An Equilibrium Model of Health Insurance Provision and Wage Determination

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Abstract

We investigate the effect of employer-provided health insurance on job mobility rates and economic welfare. Our analysis is based on an equilibrium model of search, matching, and bargaining in a stationary environment that produces a unique distribution of wage-health insurance provision pairs. The model has implications for labor market dynamics not at odds with empirical evidence. In particular, the model implies that not all jobs will provide health insurance and that the provision of health insurance and wage levels are positively associated. Using data from the 1990 to 1993 panels of the Survey of Income and Program Participation, we find that jobs that do provide health insurance last almost three times longer than jobs that do not. While this implies that the mobility rate for jobs without insurance is significantly higher than the mobility rate for jobs with insurance, this difference is welfare enhancing since jobs with health insurance are more productive jobs. Furthermore, simulations reveal that decreases in the health insurance premium paid by employers increase the steady state health insurance coverage rate, the unemployment rate, and the mean level of productivity in the economy.

1 Introduction

In the United States, health insurance is most often received through one's employer. According to U.S. Census Bureau statistics, almost 85% of Americans with private health insurance gain their coverage through the labor market. This strong link between the labor market and health insurance has generated a great deal of interest from economists and policy analysts. One particular vein of research studies the connection between employer-provided health insurance and job mobility. Individuals with high demand for health insurance (e.g. those with pre-existing medical conditions, large families, pregnant wives, etc.) may remain in jobs for fear of losing their coverage. It is claimed that if the wages paid in uninsured jobs are not high enough to offset the expected benefit associated with maintaining their employer-provided health insurance, these employees will be 'locked' into their current jobs. While a number of empirical studies address this issue, for example, Madrian (1994), Buchmueller and Valletta (1996), Kapur (1998), Anderson (1998), and Gilleskie and Lutz (1999), the subsequent welfare implications of the potential reduction in job mobility have largely been ignored.

In this paper we develop an equilibrium model of the labor market in which these types of welfare issues can be explicitly analyzed. The model assumes that unemployed individuals always search for employment and that when a worker and a firm match they bargain over the surplus of the match. In contrast to standard matching with bargaining models, we allow employee compensation to vary over both wages and health insurance coverage. Furthermore, we assume that health insurance is productivity enhancing in that it stochastically extends the duration of the worker-firm match. Based on this simple assumption, we are able to derive a number of implications that coincide with empirical observation. Namely, not all jobs provide health insurance coverage and jobs that do provide health insurance tend to pay higher wages.[1]

Using data from the 1990 to 1993 panels of the Survey of Income and Program Participation (SIPP), we find that our key assumption is satisfied. In particular, jobs that provide health insurance last, on average, almost three times longer than jobs do not. Estimation of the model yields an

[1] This last prediction cannot be produced if health insurance is only a form of compensation; in such a case, holding productivity constant, wage levels and health insurance provision are negatively related. The key to deriving a positive association between the two is to allow the value of the match to be enhanced by health insurance provision in some manner.

implied steady state health insurance coverage rate of 46 percent and an unemployment rate around 16 percent. These rates compare to a 49 percent health insurance coverage rate and a 19 percent unemployment rate observed in the data.

The remainder of the paper proceeds as follows. In the next section, we first present a search model with matching and bargaining that does not allow employer-provided health insurance. We then extend the model to allow the provision of health insurance. In this context we consider two cases which differ in terms of whether or not on-the-job (OTJ) search is allowed. Section 3 discusses the data used to estimate the equilibrium model and in Section 4 we consider issues related to the estimation of the model. Section 5 presents our preliminary empirical results and some policy simulations examining the impact of changing health insurance costs on labor market outcomes. Section 6 contains a brief conclusion.

2 A Model of Health Insurance and Wage Determination

In this section we describe the behavioral model of labor market search with matching and bargaining. The model is formulated in continuous time and assumes stationarity of the labor market environment. In the first subsection, we derive the decision rules for terminating search and for dividing the match value between worker and firm when health insurance is not an option. In the second subsection, we describe the manner in which we introduce health insurance options into the model. To focus on essential ideas, we initially rule out the possibility of on-the-job search. In this case, it is possible to characterize the impact of health insurance costs on labor market outcomes in a relatively striaghtforward manner. However, given the large number of job-to-job transitions in our data, such an assumption is clearly counterfactual. Therefore, in the third subsection we generalize the model to allow for meetings between employed individuals and new potential employers.

Throughout we assume that there exists an invariant, technologically-determined distribution of worker-firm productivity levels which is given by $G(\theta)$. All individuals begin their lives in the nonemployment state, and we assume that it is optimal for them to search. The instantaneous utility flow in the nonemployment state is b, which can be positive or negative. When a potential employee and a firm meet, which happens at rate λ if the individual is currently unemployed and at rate λ_e if she is currently employed

[$\lambda_e = 0$ in the model which does not allow for OTJ and $\lambda_e > 0$ when OTJ is allowed], the productive value of the match (θ) is immediately observed by both the applicant and the firm. At this point a division of the match value is proposed using a Nash Bargaining framework. All employment contracts terminate exogenously at a rate η. In the model without OTJ search, this is the only manner in which a job can end. In the model which allows for OTJ, a job can end either for 'exogenous' reasons or because a better quality match is located.

2.1 Labor Market Decisions without Health Insurance

We assume that the only factor of production is labor, and that total output of the firm is simply the sum of the productivity levels of all of its employees. Then if the firm "passes" on the applicant - that is, does not make an employment offer - its "disagreement" outcome is 0 [it earns no revenue but makes no wage payment]. The applicant's disagreement value is the value of continued search, which we denote V_n. For any given value of V_n there exists a corresponding critical "match" value $\theta^* = \rho V_n$, which has the property that all matches with values greater than θ^* will result in employment while all those matches of lower value will not. For any $\theta \geq \theta^*$, the wage offer is given by

$$w\left(\theta, V_n\right) = \arg\max_w \left\{V_e(w) - V_n\right\}^\alpha \left\{\frac{\theta - w}{\rho + \eta}\right\}^{1-\alpha}, \qquad (1)$$

where without loss of generality it has been assumed that the firm shares the employee's effective rate of discount, $\rho + \eta$.

The value of employment at a wage of w is easily determined. Consider an infinitesimally small period of time Δt. Over this "period," either the individual will continue to be employed at wage w or s/he will lose their job. Job loss occurs at rate η. Then

$$V_e\left(w\right) = \frac{w\Delta t}{1 + \rho\Delta t} + \frac{1}{1 + \rho\Delta t}\left[\eta\Delta t\, V_n + \left(1 - \eta\Delta t\right) V_e(w)\right] + \frac{o(\Delta t)}{1 + \rho\Delta t}, \qquad (2)$$

where the term $(1 + \rho\Delta t)^{-1}$is an "infinitesimal" discount factor associated with the small interval Δt, $\eta\Delta t$ is the approximate probability of being terminated from one's current employment by the end of Δt, V_n is the value of being nonemployed, and $o\left(\Delta t\right)$ is a term which has the property that $\lim_{\Delta t \to 0}\left(o\left(\Delta t\right)/\Delta t\right) = 0$. Note that the first term on the right hand side of [2] is the value of the wage payment over the interval, which is the total payment $w\Delta t$ multiplied by the "instantaneous" discount factor [think of the payment as being received at the end of the interval Δt]. After collecting terms and taking the limit of [2] as $\Delta t \to 0$, we have

$$V_e(w) = \frac{w + \eta V_n}{\rho + \eta}. \tag{3}$$

We now substitute [3] into [1] so as to simplify the problem as follows:

$$\begin{aligned} V_e(w) - V_n &= \frac{w + \eta V_n}{\rho + \eta} - V_n \\ &= \frac{w - \rho V_n}{\rho + \eta}, \end{aligned}$$

so that

$$\begin{aligned} w(\theta, V_n) &= \arg\max_w \, [w - \rho V_n]^{\alpha} [\theta - w]^{1-\alpha} \\ &= \alpha\theta + (1-\alpha)\rho V_n. \end{aligned} \tag{4}$$

We can now move onto computing the value of nonemployment. Using the same setup as above for defining the value of employment, we begin with the $\Delta t-$period formulation which is

$$\begin{aligned} V_n = \frac{b\Delta t}{1+\rho\Delta t} + \frac{1}{1+\rho\Delta t}\{\lambda\Delta t \int \max[V_n, V_e(w(\theta, V_n))] \, dG(\theta) \\ + (1 - \lambda\Delta t) \, V_n\} + o(\Delta t), \end{aligned} \tag{5}$$

where $\lambda\Delta t$ is the approximate probability of encountering one potential employer over the interval. Rearranging and taking limits, we have

$$\rho V_n = b + \lambda \int_{\rho V_n} [V_e(w(\theta, V_n)) - V_n] \, dG(\theta).$$

Since

$$\begin{aligned} V_e(w(\theta, V_n)) &= \frac{\alpha\theta + (1-\alpha)\rho V_n + \eta V_n}{\rho + \eta} \\ &= \frac{\alpha\theta - \alpha\rho V_n}{\rho + \eta} + V_n, \end{aligned}$$

we have

$$V_e(w(\theta, V_n)) - V_n = \frac{\alpha\theta - \alpha\rho V_n}{\rho + \eta}.$$

Then the final (implicit) expression for the value of search is

$$\rho V_n = b + \frac{\alpha\lambda}{\rho+\eta}\int_{\rho V_n}[\theta - \rho V_n]\ dG(\theta). \tag{6}$$

Note that this expression is identical to the expression for the reservation value in a model with no bargaining when θ is the payment to the individual except for the presence of the factor α. This is not unexpected, since when $\alpha = 1$, the entire match value is transferred to the worker, and thus search over θ is the same as search over w.

Now we can summarize the important properties of the model. The critical "match" value θ^* is equal to ρV_n, which is defined by [6]. Since at this match value the wage payment is equal to $w^* = w(\theta^*, V_n) = \alpha\theta^* + (1-\alpha)\theta^* = \theta^*$, the reservation wage is identical to the reservation match value. Then the probability that a random encounter generates an acceptable match is given by $\tilde{G}(\theta^*)$, where $\tilde{G}$ denotes the survivor function. The rate of leaving unemployment is $\lambda\tilde{G}(\theta^*)$. As we can see from [6], since θ^* is a decreasing function of α, rates of unemployment are higher when searchers have more bargaining power.

The observed wage density is a simple mapping from the matching density. Since

$$\begin{aligned} w(\theta, V_n) &= \alpha\theta + (1-\alpha)\theta^* \\ \Rightarrow \tilde{\theta}(w, V_n) &= \frac{w - (1-\alpha)\theta^*}{\alpha}, \end{aligned} \tag{7}$$

then the density function of observed wages is given by

$$h(w) = \begin{cases} \frac{\alpha^{-1} g\left(\tilde{\theta}(w,V_n)\right)}{\tilde{G}(\theta^*)} & w \geq \theta^* \\ 0 & w < \theta^* \end{cases}. \tag{8}$$

2.2 Bargaining with Health Insurance

2.2.1 No OTJ Search

The demand for health insurance is admittedly difficult to model. In this section we provide a very simple rationale for *both* firms and workers to demand health insurance *conditional on the value of the match*. In the previous section, we took the exogeneous rate of match dissolutions to be determined outside the model; we now allow the worker-firm pair to alter this dissolution rate through the purchase of health insurance for the worker. We take the rate of dissolution of the match to partially be determined by the health status of the worker; health insurance increases the worker's utilization rate of medical services and increases her general health status. The instantaneous health insurance premium is equal to ϕ. If purchased, the match dissolution rate decreases from η_0, the rate without insurance, to η_1. Thus matches with health insurance are, on average, longer than matches without health insurance.

