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Household Search and Health Insurance Coverage

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Abstract

Health insurance in the United States is typically acquired through an employer-sponsored program. Often an employee offerred employer-provided health insurance has the option to extend coverage to their spouse and dependents. We investigate the implications of the "publicness" of health insurance coverage for the labor market careers of spouses. The theoretical innovations in the paper are to extend the standard partial-partial equilibrium labor market search model to a multiple searcher setting with the inclusion of multi-attribute job offers, with some of the attributes treated as public goods within the household. The model is estimated using data from the Survey of Income and Program Participation (SIPP) using a Method of Simulated Moments (MSM) estimator. We demonstrate how previous estimates of the marginal willingness to pay (MWP) for health insurance based on cross-sectional linear regression estimators may be seriously biased due to the presence of dynamic selection effects and misspecification of the decision-making unit.

JEL Classification: D1, J33, J64
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1 Introduction

Health insurance in the United States is typically acquired through an employer-sponsored program. Even though health insurance can be purchased through private markets, the cost is considered prohibitive in comparison with the effective cost of purchasing health insurance though an employer. There are many possible reasons for this difference, such as tax subsidies to firms who offer such insurance to their employees, risk-pooling among a large group of relatively healthy individuals (i.e., individuals employed at a given firm), or sharing of a cost (health insurance) that improves the quality of the employment match to both sides of the contract (e.g., Dey and Flinn, 2005).

Another empirical regularity regarding health insurance purchase and coverage is that in households in which both husbands and wives work health insurance is often only purchased (through their employer) by one of the spouses. Apparently this reflects the fact that health insurance is largely a public (household) good in that most employers who offer health insurance to their employees also include the option to cover spouses and dependent children. In this research our goal is to investigate the implications of the "publicness" of health insurance coverage for the labor market careers of spouses and the cross-sectional distribution of wages and health coverage statuses of spouses. We use a relatively innovative household search framework to address this question.

A large empirical literature exists on the relationship between health insurance coverage and wage and employment outcomes, though most of it is formulated at the individual level; reasonably comprehensive surveys can be found in Gruber and Madrian (2001) and Currie and Madrian (1999). The research objective in these studies is almost invariably the estimation of a distribution of marginal willingness to pay (MWP) parameters characterizing the population, and the framework is that of compensating differentials. When a formal modeling framework is developed, it is a variant of a static labor supply model, with reference made to household rather than individual choice on rare occasions. This is a questionable choice given the great deal of concern in this literature with assessing the impact of employer-provided health care coverage on job mobility. Dey (2001) and Dey and Flinn (2005) take the position that to analyze mobility behavior requires a dynamic model with labor market frictions, which led them to employ a search framework with both unemployed and on-the-job search. Estimates from the equilibrium matching-bargaining model in Dey and Flinn (2005) led them to conclude that the productive inefficiencies resulting from the employer-provided health insurance system were not large.

The conclusions drawn from all of these empirical studies may be questioned due to their focus on individual rather than household behavior.[1] A few attempts have been made to look at the impact of the health insurance coverage of a spouse on the other's employment probability. For example, Wellington and Cobb-Clark (2000) estimate that having an employed husband with a job covered by health insurance reduces a wife's probability of employment by 20 percent. However, their econometric model does not allow for simultaneity in these decisions, labor market frictions, and does not condition on the husband's wage rate. To understand the distribution of health insurance and wages across spouses and households, it is necessary to formulate a more appropriate framework for the analysis.

To simplify the modeling and estimation problem, and to promote comparability with previous analyses, we adopt a very simple specification of household behavior. We assume the existence of a (instantaneous) household utility function in which consumption and health insurance coverage are additively separable. The subutility function associated with consumption is a quasiconcave function of (instantaneous) household income, and the instantaneous payoff if at least one of the spouses has employer-provided health insurance is ξ. Learning the parameter ξ, are something analagous to it, seems to be the goal of most empirical attempts to estimate the marginal willingness to pay (MWP) for health

[1] Outside of this particular application, the importance of looking at unemployment phenomena at the household rather than individual level was recognized early on by Humphrey (1939).

insurance coverage.

Two important contributions make clear the perils of attempting to infer tastes from cross-sectional relationships generated by dynamic choices among jobs offering different combinations of utility-yielding characteristics. Hwang et al. (1998) make the point using the equilibrium search framework of Burdett and Mortensen (1998), and Gronberg and Reed (1994) provide an empirical example by estimating a MWP parameter within a compensating differentials model using job duration data from the National Longitudinal Survey of Youth 1979. The point of both of these studies is to illustrate how the cross-sectional relationship between wages and job characteristics is determined by the primitive parameters characterizing the search equilibrium. The cross-sectional "trade off" between wages and health insurance coverage, for example, is an extremely complicated function of ξ and the parameters characterizing the labor market environments of the spouses. In general, the only way to consistently estimate ξ is to simultaneously estimate all model parameters, a path that we follow in this paper.

The contributions of this paper with respect to those mentioned in the previous paragraph are (1) the extension to a multiple agent setting in which job attributes have a public good aspect and (2) estimation of the behavioral model. We provide a lengthy discussion regarding the challenges of estimating a multiple agent model in continuous time given the discreteness of the data to which we have access. We use the method of simulated moments (MSM) in conjunction with data from the Survey of Income and Program Participation (SIPP) to estimate the model parameters. We find evidence that utility is a concave function of instantaneous income and that there is a positive valuation of health insurance coverage by the household. We show that this estimate is sensitive to the specification of the instantaneous utility function, as is to be expected. Our estimates of the preference parameter ξ vary widely depending on the moments included in the implementation of the MSM estimator. Under our preferred specification, which includes "cross moments," (which are functions of the labor market outcomes of both spouses and not only of one), we find a high estimated value of ξ, indicating the possibility of important welfare gains in the population if the health insurance coverage rate can be significantly increased.

In a section directed to policy makers, we discuss how our estimation results cast doubt on previous attempts to infer the MWP using linear regression approaches with cross-sectional data. Using our data and estimates, we demonstrate how the difference in mean earnings between those with and without employer-provided health insurance bear a complicated relationship to ξ and the other parameters describing the labor market environmnet. We also show that, even with a constant valuation of health insurance coverage in the population, cross-sectional estimates of the MWP will appear to be heterogeneous. In our framework, this phenomenon arises through the omission of relevant state variables (the labor market status of the spouse) that vary in the population in the steady state. These results point to the necessity of looking at the valuation of the health insurance coverage in the household context.

The plan of the paper is as follows. In Section 2 we develop the model of household search using a household utility function approach. Section 3 contains an analysis of the implications of the model under various specifications of the household utility function. Section 4 includes a discussion of the data source and presents some descriptive statistics. In Section 5 we develop the econometric model and discuss why cross-sectional, regression-based estimates of the MWP bear little relation to the true value of that function. Section 6 contains a discussion of the estimates of model parameters, and in Section 7 we indicate the manner in which our modeling approach and results may inform policy-makers in this field. A brief conclusion is provided in Section 8.

2 The Modeling Framework

In this section we develop our modeling framework and point out the innovations. Due to data limitations and for reasons of tractability, we assume that household preferences can be represented by a utility function with reasonably standard properties. In particular, we assume that the utility flow to the household is given by

$$U(I, d; Z, \gamma, \xi) = g(I; Z, \gamma) + \xi d,$$

where Z is a vector of household characteristics, assumed to be time invariant, I is instantaneous income of the household, d is an indicator variable that assumes the value 1 when *anyone* in the household purchases health insurance through their employer, g is a differentiable, concave function of I, γ is an unknown parameter vector, and ξ is a nonnegative scalar.[2] We assume that all household consumption is public in the sense that

$$I = w_1 + w_2 + Y_1 + Y_2,$$

where w_i is the instantaneous wage rate of spouse i and Y_i is the instantaneous receipt of nonlabor income of spouse i. As in most search-theoretic models, we ignore the capital market and assume that all income is consumed the same moment it is received.[3]

The labor market is structured as follows. When not employed spouse i receives offers of employment at a rate λ_i^N and while employed they receive offers at rate λ_i^E. When employed, spouse i is subject to "involuntary" dismissals at a rate η_i. Job opportunities are characterized by the pair (w, h), where w is the wage offer and h is an indicator variable that assumes the value 1 when the job offers health insurance. We do not assume that spouses draw from the same distributions; we denote the job offer distribution faced by spouse i as $F_i(w, h)$. Spouse i receives independently and identically distributed (i.i.d.) draws from F_i, and the wage draws of the two spouses are independently distributed conditional on observable and/or unobservable spouse-specific characteristics.

We denote the vector-valued state variable characterizing the household's decision problem by S, which includes $(w_1, h_1, w_2, h_2)'$;[4] the steady state value associated with the state vector S is given by $V(S)$. When spouse i is employed $w_i > 0$ and when not employed $w_i = 0$. While it is possible to write down one generic value function summarizing the problem for all possible values of S, doing so obscures some of the more interesting implications of the model regarding the relationship between the labor market decisions of the spouses. Thus we prefer to outline the features of each of the three qualitatively distinct decision problems faced by the household, corresponding to the cases in which zero, one, or two members are currently employed.

We begin with the more straightforward situation in which neither member is currently working. Consider a small decision period of length ε, during which at most one event can occur to the household (which in this case means that at most one of the unemployed spouses can receive a job offer). The

[2] All of the analysis is unaltered if we allow ξ to vary in the population of households, perhaps with its distribution depending on Z. Since we treat ξ as constant in the population in the empirical work conducted below, we forego this minor generalization here.

[3] This is in contrast to the model developed in Garcia-Perez and Rendon (2004). In their model of household search, which is set in discrete time, households are allowed to make savings decisions, though they are not allowed to borrow against future uncertain income.

[4] For ease of notation we omit the time invariant household characteristics Y and Z from the list of state variables.

value of the household's problem in this case is

$$\begin{aligned} V(0,0,0,0) &= (1+\rho\varepsilon)^{-1}\{g(Y)\varepsilon + \lambda_1^N\varepsilon \int \max[V(\tilde{w}_1,\tilde{h}_1,0,0), V(0,0,0,0)]dF_1(\tilde{w}_1,\tilde{h}_1) \\ &\quad +\lambda_2^N\varepsilon \int \max[V(0,0,\tilde{w}_2,\tilde{h}_2), V(0,0,0,0)]dF_2(\tilde{w}_2,\tilde{h}_2) \\ &\quad +(1-\lambda_1^N\varepsilon-\lambda_2^N\varepsilon)V(0,0,0,0)+o(\varepsilon)\}. \end{aligned}$$

where for simplicity we have omitted the arguments Z and γ from the function g and where $o(\varepsilon)$ is a function with the property that $\lim_{\varepsilon\to 0} o(\varepsilon)/\varepsilon = 0$. Because $g(I)$ is a monotone increasing function of I, w_1 and w_2 are perfect substitutes in consumption, and $d = \max(h_1, h_2)$ in the case we consider here, it is straightforward to show that the decision rule has a critical value property. That is, there exists a function $w_i^*(h_i)$ that gives the minimal acceptable wage offer to spouse i given that the job has health insurance coverage state h_i and given that both spouses are currently unemployed. Using this result, rearranging terms, and taking the limit of the function as $\varepsilon \to 0$ we can write

$$\begin{aligned} \rho V(0,0,0,0) &= g(Y) + \lambda_1^N \sum_{\tilde{h}=0}^{1} \int_{w_1^*(\tilde{h})} [V(\tilde{w},\tilde{h},0,0) - V(0,0,0,0)]dF_{w_1|h_1}(\tilde{w}|\tilde{h})p_1(\tilde{h}) \\ &\quad \lambda_2^N \sum_{\tilde{h}=0}^{1} \int_{w_2^*(\tilde{h})} [V(0,0,\tilde{w},\tilde{h}) - V(0,0,0,0)]dF_{w_2|h_2}(\tilde{w}|\tilde{h})p_2(\tilde{h}), \end{aligned}$$

where $F_{w_i|h_i}$ is the conditional distribution of wage offers given health insurance status for spouse i and p_i is the marginal distribution of health insurance statuses of job offers to spouse i. Our only comment concerning this particular value function is that it indicates that the job acceptance decisions of unemployed spouse i are a function of whether or not health insurance is offered. Moreover, the reservation wage rates for spouse i depend not only on the characteristics of spouse i's labor market environment but also on the labor market environment faced by the other spouse (who is also unemployed in this case). We also note that because we are assuming that g is concave, the critical values of each spouse depend on the level of nonlabor income. This would not be the case in the standard search framework in which g is assumed to be linear.

