Happy Together Or Home Alone: A Structural Model Of The Role Of Health Insurance In Joint Retirement

Dina Guo

Department of Economics

University of Virginia

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Abstract

As the baby-boom generation approaches retirement age, most families facing retirement today are dual-worker couples who coordinate retirement choices. The availability of retiree health insurance is a crucial factor that can influence the timing of couples' retirement decisions. By reducing the risk of catastrophic medical expenditure, retiree health insurance can induce people both a covered worker and his spouse indirectly to retire, or it can keep the spouse of someone needing care at home in the labor to maintain coverage. This paper presents a dynamic structural model of older couples' saving, retirement and insurance choices. This model not only accounts for multiple channels through which health insurance can affect retirement decisions and the interdependence of health insurance coverage among married couples, but also household financial incentives and the sources of uncertainty for couples approaching retirement. Unlike other papers, I model two spouses' health transitions to be determined jointly. Also, I control for the initial conditions associated with the observed eligibility for employer-provided health insurance. I will estimate the model using data from the Health and Retirement Study (HRS) and the Medical Expenditure Panel Survey (MEPS). These estimates will allow me to predict the effects of changes in health insurance options, for example, resulting from The Affordable Care Act, on older couples' labor supply and welfare.

1 Introduction

The baby-boom generation is fast approaching retirement age, and the majority of them are married. More than 60% of families facing retirement today are dual-worker couples, who presumably coordinate retirement choices. A significant portion of spouses retire almost simultaneously–within a year or two of each other. Most studies in the joint retirement literature focus on the correlation among spouses in wealth and retirement income and on complementarities in preferences for leisure (Gustman & Steinmeier 2004; Maestas 2001; Casanova 2010). These papers have also identified correlation in tastes for caring needs of one spouse as motivation for joint retirement. But, they do not focus on the role of health insurance, even though uncertain medical expenses play an important role for people approaching retirement. Although a variety of sources show a strong relationship between retiree health insurance and individual retirement decisions (Rust & Phelan 1997; French & Jones 2004, 2011), the influence of health insurance on the joint retirement decisions of couples has received little attention. This paper bridges the gap between the these two literatures by estimating a structural model that examines the role of health insurance in married couples' joint retirement decisions.

The availability of health insurance is a crucial factor that influences the timing of couples' retirement decisions. First, at an individual level, health deteriorates with age, and few of the near-elderly (age 55-64) can afford increasingly high premiums for individual health insurance coverage. Therefore, before individuals are eligible for Medicare, current or former employers are the main source of health insurance coverage, and the near-elderly may choose to stay in their jobs to keep their health insurance. Second, an individual's retirement decision may affect a spouse's access to health insurance. For example, suppose a wife becomes ill, and she can receive individual health insurance only through her husband's employer when he is working. Even if the husband can receive health insurance after retirement, he may choose to work until his wife is eligible for Medicare. Retiree health insurance can induce people to retire directly by decreasing the risk of suffering catastrophic medical expenditure and indirectly by inducing their spouses to retire. Ignoring these effects will lead to an underestimate of the influence of retiree health insurance on couples' retirement decisions.

In a household, spouses' health transitions may be interdependent for several reasons (Wilson 2002): 1) people tend to marry those with similar backgrounds, such as level of education and economic status, which are related to health status; 2) spouses tend to make similar choices that will affect their health, such as how much to smoke, drink, or eat; 3) spouses share emotional stresses; 4) and importantly, one spouse might provide health care for the other one, and the burden of being a caregiver for a spouse in poor health may decrease the health of the care-giving spouse. Thus, I use a bivariate probit model to capture the household health transitions of two spouses, respectively. A modified Chi-Square test shows that the joint health transitions model fits the data very well, and a Likelihood Ratio test shows that the joint health transitions model fits the data significantly better than the model that considers two spouses' health transitions separately.

An important study by Rust & Phelan (1997) showed that individuals facing retirement value health insurance because they are risk averse to uncertain medical expenses. Thus, in the literature, health insurance has been modeled as affecting retirement decisions through out-of-pocket medical expenditure. In this paper, I propose two more channels, total medical expenditure and health status, through which health insurance affect retirement decisions. First, health insurance can affect not only the out-of-pocket medical expenditure but also the total medical expenditure. People with better health insurance coverage might choose to visit doctors more often and have better treatments, so they might expect to have higher total medical expenditure. I model health insurance eligibility as an important factor that affects each spouse's total medical expenditure. Second, health insurance can affect people's health status, which is modeled as an element that affects individual's taste for leisure. People with better health insurance coverage might receive better health care, and thus they can expect better health.

Due to the interdependence of health insurance coverage among married couples, one spouse might have access to the other spouse's employer-provided health insurance, and thus can choose to be covered by his own employer or his spouse's employer. Two spouses with different jobs might have employer-provided health insurance plans with different characteristics. When one spouse is eligible for both spouses' employer-provided health insurance, he will choose the plan that minimize the medical expenses. To capture the heterogeneity in health insurance plans' characteristics, I model households not only making labor decisions for each spouse, but also choosing health insurance coverage for each spouse from his feasible choice set of health insurance plans. The feasible choice set of health insurance plans for each spouse is determined by both spouses' health insurance eligibility and retirement decisions. However, the Health and Retirement Study (HRS) provides complete information about (employer-provided) health insurance eligibility on a conditional basis–only those choose to be covered by their own employers are selected to be surveyed about their employer-provided health insurance eligibility. Thus, to generate the feasible choice set of health insurance plans for each spouse, I need to impute employer-provided health insurance eligibility for individuals in my sample who choose to cover by their spouses' employers. I use a multivariate probit model which accounts for the selection rule as the employer-provided health insurance eligibility imputing model. Using the estimates, before I estimate the dynamic structural model, I can impute employer-provided health insurance eligibility for individuals in my sample whose employer-provided health insurance eligibility cannot be observed. A Pearson's chi-squared test shows that the employer-provided health insurance imputation model fits the data very well.[1]

To examine the role of health insurance in joint retirement decisions of married couples, I develop a dynamic structural model that not only accounts for multiple channels through which health insurance can affect retirement decisions and the interdependence of health insurance coverage among married couples, but also household financial incentives and the sources of uncertainty for couples approaching retirement. At each period, each pair of husband and wife acts cooperatively to maximize a household's expected lifetime utility function. The households in my model choose when each member will retire, how much the household saves, and which health insurance plan to be covered by, among those they are eligible for. Medical expenditure is realized after a household makes those decisions. One spouse's out-of-pocket medical expenditure is modeled as total expenditure minus the part covered by health insurance, which is determined by the characteristics (including co-insurance rate and deductible) of the health insurance coverage.

The household utility flow is a weighted average of each spouses' utility and the household's taste for a discrete choice. The weight in front of each spouse's utility represents his bargaining power in the household. Following Friedberg and Webb (2006), I use reported decision-making power in the HRS to identify the distribution of bargaining power within a household without assuming a specific bargaining process. The utility function for one spouse depends on household consumption and own leisure, and the preference for leisure is determined by age, both spouses' health status, and the other spouse's leisure. Unlike other papers, I model two spouses' health transitions (and mortality rates) as determined jointly. Observed employer-provided health insurance eligibility is not exogenous, but is determined by the individual's job decision years ago. To capture the endogeneity between the observed individual's employer-provided insurance eligibility and job choice, I model the initial conditions of the observed employer-provided insurance eligibility.

I use two different data sets to estimate my model. The primary source of data is the Health and Retirement Study (HRS), which is a detailed panel survey of individuals over age 50 and their spouses. It collects extensive information about household characteristics, labor force participation and health insurance coverage as well as health transitions, income, assets, pension plans and health care expenditures. The second data is the Medical Expenditure Panel Survey (MEPS), a set of large-scale surveys of families and individuals, their medical providers, and their employers. The MEPS began in 1996 and provides averages of employer-provided plans by industry and firm size in the private sector, and for different government institutions by census division and government type in the public sector. I can use the MEPS to impute the "generic"

[1]Details of the employer-provided insurance eligibility imputing model is described in section 4.5.

co-insurance rate, deductible and paid premium for each possible health insurance plan for each individual in my sample. Combining the information on the out-of-pocket medical expenditure from the HRS and the imputed health insurance characteristics of the individual's coverage using the MEPS, I can generate each spouse's total medical expenditure for each period.

I estimate the preference parameters of the model using the Method of Maximum Simulated Likelihood Estimation (MSL). With the estimates, my model can predict the effects on retirement and saving of observed declines in coverage rates of employer-provided retiree health insurance. Moreover, I can simulate responses to policies that change health insurance options and how these policies affect workers welfare: e.g., the Affordable Care Act which helps to make health insurance independent of employment status, and the proposed policy to increase the Medicare eligibility age to 67 years. I also can calculate how increases in the Social Security Normal Retirement Age to 67 will affect retirement and government spending through joint retirement effects.

The rest of paper proceeds as follows. Section 2 presents an overview of previous literature on health insurance and retirement decisions. Section 3 develops the dynamic structural model. Section 4 describes the data. Section 5 discusses identification of parameters. Section 6 concludes.

