty-equivalent value of $25,300 for a gamble that pays $20,000 and $40,000 with equal probability, compared to $28,100 with the estimated value of the CRRA of 1.116. We re-computed the baseline simulation in column one of Table 11 and the column-five simulation that eliminates all retiree health insurance. The results are very similar to those in Table 11, showing very little sensitivity of employment choices to health insurance. Hence, the relatively low degree of risk aversion in our estimates is not the explanation for the lack of employment response to health insurance.

Third, in an effort to reconcile our findings with previous non-structural estimates that show a substantial impact of health insurance on retirement, we respecified our model to include health insurance indicators in the utility function. Previous estimates show that health insurance affects employment behavior, while our estimates that force health insurance to operate solely through the budget constraint show negligible effects on employment. By adding health insurance directly to the utility function, we can determine whether health insurance affects employment behavior through some mechanism other than the budget constraint. The only other

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visits between this simulation and the column-two simulation. The no-health-insurance scenario was used as the baseline in order to avoid the complications of computing an “effective” price for each individual given the individual’s health insurance characteristics. This was repeated setting the price of hospital nights to zero.

mechanism in our model is the utility function. We refrain from giving an economic interpretation of this specification, and simply treat it as a test of our original specification. We include binary indicators of whether the individual has own employer health insurance without RHI and whether the individual's spouse has insurance that covers the individual but lacks RHI. These are the two cases in which employment decisions affect health insurance coverage. Allowing the parameters on these variables to vary by employment choice, this adds eight new parameters to the model (two new variables for each spouse with coefficients that vary by employment choice). A likelihood ratio test strongly rejects the hypothesis that these parameters are jointly equal to zero. This indicates that health insurance affects behavior through some channel other than the budget constraint and risk aversion. The precise nature of that channel cannot be determined from these estimates. The estimates from this specification imply behavior similar to that shown in Table 2: a greater likelihood of exit from employment with RHI than without RHI.

Another possible explanation for the absence of health insurance effects on employment is that health insurance is endogenous to employment behavior. We found evidence that this is the case in our earlier non-structural work (Blau and Gilleskie, 2001b). Allowing health insurance to be a choice (as well as accounting for the possibility that the health insurance coverage observed at the beginning of the first period) proved to be beyond the limit of computational feasibility. However, as we argued above, intuition suggests that allowing for choice of health insurance would if anything weaken the impact of health insurance on employment decisions.

Our approach to modeling retiree health insurance and employment is most similar to that of Rust and Phelan (1997), whose results imply a much larger impact of RHI on labor force exit than do our results. We use more recent data (the HRS from the 1990s versus the RHS from the 1970s) and have access to more accurate measures of health insurance coverage than Rust and Phelan. Their results show a very similar degree of risk aversion to ours, 1.072 versus 1.116. Their specification allows health to affect the marginal utility of consumption, and they find that poor health increases the marginal utility of consumption by 26 percent, other things equal. In other respects, our specification is fairly similar to theirs. Consumption (net of medical expenses) is more likely to be low when in poor health than in good health. Thus if the marginal utility of consumption is higher when health is poor, then health insurance would be relatively valuable and individuals will be more likely to remain employed in order to stay insured. In on-going work we are estimating a specification that allows health to affect the marginal utility of consumption .

6. Conclusions

Our findings here indicate that health insurance has little impact on the labor force behavior of older married couples. The findings contrast sharply with estimates from reduced form and approximation models, which suggest that retiree health insurance has a strong effect on employment behavior at older ages. Studies using those approaches cannot determine whether health insurance affects employment behavior through aversion to the consequences of health risk or through some other mechanism. In the model analyzed here, aversion to the consequences of health risk is the *only* channel through which health insurance is allowed to affect behavior, and the effects we estimate are small. If these results are correct, then policy changes that alter the connection between health insurance and employment will have little impact on retirement decisions in the U.S. It is important to do more research before accepting this conclusion, however. As computing cost falls, models that allow for saving and choice of health insurance should be explored. Our intuition is that allowing saving and choice of health insurance would reinforce the conclusion that health insurance is not an important determinant of retirement decisions of older married couples, but empirical analysis is required to determine if this is correct.

Appendix

A. Sample Selection and Characteristics

Table A-1 describes how we obtain the estimation sample of 675 couples. We lose 278 of the age-eligible couples as a result of missing information on employment, demographic variables, health insurance, and health, leaving 2,749 cases.[19] Social Security records are missing for either the husband or the wife (or both) in 992 of these cases, leaving 1,757 cases. Most of the cases without Social Security records are the result of the absence of a signed release, but some cases may be due to the fact that an individual was never employed in a job covered by Social Security. This is difficult to determine from the HRS so we drop all cases without a Social Security record. Of the remaining couples, 408 include at least one member who reports being covered by employer-provided health insurance but for whom there is no record on the Health Insurance and Pension Provider Survey (HIPPS). Records are missing if the respondent did not provide a name and address for the relevant employer or if the employer did not respond to the request for an interview. There is also a substantial amount of missing health insurance information in the HIPPS records: of the 1,349 couples remaining after dropping cases with missing HIPPS data, we lose half as a result of item non-response on the HIPPS survey. The HRS interview asked respondents to provide some information about their health insurance, but did not include questions on the key variables we need, so we are forced to drop all cases with missing health insurance data. After dropping these cases, there are no further cases with missing