The value of the Nash bargaining objective function is given by

$$S\left(w,d;\theta,V_n\right)=\left\{V_e(w,d)-V_n\right\}^{\alpha}\left\{\frac{\theta-w-d\phi}{\rho+d\eta_1+(1-d)\eta_0}\right\}^{1-\alpha}, \tag{9}$$

given any wage w and health insurance provision choice d, where d is equal to 1 when health insurance is purchased and otherwise is equal to 0. Then the solution to the problem is given by

$$\left(w^*,d^*\right)\left(\theta,V_n\right)=\arg\max_{w,d}S\left(w,d;\theta,V_n\right).$$

Solving for the equilibrium contract value is most easily accomplished by first solving for an optimal w given a θ, V_n, and health insurance status d, for both cases $d=0$ and $d=1$. That is, let

$$\hat{w}\left(\delta,\theta,V_n\right)=\arg\max_{w}S\left(w,d=\delta;\theta,V_n\right),\ \delta=0,1,$$

and

$$\hat{S}\left(\delta,\theta,V_n\right)=S\left(\hat{w}\left(\delta,\theta,V_n\right),\delta;\theta,V_n\right),$$

so that $\hat{w}\left(\delta,\theta,V_n\right)$ is the optimal wage offer given health insurance status δ and $\hat{S}\left(\delta,\theta,V_n\right)$ is the maximum value of the Nash bargaining problem given health insurance status δ. Define the difference between the optimal value of the problem given insurance and the optimal value without insurance by

$$Q\left(\theta,V_n\right)=\hat{S}\left(1,\theta,V_n\right)-\hat{S}\left(0,\theta,V_n\right)$$

The optimal contract is then given by

$$\left(w^*,d^*\right)\left(\theta,V_n\right)=\begin{cases}\left(\hat{w}\left(0,\theta,V_n\right),0\right) & \Leftrightarrow \quad Q\left(\theta,\rho V_n\right)<0\\ \left(\hat{w}\left(1,\theta,V_n\right),1\right) & \Leftrightarrow \quad Q\left(\theta,\rho V_n\right)\geq 0\end{cases}.$$

The solution to the problem is both relatively easy to derive and intuitive. Conditioning on θ, V_n, and a health insurance status of $d=0$, we have

$$\hat{w}\left(0,\theta,V_n\right)=\alpha\theta+(1-\alpha)\,\rho V_n, \tag{10}$$

so that

$$
\begin{aligned}
\hat{S}\left(0,\theta,V_n\right) &= \left(\frac{\alpha\theta+\left(1-\alpha\right)\rho V_n-\rho V_n}{\rho+\eta_0}\right)^{\alpha}\left(\frac{\theta-\alpha\theta-\left(1-\alpha\right)\rho V_n}{\rho+\eta_0}\right)^{1-\alpha} \\
&= \left(\frac{\alpha\left(\theta-\rho V_n\right)}{\rho+\eta_0}\right)^{\alpha}\left(\frac{\left(1-\alpha\right)\left(\theta-\rho V_n\right)}{\rho+\eta_0}\right)^{1-\alpha} \\
&= \frac{\alpha^{\alpha}\left(1-\alpha\right)^{1-\alpha}}{\rho+\eta_0}\left(\theta-\rho V_n\right).
\end{aligned}
$$

Similarly, with health insurance with an instantaneous premium of ϕ, we have

$$
\hat{w}\left(1,\theta,V_n\right)=\alpha\left(\theta-\phi\right)+\left(1-\alpha\right)\rho V_n \tag{11}
$$

so that

$$
\begin{aligned}
\hat{S}(1,\theta,V_n) &= \left(\frac{\alpha(\theta-\phi)+(1-\alpha)\rho V_n-\rho V_n}{\rho+\eta_1}\right)^{\alpha}\times \\
&\quad \left(\frac{\theta-\alpha\left(\theta-\phi\right)-\left(1-\alpha\right)\rho V_n-\phi}{\rho+\eta_1}\right)^{1-\alpha} \\
&= \left(\frac{\alpha\left(\theta-\phi-\rho V_n\right)}{\rho+\eta_1}\right)^{\alpha}\left(\frac{\left(1-\alpha\right)\left(\theta-\phi-\rho V_n\right)}{\rho+\eta_1}\right)^{1-\alpha} \\
&= \frac{\alpha^{\alpha}\left(1-\alpha\right)^{1-\alpha}}{\rho+\eta_1}\left(\theta-\phi-\rho V_n\right).
\end{aligned}
$$

Now note that

$$
\begin{aligned}
Q\left(\theta,V_n\right) &= \alpha^{\alpha}\left(1-\alpha\right)^{1-\alpha}\left(\frac{\left(\theta-\phi-\rho V_n\right)}{\rho+\eta_1}-\frac{\left(\theta-\rho V_n\right)}{\rho+\eta_0}\right) \\
&= \frac{\alpha^{\alpha}\left(1-\alpha\right)^{1-\alpha}}{\left(\rho+\eta_1\right)\left(\rho+\eta_0\right)}\left[\left(\eta_0-\eta_1\right)\left(\theta-\rho V_n\right)-\left(\rho+\eta_0\right)\phi\right].
\end{aligned}
$$

Since $\eta_0-\eta_1>0$, $\partial Q\left(\theta,V_n\right)/\partial\theta>0$. Therefore there exists a unique critical value θ^{**} such that

$$
\begin{aligned}
0 &= Q\left(\theta^{**},V_n\right) \\
\Rightarrow \theta^{**} &= \rho V_n+\frac{\rho+\eta_0}{\eta_0-\eta_1}\phi \\
&= \theta^{*}+\frac{\rho+\eta_0}{\eta_0-\eta_1}\phi \qquad (12) \\
&> \theta^{*}.
\end{aligned}
$$

Hence, given a value of V_n, any match value of $\theta \geq \theta^*$ will be acceptable. An acceptable match value $\theta \in [\theta^*, \theta^{**})$ will result in a job without health insurance, while a job with $\theta \in [\theta^{**}, \infty)$ will carry health insurance.

The final task is to characterize the value of search V_n. After a bit of manipulation, we can write the steady state value of nonemployment in this case as

$$\begin{aligned} \rho V_n &= b + \alpha\lambda\{(\rho+\eta_0)^{-1}\int_{\rho V_n}^{\rho V_n + \frac{\rho+\eta_0}{\eta_0-\eta_1}\phi} (\theta - \rho V_n)\ dG(\theta) \\ &\quad + (\rho+\eta_1)^{-1}\int_{\rho V_n + \frac{\rho+\eta_0}{\eta_0-\eta_1}\phi}^{\infty} (\theta - \phi - \rho V_n)\ dG(\theta)\}. \end{aligned}$$

With this value of V_n, the specification of the health insurance problem is complete.

The distribution of accepted wage-health insurance pairs is defined as follows. Given that $\theta \geq \theta^{**}$, the wage density is

$$m(w \mid d=1) = \begin{cases} \frac{\alpha^{-1} g\left(\frac{w-(1-\alpha)\theta^*}{\alpha}+\phi\right)}{\tilde{G}(\theta^{**})} & w \geq w_1^{\min} \\ 0 & w < w_1^{\min} \end{cases} \tag{13}$$

where $w_1^{\min} = \theta^* + \alpha\left(\frac{\rho+\eta_1}{\eta_0-\eta_1}\right)\phi$ represents the minimum wage for a job that provides health insurance. The conditional density of wages given no health insurance is

$$m(w \mid d=0) = \begin{cases} \frac{\alpha^{-1} g\left(\frac{w-(1-\alpha)\theta^*}{\alpha}\right)}{\tilde{G}(\theta^*)-\tilde{G}(\theta^{**})} & w \in \left[w_0^{\min}, w_0^{\max}\right] \\ 0 & w \notin \left[w_0^{\min}, w_0^{\max}\right] \end{cases} \tag{14}$$

where $w_0^{\min} = \theta^*$ and $w_0^{\max} = \theta^* + \alpha\left(\frac{\rho+\eta_0}{\eta_0-\eta_1}\right)\phi$. The wage $w_0^{\min}$ is the minimum wage at jobs without health insurance, while $w_0^{\max}$ equals the maximum possible wage at an uninsured job. Since the probability of having health insurance given an acceptable match value is

$$p(d=1) = \frac{\tilde{G}(\theta^{**})}{\tilde{G}(\theta^*)}, \tag{15}$$

the unconditional (w, d) distribution is

$$m(w,d) = \begin{cases} \frac{\alpha^{-1}}{\tilde{G}(\theta^*)} g\left(\frac{w-(1-\alpha)\theta^*}{\alpha}\right) & w \in \left[w_0^{\min}, w_1^{\min}\right), d = 0 \\ \frac{\alpha^{-1}}{\tilde{G}(\theta^*)} g\left(\frac{w-(1-\alpha)\theta^*}{\alpha}\right)^{(1-d)} g\left(\frac{w-(1-\alpha)\theta^*}{\alpha} + \phi\right)^{d} & w \in \left[w_1^{\min}, w_0^{\max}\right) \\ \frac{\alpha^{-1}}{\tilde{G}(\theta^*)} g\left(\frac{w-(1-\alpha)\theta^*}{\alpha} + \phi\right) & w \geq w_0^{\max}, d = 1 \\ 0 & otherwise \end{cases}$$

Note that since $\eta_0 - \eta_1 > 0$, then $w_0^{\max} > w_1^{\min}$ so that there exists an interval of wages that both jobs with and without health insurance will pay even though there exists a unique match value, θ^{**}, that determines whether the health insurance will be provided or not.[2] Furthermore, the marginal wage density is then

$$m(w) = \begin{cases} \frac{\alpha^{-1}}{\tilde{G}(\theta^*)} g\left(\frac{w-(1-\alpha)\theta^*}{\alpha}\right) & w \in \left[w_0^{\min}, w_1^{\min}\right) \\ \frac{\alpha^{-1}}{\tilde{G}(\theta^*)} \left(g\left(\frac{w-(1-\alpha)\theta^*}{\alpha}\right) + g\left(\frac{w-(1-\alpha)\theta^*}{\alpha} + \phi\right)\right) & w \in \left[w_1^{\min}, w_0^{\max}\right) \\ \frac{\alpha^{-1}}{\tilde{G}(\theta^*)} g\left(\frac{w-(1-\alpha)\theta^*}{\alpha} + \phi\right) & w \geq w_0^{\max} \\ 0 & otherwise \end{cases}$$

Figures 1 through 3 graphically represent the implications of the model discussed above. Figure 1 depicts the productivity density, $G(\theta)$, and the critical productivity levels, θ^* and θ^{**}. The distribution can be divided into three unique sections. The first section represents the matches that do not result in a job. The second section contains the productivity matches that result in jobs that do not provide health insurance. That is, any match with a productivity level $\theta \in [\theta^*, \theta^{**})$ will not provide insurance. Any match with a productivity level greater than θ^{**} will result in an insured job. The third section represents these matches.