Next consider the situation in which one spouse is currently employed; let us assume that it is individual 1, at a job characterized by (w_1, h_1). Performing similar operations to what we did above, we can write the steady state value of this case as

$$\begin{aligned} &(\rho+\eta_1)V(w_1,h_1,0,0) = g(Y+w_1) + \xi h_1 \\ &+\lambda_1^E \sum_{\tilde{h}=0}^{1} \int_{\hat{w}_1(\tilde{h};w_1,h_1,0,0)} [V(\tilde{w},\tilde{h},0,0) - V(w_1,h_1,0,0)]dF_{w_1|h_1}(\tilde{w}|\tilde{h})p_1(\tilde{h}) \\ &+\lambda_2^N \sum_{\tilde{h}=0}^{1} \int_{\hat{w}_2(\tilde{h};w_1,h_1,0,0)} [\max[V(w_1,h_1,\tilde{w},\tilde{h}), V(0,0,\tilde{w},\tilde{h})] - V(w_1,h_1,0,0)]dF_{w_2|h_2}(\tilde{w}|\tilde{h})p_2(\tilde{h}) \\ &+\eta_1 V(0,0,0,0). \end{aligned}$$

The functions $\hat{w}_i(\tilde{h}; w_1, h_1, w_2, h_2)$ $i = 1, 2$, denote the critical value for job acceptance regarding a wage offer to spouse i associated with a health insurance status $\tilde{h}$ given a current job status of (w_1, h_1) for spouse 1 and (w_2, h_2) for spouse 2. (Thus $w_i^*(\tilde{h}) \equiv \hat{w}_i(\tilde{h}; 0, 0, 0, 0)$.) We note the following important points concerning this value function and the decision rules associated with it.

1. In this case, when spouse 1 is employed, the receipt of an offer by spouse 2 can result in three outcomes. Firstly, the offer can be rejected and the status quo maintained. Secondly, the offer can be accepted and spouse 1 can remain employed at his job, resulting in an outcome with value $V(w_1, h_1, \tilde{w}, \tilde{h})$. Thirdly, the offer could be accepted and spouse 1 could "quit" into unemployment, resulting in a value of $V(0, 0, \tilde{w}, \tilde{h})$. When a job offer is accepted by spouse 2, which of the last two possibilities occurs is determined by comparing the values associated with each of them. For example, a quit into unemployment by spouse 1 will be relatively more likely when he is working at a low wage job without health insurance. To get any quits into unemployment, it must be the case that the rate of arrival of offers in that state be less than it is when employed. The estimates of primitive parameters we obtain confirm that $\lambda_i^N \gg \lambda_i^E,\ i = 1, 2$.

2. The critical values for spouse 1 have the following properties. When the health insurance status of the current job and the potential job are the same, then the critical wage rate is simply the current wage (since there are no mobility costs), or $\hat{w}_1(h_1; w_1, h_1, 0, 0) = w_1$ for $h_1 = 0, 1$. When the current job offers health insurance and the potential job doesn't, then $\hat{w}_1(0; w_1, 1, 0, 0) \geq w_1$, where the nonnegative "wedge" between the wages is a form of "dynamic" compensating differential. Conversely, we have $\hat{w}_1(1; w_1, 0, 0, 0) \leq w_1$ due to the value of gaining health insurance for household welfare.

3. Perhaps the most interesting feature of this case is the form of the unemployed spouse's decision rule. Say that the employed spouse's job offers health insurance so that his employment is characterized by $(w_1, 1)$. Even though the family has insurance coverage at this moment in time, it is not the case that the critical wage value for the unemployed spouse is independent of the health status of a job offered to her. In particular,

$$\hat{w}_2(1; w_1, 1, 0, 0) \neq \hat{w}_2(0; w_1, 1, 0, 0).$$

   These values are not the same, in general, because having access to a job with health insurance has an "option value" even when the other spouse's current job also offers health insurance. This is due to the fact that the spouse may lose his job, either involuntarily (at rate η_1) or may have the opportunity to move to a high-paying job that does not offer health insurance. The only situation in which the inequality above will be an equality is when $\eta_1 = 0$ and $\lambda_1^E = 0$; in this case the first spouse will keep his current job forever and the family will have perpetual health insurance coverage. When this is not the case, we will have

$$\hat{w}_2(0; w_1, h_1, 0, 0) > \hat{w}_2(1; w_1, h_1, 0, 0),\ h_1 = 0, 1.$$

   This is an important result since a number of empirical studies attempt to impute the implicit price of health insurance in terms of foregone wages by looking at average wage rates of spouses (possibly conditional on other covariates as well) given the health insurance status of their spouse (see, e.g., Olson (2001)). Even though the value of health insurance is less to a woman who has an employed husband paid w_1 when he has a job covered by health insurance than when he doesn't, she is still willing to pay for health insurance with a reduced wage rate. Thus the difference in average wages of these two groups of women does not represent a pure valuation of health insurance to the family. Furthermore, the average wage earned by a woman as a function of the current health insurance status of her husband depends on when she took her job (e.g., before the husband had accepted a job with health insurance, at a point when both held jobs in the past, at a point when her husband was unemployed, etc.). Thus labor market dynamics must be accounted for in assessing the valuation of health insurance to the household and its impact on labor market outcomes.

The last case to consider is when both spouses are currently employed. The steady state value of this case can be written as

$$(\rho+\eta_1+\eta_2)V(w_1,h_1,w_2,h_2) = g(w_1+w_2+Y)+\xi\max[h_1,h_2]$$
$$+\lambda_1^E\sum_{\tilde h=0}^{1}\int_{\hat w_1(\tilde h;w_1,h_1,w_2,h_2)}[\max[V(\tilde w,\tilde h,0,0),V(\tilde w,\tilde h,w_2,h_2)]-V(w_1,h_1,w_2,h_2)]dF_{w_1|h_1}(\tilde w|\tilde h)p_1(\tilde h)$$
$$+\lambda_2^E\sum_{\tilde h=0}^{1}\int_{\hat w_2(\tilde h;w_1,h_1,w_2,h_2)}[\max[V(0,0,\tilde w,\tilde h),V(w_1,h_1,\tilde w,\tilde h)]-V(w_1,h_1,w_2,h_2)]dF_{w_2|h_2}(\tilde w|\tilde h)p_2(\tilde h)$$
$$+\eta_1 V(0,0,w_2,h_2)+\eta_2 V(w_1,h_1,0,0).$$

Given the assumptions we have made regarding the household utility function, it is not difficult to establish the existence of these critical value functions and the following properties of these functions and $V(w_1,h_1,w_2,h_2)$.

1. If the health insurance status of a job offered to spouse i is the same as that of their current job then the critical wage is equal to the current wage, or
$$\hat w_1(\tilde h;w_1,\tilde h,w_2,h_2)=w_1,\ \tilde h=0,1.$$
2. Even when the other spouse is employed at a job with health insurance, the individual is willing to pay a "premium" for a job that includes health insurance. For example, say that spouse 2 is working at a job with health insurance and spouse 1 is not. Then
$$\hat w_1(1,w_1,0,w_2,1)<w_1,$$
and if both spouses currently have jobs that provide health insurance spouse 1 will have to be "compensated" for accepting a new job that does not include it,
$$\hat w_1(0,w_1,1,w_2,1)>w_1.$$
3. Isomorphic to these properties of the critical value function is the ordering of the value functions:
$$V(w_1,1,w_2,1)>\max[V(w_1,1,w_2,0),V(w_1,0,w_2,1)]>V(w_1,0,w_2,0).$$[5]

3 Analysis of the Model

Our modeling framework is of interest not only for the analysis of health insurance and labor market transition issues, but also can be thought of as a critique of single agent models of labor market mobility. Our claim is that previous single-agent models of labor market decisions will be misleading representations of the mobility process unless certain conditions hold. One of the goals of the empirical work reported below is to assess how misleading the single-agent models are likely to be, at least within this particular application.

Our instantaneous household utility function has the form
$$U(I,d;Z,\gamma,\xi)=g(I;Z,\gamma)+\xi d.$$
We further specialize the market good utility yield function to be
$$g(I;Z,\gamma)=g(\gamma(Z)I),$$
where γ is a function of observable household characteristics Z. We consider the following special cases.

[5] The strict inequalities hold as long as the possibility of mobility (voluntary or involuntary) is positive for both spouses.

3.1 No valuation of health insurance and linear g.

This is the standard partial-partial equilibrium model of search; the only novelty in this case is the fact that there are two agents involved in the problem. But now we have

$$\begin{aligned} U(I, d; Z, \gamma, 0) &= \gamma(Z)I \\ &= \gamma(Z)(w_1 + w_2 + Y). \end{aligned}$$

Since nonlabor income is received by the household in any state of the world, and the marginal utility of income is constant, we have

$$V(w_1, w_2, Y) = \tilde{V}(w_1, w_2) + \frac{Y}{\rho}.$$

Given the constant marginal utility of income, no decision of spouse i can depend on the wage of spouse i'. Given this separability, we can write

$$\tilde{V}(w_1, w_2) = \tilde{V}_1(w_1) + \tilde{V}_2(w_2).$$

The value functions are indexed by spouse number since the search environments for the two are not constrained to be equal, where the search environments are characterized by $(\lambda_i^N, \lambda_i^E, \eta_i, F_i)$. An individual is better off within a household strictly due to income pooling. As a single agent, the value of spouse $i's$ problem is

$$\tilde{V}_i(w_i) + \frac{Y_i}{\rho},$$

where Y_i is that spouse's nonlabor income. The surplus i gets from being a member of the household is

$$\tilde{V}_{i'}(w_{i'}) + \frac{Y_{i'}}{\rho}.$$

The others spouse's wage is simply another form of nonlabor income (albeit transitory in nature), and agent i's welfare is maximized by having the spouse act so as to maximize the expectation of the present value of their wage stream.

3.2 Valuation of health insurance and linear g

Health insurance is a very particular type of good. In our model, consumption within the household is considered to be a public good, and health insurance is thought of in this way as well. This makes it fundamentally different from other components of a compensation package, such as the characteristics of one's office, the personalities of one's colleagues, etc., that yield a payoff which is primarily accrued to the individual employee. This, plus the fact that health insurance is such an important component of compensation in dollar value, makes it and pension benefits the most important components of remuneration following wages and salary.

The instantaneous payoff function in the present case is given by

$$\gamma(Z)(w_1 + w_2 + Y) + \xi d.$$

At first glance it might seem that the arguments applied to the previous case applied here as well, i.e., that household would maximize welfare by having the spouses act in a totally "decentralized" manner. This would be true if the payoff function was given by

$$\gamma(Z)(w_1 + w_2 + Y) + \xi(h_1 + h_2).$$

In this case we would have

$$V(w_1, h_1, w_2, h_2, Y) = \tilde{V}_1(w_1, h_1) + \tilde{V}_2(w_2, h_2) + \frac{Y}{\rho}.$$

However, we have assumed that health insurance benefits are perfect substitutes, so that

$$d = \max(h_1, h_2).$$

In this case the decisions cannot be uncoupled in the sense that spouse $i's$ decision of whether to accept a job offer of (w_i, h_i) will depend on the health insurance status of the spouse, $h_{i'}$, as well as their own current wage and health insurance status. As was true in the first case considered (linear g, $\xi = 0$), labor market decisions will be independent of nonlabor income (Y) given the constant marginal utility of income.

3.3 No Valuation of Health Insurance and Concave g

We now consider the form of the decision rules when the household does not value health insurance and when the marginal utility of income is decreasing. Since the payoff function is not separable in the arguments (w_1, w_2, Y), the value function can not be expressed as a sum of individual value functions either.

For spouse i currently employed at a job paying a wage of w_i, any offer greater than $w_i^*(w_i, w_{i'}, Y)$ will be accepted, where

$$w_i^*(w_i, w_{i'}, Y) = \begin{cases} w_i & \text{if} \quad w_i > 0 \\ w_i^*(0, w_{i'}, Y) & \text{if} \quad w_i = 0. \end{cases}$$

In other words, for a currently unemployed individual, the value of their spouse's current wage $(w_{i'})$ and nonlabor income Y are both arguments of the critical value function. The impact of Y and $w_{i'}$ on w_i^* is impossible to unambiguously sign, which may seem somewhat surprising at first (at least it was to the authors).

The reason for the ambiguity is that the both costs and benefits of search are altered by what is essentially nonlabor income in the job acceptance decision of spouse i. First consider household nonlabor income, Y. Given strict concavity in g, increases in Y decrease the marginal utility of any given wage offer to spouse i, w_i. Since the wage offer distribution to the spouse is fixed, this makes the expected gain from search decrease in Y. If the costs of search were fixed, we would expect the reservation wage to be a decreasing function of Y. However, the costs of search are not fixed. Instead, the flow value of search is given by $g(w_{i'} + Y)$, which is increasing in Y. Thus the cost of continued search is decreasing in Y. The net impact of the reduced expected value of search (in Y) and the reduced cost (in Y) leads to the ambiguity. The actual impact on w_i^* in general will depend on $w_{i'}$, g, and all parameters characterizing the labor market environments of both spouses.