[19]In order to make the programming easier, we also eliminated a few cases in which the wife was substantially younger than the husband and there were no other wives of similar age of husbands of a given age. These cases are: husband 53, wife less than 47; husband 56, wife less than 48; husband 58, wife less than 49; husband 60, wife less than 54; husband 62, wife less than 54.

pension data from the HIPPS survey.[20]

B. Health Insurance

Names and addresses of 4,487 establishments with health insurance plans covering an HRS respondent were obtained from the respondents in the wave 1 survey. Of these, 3,350 responded to the HIPPS telephone survey, yielding a file with observations on 6,505 plans (spouses covered by the same plan each have their own record with identical data). Some 430 individuals are covered by more than one plan from a given employer. However, the survey does not provide any information on interactions between the plans. We ignore multiple plans and use the "best" plan available for a given individual, where best is defined by the most generous coverage. If an employer had multiple health insurance plans and the HRS respondent did not provide enough information to identify which of the plans provided coverage, interviewers requested information on the plan used by most employees at the firm. The HIPPS file includes data only on those plans that appear to match a plan reported by an HRS respondent. Information about "cafeteria" plans was not elicited. Information was collected on age and tenure requirements that an employee must satisfy in order to be eligible for retiree coverage, but these data were not coded.

If an individual ever chooses employer health insurance from a source other than the HIPPS job then we assign the individual the characteristics of a "generic" employer-provided

[20]Of the individuals who report being covered by a pension from a current or former employer, about 60 percent can be matched to a written plan description provided by the employer. Over half of these descriptions are missing information that we need. However, the HRS asked respondents to provide a large amount of information about their pensions, and this allowed us to fill in missing data on pensions from former employers. We were also able to fill in missing information on pensions from current employers in some cases.

plan of the type chosen. The generic employer plan characteristics were chosen as follows. Most individuals in our sample who have a complete HIPPS record have a deductible that applies to all services, so we specify a deductible of this type for the generic plan and set it equal to the median deductible observed in the HIPPS data ($200). The generic coinsurance rate is set to 20 percent, the maximum deductible amount for office visits is $1000, the maximum deductible amount (per year) for hospital stays is $1200, and the maximum annual coverage is $50000. The premium for plans without retiree insurance is $500 and for plans with retiree coverage is $2000.

We use characteristics of Medicare that were in place as of 1994. There is no premium for Part A, which provides coverage for hospitalization. Coverage is provided for up to 90 days of inpatient care during each benefit period, where a benefit period begins on entry to a hospital and ends 60 days after the individual was last in a hospital or skilled nursing facility. The deductible for inpatient hospital care is $696. Days 1-60 in a hospital are fully covered once the deductible is met. Days 61-90 require a copayment of $174 per day. There is a lifetime reserve of 60 days of inpatient coverage that can be applied to hospital stays that exceed 90 days during a benefit period. For simplicity, we assume that the lifetime reserve is available every year. Part B provides supplementary insurance for physician care, and has a monthly premium of $41.10, an annual deductible of $100, and a coinsurance rate of 20 percent. Part B coverage is optional but we assume that everyone takes it up. Medicare is the primary payer for retirees, and is the secondary payer for workers and their spouses aged 65 and over who elect to be covered by employer-provided health insurance by a firm with at least 20 employees. Employer-provided retiree coverage converts to "Medigap" coverage at age 65 and becomes the secondary payer.

VA/CHAMPUS helps veterans pay for civilian medical care when military care is not available. There is no premium, an annual deductible of $150, a copayment of 25 percent for outpatient care, and a copayment of min($360/day, 25 percent) for inpatient care. Coverage is available regardless of employment status, and the coverage integrates with Medicare at age 65 in the same way as any other health insurance plan.

The characteristics of the private health insurance plan (except for the premium) are obtained from private plans held by individuals in the National Medical Expenditure Survey (NMES) data. The deductible is $100, the coinsurance rate is 20 percent, the maximum deductible amount is $1000, and the maximum amount covered is $100,000. The premium is obtained from the responses to the wave 1 HRS survey from those respondents who had private coverage, and is set to $2221.88, the median premium reported.

Prices for medical care services are calculated from charges for every medical care service received by NMES respondents in 1987. The per visit price of $65.00 reflects the 1987 average price for a physician office visit among males 50 years old and older, updated to 1992 dollars using the Consumer Price Index. The price per hospital night, $1210.00, is obtained similarly. The per night figure is the total cost of the hospital stay divided by the length of the hospital stay.

C. Pensions

The HIPPS Survey obtained written plan descriptions for 6,381 pension plans. The plan characteristics were coded by the Institute for Social Research (ISR) at the University of Michigan into a computer program that calculates benefits under alternative scenarios. For jobs held at the wave 1 survey, we used the program to compute the benefit to which an individual would be entitled for every possible year in which he or she could quit the firm through age 67.

The program takes as input the individual's age and tenure with the firm as of wave 1, and annual earnings for 1991 as reported by the respondent in the wave 1 survey.   For jobs held prior to wave 1, we used the program to compute the benefit available at the earliest age of benefit availability, taking as input the respondent's tenure and annual earnings at the time of exit from the firm. Benefits are computed for both defined benefit and defined contribution plans, with benefits for the latter expressed in the form of an annuity. Benefits are computed for up to three different plans from a wave 1 job and three different plans from previous jobs.