2 Literature review

This paper expands upon two important branches of the retirement literature. First, a growing number of papers study the joint retirement behavior of married couples. These papers (Gustman & Steinmeier 2000, 2004; Coile 2004; Maestas 2001; Casanova 2010) have identified four reasons that may lead spouses to retire together: (1) correlation in tastes for work; (2) complementarity in preferences for leisure; (3) correlation in economic variables, such as income and shared assets; and (4) caring needs of one spouse. I include those four factors, and I add the effects of health insurance. Besides, these papers model health transitions and morality rates for husband and wife separately. To capture the interdependence of health transitions among married couples, I allow two spouses' health transitions and morality rates to be determined jointly.

Second, this paper expands on the health insurance literature that has found a strong relationship between health insurance and labor supply decisions. One group of papers focuses on the relationship between retiree health insurance and older individual's retirement decisions.[2] Rust and Phelan (1997) demonstrate that risk aversion to medical expenditure is a key factor in explaining individual retirement before age 65. French and Jones (2004) add saving so people can self insure their medical expenditure

[2]See Gustman & Steinmeier 2000; Rust & Phelan 1997; Madrian & Beaulieu 1998; French & Jones 2004, 2011; and Guber & Madrian 1997.

risk, and find a smaller effect of health insurance. I follow these papers by assuming individuals are risk-averse and modeling the household saving decision. I extend their work by considering the interdependence of health insurance coverage among married couples, which is important because ignoring the interdependence will result biased estimates on the effects of health insurance. Another group of papers study the effects of health insurance on the labor supply of prime-aged (21-65) married couples.[3] These papers use cross-sectional data to estimate reduced form models, and they find that spousal health insurance can significantly decrease married women's labor force participation. However, their estimates may be inconsistent for two reasons. First, they assume the husband's employer-provided insurance coverage is exogenous to the wife's labor supply decision. This assumption is problematic if husbands and wives jointly make labor supply decisions. Several papers (Schone & Vistnes 2000; Olson 2000; Honig & Dushi 2005; Royalty & Abraham (2006)) try to account for the endogeneity of husband's insurance by instrumenting it using his job or human capital characteristics. Second, their static models do not consider the feedback effects from wife's labor supply to husband's insurance coverage in subsequent years. I develop a dynamic structural framework to model how spouses cooperatively choose labor supply and how previous household labor supply affects its insurance coverage and labor supply in later periods. In addition, since I focus on older couples, I consider both working and retiree health insurance.

A few studies explore the effects of health insurance on joint retirement. Kapur and Rogowski (2007) use a reduced form model to estimate the effect of each spouse's health insurance coverage on the household's simultaneous retirement decision. But, they do not consider an individual's eligibility for spousal health insurance. Blau and Gilleskie (2006) connect retirement decisions, health insurance coverage, and medical expenditure risk in a realistic and tractable way by modeling out-of-pocket medical expenditure as a function of health insurance plan characteristics (e.g., deductible, premium, and coinsurance rate) and total medical expenditure. I extend their analysis in several ways. First, I assume that total medical expenditure is endogenously determined by retirement decisions and eligibility for health insurance, and I similarly control for initial conditions. Second, I use the information in the HRS to impute each spouse's available health insurance choice set and assume households choose health insurance plans for each spouse from the available sources in each period. Lastly, I use the MEPS to impute characteristics of health insurance plans. Then I use the observed out-of-pocket medical expenditure and the imputed characteristics of the covered health insurance plan to recover the total medical expenditure.

[3] See Olson (1998), Buchmueller & Valletta (1999), and Wellington & Cobb-Clark (2000).

3 Theoretical model

In this section, I construct a dynamic structural model of household decision-making. At the beginning of each period, a couple makes decisions about whether to retire, health insurance plan, and savings.[4] Households are observed choosing different decision paths due to observed differences in household health insurance eligibility and demographic variables, due to observed differences in relative bargaining power of each spouse, and also due to unobserved heterogeneity that affect the utility associated with each choice. The model benefits from the extensive information, collected by the HRS, about labor force participation, health insurance coverage, health transitions, health care expenditure, income, assets, and pension plans.[5]

3.1 Choice Set

At each period t, each pair of husband and wife acts cooperatively to maximize a household's expected lifetime utility function. Households make three decisions: a retirement decision for each spouse, a choice of (household employer-provided) health insurance plan for each spouse, and a choice of household savings. In this paper, I assume public health insurance, such as Medicare, and privately purchased health insurance are exogenous. Thus, the household's decision about health insurance plan is actually the household's choice of employer-provided health insurance plan for each spouse. When one spouse is eligible for some employer-provided health insurance and some other health insurance, employer-provided health insurance is considered as the primary insurance plan.

3.1.1 *The Retirement Decision*

The household retirement decision consists of discrete retirement choices for the husband and wife, $L_t = (L_{mt}, L_{ft})$, where m represents the husband, and f represents the wife. Following Gustman and Steinmeier (2000), I define retirement as the decision to reduce work effort below full time. For $i = m, f$, $L_{it} = 1$ if spouse i retires in period t, and $L_{it} = 0$ if i works. I do not focus on later job transitions of older people and assume retirement is an absorbing state.[6]

[4]Total medical expenditure for the period is realized after they make those decisions. Thus, the household assets accumulated to the next period, which equals savings minus two spouses' out-of-pocket medical expenditure, is affected by the savings decision, health insurance coverage choice, and realized two spouses' total medical expenditure.

[5]The process repeats until the terminal period, T^*. The length of a period is two years. In computation, I define the terminal period as the period the younger spouse reaches age 70, or three periods after the last observed period if the younger spouse aged older than 64 at the last observed period.

[6]This means that if a spouse chooses to retire in period $t-1$, he cannot choose to work in period t. Thus, the feasible set of household retirement decisions in period t depends on the household retirement

3.1.2 *The Employer-Provided Health Insurance Choice*

The household chooses an employer-provided health insurance plan for each spouse, $j_t = (j_{mt}, j_{ft})$. $j_{it} = 0$ means either spouse i is not eligible for any health insurance provided by an employer or is eligible for health insurance but chooses to be uninsured; $j_{it} = Wm$ if spouse i chooses the husband's (m) employer-provided working (W) health insurance; $j_{it} = Rf$ if spouse i chooses the wife's (f) employer-provided retiree (R) health insurance. The feasible set of household insurance plan choices in period t is denoted as $J_t(L_t, EPHI_t)$, which is determined by the household's retirement decision L_t and the household's employer-provided health insurance eligibility, $EPHI_t = (EPHI_{mt}, EPHI_{ft})$. For spouse i, employer-provided health insurance eligibility ($EPHI_{it}$) denotes: whether i's employer offers i health insurance when i is working and retired $(EPWHI_{it}, EPRHI_{it})$, and whether these plans can cover i's spouse $(EPWHIS_{it}, EPRHIS_{it})$. With each spouse's employer-provided health insurance eligibility, I can create the set of available employer-provided health insurance plans for each spouse. Figure 1 gives an example to show how the feasible set $J_t = (J_{mt}, J_{ft})$ is determined. For each spouse i, J_{it} is the set of employer-provided health insurance plans available for i, and it is a subset of $\{0, Wm, Wf, Rm, Rf\}$.

The household discrete choice $d_t = (L_t,\, j_t)$, is a vector of the two discrete household choices described above. Medicare coverage (M_{it}) can affect a household's choice of d_t. $M_{it} = 1$ if spouse i receives Medicare in period t, otherwise $M_{it} = 0$. Someone who receives Medicare is more likely to retire because their health insurance eligibility is not tied to their jobs. Also, someone who receives Medicare is more likely to choose the employer-provided plan that supplements the Medicare the best.

3.1.3 *Saving Choice*

At the beginning of each period t, households choose savings (s_t). In this paper, I assume households make decisions before the realization of the medical expenditure. Thus, the savings is used to pay two spouses' out-of-pocket medical expenditure, and the rest of the savings is the household assets accumulated to the next period. It is important to include savings because older people can self-insure against out-of-pocket medical expenditure through savings. Excluding savings may overstate the effect of health insurance on the decision to retire. In addition, households save while working in order to finance consumption during retirement.

decision in period $t-1$. I define both fully retirement and part-time job as retirement because most part-time jobs do not offer health insurance, so the transition from a full-time job into a part-time job or fully retirement might cause losing EPHI. Besides, John Rust (1987) & Berkovec and Stern (1991) show that "very few people "unretire" by re-entering a full-time job once fully or partially retired, (or part-time job once fully retired)".

3.2 Preference

Let θ_u denote a vector of unknown parameters characterizing a household's preferences. The household utility flow depends on each spouse's utility and the household's taste $e_t(d_t)$ for a discrete choice d_t:

$$U_t(d_t, s_t; \theta_u) = \gamma u_{mt}(d_t, s_t; \theta_u) + (1-\gamma) u_{ft}(d_t, s_t; \theta_u) + e_t(d_t) \tag{3.1}$$

where γ is the bargaining power of a husband relative to his wife. It is continuous, between 0 and 1 and differs across households.