Figure 2 depicts the two conditional wage densities, $m(w \mid d = 1)$ and $m(w \mid d = 0)$. This graph highlights the strong theoretical implications

[2]The overlap is produced by a compensating differentials phenomenon. When purchasing health insurance, the firm and employee essentially split the costs in proportion to their bargaining power. An employee at a job with a match value slightly greater than θ^{**} will in general have a lower wage than will an employed individual at a job with a match value slightly less than θ^{**}. However, the value of the employment contract will be higher in the first case because the expected duration of the job will be longer due to the health insurance coverage.

that govern the wage densities. Namely, uninsured jobs will never pay a wage greater than $w_0^{\max}$ and insured jobs will never pay a wage less than $w_1^{\min}$. Figure 3 represents the unconditional wage density, $m(w)$. The key features of the unconditional wage density are the discontinuities at the critical wages, $w_1^{\min}$ and $w_0^{\max}$. As stated above, both jobs that provide health insurance coverage and jobs that do not provide coverage will pay wages in the interval $\left[w_1^{\min}, w_0^{\max}\right)$. Whereas, a job that pays a wage $w < w_1^{\min}$ is necessarily an uninsured job. Likewise, a job that pays a wage $w \geq w_0^{\max}$ must provide health insurance.

2.2.2 Comparative Statics

In the following subsection, we derive comparative static results for a number of important characteristics of the labor market. In particular, we are especially interested in the probability that a job includes health insurance, $p(d=1)$, the steady state unemployment rate, denoted u, and the steady state health insurance coverage rate, denoted h. The theoretical model developed in the previous subsection reveals that the equilibrium wage and health insurance distribution relies on the critical productivity levels, θ^* and θ^{**}. Hence, the following proposition establishes the relationship between the critical productivity levels and the cost of providing health insurance, ϕ. We focus on the relationship between the equilibrium wage-health insurance distribution and the cost of providing health insurance since any policy aimed at increasing the incidence of health insurance coverage will attempt to change the health insurance premium [at least within the confines of our modeling framework].

Proposition 1. $\frac{\partial\theta^*}{\partial\phi} < 0$ and $\frac{\partial\theta^{**}}{\partial\phi} > 0$.

Proof. Define the implicit function

$$T(\theta^*, \phi) = R(\theta^*, \phi) - \theta^* = 0$$

where

$$\begin{aligned} R(\theta^*, \phi) &= b + \alpha\lambda\{(\rho+\eta_0)^{-1}\int_{\theta^*}^{\theta^*+\frac{\rho+\eta_0}{\eta_0-\eta_1}\phi}(\theta-\theta^*)\,dG(\theta) \\ &\quad + (\rho+\eta_1)^{-1}\int_{\theta^*+\frac{\rho+\eta_0}{\eta_0-\eta_1}\phi}^{\infty}(\theta-\phi-\theta^*)\,dG(\theta)\} \end{aligned}$$

By the implicit function theorem, the partial derivative of θ^* with respect to ϕ equals

$$\frac{\partial\theta^*}{\partial\phi} = -\frac{\frac{\partial T(\theta^*,\phi)}{\partial\phi}}{\frac{\partial T(\theta^*,\phi)}{\partial\theta^*}} = -\frac{T_\phi}{T_{\theta^*}}. \tag{16}$$

Then we have

$$\begin{aligned}\frac{\partial R}{\partial\theta^*} &= -\alpha\lambda\left\{\frac{G\left(\theta^* + \frac{\rho+\eta_0}{\eta_0-\eta_1}\phi\right) - G(\theta^*)}{\rho+\eta_0} + \frac{1 - G\left(\theta^* + \frac{\rho+\eta_0}{\eta_0-\eta_1}\phi\right)}{\rho+\eta_1}\right\} \\ &\Rightarrow\ T_{\theta^*} < 0\end{aligned}$$

The derivative of T with respect to ϕ is

$$T_\phi = -\alpha\lambda\left\{\frac{1 - G\left(\theta^* + \frac{\rho+\eta_0}{\eta_0-\eta_1}\phi\right)}{\rho+\eta_1}\right\} < 0$$

By equation [16], we find that $\frac{\partial\theta^*}{\partial\phi} < 0$. Next, we know that the critical productivity levels are linked according to the equation

$$\theta^{**} = \theta^* + \frac{\rho+\eta_0}{\eta_0-\eta_1}\phi.$$

Hence, we have

$$\frac{\partial\theta^{**}}{\partial\phi} = \frac{\partial\theta^*}{\partial\phi} + \frac{\rho+\eta_0}{\eta_0-\eta_1}$$

Since $\frac{\partial\theta^*}{\partial\phi} \in (-1,0)$ and $\frac{\rho+\eta_0}{\eta_0-\eta_1} \geq 1$, then $\frac{\partial\theta^{**}}{\partial\phi} > 0$.■

Therefore, as the health insurance premium decreases, the critical productivity level that results in a job increases. This implies that as the premium decreases, the probability that a worker-firm match results in a job, $\widetilde{G}(\theta^*)$, also decreases. Thus, the mean time spent in unemployment will increase as the health insurance premium decreases. We can now derive the comparative static of the probability that a job includes health insurance, $p(d=1)$ with respect to ϕ. In addition, the next proposition shows how changes in the health insurance premium affect the steady state unemployment and health insurance coverage rates. We define these rates as

$$\begin{aligned}u &= \frac{\frac{1}{\lambda\widetilde{G}(\theta^*)}}{\frac{1}{\lambda\widetilde{G}(\theta^*)} + \frac{p(d=1)}{\eta_1} + \frac{1-p(d=1)}{\eta_0}} \\ h &= \frac{\frac{p(d=1)}{\eta_1}}{\frac{1}{\lambda\widetilde{G}(\theta^*)} + \frac{p(d=1)}{\eta_1} + \frac{1-p(d=1)}{\eta_0}}\end{aligned}$$

such that u (h) equals the expected time spent in unemployment (in a job with health insurance) relative to the expected time spent in the labor market.

Proposition 2. The economic indicators are related to the health insurance premium as follows: (a) $\frac{\partial p(d=1)}{\partial \phi} < 0$, (b) $\frac{\partial u}{\partial \phi}$ cannot be unambiguously signed and (c) $\frac{\partial h}{\partial \phi} < 0$.

Proof. Given the equation, $p(d=1) = \frac{\tilde{G}(\theta^{**})}{\tilde{G}(\theta^{*})}$, we have

$$\frac{\partial p(d=1)}{\partial \phi} = \frac{1}{\widetilde{G}(\theta^{*})}\left\{\frac{\widetilde{G}(\theta^{**})}{\widetilde{G}(\theta^{*})} g(\theta^{*}) \frac{\partial \theta^{*}}{\partial \phi} - g(\theta^{**}) \frac{\partial \theta^{**}}{\partial \phi}\right\}.$$

Since $\frac{\partial \theta^{*}}{\partial \phi} < 0$ and $\frac{\partial \theta^{**}}{\partial \phi} > 0$, we know $\frac{\partial p(d=1)}{\partial \phi} < 0$.

Next, rewrite u as

$$u = \left(1 + \frac{\lambda \widetilde{G}(\theta^{**})}{\eta_1} + \frac{\lambda\left[\widetilde{G}(\theta^{*}) - \widetilde{G}(\theta^{**})\right]}{\eta_0}\right)^{-1}$$

Differentiating with respect to ϕ yields

$$\begin{aligned}\frac{\partial u}{\partial \phi} \quad &= \quad -\left(1 + \frac{\lambda \widetilde{G}(\theta^{**})}{\eta_1} + \frac{\lambda\left[\widetilde{G}(\theta^{*}) - \widetilde{G}(\theta^{**})\right]}{\eta_0}\right)^{-2} \times \\ &\left(\left(\frac{\lambda}{\eta_0} - \frac{\lambda}{\eta_1}\right) g(\theta^{**}) \frac{\partial \theta^{**}}{\partial \phi} - \frac{\lambda}{\eta_0} g(\theta^{*}) \frac{\partial \theta^{*}}{\partial \phi}\right)\end{aligned}$$

Since $\eta_0 > \eta_1$, we know $\left(\frac{\lambda}{\eta_0} - \frac{\lambda}{\eta_1}\right) < 0$. Since $\frac{\partial \theta^{**}}{\partial \phi} > 0$ and $\frac{\partial \theta^{*}}{\partial \phi} < 0$, the sign of $\frac{\partial u}{\partial \phi}$ depends on all of the parameters of the model (as they effect both θ^{*} and θ^{**}) and the productivity density function, $g(\theta)$.

In terms of the steady state health insurance coverage rate, we can rewrite h as

$$h = \left(\frac{\eta_0 - \eta_1}{\eta_0} + \frac{\eta_1}{\lambda \widetilde{G}(\theta^{**})} + \frac{\eta_1 \widetilde{G}(\theta^{*})}{\eta_0 \widetilde{G}(\theta^{**})}\right)^{-1}$$

Differentiating h with respect to ϕ gives us

$$\frac{\partial h}{\partial \phi} = -\left(\frac{\eta_0 - \eta_1}{\eta_0} + \frac{\eta_1}{\lambda \widetilde{G}(\theta^{**})} + \frac{\eta_1 \widetilde{G}(\theta^*)}{\eta_0 \widetilde{G}(\theta^{**})}\right)^{-2} \times$$
$$\left(\frac{\eta_1 g(\theta^{**})}{\lambda \left(\widetilde{G}(\theta^{**})\right)^2} \frac{\partial \theta^{**}}{\partial \phi} + \frac{\eta_1 \widetilde{G}(\theta^*) g(\theta^{**})}{\eta_0 \left(\widetilde{G}(\theta^{**})\right)^2} \frac{\partial \theta^{**}}{\partial \phi} - \frac{\eta_1 g(\theta^*)}{\eta_0 \widetilde{G}(\theta^{**})} \frac{\partial \theta^*}{\partial \phi}\right)$$

Since $\frac{\partial \theta^{**}}{\partial \phi} > 0$ and $\frac{\partial \theta^*}{\partial \phi} < 0$, the second expression in parentheses is always positive. Hence, $\frac{\partial h}{\partial \phi} < 0.$■

Thus, Proposition 2 establishes the fact that as the health insurance premium decreases, the probability that a worker-firm match that results in a job provides health insurance coverage increases. In addition, this proposition highlights the fact that while a decrease in the health insurance premium faced by employers unambiguously increases the steady state health insurance coverage rate, the unemployment rate may increase or decrease. Table 1 further highlights these results.[3]

From the first experiment, we see that a 50 percent decrease in the health insurance premium results in an increase in θ^*, a decrease in θ^{**}, a increase in $p(d=1)$ of slightly over 20 percent, and a 2 percent increase in h. In addition, the unemployment rate decreases by 1 percent. On the other hand, the 50 percent decrease in the second experiment yields a 42 percent increase in $p(d=1)$, a 17 percent increase in the health insurance coverage rate, and a slightly more than 1 percent increase in the unemployment rate. These results of these experiments illustrate the following two points. First, even when we can derive unambiguous comparative static results, the magnitude of the changes may be quite different for similar decreases in the health insurance premium in different labor market environments. Second, since we do not know how the unemployment rate responds to changes in the health insurance premium, it is necessary to estimate the underlying economic parameters in order to determine the direction of the change.