There was a substantial amount of missing data on pension benefits due to absence of written descriptions, and written descriptions that lacked some of the information needed to compute benefits. The HRS asked respondents to report the age at which they expect to start receiving benefits and the benefit amount for every pension plan for which they are or will be eligible for a benefit. We used these data to fill in missing values for pension benefits and age of eligibility for jobs held prior to wave 1, since the respondent's employment decisions from wave 1 on do not affect the benefit amount from jobs held prior to wave 1. These data are not sufficient to fill in missing information for pensions on jobs held at wave 1, since benefits from such jobs depend on the man's employment decisions via the benefit formula, which we do not have in such cases.

The HIPPS survey covers wave 1 employers and previous employers but does not include any new employers after wave 1. If an individual took a job that provides pension coverage after wave 1 we have information from the wave 2 survey about characteristics of the pension but no information on the benefit formula, since the new employer was not included in the HIPPS survey. Thus we ignore pensions on jobs that begin after period t=1. Most individuals in our sample are too old to qualify for substantial pension benefits on new jobs.

D. Nonwage Income

Nonwage income (other than pension and Social Security benefits) consists of income from interest, dividends, rent (net of expenses), alimony, private disability insurance, trust funds, royalties, veterans benefits, and the earnings of household members other than the husband and wife. Employment-conditioned sources of income such as welfare, unemployment compensation, and workmen's compensation are excluded. The mean of a couple's wave 1 and wave 2 nonwage income is assigned to the couple for all periods. The sample mean is $9,836.

E. Social Security Benefits

The first time an individual is not employed and is at least 62 years old his or her Social Security Benefit (SSB) is computed using the exact formula for an individual of his cohort. The formula is cohort-specific as a result of the 1983 reforms that gradually increase the normal age of retirement to 67 and phase in other changes as well. We use the 1992 formula for each cohort. If an individual experiences a non-employment spell at age 62 or above and then reenters the labor force, the SSB for which he or she is eligible upon exiting employment again can be computed using the exact formula only by making the exact sequence of employment choices from age 62 onward a state variable. This makes the state space too large for solution of the dynamic programming problem. Instead we proceed as follows. First we used the exact formula to calculate the benefit for which an individual would be eligible for every possible employment sequence involving reentry after age 62. We then regressed the benefit on the PIA corresponding to the cumulative years of experience associated with the sequence at the time of re-exit, with separate regressions for each age of re-exit and for men and women. Recall that cumulative experience is a state variable, and the PIA associated with each possible level of cumulative experience is part of the data set. We use the fitted values from these regressions to assign the SSB for non-employment spells that follow a spell of employment which itself followed a spell of nonemployment from age 62 on (i.e., individuals in their second nonemployment spell after age 61). The regression is of the form SSB = a + b*PIA, and the results are

	Men		Women	
Age	a	b	a	b
63	12.481	0.779	.709	.798
64	13.171	0.811	.175	.833
65	12.876	0.844	-.861	.870
66	14.465	0.884	-1.878	.916
67	14.909	0.915	-3.013	.951
68	15.528	0.944	-4.491	.987
69	14.805	0.974	-6.428	1.023
70	13.294	1.005	-8.791	1.058

In order to follow this approach we have to keep track of whether a given sequence of states involves a man reentering employment following a nonemployment spell after age 61. This increases the size of the state space but not by as much as keeping track of the exact employment sequence. Therefore the state vector includes a binary indicator of whether a man ever reenters employment following a nonemployment spell after age 61 (defined as *re* in section 3A).

We compute benefits conditional on employment as well as non-employment, applying the Social Security earnings test to determine the benefit entitlement conditional on being employed. This test, which is also cohort-specific, results in zero benefits for most individuals, but some low-earnings individuals have a positive benefit while employed. The Appendix provides summary data on the average PIA, and further details on the computations. Finally, we compute the spouse benefit for each individual and compare it to the individual's own retired-worker benefit. The individual receives the larger of the two.

F. Earnings

Individuals who remain on the same job observed in the first period of the data are assumed to expect their earnings to remain unchanged in real terms and to be equal to the most recent value of annual earnings from the SSER. Expectations of earnings on subsequent jobs are assumed to be determined by the following equations, which were estimated by Heckit using HRS annual earnings data pooled across waves 1 and 2:

Men: ln(earnings) = 9.451 + .26*goodhealth -.12*newjob + .026*lastearn/1000.
(.074) (.08) (.07) (.002)

Women: ln(earnings) = 9.438 + .19*goodhealth + .28*newjob + .009*lastearn/1000.
(.072) (.07) (.06) (.003)