The utility function for the husband depends on household consumption and his leisure :

$$u_{mt}(d_t, s_t; \theta_u) = \frac{C_t^{\alpha}}{\alpha} + exp\{X_t^m \beta^m + \varepsilon_m\} L_{mt} \tag{3.2}$$
$$where\ X_t^m \beta^m = \beta_0^m + a_{mt}\beta_1^m + H_{mt}\beta_2^m + H_{ft}\beta_3^m + L_{ft}\beta_4^m$$

where C_t denotes the household's consumption which is assumed to be non-rivalrous and non-excludable between spouses. The parameter α measures the degree of risk aversion over consumption. The term $exp\{X_t^m \beta^m + \varepsilon_m\}$ determines the value of leisure to the husband. The vector of X_t^m includes four factors that affect the husband's value of leisure: the husband's age (a_{mt}) and health status (H_{mt}), and the wife's health status (H_{ft}) and leisure (L_{ft}). $H_{it} = 1$ if spouse i is in good health in period t, otherwise $H_{it} = 0$. As the husband's age increases and health deteriorates, $exp\{X_t^m \beta^m + \varepsilon_m\}$ increases and leisure becomes more desirable. If the wife suffers bad health, the husband may value leisure more because of care giving. If the coefficient on wife's leisure (β_4^m) is positive, the husband will value his leisure more if the wife is retired. Lastly, the husband values leisure more as his taste for leisure (ε_m) increases. The utility function for the wife is symmetric. I assume the husband's and the wife's tastes for leisure (ε_m, ε_f) are correlated.

The unobserved utility term $e_t(d_t)$ shows the household's preference for the discrete choices it faces. We may observe similar households making different retirement and insurance decisions. This variation in choices suggests the existence of unobserved heterogeneity in utility derived from the household retirement decision L_t, the household insurance plan j_t, and the combined household discrete choice d_t. I write $e_t(d_t)$ as the sum of three unobserved variables, $\eta_L + \tau_j + v_{dt}$. The first two represent the household's time-persistent tastes for L and j; the last one is the household's idiosyncratic taste for d at time t.

3.3 Budget Constraints

In each period t, household income consists of income from asset rA_t, each spouse's labor income $\sum_i w_{it}(1-L_{it})$, pension benefits $\sum_i pb_{it}$, Social Security benefits $\sum_i ssb_{it}$, and government transfers TR_t. Post-tax household income is allocated between household consumption C_t, savings s_t, and paid health insurance premium $\sum_i \Gamma_{it}$. The budget constraint can be written as:

$$C_t + s_t = A_t + Y(rA_t, \sum_{i=m,f} w_{it}(1-L_{it}), \sum_{i=m,f} pb_{it}) + \sum_{i=m,f} ssb_{it} + TR_t - \sum_{i=m,f} \Gamma_{it} \quad (3.3)$$

where $Y(.)$ is a tax function, incorporating income and payroll taxes. r is the interest rate, which is assumed to be constant.

Household assets accumulated to the next period equal household savings minus household out-of-pocket medical expenditure. Hence the asset accumulation equation is:

$$A_{t+1} = s_t - \sum_{i=m,f} m_{it} \quad (3.4)$$

Spouse i's out-of-pocket medical expenditure (m_{it}) is modeled as: $m_{it} = m^*_{it} - f(m^*_{it}, j_{it}, M_{it})$, where m^*_{it} is i's total medical expenditure; and $f(m^*_{it}, \lambda, D)$ is the portion covered by i's health insurance plan, which is determined by plan characteristics, such as the coinsurance rate (λ) and the deductible (D): $f(m^*_{it}, \lambda, D) = (1-\lambda)(m^*_{it} - D)$. This implies that health insurance coverage choice can affect out-of-pocket medical expenditure. Although household out-of-pocket medical expenditure does not affect household utility flow this period, it will affect household assets for the next period and thus will affect household utility next period.[7]

Households cannot borrow against future social security benefits, and it is very difficult to borrow against future pension benefits. Thus, I assume there is a borrowing constraint:

$$s_t \geqslant 0$$

This means the household assets at the beginning of each period might be negative when the realization of a household out-of-pocket medical expenditure is greater than the savings in the last period.

Following Hubbard, Skinner, and Zeldes (1994, 1995), government transfers is modeled as:

$$TR_t = max\{0, C_{min} - (A_t + Y_t + ssb_{mt} + ssb_{ft})\}$$

[7] $\Gamma(j_{it})$,$\lambda(j_{it})$ and $D(j_{it})$ denote the paid premium, co-insurance rate and deductible of an employer-provided insurance plan, respectively, and $\Gamma(M_{it})$, $\lambda(M_{it})$ and $D(M_{it})$ denote those of Medicare. I only consider people's primary insurance: if spouse i receives Medicare and has no employer-provided plan, Medicare is i's primary insurance, or otherwise the employer-provided one is the primary insurance.

where the parameter C_{min} is the consumption floor which is the minimum amount, or sustenance level, of consumption that a household needs in every period. Thus $C_t \geqslant C_{min}$ is satisfied for each period. Government transfers make sure that a household always consume at least C_{min}.

3.4 Total Medical Expenditure

In this paper, I model health insurance not only affect out-of-pocket medical expenditure, but also affect total medical expenditure. I model total medical expenditure as a function of health insurance eligibility. The observed employer-provided health insurance eligibility is not exogenous, but is determined by the individual's job decision years ago. To capture the endogeneity between the observed individual's employer-provided insurance eligibility and job choice, I model the initial conditions of the observed employer-provided insurance eligibility.

3.4.1 *Total medical Expenditure*

Total medical expenditure for each spouse i is realized after the household makes its decisions about retirement and health insurance plans. People with better health and more leisure may expect less total medical expenditure, while people with health insurance coverage and higher taste for health care may visit doctors more often and thus expect more total medical expenditure. I allow both spouses' total medical expenditure (m^*_{nit}) to be jointly and endogenously determined:

$$\begin{cases} ln(m^*_{nmt}) &= X_{nmt}\xi_1^m + L_{nmt}\xi_2^m + HI_{nmt}\xi_3^m + \kappa_n + \vartheta_{nm} + \chi_{nmt} \\ ln(m^*_{nft}) &= X_{nft}\xi_1^f + L_{nft}\xi_2^f + HI_{nft}\xi_3^f + \kappa_n + \vartheta_{nf} + \chi_{nft} \end{cases} \tag{3.4}$$

$$HI_{nit} = \{EPHI_{nit}, EPHI_{n,-i,t}, Medicare_{nit}, Private_{nit}\}$$

where $ln(m^*_{nmt})$ denotes the log of the expected total medical expenditure, X_{nit} denotes demographic variables including health, HI_{nit} represents all the possible health insurance options. For each spouse, the available health insurance choice set (HI_{nit}) includes his eligibilities for different types of health insurance, such as Medicare, EPHI from both spouses' employers and the privately purchased health insurance. κ_n and ϑ_{ni} denote the household's and individual's tastes for health care, respectively, and χ_{nit} is an idiosyncratic medical expenditure shock, which measures the volatility of medical expenditure. Two spouses' tastes for health care (ϑ_{nm}, ϑ_{nf}) are assumed to be correlated.

3.4.2 *Initial Conditions Problem*

The available employer-provided health insurance choice set observed in the first wave is determined earlier, perhaps decades ago, when an individual first started the current job. It depends on observed and unobserved factors: people with higher education may receive better job offers that provide health insurance; and people with high taste for health treatment may prefer jobs that offer health insurance rather than those that provide higher wages. This would make it incorrect to assume that the initial available employer-provided health insurance choice set,

$$EPHI_{ni} = (EPWHI_{ni}, EPRHI_{ni}, EPWHIS_{ni}, EPRHIS_{ni})$$

is exogenously determined, though previous work has done so. $EPWHI_{ni}/EPRHI_{ni}$ equals 1 if spouse i is eligible for his own employer-provided health insurance while working/retired, and 0 otherwise. $EPWHIS_{ni}/EPRHIS_{ni}$ equals 1 if i's employer can provide this working/retiree health insurance to his spouse, and 0 otherwise. To deal with this problem I specify the equation below to account for the $EPHI_{ni1}$:

$$\begin{cases} EPWHI^*_{ni} &= X_{ni1}\varsigma^i_1 + Z_{ni1}\varsigma^i_2 + P_{ni}\varsigma^i_3 + \mu^w_{ni} + \omega_{ni} \\ EPRHI^*_{ni} &= X_{ni1}\varsigma^i_4 + Z_{ni1}\varsigma^i_5 + P_{ni}\varsigma^i_6 + \mu^r_{ni} + \omega_{ni} \\ EPWHIS^*_{ni} &= X_{ni1}\varsigma^i_7 + Z_{ni1}\varsigma^i_8 + P_{ni}\varsigma^i_9 + \theta^w_{ni} + \omega_{ni} \\ EPRHIS^*_{ni} &= X_{ni1}\varsigma^i_{10} + Z_{ni1}\varsigma^i_{11} + P_{ni}\varsigma^i_{12} + \theta^r_{ni} + \omega_{ni} \end{cases} \tag{3.5}$$

where $EP(W/R)HI^*_{ni}$ and $EP(W/R)HIS^*_{ni}$ are the latent variables of each spouse's initial employer-provided insurance eligibilities ($EP(W/R)HI_{ni}$, $EP(W/R)HIS_{ni}$); X_{ni1}, Z_{ni1} denote demographic variables and job characteristics in wave 1; P_{ni} denotes the parents' education;[8] $\mu^{w/r}_{ni}$ and $\theta^{w/r}_{ni}$ are individual tastes for employer-provided health insurance and are correlated with the taste for health care (ϑ_{ni}); ω_{ni} is distributed $N(0,1)$, and is uncorrelated with any of the unobserved variables in the model.