[3]These simulations are based on the following assumptions. The productivity distribution $G(\theta)$ is log normal with parameters, $\mu_\theta = 1.5705$ and $\sigma_\theta = 0.8641$. The worker-firm match rate $\lambda = 0.05$ and the discount rate $\rho = 0.05$. Experiment 1 sets $\eta_0 = 0.09$, $\eta_1 = 0.003$, $\alpha = 0.75$, $b = -1.5$, while experiment 2 sets $\eta_0 = 0.009$, $\eta_1 = 0.003$, $\alpha = 0.5$, $b = -7.5$.

2.2.3 The Model with On-the-Job Search

In the previous subsection we assumed that there was no contact between employed individuals and new potential employers. Given the large number of job-to-job transitions in our data, such an assumption is clearly counterfactual. In this subsection we generalize the model to allow for such meetings, which are assumed to occur at the exogenously-determined rate λ_e. By fixing the rate of arrival of meetings, we have made the rate independent of the individual's current match value and their current contract as characterized by their wage and health insurance coverage status. For simplicity, we assume that on-the-job search is costless.

As was assumed in the case of nonemployed search, when a currently-employed individual meets a new potential employer, both sides immediately observe the value of the (new) potential match θ'. Whether or not the individual leaves the old firm for the new one and the nature of the new employment contract given that there is one depend critically on the information sets of the old and new firm and the nature of the bargaining process. We assume that (1) the individual knows the value of θ and θ'; (2) the current employer knows θ but not θ'; and (3) the potential employer knows θ' but not θ. Each firms is assumed to make a series of credible and binding wage and health insurance provision offers to the employee that can be communicated to the other firm. The bargaining process ends when one firm drops out of the bidding, which will occur when the rents from employing the worker to that firm reach zero. As long as the offers made through the bargaining process are unique mappings from the match value at the current firm and the best offer currently on the table from its competitor, then in the end of the process the match values of each firm will be revealed. The sequential bargaining process and gradual revelation of information serves to insure that the firm with the "dominated" match value doesn't drop out of the competition too quickly.

Let us introduce a bit of notation before proceeding. For an employed agent, we denote their current labor market state by (θ, w, d) and any potential new state by (θ', w', d'). When an individual is unemployed for purposes of defining the equilibrium wage and health insurance provision functions we will say that their current match value is θ^*, which is that value of θ required for an unemployed searcher and a firm to initiate an employment contract. We start by considering the rent division problem facing a currently employed agent who encounters a new potential employer.

Say that a currently employed agent with current contract given by (θ, w, d), $\theta \geq \theta^*$, meets a new potential employment match with value θ'.

We assume that the potential match will only be reported to the current employer if the employee has an incentive to do so. One situation in which this will clearly be the case is when $\theta' > \theta$. When this occurs, we assume that the bargaining process is characterized by a sequence of bids, by the current and potential employer, for the individual's services. The bidding stops when all of the rents from the match to one of the firms are exhausted [this is clearly the current employer when $\theta' > \theta$]. How are the bids determined? Let the maximal value of the match θ to the worker be given by $Q(\theta)$. Then the solution to the Nash bargaining problem when $\theta' > \theta$ is given by

$$\begin{aligned} S(\theta', w', d', \theta) &= \{V_e(\theta', w', d') - Q(\theta)\}^{\alpha} \\ &\quad \times V_f(\theta', w', d')^{1-\alpha}, \end{aligned}$$

where $V_f(\theta', w', d')$ denotes the new firm's value of the problem [recall that each firm's threat point is assumed to be zero]. For the moment, we will simply posit the existence of a employment contract outcome that is a function of the highest and the next best match value; if these values are θ and $\tilde{\theta}$, respectively, then the wage function is $w(\theta, \tilde{\theta})$ and the health insurance provision function is $d(\theta, \tilde{\theta})$. Then the firm's value of the current match situation is defined as follows:

$$\begin{aligned} V_f(\theta, w, d) &= \frac{(\theta - w - d\phi)\Delta t}{1 + \rho\Delta t} + \frac{\eta(d)\Delta t}{1 + \rho\Delta t} \cdot 0 \\ &\quad + \frac{\lambda_e \Delta t}{1 + \rho\Delta t} \int_{\hat{\theta}(w,d)}^{\theta} V_f(\theta, w(\theta, \tilde{\theta}), d(\theta, \tilde{\theta}))\, dG(\tilde{\theta}) \\ &\quad + \frac{\lambda_e \Delta t G(\hat{\theta}(w, d)}{1 + \rho\Delta t} V_f(\theta, w, d) \\ &\quad + \frac{(1 - \lambda_e \Delta t - \eta(d)\Delta t)}{1 + \rho\Delta t} V_f(\theta, w, d) + \frac{o(\Delta t)}{1 + \rho\Delta t}, \end{aligned}$$

where $\hat{\theta}(w, d)$ is defined as the maximum value of θ for which the contract (w, d) would exhaust all the rents. Any encounter with a potential firm in which the match value is less than $\hat{\theta}(w, d)$ will not be reported by the employee. After rearranging terms and taking limits, we have

$$\begin{aligned} V_f(\theta, w, d) &= [\rho + \eta(d) + \lambda_e \tilde{G}(\hat{\theta}(w, d))]^{-1} \\ &\quad \times \{\theta - w - d\phi + \lambda_e \int_{\hat{\theta}(w,d)}^{\theta} V_f(\theta, w(\theta, \tilde{\theta}), d(\theta, \tilde{\theta}))\, dG(\tilde{\theta})\}. \end{aligned}$$

For the employee, the value of employment at a current match value θ and wage and health insurance provision status (w, d) is given by

$$\begin{aligned} V_e(\theta, w, d) &= \frac{w\Delta t}{1+\rho\Delta t} + \frac{\eta(d)\Delta t}{1+\rho\Delta t} V_n \\ &+ \frac{\lambda_e \Delta t}{1+\rho\Delta t} \int_{\hat{\theta}(w,d)}^{\theta} V_e(\theta, w(\theta, \tilde{\theta}), d(\theta, \tilde{\theta}))\, dG(\tilde{\theta}) \\ &+ \frac{\lambda_e \Delta t}{1+\rho\Delta t} \int_{\theta} V_e(\tilde{\theta}, w(\tilde{\theta}, \theta), d(\tilde{\theta}, \theta))\, dG(\tilde{\theta}) \\ &+ \frac{\lambda_e \Delta t G(\hat{\theta}(w,d)}{1+\rho\Delta t} V_f(\theta, w, d) \\ &+ \frac{(1-\lambda_e\Delta t - \eta(d)\Delta t)}{1+\rho\Delta t} V_e(\theta, w, d) + \frac{o(\Delta t)}{1+\rho\Delta t}. \end{aligned}$$

Note that when an employee encounters a firm with a new match value lower than his current one but that is capable of being used to increase the value of his current employment contract [i.e., $\theta > \tilde{\theta} > \hat{\theta}(w, d)$], her new value of employment at the current firm becomes $V_e(\theta, w(\theta, \tilde{\theta}), d(\theta, \tilde{\theta}))$. Instead, when the match value at the newly contacted firm exceeds that of the current firm, mobility follows. The value of the employment at the new firm is given by $V_e(\tilde{\theta}, w(\tilde{\theta}, \theta), d(\tilde{\theta}, \theta))$ - that is, the match value at the current firm becomes the determinant of the "threat point" faced by the new firm and plays a role in the determination of the new wage. Finally, when the match value at the new firm is less than $\hat{\theta}(w, d)$, the contact is not reported to the current firm since it would not result in any improvement in the current contract. Because of this selective reporting, the value of employment contracts must be monotonically increasing both within and across consecutive job spells. Declines can only be observed following a transition into the unemployment state.

After rearranging terms and taking limits, we have

$$\begin{aligned} V_e(\theta, w, d) &= [\rho + \eta(d) + \lambda_e \tilde{G}(\hat{\theta}(w,d))]^{-1} \\ &\times \{w + \eta(d)V_n + \lambda_e \int_{\hat{\theta}(w,d)}^{\theta} V_e(\theta, w(\theta, \tilde{\theta}), d(\theta, \tilde{\theta}))\, dG(\tilde{\theta}) \\ &+ \lambda_e \int_{\theta} V_e(\tilde{\theta}, w(\tilde{\theta}, \theta), d(\tilde{\theta}, \theta))\, dG(\tilde{\theta})\}. \end{aligned}$$

With a new match value of $\theta' > \theta$, the surplus attained by the individual at the new match with respect to the value she could attain at the old match after extracting all the "rents" associated with it is

$$V_e(\theta', w', d') - Q(\theta),$$

where

$$Q(\theta) = V_e(\theta, w^*(\theta), d^*(\theta)),$$

with $(w^*, d^*)(\theta)$ denoting the value of the wage and health insurance if the agent receives all the rents from the match θ. Note that $w^*(\theta) \equiv w(\theta, \theta)$ and $d^*(\theta) \equiv d(\theta, \theta)$. Therefore

$$\begin{aligned} Q(\theta) &= [\rho + \eta(d^*(\theta)) + \lambda_e \tilde{G}(\theta)]^{-1} \\ &\quad \times \{w^*(\theta) + \eta(d^*(\theta))V_n + \lambda_e \int_\theta V_e(\tilde{\theta}, w(\tilde{\theta}, \theta), d(\tilde{\theta}, \theta))\, dG(\tilde{\theta})\}, \end{aligned}$$

where we have used the fact that $\hat{\theta}(w^*(\theta), d^*(\theta)) = \theta$. Thus

$$\begin{aligned} V_e(\theta', w', d') - Q(\theta) &= [\rho + \eta(d') + \lambda_e \tilde{G}(\hat{\theta}(w', d'))]^{-1} \\ &\quad \times \{w' + \eta(d')V_n \\ &\quad + \lambda_e \int_{\hat{\theta}(w',d')}^{\theta'} V_e(\theta', w(\theta', \tilde{\theta}), d(\theta', \tilde{\theta}))\, dG(\tilde{\theta}) \\ &\quad + \lambda_e \int_{\theta'} V_e(\tilde{\theta}, w(\tilde{\theta}, \theta'), d(\tilde{\theta}, \theta'))\, dG(\tilde{\theta})\} \\ &\quad - [\rho + \eta(d^*(\theta)) + \lambda_e \tilde{G}(\theta)]^{-1} \\ &\quad \times \{w^*(\theta) + \eta(d^*(\theta))V_n \\ &\quad + \lambda_e \int_\theta V_e(\tilde{\theta}, w(\tilde{\theta}, \theta), d(\tilde{\theta}, \theta))\, dG(\tilde{\theta})\}. \end{aligned}$$

The model is closed after specifying the value of nonemployment. Passing directly to the steady state representation of this function, we have

$$\begin{aligned} V_n &= [\rho + \lambda_n \tilde{G}(\theta^*)]^{-1} \\ &\quad \times \{b + \lambda_n \int_{\theta^*} V_e(\tilde{\theta}, w(\tilde{\theta}, \theta^*), d(\tilde{\theta}, \theta^*))\, dG(\tilde{\theta})\}, \end{aligned}$$

where θ^* is the critical match value associated with the decision to initiate an employment contract.