G. Identification

We model decisions through the terminal period T, which is the period in which the husband reaches age 67. We observe choices of couples in which the husband's age is between 51 and 65. Hence the last period for which we have data is T-1, and we observe the employment and medical care choices of some couples in period T-1. The choice probability given in equation (10)

contains the expression

$$\bar{V}^{h_{mT-1}h_{fT-1}}_{j_m v_m k_m j_f v_f k_f}(\mathbf{s_{T-1}}) =$$
$$\alpha_{0h_m h_f w_m w_f} + \frac{1}{1-\alpha_1} C_{T-1}(\cdot)^{1-\alpha_1} + \alpha_{2h_m} v_{mT-1} + \alpha_{3h_m} k_{mT-1} + \alpha_{4h_f} v_{fT-1} + \alpha_{5h_f} k_{fT-1}$$
$$+ \alpha_{6h_m} e_{mT-2} 1[j_{mT-1}=2] + \alpha_{7h_m} e_{mT-2} 1[j_{mT-1}=1] + \alpha_{8h_f} e_{fT-2} 1[j_{fT-1}=2] + \alpha_{9h_f} e_{fT-2} 1[j_{fT-1}=1]$$
$$+ \beta(1-\Pr(D_T=1))[\sum_{h'_m=0}^{1} \sum_{h'_f=0}^{1} \pi^{h_m h'_m}_{mT-1} \pi^{h_f h'_f}_{fT-1} V^{h'_m h'_f}(\mathbf{s_T})$$

$$+\ \pi_{mT-1}^{h_m 2}\sum_{h'_f=0}^{1}\pi_{fT-1}^{fh_f h'_f}V(h_{m,T}=2)\ +\ \pi_{fT-1}^{h_f 2}\sum_{h'_m=0}^{1}\pi_{mT-1}^{h_m h'_m}V(h_{f,T}=2)\ +\ \pi_{mT-1}^{h_m 2}\pi_{fT-1}^{fh_f 2}V(h_{mT}=h_{fT}=2)]$$

$$+\ \beta \Pr(D_T=1)V(D_T=1)$$

The π's are identified by the observed health transitions, and the V terms in the last two lines of the expression are all normalized to -200. Thus everything in the last three lines is known except $V^{h'_m h'_f}(\mathbf{s_T})$. Rewrite the last three lines as $\sum_{h'_m=0}^{1}\sum_{h'_f=0}^{1} a_{T-1}^{h_m h'_m h_f h'_f} V^{h'_m h'_f}(\mathbf{s_T})$ + a_{0T-1}, where a_{0T-1} represents the last two lines, $a_{T-1}^{h_m h'_m h_f h'_f} = \beta(1-\Pr(D_T=1))\pi_{mT-1}^{h_m h'_m}\pi_{fT-1}^{h_f h'_f}$, and based on the arguments above, the a's are known.

Hence we can rewrite the above expression as

$$\bar{V}_{j_m v_m k_m j_f v_f k_f}^{h_{mT-1}h_{fT-1}}(\mathbf{s_{T-1}}) = \alpha_{0h_m h_f w_m w_f} + \frac{1}{1-\alpha_1}C_{T-1}^{1-\alpha_1} + \alpha_{2h_m}v_{mT-1} + \alpha_{3h_m}k_{mT-1} + \alpha_{4h_f}v_{fT-1} + \alpha_{5h_f}k_{fT-1}$$

$$+\ \alpha_{6h_m}e_{mT-2}1[j_{mT-1}=2]\ +\ \alpha_{7h_m}e_{mT-2}1[j_{mT-1}=1]\ +\ \alpha_{8h_f}e_{fT-2}1[j_{fT-1}=2]\ +\ \alpha_{9h_f}e_{fT-2}1[j_{fT-1}=1]$$

$$+\sum_{h'_m=0}^{1}\sum_{h'_f=0}^{1} a_{T-1}^{h_m h'_m h_f h'_f}[\gamma+\ln(\sum_{j''_m=0}^{J(\mathbf{s_T})}\cdot\cdot\sum_{k''_f=1}^{K}\exp(\bar{U}_T+\sum_{h''_m=0}^{1}\sum_{h''_f=0}^{1} a_T^{h'_m h''_m h'_f h''_f} f(\mathbf{s_{T+1}}, h_{mT+1}, h_{fT+1} \mid \varsigma) + a_{0T}))],$$

where the a_T's are defined analogously with the a_{T-1}'s, f($\mathbf{s_{T+1}}$, h_{mT+1}, $h_{fT+1} \mid \varsigma$) is the approximation to the terminal value function, defined in (9), and

$$\bar{U}_T(\ ) = \alpha_{0h'_m h'_f w''_m w''_f} + \frac{1}{1-\alpha_1}C_T(\cdot)^{1-\alpha_1} + \alpha_{2h'_m}v''_{mT} + \alpha_{3h'_m}k''_{mT} + \alpha_{4h'_f}v''_{fT} + \alpha_{5h'_f}k''_{fT}$$

$$+\ \alpha_{6h'_m}e'_{mT-1}1[j''_{mT}=2]\ +\ \alpha_{7h'_m}e'_{mT-1}1[j''_{mT}=1]\ +\ \alpha_{8h'_f}e'_{fT-1}1[j''_{fT}=2]\ +\ \alpha_{9h'_f}e'_{fT}1[j''_{fT}=1].$$

The last line of the expression for $\bar{V}_{j_m v_m k_m j_f v_f k_f}^{h_{mT-1}h_{fT-1}}(\mathbf{s_{T-1}})$ is a highly nonlinear function of the utility and terminal value function parameters. The first two lines are a linear function of the utility parameters and observed choices and states. Given the nonlinearity of the last line, and a normalization of one of the utility intercepts, the utility parameters are identified. Given identification of the utility and health transition parameters, the only remaining unknown parameters are those of the terminal value function, ς. With a nonlinear functional form for the terminal value function, the ς parameters are identified.