Analysis with respect to changes in $w_{i'}$ is similar, apart from the fact that, in general, $w_{i'}$ is transitory and Y is permanent. A high value of $w_{i'}$ decreases the expected value of search by spouse i, while at the same time decreasing the cost of search. Now if the labor market environment of spouse i' was such that they would keep this wage forever, Y and $w_{i'}$ would have identical impacts on the w_i^*. However, the transitory nature of the spouse's wage requires that they be treated as separate arguments in the reservation wage function of i.[6]

[6] Consider the extreme example where the exogenous dissolution rate of spouse i' jobs grows indefinitely large. The instantaneous cost of search is then decreasing in their wage $w_{i'}$, though the impact of their wage on the expected value of continued search is 0 due to the fact that the probability that the job will end in the next small interval of time approaches unity. In this extreme case, the reservation wage will be an increasing function of $w_{i'}$.

3.4 Valuation of Health Insurance and Concave g

This is the most general case we consider, and is the focus of our empirical analysis. By extension of the previous arguments, particularly those related to the cases of linear g with positive ξ and concave g with $\xi = 0$, the critical value for job change is given by

$$\hat{w}_i(\tilde{h}; w_1, h_1, w_2, h_2, Y),$$

as defined previously (where we had omitted the argument Y since it is time invariant). In general, all arguments appear individually in the function and are necessary to characterize the turnover decision (where by turnover we also implicitly include the change from the unemployment to the employment state). In other words, the vector (w_1, h_1, w_2, h_2, Y) is a *minimal sufficient statistic* for the job acceptance decisions of household members.

3.5 Discussion

The differences in the properties of the objective functions in the four cases we have considered produce critical value functions that differ in terms of their arguments, as well as qualitative differences in household labor market histories. We present a summary of some of these differences in the following table.

Objective Function	**Arguments of w_i^***	**Simultaneous Change**	**Lower Wage**
$\alpha + \beta I$	w_i	*No*	*No*
$\alpha + \beta I + \xi d$	$w_i, \tilde{h}, h_1, h_2$	*Yes*	*Yes*
$g(I; Z, \gamma)$, g concave	$w_i, w_{i'}, Y$	*Yes*	*No*
$g(I; Z, \gamma) + \xi d$, g concave	$w_i, w_{i'}, \tilde{h}, h_1, h_2, Y$	*Yes*	*Yes*

The last two columns are interpreted as follows. Whether the model implies that the labor market states of the spouses could change at the same moment in time is indicated under "Simultaneous Change." In the first case, each spouse solves their own individual search problem with no reference to the other agent's state. Since time is continuous, the likelihood that they would be subject to independent shocks resulting in labor market state changes at the same moment in time is zero. Thus the "no" entry. All other models carry the likelihood of simultaneous state change. For example, the third model can generate simultaneous state change if the unemployed spouse of a worker being paid w_i receives a wage offer $w_{i'}$, when w_i is sufficiently low and $w_{i'}$ is sufficiently high. In this case, the unemployed spouse may accept the job offerring $w_{i'}$ and the employed spouse may quit the job paying w_i.

The last column, labelled "Lower Wage," refers to whether the same spouse could be observed directly transiting from a job paying a higher wage to one paying a lower wage. This is possible in our model only when there is a positive valuation of health insurance. In this case, a lower wage may be accepted when moving from a job not providing health insurance to one offerring it.

By varying the assumptions regarding the objective function of the household, we will be able to trace out their impact on observed labor market behavior. We will be particularly interested in seeing how the standard assumption made in the literature of linear g and $\xi = 0$ compares against the others, all of which involve some jointness in the labor market decisions of the spouses.

The jointness of household decision-making is best illustrated through examining the reservation value functions, which we now do graphically. In this set of examples and the empirical work that follows we restrict the form of g. In particular, we assume that g has the Constant Relative Risk

Aversion form, or

$$g(I; Z, \gamma, \delta) = \frac{(\gamma(z)I)^{\delta}}{\delta},$$

where $\gamma(Z) > 0$, $\forall Z$ and $\delta \in [0, 1]$. As is well-known, in this case

$$\begin{aligned} \lim_{\delta \to 1} g(I; Z, \gamma, \delta) &= \gamma(Z)I \\ \lim_{\delta \to 0} g(I; Z, \gamma, \delta) &= \ln \gamma(Z) + \ln(I). \end{aligned}$$

This functional form allows us to nest the standard expected wealth maximization model as a special case.

In Figures 1.a-1.d we plot the reservation wage function for the wife when she is unemployed as a function of her employed husband's wage, an indicator variable for whether his job provides health insurance, and an indicator variable for whether her offered job provides health insurance. The four figures correspond to the four cases considered above. In plotting these functions we have used model estimates wherever possible.[7]

Figure 1.a contains the graph of the wife's (conditional) reservation wage function for the simplest case examined, the one with a constant instantaneous marginal utility from wages and no valuation of health insurance. The independence of the wife's decision rule from the husband's wage is reflected in the constant reservation wage function. This is the reservation wage she would set in a single agent model facing the labor market environment she faces. There is no dependence of this function on the health insurance status of her offer or her husband's job since the household does not value this job attribute in this case.

In Figure 1.b things get more interesting. The household is still assumed not to value employer-provided health insurance, but the (instantaneous) marginal utility of wages is decreasing in household income. As a result, there is one conditional reservation wage function for the unemployed wife, but it is no longer constant. Beginning at the reservation wage for an unemployed husband with an unemployed wife (since this is the lowest wage he would ever accept), we see a rapid increase in the function until when the husband's wage is approximately 10. After reaching that point, the function is still increasing, but at a slower, approximately constant, rate.

The reason for the differences in the properties of the function over these two intervals is the husband's response to the wife's accepting employment at the reservation value. At low wages, the husband quits his job and begins a spell of unemployed search. At higher wages, when the wife accepts the reservation value the husband continues employment in his relatively high paying job. Consider the case in which the husband is employed at the lowest acceptable wage, which is approximately 5.20. The wife's reservation wage at this point is approximately 3.80. If she receives a wage offer slightly greater than this value, the household will continue with one employed member, after substituting the wife for the husband. The utility level in the household changes markedly in this case, from $(5.20)^{.53}/.53$ to $(3.80)^{.53}/.53$, but the household is willing to make the tradeoff because the search environment of the husband dominates that of the wife on virtually every dimension. In the extreme case in which they both faced identical search environments, on this part of the function the reservation wage of the wife would be identical to the current wage of the husband, since neither would have any comparative advantage in search. In such an instance, the household will choose to have the spouse with the highest

[7] To date we have only estimated the most general version of the model, the one with an unrestricted δ and a positive ξ. Thus for the general case (Figure 1.d), the graph corresponds to the decision rules generated by the model estimates. For the other cases, they do not. For example, in Figure 1.b we present the decision rules for the case of linear g but a positive valuation of health insurance. Since we do not estimate this restricted version of the model, only the qualitative features of these graphs can legitimately be compared.

wage offer accept employment. The divergence of the reservation wage path from the 45 degree line on this segment of the function is an indicator of the asymmetry of the labor market environments of the spouses.

The final two figures examine the cases in which the household values employer-provided health insurance. As a result, there are four separate reservation wage functions in each figure, one for each combination of h_1 (the health insurance status of the husband's job) and $\tilde{h}$ (the health insurance status of the job offered to the wife). Figure 1.c plots these four functions for the case of a constant marginal utility of consumption. The only reason for the dependence of her decision rules on his job is through the public good aspect of employer-provided health insurance.

First consider the cases in which the husband's current job does not provide health insurance, $(0, 0)$ and $(0, 1)$. The value of a job offer to the wife that provides health insurance is quite high in this case, which is reflected in the difference in the reservation wage functions. The other two conditional reservation wage functions correspond to the case in which the husband's job provides health insurance. Comparing these two functions reveals an interesting difference. Though having a job with health insurance provides no gain in household welfare at the moment it is accepted (since the household is already covered by the husband's policy), the wife is willing to accept a lower wage for such a job than for one that doesn't offer her health insurance. The reason is the "option value" associated with having both spouses covered by health insurance; if the husband should lose his job or quit into one without health insurance (the likelihood of which depends on whether the wife's job is covered by health insurance), the household will still have coverage. This option value only exists with forward-looking household members.

Figure 1.d plots the four conditional reservation wage functions for the most general case. The qualitative properties of these functions have been discussed in presenting the other cases, so we won't belabor these issues any further. These reservation wage functions, based on estimated model parameters, are used to form estimated Marginal Willingness to Pay functions, which are developed and extensively discussed in Sections 5 through 7.

4 Data and Descriptive Statistics

Data from the 1996 panel of the Survey of Income and Program Participation (SIPP) are used to estimate the model. The SIPP interviews households every four months for up to twelve times, so that at a maximum a household will have been interviewed relatively frequently over a four year period. The SIPP collects detailed monthly information regarding individual household members' demographic characteristics and labor force activity, including earnings, number of weeks worked, average hours worked, as well as a complete history of mobility decisions (i.e., transitions from unemployment to employment, transitions from employment to unemployment, and job-to-job changes) over the interview period. In addition, at each interview date the SIPP gathers data on a variety of health insurance variables including whether an individual's private health insurance is employer-provided and covers other household or non-household members.

The main advantage of using SIPP data is the richness of the data across individuals in the household and the relative ease of creating these links. This allows a detailed investigation of the relationship between spouse's labor market decisions that no other dataset allows. The main disadvantage of using the SIPP when investigating the effects of health insurance at the household level involves the inability to distinguish between the lack of coverage and the decision not to takeup coverage. For example, if the husband receives health insurance coverage through his employer that also covers his wife, we will not necessarily observe whether she has the option of purchasing health insurance through her employer.[8]

[8] While this is the case for the majority of waves (four month data collection intervals) in the SIPP, there are periodic

The sample used in the empirical work that follows is selected from original sample households that contain only one family and a married couple. Since we are using transition information in our empirical work, we select only those households (or families) that remain intact from the original interview to the eighth interview. We then select households in which both spouses meet certain standard requirements at each point over the interview period. In particular, both spouses are aged between 20 and 54, not enrolled in school, not in the Armed Forces, not self-employed, not retired, not disabled, not a contingent worker, and not receiving welfare benefits. In addition, we selected households that did not have children less than six years old since a large fraction of women with young children are not actively seeking employment. The application of these selection conditions limits our sample to 1,267 married couples.

The dataset we constructed consists of two observations of the household members separated by one year. The first set of outcomes can be viewed as cross-sectional data on the labor market characteristics of the two spouses in our sample households. For both spouses, we determine the employment status (i.e, employed or not employed), and if employed, the hourly wage and whether they were covered by their own employer-provided health insurance coverage in the final month of the second fourth month interview period or wave. We then construct the same set of labor market outcomes for all the spouses in our sample one year later. That is, we determine the employment status, hourly wage, and provision of health insurance coverage in the final month of the fifth wave. In addition, we determine whether the sample members switched employers over this one-year period. From these two observations, that are separated by one year, we can compute transition probabilities and patterns of wage changes.

Table 1 contains some descriptive statistics from the sample of households used in our empirical analysis. As discussed above, these statistics represent the cross-sectional moments pertaining to April 1997 through June 1997 depending on when the household was first interviewed. While we use the transition and wage change information in the empirical work that follows, the cross-sectional moments are certainly of first-order importance and due to the relatively high precision of these moments provide the majority of the information employed in our estimation strategy. As we discuss in detail below, while the behavioral model sets out the relationship between the employment decisions of both husbands and wives, the parameters of the model can be estimated using data from the spouses separately. Therefore, Table 1 shows key labor market outcomes of husbands and wives in our sample both conditionally and unconditionally on the labor market status of their respective spouses. We should note that the health insurance coverage rate is the percent of *employed* husbands or wives who are covered by insurance provided by their *own* employers.

To begin, consider the unconditional labor market outcomes of each spouse. There are three features of the data that deserve further attention. First, a very small fraction of husbands are unemployed while nearly 20 percent of wives are unemployed.[9] Second, husbands are much more likely than wives to be covered by health insurance when employed, 80 percent to slightly over 50 percent. Third, for both husbands and wives, the wages in insured jobs are significantly higher than the wages associated with uninsured jobs. This apparent rejection of "compensating differentials" was addressed by Dey and Flinn (2005) using an equilibrium bargaining framework. The "partial-partial" equilibrium model considered here will also be able to generate such a result, even when the exogenously determined wage offer

(twice over the four year duration of the survey) topical modules that would, in principle, allow us to more fully characterize the status of employer-provided health insurance for both spouses. In the core data, when an employed wife reports that she has health insurance through her husband's employer, we simply do not know whether health insurance is not available through her employer or she chooses not to purchase coverage that is available. Using the data from the topical module, we would be able to determine the wive's insurance status and takeup decision.