When an employed agent meets a new potential employer, the solution to the Nash bargaining problem is given by

$$(w, d)(\theta', \theta) = \arg\max_{w,d} S(\theta', w, d, \theta),$$

and as we have noted above, $(w^*, d^*)(\theta) = (w, d)(\theta, \theta)$. When an unemployed agent meets an acceptable firm, we write the bargaining problem as

$$(w, d)(\theta, \theta^*) = \arg\max_{w,d} S_n(\theta, w, d, \theta^*),$$

where $S_n(\theta, w, d, \theta^*) = (V_e(\theta, w, d) - V_n)^{\alpha} V_f(\theta, w, d)^{1-\alpha}$.

We note that an important characteristic of our model is efficient matching, that is when confronted with a choice between two employers with associated match values θ and θ', the individual always takes employment with the employer associated with the higher match value. This property is an attractive one for an equilibrium model to have, and also adds in reducing the complexity of solving the model. We begin by positing a few characteristics of the equilibrium functions (w, d) which we will later confirm to hold in equilibrium.

Conjecture 1. $d\left(\theta', \theta\right) = 1 \Leftrightarrow \theta' \geq \theta^{**}$.

In words, the decision to provide health insurance is only a function of the current best match value and not of the next-best option. There exists a critical value, here called θ^{**}, which fully characterizes the health insurance provision outcome exactly as was true in the model without OTJ search. The reason for this result is related to the fact that the payoffs for the firm and worker from buying health insurance given current match value θ' are both positive when $\theta' \geq \theta^{**}$, and are both negative when this is not the case.

Given this result, the complete characterization of the equilibrium is considerably simplified. Given knowledge (or a guess) of the critical values θ^* and θ^{**}, we can define the "conditional" Nash bargaining problem by

$$w(\theta', \theta; \theta^*, \theta^{**}) = \arg\max_{w} S(\theta', w, \chi[\theta' \geq \theta^{**}], \theta)$$

for the case of a currently employed searcher and

$$w(\theta', \theta^*; \theta^*, \theta^{**}) = \arg\max_{w} S_n(\theta', w, \chi[\theta' \geq \theta^{**}], \theta^*)$$

for the case of an unemployed searcher. The "boundary condition" associated with the equilibrium wage offer function is

$$w^*(\theta; \theta^*, \theta^{**}) = w(\theta, \theta; \theta^*, \theta^{**})$$

To solve the equilibrium requires that we search over scalars θ^* and θ^{**} and functions $w(\theta', \theta; \theta^*, \theta^{**})$ to solve the fixed point equations implicitly defined by the value functions V_e, V_n, and V_f.

In order to illustrate the theoretical implications of allowing employed individuals to meet new employers, we compute the equilibrium wage functions and the critical productivity matches for the example presented in Section 2.2.1.[4] Figure 4 depicts the productivity density corresponding to this example. As the theory states, there are two critical productivity matches that determine when an individual will exit the nonemployment state, θ^*, and when a job will provide health insurance, θ^{**}.[5]

Figures 5 and 6 show conditional wage functions $w\left(\theta', \theta \mid d=1\right)$ and $w\left(\theta', \theta \mid d=0\right)$. There are three features of these functions that should be noted. First, equilibrium wages are increasing in the current worker-firm match, θ'. Second, wages are also increasing in the potential worker-firm match, θ. The intuition behind these two results is straightforward. In the first case, since there is more surplus for both the worker and the firm to share, each must be made better off by a higher match. On the other hand, as the worker's threat point increases (i.e., the potential match θ increases), the share of surplus that the worker receives in the bargaining game must increase, so that the wage increases. Finally, although not shown explicitly in the figures, there exists a compensating wage differential. For example, $w\left(\theta'=13, \theta=4 \mid d=1\right) = \$2.67$ and $w\left(\theta'=10, \theta=4 \mid d=0\right) = \$4.77$. Therefore, while the current worker-firm match is greater for the job that provides health insurance the equilibrium wage is lower. This result is consistent with the no OTJ model model which also exhibited this property.

Finally, in the simple model without on-the-job search, the difference in the duration of jobs that provide health insurance and jobs that do not provide health insurance is generated by the assumption that the job dissolution rate for uninsured jobs is higher than that for insured jobs, i.e., $\eta_0 > \eta_1$. In contrast, by allowing employed workers to meet new employers, the difference in job durations is a combination of this assumption and the theoretical implication that jobs providing health insurance are higher productivity jobs. Specifically, we can write the hazard rate associated with employment at the worker-firm match, θ, as

$$r(\theta) = \eta_0 I(\theta < \theta^{**}) + \eta_1 I(\theta \geq \theta^{**}) + \lambda_e \widetilde{G}(\theta).$$

Since the mean employment duration is related to the inverse of the hazard rate and $\widetilde{G}(\theta)$ is decreasing in θ, the fact that only matches that are greater

[4] In addition, we assume that employed workers meet new employers at the rate, $\lambda_e = 0.02$.

[5] In order to solve for the equilibrium wage functions and critical matches, we discretize the state space. This is why Figure 1 and Figure 4 do not directly correspond.

than θ^{**} provide health insurance implies that the mean duration for insured jobs will be greater than for uninsured jobs for both reasons mentioned above.

In order to further establish the effect of including on-the-job search, we compute the mean durations for a variety of values for the employed worker-firm match rate, λ_e. The mean duration for insured jobs equals

$$\bar{t}_1 = \int_{\theta^{**}} \frac{g(\theta)}{\widetilde{G}(\theta^{**})} \frac{1}{r(\theta)} d\theta$$

while the mean duration for uninsured jobs is given by

$$\bar{t}_0 = \int_{\theta^{*}}^{\theta^{**}} \frac{g(\theta)}{\widetilde{G}(\theta^{*}) - \widetilde{G}(\theta^{**})} \frac{1}{r(\theta)} d\theta.$$

Table 2 presents the results of the simulations. For the case with no on-the-job search the mean durations simply equal the inverse of the job dissolution rates. As the employed worker-firm match rate increases, the mean durations for both types of jobs decrease since the hazard rates necessarily increase. However, while the mean durations are decreasing, the percent difference between the two types of jobs is increasing. Since insured jobs are relatively high productivity jobs, the rate at which the worker exits these jobs compared to uninsured jobs is decreasing in λ_e. Subsequently, the percent difference between the duration of insured and uninsured jobs increases as the chances of meeting a potential employer increase. For example, with a match rate equal to 0.01, insured jobs last almost three times longer than uninsured jobs, but with a match rate of 0.03, insured jobs are 3.5 times longer than uninsured jobs.

3 Data

Data from the 1990 to 1993 annual panels of the Survey of Income and Program Participation (SIPP) are used to estimate the model. The SIPP interviews individuals at four month interviews (or waves) up to nine waves. The SIPP collects detailed monthly information regarding individuals' demographic characteristics and labor force activity, including earnings, number of weeks worked, average hours worked, as well as whether the individual changed jobs during the month. In addition, the SIPP gathers data for a variety of health insurance variables including whether an individual's private health insurance is employer-provided at each interview.[6] For puposes of estimating the model, the sample is restricted to include a relatively homogeneous group of individuals. In particular, only whites between the ages of 22-39 with at least a high school education are selected. In addition, any individual who reports attendance in school, self-employment, military service, or participation in any government welfare program (i.e., AFDC, WIC, or Food Stamps) over the sample period is excluded.[7] Although the format of SIPP data makes defining job changes fairly complicated and is somewhat difficult to work with, the survey lends itself nicely to the empirical work in this study since it follows individuals for up to three years and includes data on both wages and health insurance at the current job.

Since our initial model does not allow job-to-job transitions, we first consider only transitions from unemployment to employment. In order to determine the length of employment spells, we assume that any transition out of the current employment spell is a transition into unemployment. The alternative approach is to assume that all job-to-job transitions are actually employment-to-unemployment-to-employment transitions. Therefore we would include a number of unemployment spells with very short durations. Since we are assuming that employment transitions must end with a transition into unemployment, we do not consider subsequent jobs in an individuals labor market history. That is, we assume that a labor market history begins with an unemployment spell. We then consider the first accepted job out of unemployment and no matter how this spells terminates (either into a new job or into unemployment), we characterize the transition as a dismissal into unemployment, but do not consider future jobs in the analysis.[8]

Table 3 presents the number of transitions from unemployment into ei-

[6]There are several issues involved in constructing a meaningful employer-provided health insurance variable. First, there is a timing issue since the insurance variable changes only at the interview month, while a job change can occur any time. Second, there are job spells in which the individual reports employer-provided coverage for some part of the spell and no coverage for the remainder of the spell. Since these spells do not represent more than 20 percent of the entire sample and any other solution is admittedly ad hoc, I eliminate these spells. If there are no selection issues for these spells, this should not affect the results.

[7]Some individuals, about 3 percent of the sample, had missing data at some point during the panel due to the fact that some respondents in the SIPP were not contacted during the interview month. Since the estimation relies crucially on observed durations and there is no reason to believe that any selection problem exists for respondents with missing information, these individuals were also excluded.

[8]We are currently working on estimating the model with OTJ search. When this is complete, we will update this section.

ther health insurance state, the mean accepted wages, and the mean durations for each insurance state. The most striking statistic is the difference in the mean wages between the two types of jobs. In particular, jobs that provide health insurance pay, on average, about $4 per hour more than jobs without insurance. In addition, for completed employment spells, the mean duration for jobs with insurance is about 8 weeks greater than jobs without insurance. This result is consistent with our assumption that health insurance decreases the job dissolution rate.

4 Econometric Method

4.1 Model without OTJ search

When $\lambda_e = 0$, it is relatively straightforward to estimate the model using parametric maximum likelihood estimation. In particular, since observed employment spells in our model necessarily end with a transition into unemployment or with a right censored duration, we can estimate the two dissolution rates directly from the employment duration data. In addition, the health insurance premium can be estimated non-parametrically from firm-level data on employer costs. The remaining parameters of the model that can be identified using unemployment data (both spell duration and accepted job data) will be estimated using concentrated maximum likelihood estimation. That is, we condition on the estimates of the dissolution rates and health insurance premium in deriving likelihood contributions.[9]

The dissolution rates, η_1 and η_0, can be estimated directly from employment duration data. Conditional on an individual being in a job that includes health insurance, the employment duration density equals

$$f_t\left(t \mid d=1\right) = \eta_1 \exp\left(-\eta_1 t\right). \tag{17}$$

Similarly, conditional on an individual being in a job without health insurance, the employment duration density equals

$$f_t\left(t \mid d=0\right) = \eta_0 \exp\left(-\eta_0 t\right). \tag{18}$$

According to the Bureau of Labor Statistics' "Employee Benefits Survey" from 1993, employees, on average, pay 16% of the health insurance premium and that the average monthly premium paid by the employee equals $107.

[9]We should note that we fix the bargaining parameter $\alpha = 0.4$ due to potential identification problems. We are currently examining the conditions under which this parameter is identified given the data to which we have access.