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Table 1
Employment Status and Transitions of Husbands and Wives

	Wave 1 (1992)	Wave 2 (1994)
Percentage of Wives Employed		
Husband Employed	68.1	66.5
Husband Not Employed	54.2	47.7
Difference	**13.9**	**18.8**
Percentage of Husbands Employed		
Wife Employed	81.2	76.5
Wife Not Employed	70.6	59.9
Difference	**10.6**	**16.6**
Percentage of wives who exit employment by 1994, of those employed in 1992		
Husband employed in 1992, not in 1994		15.2
Husband employed in 1992 and 1994		6.5
Difference		**8.7**
Husband not employed in 1992 or 1994		10.6
Difference from employed in 1992, not in 94		**4.6**
Percentage of husbands who exit employment by 1994, of those employed in 1992		
Wife employed in 1992, not in 1994		19.3
Wife employed in 1992 and 1994		8.5
Difference		**10.8**
Wife not employed in 1992 or 1994		11.5
Difference from employed in 1992, not in 94		**7.8**
Sample Size (couples)	2,492	2,492

Source: Tabulations from the HRS. Excludes attriters, individuals with no employer-provided health insurance, and individuals with more than one type of health insurance.

Table 2
Employment Status and Transitions by Health Insurance Status

	Husband's Health Insurance					
	Own employer			Wife's employer		
	1. RHI	2. No RHI	3. Diff. (2-1)	4. RHI	5. No RHI	6. Diff. (5-4)
1. Hus. employed at wave 1	80.7	96.7	**16.0**	70.2	78.3	8.1
2. Hus. employed at wave 2	71.8	87.7	**15.9**	65.3	67.5	2.2
3. Wife employed at wave 1	57.7	57.8	1.0	85.5	94.0	**8.5**
4. Wife employed at wave 2	54.8	57.2	2.4	77.3	88.0	**10.7**
5. Hus. exits employment between wave 1 and 2	11.5	10.5	**-1.0**	8.3	13.3	5.0
6. Wife exits employment between wave 1 and 2	7.5	5.7	-1.8	10.3	7.2	**-3.1**
Sample size	1345	332		242	83	
	Wife's Health Insurance					
	Own employer			Husband's employer		
	1. RHI	2.No RHI	3. Diff. (2-1)	4. RHI	5. No RHI	6. Diff. (5-4)
1. Hus. employed at wave 1	67.6	75.3	7.7	74.5	96.8	**22.3**
2. Hus. employed at wave 2	63.8	67.2	3.4	66.7	86.5	**19.8**
3. Wife employed at wave 1	86.3	95.5	**9.2**	52.2	52.7	0.5
4. Wife employed at wave 2	78.2	87.9	**9.7**	49.3	54.1	4.8
5. Hus. exits employment between wave 1 and 2	8.1	11.6	3.5	10.6	11.3	**0.7**
6. Wife exits employment between wave 1 and 2	10.8	8.1	**-2.7**	8.2	5.0	-3.2
Sample size	445	198		1203	222	

Note: RHI = Retiree Health Insurance

Table 3
Employment Status of the Estimation Sample

Husband	Wave 1	Wave 2
Not employed	30.4	33.3
Employed: New job	8.6	12.7
Employed: Same job	61.0	54.0
Wife		
Not employed	45.2	47.3
Employed: New job	9.6	12.7
Employed: Same job	45.2	40.0
Joint Distribution		
Husband: Not Employed		
Wife: Not employed	17.9	19.6
Wife: Employed, New job	1.9	3.7
Wife: Employed, Same job	10.5	9.9
Husband: Employed, new job		
Wife: Not employed	3.9	6.0
Wife: Employed, New job	1.3	2.0
Wife: Employed, Same job	3.4	4.5
Husband: Employed, same job		
Wife: Not employed	23.4	21.8
Wife: Employed, New job	6.4	6.2
Wife: Employed, Same job	31.3	26.2
Sample size	675	596

Table 4
Distribution of Medical Care in the Estimation Sample

	Husband		Wife	
Category	Wave 1	Wave2	Wave 1	Wave 2
		Office visits		
0 [0]	26.1	16.1	22.8	9.3
1-5 [3]	55.8	49.6	55.3	55.5
6+ [10]	18.1	34.3	21.9	35.2
Mean (sd)	3.9 (7.8)	6.3 (15.3)	4.3 (7.5)	7.4 (17.5)
		Hospital nights		
0 [0]	87.4	80.4	90.4	84.2
1-3 [2]	5.4	7.4	3.5	6.7
4+ [14]	7.2	12.2	6.1	9.1
Mean (sd)	1.3 (6.4)	2.5 (12.8)	1.1 (9.7)	1.7 (9.0)
Sample	675	644	675	646

Note: Wave 1 data refer to the 12 months prior to the survey date. Wave 2 data refer to the period between the wave 1 and wave 2 surveys, which is 24 months on average. The numbers in brackets are the values assigned to the indicated category in the solution of the model.