3.5 Social Security and Pensions

Social Security and Pensions could generate retirement incentives because they are two sources of retirement income. I model these two programs in detail.

Social Security benefits, ssb_{it}, are based on the age claiming the benefits and a worker's average indexed monthly earnings (AIME), which is roughly his average labor income during his 35 highest earnings years. Individuals can first apply for benefits at age 62, and can receive the benefits until death. The primary insurance amount (PIA) is the benefits a person would receive if he/she claiming Social Security benefits at his/her normal retirement age (age 65). PIA can be calculated by the AIME and a formula.[9]

[8] Parents with higher education may be more likely to suggest that their children choose a job that offers insurance.

[9] $$PIA_t = \begin{cases} 0.9 \times AIME_t & if\, AIME_t < \$5,724 \\ \$5,151.6 + 0.32 \times (AIME_t - \$5,724) & if\, AIME_t \in [\$5,724,\, \$34,500) \\ \$14,359.9 + 0.15 \times (AIME_t - \$34,500) & if\, AIME_t \geq \$34,500 \end{cases}$$

For individuals work less than 35 years, work more years can definitely increase their AIME and thus increase the benefits. For individuals already worked more than 35 years, remain in the labor force could increase their benefits only if labor income earned later is higher than income earned some previous years before. This gives individuals an incentive to retire later or until they have experienced highest 35 years of income.

For individuals claiming benefits before age 65, benefits are reduced by 6.67% per year of the PIA. But for individuals claiming benefits after age 65, benefits are increased by 5.5% per year until age 70. This gives individuals an incentive to delay their retirement. Individuals who claim benefits and continue working might subject to the Social Security Earnings Test. For beneficiaries age between 62 and 64, benefits are taxed at a 50% rate for the amount of labor income above the threshold of $9,120. For beneficiaries age between 65-69, benefits are taxed at a 33% rate for the amount of labor income above the threshold of $14,500. This discourage people to apply benefits before age 65.

Social Security program also provide dependent benefits for spouses. The spouse is eligible for the dependent benefits when the worker has claimed the Social Security benefits and the spouse is at lease age 62. The dependent benefits for spouses equal to one half of their partner's PIA (reduced if either the worker or the spouse claims benefits before age 65) if it is higher than the benefits based on their own earning history, and vice verse. The dependent benefits for widows or widowers equal to the deceased partner's PIA (reduced if either the deceased worker or the widow/widower claimed benefits before age 65) if it is higher than the benefits based on their own earning history, and vice verse. This gives individuals an incentive to work more so they can provide more benefits for their spouses.

In this paper, I assume individuals start claiming benefits when they retire or at age 62 if they retire before age 62. This assumption can simplify the dynamic problem because it treats the Social Security benefits as a variable determined by retirement decision, but not a separate choice variable. [10]

Pension benefits, pb_{it}, depend on retirement age and pension wealth. In particular, under defined benefits (DB) pensions plan, the pension accrual rate keeps increasing in the length of service in a firm until a peak time (usually the early or normal retirement age), after that, the pension accrual rate starts to greatly reduced and can even become negative. Thus, DB pensions give individuals strong incentives to retire at specific ages. Under defined contribution (DC) pensions plan, pension benefits only depend on the assets accumulated in the account when retire. Thus, unlike DB pensions, DC pensions do not give incentives to retire at specific ages. French and Jones (2011) find out that

[10] I think it is reasonable to make this assumption since most people actually claim benefits when they retire. Also, in Casanova (2011), the author used the same assumption and compared the actual and assumed Social Security claiming data, and the two series are very close.

people with better employer-provided health insurance coverage have higher probability of having DB pensions. They also point out that although the HRS pension data provide detailed information to calculate pension benefits for each people, Bellman's curse of dimensionality prevents them from including pension benefits as a state variable in their dynamic programming model. They model pension benefits as a function of other state variables, and thus pension benefits are not state variables themselves. In this paper, I follow the method developed in their paper and impute a worker's annual pension benefits as a function of his retirement age, his Social Security benefits at the retirement age, and the type of his employer-provided health insurance.[11]

3.6 Health Transitions and Mortality Rates

n a household, spouses' health transitions may be interdependent for several reasons (Wilson 2002): 1) people tend to marry those with similar backgrounds, such as level of education and economic status, which are related to health status; 2) spouses tend to make similar choices that will affect their health, such as how much to smoke, drink, or eat; 3) spouses share emotional stresses; 4) and importantly, one spouse might provide health care for the other one, and the burden of being a caregiver for a spouse in poor health may decrease the health of the care-giving spouse. Thus, to capture the correlation between both spouses' health transitions, I build the following bivariate probit (BP) model:

$$\begin{cases} H^*_{nht} = \beta_0^h + X'^H_{n,t-1}\beta_1^h + X'^h_{n,t-1}\beta_2^h + H^*_{nwt}\beta_3^h + u_{nht} \\ H^*_{nwt} = \beta_0^w + X'^H_{n,t-1}\beta_1^w + X'^w_{n,t-1}\beta_2^w + H^*_{nht}\beta_3^w + u_{nwt} \end{cases} \qquad (*)$$

$$H_{nit} = \begin{cases} 1; & if\ H^*_{nit} > 0 \\ 0; & otherwise \end{cases} \qquad (i = h, w)$$

Here $H_{nt} = (y_{nht}, y_{nwt})$ denotes the health status next period of the husband, h, and wife, w, in household n. H_{nit} equals 1 if spouse i is observed in good health in the next period, and equals 0 if in bad health. Spouse i's latent health status in the next period, H^*_{nit}, is modeled as a function of household characteristics this period, $X^H_{n,t-1} = (HH\_Hisp_n, HH\_race_n)$; his/her individual characteristics this period, $X^i_n = (edu_{ni}, age_{ni}, chronic\_disease_{ni}, HI1_{ni}, HI2_{ni})$; his/her health shock for the next period, u_{nit}; and the latent variable of the other spouse's health status in the next period, $H^*_{n,-it}$.[12] This means that spouse i's characteristics this period can affect the other one's health transition only through i's latent health in the next period, so they serve as exclusion restrictions. Spouses share life together, and they experience similar events that

[11]Details about how French and Jones model the pension benefits can be found in French and Jones (2011) Supplemental Material Appendix D.

[12]Since X^H_n, X^h_n, and X^w_n are vectors of variables, β_1^i and β_2^i are vectors of parameters.

might affect health. Thus, I allow both spouses' health shocks to be bivariate normally distributed,

$$(u_{nht}, u_{nwt}) \sim i.i.d\, N \left[0, \begin{pmatrix} 1 & \rho_H \\ \rho_H & 1 \end{pmatrix} \right]$$

Table 2 - Table 5 list the estimates for health transitions for different groups of households based on both spouses' original health statuses.

Due to similar reasons, two spouses' morality rates should be considered jointly. I use a bivariate probit (BP) model to capture the household morality rates. I estimate mortality rates and health transitions using the HRS demographic data outside of the structural model.

3.7 Terminal Value Functions and Bequest Function

Death can break up the original household.[13] To deal with death, follow Casanova (2011), I give a terminal value function to a household if one spouse died, and give a bequest function to a household if both spouses died. If one spouse died at period t, the behavior of the widow/widower is not modeled, and his/her remaining lifetime utility is modeled as the terminal value function,

$$TV_t^i(A_t, ssb_{mt}, ssb_{ft}) = \theta_{TV}^i \frac{(TW_t^i)^\alpha}{\alpha} \; (i = m, f)$$

where TW is the present discounted total wealth for the surviving spouse, which is the sum of available household asset and the present discounted value of the surviving spouse's Social Security benefit.[14]

$$TW_t^i = A_t + PDV_t(max\{ssb_{mt}, ssb_{ft}\})$$

If both spouses died at period t, the household value the assets bequested to survivors in the family. The household utility is modeled as the bequest function,

$$BF_t(A_t) = \theta_{BF} \frac{(A_t + K)^\alpha}{\alpha}$$

where K measures the curvature of the function.[15]

[13] Divorce is another event that break up the original household. In this paper, I do not consider divorce. It is hard to model divorce because I cannot observe how two spouses split the household assets. Besides, divorce happens only less than 1% of couples in my sample.

[14] As discussed in section 3.5, the Social Security benefits of widows/widowers equal to the higher value of the deceased partner's Social Security benefits and the survivor's own Social Security benefits.

[15] As described in Casanova (2011), $K = 0$ implies an infinite disutility of leaving non-positive bequest, and $K > 0$ implies an finite utility of zero bequest.