This implies an annual health insurance premium of \$8025. Assuming that the average worker works 35 hours per week for 52 weeks, the mean hourly premium paid by employers equals \$3.70.[10]

Ignoring measurement error for now, the probability of observing a job that does not provide health insurance and pays a wage w equals

$$p\left(w,d=0\right)=\frac{g\left(\frac{w-(1-\alpha)\theta^{*}}{\alpha}\right)}{\alpha\widetilde{G}\left(\theta^{*}\right)},\forall w\in\left[w_{0}^{\min},w_{0}^{\max}\right] \tag{19}$$

whereas the probability of observing a job that provides health insurance and pays a wage w is

$$p\left(w,d=1\right)=\frac{g\left(\frac{w-(1-\alpha)\theta^{*}}{\alpha}+\widehat{\phi}\right)}{\alpha\widetilde{G}\left(\theta^{*}\right)},\forall w\geq w_{1}^{\min}. \tag{20}$$

The unemployment duration density is given by

$$f_{t}\left(t\mid unemployed\right)=\lambda\widetilde{G}\left(\theta^{*}\right)\exp\left(-\lambda\widetilde{G}\left(\theta^{*}\right)t\right) \tag{21}$$

Since the duration density and the wage-health insurance probability are independent, we can write the probability of observing the job $(w,d=0)$ after an unemployment (uncensored) spell of t weeks as

$$p\left(w,d=0,t\right)=\frac{\lambda}{\alpha}\exp\left(-\lambda\widetilde{G}\left(\theta^{*}\right)t\right)g\left(\frac{w-\left(1-\alpha\right)\theta^{*}}{\alpha}\right)$$

with a similar definition for $p\left(w,d=1,t\right)$. For right censored unemployment durations, the likelihood contribution is simply the probability that the spell lasts longer than the observed duration.

As the expressions (19) and (20) reveal, the theoretical model yields strong implications regarding the minimum and maximum wages for jobs with and without health insurance. In particular, there is an interval of wages, $\left[w_{1}^{\min},w_{0}^{\max}\right]$, that both jobs with and without health insurance could pay. However, the two observed wage distributions overlap over a significant portion of the domain. In order to reconcile the behavioral implications of the model with the data, we follow the technique most frequently used in the literature by introducing measurement error into the observed wage

[10] We are currently investigating whether more comprehensive data are available that could be used for the estimation of the health insurance premium.

distributions. Specifically, we assume that observed wages, $\widetilde{w}$, are related to true wages, w, in the following manner

$$\widetilde{w} = w\varepsilon$$

where $\varepsilon \sim F_\varepsilon$ with a well-defined density function f_ε. Therefore, the joint probability of observing the jobs $(\widetilde{w}, d)$ and the spell duration t equal

$$p(\widetilde{w}, d = 0, t) = \frac{\lambda}{\alpha} \exp\left(-\lambda \widetilde{G}(\theta^*) t\right) \int_{w_0^{\min}}^{w_0^{\max}} f_\varepsilon\left(\frac{\widetilde{w}}{w}\right) g\left(\frac{w - (1-\alpha)\theta^*}{\alpha}\right) dw$$

$$p(\widetilde{w}, d = 1, t) = \frac{\lambda}{\alpha} \exp\left(-\lambda \widetilde{G}(\theta^*) t\right) \int_{w_1^{\min}}^{\infty} f_\varepsilon\left(\frac{\widetilde{w}}{w}\right) g\left(\frac{w - (1-\alpha)\theta^*}{\alpha} + \phi\right) dw$$

4.2 On-the-Job Search Model

In this subsection, we present the econometric method used to estimate the on-the-job search model presented in Section 2.2.3. The basis of the analysis in this section is termed a labor market cycle which is defined as the labor market history between two unemployment spells. Therefore, all observations begin with an unemployment spell and end in two possible ways. The first manner is through another unemployment spell. An example of this type of labor market cycle is shown in Figure 7. The other way a cycle can end is through right censoring. That is, the survey period ends before a transition back to unemployment is observed. Figure 8 shows this type of labor market cycle.

For every labor market cycle, the initial element of the likelihood contribution is the unemployment spell duration. For left censored and uncensored unemployment spells, the duration density is given by

$$f_t(t) = \lambda \widetilde{G}(\theta^*) \exp\left\{-\lambda \widetilde{G}(\theta^*) t\right\}.$$

While for right-censored unemployment spells, the likelihood contribution equals the probability that the spell lasts longer than the observed duration or

$$1 - F_t(t) = \exp\left\{-\lambda \widetilde{G}(\theta^*) t\right\}.$$

The observed job density (i.e., the joint density of the $\left(\widetilde{w}, \widetilde{d}\right)$ pair) given a transition out of unemployment can be derived according to the behavioral implications of the model. In particular, the model implies that the job match (i.e., the productivity match associated with the individual's current job), θ, must be greater than the bargaining match (i.e, the match that determines the individual's threat point). In this case, the bargaining match equals θ^*. In addition, if the job provides health insurance, the model demands that the job match be greater than θ^{**}. We can define the joint (true) wage - health insurance densities in terms of the equilibrium wage schedules defined in Section 2.2.3 and the underlying job match such that

$$m\left(\widehat{w}\left(1,\theta,\theta^*\right), d=1\right) = \frac{g\left(\theta\right)}{\widetilde{G}\left(\theta^*\right)},\ \forall\theta \geq \theta^{**}$$

and

$$m\left(\widehat{w}\left(0,\theta,\theta^*\right), d=0\right) = \frac{g\left(\theta\right)}{\widetilde{G}\left(\theta^*\right)},\ \forall\theta \in \left[\theta^*,\theta^{**}\right).$$

In order to reconcile the data with the strong implications of the theoretical model, we assume that both wages and health insurance are measured with error. In particular, we assume that observed wages are related to true wages in the same manner described in Section 4.1. In addition, we assume that health insurance is measured correctly with probability $(1-q)$ and is incorrectly observed with probability q.

Given these assumptions, the observed wage - true health insurance densities are given by

$$m\left(\widetilde{w}, d=1\right) = \int\limits_{\theta^{**}} \frac{g\left(\theta\right)}{\widetilde{G}\left(\theta^*\right)} f_{\varepsilon}\left(\frac{\widetilde{w}}{\widehat{w}\left(1,\theta,\theta^*\right)}\right) d\theta$$

and

$$m\left(\widetilde{w}, d=0\right) = \int\limits_{\theta^*}^{\theta^{**}} \frac{g\left(\theta\right)}{\widetilde{G}\left(\theta^*\right)} f_{\varepsilon}\left(\frac{\widetilde{w}}{\widehat{w}\left(0,\theta,\theta^*\right)}\right) d\theta.$$

Incorporating the measurement error of the health insurance variable, the joint density of the observed wage - health insurance pair is given by

$$m\left(\widetilde{w},\widetilde{d}\right) = (1-q)\, m\left(\widetilde{w}, d=\widetilde{d}\right) + qm\left(\widetilde{w}, d=1-\widetilde{d}\right).$$

Next, in order to determine the duration density associated with the job $\left(\widetilde{w},\widetilde{d}\right)$ or, more specifically, the pair of matches, (θ,θ^*), we need to know the job match, θ. In order to do so, we use the information provided by a transition from unemployment into the job $\left(\widetilde{w}, \widetilde{d}\right)$ to derive the job match density, denoted $\pi(\theta)$. Conditional on the true level of health insurance, we define the productivity densities as

$$p(\theta \mid \widetilde{w}, d=1) = \begin{cases} f_\varepsilon\left(\frac{\widetilde{w}}{\widehat{w}(1,\theta,\theta^*)}\right)\Gamma_1(\widetilde{w}) & \forall\theta \geq \theta^{**} \\ 0 & \text{otherwise} \end{cases}$$

and

$$p(\theta \mid \widetilde{w}, d=0) = \begin{cases} f_\varepsilon\left(\frac{\widetilde{w}}{\widehat{w}(0,\theta,\theta^*)}\right)\Gamma_0(\widetilde{w}) & \forall\theta \in [\theta^*, \theta^{**}) \\ 0 & \text{otherwise} \end{cases}$$

where $\Gamma_1(\widetilde{w})$ and $\Gamma_0(\widetilde{w})$ are constants to ensure that the densities sum to one. Hence, the productivity match density for the first job out of unemployment is given by

$$\pi(\theta) = (1-q)\, p\left(\theta \mid \widetilde{w}, d=\widetilde{d}\right) + qp\left(\theta \mid \widetilde{w}, d=1-\widetilde{d}\right).$$

The nature of the bargaining process and the information provided by the SIPP makes deriving the employment duration densities particularly difficult. In particular, since we allow wokers to renegotiate contracts with their current employers when they meet a new firm, (e.g., if a worker at the job (θ, θ^*) meets a new firm $\theta' \in (\theta^*, \theta)$, the worker will remain with his current employer, but now will be compensated based on the match θ'), the duration density should depend on the bargaining match, θ^*. However, since we do not observe these renegotiations in the dataset (or more precisely, we do not trust individuals to report a job change if they stay with their current employer), we must base the observed spell duration on unobserved data. To be precise, in our data we only observe job to job transitions that involve a change in the employer. Therefore, while we know that the job match equals θ over the length of the spell, we do not know the bargaining match over the entire length of the spell. Figure 9 depicts this missing data problem.

However, since the provision of health insurance is independent of the lower match value, by Conjecture 1, the rate at which the worker exits back into nonemployment similarly does not depend on the lower match value. In addition, in order for a job to job transition to be observed, we know that a new firm with a match greater than θ must be encountered. Hence, the hazard rate associated with the pair of matches, (θ, θ^*), is independent of the lower match value and is given by

$$h(\theta, \theta^*) = \eta_1 I(\theta \geq \theta^{**}) + \eta_0 I(\theta < \theta^{**}) + \lambda_e \widetilde{G}(\theta).$$

Therefore, the joint density associated with an employment spell at (θ, θ^*) of duration t that ends with a transition to another employer is given by

$$\lambda_e \widetilde{G}(\theta) \exp(-h(\theta, \theta^*) t).$$

In order to derive the likelihood contribution associated with an employment spell of duration t that ends with a transition into the new job $\left(\widetilde{w}', \widetilde{d}'\right)$, we first derive the joint wage - health insurance densities conditional on the match, θ. These densities are

$$m\left(\widehat{w}\left(1, \theta', \theta\right), d = 1 \mid \theta\right) = \frac{g(\theta')}{\widetilde{G}(\theta)}, \ \forall \theta' \geq \theta^{**}$$

and

$$m\left(\widehat{w}\left(0, \theta', \theta\right), d = 0 \mid \theta\right) = \frac{g(\theta')}{\widetilde{G}(\theta)}, \ \forall \theta' \in [\theta, \theta^{**}).$$

As with nonemployment to employment transitions, the joint density associated with the observed wage, $\widetilde{w}'$, and the true health insurance level can be written as

$$m\left(\widetilde{w}', d = 1 \mid \theta\right) = \int_{\theta^{**}} \frac{g(\theta')}{\widetilde{G}(\theta)} f_{\varepsilon}\left(\frac{\widetilde{w}'}{\widehat{w}\left(1, \theta', \theta\right)}\right) d\theta'$$

and

$$m\left(\widetilde{w}', d = 1 \mid \theta\right) = \int_{\theta}^{\theta^{**}} \frac{g(\theta')}{\widetilde{G}(\theta)} f_{\varepsilon}\left(\frac{\widetilde{w}'}{\widehat{w}\left(0, \theta', \theta\right)}\right) d\theta'.$$