[9] We use unemployment synonymously with nonemployment. Undoubtedly, some of these women are not actively seeking employment, but since we do not have good information regarding search intensity, we aggregate them all into the same labor market state.

distributions conditional on health insurance status have a compensating differential like property.[10]

Next, consider the conditional labor market outcomes of each spouse. These moments highlight the joint nature of the decision-making process and how the outcomes of the two spouses are intimately linked. First, a wife whose husband is covered by employer-provided health insurance coverage is almost three times more likely to be unemployed than a wife whose husband is employed without health insurance. The same relationship holds for husbands although the level of unemployment is obviously much lower in this case. Second, a wife whose husband is not covered by employer-provided health insurance is more than twice as likely to have health insurance coverage on her job than an employed wife whose husband is employed with insurance coverage. Again, the same relationship holds for husbands although they are only about 50 percent more likely to have employer-provided health insurance coverage when their wives are not covered. This result also suggests that in a relatively large number (about 32%) of households both spouses have employer-provided health insurance coverage. Third, the mean wages of wives employed in insured jobs whose husbands also have employer-provided coverage are significantly lower than the mean wages of wives employed in insured jobs whose husbands do not have employer-provided coverage. This result is somewhat at odds with the previous discussion of reservation wages and the results presented in Figure 1.d. above. In this case, the reservation wage of an unemployed wife who receives an offer that includes health insurance is higher when her husband has employer-provided health insurance (the $(1,1)$ line in the figure) compared to when he does not (the $(0,1)$ line in the figure). Based solely on reservation wages, this would suggest the opposite relationship between the conditional mean wages. This suggests that the cross-sectional distribution of employment states of the household members is a complicated function of the labor market environments facing both household members and it is impossible to recover reservation wages (and hence marginal willingness to pay) from cross-sectional data. Finally, the mean wages of wives employed in uninsured jobs whose husbands have employer-provided health insurance coverage are significantly higher than the mean wages of wives employed in uninsured jobs whose husbands do not have employer-provided insurance coverage. This result is again difficult to interpret given the dynamic and joint nature of the employment decisions made by the household members.

5 Econometric Issues

The model is parsimoniously characterized in terms of the parameter vector

$$\theta = (\lambda_1^N, \lambda_2^N, \lambda_1^E, \lambda_2^E, \eta_1, \eta_2, F_{w_1|h_1}, F_{w_2|h_2}, p_1, p_2, \gamma, \rho, \xi)',$$

where all the parameters have been previously defined. In this section we discuss issues connected with the estimation of this household model.

In previous research (Dey and Flinn, 2005), we estimated a single-agent equilibrium version of this model using a simulated maximum likelihood estimator. It is difficult to follow the same strategy in the two-agent case when using a continuous-time framework. As noted when describing the behavioral model, certain shocks will lead to simultaneous changes in the labor market status of both members of the household. For example, a wife at a low wage job (with or without health insurance) whose unemployed husband receives a sufficiently high wage offer (with health insurance, say), will quit her job at the same instant the husband accepts the offer. While the continuous time framework is a fiction, of course, there is no nonarbitrary way to "fix" this problem.[11]

[10] An example of this would be when the wage offer distribution for jobs not offering health insurance (first order) stochastically dominates the wage offer distribution of jobs that include health insurance. Even in such a case, dynamic selection on attributes can produce the "good job - bad job" phenomenon in the cross-section.

[11] For example, one might assume that any time spouses changed states with a period of length Δ, that the moves were

There are several alternatives one can pursue in this situation. One obvious choice is to abandon the continuous time framework altogether in favor of a discrete time setting. This approach is not without its pitfalls, however, there being at least two serious problems. The first is the arbitrariness of the choice of decision unit. Given the characteristics of the SIPP data, the most obvious choice would be a monthly unit of analysis. Changes in labor market state of both spouses could then be considered simultaneous, apparently making the filtered data more coherent with the theoretical model. But once a time period is chosen, we have no model of multiple changes of state within a decision period. While two or more changes in labor market status of an individual within a given month may be rare, an even more serious time aggregation problem exists. That problem is the arbitrariness of the boundaries of the decision period. Say that we choose the first day of a calendar month as the beginning of a decision period and the last day of that month as the end of that period. Then if the wife accepts a new job on February 21 and the husband quits his job on February 28, those two changes in state would be considered simultaneous. However, if she accepted her new job on February 28 and he quits on March 1, those would be considered two independent events under this definition of decision periods. The general point is that any time aggregation scheme adopted is arbitrary, with impacts on estimates and inferences that are difficult to assess.

The other argument against "time aggregation" of the type required to map a continuous time process into a discrete time one is the impact on equilibrium outcomes. In a continuous time point process type model at most one event occurs at any given moment in time, and both agents respond to this same event. This allows us to avoid the multiple equilibria-type problems we encounter in the context of simultaneous move games. In a discrete time model, both agents may receive offers in a period (an event that has positive probability, in general). In our household utility case, in which we can think of there being one decision maker, there is no problem in defining a single optimal choice, in general. However, as we extend the model to look at household behavior when the spouses have distinct preference maps, we can easily produce examples of multiple equilibria in the simultaneous move context.[12]

We have chosen to estimate the model off of moments of the stationary distribution of labor market outcomes and the steady state transition function. By not using the "fine detail" of the individual event histories, we do not have to directly confront the lack of simultaneity issue that is apparent only in the individual level event history data.

The algorithm used in obtaining the estimates is as follows. Consider some particular sample path of one simulated history. A simulated history is a mapping from some fixed (over iterations) draws using a pseudo-random number generator and a value of the parameter vector θ_k into an event history for a household. We denote the r^{th} vector of pseudo-random draws by ψ_r, where the dimension of ψ_r is $\tau \times 1$ and τ is large. Then the event history associated with the r^{th} replication when using parameter vector θ is

$$\Im_r(\theta) = J(\psi_r, \theta).$$

We then define outcomes as functions of the event history, and these outcomes ultimately are used to compute the simulated moments upon which the estimator is based. In particular, a *data mapping* is a function that maps characteristics of event history $\Im$ into point-sampled or transitional "data" x, and is given by $x = B(\Im)$. By plugging a number of independently generated event histories into B we create an artificial data set $\{x\}$. From this set of "observations" the simulated moments are calculated.

To give a concrete example, one of the moments used throughout is the proportion of married

simultaneous. In this case, estimated parameters will critically depend on the choice of Δ. Moreover, for large enough Δ we will observe changes of state of the same individual, which by definition cannot be made coincidentally.

[12] For example, say two unemployed spouses receive offers of x and y, respectively. It is easy to find cases where two Nash equilibria exist in which the first accepts x and the second declines y or the first declines x and the second accepts y.

women who are employed in the steady state. To compute this moment we will need to measure whether a wife is employed at an arbitrarily selected point in the event history that is sufficiently far away from the initialization of the process. Without loss of generality, all simulated household histories begin at time 0 with both spouses unemployed. After fixing a value of the primitive parameters, θ_k, say, we generate events, such as offer arrivals or dismissals, and their impact on the state variable describing household labor market characteristics is determined by passing the events through the expected welfare maximizing decision rules. At a point $T \gg 0$, we look at the household's state, $(w_1(T), h_1(T), w_2(T), h_2(T))$. If the first element of x is the wife's labor market status at time T, then

$$x_1 = \begin{cases} 1 & \Leftrightarrow \quad w_2(T) > 0 \\ 0 & \Leftrightarrow \quad w_2(T) = 0 \end{cases} .$$

If we compute a total of R simulation histories evaluated at the parameter θ_k, then

$$E(x_1|\theta_k) = \operatorname*{plim}_{R\to\infty} R^{-1} \sum_{r=1}^{R} x_1(r),$$

where $x_1(r)$ is the value of x_1 in replication r.

In order to estimate the model we must attempt to match at least as many characteristics of the stationary distribution and transition function as there are primitive parameters. Let the dimension of θ be K. The moments and transition parameters generated from $\{x\}$ are a mapping given by Γ, or

$$\begin{aligned} Q(\theta_k) &= \Gamma(\{x(r;\theta_k)\}) \\ &= \Gamma(\{B(\Im_r(\theta_k))\}). \end{aligned}$$

Let the corresponding sample moments and transition parameters be given by q_S. Then we define the method of simulated moments estimator by

$$\hat{\theta}_{MSM} = \arg\min_{\theta}(Q(\theta) - q_s)'W(Q(\theta) - q_s),$$

where $\dim(Q(\theta)) = \dim(q_s) = L \geq K$, and W is a symmetric, positive definite weighting matrix that is $L \times L$.[13] Now the q_s are computed from a sample of size N. Given identification of the elements of θ, we have

$$\operatorname*{plim}_{N\to\infty, R\to\infty} \hat{\theta}_{MSM} = \theta.$$

Consistency requires that both the sample size and the number of simulation histories become indefinitely large due to the nonlinearity of the model. We believe that our sample size is large enough to satisfy the first requirement, and that the large number of simulated histories ($R = 10,000$) satisfies the second.

In computing standard errors we do not rely upon asymptotic approximations. Instead we compute bootstrap estimates of the standard errors by resampling the original dataset 25 times, reestimating the model, and then computing the standard deviation of the parameter estimates across the 25 samples. We maintain the same set of simulation draws across all resamples to speed convergence. Because we have not allowed variation in the simulation draws, the covariance matrix of our estimates is most likely

[13] The weighting matrix is derived directly from the data as follows. We estimate the variances of the sample moments used in MSM procedure by standard bootstrap techniques with 10,000 resamples of the data. We then define W as a diagonal matrix with diagonal elements that are the inverses of the bootstrap variances. This particular choice of the weighting matrix addresses two concerns. The first is to make the scale of the moments roughly the same. The second is to give more weight to sample moments that are more precisely estimated.

downward-biased, but since we have used such a large number of simulations we don't believe that this bias is substantial.

To be more precise about the nature of the moments we use in the empirical work, we begin with a discussion of the information used to estimate the single-agent specifications. In these specifications (one for husbands and one for wives), the moments fall into one of eight categories. Since we do not present the full list of moments in the results section below, we will do so here. The number in parentheses is the number of moments in the preceeding category. The categories include the steady-state employment probabilities (2), conditional (on health insurance status) mean and standard deviation of wages (4), transition probabilities out of unemployment (2), transition probabilities out of insured jobs (3), transition probabilities out of uninsured jobs (3), conditional (on health insurance status) mean and standard deviation of wages following a transition out of unemployment (4), conditional mean and standard deviation of initial and subsequent wages following a transition out of an insured job (10), and conditional mean and standard deviation of initial and subsequent wages following a transition out of an uninsured job (10). Therefore, in the single-agent specifications we are estimating 11 parameters with 38 moments. In the first joint specification, we do not use any cross or household moments so we are estimating 20 parameters with 76 moments. Finally, in the joint specification with cross moments we include eight additional moments, include four steady-state joint employment probabilities and the conditional (on health insurance status of employed spouses) covariance of wages. Hence, in the final specification we are estimating 20 parameters with 84 moments.

It is notoriously difficult to determine analytically whether a rather complicated nonlinear model such as this one is identified. From Flinn and Heckman (1982) we know that the c.d.f.s $F_{w_i|h_i}$, $i = 1, 2$, are not identified nonparametrically. We assume that they both are (conditional) lognormal distributions, which means that we must estimate 8 parameters (2 lognormal parameters for 2 spouses for 2 health insurance states). The marginal health insurance offer functions p_1 and p_2 are each characterized by 3 parameters. While estimation of ρ is in principle possible given some set of assumptions on g, we will not attempt to do so and will instead fix it using the prevailing interest rate. At present we assume that the population is homogeneous in the sense that all face the same set of primitive parameters describing the search environment. The households only differ in terms of the observed state variable Y, household nonlabor income.[14]

5.1 Estimation of the MWP for Health Insurance

Almost the entire empirical literature on the relationship between health insurance status and wages is based on cross-sectional analysis. Most papers use a linear regression approach in which a function of an individual's wage is regressed on whether or not the job provides health insurance coverage and a vector of conditioning variables designed to capture the value of the individual to his or her employer. A few analyses have proposed instrumental variable estimators to potentially deal with the lack of independence between the disturbance in such a regression and the health insurance status of the job. None of these approaches are likely to lead to credible estimates of the MWP, most obviously due to the fact that the regression framework is an inappropriate one to use with an inherently dynamic phenomenon.