3.8 Value Function

Let z_t be the vector of observed state variables in period t, which includes: household assets from the last period (A_t); each spouse's demographic variables (X_{it}), such as age (a_{it}), education degree, and health status (H_{it}); job characteristics (Z_{it}), such as wage (w_{it}), pension (p_{it}), Social Security benefits (ssb_{it}), union status, industry, and firm size; employer-provided health insurance eligibility ($EPHI_{it}$); and Medicare eligibility (M_{it}). Let $y_t = (\varepsilon_i, \vartheta_i, \mu_i, \theta_i, \chi_{it}, e_t(d_t), \kappa)$ be the vector of unobserved state variables, which represent the full set of unobserved heterogeneity terms across couples. I rewrite a household's utility flow at period t in a more formal way: $U_t(d_t, s_t; z_t, y_t; \theta_u)$. The expected present discounted value (EPDV) of the household's remaining lifetime utility in period t under a choice set (d_t, s_t) is:

$$V_t(d_t, s_t; z_t, y_t; \theta) = U_t(d_t, s_t; z_t, y_t; \theta_u) + \beta E_t[V_{t+1}(z_{t+1})|z_t] \tag{3.4}$$

$$where\ E_t[V_{t+1}(z_{t+1})|z_t] = \sum_{z_{t+1}} \pi(z_{t+1}|z_t, d_t, s_t, \theta_\pi)V_{t+1}(z_{t+1})$$

The $U_t(d_t, s_t; z_t, y_t; \theta_u)$ term is household utility flow at period t. $\pi(z_{t+1}|z_t, d_t, s_t, \theta_\pi)$ represents the household's subjective beliefs about uncertain future events, and θ_π denotes a vector of unknown parameters characterizing households' beliefs about uncertain events. $V_{t+1}(z_{t+1})$ is the household maximum EPDV unconditional on period $t+1$ choices and is defined as:

$$V_{t+1}(z_{t+1}) = E_t max_{(d_{t+1}, s_{t+1})} V_{t+1}(d_{t+1}, s_{t+1}; z_{t+1}, y_{t+1})$$

where the expectation is taken with respect to y_{t+1}, and the *max* is taken with respect to the set of feasible choices. At period $t+1$, if one spouse died, then $V_{t+1}(Z_{t+1}) = TV^i_{t+1}$, and if both spouses died, then $V_{t+1}(Z_{t+1}) = BF_{t+1}(A_{t+1})$.

4 Data

I use two different data sets to estimate my model. The primary source of data is the Health and Retirement Study (HRS), which is a detailed panel survey of individuals over age 50 and their spouses. It collects extensive information about household characteristics, labor force participation and health insurance coverage as well as health transitions, income, assets, pension plans and health care expenditures. The HRS began in 1992 and re-interviewed the same households every two years thereafter.[16] There are currently nine available waves, covering from 1992 to 2008. The second data is the

[16]New cohorts are added every three waves to make sure that every survey contains people aged 51 and above.

Medical Expenditure Panel Survey (MEPS), a set of large-scale surveys of families and individuals, their medical providers, and their employers. The MEPS began in 1996 and provides provides information on the co-insurance rates, the deductibles and the premiums of available employer-provided health insurance plans, which cannot be observed in the HRS data.

4.1 Sample

I restrict my sample to couples in a long-term marriage where both spouses are full-time workers.[17] The initial HRS sample (1992) contains 923 couples in which both spouses are full-time workers and entered into the current marriage before the age of 35.[18] To avoid sample selection bias based on work status at later ages, I drop couples where both spouses are initially older than age 56 or where the age difference between the spouses is greater than 10 years.[19] The resulting estimation sample is 702 couples, and 557 of them remaining in the sample in 2008. Around 77% of the sample attrition is due to household refuse to answer the survey anymore, and the left 23% is due to both spouses die. Table 1 lists the sample selection reasons.[20]

4.2 Employment

Employment status is collected in each wave in the HRS. Since most part-time jobs do not offer health insurance, following Gustman and Steinmeier (2000), I define retirement as the decision to reduce work effort below full time. Figure 2 displays the household retirement rates for the estimation sample at the nine survey dates. The rate of having both spouses retired increases by about 9.5% on average between adjacent surveys. Figure 3 displays the household retirement propensities between every two adjacent waves. The propensity for simultaneous retirement increases from 2.5% in 1994 to 17.6% in 2008.

[17]A Full-time work is defined as 30+ hours per week and 36+ weeks per year.

[18]Gustman and Steinmeier (2002) point out that, for those who change spouses after age 35, it is necessary to consider how much wealth each spouse bring into the marriage and how they split obligations to children, which are not observed in the HRS data. In addition, marriage decisions at older age may depend on the other spouse's economic situation and insurance benefits, which is not the case studied in my model.

[19]If age difference is greater 10 years, couples may less likely to choose simultaneous retirement. Including them will make my sample not representative enough. If both spouses are full-time workers and over age 56, they might value working more than others, and thus they cannot represent ordinary couples where both spouses over age 56.

[20]Since the HRS survey include more households every three waves, so I will include households that entered into the HRS in 1996 and satisfy those selection rules.

4.3 Bargaining Power

In the first wave (1992), each spouse was asked the question about decisions making power: *"When it comes to making major family decisions, who has the final say-you or your (husband/wife/partner)?"*[21] Individuals could answer that they themselves have the final say, that their spouses did, or the division of responsibility was "about equal". Both because the answers are discrete and because there exist disagreements between two spouses' reports, following Friedberg and Webb (2006), I treat the answers as noisy, discreted measures, and I use a bivariate ordered probit model to impute the continuous true bargaining power γ.[22] More details about this imputation model is described in section 5.2.

4.4 Medical Expenditure

Each spouse's out-of-pocket medical expenditure depends on his total medical expenditure and the characteristics of the health insurance plan that is chosen by the household. Thus I need data on total expenditure to predict out-of-pocket expenditure under alternative health insurance plans. The HRS has a great deal of information on medical expenditure, but it is problematic for three reasons: 1) There are no data for 1992, and the 1994 data are not comparable to the data from later surveys; 2) information is collected only on out-of-pocket expenditure, rather than total expenditure; and 3) the HRS collects data on characteristics of health insurance plans from the employers of the respondents, but this employer-provided data is available only on a restricted basis and is often missing.[23]

The rand HRS imputes a consistent measure of out-of-pocket medical expenditure for each wave.[24] The MEPS provides averages of employer-provided plans by industry and firm size in the private sector, and for different government institutions by census division and government type in the public sector. I can use the MEPS to impute the "generic" co-insurance rate, deductible and paid premium for each possible health

[21] "By 'major family decisions' we mean things like when to retire, where to live, or how much money to spend on a major purchase."

[22] I do not consider the dynamics of bargaining power for two reasons: 1) Households in my sample are older couples with long marriages, which means they have happier and more harmonious marriages than average. I can treat the reported decision-making power as the steady-state of a repeated game. 2) Friedberg and Webb (2006) found that average past earnings have a substantially greater impact on decision-making power than current earnings; and the effects of each spouse's pension income from earlier jobs and pension participation in a current job on decision-making power are not statistically significant. This means that the retirement decision may not affect the decision-making power very much.

[23] Besides employer-provided health insurance, I also consider Medicare in my model. The deductible of Medicare is the same for everyone and is set by the Social Security Administration. The premium of Medicare depends on individuals earning income and can be calculated easily.

[24] The rand HRS also imputes total medical expenditures, but only for the first 6 waves. The details about the imputation method is described in *RAND HRS Data Documentation, Version J, page* 19-21.

insurance plan for each individual in my sample. To generate total medical expenditure, I use information on the out-of-pocket medical expenditure from the rand HRS and the imputed health insurance characteristics of the individual's coverage using the MEPS.

4.5 Health and Health Insurance

I measure health status of respondents in the HRS by their response to the question *"Would you say your health is excellent, very good, good, fair or poor?"* I define their health status as good if their answer is excellent, very good, or good and bad otherwise.[25] Although several researchers raise concerns about the reliability of self-reported health status, I assume that it is reported accurately due to the discussion in Benitez-Silva, Buchinsky and Rust (2004).[26]

Because I model the household choice of a health insurance plan for each spouse, I need to know all the health insurance plans that are available for each spouse under different household retirement decisions. Information about different options is reported on a conditional basis, depending on the individual's take-up of offered insurance. If both spouses are covered by one spouse's employer, says the husband, the HRS provides detailed information on health insurance coverage from the husband's employer, but no information from the wife's employer. In this case, I have to impute four pieces of information about the health insurance coverage for the wife: 1) whether she is eligible for her own employer-provided working health insurance ($EPWHI$), 2) if yes whether she can cover her husband ($EPWHIS$); 3) whether she is eligible for her employer-provided retiree health insurance ($EPRHI$), 4) if yes whether she can cover her spouse ($EPRHIS$). If each spouse is covered by his or her own employer, the HRS provides information on whether they are eligible for employer-provided health insurance both when they are working and retired. But, there is no information on whether their working/retiree health insurance can cover their spouses.

The HRS provides complete information about employer-provided health insurance eligibilities only for those who choose to be covered by their own employer-provided health insurance. This means whether one spouse's employer-provided health insurance eligibilities can be observed depends on his choice of employer-provided health insurance coverage. I can deal with this selection problem by modeling the selection rule of being observed. The model I use to impute employer-provided health insurance eligibilities is described as below:

[25] The health transition probabilities are a function of age and gender; and mortality rates are a function of previous health, age and gender.