Hence, the joint density of the observed job $\left(\widetilde{w}', \widetilde{d}'\right)$ conditional on the initial match θ is given by

$$m\left(\widetilde{w}', \widetilde{d}' \mid \theta\right) = (1-q)\, m\left(\widetilde{w}', d = \widetilde{d}' \mid \theta\right) + q m\left(\widetilde{w}', d = 1 - \widetilde{d}' \mid \theta\right).$$

and the joint density associated with a transition from an employment spell at match θ to the new job $\left(\widetilde{w}', \widetilde{d}'\right)$ after t periods equals

$$m\left(t, \widetilde{w}', \widetilde{d}' \mid \theta\right) = \lambda_e \widetilde{G}(\theta)\, m\left(\widetilde{w}', \widetilde{d}' \mid \theta\right) \exp\left(-h\left(\theta, \theta^*\right) t\right).$$

On the other hand, for a transition into nonemployment the conditional density equals

$$m\left(t, unemployment \mid \theta\right) = \left(\eta_1 I\left(\theta \geq \theta^{**}\right) + \eta_0 I\left(\theta < \theta^{**}\right)\right) \exp\left(-h\left(\theta, \theta^*\right) t\right).$$

Since we do not observe the bargaining match, θ, but have previously inferred the corresponding density, $\pi(\theta)$, we can write the unconditional joint densities as

$$m\left(\widetilde{w}', \widetilde{d}', t\right) = \int_{\theta^*} m\left(t, \widetilde{w}', \widetilde{d}' \mid \theta\right) \pi(\theta)\, d\theta$$

and

$$m\left(t, unemployment\right) = \int_{\theta^*} m\left(t, unemployment \mid \theta\right) \pi(\theta)\, d\theta.$$

We should note that computing the match density, $\pi(\theta)$, depends on the previous labor market state. For the derivation above, the previous labor market state was unemployment. If the previous labor market state is employment, we first need to derive the match density conditional on the previous match, or $\pi\left(\theta' \mid \theta\right)$. For a particular θ, the conditional density equals

$$\pi\left(\theta' \mid \theta\right) = (1-q)\, p\left(\theta' \mid \widetilde{w}', d = \widetilde{d}', \theta\right) + qp\left(\theta' \mid \widetilde{w}', d = 1 - \widetilde{d}', \theta\right)$$

where

$$p\left(\theta' \mid \widetilde{w}', d = 1, \theta\right) = \begin{cases} f_\varepsilon\left(\frac{\widetilde{w}'}{\widehat{w}(1, \theta', \theta)}\right) \Gamma_1\left(\widetilde{w}'\right) & \forall \theta' \geq \theta^{**} \\ 0 & \text{otherwise} \end{cases}$$

and

$$p\left(\theta' \mid \widetilde{w}', d = 0, \theta\right) = \begin{cases} f_\varepsilon\left(\frac{\widetilde{w}'}{\widehat{w}(0, \theta', \theta)}\right) \Gamma_0\left(\widetilde{w}'\right) & \forall \theta \in \left[\theta, \theta^{**}\right) \\ 0 & \text{otherwise} \end{cases}$$

Subsequently, the density of the current productivity match is given by

$$\pi\left(\theta'\right) = \int_{\theta^*} \pi(\theta)\, \pi\left(\theta' \mid \theta\right) d\theta.$$

5 Results and Simulations

This section presents the estimation results based on the econometric model discussed in the previous section. In the estimation, we assume that the productivity distribution $G(\theta)$ is log normal with parameters μ_θ and σ_θ. Furthermore, we assume a log normal distribution for the measurement error distribution with parameters μ_ε and σ_ε.[11] In addition, we simulate the implications of implementing a very simple program aimed at decreasing the cost of providing health insurance. Since we are ignoring tax policy issues at this point, we consider the labor market effects of passing legislation that streamlines the filing of insurance claims. It is a common complaint of health care professionals that dealing with the current health insurance system is both time consuming and requires some technical expertise. Hence, if the government were able to mandate that all insurers simplify their filing systems, it is likely that the cost of purchasing health insurance, ϕ, would decrease. We examine the labor market effects of such cost-reducing legislation.

5.1 The Case of $\lambda_e = 0$

Table 4 presents the maximum likelihood estimates for the model without OTJ search. Our estimates support the critical assumption of our model, namely $\eta_0 > \eta_1$. As previously noted, the time unit in which durations are measured is the week. Our estimates imply that jobs with health insurance last slightly more than 5 years on average, while jobs without health insurance have an expected length of slightly less than 2 years, which is quite a dramatic difference. The point estimate of λ implies that job contacts are made about every six months. As we can see from Figure 1, the probability of finding an acceptable match given a contact with a potential employer is quite high.

Of course, our primary interest in estimating the model was motivated by a desire to carry out some very simple policy experiments. Our 'estimate' of the cost of health insurance was \$3.70 per hour. We looked at the effect of reducing this cost [by 10 percent, 25 percent, and 50 percent] on the steady state equilibrium. Table 5 presents the summary measures associated with three different changes in the health insurance premium as well as the baseline case. In particular, we consider how decreases in the health insurance premium affect the probability that a job includes health

[11] We assume that $\mu_\varepsilon = -.5\sigma_\varepsilon^2$ to ensure that the observed wage equals the true wage in expectation.

insurance, $p(d=1)$, the steady state health insurance coveage rate, h, the steady state unemployment rate, u, and the mean productivity level of the economy, denoted $\overline{\theta}$. The mean productivity is defined by the following equation

$$\begin{aligned}\overline{\theta} &= u \times 0 + h \times E[\theta \mid \theta \geq \theta^{**}] + (1-u-h) E[\theta \mid \theta^{**} \geq \theta \geq \theta^{*}] \\ \overline{\theta} &= h \int_{\theta^{**}}^{\infty} \theta \frac{g(\theta)}{\widetilde{G}(\theta^{**})} d\theta + (1-u-h) \int_{\theta^{*}}^{\theta^{**}} \theta \frac{g(\theta)}{\widetilde{G}(\theta^{*}) - \widetilde{G}(\theta^{**})} d\theta.\end{aligned}$$

The most interesting result is that a small decrease in the health insurance premium leads to an increase in the mean productivity of the economy, but a large decrease results in a decrease in the mean productivity.

6 Conclusions and Extensions

The model developed and estimated above provides a relatively simple economic framework that results in an implied wage and health insurance distribution that resembles what is observed empirically. Specifically, not all jobs offer health insurance and jobs that do provide insurance are, on average, high wage jobs. The estimation and subsequent simulation results reveal two very interesting facts. First, by lowering the cost of insurance, the percent of worker-firm matches that result in jobs that provide health insurance increases. In our example, a twenty-five percent decrease in the health insurance premium will result in a twenty-two percent increase in the probability that a job provides insurance. Second, we find that decreasing the cost of providing health insurance may lead to either an increase or a decrease in the mean productivity of the economy.

While we have intentionally ignored any consideration of tax policy up to this point, we plan on examining what the effects of changing the tax subsidy to health insurance are. While the tax advantage to the provision of health insurance benefits is not sufficient to generate the observed equilibrium wage - health insurance distribution, it is very likely that accounting for these tax advantages will alter our results.

Table 1: Comparative Statics

	Experiment 1	
Statistic	$\phi = 2.50$	$\phi = 1.25$
Critical match out of nonemployment	13.154	14.277
Critical match for provision of insurance	15.768	15.584
Probability job includes health insurance	0.693	0.835
Steady state unemployment rate	0.411	0.407
Steady state health insurance coverage rate	0.580	0.589
Steady state mean productivity	14.528	14.547
	Experiment 2	
Statistic	$\phi = 2.50$	$\phi = 1.25$
Critical match out of nonemployment	7.183	8.351
Critical match for provision of insurance	11.334	10.427
Probability job includes health insurance	0.500	0.708
Steady state unemployment rate	0.219	0.222
Steady state health insurance coverage rate	0.586	0.684
Steady state mean productivity	13.093	13.351

Note: Experiments based on the parametric assumptions discussed in the text.

Table 2: Comparison of Mean Durations

$\boldsymbol{\lambda_e}$	**Uninsured**	**Insured**	**% difference**
0	102.72	266.85	61.51
0.01	57.58	168.42	65.81
0.02	41.38	138.68	70.16
0.03	30.60	106.24	71.20

Note: Mean durations (in weeks) are simulated based on the parameter estimates of the model with no on-the-job search presented in Table 4.

Table 3: Summary Statistics

Statistic	
Transitions from nonemployment to a job with insurance	421
Transitions from nonemployment to a job without insurance	872
Right censored nonemployment spells	80
Mean uncensored nonemployment spell duration	32.57 (31.34)
Mean right censored nonemployment spell duration	41.76 (22.23)
Mean wage for jobs with insurance	11.46 (6.20)
Mean wage for jobs without insurance	7.56 (5.38)
Uncensored job spells with health insurance	102
Mean duration of uncensored job spells with insurance	36.03 (29.89)
Mean duration of right censored job spells with insurance	73.81 (38.19)
Uncensored job spells without health insurance	374
Mean duration of uncensored job spells without insurance	28.48 (22.82)
Mean duration of right censored job spells without insurance	55.75 (38.71)

Note: Based on the 1990 to 1993 panels of the Survey of Income and Program Participation. The sample excludes all individuals who were self-employed, attended school, served in the military, or participated in any welfare program over the length of the survey.

Table 4: Maximum Likelihood Estimates - Simple Model

Parameter	**Estimate**
Worker-firm match rate, λ	0.0373 (0.0015)
Mean log productivity level, μ_θ	2.1824 (0.0402)
Standard deviation of log productivity levels, σ_θ	0.8132 (0.0240)
Critical match out of nonemployment, θ^*	4.4814 (0.0182)
Critical match for provision of health insurance, θ^{**}	11.4476 (0.6199)
Probability job includes health insurance, $p(d=1)$	0.4736 (0.0315)
Job dissolution rate for jobs with insurance, η_1	0.0037 (0.0004)
Job dissolution rate for jobs without insurance, η_0	0.0097 (0.0005)
Unemployment utility flow, b	-9.6345 (1.3936)
Log likelihood value	-2778.2
Concentrated log likelihood value	-10182.0

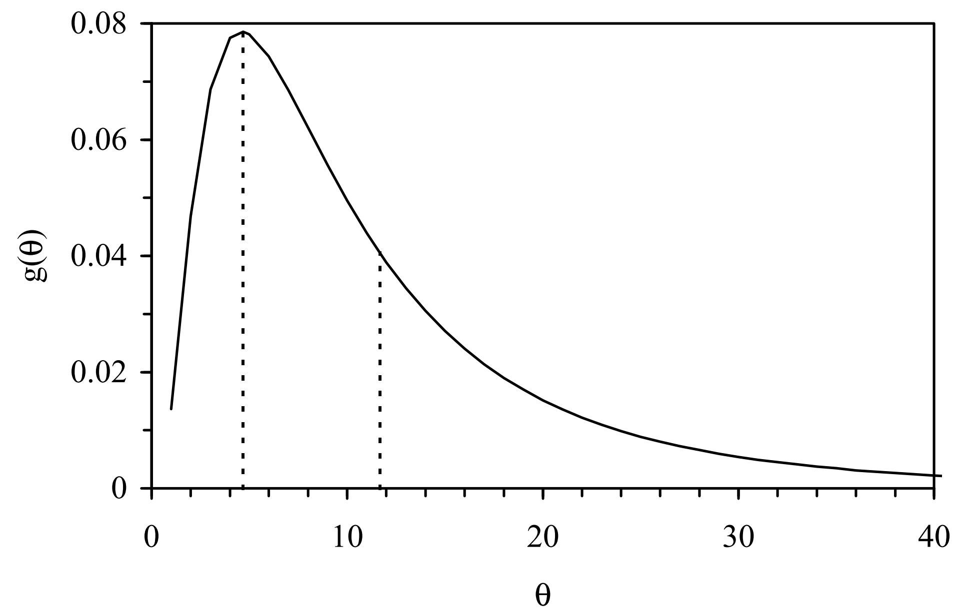
Note: Estimates based on the following assumptions: the annual discount rate is set to 0.08, the bargaining power parameter equals 0.40, the health insurance premium is estimated to be $3.70 per hour, and the standard deviation of the measurement error distribution is set to 0.05. Standard errors are in parentheses. The standard errors on the implied estimates are computed using the delta method, while the standard error on the unemployment utility flow is simulated using the asymptotic distribution of the estimated parameters. The log likelihood value represents the likelihood function based on employment durations. The concentrated log likelihood value takes the estimates of the dissolution rates and the health insurance premium as fixed.