Gronberg and Reed (1994) and Hwang et al. (1998) provide instructive examples and analysis of the problem of inferring the MWP using cross-sectional regression methods when the individuals make job acceptance decisions in a job search environment. We will discuss the problem in the context of our

[14]While this is true in principle, in practice we choose to fix the nonlabor income of the household at 0 for two reasons. First, if we allowed Y to vary across households, we would need to solve the model for each value of Y that we observed. This would significantly increase the computational time required to estimate the model. Second, the measures of nonlabor income are often of poor quality due to a very high non-response rate.

specific application (in which the nonpecuniary characteristic is binary) and where the offer distribution is taken as fixed. We will begin with the simpler case of individual search. Let an individual have a linear payoff function,

$$u(w,h)=w+\xi h, \tag{1}$$

and assume -=-0-that all labor market participants share a common value of ξ. In this setup, ξ measures the willingness to pay for health insurance, for an individual will be indifferent between any two jobs, with and without health insurance, such that

$$w+\xi=w',$$

where the first job (with wage w) is the one that includes health insurance. In our partial equilibrium search model, the searcher faces an exogenously-given (w,h) offer distribution, $F(w,h)$. But given (1), the payoff from a job (w,h) is given by the scalar random variable

$$\nu=w+\xi h.$$

Thus from the point of view of labor market decisions and the resulting labor market process, only the distribution of ν is relevant. The distribution of ν is given by M, and is a function of F and ξ. In particular, there exists a reservation value of ν, ν^* say, such that any job offer with an associated value of ν at least as great as ν^* will be accepted (by unemployed searchers) while any $\nu<\nu^*$ will be rejected. Then in this simple case (with binary h), we have

$$\nu^*=w^*(1)+\xi=w^*(0),$$

where $w^*(1)$ is the reservation wage associated with a jobs offering health insurance and $w^*(0)$ the reservation wage for a job without health insurance. In a model with homogeneous agents then and no measurement error in wages and health insurance status, the following consistent estimator of ξ is suggested by the analysis of Flinn and Heckman (1982). Define

$$\begin{aligned}\underline{w}(1) &= \min_{S_1}\{w_k\}_{k=1}^{N_1}\\ \underline{w}(0) &= \min_{S_0}\{w_k\}_{k=1}^{N_0},\end{aligned}$$

where S_1 is the set of wage offers associated with jobs offering health insurance that were accepted by unemployed individuals in the sample, N_1 is the cardinality of that set, and S_0 and N_0 are similarly defined for the accepted jobs not offering health insurance. Then Flinn and Heckman (1982) show that

$$\operatorname*{plim}_{N_j\to\infty}\underline{w}(j)=w^*(j),\ j=0,1,$$

so that

$$\hat{\xi}=\underline{w}(0)-\underline{w}(1)$$

is a consistent estimator of ξ.

Cross-sectional regression-type estimators, which amount to differences in means in our application with a single binary nonwage characteristic, are not generally expressible simply in terms of reservation wages. Instead, we will think of the cross-sectional relationship between mean wages in the two sub-populations of jobs defined by health insurance provision as generated by the steady state equilibrium distribution of jobs. It is well known that with OTJ search in a stationary environment, the steady state distribution of ν is given by

$$R(\nu)=\frac{M(\nu)}{1+\kappa\tilde{M}(\nu)},$$

where

$$\kappa = \frac{\lambda^E}{\eta}.$$

The relationship between the steady state density of ν and the offer distribution of ν is given by

$$r(\nu) = \frac{1+\kappa}{[1+\kappa\tilde{M}(\nu)]^2} m(\nu).$$

It is reasonably immediate to go from the density of $r(\nu)$ to the steady state wage distributions associated with the two health insurance states. Since all the matters in terms of welfare is ν, there is no difference between the proportion of jobs providing health insurance given ν in the steady state and the proportion providing health insurance at ν from the offer distribution. Thus the probability of health insurance given a value of ν is determined as follows. If a firm offers health insurance given ν, then the wage offer is $\nu - \xi$. If the firm does not offer health insurance given ν the wage offer is ν. The likelihood of health insurance and a wage offer of $\nu - \xi$ is given by $f(\nu - \xi, 1)$, while the likelihood of no health insurance and a wage offer of ν is $f(\nu, 0)$.Then the probability of receiving health insurance given ν is

$$p(h=1|\nu) = \frac{f(\nu-\xi,1)}{f(\nu-\xi,1)+f(\nu,0)}.$$

The marginal probability of health insurance in the steady state is

$$p(h=1) = \int p(h=1|\nu) r(\nu) d\nu.$$

Then the conditional steady state distribution of ν given h is

$$r(\nu|h) = \frac{p(h|\nu)r(\nu)}{p(h)}, \quad h=0,1.$$

The mean of the steady state distribution of wage offers given h is

$$E_{SS}(w|h) = \int (\nu - h\cdot\xi) r(v|h) d\nu. \tag{2}$$

Using (2) we can look at the issue of bias in estimates of the willingness to pay using differences in the mean wages. The difference in means in the steady state (taken to represent the cross-section) is

$$\begin{gathered} E_{SS}(w|h=0) - E_{SS}(w|h=1) \\ = \int \nu r(\nu|h=0) d\nu - \int \nu r(\nu|h=1) d\nu + \xi. \end{gathered}$$

Then the difference in cross-sectional mean wages is a consistent estimator of the willingness to pay if and only if

$$\int \nu r(\nu|h=0) d\nu = \int \nu r(\nu|h=1) d\nu.$$

There is nothing in the construction of the model that suggests this condition should be satisfied, though it is possible to construct examples in which it is. Given estimates of the primitive parameters of the model, we can compute this expression and determine how badly biased the cross-sectional estimator of the MWP would be. We conclude this section with an example to fix ideas.

Example 1 *Let $\xi = 1$. To keep things simple, suppose the wage-health insurance offer distribution is discrete and assumes four values (with equal probability) and let $\kappa = 2$. The characteristics of the distributions of interest appear below.*

(w,h)	ν	$M(\nu)$	$R(\nu)$	$p(h\|\nu)$	$R(\nu\|h=1)$	$R(\nu\|h=0)$
$(2,1)$	3	.25	.10	1	.286	0
$(4,0)$	4	.50	.25	0	.286	.231
$(4,1)$	5	.75	.50	1	1.00	.231
$(6,0)$	6	1.00	1.00	0	1.00	1.00

Among the population in the health insurance state, there are only two observable wages, 2 and 4, with $p_{SS}(w = 2|h = 1) = .286$ and $p_{SS}(w = 4|h = 1) = .714$, so that the mean wage is 3.428 among those with health insurance. In the population without health insurance we have $p_{SS}(w = 4|h = 0) = .231$ and $p_{SS}(w = 6|h = 0) = .769$. Then the mean wage in this group is 5.538. The difference in means in this example is

$$\begin{aligned} E_{SS}(w|h &= 0) - E_{SS}(w|h=1) \\ &= 2.11 \\ &> 1 = MWP. \end{aligned}$$

Thus this difference severely overestimates the individual's marginal valuation of health insurance provision.

The example serves to illustrate the point that there is little relationship between the cross-sectional differences in means and the MWP defined in terms of the utility function. By altering the offer distribution probabilities (*i.e.*, M), we could get the steady state differences to equal MWP, or be less than it, etc. The fundamental indeterminacy we are illustrating is *not* due to the fact that we are not utilizing an equilibrium search framework (in which the offer distribution is endogenous). In fact, Hwang et al. (1998) develop a parallel argument using the equilibrium search model framework of Burdett and Mortensen (1998).

The case of household search is a bit more involved, clearly. The main lesson we have learned from the model analysis presented above is that, even when health insurance coverage at the spouses' jobs are perfect substitutes in an instantaneous sense, they are not in a dynamic one. Moreover, we have shown that the estimation of a dynamic, *single-agent* model of labor market decisions will lead to inconsistent estimates of the parameters of that agent's labor market environment and preferences.

6 Empirical Results

This section presents the estimation results based on the econometric model discussed in the previous section. Table 2 presents the method of simulated moments estimates for three specifications of the model.[15] The first specification treats the spouses as individual agents and hence there is no link between the labor market decisions of the spouses. The second specification accounts for the joint nature of the employment decision-making process, but does not include any information about the relationship between the labor market outcomes of the two spouses. In this specification we simply include the same moments that we used in the single-agent specifications, but allow for interaction

[15] Table A1 in the appendix presents the results for the moments used in the estimation procedure for each of the three specifications. In addition, the table presents the sample value and the weight associated with each moment.

between the behavior of the two spouses. In the final specification, we include additional information that accounts for the relationship between the labor market outcomes of the two spouses. Obviously this is our preferred specification since it not only takes into account the joint nature of the decision-making process, but explicitly includes information about the joint outcomes of the household members. Hence, all the results that follow are based on the final specification, what we are calling the "Joint specification with Cross Moments." There are four key results that deserve further discussion.

First, for both spouses the wage offer distribution of insured jobs stochastically dominates the wage offer distribution of uninsured jobs. This result points directly to the difficulty in trying to uncover the marginal willingness to pay for health insurance using cross-sectional analysis. This relationship is consistent across the various specifications of the model. In addition, the proportion of job offers that include health insurance coverage is roughly the same for husbands and wives. Again, this result is consistent across the various specifications of the model. This result indicates that the large differences between health insurance coverage patterns of husbands and wives that we observe in the data cannot be explained by the proportion of jobs that offer health insurance coverage, but arise due to differences in the relative wage distributions of the household members.

A second important result is the rather large difference in the labor market environments faced by husbands and wives. The estimates from the single-agent specifications indicate that while husbands receive job offers at nearly twice the rate of wives when unemployed, they receive offers at approximately the same rate when employed. However, once we account for the joint nature of the decision-making process the job offer rates in unemployment converge while the job offer rates in employment diverge. In the final specification, husbands receive job offers when unemployed at only a slightly higher rate than wives, but the rate at which they receive offers in employment is nearly four times higher. This suggests that the single-agent specifications are misspecified since they do not take into account the earnings process of the other spouse. For example, the high observed unemployment rate of wives translates into a low job offer rate in unemployment in the single-agent specification. In the joint specifications, however, the high rate of unemployment can be largely explained by the wage process of husbands and hence the estimated job offer rate increases substantially.

The third and perhaps most important result within the context of our desire and ability to estimate the marginal willingness to pay for health insurance coverage are the estimates for the utility premium from health insurance coverage, ξ. In the single-agent specifications, the estimate of ξ for both husbands and wives is quite low. In the joint specification without additional moments, the household value of health insurance is still seemingly quite low. On the other hand, once we include additional moments that capture some information about the joint nature of the labor market outcomes the estimate of ξ increases substantially.

Given the fact that we are allowing for decreasing marginal utility of income, it is difficult to interpret the parameter, ξ. One way to interpret the effect of ξ is by computing the marginal willingness to pay when both spouses are unemployed. To begin, in the single-agent specifications, the marginal willingness to pay for husbands can be computed as $w_1^*(0) - w_1^*(1) = 10.11 - 9.40 = 0.71$. This differential suggests that husbands are willing to take a 7% pay cut to take a job with health insurance coverage. Similarly, the marginal willingness to pay for women is given by $w_2^*(0) - w_2^*(1) = 6.25 - 5.79 = 0.46$. Again, this differential suggests that wives are willing to take a 7.4% pay cut to take a job with health insurance coverage. In the initial joint specification, the household is willing to take a 8.5% pay cut for the husband to take a job with health insurance coverage and a 8.4% pay cut for the wife to take a job with health insurance coverage. Since other parameter estimates changed between the single-agent specifications and the initial joint specification it is interesting to note that the marginal willingness to pay estimates do not change substantially. Finally, in the joint specification that includes cross moments, we can calculate the marginal willingness to pay for health insurance coverage for husbands as $w_1^*(0) - w_1^*(1) = 5.96 - 3.51 = 2.45$. This implies that the household in this employment state would be willing to have the husband take a 41% pay cut to take a job with health insurance coverage. Similarly, the marginal willingness to pay for health insurance coverage for wives can be calculated as $w_2^*(0) - w_2^*(1) = 4.88 - 2.67 = 2.21$ which implies that the household is willing to have the wife take a 45% pay cut to take a job with health insurance coverage. Since most of the estimates of the labor market parameters are similar in the two joint specifications, it is fairly safe to assume that the large increase in the estimated value of ξ is driving the dramatic increases in these two marginal willingness to pay estimates.

To allow a direct comparison to frequently cited statistics, Table 3 contains the predicted values for the same descriptive statistics presented in Table 1. We fit the cross-sectional moments for husbands quite well. The predicted unemployment rate, health insurance coverage rate, and the conditional mean wages are all relatively close to their sample analogs. On the other hand, we do not fit the cross-sectional moments for wives nearly as well. The most striking difference is between the predicted unemployment rate (about 7%) and the sample unemployment rate (about 20%). In addition, in contrast to what is observed in the data, the estimates suggest that mean wages are higher in uninsured jobs than in insured jobs for wives.

It is also interesting to note that the model does a reasonably good job of predicting the conditional unemployment and health insurance coverage rates, but a poor job of predicting the relationship between conditional mean wages. In particular, as was discussed in the data section above, the unemployment rate is higher for wives whose husbands have employer-provided health insurance. The model predicts the same relationship. Similarly, the health insurance coverage rate is higher for wives whose hubands do not have employer-provided health insurance and the model predicts this relationship as well.

In order to determine how changes in the underlying parameters of the model affect the labor market outcomes of the spouses and the household as a unit, we carry out a straightforward comparative static exercise. The results of this exercise are presented in Table 4. Each entry in the table measures the percent change in the outcome given a 10% increase in the parameter of interest while holding the other parameters fixed at their estimated values. For example, if we increase the husband's job offer rate in unemployment, λ_1^N, by 10% from 0.279 to 0.307, the unemployment rate of husbands decreases from 1.41% to 1.40% or a 0.71% decline. Similarly, the unemployment rate of wives decreases from 6.67% to 6.18% for a 7.3% decline. These comparative static results highlight the fact that the labor market environment of one spouse will not only affect the labor market outcomes of that spouse, but also will affect the labor market outcomes of the other spouse and the household as a unit.