[26] They argue that respondents should report their true health status because the HRS data has very high level of confidentiality.

$$\begin{cases} WHI_{ni} & = & X_{ni}\varsigma^1_{WHI} + Z_{ni}\varsigma^2_{WHI} + \omega^{WHI}_{ni} \\ WHS_{ni} & = & X_{ni}\varsigma^1_{WHS} + Z_{ni}\varsigma^2_{WHS} + \omega^{WHS}_{ni} \\ RHI_{ni} & = & X_{ni}\varsigma^1_{RHI} + Z_{ni}\varsigma^2_{RHI} + \omega^{RHI}_{ni} \\ RHS_{ni} & = & X_{ni}\varsigma^1_{RHS} + Z_{ni}\varsigma^2_{RHS} + \omega^{RHS}_{ni} \\ Cover_{ni} & = & X_{ni}\varsigma^1_{Cover} + Z_{ni}\varsigma^2_{Cover} + Z_{n,-i}\varsigma^3_{Cover} + \omega^{Cover}_{ni} \end{cases} \tag{4.1}$$

For individual i, he/she is eligible for employer-provided health insurance while working ($EPWHI = 1$) when $WHI_i \geq 0$, and this working health insurance can cover his/her spouse ($EPWHIS = 1$) when $WHI_i \geq 0 \& WHS_i \geq 0$; he/she is eligible for EPHI after retire ($EPRHI = 1$) when $WHI_i \geq 0 \& RHI_i \geq 0$, and this retiree health insurance can cover his/her spouse when $WHI_i \geq 0 \& WHS_i \geq 0 \& RHS_i \geq 0$. $Cover_i \geq 0$ when individual i chooses to be covered by his own employer-provided health insurance. I assume an individual's employer-provided health insurance eligibility can be predicted by demographic characteristics (X_{ni}) and employment characteristics (Z_{ni}), and the observed EPHI coverage can be predicted by demographic characteristics, employment characteristics, and spousal employment status $(Z_{n,-i})$. [27] $(\omega^{WHI}_{ni}$, ω^{WHS}_{ni}, ω^{RHI}_{ni}, ω^{RHS}_{ni}, $\omega^{Cover}_{ni})$ are distributed $N(0,1)$. I use married people in the HRS that covered by their own employer-provided retiree health insurance to estimate the imputing model (4.1), and use the estimates to impute employer-provided retiree health insurance eligibility for individual with incomplete information about employer-provided retiree health insurance eligibilities in my sample. I use the method of Pearson's chi-squared test to test the goodness-of-fit of the employer-provided retiree health insurance imputing model (4.1), and it fits the data very well. Using the estimates, before I estimate the dynamic structural model, I impute employer-provided retiree health insurance eligibility for individuals in my sample whose eligibility cannot be observed.

4.6 Income

The HRS provides information on both spouses' labor income in a current year. To simplify the dynamic computation, I do not treat labor incomes as state variables. Instead, I assume a worker knows his labor income for each period at the beginning of the first period (1992).

Pension and Social Security are part of the household's income and generate retirement incentives that vary by age. As stated in section 3.5, pension benefits are modeled as a function of Social Security benefits which depend on AIME. Instead of keeping track of a worker's entire earnings history, I assume the annualized AIME can be approximated by the equation established in the Appendix C of French and Jones

[27] Demographic characteristics (X_{ni}) include race, gender, age, health and education. Employment characteristics include occupation, industry, firm size, wage, tenure, and pension

(2011).[28] The HRS provides information on both spouses' labor income since year 1992 but I cannot observe earnings history before year 1992. French and Jones (2011) use the supplement of the HRS on Social Security earnings records (SSER) to calculate the AIME at the beginning of the first period. However, this supplements is available on a restricted basis. Instead, I use data from the Panel Study of Income Dynamics (PSID), from 1969 to 1990, to estimate the labor income growth trend by gender, age, race and education. Using the estimates and observed labor income in 1992, for each individual in my sample, I can predict the labor income backwards for each year prior to 1992, and then calculate the AIME in 1991. With the initial AIME in 1991 and the AIME updating equation, I can update AIME for each period under all possible retirement decisions. Then I can calculate Social Security benefits and pension benefits.

5 Model Estimation and Identification

To estimate the model, I use a two-step strategy.[29] First, I estimate parameters that can be identified outside the model. For example, I estimate bargaining power, health transitions, and mortality rates using demographic data from the HRS. Then, I estimate the preference parameters of the model using the Method of Maximum Simulated Likelihood Estimation (MSL).

5.1 The Likelihood Function

At period t, a household knows the value of the unobserved state variables. The vector of both spouses' tastes for work $\varepsilon = (\varepsilon_m, \varepsilon_f)$ is assumed to be bivariate normally distributed: $\varepsilon \sim N(0, \Sigma_\varepsilon)$, where ρ is the correlation between ε_m and ε_f. The unobserved utility term derived from the household discrete choice is $e_t(d_t) = \eta_L + \tau_j + v_{dt}$. η_L, τ_j denote household's time-invariant tastes for a retirement decision and a health insurance plan choice. η and τ are the vectors of η_L and τ_j, and both are assumed to be multivariate normally distributed $\eta \sim N(0, \Sigma_\eta)$; $\tau \sim N(0, \Sigma_\tau)$. v_{dt} varies over both time and household discrete choices and is distributed i.i.d. Extreme value. The set of unobserved tastes $\varpi = (\kappa, \vartheta_m, \vartheta_f, \mu_m, \mu_f)$ that affect household total medical expenditure is assumed to be multivariate normally distributed $\varpi \sim N(0, \Sigma_\varpi)$. η, τ and ϖ are known by the household at the beginning of the first period, while v_{dt} is known only upon reaching the period they occur. The idiosyncratic individual medical expenditure

[28] The AIME updating equation is $AIME_{t+1} = (1 + g \times 1\{age_t \leq 60\})AIME_t + \frac{1}{35} max\{0, w_t \times hours_t - \alpha_t(1 + g \times 1\{age_t \leq 60\})AIME_t\}$. g is average real wage growth, and equals 0.016. For workers aged 55 and younger, $\alpha_t = 0$. For workers aged older than 55, α_t have different values for different ages.

[29] This strategy is similar to the one used by French and Jones (2011), Gourinchas and Parker (2002), French (2005), and Laibson, Repetto, and Tobacman (2007).

shock χ_{nit} is assumed to be normally distributed $N(0,\sigma_\chi)$. χ_{nit} is unknown at the time the household choices are made, while σ_χ is known by the household at the beginning of the first period.

The vector $\theta = (\beta, \theta_u, \theta_\pi)$ characterizes household preferences and beliefs. Given panel data $\{z_t^n; d_t^n, s_t^n\}$ $(t = 1,...,T_n; n = 1,...,N)$ on the observed states and decisions of N households, one can estimate θ by finding the value $\hat{\theta}$ such that the predictions of the model fits the data best. In my case, $\hat{\theta}$ are the parameter value that maximizes the likelihood function $L(\theta)$ defined by:[30]

$$L(\theta) = \prod_{n=1}^{N}\prod_{t=1}^{T_n} Pr_t[d_t^n, s_t^n|z_t^n, \theta]\pi(z_t^n|z_{t-1}^n, d_{t-1}^n, s_{t-1}^n\,\theta_\pi) \tag{5.1}$$

5.2 Identification

The vector of parameters $\theta_u = (\gamma,\alpha,\beta^i,\xi^i,\varsigma^i,\Sigma_\varepsilon,\Sigma_\eta,\Sigma_\tau,\Sigma_\varpi,\sigma_\chi)$ that characterizes a household's preference are of the most interest.

Following Friedberg and Webb (2006), the bargaining power of a husband relative to his wife γ is identified by both spouses' reports of 'the final say'. Let γ_n be the true bargaining power in household n, and assume it is a function of household observables X_n; let R_{ni} represent spouse i's reports, where

$$R_{ni} = \{husband\,has\,final\,say,\,about\,equal,\,wife\,has\,final\,say\} = \{1, 0, -1\}$$

Let R_{ni}^* be the underlying continuous measure of R_{ni}, which depends on the true bargaining power γ_n and some reporting bias $X_n\beta_i^\gamma$. $R_{ni} = -1\,if\,R_{ni}^* \le \mu_0$; $R_{ni} = 0\,if\,\mu_0 < R_{ni}^* \le \mu_1$; and $R_{ni} = 1\,if\,R_{ni}^* > \mu_1$.

$$\gamma_n = X_n\alpha^\gamma + u_n^\gamma \tag{5.2}$$

$$R_{ni}^* = \gamma_n + X_n\beta_i^\gamma + u_{ni}^\gamma = X_n(\alpha^\gamma + \beta_i^\gamma) + \tilde{u}_{ni}\;\; i \in \{m,f\} \tag{5.3}$$

Assuming that $\tilde{u}_{ni} = (u_{ni}^\gamma + u_i^\gamma) \sim N(0,\sigma_\gamma^2)$, and $cor(\tilde{u}_{nm},\tilde{u}_{nf}) = \rho_\gamma$. $(\alpha^\gamma+\beta_i^\gamma),\sigma_\gamma,\rho_\gamma,\mu_0,\mu_1$ are identified by estimating the bivariate ordered probit model. α^γ can be estimated after imposing the restriction $\beta_m^\gamma + \beta_f^\gamma = 0$. With the estimated α^γ, I can predict the value of γ_n.