Table 5: Simulations - Changes in the health insurance premium

Statistic	Baseline	10% decrease	25% decrease	50% decrease
$p(d=1)$	0.4587	0.4955	0.5566	0.6766
Unemployment rate, u	0.1616	0.1591	0.1554	0.1489
Coverage rate, h	0.5765	0.6041	0.6464	0.7188
Mean productivity level, $\overline{\theta}$	13.9558	13.9640	13.9511	13.8577

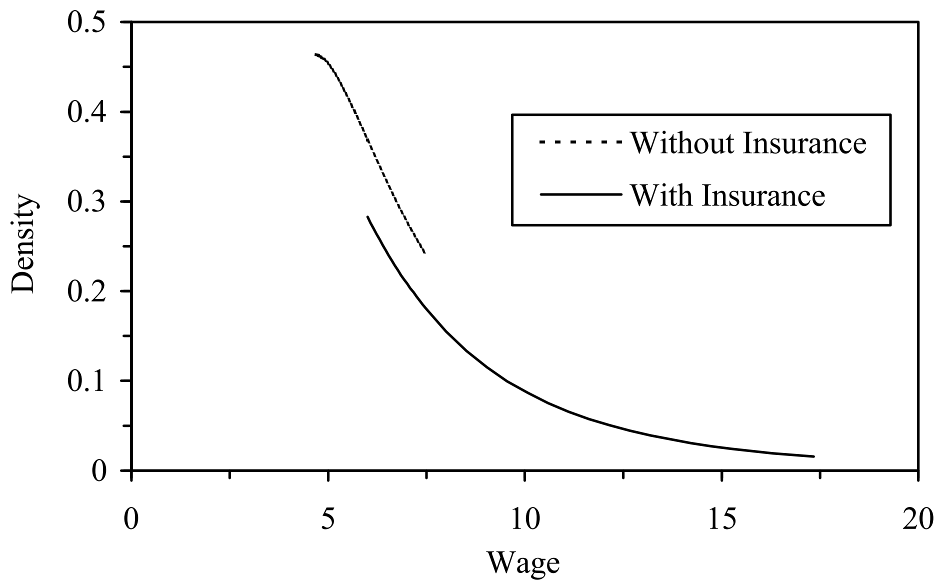
Note: Simulations are based upon the parameter estimates presented in Table 4. The definitions of the steady state unemployment rate, health insurance coverage rate, and mean productivity level are detailed in the text. We assume that unemployed persons do not receive health insurance coverage and have zero productivity.

Figure 1: Productivity Density - Simple Model



Note: Figure based on the parameter estimates presented in Table 4. The dotted vertical lines represent the critical productivity matches for transitions out of nonemployment and for health insurance provision.

Figure 2: Conditional Wage Densities

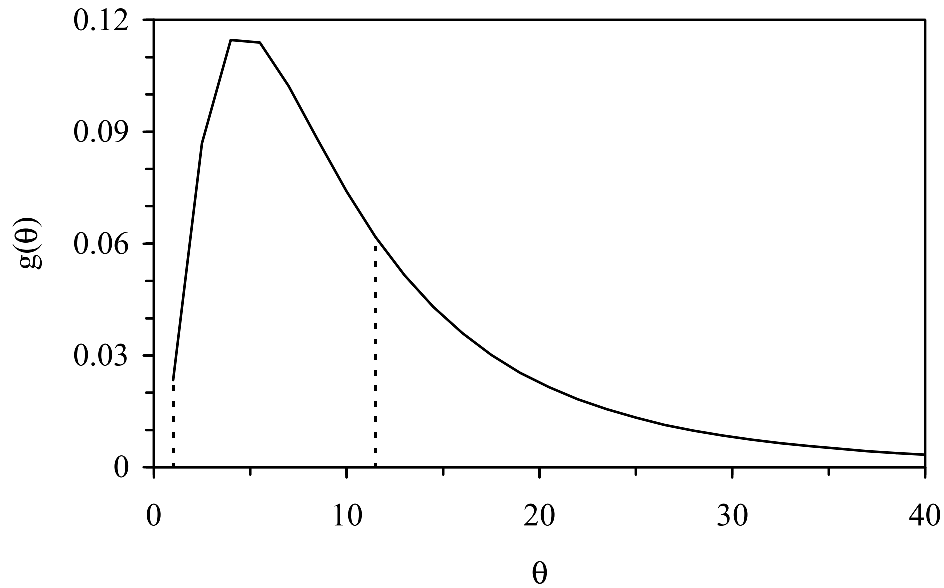


Note: Figure based on the parameter estimates presented in Table 4. In this example, the minimum wage for jobs without insurance equals $4.69, while the maximum wage equals $7.48. For jobs with insurance, the minimum wage is $6.00.

Figure 3: Unconditional Wage Density

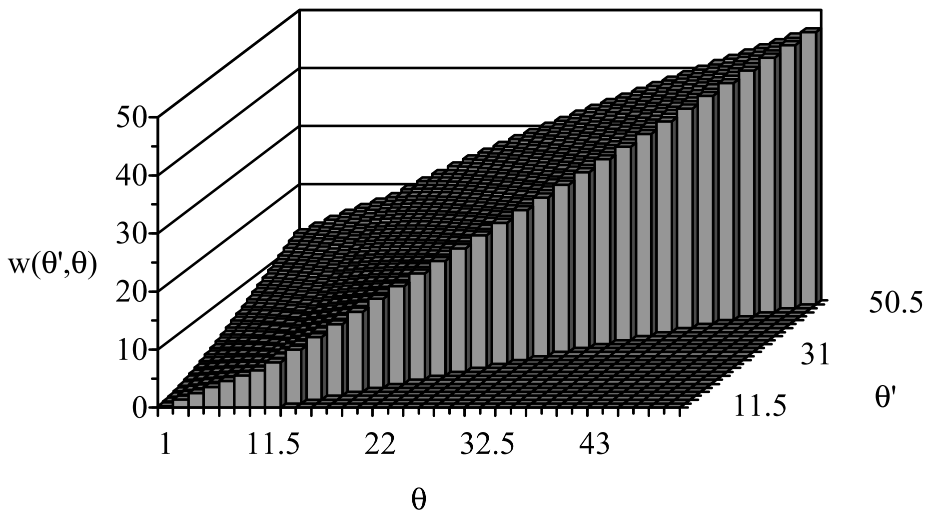
Note: Figure based on the parameter estimates presented in Table 4. The minimum wage for jobs with health insurance equals $6.00 and the maximum wage for jobs without health insurance equals $7.48.

Figure 4: Productivity Density: On-the-Job Search



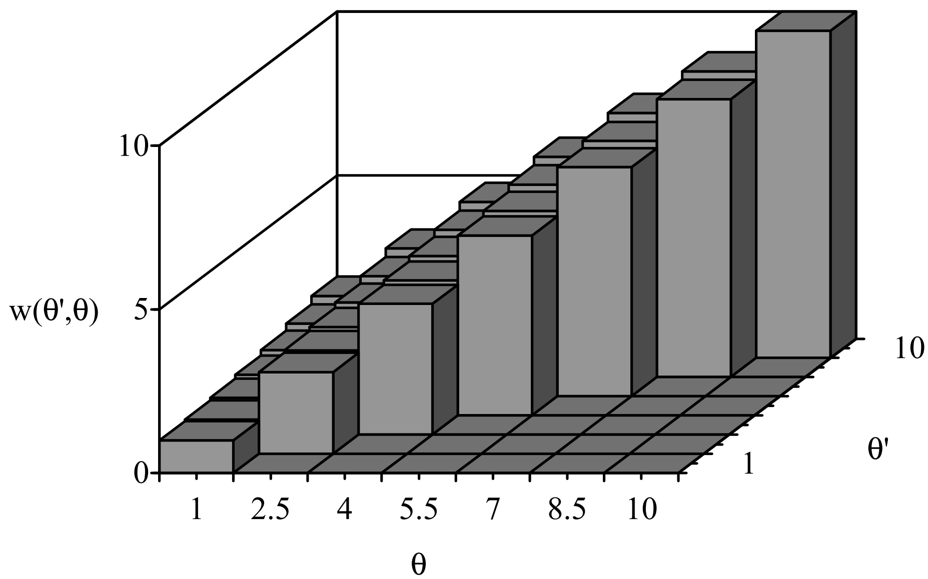
Note: Figure based on the parameter estimates presented in Table 4 with the employed worker-firm match rate set to 0.02. The dotted vertical lines represent the critical matches for transitions out of nonemployment and for health insurance provision.

Figure 5: Wage Function: Insured Jobs



Note: Figure based on the parameter estimates presented in Table 4 (employed worker-firm match rate set to 0.02). The critical match for transitions out of nonemployment, $\theta^{*} = 1$, and the critical match for the provision of health insurance, $\theta^{**} = 11.5$.

Figure 6: Wage Function: Uninsured Jobs



Note: Figure based on the parameter estimates presented in Table 4 (employed worker-firm match rate set to 0.02). In this example, the critical match out of nonemployment, $\theta^{*} = 1$, and the critical match for the provision of health insurance, $\theta^{**} = 11.5$.

Figure 7: Labor Market Cycle - Type 1

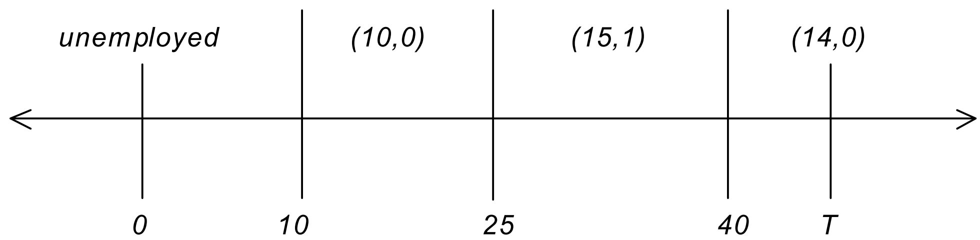


Figure 8: Labor Market Cycle - Type 2

Figure 9: Employment Spells - Missing Data Problem