Since we are particularly interested in how certain parameters affect whether the household is covered by employer-provided health insurance, we will only discuss how health insurance coverage rates are affected by changes in the labor market environment. Since the results are qualitatively similar when we change the labor market environment of the husband or the wife ,we will focus solely on changes to the husbands labor market environment. First, an 10% increase in the proportion of job offers that provide health insurance, π, leads to a slightly greater than 10% increase in the cross-sectional proportion of employed husbands who have employer-provided health insurance and a 7% decline in the proportion of employed wives who have employer-provided health insurance coverage. On net, this increase leads to only a 0.5% increase in the proportion of households that are covered by employer-provided health insurance. One way to think about this result is to think about what happens when all the job offers received by the husbands provide insurance. In this case, wives will still value employer-provided health insurance since their husbands may become unemployed at some point in the future. Therefore, there is still the option value of spousal health insurance but it declines in π.

Second, a 10% increase in the location parameter of the insured wage distribution, μ^1, leads to a 30% increase in the coverage rate of employed husbands, a 22% decline in the coverage rate of employed wives, and a net increase in the coverage rate of 1.7%. This increase essentially makes insured jobs for husbands better for two reasons, the health insurance coverage and the higher wages. This shift in the insured wage distribution facing husbands makes them more likely to wait for an insured job (hence the small increase in the unemployment rate) and also makes wives' health insurance coverage relatively less valuable to the household since husbands are much more likely to be employed at a high paying insured job. Conversely, a 10% increase in the location parameter of the uninsured wage distribution, μ^0, drops the coverage rate of employed husbands by more than 62%, increases the coverage rate of employed wives by 44%, and leads an almost 3% decline in the coverage rate of the household.

Finally, and perhaps most importantly for the discussion that follows, a 10% increase in the value of health insurance, ξ, leads to relatively small increases in the coverage rates of both spouses and for the household as a unit. By increasing the value of health insurance, the household is more willing to trade income for health insurance and therefore the coverage rates will increase. It is interesting to note that while the percent of employed husbands with coverage increases by 0.33% and the percent of employed wives with coverage increases by 0.53%, the household coverage rate only increases by 0.28%. This results suggests that proportion of households with two health insurance policies increases substantially.

We conclude this section by returning to the discussion of the ability to estimate the households' marginal willingness to pay for health insurance within the context of our behavioral model. We present two sets of estimates in Figure 2a and Figure 2b. The first set of estimates considers the situation in which the husband is currently employed and the wife is unemployed and searching for employment. While it is certainly the case that there exists a continuum of marginal willingness to pay estimates within the current employment state faced by the household, we consider only one particular set of estimates. Namely, assume that the wife has a wage offer without health insurance coverage that makes her indifferent between remaining unemployed and accepting the job. We denote this reservation wage as $\hat{w}_2(0; w_1, h_1, 0, 0)$ where (w_1, h_1) indicates the characteristics of the husband's current job. We then estimate the MWP for health insurance for wives as the difference between this wage and the minimally acceptable wage in a job that provides health insurance. This reservation wage is denoted as $\hat{w}_2(1; w_1, h_1, 0, 0)$ and the marginal willingness to pay for health insurance for wives is given by

$$MWP_2(w_1, h_1) = \hat{w}_2(0; w_1, h_1, 0, 0) - \hat{w}_2(1; w_1, h_1, 0, 0).$$

Figure 2a plots these estimates when $h_1 = 1$ (Insured Husband) and $h_1 = 0$ (Uninsured Husband) and considers all acceptable wages such that $w_1 \geq w_1^*(h_1)$. Similarly, in Figure 2b we plot the marginal willingness to pay for health insurance for husbands which is estimated by

$$MWP_1(w_2, h_2) = \hat{w}_1(0; 0, 0, w_2, h_2) - \hat{w}_1(1; 0, 0, w_2, h_2).$$

Again, we consider the cases when $h_2 = 1$ (Insured Wife) and $h_2 = 0$ (Uninsured Wife) and consider all acceptable wages for the wife such that $w_2 \geq w_2^*(h_2)$.

The estimates presented in the figures highlight two particularly interesting and important results. First, when the husband does not have health insurance coverage at his current job, the marginal willingness to pay for health insurance for his wife increases (although not everywhere) in the husband's wage. This result comes directly from the nonlinearity in the utility function (recall that $\hat{\delta} = 0.53$) and the implication that the marginal utility of income is decreasing. Therefore as the husband's wage increases the household is more willing to trade additional wages for health insurance coverage. A similar result is true for the marginal willingness to pay for health insurance coverage for husbands when the wife is currently employed at an uninsured job.

Second, when the husband's current job provides health insurance coverage, the marginal willingness to pay for coverage for the wife is (for the most part) decreasing in the husband's current wage. In spite of this fact, the marginal willingness to pay always remains positive. This fact clearly depicts the option value of a second health insurance coverage for the household when employer-provided health insurance is a household public good.

7 Policy Implications of the Analysis

Many developed countries make the provision of health care services a governmental responsibility. In the U.S., the costs and benefits of a government-provided national health care system have been hotly debated for decades. Although health care costs consume about one-seventh of the Gross Domestic Product of the U.S. even as health indicators of the U.S. population significantly trail those of other developed countries, the U.S. has not moved to implement any sweeping changes in health care policy. In part this is attributable to the sheer magnitude of the task of forecasting the effects of changing an institution that has such a direct impact on the lives of every population member.

One problem with performing a cost-benefit analysis for any type of major change in health care institutions is determining the benefits. Social science research has not been terribly helpful in pinning down exactly what are the benefits from health insurance coverage. For example, to this day it has not definitely established that health insurance coverage, per se, leads to better health outcomes.[16] Of course, even if health care insurance provision and health outcomes are unrelated, on average, doesn't imply that individuals do not value having health insurance. Health insurance may be particularly valued in the case of catastrophic illnesses, for example, especially when individuals exhibit high degrees of risk aversion.

To assess the valuation of health insurance, economists have attempted to compute the willingness to pay for given levels of health insurance coverage, most often utilizing wage information. Since over 90 percent of individuals covered by health insurance plans receive their insurance through their own or a family member's employer, a natural way to proceed is to attempt to infer the valuation of health insurance by the difference in wages paid to similarly-skilled workers by employers providing health insurance coverage and by those who do not. This has lead to a large empirical literature in which a function of an employee's wage appears as a dependent variable and regressors include the individual's "productivity" characteristics (e.g., schooling, age, tenure at the firm) as well as whether he or she receives employer-provided health insurance. In the simplest possible specification, the coefficient associated with the health insurance provision indicator variable (which should be negative under the theory of compensating differentials) indicates the wage penalty the individual is willing to accept to be covered by health insurance. The higher is this coefficient, in absolute value, the greater the benefit of providing health insurance coverage universally, for example.

Consider the following example. Let $x_1(h_1, h_2)$ denote the mean wage paid to husbands when the health insurance status of their jobs is h_1 and their wives' jobs is h_2. Assuming that health insurance coverage for one spouse extends to entire household and thinking about the trade-off between wages and health insurance coverage in a static way means there is no value to "double" coverage. Then, consider the difference

$$x_1(0, 1) - x_1(1, 1).$$

Since the household is covered by health insurance in this case (i.e., the wives have coverage), there is no value of health insurance to the husband and, other things equal, there should be no wage penalty.

[16] The only large scale experimental study capable of yielding relatively unambiguous causal inferences was the Rand Health Insurance Experiment, which was conducted in the 1970s, and which found limited effects of free health insurance on health outcomes. The researcher's interpretation was that health care utilization is high even when unsubsidized, so that price reductions, even to zero, have small effects on health outcomes (Keeler (1992)).

This is the control group. Next, consider the difference

$$x_1(0,0) - x_1(1,0).$$

This difference measures the wage premium that a husband pays for health insurance coverage. Then, the difference-in-difference estimate of the wage penalty for husband's health insurance coverage is given by

$$[x_1(0,0) - x_1(1,0)] - [x_1(0,1) - x_1(1,1)].$$

Since the first term in brackets reflects the wage premium that husbands pay for health insurance and whatever differences there are in the wage offer distributions and the second term only contains the "selection" factor, the difference is the wage penalty for health insurance coverage. This could also be applied to wives, of course.

Using the data in our cross-section, we estimate that the wage penalty for husbands is

$$\begin{aligned} [x_1(0,0) - x_1(1,0)] - [x_1(0,1) - x_1(1,1)] &= [12.48 - 18.49] - [14.92 - 16.09] \\ &= -6.01 - (-1.17) \\ &= -4.84 \end{aligned}$$

Similarly, we find that the wage penalty for wives is given by

$$\begin{aligned} [x_2(0,0) - x_2(0,1)] - [x_2(1,0) - x_2(1,1)] &= [9.09 - 15.32] - [11.88 - 14.17] \\ &= -6.23 - (-2.29) \\ &= -3.94 \end{aligned}$$

In both cases we find no evidence of a wage penalty in the data.

While relatively sophisticated econometric methods have been used in an attempt to mitigate such likely problems as the correlation between the disturbance term in the regression and health insurance coverage, less attention has been given to the interpretation of the willingness to pay estimates obtained from these linear regression estimators. Moreover, although some research has explicitly considered the existence of population heterogeneity in the marginal willingness to pay, the source of this heterogeneity is not investigated. Though it could be due to heterogeneous attitudes towards risk, we argue in this paper that cross-sectional regression specifications from which these estimates are obtained are fundamentally misspecified. In our highly stylized model of the demand for health insurance, we posit that the (cardinal) utility gain from having health insurance is homogeneous in the population. Even under this highly restrictive assumption, our model generates heterogeneity in the marginal willingness to pay for health insurance in the cross-section when we do not properly account for variation in the state variables characterizing the household's current environment.

We now turn to an illustration of this point using our model estimates. The time-varying state variables of which we are speaking are the vector (w_1, h_1, w_2, h_2).[17] As was discussed above, in the case of a single-individual model, it is reasonable to define the MWP as the difference in reservation wages for an individual who is currently unemployed. In this case, the MWP is a scalar. In the case of two spouses, the MWP for one spouse is a function of the job employment status of the their mate. In the case of the husband, his marginal willingness to pay for health insurance is a function of the wife's characteristics, (w_2, h_2). Let his MWP function be given by $MWP_1(w_2, h_2)$. The function itself is determined by all of the parameters that characterize the market and household environment, including

[17] The nonlabor income of the household is treated as a time-invariant characteristic of the household in our modeling framework, and we do not emphasize its contribution to heterogeneity in the MWP in this discussion.

preference parameters, wage and health insurance offer distributions for both spouses, rates of arrival of offers, etc. By the same token, the distribution of the (w_2, h_2), in the long run, is determined by these same primitive parameters. If we define the steady state distribution of all four state variables by $F^{SS}(w_1, h_1, h_2, d_2)$, then the marginal bivariate distribution of the wife's labor market characteristics are given by $F_2^{SS}(w_2, h_2) = F_{2C}^{SS}(w_2|h_2)p_2^{SS}(h_2)$. In the steady state, the husband's MWP can be defined as

$$\overline{MWP}_1 = \sum_{h_2=0}^{1} \int MWP_1(w_2, h_2) dF_{2C}^{SS}(w_2|h_2) p_2^{SS}(h_2).$$

This is clearly an average measure of the willingness to pay over the various employment states the wife can occupy. This long run expected value is an adequate representation of preferences regarding health insurance in the population only when the distribution of F_2^{SS} is degenerate and/or MWP_1 is (approximately) across states. If we are willing to assume that the function MWP_1 is differentiable in its first argument (the wage of the wife), then using a first order Taylor series expansion we have

$$\begin{aligned} VAR(MWP_1) \doteq \frac{\partial MWP_1(E(w_2|h_2=0),0)}{\partial w_2} VAR(w_2|h=0)p_2^{SS}(h=0) \\ + \frac{\partial MWP_1(E(w_2|h_2=1),1)}{\partial w_2} VAR(w_2|h=1)p_2^{SS}(h=1). \end{aligned}$$

Given the substantial variability we observe in health insurance and wage outcomes given the model estimates, and the substantial variability in the MWP function with respect to wages, we are able to generate significant variation in MWP_1 simply through labor market dynamics. This variability does not come from any inherent differences in preferences regarding health insurance, it must be remembered. Adding this feature to the model would be likely to increase the variation in MWP_1 from the model.[18]

We have considered the MWP in the case where the husband was the unemployed searcher. We can repeat the analysis of the MWP after reversing the role of the husband and wife. The results will differ whenever the labor market environments of wives and husbands differ, which is clearly the case here given our model estimates.

Using our model estimates, we find that the steady-state marginal willingness to pay for husband's health insurance coverage is 1.73 while it is 1.29 for wives. This difference suggests that even though health insurance is a public good within the household and there is a common valuation of coverage within the household ξ, the average amount that the household is willing to pay for the husband's coverage is higher than the average amount the household is willing to pay for the wife's coverage. This difference is driven by differences in underlying labor market environments facing the two spouese. Moreover, we estimate that the variance in the marginal willingness to pay is 5.14 for husbands and 1.90 for wives. In both cases, there is a substantial amount of variability in the marginal willingness to pay that does not arise from any inherent heterogeneity in preferences for health insurance coverage, but due to the dynamic decision-making process of the household.