The risk aversion parameter α is identified by the co-variation in the retiree health insurance eligibility and the household retirement choice. The extent to which households eligible for employer-provided retiree health insurance are more likely to simultaneous retirement than those who are not eligible identifies the degree of risk

[30] $Pr_t[d_t^n, s_t^n|z_t^n, \theta]$ is the probability that household n chooses (d_t, s_t) in period t conditional on state variables and parameters, thus $Pr_t[d_t, s_t|z_t, \theta] = \int_{y_t} I\{(d_t, s_t) = \delta_t(z_t, y_t, \theta)\}F(dy_t|z_t)$, where $\delta = (\delta_0,...,\delta_T)$ is the optimal decision path, and $F(y_t|z_t)$ is the multivariate distribution of unobserved variables.

aversion. Also households after age 65 are eligible for Medicare and thus are more likely to choose simultaneously retire than when they before age 65. Since γ is identified by the observed reports of 'the final say', $(\beta_0^i, \beta_1^i, \beta_2^i, \beta_3^i, \beta_4^i, i \in \{m, f\})$ are identified by the co-variation in the household retirement choices and the observed (a_m, a_f, H_m, H_f) conditional on household health insurance eligibility and observable characteristics.[31]

Each spouse's unobserved taste for leisure (ε_i) together with the household's unobserved tastes for available household retirement choices (η) can affect household retirement decision. The distributional parameters of ε and η are identified by the co-variation in the household retirement choices and that cannot be explained by the observables.[32] Based on observables I can predict the weighted sum of each spouse's utility for all available retirement choices and thus the household retirement choice. A household in which the wife has a high taste for leisure (ε_f) and the household has a high taste for the wife's home production will more likely be observed having only the wife retired, compared to what would otherwise predicted. Also, if I observe some households with high values of $X^m\beta^m$ and $X^f\beta^f$ choosing to work together or retire simultaneously, rather than have only one spouse work, conditional on household insurance eligibility and observable characteristics, then the correlation between ε_m and ε_f would be positive. The distributional parameters of the variance matrices Σ_τ can be identified when households choose an insurance plan that does not minimize out-of-pocket medical expenditure.

The parameters of the total medical expenditure equation (3.4), ξ^i, are identified by the co-variation in total medical expenditure and observable characteristics $(X_{ni}, H_{ni}, L_{ni}, HI_{ni})$ for household n spouse i. The parameters of the initial condition equation (3.5), ς^i, are identified by the co-variation in the first-wave available employer-provided insurance choice set and observable characteristics (X_{ni}, Z_{ni}, P_{ni}). The average residual within a household of equation (3.4) can help to identify the variance of κ_n (σ_κ); with σ_κ, the average residual for a spouse over time can help to identify the variance of ϑ_{ni} (σ_ϑ); and finally with σ_κ and σ_ϑ, the residual of (3.4) identify the variance of medical expenditure shock χ_{nit} (σ_χ). The residual for a spouse of equation (3.5) can help to identify the variance of μ_{ni}. The correlation in residuals for two spouses of (3.4) within a household identifies the correlation between ϑ_{nm} and ϑ_{nf}, and the correlation in residuals for two spouses of (3.5) within a household identifies the correlation between μ_{nm} and μ_{nf}. The correlation in residuals of (3.4) and (3.5) for a spouse i identifies the correlation between ϑ_{ni} and μ_{ni}. Thus, the variance matrix Σ_ϖ is identified.

[31] Actually the co-variation in the household retirement choices and the observed can only identify $\gamma\beta_4^m + (1-\gamma)\beta_4^f$. Since γ is identified and it varies across households, β_4^m and β_4^f can be separately identified.

[32] $\varepsilon = (\varepsilon_m, \varepsilon_f)$ and $\eta = (\eta_{(0,0)}, \eta_{(0,1)}, \eta_{(1,0)}, \eta_{(1,1)})$

6 Conclusions

In this paper, I present a dynamic structural model to examine the role of health insurance in household joint retirement decisions. I propose three channels through which health insurance affect retirement decisions: 1) health insurance can affect the total medical expenditure which is modeled as endogenously determined; 2) health insurance reduce the out-of-pocket medical expenditure; and 3) health insurance coverage can affect future health status. Health insurance can affect retirement decisions by changing the budget constraints through the first two channels, and can affect retirement decisions by affecting the preference for leisure through the last channel. The model not only accounts for the interdependence of health transitions and mortality rates among married couples, but also accounts for the interdependence of health insurance coverage among married couples by carefully generate feasible set of health insurance plans which depend on both spouses' health insurance eligibility and retirement decisions, and allow household to choose health insurance plan from the feasible set for each spouse.

My estimates of household joint health transitions show the following. 1) When the wife is in good health, improvement in her (latent) health raises the husband's (latent) health next period. But, this is not observed if the husband is in good health. 2) When the wife is originally in good health, spouses' health shocks are positively correlated. This means spouses might both have positive health shocks that are good for health, or both have negative health shocks that are bad for health. But, spouses' health shocks become negatively correlated when the wife is originally in bad health. This might also arise because usually the wife takes care of health of the whole family. When the wife is in good health, she can take better care for both spouses, and thus both are more likely to have some good health shocks. 3) Spouses covered by Medicare below age 64 and Medicaid (likely because they are disabled) are more likely to be in bad health in the next period, and the effects are significant, while spouses covered by Medicare above age 64 and private health insurance are more likely to be in good health in the next period. Note, too, that the earlier effects of one spouse's health on another persist in the model even if I exclude these potentially endogenous variables reflecting health insurance coverage. 4) Lastly, having higher education can significantly increase the probability of being healthy next period. Also chronic diseases significantly increase the probability of bad health next period.

To impute employer-provided health insurance eligibility for individuals whose employer-provided health insurance eligibility cannot be observed, I construct a multivariate probit model that accounts for the selection rule which determines whether an individual's employer-provided health insurance eligibility can be observed or not. This multivariate probit model fits the data very well. This model can used in projects that need information about employer-provided health insurance eligibility but lack of data providing complete information.

With the estimates, my model can predict the effects of observed declines in coverage rates of employer-provided retiree health insurance. Moreover, I can simulate responses to policies that change health insurance options and how these policies affect workers welfare: e.g., the Affordable Care Act which helps to make health insurance independent of employment status, and the proposed policy to increase the Medicare eligibility age to 67 years. I also can calculate how increases in the Social Security Normal Retirement Age to 67 will affect retirement and government spending through joint retirement effects.