Table 5
Health Distribution in the Estimation Sample

	Husband	Wife
Wave 1: Good	76.1	82.2
Wave 2: Good	91.3	89.3
Wave 2: Bad	7.3	10.2
Wave 2: Dead	1.4	0.6
Wave 1: Bad	23.9	17.8
Wave 2: Good	21.2	27.8
Wave 2: Bad	69.0	68.7
Wave 2: Dead	9.7	3.5
Sample size	648	646

Table 6
Health Insurance Distribution in the Estimation Sample

	Husband		Wife	
	Wave 1	Wave 2	Wave 1	Wave 2
None	23.6	22.6	27.1	29.1
Own employer with RHI	31.1	33.8	14.5	18.4
Own employer without RHI	7.7	8.2	5.0	5.9
Spouse employer with RHI	7.7	7.0	24.1	21.8
Spouse employer without RHI	3.8	3.2	6.8	5.0
Private	18.1	13.9	18.6	13.6
Medicare	8.0	11.4	3.8	6.2
Sample Size	675	598	675	598

Note: RHI = Retiree Health Insurance

Table 7: Utility Function Parameter Estimates

Consumption				α_1	1.116 (.009)	**Medical Care effects**[b]		
Intercepts						Doctor visits, good health	α_{20},α_{40}	-0.091 (.006)
Hus. health	Wife health	Hus. empl.	Wife empl.			Doctor visits, bad health	α_{21},α_{41}	0.048 (.004)
good	good	no	no	α_{00000}	.000[a]	Hospital nights, good health	α_{30},α_{50}	-0.544 (.012)
good	good	no	yes	α_{00001}	-1.096 (.112)	Hospital nights, bad health	α_{31},α_{51}	-0.072 (.006)
good	good	yes	no	α_{00010}	1.765 (.122)			
good	good	yes	yes	α_{00011}	0.746 (.016)	**Employment effects**[b]		
good	bad	no	no	α_{00100}	-0.045 (.005)	Change job, good health	α_{60},α_{80}	-2.243 (.194)
good	bad	no	yes	α_{00101}	-1.524 (.178)	Change job, bad health	α_{60},α_{81}	-2.644 (.108)
good	bad	yes	no	α_{00110}	1.586 (.140)	Exit empl, good health	α_{71},α_{90}	-2.570 (.129)
good	bad	yes	yes	α_{00111}	0.090 (.009)	Exit empl, bad health	α_{70},α_{91}	-2.206 (.156)
bad	good	no	no	α_{01000}	0.587 (.050)	**Age effects**[c]		
bad	good	no	yes	α_{01001}	0.031 (.003)	Hus., good health, not empl.	$\alpha_{10,00}$	0.875 (.064)
bad	good	yes	no	α_{01010}	0.284 (.035)	Hus., good health, empl.	$\alpha_{10,01}$	-0.744 (.060)
bad	good	yes	yes	α_{01011}	-0.367 (.050)	Hus., bad health, not empl.	$\alpha_{10,10}$	-0.294 (.032)
bad	bad	no	no	α_{01100}	0.208 (.018)	Hus., bad health, empl.	$\alpha_{10,11}$	-1.452 (.090)
bad	bad	no	yes	α_{01101}	-1.536 (.160)	Wife, good health, not empl.	$\alpha_{11,00}$	.0238 (.022)
bad	bad	yes	no	α_{01110}	-0.505 (.056)	Wife, good health, empl.	$\alpha_{11,01}$	-0.087 (.007)
bad	bad	yes	yes	α_{01111}	-2.023 (.176)	Wife, bad health, not empl.	$\alpha_{11,10}$	-0.541 (.063)
						Wife, bad health, empl.	$\alpha_{11,11}$	-1.116 (.080)
						Consumption $\leq$ 0	α_{12}	-11.121 (.676)

Notes: Asymptotic standard error estimates are in parentheses. Estimated by the BHHH method.
a. Fixed.
b. Constrained to be equal for husbands and wives.
c. Age is measured as (age-41)/10.

Table 8: Model Fit, Overall and by Employment and Health Status

	Husband						Wife					
A. Employment												
Empl in previous period	Not empl.		New job		Old job		Not empl.		New job		Old job	
	A	P	A	P	A	P	A	P	A	P	A	P
All	.319	.338	.097	.115	.584	.547	.466	.494	.101	.130	.434	.376
No	.767	.771	.232	.229			.829	.794	.171	.205		
Yes	.136	.162	.043	.068	.821	.770	.145	.228	.039	.064	.816	.708
B. Doctor Visits												
Health	0		1-5		6+		0		1-5		6+	
All	.279	.414	.566	.341	.155	.245	.225	.421	.588	.343	.187	.237
Good	.318	.457	.593	.351	.089	.192	.247	.457	.621	.351	.132	.192
Bad	.154	.274	.475	.309	.371	.417	.136	.275	.457	.309	.407	.416
C. Hospital Nights												
Health	0		1-3		4+		0		1-3		4+	
All	.854	.673	.073	.274	.073	.053	.890	.683	.052	.269	.057	.048
Good	.918	.738	.055	.245	.028	.017	.927	.738	.041	.245	.032	.018
Bad	.647	.459	.133	.371	.220	.169	.741	.463	.099	.368	.160	.169

D. Joint Employment

Empl in previous period	H olf W olf		H olf W nj		H olf W oj		H nj W olf		H nj W nj		H nj W oj	
	A	P	A	P	A	P	A	P	A	P	A	P
All	.192	.183	.024	.046	.103	.109	.045	.059	.016	.017	.037	.039
Both	.036	.045	.004	.013	.080	.105	.008	.019	.004	.005	.022	.044
Neither	.730	.646	.064	.132			.142	.171	.064	.051		
	H oj W olf		H oj W nj		H oj W oj							
All	.229	.252	.061	.067	.293	.228						
Both	.096	.167	.032	.044	.717	.558						
Neither												

Notes: A = actual; P = predicted; H = husband; W = wife; olf = out of the labor force (not empl); nj = new job; oj = old job.