From the policy perspective, probably the most important point that can be taken from our analysis is that in a tightly specified, dynamic labor market model that incorporates household behavior and demand for employer-provided health insurance coverage, there exists substantial variability in the willingness to pay for health insurance across labor market states. Attempts to estimate an individual's or household's valuation of health insurance that abstract from labor market dynamics or the "publicness"

[18] Adding heterogeneity in preferences, say the parameter ξ, would not necessarily lead to increased cross-sectional variability in MWP_1. To determine whether this is the case requires solving for the reservation wage of each type of agent and then aggregating outcomes. Allowing variance in a parameter that is currently constrained to be constant does not necessarily lead to increased cross-sectional variation in such a case.

of most employer-provided health insurance coverage are likely to lead to incorrect inferences. Our analysis is a first step in looking at the determinants of the willingness to pay, where variability in this measures stems from the distribution of labor market outcomes in the population.

To be truly useful as an input into policy decisions, the framework of our analysis would have to be expanded considerably. The most fundamental question we have failed to address, as have the vast majority of researchers before us, is what drives the demand for health insurance? For example, does it primarily stem from the fear that a catastrophic illness will lead to financial ruin? If so, do these concerns have a basis in fact? Given the lack of hard evidence regarding the effect of health insurance coverage on health outcomes, it is a challenging and important task to understand the positive valuation of health insurance coverage. Only after we have some idea regarding these motivations can we begin to perform modeling and estimation exercises that will yield results directly usable by policy makers.

8 Conclusion

In this paper we have taken a first step in rectifying the neglect of spousal search in a dynamic model of household behavior. The framework within which we have worked is highly stylized, and most importantly omits strategic interactions between spouses as well as the presence of capital markets. It shares the problem of most theoretical and empirical studies of health insurance by not specifying the underlying behavioral and technological motives for its demand by the household.

In terms of other theoretical contributions, we consider the case of multiattribute offers. While there are a number of other job characteristics besides health insurance provision that could be included in this model, health insurance is a particularly important characteristic in the household search framework given its quasi-publicness. We illustrate the manner in which the publicness of health insurance coverage and a nonconstant marginal utility of household consumption combine to link the labor market decisions of the spouses. This interdependence in decision-making and payoffs in a dynamic context makes attempts to compute the willingness to pay for health insurance from cross-sectional wage-health insurance relationships misguided. Given the model structure, we can compute willingness to pay functions given the state variables defining the household at a given moment in time. Needless to say, there is in general no single constant MWP parameter that arises.

We estimate a valuation of health insurance by the household that seems somewhat reasonable. This gives us some hope that this type of analysis, conducted in a more ambitious equilibrium framework, may eventually prove useful in stimulating and guiding the policy debate on the health insurance coverage question.

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Table 1. -- Summary Statistics

	Total	Spouse's Employment Status: Employed with Insurance	Employed without Insurance	Unemployed
Husband's Labor Market Outcomes as a function of Wife's Employment Status				
Unemployment Rate	1.82	2.69	0.99	1.61
Health Insurance Coverage Rate (when Employed)	79.82	60.79	93.30	91.91
Mean Wage in Insured Jobs	18.03	16.09	18.49	19.74
	(7.80)	(6.76)	(7.90)	(8.39)
Mean Wage in Uninsured Jobs	14.57	14.92	12.48	14.58
	(6.66)	(6.89)	(5.10)	(6.22)
Wife's Labor Market Outcomes as a function of Husband's Employment Status				
Unemployment Rate	19.81	22.86	7.98	17.68
Health Insurance Coverage Rate (when Employed)	51.08	40.08	85.74	73.83
Mean Wage in Insured Jobs	14.58	14.17	15.32	13.28
	(7.20)	(7.20)	(7.31)	(4.85)
Mean Wage in Uninsured Jobs	11.63	11.88	9.09	5.99
	(5.65)	(5.65)	(5.12)	(0.51)

Note: Based on the 1996 panel of the Survey of Income and Program Participation (SIPP). The sample includes 1,267 married couples that meet certain selection criteria. Standard deviations of the various conditional wages are in parentheses.

Table 2. -- Parameter Estimates

Parameter	Single-Agent Specifications: Husbands	Single-Agent Specifications: Wives	Joint Specification with No Cross Moments: Husbands	Joint Specification with No Cross Moments: Wives	Joint Specification with Cross Moments: Husbands	Joint Specification with Cross Moments: Wives
λ^N	0.236 (0.005)	0.091 (0.004)	0.277 (0.003)	0.223 (0.004)	0.279 (0.010)	0.243 (0.005)
λ^E	0.027 (0.002)	0.027 (0.003)	0.065 (0.002)	0.027 (0.003)	0.070 (0.004)	0.017 (0.001)
η^1	0.018 (0.001)	0.041 (0.006)	0.022 (0.001)	0.015 (0.001)	0.027 (0.002)	0.013 (0.001)
η^0	0.033 (0.002)	0.023 (0.003)	0.031 (0.001)	0.047 (0.002)	0.032 (0.003)	0.050 (0.004)
π	0.699 (0.003)	0.739 (0.011)	0.703 (0.001)	0.715 (0.002)	0.733 (0.004)	0.791 (0.004)
μ^1	2.331 (0.009)	1.831 (0.024)	2.307 (0.007)	1.821 (0.008)	2.282 (0.006)	1.756 (0.019)
σ^1	0.441 (0.005)	0.493 (0.010)	0.415 (0.004)	0.390 (0.006)	0.415 (0.012)	0.346 (0.007)
μ^0	2.498 (0.008)	2.310 (0.017)	2.445 (0.005)	2.393 (0.011)	2.514 (0.005)	2.403 (0.11)
σ^0	0.182 (0.006)	0.162 (0.007)	0.173 (0.002)	0.141 (0.003)	0.139 (0.005)	0.135 (0.004)
			Household		Household	
ξ	0.192 (0.004)	0.263 (0.008)	0.199 (0.002)		1.210 (0.003)	
δ	0.417 (0.001)	0.628 (0.003)	0.523 (0.001)		0.526 (0.001)	

Note: Parameter estimates based on the 1996 panel of the Survey of Income and Program Participation. The model is estimated using the simulated method of moments estimator described in the text. The job offer arrival rates are measured in weeks and the dismissal rates are measured in tens of weeks. Non-labor income is set to zero and the discount rate is set to eight percent annually. Standard errors are in parentheses and are computed using bootstrap methods with 25 replications of the data.

Table 3. -- Predicted Statistics

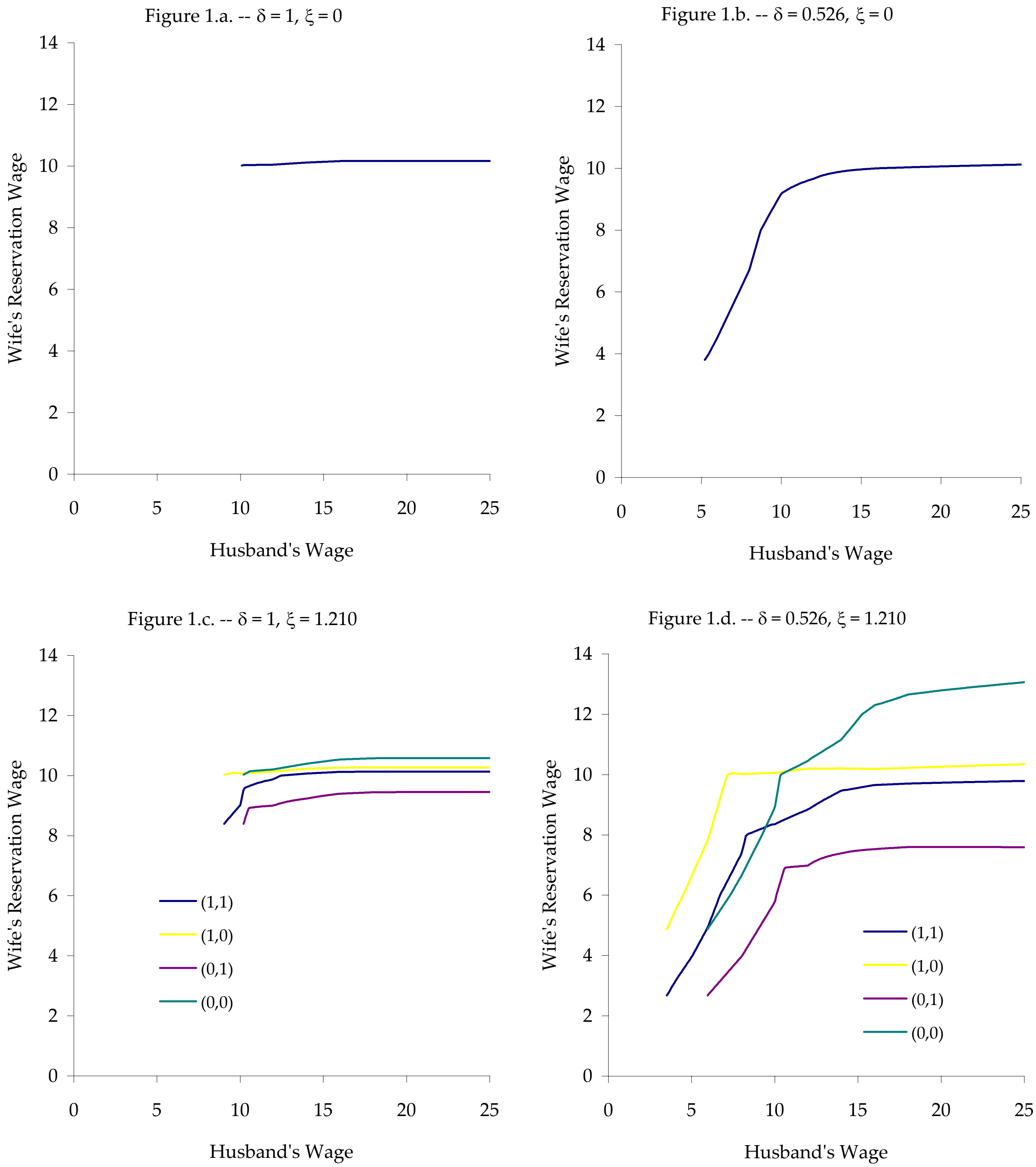
	Total	Spouse's Employment Status: Employed with Insurance	Employed without Insurance	Unemployed
Husband's Labor Market Outcomes as a function of Wife's Employment Status				
Unemployment Rate	1.41	1.68	1.12	0.90
Health Insurance Coverage Rate (when Employed)	73.13	55.37	96.16	85.93
Mean Wage in Insured Jobs	17.99	18.52	17.56	17.91
	(5.65)	(5.79)	(5.50)	(5.64)
Mean Wage in Uninsured Jobs	14.87	14.86	14.90	15.12
	(1.78)	(1.77)	(1.88)	(1.69)
Wife's Labor Market Outcomes as a function of Husband's Employment Status				
Unemployment Rate	6.67	7.88	3.51	4.26
Health Insurance Coverage Rate (when Employed)	58.85	45.02	94.29	98.58
Mean Wage in Insured Jobs	11.49	11.82	11.09	11.17
	(1.99)	(1.86)	(2.08)	(2.29)
Mean Wage in Uninsured Jobs	12.29	12.26	13.10	12.33
	(1.32)	(1.31)	(1.17)	(1.57)

Note: Based on parameter estimates from the "Joint specification with cross moments" presented in Table 2. Standard deviations of the various conditional wages are in parentheses.

Table 4. -- Comparative Static Results

	Unemployment Rates		Health Insurance Coverage Rates			Mean Hourly Wages		
	Husbands	Wives	Husbands	Wives	Household	Husbands	Wives	Household
Husband's Labor Market Parameters								
λ^N	-0.709	-7.346	-0.967	0.764	-0.082	-0.164	-0.041	0.098
λ^E	1.418	-3.148	-0.216	0.702	0.154	0.681	0.019	0.496
η^1	2.837	-5.397	-2.804	1.847	0.000	-1.038	-0.243	-0.597
η^0	4.255	-3.448	2.420	-1.626	0.124	-0.114	0.252	0.091
π	7.092	-0.600	10.098	-6.795	0.525	0.551	0.841	0.621
μ^1	1.418	7.946	30.179	-22.392	1.709	24.120	2.641	15.394
σ^1	1.418	0.150	1.380	-0.190	0.196	3.791	-0.002	2.276
μ^0	109.220	-23.388	-62.761	44.991	-2.749	11.557	-6.504	3.988
σ^0	4.965	-4.948	-0.651	1.607	-0.237	1.677	-0.105	1.069
Wife's Labor Market Parameters								
λ^N	-8.511	-1.199	-0.482	-2.069	-0.134	-0.396	0.906	0.226
λ^E	2.128	-3.898	-0.968	1.411	-0.021	-0.217	0.064	-0.014
η^1	4.255	-0.150	0.894	-2.432	-0.072	-0.006	-0.176	-0.106
η^0	-12.766	-5.097	-1.816	4.753	0.288	-0.144	-0.621	-0.079
π	3.546	-10.645	-9.455	24.147	0.360	-0.444	-1.887	-0.749
μ^1	8.511	-15.982	-15.209	39.818	0.855	-0.320	10.362	4.319
σ^1	8.511	0.150	-3.489	10.919	0.010	-0.463	4.302	1.341
μ^0	-4.965	26.537	21.439	-60.559	-1.133	-0.417	24.013	8.343
σ^0	1.418	1.199	0.367	-1.208	-0.124	-0.116	0.997	0.277
Household's Utility Function Parameters								
ξ	-2.837	1.049	0.334	0.531	0.278	-0.204	-0.108	-0.172
δ	2.128	-4.498	-1.690	-2.008	-0.958	-0.211	0.428	0.151

Note: Based on the parameter estimates from the "Joint specification with cross moments" presented in Table 2. Each entry measures the percent change in the outcome given a 10% increase in the parameter of interest and holding the other parameters constant. See text for more details.