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Figures

Figure 1: The Feasible Set of Household Insurance Plans J_t

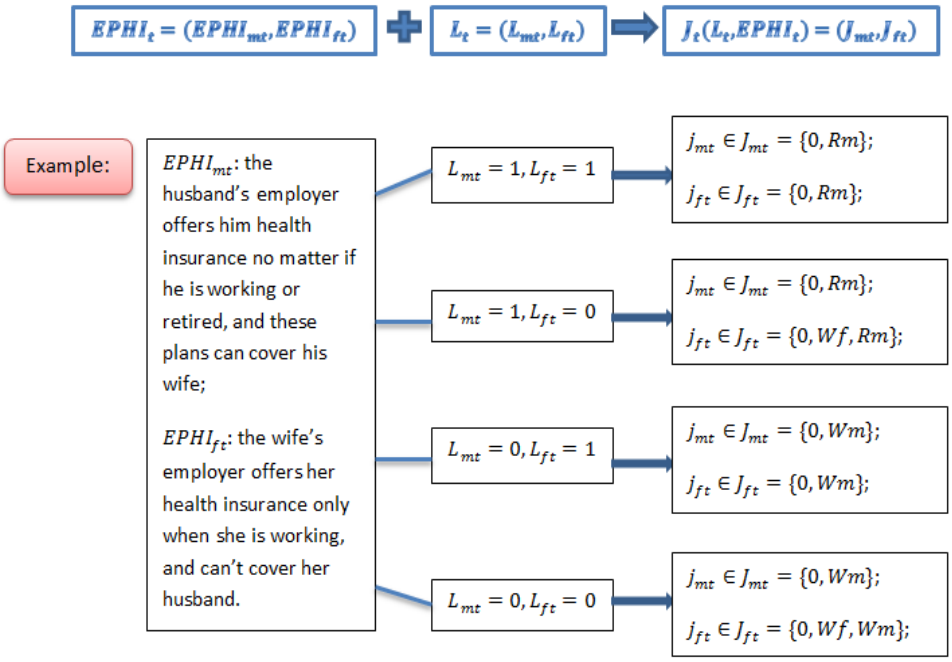


Figure 2: Household Retirement Rates

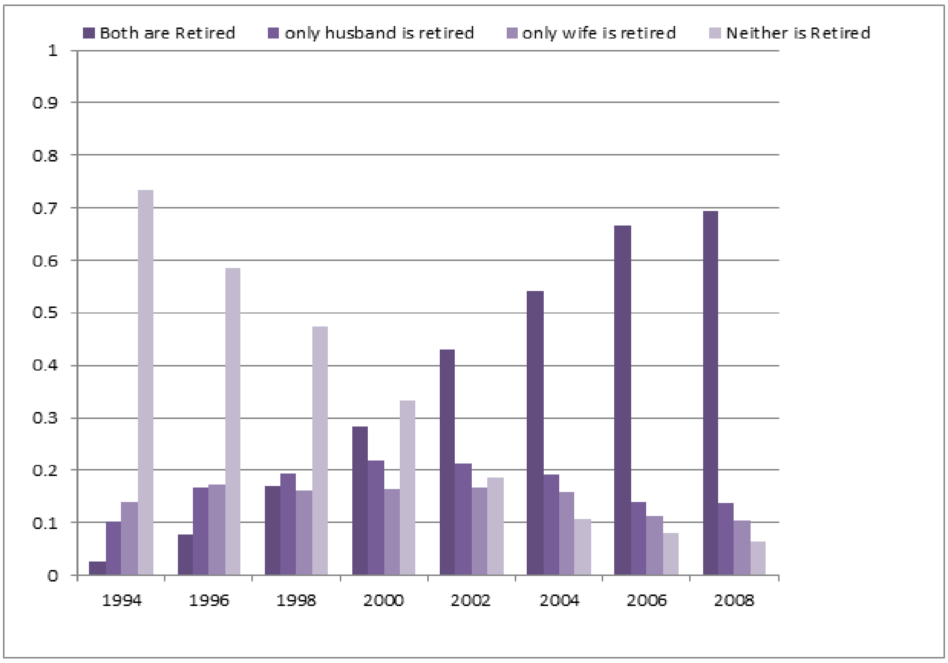
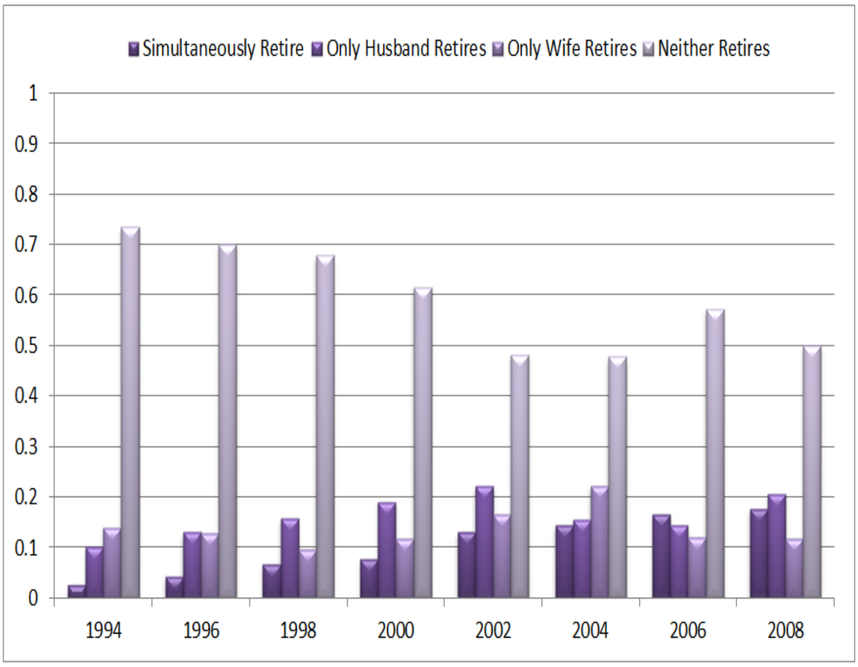


Figure 3: Household Retirement Propensities



Tables

Table 1: Sample Selection Criteria for the HRS Sample

	Observation Deleted	Observation Remaining
1) Couples with only one spouse interviewed		4746
2) Changed spouses after age 35	1310	3436
3) Not both full-time workers	2513	923
4) Both spouses over age 65	206	717
5) Age difference is greater than 10	15	702

Table 2: Health Transitions Estimates for Households where Both are Originally in Good Health

Husband Equation				**Wife Equation**			
Variable	Estimates		Std Err	Variable	Estimates		Std Err
Constant	-1.189	*	0.469	Constant	-0.475		0.391
Hispanic	-0.304	**	0.057	Hispanic	-0.395	**	0.058
Race				**Race**			
white (base)	omitted			white (base)	omitted		
black	-0.189	**	0.043	black	-0.156	**	0.048
others	-0.183	**	0.051	others	-0.141	*	0.056
Chronic_disease	-0.227	**	0.01	Chronic_disease	-0.246	**	0.011
age	0.082	**	0.014	age	0.063	**	0.012
age^2	-0.001	**	0.000	age^2	-0.001	**	0.000
Type I HI	-0.431	**	0.06	Type I HI	-0.426	**	0.068
Type II HI	0.136	**	0.042	Type II HI	0.123	**	0.04
Education				**Education**			
Less HS (base)	omitted			Less HS (base)	omitted		
HS	0.259	**	0.031	HS	0.326	**	0.035
College & above	0.554	**	0.037	College & above	0.573	**	0.047
Wife's latent health	0.073	*	0.035	Husband's latent health	0.129	**	0.038
correlation coefficient	-0.081						

Note: 1) Subsample size: 21885; 2) Double-starred items are statistically significant at the 5% level, and single-starred items are statistically significant at the 1% level. 3) Type I HI represents Medicare below age 64 and Medicaid, while Type II HI represents Medicare above age 64 and private insurance.

Table 3: Health Transitions Estimates for Households where Only Wife is Originally in Good Health

Husband Equation				**Wife Equation**			
Variable	Estimates		Std Err	Variable	Estimates		Std Err
Constant	-0.491		0.74	Constant	-1.259		0.657
Hispanic	-0.123		0.087	Hispanic	-0.466	**	0.087
Race				**Race**			
white (base)	omitted			white (base)	omitted		
black	-0.138	*	0.061	black	-0.167	*	0.066
others	0.028		0.082	others	-0.078		0.097
Chronic_disease	-0.192	**	0.016	Chronic_disease	-0.253	**	0.02
age	0.016		0.022	age	0.083	**	0.021
age^2	0.000		0.000	age^2	-0.001	**	0.000
Type I HI	-0.303	**	0.064	Type I HI	-0.266	**	0.09
Type II HI	0.066		0.064	Type II HI	0.181	**	0.064
Education				**Education**			
Less HS (base)	omitted			Less HS (base)	omitted		
HS	0.124	**	0.044	HS	0.329	**	0.053
College & above	0.243	**	0.063	College & above	0.631	**	0.093
Wife's latent health	0.132	*	0.054	Husband's latent health	0.183	*	0.073
correlation coefficient	-0.238						

Note: 1) Subsample size: 4948; 2) Double-starred items are statistically significant at the 5% level, and single-starred items are statistically significant at the 1% level. 3) Type I HI represents Medicare below age 64 and Medicaid, while Type II HI represents Medicare above age 64 and private insurance.

Table 4: Health Transitions Estimates for Households where Only Husband is Originally in Good Health

Husband Equation				**Wife Equation**			
Variable	Estimates		Std Err	Variable	Estimates		Std Err
Constant	-0.172		0.837	Constant	-0.714		0.604
Hispanic	-0.345	**	0.073	Hispanic	-0.214	**	0.079
Race				**Race**			
white (base)	omitted			white (base)	omitted		
black	-0.149	*	0.069	black	-0.148	*	0.067
others	-0.024		0.09	others	0.063		0.082
Chronic_disease	-0.208	**	0.019	Chronic_disease	-0.161	**	0.016
age	0.043		0.025	age	0.026		0.019
age^2	0.000	*	0.000	age^2	0.000		0.000
Type I HI	-0.264	**	0.091	Type I HI	-0.43	**	0.071
Type II HI	0.279	**	0.074	Type II HI	0.111		0.061
Education				**Education**			
Less HS (base)	omitted			Less HS (base)	omitted		
HS	0.29	**	0.052	HS	0.094		0.049
College & above	0.564	**	0.08	College & above	0.177	*	0.081
Wife's latent health	0.077		0.076	Husband's latent health	-0.025		0.064
correlation coefficient	0.106						

Note: 1) Subsample size: 4813; 2) Double-starred items are statistically significant at the 5% level, and single-starred items are statistically significant at the 1% level. 3) Type I HI represents Medicare below age 64 and Medicaid, while Type II HI represents Medicare above age 64 and private insurance.

Table 5: Health Transitions Estimates for Households where Both are Originally in Bad Health

Husband Equation				**Wife Equation**			
Variable	Estimates		Std Err	Variable	Estimates		Std Err
Constant	-0.255		1.088	Constant	-0.575		0.843
Hispanic	-0.061		0.081	Hispanic	-0.171	*	0.081
Race				**Race**			
white (base)	omitted			white (base)	omitted		
black	0.058		0.074	black	0.033		0.075
others	-0.157		0.099	others	0.069		0.096
Chronic_disease	-0.165	**	0.02	Chronic_disease	-0.193	**	0.021
age	-0.004		0.032	age	0.015		0.026
age^2	0.000		0.000	age^2	0.000		0.000
Type I HI	-0.266	**	0.075	Type I HI	-0.176	*	0.077
Type II HI	0.076		0.08	Type II HI	0.164	*	0.074
Education				**Education**			
Less HS (base)	omitted			Less HS (base)	omitted		
HS	0.228	**	0.061	HS	0.216	**	0.059
College & above	0.276	*	0.107	College & above	0.087		0.142
Wife's latent health	0.083		0.081	Husband's latent health	0.063		0.098
correlation coefficient	0.035						

Note: 1) Subsample size: 2817; 2) Double-starred items are statistically significant at the 5% level, and single-starred items are statistically significant at the 1% level. 3) Type I HI represents Medicare below age 64 and Medicaid, while Type II HI represents Medicare above age 64 and private insurance.