Table 9: Employment Fit by Health Insurance Category

	Husband						Wife					
Husband's health insurance	Not empl.		New job		Old job		Not empl.		New job		Old job	
	A	P	A	P	A	P	A	P	A	P	A	P
None	.375	.356	.143	.145	.482	.499	.632	.592	.136	.167	.232	.240
Own employer, RHI	.241	.269	.063	.090	.697	.641	.386	.457	.108	.103	.506	.440
Own employer, no RHI.	.031	.160	.062	.077	.907	.763	.423	.475	.103	.123	.474	.402
Spouse employer, RHI	.337	.332	.076	.110	.587	.558	.152	.275	.033	.067	.815	.658
Spouse employer, no RHI	.333	.415	.195	.120	.476	.466	.048	.210	.000	.065	.952	.716
Private	.174	.271	.143	.121	.684	.608	.541	.519	.082	.153	.378	.328
Medicare	.930	.776	.044	.153	.026	.070	.649	.632	.114	.175	.237	.193
Wife's health insurance	Not empl.		New job		Old job		Not empl.		New job		Old job	
	A	P	A	P	A	P	A	P	A	P	A	P
None	.425	.402	.142	.140	.434	.458	.625	.596	.142	.167	.233	.236
Own employer, RHI	.286	.310	.064	.095	.650	.595	.138	.279	.034	.070	.828	.651
Own employer, no RHI.	.254	.356	.159	.108	.587	.535	.048	.217	.000	.065	.952	.718
Spouse employer, RHI	.280	.288	.066	.092	.654	.620	.448	.505	.126	.109	.427	.386
Spouse employer, no RHI	.013	.145	.027	.068	.959	.787	.473	.510	.135	.130	.392	.360
Private	.264	.322	.107	.125	.629	.552	.558	.546	.096	.155	.345	.299
Medicare	.655	.587	.103	.184	.241	.229	.897	.691	.052	.216	.052	.092

Notes: A = actual; P = predicted.

Table 10: Employment Fit by Health Insurance Category
Conditional on Previous Period Employment Status

	Husband						Wife					
	Not empl.		New job		Old job		Not empl.		New job		Old job	
	A	P	A	P	A	P	A	P	A	P	A	P
Husband's health insurance	Not employed in previous period											
Own empl, RHI	.789	.786	.210	.214			.791	.826	.209	.174		
Own empl, no RHI.	.200	.679	.800	.321			.780	.785	.219	.215		
Spouse empl, RHI	.833	.758	.167	.242			.875	.839	.125	.161		
Spou. empl no RHI	.625	.785	.375	.215			1.00	.824	.000	.176		
	Employed in previous period											
Own empl, RHI	.111	.147	.028	.061	.861	.792	.120	.215	.041	.056	.838	.729
Own empl, no RHI.	.022	.132	.022	.063	.956	.805	.161	.247	.018	.056	.821	.697
Spouse empl, RHI	.162	.182	.044	.063	.794	.755	.083	.221	.024	.058	.893	.720
Spou. empl no RHI	.154	.187	.077	.061	.769	.752	.000	.189	.000	.060	1.00	.751
Wife's health insurance	Not employed in previous period											
Own empl, RHI	.872	.791	.128	.209			.750	.836	.250	.164		
Own empl, no RHI.	.556	.785	.444	.215			1.00	.824	.000	.176		
Spouse empl, RHI	.803	.794	.197	.206			.797	.831	.203	.169		
Spou. empl no RHI	.000	.785	1.00	.215			.743	.788	.257	.212		
	Employed in previous period											
Own empl, RHI	.109	.164	.045	.061	.846	.774	.071	.218	.011	.059	.918	.722
Own empl, no RHI.	.133	.184	.044	.066	.822	.750	.016	.198	.000	.061	.984	.741
Spouse empl, RHI	.138	.151	.031	.061	.831	.788	.144	.221	.059	.057	.797	.722
Spou. empl no RHI	.014	.127	.000	.064	.986	.809	.231	.260	.026	.057	.744	.682

Notes: A = actual; P = predicted.

Table 11: Policy Simulations

Husband	1. Base line	2. No Health Insurance	3. Universal Health Insurance	4. Add RHI to employer plans	5. Eliminate RHI from employer plans	6. Change spouse to own HI	7. Medi-care age = 67
Not employed	.450	.453	.437	.451	.448	.449	.449
NE at t-1	.830	.818	.812	.833	.829	.837	.829
Empl at t-1	.223	.232	.221	.222	.223	.219	.223
Employed	.550	.547	.563	.549	.552	.551	.551
NE at t-1	.170	.182	.187	.167	.171	.163	.171
Empl at t-1	.777	.768	.779	.778	.777	.781	.777
Wife							
Not employed	.540	.552	.542	.539	.537	.544	.543
NE at t-1	.815	.809	.804	.810	.809	.830	.817
Empl at t-1	.261	.275	.274	.261	.262	.252	.264
Employed	.460	.448	.458	.461	.463	.456	.457
NE at t-1	.185	.191	.196	.190	.191	.170	.182
Empl at t-1	.739	.725	.726	.739	.738	.748	.736
Joint							
Neither employed	.264	.268	.251	.267	.263	.275	.268
Neither empl at t-1	.779	.735	.748	.779	.768	.787	.781
Both employed	.274	.263	.273	.277	.278	.282	.275
Both Empl at t-1	.577	.564	.556	.580	.579	.599	.582