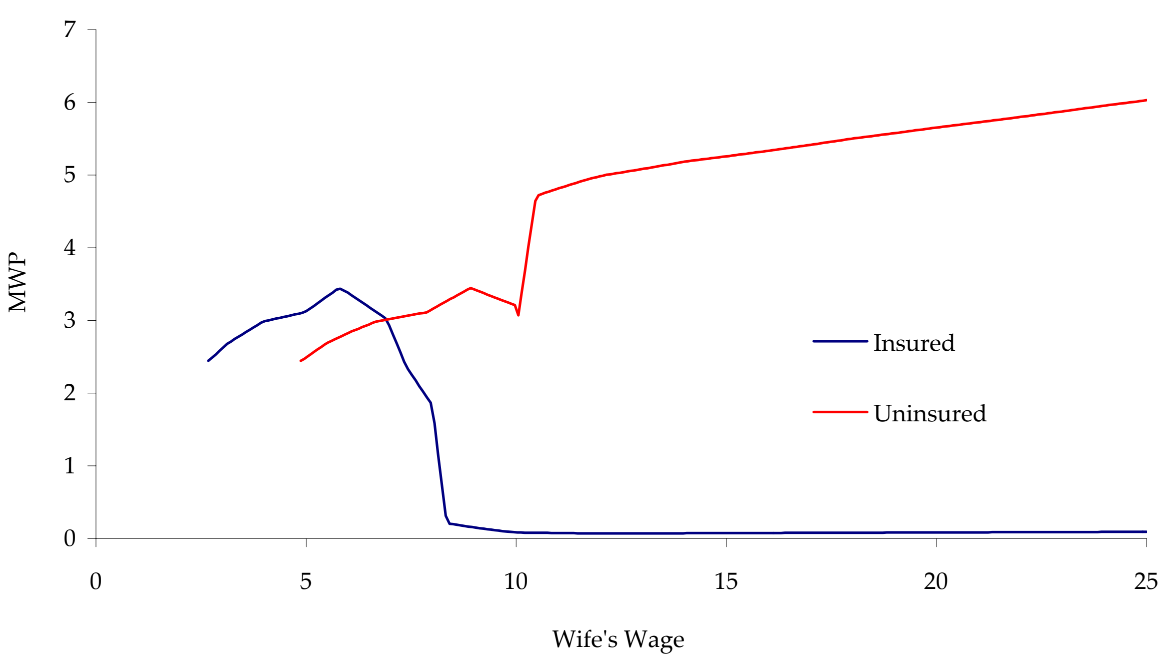


Note: Based on the parameter estimates from the "Joint specification with cross moments" presented in Table 2. See text for more details.

Figure 2.a. -- Marginal Willingness to Pay for Wife's Insurance

Note: Based on the parameter estimates from the "Joint specification with cross moments" presented in Table 2.

Figure 2.b. -- Marginal Willingness to Pay for Husband's Insurance



Note: Based on parameter estimates from the "Joint specification with cross moments presented in Table 2.

Table A1 -- Sample and Estimated Moments

Moment	Sample	Weight	Estimate: Single Agent	Estimate: Joint Specification without Cross Moments	Estimate: Joint Specification with Cross Moments
Husband's Labor Market Outcomes					
m(I(s0 = 1))	0.784	87.225	0.762	0.730	0.721
m(I(s0 = 0))	0.198	89.337	0.226	0.255	0.265
m(w0 x I(s0 = 1))	14.134	3.545	14.261	14.179	12.968
sd(w0 x I(s0 = 1))	10.143	5.000	9.514	9.893	9.386
m(w0 x I(s0 = 0))	2.887	5.452	3.399	3.830	3.940
sd(w0 x I(s0 = 0))	6.520	3.959	6.384	6.619	6.627
m(I(s0 = -1) x I(s1 = 1))	0.002	741.097	0.009	0.010	0.009
m(I(s0 = -1) x I(s1 = 0))	0.007	422.417	0.003	0.005	0.005
m(I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	0.058	151.783	0.069	0.071	0.098
m(I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	0.053	157.841	0.036	0.046	0.046
m(I(s0 = 1) x I(s1 = -1))	0.011	335.924	0.007	0.011	0.009
m(I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	0.026	222.210	0.023	0.033	0.043
m(I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	0.040	179.791	0.040	0.043	0.040
m(I(s0 = 0) x I(s1 = -1))	0.002	720.440	0.003	0.007	0.004
m(w1 x I(s0 = -1) x I(s1 = 1))	0.030	57.171	0.136	0.149	0.129
sd(w1 x I(s0 = -1) x I(s1 = 1))	0.629	4.578	1.494	1.570	1.426
m(w1 x I(s0 = -1) x I(s1 = 0))	0.099	28.612	0.038	0.073	0.067
sd(w1 x I(s0 = -1) x I(s1 = 0))	1.248	3.816	0.705	0.999	0.950
m(w0 x I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	1.071	7.523	1.089	1.193	1.504
sd(w0 x I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	4.738	2.862	4.280	4.560	4.903
m((w1 - w0) x I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	0.139	16.758	0.068	0.044	-0.028
sd((w1 - w0) x I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	2.131	3.580	2.455	2.444	2.661
m(w0 x I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	0.821	9.405	0.566	0.772	0.701
sd(w0 x I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	3.784	3.500	3.093	3.702	3.405
m((w1 - w0) x I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	0.097	24.018	-0.056	-0.137	-0.061
sd((w1 - w0) x I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	1.476	4.402	1.217	1.451	1.277
m(w0 x I(s0 = 1) x I(s1 = -1))	0.206	16.231	0.132	0.212	0.154
sd(w0 x I(s0 = 1) x I(s1 = -1))	2.185	2.288	1.585	2.102	1.717
m(w0 x I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	0.316	17.061	0.320	0.456	0.596
sd(w0 x I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	2.096	4.453	2.118	2.509	2.845
m((w1 - w0) x I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	0.040	29.874	0.008	0.002	0.011
sd((w1 - w0) x I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	1.192	3.959	0.461	0.479	0.477
m(w0 x I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	0.642	10.323	0.562	0.592	0.561
sd(w0 x I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	3.420	3.182	2.798	2.842	2.762
m((w1 - w0) x I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	0.085	38.466	0.129	0.198	0.090
sd((w1 - w0) x I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	0.922	7.265	1.453	1.665	1.302

m(w0 x I(s0 = 0) x I(s1 = -1))	0.035	41.707	0.050	0.099	0.066
sd(w0 x I(s0 = 0) x I(s1 = -1))	0.832	2.563	0.878	1.229	0.997
Wife's Labor Market Outcomes					
m(I(s0 = 1))	0.410	72.518	0.489	0.491	0.549
m(I(s0 = 0))	0.392	73.885	0.458	0.454	0.384
m(w0 x I(s0 = 1))	5.974	4.221	6.657	6.700	6.309
sd(w0 x I(s0 = 1))	8.526	4.170	7.565	7.062	5.905
m(w0 x I(s0 = 0))	4.564	5.314	5.335	5.695	4.721
sd(w0 x I(s0 = 0))	6.695	5.527	5.921	6.309	6.034
m(I(s0 = -1) x I(s1 = 1))	0.006	460.691	0.027	0.015	0.022
m(I(s0 = -1) x I(s1 = 0))	0.030	209.618	0.021	0.034	0.036
m(I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	0.028	222.174	0.074	0.027	0.027
m(I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	0.047	164.422	0.055	0.032	0.026
m(I(s0 = 1) x I(s1 = -1))	0.006	456.353	0.029	0.014	0.019
m(I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	0.046	170.338	0.048	0.076	0.054
m(I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	0.043	178.650	0.060	0.041	0.030
m(I(s0 = 0) x I(s1 = -1))	0.025	226.110	0.016	0.033	0.035
m(w1 x I(s0 = -1) x I(s1 = 1))	0.085	32.485	0.288	0.192	0.234
sd(w1 x I(s0 = -1) x I(s1 = 1))	1.142	4.018	1.846	1.564	1.583
m(w1 x I(s0 = -1) x I(s1 = 0))	0.279	20.801	0.230	0.405	0.421
sd(w1 x I(s0 = -1) x I(s1 = 0))	1.747	4.941	1.581	2.176	2.207
m(w0 x I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	0.425	12.467	0.860	0.349	0.288
sd(w0 x I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	2.876	2.584	3.247	2.146	1.757
m((w1 - w0) x I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	0.097	24.802	0.042	0.021	0.008
sd((w1 - w0) x I(s0 = 1) x I(s1 = 1) x I(e0 ≠ e1))	1.470	3.293	1.672	0.607	0.485
m(w0 x I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	0.604	11.461	0.607	0.401	0.279
sd(w0 x I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	3.068	3.380	2.707	2.245	1.726
m((w1 - w0) x I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	0.025	35.903	-0.007	0.003	0.044
sd((w1 - w0) x I(s0 = 1) x I(s1 = 0) x I(e0 ≠ e1))	1.005	6.420	1.094	0.517	0.454
m(w0 x I(s0 = 1) x I(s1 = -1))	0.074	37.384	0.391	0.194	0.213
sd(w0 x I(s0 = 1) x I(s1 = -1))	0.976	4.913	2.410	1.652	1.555
m(w0 x I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	0.471	14.079	0.514	0.923	0.655
sd(w0 x I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	2.494	3.657	2.308	3.233	2.751
m((w1 - w0) x I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	-0.008	44.999	0.042	0.018	0.000
sd((w1 - w0) x I(s0 = 0) x I(s1 = 0) x I(e0 ≠ e1))	0.784	8.453	0.518	0.501	0.424
m(w0 x I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	0.541	12.897	0.664	0.502	0.370
sd(w0 x I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	2.779	4.138	2.664	2.451	2.108
m((w1 - w0) x I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	0.046	25.911	0.101	0.028	-0.033
sd((w1 - w0) x I(s0 = 0) x I(s1 = 1) x I(e0 ≠ e1))	1.389	3.523	1.206	0.554	0.438
m(w0 x I(s0 = 0) x I(s1 = -1))	0.241	21.685	0.180	0.415	0.423
sd(w0 x I(s0 = 0) x I(s1 = -1))	1.650	4.566	1.438	2.259	2.250

Joint Labor Market Outcomes

$m(I(s0^{(1)} = 1) \times I(s0^{(2)} = -1))$	0.179	92.975	0.057
$m(I(s0^{(1)} = 0) \times I(s0^{(2)} = -1))$	0.016	281.070	0.009
$m(I(s0^{(1)} = 1) \times I(s0^{(2)} = 1))$	0.242	82.375	0.299
$m(I(s0^{(1)} = 0) \times I(s0^{(2)} = 0))$	0.026	224.966	0.015
$m(w0^{(1)} \times w0^{(2)} \times I(s0^{(1)} = 1) \times I(s0^{(2)} = 1))$	61.499	0.227	65.615
$m(w0^{(1)} \times w0^{(2)} \times I(s0^{(1)} = 1) \times I(s0^{(2)} = 0))$	84.625	0.219	78.636
$m(w0^{(1)} \times w0^{(2)} \times I(s0^{(1)} = 0) \times I(s0^{(2)} = 1))$	39.725	0.268	39.631
$m(w0^{(1)} \times w0^{(2)} \times I(s0^{(1)} = 0) \times I(s0^{(2)} = 0))$	3.105	1.462	2.857

Note: The function *m* represents the mean, the function *sd* represents the standard deviation, and the function *I* is the indicator function that equals 1 if the argument is true. The variable definitions are as follows: *{s0, w0, e0}* are the labor market state (equal to 1 if at an insured job, 0 if at an uninsured job, and -1 if unemployed), hourly wage rate, and employer number at the initial observation, *{s1, w1, e1 }* are the labor market state, hourly wage rate, and employer number at the subsequent observation. In the bottom panel the superscipt *(1)* refers to husbands and the superscript *(2)* refers to wives.