Table A-1
Sample Selection

1. Married couples at Wave 1	4,704
2. Age eligible	3,027
3. No missing data on key variables from the HRS survey	2,749
4. With Social Security records for both spouses	1,757
5. With employer-provided health insurance and a HIPPS record or no employer-provided health insurance	1,349
6. With no missing data from the HIPPS survey	675

Table A-2
Sample Characteristics

	Full Sample		Estimation Sample	
	Husband	Wife	Husband	Wife
Age in 1992	57.7	53.5	56.7	53.2
Education	12.1	12.2	12.0	12.0
Black	.12	.12	.07	.07
Hispanic	.08	.09	.10	.09
Employer health insurance (EHI)	.74	.74	.50	.51
Retiree coverage, of those with EHI	.80	.79	.77	.77
Employed at the 1992 survey date	.726	.609	.696	.548
Hourly wage in 1992 (if employed)	17.99	11.53	16.58	11.25
Pension in 1992	.48	.28	.46	.23
Good health in 1992	.79	.82	.77	.81
Died, divorced, or attrited by 1994	.12	.12	.09	.08
Net worth in 1992	266,150		270,268	
Sample size	4,704		675	

Table A-3
Health Insurance Characteristics in the Estimation Sample

	Husband		Wife	
	%	Value	%	Value
Individual premium (annual)	49	474	50	515
Family premium (annual)	63	1426	65	1397
Retiree premium (annual)	7	2259	7	2296
Deductible for office visits	5	131	5	138
Deductible for all services	60	250	60	256
Maximum annual coverage	65	68361	66	75293
Maximum lifetime coverage	61	1030907	62	1092249
Dollar copayment per office visit	33	10	33	10
Percent copayment per office visit	35	17	36	18
Maximum out-of-pocket cost for office visits	33	1749	34	1745
Copayment per hospital stay	12	133	12	145
Annual copayment for hospital stays	4	522	4	805
Maximum out of pocket cost per hospital stay	2	325	2	325
Annual maximum out of pocket cost for hospital stays	32	1741	34	1688
Sample size	334		337	

Note: % = percent of the sample that has a positive value for the characteristic. Value = mean value of the characteristic in the sub-sample with positive values.

Table A-4
Pension Characteristics in the Estimation Sample

Wave 1 Job	Husband	Wife
Youngest age at which benefits could be collected	57.7	57.4
Annual Benefit		
If exit job in 1992	13,837	6,854
If exit job in 1997	15,087	7,966
If exit job in 2002	18,015	10,152
If exit job in 2007	21,267	11,149
Sample size	170	108
Previous Job		
Youngest age at which benefits could be collected	56.0	59.9
Annual Benefit	11,749	2,987
Sample Size	190	49

Notes: Dollar values are measured in 1992 dollars.

Table A-5
Social Security Primary Insurance Amount (PIA) in the Estimation Sample

	Husband	Wife
Initial PIA	775	321
PIA after 5 additional years of work	820	377
PIA after 10 additional years of work	851	417
PIA after 15 additional years of work	877	454
Sample size (initial PIA)	672	637

Notes: Initial PIA is the value computed from the Social Security Earnings Record file. The sample in each row includes only those individuals who are 70 or less after the indicated number of additional years of work. Dollar values are measured in 1992 dollars.

Table A-6: Health Transition and Other Parameters

Health transition parameters							
Hus, good → good:	intercept	γ_{000}	8.06 (2.20)	Wife, good → good:	intercept	γ_{000}	9.07 (2.99)
	Age	γ_{100}	-2.29 (1.18)		Age	γ_{100}	-2.77 (1.80)
Hus, good → bad:	intercept	γ_{001}	5.13 (2.30)	Wife, good → bad:	intercept	γ_{001}	6.40 (3.03)
	Age	γ_{101}	-2.03 (1.25)		Age	γ_{101}	-2.38 (1.83)
Hus, bad → good:	intercept	γ_{010}	1.45 (1.40)	Wife, bad → good:	intercept	γ_{010}	1.39 (1.45)
	Age	γ_{110}	-0.41 (0.84)		Age	γ_{110}	0.58 (1.18)
Hus, bad → bad:	intercept	γ_{011}	2.29 (1.25)	Wife, bad → bad:	intercept	γ_{011}	2.53 (1.40)
	Age	γ_{111}	-0.20 (0.73)		Age	γ_{111}	0.39 (1.15)
Other Parameters							
Terminal Value Function		ς	4.536 (.448)				
Probability of Divorce		ζ	-4.314[a]				
Probability of Layoff		δ	-3.892[a]				
Discount Factor		β	.925[a]				

Notes: a. Fixed. Probability of divorce is $e^{\zeta}/(1+e^{\zeta})$. Probability of layoff is $e^{\delta}/(1+e^{\delta})$. Terminal value function is $-e^{\varsigma}$. Age is measured as (age-41)/10. Standard errors are in parentheses.